ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Iona Breakwater Project
Volume II – Main Report

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GLOSSARY

Term	Definition
ABRC	Argyll Biological Records Centre
ACOP	Approved Code of Practice
ADCP	Acoustic Doppler Current Profile
ADDs	Acoustic Deterrent Devices
AIS	Automatic Identification System
AL	Action Level
ALARP	As Low as Reasonably Practicable
ALRS	Admiralty List of Radio Signals
AONB	Area of Outstanding Natural Beauty
APQ	Area of Panoramic Quality
AtN	Aids to Navigation
BAP	Biodiversity Action Plan
BH	Borehole
BPEO	Best Practical Environmental Option
BS	British Standard
BSH	Broad Scale Habitats
BSI	British Standard Institute
BT	British Telecom
BTO	British Trust for Ornithology
CalMac	Caledonian MacBrayne
CCA	Coastal Character Area
CCT	Coastal Character Type
CD	Chart Datum
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CFP	Computational Fluid Dynamic
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CLVIA	Cumulative Landscape and Visual Impact Assessment
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
DAERA	Department of Agriculture, Environment and Rural Affairs
Db	Decibel
DDC	Drop Down Camera
DECC	Department of Energy and Climate Change
DEM	Digital Elevation Model
DfT	Department for Transport
DHI	Danish Hydraulic Institute
DMRB	Design Manual for Road and Bridges
DRS	Deposit Return Scheme
EA	Environment Agency
EAR	Environmental Appraisal Report
EC	European Commission
ECMWF	European Centre for Medium-range Weather Forecasting
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment

EIAR	Environmental Impact Assessment Report
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EUNIS	European Nature Information System
EPR	Extended Producer Responsibility
EPS	European Protected Species
ES	Environmental Statement
GDL	Gardens and Designed Landscape
GDPR	General Data Protection Regulations
GES	Good Ecological Status
GHG	Greenhouse Gas
GIS	Geographical Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPP	Guidance for Pollution Prevention
GWP	Global Warming Potential
FSA	Formal Safety Assessment
HAS	Highest Astronomical Tide
HD	Hydrodynamic
HER	Historic Environment Record
HES	Historic Environment Scotland
HF	High Frequency
HIA	Health Impact Assessment
HNS	Hazardous Noxious Substances
HRA	Habitats Regulation Appraisal
HSE	Health and Safety Executive
HWDT	Hebridean Whale and Dolphin Trust
IAIA	International Association for Impact Assessment
IAMMWG	Inter-Agency Marine Mammal Working Group
ICC	Iona Community Council
IDA	Industrial Denatured Alcohol
IEFs	Important Ecological Features
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organization
INNS	Invasive non-native species
IOF	Important Ecological Features
IPCC	Intergovernmental Panel on Climate Change
IPH	Institute of Public Health
ISSF	Irish Storm Surge Forecasting
IUCN	International Union for Convention of Nature
JNCC	Joint Nature Conservation Committee
LATN	Local Aids to Navigation
LBAP	Local Biodiversity Action Plan
LCA	Life Cycle Assessment
LCT	Landscape Character Type
LDP	Local Development Plan
LF	Low Frequency
LLA	Local Landscape Area
LNCA	Local Nature Conservation Site
LNR	Local Nature Reserve
LSE	Likely Significant Effect
LULUCF	Land Use, Land Use Change And Forestry

LVIA	Landscape and Visual Impact Assessment
MAIB	Marine Accident Investigation Branch
MARESA	Marine Evidence-based Assessment
MarLIN	Marine Life Information Network
MAU	Marine Analytical Unit
MCA	Maritime and Coastguard Agency
MCL	Morphological Condition Limit
MCS	Marine conservation Society
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MNCR	Marine Nature Conservation Review
MoD	Ministry of Defence
MPA	Marine Protected Area
MPS	Marine Policy Statement
MS	Method Statement
MSFD	Marine Strategy Framework Directive
MSL	Mean Sea Level
MSLOT	Marine Scotland Licencing Operations Team
MSS	Marine Scotland Science
MV	Motor Vessel
NBN	National Biodiversity Network
NHS	National Health Service
NIEA	Northern Ireland Environment Agency
NLB	Northern Lighthouse Board
NMBAQC	National Marine Biological Analytical Quality Control
NML	Noise Monitoring Location
NMPI	National Marine Plan Interactive
NPF	National Planning Framework
NRW	Natural Resources Wales
NTS	Non-Technical Summary
NS	NatureScot
NSA	National Scenic Area
NTS	National Trust for Scotland
OD	Ordnance Datum
OEMP	Operational Environmental Management Plan
OPW	Office of Public Works
OREI	Offshore Renewable Energy Installations
OS	Ordnance Survey
PAN	Planning Advice Note
PEA	Preliminary Ecological Appraisal
PEL	Probable Effect Levels
PIN	Planning Inspectorate
PMF	Priority Marine Feature
PMSC	Port Marine Safety Code
PPC	Pollution Prevention Control
PPG	Pollution Prevention Guidance
PPV	Peak Particle Velocity
PSA	Particle Size Analysis
PSD	Particle Size Distribution
PTS	Permanent Threshold Shift

QAF	Quality Assurance Framework
RBD	River Basin District
RBMP	River Basin Management Plan
RNLI	Royal Nautical Lifeboat Institute
RSPB	Royal Society for the Protection of Birds
rWFD	Revised Waste Framework Directive
SAC	Special Area of Conservation
SCOS	Special Committee on Seals
SEIA	Socio Economic Impact Assessment
SEL	Sound Exposure Levels
SEPA	Scottish Environment Protection Agency
SFFS	Scottish Flood Forecasting Service
SHA	Statutory Harbour Authority
SHIIAN	Scottish Health and Inequality Impact Assessment Network
SIMD	Scottish Index of Multiple Deprivation
SINCs	Sites of Importance for Nature Conservation
SMR	Scottish Marine Region
SNH	Scottish Natural Heritage
SoIHC	Sound of Iona Harbours Committee
SOP	Standard Operating Procedure
SPA	Special Protection Area
SPM	Suspended Particulate Matter
SPP	Scottish Planning Policy
SSCs	Suspended Sediment Concentrations
SSSI	Sites of Special Scientific Interest
SW	Scottish Water
SWMP	Site Waste Management Plan
TAN	Technical Advice Note
TEL	Threshold Effect Levels
TNMP	Traffic and Navigation Management Plan
TraC-MImAS	Transitional and Coastal waters Morphological Impact Assessment System
TTS	Temporary Threshold Shift
TTTC	Through the Tide Count
UAV	Unmanned Aerial Vehicle
UKCP	UK Climate Projections
VHF	Very High Frequency
WDC	Whale and Dolphin Conservation
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WML	Waste Management Licence
WoE	Weight of Evidence
WoRMS	World Register of Marine Species
WoSAS	West of Scotland Archaeology Service
WSI	Written Scheme of Investigation
WWT	Wildfowl and Wetlands Trust
ZoI	Zone of Impact or Zone of Influence
ZTV	Zone of Theoretical Visibility

1 INTRODUCTION

1.1 Context

This Environmental Impact Assessment Report (EIAR) has been prepared by RPS on behalf of Argyll & Bute Council for the proposed Iona Breakwater Project, hereafter referred to as the 'Proposed Development', for which development consent is sought.

The Proposed Development falls under paragraph 10(m) of Schedule 2 of The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) ("the 2017 MW Regulations"), and as such an Environmental Impact Assessment must be carried out in support of the Marine Licence Application.

1.2 Purpose of the EIAR

Environmental Impact Assessment (EIA) is a procedure under the terms of European Directives[1] for the assessment of the likely significant effects of a project on the environment. An Environmental Impact Assessment Report (EIAR) is a statement prepared by the applicant, providing information on the likely significant effects on the environment based on current knowledge and methods of assessment. It is carried out by competent experts, with appropriate expertise, to provide informed assessment within their discipline.

The primary objective of the EIAR is to identify the baseline environmental context of the Proposed Development, predict potential beneficial and/or adverse effects of the Proposed Development and propose appropriate mitigation measures where necessary. In preparing the EIAR, the following legal provisions and guidelines were considered:

- European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU) (European Commission, 2017);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, Draft August 2017);
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017);
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- Marine (Scotland) Act 2010.

[1] *EU Directive 85/337/EEC as amended by Directives 2011/92/EU and DIRECTIVE 2014/52/EU*

1.3 Function of the EIAR

This EIAR is a report of the effects, if any, which the Proposed Development, if carried out, would have on the environment, and includes the information specified in Annex IV of the Environmental Impact Assessment Directive and in Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations and the Marine Works (Environmental Impact Assessment) (Scotland) Regulations. The EIAR is the document prepared on behalf of the applicant that presents the output of the assessment conducted on behalf of the applicant, and contains information regarding:

- the Proposed Development;
- reasonable proposed alternatives;
- the baseline scenario;
- the likely significant effects of the project;
- the features and measures to avoid, prevent, reduce or offset significant adverse effects;
- any additional information specified in Annex IV of the EIA Directive and Schedule 4 the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations and the Marine Works (Environmental Impact Assessment) (Scotland) Regulations; as well as
- the Non-Technical Summary.

The EIAR must include the necessary information for the competent authority to reach a reasoned conclusion and should be of a sufficient quality to enable this judgement. Many of the the requirements and provisions of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations and the Marine Works (Environmental Impact Assessment) (Scotland) Regulations aim to ensure that the EIAR is of a sufficient quality to effectively serve this purpose.

The EIAR has been prepared following an examination, analysis and evaluation of the direct and indirect significant effects of the Proposed Development in relation to the receiving environment.

1.4 The Proposed Development

The Proposed Development is described in detail in Chapter 3, and comprises the following elements:

- Construction of a rock armour breakwater located approximately 70m south of the existing slipway in Iona; and
- Minor overburden dredging covering an area of 2,017 m^2 with a dredge removal volume of 1,225m^3

The total duration of the works is expected to be 52 weeks and it is not anticipated that the works will interfere with any infrastructure in the area. Materials will be transported to the site by barge, meaning that disruption to road transport will be minimal.

1.5 Methodology & Structure of the EIAR

The main aim of this EIAR is to provide information on the Proposed Development to the public concerned, prescribed bodies and the competent authority. To this end, Article 3(1) of the EIA Directive requires that significant effects are identified, assessed, and described in an 'appropriate manner'.

Article 5(1) of the EIA Directive sets out the information that should be presented in an EIAR to enable stakeholders and authorities to form opinions, and to make decisions regarding the project. While there are no formal requirements concerning the format and the presentation of the report, this EIAR clearly sets out the methodological considerations and the reasoning behind the identification and assessment of likely significant effects.

1.5.1 EIAR Content

Article 5(1) of the EIA Directive sets out what must be included *as a minimum* in the EIAR. Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2017 specify information to be included in an EIAR:

1. A description of the project and of the regulated activity, including details of the following matters—
    a. the location, size and nature of the project and the regulated activity;
    b. the quantity and nature and source of the materials to be used in the course of the project and the regulated activity;
    c. the quantity, nature and source of any items or materials to be deposited in the sea in the course of the project and the regulated activity; and
    d. the working methods to be used in the course of the project and the regulated activity.
2. A description of the aspects of the environment likely to be significantly affected by the project and the regulated activity, including—
    a. human beings, fauna and flora;
    b. soil, water, air, climate and the landscape;
    c. material assets and the cultural heritage; and
    d. the interaction between any two or more of the things mentioned in the preceding sub-paragraphs.
3. (1) A description, complying with sub-paragraph (2), of the likely significant effects of the project and the regulated activity on the environment resulting from—
    a. the nature of the activities to be carried out and the manner in which they are to be carried out;
    b. the use of natural resources;

c. the emission of pollutants;

d. the creation of nuisances; and

e. the elimination of waste.

(2) The description should cover each of the following categories of effect—

a. direct and indirect effects;

b. secondary effects;

c. cumulative effects;

d. short-term, medium-term and long-term effects;

e. permanent and temporary effects; and

f. positive and negative effects.

4. The forecasting methods used by the applicant to assess the main effects that the project and the regulated activity are likely to have on the environment.

5. A description of the measures envisaged to prevent, reduce and offset any significant adverse effects of the project and the regulated activity on the environment.

6. An outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects of those alternatives and the project as proposed.

7. A non-technical summary of the information provided under paragraphs 1 to 6.

8. Any difficulties, such as technical deficiencies or lack of knowledge, encountered in compiling any information of a kind specified in paragraphs 1 to 6.

1.5.2 Assessment of Environmental Effects

1.5.2.1 Assessment Methodology

The assessment of whether the Proposed Development is likely to have a significant effect on the environment has been undertaken through a variety of methods:

- Professional judgment and experience based on published guidance criteria;
- Assessment of both temporary and permanent effects (direct, indirect, secondary and residual);
- Assessment of interaction and cumulative effects;
- Assessment of duration and reversibility of these effects;
- Assessment against local, regional and national planning policy; and
- Consultation with statutory and non-statutory consultees.

Generally, the significance of effects is determined referring to the Institute of Environmental Management and Assessment (IEMA) guidance as illustrated in Figure 1-1 unless otherwise outlined in specific chapters of this report.

More Significant	**Effects which are substantial.** They represent key factors in the decision-making process with regard to development consent. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer the most damaging impact and loss of resource integrity.
	Effects which are major. These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
	Effects which are moderate. These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
	Effects which are minor. These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
Less Significant	**Effects which are negligible.** No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Figure 1-1 General categorisation of the scale of significance

The cumulative effects of the Proposed Development, in conjunction with other proposed projects, are considered within each topic chapter. Relevant developments considered within the cumulative assessments include those which are:

- Under construction;
- Permitted, but not yet implemented;
- Submitted, but not yet determined; and
- Identified in the Local Development Plan (and emerging Local Development Plans), recognising that much information on any relevant proposals is limited.

It is noted that projects that are built and operational at the time of submission are considered to be part of the existing baseline conditions.

Each chapter further considers whether there are significant cumulative effects which are likely to arise as a result of interactions within topic chapters and/or as a result of the Proposed Development.

1.5.2.2 Mitigation and/or Compensation Measures

Where required, mitigation measures are identified and described within individual topic chapters. These are measures which could avoid, prevent, reduce and, where possible, offset likely significant adverse effects upon the environment.

The description of mitigation measures includes details regarding the specific adverse effects for which measures are proposed, an assessment of the expected effectiveness, reliability and certainty of the measures, and any commitments regarding their implementation and future monitoring.

1.5.2.3 Monitoring

Further to mitigation measures, appropriate and proportionate monitoring measures are also identified and summarised within individual topic chapters.

Such monitoring measures may arise owing to legislative requirements and/or directly in response to the anticipated effects of the Proposed Development upon environmental factors. Nevertheless, duplication of efforts will be strictly avoided.

1.5.2.4 Conclusion on Likely Significant Effects

A conclusion by the authors of the EIAR on the likely significant effects of the Proposed Development on the environment, taking into account the results of the examination of the information presented in the EIAR is provided. In addition, a summary of the key impacts and mitigation and monitoring measures associated with the Proposed Development is provided, along with a discussion of cumulative impacts, interactions and inter-relationships between environmental topics. This conclusion will inform the reasoned conclusion to be made by the competent authority in conducting the Environmental Impact Assessment.

1.5.3 Structure of the EIAR

The EIAR has been structured in accordance with the European Commission's Guidance "Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)" (2017). Accordingly, the EIAR:

- Is presented with a clear structure with a logical sequence that describes, inter alia, existing baseline conditions, predicted impacts (nature, extent and magnitude), scope for mitigation, proposed mitigation measures, significance of unavoidable/residual impacts for each environmental factor;
- Contains a table of contents at the beginning of the document;
- Comprises a description of the consent procedure and how Environmental Impact Assessment fits within it;
- Reads as a single document with appropriate cross-referencing and is concise, comprehensive and objective;
- Is written in an impartial manner without bias;
- Includes a full description and comparison of the alternatives studied;

- Makes effective use of diagrams, illustrations, photographs and other graphics to support the text;
- Uses consistent terminology with a glossary;
- References all information sources used;
- Has a clear explanation of complex issues;
- Contains a good description of the methods used for the studies of each environmental factor;
- Covers each environmental factor in a way which is proportionate to its importance;
- Provides evidence of effective consultations;
- Provides a basis for effective consultations to come;
- Makes a commitment to mitigation (with a programme) and to monitoring;
- Contains a Non-Technical Summary which does not contain technical jargon;
- Contains, where relevant, a reference list detailing the sources used for the description and assessments included in the EIAR.

The EIAR is broken down into the Chapters shown in Table 1-1 below.

Table 1-1 EIAR Chapter Structure Breakdown

Chapter Number	Chapter Title	Additional Information
N/A	Glossary	Glossary of terms
1	Introduction	Introduction to the project, purpose and function of the EIAR and methodology and structure of the EIAR.
2	Need for the Project	Description of the current baseline conditions at Iona pier and slipway, the objectives of the Proposed Development and spatial planning policy relevant to the project.
3	Project Description	Description of the Proposed Development being assessed through this EIAR. Includes a description of the site location.
4	Assessment of Alternatives	Summary of alternative options explored as part of the project. Includes strategic level and project level options.
5	Project Scoping & Consultation	Summary of EIA Scoping and consultation undertaken to date.
6	Navigation & Safety	These Chapters address specific environmental factors and provide a description of the existing environment, the likelihood of effects, the significance of effects, remedial and mitigation measures, residual impacts and monitoring measures. The specific environmental factors considered, following Environmental Impact Assessment Scoping as described in Chapter 5 of this report.
7	Terrestrial Biodiversity	
8	Marine Biodiversity	
9	Ornithology	
10	Terrestrial Noise & Vibration	
11	Water Quality	
12	Flood Risk	
13	Coastal Processes	
14	Population & Human Health	
15	Landscape & Visual	
16	Cultural Heritage	

Chapter Number	Chapter Title	Additional Information
17	Waste	
18	Greenhouse Gas Assessment	
19	Risk of Major Accidents & Disasters	
20	Summary of Mitigation Measures	Summary of Mitigation Measures proposed within the EIAR
21	Cumulative Effects & Environmental Interactions	Summary of the assessment of cumulative effects which may arise from adjacent or nearby developments together with those predicted for the Proposed Development as well as the environmental interactions which have been examined within the individual technical assessment chapters.
22	Summary & Conclusions	Summary & Conclusions of EIAR.
23	References & Bibliography	List of references included within the EIAR.

The advantages of using this type of format are that it is easy to examine each environmental topic and it facilitates easy cross-reference to specialist studies undertaken as part of the assessment.

Each topic of environmental assessment is considered as a separate chapter and is drafted by relevant specialists (Table 1-2).

The EIAR is presented in three volumes of the application documentation, as follows:

- Volume I EIAR Non-Technical Summary
- Volume II EIAR Main Report
- Volume III EIAR Technical Appendices

The following companies were involved in the preparation of the EIAR:

- RPS – Lead Environmental consultants
- ABPmer (Global Marine Consultancy Services) – Risk of Major Accidents (Navigation)

The production of the EIAR has been co-ordinated by RPS. The EIAR structure, responsibility and qualified input for each chapter are detailed in Table 1-2.

Table 1-2 List of Contributors to EIAR Chapters

Chapter of EIAR	Lead Author(s)	Company	Subject	Qualifications
Chapter 1	Laura McAnallen	RPS	Introduction	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 2	Laura McAnallen	RPS	Need for Project	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 3	Laura McAnallen	RPS	Project Description	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 4	Laura McAnallen	RPS	Assessment of Alternatives	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 5	Laura McAnallen	RPS	Project Scoping & Consultation	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 6	Monty Smedley	ABPmer	Risk of Major Accidents (Navigation)	BSc
Chapter 7	Julia Ferguson	RPS	Terrestrial Biodiversity	BSc, MSC MCIEEM
Chapter 8	Tessa McGarry	RPS	Marine Biodiversity	PhD, MRes, BSc, MCIEEM
Chapter 9	Simon Zisman	RPS	Ornithology	BSc, MSc, PhD
Chapter 10	Catriona Cooper	RPS	Terrestrial Noise & Vibration	BSc, PG Dip, MCIEH, MIoA, MIAQM
Chapter 11	Mark Magee	RPS	Water Quality	BSc MSc CSci C.WEM MCIWEM
Chapter 12	Diane McGinnis	RPS	Flood Risk Assessment	BEng, CEng, MSc, MIEI, MICE
Chapter 13	Adrian Bell	RPS	Coastal Processes	BSc CEng FIAE FIEI MICE MIStructE
Chapter 14	Senuri Mahamithawa	RPS	Population & Human Health	BSc, MSc, AIEMA
Chapter 15	Raymond Holbeach	RPS	Landscape & Visual	MSc CMIL
Chapter 16	Richard Connolly	RPS	Cultural Heritage	MA, MCIfA FSA Scot
Chapter 17	Ciara Devine	RPS	Waste	BSc, MSc, MCIWM
Chapter 18	Stephen McAfee	RPS	Greenhouse Gas Assessment	BSc,MSc, C.Sci, AIEMA, IAQM
Chapter 19	James Hamilton	RPS	Risk of Major Accidents & Disasters	BSc, MSc
Chapter 20	Laura McAnallen	RPS	Summary of Mitigation Measures	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 21	Laura McAnallen	RPS	Cumulative Effects & Environmental Interactions	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 22	Laura McAnallen	RPS	Summary & Conclusions	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM
Chapter 23	Laura McAnallen	RPS	References & Bibliography	BSc, MSc, PhD, C.Sci, C.WEM MCIWEM

2 NEED FOR THE PROJECT

2.1 Introduction

This chapter of the EIAR details the need for the Proposed Development and examines this in the context of relevant spatial planning policy having regard to international, national, regional, and local policy objectives.

This chapter should be read in conjunction with Chapter 3 'Project Description' which describes the Proposed Development and provides information on the project site, design, size, and other relevant features.

2.2 Project Rationale

2.2.1 Introduction

Iona is a small island located to the west of the Isle of Mull. The Sound of Iona, which is orientated north-by-northeast to south-by-southwest and is open to the Atlantic Ocean particularly from the southwest, separates the Isle of Iona and the Isle of Mull. At Iona, an existing ferry terminal, comprising a pier and a steep slipway, is located within the small village of Baile Mòr. A small-scale passenger ferry operates from this location between the Iona ferry terminal and the Fionnphort ferry terminal, on the Isle of Mull.

As part of the Argyll & Bute Council Local Development Plan (LDP)[2], a new strategy for Oban, Lorn and the Isles was developed in order to address known infrastructure constraints and improve ferry services. More information on the Argyll & Bute LDP can be found in Section 4.2.1 of this report.

2.2.2 Proposed Development Objectives

The overall objective is to provide improved access facilities at Iona for the ferry which operates between the two villages of Iona and Fionnphort, across the Iona Sound.

The current facilities consist of a pier for ferry operations, fishing and some commercial vessels. Berthing is also available for visiting craft. The following parties operate from the pier:

- The Iona ferry route is operated by Caledonian MacBrayne (CalMac) Ferries Ltd with the Motor Vessel (MV) Loch Buie as the assigned vessel. The MV Loch Buie is 30.2m length overall, with a beam of 10m and a draught of 1.6m. The crossing time is typically 10 minutes with the lifeline ferry service providing for passengers and occasional vehicles transported between the islands of Mull and Iona;

[2] Argyll & Bute Local Development Plan - https://www.argyll-bute.gov.uk/ldp

- Crab/fishing vessel operators;
- Leisure boat operators; and
- Private boat owners.

The Iona ferry, operated by CalMac, operates daily all year round with the total number of passengers transported to and from Iona recorded in 2009 as amounting to 232,215[3]. This figure at that time represented a 4.48% increase on the previous year's passenger numbers. Of that figure over 70% were visitors to Iona.

Consultation was undertaken with CalMac to ascertain the number of scheduled and cancelled ferry operations on the return journey from Fionnphort and Iona in recent years. Data was assessed from 2017 – 2022 and is provided in Table 2-1.

Table 2-1 CalMac scheduled and cancelled ferry operations

	Year					2017-2022
	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	
Total scheduled return sailings between Iona and Fionnphort	8,400	8,402	5,219	7,653	8,420	**38,094**
Cancelled sailings total	296	346	434	260	520	**1,856**
Cancelled sailings due to weather	268	336	432	249	486	**1,771**
Percentage of cancelled sailings which are attributed to weather						**95.4%**

Over the last five years almost 1,900 scheduled return ferry journeys between Fionnphort and Iona were cancelled. Of these cancellations 95.4% were directly attributed to poor weather conditions, and could therefore have been mitigated, if the current berthing practice was improved.

The current berthing practice at Iona is that after traversing the Sound, the ferry holds its position at Iona using the weight of the ramp and the friction between the ramp and the slipway deck, however the slipway at Iona is currently very vulnerable to waves, particularly from the south, resulting in the ramp of the ferry rising and falling from the deck of the slipway. The instability of the ferry, as a result of swells, presents a risk to both ferry operators, passengers embarking and disembarking, vehicles and other slipway users.

During storm events or periods of intense wave action, the health and safety risk associated with the current berthing practice means that the ferry is not able to operate and results in cancelled sailings. This means that ferry users are not able to access Iona, or in fact, may become trapped at Iona until

[3] Sound of Iona Piers Development Framework and Master Plan (2013)

the ferry is able to operate again. This presents issues such as lack of accommodation (visitor accommodation on Iona is limited to two hotels, a number of B&Bs, self-catering units, and a campsite), with tourists having to sleep in their vehicles[4] and subsequent reputational issues, with tourists unlikely to revisit after having a poor experience. In addition, there is no shelter or indoor waiting area for ferry passengers in times of unfavourable weather conditions. This often presents difficulties when the weather is either wet or windy.

The current berthing practice also has a negative impact on service provision to residents of Iona. These problems have had a direct impact on the lives of the people who live there. A day without a ferry operating results in essential services to the island being affected – medical, educational, refuse collection, business delivery etc.

In addition to improved ferry operation (including health and safety mitigations), the Island and the Sound bring people visiting on holiday including discernible increases in the total numbers of leisure yachts, which sail around Mull and Iona in the summer season berthing within the Sound as a safe overnight mooring. This is an opportunity for these visitors to eat locally as well as stock up on supplies.

The Proposed Development aims to address these issues by making the connection between the Isle of Mull and Iona safer, more efficient, and more attractive to both ferry customers and leisure sailors. The Proposed Development is intended to make the ferry crossings more reliable and safer. It is not intended to increase the frequency of the ferry crossings and thereby no change in vessel traffic is expected as a result of the works.

2.3 Spatial Planning Policy

2.3.1 Introduction

This section of the EIAR considers national, regional and local land use and development policy guiding and regulating the development of the Proposed Development. Figure 2-1 illustrates an overview of the Scottish Planning System and the importance of policy in the assessment of planning applications. The relevant planning policies are set out for each level within the hierarchy in the sections that follow.

[4] BBC News Article 2021 - https://www.bbc.co.uk/news/articles/ce9n25zeyx1o

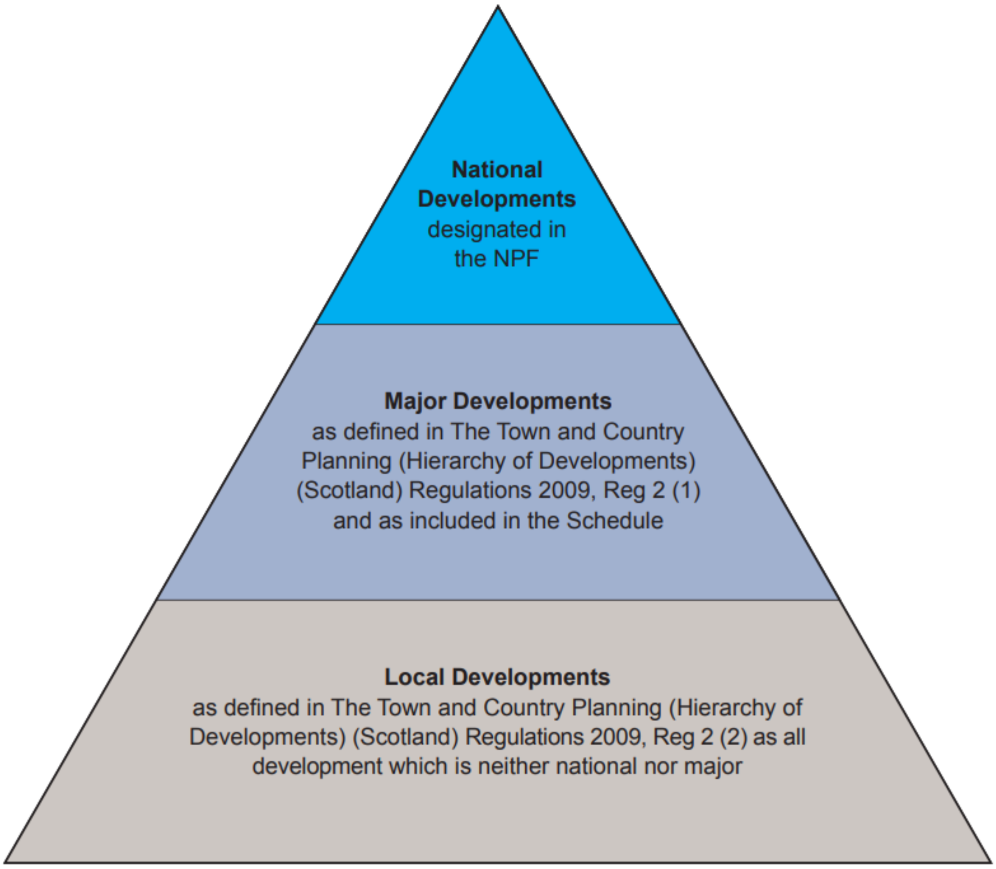

Figure 2-1: Planning Policy Hierarchy (Source: https://www.gov.scot/publications/guide-planning-system-scotland/documents/)

2.3.2 Relevant National Planning and Development Policy

2.3.2.1 Scottish Planning Policy

Scottish Planning Policy (SPP) aims to set out national policies which reflect Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. The SPP promotes consistency in application of policy across Scotland whilst allowing flexibility to account for local variations. It relates to:

- Preparation of development plans;
- Design of development, from concept to delivery; and
- Determination of planning applications and appeals.

2.3.2.2 National Planning Framework

The National Planning Framework (NPF) is a long-term strategy for Scotland which is the spatial expression of the Government Economic Strategy. NPF identifies national developments and other strategically important development opportunities in Scotland. Statutory developments must have regard to the NPF along with the National and Regional Marine Plans where necessary. Together with SPP, NPF aims to help the planning system to deliver Scottish Government visions for Scotland.

2.3.2.3 Scotland's National Marine Plan

Scotland's National Marine Plan sets out strategic policies for the sustainable development of Scotland's marine resources out to 200 nautical miles. It is required to be compatible with the UK Marine Policy Statement (MPS) and existing plans across the UK. This allows for a review at a national scale of the effectiveness of policies implemented against the plan and the progress made towards securing the objectives set out within the plan. See Section 2.3.3.2 for Regional Marine Plans which fall under Scotland's National Marine Plan.

2.3.3 Relevant Regional & Local Planning and Development Policy

2.3.3.1 Argyll & Bute Local Development Plan

The Argyll & Bute Local Development Plan (LDP) is a planning document, adopted in 2015, focusing both on land and aquaculture. It sets out a strategy for how Argyll & Bute Council wants to see the region develop to 2024 and beyond. Overall, the Argyll & Bute LDP provides an important foundation which port and harbour development projects should build upon. The Proposed Development is important in helping Argyll & Bute Council achieve its development goals by 2024.

It is important to note that an updated LDP (Argyll & Bute LPD2) is currently being prepared by Argyll & Bute Council which will replace the existing LDP that was adopted in 2015.

The LDP takes account of projected population changes, economic changes, transport and infrastructure needs, housing needs, the impacts of climate change, the need to protect and enhance the outstanding natural, built and cultural heritage of the area and the need to improve quality of life for workers, residents and visitors.

The current LDP provides a number of themes including:

- The Settlement and Spatial Strategy – Aims to deliver sustainable growth by steering significant development to existing settlements where essential services, employment opportunities, community facilities and infrastructure assets are found. Furthermore, a network of Key Rural Settlements has been identified to help establish rural growth points.
- Key Policy Themes:
  - Protecting, Conserving and Enhancing Our Outstanding Environment Together – Aims to protect, conserve, and enhance the existing environment through policy and implementation of actions in identified key areas.
  - Creating a Sustainable and Growing Economy Together – Aims to adopt a flexible approach to ensure that economic opportunities can be realised while preserving assets that already underpin the economy.

- Strengthening Our Communities Together – Aims to meet housing needs through a proactive and flexible approach, stimulating the economy by creating employment opportunities, investing in urban areas and green spaces, improving community infrastructure, improving designs of urban areas, improving access to services and community facilities, improving public transport, supporting community plans and local regeneration activities, and creating better recreational and leisure opportunities.
- Maximising Our Resources and Reducing Consumption Together – Aims to establish a land use framework that enables the further development of sustainable growth, especially in the renewables sector.
- Improving Our Connectivity and Infrastructure Together – Aims to ensure integrated land use with regional transport strategies as well as focussing funding on key transport infrastructure and ensuring new developments do not hinder existing infrastructure. There is also a focus on improving designs of new infrastructure to maximise the benefit and reduce impacts where possible.

2.3.3.2 Regional Marine Planning

Regional Marine Plans are implemented at a local level within Scottish Marine Regions, extending out to 12 nautical miles. This allows plans to be developed by Marine Planning Partnerships in order to account for local variations and smaller ecosystem units. These regional plans fall under Scotland's National Marine Plan (see Section 2.3.2.3).

2.3.3.3 Sound of Iona Piers Development Framework and Master Plan

The Sound of Iona Piers Development Framework was developed in 2013 by the Sound of Iona Harbours Committee (SoIHC) in conjunction with Sinclair Knight Metz (SKM). The Master Plan lays out a number of objectives to contribute to the wider regeneration and revitalisation of the settlements on either side of the Sound of Iona. The objectives are as follows:

- Creating safer landing facilities for tourists, fishermen and CalMac staff;
- Developing the marine heritage of the Sound of Iona to support higher forms of tourism activities;
- Improving the local economy by providing a wider range of facilities which build on the existing maritime activities;
- Increasing the attractiveness of the pier areas for visitors and local users; and
- Contributing towards the long-term growth in population within the settlements.

Within the Sound of Iona Piers Development Framework and Master Plan, the Fionnphort and Iona piers are recognised as being essential for the provision of a transport link between Iona and Mull. As such, preparation of this Master Plan involved the examination of a series of development options in and around Iona drawn from existing baseline information, the views of the communities and other key stakeholders and the analysis of socio-economic target data and notes related to the Ross of Mull. The Sound of Iona Piers Development Framework and Master Plan is provided in Volume III, Appendix 2.1.

3 PROJECT DESCRIPTION

3.1 Location of Project and Site Characteristics

3.1.1 Site Location

Iona is a small island located west of the Isle of Mull, on the west coast of Scotland (Figure 3-1). The Iona Ferry Terminal consists of a slipway and pier jutting out into the Sound of Iona. There is a passenger queueing area along the slipway, but there is no shelter in wet weather. There is no car parking. The National Grid Reference for the site is NM275245. Photographs of the Iona slipway are included in Figure 3-2 and Figure 3-3.

There are multiple sand bars in the Sound of Iona (Figure 3-4), however there is limited migration of the sandwaves, with most of the sandwave crests not moving significantly within six years. The prevailing wind and wave conditions are from the southwest.

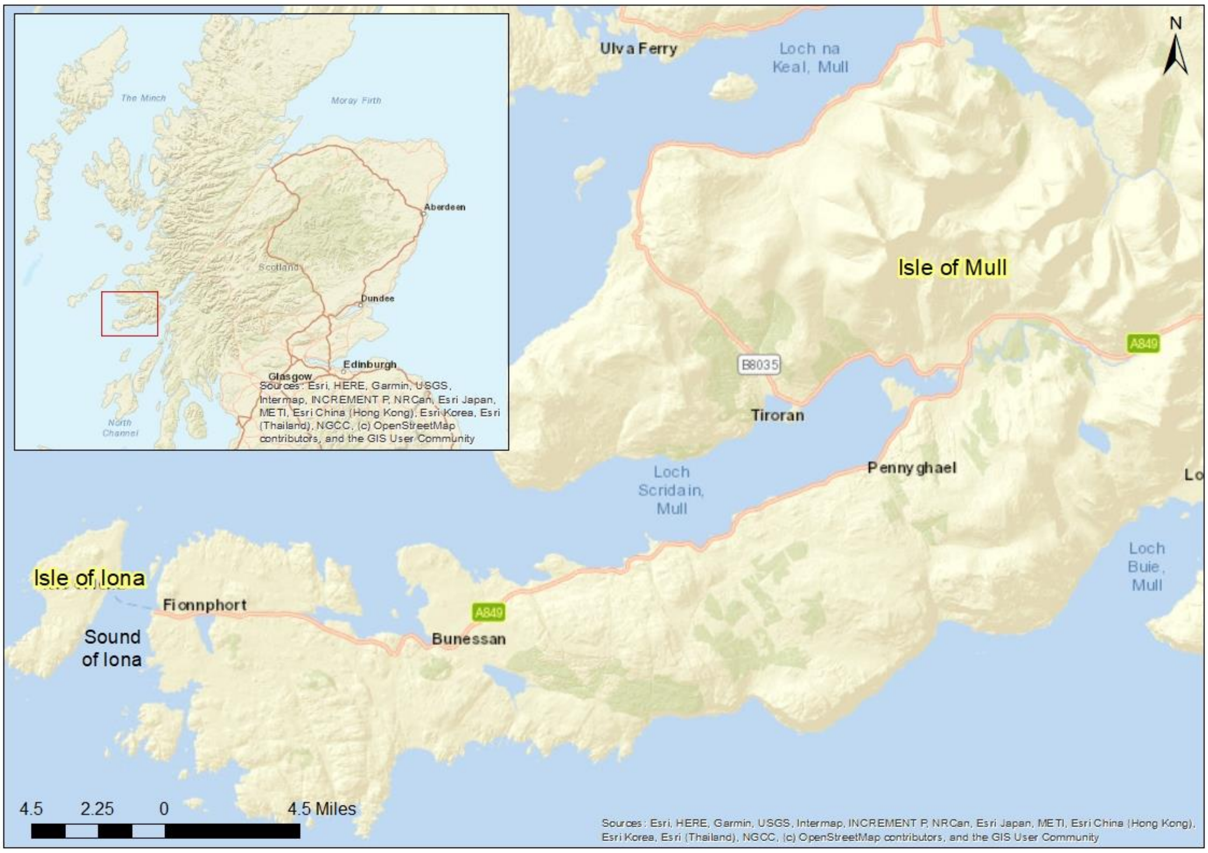

Figure 3-1 Proposed Development (Site Location)

Figure 3-2 Iona slipway (*Image Source: Google.com (dated July 2018)*)

Figure 3-3 CalMac Ferry at Iona (*Image Source: Google.com (dated August 2015))*

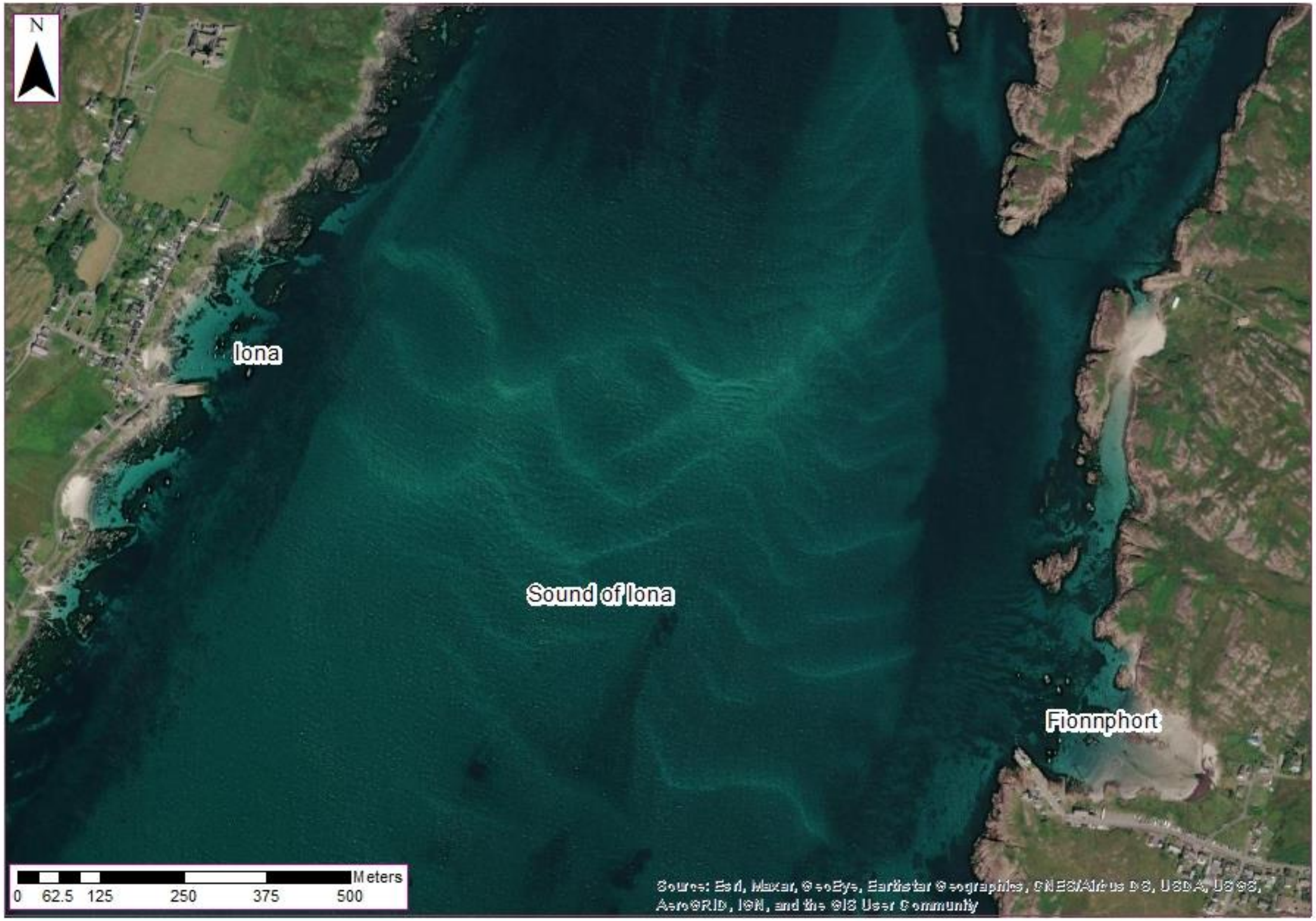

Figure 3-4 Sound of Iona

3.2 Proposed Development

In 2019, a Feasibility Study was undertaken by Byrne Looby (Byrne Looby, 2019) on behalf of Argyll & Bute Council whereby five different options for a rubble mound breakwater, as well as construction methodologies were explored.

The Proposed Development builds on Option 1B of the Feasibility Study (Byrne Looby, 2019). The Proposed Development consists of a new rock armour breakwater and dredging (Figure 3-5). The following detailed drawings are available for reference in Volume III, Appendix 3.1:

- Iona location plan, ownership boundary and site boundary;
- Iona existing general arrangement and elevation;
- Iona proposed general arrangement and elevation;
- Iona proposed sections and typical details; and
- Proposed dredge deposit location.

The Proposed Development consists of the construction of a new rock armour breakwater (185m crest length) to the south of the existing slipway. Minor overburden dredging (2,017m^2 area, 1,225m^3 dredge volume) will be required in order to accommodate the new navigation channel requirements. Descriptions of these proposed activities are provided in the sub-sections below.

Earlier iterations of the breakwater design include for berthing piles, which were subject to some of the early baseline environmental assessments included in Volume III Appendix, which have fed into the final assessments. All piling has been removed from the final design of the Iona breakwater. The early baseline environmental assessments therefore considered a development with a greater potential environmental impact than is actually proposed. The analysis of environmental impact for the proposed development is therefore rigorous and robust for the final design at Iona. All final assessments included in Sections 6- 19 of the EIAR have considered the environmental impact of the most up to date breakwater design at Iona.

3.2.1 Rock Armour Breakwater

The function of the structure is primarily to provide defence from waves propagating from the prevailing southerly direction and provide protection for slipway users and ferry vessels. The breakwater will result in an overall reduction of wave heights at the slipway. This will significantly reduce the risks to ferry operators and passengers and vehicles boarding and disembarking the ferry. The reduction in wave height provides a greater grip between the ferry ramp and the slipway deck.

The design details of the rock armour breakwater are listed below:

- The breakwater will be located approximately 70m south of the existing slipway in Iona.
- Crest length of circa 185m.
- 2:1 slope on outer face (non-slipway side) and 1:1.5 on the inner face (slipway side).
- The proposed maximum crest level will be 7.71m CD.
- Due to high flows through the crest during storm conditions, the crest width will be 4m.
- The base of the breakwater will be lined with a tear resistant geotextile membrane with the bedding placed on top of this layer comprising a 500mm deep layer of 300-1000kg graded rock.
- The core will be constructed of 1000 – 3000kg graded rock.
- The outer layer will be constructed of 3000-6000kg graded rock.
- A 3m wide and 2.5m high toe will be constructed on each face of 3000-6000kg graded rock. The toe will not be visible as it will be under a layer of sediment. Therefore, an area of sediment will need to be excavated, however this material will be replaced after construction is complete.
- At the end of the breakwater, a 5:1 batter will be constructed of 1000-3000kg of graded rock.
- The overall footprint of the breakwater is approximately 2.18ha.
- The rock armour breakwater will be constructed of clean quarried rock.
- The estimated volume of rock armour required for the proposed breakwater is 149,812 tonnes.
- It is likely that local sources of rock armour will not be suitable, however Glensanda Quarry (Aggregate Industries) in Oban has been identified as a quarry which will be capable of producing rock armour material to a grading sufficient for the application at Iona. The quarry is equipped with marine loading facilities.

Figure 3-6 and Figure 3-7 illustrate the design of the proposed breakwater in more detail.

3.2.2 Dredging

In order to accommodate the new navigation channel requirements, some dredging works will be required, however these will be minor in nature and comprise overburden dredging only (Figure 3-5). The approximate dredge area is 2,017m^2. The approximate dredge volume to be removed is 1,225m^3. It is proposed that this is carried out by a backhoe dredger, with the material deposited at the location shown in Figure 3-8.

In November 2020, Argyll & Bute Council commissioned Structural Soil Limited to undertake a ground investigation at the Proposed Development site. This included three seabed sediment cores within the dredge area and six grab samples in the vicinity of the breakwater. The sediments were analysed for a suite of chemical parameters and screened against Marine Scotland Revised Action Levels (AL) 1 and 2, in order to identify any contamination which may be present. All samples within the dredge area were below the revised AL1 and AL2 Action Levels. See Table 5-1 for further information.

Figure 3-5 Proposed Development Overview, Site Boundary and Working Areas

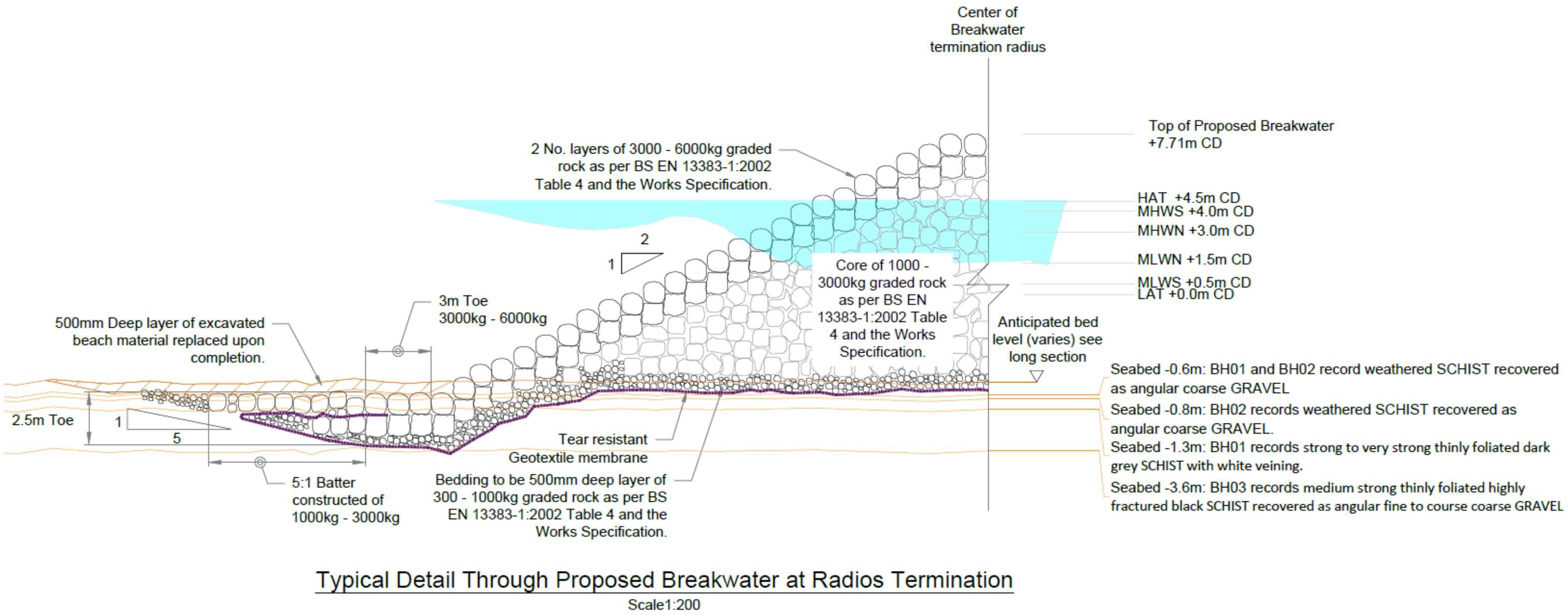

Figure 3-6: Proposed Breakwater Design (End of Breakwater)

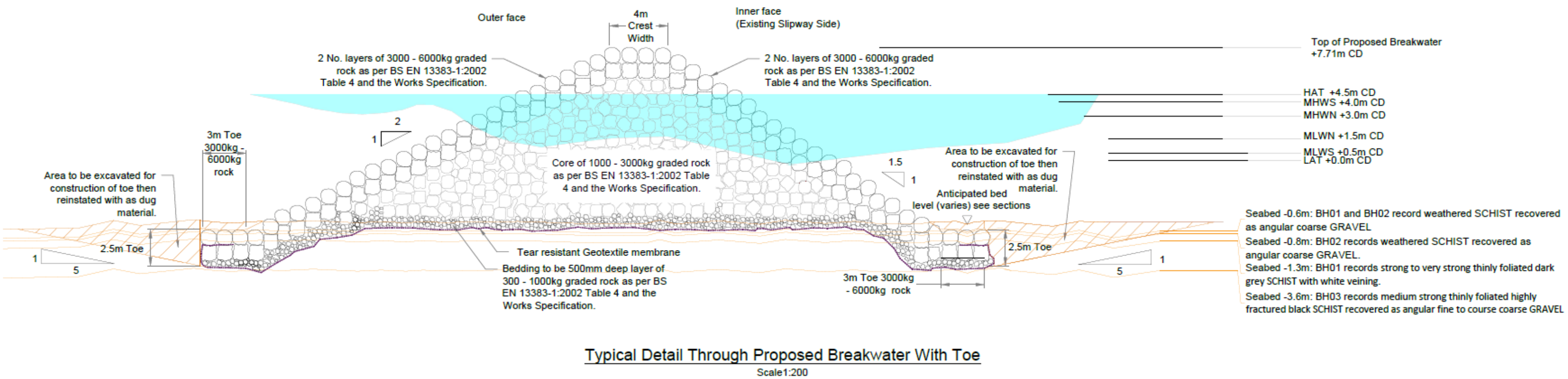

Figure 3-7: Proposed Breakwater Design (Cross Section)

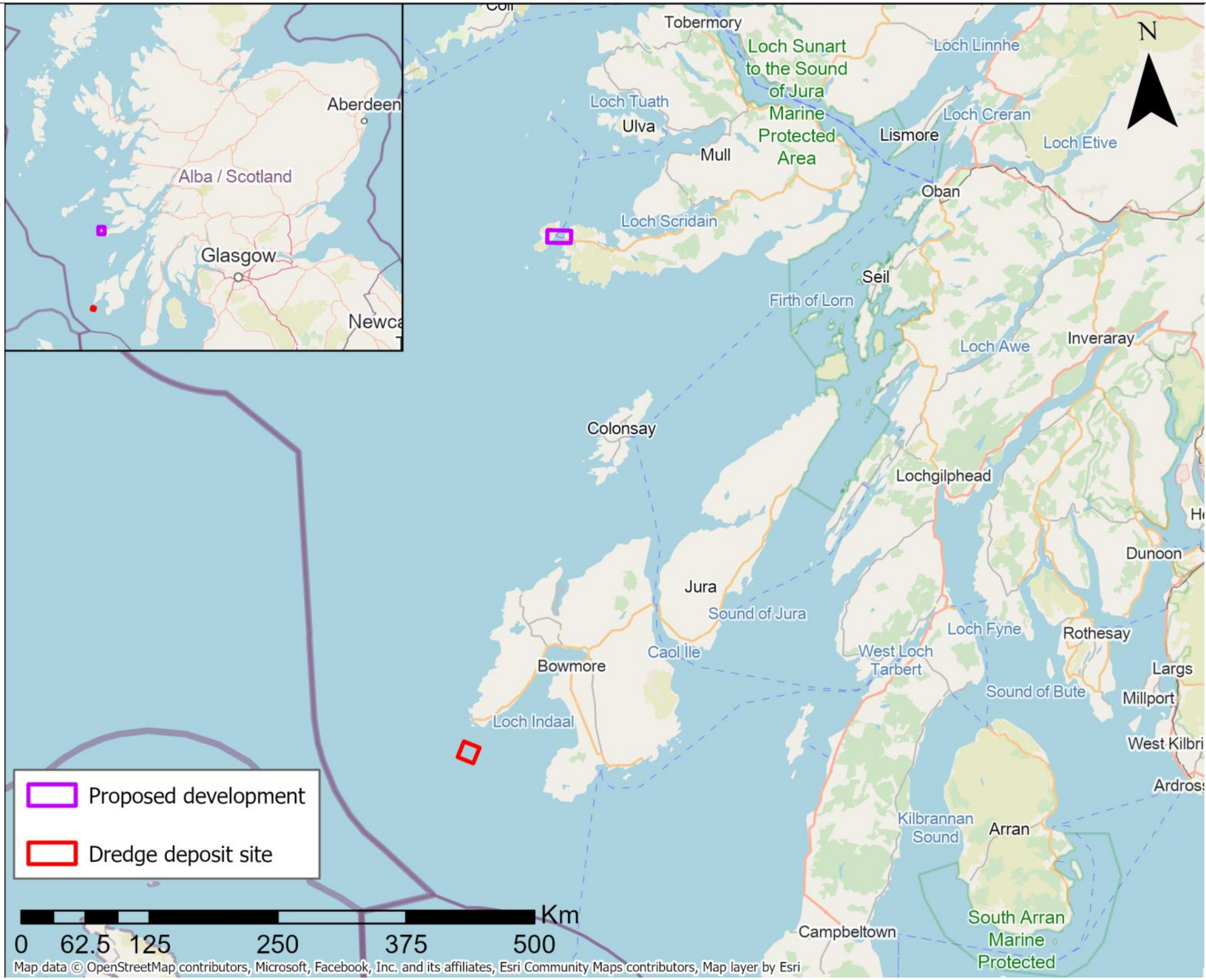

Figure 3-8: Potential dredge deposit location (shown in red)

3.2.3 Other Technical Information relating to Proposed Development

- Design Life: The design life of the structure is 120 years in accordance with the UK National Annex to BS EN 1990:2002, Category 5.
- Transport of Material to site: Materials are expected to be transported to site by barge and installed from a barge. Transport by road will be minimal – there is no estimated impact on the road transport network.
- Duration of Works: The duration of the works at Iona is estimated to be 52 weeks.
- Dredging: It is expected that dredging work will last for a maximum of 1 week. The dredge pocket will be undertaken prior to breakwater construction.
- Maintenance: Maintenance dredging will be required after construction is complete. The frequency of maintenance dredging will be established as part of the construction contract following the construction of the breakwater. Maintenance of the breakwater will be required as rock armour will move/adjust for a period of time. The defect period is expected to be 104 weeks during which the breakwater will be monitored, and any movement recorded and reported. After this, the breakwater will be inspected as part of the ongoing seabed bathymetric surveys regime. Systematic surveying of the UK's coastal waters is administered by the Maritime and Coastguard Agency (MCA) under the Civil Hydrology Programme[5].
- Services: Mains electric is known to be present well to the north of the site and the proposed works will have no interference with these services.
- Current ferry services: Given that the breakwater is proposed to be located c.70m south of the existing slipway, it is expected that current ferry operations are not likely to be disturbed during the construction phase. Dredging activities are expected to be undertaken overnight to minimise any disturbance during this time.

3.3 Outline Method Statement

The outline method of construction is likely to be:

1. Undertaking of site dilapidation survey and level surveys as required to show the condition of the surrounding area and roads prior to the start of the works.
2. Site welfare facilities, site compound and storage areas established within the area. The site boundaries on land around the site compound and storage areas shall be defined with Heras fencing. Working area over water shall be marked with indicative safety buoys deployed at approx. 10m centres to delineate.

[5] The Civil Hydrography Programme - https://www.gov.uk/guidance/the-civil-hydrography-programme

3. Dredging Works:
    a) Mobilisation of dredging plant to site.
    b) Pre-dredge bathymetric survey.
    c) Removal/relocation of existing private moorings and buoys from within the site boundary, working areas and dredging area and subsequent installation of the moorings at temporary locations nearby.
    d) Dredge pocket to the northeast of the existing Iona slipway as shown in Figure 3-5. As part of the dredging is along the ferry route, the dredging operations shall be overnight or as arranged with the ferry operator CalMac Ferries Ltd.
    e) Post-dredge bathymetric survey.
4. Construction of Breakwater:
    a) Mobilisation of plant and operations team to site.
    b) Rock armour and materials for breakwater delivered to site by barge. Rock armour can be stored below MHWS on the south side of the proposed breakwater.
    c) Removal of existing toilet block septic tank outfall pipe with concrete surround.
    d) Formation of breakwater footprint.
    e) Installation of Geotextile membrane.
    f) Installation of secondary rock and primary rock to existing seabed level.
    g) Partial reinstatement with new pipe and concrete surround (the section from the septic through the breakwater to where it breaks through the south face only).
    h) Installation of inner core & primary rock armour.
    i) Installation of beacon access steps.
    j) Installation of navigation beacon to crest of breakwater.
    k) Reinstatement of breakwater toe to existing seabed level with site won seabed material.
    l) Disposal of surplus seabed material in accordance with Marine Dredging Licence.
    m) Installation of final length of pipe and concrete protection for the toilet block septic tank outfall to reinstate its original length.
    n) Installation of rock armour along shore between existing slipway and south end of existing restaurant.
    o) Reinstatement of private moorings and buoys to final, permanent locations.
    p) Removal of safety buoys marking out the site.
    q) Installation of security gate.

r) As-built surveys.

s) Demobilisation.

t) Submission of Health and Safety File.

It should be noted that a Construction Environmental Management Plan (CEMP) which will include a Traffic & Navigation Management Plan (TNMP) and a Method Statement (MS) will be prepared by the successful contractor. The Planning Schedule of Conditions should include a requirement for a CEMP, TNMP & MS prior to construction commencing in the usual manner.

4 ASSESSMENT OF ALTERNATIVES

4.1 Introduction

Assessment of reasonable alternatives is mandatory under the EIA Directive. The process allows for adjustment to minimise environmental impact thus minimising significant effects on the environment.

Alternatives are different ways of carrying out a Project in order to meet its agreed objective(s). There are a range of alternative types that can be considered in relation to a Project. These relate to the following:

- Design;
- Technology;
- Location;
- Size; and
- Scale.

The assessment of alternatives for the Proposed Development has been undertaken in accordance with the following guidance documents:

- The EU Commission's Environmental Impact Assessment of Projects Guidance on the Preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014 /52/EU)
- NatureScot's Advice Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment Process in Scotland (2018)
- SEPA's notes on Marine Development and Marine Aquaculture Planning Guidance (2014).

4.2 Examination of Strategic Level Alternatives

4.2.1 Argyll & Bute Local Development Plan

In the Argyll & Bute Local Development Plan (LDP), the council lays out its '*Settlement and Spatial Strategy'*, in which one of the key objectives for Oban, Lorn and the Isles is:

> *"A better connected and accessible place with improved ferry services, road, rail, air and active travel links together with improved telecommunications networks and broadband coverage."*

Further to this under '*Key Policy Theme: Improving our Connectivity and Infrastructure Together'* Argyll & Bute Council list the enhancement of key ports and harbours as a key issue for the LDP in terms of connectivity. It is also highlighted that the continual improvement of strategic links (including lifeline ferry services) is a key aim of the LDP up to 2024.

Overall, the Argyll & Bute LDP provides an important foundation which port and harbour development projects should build upon. Therefore, the Proposed Development is important in helping Argyll & Bute Council achieve its development goals by 2024.

4.2.2 Sound of Iona Piers Development Framework and Master Plan

In July 2013, the Sound of Iona Harbours Committee (SoIHC) awarded Sinclair Knight Merz (SKM) a commission to undertake a Master Plan of the piers at both Iona and Fionnphort. Preparation of this Master Plan involved the examination of a series of development options in and around Iona drawn from existing baseline information, the views of the communities and other key stakeholders and the analysis of socio-economic target data and notes related to the Ross of Mull.

Following commissioning, an Interim Report was produced on 3 October 2013 which identified and reported on lessons learned and the opportunities for future development. This report also described studies on related areas at Lindisfarne in Northumberland, northeast England, and St David’s in Pembrokeshire, southwest Wales. The Interim Report identified the baseline conditions which formed the Inventory of Findings on which the recommendations on Master Plan options in and around the piers at Fionnphort and Iona. The key development factors included:

- A broad range of costs;
- Feasibility and timescales;
- Advantages and disadvantages;
- Delivery; and
- Source of funding.

These summaries are, by their nature, outlines, and intended to inform thinking and priorities at a strategic level rather than offering detailed analysis on individual development options. The main findings identified that, as a major project activity, the Proposed Development will require a significant investment in its design, consenting, and construction. The precise location of the breakwater would be dependent on detailed technical studies including hydrographical, bathymetric and marine geotechnical surveys in the first instance, together with detailed modelling and analysis to understand issues such as wave propagation and energy absorption, residual wave conditions within the protected waters, the impact on currents and the risks of any resultant erosion/accretion of mobile sands and sediments. The approach would also need careful assessment to ensure the safe navigation of vessels.

It was identified that the form of the breakwater would require careful consideration. The requirement considered a rock boulder breakwater, in order to permit tidal flows through the body of the breakwater whilst absorbing the energy of waves impacting the breakwater; or a reef breakwater permitting waves and high water to pass over the top. However, feasibility of this would be determined by detailed survey and design. Any design concepts should also be considered alongside ferry passenger management to ensure limited disruption to current services.

4.3 Examination of Project Level Alternative Options

Upon completion of strategic level studies to identify the options available, project level studies were undertaken. This section of the EIAR describes the project level evolution of the design of the proposed works required to achieve the objective of the Proposed Development. The key objective is to create a safer, more efficient and more attractive ferry service that links the Isle of Mull and the Isle of Iona, as outlined in the Argyll & Bute Council LDP.

4.3.1 Do Nothing Option

The overall objective is to provide improved access facilities at both Fionnphort and Iona for the ferry which operates between the two villages across the Sound of Iona. The Iona ferry route is operated by Caledonian MacBrayne (CalMac) Ferries Ltd with the Motor Vessel (MV) Loch Buie as the assigned vessel. The MV Loch Buie is 30.2m length overall, with a beam of 10m and a draught of 1.6m. The crossing time is typically 10 minutes with the lifeline ferry service providing for passengers and occasional vehicles transported between the islands of Mull and Iona.

The ferry holds its position at Iona using the weight of the ramp and the friction between the ramp and the slipway deck, however the slipway at Iona is currently very vulnerable to waves, particularly from the south, resulting in the ramp of the ferry rising and falling from the deck of the slipway. The instability of the ferry as a result of wave action presents a risk to both ferry operators, passengers, vehicles and other slipway users.

During storm events or periods of intense wave action, the risk associated with the current berthing practice means that the ferry is not able to operate. This means that ferry users are not able to access Iona, or in fact, may become trapped at Iona until the ferry is able to operate again. This presents issues such as lack of accommodation, with tourists having to sleep in their vehicles[6] and subsequent reputational issues, with tourists unlikely to revisit after having a poor experience.

The current berthing practice also has a negative impact on service provision to residents of Iona. These problems have had a direct impact on the lives of the people who live there. A day without a ferry operating results in essential services to the island being affected – medical, educational, refuse collection, business delivery etc.

In the 'Do Nothing' scenario, i.e., in the absence of the Proposed Development, ferry service provision will continue to be impacted by poor weather, presenting a continued health and safety risk to ferry operators, passengers, vehicles and other slipway users.

Tourists visiting the Isle of Iona will continue to be impacted by disturbances to the ferry operations which could potentially have negative consequences for future tourist numbers and consequently, the tourist economy of the island.

[6] BBC News Article 2021 - https://www.bbc.co.uk/news/articles/ce9n25zeyx1o

Residents of Iona will continue to be impacted by disturbances to the ferry operations, which will continue to impact on the delivery of essential services.

4.3.2 A New Pier Attached to the South Side of the Existing Slipway

A new pier could be built along the southern side of the slipway so as to cut off waves coming from the dominant south to south westerly wave direction. This structure, shown indicatively in red in Figure 4-1, would extend beyond the end of the existing slipway so as to shelter the ferry when it is loading and unloading at the slipway.

Figure 4-1 Indicative layout of pier at slipway

While this new pier would only have a small additional footprint on the seabed, and is in an area of the coast which is already impacted by the existing concrete slipway, the level of the crest of the new pier would have to be very high to prevent any wave overtopping during storms up to a 1 in 1 year return period event. Pedestrians waiting to board the ferry would be very vulnerable to any wave overtopping as they would be unable to see the waves coming and would thus be more susceptible to injury from overtopping waves. The net result of this is that the crest level of the pier would need to be excessive thus making the new structure very visually intrusive. Furthermore, during periods when waves approach the slipway from the north, the wave reflections from the northern side of the new pier would make conditions at the slipway considerably worse than they are at present.

As the tides in the Sound of Iona are relatively strong, any pier jutting out from the coastline will result in an accelerated flow around the end of the pier. If the pier is close to the slipway, then this would result in a significant navigational hazard as the ferry approaches or leaves the slipway. This results from the impact of the accelerated tidal flow around the end of the pier on the ferry as it enters or leaves the shelter of the pier; when half of the ferry will be in the accelerated tidal flow while the other half of the ferry will be sheltered. This will result in the ferry being slewed around by the accelerated tidal flow, which could lead to a serious accident.

Given the tidal and wave conditions at Iona, the construction of a pier attached to the existing slipway would present a very significant navigational hazard and thus is not a safe option for this site.

4.3.3 A Traditional Pier Located 50m to the South of the Existing Slipway

A traditional pier could be constructed some 50 metres to the south of the slipway as indicated in red in Figure 4-2 and the northern face of the pier would provide berthing for local boats and visiting yachts.

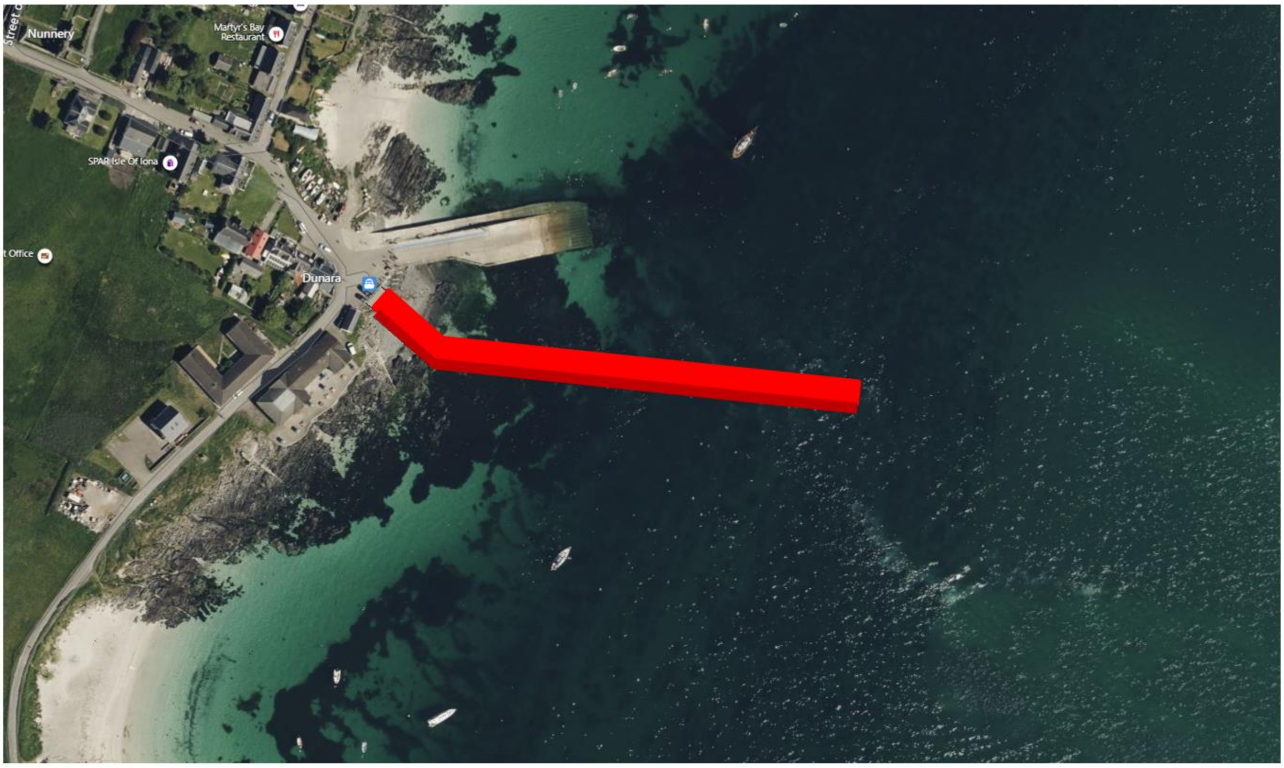

Figure 4-2 Traditional pier located 50m to the south of the slipway

The outer end of this pier would be at a sufficient distance from the slipway for the acceleration of the tidal currents around the end of the pier not to impose a navigational constraint when the ferry is approaching the slipway and this traditional, vertical faced, pier would have a relatively small footprint on the seabed. However, wave reflections from this structure would have an influence on the wave climate approaching Martyrs Bay during southerly storms and, in particular, on the slipway during times when waves approach from the northerly sector. Local scour from wave reflection along the face of the pier will also substantially increase the impact of the pier on the seabed and, unlike rubble mound breakwaters, the pier structure would not provide any additional habitat for marine life.

While this pier could provide extra berthing space for visiting boats during good weather, the crest wall on the southern side of the pier would need to have a very high crest level to prevent excess overtopping, being a danger to those using the pier in bad weather. This would make the pier very visibly intrusive.

The impact of wave reflection from this pier makes a vertical faced structure unsuitable for this site.

4.3.4 Rubble Mound Breakwater

The assessment of vertical faced piers/breakwaters indicated that these types of structure were unlikely to provide a feasible solution for this project and that the use of a rubble mound (rock armour) breakwater with its wave absorbing characteristics and increased habitat for marine life would be more suited to the environment at this site.

As previously mentioned, in a 2019 Feasibility Study by Byrne Looby (Byrne Looby, 2019), five different options for a rubble mound breakwater, as well as construction methodologies, were explored with regard to the Proposed Development. The five options are presented in this section as well as resources, materials and constructability information.

4.3.4.1 Byrne Looby – Option 1A

Option 1A comprises a breakwater development approximately 70m south of the existing slipway in Iona. The overall length of the breakwater crest is 140m. The breakwater comprises a rock armour structure with a proposed slope of 1 in 1.5. The function of the structure is primarily to provide defence from waves propagating from a southerly direction. This option was discounted as Option 1B provided greater wave reduction. Figure 4-3 shows an outline map of Option 1A.

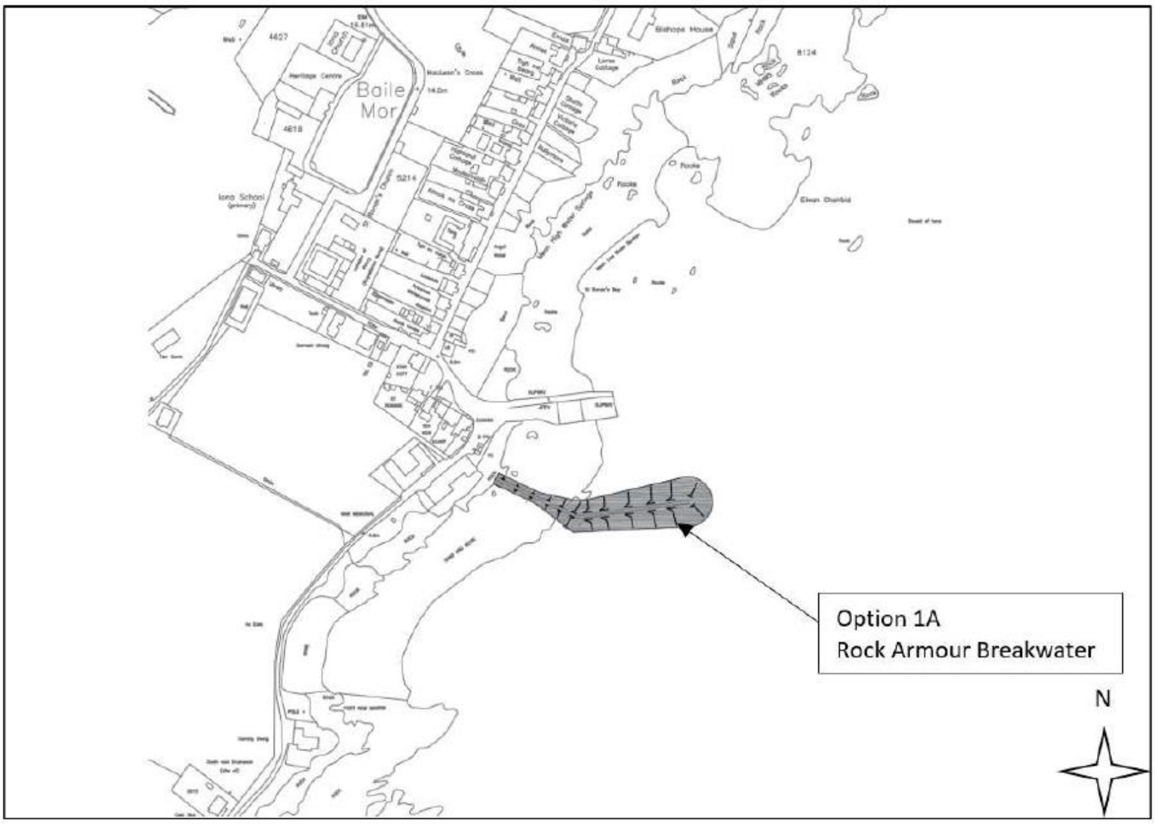

Figure 4-3 Option 1A

4.3.4.2 Byrne Looby – Option 1B

Option 1B comprises an extension of Option 1A and has an overall crest length of 177m. It is located approximately 70m south of the existing slipway in Iona. The breakwater comprises a rock armour structure with a proposed slope of 1 in 1.5. The function of the structure is primarily to provide defence from waves propagating from a southerly direction but is anticipated to provide greater protection than Option 1A and it also provides protection for future longer ferry vessels.

The structure is likely to have a negative impact on the typical track of the ferry; however, it is understood that the vessel operator will alter their course in a more northerly trajectory when approaching the slipway. It should be noted that this was selected as the preferred option. Figure 4-4 shows an outline map of option 1B.

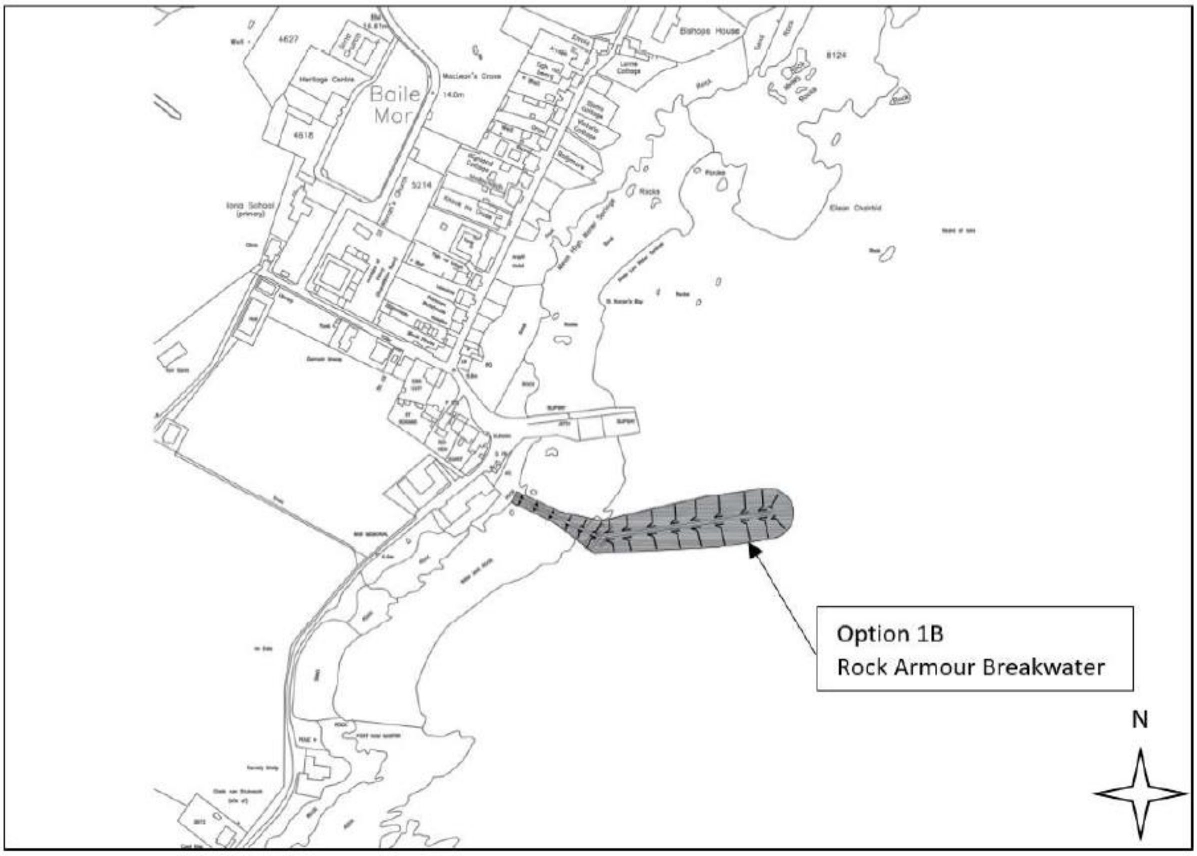

Figure 4-4 Option 1B

4.3.4.3 Byrne Looby – Option 2A

Option 2A comprises a breakwater with an approximate crest length of 140m located approximately 210m south of the slipway at Iona. The breakwater comprises a rock armour structure with a proposed slope of 1 in 1.5. The function of the structure is primarily to provide defence from waves propagating from a southerly direction. It extends from an existing natural rock outcrop which provides some natural protection to the slipway and comprises two legs; leg 1 extends approximately west to east, and leg 2 extends in an east-north-east direction. This option was discounted as Option 1B provided greater wave reduction. Figure 4-5 shows an outline map of Option 2A.

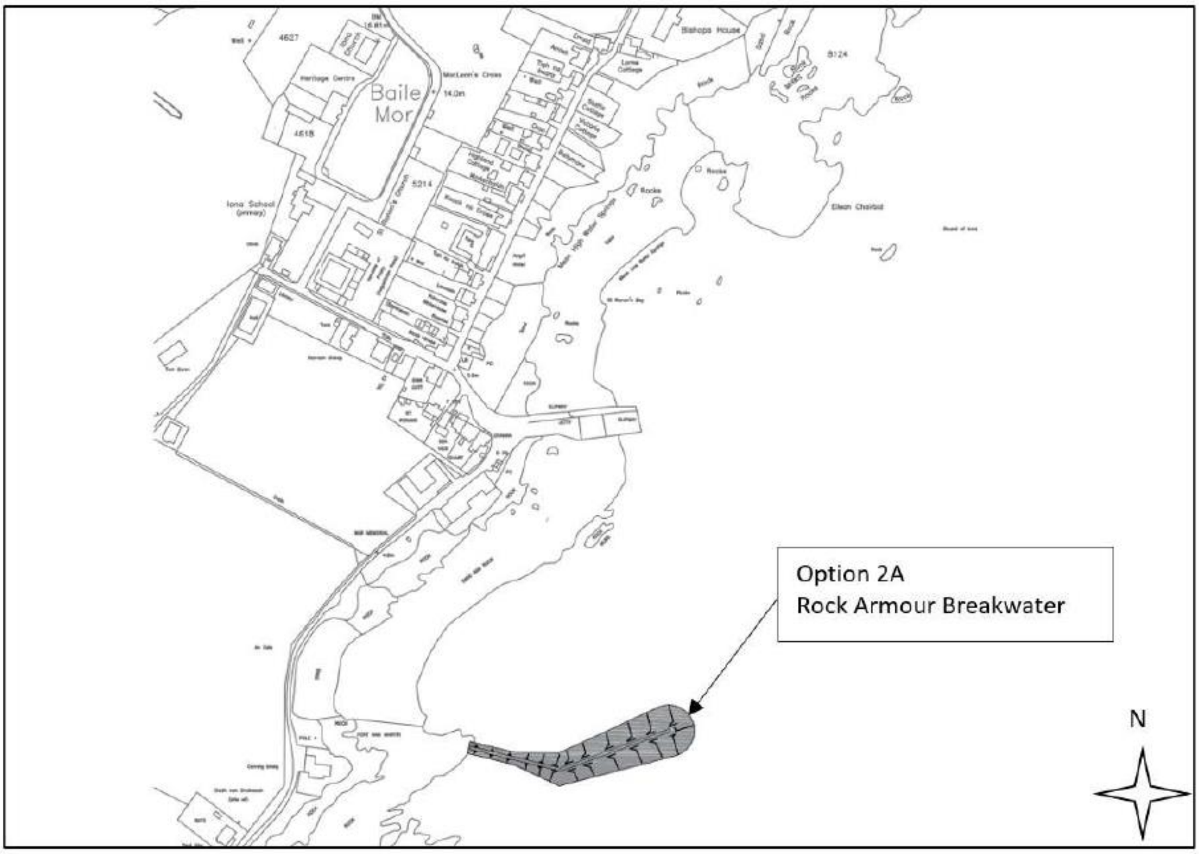

Figure 4-5 Option 2A

4.3.4.4 Byrne Looby – Option 2B

Option 2B comprises an extension of Option 2A and has an overall crest length of 235m. It comprises the first two legs of Option 2A, with a third leg extending in a north-easterly direction. The breakwater comprises a rock armour structure with a proposed slope of 1 in 1.5. The function of the structure is primarily to provide defence from waves propagating from a southerly direction but is anticipated to provide greater protection than Option 2A. This option was discounted due to high capital development costs. The option would also provide only marginal wave reduction. Figure 4-6 shows an outline map of Option 2B.

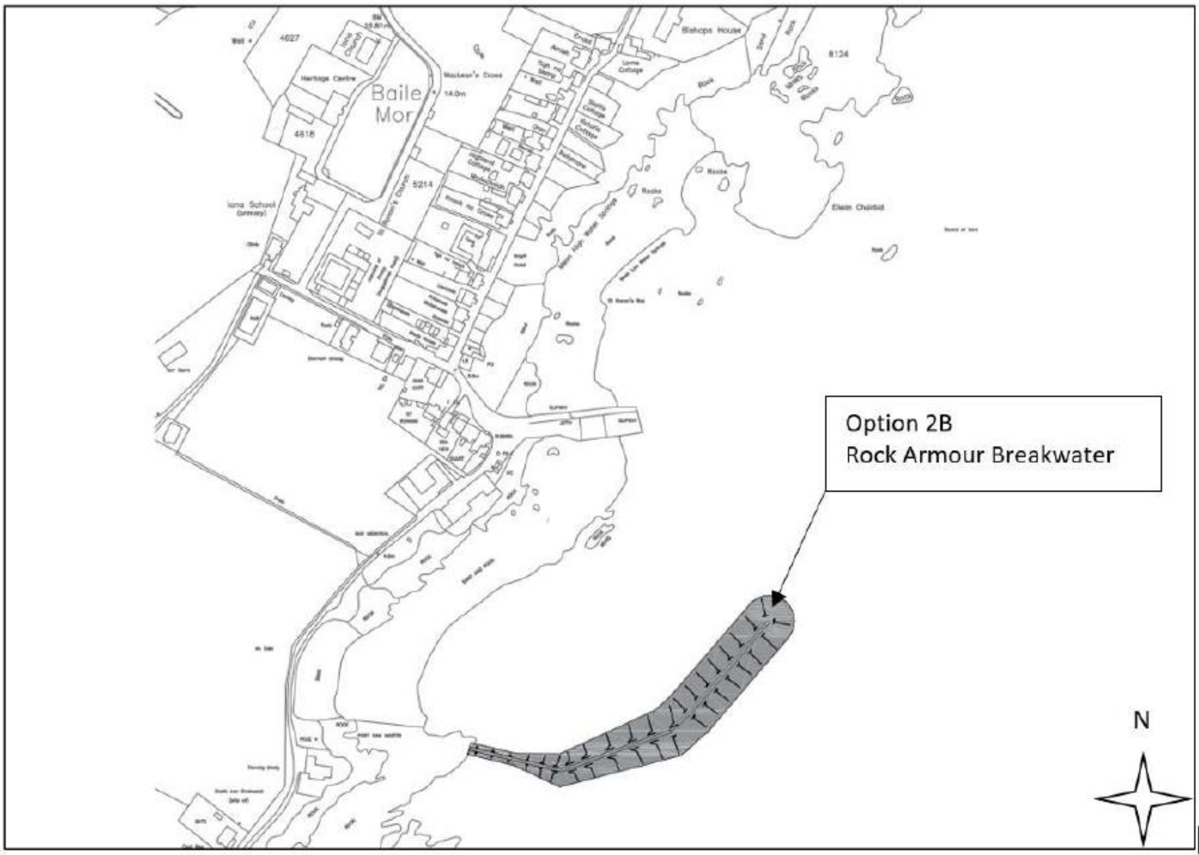

Figure 4-6 Option 2B

4.3.4.5 Byrne Looby – Option 3

Option 3 comprises Option 2B to the south with an additional breakwater to the north. The purpose of the northern breakwater is to provide additional protection from waves incident from the north. The northern breakwater comprises a rock armour structure with a crest length of 118m. The southern end of the north breakwater is approximately 170m from the slipway. This option was discounted due to high capital development costs. There was also strong local opposition due to the proximity of the option to Iona Abbey. Figure 4-7 shows an outline map of option 3.

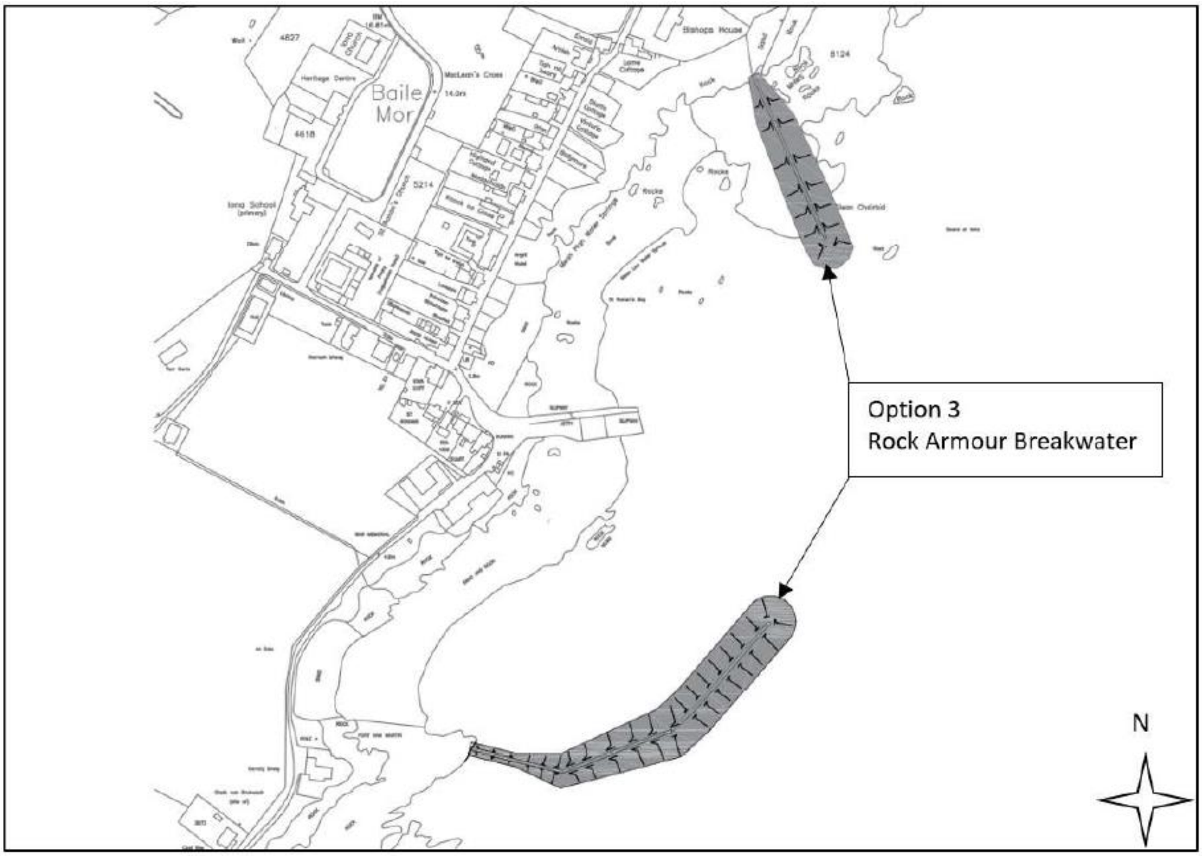

Figure 4-7 Option 3

The 2019 Byrne Looby Feasibility Report identified that the existing marine infrastructure between Fionnphort and Iona is in urgent need of investment. The primary investment required is the installation of coastal protection structures in order to reduce wave heights and reduce safety risks to passengers and operators. Option 1B was selected by Byrne Looby as the preferred option at Iona. This layout was generally accepted by the stakeholders, provides a good degree of protection to the slipway and is a medium cost solution. It is noted however that this structure will not provide protection from waves incident from the north or east. The estimated cost of this development at the time of writing was £9.9m.

4.4 Summary of Consideration of Alternative Options

At a strategic level, the Argyll & Bute LDP provides a number of key connectivity and infrastructure improvement goals that the council aims to achieve by 2024. The LDP is a key document, and all development of harbour and port infrastructure should be carried out in such a way that these goals can be realised.

Building on the themes laid out in the LDP, the Sound of Iona Piers Development Framework and the Master Plan identified that development of a breakwater, pier extension or pier repair was vital to the improvement of transport links between Mull and Iona.

While the Sound of Iona Piers Development Framework and Master Plan did not outline a preferred option moving forward, it did bring a number of different avenues to the attention of the SoIHC and provided a more detailed outline of ways to improve the infrastructure in the Sound of Iona, building upon the goals of the LDP.

The Proposed Development is therefore concluded to be an essential step in building upon the foundations laid down in the LDP and developing some of the options presented in the Sound of Iona Piers Development Framework and Master Plan in more detail.

At design level, there were a number of different options considered for a return period of 1 year, which led to the adoption of a rubble mound breakwater as the optimum type of structure for the site at Iona. The 2019 Byrne Looby Feasibility Study examined the location for a suitable rubble mound structure and, after analysis of costs, constructability, hydrodynamic modelling, surveys and consultation responses, Option 1B was selected as the preferred option. The preferred option identified by Byrne Looby was then taken forward and adapted by Argyll & Bute Council. As such, in 2020, Argyll & Bute Council commissioned JBA Consulting to undertake a morphodynamic modelling assessment to investigate the impact of the proposed new berthing facilities on sedimentation at Iona and to assess how the new berthing facilities would impact the morphodynamics in the Sound of Iona and determine areas where significant sedimentation or erosion would occur.

In 2021, Argyll & Bute Council appointed RPS to undertake an expert review of all works carried out to date. This included the requirement for more detailed information relating to crest levels and overtopping, toe design and the interaction with tidal, flow or sediment transport regimes within the Sound. As such, Argyll & Bute Council, aided by RPS, have refined the preferred option on the basis of findings from coastal process hydrodynamic modelling, as presented in Chapter 3. In particular, detailed Computation Fluid Dynamic (CFD) breakwater overtopping modelling was undertaken to refine the breakwater cross section and crest levels to reduce the height of the breakwater, to reduce the visual impact of the proposed structure while ensuring that it remains effective.

5 PROJECT SCOPING & CONSULTATION

5.1 Introduction

The Proposed Development has been brought forward for development based on the objectives of the Argyll & Bute LDP, the Sound of Iona Piers Development Framework and Master Plan, and the preferred option has built upon the Byrne Looby Feasibility Study. The process of early consultation has enabled Argyll & Bute Council to solicit opinions on general development options for the Iona Breakwater and facilitated differing perspectives to be taken into account in the initial stages of the project.

The Environmental Impact Assessment (EIA) Directive provides for a mandatory scoping process. Scoping for the Proposed Development was undertaken in accordance with the European Commission's 2017 "Environmental Impact Assessment of Projects Guidance on Scoping", which states:

> "*It is good practice to carry out Scoping even if it is not required by legislation: Developers should endeavour to include a Scoping stage in their work programme for EIA, so that all of the concerns can be identified and addressed during the Scoping stage*."

The purpose of the EIAR scoping process is to identify the issues which are likely to be important during the environmental impact assessment and to eliminate those that are not relevant. The scoping process identifies the sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected. It defines the appropriate level of detail for the information to be provided in the EIAR. The primary focus of scoping is to define the most appropriate assessment of significant effects related to the Proposed Development.

In relation to consultation, the EIA Directive, implementing legislation and guidance documentation make clear that there are specific requirements regarding the use of the EIAR, both as a tool to inform concerned stakeholders and the public, as well as to make decisions regarding development consent for projects. Accordingly, this EIAR provides evidence of effective consultations which have already taken place and provides the basis for effective consultations to come.

Consultation with statutory and non-statutory bodies has been undertaken from the project inception by Argyll & Bute Council in order to ensure the considerations of local stakeholders and community groups are taken on board throughout the design process.

Argyll & Bute Council undertook all public consultations to ensure the considerations of local stakeholders and community groups are taken on board throughout the design process.

5.2 Scoping

5.2.1 Scoping Approach

An EIA Screening Opinion on the Iona Breakwater Project was issued from Marine Scotland Licensing Operations Team (MSLOT) in February 2021. The Opinion determined that the Proposed Development falls under paragraph 10(m) of Schedule 2 of The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) ("the 2017 MW Regulations"), and as such an Environmental Impact Assessment must be carried out in support of the Marine Licence Application.

An EIA Scoping Report, developed by RPS, was submitted to MSLOT in August 2021, accompanying a request for a Scoping Opinion. A subsequent EIA Scoping Opinion was received from MSLOT in May 2022. The Scoping Opinion was adopted by the Scottish Ministers, under regulation 14 of the EIA Regulations and forms the basis of the EIAR.

5.2.2 Scoping Responses

Upon completion of the EIA Scoping Report, it was sent to MSLOT who then distributed it to a variety of statutory consultees for a Scoping Opinion. The bodies that the report was sent to were:

- Marine Scotland Science (MSS);
- Historic Environment Scotland (HES);
- Iona Community Council (ICC);
- Maritime & Coastguard Agency (MCA);
- Ministry of Defence (MoD);
- Northern Lighthouse Board (NLB);
- Scottish Environmental Protection Agency (SEPA);
- Scottish Water (SW);
- Transport Scotland;
- NatureScot (NS);
- National Trust for Scotland (NTS); and
- Whale and Dolphin Conservation (WDC).

Each of the listed bodies provided a scoping response to MSLOT, outlined whether they agreed or disagreed with the scoping in or out of the various chapters, and provided any feedback to help improve each of the chapters. Responses from each of the listed consultees were provided to Marine Scotland and aided in the formation of their Scoping Opinion.

The scoping process/report identified the issues that are likely to be important to consider in the environmental impact assessment of the Proposed Development. The scoping process identified the sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected, and defined the appropriate level of detail for the information to be provided in the EIAR. Certain environmental topics were scoped out as part of this formal scoping process. The topics proposed to be scoped out at the scoping stage and the reasoning for this are set out in Table 5-1.

Table 5-1 Topics scoped out during the scoping process

Topic	Reasons for scoping topic out
LAND, SOILS, GEOLOGY & HYDROGEOLOGY	
Land	The Proposed Development will not result in land take during construction. Site welfare facilities and site compound are expected to be established on a barge, as the works will all be undertaken from a barge, however there will likely be a small compound on shore which could be established at the car park adjacent to the pier (occupying maximum 2 spaces). The potential impact on land during construction is considered to be negligible. The Proposed Development will not result in land take during operation. The overall footprint of the breakwater is approximately 7,000m^2. The future land uses within the footprint of the Proposed Development will not significantly change. The potential impact on land during operation is considered to be minimal.
Soils	As shown in the results of the sediment analysis, the sediment chemistry results show very low levels of contamination. The sediments in the vicinity of the Iona dredge area were below the Marine Scotland Revised Action Levels (AL1 and AL2). The potential impact from the mobilisation of any contaminated suspended sediment during dredging operations is considered to be negligible but will be considered fully within the Coastal Processes chapter and Water quality chapter. The Proposed Development consists of the construction of a breakwater and/or changes in the configuration of the seabed bathymetry through localised capital dredging works. These elements have the potential to impact on the mobility of the sand waves within the Sound of Iona during the operational phase of the project. The potential impacts of the Proposed Development will be assessed in the Coastal Processes section of the EIAR.
Geology	The Proposed Development is not located within any sites of geological significance, and there are no faults or outcrops mapped in the vicinity of the site, therefore it is unlikely that the Proposed Development will have any significant effects on geology. The potential impact on Geology during construction is considered to be negligible.
Hydrogeology	Given that no significant sources of contamination were identified during previous ground investigations, the potential impact on Hydrogeology during construction is considered to be negligible. Impacts to hydrogeology will be assessed within the Water Quality chapter.

Topic	Reasons for scoping topic out
AIR QUALITY AND CLIMATE CHANGE	
Air Quality and Climate Change	All dredged material will inherently have high moisture content and hence a lower risk of dust impact. The dredging operations are considered very low risk for dust impacts given that this material will have very high moisture content (circa 50% by weight). This is also the case for the transport of this material. As such, these operations are considered to have negligible dust impacts. With regards to potential impacts from emissions to the atmosphere from construction plant and marine vessels during dredging and material handling, all dredging and construction material handling will be undertaken within the marine environment with limited requirement for road traffic. All construction material will be brought to site via barge and as such, there will be no perceptible traffic impact on the national road network and hence the potential for impacts from emissions on air quality from road transport are considered negligible. The Scottish Ministers are mindful that Greenhouse Gas (GHG) emissions from all projects contribute to climate change. As such, the Scottish Ministers have requested that climate change must be considered within a GHG Assessment which should be based on a Life Cycle Assessment (LCA) approach, at the pre-construction, construction, operation and decommissioning phases. This assessment is included within Chapter 18 of this EIAR.
MATERIAL ASSETS	
Material Assets	Material Assets are considered under two categories: built assets and natural assets. Built assets include transport, energy, services infrastructure, settlement and commercial land, port / harbour infrastructure, community resources and the historic environment. Natural assets include forestry, open space, minerals, water resources and watercourses. Given the nature of the Proposed Development, in this case, Material Assets considered are those below the MHWS. Existing utilities infrastructure are anticipated to be unaffected by the Proposed Development. Good consultation with the utilities companies is recommended to identify exact locations of services in order that these can be considered as necessary at the detailed design stage. The Proposed Development will be an improvement of the existing Iona facilities which will facilitate ongoing use of the port by ferry, fishing, commercial and leisure craft. Whilst the Proposed Development will not result in a direct increase in port usage (through for example the introduction of new services i.e., a new ferry route), the continuation of the existing services with greater reliability and safety, will result in a positive impact in terms of connectivity, port related services, tourism offer and ongoing provision of services to the local population.
TRAFFIC AND TRANSPORTATION	
Traffic and Transportation	Potential effects on Traffic and Transportation associated with the Proposed Development are predicted to be limited. Construction related traffic can often be the cause of significant impacts due to an increase in the volume and the type of traffic (e.g., HGVs, heavy plant and machinery). However, materials will be transported to site and installed via a barge, with project related traffic volumes, using the local network, anticipated to be minimal.

Topic	Reasons for scoping topic out
WASTE	
Waste	Construction of the new rock armour breakwater will use clean quarried stone and dredge material will be disposed of at a licenced offshore sea disposal site. The Scottish Ministers disagreed with the Scoping Report decision to scope out Waste from the EIAR. The Scottish Ministers advised that Waste must be scoped in for further assessment and a qualitative assessment of waste must be completed. This assessment is included within Chapter 17 of this EIAR.

The Scoping Opinion also provided comments regarding the contents and detail to be included in the EIAR. From these, RPS set out the actions required to ensure that the Scoping Opinion would be fully considered in the EIAR, as shown in Table 5-2.

Table 5-2 Summary of comments and actions required from Marine Scotland Scoping Opinion

Chapter Title	Comment	Action Required
General Comments	A Best Practical Environmental Option (BPEO) statement must be prepared in relation to the deposit of dredge material and a separate marine licence to deposit this material will be required	Feedback passed on to chapter author(s)/ the Applicant
	The impacts of dredging activities on other users (apart from ferry operator) need to be considered (e.g., local residents, tour boat operators etc.)	
	More detail is required relating to rock armour installation (i.e., use of a diving team).	
	Detailed charts of distances of breakwater from key infrastructure is required	
	EIAR should include consideration of the impacts of vessel movements on relevant receptors during construction of the breakwater	
	If details of the Proposed Works cannot be defined precisely, then a Design Envelope approach should be adopted	
	EIAR must include an up to date consideration of the reasonable alternatives studied	
	The likely efficacy of mitigation proposed should be explained with reference to residual effects. The EIAR must identify and describe any proposed monitoring of significant effects and how the results of such monitoring would be utilised to inform any necessary remedial actions. The EIAR should demonstrate the use of the mitigation hierarchy. The EIAR must include a table of mitigation which corresponds with the mitigation identified and discussed within the various EIA chapters.	
	Navigation & Safety and Risk of Major Accidents and/or Disasters must be addressed as two separate chapters in the EIAR	
	Greenhouse gas emissions from all projects contribute to climate change, therefore Scottish Ministers highlight the need for climate change to be assessed in the EIAR. IEMA guidance should be used to develop this GHG assessment	
Navigation & Safety	The Scottish Ministers agree with scoping and advise that the Applicant must assess the impacts to recreational vessels and sea kayakers with full consideration of points raised by the Argyll & Bute Council. For the avoidance of doubt this includes, but is not limited to, an assessment of the impact of the Proposed Development on sea kayaking in the area and the safety implications of this, the impact of the height of the structure on water level crafts, and the impact on navigation and/or anchorage of recreational vessels.	Feedback passed on to chapter author(s)/ the Applicant
Terrestrial Biodiversity	The Scottish Ministers note that ornithology has been included within Section 3.2 of the Scoping Report, however, advise that its inclusion within the section titled ‘Marine Biodiversity’ would be more appropriate.	Specialist authors have decided that it would be more pragmatic to have a

Chapter Title	Comment	Action Required
		standalone Ornithology chapter
	The Scottish Ministers highlight acknowledgement from NS confirming that the Applicant has been in contact regarding methodologies and species / habitat locations and further advise the Applicant to engage with NS to ensure appropriate surveys are undertaken.	Feedback passed on to chapter author(s)/ the Applicant
	Applicant must make use of the National Biodiversity Network Atlas NBN Atlas in establishing <Re baselines. Additionally, the Scottish Ministers direct the Applicant to representation from ICC and advise that the Applicant must consult with the Ross of Mull Ranger to inform the EIA Report.	
	The Scottish Ministers agree with the representation from ABC and advise that species management plans, ecological surveys and a construction environmental management plan must form part of the wider assessment.	
	The Scottish Ministers agree with the Applicant and consultees and advise that terrestrial biodiversity is scoped in for further assessment in the EIA Report for the construction and operational phases.	
Marine Biodiversity	Benthic ecology – no issues, agree with scoping	N/A
	Marine fish ecology – generally agree with scoping however, Scottish Ministers advise that information should be provided on fish spawning and nursery periods to be considered alongside construction programme timeline. Also, must assess the effects of increased suspended sediment concentrations and sediment deposition on marine fish and shellfish (including eggs and larvae). Applicant also must consider marine fish species within the underwater noise propagation modelling with consideration of timing of noisy construction activities relative to fish spawning periods.	Feedback passed on to chapter author(s)/ the Applicant
	Diadromous fish – Scottish Ministers consider that there is a lack of detail and consideration given in Scoping Report. Recommend engaging with Argyll Fisheries Trust	
	Marine mammals – Scottish Ministers advise that disturbance from the physical presence of vessels must be scoped in. Also advise that the impact through changes in prey distribution and abundance during construction and operation be scoped in. Impacts to marine mammals may be through other pathways, not just noise and these should be assessed for the construction phase. Need to include assessments on effects on harbour porpoise, minke whale and <Redacted> Recommend that applicant engages with MSS for further advice on suitable underwater noise propagation modelling.	
	Marine ornithology – needs to be moved into the Marine Biodiversity chapter. Vessel activity (other than noise) should also be considered. Scottish Ministers do not consider the list of species likely to be impacted as exhaustive and therefore more species must be considered. Foraging ranges for seabird species exceed 30km, therefore designated sites further away must be considered. Scoping Report does not make it clear if Through the Tide Counts are restricted to the traditional	Ornithology now included as a standalone chapter

Chapter Title	Comment	Action Required
	species included in Wetland Bird Surveys or will include all marine bird species present during observations. A small number of breeding bird surveys must be conducted to assess the impact of construction works during the breeding period and used to identify if any mitigation is required. Scottish ministers direct the applicant to advice from MSS and encourage engagement to ensure mitigation measures are appropriate. Marine ornithology should be scoped in for further assessment for both the construction and operational phases.	
Land Soils, Geology & Hydrogeology	Agree with scoping conclusion and no major issues.	N/A
Water Quality	The Scottish Ministers acknowledge the Applicant's commitment to consider the WFD and direct the Applicant to representation from SEPA which provides further information and guidance on how to meet the requirements of the WFD and what should be considered in the assessment. The Scottish Ministers advise that the Applicant must address this advice from SEPA, including advice that relates to the site layout.	Feedback passed on to chapter author(s)/ the Applicant
	The Scottish Ministers advise the Applicant to refer to SEPA's Pollution Prevention guidelines and other guidance produced by the Construction Industry Research and Information Association ("CIRIA"). The draft Schedule of Mitigation must be included in the oCEMP.	
	Scottish Ministers direct the Applicant to representation from SW regarding surface water and advise the Applicant to consider this advice and contact SW directly if necessary.	
Flood Risk	Agree with scoping. No major issues. Scottish ministers direct the applicant to SEPA guidance.	N/A
Air Quality & Climate Change	Need to consider climate change (this was scoped out)	GHG Assessment now included as a standalone chapter
	Air quality can be scoped out on the basis that material is not brought in via the road network.	
	Dust and emissions management plan should be included in the oCEMP	
Terrestrial Noise & Vibration	Agree with scoping, no major issues	N/A
Coastal Processes	Representation from ABC states that assessment of whether the design of the structure could influence wave refraction, tidal velocity or current direction in the sound must be undertaken, and MSS advise that hydrodynamic and sediment transport conditions, including waves and tidal currents in the Sound and suspended sediment transport, must be considered to support calibration validation. Additionally, aspects of tidal scouring and changes in tidal stream velocities (and turbulence) must be explored in more detail in the EIA Report	Feedback passed on to chapter author(s)/ the Applicant

Chapter Title	Comment	Action Required
	The Scottish Ministers highlight advice from MSS supporting these simulations and advise that a 1:100 year storm event must be included as a worst case scenario. Further, the Scottish Ministers advise that cumulative effects with the works at Fionnphort also need to be considered, so a combined modelling study must be undertaken. The Scottish Ministers highlight representation from ICC regarding the lack of detail surrounding mitigation measures for coastal processes provided in the Scoping Report and encourage the Applicant to engage with ICC whilst determining appropriate mitigation measures.	
	The coastal processes section must also include an assessment of the Proposed Works on the mobility of sand waves within the Sound of Iona	
Material Assets	Agree to scope out, however topics considered under other chapters (Navigation and Safety, Landscape and Visual, Population and Human Health).	N/A
Traffic and Transport	Agree to scope out as material will be transported via barge.	N/A
Cultural Heritage	Overall agree the need to scope in chapter	Feedback passed on to chapter author(s)/ the Applicant
	The Scottish Ministers highlight representation from ICC regarding the lack of clarity on the methodology of the Proposed Works or any proposed mitigation relating to cultural heritage aspects	
	The Scottish Ministers agree with the views of ICC and advise that the Applicant must consult with the local community with regards to both the methodology and mitigation measures to ensure the value and importance of cultural heritage is considered appropriately.	
Landscape & Visual	Concerns raised regarding the potential impacts on the surrounding area due to the high importance of Iona's cultural and natural heritage	Feedback passed on to chapter author(s)/ the Applicant
	Lack of clarity in the Scoping Report on what is being assessed under Landscape and Visual Assessment	
	Must consider the whole island in the Landscape Character Assessment	
	Must include mitigation that enhances the design and ensures the Proposed Works are an attractive feature	
	Evaluation of any potential cumulative visual impacts and navigational lighting and markings, including night time impacts must be included in the Landscape Character Assessment and Visual Impact Assessment	
	Issues with viewpoints selected as they are not considered to be representative of the area, are out of date and incorrectly labelled. Further viewpoints should be considered in the assessments (2 additional viewpoints recommended by NTS)	
	Advise applicant to engage with ICC regarding the inclusion of further appropriate visualisations.	

Chapter Title	Comment	Action Required
	Applicant must engage with ICC and HES to discuss mitigation of impacts.	
Population & Human Health	The scoping contains limited consideration for the socio-economic impact of the Proposed Works. This should be considered in its own chapter of the EIAR.	Feedback passed on to chapter author(s)/ the Applicant
	Consideration of potential benefits of the Proposed Works should also be included.	
	Particular attention should be directed towards consideration of other sea users who may be pushed into more dangerous waters due to the Proposed Works (Sail boats and kayaks)	
	Consider the impact of noise on other users	
Waste	The Scottish Ministers disagree with the Applicants proposal that waste can be scoped out of the EIA Report. The Scottish Ministers advise that waste must be scoped in for further assessment within the EIA Report and a qualitative assessment on the effects of waste must be completed.	Waste chapter now scoped in
	This assessment should be comprehensive enough to allow an understanding of the potential impacts of waste during the construction and operational phases of the Proposed Works.	
Cumulative Effects	The Scottish Ministers advise that cumulative effects do not necessarily require a standalone chapter in the EIA Report, but cumulative impacts must be considered in relation to each of the chapters scoped in above. The Scottish Ministers also advise the Applicant to consider representation from Argyll & Bute Council, ICC, MCC, SoIHC, SEPA, and advice from MSS when assessing cumulative effects	Feedback passed on to chapter author(s)/ the Applicant
Socio-Economic	The review of Population and Human Health contains limited consideration of the socio-economic impact of the Proposed Development.	Feedback passed on to chapter author(s)/ the Applicant. Information on the socio-economics of the Proposed Development has been previously undertaken and the information is included within Appendix 2.1.
	Consider a broader range of socio-economic impacts through a Socio-Economic Impact Assessment (SEIA)	
	Consideration must be given to whether the Proposed Works may displace fishing activity or restrict access to the harbour. Engagement with the local fishing community is important in this regard.	
	There is a lack of context concerning communities in the Scoping Report. The EIAR must include context about the communities as well as baseline information about the current level of disruption as per MAU advice. The MAU recommend further assessment of economic opportunities as a result of the Proposed Works.	
	Must include details on how the Proposed Works might cause disruption to the lifeline ferry during the construction phase and details of how this will be mitigated	

Following the receipt of this feedback, RPS shared the MSLOT Scoping Opinion with each of the chapter lead authors to ensure all feedback was incorporated into the EIAR. The Scoping Opinion was also shared with the Applicant (Argyll & Bute Council) to ensure that all feedback was considered within the design of the Proposed Development.

The main changes to the structure of the EIAR were:

- The scoping in of a Greenhouse Gas Assessment chapter and Waste chapter;
- The development of a standalone Ornithology chapter; and
- The inclusion of a separate Risk of Major Accidents & Disasters chapter (in addition to Navigation & Safety).

6 NAVIGATION & SAFETY

6.1 Introduction

This chapter of the EIAR describes the likely significant impacts to Navigation from both the construction and the operation of the Proposed Development, plus the wider effects of vessel traffic transiting to locations outside of the immediate area of study.

The result of this assessment is based on the assumption that the Proposed Development will not lead to any substantial increase in vessel traffic. The breakwater will be located outside an established Statutory Harbour Authority (SHA) and therefore the competent authority with respect to marine safety is the Maritime and Coastguard Agency (MCA).

6.2 Assessment Methodology

6.2.1 Relevant Guidance

When assessing the effects of the Proposed Development on navigation and marine safety, the following guidance documents have been used in the preparation of the EIAR chapter and Navigational Risk Assessment (NRA) (see Volume III, Appendix 6.1):

- The Department for Transport's (DfT) 'Port Marine Safety Code', (DfT, 2016); and
- The DfT, 'A Guide to Good Practice on Port Marine Operations', (DfT, 2018).

The following documents provide additional considerations and supplementary information that, when applicable, have been used within the NRA process:

- International Maritime Organization (IMO) Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule making process (IMO, 2018);
- Marine Guidance Note (MGN 654) Offshore Renewable Energy Installations (OREI) safety response. Incorporating: Annex 1 Methodology for assessing marine navigational safety and emergency response risks of OREIs. Maritime and Coastguard Agency (MCA, 2021a);
- Marine safety guidance and advice from the MCA as the competent authority for marine safety, Argyll and Bute Council as the marine facility owner and CalMac Ferries Limited as the ferry route operator; and
- Argyll and Bute Council's Marine Safety Management System (A&BC, 2020).

6.2.2 Study Area

The study area for the navigation assessment comprises the marine works within the Sound of Iona, plus the route that the dredger and disposal craft will take between the dredge site at Iona and the proposed disposal site, see Figure 6-1.

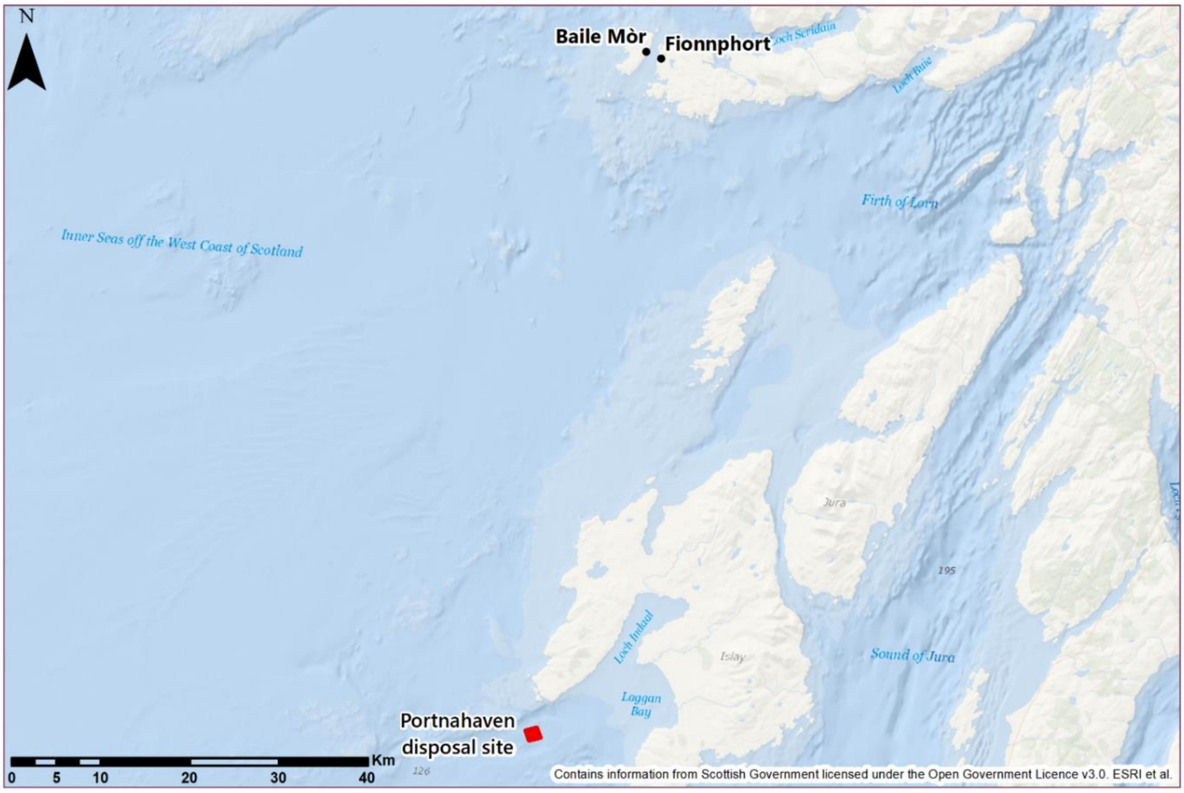

Figure 6-1 Study Area

6.2.3 Baseline Scenario

In order to assess the impact of the Proposed Development on navigation and shipping within the study area (and the routes work vessels take), a full NRA has been conducted (see Volume II, Appendix 6.1). Listed below are the analysis methods and data that this assessment is based on:

- An evaluation of legislation and guidance concerning the area.
- An analysis of the navigational environment: Aids to Navigation, tidal flows, wind, waves and emergency response capabilities.
- Marine traffic analysis using Automatic Identification System (AIS) from 01 November 2021 to 31 October 2022. This data includes both AIS-A and AIS-B and is sourced from a commercial provider by ABPmer to create a geodatabase of vessel transits.
- A review of marine incidents using data recorded by the Marine Accident Investigation Branch (MAIB) and the Royal Nautical Lifeboat Institute (RNLI).
- A Hazard Identification Workshop with key stakeholders providing stakeholder consultation to inform the risk assessments produced as part of the NRA.

6.2.4 Consultation

Consultation with marine stakeholders took place in the form of a Hazard Identification Workshop on 9th September 2021. Table 6-1 lists the organisations and stakeholders that attended this workshop.

Additional invitees that were unable to attend the workshop included individual local fishermen, the Scottish Canoe Association, the Royal Yachting Association (RYA) and the RNLI.

Table 6-1 Attendees at the Hazard Identification Workshop

Attendee	Organisation
Scott Reid	Argyll & Bute Council
Elsa Simoes	Argyll & Bute Council
Jamie Salmon	Argyll & Bute Council
James Hamilton	RPS
Helen Croxson	Maritime & Coastguard Agecy (MCA)
Sam Chudley	MCA
Peter Douglas	Northern Lighthouse Board (NLB)
David McHardie	Caledonian Maritime Assets Ltd
Alastair Mackie	Fionnphort Fishing Vessel Owner
Mark Jardine	Iona Tour Boat

6.2.5 Assessment Criteria and Assessment of Significance

When a receptor is exposed to an impact, the overall sensitivity of the receptor to that impact needs to be considered. This process incorporates a degree of subjectivity. The sensitivity assessments for shipping and navigation receptors have applied expert opinion and have had regard to the following:

- Outputs of the NRA (Volume III, Appendix 6.1);
- Number of transits of specific vessels and/or vessel type; and
- Level of risk established through assessment of the accident-incident rate.

For the purposes of assessing the impact on shipping and navigation receptors, the level of sensitivity covers a range from neutral to very high. The greater the safety impact and/or the lower the ability for the receptor to adapt to the impact, the greater the level of sensitivity. A safety impact is classified as any impact that may influence the navigational safety of the shipping and navigation receptor.

Table 6-2 presents the definitions of sensitivity that have been applied in the assessment.

Table 6-2 Definition of Receptor Sensitivity

Sensitivity	Example Descriptor
Very High	Very high level of safety impact for vessels and navigation receptors. Very limited ability to adapt to impact.
High	High level of safety impact for shipping and navigation receptors. Limited ability to adapt.
Medium	Medium level of safety impact for shipping and navigation receptors. Some ability to adapt.
Low	Low level of safety impact for shipping and navigation receptors. Ability to adapt to majority of impact.
Negligible	Negligible level of safety impact for shipping and navigation receptors. Ability to adapt to all of impact.
Neutral	No impact for shipping and navigation receptors.

Once the sensitivity of the receptor has been defined, an assessment is undertaken of the magnitude of the impact as defined by its geographical extent, frequency of occurrence and duration. Determining the overall magnitude of shipping and navigation impacts also incorporates a degree of subjectivity as decisions are based on expert opinion in combination with baseline data and information from the Study Area.

Table 6-3 presents the definitions of impact magnitude that have been applied in this assessment.

Table 6-3 Definitions of Impact Magnitude

Magnitude	Example Descriptor
High	Impact geographical area beyond the extent of the study area. Impact present on a permanent basis throughout the operation of the Marine works/Operational area. Incidents very likely, monthly accidents.
Medium	Impact localised to geographical extent of the study area. Impact present on a permanent basis throughout the operation of the Marine works/ Operational area. Incidents are likely, may occur annually.
Low	Impact localised to geographical extent of Marine Works/Operational area. Impact present on a temporary basis. Impacts relatively infrequently.
Neutral	No impact on vessels or navigational receptors.
Positive	Navigation receptors benefit as a result of the impact.

6.2.6 Significance of Effects

The outcomes of the assessment of the sensitivity of the receptor and the magnitude of the potential impact are applied to a matrix to define the significance of the resulting effect. Any impact that is deemed to be moderate or greater is considered significant.

Table 6-4 presents the matrix that has been used to define the significance of effects in this assessment.

Table 6-4 Significance of effect matrix

Sensitivity	Magnitude of Impact				
	Positive	**Neutral**	**Low**	**Medium**	**High**
Neutral	No effect	No effect	No effect	No effect	No effect
Negligible	Negligible	No effect	Negligible to minor adverse	Negligible to minor adverse	Minor adverse
Low	Minor beneficial	No effect	Negligible to minor adverse	Negligible to minor adverse	Minor adverse
Medium	Moderate beneficial	No effect	Negligible to minor adverse	Minor adverse	Moderate adverse
High	Major to minor beneficial	No effect	Minor adverse	Minor to moderate adverse	Moderate to major adverse
Very high	Major to minor beneficial	No effect	Minor to moderate adverse	Moderate to major adverse	Major to substantial adverse

6.3 Baseline Scenario

The Sound of Iona separates the islands of Mull and Iona. It is approximately 0.7 nm wide at the ferry crossing point. The Sound is approximately four nautical miles (nm) long, with the island of Erraid at the southern end, as well as a number of smaller islands and skerries including Eilean nam Bàn, Eilean Dubh na Ciste and Eilean Ghòmhain. The Sound of Iona provides sheltered waters but can be exposed to south-westerly winds and swell from the south.

Baile Mòr on the Isle of Iona is the location of the Iona slipway and pier used by the Iona Ferry. Fionnphort is the Mull terminal for the Iona Ferry. Both ports have a slipway providing passenger and vehicle access to the ferry, plus a pier which is used by local fishing vessels, recreational and privately-owned craft. The marine access facilities at Baile Mòr slipway are owned by Argyll & Bute Council. However, the area does not form part of a Statutory Harbour Authority. This means the MCA, which is an executive agency of the DfT has the responsibility to ensure that the area is competently managed. The Iona to Fionnphort ferry is operated by CalMac Ferries Ltd who provide the safety and management processes for all aspects of the shipboard operations including berthing.

The maximum tidal flow occurs during a spring tide ebb flow and is over 2.0 knots (1.04 m/s) just north of the midpoint between Iona and Fionnphort. The area is particularly exposed to winds from the south, south-west and west of the site, the strongest of these are greater than 16 m/s. These winds would correspond to a maximum wave height of 3.0 m on the transect line between Baile Mòr and Fionnphort, and 5.0 m at the southern end of the Sound.

Vessel traffic within the Sound of Iona can be characterised into two groups. The first is the ferry traffic which navigates between Fionnphort and Baile Mòr on the Isle of Iona (approximate east to west route, linking the Isles of Mull and Iona). The second is traffic transiting through the Sound (approximate north-east, south-west direction) which is comprised of fishing vessels, recreational vessels and the Staffa Tour boats which operate from Fionnphort and Iona Baile Mòr (see Figure 6-1 for locations).

Analysis of vessel traffic using the 365 days of traffic data (from 01 November 2021 to 31 October 2022) identifies a high density of traffic transiting between Fionnphort and Baile Mòr, and a clear route along the Fionnphort shore towards Bull Hole Channel where the ferries currently berth overnight. This location is also used as an anchorage during bad weather by local boat owners. The average weekly vessel density is shown in Figure 6-2.

From the AIS data, nearly all the vessels transiting across the Sound of Iona between Baile Mòr and Fionnphort were passenger vessels (including the ferry and tour boat operators). Vessels transiting through the Sound of Iona were mainly fishing vessels. However, recreational, and small fishing vessels are not required to carry AIS so may not be captured within this data. Anecdotal information sources from stakeholder consultation have been used to characterise the area in the absence of AIS data.

There were two RNLI and three MAIB recorded incidents within 2010 – 2019 (inclusive). These comprised two groundings, two equipment failures (vessel) and one person in distress. Notably, both groundings were near Erraid in an area with numerous rocky outcrops which covers and uncovers with the tide.

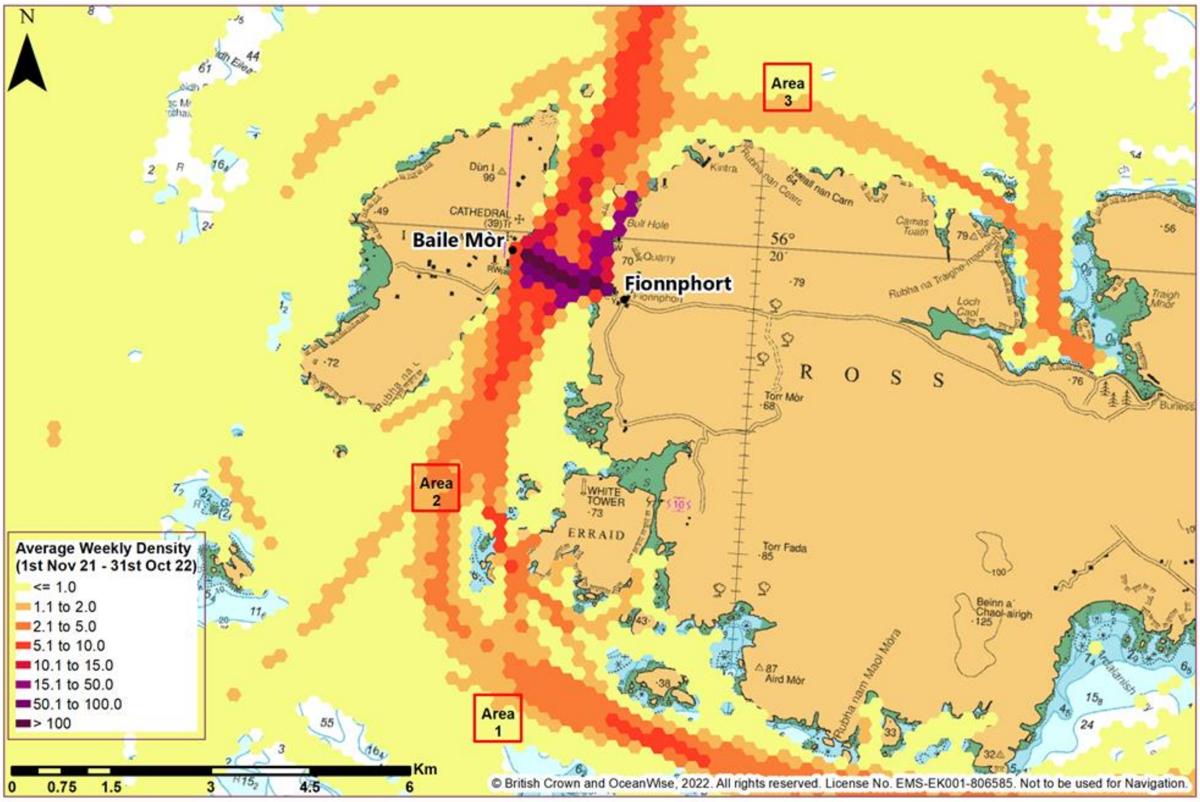

Figure 6-2 Average Weekly Vessel Density (using AIS from 01 Nov 2021 to 31 Oct 2022)

6.4 Description of Likely Significant Effects

This section identifies preliminary potential likely effects on the commercial and recreational navigation receptors as a result of the construction and subsequent operation of the Proposed Development.

6.4.1 Assessment of Construction Effects

Based on the existing understanding of the scale of the Proposed Development, together with the navigational baseline and stakeholder comments from the Scoping Opinion, the potential effects during the construction phase that are considered to be potentially relevant and require further assessment are as follows:

- Ferry or tour boat allision (heavy contact) with the Proposed Development: ferry or tour boats manoeuvring in close proximity to the breakwater have the potential for heavy contact with the breakwater during construction.
- Dredger flooding whilst engaged in operations: an ingress of water affects the vessel stability and has the potential to lead to the dredger sinking.
- Dredge/construction plant impact with the Proposed Development during the construction phase: manoeuvring of construction/dredge craft in close proximity to the breakwater has the potential for heavy contact with the breakwater during construction.
- Recreational or fishing vessel allision with the Proposed Development: vessel (fishing or recreational) manoeuvring in close proximity to the breakwater has the potential for contact with the breakwater during construction.
- Dredge/construction plant collision with recreational/fishing vessel: vessel collision (recreational or fishing) with the construction or dredging craft whilst transiting to/from the site or during activities within the disposal site.
- Tug and tow collision with recreational/fishing vessel: vessel collision (recreational or fishing) with the tug and tow whilst transiting to/from the site.
- Tug and tow collision with ferry/tour boat: vessel collision (ferry or tour boat) with the construction or dredging craft whilst transiting to/from the site or during activities within the disposal site.
- Accidental spill during marine works: an accidental spill during the construction phase has the possibility to lead to pollution in and around the Sound of Iona.
- Heavy lift failure, or failure of lifting gear: failure of lifting gear has the potential to result in injuries and damage to the vessel.
- Small non-powered craft displaced by the Proposed Development: the Proposed Development may cause the displacement of small craft into deeper water and potentially lead to a collision with other vessels transiting across the Sound of Iona.

These are examined in further detail in Sections 6.4.1.1 to 6.4.1.10 below.

6.4.1.1 Ferry or tour boat allision with the Proposed Development

Ferry and tour boats transiting in proximity to the Proposed Development have the potential to make heavy contact (allision) with the works. Allision risk will be increased during times of adverse weather when wind activity and wave action have the potential to adversely affect vessel manoeuvring, and in periods of reduced visibility where it will be difficult to see the breakwater. The risk will also be increased in periods of high vessel movements as this will decrease the available space for manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (for example, a fuel or oil spill) and, due to passengers being often onboard the vessel, there is a risk of multiple injuries and associated negative publicity.

This potential effect would have a medium level of sensitivity as vessels have some ability to adapt to the situation through the application of their engines to manoeuvre or use of anchors to avoid/reduce the impact of an allision. These vessels will also have Standard Operating Procedures (SOPs) in place which would provide a process to follow for crew and passengers if a marine incident occurs. This could potentially reduce the severity of an incident. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase and therefore has a medium negative magnitude. Therefore, the overall outcome is **moderate to minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered to be 'as low as reasonably practicable' (ALARP):

- Notices to mariners – issued on the Council website containing details about construction activities.
- Aids to navigation, provision and maintenance of – illumination of marine works at night.
- Marine liaison officer – central point of contact to coordinate activities.
- Availability of pollution response equipment – contractor to have Tier 1 pollution equipment.
- Promulgation of information – information on activities shared with local communities.

Following the implementation of these measures, specifically the appointment of a marine liaison officer, notices to mariners and the illumination of the Proposed Development at night, the magnitude (Table 6-3) is reduced to small negative as likelihood of an allision is reduced. Therefore, the scenario is assessed as **minor adverse**.

6.4.1.2 Dredger flooding whilst engaged in operations

During the construction phase dredge and marine works, there is an increased risk of dredge vessels having an ingress of water during dredge operations through a weld failure, sea value defect or dredge cargo loading error with the vessel close inshore, in complex tidal conditions. The outcome would have a low negative magnitude as the potential impact will be localised to the extent of the marine construction area and will be present for the construction phase only. The hazard scenario has the potential to occur throughout the construction phase and would have a high impact on safety with limited ability to adapt to the situation, hence the sensitivity is high. Therefore, the dredger flooding has an overall assessment of **minor adverse**.

The following mitigation measure would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- Marine liaison officer – to coordinate emergency response with shore side resources.

Following the implementation of this measure neither the sensitivity nor the magnitude of this assessment will change and therefore it will still be considered **minor adverse**.

6.4.1.3 Dredge/construction plant impact with the Proposed Development during construction phase

Dredge/construction plant used during the construction phase of the Proposed Development has the potential to make heavy contact with the works. These vessels include jack-up platforms, barges, tugs and tows, dredging plant and workboat support craft. It should be noted that construction activities carried out from platforms held in place by spud support legs are not subject to allision when the platform is elevated. However, when being manoeuvred into position there is a risk of contact between the vessel and structures within the marine construction area. Allision risk increases during times of adverse weather when wind activity and wave action have the potential to adversely affect vessel manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (for example, a fuel or oil spill).

This potential effect would have a high level of sensitivity as the vessels have some ability to adapt to the situation through the application of their engines, anchors or adjusting moorings. In addition, it is likely that dredge and construction vessels would be moving at a slow speed whilst working making any allision a controlled outcome if avoidance action is taken. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase whilst vessels are manoeuvring leading to a magnitude of medium thus this scenario has an overall outcome of **major to moderate adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all construction craft to carry AIS to reduce the severity of the hazard if it were to occur.
- Aids to navigation, provision and maintenance of – illumination of marine works at night.
- Marine liaison officer – central point of contact to coordinate activities.
- Weather forecasting – monitored by construction personnel with weather limits for activities identified.
- Operational weather limits – Maximum wind/wave limits for construction activities.

Following the implementation of these measures, specifically the appointment of a marine liaison officer, operational weather limits and the illumination of marine works at night, the sensitivity is reduced to low. Therefore, the scenario is assessed as **minor adverse**.

6.4.1.4 Recreational or fishing vessel allision with the Proposed Development

Recreational and fishing vessels transiting proximate to the Proposed Development have the potential to make heavy contact with the works during construction. Allision risk will be increased during times of adverse weather when wind activity and wave action have the potential to adversely affect vessel manoeuvring, and in periods of reduced visibility where it will be difficult to see the breakwater. The risk will also be increased in periods of high vessel movements as this will decrease the available space for manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (for example, a fuel or oil spill).

This potential effect would have a high level of sensitivity as the vessels have some ability to adapt to the situation through the application of their engines to manoeuvre or use of anchors to avoid/reduce the impact of an allision. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase, with accidents occurring often, leading to a medium negative magnitude. Therefore, the overall outcome is major to moderate adverse.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- Notices to mariners – issued on the Council website containing details about construction activities.
- Aids to navigation, provision and maintenance of – illumination of marine works at night.
- Marine liaison officer – central point of contact to coordinate activities.
- Availability of pollution response equipment – contractor to have Tier 1 pollution equipment.
- Promulgation of information – information on activities shared with local communities.
- Communications –stakeholders should be informed of the need to move buoyed areas prior to construction and advised of other suitable locations.

Following the implementation of these measures, specifically the appointment of a marine liaison officer, notices to mariners and the illumination of marine works at night, the magnitude is reduced to low negative. Therefore, the scenario is assessed as **minor adverse**.

6.4.1.5 Dredge/construction plant collision with recreational/fishing vessel

Dredge/construction plant used during the construction phase of the Proposed Development have the potential to collide with recreational and fishing vessels transiting past the works or accessing moorings at Iona. The dredge and construction vessels include jack-up platforms, barges, dredging plant and workboat support craft. Tugs and tows are considered under a separate assessment (see Section 6.4.1.6). Collision risk will be increased during times of adverse weather when wind activity and wave action have the potential to adversely affect vessel manoeuvring, or when there is high vessel activity in the area. Any collision has the potential to result in damage which may lead to a pollution event (for example, a fuel or oil spill).

This potential effect would have a high level of sensitivity as there is a high level of safety impact for shipping and navigation receptors, despite vessels having some ability to adapt to the situation through the application of their engines, anchors or adjusting moorings. It is likely that dredge and construction vessels would be moving at a slow speed whilst working making any potential collision more avoidable and having a smaller impact. The potential effect from a collision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase whilst vessels are manoeuvring leading to an assessed magnitude of medium. Therefore, the assessment of significance is **moderate to minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B (see Volume III, Appendix 6.1, Section 2.1 for definitions of AIS signals)).
- Notices to mariners – issued on the Council website containing details about construction activities.
- Promulgation of information – information on activities shared with local communities.
- Safety boat – available and manned during construction activities.
- Marine liaison officer – to provide safety information to vessels navigating in the area and to local authorities.
- Communications – stakeholders should be informed of the need to move buoyed areas prior to construction and advised of other suitable locations.

Following the implementation of these measures, specifically the appointment of a marine liaison officer, the publicising of the notices to mariners and AIS coverage, the magnitude is reduced to low. Therefore, the scenario is assessed as **minor adverse**.

6.4.1.6 Tug and tow collision with recreational/fishing vessel

A tug and tow moving material to the construction site or departing for sea may come into contact and collide with a recreational or fishing vessel. Collision risk is increased during periods of high vessel traffic, and when adverse weather may adversely affect the ability of either vessel type to manoeuvre. Collision has the potential to result in damage which may lead to a pollution event (for example, a fuel spill).

The potential effect would have a high level of sensitivity as there is a high level of safety impact and the vessels will also have some ability to adapt to the situation through application of their engines, anchors or adjustment of moorings. It is likely the tug and tow vessels will be moving at slow speed to transport material short distances between the barge and the marine works. The potential effect from the collision will be localised to the immediate extent of the marine construction area. The magnitude of effect is considered to be medium due to the frequency of tug and tow movements during the works. Hence the overall significance is **moderate adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B (see Volume III, Appendix 6.1, Section 2.1 for definitions of AIS signals)).
- Communications –stakeholders should be informed of the need to move buoyed areas prior to construction and advised of other suitable locations.

Following the implementation of this measure the risk would be reduced but remains within the classification of **moderate adverse**. This is reflective of the fact that once a tug and tow has left the immediate vicinity of the works, vessels will navigate in the usual way, following international rules such as the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS). The ability of the project scheme to implement additional controls is limited past the requirement to use AIS for identification.

6.4.1.7 Tug and tow collision with ferry/tour boat

A tug and tow collision with a ferry/tour boat carries a risk when the ferry/tour boat is travelling to and from the current slipway or pier. Collision risk is increased during periods of high vessel traffic, and when adverse weather may negatively affect vessel manoeuvrability. The collision has the potential to result in damage which may lead to a pollution event (for example, a fuel spill).

This assessment has a medium level of sensitivity as vessels have some ability to adapt to the situation through application of their engines, anchors or adjustment of moorings. In addition, it is likely the tug and tows will be moving at slow speed to transport material short distances between the barge and the marine works. The potential effect from a collision will be localised to the immediate extent of the marine construction area. The impact has potential to occur throughout the construction phase when these vessels are manoeuvring thus it has a magnitude of high negative. Therefore, the collision risk has an overall assessment of **moderate adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B (see Volume III, Appendix 6.1, Section 2.1 for definitions of AIS signals)).
- Notices to mariners – issued on the Council website containing details about construction activities.
- Marine liaison officer – to provide safety information to vessels navigating in the area and to local authorities.

Following the implementation of these measures, specifically the issuing of notices to mariners and AIS coverage, the impact reduces to medium as incidents and accidents are less likely. Therefore, the scenario is assessed as **moderate to minor adverse**.

6.4.1.8 Accidental spill during marine works

During the marine works there is an increased risk of accidental spillage of oil, fuel and chemical pollutants from the dredge plant, construction vessel activity and marine construction works. This may result in a reduction in water quality. The prevailing weather conditions during any marine pollution event will dictate the path and extent of surface water sheens.

The impact has the potential to occur infrequently throughout the period; and the volume of a spill is likely to be small scale due to the volume which could be spilled at any one time through construction activity. It should be noted that Argyll & Bute Council have oil spill contingency plans in place, which include a Tier 2 response contractor. These factors lead to an assessment of the magnitude of a spill as low and a sensitivity as high. Therefore, the overall assessment is **minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that can be considered ALARP:

- Availability of pollution response equipment – contractor to have Tier 1 pollution equipment.
- Marine liaison officer – coordinating activities for the construction.

Following the implementation of these measures, specifically the availability of pollution response equipment, the future risk is assessed to remain as **minor adverse**.

6.4.1.9 Heavy lift failure, or failure of lifting gear

During the marine works there is a risk of lifting gear failure whilst a load is slung or a heavy load is transferred between vessels, a vessel and the marine works, or rock is placed along the breakwater. The nature of the loads during the construction phase of the marine works means that should a failure occur, and the load be dropped onto a vessel, it would lead to major damage for the vessel and possible fatalities. The prevailing weather conditions will be the main factor leading to this impact occurring; especially high wind conditions affecting cranes, and large swell causing movement of vessels.

The potential effect would have a high level of impact for vessels and crew, with limited ability to adapt to a quickly developing incident. The sensitivity is therefore assessed as high. The potential effect would be localised to the extent of the incident within the study area and will be present for the construction phase only. The impact has the potential to occur infrequently throughout the period of the construction, which leads to low negative magnitude and an overall outcome of **minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that can be considered ALARP:

- Weather forecasting – monitoring of weather conditions.
- Operational weather limits – maximum wind/wave limits for construction activities.
- Marine liaison officer – coordinating activities for the construction.

Following the implementation of these measures, specifically the implementation of operational weather limits, the future risk is assessed to remain as **minor adverse**.

6.4.1.10 Small non-powered craft displaced by the Proposed Development

Small non-powered craft may be displaced by the Proposed Development into deeper water in the Sound of Iona. There is an increased risk of collision of these vessels transiting across the Sound of Iona, particularly as the small non-powered craft may not be visible to the transiting vessels. The collision has the potential to result in multiple fatalities.

The potential effect would have high level of sensitivity as there is a high level of safety impact and the powered vessels will also have some ability to adapt to the situation through application of their engines, anchors or adjustment of moorings. The potential effect from the collision will be localised to the immediate extent of the marine construction area. The magnitude of effect is considered to be low negative due to the frequency of non-powered craft using the area. Hence the overall significance is **minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- Notices to mariners: published on the Council website containing details about construction activities, particularly times when high vessel density is expected.
- Aids to navigation, provision and maintenance of: marine works are illuminated at night.
- Marine liaison officer: coordinating activities for construction.
- Promulgation of information: information promulgated to local communities and known groups that will be affected.

Following the implementation of this measure the risk would be reduced but remains within the classification of **minor adverse**. This is reflective of the fact that the above controls will reduce the likelihood of the event happening, however the effect of the event is unlikely to change drastically.

6.4.2 Assessment of Operational Effects

Based on the existing understanding of the scale (height, length and width) of the Proposed Development, together with the navigational baseline and stakeholder comments from the Scoping Opinion, the potential effects during the operational phase that are considered to be potentially relevant and require further assessment are listed below:

- Ferry or tour boat allision with the breakwater: ferry or tour boats manoeuvring in close proximity to the breakwater have the potential for heavy contact with the breakwater.
- Small non-powered craft displaced by the breakwater: the breakwater causes the displacement of small craft into deeper water and potentially leads to a collision with other vessels transiting across the Sound of Iona.

These are examined in further detail in Sections 6.4.2.1 to 6.4.2.2 below.

6.4.2.1 Ferry or tour boat allision with the breakwater

Any allision has the potential to cause damage to a vessel which may lead to a pollution event and cause injuries to personnel. This risk will diminish with time as crew become familiar with the new breakwater location and the effects of wind and tidal flow at this location. The passage of the ferry would be altered by the Proposed Development as the presence of the breakwater would require the ferry and tour boats to transit around the new structure, thereby altering the approach/departure route compared to that used presently.

This potential effect would have a medium level of sensitivity due to safety impacts for the vessel from an allision. It is likely that any allision would be at low speed given that vessels are arriving or departing the port on the approach to the berth; meaning that there is time to react to an allision situation by use of the vessel’s engines, rudder and bow thruster (if fitted). In addition, the potential impact is localised to the area of the marine facilities but can occur throughout the operational phase leading to a magnitude of medium and an overall ranking of **moderate to minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that can be considered ALARP:

- Passage planning – update to CalMac Ferries Ltd. passage plan.
- Update Admiralty List of Radio Signals (ALRS) and Sailing Directions – updates to include new structures.
- Review of available powers – Argyll & Bute Council should review their powers in relation to operating the port facility at Iona to determine whether further powers are required to ensure navigational safety.
- Shore side facility maintenance programme – schedule of maintenance including Aids to Navigation (AtoN).

Following the implementation of these measures, specifically the review of available powers and the updates to the marine safety management system, the overall ranking will be reduced to **minor adverse**.

6.4.2.2 Small non-powered craft displaced by the breakwater

Small non-powered craft may be displaced by the breakwater into deeper water in the Sound of Iona. There is an increased risk of collision with vessels transiting across the Sound of Iona, particularly as the small non-powered craft may not be visible to the transiting vessels. The collision has the potential to result in multiple fatalities.

The potential effect would have a high level of sensitivity as there is a high level of safety impact and the powered vessels will also have some ability to adapt to the situation through application of their engines, anchors or adjustment of moorings. The potential effect from the collision will be localised to the immediate extent of the marine construction area. The magnitude of effect is considered to be low negative due to the frequency of non-powered craft using the area. Hence the overall significance is **minor adverse**.

The following mitigation measures would need to be introduced by Argyll & Bute Council to reduce the risk to a level that could be considered ALARP:

- Notices to mariners: published on the Council website containing details about construction start and completion dates.
- Aids to navigation, provision and maintenance of: breakwater is illuminated at night.
- Promulgation of information: information promulgated to local communities and known groups that will be affected.

Following the implementation of these measures the risk would be reduced but remains within the classification of **minor adverse**. This is reflective of the fact that the above controls will reduce the likelihood of the event happening, however the effect of the event is unlikely to change drastically.

6.5 Mitigation Measures

The following mitigation measures were identified to ensure marine safety at Iona.

- Marine liaison officer – the marine liaison officer provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations. This provides a central point of contact.
- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B (see Volume III, Appendix 6.1, Section 2.1 for definitions of AIS signals)).
- Notices to mariners – issued by Argyll & Bute Council containing details about the construction works. These should be issued prior to any works (or any related activities such as diving or towage movements).
- Availability of pollution response equipment – pollution response equipment should be available and carried by the contractors for use at Iona. The equipment should be appropriate for the type and scale of pollution that may occur.
- Weather forecasting – a weather forecasting service should be regularly monitored to indicate any periods of upcoming adverse weather conditions. Appropriate actions should then be taken to mitigate any potential situations that may arise. These actions should be documented in the safety management system, detailing the specific weather conditions that will necessitate action(s).
- Operational weather limits – including maximum wave and wind limits for construction activities should be detailed in the contractors 'Risk Assessment Method Statement'.
- Promulgation of information – information on the Proposed Development and upcoming operations with associated vessel movements should be provided to local stakeholders. A website page

(potentially on the Council's website) for the project, providing information and a method to contact the project would allow any vessels in the area to obtain information.

- Provision and maintenance of aids to navigation – aids to navigation should be provided after consultation and approval of the NLB. Marine works to be illuminated at night. The aids to navigation must be maintained so that they are available, as required, to the NLB with any out of service periods reported via the Local Aids to Navigation (LATON) system.
- Safety boat – the safety boat should be appropriate for the wind and wave conditions in the area. It should be available on site and manned during construction operations in order to provide quick assistance if any incident was to occur.
- Passage planning – CalMac should update their passage plan, both during the works and on completion of the works to recognise the altered route.
- Operational planning – capital dredging should be scheduled, as far as possible, to avoid disruption to ferry operations.
- Review of available powers – Argyll & Bute Council should review their powers in relation to operating the port facility at Iona to determine whether further powers are required to ensure navigational safety
- Update ALRS volume 6 and Sailing Directions – updates to include new structures after completion of the marine works.
- Shore side facility maintenance programme – to schedule the maintenance of the site, including the AtoN.
- Communications – stakeholders should be informed of the need to move buoyed areas prior to construction and advised of other suitable locations.
- Safety - Lighting - it is important that any marine works at night or at times of reduced visibility are sufficiently illuminated in accordance with the Health and Safety Executive (HSE) Approved Code of Practice (ACOP) 'Safety in Docks' (HSE, 2014). The guidance on illumination levels is drawn from the 'Safety and Health in Ports' code of practice published by the International Labour Organization; this states that: "On access routes for people, plant and vehicles and in lorry parks and similar areas, the minimum level of illumination should not be less than 10 lux. In operational areas where people and vehicles or plant work together, the minimum level of illumination should not be less than 50 lux". (ILA, 2016). This level of illumination must be balanced alongside the requirements provided in the British Standard Institute (BSI) publication 'Design of Road Lighting' BS5489.

A further three additional mitigation measures were listed in risk assessments that were not brought forward as having a 'Significant' or higher current risk. These are listed below and detailed in Volume III, Appendix 6.1, Section 10.

- Hydrographic surveying program

- Loading/unloading plan
- Operation planning

6.6 Potential Cumulative Effects

There is no potential for cumulative impacts on navigational safety during the operational phase due to the implementation of adequate risk controls that are needed to ensure marine safety. There will be no significant cumulative impacts during the construction phase.

6.7 Residual Effects

Following the implementation of mitigation measures and incorporation of the controls into operating procedures, the residual effects are likely to be reduced to minor adverse which is concluded to be ALARP as applied within the context of the Port Marine Safety Code (PMSC).

6.8 Conclusions and Summary of Effects

A summary of the effects expected on shipping and navigation, following the application of mitigation measures during the construction and operational phases is shown in Table 6-5 and Table 6-6, respectively. There are no residual effects that are considered significant.

Table 6-5 Summary of likely effects on shipping and navigation during the construction phase following the application of mitigation measures

Receptor	Sensitivity of Receptor	Duration	Magnitude	Significance	Significant/Not significant
Ferry or tour boat allision with marine works	Medium	Construction phase	Low negative	Minor adverse	Not significant
Dredger flooding whilst engaged in operations	High	Construction phase	Low negative	Minor adverse	Not significant
Dredge/construction plant impact with marine works	Low	Construction phase	Medium negative	Minor adverse	Not significant
Recreational/fishing vessel allision with marine works	High	Construction phase	Low negative	Minor adverse	Not significant
Dredge/construction plant collision with recreational/fishing vessel	High	Construction phase	Low negative	Minor Adverse	Not significant
Tug and tow collision with recreational/fishing vessel	High	Construction phase	Medium negative	Moderate adverse	Not significant
Tug and tow collision with ferry/tour boat	Medium	Construction phase	Medium negative	Moderate to minor adverse	Not significant
Accidental spill during marine works	High	Construction phase	Low negative	Minor adverse	Not significant
Heavy lift failure, or failure of lifting gear	High	Construction phase	Low negative	Minor adverse	Not significant

Receptor	Sensitivity of Receptor	Duration	Magnitude	Significance	Significant/Not significant
Small non-powered craft displaced by marine works	High	Construction phase	Low negative	Minor adverse	Not significant

Table 6-6 Summary of likely effects on shipping and navigation during the operational phase following the application of mitigation measures

Receptor	Sensitivity of Receptor	Duration	Magnitude	Significance	Significant/Not significant
Ferry or tour boat allision with breakwater	Medium	Long term	Medium negative	Minor adverse	Not significant
Small non-powered craft displaced by breakwater	High	Long term	Low negative	Minor adverse	Not significant

7 TERRESTRIAL BIODIVERSITY

7.1 Introduction

This chapter considers the likely significant effects on terrestrial ecological receptors associated with the construction, operation and decommissioning of the Proposed Development. The effects associated with the construction phase of the Proposed Development on terrestrial ecological receptors can be considered representative of reasonable worst-case decommissioning effects, therefore a separate assessment of the decommissioning phase has not been undertaken as part of this assessment.

The specific objectives of the chapter are to:

- Describe the terrestrial ecological baseline;
- Describe the assessment methodology and significance criteria used in completing the impact assessment;
- Describe the potential effects, including direct, indirect and cumulative effects;
- Describe the mitigation measures proposed to address likely significant effects; and
- Assess the residual effects remaining following the implementation of mitigation.

The assessment has been carried out by RPS Ecologists with relevant accreditations (MCIEEM). The assessment of terrestrial ecological effects follows the guidance produced by CIEEM (2018). This sets out the process for assessment as a series of stages;

- Describing the terrestrial biodiversity baseline in the Zone of Influence (ZoI) through survey and desk study;
- Identifying Important Ecological Features (IEFs): these are the species of highest ecological importance present in the ZoI;
- Determining the nature conservation importance of the IEFs present within the ZoI;
- Identifying and characterising the potential impacts on these IEFs, based on the nature of the construction, operation and decommissioning activities associated with the Proposed Development;
- Determining the magnitude of the impacts including consideration of the sensitivity of the terrestrial ecological feature and the duration and reversibility of the effect;
- Determining the significance of the impacts based on the interaction between the effect magnitude/duration, the likelihood of the effect occurring, and the nature conservation value of the IEF;
- Identifying embedded mitigation that will counteract or avoid adverse impacts;

- Determining the residual impact significance after the effects of mitigation have been considered, including a description of any legal and policy consequences;
- Determining potential cumulative effects; and
- Identification of any monitoring requirements.

This chapter is supported by the following technical appendices (see Volume III: EIAR Appendices):

- Appendix 7.1: Terrestrial Biodiversity Survey Results; and
- Appendix 7.2: Otter Protection Plan.

7.2 Assessment Methodology

7.2.1 Scope of Assessment

This chapter details the results of the terrestrial biodiversity surveys undertaken to inform the assessment of the Proposed Development, which is described in Chapter 3: Project Description.

The surveys were designed to assess the presence and use by protected and notable species of the intertidal and near shore coastal habitats within the Iona Breakwater development zone. The surveys focussed particularly on the qualifying species of coastal/ marine designated sites of nature conservation interest associated with the Sound of Iona and wider area within the Seas of the Hebrides (shown in Figure 7-1 and Figure 7-2).

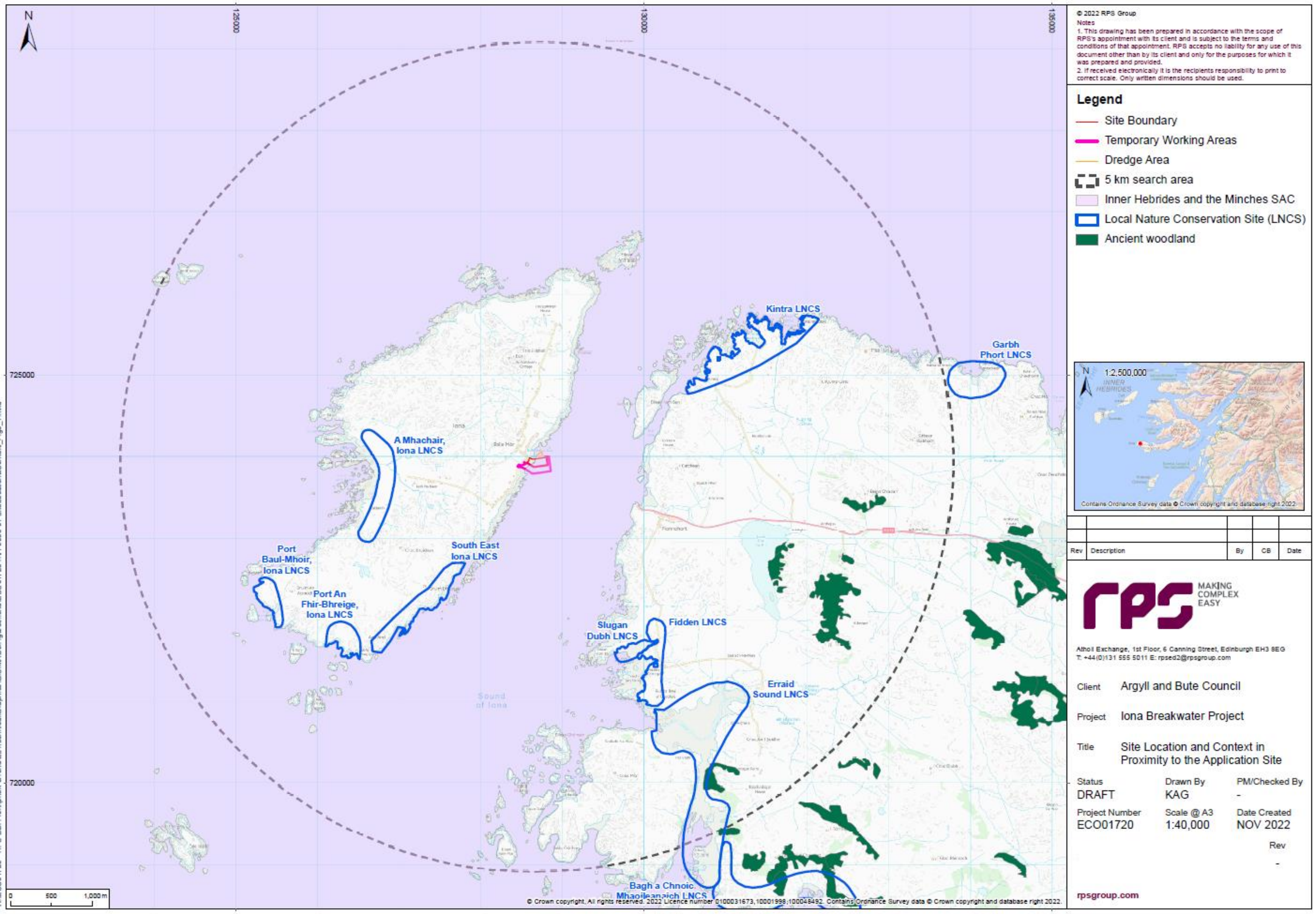

Figure 7-1 Location of sites of nature conservation interest in proximity to the Proposed Development

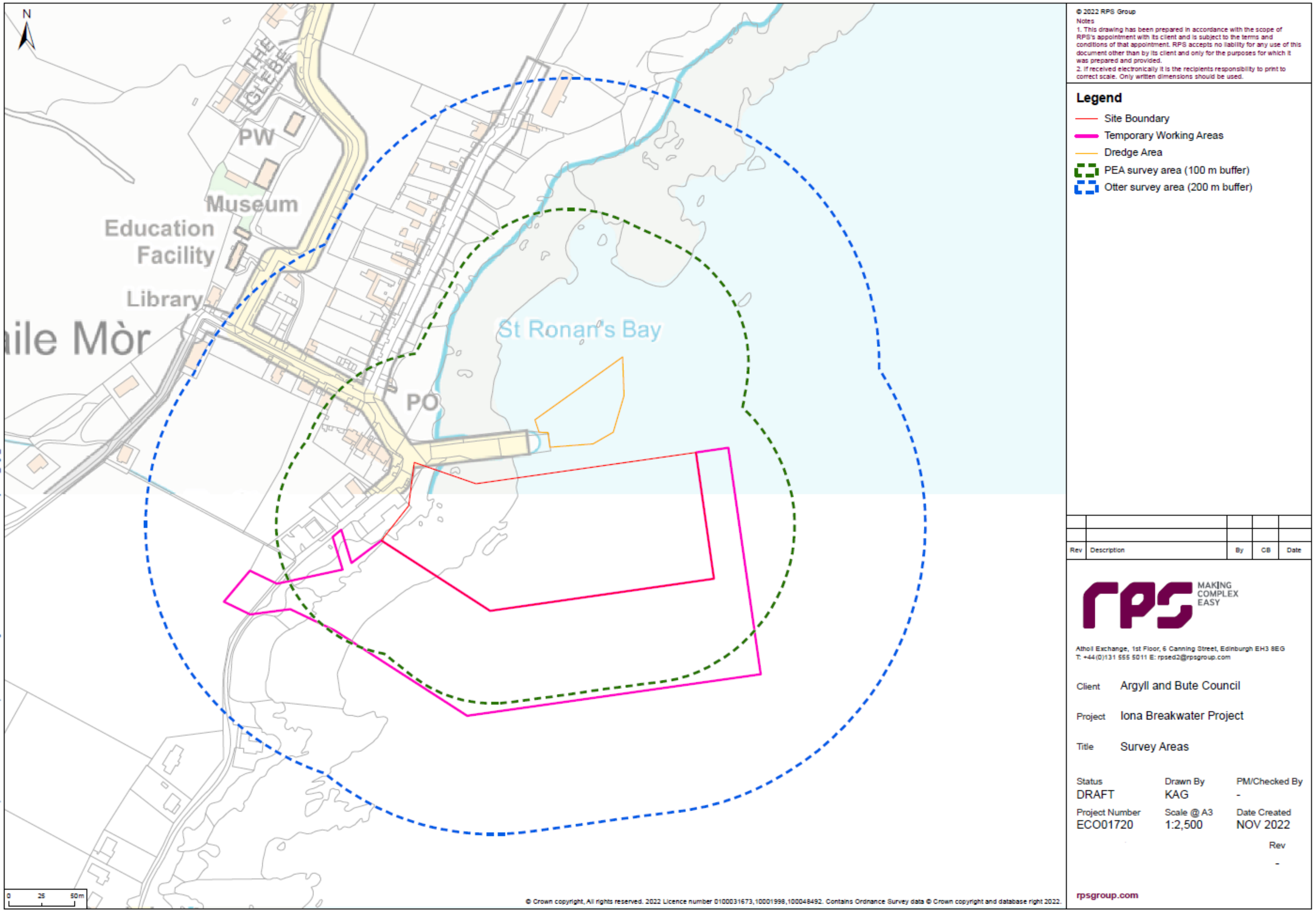

Figure 7-2 Survey Areas

The scope of the assessment has been informed by the guidelines/policies outlined in below and the consultation responses summarised in Table 7-1:

- Environmental Impact Assessment Directive 2014/52/EU (the EIA Directive);
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive);
- The Conservation (Natural Habitats &c.) Amendment (Scotland) Regulations 2012, relating to reserved matters in Scotland;
- Wildlife and Countryside Act 1981 (as amended);
- The Nature Conservation Act (Scotland) Act 2004;
- The Wildlife and Natural Environment (Scotland) Act (2011);
- The Protection of Badgers Act 1992;
- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, which transpose the EIA Directive into the Scottish planning system;
- Planning Circular 1/2017 – Environmental Impact Assessment Regulations (Scottish Government 2017);
- PAN 51: Planning Environmental Protection and Regulation (revised 2006);
- PAN 60: Planning for Natural Heritage (Scottish Government 2000);
- Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000);
- Scottish Planning Policy (SPP);
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018);

7.2.1.1 Consultation

Table 7-1 summarises the relevant consultation responses to the EIA Screening / Scoping report and provides information on where and/or how they have been addressed in this assessment. Only NatureScot made comment on terrestrial biodiversity.

Information on the Scoping and Consultation can be found in Chapter 5.

Table 7-1 Consultation Responses of relevance to Terrestrial Biodiversity

Consultee and Date	Consultation	Issue Raised	Response / Action Taken	Where issue is addressed in EIA Report
NatureScot and Marine Scotland ***May 2021***	EIA screening opinion	<Re surveys required	<Re surveys were undertaken within 200m of the Proposed Development	Survey methodologies and results detailed in Appendix 7.1
NatureScot	Terrestrial ecology survey scope	No response		

The findings of these surveys have been used to inform the Environmental Impact Assessment (EIA) for the Proposed Development.

This chapter considers the potential for likely significant effects on the qualifying species of the terrestrial SACs and additional species assessed to be sensitive Important Ecological Features (IEFs) of international, national or regional importance.

7.2.1.2 Potential Effects Scoped Out

The scope of this assessment takes account of the committed mitigation measures both incorporated into the design and those standard construction and decommissioning mitigation measures incorporated into the Proposed Development, as described in Chapter 3: Project Description. No other issues have been scoped out of the assessment.

7.2.2 Assessment Methodology and Significance Criteria

7.2.2.1 Method of Baseline Characterisation

Extent of the Study Area

The study area for the purpose of the assessment comprises a set of buffers from the Proposed Development site that are of varying distance, depending on the nature of the potential receptor. These include:

- Sites designated for terrestrial biological features within 5km (e.g., Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Local Nature Reserves (LNR) and Local Nature Conservation Sites (LNCS);
- Given the coastal location of the Proposed Development and the wide-ranging foraging behaviour of <Red which may be present in the area, consideration was given to SACs designated for <Red within 20km;
- Records of Notable (i.e., species with conservation designations, but no legal protection) and Protected Species within 2km;
- Preliminary Ecological Appraisal (PEA) within 100m;

- Phase 1 Habitat survey within 100m; and
- Species survey of Otter within 200m

These study areas are presented in Figure 7-2.

Desk Study

A request was made to the Argyll & Bute Local Records Centre for all records of Notable and Protected Species within 2km of the site within the last 10 years. A buffer of 2km was used as it is considered unlikely the proposal would affect specific interests over and above this distance.

The desk study also sought to collate relevant information on all sites with designated terrestrial ecological features (SPAs/ SACs/ Ramsar Sites/ SSSIs/ LNRs/ LNCS) where there may exist ecological connectivity between the Site and protected or notable species.

A search for all designated sites within the defined study areas outlined above was made utilising online sources, allowing the identification of all designated sites with qualifying ecological interests. The online sources used to obtain this information were;

- NatureScot Sitelink[7];
- JNCC website[8];
- Scotland's environment web[9];
- Argyll and Bute Council open data website[10]; and
- Aerial imagery which was studied prior to the survey to inform any areas of high sensitivity which might require additional survey effort during the site visit.

Field Survey

Aerial imagery was studied in the process of the desk-based assessment to ascertain the likely habitats within and surrounding the Proposed Development, and the species these may be likely to support. As such the following surveys were carried out to complete the baseline assessment of ecological features present within the Proposed Development site and surrounding area. Full details of the field surveys undertaken are outlined in Volume III, Appendix 9.1 and are summarised below.

A Preliminary Ecological Appraisal (incorporating a Phase 1 Habitat survey) was undertaken to establish the broad habitat types present and the potential for the site to support protected species in

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[7] https://sitelink.nature.scot/home

[8] https://jncc.gov.uk/our-work/list-of-spas/

[9] https://map.environment.gov.scot/sewebmap/

[10] https://data-argyll-bute.opendata.arcgis.com/datasets/open-data-local-nature-conservation-site

line with CIEEM guidelines (CIEEM 2017). The Phase 1 Habitat surveys followed the Joint Nature Conservation Committee (JNCC) Phase 1 Habitat survey methodology detailed in JNCC (2016).

A species-specific survey for otters was undertaken looking for otter field signs as described in Bang & Dahlstrøm (2001), within a 200m buffer of the Proposed Development site.

7.2.2.2 Assessment Criteria and Assignment of Significance

The method of assessment for this Chapter follows that of CIEEM (2018) guidance. The term Important Ecological Features (IEFs) is used for those species and habitats identified in the assessment. For each impact with the potential to affect the relevant IEFs, the assessment considers the following parameters:

- Whether the impact is positive or negative in its influence;
- The extent of the impact;
- The magnitude, duration and timing of the impact; and
- The impact's frequency and ease of reversibility.

The assessment similarly includes consideration of any proposed mitigation to avoid or minimise the effect of any potential impact to the relevant IEFs and identifies any potential cumulative impacts from surrounding developments prior to determining the residual significance of any effect, be this negligible, minor, moderate or major. Effects can be either adverse or beneficial.

Criteria for Assessing the Sensitivity of Receptors

The identification of IEFs and assessment of their level of importance is guided by a range of criteria, as defined in Table 7-2. These criteria are a guide and not definitive; ecologists should apply judgment based on knowledge of the region and populations involved.

Table 7-2 Approach to Valuing Ecological Receptors

Level of importance	Example of IEF
International	Species listed as qualifying feature of an internationally designated site (SAC/SPA/Ramsar Site, including candidate sites). European Protected Species (EPS) (e.g., otters, bat species).
National*	A species listed as a qualifying feature of a nationally designated site (e.g., SSSI). Species and habitats given special protection under UK legislation.
Regional*	Species that are subject to conservation action plans e.g., Scottish Biodiversity List (SBL)/UKBAP/LBAP.
District*	Species and habitats of some conservation concern listed on Local Biodiversity Action Plan (LBAP).
Local*	A species or habitat that is of nature conservation value in a local context only, with insufficient value to merit a formal designation (e.g., Red and Amber-listed BoCC bird species).
Negligible	Common and widespread species or habitat of little or no conservation value/importance.
*"National" refers to the whole of the UK; "Regional" refers to Scotland, "District" refers to Argyll and Bute and "Local" refers to the Project site and immediate environs	

For the purposes of this assessment, the important populations described in Table 7-2 are graded as High, Medium and Low sensitivity as follows:

- High: Site population is of International / National importance;
- Medium: Site population is of Regional / District importance;
- Low: local: Site population is of Local / Negligible importance.

Whilst it is important to assess the importance or value of the species found during baseline surveys, the most critical consideration with regards to the EIA is the importance of the Proposed Development for these species at a population level. This is because the EIA process requires an assessment of impacts on the populations using the site of the Proposed Development.

Therefore, in the following assessment, each IEF present at the Proposed Development site is assigned a level of importance from International to Negligible. The Site level of importance is a function of the species value in combination with the size of the population that occupy or are reliant on, the Site. For example, if an internationally important species has been recorded at a site only once, or only over-flying the survey area, then the Site level of importance would be considered negligible.

Criteria for Assessing the Magnitude of Change

The magnitude of change is described in the EIAR as a quantitative value as far as is practicable. For example, magnitude of change can be quantified as a percentage decline of a population or as area of habitat from which otters will be displaced.

The magnitude of change resulting from a given development will differ between species and populations, and therefore assessing the magnitude requires consideration of a species' behavioural sensitivity, population size and condition (among other considerations, notably (relevant to this site), the degree or habituation to pre-existing background levels of human activity – walkers, dog walkers, cyclists, adjacent road traffic and off-road motorbikes). Examples include different species' responses to disturbance, and the greater vulnerability of small, declining and isolated populations to the impacts of additional pressures.

In addition, the magnitude of an impact is influenced by the duration of the impact, irreversibility and cumulative effects of other impacts. With regard to the duration of an impact, it can be defined as permanent (beyond 25 years duration), long-term (15-25 years), medium-term (5-15 years) or short-term (up to 5 years). Again, knowledge of the populations' ability to recover from impacts is required to assess the duration of the effect. For example, mortality events for species with relatively small population sizes and low reproductive output (such as otters) will take considerably longer for a population to recover from than abundant and widespread species that have high output and will fill vacant territories and replace numbers rapidly (e.g. water voles).

Consideration of the above factors allows quantification as to the magnitude of effect. Table 7-3 presents magnitude at four levels, from Major to Negligible, and this is the scale by which effect or change is quantified in this chapter. Note that the magnitude of effect is sometimes referred to as magnitude of change, as the level of effect can be quantified in terms of change in population, range etc. Note that some of the lower magnitudes of effect can be applied to beneficial (positive) impacts.

Table 7-3 Defining the Magnitude of Effect on Important Ecological Features

Magnitude	Typical Descriptors of Effect
Major	Would cause the loss of a major proportion or whole feature/population or cause sufficient damage to a feature so as to immediately compromise long-term viability. Irreversible. For example, more than 20% decline in population that an area is able to support in the long-term.
Moderate	Effects that are detectable in short and longer-term but which should not alter the long-term viability of the feature/population, for example 10-20% decline in population that an area is able to support.
Minor	Minor effects, either sufficiently small-scale or short-duration, which cause no long-term decline in feature/population, for example less than 10% decline in population that an area is able to support.
Negligible	A potential impact that is not expected to affect the feature/population in any meaningful way, with no detectable decline in population/distribution. Any change from baseline conditions predicted at <1%.

Criteria for Assessing Cumulative Effects

Cumulative Impact Assessment (CIA) requires the availability of EIA Report chapters and appraisals for adjacent developments which have concluded potential effects on the same IEF populations that this chapter has identified to be subject to potential effects from the Proposed Development. This includes a consideration of other developments that are operational, consented, or for which a valid application has been submitted.

Varying degrees of access to these appraisals, and their differing degrees of detail or completeness, complicates the ability to undertake a thorough review of all impacts for cumulative impact assessment. Even where the appraisals are available, survey periods and methods may differ following changes to guidance and legislation over time. Furthermore, some schemes may have been in operation for many years, and therefore contemporary data is not available.

Criteria for Assessing Significance

Having followed the process of assessing the importance of IEF populations and quantifying the magnitude of impact (through consideration of the sensitivity of the population and duration of effect), the final stage of the EIA process is to establish the significance of the effect.

CIEEM (2018) guidance requires a determination of whether an effect is significant or not significant. Significance of an effect is determined by a combination of the magnitude of the impact and the importance of the population/ feature.

This chapter uses the definition of a significant effect, as defined by the EIA Regulations, as *an effect that threatens the integrity of a designated ecological feature of international importance*, such as the viability of SAC populations of breeding otters.

CIEEM discourages the use of matrices for determination of significant effects, advising professional judgement is to be used. However, a matrix for determining significant effects is often requested, and it is often useful in illustrating the process behind determination of significance.

Table 7-4shows the matrix used here for determination of significance. This is a generic matrix (for all EIA considerations) and notes have been added to illustrate the considerations for ecological features.

Table 7-4 Matrix for Determination of Significant Effects

		Magnitude of change			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity	**High**	Major	Major/ Moderate	Moderate	Moderate/Minor
	Medium	Major/ Moderate	Moderate	Moderate/ Minor	Minor
	Low	Moderate	Moderate/ Minor	Minor	Minor/ Negligible

Sensitivity: Conservation importance of IEF
High: Site population is of **International / national importance**
Medium: Site population is **Regional / District importance**
Low: local: Site population is **Local / Negligible importance**
Magnitude of change: Size of effect on population/feature. Assessed with consideration of sensitivity of species/feature to impact, duration of effect and ability of species/feature to recover (among other factors)
***Potentially* significant effects are in dark shading**

Limitations and Assumptions

The desk study data is third party controlled data, purchased for the purpose of this report only. RPS cannot vouch for its accuracy and cannot be held liable for any error(s) in these data.

The assessment of likely significant effects is based, as much as is possible, on published scientific research and the most current known population data. When empirical data is lacking or insufficient, the judgement of experienced ecologists with detailed knowledge of animal behaviour and ecology is required. Any assumptions made during this assessment are clearly stated. With regard to uncertainty about the magnitude of adverse effects, the precautionary principle is applied, i.e., lack of full scientific certainty should not be used as a reason for postponing or failing to take measures to mitigate these adverse effects.

Following completion of the field surveys, the proposed site boundary was altered, and a Temporary Works Area was added to the Project design. As such, a small area of the Proposed Development site fell outwith the survey buffer for the Phase 1 Habitat Survey (see Figure 7-3). For completeness, this area was mapped using aerial photography and knowledge of the adjacent habitats.

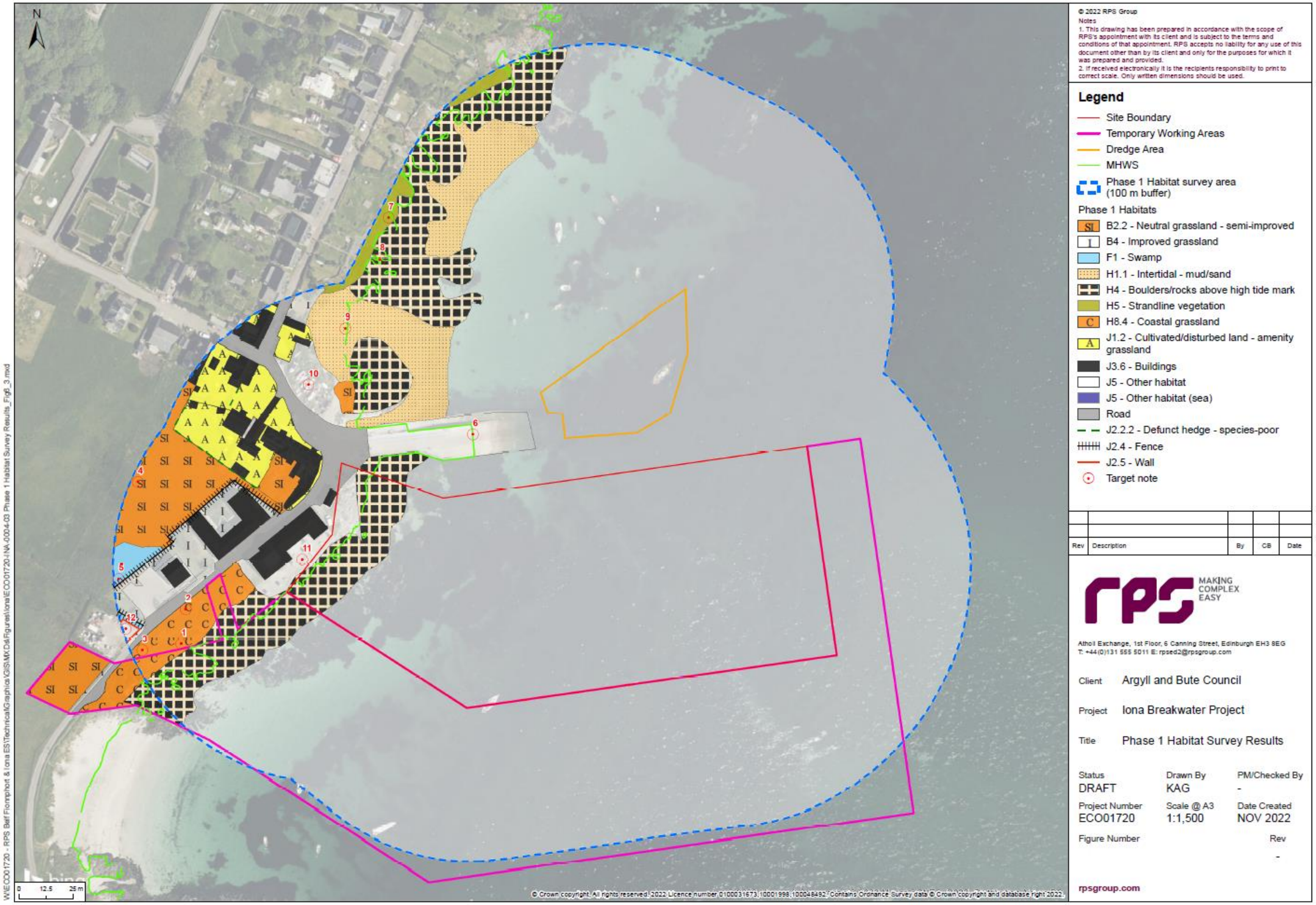


Figure 7-3 Phase I Habitat Survey Results

7.3 Baseline Scenario

7.3.1 Current Baseline

7.3.1.1 Desk Study

Designated Sites

The desk study identified the presence of the following (Table 7-5) designated sites within 5km of the site. No SACs designated for otters were identified within 20km:

Table 7-5 Statutory and Non-Statutory Designated Sites Relating to Terrestrial Ecology (Excluding Avian Interests).

Site	Designation	Distance from site	Features of interest
South East Iona	LNCS	1.4	No Information available
A Mhachair, Iona	LNCS	1.5	No Information available
Port Baul-Mhoir, Iona	LNCS	3.3	No Information available
Port an Fhir-Bheige, Iona	LNCS	2.8	No Information available
Kintra	LNCS	1.9	No Information available
Slugan Dubh	LNCS	2.3	No Information available
Fidden	LNCS	2.2	No Information available
Erraid Sound	LNCS	3.2	No Information available

No information was available on the NatureScot SiteLink website[11] or from the local authority on the nature of the designations listed in the table above. Only the first four of these were located on Iona, with the remaining sites located on Mull. Given the distance and lack of connectivity from the Proposed Development to the LNCSs it is considered that there will be no impacts on these due to the works and, as such, they are not considered further in this chapter.

No areas of ancient woodland were identified on Iona. As such, impacts relating to ancient woodland are not considered further in this chapter.

Biological Records

Argyll Biological Records Centre (ABReC) responded on 31 August 2021 stating that they could not produce full data reports at this time and granted permission for their data to be downloaded from NBN Atlas[12] in relation to the Proposed Development. The key species that have been recorded within 2km of the Proposed Development site are noted below. Of the species reported in Table 7-6, none were identified within the Proposed Development site boundary.

[11] https://sitelink.nature.scot/home

[12] https://scotland.nbnatlas.org/

Table 7-6 ABReC Records from the Last 10 Years, of Protected and Notable Species (Excluding Birds) Within 2km of the Proposed Development site

Common Name	Taxon Name	European Protected Species (Following EU Exit)	Wildlife and Countryside Act 1981 (as amended)	Argyll and Bute Local Biodiversity Action Plan
Mammal				
Eurasian otter	*Lutra lutra*	EPS (Habitats Directive)		Yes
West European hedgehog	*Erinaceus europaeus*			
Reptile				
Common lizard	*Zootoca vivipara*		Schedule 5 (Section 9(5))	

7.3.1.2 Field Surveys

Habitats

The Phase 1 Habitat Survey types identified during the survey are mapped in Figure 7-3. Table 7-7 lists the broad Phase 1 Habitat types present within the Proposed Development site. All habitats below the Mean High Water Springs (MHWS) line have been excluded from the calculations as these are considered in Chapter 8 (Marine Biodiversity). The habitats found within the Proposed Development site are discussed in detail in Volume III, Appendix 7.1.

Table 7-7 Phase 1 Habitat Types

Phase 1 Habitat Type	Survey Area (ha)*	Area in Site Boundary and Temporary Work Area (ha)
Neutral grassland - semi-improved - B2.2	0.29	0.06
Improved grassland - B4	0.12	0.01
Swamp - F1	0.03	-
Intertidal – mud/sand – H1.1	0.06	-
Boulders/rocks above high tide mark – H4	0.16	0.06
Strandline vegetation – H5	0.05	-
Coastal grassland – H8.4	0.14	0.06
Cultivated/disturbed land – amenity grassland – J1.2	0.18	-
Buildings J3.6	0.22	-
Defunct hedge – species poor - J2.2.2	N/A	-
Fence – J2.4	N/A	-
Wall – J2.5	N/A	-
Other habitat - J5 (pier, hardstanding)	0.25	0.03
Road/track	0.20	0.02
Total	1.70	0.24

* Survey Area includes those habitats mapped during the Phase 1 survey as well as a small section of the temporary working area which was mapped from aerial photography.

The Proposed Development is located offshore and, as such, the terrestrial habitats recorded were limited to an area of boulders/ rocks above high tide. The coastal habitats in the western site buffer are a mixture of coastal rock/ sand habitats and grassland habitats (coastal/ semi-improved/ amenity). A number of buildings associated with the ferry terminal and the local village were also located in the survey area. The majority of the survey area was occupied by open sea. The habitats associated with the marine environment are discussed in Chapter 8.

Otters

The coastal habitats present offer good commuting potential for otters. Inland, there is limited connectivity within the survey area from the coastal habitats to inland freshwater foraging habitats. Due to the high levels of disturbance associated with the presence of a ferry terminal and the local village it is unlikely that the habitats in the survey area are used as refugia by otters.

During the otter survey undertaken on 16 June 2021, no field signs of otter were recorded (see Volume III, Appendix 7.2).

Bats

The Proposed Development site offers little to no foraging or commuting habitat for bats due to its marine situation. The terrestrial habitats in the survey buffer to the west offer low foraging and commuting habitat potential for bat species, due to the exposed nature and lack of woodland and watercourses. The semi-improved neutral grassland, coastal grassland, swamp habitat and gardens offer foraging potential, however the foraging potential in the wider area is also relatively limited with generally poor connectivity.

During the Preliminary Ecological Appraisal (PEA) survey undertaken on 16 of June 2021, two trees were found within the survey area, neither of which had potential bat roost features. The buildings in Baile Mòr village within the survey buffer could offer moderate potential for roosting bat species utilising the area.

Therefore, the site has been assessed as having negligible potential for foraging, commuting and roosting bat species, with the terrestrial habitats to the west offering moderate potential for roosting bats and low potential for foraging and commuting.

Reptiles

The Proposed Development site offers no suitable habitat for reptiles. The survey buffer to the west has been assessed as having the potential to support common lizard (*Zootoca vivipara*) and slow worms (*Anguis fragilis*). This is due to the presence of semi-improved neutral grassland and an area of coastal grassland. The desk study only identified the presence of common lizards in Iona.

7.3.1.3 Identification of Important Ecological Features

The majority of the terrestrial ecological receptors from the Proposed Development are only likely to be impacted (ecologically) at site or regional level. This is because impacts on the potential receptors will only occur within the Proposed Development site itself.

Potential terrestrial ecological receptors identified during the desk studies and field surveys include bat species, otters, and reptiles. Those designated sites identified by the desk study relating to non-avian ecological receptors comprise eight LNCS.

Of the potential ecological receptors which could be impacted, a number were discounted:

- Designated sites – The seven LNCSs are all located over 1.5km from the site and will not directly be impacted by the development. Due to the distance from site, there are not anticipated to be any indirect impacts relating to noise disturbance. It is therefore considered that construction activities at the Proposed Development will not impact the LNCSs located within the search area;
- Bat species – the Proposed Development offers negligible foraging or commuting habitat due to its marine location. The terrestrial habitats in the survey buffer to the west offer low foraging and commuting habitat for bat species, due to the exposed nature and lack of woodland and watercourses. The buildings in Baile Mòr village within the survey buffer could offer moderate potential for roosting bat species utilising the area. As the works will all predominantly be undertaken by barge at sea, with no construction activities occurring on land, in an area where bats will already be habituated to disturbance relating to ferry traffic (both terrestrial and marine), it is anticipated that there will be no impacts on bat species utilising roosts within the survey buffer. As such, bat species have been scoped out of the assessment; and
- Reptiles – the Proposed Development has no suitable habitat for reptiles. As per the bat species, there will be no impact on suitable terrestrial habitats used by reptiles relating to damage or disturbance to reptiles and, as such, they have been scoped out of the assessment.

The following non-avian IEFs have therefore been identified for the Proposed Development site and are considered further in the assessment: habitats and otters.

7.3.2 Future Baseline

The Overview Report for Climate Change Projections and factsheets (MOHC, 2018) indicates that, in general, warmer, wetter winters and hotter, drier summers are predicted, though of course still with natural variations in that pattern from year to year. No clear trend in wind speeds or storms is predicted, though the data currently published cannot make projections for local conditions and wind gusts. Sea levels are predicted to rise overall with increases in extreme coastal water levels.

In the short term, between the time of survey and the start of construction, there are no predicted changes to the baseline scenario. In the longer term, in the absence of development it is likely that the same intertidal habitats will be present in the survey area but in different proportions due to increased fluctuations in sea level and a gradual increase in coastal water levels.

7.3.3 Summary of Sensitive Receptors

Table 7-8 summarises the IEF's to be included in the assessment and their sensitivity.

Table 7-8 Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
Habitats	Low	Only a small section of terrestrial habitat will fall within the Proposed Development site. The habitats are not UKBAP priority habitats, SBL habitats or included as priority habitats in the local Biodiversity Action Plan (Argyll and Bute Planning Service 2017).
Otters	Medium (No signs of otter recorded during the surveys)	Otter is designated as an EPS and is listed as an SBL, LBAP and UKBAP priority species. However, no field signs or resting sites were identified during the surveys and the relatively high level of baseline disturbance from the harbour may deter otters from regularly using the immediate surrounding area.

7.4 Description of Likely Significant Effects

During construction, all works will be undertaken offshore using barges to ship in materials and undertake the construction works. Welfare facilities will be located on the barge, however there will likely be a small compound established within the Temporary Work Area (Figure 7-2). Full details of the construction methods to be employed are outlined in Chapter 3, Section 3.2.

7.4.1 Potential Effects

The following potentially significant impacts have been identified for the works associated with the construction phase of the Proposed Development:

- Temporary disturbance/ loss of habitat arising from activities within the terrestrial area of the Temporary Work Area (namely the establishment of a work compound and storage of rock);
- Temporary disturbance/ loss of habitat due to airborne noise and visual disturbance from construction activities;
- Permanent loss of habitat arising from reclamation of seabed during the construction of a new rock armour breakwater to the south of the existing slipway; and
- Temporary effects on prey species due to underwater noise arising from construction activities (notably dredging and vessel noise), increased suspended sediment concentrations and sediment deposition.

The following potential impacts have been identified during the operational phase of the Proposed Development:

- Long term increase in disturbance to habitat arising from increased levels of marine activity due to improved ferry services;

- Long term increase in disturbance of habitat due to airborne noise and visual disturbance associated with the increase in terrestrial activity; and
- Long term effects on prey species due to noise arising from vessels and potential for pollution events linked with increased levels of marine activity.

7.4.2 Assessment of Construction Effects

Habitats

When considering habitats, only terrestrial habitats have been assessed, therefore all areas mapped below the MHWS line are shown as 'sea' and have been excluded from the habitat loss calculations below (Table 7-9). Habitats below the MHWS line are considered in Chapter 8 (Marine Biodiversity). When considering habitat loss, only the areas mapped as terrestrial habitat that overlap with the proposed breakwater and rock armour have been considered. All terrestrial habitats within the Temporary Work Area have been included in the habitat change calculations as these areas will be used for the site compound and rock storage, which is likely to also involve machinery movement and temporary damage to the underlying habitats.

Table 7-9 Terrestrial Habitat Loss and Change

Phase 1 Habitat Type	Total Area of Terrestrial Habitat in Site Boundary and Temporary Work Area (Ha)	Total Permanent Loss (Rock Armour and Breakwater) (Ha)	Total Area of Habitat Change (Temporary Work Area) (Ha)	Total Area Affected (Ha)	% Of Each Habitat in Proposed Development Affected
Neutral grassland - semi-improved - B2.2	0.06	-	0.06	0.06	100%
Improved grassland - B4	0.01	-	0.01	0.01	100%
Boulders/rocks above high tide mark – H4	0.06	0.01	0.04	0.05	83%
Coastal grassland – H8.4	0.06	-	0.06	0.06	100%
Other habitat - J5 (pier, hardstanding)	0.03	0.01		0.01	33%
Road/track	0.02	-	0.01	0.01	50%
Total	**0.24**	**0.01**	**0.18**	**0.19**	**79%**

* Survey Area includes those habitats mapped during the Phase 1 survey as well as a small section of the temporary working area which was mapped from aerial photography.

The construction phase will result in the loss of approximately 0.02ha of terrestrial habitat, with 0.1ha in the form of boulders/ rocks above high tide mark. This habitat is locally common in the coastal areas around Iona and is not a protected habitat. As such the habitats to be lost are considered to be of local conservation value.

Impacts relating to habitat change and damage within the Temporary Work Area are considered short term in duration and reversible, with the habitats to be affected generally locally common and of local or negligible conservation value.

Given the above, the magnitude of the impact has been assessed as minor. When considering the local conservation value as low sensitivity, the overall assessment of effect is deemed to be Minor Adverse. In terms of the EIA Regulations this is deemed a non-significant effect.

Otters

No field signs relating to otters were identified during the survey. The desk study identified otters as being present within the wider landscape. The coastal habitat is considered to provide suitable foraging and commuting habitat for otters; however, the baseline disturbance due to the presence of an active ferry terminal and dog walkers may deter otters from establishing resting sites within the survey area. Therefore, given the lack of evidence of the current use of the area by otters, it is anticipated that there will be no physical damage or disturbance to resting sites during the construction phase and the magnitude of change in relation to injuries or fatalities is negligible.

Noise and visual disturbance may result in a temporary reduction in foraging habitat (through both prey disturbance and disturbance to otters) within the immediate vicinity of the construction works. Given the widely available food sources in the immediate environs it is considered the magnitude of change in relation to reduction of foraging habitat and prey availability due to construction works is minor.

Pollution events could result in a reduction of prey availability and injury/fatality to otters. The magnitude of change in relation to injuries or fatalities is minor.

Given the above, the overall magnitude of the impact has been assessed as moderate. When considering the international conservation value and medium sensitivity at the site level, the overall assessment is deemed to be Minor Adverse. In terms of the EIA Regulations this is deemed a non-significant effect.

7.4.3 Assessment of Operational Effects

Habitats

During the operational phase there are no predicted effects on habitats.

Otters

During the operational phase there is the potential for disturbance to otters from the increase in marine activity due to the improved ferry services. Any otters using habitat around the existing ferry terminal will be tolerant to disturbance and so the additional ferry services are unlikely to have a significant impact on their foraging and commuting behaviour. This is also considered the case for prey species. Due to the low likelihood of this work disturbing protected species, these potential impacts are assessed as being of low magnitude and their effects as of Negligible significance. In terms of the EIA Regulations this is deemed a non-significant effect.

7.5 Mitigation Measures

7.5.1 Mitigation During Construction

The only impact predicted to have a minor (though not significant) effect relates to injury to otters during construction. The following mitigation describes methods that will reduce the risk for otters:

- Production of an Otter Species Protection Plan (see Volume III, Appendix 7.2) and adherence to all recommendations made within;
- Production of a Construction and Environmental Management Plan (oCEMP); and
- An Ecological Clerk of Works (ECoW) will be appointed to monitor the works in respect to otter activity.

7.5.2 Mitigation During Operation

No additional mitigation measures are required for the operational phase of the Proposed Development. The Environmental Management Plan (EMP) will manage the risks of all operational activities, facilities and cargo handled by the port and will include best practice measures to control pollution following standard guidelines such as the Environment Agency Pollution Prevention Guidelines. This is considered sufficient to limit any potential impacts relating to pollution events.

7.6 Potential Cumulative Effects

The above sections have considered the implications of the Proposed Development on IEFs in isolation from the potential effects of other plans and projects. The CIEEM guidelines also require that the Proposed Development be assessed cumulatively, so that any potential cumulative effects can be identified.

Chapter 21 summarises the criteria for selecting the list of projects to be considered. Two projects have been identified in the vicinity of the Proposed Development. These are listed below:

- The Fionnphort Breakwater and Overnight Berthing Project c.1.3km to the east. No assessment has been made in respect to this development as yet, but it is anticipated that the impacts would be of a similar nature to the Proposed Development. Due to the distance and separation of the two developments by the Sound of Iona, it is unlikely that any in-combination effects on IEFs would occur; and
- Cable installation – Iona to Fionnphort c.900m to the south. The project involves the installation of fibre optic cable and is proposed in the first half of 2023. No information on the potential impacts of this work on otters or habitats was available through the Marine Scotland website[13]. There is the potential for cumulative impacts relating to disturbance for otters using the Iona coastline. Given

[13] https://marine.gov.scot/marine-projects

the distance between the sites and the presence of alternative foraging and commuting habitats for otter to use along the coastline and inland, it is considered that that any in-combination effects would be negligible.

7.7 Residual Effects

7.7.1 Residual Construction Effects

Habitats

Following implementation of the oCEMP, as highlighted in Section 7.5, it is considered that impacts relating to habitats would be of minor magnitude and their effects of negligible significance. In terms of the EIA Regulations this is deemed a non-significant effect.

Otters

Following implementation of the mitigation outlined in Section 7.5 and Technical Appendix 6.2, the magnitude of the impact has been assessed as minor. When considering the international conservation value and medium sensitivity at the site level, the overall assessment of effects is deemed to be negligible. In terms of the EIA Regulations this is deemed a non-significant effect.

7.7.2 Residual Cumulative Effects

7.7.2.1 Ecology

Otters

Following implementation of the mitigation outlined in Section 7.5 and Appendix 7.2, it is considered that in-combination effects relating to otters would be of negligible magnitude and their effects as of minor significance. In terms of the EIA Regulations this is deemed a non-significant effect.

7.8 Conclusions and Summary of Effects

In summary, the terrestrial impacts relating to the Proposed Development will be non-significant, with the most notable impacts relating to the potential for impacts on otters (minor adverse during construction). Despite the absence of otter activity within the study area, a precautionary approach has been adopted and an Otter Protection Plan (Technical Appendix 7.2) has been included to ensure that there will be no significant effects to terrestrial IEF's.

In addition to the above, a Habitats Regulation Appraisal (HRA) has been undertaken to determine the potential for the Proposed Development to have a Likely Significant Effects (LSE) on designated sites in the UK national network of sites ('European sites'). The initial screening process (Stage 1: Screening) did not identify any sites designated for terrestrial biodiversity to be taken forward for determination of LSE via a Stage 2 Appropriate Assessment.

8 MARINE BIODIVERSITY

8.1 Introduction

This chapter of the EIAR presents the assessment of the likely significant effects on marine biodiversity receptors from the Proposed Development. Specifically, this chapter considers the likely significant effects of the Proposed Development seaward of Mean High Water Springs (MHWS) during the construction, operation and maintenance phases.

A detailed baseline that underpins the impact assessment is included in Section 8.3 of this chapter. This provides a characterisation of the marine biodiversity receptors within the Marine Biodiversity Study Area and a 100 km search area around the Marine Biodiversity Study Area.

8.1.1 Purpose of this Chapter

This EIAR chapter:

- Presents the existing environmental baseline established from desk studies, site-specific surveys and consultation;
- Presents the likely significant effects on marine ecological receptors, based on the information gathered and the analysis and assessments undertaken;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Highlights any necessary monitoring and/or mitigation and/or compensation measures which could prevent, minimise, reduce or offset the likely significant effects identified in the impact assessment section of this chapter.

8.1.2 Planning Policy & Legislation

This section outlines the international and national policy and legislation relevant to the assessment of likely significant effects on marine biodiversity receptors.

8.1.2.1 International

The following international policies were consulted to guide the production of this chapter of the EIAR:

- **EU Habitats Directive (Directive 92/43/EEC)** - All species of cetacean are listed in Annex IV of the EU Habitats Directive as European Protected Species (EPS) where the killing, disturbance or destruction of these species or their habitat is banned (Article 12). Two cetacean species, the bottlenose dolphin *Tursiops truncatus* and the harbour porpoise *Phocoena phocoena*, as well as the two pinniped species, harbour seal *Phoca vitulina* and grey seal *Halichoerus grypus* are also listed in Annex II as species whose conservation requires the designation of Special Areas of Conservation (SAC). Harbour seal and grey seal are also listed in Annex V.

- **Conservation of European wildlife and Natural Habitats Convention (Bern Convention)** - aims to ensure conservation and protection of wild animal species and their natural habitats, increase cooperation between contracting parties and to regulate the exploitation of those species.
- **The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention) and the Convention on the Conservation of Migratory Species of Wild Animals** - Selected species are also protected by these policies. All toothed whales, or odontocetes, (except for the sperm whale) are protected under the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) Agreement, which is a legally binding Agreement, ratified under the Bonn Convention.
- **Marine Strategy Framework Directive -** The Marine Strategy Framework Directive (MSFD) requires Member States to prepare national strategies to manage their seas to achieve Good Environmental Status (GES) by 2020. It was transposed into UK law by the Marine Strategy Regulations in 2010.

8.1.2.2 National

The following national policies and legislation were consulted to guide the production of this chapter of the EIAR:

- **UK Marine Policy Statement** - The UK Marine Policy Statement (MPS) framework has been adopted to help achieve the vision of *'sustainable development in the United Kingdom marine area'.*
- **National Marine Plan (Scotland) -** provides a comprehensive overarching framework for all marine activity in Scottish waters. Aims to drive sustainable development and use of Scotland's marine area in a way which will protect and enhance the marine environment whilst promoting both existing and emerging industries.
- **Wildlife and Countryside Act 1981** - Species listed in Schedule 5 are protected against deliberate killing, injuring or disturbance. The Nature Conservation (Scotland) Act 2004 makes amendments to the Wildlife and Countryside Act 1981 in Scottish waters
- **UK Biodiversity Action Plan** - UK Biodiversity Action Plan (BAP) Priority species and habitats are those identified as being the most threatened and requiring conservation action. This is an important reference source and has been used to drive the statutory list of priority species in Scotland. Species of cetacean occurring regularly in UK waters are designated as UK BAP species
- **Scottish Biodiversity List** - The Scottish Biodiversity List is a list of animals, plants and habitats that are of principal importance for biodiversity conservation in Scotland. 21 species of cetacean, one pinniped species and 54 species of fish and shellfish are included on the Scottish Biodiversity List.
- **Priority Marine Features** - Scottish Ministers adopted a list of 81 priority marine features (PMF), many of which are features characteristic of the Scottish marine environment. The list helps to deliver Marine Scotland's vision for marine nature conservation.

8.1.2.3 Regional

The following regional policy was consulted to guide the production of this chapter of the EIAR:

- **Regional Marine Plans** - The Proposed Development lies within the Argyll Scottish Marine Region (SMR). At the time of writing (October 2022), there is no RMP in place for the region. See Section 2.3.3.2 for further details on Regional Marine Plans.

8.1.2.4 Local

The following local policies were consulted to guide the production of this chapter of the EIAR:

- **The Argyll & Bute Local Development Plan** - The Argyll & Bute Local Development Plan (LDP) provides the local planning framework for the Council area. See Section 2.3.3.1 for further details on the Argyll & Bute LDP.
- **Western Isles Local Biodiversity Action Plan** - The Argyll & Bute Local Biodiversity Action Plan (A&B LBAP) 2010-2015 sets out over 70 priority conservation projects being implemented by various groups. These priority projects will help assess, maintain and enhance a wide range of habitats and species across the Council area. The Plan focused on the most important priorities for conservation over 2010-2015, building on the work achieved to date and aiming to reach the longer-term vision set out for 2030 by the Scottish Biodiversity Strategy therefore, its assumptions are an important reference source in terms of biodiversity conservation.

8.1.3 Structure of this Chapter

The structure of this chapter is as follows:

- **Section 8.2 – Baseline Methodology**: This section provides details on the methodology used to undertake the desktop study, designated sites and site-specific surveys;
- **Section 8.3 – Baseline Scenario:** This section provides a characterisation of the marine biodiversity receptors;
- **Section 8.4 – Future Baseline Conditions:** This section considers the evolution of the Baseline Scenario over time in response to natural changes e.g., climate change;
- **Section 8.5 – Assessment Methodology:** This section describes the methodology used to assess the Proposed Development on the Baseline Scenario;
- **Section 8.6 – Embedded Mitigation:** This section describes the embedded mitigation measures taken as part of the Proposed Development;
- **Section 8.7 – Description of Likely Significant Effects:** This section provides details on the assessment undertaken for the Proposed Development;

- **Section 8.8 – Potential Cumulative Effects:** This section describes the potential cumulative effects on the Baseline Scenario of the Proposed Development in combination with other projects screened in for assessment;
- **Section 8.9 – Inter-Related Effects:** This section describes the likely inter-related effects arising from the Proposed Development;
- **Section 8.10 – Mitigation Measures:** This section describes the embedded mitigation measures and other mitigation to be undertaken in response to likely significant effects on the Baseline Scenario; and
- **Section 8.11 – Conclusion and Summary of Effects:** This section summarises the Baseline Scenario, description of likely significant effects, mitigation measures, potential cumulative effects and residual effects.

8.2 Baseline Methodology

8.2.1 Desktop Study

An evidence-based approach has been used to inform the Baseline Scenario. This involved utilising existing data and information from sufficiently similar studies. This evidence-based approach means that it is not always necessary for new data to be collected, or new modelling studies to be undertaken, to characterise likely significant effects with sufficient confidence for an Environmental Impact Assessment (EIA).

Data has been acquired through relevant historical data, previous studies and surveys, to characterise the Baseline Scenario. Key sources used to inform the baseline characterisation of the Marine Biodiversity Study Area are summarised in Table 8-1.

Table 8-1 Summary of key desktop reports

Title	Source	Year	Author
Annex I and II of the EU Habitats Directive	Habitats Directive (Council Directive 92/43/EEC)	1992	European Union Commission
Assessing the sensitivity of seagrass bed biotopes to pressures associated with marine activities.	JNCC	2014	D'Avack *et al*.
BAP Species List	UK Post-2010 Biodiversity Framework	2012	UK Government
BERN Convention Appendix II and II	Convention on the Conservation of European Wildlife and Natural Habitats	1979	Council of Europe
Biotope Mapping and Survey of the Treshnish Isles Candidate Special Area of Conservation	ERT	2004	ERT (Scotland) Ltd.
CITES Appendix I and II	Convention on International Trade in Endangered Species	1975	IUCN, International Treaty
EMODnet	EMODnet	2022	European Commission, EMODnet

Title	Source	Year	Author
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys.	SCANS-III	2017	Hammond *et al*.
EUNIS Seabed and Biotope classification system	EUNIS	2019	Parry *et al.*
Fisheries sensitivity Maps in British Waters	UKOOA	1998	Coull *et al*.
Hebridean Marine Mammal Atlas. Part 1: Silurian, 15 years of marine mammal monitoring in the Hebrides	HWDT	2018	Hebridean Whale and Dolphin Trust
Isle of Mull Rivers Project: Summary of 2010 fish populations, Habitat Surveys and Potential Habitat Management Initiatives.	Argyll Fisheries Trust	2011	Argyll Fisheries Trust
IUCN Red List	International Union for the Conservation of Nature	2022	IUCN
MPA Network for Scottish Designated Sites	Scottish Government	2021	Scottish Government
Mapping the spawning and nursery grounds of selected fish for spatial planning	DEFRA	2012	Ellis *et al*.
NMFS Reports	NMFS	Various	National Marine Fisheries Service
NBN Atlas	National Biodiversity Network Scotland	2021	NBN Atlas Scotland
NMPI	National Marine Plan Interactive	2022	Marine Scotland
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic	1992	European Commission
Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters	Marine Scotland Science	2020	Hague *et al.*
SAC characteristic reports	NatureScot	2021	NatureScot reports
Special Committee on Seals Reports	SCOS	Various	Sea Mammal Research Unit
Zostera marina beds on lower shore or infralittoral clean or muddy sand	MARLIN	2019	D'Avack *et al*.

8.2.1.1 Relevant Guidance

Guidance relevant to EIA for the Marine Biodiversity chapter is as follows:

- Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for ecological impact assessment (CIEEM, 2018);
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the EIA process in Scotland (Scottish Natural Heritage (SNH), 2018);
- European Commission (EC) Guidelines on the Implementation of the Birds and Habitats Directive in Relation to Port Developments (EC, 2011);
- SNH Priority Marine Features Guidance (SNH, 2017a);

- The protection of Marine European Protected Species from injury and disturbance – Guidance for Scottish Inshore Waters (Marine Scotland, 2020);
- Marine Life Information Network (MarLIN) species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2001); and
- Marine Life Information Network (MarLIN) Marine Evidence-based Assessment (MARESA) – A guide (Tyler-Walters *et al*., 2018).

8.2.2 Assumptions and Limitations

8.2.2.1 Fish and Shellfish

Spawning and nursery areas vary spatially and temporally (Ellis *et al.,* 2010) and as such data only provides an indicative location, representing a 'snapshot' of available species. For this Proposed Development, it has been assumed that if the Marine Biodiversity Study Area overlaps with either spawning or nursery areas then species have been included within the assessment, unless evidence suggests otherwise (i.e., incompatible ecological parameters e.g., freshwater species in marine environments or fish known to only occur at depths not found within the Marine Biodiversity Study Area).

8.2.2.2 Marine Mammals

Mobile species, such as cetaceans and pinnipeds exhibit varying spatial and temporal patterns. All historic surveys across the Marine Biodiversity Study Area represent snapshots of the species considered at the time of sampling. The abundance and distribution of species are likely to vary both seasonally and annually.

8.2.3 Designated Sites

All designated sites within the Marine Biodiversity Study Area (Figure 8-1) with marine mammals, fish and shellfish or benthic habitats as qualifying interest features that could be potentially impacted by the Proposed Development were identified using the following approach (note terrestrial biodiversity and ornithology are assessed under Chapters 7 and 9, respectively):

- Step 1: All designated sites of international, national and local importance were identified using a number of sources (Table 8-1), encompassing Marine Protected Areas (MPAs), SACs, Special Protection Areas (SPAs), and Sites of Special Scientific Interest (SSSIs) identified by examining the Joint Nature Conservation Committee's (JNCC) website, the European Nature Information System (EUNIS) database and the Marine Scotland National Marine Plan Interactive (NMPI) website;
- Step 2: Information was compiled on the relevant qualifying feature(s) for each of these sites by examining each data source. The known occurrence of each qualifying feature within the Marine Biodiversity Study Area was based on relevant desktop information (Table 8-1);

- Step 3: Using the above information and expert judgement, sites were included in the assessment if:
    - *A designated site directly overlaps with the* Proposed Development*;*
    - *Sites and associated features were located within the potential Zone of Impact (ZoI) for impacts associated with the* Proposed Development*, based on expert judgement;*
    - *Qualifying features of a designated site were either recorded as present during historic surveys within the* Proposed Development *area or identified during the desktop study as having the potential to occur within the* Proposed Development *area; and*
    - *Where a national site falls outside of an international site but is located within identified study areas, the national site has been taken forward for further assessment of a particular feature.*

8.2.4 Site Specific Surveys

To characterise seabed sediments, and intertidal and subtidal benthic communities within the Marine Biodiversity Study Area, with a focus on the area most relevant to the Proposed Development, a number of site-specific surveys were commissioned.

8.2.4.1 Seabed Sediment Analysis

A ground investigation was undertaken between 4 November 2022 and 5 November 2022 by Structural Soils Limited. The purpose of the investigation was to characterise the sediment found within the Proposed Development dredging area. A total of three sediment cores were taken from the area via vibrocoring, with subsequent geotechnical and geoenvironmental testing and analysis performed (BHI1 – BHI3; Figure 8-1).

Samples for geotechnical testing were returned to MATtest Limited UKAS accredited laboratory, and those for geoenvironmental testing were sent to SOCOTEC Limited, a MCERTS and UKAS accredited testing laboratory.

A summary of the test results can be found in Volume III, Appendix 8.1.

8.2.4.2 Benthic Intertidal Survey

Benthic intertidal surveys, undertaken between 22nd August 2021 and 24th August 2021, involved a Phase I and Phase II intertidal walkover survey at low tide following guidance in the Marine Monitoring Handbook (Davies *et al.,* 2001), Countryside Council for Wales Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn *et al.* 2006) and the latest guidance for characterising intertidal rocky shore and sediment habitats (Natural Resources Wales (NRW) 2019, Wales 2019).

The intertidal surveys covered the area extending from Mean Low Water Springs (MLWS) to Mean High Water Springs (MHWS) at each location. The survey identified representative biotopes and the extent of each to produce a spatially referenced biotope map according to the EUNIS classification system (Figure 8-4; Parry, 2019) (and correlated to the Marine Nature Conservation Review (MNCR) biotopes).

An Unmanned Aerial Vehicle (UAV) survey was undertaken to collect high-resolution imagery across the intertidal survey areas at low water, to accurately map the extent of each biotope and facilitate the production of the intertidal maps. Unmanned Aerial Vehicle mapping was undertaken in consideration of JNCC guidance for use of UAVs in marine benthic monitoring (Crabb *et al.* 2019). Additionally, a total of 86 quadrat locations were selected across the intertidal survey areas to ground truth the UAV imagery and inform the subsequent habitat/biotope mapping.

The distribution of any features of conservation interest were recorded using photographs and GPS fixes where encountered. The presence of any invasive non-native species (INNS) (e.g., *Crepidula fornicata*) were also noted and their location was recorded. All images collected during the UAV mapping flights underwent Terrain (2D) processing in the Drone Deploy software and were 'stitched' together to generate orthomosaic and Digital Elevation Model (DEM) outputs for both intertidal survey areas. Other information noted included general site conditions, sediment surface features (e.g., *Polydora sp*. Mats), sediment type and characteristics, topography and anthropogenic pressures.

The full intertidal survey report can be found in Volume III, Appendix 8.2.

8.2.4.3 Benthic Subtidal Survey

Subtidal benthic surveys, undertaken between 20th August 2022 and 23rd August 2022, involved the completion of 21 Drop-Down Camera (DDC) stations, 28 DDC transects and the collection of 20 grab samples. DDC sampling resulted in the collection of 1,033 still images. Grab sampling stations were micro-sited to avoid the notable seagrass beds that were identified during the in-field interpretation of the seabed imagery collected across both areas.

Following the survey, DDC data were analysed using the Bio-Image Indexing and Graphical Labelling Environment (BIIGLE) annotation platform (Langenkämper *et al., 2017*) and in consideration of the JNCC epibiota remote monitoring interpretation guidelines (Turner *et al., 2016*) and the most recent National Marine Biological Analytical Quality Control (NMBAQC)/JNCC Epibiota Quality Assurance Framework (QAF) guidance and identification protocols. Analysis of still images was undertaken in two stages. The first stage, "Tier 1", consisted of labels that referred to the whole image being assigned, providing appropriate metadata for the image. The second stage, "Tier 2", was used to assign percentage cover of reef types by drawing polygons. A full seagrass assessment was carried out on all images during the "Tier 1" stage whereby the percentage cover of seagrass in images was estimated based on the following percentage cover categories: 0, <5, 5-25, 26-50, 51-75 and 76-100% cover. To qualify as a PMF seagrass bed, the area covered by seagrass must have at least 5% coverage (Tyler-Walters *et al.,* 2016). The "Tier 1" analysis also included a full reef habitat assessment on all images to determine whether habitats met the definitions of Annex I reef habitats (as set out in Table 1 and Table 2 of Appendix 8.3). The annotation label tree used during analysis had major headings for each reef type. Under each reef type, labels were assigned for each of the categories required to determine whether reef habitat was present.

To classify the sediments of the grab sample Particle Size Distribution (PSD) analysis was undertaken. The process involved sample preparation, dry sieving and laser diffraction. PSD statistics for each sample were calculated from the raw data using Gradistat V8.0 (Blott, 2010) and converted into Broad Scale Habitats (BSH) (EUNIS Level 3) using the adapted Folk trigon (Long, 2006).

Furthermore, macrobenthic analysis of grab samples was undertaken to classify the faunal species. For each macrobenthic sample, the excess formalin was drained off into a labelled container over a 1 mm mesh sieve in a well-ventilated area. The samples were then re-sieved over a 1 mm mesh sieve to remove all remaining fine sediment and fixative. The low-density fauna was then separated by elutriation with fresh water, poured over a 1 mm mesh sieve, transferred into a Nalgene bottle and preserved in 70 % Industrial Denatured Alcohol (IDA). The remaining sediment from each sample was subsequently separated into 1 mm, 2 mm and 4 mm fractions and sorted under a stereomicroscope to extract any remaining fauna. Following faunal identification, the macrobenthic species list was checked using the R package ‘worms’ (Holstein, 2018) to check against the World Register of Marine Species (WoRMS) taxon lists and standardise species nomenclature. All data were collated in excel spreadsheets and made suitable for statistical analysis. All data processing and statistical analysis were undertaken using R v 1.2 1335 (Team & R Core Team, 2020) and PRIMER v7 (Clarke & Gorley, 2015) software packages. Multivariate analysis was then undertaken on the biotic macrobenthic dataset.

Habitats and/or biotopes were identified and classified in accordance with the EUNIS habitat classification system, in consideration of JNCC guidance on assigning benthic biotopes (Figure 8-5; Parry, 2019). Classifications were assigned based on the combined analysis of seabed imagery and BSH data derived from both PSD and macrobenthic analyses, alongside existing habitat maps (European Marine Observation and Data Network (EMODnet) and NMPI). Seabed features were assigned as high-level classification as possible.

The full subtidal survey report can be found in Volume III, Appendix 8.3.

8.3 Baseline Environment

The Sound of Iona is a sound between the Inner Hebridean islands of Mull and Iona in western Scotland which forms part of the Atlantic Ocean. It is less than one mile across and very little is known about its ecology. However, the wider area of the western isles, the Sea of the Hebrides and the Minch is home to a multitude of benthic communities, fish and shellfish species (of both commercial and conservation value) and marine mammals. Designated sites (SACs and MPAs) within the Marine Biodiversity Study Area and wider 100 km search area are defined with minke whale *Balaenoptera acutorostrata,* harbour seal *Phoca vitulina*, grey seal *Haligochoerus grypus*, harbour porpoise *Phocoena phocoena* and <Redacted> as primary reasons for designation. The Inner Hebrides and the Minches SAC (designated for harbour porpoise) and the Sea of the Hebrides MPA (designated for minke whale and <Redacted> overlap with the Proposed Development. Species within the wider area are mercurial, transitory and can be found to migrate through the area.

8.3.1 Marine Biodiversity Study Area

The Marine Biodiversity Study Area includes the Proposed Development boundary. The area has been defined to encompass the maximum spatial extents of likely significant effects on identified receptors, based on professional judgement. The Marine Biodiversity Study Area along with the Proposed Development is shown in Figure 8-1.

The Marine Biodiversity Study Area lies within the region of the western isles, the Sea of Hebrides and the Minch. To consider all receptors that may have connectivity with the Proposed Development and its local surroundings, ecological information was sought from the wider region and included an area of approximately 100 km radius from the Proposed Development (Figure 8-3).

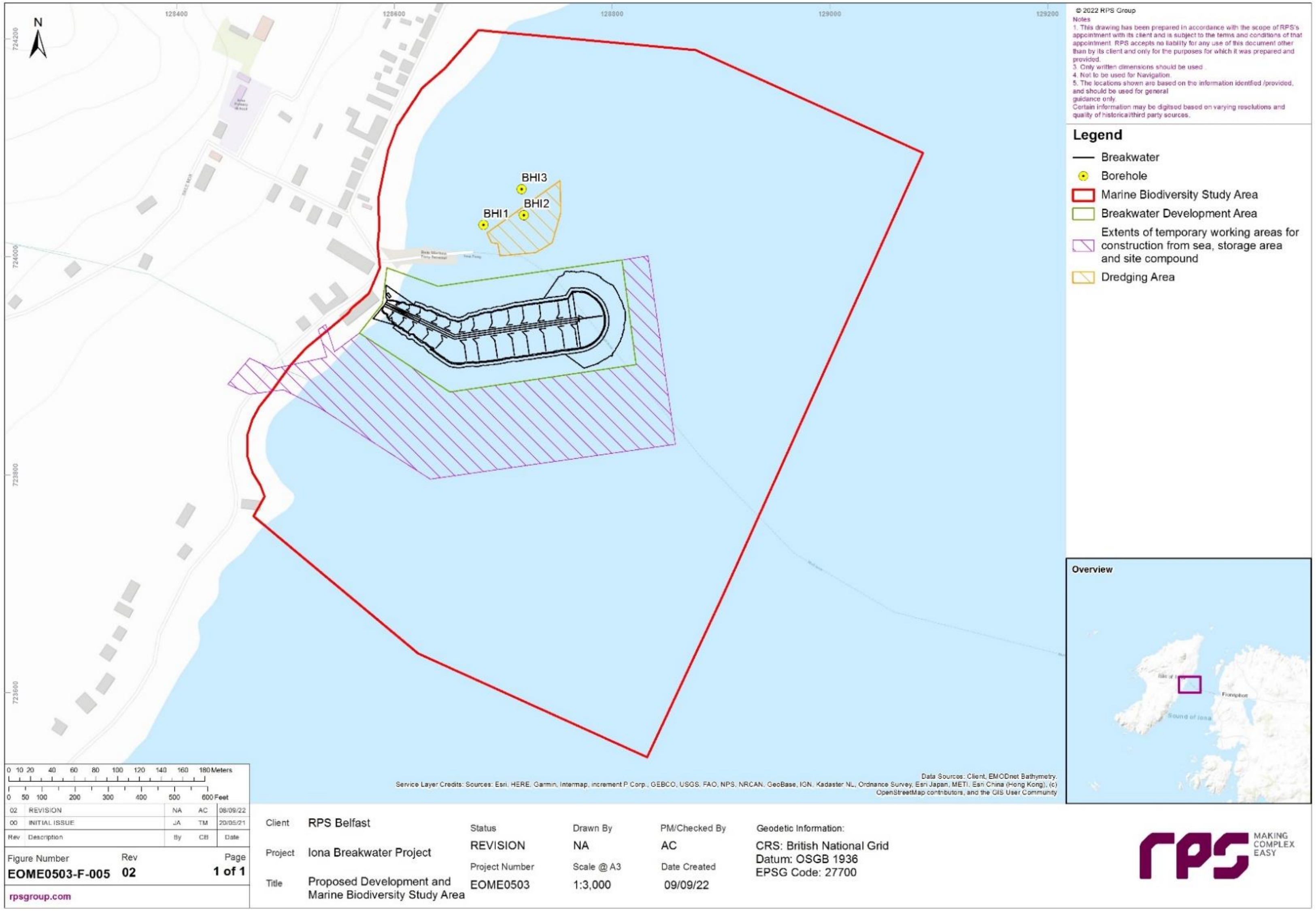


Figure 8-1 Marine Biodiversity Study Area

8.3.2 Geology

The predominant geology in the area was found to be marine beach deposits of sand and raised marine deposits of gravel, sands and silt. This is underlain by the Iona group of metasandstone and metamudstone, with some dyke intrusions (part of the Iona – Ross of Mull dyke swarm comprising Camptonite and Monchiquite igneous rocks).

Particle size analysis was undertaken as part of the geoenvironmental analysis (see Section 8.3.4). This showed the predominant sediment type was sand (91.1%), gravel (7.2%) and silt (1.7%; Figure 8-2).

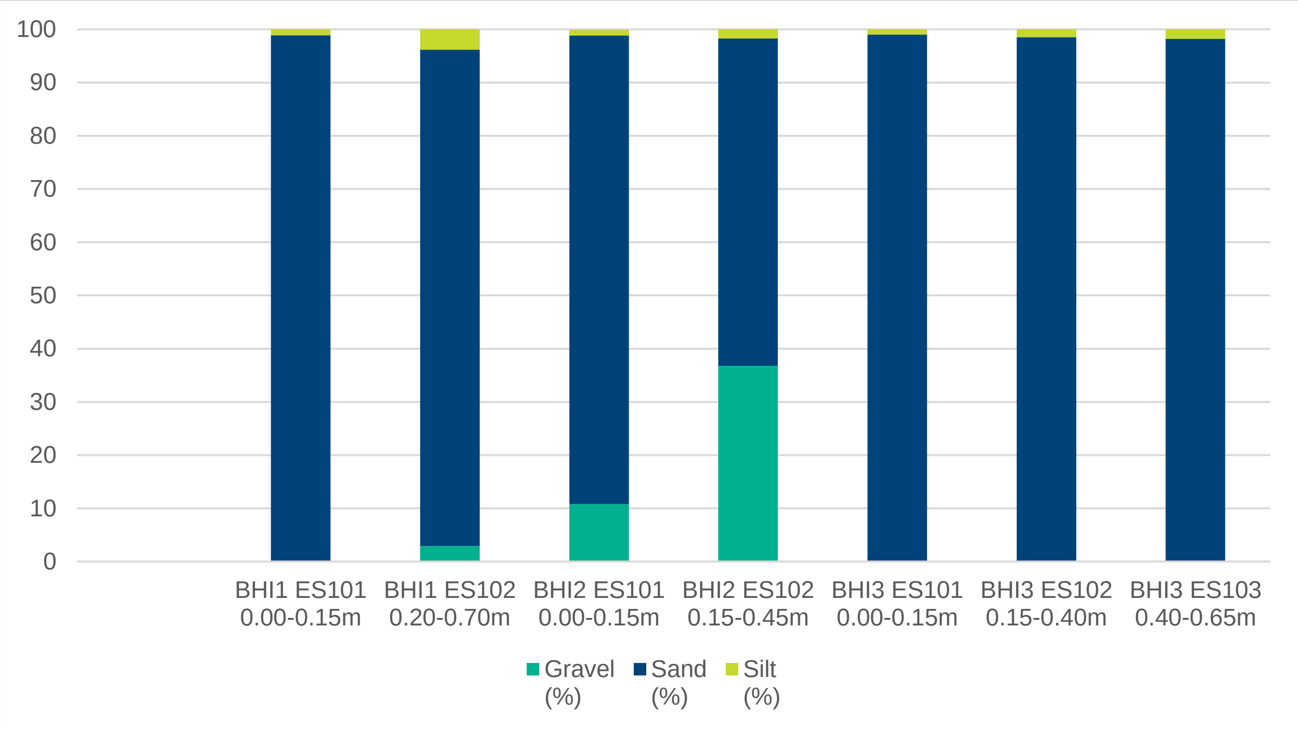


Figure 8-2 Particle size analysis. Core locations have been denoted within Figure 8-1.

8.3.3 Designated Sites

MPAs afford protection to habitats and species within the marine environment. There are three categories of MPA, namely Nature Conservation MPAs, Demonstration and Research MPAs and Historic MPAs.

The Scottish MPA network includes sites for nature conservation, protection of biodiversity, demonstrating sustainable management, and protecting Scottish heritage. As of July 2021, the MPA network covered approximately 37% of the Scottish seas and comprised (Scottish Government, 2022):

- 231 sites for nature conservation protecting a broad range of habitats and species, ranging from rocky shores and sea caves at the coastline to deep-sea habitats;
- Five other area-based measures which protect species such as sandeel and blue ling, as well as vulnerable marine ecosystems;

- One Demonstration and Research MPA around Fair Isle to investigate the factors affecting seabird populations to demonstrate the socio-economic benefits of the marine environment; and
- Eight Historic MPAs to preserve sites of historical importance around the Scottish coast.

Designated sites identified for the marine biodiversity assessment are described in Table 8-2 and shown in Figure 8-3. In addition, a summary of the conservation interest of each site with respect to relevant qualifying features is provided below.

Table 8-2 Designated sites identified for marine biodiversity receptors considered in this assessment

Designated sites	Closest distance to development (km)	Relevant qualifying feature
Sea of the Hebrides MPA	0	<Redacted>
		Minke whale *Balaenoptera acutorostrata*
Inner Hebrides and the Minches SAC	0	Harbour porpoise *Phocoena phocoena*
Treshnish Isles SAC	15.5	Grey seal *Halichoerus grypus*
Loch Sunart to the Sound of Jura MPA	33	Common skate *Dipturus intermedia*
Eileanan agus Sgeiran Lios mor SAC	51.5	Harbour seal *Phoca vitulina*
South-East Islay Skerries SAC	75.6	Harbour seal *Phoca vitulina*
Sound of Barra SAC	91.2	Harbour seal *Phoca vitulina*

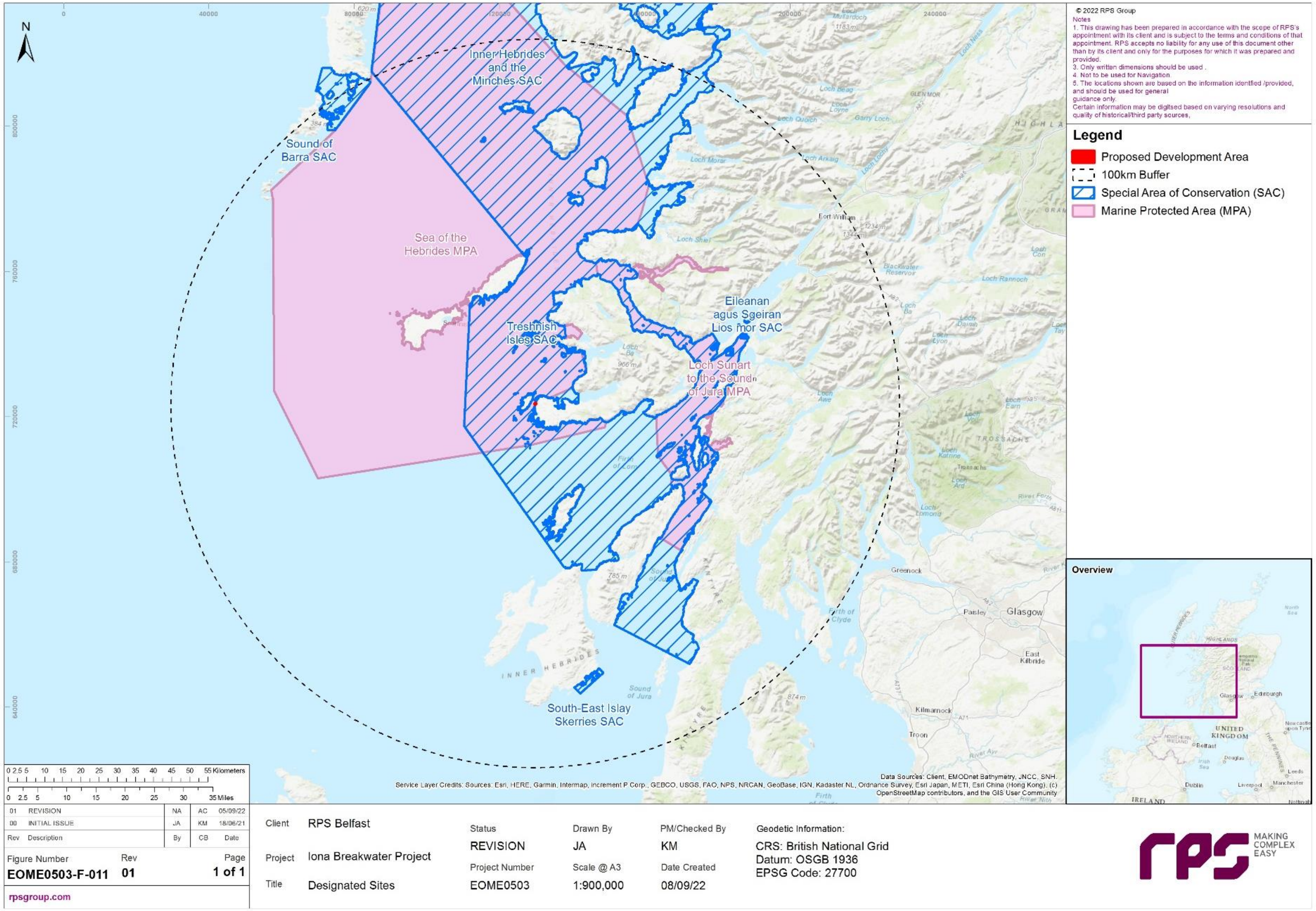


Figure 8-3 Designated sites identified for marine biodiversity receptors considered in this assessment

8.3.3.1 Species Management Plans

Conservation and environmental sensitivities along with management plans relevant to those marine biodiversity receptors considered in this chapter are summarised in Table 8-3.

8.3.3.2 Sea of the Hebrides MPA

The Sea of Hebrides MPA overlaps with the Proposed Development and encompasses the following biodiversity features: <Redacted> *minke whale* and *fronts*. The large-scale front feature, which appears during the spring and summer southwest of Tiree, provides an important functional link to both <Redacted> and minke whale by facilitating favourable feeding conditions. The protected features also include *marine geomorphology of the Scottish shelf seabed (Inner Hebrides Carbonate Production Area)*, which is an internationally important example of a non-tropical shelf carbonate system characterised by very carbonate-rich sediments (NatureScot, 2021b).

Minke whales are observed seasonally, most frequently during summer in the northwest region, throughout the MPA. Sighting data highlights an area in the south and east of the MPA region, particularly around Coll and Tiree. <Redacted> remain within the MPA between June and October (NatureScot, 2021b).

In summary, the conservation objectives for this designation are:

- Protecting high densities of <Redacted> and minke whales, compared to other parts of Scottish territorial waters, particularly from April to October;
- Protection of important areas where <Redacted> an OSPAR-threatened and declining species, feed and show social, group and courtship-like behaviours;
- Recognition of fronts as an important feature that provides benefits to both <Redacted> and minke whale by enhancing primary productivity and prey availability; and
- Conservation of the Inner Hebrides Carbonate Production Area (the geodiversity feature) ensures that important biogenic habitats such as maerl beds and seagrass are protected and that vital processes, such as the production and supply of shell-rich sands to beaches are maintained.

8.3.3.3 Inner Hebrides and the Minches SAC

The Inner Hebrides and the Minches SAC overlaps with the Proposed Development boundary. The site is designated for harbour porpoise *Phocoena phocoena*. It covers an area of 13,814km^2 of important summer habitat where the density of animals has been shown to be consistently above average. It is estimated that the site supports (based on the SCANS-II survey which took place in July 2005 only; SCANS II, 2005) approximately 5438 individuals (95% Confidence Interval (CI): 2426-12191) for at least part of the year, as seasonal differences are likely to occur, and represents approximately 32% of the population within the UK (in water depths of 200m or less) (NatureScot, 2021c). Although there are more data from the summer months, harbour porpoise are present throughout the year and thus the designation applies year-round (NatureScot, 2021a). The latest assessed condition (31st December

2016) demonstrates that the favourable conservation status is 'maintained' (NatureScot, 2021c). Studies have shown that higher densities of harbour porpoise were consistently associated with depths of between 50m and 150m (NatureScot, 2021c).

In summary, the conservation objectives for this designation are:

- To ensure that the Inner Hebrides and the Minches SAC continues to make an appropriate contribution to harbour porpoise remaining at favourable conservation status.
- To ensure for harbour porpoise within the context of environmental changes, that the integrity of the Inner Hebrides and the Minches SAC is maintained through 2a, 2b and 2c:
  - 2a. Harbour porpoise within the Inner Hebrides and the Minches are not at significant risk from injury or killing;
  - 2b. The distribution of harbour porpoise throughout the site is maintained by avoiding significant disturbance; and
  - 2c. The condition of supporting habitats and the availability of prey for harbour porpoise are maintained.

8.3.3.4 Loch Sunart to the Sound of Jura MPA

The Loch Sunart to the Sound of Jura MPA overlaps with two existing SACs, which are designated for subtidal reef habitats. The MPA itself was designated to protect critically endangered common skates *Dipturus spp.* and geodiversity features, namely Quaternary of Scotland, characterised by a number of the deep glaciated channels which provide suitable habitats to reproductively mature common skates. Around the UK, common skates are found almost exclusively in Scottish waters. The MPA contains a significant coastal population of mature common skate, which is believed to breed in the area. The tag-recapture data suggest that up to 400 individuals are residents within the MPA region, with juveniles present within the population (NatureScot, 2021a).

The conservation objective for the Quaternary of Scotland and common skate is to 'conserve' (NatureScot, 2021a).

8.3.3.5 Treshnish Isles SAC

The Treshnish Isles are a remote chain of uninhabited islands and skerries situated in southwest Scotland, located approximately 15.5 km from the Proposed Development. The islands, numerous skerries, islets and reefs support a breeding colony of designated feature species, grey seal *Halichoerus grypus*, contributing just under 3% of annual UK pup production. The SAC covers an area of approximately 20 km^2 (NatureScot, 2021d).

In summary, the conservation objectives for this designation are:

- 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, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features;

- To ensure for the qualifying species that the following are maintained in the long term:
  - Population of the species as a viable component of the site;
  - Distribution of the species within the site;
  - Distribution and extent of habitats supporting the species;
  - Structure, function and supporting processes of habitats supporting the species; and
  - No significant disturbance of the species.

8.3.3.6 Eileanan agus Sgeiran Lios mor SAC

The Eileanan agus Sgeiran Lios mor SAC comprises the islands of Lismore on the west coast of Scotland which provides the most sheltered and enclosed site for the designated feature, harbour seal *Phoca vitulina*. Lismore is a composite site comprising five groups of small offshore islands and skerries which are extensively used as haul-out sites by the colony. Seal numbers (501-1000 individuals) represent just over 1% of the UK population (NatureScot, 2021e). The site is located approximately 51.5 km from the Proposed Development and covers an area of around 11km^2.

In summary, the conservation objectives for this designation are:

- 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, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features;
- To ensure for the qualifying species that the following are maintained in the long term:
  - Population of the species as a viable component of the site;
  - Distribution of the species within the site;
  - Distribution and extent of habitats supporting the species;
  - Structure, function and supporting processes of habitats supporting the species; and
  - No significant disturbance of the species.

8.3.3.7 South East Islay Skerries SAC

The South-East Islay Skerries SAC comprises the skerries, islands and rugged coastline of the Inner Hebridean island of Islay which hold a nationally important population of the designated feature, harbour seal *Phoca vitulina* (between 501 and 1000 individuals). The south-east coastline areas (approximately 15 km^2) are extensively used as pupping, moulting and haul-out sites by harbour seals, which represent between 1.5% and 2% of the UK population (NatureScot, 2021f). The site is located approximately 75 km from the Proposed Development and covers an area of 15 km^2.

In summary, the conservation objectives for this designation are:

- 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, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and
- To ensure for the qualifying species that the following are maintained in the long term:
  - Population of the species as a viable component of the site;
  - Distribution of the species within the site;
  - Distribution and extent of habitats supporting the species;
  - Structure, function and supporting processes of habitats supporting the species; and
  - No significant disturbance of the species.

8.3.3.8 Sound of Barra SAC

The Sound of Barra SAC has consistently supported a significant breeding population of harbour seal since the 1970s and is the only site designated for harbour seal in Outer Hebrides. This Annex II species is a qualifying feature, but not a primary reason for site selection. The SAC is located approximately 92 km from the Proposed Development. It covers an area of 125 km^2 and supports 116 individuals (NatureScot, 2021g).

In summary, the conservation objectives for this designation are:

- 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, and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and
- To ensure for the qualifying species that the following are maintained in the long term:
  - Population of the species as a viable component of the site;
  - Distribution of the species within the site;
  - Distribution and extent of habitats supporting the species;
  - Structure, function and supporting processes of habitats supporting the species; and
  - No significant disturbance of the species.

Table 8-3 Species potentially present in the wider area of the western isles, Sea of Hebrides and the Minch with specific conservation/environmental sensitivities and/or management plans

juv. = juvenile, v = vulnerable, nt = near threatened, ce = critically endangered.

	Legislation/environmental sensitivity or management plan															
Species	**Annex I of the EU Habitats Directive**	**Annex II of the EU Habitats Directive**	**EPS**	**BAP Species**	**Priority Marine Feature**	**OSPAR**	**CMS Appendix I**	**CMS Appendix II**	**ASCOBANS**	**IUCN Red List**	**Bern Convention Appendix I**	**Bern Convention Appendix II**	**Bern Convention Appendix III**	**CITES Appendix I**	**CITES Appendix II**	**EU Management Plans**
Benthic Ecology																
Eelgrass *Zostera marina*	x			x	x	x					x					
Dwarf eelgrass *Zostera noltii*	x			x	x	x										
Maerl beds *Phymatolithon calcareum*	x			x	x	x										
Burrowing sea anemone *Arachnanthus sarsi*				x	x											
Fan mussel *Atrina fragilis*				x	x											
Ocean quahog *Arctica islandica*					x	x										
Tall sea pen *Funiculina quadrangularis*				x						x (v)						
Fireworks anemone *Pachycerianthus multiplicatus*				x												
Fish and Shellfish																
Angler fish *Lophius piscatorius*				x	x (juv.)											
Atlantic salmon *Salmo salar*		x		x	x	x										
<Redacted>				x	x	x	x	x		x (v)		x			x	
Cod *Gadus morhua*				x		x				x (v)						x
Common skate *Dipturus* spp.				x	x	x				x (ce)						

Species	Legislation/environmental sensitivity or management plan															
	Annex I of the EU Habitats Directive	Annex II of the EU Habitats Directive	EPS	BAP Species	Priority Marine Feature	OSPAR	CMS Appendix I	CMS Appendix II	ASCOBANS	IUCN Red List	Bern Convention Appendix I	Bern Convention Appendix II	Bern Convention Appendix III	CITES Appendix I	CITES Appendix II	EU Management Plans
Crawfish *Palinurus elephas*				x	x					x (v)						
European eel *Anguilla anguilla*				x	x	x		x		x (ce)						x
Haddock *Melanogrammus aeglefinus*										x (v)						
Hake *Merluccius merluccius*				x												x
Herring *Clupea harengus*				x												x
Horse mackerel *Trachurus trachurus*				x	x					x (v)						
Mackerel *Scomber scombrus*				x	x											
<Redacted>				x		x										
Norway pout *Trisopterus esmarkii*					x											
Plaice *Pleuronectes platessa*				x												x
Saithe *Pollachius virens*					x (juv.)											
Sandeel *Ammodytes marinus*				x	x											
Sand goby *Pomatoschistus minutus*					x								x			
Sea trout *Salmo trutta*				x	x											
Spurdog *Squalus acanthias*				x	x			x		x (v)						
Thornback ray *Raja clavata*						x				x (nt)						
Whiting *Merlangius merlangus*				x	x											
Marine Mammals																
Bottlenose dolphin *Tursiops truncatus*		x	x	x	x			x	x			x			x	

	Legislation/environmental sensitivity or management plan															
Species	**Annex I of the EU Habitats Directive**	**Annex II of the EU Habitats Directive**	**EPS**	**BAP Species**	**Priority Marine Feature**	**OSPAR**	**CMS Appendix I**	**CMS Appendix II**	**ASCOBANS**	**IUCN Red List**	**Bern Convention Appendix I**	**Bern Convention Appendix II**	**Bern Convention Appendix III**	**CITES Appendix I**	**CITES Appendix II**	**EU Management Plans**
Harbour porpoise *Phocoena phocoena*		x	x	x	x	x		x	x			x			x	
Killer whale *Orcinus orca*			x		x			x	x			x			x	
Minke whale *Baleanoptera acutorostrata*			x		x				x			x		x		
Common dolphin *Delphinus delphis*				x	x			x	x			x				
White-beaked dolphin *Lagenorhynchus albirostris*			x		x			x	x			x			x	
Grey seal *Halichoerus grypus*		x			x			x					x			
Harbour seal *Phoca vitulina*		x			x			x					x			

8.3.4 Benthic Ecology

8.3.4.1 Intertidal

Along the west coasts of Great Britain, from the Isle of Wight around to the Orkney Islands, common fauna species include limpets *Tectura testudinalis,* bivalves *Callista chione*, sea urchins *Paracentrotius lividus, Strongylocentrotus droebachiensis* and molluscs *Volutopsis norwegicus*, *Hemithiris psittacea*, *Trichotropis borealis* (Forbes (1858) from Hiscock *et al.,* 2001).

In addition, studies of harbour and dock sediments have demonstrated very low densities of only a few macrobenthic species (Derweduwen *et al.,* 2014) and those that have been recorded have generally been short lived species (Hawkins *et al*., 2002).

Phase 1 Intertidal Results

The UAV and intertidal walkover were undertaken at Iona during low tide periods between 22 August 2021 and 24 August 2021. A total of 86 quadrat samples/target notes and 385 UAV images were collected.

A total of 18 unique biotopes from 13 EUNIS broadscale habitats were observed across the Iona intertidal survey area (Figure 8-4). High to moderate energy littoral rock habitats (A1.1 and A1.2) and sand and muddy sand (A2.2) made up the majority of the survey area at Iona.

Part of the survey area closer to the land was fringed by supralittoral and littoral fringe rock covered in lichens or small green algae (B3.11). The middle shore was interspersed with rocky habitats of different exposures (e.g., A1.2 and A1.3), littoral sand and mixed sediments (A2.4), and the lower and extreme lower shores were dominated by sand and included patches of rocks and sediments covered with kelp and seaweed communities (A3.21 and A5.52). There were also patches of barren littoral shingle (A2.111) localised in the upper shore to the north of the survey area and just south of the existing slipway.

To the north of the existing slipway, there was clear zonation observed. Lichens or green algae occurred on supralittoral and littoral fringe rock (B3.11) with exposed bedrock and large boulders representative of biotopes A1.1131 and A1.1133 with fucoids present in the fissures and crevices of the bedrock (A1.1132) in the upper to middle shore. The middle to lower shore comprised of sand (A2.2) with a mosaic of rocky habitats covered in fucoids, including *F. serratus* (A1.2141 and A1.2142), *Pelvetia caniculata* (A1.211) and *Himanthalia elongata* (A1.123). The low and extremely low shore was dominated by sand with patches covered in kelp (*L. digitata*) and seaweeds (A5.52) in the central part, while kelp on rock (A3.21) was present to the north. Similar zonation was observed south of the existing slipway; however this part of the survey area was mostly dominated by rocks.

EUNIS classifications B3.1 and B3.11 are included under ‘Supralittoral Rock: Cliff and Slopes’ on the list of Section 2(4) Habitat of Principal Importance under the Nature Conservation (Scotland) Act 2004. Similarly, EUNIS classifications A1.1133 and A1.2142 are listed as ‘Littoral Rock: Intertidal Underboulder Communities’.

No PMFs were recorded during the intertidal survey at Iona. There were no observations of seagrass or seagrass beds, INNS, or maerl (dead or alive) made within the intertidal area. Kelp was observed/noted at two locations in the northern portion of the Iona survey area; however, these observations alone did not provide enough evidence to confidently define boundaries and extent of features potentially representative of kelp bed habitats. As described above, there were large areas of rocky habitat observed across the survey area. The areas of rocky habitat in the mid to lower shore did fall within the boundary of the Inner Hebrides and the Minches Marine SAC and could therefore qualify as Annex I bedrock reef habitat, however, these areas are not afforded protection under the Habitats Directive as the SAC is not designated to protect benthic features. Similarly, some areas of sandy habitat were found within the boundary of the Inner Hebrides and the Minches Marine SAC and could be representative of Annex I mudflats and sandflats not covered by seawater at low tide, however again, these areas are not afforded protection under the Habitats Directive as this is not a qualifying feature of the SAC.

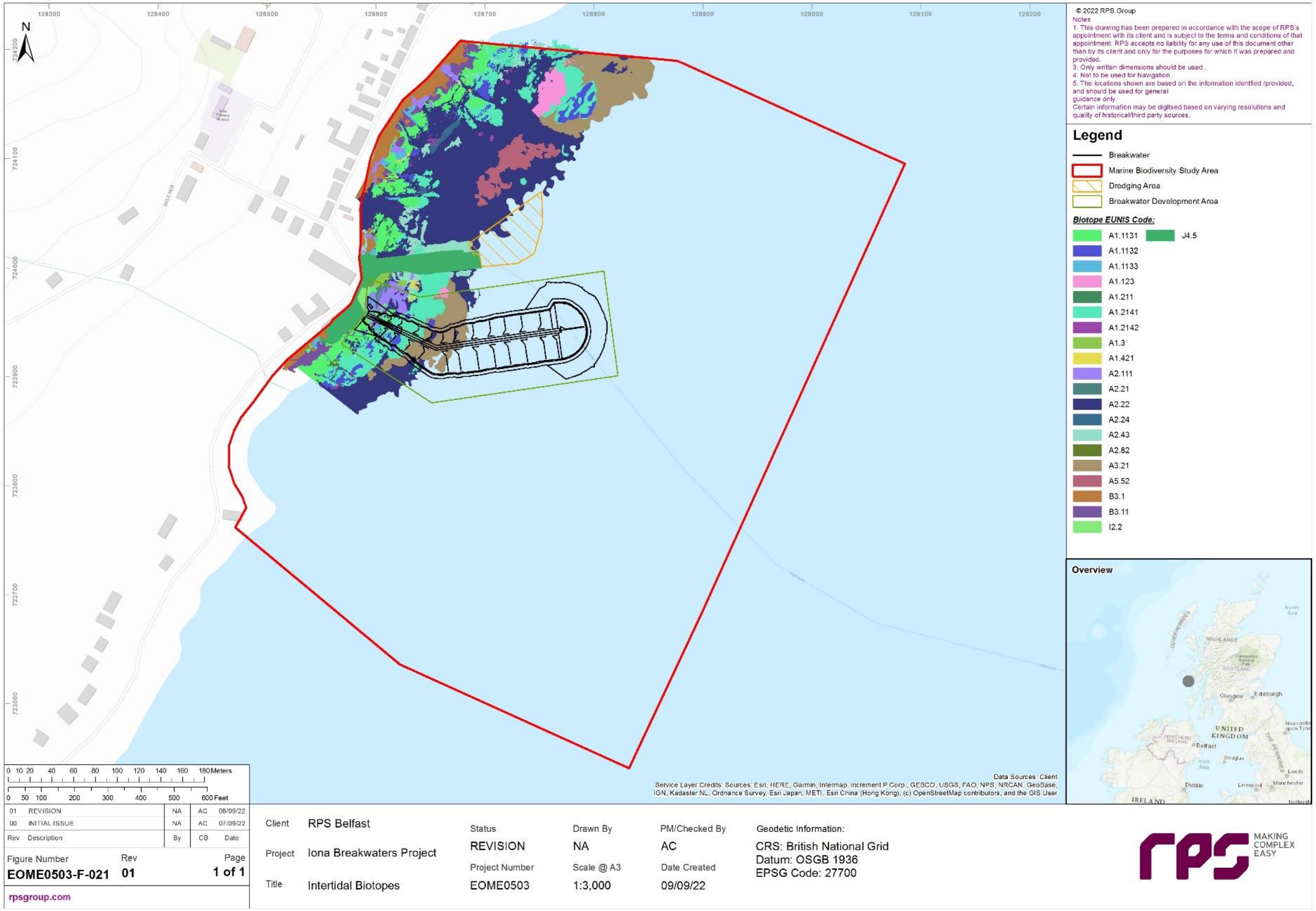


Figure 8-4 Intertidal biotopes classified within the Marine Biodiversity Study Area

8.3.4.2 Subtidal

The EMODnet indicated that the bathymetry of the Sound of Iona has a depth range of between 0 m to approximately 10 m Chart Datum (CD) (EMODnet, 2021). A review of the EMODnet broad-scale predictive habitat maps, full-detail habitat classification (EUNIS), indicates that the majority of the Sound of Iona is 'high energy infralittoral seabed'. The subtidal fringe along the east coast of Iona, within the Marine Biodiversity Study Area, has been recorded as 'low energy infralittoral seabed'. Seabed sediment in the Sound of Iona is described as "rock and hard substrate" by Marine Scotland's NMPI portal (NMPI, 2021). Other habitats recorded to the west, south and north of the Isle of Iona include Atlantic and Mediterranean high-energy infralittoral rock (A3.1), high-energy circalittoral seabed and Atlantic and Mediterranean high-energy circalittoral rock (A4.1) (EMODnet, 2021).

A review of available data has concluded that seagrass beds (a PMF) are likely to be present in the vicinity of Iona and the wider area of the western isles, Sea of the Hebrides and the Minch (Seagrass Spotter, 2021). The Sound of Iona has been identified by NatureScot as an area of management consideration for seagrass due to its coastal and shallow characteristics. *Zostera marina/angustifolia* beds on infralittoral clean or muddy sand (SS.SMp.SSgr.Zmar) were recorded in 2016, located 1km east of Iona, north of Fionnphort. This was described as many large patches located in subtidal sandy habitat at 4-6 m depth. Additionally, seagrass (*Zostera marina*) has also been recorded further north (approximately 18km) during the 'Biotope Mapping and Survey of the Treshnish Isles Candidate Special Area of Conservation (cSAC)', undertaken by ERT (Scotland) Ltd in 2004 (ERT, 2004). Seagrass species, *Zostera marina*, *Ruppia maritima*, and *Zostera noltii*, have been recorded in the wider area on Colonsay, Skye, the Outer Hebrides, and the west coast of mainland Scotland.

Other benthic PMFs associated with the wider area of the western isles, Sea of the Hebrides and the Minch include:

- Maerl or coarse shell gravel with burrowing sea cucumbers (SS.SCS.CCS.Nmix) – recorded at the nearest point of approximately 6.5 km and 10 km to the south of Iona;
- Northern sea fan and sponge communities (CR.MCR.EcCr.CarSwi) - recorded at the nearest point of approximately 15 km to the south-east and 10 km to the north-east of Iona;
- Maerl beds (SS.SMp.Mrl) - recorded at the nearest point of approximately 18 km to the north (around the Treshnish Isles) and approximately 16 km to the north-east (around Ulva) of Iona; and
- Seagrass beds (SS.SMp.SSgr.Zmar) - recorded formally at the nearest point of approximately 18 km to the north of Iona (around the Treshnish Isles). However, local consultation has determined that the Proposed Development overlaps with seagrass beds.

Subtidal Benthic Survey Results

The survey took place at Iona between 20th August 2021 to 23rd August 2021 and involved the completion of 21 DDC stations, 28 DDC transects and the collection of 20 grab samples. DDC sampling resulted in the collection of 1,033 still images supporting the classification of biotopes (Figure 8-5).

The prevailing sediment type within the Iona survey area was found to be sand, with 80% of stations dominated by Slightly Gravelly Sand ((g)S) representing EUNIS BSH A5.2 (Sand and Muddy Sand) and 20% as Gravelly Sand (gS) representing EUNIS BSH A5.1 (coarse sediment). Sand (0.63 mm to 2 mm) was the main sediment fraction present at all stations with content varying between 75.8% to 99.6%. Mud content was low with a maximum of 1.6%.

A broad trend in the distribution of habitats was apparent at the survey site with habitats further offshore characterised as infralittoral sand biotopes (A5.233) with a clear transition into areas dominated by kelp (A5.52) extending all the way to the intertidal zone. Kelp and red seaweeds (moderate energy infralittoral rock, A3.21) habitat were present in the near-shore areas (3.21%).

The dominant EUNIS BSH habitat accounting for 74.6% of the surveyed area was A5.5 – Subtidal Macrophyte Dominated Sediment. That included the following habitats:

- A5.233 - *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (38.1%);
- A5.52 - Kelp and seaweed communities on sublittoral sediment (31.4%); and
- A5.5331 - *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand (5.1%).

Other than seagrass beds (A5.5331), other PMFs such as 'Kelp and seaweed communities on sublittoral sediment' (A5.52) and 'Kelp beds' (A3.125) were also recorded, encompassing 31.4% and 0.001% of the surveyed area, respectively. No live maerl was identified, however dead maerl was observed across 14% and 21% of all DDC stations and transects, respectively.

Evidence of bedrock reef was identified across one transect only, however, no evidence of stony or biogenic reef which would qualify as Annex I reef was observed during subtidal benthic surveys.

The bivalve *Goodallia triangularis* was the most abundant taxa recorded, however, the most abundant major taxonomic group was Crustacea. The major macrobenthic group was characterised by the presence of Nematoda, *Bathyporeia guilliamsoniana,* Nemerteans *and Nephtys cirrosa.* The presence of *B. guilliamsoniana* and *N. cirrosa* as well as the identification of sand-dominated sediments led to the classification of sediments under the EUNIS biotope 'A5.233 *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand', which is characteristic for sediments subject to physical disturbance.

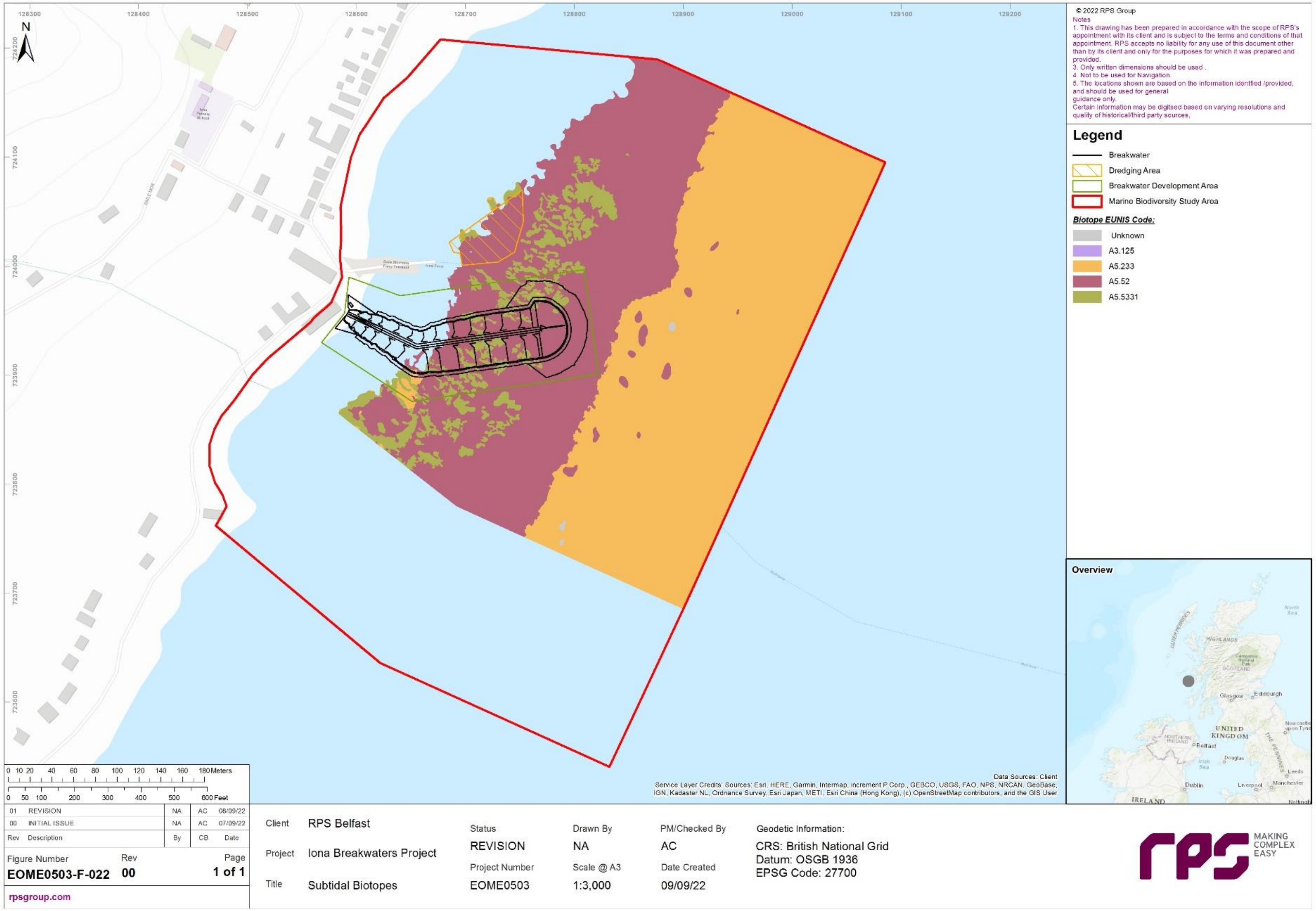


Figure 8-5: Subtidal biotopes classified within the Marine Biodiversity Study

8.3.4.3 Seagrass

Out of 55 seagrass species worldwide (Green and Short, 2003), three are found in the UK: the eelgrass *Zostera marina*, the narrow-leaved eelgrass *Zostera angustifolia* and the dwarf eelgrass *Zostera noltei*. The presence of common eelgrass *Z. marina* was recorded during seagrass mapping surveys in the vicinity of the Proposed Development.

Seagrasses are aquatic angiosperms (flowering plants) adapted to an aquatic environment. *Z. marina* grows in depths of up to 10 m depending on water clarity. The plant has dark green, narrow blade-like leaves with leaf widths varying between 2 cm for young individuals and up to 10 cm for mature plants. The leaves grow between 30 and 60 cm in length but can in some cases reach 1.5 m (D'Avack *et al.,* 2014). Morphological differences may vary with environmental conditions (Phillips & Menez 1988). *Z. marina* can be a perennial or annual species. It exhibits seasonal changes, particularly in leaf growth. The long summer leaves are replaced by shorter, slower-growing ones during the winter months.

The seagrass is found on soft sediments such as sand, mud or a mixture of sand, gravel and mud in sheltered environments such as bays, estuaries, shallow inlets and saline lagoons (D'Avack *et al.,* 2014). All three British seaweed *Zostera* species are found on sedimentary substrata, in sheltered or extremely sheltered locations with slow current velocity. Therefore, excessive sedimentation can be harmful as it smothers plants and turbid water may inhibit growth by reducing the amount of light available for photosynthesis (D'Avack *et al.,* 2014).

Seagrasses reproduce sexually via pollination of flowers and resultant sexual seed but can also reproduce and colonize sediment asexually (D'Avack *et al.,* 2019). In subtidal areas where salinity fluctuation is minimal, dense stands of perennial plants reproduce vegetatively (i.e., by the growth of rhizome (Phillips *et al.,* 1983)). Boese *et al*. (2009) found that natural seedling production was not of significance in the recovery of seagrass beds, but that recovery was due exclusively to rhizome growth from adjacent perennial beds. Manley *et al.* (2015) reported a rhizome growth rate of 26 cm/yr. *Z. marina* plants are monomorphic, restricted to the horizontal growth of roots and, hence, unable to grow rhizomes vertically. This restriction to horizontal elongation of the roots makes the recolonization of adjacent bare patches difficult and is the reason why large beds are only found in gently sloping locations. A depression of the seabed caused by disturbance of the sediment can therefore restrict the expansion of the bed (D'Avack *et al.,* 2019). Maxwell *et al.* (2014) reported that phenotypic plasticity can increase the length of time seagrass can persist in unfavourable environments such as reduced light availability and it is therefore a key element in the resilience of seagrass biotopes. This finding also indicated that different populations would have different resilience to external pressures.

Seagrass beds provide a range of environmental services and are considered of considerable economic and conservation importance. Seagrass beds can improve water clarity by trapping re-suspended sediments and their extensive root systems act as bottom stabilisers reducing the risk of coastal erosion. Roots and leaves provide important food for wildfowl, such as brent geese, and nutrients to support animal communities on the seabed (d'Avack *et al*., 2014). Bertelli & Unsworth (2012) reported that seagrass beds provide fish nurseries for economically important species such as plaice, pollock, herring, cod and whiting and constitute permanent habitats for species of principle importance for conservation such as stalked jellyfish and seahorses (Hiscock *et al.,* 2005).

Furthermore, consultation undertaken with the local community has provided further local knowledge on the extent of seagrass beds in and around the Isle of Iona. It is important to note that this information was subjective and undertaken by visual observation, however, using the precautionary principle, these observations will be considered during the assessment. From these visual observations, seagrass beds were found to be present at Martyr's Bay, St Ronan's Bay and Traighmor to the south, all on the east coast of Iona.

Seagrass Survey Results

Survey results confirmed the presence of extensive seagrass beds representative of the PMF "seagrass beds". Seagrass beds with at least 5% coverage were identified across 23% of all DDC stations and 25% of DDC transects. Areas of dense seagrass coverage (76-100% coverage) were mostly observed in the near-shore areas across 9.5% and 17.8% of all DDC stations and transects, respectively. In total, seagrass habitats (A5.5331) covered 5.1% of the surveyed area (circa 9422 m^2) and were confined to the shallow subtidal zone towards the southern extent of the survey area, perpendicular to the shoreline and almost exclusively present in areas of kelp habitat (A5.52). Aerial imagery results suggest that the seagrass beds observed are very likely to extend along the coast beyond the areas mapped and potentially along much of the shallow subtidal areas of the Sound of Iona.

8.3.4.4 Important Ecological Features

Table 8-4 summarises the Important Ecological Features (IEFs) and the value of each IEF for benthic ecology considered within the Marine Biodiversity Study Area based on definitions provided in Table 8-8.

Table 8-4 Benthic Ecology IEFs identified for this assessment

Benthic ecology IEFs	Representative biotopes	Value within the Marine Biodiversity Study Area	Justification
Littoral rock	A1.1131 A1.1132 A1.1133 A1.123 A1.211 A1.2141 A1.2142 A2.82	Regional	Identified flora and fauna is common throughout the UK, however biotope A1.2142 is listed as a UK BAP Priority habitat (Intertidal Underboulder Communities). No littoral rock biotopes were deemed to qualify as Annex I reefs.
Littoral sediment	A2.111 A2.22 A2.24	Regional	Identified flora and fauna is common throughout the UK, however biotope A2.24 is listed as a UK BAP Priority habitat (Intertidal Mudflats). No biotopes were deemed to qualify as Annex I habitats.

Benthic ecology IEFs	Representative biotopes	Value within the Marine Biodiversity Study Area	Justification
Infralittoral rock	A3.125 A3.21	National	Biotope A3.125 is considered as PMF.
Sublittoral sediment	A5.233	Regional	UK BAP Priority habitat “Subtidal Sands and Gravels“.
	A5.52	National	A5.52 is considered a PMF.
	A5.5331	National	OSPAR threatened and/or declining habitats.

8.3.5 Fish and Shellfish

8.3.5.1 Regional Fish and Shellfish Assemblages

The regional fish assemblage of the area is typical of species found within the northern Atlantic including species of both commercial and conservation value. Migratory species such as Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* have been found to spawn and migrate to and from Scottish rivers and lochs, including Loch Ba, Loch Assapol, Loch Scridain and Loch Na Keal (Argyll Fisheries Trust, 2011). European eel *Anguilla anguilla* may also be present in the wider area of the western isles, Sea of the Hebrides and the Minch (National Biodiversity Network (NBN) Atlas Scotland, 2021). The Sea of Hebrides MPA has been proposed for the protection of <Redacted> which occurs consistently at higher than average densities in the south and east of the MPA proposal, particularly around Coll and Tiree. In addition, common skate *Dipturus intermedia* have been found distributed throughout the west coast of Scotland. Loch Sunart to the Sound of Jura MPA has been shown to support a good number of resident mature common skate that may also be breeding in the area.

The following commercial fish and shellfish stocks were recorded in the wider area of the western isles, Sea of the Hebrides and the Minch (Marine Scotland, 2021):

- Cod *Gadus morhua;*
- European hake *Merluccius merluccius;*
- Haddock *Melogrammus aeglefinus;*
- Herring *Clupea harengus;*
- Horse mackerel *Trachurus trachurus;*
- Mackerel *Scomber scombrus;*
- Norway lobster *Nephrops norvegicus;*
- Norway pout *Trisopterus esmarkii;*
- Plaice *Pleuronectes platessa;*
- Saithe *Pollachius virens;*

- Sandeel *Ammodytes* spp.;
- Sprat *Sprattus sprattus*; and
- Whiting *Merlangius merlangus.*

These results were corroborated by the International Council for the Exploration of the Sea (ICES) (2018) during surveys along the northeastern Atlantic. Target species such as cod, European hake, haddock, herring, mackerel, Norway pout, saithe, sprat, whiting and plaice were recorded along the west coast of Scotland. Shellfish stocks were not included in the scope of this study. In 2020 National Statistics published a report about the landings of sea fish and shellfish by Scottish vessels and stated that landings into the south-west were dominated by shellfish with crabs (edible and velvet), lobsters and whelk caught alongside major fisheries for scallop and *Nephrops* (Scottish Government, 2020).

8.3.5.2 Local Fish Assemblages

The fish assemblages in the vicinity of the Isle of Iona would be expected to reflect species known to occur within the wider area of the western isles, Sea of the Hebrides and the Minch. No fish and shellfish surveys have been undertaken within the Sound of Iona. Based on studies conducted in the wider area, the key fish species likely to be present within and in close proximity to the Marine Biodiversity Study Area include elasmobranchs such as lesser spotted dogfish *Scyliorhinus canicula*, spurdog *Squalus acanthius*, common skate *Dipturus intermedia*, cuckoo ray *Leucoraja naevus*, nursehound *Scyliorhinus stellaris* and thornback ray *Raja clavate* (NBN Atlas, 2021). The Marine Biodiversity Study Area is located within the area designated for <Redacted> and approximately 35 km from the area that supports a resident population of common skate (Nature Scot, 2021a).

A number of commercially important fish species are expected to be encountered within or in the vicinity of the Marine Biodiversity Study Area, either as adults or juveniles, including sandeel, herring, mackerel, cod, haddock and saithe (Marine Scotland, 2021). Norway pout, cod, horse mackerel, sandeel, saithe (juvenile) and whiting (juvenile) are recognised as PMFs.

8.3.5.3 Migratory Species

Two species of anadromous[14] fish, the Atlantic salmon and sea trout have the potential to be present in the Marine Biodiversity Study Area.

Atlantic Salmon

The juvenile life stage typically lasts between one to four years before migrating to the sea. Following migration to the sea, salmon are known as post-smolts until the spring of the following year and after one winter as grilse. Adult Atlantic salmon spend the majority of their lives at sea, growing rapidly and only returning to freshwater environments to spawn from November to December (extending from October to late February) (SNH, 2017). Due to a highly acute sense of smell, the Atlantic salmon is able

[14] Anadromous: Migrating from sea to fresh water to spawn.

to locate the river in which it originated and on maturity migrates back to spawn (Dipper, 2001; Lockwood, 2005).

Atlantic salmon are widely distributed throughout Scotland and are recognised as Annex II (EU Habitats Directive), UK BAP species, Scottish PMF (juvenile) and an OSPAR species. They are currently both nationally and internationally important species. In recognition of the importance of Scottish salmon populations, numerous rivers have been designated as SACs for the Atlantic salmon. However, no SACs are located within a 100 km radius of the Marine Biodiversity Study Area. The nearest area where salmon presence was recorded is Bunessan River, located approximately 10 km to the east of the isle of Iona and for which the fishery catch data has been historically collected. Argyll Fisheries Trust (2011) reported that in 2010, salmon fry and parr were found at only one of the five sites surveyed where abundance was high for fry and moderate for parr. Although more parr was found in the catchment in 2010 when compared with 2003, the relatively low distribution and abundance suggest a potential threat of local extinction. The ecological potential of the Bunessan catchment was identified as bad due to the use of Loch Assapol as a resource for supplying drinking water to nearby communities. The main factors affecting trout habitats were identified as modified river morphology and channel characteristics, condition of riparian habitats (influenced by land use - grazing and forestry), aquaculture-related aspects and climate change (Argyll Fisheries Trust, 2011).

Data and information on the movements of salmon during their sea migration are limited. Smolts are believed to school and move to deep-sea feeding areas. Prior to seaward migration, the fish undergo a preparatory smolting process involving morphological, biochemical, physiological and behavioural changes that preadapt them for life within the marine environment (Hoar, 1988; Høgasen, 1998; Thorpe *et al*., 1998; Finstad & Jonsson, 2001). The migration from freshwater through the estuary and into the marine environment is predominantly nocturnal during the early part of the smolt run. During the latter part of the season, a significant proportion of the smolts switch to migration during both day and night (Thorstad *et al.,* 2012). The average total body length of wild smolts is usually 10–20 cm, and they may weigh from 10 to 80 g (Thorstad *et al*., 2011). The EU SALSEA–Merge project reported that the increase in body length after the post-smolts enter the sea was estimated to be 0.6% per day (Salsea Merge, 2012).

Malcolm *et al.* (2010) reported that salmon post-smolts originating from Scottish rivers inevitably use near-shore areas at the commencement of the marine migration. Some post-smolts migrate northwards off the western coast of Scotland along the continental shelf edge, apparently making use of the dominant ocean currents. High densities of post-smolts were reported to the northwest of Scotland in a highly dispersed pattern distribution throughout much of the Norwegian Sea. The EU SALSEA–Merge project investigated salmon migration and corroborated that the post-smolts migrate northward, through the Faroe-Shetland Channel or Faroese, to the North of the Norwegian Sea (Salsea Merge, 2012). The migration direction may alter between the years because of shifts in the surface currents due to wind changes.

Sea Trout

The sea trout *Salmo trutta* (also known as brown trout) has a similar ecology to the Atlantic salmon but is smaller in size, has a much larger distribution and remains within nearshore waters rather than undergoing extensive migration offshore (Sindre, 2020).

Trout spawn in winter from October to January, with the eggs deposited in redds[15], small deviations in the riverbed, cut by the female in the river gravel. A review carried out by Malcolm *et al.* (2010) concluded sea trout may spend a variable number of years in freshwater before migrating to sea, where they may spend variable periods of time before reaching maturity. On reaching maturity sea trout may spawn one or more times, normally annually. Pemberton (1976) studied the abundance of sea trout in sea lochs on the west coast of Scotland and concluded that post-smolts move from rivers to sea lochs primarily between April and early June, moving to the open sea in late June and July, before returning in August and September. Malcolm *et al.* (2010) also reported that post-smolts disperse slowly into the marine environment in the weeks following emigration from fresh water, with only 36% of fish detected further than 6 km from their release site.

Fishery catch data has been historically collected for three fishery districts on Isle of Mull, including Bunessan (Loch Assapol), located approximately 10 km from Iona. Argyll Fisheries Trust (2011) reported that in 2010, trout fry and parr abundances were variable, with relatively low minimum abundance and moderate (fry) and very high (parr) maximum abundance. The abundance of trout fry and parr in the Bunessan in 2010 decreased when compared to 2003 data. The ecological potential of the Bunessan catchment was identified as bad due to the use of Loch Assapol as a resource for supplying drinking water to nearby communities. The main factors affecting trout habitats were identified as modified river morphology and channel characteristics, condition of riparian habitats, aquaculture-related aspects and climate change (Argyll Fisheries Trust, 2011).

As mentioned above, sea trout have a large distribution throughout Scotland and are a UK BAP Priority Species. The nearest loch that supports a significant breeding sea trout population is Loch Pottie. Fish migrate to the sea via a stream which has its outlet near Fidden (Tobermory Angling Club, 2021). The loch is located on the Isle of Mull approximately 3km from Iona.

8.3.5.4 Elasmobranchs

Elasmobranchs are a cartilaginous fish group that comprises sharks, rays and skates. Shark species expected to be present in the wider area, as well as the Marine Biodiversity Study area, include <Redacted> spurdog *Squalus acanthias*, lesser spotted dogfish *Scyliorhinus canicular*, common skate *Dipturus spp.*, cuckoo ray *Leucoraja naevus*, nursehound *Scyliorhinus stellaris* and thornback ray *Raja clavata*. The <Redacted> and common skate are PMFs and as such have been given a species account.

[15] 'Nests' of spawning fish.

<Redacted>

The <Redacted> is the second largest fish in the world, growing up to a typical length of 6 – 8 m. Mating is thought to occur in early summer with males following females into shallow water and birthing occurring in late summer approximately a year later. <Redacted> are ovoviviparous, developing embryos with a yolk sac. The young are born fully developed, measuring 1.5 – 2 m.

The <Redacted> has been identified as being of both commercial and conservation value and has been categorised as a UK BAP species, PMF, OSPAR species, International Union for the Conservation of Nature (IUCN) red list species (vulnerable) and is listed on the Bern Convention Appendix II and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix II.

The Marine Conservation Society (MCS) has been collating UK-wide sightings of <Redacted> since 1987 in a project called the <Redacted> Watch Project, through which they have temporal and spatial data of over 21,000 sharks from over 5,200 records. Over 90% of <Redacted> sightings in the UK are reported between May and August when sightings peak earliest in the southwest UK and lastly in Scotland around August (MSC, 2008). Sightings in 2009 were highest from July to September (MSC, 2009).

Witt *et al*. (2016) in the satellite tagging study found that sharks demonstrated inter-annual fidelity to waters around the Isles of Coll and Tiree (approximately 30 km north-west from Iona) in the Sea of Hebrides during summer months (July to September), returning to the same coastal waters in consecutive summers. Based on that evidence, a Sea of Hebrides MPA was designed to protect this species. <Redacted> tend to occupy shallow coastal waters during summer, predominantly using surface waters, but move to deeper waters from autumn onwards. Most frequently occupied depths were between 25 and 50 m. When occupying near surface waters (top 10 m), <Redacted> spend more time in the top 1 m of the water column. <Redacted> demonstrated foraging behaviour within the Sea of Hebrides MPA and it is anticipated that the site fidelity might be associated with the availability of prey. <Redacted> are selective filter-feeders that choose the richest, most profitable plankton patches. Sims and Quayle (1998) reported that they forage along thermal fronts and actively select areas that contain high densities of large zooplankton above a threshold density. They migrate into the Sea of Hebrides during the summer and can be seen feeding at the surface between June and October each year before heading into deeper water for the winter (NatureScot, 2021b).

Common Skate

Common skate are a demersal species that is distributed along the west and north of Scotland, and throughout the UK and can be found at depths of 10 – 600 m. Juveniles will often occupy shallower waters on sandy and muddy sediments. Common skate tend to remain in a relatively small geographical area throughout the year, feeding on crustaceans and shellfish, as well as other fish such as flatfish. Larger skate will also hunt in mid-water for pelagic fish (Nature Scot, 2021).

Common skate have been identified as having conservation importance and have been categorised as a UK BAP species, PMF, OSPAR species and critically endangered on the IUCN red list.

During an acoustic study in the Firth of Lorn and Sound of Mull, Thornburn *et al.* (2018) found that skate mostly remain in water depths between 100 – 150 m over summer months (March-August) with some individuals having a larger depth range over winter months (September – February). In addition, tagged females displayed higher occupancy in the surveyed area of the MPA than males. The tag-recapture data suggest that up to 400 individuals are residents within the Sound of Jura (Neat *et al*., 2014), but it is not clear how many individuals inhabit the full extent of the MPA.

8.3.5.5 Local Shellfish Assemblages

Shellfish are aquatic demersal-shelled molluscs. Using commercial landing data as a proxy for species present in the Marine Biodiversity Study Area, species most landed within ICES rectangle 41E3 in 2019 include the Norway lobster *Nephrops norvegicus*, Nehrops *Nephrops norvegicus,* brown crab *Cancer pagarus*, green crab *Carcinus maenas,* velvet crab *Necora puber*, razor clams *Solen spp*., great Atlantic scallop *Pecten maximus,* crawfish *Palinurus elephas* and squid (ICES, 2020).

There are no classified shellfish harvesting waters or shellfish water-protected areas within the Marine Biodiversity Study Area. The nearest classified shellfish harvesting waters and shellfish water protected area is located within Loch Scridain (common mussels), circa 16 km east of Iona.

8.3.5.6 Spawning and Nursery Grounds

The Marine Biodiversity Study Area and the wider area of the western isles, Sea of the Hebrides and the Minch have been identified as a spawning ground for a range of demersal and pelagic species and a nursery ground for species, such as cod *Gadus morhua,* saithe *Pollachinus virens, sprat Sprattus sprattus,* whiting *Merlangius merlangus* and sandeel *Ammodytidae.* The species identified as having spawning, or nursery grounds within the wider Marine Biodiversity Study Area, based on existing data, are summarised in Table 8-5. Nursery and spawning habitats were categorised by Ellis *et al.* (2012) as either high or low-intensity dependant on the level of spawning activity or abundance of juveniles recorded within these habitats. Species with nursery grounds within the Marine Biodiversity Study Area have been given individual species accounts, except migratory species Atlantic salmon, sea trout, <Redacted> and common skate, which have been described above.

Table 8-5 Key species with spawning and nursery areas (Coull *et al.*, 1998 and Ellis *et al.*, 2012) in the wider Marine Biodiversity Study Area

Common Name	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Nursery area
Atlantic Salmon	*Salmo salar*													
Cod	*Gadus morhua*	Do not spawn in the area												
Common skate	*Dipturus spp.*	Unknown												
Herring[16]	*Clupea harengus*													High Intensity
Plaice	*Pleuronectes platessa*													
Saithe	*Pollachinus virens*	Do not spawn in the area												
Sandeel	*Ammodytidae*													
Sea trout	*Salmo trutta*													
Mackerel	*Scomber scombrus*	Do not spawn in the area												
Norway lobster	*Nephrops norvegicus*													
Norway pout	*Trisopterus esmarkii*													
Sprat	*Sprattus sprattus*													
Whiting	*Merlangius merlangus*	Do not spawn in the area												High Intensity
Spotted ray	*Raja montagui*													
Spurdog	*Squalus sp.*													High Intensity
European hake	*Merluccius merluccius*	Do not spawn in the area												
Anglerfish	*Lophius piscatorius*	Do not spawn in the area												

	Spawning period
	Peak Spawning
	Overlap with Marine Biodiversity Study Area

[16] Based on data for NW Scotland (Ellis *et al.* 2012)

Cod

Cod are a widely distributed demersal species that occurs throughout the UK waters and are found from the shoreline to depths of circa 600 m. Spawning occurs between January and April, with peak spawning occurring in February to March, whereby up to 6 million buoyant eggs are released into the pelagic environment. The eggs hatch after approximately 12 days and the larvae enters the plankton for up to 2 months before settling on the seabed (Dipper, 2001). Cod do not spawn within the wider area of the western isles, Sea of Hebrides and the Minch, but low-intensity nursery areas involve most of the north-western Scottish coast (Ellis *et al.* 2012).

Cod have been identified as having both commercial and conservation importance. They have been categorised as a UK BAP species, OSPAR, IUCN red list (vulnerable), PMF and have been afforded an EU management plan.

Herring

Herring are widely distributed throughout Scottish waters and can be found in deep waters to depths of 200 m. The highest populations are located in the northern North Sea off the coast of Scotland and in Northern Irish waters. Spawning times are dependent on sub-populations and herring found in Scotland have been found to spawn from March to April and again from August to September (Ellis *et al.* 2012). Sticky eggs are deposited on a wide range of substrate types, but the preferred substrate type is gravel (Drapeau, 1973; Rogers & Stock, 2001). The eggs adhere to the seabed and can form extensive beds. After hatching, the larvae enter the plankton and drift with the current until reaching inshore nursery grounds. After a year they migrate further offshore to join adults at feeding grounds. The spawning area is situated approximately 35 km to the northwest of Iona, although high-intensity nursery grounds overlap with the Marine Biodiversity Study Area (Ellis *et al.* 2012).

Herring currently have a UK BAP designation in place and are under an EU management plan to ensure fish stocks are exploited at a maximum sustainable yield.

Saithe

Saithe are widely distributed benthopelagic species that occur throughout Britain. Saithe are distributed in coastal waters until they reach maturity, after which they migrate offshore and live in depths of 200 – 400 m. Juvenile saithe have a similar diet to adults, consuming herring, cod and sandeels as well as benthic invertebrates, often growing to 1.2 m in length. Saithe nursery areas have been found all along the inshore waters of the Scottish coast although they do not spawn near or within the wider area of the western isles, Sea of Hebrides and the Minch (Coull *et al.*, 1998). High-intensity whiting nursery areas overlap with the Marine Biodiversity Study Area.

Saithe have been categorised as a PMF (juvenile life stage).

Sandeel

There are five species of sandeel in Scottish waters and commercial catch has found that approximately 90% of this catch is *Ammodytes marinus* (Faber Maunsell, 2007). During the winter sandeel remain in the sediment only emerging to spawn. Sexual maturity is reached at the age of two. The eggs are laid in clumps within a sandy substrate until they hatch, after which they enter the water column. Sandeels will then metamorphose and settle in sandy sediments amongst adults (Van Deurs *et al.,* 2009). As a result, there is very little movement between spawning and feeding grounds. Sandeel nursery grounds occur throughout the northern coastal waters of Scotland and extend northeast towards Norway. Spawning, as well as nursery grounds, overlap with the Marine Biodiversity Study Area (Ellis *et al.* 2012).

Sandeel have been identified as a highly commercial species and have been categorised as UK BAP species and a PMF.

Norway Lobster

Norway lobster are mud-burrowing marine decapod crustaceans, distributed at depths from 20 to 800 m. A high slit and clay sediment content (>40%) is necessary to support the burrows of large *Nephrops*, as their density tends to decline in coarse sand sediments (Tuck *et al.,* 1997; Phillips, 2008). General hydrographic conditions might influence the densities of Norway lobsters. Since they are dependent on particular types of seabed sediment, Norway lobster geographical distribution is highly discontinuous, but generally dispersed on the continental shelves and upper continental slopes of the north-east Atlantic (Philips, 2008). *Nephrops* are sedentary and only rarely migrate over distances longer than a few hundred metres. In the relatively shallow water populations of north-western and northern Europe, female *Nephrops* reach maturity at a size between 23- and 30mm carapace length (Philips, 2008). Spawning occurs throughout the year, and as well as the nursery areas encompass most of the western Scottish coast (Coull *et al.* 1998).

Norway lobster is the most important commercial crustacean in Europe.

Whiting

Whiting is a gadoid benthopelagic species distributed across the northeast Atlantic, from Iceland to the Baltic and occurs in high abundance around the British Isles. It is usually found at depths of 30 m to 100 m near mud and gravel bottoms, but also above sand and rock. In the north-east Atlantic whiting prey upon species such as lesser sandeel, sprat, herring and Norway pout (Ross *et al.*, 2018*)*. They typically have extended spawning seasons, spawning from February to June across the species range, although the spawning areas do not overlap with the wider area of the western isles, Sea of Hebrides and the Minch (Coull *et al.*, 1998). High-intensity whiting nursery areas overlap with the Marine Biodiversity Study Area.

Whiting is currently listed as a UK BAP Priority Marine Species and PMF (juvenile stage). There is currently no specific management plan for the stock in the West of Scotland.

Spotted Ray

Spotted ray have been found to inhabit inshore waters to depths of 8 – 283 m. Juveniles tend to occur on sandy sediments, closer inshore and adults occur offshore in coarse gravel substrates. Low-intensity nursery grounds have been found to occur on the west coast of Scotland overlapping with the Marine Biodiversity Study Area.

Spotted ray have been identified as being of commercial importance and have been categorised as an OSPAR species.

Spurdog

The spurdog is an umbrella term for benthopelagic species in the *Squalus* genus. *Squalus spp.* are widely distributed, and tolerant of a wide range of salinities, occurring at depths between 10 m and 100 m. They are viviparous and produce live young, often with females migrating inshore to give birth. Locations and temporal stability of specific spawning grounds are not well established, although a high-intensity nursery ground extends along the west coast of Scotland and overlaps with the Marine Biodiversity Study Area (Ellis *et al.* 2010).

The most widely known species, *Squalus acanthias*, is currently listed as a UK BAP species and PMF.

European Hake

The European hake is a demersal species, usually found at depths of 70 m – 350 m. It is distributed throughout deeper offshore waters around Northern Europe. European hake mainly preys upon species such as mackerel, herring, pouting, sandeels and squid. It stays on the seabed during daylight, feeding little, and moves into mid-water to feed during darkness. Hake has an extensive spawning area, extending all along the western margin of Europe although it does not overlap with the wider area of the western isles, Sea of Hebrides and the Minch. While hake eggs are mainly found close to the shelf break and outer shelf, juveniles are usually located closer to the coast and the nursery areas overlap with the Marine Biodiversity Study Area (Alvarez *et al.*, 2004, Ellis *et al.*, 2012).

European hake is a species of great economic importance, currently listed as a UK BAP Priority Marine Species and PMF.

Angler Fish

Angler fish is a slow-moving, bottom-dwelling fish, found on sandy or muddy bottoms as well as shell, gravel and occasionally rocky areas (Reeve, 2008). Angler fish usually occur within the sublittoral zone from 18 m to over 550m, but it also migrate down to as deep as 2000 m in offshore waters to spawn. Angler fish is distributed throughout coastal waters all around the UK. The most recognisable feature is a fleshy lure at the end of its first dorsal spine to attract prey. Prey species generally include species such as spurdogs, rays, sand eels, cod, whiting, pouting, haddock and flatfishes. Occasionally, a range of other species were found in anglerfish stomachs, including lobsters, crabs and squids.

Otherwise known as monkfish, angler fish is an important commercial fish, included in the UK BAP and listed as a PMF in territorial waters with a focus on juveniles.

8.3.5.7 Important Ecological Features

Table 8-6 summarises the Important Ecological Features (IEFs) and the value of each IEF for fish and shellfish ecology considered within the Marine Biodiversity Study Area based on definitions provided in Table 8-8.

Table 8-6: Fish and Shellfish IEFs identified for this assessment

Fish and shellfish IEFs	Representative species	Value within the Marine Biodiversity Study Area	Justification
Demersal fish species	Plaice Horse mackerel	National	UK BAP Priority species and PMFs
Benthopelagic and pelagic fish species	Cod Haddock Sandeel Atlantic mackerel Atlantic herring European hake Sprat Whiting Saithe Norway pout	National	A regionally important population of UK BAP Priority species and PMFs.
Migratory fish species	Sea trout	National	UK BAP Priority species
	Atlantic salmon	National	Annex II of the EU habitats directive, OSPAR Annex V, PMF and UK BAP Priority species.
Elasmobranchs	Lesser spotted dogfish Nurse hound Cuckoo ray	Local	Species that form a key component of the ecosystem: no specific protection.
	Common skate Thornback ray Spurdog	National	PMFs, UK BAP Priority species, IUCN critically endangered, near threatened or vulnerable.
	<Redacted>	National	Internationally important protected species under the Bern Convention and CITES.
Shellfish assemblage	Periwinkles Whelks Mussel	Local	Commonly recorded within the Marine Biodiversity Study Area but no conservation value. There are no classified shellfish harvesting waters or shellfish water-protected areas within the Marine Biodiversity Study Area.
	Nephrops Brown crab Green crab Velvet crab Razor clam Great Atlantic scallop Razor clam Crawfish	Regional	Species that are of commercial value to the fisheries which operate within the wider Marine Biodiversity Study Area.
Spawning or nursery grounds	Atlantic Salmon Cod Plaice Saithe Sandeel Sea trout Mackerel Norway lobster Norway pout	Regional	Low-intensity spawning or nursery habitat overlaps the wider Marine Biodiversity Study Area.

Fish and shellfish IEFs	Representative species	Value within the Marine Biodiversity Study Area	Justification
	Sprat Spotted ray European hake Anglerfish		
	Herring Whiting Spurdog Common skate	National	High-intensity spawning or nursery habitat overlaps the wider Marine Biodiversity Study Area.

8.3.6 Marine Mammals

Over the last 25 years, a total of 23 cetacean species have been recorded in Scottish waters, of which 11 are regularly sighted. The remaining 12 are considered to be vagrants or rare visitors which do not occur regularly in Scottish waters. Cetaceans have the potential to range widely with some undertaking large-scale seasonal migrations to other parts of Europe or the rest of the world. Some species are more localised in their distribution and resident populations of some species are present in Scottish waters. Many of these species may use areas within proximity of the Proposed Development and the sound of Iona.

Based on data available from the Hebridean Whale and Dolphin Trust (HWDT, 2018), Marine Scotland (2021) and NBN Atlas Scotland (2021) within the vicinity of the Proposed Development, the most likely species to be present in the wider area of the western isles, Sea of Hebrides and the Minch include bottlenose dolphin *Tursiops truncatus*, common dolphin *Delphinus delphis*, harbour porpoise *Phocoena phocoena*, killer whale *Orcinus orca*, minke whale *Baleanoptera acutorostrata*, and white-beaked dolphin *Lagenorhynchus albirostris*. Peak sightings typically occur in summer months for <Redacted> and common dolphin, although killer whale, harbour porpoise, bottlenose dolphin and white-beaked dolphin sightings have been reported throughout the year (HWDT, 2018).

Two species of seals: grey seal; and harbour (common) seal, are found around Scotland's coast and inshore waters. Seal usage data presented by Russell *et al*. (2017) demonstrate that both grey seal and harbour seal are present in the vicinity of the Marine Biodiversity Study Area and the wider area of the western isles, Sea of Hebrides and the Minch. The nearest SACs designated for grey seals are the Treshnish Isles SAC, situated approximately 15.5 km to the north of Iona and Eileanan agus Sgeiran Lios mor SAC, situated approximately 51.5 km to the northeast of Iona. The nearest site designated for harbour seals is also Eileanan agus Sgeiran Lios mor SAC.

Regional abundance and density data for cetaceans was taken from the SCANS III surveys (Hammond *et al*., 2017), which were carried out in 2016, and presented to provide design-based estimates of abundance. These large-scale cetacean surveys used both aerial and boat-based transects to identify cetacean species across the European shelf. The Marine Biodiversity Study Area and the 100 km search area falls into ‘Block G’ of the Scans III survey. Figure 8-6 shows the location of Block G in the context of the wider SCANS III surveys.

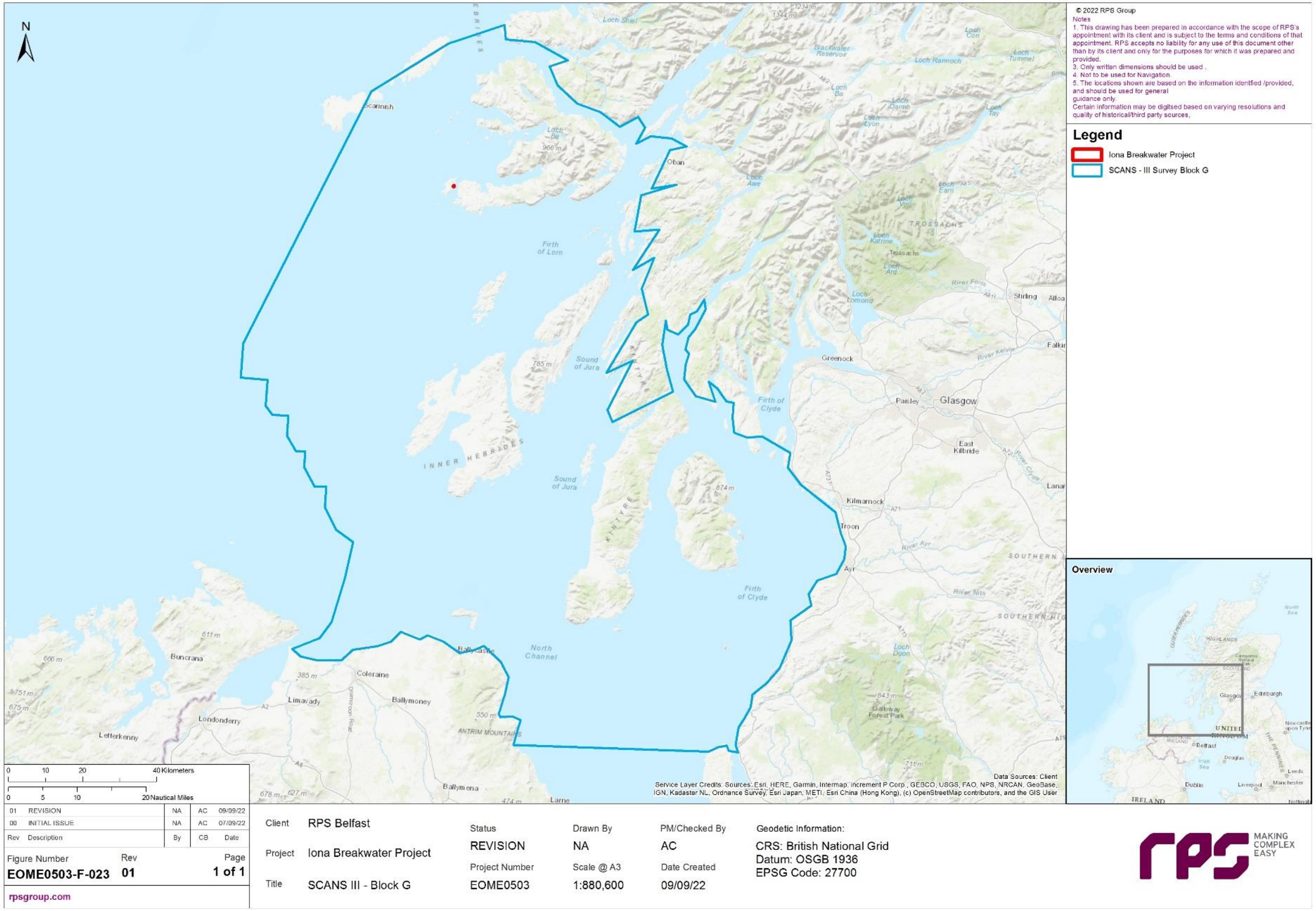


Figure 8-6: SCANS III survey area block G

8.3.6.1 Cetaceans

Bottlenose Dolphin

The bottlenose dolphins *Tursiops truncatus* encountered in the Hebrides are near the northernmost extreme of the species' global range. They generally stay close to shore, following the coastline as they travel throughout the area, and can be seen around headlands and bays. They are most often seen in and around the Sound of Barra and throughout the Inner Hebrides, with most sightings around Mull, the Small Isles and Skye. In the Hebrides, bottlenose dolphins travel in small, social groups of between three and ten individuals, but larger group sizes are not unusual (Serani and Diez, 2017).

The bottlenose dolphin feeds on a wide range of benthic and pelagic fish species in addition to cephalopods; in Scottish waters, the stomach contents of stranded animals indicate that the species prey primarily upon cod, saithe, whiting and sandeel (Santos *et al*., 2001)

Studies revealed that the west of Scotland is home to two separate groups of bottlenose dolphins, which live in the area all year round: the Inner Hebrides community, consisting of 30 to 40 animals, and a smaller group of around 15 dolphins, the Sound of Barra community (van Geel, 2016). The Sound of Barra dolphins have a restricted range, staying close to the Sound of Barra all year. In contrast, the Inner Hebrides community travel large distances throughout the Inner Hebrides and mainland coasts mainly from the Kintyre peninsula to the south of Skye (van Geel, 2016; HWDT, 2018). Distribution patterns presented by Chetney *et al.* (2013) provide evidence of the widespread occurrence of bottlenose dolphins in the Inner Hebrides. Bottlenose dolphin are one of the resident species off the west coast and remain in the area throughout the year.

The SCANS III total abundance of bottlenose dolphins in the whole survey area was calculated as 27,697 (95% CI = 17,662 – 43,432) (Hammond *et al.*, 2017). The total density estimate was predicted as 0.015 animals/km^2. Bottlenose dolphin abundance estimated for regions covered by aerial surveys was provided as 19,201 (95% CI = 11,404 – 29,670) with density of 0.24 animals/km^2. Based on photo-identification studies, the west coast total abundance estimate is 41 (95% CI = 35 - 49) (Thompson *et al*., 2011), corroborated by Cheney *et al.* (2013) who, via integrated multiple data sources, placed the west coast bottlenose dolphin population estimate in 2007 at 45 (95% CI = 33 - 66). Abundance in block G of the SCANS III aerial survey covering the Marine Biodiversity Study Area was calculated as 1,824 (95% CI = 0 – 4,474) (Hammond *et al.*, 2017) with a density estimate of 0.121 animals/km^2 (Figure 8-6).

Common Dolphin

Short-beaked common dolphins *Delphinus delphis* were the most commonly sighted dolphin species during HWDT (2018) surveys, accounting for 4% of all marine animal sightings. Common dolphins can be seen throughout the west coast, with most sightings east of the Outer Hebrides in the Minch, Little Minch and the Sea of the Hebrides as well as in the coastal areas. Sightings of common dolphins in the Hebrides peak between April and October each year, although some animals now remain in the area throughout the winter months.

Hammond *et al.* (2017) highlighted that the total abundance of common dolphin in 2016 was estimated to be 467,7673 (95% CI = 281,129 to 777,998; density 0.261 animals/km^2). This was substantially larger than the estimates for 2005/2007 of 174,000 common dolphin. The estimated abundance for regions covered by aerial surveys was calculated as 268,540 (95% CI = 186,851 – 390,528) with density 0.222 animals/km^2. Whilst no sightings occurred in Block G of the SCANS III aerial survey, other studies reported that in the period 1992 to 2003 the relative frequency of strandings of common dolphin in northwest Scotland have increased (MacLeod *et al*., 2005). Similarly, sightings surveys conducted from May to September 2002 and 2003 show that the relative occurrence and abundance of common dolphins increased in comparison to previous surveys conducted between 1973 and 1999 (MacLeod *et al.*, 2005). These results are corroborated by HWDT (2018) who reported that during 15 years of monitoring Hebridean seas (2003 to 2017), sightings of common dolphins have increased twenty-fold and they are now the most commonly encountered dolphin species during the surveys.

Harbour Porpoise

Harbour porpoises *Phocoena phocoena* can be found in inshore waters throughout the Northern Hemisphere, but the density of porpoise in Hebridean waters is amongst the highest in Europe. They are the most frequently seen cetacean, accounting for almost half of sightings from the *Silurian* (Pierpoint, 2008). They are widespread and can be seen in most coastal areas of the Hebrides, with the highest encounter rates occurring around the Small Isles.

Often associated with near-shore headlands and strong tidal currents, porpoise are commonly observed within shallow bays, estuaries and narrow tidal channels (Pierpoint, 2008; Pierpoint *et al.*, 1999). Harbour porpoise exhibit diet flexibility, feeding on a varied diet of fish, cephalopods and crustaceans.

Data from SCANS III surveys reported a total abundance of harbour porpoises within the whole survey area as 466,569 (95% CI = 345,306 – 630,417). The mean density was estimated as 0.381 animals per km^2 for this species. The estimated abundance for regions covered by aerial surveys was calculated as 424,245 (95% CI = 313,151 – 596,827) with a density of 0.351 animals per km^2. Abundance in block G of the SCANS III aerial survey covering the Marine Biodiversity Study Area was calculated as 5,087 (95% CI = 1,701 – 10,386) (Hammond *et al*, 2017) with a density estimate of 0.336 animals/km^2 (Figure 8-6). Based on a boat-based visual survey conducted during May-August 2002-2004, Goodwin & Speedie (2008) reported that harbour porpoise density showed an increase for West Scotland over the study period and the population of West Scotland was estimated at 3105 (95% CI = 2032 – 4745) during August and September.

Killer Whale

Killer whale *Orcinus orca* can be seen throughout the west coast of Scotland and can be seen from the shore in coastal areas as well as offshore. During HWDT (2018) surveys there have been just 16 sightings between 2002 and 2017, most of which have been of a small unique group called the West Coast Community, the UK's only resident group of killer whales. The West Coast Community amounts to eight individuals. Although the group is wide-ranging (seen along the whole of the west coast of the

UK, from the Hebrides to the south of Ireland), most sightings have been within the Hebrides. Sightings of killer whales are infrequent, but they are present in Hebridean waters all year round and are generally recorded near-shore between April and October (Evans, 1988, 1992 in Reid *et al.,* 2006) and further offshore between November and March. Recent surveys north and west of Scotland suggest that killer whales concentrate along the continental slope north of Shetland between May and June (Reid *et al.*, 2006). Seasonal movements may be associated with the distribution of particular prey (e.g., seals are preyed upon close to land particularly in June to October when they haul out to breed).

There is no overall population estimate for the north Atlantic killer whale population, however, sightings surveys in the eastern north Atlantic, mainly between Iceland and Faroe Islands indicate a population in the region of somewhere between 3,500 and 12,500 (Gunnlaugsson and Sigurjonsson 1990 in Reid *et. al.,* 2003).

A study based on the photo-identification data from across the Northeast Atlantic showed that there was only one match between the Northern Isles and the Hebridean and Western Isles (recorded in May 2006 at St. Kilda) from 91 encounters between 1992 and 2008 (Foote *et al.,* 2010). That suggests a very limited movement of killer whales between the Hebrides, the Northern Isles and the North Sea.

Minke Whale

Minke whales *Balaenoptera acutorostrata* are one of the most widely distributed baleen whales and can be found from the subtropics to polar waters in the Northern Hemisphere. Their migration patterns are not fully understood, although they are thought to make a general migration between winter breeding grounds to the south of the British Isles and feeding grounds in the cooler, more productive waters during the summer. The second most frequently seen cetacean from HWDT surveys between 2003 and 2017, minke whales account for 7% of all marine animal sightings. The highest encounter rates and most frequent sightings are around the Small Isles and east of the Outer Hebrides throughout the Minch and Sea of the Hebrides.

In Scottish waters, sandeel are the most important prey species for minke whales, comprising 62% of the diet by weight (Pierce *et al*., 2004). Clupeids (herring and sprat) account for around 30% of the diet (Pierce *et al*., 2004). Minke whales often forage in areas of upwelling or strong currents around headlands and small islands.

Data from SCANS III surveys reported a total abundance of minke whales within the whole survey area as 17,759 (CI = 7,908 – 27,544). The mean density was estimated at 0.010 animals per km^2 for this species. The estimated abundance for regions covered by aerial surveys was calculated as 13,101 (CI = 7,050 – 26,721) with a density of 0.011 animals per km^2. Abundance in block G of the SCANS III aerial survey covering the Marine Biodiversity Study Area was calculated as 410 (95% CI = 0 – 1,259) (Hammond *et al*., 2017) with a density estimate of 0.0.027 animals/km^2 (Figure 8-6).

White-Beaked Dolphin

White-beaked dolphins *Lagenorhynchus albirostris* have a relatively restricted range and are only found in the temperate and subarctic waters of the North Atlantic. The Hebrides are towards the southern extreme of their range, they are usually seen in open waters further from the coast and favour the waters around the Outer Hebrides and the north Minch. White-beaked dolphins are present in Hebridean waters all year round.

Haddock and whiting have been identified as the most important prey items in the diet of white-beaked dolphins in British waters, with cod, herring and mackerel also identified as prey (Canning *et al*., 2008).

Data from SCANS III surveys reported a total abundance of white-beaked dolphin within the whole survey area as 36,287 (Cl = 18,694 – 61,869). The mean density was estimated at 0.020 animals per km^2 for this species. The estimated abundance for regions covered by aerial surveys was calculated as 36,287 (Cl =18,694 – 61,869) with a density of 0.030 animals per km^2. Whilst no sightings occurred in Block G of the SCANS III aerial survey, other studies reported that in the period 1992 to 2003 the relative frequency of strandings of white-beaked dolphin in northwest Scotland has declined (MacLeod *et al*., 2005). Similarly, sightings surveys conducted in May-September 2002 and 2003 show that the relative occurrence and abundance of white-beaked dolphin have declined in comparison to previous surveys conducted between 1973 and 1999 (MacLeod *et al.*, 2005).

8.3.6.2 Pinnipeds

Harbour Seal

Harbour seals *Phoca vitulina*, are central place foragers, requiring haul-out sites on land for resting, moulting and breeding, and dispersing from these sites to forage at sea. In order to reduce time and energy searching for prey, animals are likely to travel directly to areas of previously or predictably high foraging success (Bailey *et al.*, 2014). Harbour seals persist in discrete metapopulations and stay within 50 km of the coast (Russel & McConnell, 2014).

Based on faecal samples collected in two sites on the west coast of Scotland (Skye and Isle of Mull) in 1993 and 1994, Pierce & Santos (2003) assessed the diet of harbour seals. It included a range of fish and cephalopod species, of which the most important were gadoids, particularly whiting *Merlangius merlangus*, along with pelagic European horse mackerel *Trachurus trachurus* and herring *Clupea harengus.*

The total harbour seal August counts for West Scotland between 2016 and 2021 were 15,600 (SCOS, 2021). Although the West Scotland region is defined as a single management unit, it is very large geographically in terms of total coastline and contains a large proportion of the UK harbour seal population; 49% of the most recent UK total count. The Isle of Mull and Marine Biodiversity Study Area fall within the southern sub-region, where there was no detectable trend in the overall population since the early 1990s, with counts varying between approximately 5,000 and 7,000 over the period 1990 to 2018. Based on surveys carried out between 2017 and 2018, the harbour seal count for Southwest Scotland was 7,053 (SCOS, 2021). Populations in West Scotland and Southwest Scotland are now increasing.

Grey Seal

The coast of the UK supports 38% of the world's grey seals *Halichoerus grypus* (Special Committee on Seals (SCOS), 2017); 88% of these animals breed at colonies in Scotland with the main concentrations in the Outer Hebrides and Orkney (SCOS, 2017).

Grey seals gather in colonies on land (known as haul-outs) where they breed, rest, moult and engage in social activity. Breeding occurs between September to December and the annual moult between November to April (Harwood & Wylie, 1987). Preferred breeding locations around the UK coast include rocky shores, beaches, caves, sandbanks and small largely uninhabited islands. Pupping tends to take place between August and November (SCOS, 2018) in the UK. The largest pupping sites are located in the Inner and Outer Hebrides, Orkney, Isle of May, Farne Islands and Donna Nook (JNCC, 2021). Grey seals tend to forage in the open sea, returning to land regularly to haul out. Foraging trips can be wide-ranging, however, tracking studies have shown that most foraging is likely to occur within 100 km of a haul-out site (SCOS, 2018).

Along the Scottish coast, grey seals exhibit offshore foraging behaviour (Damseaux *et al.,* 2021). Additionally, studies in Scotland revealed a selective diet, mostly comprised of flatfish and sandeels. Grey seal diet was proved to be composed of 50% plaice *Pleuronectes platessa* and sole *Solea solea* but also 46% sandeels *Ammodytes marinus.* Hammond and Wilson (2016) also highlighted sandeels as an important prey item for grey seals in Scottish waters where they account for approximately 50% of the diet.

Grey seal population size is normally derived from the number of pups born during their autumn breeding season. Grey seal distribution during their breeding season is, however, very different to their distribution at other times of the year. For this reason, the number of grey seal pups born in the autumn is provided as well as the summer counts of grey seals for each Management Unit (Inter-Agency Marine Mammal Working Group (IAMMWG), 2015). From 2010 to 2016 Treshnish Isles SAC produced approximately 25% of the pups born in the Inner Hebrides (SCOS, 2020).

The UK grey seal population size in regularly monitored colonies was estimated at 133,900 individuals (approximate 95% CI = 115,300 – 156,500) (SCOS, 2020). Pup production in 2016 at biennially surveyed colonies in the Inner Hebrides was estimated as 4,541 (approximate 95% CI = 3,900 – 5,200), which is a 5.8% increase since 2014 (SCOS, 2020). The total grey seal August counts for West Scotland between 2016 and 2019 were 4,174 (SCOS, 2020). The estimated size of grey seal population at Inner Hebrides at the start of 2019 was estimated as 8,200 (95% CI = 6,900 – 10,100) (SCOS, 2020).

8.3.7 Important Ecological Features

Table 8-7 summarises the Important Ecological Features (IEFs) and the value of each IEF for fish, shellfish and marine mammal ecology considered within the Marine Biodiversity Study Area based on definitions provided in Table 8-8.

Table 8-7 Marine Mammals IEFs identified for this assessment

Marine mammals IEFs	Value within the Marine Biodiversity Study Area	Justification
Harbour porpoise	International	Annex II species protected under international legislation, and a qualifying interest of the Inner Hebrides and the Minches SAC that overlaps with the Proposed Development boundary.
Minke whale	International	Scottish Protected Species, internationally protected species, protected feature of the Sea of Hebrides MPA.
Bottlenose dolphin	National	Annex II species protected under international legislation, PMF.
Common dolphin	National	Scottish Protected Species, internationally protected species.
Killer whale	National	Scottish Protected Species, internationally protected species.
White-beaked dolphin	National	Scottish Protected Species, internationally protected species.
Harbour seal	International	Annex II species protected under international legislation, and a qualifying interest of the Eileanan agus Sgeiran Lios mor SAC, South-East Islay Skerries SAC and Sound of Barra SAC.
Grey seal	International	Annex II species protected under international legislation, and a qualifying interest of the Treshnish Isles SAC.

8.4 Future Baseline Conditions

Annex IV of the EIA Directive and Schedule 4(3) of the Marine Scotland EIA Regulations set out the information required in the EIAR as: “a description of the relevant aspects of the current state of the environment (baseline scenario), and an outline of the likely evolution thereof without implementation of the Proposed Development, as far as natural changes from the baseline scenario can be assessed with reasonable effort based on the availability of environmental information and scientific knowledge” is included in the EIAR. An assessment of the future baseline conditions, should the Proposed Development not proceed, has been carried out and described in this section.

8.4.1 Benthic Ecology

Benthic communities will exhibit some degree of natural change over time, even if the Proposed Development is not developed, due to naturally occurring cycles and processes. Variability and long-term changes in physical influences may bring direct and indirect changes to benthic habitats and communities in the mid to long-term future (Department of Energy and Climate Change (DECC), 2016). Benthic communities are also predicted to be influenced by anthropogenic activities, including contamination, or seabed disturbing activities such as trawling, dredging and development (AECOM *et al*., 2010).

There is a strong evidence base indicating that climate change could have profound implications for biodiversity, including long-term changes to benthic communities (DECC, 2016). Climatic changes are considered the leading factor in the dynamics of the biomass of the macrobenthos (Manushin *et al.*, 2020). It has also been reported that benthic biomass has increased by at least 250% to 400% over the last three decades, driven by an increase in opportunistic and short-lived species and a decrease in long-living sessile animals (Krönke, 1995; Krönke, 2011). The sea surface temperature trend in Scotland has been upward at a rate of +0.2 to 0.4˚C (Hughes *et al*., 2010). Modelling sea surface temperature in relation to climate change in the UK has shown that over the coming century the sea surface temperature will continue to rise. It has also shown that the rate of temperature increase over the previous 50 years has been greater in waters off the east coast of the UK compared to the west, as well as the south compared to the north, and this is predicted to continue for the next 50 years (MCCIP, 2013; Lowe *et al.,* 2009). In addition, oceanic changes in temperature due to global climate change are causing poleward shifts in the latitudinal distribution of species toward cooler marine environmental regions. Studies found clear evidence of change in the distribution and abundance of benthic species in response to seawater temperature change (Birchenough *et al.,* 2015). Marine benthic communities could also be impacted by sea level rise and associated coastal squeeze, resulting in loss of habitat, and environmental changes, such as steepening of the intertidal slope and sediment coarsening (Birchenough *et al.,* 2015). As such, the baseline of the benthic subtidal and intertidal Marine Biodiversity Study Area described in Section 8.3.4 *et seq.* can only be considered as a 'snapshot' of the present benthic ecosystem within a gradual yet continuously changing environment. Any changes that may occur during the lifetime of the Proposed Development should be considered in the context of both greater variability and sustained trends occurring on national and international scales in the marine environment.

8.4.2 Fish and Shellfish

There is a broad body of evidence that climatic fluctuations play an important role in changing fish and shellfish distributions and abundances. The biological and physical influence of climate change is also important in considering key life-cycle stages of various species, including the dispersal of eggs and larvae by water currents; the timing of spawning in relation to seasonal zooplankton productivity which forms key prey items for larvae; the physiological effects of temperature on growth and maturation; and the alteration of migration cues for adult fish (Heath *et al*., 2012). Therefore, variability and long-term changes in physical influences may bring direct and indirect changes to fish and shellfish assemblages in the mid to long-term future (UK Department for Business, Energy and Industrial Strategy (BEIS), 2016).

Fish and shellfish populations are subject to natural variation in population size and distribution, largely as a result of year-to-year variation in recruitment success (White *et al.,* 2019). These population trends will be influenced by broad-scale climatic and hydrological variations. Fish and shellfish are a key link in the food web, linking primary and zooplankton production to top predators and therefore facilitating the transfer of energy from some of the lowest to the highest trophic levels within the ecosystem.

Climate change may influence fish distribution and abundance, affecting growth rates, recruitment, behaviour, survival and response to changes in other trophic levels (Heath *et al.,* 2012). Due to the increasing sea temperature causing unfavourable habitat conditions, species may contract from their former range through lowered survival and failure to reproduce or recruit. For example, in British waters, the lesser sandeel (*Ammodytes marinus*) is identified as being at particular risk from climate change. Owing to its strict association with coarse sandy sediments it is unable to adapt its distribution to compensate for warming sea temperatures (Heath *et al.,* 2012). Climate change may also affect key life history stages of fish and shellfish species, including the timing of spawning migrations (DECC, 2016). However, climate change effects on marine fish populations are difficult to predict and the evidence is not easy to interpret, therefore it is difficult to make accurate estimations of the future baseline scenario for the entire lifetime of the Proposed Development.

In addition to climate change, human activities, including overfishing and species introduction have had a dramatic impact on fish and shellfish communities. Overfishing subjects many fish species to considerable pressure, reducing the biomass of commercially valuable species as well as non-target species (Thurstan *et al.,* 2010). Numerous studies suggested that global predatory fish biomass is only approximately 10% of preindustrial levels (Christensen *et al.,* 2003; Myers & Worm, 2003). A study conducted by Jennings and Blanchard suggested that the current biomass of large fishes in the North Sea weighing 4–16 and 16–66 kg, respectively, is 97.4 and 99.2% lower than it would be if no fishing had occurred. Overfishing can also reduce the resilience of fish and shellfish populations to other pressures. For example, a study on cod in an area where trawl fishing has been banned since 1932 indicated that this population was significantly more resilient to environmental change (including climate change) than populations in neighbouring fished areas (Lindegren *et al.,* 2010). There are indications that overfishing in UK waters is reducing to some degree, as recently JNCC reported an overall positive trend towards a greater proportion of stocks fished sustainably in both the long and short-term (JNCC, 2021). There is also a positive trend for fishing within safe biological limits in the long term, but a negative trend in the short term (JNCC, 2021).

The fish and shellfish baseline characterisation described in Section 8.3.5 represents a ‘snapshot’ of the fish and shellfish assemblages of the wider area of the western isles, Sea of Hebrides and the Minch, within a gradual and continuously changing environment. Any changes that may occur during the lifetime of the Proposed Development should be considered in the context of the natural variability and anthropogenic effects, including climate change, overfishing and other likely significant effects.

8.4.3 Marine Mammals

Marine mammal populations naturally fluctuate over space and time, and changes are likely to be observed over the lifetime of the Proposed Development. The distribution of marine mammal populations is, to a large extent, mediated by the distribution and abundance of prey species. Many species range over large distances and, to a certain extent, therefore, can potentially adapt to gradual changes in the environment, such as those that may occur as a result of climate change (Hoegh-Guldberg and Bruno, 2010). However, species that have more restricted habitat ranges are likely to be more vulnerable to changes in their environment. Species such as grey seal or harbour seal (identified as IEFs in Table 8-7), whose natural foraging ranges are more restricted than cetacean species (most foraging trips remain within 145 km and 50 km, respectively, from haul-out sites (SCOS, 2015), may be more sensitive to long-term changes.

Marine mammals fulfil key and irreplaceable ecological roles in the ocean; however, they are vulnerable to global warming. Numerous consequences are caused by anthropogenic-induced climate change, including indirect effects such as decreased productivity of the oceans, altered food-web dynamics, reduced abundance of habitat-forming species, shifting species distributions, altered reproductive success and direct effects on the survival rates by increasing stress of organisms, fostering the development of pathogens and increasing the propagation of pathogens to new species by causing species to experience range shifts (Albouy *et al.,* 2020). One of the most common responses of marine mammals to temperature changes is shifts in their spatial distributions, which could result in modifications of the ranges of the species. Various species will respond to change differently. For example, it has been reported that in the wider Marine Biodiversity Study Area, the range of the common dolphin, a warm-water species, is increasing, while the range of the white-beaked dolphin, a cold-water species, is reducing with fewer sightings and strandings of the latter being reported (Elliott & Simmonds, 2007).

Anthropogenic activities in the marine environment can influence the distribution and abundance of marine mammal populations, and therefore can affect the future baseline of populations. In the wider area of the western isles, Sea of Hebrides and the Minch, potential effects include probable mortality due to entanglement in fishing gear (particularly harbour porpoise due to their feeding behaviour), injury and disturbance from vessels, underwater noise caused by military activity as well as aquaculture and acoustic deterrent devices (ADDs) and marine pollution (including litter and organic pollutants) (HWDT, 2018).

The West Scotland SCOS region overlaps with the wider Marine Biodiversity Study Area and is the largest harbour seal population in the UK with 49% of the most recent UK total harbour seal count (SCOS, 2020). The 2015 West Scotland harbour seal count was 43% higher than the 2009 count, equivalent to an average annual increase of 5.3%. However, trajectories of counts within the south sub-division of the West Scotland region, where the Proposed Development is located, reported no detectable trend in the overall population since the early 1990s (SCOS, 2020). For grey seals, population trend objectives have been based on pup production, since that metric has been long established as the most robust for determining changes in population dynamics There has been an increase in the estimated grey seal pup production in the Inner Hebrides at an average annual change of 5.8% since 2014 (SCOS, 2020).

Changes in sea level are likely to affect the availability of protected cave sites for breeding seals, as well as low-lying areas and other haul-out sites (e.g., grey seal) and lead to increased wave action on breeding sites which can increase pup mortality (SCOS, 2020). Climate-driven changes in prey distribution and/or availability, increases in harmful algal blooms and/or increased disease prevalence are likely to impact seal populations in future however there are currently many uncertainties in predicting the consequences of climate change at a population level (SCOS, 2020).

Similar to fish and shellfish, the marine mammals' baseline characterisation described in Section 8.3.6 represents a 'snapshot' of the marine mammals within a gradual and continuously changing environment. Any changes that may occur during the lifetime of the Proposed Development should be considered in the context of the natural variability and anthropogenic effects, including climate change, overfishing and other environmental effects.

8.5 Assessment Methodology

The criterion for determining the significance of effect of an identified impact is a two-stage process that involves defining the magnitude of the impact and sensitivity of the receptors to that impact. This section describes the methodology applied in this chapter to assign values to the receptor to assist in defining the sensitivity of receptors and the magnitude of potential effects.

An assessment of the ecological effects of a Proposed Development should focus on 'Important Ecological Features' (IEFs). These are species and habitats that are valued in some way and could be affected by a Proposed Development; other IEFs may occur on or in the vicinity of the site of a Proposed Development but do not need to be considered because there is no potential for them to be affected significantly.

The value of IEFs is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (CIEEM, 2018). The most straightforward context for assessing ecological value is to identify those species and habitats that have specific biodiversity importance recognised through international or national legislation or local, regional or national conservation plans (e.g., Annex I habitats under the Habitats Directive, OSPAR, BAP habitats and species). However, only a very small proportion of marine habitats and species are afforded protection under the existing legislative or policy framework and therefore evaluation must also assess value according to the functional role of the habitat or species. For example, some features may not have a specific conservation value in themselves but may be functionally linked to a feature of high conservation value. Table 8-8 shows the criteria applied to determine the ecological value of IEFs.

Table 8-8 Criteria used to inform the valuation of receptors

Value	Definition
International	• Internationally designated sites. • Habitats and species protected under international law (i.e., Annex I habitats within a SAC boundary; Annex II protected species designated as a feature of a European designated site).
National	• Nationally designated sites. • Species that are protected under national law. • Internationally protected species (including EPS) that are not qualifying features of a candidate of designated European site but are regularly recorded within the Proposed Development and its surrounding environs (Marine Biodiversity Study Area). • Annex I habitats that are not within an SAC boundary. • UK BAP priority habitats and species and PMFs that have nationally important populations within the Marine Biodiversity Study Area, particularly in the context of species/habitat that may be rare or threatened in the UK, and specifically Scotland. • OSPAR List of Threatened and/or Declining Species and Habitats. • Habitats and species that are features of MPAs.
Regional	• Internationally protected species that are not qualifying features of a European designated site and are infrequently recorded within the regional Marine Biodiversity Study Area in very low numbers compared to other regions of the British Isles. • UK BAP priority habitats or Priority Marine Features that have regionally important populations within the Marine Biodiversity Study Area (i.e., are locally widespread and/or abundant). • Habitats or species that provide important prey items for other species of conservation or commercial value.
Local	• Habitats and species which are not protected under conservation legislation and form a key component of the marine ecology within the Marine Biodiversity Study Area.
Negligible	• Habitats and species of very local importance only.

8.5.1 Magnitude of Impact

The categorisation of the ***magnitude*** of impact is topic-specific but generally takes into account factors such as:

- Extent;
- Duration;
- Frequency; and
- Reversibility.

With respect to the duration of effects, the following has been used as a guide within this assessment, unless defined separately within the topic assessments:

- **Short term**: A period of months, up to one year;
- **Medium term**: A period of more than one year, up to five years; and
- **Long term**: A period of greater than five years.

The criteria for defining magnitude in this chapter is outlined in Table 8-9.

Table 8-9 Example definitions of magnitude of impact

Magnitude of Impact	Typical Descriptors
High	Large scale loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

8.5.2 Receptor Sensitivity

To understand the effect that an impact has on an IEF, the sensitivity of that IEF has been defined by categorising according to the five-point scale presented in Table 8-8. This scale is based on:

- The **vulnerability** of the receptor to the impact;
- The potential for recovery of the receptor following the impact (**recoverability**); and
- **Value/importance** of the receptor.
- Sensitivity is generally described using the scale presented in Table 8-10 below.

Table 8-10 Example of definitions of sensitivity

Sensitivity	Typical Descriptors
Very High	International or National IEFs with high vulnerability and no ability for recovery.
High	Regional IEF with high vulnerability and no ability for recovery. International or National IEF with high vulnerability and low recoverability.
Medium	Local IEF with high vulnerability and no ability for recovery. Regional IEF with medium to high vulnerability and low recoverability. International or National IEFs with medium vulnerability and medium recoverability.
Low	Local IEF with medium to high vulnerability and low recoverability. Regional IEF with low vulnerability and medium to high recoverability. International or National IEFs with low vulnerability and high recoverability.
Negligible	Receptor is not vulnerable to effects regardless of value/importance. Local IEF with low vulnerability and medium to high recoverability.

8.5.3 Significance of Effect

The significance of the effect upon marine biodiversity receptors is determined by correlating the magnitude of the impact and the sensitivity of the receptor. A range of significance of effect is presented in Table 8-11, the final assessment for each effect is based upon expert judgement.

For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

Table 8-11 Significance of Effect Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

8.6 Embedded Mitigation Measures

A number of embedded mitigation measures relevant to marine biodiversity are proposed to be incorporated into the design and construction method to manage the effect on the environment. This is further discussed in Section 8.10.1 and Table 8-17.

8.7 Description of Likely Significant Effects

This section presents an assessment of the likely significant effects associated with the construction and operation phases of the Proposed Development on marine biodiversity features within the potential ZoI.

This section should be read in conjunction with the Assessment Methodology, Section 8.5, the benthic IEFs in Table 8-4, fish and shellfish IEFs in Table 8-6 and marine mammal IEFs in Table 8-7. This section has been summarised within Table 8-18.

8.7.1 Assessment of Construction and Operational Effects

This section assesses the effects of activities which occur over both the construction and operational phases of the Proposed Development. Capital dredging will occur as part of the construction activities, and annual maintenance dredging will occur under operational activities, over the same area of the seabed. Given the geographical overlap and ongoing nature of potential effects, it has been concluded that these activities cannot be considered independent of one another. As such, the assessment of

Likely Significant Effects has considered them as a single impact: 'temporary disturbance/loss of habitat arising from capital and maintenance dredging activity'). In light of this, the assessment has also considered the effects of increased suspended sediment concentrations (SSC) and sediment deposition as a result of capital and maintenance dredging as a single impact: 'effects of increased suspended sediment concentrations and sediment deposition'.

8.7.1.1 Temporary disturbance/loss of habitat arising from capital and maintenance dredging activity

Direct temporary habitat loss and disturbance to subtidal habitats will occur during construction as a result of dredging.

Magnitude of Impact

Dredging, in the form of capital dredging, will be required to accommodate the new navigation channel. The approximate dredge area (footprint/ extent) will be 2,017 m^2, removing an approximate dredge volume of 1,225 m^3 by backhoe dredger. Currently, the depth of this area is approximately between -1.0 m and -3.5 m CD. This area will be dredged to -3.0 m CD by a self-propelled vessel with an excavator mounted on the bow (backhoe excavator).

The maintenance dredge operations are expected to be undertaken over a similar extent of an area originally dredged (2,017 m^2). As the volume of dredged material to be removed is currently unknown at this stage, the capital dredge volume will be used as a worst-case scenario (1,225 m^3). Maintenance dredge depth and volume by definition is generally less than that of capital dredging.

All dredging activities will be short-term in duration (expected maximum one week), however, there will be a requirement to undertake maintenance dredging over the course of the project life. The frequency of ongoing maintenance dredging shall be established as part of the construction contract, however it is anticipated that annual maintenance dredging will be required based on previous sedimentation reports. As stated above, the maintenance dredging footprint is expected to be equal to or smaller than the capital dredging footprint, therefore following the cessation of capital dredging, sediments are expected to gradually infill part of the footprint over time. Whilst sediment infill is not expected over the footprint of the maintenance dredging area, this area is considered to be small in the context of the wider habitat.

The magnitude is predicted to be of highly localised spatial extent, have a short-term duration (up to one week) and will likely be undertaken on an annual frequency. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

Benthic Ecology

Biotopes that directly overlap with the dredging area comprise Littoral Sediment biotopes: littoral sand and muddy sand (A2.2); Infralittoral Rock biotopes: 'Kelp beds' (A3.125); Sublittoral Sediment biotopes: *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (A5.233), kelp and seaweed communities on sublittoral sediment (A5.52) and *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand (A5.5331).

Biotopes that are present outside of the direct dredging area may be affected by the dredging campaign and have been assessed within ‘Effects of increased suspended sediment concentrations and sediment deposition’.

Littoral Sediment

Amphipod-dominated mobile sand shores (A2.22) are characterised by mobile sands (coarse, medium or fine-grained), which retain little water and organic matter, and thus are subject to drying out between tides. This biotope supports a limited range of species, including amphipod, isopod and polychaetes (MarLIN, 2021a). This biotope is subject to high levels of abrasion resulting from sediment mobility, therefore if any species are present, these are robust animals that can withstand some physical disturbance, recover rapidly following the disturbance or migrate as adults into the biotope (MarLIN, 2021a). Resistance to this pressure is therefore assessed as 'High' and resilience as ‘High’ (MarLIN, 2021a).

The Littoral Sediment IEF has been assessed to have a regional importance, low vulnerability and have high recoverability to the temporary disturbance and habitat loss and therefore their sensitivity has been deemed as low.

Infralittoral Rock

The Priority Marine feature, ‘Kelp beds’ (A3.125), was recorded to have direct overlap with the dredge area. However, the result of biotope mapping indicates that this area is approximately 2 m^2. The scouring of rock through dredge action is likely to removal individuals from the area resulting in high mortality, however *Saccharina latissimi*, part of the A3.125 community, has been shown to be an early coloniser within macroalgal succession, appearing within two weeks of clearance, with *Desmarestia* spp. and *Saccorhiza polyschide*s capable of reaching maturity within a year (Stamp and Tyler-Walters, 2022).

The Infralittoral Rock IEF has been assessed to have a very small extent, national importance, high vulnerability and have high recoverability to the temporary disturbance and habitat loss and therefore their sensitivity has been deemed as low.

Sublittoral Sediment

Biotopes such as ‘*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand’ (A5.233), a PMF ‘Kelp and seaweed communities on sublittoral sediment’ (A5.52) and ‘*Zostera marina*/*angustifolia* beds on lower shore or infralittoral clean or muddy sand’ (A5.5331) were recorded. A5.52 and A5.5331 represent the greatest area of habitat that may be affected.

Removal of sediments associated with kelp and seaweed communities (A5.52) is likely to remove individuals from the area resulting in high mortality, however, individuals of this habitat have rapid growth rates and are likely to recover following the cessation of works within two weeks of clearance

(Stamp *et al.* 2022). Resistance to this pressure is therefore assessed as 'None' and resilience as 'High' (Stamp *et al.* 2022). Therefore, the sensitivity has been assessed as low.

The root systems of *M. Zostera* (A5.5331) are typically located within the top 20 cm of sediment, therefore, activities such as dredging can uproot and disturb seagrass beds, leading to a loss of seagrass cover. Recolonisation of a disturbed area by seagrass can occur via sexual reproduction (seed supply) and asexual reproduction (vegetative growth of adjacent rhizomes), and, as a clonal plant, it commonly reproduces asexually (Johnson *et al*., 2020). In general, larger plots are likely to take longer to recover than smaller scars, with horizontal expansion through rhizome growth faster in patch edges where newly available bare ground is available (Natural England, 2013). A study by Boese *et al*. (1999) found that seagrass beds in intertidal transition zones which were prone to repeated disturbance through boating activities were more vulnerable and less likely to recover, in comparison to recovery of lower intertidal continuous perennial beds which were subject to a single disturbance event. In this study, the intertidal continuous perennial beds subject to one disturbance event began recovery within a month of disturbance and fully recovered within two years. However, dredging operations at the Proposed Development will be a recurring event, therefore even if the recolonisation through vegetative growth takes place it is likely to be further disturbed by maintenance activities.

The recovery of seagrass beds after disturbance to the sub-surface of the sediment is expected to be slow with the speed depending on the extent of removal. *Zostera marina* is typically found at depths between 0.5 m and 4 m around the UK, but in clear waters, it can be found in depths up to 10 m (Davidson and Hughes, 1998 *in* Natural England, 2013). *Z. marina* roots and rhizomes are buried no deeper than 20 cm below the surface (d'Avack *et al.*, 2014). Given that the depth of the dredged area is approximately between -1.0 m and -3.0 m, and it will be dredged to -3.0 m CD, it is likely to remove seagrass roots completely. However, because dredging will occur in areas where adjacent seed sources and viable grass beds are present, the rate of the recovery is likely to be accelerated through rhizome exchange to dredged areas (Boese *et al*., 2009) but seagrass beds have been shown to take at least five years to establish, even when near adjacent established beds (d'Avack *et al.,* 2022).

In summary, recolonisation and recovery of seagrass beds after the dredging activity is unlikely, dredging will be a recurring activity and will limit the extent of recoverability i.e., no recovery. Resistance to this pressure is "none" and resilience will be "very low" (d'Avack *et al.,* 2022). Taking into account the national value of this receptor (OSPAR list of threatened and/or declining species and habitats) a resulting sensitivity score for seagrass is high. However, it is important to note that extensive seagrass beds have been found around the Isle of Iona. Loss of seagrass within the dredging footprint represents a small proportion of seagrass beds found within the wider area.

The Sublittoral Sediment IEF has been assessed to have national importance and has been assessed to have a low to high sensitivity.

Fish and Shellfish

In general, mobile fish species, such as demersal fish, benthopelagic and pelagic fish, migratory fish and elasmobranchs are able to avoid areas subject to temporary habitat disturbance (EMU, 2004). The most vulnerable species are likely to be a part of the shellfish assemblage which are much less mobile than fish, with fragile slow-recruiting species being most highly impacted by short-term disturbance events (MacDonald *et al.*, 1996). Additionally, high and low-intensity areas may overlap with the Marine Biodiversity Study Area and may be affected during the dredging campaign. Therefore, on the basis that mobile IEFs are likely to move away from disturbance, only the ‘shellfish assemblage’ and ‘spawning and nursery grounds’ IEFs have been taken forward for further assessment.

Shellfish Assemblage

The shellfish assemblage includes periwinkles, whelks, mussel, *Nephrops*, brown crab, green crab, velvet crab, razor clam, great Atlantic scallop, razor clam and crawfish that are known to inhabit the Marine Biodiversity Study Area. Temporary habitat loss during dredging in this area will represent a relatively small temporary disturbance to these habitats, with relatively rapid recovery of sediments expected thereafter, followed by recovery of associated communities including shellfish populations into these areas. The recoverability and rate of recovery of an area after seabed disturbance are linked to the substrate type. Specifically, mud or sand habitats, similar to those found in the Marine Biodiversity Study Area, have been shown to return to baseline species abundance after approximately one to two years (Newell *et al*., 1998; Desprez, 2000).

As maintenance dredging is likely to be undertaken on an annual frequency, this will impede the ability of the shellfish assemblage to recolonise the area. However, the dredging area only comprises a small area of the available wider habitat which shellfish are able to populate.

The Shellfish Assemblage IEF has been assessed to have a local to regional importance, low vulnerability and medium recoverability to the temporary disturbance and habitat loss and therefore their sensitivity has been deemed as low.

Spawning and Nursery Grounds

The fish species within the Marine Biodiversity Study Area which are likely to be most sensitive to temporary habitat loss are those species which spawn on or near the seabed sediment (e.g., sandeel, herring and elasmobranchs, including spotted ray). Adult specimens of the majority of spawning and nursery ground IEFs are mostly pelagic and highly mobile when not spawning and are therefore likely to avoid dredging operations, recovering to baseline conditions immediately after cessation of works.

Sandeel spawn and have a nursery area within the Marine Biodiversity Study Area (Coull *et al*., 1998). Recovery of any impacted sandeel populations would be expected following construction operations, with the rate of recovery depending on the recovery of sediments to a condition suitable for sandeel recolonisation. The recovery potential of sandeel populations can also be inferred from a study by Jensen *et al*. (2010), which found sandeel populations mix within fishing grounds to distances of up to 28 km.

Herring spawn and have a high-intensity nursery ground within Marine Biodiversity Study Area, but these are unlikely to be significantly impacted as there are suitable alternative spawning areas available. Dredging carried out during spawning periods has the potential to result in the mortality of eggs and reduced opportunity due to the removal of suitable habitat. However, the area which will be dredged is small given the abundance of similar substrate types across the Marine Biodiversity Study Area and the extensive nature of fish spawning grounds around Iona more broadly.

Dredging activities within the Marine Biodiversity Study Area may also impact spawning and nursery habitats for whiting, as these areas overlap the Marine Biodiversity Study Area. If effects do occur, larval settlement from nearby undisturbed areas will likely increase the rate of recovery (Phua *et al*., 2002).

Similarly, the year-round demersal spawning of spurdog is unlikely to be impacted significantly, and recruitment from unimpacted areas would likely allow rapid recovery.

As maintenance dredging is likely to be undertaken on an annual frequency, this will impede the ability of the spawning and nursery grounds to use the area. However, the dredging area only comprises a small area of the available wider habitat which fish can use as spawning and nursery grounds.

The Spawning and Nursery Ground IEF has been assessed to have a regional to national importance, low vulnerability and high recoverability to the temporary disturbance and habitat loss and therefore their sensitivity has been deemed as low.

Significance of Effects

Benthic Ecology

Littoral Sediment IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Infralittoral Rock IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Subtidal Sediment IEF is deemed to have a low to high sensitivity and low magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Overall, the significance of effect is deemed to be of **minor** significance, which is not significant in EIA terms.

Fish and Shellfish

Shellfish Assemblage IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Spawning and Nursery Grounds IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Overall, the significance of effect is deemed to be of **negligible** significance, which is not significant in EIA terms.

8.7.1.2 Effects of increased suspended sediment concentrations and sediment deposition

Increases in suspended sediments and associated sediment deposition are predicted to occur during the construction phase as a result of dredging activities.

The suspended sediment produced by the installation of rock armour for the breakwater is likely to be of negligible concern and hasn't been taken forward for assessment. Rock armour once placed on sediment is unlikely to produce increases in localised suspended sediment concentrations, any suspended sediments are likely to be of short duration (minutes) and taken away by the current. Similarly, only one rock is likely to be placed at any one time allowing for any sediments to fall out of suspension.

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Climatology Report 2016 (Silva *et al.*, 2016) shows the spatial distribution of average non-algal Suspended Particulate Matter (SPM) for the majority of the UK continental shelf. Between 1998 and 2005, the greatest plumes were associated with large rivers such as those that discharge into the Thames Estuary, The Wash and Liverpool Bay, which show mean values of SPM above 30 mg/l. Using this study, it is estimated that the average SPM associated with the Iona region is approximately 10-15 mg/l.

Magnitude of Impact

As discussed above, the approximate dredge area will be 2,017 m^2, with the approximate dredge volume to be removed 1,225 m^3, with operations expected to last a maximum of one week.

To determine the fate of sediments to be released during dredging an estimate of the spill volume was calculated based on Aarninkhof *et al.* (2018) and Becker *et al*. (2015). For a backhoe dredge CEDA (2018) predicts a sediment volume of 3.5% release of the total dredge volume while Becker *et al.* (2015) states a sediment release of between 1-5% of the total dredge volume. For the purposes of this sediment plume assessment, a conservative spill volume of 5% was assumed, which equates to approximately 61 m^3 of potential overspill loss as a result of the dredging campaign.

The fate of three types of sediment fractions (gravel, sand and silt) was assessed for dredging, during flood and ebb spring tides.

Gravel fractions make up approximately 7.2% of the sediment composition in the area. This would result in a total volume of circa 4 m^3 being released.

Coarse sand (which is the same as finest gravel) makes up approximately 91.1% of the sediment composition in the area. This would result in a total volume of circa 56 m^3 being released.

For silt fractions, an average silt particle of 0.03 mm diameter will make up approximately 1.7% of the sediment composition in the area. This would result in a total volume of circa 1 m^3 being released.

Elevated suspended sediment levels would be experienced in the locality of the site due to the sand fraction, similar to those experienced during a storm event (Little *et al*., 2009). However, beyond the dredging area, the large tidal currents would provide increased dispersion and dilution and the finer material would be indiscernible from background levels (Little *et al.*, 2009).

During maintenance dredging, as volumes to be dredged are currently unknown, the capital dredging volumes can be used as a worst-case scenario. However, it should be noted that maintenance dredging removes less sediment than the capital dredge works. Operations are expected to last a similar amount of time.

The effects of increased suspended sediment concentrations and sediment deposition are predicted to be of highly localised spatial extent, short-term duration, and reoccur on an annual basis. The magnitude of this impact is considered to be low.

Sensitivity of Receptor

Benthic Ecology

Biotopes that directly overlap with the dredging area comprise Littoral Sediment biotopes: Littoral sand and muddy sand (A2.2). Infralittoral Rock biotopes: 'Kelp beds' (A3.125). Sublittoral Sediment biotopes: *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (A5.233), kelp and seaweed communities on sublittoral sediment (A5.52) and *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand (A5.5331).

<u>Littoral sediment</u>

Littoral sediment biotopes tend to have low sensitivity to increases in suspended solid concentrations, due largely to their typically mobile sedimentary characteristics. Combined with the lack of sediment plumes from dredging, this impact will likely have little to no effect on most identified IEF biotopes. However, the A2.24 biotope, consisting of polychaete or bivalve dominated muddy sand shores, is a BAP Priority habitat, and is therefore evaluated here as a precautionary measure. Specifically, boring polychaete species and epibenthic suspension feeders are known to be highly vulnerable to as little as 1 cm of sediment deposition (Maurer, 1981). However, the muddy intertidal habitat presents a natural risk of smothering to local species, and any spillage from the dredging activities will not represent a significant increase in sediment deposition. Also, common polychaetes such as *Nereis* species or *Arenicola marina* are important intertidal deposit feeders, and are able to cause bioturbation of deposited sediment, improving carbon flux and increasing overall biodiversity in the area (Kristensen, 2001), with this very high recoverability giving this biotope a very low sensitivity to this impact.

The Littoral Sediment IEF is of regional importance, expected to have low vulnerability, high recoverability, and therefore have low sensitivity.

<u>Infralittoral rock</u>

The infralittoral rock biotope in the Marine Biodiversity Study Area consists of kelp species (A3.125). An increase in turbidity has the potential to reduce photosynthetic capacity of *Laminaria* spp. by up to 50% when light attenuation decreases by 10% (Staehr and Wernberg, 2009). However, this impact is highly unlikely to occur due to lack of predicted sediment plumes from the dredging activities.

Light sediment deposition is unlikely to significantly impact adult specimens, due to their resilience to highly variable intertidal and subtidal coastal environmental conditions. However, sedimentation could potentially impact *Saccharina latissima* zoospore settlement, with possible negative implications for long term recruitment trends within this species (Moy and Christie, 2012). This is again unlikely to occur;

long term recruitment is only likely to be disrupted in this species with a minimum sediment deposition of 5 cm, which is unlikely to occur as a result of minor dredge bucket overspill. Also, *Saccarina* gametophytes are known to be resilient to direct smothering, resuming normal growth within one month of sediment removal (Dieck, 1993).

The Infralittoral Rock IEF biotope is of national importance, expected to have low vulnerability, high recoverability, and therefore have low sensitivity.

<u>Sublittoral Sediment</u>

Sublittoral sediment biotopes are most likely to be affected by this impact, due to close proximity to the dredging area, although the lack of sediment plumes will cause no significant impact on any biotopes present. In terms of sediment deposition, the *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (A5.223) are known to be able to burrow through up to 20 cm of introduced coarse sediments (Essink, 1999), with this amount of overspill highly unlikely to occur in this instance. Therefore, the vulnerability of these species to sediment deposition is low, with the potential for high recoverability once the sediment has been removed naturally within a few tidal cycles. As well as being regionally important, this biotope is therefore considered to have low sensitivity to this impact.

The seagrass *Zostera marina* A5.5331 biotope, is listed as a PMF, and is known to have high vulnerability and medium recoverability to light smothering from dredge bucket overspill, giving medium sensitivity to this impact. This biotope also has high sensitivity to increases in fine suspended solids, although this impact is less likely to occur at this site. It is known that, globally, dredging and port construction activities can have significant negative effects on seagrass bed coverage and ecological stability (Grech *et al*., 2012). Significant increases in turbidity from dredge overspill can cause reductions in seagrass bed coverage (Giesen *et al*., 1990), arising from reduction in light availability overall, and specifically reductions in shorter wavelengths of visible light most commonly utilised by the seagrass beds (Cussioli *et al*., 2020). Despite these vulnerabilities to construction effects, seagrass is known to have a medium level of recoverability, with post-dredging recovery being seen after a small-scale harbour installation within two years in New England (Sabol *et al*., 2005). The ongoing maintenance dredging is likely to resuspend sediments but, similar to the capital dredging works, sediments are expected to dissipate following the cessation of works.

The Sublittoral Sediment IEF has national importance, the vulnerability to this impact is medium, the recoverability is medium, and the sensitivity is deemed to be medium.

Fish and Shellfish

Mobile fish species are generally able to avoid areas which experience increases in suspended sediments. Demersal fish species, benthopelagic and pelagic fish species, migratory fish species and elasmobranchs that are likely to interact with the Marine Biodiversity Study Area are only likely to do so by passing through the area. Mobile fish species may show avoidance behaviour within areas affected by increased suspended sediments (EMU, 2004). Sessile shellfish species, such as the great Atlantic scallop and razor clam, may experience smothering effects as a result of sediment deposition.

Demersal Fish Species

The demersal fish IEF species identified include plaice and horse mackerel, which heavily utilise the benthic environment in their feeding behaviours but are both highly mobile, therefore being naturally adapted for survival in sandy and mobile sediments. This mobility has been noted to allow these species, along with other macrobenthic organisms, to survive the deposition of up to 30 cm of sediment directly onto and around the organisms (Karel, 1999). As the volume of sediment deposition is likely to be low overall, the effect of this impact will similarly be low, and the potential also exists for plaice and horse mackerel to move away from disturbances (Gibson, 1980).

The Demersal Fish Species IEFs in the Marine Biodiversity Study Area have been assessed to have national importance, low vulnerability, and high recoverability to this impact. Therefore, the sensitivity has been deemed to be negligible.

Benthopelagic and Pelagic Fish Species

All benthopelagic and pelagic fish species IEFs likely to be affected by sediment deposition are mobile, and either feed or spawn on or near the seabed. Demersal spawners within the Marine Biodiversity Study Area include nationally important and mobile sandeel species, although they are likely to avoid active dredging activities. Therefore, effects on sandeel spawning populations are predicted to be limited. Sandeel populations prefer coarse to medium sands (Wright *et al.*, 2000), with sensitivity to changes in this habitat, and show reduced selection or avoidance of gravel and fine sediments (Holland *et al.*, 2005). Therefore, any increase in the fine sediment fraction of their habitat may cause avoidance behaviour until such time that currents remove fine sediments from the seabed, although the volume of expected overspill and lack of fine sediment plumes suggests this will cause a very low level of impact.

Other mobile species include herring, cod, whiting, and sprat, which live mostly in entirely pelagic habitats, and utilise a variety of habitats for feeding and spawning behaviours. The impact of sediment deposition on mobile pelagic species such as these is understood to be low, requiring high concentrations of suspended sediments to directly affect individuals to cause significant effects on survivability (Hvidt *et al*., 2002). Studies on herring juveniles showed some effects on feeding behaviour at 2.5 mg/l SSC (Mesieh *et al*., 1981), although this was caused mostly by increases in fine sediment concentration, which are not present in significant volumes in the Proposed Development dredging area and are highly unlikely to overspill from the dredge bucket in volumes required for this level of impact.

The Benthopelagic and Pelagic Fish Species IEFs in the Marine Biodiversity Study Area have been assessed to have national importance, low vulnerability, and high recoverability to this impact. Therefore, the sensitivity has been deemed to be low.

Migratory Fish Species

Migratory fish species, specifically sea trout and Atlantic salmon, are known to occur in the area and are expected to have some tolerance to naturally high suspended sediments, given that their migration routes pass through estuarine habitats, which have high suspended sediment concentrations (when compared to offshore habitats). As it is predicted that dredging and other construction activities associated with the Proposed Development will produce very little increase in suspended sediments, with levels well below those experienced in estuarine environments, it would be expected that any mobile migratory fish species should only be temporarily affected (if at all). Any negative effects on these species are likely to be short term behavioural effects, such as avoidance (Boubee, *et al*., 1996), or temporary slightly erratic alarmed swimming behaviour (Chiasson, 2011), and are not expected to create a barrier to migration to rivers or estuaries used by these species in the Marine Biodiversity Study Area. Although effects of increased sediment depositions have been noted in terms of decreased growth and survival rates of salmonid juveniles (Suttle, *et al*., 2004), these effects were only seen upstream after direct introduction of large volumes of fine sediment during juvenile development. As any sediment is likely to be relatively coarse, of very low spillage volume, and entirely offshore, this impact will not affect salmonid species which may utilise the Marine Biodiversity Study Area for migration purposes.

Migratory Fish Species IEFs in the Marine Biodiversity Study Area are deemed to be of low vulnerability, high recoverability and regional to international importance. The sensitivity of the receptors is therefore, conservatively, considered to be low.

Elasmobranchs

The Elasmobranch IEFs identified as potentially being present within the Marine Biodiversity Study Area could potentially be impacted if individuals overlap with sediment overspill. Potential short-term physiological stress responses can occur (Skomal and Mandelman, 2012) which revert to baseline following the removal of the stressor. However, highly mobile elasmobranchs are known to be able to detect anthropogenic activity (Mickle and Higgs, 2022), and are thus likely to avoid any significant construction or operational dredging activity and are thus unlikely to remain in or around the dredge area for long enough for any overspill to cause issues.

The Elasmobranch IEFs in the Marine Biodiversity Study Area are deemed to be of local to international importance, low vulnerability, and high reversibility. Given the international importance and range of species designations, the sensitivity of the receptors is therefore considered to be low.

Shellfish assemblage

Many shellfish species, such as edible crab, have a high tolerance to suspended sediments and are reported to be insensitive to increases in turbidity; however, they are likely to avoid areas of increased suspended sediments as they rely on visual acuity during predation (Neal and Wilson, 2008). Buried crustaceans (e.g., European lobster and *Nephrops*) are likely to be more vulnerable to increased suspended sediments as the eggs carried by these species require regular aeration. Increased suspended sediments within the Proposed Development will only affect a very small area at any one time for up to two weeks, with sediments settling to the seabed quickly following disturbance. *Nephrops* are not considered to be sensitive to increases in suspended sediments or subsequent sediment deposition, since this is a burrowing species with the ability to excavate any sediment deposited within their burrows (Sabatini and Hill, 2008). This lack of sensitivity also applies to mussel species, wherein juvenile mussels are able to climb onto and embed themselves within any deposited sediment (Leeuwen *et al*., 2010), suggesting a very low sensitivity to this impact.

Great Atlantic scallop and razor clams are largely sedentary suspension feeders, with little research done on the direct effects of increased suspended sediments or smothering on either species specifically. However, it is known that higher concentrations of suspended particulate matter near to the seabed has a negative impact on tissue growth in Atlantic scallop (Emerson *et al*., 1994), although this was largely biological material and may not be applicable in this case. Research into king and queen scallops, which share ecological features and habitats with the Atlantic scallop, have found little to no long-term direct negative impact from increased suspended sediments or sediment deposition (Hendrick *et al*., 2016).

The Shellfish Assemblage IEF has been assessed to have a local to national importance, low vulnerability and have high recoverability to suspended sediment and deposition and therefore their sensitivity has been deemed as low.

<u>Spawning or Nursery Grounds</u>

Juvenile fish are more likely to be affected by habitat disturbances such as increased suspended sediments than adult fish. This is due to the decreased mobility of juvenile fish and therefore lower ability to avoid effects. Due to the temporary increases in suspended sediments associated with winter storm events and the occurrence of juveniles in inshore areas (where suspended sediments are typically higher), it can be expected that most fish juveniles will be largely unaffected by the low level temporary increases in suspended sediments. The concentrations are likely to be within the range of natural variability for these species and will reduce to background concentrations within a very short period (approximately two tidal cycles).

Appleby and Scarratt (1989) found that the development of eggs and larvae have the potential to be affected by suspended sediments. However, Chapter 13: Coastal Processes concluded that dredging operations required for the Proposed Development would not result in any significant impact on water quality in terms of suspended sediments. Therefore, effects on egg and larvae development by suspended sediments are considered unlikely.

Spawning areas for sandeel occur within the Proposed Development, however sandeel eggs are likely to be tolerant to some level of sediment deposition due to the nature of re-suspension and deposition within their natural high energy environment. Therefore, effects on sandeel spawning populations are predicted to be limited. Sandeel populations are also sensitive to sediment type within their habitat, preferring coarse to medium sands and showing reduced selection or avoidance of gravel and fine sediments (Holland *et al*., 2005). Therefore, any increase in the fine sediment fraction concentrated within their habitat may cause avoidance behaviour until such time that currents remove fine sediments from the seabed.

With respect to the effects of sediment deposition on herring spawning activity, it has been shown that herring eggs may be tolerant of very high levels of suspended sediments (Mesieh *et al*., 1981; Kiorbe *et al*., 1981). Detrimental effects may be seen if smothering occurs and the deposited sediment is not removed by the currents (Birklund and Wijsmam, 2005), however this would be expected to occur quickly.

The Spawning or Nursery Ground IEF has been assessed to have a regional to national importance, low vulnerability and have high recoverability to suspended sediment and deposition and therefore their sensitivity has been deemed as low.

Significance of Effects

Benthic Ecology

Littoral Sediment IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms

Infralittoral Rock IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Subtidal Sediment IEF is deemed to have low sensitivity to medium (seagrass) sensitivity and low magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Overall, the significance of effect is deemed to be of **minor** significance, which is not significant in EIA terms.

Fish and Shellfish

Demersal Fish Species IEF is deemed to have a negligible sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Benthopelagic and Pelagic Fish Species IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Migratory Fish Species IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Elasmobranchs IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Shellfish Assemblage IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Spawning and Nursery Grounds IEF is deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Overall, the significance of effect is deemed to be of **negligible** significance, which is not significant in EIA terms.

8.7.1.3 Potential for resuspension of contaminated sediments

Seabed sediment analysis indicated that there are no chemical determinants that exceed the CEFAS Action Levels 1 or 2, and Canadian Threshold Effect Levels (TEL) or Probable Effect Levels (PEL), see Volume III Appendix 8.1. Therefore, this impact has been scoped out on the basis that there are no contaminated sediments, as directed by the CEFAS Action Levels and Canadian Effect Levels, to be resuspended during the construction phase.

8.7.2 Assessment of Construction Effects

This section assesses the effects of activities which occur during the construction phase of the Proposed Development. Construction phase activities include both the construction of the breakwater and dredging activities.

8.7.2.1 Temporary disturbance/loss of habitat arising from the displacement/compaction of the seabed by anchors and jack-up barge spud legs

Construction activities, such as anchor placement and jack up barge spud legs, may lead to a temporary loss/disturbance of habitat.

Magnitude of Impact

Anchors will remain on the seabed for short periods of time with a footprint of <1 m^2 per anchor, and likely to be removed during the same day. Observations from Studland Bay, Dorset, indicated that anchoring scars are typically 1 - 4 m^2 (Natural England, 2013).

A jack-up barge, with 18 m jack-up legs (circa 500 mm diameter) is expected to be used for the Proposed Development. Similarly, to the above, the legs are expected to only be in-situ for a short duration.

It is expected that there will be approximately 40-50 vessel movements over the course of 52 weeks to deliver the rock armour. It is likely that the jack-up barge will remain in place during the placement of rock armour with the barge delivery either moored or anchored in close proximity. The jack-up barge is expected to only be moved a small number of times in order to complete the breakwater.

These works will only be undertaken within the Temporary Works Area as identified within Figure 8-1.

The magnitude of this impact is considered to be low due to the relatively small spatial scale of impact and short to medium term duration.

Sensitivity of Receptor

Benthic Ecology

Physical disturbance as a result of anchor placement can cause direct mortality through smothering or displacement of benthic species in the impacted area. The subtidal habitats that overlap with the temporary working area include the Infralittoral Rock: Kelp and red seaweeds (A3.21). Subtidal Sediment: heavily dominated by kelp and seaweed communities on sublittoral sediment (A5.52), *Zostera marina*/*angustifolia* beds on lower shore or infralittoral clean or muddy sand (A5.5331) and *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (A5.233).

Littoral Sediment

The sensitivities of Littoral Sediment habitats are expected to be similar to the 'Temporary disturbance/loss of habitat arising from dredging activity' impact. Furthermore, most of these biotopes are found within the intertidal region where it is highly unlikely that anchoring or jack-up operations will occur. Therefore, these biotopes are unlikely to be impacted.

The Littoral Sediment IEF have been assessed to have a regional importance, low vulnerability and have high recoverability to the temporary disturbance and habitat loss and therefore their sensitivity has been deemed as negligible.

Infralittoral Rock

Kelp and red seaweeds (A3.21) are characterised by epifauna/epiflora that occur on hard rock, which is resistant to subsurface penetration, however abrasion could remove a proportion of the faunal community. Evidence from Engelen *et al.* (2011) has demonstrated that complete recovery of this biotope occurs 18-24 months after complete removal of flora and fauna present.

The Infralittoral Rock IEF has been assessed to have a national importance, medium vulnerability and have medium recoverability, therefore their sensitivity has been deemed as medium.

Sublittoral Sediment

Biotopes such as '*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand' (A5.233), kelp and seaweed communities on sublittoral sediment (A5.52) and '*Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand' (A5.5331) were recorded. A5.52 and A5.5331 represent the most important biotopes that may be affected.

The A5.52 kelp and seaweed communities on sublittoral sediment biotope is typically characterised by the sugar kelp *Saccharina latissima*, the bootlace weed *Chorda filum*, and various red and brown seaweeds, particularly filamentous types, with associated high abundance of the burrowing polychaete *Mediomastus fragilis* and a mixed infaunal community of gammarids, amphipods, and bivalves. Growth of *Saccharina latissima* is affected most strongly by seasonal fluctuations in light and nitrogen availability (Nielsen *et al*., 2014), with relatively high tolerance of physical disturbance (Andersen *et al*., 2011, Moy and Christie, 2012). This resistance to physical disturbance, alongside the known wide seasonal spore dispersal range of this species (Andersen, 2013), with currents carrying spores relatively short distances from very similar nearby habitats, suggests a high recoverability in the impacted areas, likely beginning as soon as the materials causing compaction and temporary habitat loss are removed.

Zostera root systems are typically located within the top 20 cm of the sediment and can be easily uprooted. Anchoring may damage seagrass beds through removal of plants, breakage of rhizomes and burial of seeds too deeply to allow germination (Marine Scotland, 2021). Roots and rhizomes of *Zostera* grow horizontally, rather than vertically. Therefore, due to the typically small spatial scale of anchoring, seagrass beds may be more resilient to physical damage caused by anchors, and recolonisation of these areas may be possible (d'Avack *et al.*, 2014). However, seagrass beds have been shown to take at least five years to establish, even when near adjacent established beds (d'Avack *et al.,* 2022).

The compaction events from vessel mooring anchors will be short-term and not repeated often following construction, with recolonisation likely to occur following removal of anchors. Additionally, through embedded mitigation, sensitive features, such as seagrass, can be avoided through the careful placement of anchors and jack-up barge legs via visual direction (i.e., direct instruction of anchors and jack-up legs by members of the crew, or via the presence of sensitive features polygons on the shipboard navigation system, derived from the subtidal surveys).

The Subtidal Sediment IEF have been assessed to have a national importance, low vulnerability and have medium recoverability following removal of construction equipment, therefore the sensitivity has been deemed as medium.

Fish and Shellfish

Effects to Fish and Shellfish IEFs are expected to be similar to, or smaller than, the impact of 'Temporary disturbance/loss of habitat arising from dredging activity'.

The sensitivity of all Fish and Shellfish IEFs is considered to be low for 'Temporary disturbance/loss of habitat arising from dredging activity', therefore, the sensitivity has been deemed as low.

Significance of Effects

Benthic Ecology

Littoral Sediment IEF is deemed to have a negligible sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Infralittoral Rock IEF is deemed to have a medium sensitivity and low magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Subtidal Sediment IEF is deemed to have a medium sensitivity and low magnitude; therefore, the significance of effect is considered to be **minor**, which is significant in EIA terms.

Overall, the significance of effect is deemed to be of **minor** significance, which is not significant in EIA terms.

Fish and Shellfish

The significance of effect for all Fish and Shellfish IEFs is deemed to be of **negligible** significance, which is not significant in EIA terms.

8.7.2.2 Permanent habitat loss arising from placement of material on the seabed for the breakwater

Permanent long term habitat loss will occur directly under the new breakwater structure. The footprint of the breakwater below MHWS is approximately 10,037 m^2, with approximately 149,812 tonnes of rock armour to be laid. The works will be carried out once but will remain in-situ up to 120 years for the design life and will be non-reversable.

The long-term habitat loss/disturbance is predicted to be of localised spatial extent, long-term duration, and continuous, and the impact will affect receptors directly. The magnitude of the impact is considered to be medium.

Sensitivity of Receptor

Benthic Ecology

Where the rock armour for the breakwater is to be installed on the seabed, there will be a permanent loss of habitat due to the fundamental change in substrate type. The introduction of hard substrate through installation of the breakwater has the potential to influence change in the benthic community and associated fauna through artificial reef effects.

Biotopes that directly overlap with the breakwater area comprised Littoral Rock biotopes: high energy littoral rock (A1.1) and moderate energy littoral rock (A1.2); Littoral Sediment biotopes: barren littoral shingle (A2.1) and littoral sand and muddy sand (A2.2) and Sublittoral Sediment biotopes: *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand (A5.5331), kelp and seaweed communities on sublittoral sediment (A5.52) and *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand (A5.233).

<u>Littoral Rock</u>

High energy littoral rock (A1.1) and moderate energy littoral rock (A1.2) are characterised by the presence of *Semibalanus balanoides, Patella vulgata, Littorina spp., Fucus vesiculosus, Himanthalia elongate, Pelvetia canaliculata, Fucus serratus* and red seaweeds. Recovery of *Semibalanus balanoides* and the limpet *Patella vulgata* will depend on re-colonization and community regulation by larvae (Petzold and Scrosati, 2014). As these are common, widespread species and the footprint of the impact will be relatively small, larval supply from adjacent populations/nearby similar biotopes are likely to support recolonisation. As such, full recovery of the A1.1 habitat to baseline levels (i.e., to the pre-construction baseline) is therefore expected within two years (Tillin & Hill, 2018a; Tillin & Hill, 2018b; Tillin, 2015; Tillin & Budd, 2016). The recovery time for A1.2 biotopes will be slightly longer with full recovery expected within two to five years.

Littoral Rock IEF have been assessed to have a regional importance, low to medium vulnerability, are commonly found within the Marine Biodiversity Study Area and have high recoverability to permanent habitat loss arising from the placement of material on the seabed, therefore their sensitivity has been deemed as low.

<u>Littoral Sediment</u>

Barren littoral shingle (A2.1) or amphipod-dominated mobile sand shores (A2.22) are characterised by mobile sands (coarse, medium or fine-grained), which retain little water and organic matter, and thus are subject to drying out between tides. The A2.22 biotope supports a limited range of species, including amphipod, isopod and polychaetes (MarLIN, 2021a). The existing biotopes present within the breakwater footprint will be lost but recolonisation is expected within days or weeks, subject to adequate source population (Leewis *et al.* 2012). Sediments present in between the breakwater are likely to be recolonised quickly from nearby biotopes and larvae supply.

Littoral Sediment IEF have been assessed to have a regional importance, low vulnerability and have high recoverability to permanent habitat loss arising from the placement of material on the seabed, therefore the sensitivity has been deemed as low.

Sublittoral Sediment

Effects to Sublittoral Sediment, 'Kelp and seaweed communities on sublittoral sediment' A5.52 and '*Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand' A5.5331 are expected to be similar to 'Temporary disturbance/loss of habitat arising from dredging activity', with the exception that any biotopes present within the breakwater area will be lost.

Permanent loss of the biotope A5.52 is likely to occur from within the breakwater footprint area resulting in high mortality. As sediment is to be replaced with rock, this would represent a fundamental change to the biotope (Macleod *et al.*, 2014). All the characterizing species within this biotope can grow on rock biotopes (Birkett *et al*., 1998; Connor *et al.*, 2004), however, A5.52 by definition is a sediment biotope and introduction of rock would result in a change to a rock-based habitat complex, and the A5.52 biotope would be lost. Therefore, the biotope has high vulnerability and no ability to recover but has the ability to become a different biotope. This biotope has been assessed to have a national importance, low vulnerability (as the biotope is found throughout the Marine Biodiversity Study Area) and has no ability to recover. The A5.52 biotope is expected to be lost but recovery of the characterising species is expected to occur within two weeks, thereby increasing recoverability. The sensitivity for this biotope is therefore deemed as low.

A change to another seabed type (from sediment to hard rock) will result in a permanent loss of suitable habitat for the seagrass PMF. D'Avack *et al.* (2022) assessed the resistance as 'None', as this pressure represents a permanent change; recovery is impossible as a suitable substratum for seagrasses will not be present. However, it is important to note that extensive seagrass beds have been found around the isle of Iona. The seagrass beds represent a small loss of habitat in the wider context of the area.

The Sublittoral Sediment IEF has been assessed to have a national importance, high vulnerability and have no recoverability, therefore the sensitivity has been deemed as high.

Fish and Shellfish

Fish and shellfish species that are reliant upon the presence of suitable sediment/habitat for their survival are considered to be more vulnerable to change depending on the availability of habitat within the wider geographical region. The seabed habitats removed by the installation of the breakwater will reduce the amount of suitable habitat and available food resource for fish and shellfish species and communities associated with the baseline substrates/sediments. However, this area represents a small proportion of the wider area.

Mobile fish species are generally able to avoid areas subject to long term subtidal habitat loss. Demersal fish species, benthopelagic and pelagic fish species, migratory fish species and elasmobranchs that are likely to interact with the Marine Biodiversity Study Area are only likely to do so by passing through the area. The habitats within the Marine Biodiversity Study Area are not expected to be particularly important for mobile fish species and therefore habitat loss during the construction of the Proposed Development is unlikely to cause any direct impact to mobile fish species. Conversely, once construction has been completed, the heterogenic environment is likely to act as a fish aggregation area, increasing local fish populations (Froeschke *et al.*, 2005; Cenci *et al.*, 2011).

Sessile shellfish species, such as the great Atlantic scallop and razor clam, may be affected as suitable sediments for colonisation will be lost. However, the permanent habitat lost is unlikely to affect the wider population as alternative areas are available for colonisation. Conversely, once the breakwaters have been built, they will act as suitable colonisation areas for other shellfish species, such as crabs and lobsters.

The Proposed Development coincides with low and high intensity spawning and nursery habitat. The presence of the breakwater will result in direct effects on this habitat, though the proportion of spawning and nursery area affected is small in the context of the known spawning and nursery areas. These areas are unlikely to be affected in the long term, and once constructed, the breakwater will act as a refuge site from predators, likely contributing to species nursery areas.

Therefore, on the basis that mobile IEFs are likely to move away from disturbance, only the Shellfish Assemblage and Spawning and Nursery Grounds IEF have been taken forward for further assessment.

<u>Shellfish Assemblage</u>

Permanent habitat loss during the placement of rock armour in this area will represent a change in substrate type from sediment to hard substrate. This will result in the sessile shellfish assemblages within the footprint being lost and unlikely to recover. However, the extent of the area is small with alternative habitats available. Additionally, mobile shellfish species, such as crab and lobster, have a preference for rocky environments and are likely to quickly colonise the breakwater (Neal & Pizzolla, 2008; Wilson, 2008).

The ‘shellfish assemblage’ IEF has been assessed to have a local to regional importance, high vulnerability and have medium recoverability to permanent habitat loss, therefore their sensitivity has been deemed as low.

<u>Spawning and Nursery Grounds</u>

The fish species within the Marine Biodiversity Study Area which are likely to be most sensitive to permanent habitat loss are those species which spawn on or near the seabed sediment (e.g., sandeel, herring and elasmobranchs, including spotted ray). Adult specimens of the majority of spawning and nursery grounds IEFs are mostly pelagic and highly mobile when not spawning and are therefore likely to avoid breakwater placement operations, recovering to baseline conditions immediately after the cessation of works.

Sandeel spawn and have a nursery area present within the Marine Biodiversity Study Area (Coull *et al*., 1998). Spawning and nursery areas are likely to be lost due to the preference of sediments required for spawning. However, the extent of the area lost is unlikely to affect the population due to prolific spawning behaviours, with up to 4,000 - 20,000 eggs produced (Rowley, 2008). Alternative suitable spawning grounds are found within the wider area.

Herring have spawning areas and high intensity nursery grounds within the Marine Biodiversity Study Area, but these are unlikely to be significantly impacted as there are suitable alternative spawning areas available. Rock armour placement undertaken during spawning periods have the potential to result in the mortality of eggs and reduced opportunity due to the removal of suitable habitat. However, the area which will be affected is small given the abundance of similar substrate types across the Marine Biodiversity Study Area and the extensive nature of fish spawning grounds around Iona more broadly.

Breakwater placement activities within the Marine Biodiversity Study Area may also impact on spawning and nursery habitats for herring and whiting, as these areas overlap the Marine Biodiversity Study Area. However, the impact from the breakwater will have limited impact on these. If effects do occur, larval settlement from nearby undisturbed areas will increase the rate of recovery (Phua *et al*., 2002).

Similarly, the year-round demersal spawning of spurdog is unlikely to be impacted significantly, and recruitment from unimpacted areas would likely allow rapid recovery.

The Spawning and Nursery Ground IEF has been assessed to have a regional to national importance, low vulnerability and have high recoverability to permanent habitat loss and therefore their sensitivity has been deemed as low.

Significance of Effects

Benthic Ecology

Littoral Rock IEF is deemed to have a low sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Littoral Sediment IEF is deemed to have a low sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms

Subtidal Sediment IEF is deemed to have a low to high sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor** for the other biotope class but **moderate** due to the presence of the seagrass PMF, which is significant in EIA terms.

Overall, the significance of effect is deemed to be of **moderate** significance due to the potential impact on seagrass PMF. All other habitats have been deemed minor, which is not significant in EIA terms.

Fish and Shellfish

Shellfish Assemblage IEF is deemed to have a low sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Spawning and Nursery Grounds IEF is deemed to have a low sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor**, which is not significant in EIA terms.

Overall, the significance of effect is deemed to be of **minor** significance, which is not significant in EIA terms.

Residual Effects

Benthic Ecology

Permanent habitat loss arising from the placement of material on the seabed for the breakwater is likely to have a significant effect on the seagrass PMF found within the breakwater footprint. As the receptor is being directly affected due to the placement of rock armour, there will be no possibility of being able to mitigate for this loss. Therefore, compensation and/or monitoring has been proposed within Section 8.10.

8.7.2.3 Effects of underwater noise arising from construction activities

The installation of the Proposed Development will involve dredging and vessel noise, all of which produce noise levels which have the potential to effect fish and shellfish and marine mammal IEFs.

Magnitude of Impact

To understand the significance of impact of noise emissions of dredging and vessel noise, subsea noise modelling has been undertaken, and is presented in Volume III, Appendix 8.4. The Subsea Noise Modelling also assessed the installation of piles using drilling however, this activity is no longer part of the Proposed Development. Therefore, only dredging and vessel movements, as non-impulsive noise sources have been assessed below.

Capital dredging will require the use of a backhoe excavator for up to one week of operation. Once the dredging is complete the backhoe excavator will demobilise from site.

Vessel operations, to support the construction of the breakwater are expected to be within the area for up to 52 weeks, with approximately 40 - 50 vessel movements to delivery rock armour. However, it is unlikely that vessels will be continuously operating for this duration.

The subsea noise modelling predicted that, for fish with swim bladders (i.e., fish most sensitive to underwater noise) (using the SPL_{rms} metric), Temporary Threshold Shift (TTS) is not expected to occur beyond 10 m of the sound source (for both dredging and vessels). For low frequency cetaceans, such as baleen whales, TTS ranges were calculated at 250 m and 180 m for vessel and dredging noises, respectively. TTS ranges for cetaceans were predicted to be 30 m and 20 m for vessel and dredging activities, respectively. Note the Permanent Threshold Shift was not exceeded.

Therefore, the effects of underwater noise arising from construction activities are predicted to be of highly localised spatial extent, short-term duration, intermittent and reversable following cessation of works. The magnitude of this impact is considered to be low.

Sensitivity of Receptor

Volume III, Appendix 8.4 presents the criteria, baseline noise methodology, noise modelling outputs and predicted effects of noise arising from construction activities. The results have been summarised below within the Fish and Shellfish (specifically for fish) and Marine Mammal sections for ease of reference.

Fish and Shellfish

Underwater noise can potentially negatively impact fish species through physical injury and/or behavioural effects. Although adult fish are highly mobile and are generally able to vacate the area and avoid physical injury if they are outwith the immediate vicinity of the noise generating activity, larvae and spawn are not highly mobile and are therefore more susceptible to injury from sound energy.

For fish, the most relevant criteria for injury are considered to be those contained in ASA S3/SC1.4 TR-2014, Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al*. 2014) (Table 8-12). The guidelines set out criteria for injury due to different sources of noise. The criteria include a mixture of indices including SEL, rms and peak sound pressure levels. Where insufficient data exists to determine a quantitative guideline value the risk is categorised in relative terms as “high”, “moderate” or “low” at three distances from the source: “near” (i.e., in the tens of metres), “intermediate” (i.e., in the hundreds of metres) or “far” (i.e., in the thousands of metres).

Table 8-12 ASA guideline criteria for injury in fish due to non-impulsive sound

Type of animal	Mortality and potential mortal injury	Impairment	
		Recoverable injury	Temporary Threshold Shift (TTS)
Fish: no swim bladder (particle motion detection)	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low	(Near) Moderate (Intermediate) Low (Far) Low
Fish: where swim bladder is not involved in hearing (particle motion detection)	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low	(Near) Moderate (Intermediate) Low (Far) Low
Fish: where swim bladder is involved in hearing (primarily pressure detection)	(Near) Low (Intermediate) Low (Far) Low	170 dB re 1 μPa (rms) for 48 hours	158 dB re 1 μPa (rms) for 12 hours
Eggs and larvae	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low	(Near) Low (Intermediate) Low (Far) Low

Notes:
Range of effect classified as Near = tens of metres / Intermediate= hundreds of metres / Far = thousands of metres
Relative risk classified as high, moderate or low

Behavioural reactions of fish to sound have been found to vary between species based on their hearing sensitivity. Typically, fish sense sound via particle motion in the inner ear which is detected from sound-induced motions in the fish’s body. The detection of sound pressure is restricted to those fish which have air filled swim bladders; however, particle motion (induced by sound) can be detected by fish without swim bladders.

The most recent criteria for disturbance are considered to be those contained in ASA S3/SC1.4 TR-2014, Sound Exposure Guidelines for Fishes and Sea Turtles (Popper *et al*., 2014) which set out criteria for disturbance due to different sources of noise (Table 8-13). The risk of behavioural effects is categorised in relative terms as “high”, “moderate” or “low” at three distances from the source: “near” (i.e., in the tens of metres), “intermediate” (i.e., in the hundreds of metres) or “far” (i.e., in the thousands of metres).

Table 8-13 ASA guideline criteria for onset of behavioural effects in fish due to non-impulsive sound

Type of Animal	Relative Risk of Behavioural Effects
Fish: no swim bladder (particle motion detection)	(Near) Moderate (Intermediate) Moderate (Far) Low
Fish: where swim bladder is not involved in hearing (particle motion detection)	(Near) Moderate (Intermediate) Moderate (Far) Low
Fish: where swim bladder is involved in hearing (primarily pressure detection)	(Near) High (Intermediate) Moderate (Far) Low
Eggs and larvae	(Near) Moderate (Intermediate) Moderate (Far) Low

There are a number of species of fish which use the Marine Biodiversity Study Area as spawning and nursery grounds which may be sensitive to underwater noise. As shown in Table 8-13 above, Popper *et al*. (2014) group fish into categories dependent on their hearing capabilities.

Of highest sensitivity to underwater noise are species such as herring (clupeids) and cod (gadoids) where a swim bladder is involved in hearing. These species are most susceptible to barotrauma from underwater noise. There are spawning areas for herring within the wider study area, and high intensity nursery grounds are present within the Marine Biodiversity Study Area. Cod does not spawn in the wider study area, but the Marine Biodiversity Study Area does overlap with nursery grounds. Other species where a swim bladder is involved in hearing include saithe, Norway pout, sprat, whiting, hake and anglerfish, of which only Norway pout and sprat spawn in the wider area.

Atlantic salmon and sea trout also have swim bladders; however, these are not involved in hearing. They are still susceptible to barotrauma, but less so in comparison to clupeid and gadoid species. Flatfishes, such as plaice, mackerel, sandeels, elasmobranchs and shellfish do not have swim bladders so have low sensitivity to underwater noise as they are less susceptible to barotrauma.

The results of the subsea noise modelling determined that there is little potential for TTS to be experienced by fish due to the construction activities. For fish with swim bladders, the maximum range of impact for TTS is 10 m (using the SPL_{rms} metric), however, an individual would need to be exposed for a period of 12 hours before adverse effects are expressed.

Fish Species IEF are deemed to be of low vulnerability, high recoverability and local to international importance. The sensitivity of the receptor is therefore considered to be low.

Marine Mammals

Underwater noise has the potential to injure and/or disturb marine mammals. Auditory injury can occur as either a Permanent Threshold Shift (PTS), where there is no hearing recovery in the animal, or as a TTS, where an animal can recover from the tissue damage. Disturbance from underwater noise can result in changes in behaviour, such as migration, breeding, or feeding.

Sound propagation models can be constructed to allow the received noise level at different distances from the source to be calculated. To determine the consequence of these received levels on any marine mammals which might experience such noise emissions, it is necessary to relate the levels to known or estimated impact thresholds. The injury criteria proposed by Southall *et al.* (2019) are based on a combination of linear (i.e., un-weighted) peak pressure levels and mammal hearing weighted sound exposure levels (SEL). The hearing weighting function is designed to represent the bandwidth for each group within which acoustic exposures can have auditory effects. The categories include:

- low-frequency (LF) cetaceans (i.e., marine mammal species such as baleen whales);
- high-frequency (HF) cetaceans (i.e., marine mammal species such as dolphins, toothed whales, beaked whales and bottlenose whales);
- very high-frequency (VHF) cetaceans (i.e., marine mammal species such as true porpoises, river dolphins and pygmy/dwarf sperm whales and some oceanic dolphins, generally with auditory centre frequencies above 100 kHz);
- phocid pinnipeds (PCW) (i.e., true seals; hearing in air is considered separately in the group PCA); and
- other marine carnivores (OCW) (including otariid pinnipeds (e.g., sea lions and fur seals), sea otters and polar bears; air hearing considered separately in the group OCA).

Injury criteria proposed in Southall *et al.* (2019) are for two different types of sound as follows:

- Impulsive sounds which are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; ANSI 2005). This category includes sound sources such as seismic surveys, impact piling and underwater explosions; and
- Non-impulsive sounds which can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI 1995; NIOSH 1998). This category includes sound sources such as continuous running machinery, sonar and vessels.

The criteria for non-impulsive sound have been adopted for this study given the nature of the sound source used during construction activities. A summary of the PTS onset acoustic thresholds for these categories is given in Table 8-14.

Table 8-14 Summary of PTS onset acoustic thresholds (Southall *et al*. 2019)

Hearing Group	Parameter	Impulsive	Non-impulsive
Low-frequency (LF) cetaceans	Peak, unweighted	219	-
	SEL, LF weighted	183	199
High-frequency (HF) cetaceans	Peak, unweighted	230	-
	SEL, MF weighted	185	198
Very high-frequency (VHF) cetaceans	Peak, unweighted	202	-
	SEL, HF weighted	155	173
Phocid Carnivores in Water (PCW)	Peak, unweighted	218	-
	SEL, PW weighted	185	201
Other Marine Carnivores in Water	Peak, unweighted	232	-
	SEL, OW weighted	203	219

Marine mammal species that could be present within the Iona Sound include cetaceans: bottlenose dolphin, common dolphin, harbour porpoise, killer whale, minke whale and white-beaked dolphin; and pinnipeds: grey seal and harbour seal. According to Southall *et al*. (2019), minke whale is classified as a low-frequency cetacean; killer whale, common dolphin, white-beaked dolphin and bottlenose dolphin are classed as high-frequency cetaceans; and harbour porpoise is classed as a very high frequency cetacean. The two pinniped species, grey seal and harbour seal, are classed as phocid carnivores in water. In terms of non-impulsive noise, grey seal and harbour seal have the highest threshold for PTS onset, followed by minke whale, and the four species of high frequency cetaceans. Harbour porpoise has the lowest threshold for PTS onset.

Significant (i.e., non-trivial) disturbance may occur when there is a risk of animals incurring sustained or chronic disruption of behaviour or when animals are displaced from an area, with subsequent redistribution being significantly different from that occurring due to natural variation.

The National Marine Fisheries Service (NMFS, 2005) guidance sets the marine mammal level B harassment threshold for continuous noise at 120 dB re 1 μPa (rms). The relevant criteria for marine mammals are summarised in Table 8-15. This includes the thresholds for non-impulsive sound based on the relevant guidelines (NMFS 2018, NMFS 2005). In Table 8-15 SELs are expressed as dB re 1 μPa2s (cumulative over a 24-hour period) and RMS sound pressure levels are in dB re 1 μPa (rms).

Table 8-15 Summary of acoustic thresholds for marine mammals for non-impulsive sound

Hearing Group	Parameter	PTS	TTS	Disturbance
Low-frequency (LF) cetaceans	SEL, LF weighted dB re 1 μPa^{2}s	199	179	-
	RMST90 dB re 1 μPa (rms)	-	-	120
High-frequency (HF) cetaceans	SEL, MF weighted dB re 1 μPa^{2}s	198	178	-
	RMST90 dB re 1 μPa (rms)	-	-	120
Very high-frequency (VHF) cetaceans	SEL, HF weighted dB re 1 μPa^{2}s	173	153	-
	RMST90 dB re 1 μPa (rms)	-	-	120
Phocid Carnivores in Water (PCW)	SEL, PW weighted dB re 1 μPa^{2}s	201	181	-
	RMST90 dB re 1 μPa (rms)	-	-	120
Other Marine Carnivores in Water	SEL, OW weighted dB re 1 μPa^{2}s	219	199	-

Hearing Group	Parameter	PTS	TTS	Disturbance
	RMST90 dB re 1 µPa (rms)	-	-	120

The subsea noise modelling (Volume III, Appendix 8.4) predicted that for both dredging and vessel movements the threshold for PTS (using the SPL_{rms} metric) was not exceeded for any marine mammal species. With regard to TTS, vessel noise resulted in the largest range of effect, with TTS onset exceeded up to 270 metres from the source.

Based on the subsea modelling, there is little potential for TTS to be experienced by marine mammals due to the Proposed Development. Impact only occurs for a stationary seal being within 30 m of the construction work for 24 hours. This represents a worst-case scenario, and it is considered highly unlikely that a marine mammal would remain within this range for a period of 24 hours.

Marine Mammals IEF are deemed to be of low vulnerability, high recoverability and national to international importance. The sensitivity of the receptor is therefore, considered to be low.

Significance of Effects

Fish and Shellfish

All Fish and Shellfish IEFs are deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

Marine Mammals

All Marine Mammals IEFs are deemed to have a low sensitivity and low magnitude; therefore, the significance of effect is considered to be **negligible**, which is not significant in EIA terms.

8.7.2.4 Disturbance and collision risk to marine mammals from increased vessel traffic during construction

Marine Mammals

There will be no significant increase in vessel traffic outside of the normal working ferry traffic movements during the construction of the Proposed Development. Therefore, this impact has been scoped out as there is no change in the likelihood or magnitude of marine mammal collision with vessels.

8.7.3 Assessment of Operational Effects

This section assesses the effects of activities which occur during the operational phase of the Proposed Development. Operational phase assessment considers the footprint of the breakwater post construction.

8.7.3.1 Permanent habitat creation arising from the placement of material on the seabed for the breakwater

During the operational phase, permanent long term habitat loss will have occurred within the new breakwater footprint following the construction phase. The effect on benthic receptors (i.e., habitat loss effects) will be experienced throughout the lifetime of the structure. However, the presence of hard substrate will likely result in an increase in the heterogeneity of the surrounding environment. The presence of hard structures is likely to be colonised by species in the area, therefore having a beneficial effect on benthic ecology. In addition, this potential increase in colonising species may result in an increase in prey species made available for fish and shellfish.

Habitats that are characterised by pioneering species are likely to recolonise the area resulting in high recoverability from IEFs identified within the baseline. No further habitat loss is expected due to placement of materials on the seabed.

Magnitude of Impact

Permanent habitat creation will occur due to the presence of the breakwater structure. The overall footprint of the breakwater is approximately 21,800 m^2, with approximately 149,812 tonnes of rock armour laid. The structure will remain in-situ up to 120 years for the design life.

The long-term habitat creation is predicted to be of highly localised spatial extent, long-term duration, and continuous, and the impact will affect benthic ecology receptors directly. The magnitude of this impact is considered to be medium.

Sensitivity of Receptor

Benthic Ecology

Benthic biotopes that are dependent on sediment, such as those found within the littoral sediment and sublittoral sediment benthic ecology IEFs (Table 8-4) will be affected by long-term subtidal habitat loss during the operational phase. These species will be removed along with the substratum underneath the breakwater structure, therefore all the IEFs are considered highly intolerant of, and vulnerable to, complete habitat loss. Given the small spatial scales of the total long-term habitat loss this loss is not expected to undermine regional ecosystem functions or diminish biodiversity.

Although there is an impact on IEFs, this will not create significant impact on the regional, national and international status of these features. This is because of the highly localised nature of the impact only causing biotope loss in one discrete location.

Furthermore, biotope A5.52, as described within the construction phase, will fundamentally be lost, due to the change in underlying substrate from sediment to rock, but the characterising species of this biotope are able to colonise rock substrate. These species will benefit from the creation of a hard habitat (Stamp *et al.*, 2021; Stamp *et al.*, 2022), resulting in a positive effect on characterising species.

Therefore, Benthic Ecology are deemed to be of low vulnerability, high recoverability and regional to international importance. The sensitivity of the receptor is therefore, considered to be low (positive).

Fish and Shellfish

The presence of the breakwater during the operational phase may result in an increase in heterogenic habitat, refuge areas and act as a fish aggregation area. Mobile fish species are likely to move back into the area following cessation of the construction period. Similarly, mobile shellfish species are likely to use the breakwaters as refuge areas. Overall, the likely effect on fish and shellfish species is positive during the operational phase.

Therefore, Fish and shellfish species are deemed to be of low vulnerability, high recoverability and local to international importance. The sensitivity of the receptor is therefore, considered to be low (positive).

Significance of Effects

Benthic Ecology

Benthic Ecology are deemed to have a low sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor (positive)**, which is not significant in EIA terms.

Fish and Shellfish

Fish and Shellfish are deemed to have a low sensitivity and medium magnitude; therefore, the significance of effect is considered to be **minor (positive)**, which is not significant in EIA terms.

8.7.3.2 Changes in the hydrodynamic regime due to the presence of the breakwater

Hard coastal defence structures, such as a breakwater, are designed to alter/change the hydrodynamic regime of an area. The Breakwater will reduce the intensity of wave action in inshore waters providing a safe area for the ferry to moor up against. This change in hydrodynamic regime may result in benthic ecology receptors being directly affected, by leading to increases or decreases in sediment disposition, currents and/or water flow within the protected area. However, Chapter 13: Coastal Processes has identified that there are no significant changes to the hydrodynamic regime of the area due to the presence of the breakwater.

8.8 Potential Cumulative Effects

This section considers the potential for cumulative effects arising from the Proposed Development alongside other known activities. The cumulative effects assessment uses the outcome of the assessment of effects in Section 8.7 to determine whether cumulative effects are likely and if so whether together they have the potential to increase the effects outlined for each receptor group.

A review of activities which may potentially act cumulatively with the Proposed Development was carried out. The sister breakwater project to be undertaken at Fionnphort, detailed in Chapter 21, is likely to have the potential for cumulative effects. Therefore, this project has been taken forward for assessment. It is important to note that this project is still in its design stage and therefore exact project details are currently unknown.

The above project does not overlap spatially with the Proposed Development however, the two projects may overlap temporally. The main effects that require consideration are those that were identified to have significant effects on benthic receptors. As a result, the key effect to be considered within the assessment is 'Permanent habitat loss arising from the placement of material on the seabed for the breakwater' during the construction phase on benthic receptors. All other effects were found to be not significant and therefore have been scoped out.

8.8.1 Assessment of Construction Effects

8.8.1.1 Permanent habitat loss arising from the placement of material on the seabed for the breakwater

Cumulative effects due to permanent long-term habitat loss will occur directly under the new breakwater structures at Iona and Fionnphort. The effect on benthic receptors (i.e., habitat loss effects) will be experienced throughout the lifetime of the structure.

Magnitude of Impact

At Iona, permanent long-term habitat loss will occur directly under the new breakwater structure. The overall footprint of the breakwater is approximately 10,037 m^2, with approximately 149,812 tonnes of rock armour to be laid. The works will be carried out once but will remain in situ for up to 120 years for the design life and will be non-reversible.

At Fionnphort, permanent long-term habitat loss will occur directly under the new breakwater structure. The overall footprint of the breakwater is approximately 4,200 m^2 (i.e., not including the temporary working area) (this figure is based on the Fionnphort Scoping Report dated July 2021 and therefore may be subject to slight variation). The works will be carried out once but will remain in situ for up to 120 years for the design life and will be non-reversible.

The potentially combined permanent loss of habitat due to the breakwaters would be 7,000 m^2. It is expected that construction for both projects would be over 52 weeks.

The long-term habitat loss/disturbance is predicted to be of localised spatial extent, long-term duration, and continuous, and the impact will affect receptors directly. The magnitude of this impact is considered to be medium.

Sensitivity of Receptor

Benthic Ecology

Benthic ecology receptors were assessed to have a low to high sensitivity and were found to have a major significance. However, it is important to note that the high sensitivity was determined only for the subtidal sediment IEF and specifically for the seagrass receptor. Therefore, only the seagrass receptor has been considered for the potential for cumulative effects.

Therefore, the Sublittoral Sediment IEF has been assessed to have a high sensitivity.

Significance of Effects

Benthic Ecology

Subtidal Sediment IEF is deemed to have a high sensitivity and medium magnitude; therefore, the significance of the effect is considered to be **moderate**, which is significant in EIA terms. Further compensation/mitigation measures have been discussed within Section 8.10.

Overall, the significance of the effect is deemed to be of **moderate** significance due to the potential impact on seagrass beds.

8.9 Inter-Related Effects

This section presents the results of the Likely Significant Effects in respect of the inter-related effects of the Proposed Development during its construction and operational phases.

Benthic Ecology receptors are likely to be affected most by the Proposed Development, only effects that were found to have a minor significance or above were taken forward for consideration. All other receptor groups have been screened out on the basis that there are unlikely to be significant inter-related effects.

For Benthic Ecology, the following effects have been considered within the inter-related assessment:

- Temporary disturbance/loss of habitat arising from capital and maintenance dredging activity;
- Effects of increased suspended sediment concentrations and sediment deposition;
- Temporary disturbance/loss of habitat arising from displacement/compaction of the seabed by anchors and jack-up barge spud legs;
- Permanent habitat loss arising from the placement of material on the seabed for the breakwater; and
- Permanent habitat creation arising from the placement of material on the seabed for the breakwater.

Table 8-16 lists the inter-related effects that are predicted to arise during the construction phase of the Proposed Development and also the inter-related effects that are predicted to arise for benthic ecology receptors.

Table 8-16 Likely Significant Inter-Related Effects on Benthic Ecology from Individual Effects Occurring across the Construction and Operational Phases of the Proposed Development and from Multiple Effects Interacting Across all Phases (Receptor-led Effects)

Description of Impact	Phase		Likely Significant Inter-Related Effects
	Construction	Operation	
Temporary disturbance/loss of habitat arising from capital and maintenance dredging activity	Negligible to Minor Adverse		When habitat disturbance or loss is considered additively across all phases, the total area of habitat affected is unlikely to increase. This is due to maintenance dredging during the operational phase only being undertaken within the original capital dredging area footprint (construction phase). The temporary disturbance/loss will be highly localised to the vicinity of the dredging activity (i.e., limited to the immediate footprint) during each phase. Subtidal Sediments IEF, specifically seagrass habitats are unlikely to recover. This is due to initial habitat loss during construction and repeat disturbance during the operational phase. Therefore, across the project lifetime, the effects on benthic ecology IEFs are anticipated to interact in such a way as to result in combined effects of minor significance in the construction and operational phase (i.e., not of greater significance than the assessments presented for each phase).
Effects of increased suspended sediment concentrations and sediment deposition	Negligible to Minor Adverse		The majority of the seabed disturbance (resulting in the highest suspended sediment concentrations/deposition) will occur during the construction phase, from capital dredging. During the operational phase, the material to be removed by maintenance dredging is likely to be less than that in the capital dredging phase and by extension the length of operation. The interaction across the project life cycle is not predicted to result in an effect of any greater significance than those assessed in the individual project phases.
Temporary disturbance/loss of habitat arising from displacement/compaction of the seabed by anchors and jack-up barge spud leg	Negligible to Minor Adverse	×	This effect will only arise during the construction phase and as such there will be no interaction effects across the project phases.
Permanent habitat loss arising from the placement of material on the seabed for the breakwater	Minor to Moderate Adverse	×	This effect will only arise during the construction phase and as such there will be no interaction effects across the project phases.
Receptor Led Effects			
Potential exists for spatial and temporal interactions between the effects arising from temporary/permanent habitat disturbance/loss of habitat and the effects of increased suspended sediment concentrations and sediment deposition during the lifetime of the Proposed Development. ***Based on current understanding, and expert knowledge, the greatest potential for inter-related impacts is predicted to arise through the interaction of direct (both temporary and permanent) habitat disturbance/loss from capital/maintenance dredging activity/anchor/jack-up barge spud leg placement/ breakwater placement and effects of increased suspended sediment concentrations and sediment deposition on Subtidal Sediments IEFs, specifically seagrass.*** ***These individual impacts were assigned a significance of negligible/minor/moderate adverse as standalone impacts and although potential combined impacts may arise (i.e., spatial and temporal overlap of direct habitat disturbance), it is predicted that this will not be any more significant than the individual impacts in isolation. This is because the combined amount of habitat potentially affected would be very limited (within the Marine Biodiversity Study Area) and the biotopes affected are widespread around the Isle of Iona. As such, these interactions are predicted to be no greater than the individual effects assessed in isolation.***			

8.10 Mitigation Measures

The following sections outline the mitigation measures which will be implemented to reduce the effects on key receptors.

8.10.1 Embedded Mitigation Measures

A number of embedded mitigation measures relevant to marine biodiversity are proposed to be incorporated into the design and construction method to manage the effect on the environment. These are shown in Table 8-17.

Table 8-17 Designed-In Mitigation Measures Adopted.

Measures Adopted	Justification
Construction Environmental Management Plan (CEMP)	Control of pollution during construction will be set out in a CEMP. This will include best practice measures to prevent accidental spillage of chemicals during construction activities.
Environmental Management Plan (EMP)	The EMP will manage the risks of all operational activities, facilities and cargo handled by the port and will include best practice measures to control pollution following standard guidelines such as the Environment Agency Pollution Prevention Guidelines.
Invasive and Non-Native Species (INNS) Management Plan	A document detailing how the risk of potential introduction and spread of INNS should be produced. The plan will outline measures to ensure vessels comply with the International Maritime Organization (IMO) ballast water management guidelines, it will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as measures to be adopted if a high alert species is recorded. Plant, equipment and material (where required), will follow the 'check, clean, dry method'.
Sensitive features present on shipboard navigation systems	The presence of sensitive features onboard the ship's navigation systems will aid the vessel master in placing either anchor or jack-up legs to avoid these sensitive features.

8.10.2 Benthic Ecology

The assessment of Likely Significant Effects has deemed the effect of 'Permanent habitat loss arising from the placement of material on the seabed for the breakwater' on '*Zostera marina/angustifolia'* beds on lower shore or infralittoral clean or muddy sand' (A5.5331) to be moderate, which is significant in EIA terms.

As such, a 'Seagrass Compensation and Monitoring Plan' has been proposed. Direct habitat loss is predicted to occur as a result of the Proposed Development; therefore, to ensure that seagrass habitat is not permanently lost, compensation will be undertaken to ensure that the habitat is restored. An assessment has already been undertaken in the form of the intertidal and subtidal survey, with the extent of biotopes derived. This data will be used to inform the 'Seagrass Compensation and Monitoring Plan'.

This approach will be agreed upon with Marine Scotland, its advisors, and in consultation with seagrass restoration projects, with reference to documents such as Seagrass restoration in Scotland - handbook and guidance (Kent *et al*., 2021) and Seagrass Restoration Handbook (Gamble *et al.*, 2021).

Cumulative Effects Mitigation

As there is likely to be a significant effect on seagrass, an agreement will be sought between the Iona Proposed Development and the Fionnphort project on the compensation/ mitigation strategy for the seagrass.

8.11 Conclusion and Summary of Effects

The Proposed Development was assessed with respect to effects on marine environment receptors. Potential effects identified from the construction and operational phases were identified, these were temporary and permanent habitat loss, increases in suspended sediments, underwater noise emissions, presence of the breakwater structure, and permanent habitat creation.

The assessment found that almost all effects were of either negligible or minor significance, which is not significant in EIA terms. However, for the benthic habitat '*Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand A5.5331', the assessment determined that 'Permanent habitat loss arising from the placement of material on the seabed for the breakwater' was deemed of moderate significant effect.

To address the moderate significant effect of the temporary and permanent habitat loss, a 'Seagrass Compensation and Monitoring Plan' has been proposed to reduce the impact of the Proposed Development on seagrass receptors.

A summary of the likely environmental effects is provided in Table 8-18.

Table 8-18 Summary of Likely Environmental Effects on Marine Environment

Description Of Effects	Magnitude Of Effects	Receptor	Sensitivity Of Receptor	Significance Of Effect	Significant /Not Significant	Residual Effects
Construction and Operational Effects						
Temporary disturbance/loss of habitat arising from capital and maintenance dredging activity	Low	Benthic Ecology	Low/High	Negligible/Minor	Not Significant	N/A
		Fish and Shellfish	Low	Negligible	Not Significant	N/A
Effects of increased suspended sediment concentrations and sediment deposition	Low	Benthic Ecology	Low/Medium	Negligible/Minor	Not Significant	N/A
		Fish and Shellfish	Negligible/Low	Negligible	Not Significant	N/A
Potential for resuspension of contaminated sediments	Scoped out of an assessment on the basis that seabed sediment analysis indicated that there are no chemical determinands that exceed the CEFAS Action Levels 1 or 2, and Canadian Threshold Effect Levels (TEL) or Probable Effect Levels (PEL), see Volume III, Appendix 8.1.					
Construction Effects						
Temporary disturbance/loss of habitat arising from displacement/compaction of the seabed by anchors and jack-up barge spud legs	Low	Benthic Ecology	Negligible/Medium	Negligible/Minor	Not Significant	N/A
		Fish and Shellfish	Low	Negligible	Not Significant	N/A
Permanent habitat loss arising from the placement of material on the seabed for the breakwater	Medium	Benthic Ecology	Benthic Receptors – Low Seagrass –High	Benthic Receptors – Minor Seagrass – Moderate	Benthic Receptors – Not Significant Seagrass – **Significant**	See Section 8.10.2
		Fish and Shellfish	Low	Minor	Not Significant	N/A
Effects of underwater noise arising from construction activities	Low	Fish and Shellfish	Low	Negligible	Not Significant	N/A
		Marine Mammals	Low	Negligible	Not Significant	N/A
Disturbance and collision risk to marine mammals from increased vessel traffic during construction	Effect was scoped out on the basis that there will be no significant increase in vessel traffic beyond the operational ferry crossings.					
Operational Phase						
	Medium	Benthic Ecology	Low	Minor (positive)	Not Significant	N/A

Description Of Effects	Magnitude Of Effects	Receptor	Sensitivity Of Receptor	Significance Of Effect	Significant /Not Significant	Residual Effects
Permanent habitat creation arising from the placement of material on the seabed for the breakwater		Fish and Shellfish	Low	Minor (positive)	Not Significant	N/A
Change in the hydrodynamic regime due to the presence of the breakwater	Effect was scoped out on the basis that there will be no significant changes to the hydrodynamic regime due to the presence of the breakwater, as assessed by Chapter 13: Coastal Processes.					

In addition to the above, a HRA has been undertaken to determine the potential for the Proposed Development to have a LSE on designated sites in the UK national network of sites (‘European sites’). The potential for LSE could not be excluded at the screening stage for three European sites (Inner Hebrides and Minches SAC; Treshnish Isles SAC; and Eileanan agus Sgeiran Lios mor SAC.), without further evaluation, or the application of mitigation measures intended to reduce effects of the Proposed Development on the European sites concerned.

A subsequent assessment to inform a Stage 2 Appropriate Assessment of the implications of the Proposed Development on European sites allowed the introduction of measures intended to avoid or reduce the potential adverse effects of the Proposed Development on European sites. These measures ensure that the Proposed Development will not undermine the conservation objectives of the sites concerned, and as such will not adversely affect the integrity of any European site.

9 ORNITHOLOGY

9.1 Introduction

This chapter considers the likely significant effects on ornithological receptors associated with the construction, operation and decommissioning of the Proposed Development. The effects associated with the construction phase of the Proposed Development on ornithological receptors can be considered representative of reasonable worst-case decommissioning effects, therefore a separate assessment of the decommissioning phase has not been undertaken as part of this assessment.

The specific objectives of the chapter are to:

- Describe the ornithological baseline;
- Describe the assessment methodology and significance criteria used in completing the impact assessment;
- Describe the potential effects, including direct, indirect and cumulative effects;
- Describe the mitigation measures proposed to address likely significant effects; and
- Assess the residual effects remaining following the implementation of mitigation.

The assessment has been carried out by Ecologists with relevant accreditations (MCIEEM) of RPS. The assessment of ornithological effects follows the guidance produced by CIEEM (2018). This sets out the process for assessment as a series of stages;

- Describing the ornithological baseline in the Zone of Influence (ZoI) through survey and desk study;
- Identifying Important Ornithological Features (IOFs): these are the species of the highest ecological importance present in the ZoI;
- Determining the nature conservation importance of the IOFs present within the ZoI;
- Identifying and characterising the potential impacts on these IOFs, based on the nature of the construction, operation and decommissioning activities associated with the Proposed Development;
- Determining the magnitude of the impacts including consideration of the sensitivity of the ornithological feature and the duration and reversibility of the effect;
- Determining the significance of the impacts based on the interaction between the effect magnitude/duration, the likelihood of the effect occurring and the nature conservation value of the IOF;
- Identifying embedded mitigation that will counteract or avoid adverse impacts;
- Determining the residual impact significance after the effects of mitigation have been considered, including a description of any legal and policy consequences;

- Determining potential cumulative effects; and
- Identification of any monitoring requirements.

This chapter is supported by the following figures and technical appendices (see Volume III: EIAR Appendices):

- Figure 9-1: Nature Conservation Designated Sites in Proximity to the Application Site;
- Figure 9-2: Intertidal and Near Shore Survey Areas; and
- Appendix 9.1: Ornithology.

9.2 Assessment Methodology

9.2.1 Scope of Assessment

This report details the results of the near shore coastal surveys undertaken to inform the assessment of the Proposed Development, which is described in Chapter 3: Project Description.

The surveys were designed to assess the presence and use by protected and notable bird species of the intertidal and near shore coastal habitats within the Iona Breakwater development zone. The surveys focussed particularly on the qualifying species of coastal/marine designated sites of nature conservation interest associated with the Sound of Iona and wider area within the Seas of the Hebrides (shown in Figure 9-1 and Figure 9-2).

Given the coastal location of the Proposed Development, consideration was given to screening protected areas within foraging ranges of seabirds, using seabird ranging distances from Woodward *et al.,* (2019). Given that the Proposed Development is so small as a proportion of these foraging ranges, has such a small ZoI (including habitat footprint), and impacts being largely temporary (during construction), and there being so few individuals recorded within the survey area, the screening process completed concluded that the more distant sites designated for their ornithological features (Special Protection Areas (SPAs)) could be excluded from the assessment. Although within the Woodward *et al.,* (2019) foraging ranges of certain species (e.g., kittiwake and gannet) from these SPAs, the risk of any likely significant effects from the Proposed Development to these birds were concluded to be *de minimus* and therefore have not been considered further. SPAs within 30 km were given further consideration however, as a precaution (see Figure 9-1).

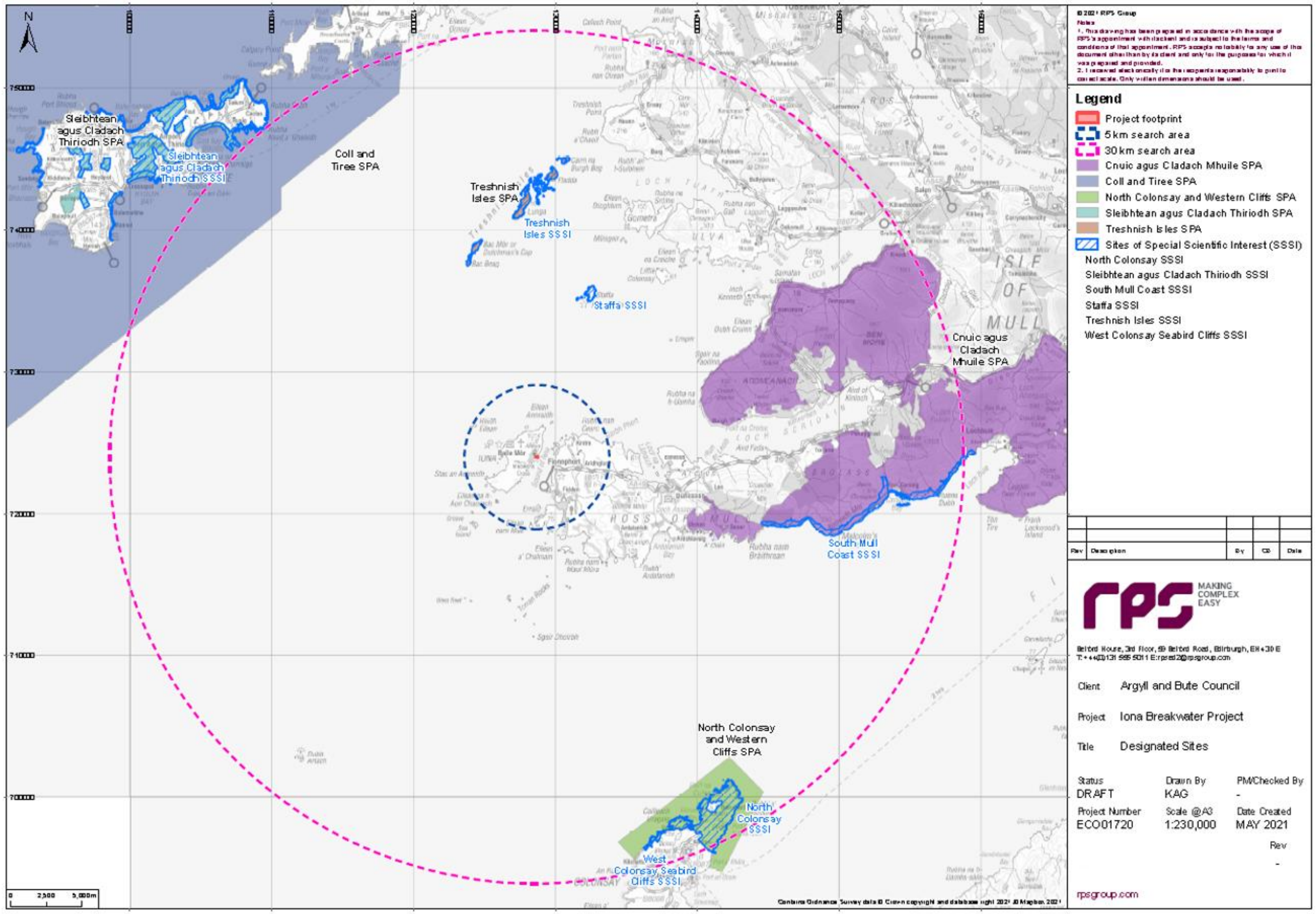


Figure 9-1 Location of sites of nature conservation interest in proximity to the Proposed Development

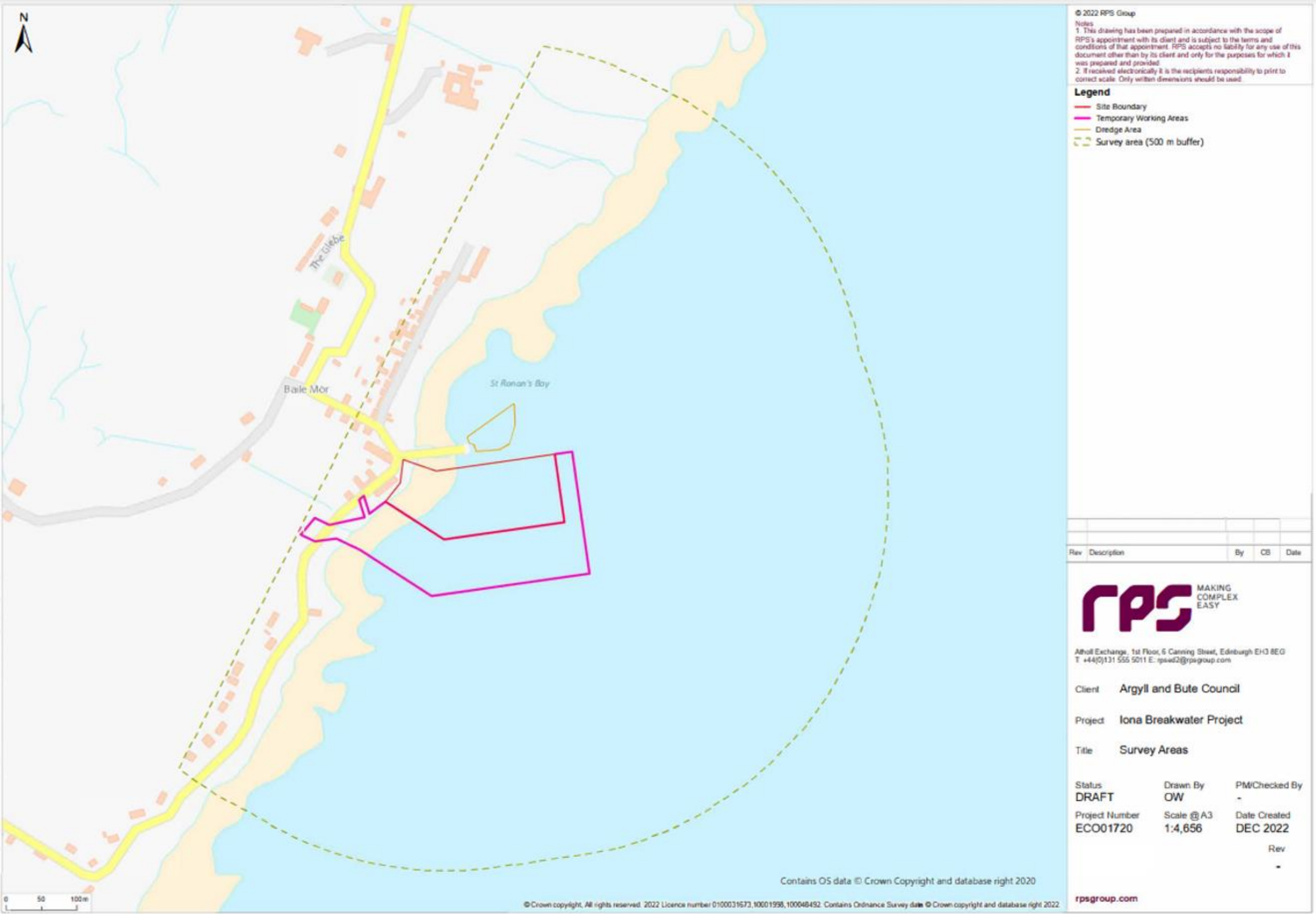


Figure 9-2 Survey Areas

The scope of the assessment has been informed by the guidelines/policies outlined below and the consultation responses summarised in Table 9-1:

- Environmental Impact Assessment Directive 2014/52/EU (the EIA Directive);
- Directive 2009/147/EC on the Conservation of Wild Birds (the Birds Directive);
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive);
- The Conservation (Natural Habitats &c.) Amendment (Scotland) Regulations 2012, relating to reserved matters in Scotland;
- Wildlife and Countryside Act 1981 (as amended);
- The Nature Conservation Act (Scotland) Act 2004;
- The Wildlife and Natural Environment (Scotland) Act (2011);
- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, which transpose the EIA Directive into the Scottish planning system;
- Planning Circular 1/2017 – Environmental Impact Assessment regulations (Scottish Government 2017);
- PAN 51: Planning Environmental Protection and Regulation (revised 2006);
- PAN 60: Planning for Natural Heritage (Scottish Government 2000);
- Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000);
- Scottish Planning Policy (SPP);
- The State of the UK's Birds 2020;
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018);
- Bird Monitoring Methods; and
- Birds of Conservation Concern (BoCC) 5: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man.

9.2.1.1 Consultation

Table 9-1 summarises the consultation responses and provides information on where and/or how they have been addressed in this assessment.

Information on the Scoping and Consultation processes can be found in Chapter 5.

Table 9-1 Consultation Responses

Consultee and Date	Consultation	Issue Raised	Response / Action Taken	Where issue is addressed in EIA Report
NatureScot	Ornithology survey scope	No response	N/A	N/A

The findings of these surveys have been used to inform the EIA for the Proposed Development.

This chapter also considers the potential for likely significant effects on the qualifying species of the SPAs and the additional bird species assessed to be a sensitive IOF of international, national or regional importance.

9.2.1.2 Potential Effects Scoped Out

The scope of this assessment takes account of the committed mitigation measures both incorporated into the design and those standard construction and decommissioning mitigation measures incorporated into the Proposed Development, as described in Chapter 3: Project Description. No other issues have been scoped out of the assessment.

9.2.2 Assessment Methodology and Significance Criteria

9.2.2.1 Method of Baseline Characterisation

Extent of the Study Area

The study area for the purpose of the assessment comprises a set of buffers from the Proposed Development site that are of varying distance, depending on the nature of the potential receptor. These include:

- International designated sites within 30 km of the site boundary designated for ornithological features (e.g., SPAs/ Ramsar sites);
- Sites designated for all other ornithological features with 5 km, where there may exist ecological connectivity between the Site and qualifying bird populations (e.g., Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR) and Sites of Importance for Nature Conservation (SINCs);
- Records of notable and protected species within 2 km; and
- Monthly Through the Tide Counts (TTTC) for intertidal and nearshore birds within 500 m.

These study areas are presented in Figure 9-2.

Desk Study

A request was made to the Argyll and Bute Local Records Centre for all records of Notable and Protected Species within 2 km of the site within the last 10 years.

The desk study also sought to collate relevant information on all sites with designated ornithological features including Ramsar sites, SPAs, SSSIs and SINCs where there may be existing ecological connectivity between the Proposed Development and qualifying bird populations. This included a review of international sites with qualifying mobile species whose range (e.g., foraging, migratory, overwintering, breeding or natural habitat range) overlapped with the Proposed Development. For example, during the breeding season, the mean-maximum foraging range of gannet is 315.2 km (Woodward *et al.,* 2019) therefore there is potential for gannets observed within the Proposed Development to originate from SPA colonies located within that distance. However, it should be noted that most seabirds feed mostly offshore, with the exception of <Red which may feed close inshore.

A search for relevant designated sites was made using online sources, allowing the identification of all designated sites with qualifying ornithological interests. The search radius of 30 km for internationally designated sites is consistent with published connectivity distances, across which any bird populations may have interaction with the Site. The online sources used to obtain this information were:

- NatureScot Sitelink[17];
- Joint Nature Conservation Committee (JNCC) website[18];
- Argyll and Bute Council open data website[19]; and
- Defra MAGIC website[20].

In addition, information from both confidential and public domain survey data, scientific publications, grey literature (i.e., information not produced or controlled by commercial publishers, e.g., policy documents, web content, conference proceedings, etc.) and ES/EIA/Consultations for nearby developments was searched to build understanding of ornithological interests in and around the Proposed Development.

The British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) website was also consulted to identify if count data was held for the site and immediate environs. No relevant data was held pertaining to the Proposed Development.

Field Survey

The intertidal and nearshore surveys comprised a programme of monthly surveys carried out over a period of five months between April and August 2021 inclusive.

The survey area comprised a 500 m buffer area around the Proposed Development area in the intertidal and nearshore habitats. During each survey the number of birds present along the foreshore and near

[17] https://sitelink.nature.scot/home

[18] https://jncc.gov.uk/our-work/list-of-spas/

[19] https://data-argyll-bute.opendata.arcgis.com/datasets/open-data-local-nature-conservation-site

[20] https://magic.defra.gov.uk/

shore coastal waters was counted. Observations of bird species (including the numbers of each species in a given location and behaviour – see below) were plotted onto a field map using standard BTO species codes and notation.

Surveys were scheduled to cover a range of different tidal conditions (high, low and mid-tide; spring and neap tides) throughout the survey programme. Survey methods were based on the high tide (core count) methodology of the BTO/ JNCC/ Royal Society for the Protection of Birds (RSPB)/ Wildfowl and Wetlands Trust (WWT) Wetland Bird Survey (WeBS) scheme (Musgrove *et al.* 2003 and Holt *et al.* 2011). This involved the surveyor counting birds from vantage points along the coast using binoculars and a telescope. In addition to the location and number of birds, notes were also made as to whether they were foraging, roosting or loafing. Flying birds were also recorded, although for the purposes of this report only those birds which were obviously using the habitats of the survey area (e.g., <Re or gannets, as opposed to birds simply flying over/through the sectors), have been included here.

Field records were transferred to a Geographic Information System (GIS). This produced accurate information on the distribution of birds within the study area and enabled maps to be produced so that areas of ornithological importance could be identified.

Weather conditions including wind speed (using the Beaufort Scale), cloud cover (estimated as eighths or octas of the sky), visibility and temperature were also recorded as well as sources of disturbance to birds encountered during surveys. Details of the intertidal and near shore coastal bird survey effort is presented in Table 7-1 of the Technical Appendix 7.1: Ornithology.

9.2.2.2 Assessment Criteria and Assignment of Significance

The method of assessment for this Chapter follows that of CIEEM (2018) guidance. The term IOFs is used for those species and habitats identified in the assessment. For each impact with the potential to affect the relevant IOFs, the assessment considers the following parameters:

- Whether the impact is positive or negative in its influence;
- The extent of the impact;
- The magnitude, duration and timing of the impact; and,
- The impact's frequency and ease of reversibility.

The assessment similarly includes consideration of any proposed mitigation to avoid or minimise the effect of any potential impact to the relevant IOFs and identifies any potential cumulative impacts from surrounding developments prior to determining the residual significance of any effect, be this negligible, minor, moderate or major. Effects can be either adverse or beneficial.

Criteria for Assessing the Sensitivity of Receptors

The identification of IOFs and assessment of their level of importance is guided by a range of criteria, as defined in Table 9-2. These criteria are a guide and not definitive; ecologists should apply judgment based on knowledge of the region and populations involved.

Table 9-2 Approach to Valuing Ecological Receptors

Level of importance	Example of IOF
International	Species listed as qualifying feature of an internationally designated site (SPA/Ramsar Site, including candidate sites). Birds listed as Annex I/Schedule I. This includes birds outside of protected areas, particularly when clear connectivity with internationally designated populations or where population at levels with sufficient conservation importance to meet criteria for SPA selection.
National*	A species listed as a qualifying feature of a nationally designated site (e.g., SSSI).
Regional*	Species that are subject to conservation action plans e.g., Scottish Biodiversity List (SBL)/UKBAP/LBAP. Birds that form part of the cited interests of a LNR, or some local–level site designation.
District*	Bird species where a significant proportion (greater than 1%) of the sub-region/district population uses the Site.
Local*	A species or habitat that is of nature conservation value in a local context only, with insufficient value to merit a formal designation (e.g., Red and Amber-listed BoCC species).
Negligible	Common and widespread species of little or no conservation importance (Green-listed BoCC species).
*“National” refers to the whole of the UK; “Regional” refers to Scotland, “District” refers to Argyll and Bute and “Local” refers to the Project site and immediate environs	

For the purposes of this assessment, the important populations described in Table 9-2 are graded as High, Medium and Low sensitivity as follows:

- High: Site population is of International / National importance;
- Medium: Site population is Regional / District importance;
- Low: Site population is Local / Negligible importance.

Whilst it is important to assess the importance or value of the species found during baseline surveys, the most critical consideration with regards to the EIA is the importance of the Proposed Development for these species at a population level. This is because the EIA process requires an assessment of impacts on the populations using the site of the Proposed Development.

Therefore, in the following assessment, each IOF present at the Proposed Development site is assigned a level of importance from International to Negligible. The Site level of importance is a function of the species value in combination with the size of the population that occupy or are reliant on, the Site. For example, if an internationally important species has been recorded at a site only once, or only over-flying the survey area, then the Site level of importance would be considered negligible.

Criteria for Assessing the Magnitude of Change

The magnitude of change is described in the EIAR as a quantitative value as far as is practicable. For example, magnitude of change can be quantified as a percentage decline of a population or as area of habitat from which birds will be displaced.

The magnitude of change resulting from a given development will differ between species and populations, and therefore assessing the magnitude requires consideration of a species’ behavioural sensitivity, population size and condition (among other considerations, notably (relevant to this site), the degree or habituation to pre-existing background levels of human activity – walkers, dog walkers, fishing vessel, ferries and recreational craft). Examples include different species' responses to disturbance, and the greater vulnerability of small, declining and isolated populations to the impacts of additional pressures.

In addition, the magnitude of an impact is influenced by the duration of the impact, irreversibility and cumulative effects of other impacts. With regard to the duration of an impact, it can be defined as permanent (beyond 25 years duration), long-term (15-25 years), medium-term (5-15 years) or short-term (up to 5 years). Again, knowledge of the populations' ability to recover from impacts is required to assess the duration of the effect. For example, mortality events for species with relatively small population sizes and low reproductive output (such as raptors) will take considerably longer than abundant and widespread species that have high output and will fill vacant territories and replace numbers rapidly (e.g., small passerines such as skylark and meadow pipit).

Consideration of the above factors allows quantification as to the magnitude of effect. Table 9-3 presents magnitude at four levels, from major to negligible and this is the scale by which effect or change is quantified in this chapter. Note that the magnitude of effect is sometimes referred to as magnitude of change, as the level of effect can be quantified in terms of change in population, range etc. Note that some of the lower magnitudes of effect can typically also be applied to beneficial (positive) impacts.

Table 9-3 Defining the Magnitude of Effect on Important Ornithological Features

Magnitude	Typical Descriptors of Effect
Major	Would cause the loss of a major proportion or whole feature/population, or cause sufficient damage to a feature so as to immediately compromise long-term viability. Irreversible. For example, more than 20% decline in population an area is able to support in the long-term.
Moderate	Effects that are detectable in short and longer-term, but which should not alter the long-term viability of the feature/population, for example 10-20% decline in population an area is able to support.
Minor	Minor effects, ether sufficiently small-scale or short-duration, which cause no long-term decline in feature/population, for example less than 10% decline in population an area is able to support.
Negligible	A potential impact that is not expected to affect the feature/population in any meaningful way, with no detectable decline in population/distribution. Any change from baseline conditions predicted at <1%.

Criteria for Assessing Cumulative Effects

Cumulative Impact Assessment (CIA) requires the availability of EIA Report chapters and appraisals for adjacent developments which have concluded effects on the same IOFs that this chapter has identified to be subject to effects from the Proposed Development. This includes a consideration of other developments that are operational, consented, or for which a valid application has been submitted.

Varying degrees of access to these appraisals, and their differing degrees of detail, divergent survey design and effort, and changes in guidance over time can all be obstacles to achieving a completely systematic cumulative impact assessment. Furthermore, some schemes may have been in operation for many years, in which case contemporary data would not be available.

These considerations aside, for cumulative impacts on avian receptors, NatureScot guidance was followed.

Criteria for Assessing Significance

Having followed the process of assessing the importance of IOF populations and quantifying the magnitude of impact (through consideration of the sensitivity of the population and duration of effect), the final stage of the EIA process is to establish the significance of the effect.

CIEEM (2018) guidance requires a determination of whether an effect is significant or not significant. Significance of an effect is determined by a combination of the magnitude of the impact and the importance of the population/ feature.

This chapter uses the definition of a significant effect, as defined by the EIA Regulations, as *an effect that threatens the integrity of a designated ecological feature of international importance*, such as the viability of SPA populations.

CIEEM discourages the use of matrices for determination of significant effects, advising that professional judgement is to be used. However, a matrix for determining significant effects is often requested by stakeholders, and it is often useful in illustrating the process behind determination of significance.

Table 9-4 shows the matrix used here for determination of significance. This is a generic matrix (for all EIA considerations) and notes have been added to illustrate the considerations for birds.

Table 9-4 Matrix for Determination of Significant Impacts

		Magnitude of change			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity	**High**	Major	Major/ Moderate	Moderate	Moderate/Minor
	Medium	Major/ Moderate	Moderate	Moderate/ Minor	Minor
	Low	Moderate	Moderate/ Minor	Minor	Minor/ Negligible

Sensitivity: Conservation importance of IOF
High: Site population is of **International / National importance**
Medium: Site population is **Regional / District importance**
Low: local: Site population is **Local / Negligible importance**
Magnitude of change: Size of effect on population/feature. Assessed with consideration of sensitivity of species/feature to impact, duration of effect and ability of species/feature to recover (among other factors)
***Potentially* significant impacts are in dark shading**

Limitations and Assumptions

The desk study data is third party controlled data, purchased for the purpose of this report only. RPS cannot vouch for its accuracy and cannot be held liable for any error(s) in these data.

The assessment of likely significant effects is based, as much as possible, on published scientific research and the most current known population data. When empirical data is lacking or insufficient, the judgement of experienced ecologists with detailed knowledge of animal behaviour and ecology is required. Any assumptions made during this assessment are clearly stated. With regard to uncertainty in the magnitude of adverse effects, the precautionary principle is applied; i.e., lack of full scientific certainty should not be used as a reason for postponing or failing to take measures to mitigate these adverse effects.

9.3 Baseline Scenario

9.3.1 Current Baseline

9.3.1.1 Desk Study

Designated Sites

The desk study identified the following three international sites with seabirds or migratory waterbirds as qualifying interest features within 30 km of the Proposed Development (Figure 9-1 and 9-2). These sites are:

- Treshnish Isles SPA;
- Coll and Tiree SPA; and
- North Colonsay and Western Cliffs SPA.

A fourth SPA, Cnuic agus Cladach Mhuile, was located within the 30 km search radius, to the east of the Proposed Development. Cnuic agus Cladach Mhuile SPA is a large, predominantly upland site on the island of Mull in the Inner Hebrides, designated for its breeding population of <Redacted>

No other statutory designated sites (e.g., SSSIs) were located within a 5 km search radius of the Proposed Development.

Further details of each of these SPAs can be found in the Technical Appendix 9.1: Ornithology.

The SPA qualifying species that were either recorded using the Site during baseline surveys or were reported from the Site in desk study sources are described in Section 9.4 of the Technical Appendix 9.1: Ornithology.

9.3.1.2 Field Surveys

Bird Survey Results

A total of 16 bird species were recorded during the surveys undertaken between April and August 2021, of which two were qualifying species for SPAs within 30 km: black-legged kittiwake and great northern diver. The most commonly observed species recorded was greylag goose (peak count 130 individuals in July 2021) and shag (peak count 114 individuals in August 2021). Other species were generally observed in numbers between 1 and 20 individuals.

Black-legged kittiwake (one individual) was recorded on only one occasion in August, along the intertidal foreshore.

Great northern diver was recorded on just two occasions and were represented by no more than two individuals (recorded in April).

All other species recorded in the survey area were typically coastal birds which included gulls, other seabirds (e.g., shags, cormorant and Manx shearwater) and waterfowl (e.g., Canada and greylag geese).

All of these species recorded are common and widespread and regularly occur in the coastal waters of west Scotland either throughout the year, or during the breeding or non-breeding season. All species were recorded in very low or low numbers compared to their national breeding and wintering populations, revealing the site to be of local importance for these species.

Further details of the results of the field surveys undertaken is included in the Technical Appendix 9.1: Ornithology.

9.3.1.3 Identification of Important Ornithological Features

The IOFs included within the assessment are those species recorded during the surveys that could be potentially affected by the Proposed Development. Species that were recorded in very small numbers or very infrequently during the baseline surveys are excluded because the risk of a significant effect on their populations is negligible.

The importance of ecological features is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (CIEEM, 2018). IOFs have been identified based on biodiversity importance, recognised through international or national legislation, or through local, regional or national conservation plans, and on assessment of value according to the functional role of the species. This includes:

- Species listed on Annex 1 of the Birds Directive;
- Species populations which are of international importance in Scotland; and
- Populations occurring within the Proposed Development area which are considered to be of regional, national or international importance.

Geographical thresholds were defined as follows:

- International importance: a peak population estimate within the survey area which exceeds 1% of the international population estimate;
- National importance: a peak population estimate within the survey area which exceeds 1% of the national population estimate; and
- Regional importance: a peak population estimate within the survey area which exceeds 1% of the regional population estimate.

Of the potential receptors which could be impacted, a number were discounted:

- Designated sites (within 30 km) – the closest international site to the Proposed Development is Treshnish Isles SPA, 14.3 km to the north of the site. SPAs will not directly be impacted by the Proposed Development. Due to the distance from site, there are not anticipated to be any indirect impacts relating to noise disturbance. It is therefore considered that activities at the Proposed

Development (including construction) will not impact any SPA located within the 30 km search area (or beyond);

- Designated sites with qualifying features/interests within mean-maximum foraging range – the Proposed Development lies within the mean-maximum foraging range of a number of qualifying features/interests of SPAs outwith the 30 km search radius, for example gannet (mean-maximum foraging range of 315.2 km) which is a qualifying feature of Ailsa Craig SPA and St Kilda SPA, located 174 km and 234 km from the Proposed Development respectively. Given the very low number of individual birds recorded during the survey and the nature of the Proposed Development (i.e., the works are of a small-scale and local spatial extent), the impact on qualifying features of these SPAs is considered *de minimis* and therefore not considered further in this assessment; and
- Seabirds – with the exception of gull species, seabirds are obligate marine foragers and therefore the Proposed Development is unlikely to affect foraging opportunities. Shag and cormorant are the only species likely to consistently forage in the near shore zone, the remaining species are highly pelagic foragers. The near shore area of disturbance is small in size and distant from colonies and seabirds have a great deal of flexibility in their foraging behaviour.

Therefore, it is expected that adverse effects on seabirds would be negligible, and they are scoped out of further consideration in this assessment.

Further details of species scoped out of the assessment are provided in the results sections of the Technical Appendix 9.1: Ornithology.

The following IOFs have therefore been identified for the main Proposed Development site and are considered further in the assessment: greylag goose, oystercatcher and shag.

9.3.2 Future Baseline

The Overview Report for Climate Change Projections and factsheets (MOHC, 2018) indicate that in general, warmer, wetter winters and hotter, drier summers are predicted, though of course still with natural variations in that pattern from year to year. No clear trend in wind speeds or storms is predicted, though the data currently published cannot make projections for local conditions and wind gusts. Sea levels are predicted to rise overall with increases in extreme coastal water levels.

In the short term, between the time of survey and the start of construction, there are no predicted changes to the baseline scenario. In the longer term, in the absence of development it is likely that the same intertidal habitats will be present in the survey area but in different proportions due to increased fluctuations in sea level and a gradual increase in coastal water levels. This could lead to a loss of intertidal habitats and modification of subtidal zone habitats which wintering, migratory and breeding wildfowl and waders rely upon.

9.3.3 Summary of Sensitive Receptors

Table 9-5 summarises the IOF's to be included in the assessment and their sensitivity.

Table 9-5 Summary of Receptor Sensitivity

Receptor	Sensitivity	Justification
Greylag goose	Low	BoCC Amber species, recorded in moderate abundance within the site boundary.
Oystercatcher	Medium	BoCC Amber species, recorded in moderate abundance within the site boundary during both low and high tide states.
Shag	Medium	BoCC Red species, recorded in high abundance within the site boundary.

9.4 Description of Likely Significant Effects

During construction, all works will be undertaken offshore using barges to ship in materials and undertake the construction works. Welfare facilities will be located on the barge, however there will likely be a small compound established within the Temporary Work Area (Figure 9-2). Full details of the construction methods to be employed are outlined in Chapter 3, Section 3.2.

9.4.1 Potential Effects

The following potentially significant impacts have been identified for the works associated with the construction phase of the Proposed Development:

- Temporary disturbance/loss of habitat arising from activities within the terrestrial area of the Temporary Work Area (namely the establishment of a work compound and storage of rock);
- Temporary disturbance/loss of habitat due to airborne noise and visual disturbance from construction activities;
- Permanent loss of habitat arising from reclamation of seabed during the construction of a new rock armour breakwater to the south of the existing slipway; and
- Temporary effects on prey species due to underwater noise arising from construction activities (notably dredging and vessel noise), increased suspended sediment concentrations and sediment deposition.

The following potential impacts have been identified during the operational phase of the Proposed Development:

- Long-term increase in disturbance to habitat arising from increased levels of marine activity due to improved ferry services;
- Long-term increase in disturbance of habitat due to airborne noise and visual disturbance associated with the increase in terrestrial activity; and
- Long-term effects on prey species due to noise arising from vessels and potential for pollution events linked with potential increased levels of marine activity.

9.4.2 Assessment of Construction Effects

The predicted effects on the assessed IOFs at the site comprise disturbance of short duration during construction. Other effects of habitat loss and/or population decline (of wintering populations) are considered to be absent or negligible. Such effects are considered highly improbable as:

- There would be limited impacts on the extent or condition of intertidal habitat during construction or operation. Therefore, effects by loss of intertidal foraging and roosting habitat for waders will be negligible; and
- There are no bird populations for which sites are designated within 30 km of the Proposed Development where effects on survival are considered likely (either direct impacts on breeding site or indirect effects on foraging adults).

Therefore, discussion and assessment of potential effects on IOFs is focussed on the effects of disturbance during construction.

The potential responses to disturbance by estuarine birds include the following behaviours:

- Redistribution of birds (either short-term or complete avoidance/abandonment);
- Reduced food intake; either due to reduced foraging time or by displacement from high quality foraging sites;
- Increased energy expenditure due to energetic cost of being flushed from roost /feeding sites and, where occurring, redistribution to new locations;
- Physiological cost from increased stress; and
- Direct mortality.

The response of roosting (and feeding) waders to disturbance at the Proposed Development site is difficult to predict, as studies have revealed that this is affected by the species involved, type of disturbance, degree of habituation, availability of alternative roost/feeding locations, and other factors such as the individual bird’s condition and need for feeding or resting.

Kirby *et al.* (1993) studied disturbance effects on waders roosting at the Dee Estuary, including oystercatcher. Roosting oystercatcher exhibited a ‘medium’ response to disturbance (redistributing to alternative roosts outside the study area but within the estuary).

Several studies show that the behavioural response to disturbance is mediated significantly by habituation to the source of disturbance. For example, Urfi *et al.* (1996) found that oystercatcher ‘escape distance’ (i.e., the distance at which birds take flight on approach of people) reduced when people are present more frequently, which is likely to be true at this location given the existing ferry services and regular anthropogenic disturbance. However, habituation to one source of regular disturbance would not necessarily lead to greater tolerance of novel disturbance, such as construction activity.

Studies at major construction sites within estuaries has been demonstrated to lead to reduced densities of waders and wildfowl at Cardiff Bay (Burton *et al.*, 2002). Noise is often a significant source of construction-related disturbance, particularly where activities such as piling are undertaken. Kusters *et al.* (1998) found that the strength of reaction to noise and other disturbance was greater when large numbers of birds are closely aggregated (such as roosting birds).

Pollution events could result in a slight reduction of prey availability and injury/fatality to species present using the site. However, the magnitude of change in relation to injuries or fatalities is considered to be minor.

The impact of disturbance caused by construction activities is predicted to be of local spatial extent, short-term duration, and reversible. Given that there is suitable alternative roost and foraging locations within a short distance of the location of proposed construction activity, the overall magnitude of change for all species is assessed as minor or negligible.

When considering the conservation value and low sensitivity at the site level, the overall assessment is deemed to be minor or negligible adverse. In terms of the EIA Regulations this is deemed a non-significant effect.

The impact matrix for the IOFs assessed is presented in Table 9-6 below.

Table 9-6 Impact assessment for construction effects on IOFs

Receptor	Effect	Sensitivity to effect	Receptor sensitivity	Magnitude of change	Impact	Significance of impact
Greylag goose	Disturbance at foraging and roosting locations; short duration	Low	Low	Low/negligible	Minor/Negligible	Not significant
Oystercatcher	Disturbance at foraging and roosting locations; short duration	Medium	Low	Low/negligible	Minor/Negligible	Not significant
Shag	Disturbance at foraging locations; short duration	Medium	Low	Low/negligible	Minor/Negligible	Not significant

9.4.3 Assessment of Operational Effects

During the operational phase there is the potential for disturbance to breeding and wintering birds through human presence on the site and from an increase in marine activity due to the improved ferry services. It is likely that birds using the site will be tolerant to disturbance from the existing ferry services and therefore no additional impacts above those assessed for the construction stage are considered likely. This is also considered the case for prey species.

Due to the low likelihood of this work disturbing protected species these potential impacts are assessed as being of low magnitude and their effects as of negligible significance. In terms of the EIA Regulations this is deemed a non-significant effect.

9.5 Mitigation Measures

9.5.1 Mitigation During Construction

The only effect predicted to have a minor impact is disturbance during construction. The greatest magnitude of change is anticipated for waders and waterfowl foraging in near shore waters and for roosting aggregations of those individuals at high tide. Therefore, the following mitigation describes methods that will reduce disturbance for these IOFs, which are additional to standard practice construction environmental management, as outlined in the Construction Environmental Management Plan (CEMP).

The most highly sensitive IOFs are non-breeding populations and therefore measures to reduce disturbance around the nearshore area shall be undertaken as far as is practical during the period between September and April.

Noise from construction activities has been identified as a significant source of disturbance for roosting (and breeding) birds. Methods to attenuate noise will be utilised, notably the use of sound walls and any modification of drilling rigs that would reduce noise levels. Works undertaken in the vicinity of roosting birds or near occupied nests of sensitive species will be supervised by a suitably qualified and experienced Ecological Clerk of Works (ECoW) to determine if additional measures may be required. It is assumed here that no significant noise-creating activities will be undertaken in the marine environment (drilling, piling etc).

Near-shore vessel-based activities should aim to reduce disturbance to foraging seabirds and waterfowl, particularly if works coincide with the winter period when <Red , <Reda and sea duck may be present.

9.5.2 Mitigation During Operation

No further mitigation is anticipated to be required for the operational phase of the Proposed Development. Documentation should be reviewed and updated throughout the construction phase if further effects or mitigation are identified.

9.6 Potential Cumulative Effects

The above sections have considered the implications of the Proposed Development on IOFs in isolation from the potential effects of other plans and projects. The CIEEM (2018) guidelines also require that the Proposed Development be assessed cumulatively, so any cumulative effects can be identified.

Chapter 20 summarises the criteria for selecting the list of projects to be considered. Two projects have been identified in the vicinity of the Proposed Development. These are listed below:

- The Fionnphort Breakwater and Overnight Berthing Project c.1.3 km to the east. No assessment has been made in respect to this development as yet, but it is anticipated that the impacts would be of a similar nature to the Proposed Development. Due to the distance and separation of the two developments by the Sound of Iona, it is unlikely that any in-combination effects on IOFs would occur;

- Cable installation – Iona to Fionnphort c.900 m to the south. The project involves the installation of fibre optic cable and is proposed in the first half of 2023. No information on the potential impacts of this work on birds was available through the Marine Scotland website[21]. Given the distance between the sites and the presence of alternative foraging habitats along the coastline and inland, it is considered that that any in-combination effects would be negligible.

9.7 Residual Effects

9.7.1 Residual Construction Effects

Following implementation of the mitigation outlined in Section 9.5 and Technical Appendix 9.1, the magnitude of the impact has been assessed as minor. When considering the conservation value and low sensitivity at the site level, the overall assessment of effects is deemed to be minor to negligible. In terms of the EIA Regulations this is deemed a non-significant effect.

9.7.2 Residual Cumulative Effects

Following implementation of the mitigation outlined in Section 9.5, it is considered that in-combination effects relating to ornithology would be of negligible magnitude and their effects as of minor significance. In terms of the EIA Regulations this is deemed a non-significant effect.

9.8 Conclusions and Summary of Effects

In summary, the only predicted effect on sensitive IOFs is disturbance during construction. Species regarded as particularly sensitive to disturbance are waders and waterfowl at high-tide roosts and foraging areas and shag, which were recorded in moderate abundance in the near shore zone.

Due to the localised and temporary nature of the activities and the small number of birds affected as a result, these were considered to be of minor to negligible adverse impact.

In addition to the above, a HRA has been undertaken to determine the potential for the Proposed Development to have a LSE on designated sites in the UK national network of sites (‘European sites’). The initial screening process (Stage 1: Screening) did not identify any sites designated for ornithological features to be taken forward for determination of LSE via a Stage 2 Appropriate Assessment.

[21] Marine Licence Application - Cable Installation - Iona to Fionnphort - 00009614 | Marine Scotland Information

10 TERRESTRIAL NOISE & VIBRATION

10.1 Introduction

This chapter outlines the noise and vibration impact assessment for the Proposed Development, and assesses the potential impacts and likely significant effects of noise and vibration associated with the construction of the Proposed Development.

During the construction phase, there is potential for noise impacts at the nearest noise sensitive properties from the use of associated construction plant and equipment. The effect of construction noise has been assessed in full within this noise and vibration chapter. The construction noise targets are set out along with the assessment methodology and results of the construction noise predictions. Construction noise mitigation measures are detailed such that noise targets are met throughout the construction phase.

The specific objectives of the noise and vibration assessment are to:

- Describe the existing noise baseline;
- Define the assessment methodology and significance criteria used in completing the noise and vibration impact assessment;
- Describe the potential effects, including direct, indirect and cumulative effects;
- Describe the mitigation measures proposed to address the likely significant effects; and
- Assess the residual effects remaining following the implementation of mitigation.

This Chapter is supported by the following Volume III Technical Appendices:

- Appendix 10.1: Noise Monitoring Methodology;
- Appendix 10.2: Noise Monitoring Location;
- Appendix 10.3: Baseline Noise Monitoring Survey Data;
- Appendix 10.4: Construction Noise Receptors; and
- Appendix 10.5: Construction Noise Assessment.

Operational vibration affecting construction noise receptors has been scoped out as there are no known significant vibration sources associated with the Proposed Development. There are no significant operational vibration impacts. Baseline vibration monitoring was not undertaken within the Proposed Development site.

10.2 Assessment Methodology

10.2.1 Noise Policy and Guidance

The noise assessment has considered the following relevant policy and guidance documents:

- **Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (IEMA, 2014);**

IEMA noise impact assessment guidelines address the key principles of noise impact assessment and are applicable to development proposals where noise effects are likely to occur.

The guidelines provide specific support on how noise impact assessment fits within the Environmental Impact Assessment (EIA) process. They cover:

- how to scope a noise assessment;
- issues to be considered when defining the baseline noise environment;
- prediction of changes in noise levels as a result of implementing development proposals; and
- definition and evaluation of the significance of the effect of changes in noise levels (for use only where the assessment is undertaken within an EIA).

The guidelines define core methods and techniques, used within the noise impact assessment process, and endeavour to highlight their limitations, where relevant. They can be applicable to all stages of a project, from construction through operation to restoration and decommissioning.

- **Scottish Government Planning Advice Note (Scotland) PAN 1/2011 and Technical Advice Note;**

The Planning Advice Note (Scotland) PAN 1/2011 provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. It should be read in conjunction with "Planning Guidance (Scotland): Planning Policy, Technical Advice Note (TAN) and circulars.

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business."

It includes details of the legislation, technical standards and codes of practice for specific noise issues. The PAN promotes the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected, and that new development continues to support sustainable economic growth. Environmental Health Officers and/or professional acousticians should be involved at an early stage in development proposals which are likely to have significant adverse noise impacts or be affected by existing noisy developments.

The Environmental Noise (Scotland) Regulations 2006 transposed the European Directive 2002/49/EC (the Environmental Noise Directive) into Scottish law. The Regulations affect large urban areas, major transport corridors and major airports. They require Scottish Ministers and airport authorities to manage noise through a process of strategic noise mapping and noise action plans. In the areas affected by the Regulations, planning authorities have a role in helping to prevent and limit the adverse effects of environmental noise. Areas affected by the Regulations can be seen on the Scottish Noise Mapping website.

- **British Standard BS5228 BS 5228:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites;**

BS 5228 consists of two parts and covers control of noise and vibration for persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control in respect of construction operations and for architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners. This guidance document has been used for the assessment control of construction noise from the Proposed Development.

British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise

Part 1 of the standard provides a method of calculating noise from construction plant, including:

- Tables of source noise levels;
- Methods for summing up contributions from intermittently operating plant;
- A procedure for calculating noise propagation;
- A method for calculating noise screening effects; and
- A way of predicting noise from mobile plant, such as haul roads.

The standard also provides guidance on legislative background, community relations, training, nuisance, project supervision and control of noise and vibration.

The ABC method outlined in Section E3.2 has been used for the purposes of determining whether the predicted noise levels from the construction activities will result in any significant noise impact at the nearest noise sensitive properties. Table 10-1 outlines the applicable noise threshold of significant effect at the nearest construction noise receptors. The determination of what category to apply is dependent on the existing background ambient (L_{Aeq}) noise level (rounded to the nearest 5 dB) at the nearest noise sensitive property. For daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e., 65 dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e., 70 dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. ,75 dB) applies.

Table 10-1 Noise Threshold Limits at Construction Noise Receptors for Construction Activities (Ref BS5228)

	Threshold Limits [dB(A)]		
	Category A	Category B	Category C
Night-time (23:00 - 07:00)	45	50	55
Evening and Weekends (19:00 - 23:00 Weekdays, 13:00-23:00 Saturdays, 07:00-23:00 Sundays)	55	60	65
Weekday day-time (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total LAeq noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e., the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total LAeq noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 2: Vibration

Part 2 of the standard gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry-specific guidance.

Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the Peak Particle Velocity (PPV) range of 0.14 $mm \cdot s^{-1}$ to 0.3 $mm \cdot s^{-1}$. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote anxiety lest some structural mishap might occur. Guidance of effects of vibration levels are illustrated in Table 10-2.

Table 10-2 Guidance on the Effects of Vibration Levels (Reference BS5228 Part 2, Table B.1)

Vibration Level mms^{-1}	Effect
0.14	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies with construction. At lower frequencies people are less sensitive to vibration
0.30	Vibration might be just perceptible in residential environments
1.00	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10.00	Vibration is likely to be tolerable for any more than a very brief exposure to the level

Limits of transient vibration, above which cosmetic damage could occur, are given numerically in Table 10-3 (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 10-3, and major damage to a building structure can occur at values greater than four times the tabulated values.

Table 10-3 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Rand of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Un-reinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

The majority of people are known to be very sensitive to vibration, the threshold of perception being typically in the peak particle velocity (PPV) range of between 0.14 mms^{-1} and 0.30 mms^{-1}. Vibration levels above these values can cause disturbance.

- **Environmental Protection Act, 1990;**

Environmental Protection Act gives Scottish Local Authorities considerable and wide-ranging powers to tackle noise nuisance. Section 79 of the 1990 Act imposes a duty on Local Authorities to take reasonable steps to investigate complaints of nuisance and to inspect their area from time to time to detect statutory noise nuisances. Where a Local Authority is satisfied that the noise emitted is prejudicial to health or constitutes a 'nuisance', it must serve an abatement notice on the person responsible for the noise. The notice may require the noise to be stopped completely, reduced, or limited to certain times of the day. Local Authorities can exercise these controls at any time if satisfied there is a statutory nuisance, regardless of the terms of any planning permission.

- **Highways England (2019). Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA111 Noise and Vibration (formerly HD213/11, IAN 185/15) Revision 0**

The United Kingdom Design Manual for Road and Bridges (UK DMRB), Sustainability & Environment Appraisal LA111 Noise and Vibration, gives advice on the appraisal of noise and vibration impacts due to changes in road traffic noise and vibration for UK trunk roads. The UK DMRB identifies various stages of assessment, with each stage becoming increasingly detailed. The objective of the UK DMRB noise assessment is to establish the magnitude of the significance of noise changes for areas where existing traffic is likely to at least increase by 25% or reduce by 20%. The UK DMRB advises that these changes are equivalent to a change in noise level of 1 dB(A), which is the minimum change that can be detected by the human ear in the short term (e.g., on opening of a development or scheme).

The UK DMRB assessment methodology dictates that all properties experiencing changes in noise greater than 1 dB(A) due to the Proposed Development should be assessed. Properties experiencing a change in noise of less than 1 dB(A) do not need to be considered, the inference being that such a slight change in the level of noise is so small as to be negligible. A doubling or halving of the total flow of traffic would cause the noise level to change by 3 dB(A) which is considered the minimum perceptible change under normal conditions. A change in the noise level of 1 dB(A) is generally only perceptible under controlled conditions. However, the UK DMRB indicates that those subjected to a sudden change in noise level as low as 1 dB(A), such as that which accompanies the opening of a road scheme, may just perceive the change and experience either a benefit or disbenefit.

- **British Standard BS 7445-1 Description and Measurement of Environmental Noise – Part 1: Guide to Quantities and Procedures (BS, 7445-1);**

British Standard BS7445 provides the framework within which environmental noise should be quantified. BS 7445: Part 1 provides guidance to quantities and procedures in relation to environmental noise monitoring. BS7445-1 states that sound level meters that are used should conform to specifications of Class or Type 1 (or Class or Type 2 as a minimum) as given in BESN 61672.

The Class of a noise level meter describes its accuracy as defined by the relevant international standards. Sound level meters are defined by International Standards such as IEC 61672-1:2013 (or BS EN61672-1:2003). These standards define a wide range of complex accuracy, performance and calibration criteria that instruments must meet to be fit for purpose. Within the Standard, there are two allowable levels of tolerance, and these are known as Class 1 and Class 2. Class 1 is more accurate than Class 2.

These Class 1 and Class 2 tolerances are necessary as a way of dealing with variations in the instruments. The variations are caused by the different electronic components used inside the sound level meters and because of the way different meters have been designed and verified. Even the test equipment used to check the sound level meters during manufacture will introduce some variation.

All equipment shall be calibrated and the configuration for calibration shall be in accordance with the manufacturer’s instructions. A comprehensive recalibration at certain time intervals (for example annually) may be prescribed by authorities responsible for the use of the measurement results. A field check shall be made by the user at least before and after each series of measurements, preferably including an acoustic check of the microphone. Meteorological conditions are not prescribed but it is recommended that wind speed should not exceed 5 m /s at height of 3-11 m above ground, any temperature inversions near ground, or heavy precipitation.

10.2.2 Potential Effects Scoped Out

Having considered the proposed works, it was concluded that several factors could be scoped out of the detailed assessment including:

- Operational Noise. This has been scoped out as there is no inclusion of new significant noise sources likely to generate perceptible noise levels when the Proposed Development is operational. In addition, there are no operational cumulative effects;
- Construction vibration. This has been scoped out as the proposed construction activities do not include piling; and
- Operational vibration. This has been scoped out as there shall be no new significant vibration sources likely to generate perceptible levels of vibration when the Proposed Development is operational.

Reference to the relevant vibration legislation is still included for completeness.

10.2.3 Potential Effects Scoped In

The noise and vibration effects of the construction stage and all operations associated with the Proposed Development have been assessed at the nearest construction noise receptors.

Construction phase includes:

1. Construction noise from on-site activities affecting nearby sensitive receptors; and
2. Construction noise from construction traffic affecting nearby sensitive receptors. Chapter 3 Project Description states "*Transport by road will be minimal – there is no estimated impact on the road transport network*". Therefore, there is no construction traffic noise impact associated with the Proposed Development.

10.3 Baseline Scenario

A description of the Proposed Development is presented in Chapter 3. Figure 3-5 illustrates the design of the proposed breakwater.

The Iona Ferry Terminal consists of a slipway and pier jutting out into the Sound of Iona. The site boundary and associated 500 m buffer highlighting the construction noise study area is shown below in Figure 10-1.

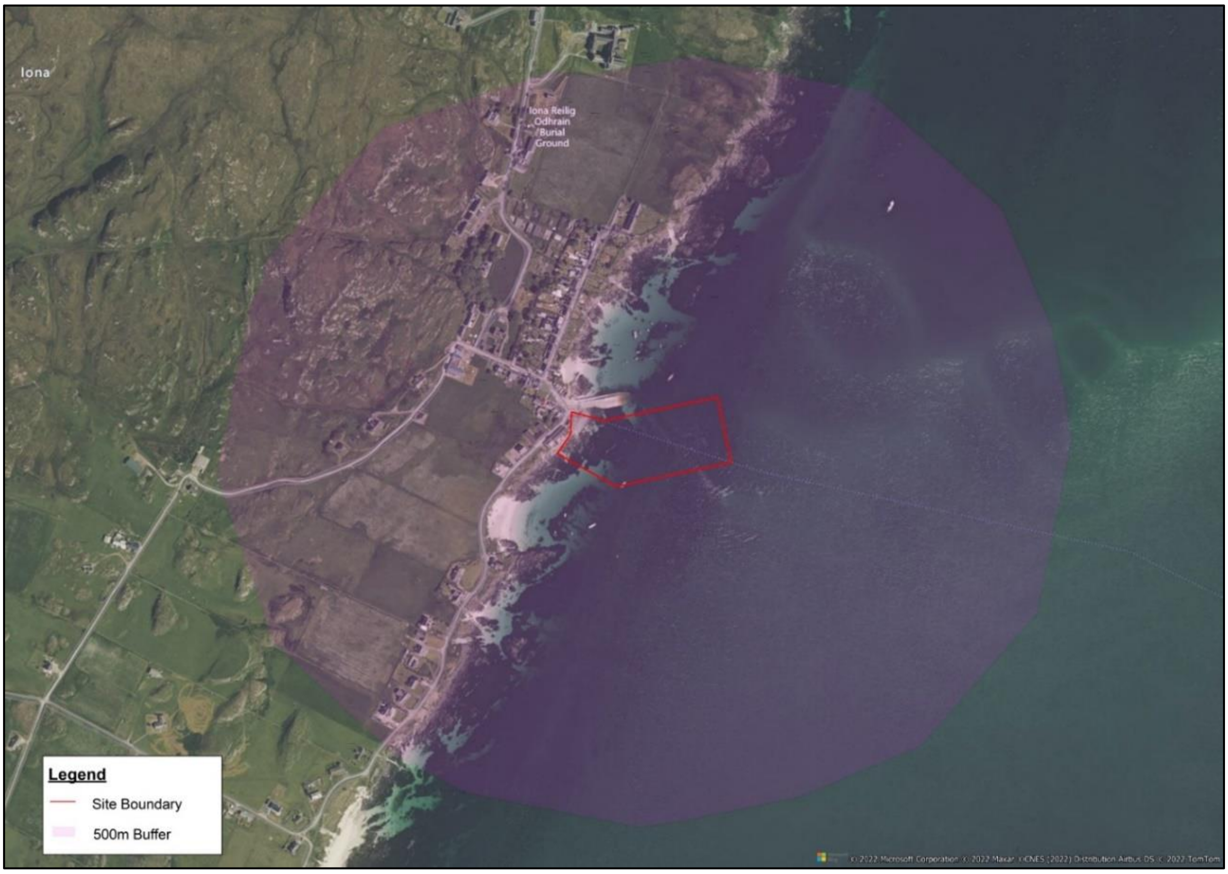


Figure 10-1 Location of Proposed Development and 500 m Site Boundary

The primary study area for construction noise is based upon guidance detailed in DMRB LA111 Noise and Vibration:

> *"A construction noise study area shall be defined, where the need for further assessment has been established to include all noise sensitive receptors: 1) that are potentially affected by construction noise; in areas where there is a reasonable stakeholder expectation that a construction noise assessment will be undertaken."*

DMRB LA111 Noise and Vibration guidance 2019 suggests that "*a study area of 300m from the closest construction activity is normally sufficient to encompass noise sensitive receptors*."

The study area for the construction noise and vibration assessment encompasses the Proposed Development extended to include noise sensitive receptors within a 500 m radius.

10.3.1 Baseline Noise Monitoring Survey

A baseline noise monitoring survey consisting of attended and unattended noise measurements was conducted within the vicinity of the Proposed Development site.

The noise monitoring location (NML) was chosen to be representative of the nearest construction noise receptors within and near the Proposed Development site. The purpose of the noise monitoring survey was to determine the baseline noise levels at the nearest noise sensitive receptors and to assess these levels in accordance with the relevant guidance to determine the following:

- The applicable BS 5228 construction noise threshold limit in accordance with British Standard BS5228, Code of Practice of Noise Control on Construction and Open sites; and
- Evaluate the noise climate in the Noise and Vibration Study Area.

The NML and respective dates of monitoring and equipment used are summarised below in Table 10-4.

Table 10-4 Summary of Baseline Noise Monitoring Survey

Noise Monitoring Location	Description of Noise Monitoring Location	Start Date and Time	End Date and Time	Sound Level Meter
NML 1	Iona House, Iona.	17:00 29/06/2021	12:45 02/07/2021	Norsonic 140

A summary of the noise monitoring methodology, instrumentation and calibration certificates are illustrated in Volume III Appendix 10.1.

The NML is detailed in Volume III, Appendix 10.2, which also includes a photograph of Noise Monitoring Location 1.

Results of the baseline noise monitoring survey are detailed in Volume III, Appendix 10.3.

Measurements were made at a height of 1.2 – 1.5 m above ground level. The weather conditions were in accordance with the requirements of ISO 1996: *Acoustics - Description, Measurement and Assessment of Environmental Noise*.

The following parameters were recorded during each monitoring period:

- **L_{Aeq}:** The continuous equivalent A-weighted sound pressure level. This is an ‘average’ of the sound pressure level.
- **L_{Amax}:** This is the maximum A-weighed sound level measured during the sample period.
- **L_{Amin}:** This is the minimum A-weighted sound level measured during the sample period.
- **L_{A10}:** This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.
- **L_{A90}:** This is the A-weighted sound level that is exceeded for 90% of the sample period.

The ‘A’ suffix for the noise parameters denotes the fact that the sound levels have been ‘A-weighted’ in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

The typical measured ambient (L_{Aeq}) noise level has been used as the baseline for the construction noise assessment.

10.3.2 Background Vibration Monitoring Survey

Background vibration monitoring was not undertaken as there are currently no vibration sources on site.

10.3.3 Construction Noise Receptors

Noise sensitive receptor locations, referenced as construction noise receptors, were obtained from the following data sources:

- Aerial mapping included Google and Bing aerial maps

The construction noise receptor locations[22] are shown in Volume III Appendix 10.4.

(N. B. Addresses of the construction noise receptors have not been included due to General Data Protection Regulations (GDPR) and publication of personal data).

The majority of construction noise receptors identified within the noise and vibration study area are residential properties.

10.4 Description of Likely Significant Effects

10.4.1 Likelihood of Impacts

In keeping with the typical scope of an Environmental Impact Assessment (EIA), the emphasis of this Noise and Vibration Chapter is on the assessment of the potential effects of the Proposed Development upon the surrounding environment (nearest noise sensitive receptors) during the construction phase.

As detailed in IEMA Guidelines for Environmental Noise Impact Assessment the following terminology and definitions are detailed as:

1. Noise Impact -The difference in the acoustic environment before and after the implementation of the proposals (also known as the magnitude of change). This includes any change in noise level and in other characteristics/features, and the relationship of the resulting noise level to any standard benchmarks.
2. Noise Effect -The consequence of the noise impact. This may be in the form of a change in the annoyance caused, a change in the degree of intrusion or disturbance caused by the acoustic environment, or the potential for the change to alter the character of an area such that there is a perceived change in quality of life. This will be dependent on the receptor and its sensitivity.
3. Significance of Effect -The evaluation of the noise effect and, particularly if the noise impact assessment is part of a formal EIA, deciding whether or not that impact is significant.

[22] (N. B. Addresses of the construction noise receptors have not been included due to General Data Protection Regulations (GDPR) and publication of personal data).

10.4.1.1 Receptor Sensitivity / Value

Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise sensitive commercial premises. This is taken from the Scottish Government's Technical Advice Note (TAN) on Assessment of Noise, Table 2.1 Level of sensitivity associated with various examples of noise sensitive receptors. Section 2.21 of TAN States:

> "*There are three levels of sensitivity "high" "medium" and "low". The ranking is primarily based on the relationship between the amenity associated with a NSR and its susceptibility to noise*."

TAN Chapter 2, Table 2.1 Level of Sensitivity Associated with Various Examples of Noise Sensitive Receptors provides sensitivity, description and examples of noise sensitive receptors. Therefore, sensitivity of receptors, as defined in TAN has been used as reference criteria for sensitivity of receptors within this chapter.

The sensitivity of receptors to noise and vibration during construction is defined below in Table 10-5.

Table 10-5 Receptor Sensitivity (Ref: TAN Assessment of Noise)

Sensitivity	Description	Examples of NSR
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate. Quiet outdoor areas used for recreation Conference facilities Theatres/Auditoria/Studios Schools during the daytime Hospitals/residential care homes Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive. Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g,. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	Buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator noise is a normal part of the event Night Clubs

The majority of receptors expected to be affected by noise and vibration impacts from the Proposed Development are residential receptors who are deemed to be sensitive.

The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact it is exposed to, as summarised below in
Table **10-6**.

Table 10-6 Matrix for Determining Significance of Effect for Receptors of High Sensitivity

Magnitude of Impact (Beneficial or Adverse)	Significance of Effect for Receptors of High Sensitivity
Major	Large or Very Large
Moderate	Moderate or Large
Minor	Slight
Negligible	Slight
No Impact	Neutral

10.4.1.2 Magnitude of Impact / Level of Significance

10.4.1.2.1 Construction Noise

Construction noise comprises both plant noise and site traffic noise. The construction noise 'of effect' for this assessment is based on the '5 dB change' method in BS5228-1:2009 2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' which is summarised in Table 10-7 below.

BS 5228:2009+A1:2014 does not contain any significance criteria equivalent to that presented in Table 10-1, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are presented. In this case Example Method 2, which refers to change of 5 dBA in the ambient noise level, has been used to assess the effects at residential receptors.

The magnitude of construction noise Impacts has been determined in accordance with Annex E of BS 5228-1:2009+A1:2014. The significance criteria for assessing noise impact from construction works have been based on example Method 2 contained within Annex E.3.3 of BS 5228-1:2009+A1:2014, as referred to above. This indicates that:

> *"Noise levels generated by site activities are deemed to be potentially significant if the total noise (preconstruction ambient plus site noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut off values of 65dB, 55dB and 45dB L_{Aeq} period, from site noise alone, for the daytime, evening, and night-time periods, respectively, and a duration of one months or more, unless works of a shorter duration are likely to result in a significant effect. "*

Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction baseline plus construction noise) exceeds the pre-construction baseline by more than 5 dBA subject to the lower cut-off value of 65 dBA noise from construction activities alone.

For the majority of noise sensitive receptors, pre-construction ambient noise levels are relatively low, resulting in the criteria set within the lower cut-off levels given in Table 10-7 below applying the most stringent limits. As such the lower cut-off levels are used throughout the construction assessment to all noise sensitive receptors.

This classifies the magnitude of effect based on the sound level difference between the ambient noise level with and without construction. This is calculated by finding the difference between the baseline ambient level and the total level (construction noise plus baseline ambient level) at each location.

Table 10-7 Magnitude of Impact: Construction Noise Day-time (Ref: BS 5228 Part 1)

Sound Level Difference between Ambient Noise and Total Noise (dB, L_{Aeq})	Total Day-time Noise Level (dB $L_{Aeq, 12h}$) (Ambient and Construction Noise)	Magnitude of Impact
< 0 dB	< 65 dB (lower cut-off level)	Negligible
0 - 5 dB	65 - 70 dB	Low
5 – 10 dB	70 –75 dB	Medium
> 10 dB	> 75 dB	High

Table 10-8 Magnitude of Impact: Construction Noise Night-time (Ref: BS 5228 Part 1)

Sound Level Difference between Ambient Noise and Total Noise (dB, L_{Aeq})	Total Night-time Noise Level (dB $L_{Aeq, 12h}$) (Ambient and Construction Noise)	Magnitude of Impact
< 0 dB	< 65 dB (lower cut-off level)	Negligible
0 - 5 dB	65 - 70 dB	Low
5 – 10 dB	70 –75 dB	Medium
> 10 dB	> 75 dB	High

On account of the temporary nature of construction activities, higher noise threshold limits apply to construction phase activities when compared to permanent operational phase activities.

10.4.1.3 Significance of Effects

Following the identification of receptor importance and magnitude of the effect, it is possible to determine the significance of the impact. TAN Chapter 2 Table 2.6 Significance of Effects provides the framework in determining the level of significance, by relating the magnitude with the sensitivity of the receptor.

The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact the receptor is exposed to. The significance of effects for receptors of high sensitivity are summarised below in Table 10-9.

Table 10-9 Matrix for Determining Significance of Effect for Receptors of High Sensitivity (Ref: TAN Table 2.6)

Sensitivity of receptor	Magnitude of Impact →	Negligible	Low	Medium	High
	Negligible	Imperceptible	Imperceptible or slight	Imperceptible orslight/ minor	Slight/ minor
	Low	Imperceptible or slight	Imperceptible or slight/ minor	Slight/ minor	Slight/ minor or moderate
	Medium	Imperceptible or slight/ minor	Slight/ minor	Moderate	Moderate or major
	High/ Particularly Sensitive	Slight/ minor	Slight/ minor or moderate	Moderate or major	Major or Profound

In line with the guidance:

- Major or Profound adverse effects are considered to be significant and should be prevented;
- Moderate adverse effects are significant and should be mitigated, where possible;
- Slight/ minor adverse effects are not significant but should be mitigated where possible; and
- Imperceptible/ negligible adverse effects are not significant and should not require mitigation.

Effects are considered to be significant when identified as likely to have a Moderate/ Major or Profound effect.

10.4.2 Assessment of Construction Effects

The outline construction method statement is described in Section 3.3.

Based on the information presented in Chapter 3, the likely significant noise impacts are considered for the construction activities.

The predicted construction noise impacts are assessed in accordance with BS 5228: Noise and Vibration Control on Construction and Open Sites Noise threshold limits.

The proposed construction phasing, construction noise receptors ID's eastings and northings, together with applicable BS 5228 noise limits are detailed in Volume III, Appendix 10.5.

10.4.2.1 Construction Traffic

Materials are expected to be transported to site by barge and installed from a barge. Transport by road will be minimal. Therefore, there is no estimated construction road traffic impact on the road transport network.

10.4.2.2 Construction Duration and Hours

The total time to complete construction works at Iona is estimated to be 52 weeks.

BS 5228 defines the day-time period as 07:00 to 19:00 hrs; the evening period as 19:00 to 23:00 hrs; and the night-time period as 23:00 to 07:00 hrs. There is potential for day-time, evening and night-time construction works, dependent on the awarded contractor.

Dredging

Dredging is likely to occur during night-time hours to prevent disruption to the current ferry operation. The breakwater will be constructed 70 m south of the slipway, and therefore will not impact on the ferry operation. Therefore, construction works will be during daytime hours.

10.4.2.3 Construction Noise Receptors

As previously detailed, there are residential properties adjacent to, and in close proximity to, the Proposed Development. Construction Noise Receptor locations are detailed in Volume III Appendix 10.4.

10.4.2.4 Construction Activities

There is no piling proposed for the construction of the Proposed Development.

The two construction activities to be undertaken for the Proposed Development include construction of a breakwater and dredging.

Construction of the breakwater includes all material brought to site on the flat top barge that will then be manoeuvred from the barge to construct the breakwater using the Jack up barge (OCM-50).

The dredging will be undertaken using a self-propelled backhoe dredger and a secondary spud legged barge with long reach will be used to move the dredge material onto a vessel for disposal at sea.

Construction of Breakwater

In order to predict worst-case construction noise impacts, it was necessary to define the plant and equipment to be used as part of the construction phase activities associated with the construction of the breakwater. Vessels will be used for the construction activities for the Proposed Development. The vessel type will be contractor specific, however these are likely to be used:

- Typical vessel type for rock armour delivery could be similar to Flat Top Barge – Mormaen 15 | Keynvor MorLift Ltd; and
- Typical Jack-up barge 1 - OCM 50 - 18m jack legs.

The plant shown in Table 10-10 is generally representative of the type of plant that will be in use during the construction of the breakwater of the Proposed Development.

Table 10-10: Noise Levels for Construction Plant for Breakwater

Construction Activity	Construction Plant	Sound Power Level (dB)	Sound Pressure Level at 10m (dB)
Construction of Breakwater Dredging	Flat top barge	115	87
	Jack-up barge	115	87

The typical sound power level of 115 dB has been assumed for the 2 vessels as a worst-case scenario.

The sound power level of the equipment was converted to sound pressure level at 10 m.

The following formula is used to convert sound power level (L_W) to sound pressure level (L_P) at distance r.

This calculation assumes hemispherical propagation:

$$L_P = L_W - 10*\log_{10}(2*\pi*r^2)$$

Where:

L_P = Sound Pressure level

L_W = Sound Power Level

r = Distance from source to receiver

The construction noise predictions for the breakwater are deemed to be worst case based on the following:

- Full power operation of each construction activity throughout the daytime period;
- Ground absorption effects are ignored (ground absorption can provide some attenuation);
- Construction plant is assumed to be operational at closest point to receptors, the worst-case result for each receptor is chosen for the report; and/ or
- Predictions are based on the construction plant simultaneously operational, where applicable.

All plant is assumed to be operational at the closest point to receptors, e.g., for construction of the breakwater all vessels were assumed to be operational at the closest point within the construction area to the receptors; the worst-case result for each receptor is chosen for the report.

The worst-case predicted construction noise levels have been compared to the derived threshold noise limits using ABC Method from British Standard BS 5228 as detailed in Table 10-1.

Dredging

In order to predict worst-case construction noise impacts, it was necessary to define the plant and equipment to be used as part of the dredging construction phase activities.

Given the small dredge area and quantities, it is anticipated that the dredging can be undertaken by a self-contained, self-propelled vessel with an excavator mounted on its bow; and given the small dredge area and quantities, it is anticipated that a secondary spur legged barge with long reach can be utilised.

The plant shown in Table 10-11 is generally representative of the type of plant that will be in use for the dredging phase of the Proposed Development. Typical noise levels from the dredging construction plant are obtained from BS 5228:2009+A1:2014 Part 1.

Table 10-11: Typical Construction Plant for Dredging (Ref: BS5228)

Construction Activity	Construction Plant	Reference from Annex C & D BS5228	Sound Pressure Level at 10m (dB	Numbers
Dredging	Grab hopper dredging ship	C.7.2	82	2

Construction noise predictions have been undertaken for the proposed dredging at all noise sensitive receptors within the construction noise study area.

The construction noise predictions are deemed to be worst-case based on the following:

- Full power operation of each construction activity throughout the daytime period;
- Ground absorption effects are ignored (ground absorption can provide some attenuation); and
- Dredging plant is assumed to be operational at the closest point to receptors, e.g., for dredging both dredging vessels were assumed to be operational at the closest point within the dredging area to the receptors; the worst-case result for each receptor is chosen for the report.

The worst-case predicted dredging noise levels have been compared to the derived threshold noise limits using ABC Method from British Standard BS 5228 as detailed in Table 10-1.

10.4.2.5 Predicted Effects of Construction Noise

The precise construction strategy to be adopted will be a matter for the contractor, but it is likely that construction noise levels experienced during the construction phase will be similar to the typical construction noise levels indicated in Table 10-10 and Table 10-11 for the construction plant/ vessels.

In order to assess the worst-case construction noise level from the Proposed Development, the noise level for each of the construction plant detailed in Table 10-12, at a distance of 10 m will be used for the purpose of the construction noise assessment. Distances from the construction phase boundaries for each of the construction activities were measured to each of the construction noise receptors as detailed within Volume III Appendix 10.5.

The attenuation calculation assumes a direct line of sight from the noise source to the receiver and without a barrier being considered, which is a worst-case scenario. Construction noise predictions were calculated for each construction activity as detailed in Volume III Appendix 10.5.

The construction programme indicates that it is unlikely that construction of the breakwater and dredging will occur simultaneously.

Predicted Noise Effects from Breakwater Construction

Predicted noise levels due to the construction of the breakwater are summarised below in Table 10-12. This table illustrates the worst-case predicted noise from construction activities associated with the breakwater construction. These worst-case predicted noise levels assume a level of simultaneous activity of plant/ equipment close to the receptor. This is unlikely to occur in practice but is used to present potential worst-case noise levels that may occur during the construction phase of the Proposed Development.

Table 10-12: Predicted Noise Levels from Breakwater Construction

Construction Receptor ID	Residential	Sensitivity	BS5228 Category A Guideline (Day-time)	BS5228 Category A Guideline (Night-time)	Construction of Breakwater Total SPL (dB)
1	Yes	High	65	45	54.7
2	No	Medium	65	45	55.3
3	No	Medium	65	45	56.4
4	Yes	High	65	45	56.7
5	No	Medium	65	45	58.0
6	No	Medium	65	45	57.8
7	No	Medium	65	45	58.5
8	No	Medium	65	45	61.2
9	Yes	High	65	45	61.2
10	Yes	High	65	45	59.7
11	No	Medium	65	45	60.7
12	No	Medium	65	45	61.6
13	Yes	High	65	45	63.8
14	No	Medium	65	45	66.3
15	Yes	High	65	45	63.5
16	No	Medium	65	45	**70.8**
17	No	Medium	65	45	**71.9**
18	Yes	High	65	45	**82.9**
19	Yes	High	65	45	62.7
20	Yes	High	65	45	63.3
21	No	Medium	65	45	**78.0**
22	No	Medium	65	45	**73.8**
23	No	Medium	65	45	60.9
24	Yes	High	65	45	59.6
25	Yes	High	65	45	63.8
26	Yes	High	65	45	62.4
27	Yes	High	65	45	61.3
28	Yes	High	65	45	59.5
29	Yes	High	65	45	59.1
30	Yes	High	65	45	58.8
31	Yes	High	65	45	58.2
32	Yes	High	65	45	57.7
33	No	High	65	45	57.2

Construction Receptor ID	Residential	Sensitivity	BS5228 Category A Guideline (Day-time)	BS5228 Category A Guideline (Night-time)	Construction of Breakwater Total SPL (dB)
34	Yes	High	65	45	56.5

Exceedances of Category A Guideline (day-time) are highlighted in dark shading

Worst-case construction noise predictions exceed the 65 dB BS 5228 noise limit at a number of construction noise receptors during daytime hours.

Worst-case construction noise predictions exceed the 45 dB BS 5228 noise limit at a number of construction noise receptors during night-time hours.

Unmitigated construction noise daytime predictions in excess of 65 dB would be deemed to have a temporary moderate impact at four receptors of medium sensitivity, and temporary moderate / major impact at one receptor of high sensitivity as summarised below in Table 10-13.

Table 10-13: Breakwater Construction Impact Significance

Construction Receptor ID	Residential	Receptor Sensitivity	Construction of Breakwater Total SPL (dB)	Magnitude of Impact Ref: Table 10:7)	Impact Significance (Ref: Table 10:8)
16	No	Medium	70.8	Medium	**Moderate**
17	No	Medium	71.9	Medium	**Moderate**
18	Yes	High	82.9	High	**Moderate or major**
21	No	Medium	78.0	High	**Moderate**
22	No	Medium	73.8	Medium	**Moderate**

The receptors most likely to be impacted are non-residential. The worst-case noise predictions are based on closest proximity of proposed construction activities to receptors, which will have temporary duration and subsequent impacts. Noise mitigations for construction activities are outlined in Section 10.5.

Predicted Noise Effects from Dredging

Predicted noise levels due to dredging are summarised below in Table 10-14. This table illustrates the worst-case predicted noise from dredging. These worst-case predicted noise levels assume a level of simultaneous activity of plant/equipment close to the receptor. This is unlikely to occur in practice but is used to present potential worst-case noise levels that may occur during the dredging.

Table 10-14: Predicted Worst-Case Noise Levels from Dredging

Construction Receptor ID	Residential	Sensitivity	BS5228 Category A Guideline (Day-time)	BS5228 Category A Guideline (Night-time)	Dredging (dBA)
1	Yes	High	65	45	50.7
2	No	Medium	65	45	51.7
3	No	Medium	65	45	52.6
4	Yes	High	65	45	52.2
5	No	Medium	65	45	53.9
6	No	Medium	65	45	53.3
7	No	Medium	65	45	53.7
8	No	Medium	65	45	59.1
9	Yes	High	65	45	58.7
10	Yes	High	65	45	54.4
11	No	Medium	65	45	55.6
12	No	Medium	65	45	56.0
13	Yes	High	65	45	60.3
14	No	Medium	65	45	61.8
15	Yes	High	65	45	56.5
16	No	Medium	65	45	62.4
17	No	Medium	65	45	61.8
18	Yes	High	65	45	64.1
19	Yes	High	65	45	55.1
20	Yes	High	65	45	55.0
21	No	Medium	65	45	61.2
22	No	Medium	65	45	59.6
23	No	Medium	65	45	53.3
24	Yes	High	65	45	52.1
25	Yes	High	65	45	54.8
26	Yes	High	65	45	53.7
27	Yes	High	65	45	53.0
28	Yes	High	65	45	51.8
29	Yes	High	65	45	51.5
30	Yes	High	65	45	51.3
31	Yes	High	65	45	50.9
32	Yes	High	65	45	50.5
33	No	High	65	45	50.1
34	Yes	High	65	45	49.6

Worst-case construction noise predictions do not exceed that 65 dB daytime BS 5228 noise limits at all receptors, concluding negligible impact.

Worst-case construction noise predictions exceed the 45 dB night-time BS 5228 noise limit for all construction noise receptors during night-time hours. Unmitigated construction noise night-time predictions in excess of 45 dB would be deemed to be temporary moderate / major adverse impact at all medium and high sensitivity receptors

The noise level predictions are based on close proximity to receptors which will be of a temporary duration with dredging anticipated to occur over a one-week period. Noise mitigation measures for construction activities are outlined in Section 10.5. Generating peak levels of noise will be carried out intermittently over this time and will not be constant for those periods.

On the basis of the predicted worst-case construction noise levels from the Proposed Development, it is clear that there will be a requirement for mitigation measures to be put in place in order to ensure that construction noise levels are reduced as much as practicable and that they do not exceed the daytime noise threshold limit of 65 dB and night-time noise threshold limit of 45 dB.

10.4.3 Assessment of Operational Effects

Occasional maintenance to the various scheme elements may be required during operation, but the earthworks and traffic movements associated with this maintenance are likely to be minimal, and therefore operational phase noise and vibration impacts were scoped out of the assessment.

Operational noise has not been included as there is no inclusion of new significant noise sources likely to generate perceptible noise levels when the Proposed Development is operational. The Proposed Development will not result in any significant permanent adverse effects on the noise environment within the Study Area.

Operational vibration has not been included as there is no inclusion of new significant vibration sources likely to generate perceptible levels of vibration when the Proposed Development is operational.

10.4.4 Assessment of Decommissioning Effects

The design life of the structure is 120 years in accordance with the UK National Annex to BS EN 1990:2002, Category 5. It is unlikely that it will be decommissioned in its entirety. It is more likely that the scheme will be repaired, or sections replaced or improved if needed in the future.

10.5 Mitigation Measures

10.5.1 Construction Phase

Worst-case construction noise predictions can be reduced through use of appropriate mitigation measures, as detailed below.

BS 5228-1 states that:

> "…*if the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect*."

These factors have therefore been considered to determine the effect significance.

To summarise the proposed construction works:

- Construction works will be temporary and limited in duration;
- Construction plant and machinery has been assessed as operating for the full working period of the day, i.e., 100% duty cycle. Due to natural pauses in activity and rest breaks equipment will not be fully operational during the working day; and
- Construction works associated with the breakwater construction are not proposed to occur during night-time or on Sundays, unless for emergency works. Therefore, there will be no associated construction noise impact during these times at construction noise receptors. However, dredging is likely to occur during night-time hours but for a short, temporary (one week) duration.

Night-time Noise Impacts

Night-time noise impacts will be required during the dredging on occasions. BS 82233 night-time noise limit of 45 dB will be applicable at the receptor locations. Night-time construction noise impact indicates that there is the potential for significant impact without mitigations. Screening at source of potentially affected receptors would ensure that the BS 5228 noise limit is achieved, reducing impact to temporary minor adverse.

Construction mitigation measures will be put in place to ensure construction noise levels are attenuated and reduced where necessary.

Best practice measures will be employed to ensure that construction phase noise levels are reduced to the lowest possible levels.

BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures will be applied by the contractor where appropriate during the construction phase of the Proposed Development. Construction best practice measures which will be implemented include:

1. Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
2. Careful selection of quiet plant and machinery to undertake the required work where available;
3. Machines in intermittent use will be shut down in the intervening periods between work;
4. Ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, temporary construction barriers or enclosures will be utilised around noisy plant and equipment;
5. Handling of all materials will take place in a manner which minimises noise emissions; and
6. Audible warning systems will be switched to the minimum setting required by the Health & Safety Executive.

The use of the proposed construction noise mitigation measures will ensure that construction noise levels are controlled to the lowest levels practicable.

Dredging Mitigation

Although recognised that the choice of dredgers is likely to be determined by the engineering requirements and the suitability of available equipment, dredging activities should be planned where possible to reduce the overall source noise level during the works – e.g., limiting night-time works directly adjacent to noise-sensitive properties etc.

Any dredger used for the works will be expected to be fitted with effective engine exhaust silencers, and there will be a requirement placed on the chosen dredger operator to ensure that all engine silencers are effective and reducing engine exhaust noise levels to the lowest reasonably practicable level.

Screening shall be provided nearest to those properties most likely to experience high noise levels from dredging, particularly during more sensitive night-time periods.

10.5.1.1 Consultation and Communication

Mitigation in the form of timely and effective stakeholder consultation is outlined within the oCEMP. This would ensure that residents are kept informed of on-going and future operations. For example, local residents would be informed by letter drop of proposed works, particularly where these are due to occur outside standard working hours. The letter would include details of proposed cause, start dates and duration of works to be carried out.

In order to minimise the likelihood of complaints, Argyll & Bute Council and affected residents should be kept informed of the works to be carried out and of any proposals for work outside normal hours. All complaints will be recorded by the appointed contractor. The appointed contractor will investigate the circumstances and ensure the necessary corrective measures are taken.

10.5.1.2 Construction Noise Monitoring

Construction noise monitoring will be undertaken as part of noise control planning at nearby sensitive receptors.

The need for monitoring of construction noise during key periods of the construction programme for the dredging activities would be discussed in consultation with Argyll & Bute Council.

There will be no requirement for post-construction surveys or monitoring for operational noise.

10.5.2 Operational Phase

10.5.2.1 Operational Noise

No operational noise impacts resulting from the operation of the Proposed Development are anticipated. Therefore, no specific mitigation measures are proposed during the Project operation.

10.5.2.2 Operational Vibration

No operational vibration impacts resulting from the operation of the Proposed Development are anticipated. Therefore, no specific mitigation measures are proposed during the Project operation.

10.6 Residual Effects

10.6.1 Construction Phase

Pre-mitigation, the predicted construction noise impacts are anticipated to result in effects ranging from negligible to major at construction noise receptors.

However, mitigation by careful scheduling of the works, timing of activities and using best practice will be implemented such that no significant effects arise, and levels are as low as possible.

Residents will be informed of the timing and duration of activities that may produce high noise. Elevated levels can be tolerated if prior notification and explanation is given.

Temporary slight adverse impacts due to construction noise have been identified at the closest receptors to the proposed construction works. No permanent residual noise and vibration impacts are predicted during construction of the Proposed Development. With construction mitigation measures in place as proposed through the oCEMP and associated appendices, construction noise monitoring, and a temporary construction noise barrier, the noise impacts of construction activities is predicted to be reduced to temporary slight/ moderate.

No significant residual impacts will arise.

10.6.2 Operational Phase

No residual impacts or residual significant effects are predicted for the operational stage of the Proposed Development.

10.6.3 Decommissioning Phase

No permanent residual noise and vibration impacts are predicted during decommissioning of the Proposed Development.

10.6.4 Transboundary

The Proposed Development is not located close to any international boundaries and there will be no transboundary effects in relation to noise and vibration.

10.7 Potential Cumulative Impacts

The potential for cumulative effects has been considered for the construction, operation and decommissioning of the Proposed Development cumulatively with other projects. There are two proposed projects in the vicinity of the Proposed Development. These are listed below and fully detailed in Chapter 21:

- The Fionnphort Breakwater and Overnight Berthing Project
- Cable installation – Iona to Fionnphort

The potential for cumulative vibration and operational noise impacts are screened out of the assessment.

The assumed worst-case scenario is that construction impacts of the Proposed Development may overlap with the construction of the Fionnphort Breakwater and Overnight Berthing Project, or cable installation – Iona to Fionnphort. Any cumulative construction noise or vibration impact is predicted to be of local spatial extent, temporary duration, and intermittent. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be low and therefore not significant.

10.8 Conclusions and Summary of Effects

An assessment of potential noise effects associated with the Proposed Development has been carried out.

During the construction phase, there is potential for noise impacts at the nearest noise sensitive properties from construction plant and equipment. The effect of construction noise has been assessed in full within this noise and vibration chapter.

The construction noise targets are set out along with the assessment methodology and results of the construction noise predictions.

Construction noise mitigation measures are detailed such that noise targets are met throughout the construction phases.

No operational noise or vibration impacts resulting from the operation of the Proposed Development are anticipated. There will be no significant effects arising from the operational phase.

Overall, it is concluded that there is the potential for moderate to major significant impacts arising from the Proposed Development during the construction phase. These are associated with the dredging activity, should this occur over the night-time period, however these effects will be temporary in nature.

With construction mitigation measures in place as proposed through the oCEMP and associated appendices, construction noise monitoring, and temporary construction noise barrier, the noise impacts associated with night-time dredging is predicted to be reduced to temporary slight or moderate.

11 WATER QUALITY

This chapter of the EIAR assesses the potential impact of the Proposed Development on water quality within the receiving environment. Existing water quality in the vicinity of the Proposed Development is established based on available water quality information. The assessment of impacts includes analysis and interpretation of baseline data acquired from existing water quality monitoring stations included in the Scottish Environment Protection Agency (SEPA) Water Framework Directive (WFD) monitoring programme. The potential impacts related to the construction and operational phases of the Proposed Development have been assessed and mitigation measures proposed to reduce significant environmental impacts on the receiving water environment. The assessments are based on the project description detailed in Chapter 3.

The main aspects of the Proposed Development that have the potential to impact on water quality and the overall status of water bodies in the vicinity of the Proposed Development are from dredging, physical changes to the water bodies and/ or construction activities. In general terms the construction of the Proposed Development and dredging activities could have the following impacts:

- Short term construction impacts particularly due to sediment release and/ or contaminant dispersal;
- Pollution from accidental spillage/ leakage;
- Changes to the hydromorphological supporting conditions affecting the hydromorphological status and the biological elements which it supports, and
- Impacts on biodiversity, particularly on harbour porpoise within the Inner Hebrides and the Minches Special Area of conservation (SAC).

The assessment presented is informed by and inclusive of information further described in the following EIA chapters:

- Chapter 8 Marine Biodiversity; and
- Chapter 13 Coastal Processes.

11.1 Assessment Methodology

This section outlines the policy context relevant to the assessment of potential impacts to water quality.

11.1.1 International Policy Context

The Water Framework Directive (WFD) (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted by the European Commission in December 2000. The WFD requires that all European Union Member States prevent deterioration and protect, enhance and restore all bodies of water. This means that Member States must ensure that new schemes do not adversely impact upon the status of aquatic ecosystems, and that they must address historical modifications that are already impacting a water body. Whilst the WFD originates from the EU it has been retained in UK law following the UK's exit from Europe. The Environment (EU Exit) (Scotland) (Amendment etc.) Regulations 2019 is the implementing legislation which ensures principals of the Directive are largely retained with Scottish legislation.

The key focus of the water quality assessment is to ensure that the Proposed Development is undertaken in a manner which is consistent with the objectives of the Water Framework Directive (2000/60/EC) (WFD). The WFD is the European legislation which was developed to establish systems to manage Europe's water environment - rivers, lochs, estuaries, coastal waters and groundwater; a fundamental requirement of the WFD is to attain good ecological and chemical water quality status and ensure that any deterioration in the status of waters is prevented. Any new development must ensure that these two fundamental requirements of the Directive are not compromised, nor are there any detrimental impacts to the protected area objectives of water dependent protected areas that are associated with the water body e.g., nearby designated European Sites on the national site network.

11.1.2 National Policy Context

The Proposed Development will be undertaken in line with the Marine (Scotland) Act 2010. This Act makes provisions for those functions and activities in the marine area, including provision about marine plans, licensing of marine activities, the protection of the area and its wildlife including seals and regulation of sea fisheries, and for connected purposes.

The following relevant national legislation was also considered during the preparation of this chapter:

- The Water Environment and Water Services (Scotland) Act 2003; this Act transposes the requirement of the WFD into Scottish law;
- The Environment (EU Exit) (Scotland) (Amendment etc.) Regulations 2019; and
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended); these regulations were introduced under the 2003 Act to specify the control regimes for discharges to, abstractions from and impoundments and engineering activities affecting the water environment (i.e., rivers, lochs, transitional waters (estuaries), coastal waters groundwater, and groundwater dependant wetlands).

11.1.3 Relevant Guidance

The Marine Scotland Licensing Operations Team (MSLOT) consider that any impact from a development that compromises the achievement of WFD objectives or causes deterioration in the status of waters, to be a significant environmental impact in terms under Part 2, Regulation 11 of the Marine Works (Environmental Impact Assessment) Scotland Regulations 2017 (as amended). A key requirement of the WFD is that surface water bodies attain at least good surface water status, requiring ecological status to be at least good and chemical status to pass the environmental quality standards for hazardous and priority hazardous substances, and that there should be no deterioration in existing status. This is particularly important for the

Sound of Iona coastal water body which is currently classified at high ecological status and therefore must not be allowed to deteriorate unless a derogation under Article 4(7) of the Habitats Directive is justified.

The EIA scoping report identified potential impacts to water quality and has proposed that further assessment is required in line with the WFD. The source of these impacts has been identified as dredging, potential effects of the proposed works on hydromorphology from the operation of the breakwater, and potential accidental pollution events. The suitability for disposal of dredge material at sea is based on chemical action levels (cALs) identified by Marine Scotland (2017).

Guidance relevant to the EIA for the water quality chapter is as follows:

- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the EIA process in Scotland (SNH, 2018);
- Pollution Prevention Guidance 1 (PPG): General guide to the prevention of pollution;
- PPG3: Use and design of oil separators in surface water drainage systems (to be read in conjunction with ‘Oil Separator Manufacturers – Version 7 – November 19th, 2007);
- PPG 6: Working at construction and demolition sites;
- PPG 7: Refuelling facilities;
- PPG 18: Managing for water and major spillages;
- PPG 22: Incident response – dealing with spills;
- PPG26: Storage & handling of drums & intermediate bulk containers;
- Guidance for Pollution Prevention (GPP) 2: Above ground oil storage tanks;
- GPP 5: Works and maintenance in or near water;
- GPP 8: Safe storage and disposal of used oils;
- GPP 21: Pollution incident response planning;
- WAT-SG-26: Good Practice Guide – Sediment Management; and
- WAT-SG-29: Good Practice Guide – Construction Methods.

11.1.4 TraC MiMAS Assessment

Whilst the supporting physico chemical conditions of a water body can be impacted through construction of the Proposed Development (through suspended sediment and the potential impact from oils, fuels, cement/concrete spillages, which has the potential to have a significant effect on the biological elements), an important element of WFD ecological status is the supporting hydromorphological conditions. Hydromorphology considers elements such as hydrodynamic regime, the quantity, structure and substrate of the seabed and the structure of the intertidal zone and sub-tidal zones; all of which can affect the ecology of aquatic ecosystems. Good hydromorphological conditions support aquatic ecosystems (i.e., morphological elements such as flow regime and substrate provide physical habitat for biota such as fish, invertebrates and aquatic macrophytes). As part of WFD classification for ecological status of a water body, if the supporting morphological elements are not consistent with the conditions required to support “high status” for the biological element, then the ecological status of the water body is limited to “good status”, i.e., a water body cannot be classed as high ecological status if the morphological status is not classed as high.

There is also the risk that by allowing morphological conditions to fall below those consistent with ‘good’, the biological elements will also deteriorate, resulting in less than good ecological status and by extension, non-compliance with the WFD. Therefore, it is essential that any changes to the physical conditions of a water body that could have the potential to affect morphological conditions or the capacity of a water body to assimilate these pressures are assessed to ensure that the biological elements and the water body environmental objectives are not compromised.

The Transitional and Coastal waters Morphological Impact Assessment System (TraC-MImAS) is a risk-based decision support tool which helps regulators identify projects that may result in a deterioration of water body status as a result of hydromorphological changes. The assessment is geographically limited to aspects of projects within 3 nautical miles of the coast.

TraC-MImAS is used to help assess the impact of a new project on the system capacity of the waterbody into which the proposed project will be built. This assessment is currently carried out by MSLOT with results provided to SEPA for WFD reporting. The assessment examines the total footprint of a project based on the individual types of pressures that may be applied to a waterbody from a new development. The assessment requires details of a proposed project’s built footprint, including morphological changes such as dredging.

The TraC-MImAS tool is based on five modules (Figure 11-1). Collectively the modules provide an assessment of impacts to morphological conditions.

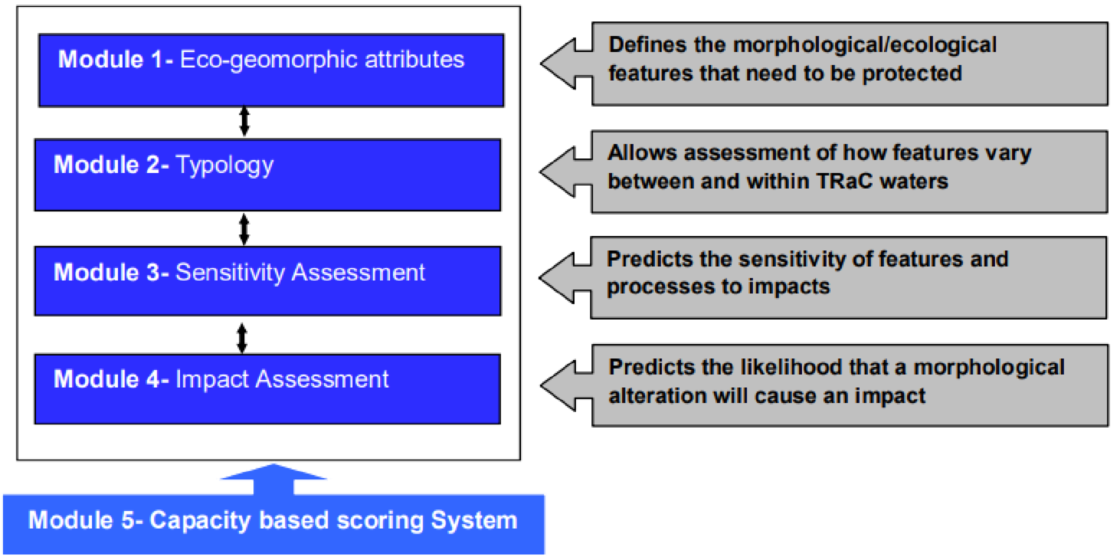


Figure 11-1 Overview on the modular components of TraC-MImAS

It is assumed that different morphological alterations will use up different amounts of system capacity, with the amount of capacity being used dependant on:

- The type of alterations;
- The sensitivity of the water environment to the alterations; and
- The spatial scale of the alterations.

Where a new development is proposed, the tools can be used to predict the impact of the proposal on "system capacity". By considering impacts on system capacity, the tool can be used to determine the level of risk presented by a new proposal. This information can then be used to inform regulatory decisions, for instance, to identify where more detailed assessments may be necessary, or to identify where there is a high risk of a deterioration in status, and, therefore, where a regulatory exemption test to determine if the work should proceed on the basis of benefits to human health, human safety or sustainable development may be required. To help quantify the risk that a new morphological alteration could impair achievement of the ecological objectives of the WFD, a series of "morphological condition limits" have been defined.

11.1.5 Assessment Criteria and Assignment of Significance

11.1.5.1 Receptor Sensitivity/ Value

The significance of effects on water quality likely to occur during the Proposed Development works (particularly from dredging activities and physical changes to the water body) at Iona are determined using the predominantly qualitative process described below. The criteria for determining the significance of effects is a two-stage process. The first step in the process is to determine the sensitivity of the receiving environment and then to define the magnitude of the potential impact This section describes the criteria applied in this chapter to assign values to the receptor to assist in defining sensitivity of receptors (Table 11-1) and the magnitude of potential impacts.

Table 11-1 Sensitivity Indication

Value (Sensitivity)	Typical descriptors
Very High	**Very high importance and rarity, international scale and very limited potential for substitution.** Examples: Water body protected area, interests are of international importance and are included on the WFD Register of Protected areas, having been designated under the Habitats, Birds, Shellfish, Bathing Water, Drinking Water or Nitrate Directives. High Status Water bodies.
High	**High importance and rarity, national scale, and limited potential for substitution.** Examples: Water body where the current status is good or better and no deterioration is permitted. National designation e.g., Sites of Special Scientific Interest (SSSI),
Medium	**High or medium importance and rarity, regional scale, limited potential for substitution.** Examples: Moderate Status with an objective of good status by 2027, regionally important resource in terms of ecology or fisheries interest.
Low	**Low or medium importance and rarity, local scale.** Examples: Local potable water source supplying <50 homes. WFD Status Poor. Amenity site used by small numbers of local people.
Negligible	**Very low importance and rarity, local scale.** Examples: WFD Status Bad, limited amenity value or fisheries interest.

11.1.5.2 Magnitude of Impact

The magnitude of the impact has also been adapted from the generic methodology for environmental assessment outlined in the Design Manual for Roads and Bridges (2011) (Table 11-2). Impacts may be considered to have no affect or be negligible to major adverse or beneficial and their magnitude has necessarily been assessed on a qualitative basis.

Table 11-2 Magnitude of Impact Indicating Type and Scale of Effect (DMRB, 2011)

Magnitude	Type and scale of effect
Major	Major alteration to water body status causing deterioration in either the ecological status including supporting elements, i.e., physico-chemical, specific pollutants and hydromorphology, chemical status or protected area status. Severe damage to key water body characteristics, features or elements (Adverse). Large scale or major improvement to water body status, extensive restoration or enhancement of water body (Beneficial).
Moderate	Water quality impact but not adversely affecting the integrity or status of the water body, partial loss or damage of certain characteristics or water body attributes (Adverse). Benefit to or addition of key characteristics or features of the water body, improvement in water status (Beneficial).
Minor	Some measurable change in water quality attributes, minor loss or alteration to one (maybe more) key characteristics (Adverse). Minor benefit to one or more key characteristics, features or elements of the water body (Beneficial)
Negligible	Very minor loss to water body characteristics, features or elements (Adverse). Very minor benefit to or positive addition of one or more water body characteristics, features or elements (Beneficial).
No change	No loss or alteration to water quality or water body status.

11.1.5.3 Significance of Effects

Applying the formula, the greater the environmental sensitivity or value of the receptor or resource, and the greater the magnitude of impact, the more significant the effect. The consequences of a highly valued environmental resource suffering a major detrimental impact would be a very significant adverse effect. Table 11-3 illustrates how the sensitivity of attributes was considered against the magnitude of impacts to determine the significance of potential impacts.

Table 11-3 Assessment Matrix

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

Based on the importance of the receiving water body, which has been assessed to be of extremely high importance (due to the presence of Natura 2000 sites and bathing waters), and the impact significance, an assessment of the potential environmental impacts of the Proposed Development has been made based on the matrix presented in Table 11-1 to Table 11-3 above.

11.2 Baseline Scenario

The Iona ferry terminal is located along the western edge of the Sound of Iona, a coastal water body (ID: 200063), in the Scotland River Basin District (RBD) as illustrated in Figure 11-2. It is 12.1 km^2 in area and the most recent available WFD reporting data (2018) is outlined in Table 11-4.

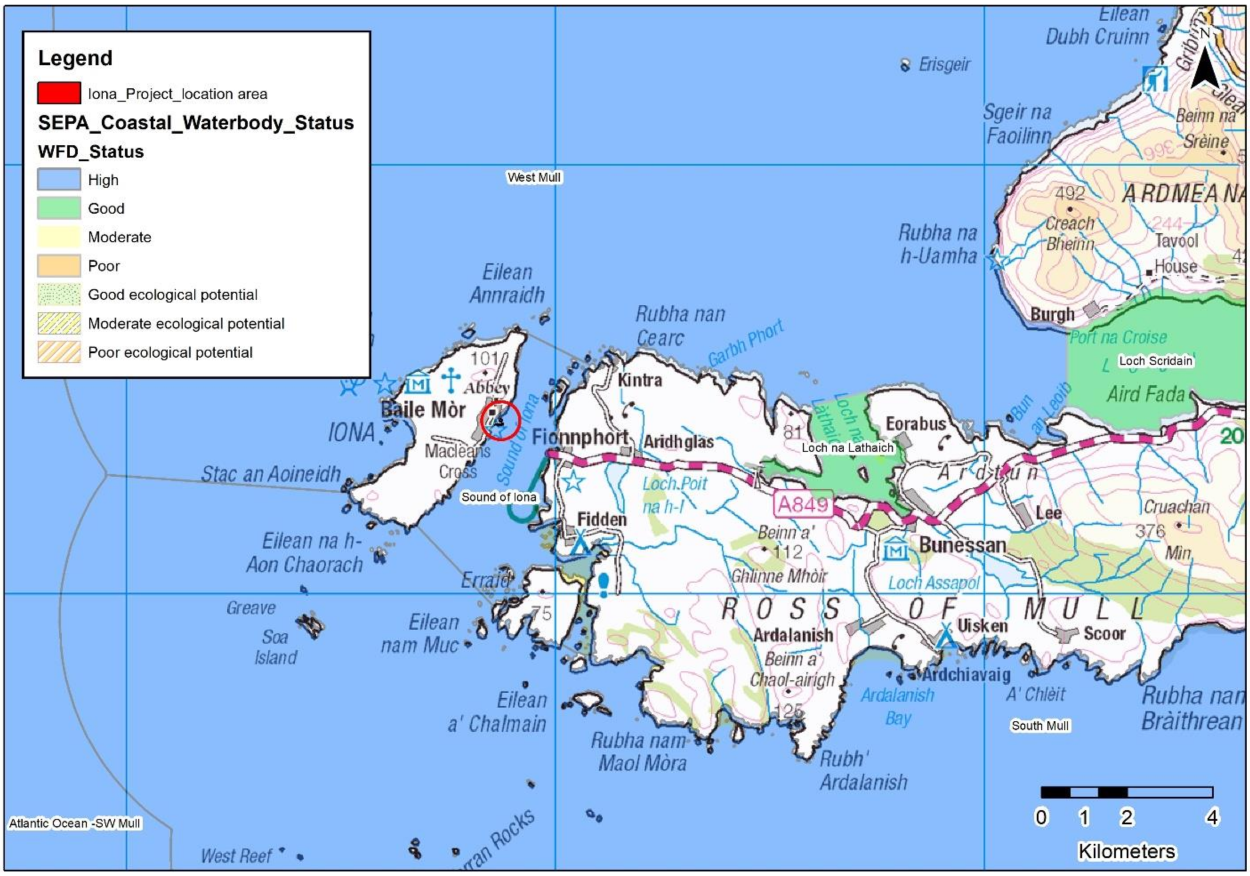


Figure 11-2 Coastal and Surface Waterbodies

Table 11-4 WFD Reporting Data for coastal water bodies in the vicinity of the development (2020)

Parameter	Sound of Iona ID: 200063	West Mull ID: 200083	South Mull ID: 200059
1: Overall status	High	High	High
1-1: Pre-HMWB status	High	High	High
1-3: Overall ecology	High	High	High
1-3-1: Physico-Chem	High	High	High
1-3-1-4: Dissolved Oxygen	High	High	High
1-3-1-8: Dissolved inorganic nitrogen	High	High	High
1-3-2: Biological elements	High	High	High
1-3-2-3: Invertebrate animals	High	High	High
1-3-2-3-4: Benthic invertebrates (IQI)	High	High	High
1-3-2-9-1: Phytoplankton	High	High	High
1-3-3: Specific pollutants	Pass	Pass	Pass
1-3-3-15: Unionised ammonia	Pass	Pass	Pass
1-3-4: Hydromorphology	High	High	High
1-3-4-1: Morphology	High	High	High
4-1 : Water Quality	High	High	High

There are designated sites in the vicinity (Figure 11-3), in particular the Sea of the Hebrides Marine Protected Area (MPA), the Inner Hebrides and the Minches SAC and the Cnuic agus Cladach Mhuile Special Protection Area (SPA). The SAC is designated for migrating harbour porpoise (*Phocoena phocoena*), the SPA for <Redacted> (*Aquila chysaetos*) while the MPA conservation objectives encompass <Redacted> Fronts, minke whale (*Balaenoptera bonaerensis*) and marine geomorphology of the Scottish Shelf.

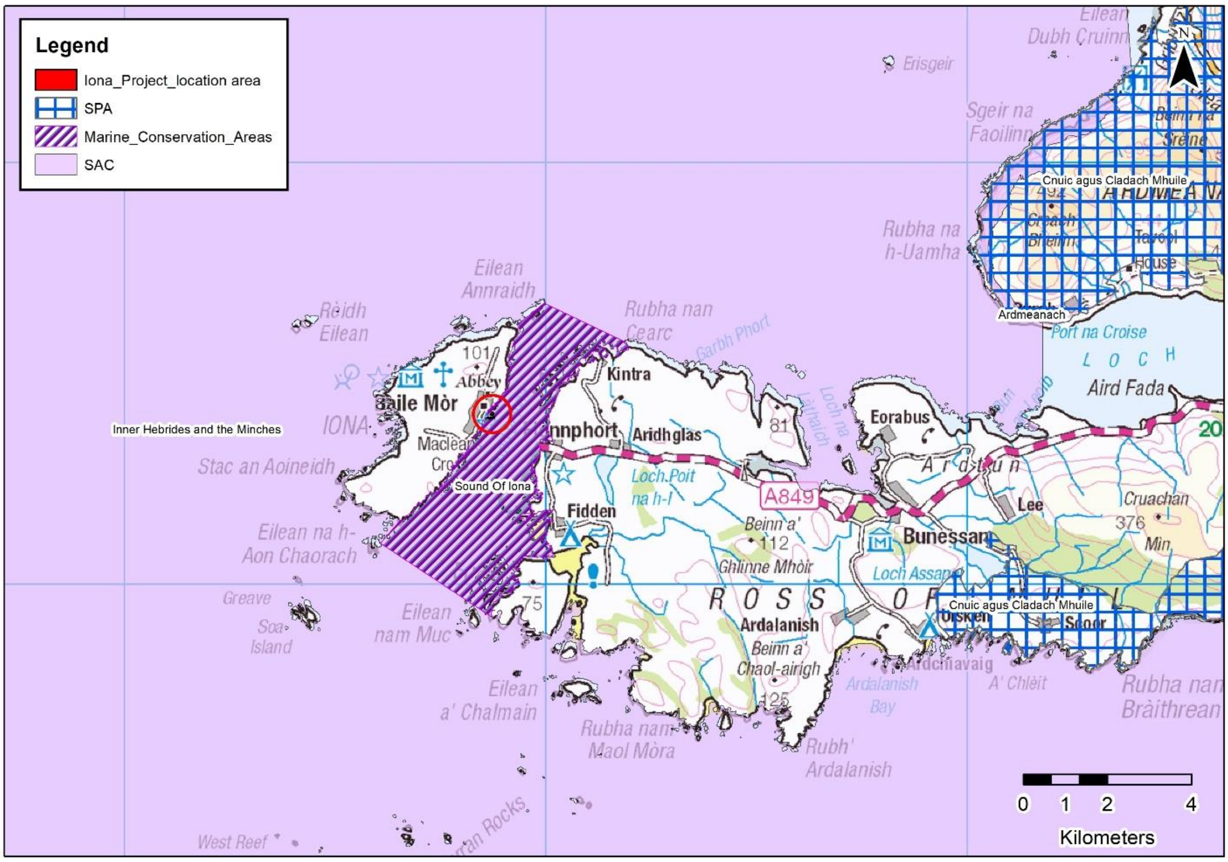


Figure 11-3 Location of Iona and surrounding designated sites

11.2.1 Consultation

Consultations were undertaken with relevant parties in order to determine the existing water quality status in the context of the Water Framework Directive (WFD) and to establish a scope for the assessment of water quality impacts, thereby enabling an appropriate assessment of the impact of the development to be made. A summary of the relevant issues identified and how these have been addressed are included in

Table **11-5**.

Table 11-5 Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where addressed
October 2020	Argyll and Bute Council: Assessment of the effects on water quality from suspended sediment and possible contaminant dispersion should be included (dredging activities).	Mitigation measures to address the impact from suspended sediments and contaminant dispersion will follow best practice guidance and sound design principals. Sediment control measures will be consistent with the relevant legislation and guidance.
September 2021	Scottish Environment Protection Agency (SEPA): Referred out to SEPA triage guidance and standard scoping advice for marine developments.	Advice reviewed and adhered to.
29th September 2021	Marine Scotland: Advised that dredging/disposal activities and the placement of rock armour could have a potential impact to marine mammals through pathways other than underwater noise. It was also noted that changes in hydrological conditions (current, water flow, wave height and strength) and the effect on surrounding benthic and intertidal communities should be assessed.	Mitigation measures to address the impact from the dredging activities will be adhered to. A MImAS Assessment in conjunction with modelling from the Coastal Processes chapter has been analysed to establish any hydromorphological considerations.

11.2.2 Study Area Water Bodies

The Inner Hebrides and the Minches SAC has been designated for the Annex II species harbour porpoise (*Phocoena phocoena*). A scoping assessment has determined that the Proposed Development at Iona has the potential to affect harbour porpoise by noise, sedimentation and pollution risk associated with the construction and dredging activities.

Table 11-6 below details the water quality information for the Sound of Iona where the Proposed Development is to be located and the surrounding waterbodies in West Mull and South Mull. All three of these waterbodies have achieved high ecological status under the WFD since 2014. It is essential that the Proposed Development does not cause a deterioration in this high status achieved.

Table 11-6 Water quality information for the Sound of Iona and surrounding waterbodies from 2014- 2020[23]

Parameter	Sound of Iona ID: 200063		West Mull ID: 200083		South Mull ID: 200059	
	2014	**2020**	**2014**	**2020**	**2014**	**2020**
Overall status	High	High	High	High	High	High
Physical condition	High	High	High	High	High	High
Freedom from invasive species	High	High	High	High	High	High
Water quality	High	High	High	High	High	High

[23] https://www.sepa.org.uk/data-visualisation/water-environment-hub/

[H= high, G= good, P= poor]

There are no designated bathing waters within proximity to the Proposed Development.

11.2.3 Sediment Analysis of Area to be Dredged

In line with Marine Scotland Licencing Operations, dredged material must be analysed in order to assess suitability for disposal at sea. Dredging works will be minor in nature and will comprise overburden dredging only. The approximate dredge area is 2,017 m^2. The approximate dredge volume to be removed is 1,225 m^3. It is proposed that this is carried out by backhoe dredger, with the material deposited at the location shown in Figure 11-4.

Sampling and analysis of dredge material was undertaken to determine suitability of the dredge material for disposal at sea or disposal at an off-site licenced landfill; or a combination of these solutions. This included three sediment cores to 0.65 m depth and 6 grab samples of the seabed sediment in compliance with the requirements of MSLOT seabed sampling and testing. These results from the seabed sediment analysis are included in Appendix 8.1 and the proposed dredge disposal location are included in Figure 11-4.

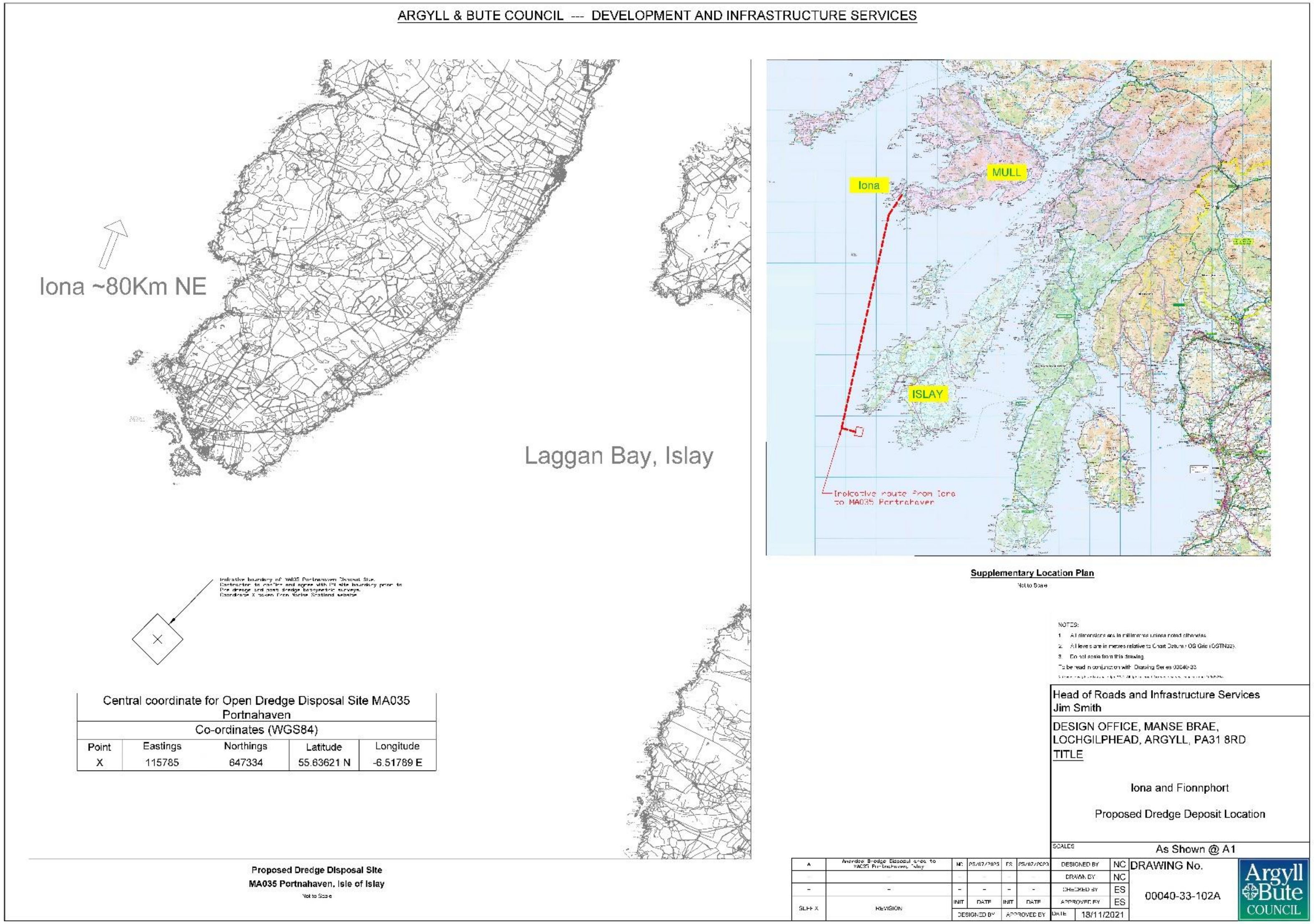


Figure 11-4: Dredge deposit location

Ground investigations and sediment samples have been undertaken to determine the nature of the dredge material. This included 3 seabed sediment cores within the dredge area and 6 grab samples in the vicinity of the breakwater.

Chemical Action Levels (cALs) as determined by Marine Scotland (2017) are used as part of a 'weight of evidence' (WOE) approach to licensing the disposal of dredged material at sea. Contaminant levels in dredged material below chemical Action Level 1 (cAL1) are generally assumed to be of no concern and are unlikely to influence the licensing decision, however for samples that fall between cAL1 and cAL2, further consideration is required before a licensing decision is made.

There is currently no formal guidance or procedures in place for handling of samples between cAL1 and cAL2, however an informed decision is made by MSLOT, given further assessment against: historic levels of contamination; the extent of contamination (i.e., if localised or widespread); the level of contamination (i.e., if concentrations are closer to cAL1 or cAL2); and how concentrations compare to natural background concentrations in the area.

The sediments were analysed for a suite of chemical parameters and screened against Marine Scotland cALs in order to identify any contamination which may be present. All samples within the dredge area were below the revised Chemical Action Levels (both cAL1 and cAL2).

11.3 Description of Likely Significant Effects

11.3.1 Assessment of Construction Effects

The key issues identified with regards to water quality are associated with the physical disturbance of the surrounding environment during dredging and construction. There may be a potential issue arising for sediment release which may have a negative impact on water quality on the Sound of Iona waterbody and on the Inner Hebrides and the Minches SAC, having a negative effect on these sites meeting their WFD objectives. In addition, dredging and construction activities may cause noise that could have a negative effect on the harbour porpoise for which the SAC is designated.

The Proposed Development has the potential to affect nearby designated sites by noise, sedimentation and pollution risk associated with construction and dredging activities and through accidental fuel spillage/ leakage. The status of the sites mean that the requirements of the Conservation (Natural Habitats, &c.) Regulations 1994 as amended (the "Habitats Regulations") apply and as such, Marine Scotland is required to consider the effect of the proposal on these sites before it can be consented (commonly known as Habitats Regulations Appraisal).

An assessment of the Proposed Development in terms of current status and the WFD objectives for the Sound of Iona (ID: 200063), West Mull (ID: 200083) and South Mull (ID: 200059) coastal water bodies was undertaken, including an assessment of potential impact.

To determine the impact of the Proposed Development upon the water quality of the Sound of Iona, West Mull, South Mull and the Inner Hebrides and the Minches SAC, baseline data have been analysed from existing monitoring stations included in the SEPA WFD monitoring programme, as part of their River Basin Management Plan (RBMP) reporting.

The key issues surrounding the construction phase, which relate to water quality are further discussed in detail in sections 11.3.1.1 to 11.3.1.3. Those identified have the potential to negatively affect water quality and subsequently the marine biodiversity of the waters. As detailed in previous sections, it is imperative that the objectives of the WFD and the protected area objectives are not impacted by the Proposed Development. Chapter 8 (Marine Biodiversity) has determined that during the construction phase, in the absence of mitigation the impact on biological elements that contribute to the ecological status of the waters are not all negligible or minor, therefore significant in EIA terms and mitigation has been deemed necessary.

11.3.1.1 Suspended Sediment and dredging

There is the potential for increased suspended sediment during the construction works of the breakwater and the dredging process. However, the Coastal Processes chapter anticipates that the impacts of dredging resulting in suspended sediment in the water column are low due to the larger particle size of the dredge area. Sand and gravels disposed of at the open licensed offshore dumping site are expected to remain at the site and not increase the background level of suspended sediments outside of the area. In the absence of mitigation measures, the impact of construction activities may result in temporary, localised impact to water quality in the immediate vicinity of the breakwater.

Any sediment plumes generated during disposal are expected to be limited but may result in a temporary increase in turbidity. Given the distance between the dredge site and the proposed disposal site, and that the dredged material is classed as medium to coarse sand, the Coastal Processes assessment of disposal of dredge spoil arising from the Proposed Development concluded that the disposal operations would not likely result in any significant increases to the background level of suspended sediments and would not, therefore, impact the existing water quality in the area.

In addition, the journey by vessel to and from the proposed disposal site is not expected to result in ecological impacts unless there is accidental spillage. Mitigation methods include following standard pollution prevention guidelines and GPP 21: Pollution incident response planning (NIEA/ DAERA/SEPA/ NRW, 2017) to mitigate against the potential for vessel fuel spillage.

The sediments were analysed for a suite of chemical parameters and screened against Marine Scotland cALs (cAL1 and cAL2) in order to identify any contamination which may be present. All samples within the dredge area were below the revised cALs (both AL1 and AL2). Therefore, dredging will not result in release of contaminants nor impact on the physico-chemical supporting conditions, the chemical status and ultimately the biological elements of the waterbodies.

Given the scale of the Proposed Development, the magnitude of the impact is considered to be minor, however, the Sound of Iona water body is considered to be of very high importance and based on the rating of the environmental impact presented in Table 11-3 the impact is assessed as moderate to major in the absence of mitigation.

11.3.1.2 Noise impacts on biological elements and protected area objectives

Various fish species are likely to be in the waters surrounding Iona. Dredging activities associated with the Proposed Development are likely to produce noise which is likely to disturb species in the area. The works are located within the Inner Hebrides and the Minches SAC and therefore, in accordance with Article 6 of the WFD ANNEX IV, Protected Areas are afforded protection to conserve habitats or species directly dependent on waters.

The effects of underwater noise arising from construction activities are predicted to be of highly localised spatial extent, short-term duration, intermittent and reversable following cessation of works. In conjunction with this, the modelling undertaken in Chapter 8 (Marine Biodiversity) determined the impact on the marine mammals to be low in the absence of mitigation measures as the threshold for Permanent Threshold Shift (PTS) was not exceeded for any of the marine mammals. Therefore, the impact of construction and dredging activities on harbour porpoise is limited but may result in temporary, localised impact to those in the immediate vicinity. Works are unlikely to negatively affect the potential of the waterbody to maintain its WFD Protected Area objectives.

Given the scale of the Proposed Development, the magnitude of the impact is considered to be negligible, however, the Sound of Iona water body is considered to be of very high importance and based on the rating of the environmental impact presented in Table 11-3 the impact is assessed as minor in the absence of mitigation which is not significant in EIA terms.

11.3.1.3 Fuel, oil and other chemicals

During the construction phase, there is potential for accidental oil/ fuel spillages on site due to increased vessel presence and associated fuel storage. The use of oils and chemicals on-site requires significant care and attention and will adhere to the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011. It is important to ensure that the following mitigation measures are adhered to, to reduce the potential risk from oils and chemicals:

- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP2 shall be implemented to ensure safe storage of oils and chemicals;
- The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b);
- All machinery used during the construction phase of the works will be required to be in good working order and free from oil and hydraulic fluid leakages. Where machinery maintenance has to take place, it will be carried out at the allocated Contractor's compound;
- With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works; and

- An Oil Spill Contingency Plan must be adhered to in the event of an accidental discharge of oil and/or Hazardous Noxious Substances (HNS). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner.

Given the scale of the Proposed Development, the magnitude of the impact is considered to be medium, however, the Sound of Iona water body is considered to be of very high importance and based on the rating of the environmental impact presented in Table 11-3 the impact is assessed as major or substantial in the absence of mitigation.

11.3.2 Assessment of Operational Effects

The key issues surrounding the operational phase which relate to water quality are listed below in Sections 11.3.2.1 to 11.3.2.2. Those identified, have the potential to negatively affect water quality or the marine biodiversity of the waters thus potentially impacting the WFD objectives of the waterbodies. As detailed in previous sections, it is imperative that the objectives of the WFD and the protected areas objectives are not impacted by the Proposed Development. Chapter 8 (Marine Biodiversity) has determined that during the operational phase, in the absence of mitigation, the impact on biological elements that contribute to the ecological status of the waters is considered to be medium. Overall, the significance of the effect is deemed to be of moderate significance due to the potential impact on seagrass beds. This is due to the permanent long term habitat loss of Seagrass beds within the new breakwater footprint following the construction phase. However, it is also recognised that this will also create other permanent habitat occurrence due to the presence of the breakwater structure. The presence of the rubble mound breakwater is likely to be colonised by species in the area, therefore having a beneficial effect on benthic ecology. In addition, this potential increase in colonising species may result in an increase in prey species made available for fish and shellfish. With the exception of the loss in footprint of seagrass, the remaining biological elements are deemed to be of low vulnerability, high recoverability and local to international importance. Therefore, the assessment determined the significance of effect on these elements as minor (positive) and not significant in EIA terms. However, the assessment of Likely Significant Effects has deemed the effect of ‘permanent habitat loss arising from the placement of material on the seabed for the breakwater’ on seagrass to be moderate, which is significant in EIA terms.

11.3.2.1 Physical alterations/Hydromorphology

The presence of physical alterations within a waterbody has the potential to impact on the hydromorphology of the waterbody. Therefore, should the inclusion of the breakwater within the Sound of Iona waterbody impact negatively on the hydromorphology, the waterbody may potentially be at risk of deterioration and unable to maintain its current high status under the WFD.

To determine the impact the proposed breakwater will have on the waterbody during the operational phase, the Transitional and Coastal waters Morphological Impact Assessment System (TraC-MImAS) risk assessment was undertaken. As discussed in Section 11.1.4, TraC-MImAS is a risk-based decision support tool which helps regulators identify projects that may result in a deterioration of water body status as a result of hydromorphological changes.

It is used to help assess the impact of a new project on the system capacity of the waterbody into which the proposed project will be built by examining the total footprint of a project based on the individual types of pressures that may be applied to a waterbody from a new development. The assessment requires details of a proposed project's built footprint and detail on the morphological changes such as dredging and breakwater construction in this case. The waterbody is assessed under three zones established for their different ecogeomorphic attributes; Hydrodynamics, Intertidal and Subtidal zones.

The outputs of the assessment showed that under the Stage 1 assessment at a preliminary scale - 0.5 km^2, the local area was at risk of deteriorating from its current high status to less than good status. This was due to all three zones assessed breaching the 5% high status Morphological Condition Limit (MCL) at the local scale.

A Stage 2 assessment was then undertaken at a waterbody scale which determined that the predicted waterbody status post construction would remain at high status and not breach MCLs for each of the three zones. Therefore, the Proposed Development would not result in an overall deterioration in the ecological status at the water body status, i.e., would remain within high WFD status and the breakwater would not pose a risk to the supporting hydromorphological supporting conditions of the waterbody or a risk of a deterioration in ecological status. Additional detail of the assessment is included in Volume III Technical Appendices Appendix 11.1.

Furthermore, this risk assessment is supported by the detailed assessment undertaken in Chapter 13 (Coastal Processes) which concludes that the tidal regime is predicted to remain substantially unchanged during operation. Given the localised nature and small absolute magnitude of any predicted changes in tidal current velocity, it is unlikely that there will be any significant change in net scouring or deposition of sediments within the centre of the Sound of Iona. The risk of impact is determined to be negligible, and no mitigation is required. The Proposed Development is therefore not expected to have a significant effect on coastal processes or make a significant change to the existing morphology.

11.3.2.2 Operational Maintenance

Upon completion of the construction of the Proposed Development, little will be required in terms of maintenance. Any impact from such maintenance works associated with the Proposed Development can be considered negligible/ imperceptible.

Given the small scale of the Proposed Development, the magnitude of the impact is considered to be negligible however the Sound of Iona waterbody is considered to be of very high importance and, based on the rating of the environmental impact presented in Table 11-3, the impact is assessed as minor in the absence of mitigation which is not significant in EIA terms.

11.4 Mitigation Measures

Mitigation measures will be adopted through the construction and operational phases of the Proposed Development to minimise the impact on water quality.

11.4.1 Construction Phase Mitigation

Mitigation measures required to reduce the potential impacts from noise have been identified and included and the impacts of dredging and suspended solids on general marine life. These measures follow the Joint Nature Conservation Committee recommendations and guidance for minimising risk to marine wildlife (JNCC, 2010). Sediment control measures will be consistent with the following guidance:

- Technical Guidance C648: Control of Water Pollution from Linear Construction Projects, (CIRIA, 2006);
- Technical Guidance C532: Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors (CIRIA, 2001);
- GPP 5: Works and maintenance in or near water (NIEA / DAERA / SEPA / NRW, 2017);
- PPG 6: Working at construction and demolition sites (EA / NIEA / SEPA, 2012); and
- GPP 21: Pollution incident response planning (NIEA / DAERA / SEPA / NRW, 2017)

The use of oils and chemicals on-site requires significant care and attention and will adhere to the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011, particularly General Binding Rule 28 and GPP2, Above Ground Oil Storage Tanks. It is important to ensure that the following procedures are followed to reduce the potential risk from oils and chemicals:

- No losses of concrete (cement) to the waters will be permitted during the works;
- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP2 shall be implemented to ensure safe storage of oils and chemicals;
- The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b);
- With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works;
- An Oil Spill Contingency Plan which must be adhered to by all staff including those employed to carry out works. Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner; and
- Given that there will be berthing of oil, gas and renewables supply vessels and associated refuelling, a full retention oil separator is recommended to mitigate for the potential impacts of fuel/

oil spillage or leakage. This is recommended to be maintained in accordance with the manufacturer's instructions by experienced personnel.

Furthermore, SEPA's Standing Advice for Construction activities – pollution prevention has been consulted and will be adhered to. In relation to the standing advice, the contractors Environmental Clerk of Works will be required to monitor mitigation measures and auditing of the contractor's environmental controls will be undertaken by the clients representative.

11.4.1.1 Suspended Sediment and dredging

The dredging activities will not result in a release of contaminated sediments due to the analysed sediment sample results within the dredge area being below the revised CALs (both AL1 and AL2). Therefore, dredging will not impact on the physico-chemical supporting conditions, the chemical conditions and ultimately the biological elements of the waterbodies. Furthermore, during the construction of the breakwater structure, the good practice construction measures listed above in Section 11.4.1, together with SEPAs standing advice for "Construction Activities – Pollution Prevention" will be used.

Given the scale of the Proposed Development, the magnitude of the impact is considered to be negligible with mitigation applied. Given that the Sound of Iona water body is considered to be of very high importance, and based on the rating of the environmental impact presented in Table 11-3, the impact is assessed as minor where mitigation is applied ensuring that the impact is not significant in EIA terms.

11.4.1.2 Noise and vibration impacts on biological elements and protected area objectives

Given that the impact is assessed as minor in the absence of mitigation, no mitigation is proposed.

11.4.1.3 Fuel, oil and other chemicals

The significance of the impact is assessed as potentially moderate in the absence of mitigation. However, with the mitigation measures proposed in Section 11.4.1, the risk of accidental spillage of oil and chemicals means the potential significance of the impact is considered to be minor.

11.4.2 Operational Phase Mitigation

The installation of the breakwater structure will result in permanent long-term habitat loss within the new breakwater footprint following the construction phase. The effect on benthic receptors, one of the biological elements contributing to WFD Status (i.e., habitat loss effects), will be experienced throughout the lifetime of the structure. However, the presence of the breakwater will also create permanent habitat occurrence. The new structure is likely to be colonised by species, therefore having a beneficial effect on other benthic ecology. Therefore, Chapter 8 (Marine Biodiversity) stated that, with the exception of the loss in footprint of seagrass, the remaining biological elements are deemed to be of low vulnerability, high recoverability and of local to international importance. Therefore, the assessment determined the significance of effect on these elements as minor (positive) and not significant in EIA terms.

However, the assessment of Likely Significant Effects has deemed the effect of ‘Permanent habitat loss arising from the placement of material on the seabed for the breakwater’ on seagrass to be moderate, which is significant in EIA terms.

As such, a ‘Seagrass Compensation and Monitoring Plan’ has been proposed to counter the direct habitat loss predicted to occur as a result of the Proposed Development. This will ensure that the loss of existing seagrass habitat is compensated ensuring no net loss of habitat.

11.4.3 Future Monitoring

Given the temporary and localised nature of the construction and dredging activities, continuous in-situ water quality monitoring is not considered necessary as the sediment plume will remain within the immediate area, with the concentrations returning to background levels in the wider waterbody. However, the contractor’s Environmental Clerk of Works will undertake regular checks and monitoring of grab samples, while auditing of the contractor’s environmental controls will also be undertaken by the clients representative.

During the operational phase of the works, it is not anticipated that monitoring will be required.

11.5 Potential Cumulative Effects

11.5.1 Assessment of Cumulative Effects

The EIA Directive 2014/52/EU specifies at Annex III that "the likely significant effects of projects on the environment must be considered […] taking into account [inter alia] the cumulation of the impact with the impact of other existing and/or approved projects"; and at Annex IV that "a description of the likely significant effects of the project on the environment resulting from, inter alia […] the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources" is required.

This obligation is mirrored in Schedule 4 to The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017. As such, a desk study involving general internet searches and in particular, the Highland Council planning website and MSLOT website have been undertaken to identify other projects which could act cumulatively with the Proposed Development.

The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the proposed redevelopment:

- Scottish Natural Heritage Environmental Impact Assessment Handbook (v5) (2018);
- Scottish Government Planning Circular 1/2017: Environmental Impact Assessment Regulations (2017);

- The Planning Inspectorate Advice Note 17: Cumulative Effects Assessment (2015); and
- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999).

The Proposed Development at Fionnphort which could potentially give rise to in-combination effects from a water quality perspective was included for further assessment. Based on the modelling undertaken in the Coastal Processes chapter and the outputs of the MImAS assessment of both projects on the Sound of Iona costal water body (see Volume III Technical Appendices, Appendix 11.1), the cumulative impacts of both projects is unlikely to have a significant impact on during the construction and operational phases of the Proposed Developments.

The potential for cumulative effects has been identified in Chapter 8 (Marine Biodiversity), due to the permanent long-term habitat loss experienced as a result of the structures' footprints during the operational phases. As there is likely to be a significant effect on seagrass, an agreement will be sought between the Iona Proposed Development and the proposed Fionnphort Project on the compensation/ mitigation strategy of the seagrass to ensure that the ecological status of the water body is not affected.

11.5.2 Inter-relationships

The impact assessment also considers the inter-relationship of impacts on individual receptors. Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor.

There are not considered to be any potential marine biodiversity inter-related effects.

The aforementioned inter-relationship between disposal of dredged material at sea and the potential for impact on water quality from dredging and disposal has been assessed. Given that the sand and gravels disposed of at the proposed licensed offshore dumping site are uncontaminated and expected to remain at the site and not increase the background level of suspended sediments outside of the area Chapter 13 (Coastal Processes), there is unlikely to be any significant inter-related impact to water quality.

11.6 Residual Effects

In circumstances where the mitigation measures are fully implemented during the construction and operational phases, as outlined in in the above sections, the impact of the Proposed Development on the water quality and WFD Status within the Sound of Iona would consist of small-scale, minor impacts on hydromorphology, physico-chemical supporting conditions and the biological elements of WFD Status.

The Proposed Development is therefore not expected to have a significant effect on water quality or the ability of the waterbody to continue to achieve its WFD objectives.

11.7 Conclusions and Summary of Effects

The key issue in relation to water quality throughout the construction phase is associated with the physical disturbance in the marine environment, particularly dredging activities and the potential impact this may have on the Inner Hebrides and the Minches SAC.

The sediments were analysed for a suite of chemical parameters and screened against Marine Scotland revised Chemical Action Levels (cAL1 and cAL2) in order to identify any contamination which may be present. All samples within the dredge area were below the revised cALs (both cAL1 and cAL2).

Coastal process modelling of sediment plume dispersal has determined that the impact of the construction activities, i.e., dredging of sediment, will result in low impact due to the larger particle size present leading to immediate settlement from any overspill. Furthermore, sand and gravels dumped at the licensed offshore dumping site are expected to remain at the site and not increase the background level of suspended sediments outside the area. The magnitude of the potential impacts arising from dredged sediment entering the aquatic environment are therefore considered to be minor with regard to localised water quality and negligible in relation to the wider coastal water body.

Additional pressures with regards to the potential for oil/ fuel spillages both during the construction and operational phases of the Proposed Development have been assessed. The use of oils and chemicals on-site requires significant care and attention and will adhere to the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 and GPP2, Above Ground Oil Storage Tanks.

The key issue in relation to the water environment throughout the operational phase of the Proposed Development is the direct permanent long-term habitat loss within the new breakwater footprint which could impact on the seagrass which is a biological element contributing to the water body status. However, this will also create permanent habitat occurrence due to the presence of the rubble mound breakwater. The new rubble mound breakwater is likely to be colonised by species, therefore having a beneficial effect on benthic ecology. With the exception of the loss in footprint of seagrass currently present, the remaining biological elements are deemed to be of low vulnerability, high recoverability and local to international importance. Therefore, the assessment determined the significance of effect on the biological elements, other than seagrass (angiosperms) as minor (positive) and not significant in EIA terms. In order to counteract the loss in seagrass habitat a 'Seagrass Compensation and Monitoring Plan' has been proposed with compensatory measures to ensure there is no net loss in this habitat within the water body.

The Proposed Development is therefore not expected to have a significant effect on water quality or the ability of the waterbody to continue to achieve its WFD objectives.

12 FLOOD RISK

12.1 Introduction

This section of the EIAR considers the potential impact of the Proposed Development on flood risk within the study area. It defines the baseline flood risk from a desk-based assessment and consultation, sets out the methodology to determine the potential effects of the Proposed Development on local flood risk, and then assesses the potential impact of the Proposed Development and the residual impact following mitigation. The assessment takes account of Scottish Planning Policy (SPP), SEPA guidance and the Argyll & Bute Council Local Development Plan.

12.2 Assessment Methodology

To determine the impact of the development upon flood risk, an assessment of flood risk will be made in line with Scottish Environmental Protection Agency's (SEPA's) requirements for flood risk assessment for new development.

The following tasks will be implemented to complete the assessment:

- Identify and assess the hazard from all sources of flooding to the Proposed Development;
- Appraisal of the Proposed Development with respect to the main sources of flooding;
- Consideration of the impact of the Proposed Development on flooding elsewhere;
- Identification of any mitigation measures required;
- Assessment of any residual impacts; and
- Demonstrate that the Proposed Development complies with national planning policy and guidance.

12.3 Baseline Scenario

12.3.1 Present Day

The existing Iona Ferry Terminal consists of a slipway and pier jutting out into the Sound of Iona. The Proposed Development consists of a new rock armour breakwater to the south of the existing pier and dredging to the north of the breakwater.

SEPA flood maps[24] have been used to determine the existing flood risk to the site. A review of the SEPA strategic flood mapping identifies a risk of coastal flooding within the proposed site for all mapped events (high, medium and low likelihood). An extract from the SEPA present day coastal flood extents map is shown in Figure 12-1 with the approximate site location illustrated in red. Under Scottish Planning Policy

[24] SEPA flood maps - https://map.sepa.org.uk/floodmaps

the site would be considered as 'Medium to High Risk', where the annual probability of coastal flooding is greater than 0.5% (1:200 years).

No other potential sources of flooding were identified within the site.

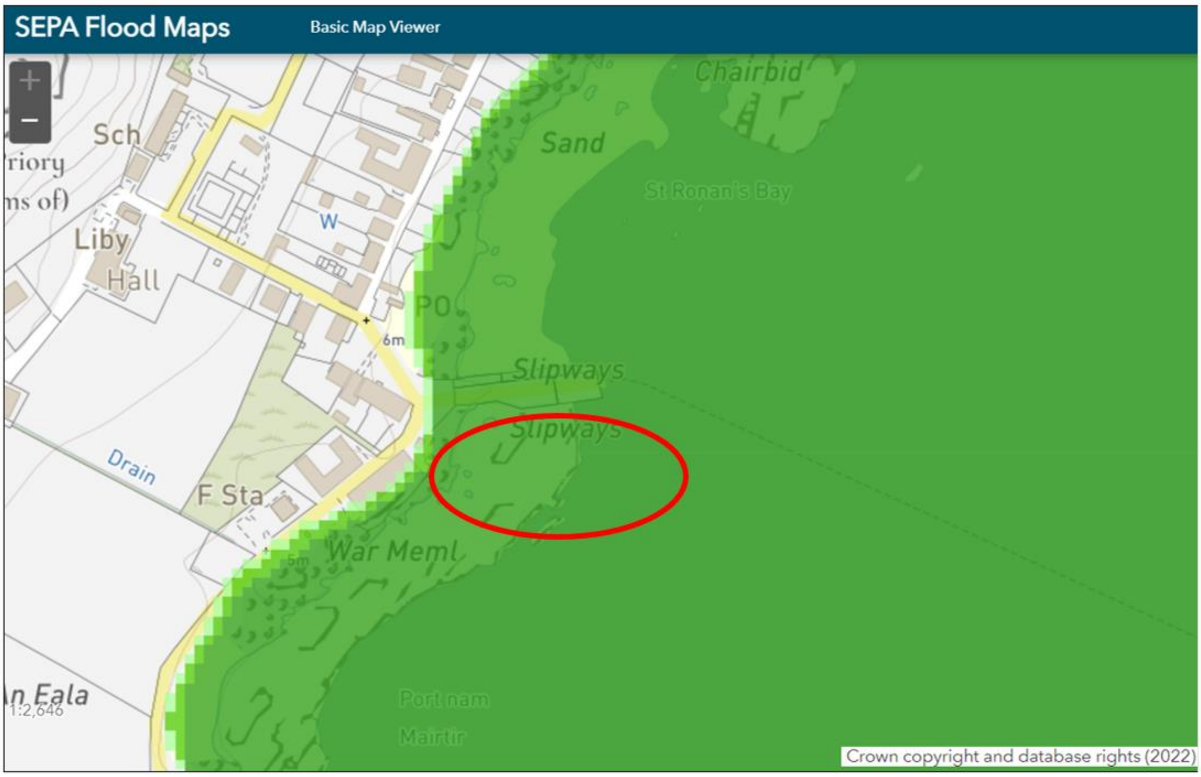


Figure 12-1 Extract from SEPA flood maps – present day coastal flood extents map (all events)

In accordance with 'Technical Flood Risk Guidance for Stakeholders', SEPA requires flood risk to be considered where available information indicates that there may be a risk of flooding to the site, or development of the site may increase risk elsewhere. As the site has been identified as at risk of coastal flooding then flood risk should be assessed.

12.3.2 Climate Change

An extract from the SEPA 2080 0.5% AEP coastal flood extents map is shown in Figure 12-2 with the approximate site location illustrated in red.

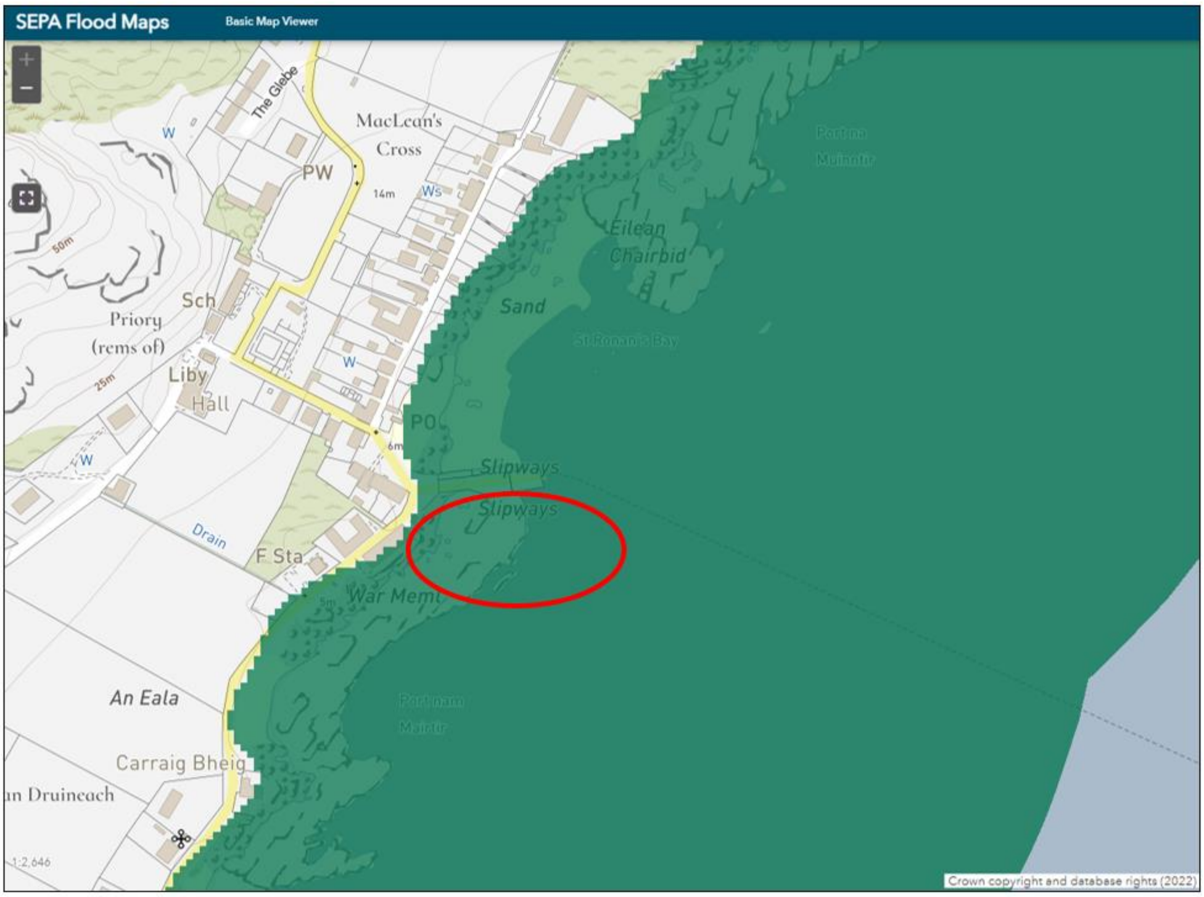


Figure 12-2 Extract from SEPA 2080 coastal flood extents map (0.5% AEP)

When considering coastal flooding, a sea level rise should be considered to account for future climate change. The SEPA publication 'Climate change allowances for flood risk assessment in land use planning' provides allowance for sea level from 2017 to 2100 based on the outputs from UK Climate Projections 2018 (UKCP18). For Argyll, which is the applicable River Basin District, the allowance is 0.86 m. As this area is vulnerable to coastal flooding, the sea level allowance of 0.86 m used by used.

12.4 Description of Likely Significant Effects

12.4.1 Classification of Proposed Development

As described in the SEPA 'Flood Risk & Land Use Vulnerability Guidance', the proposed works can be classified as 'Water Compatible Uses' (docks, marinas and wharves). This type of use is generally suitable for development in all flood risk areas, including 'Medium to High Risk' areas. There are no elements of the proposal that would be considered as unsuitable in terms of flood risk. It is important to note that the developments permitted in these areas will be at risk of flooding, so mitigation measures are required.

Policy SG LDP SERV 7 'Flooding and Land Erosion' of the Argyll & Bute Local Development Plan Supplementary Guidance states that '*Essential development such as navigation and water-based* *recreation use, agriculture and essential transport' is acceptable in 'medium to high risk areas'*. The development is therefore in accordance with this policy.

12.4.2 Assessment of Construction Effects

As the area is at risk of coastal flooding (Figure 12-2), during construction, there is a risk of flooding to the works from extreme tidal events that will need to be managed.

12.4.3 Assessment of Operational Effects

The Proposed Development will be at risk of coastal flooding during the operational phase. The proposed breakwater is not designed for flood protection but rather for the protection of the ferries from rough seas. The breakwater will not be adversely affected during extreme tidal events as it has been designed to withstand these events.

Wider coastal processes should always be considered when assessing coastal flood risk, in particular thinking about how coastal flooding may be exacerbated in certain locations due to physical factors that can occur individually or in combination as a result of the project. Coastal process modelling has been undertaken (see Chapter 13). This shows that the tidal currents and levels within the Sound of Iona are predicted to remain substantially unchanged in the operational phase when the project is considered alone, and in combination with the Fionnphort project. Minor local changes to the currents are expected around the breakwater such as an increase in the current velocity around the structure. The impact on the existing tidal regime is, therefore, determined to be negligible. The assessment of potential changes to the inshore wave climate found that the maximum change in wave heights in the Sound of Iona during storm events from the southwest did not exceed ±0.20 m during high water springs. These increases were confined primarily to the outer face of the breakwater, with a large decrease in wave height behind the breakwater as per the design requirements. Minimal change in the wave height is observed elsewhere in the Sound of Iona, and when the project is considered in combination with the development at Fionnphort. These changes to the wave climate behind the structure are considered significantly beneficial to slipway users and ferry users and would not increase the risk of coastal flooding in the area. Overall, the Proposed Development does not increase the risk of coastal flooding by altering tidal levels or wave overtopping.

It should be noted that the existing slipway and pier are currently at risk of coastal flooding, and this will still be the case with the Proposed Development. As the site is already operating for the same use there will be no new receptors introduced into the flood hazard area and therefore there is no increase to the overall flood risk.

The proposed works will not create any surface water runoff that could cause a flood risk. No connections are required to the Scottish Water system.

12.5 Mitigation Measures

12.5.1 Construction Phase

During construction, there is a risk of flooding to the works from extreme tidal events. Floodline is operated by SEPA. It provides live flooding information and advice on how to prepare for or cope with the impacts of flooding 24 hours a day, 7 days a week. The contractor can sign up to the service and get notified when the area is at risk of flooding. The Scottish Flood Forecast is a new 3-day flood forecast which is produced by the Scottish Flood Forecasting Service (SFFS) daily. The SFFS is a partnership between SEPA and the Met Office. It is available on SEPA's website at www.sepa.org.uk/scottishfloodforecast. The Scottish Flood Forecast complements the existing regional flood alerting and local flood warning services. The use of these services can ensure that the risk of flooding to the construction works is minimised.

12.5.2 Operational Phase

Mitigation measures are elements of design that may be used to manage flood risk to the development, or to avoid an increase in flood risk elsewhere. The proposed rock armour breakwater has been designed to withstand extreme tidal events and therefore no mitigation measures are proposed to manage flood risk to the development itself. The impact of the Proposed Development on the existing tidal regime is determined to be negligible and no mitigation measures are required to avoid an increase in flood risk elsewhere.

Whilst the physical infrastructure of the Proposed Development will not be adversely impacted by flooding, mitigation measures are required for the users of the Proposed Development. Tidal warning will be the key mitigation measure for the operation of the site. The Floodline Warning Service and the Scottish Flood Forecast as described above can be used. If an extreme event is forecast, any sailings from the ferry terminal are likely to be cancelled. Given that the entire area is at risk of coastal flooding, it is likely to be completely closed and evacuated, which will ensure people are not at risk in the area.

12.6 Potential Cumulative Effects

There will be no cumulative impact on coastal flood risk when the Proposed Development is considered together with other Proposed Developments in the area.

12.7 Residual Effects

Residual flood risk is the risk that remains after all mitigation measures have been taken to reduce the frequency of flooding. Coastal flood risk will remain following the completion of the development. However, given the current risk of coastal flooding, sufficient warning will be available to evacuate the area. This means that there is a low likelihood of any potential flood risk areas being occupied. The proposed infrastructure is resilient to flooding in that no damage will be caused by extreme tidal events. The overall residual risk is considered to be low.

12.8 Conclusions and Summary of Effects

The flood risk to the application site has been assessed and the predominant source of flood risk emanates from coastal flooding. Under Scottish Planning Policy the site would be considered as 'Medium to High Risk', where the annual probability of coastal flooding is greater than 0.5% (1:200 years). No other potential sources of flooding were identified within the site.

As described in SEPA 'Flood Risk & Land Use Vulnerability Classification', the proposed works can be classified as 'Water Compatible Uses' which are generally suitable for development in all flood risk areas, including 'Medium to High Risk' areas. It is important to note that the developments permitted in these areas will be at risk of flooding, so mitigation measures are required. The proposed works are also in accordance with Policy SG LDP SERV 7 'Flooding and Land Erosion' of the Argyll & Bute Local Development Plan Supplementary Guidance which states that '*Essential development such as navigation and water-based recreation use, agriculture and essential transport' is acceptable in 'medium to high risk areas'*.

During construction, there is a risk of flooding to the works from extreme tidal events that will need to be managed. Floodline operated by SEPA and the Scottish Flood Forecasting Service (SFFS), which is a partnership between SEPA and the Met Office, can be used by the Contractor to ensure that the risk of flooding to the construction works is minimised.

It should be noted that the existing slipway and pier are currently at risk of coastal flooding, and this will still be the case with the Proposed Development. As the site is already operating for the same use there will be no new receptors introduced into the flood hazard area and therefore there is no increase to the overall flood risk.

The Proposed Development will be at risk of coastal flooding during the operational phase. Mitigation measures are elements of design that may be used to manage flood risk to the development, or to avoid an increase in flood risk elsewhere. The proposed rock armour breakwater has been designed for extreme tidal events and therefore no mitigation measures are proposed to manage flood risk to the development itself. The impact of the Proposed Development on the existing tidal regime is determined to be negligible and no mitigation measures are required to avoid an increase in flood risk elsewhere. Whilst the physical infrastructure of the Proposed Development will not be adversely impacted by flooding, mitigation measures are required for the users of the Proposed Development. Tidal warning will be the key mitigation measure for the operation of the site. The Floodline Warning Service and the Scottish Flood Forecast can be used. If an extreme event is forecast, any sailings from the ferry terminal are likely to be cancelled. The entire area is at risk of coastal flooding so it is likely to be closed and evacuated, which will ensure people are not at risk in the area.

13 COASTAL PROCESSES

13.1 Introduction

This chapter assesses the potential impact of the Proposed Development on the coastal processes in the Sound of Iona, including information about the tidal regime and the inshore wave climate, to enable the competent authority to determine the potential impacts on coastal processes.

As this chapter includes information regarding wave climate and sediments in the receiving environment along the proposed breakwater, as well as more generally within the Sound of Iona, its findings are also of relevance to Chapters 11 and 12, which concern Water Quality and Flood Risk, respectively.

The assessment presented in this Chapter is based on the project description detailed in Chapter 3 of this EIAR.

13.2 Assessment Methodology

13.2.1 Modelling Methodology

RPS used the MIKE 21 hydrodynamic numerical modelling software package developed by the Danish Hydraulic Institute (DHI), to address potential coastal processes impacts / issues. This was achieved by developing a range of two-dimensional numerical models to represent:

- the pre-project scenario; and
- the post-project scenario with the Iona breakwater in place.

These models were used in conjunction with hydrographic survey data and site-specific sediment data to assess the potential construction and operational impacts of the Proposed Development in the context of the following coastal processes:

- The tidal regime;
- The inshore wave climate at high water springs;
- Littoral currents; and
- Sedimentology.

The impact of the Proposed Development on these coastal processes has been quantified using difference plots throughout this chapter, i.e., post-project minus pre-project conditions. As such, the extent and magnitude of potential impacts as a result of the Proposed Development could be identified and compared against baseline conditions. To conclude the assessment, mitigation measures were proposed to reduce impacts, where appropriate. This enabled a “with mitigation” assessment to be made of any residual impact as a result of the construction and operational phases of the Proposed Development and/or in combination with other projects in the vicinity of Iona. In particular, this included the assessment of the in-combination effects resulting from the construction of a similar breakwater at Fionnphort to ensure all potential environmental effects were identified. The scoping response from

Marine Scotland Science supported the use of a 1 in 100-year event as a worst-case scenario, however, this assessment has used a 1 in 200-year event as the worst-case scenario to provide a more robust assessment.

13.2.2 Coastal Process Modelling Software

A suite of coastal process models, based on the MIKE software developed by DHI, was used to assess the potential impact of the Proposed Development on the coastal processes within the Sound of Iona. The MIKE system is a state-of-the-art, industry-standard, modelling system, based on a flexible mesh approach. This software was developed for applications within oceanographic, coastal and estuarine environments.

A brief synopsis of the MIKE system and modules used for this assessment is outlined below:

MIKE 21 & MIKE 3 Flow Model FM system - Using these flexible mesh modelling systems, it is possible to simulate the mutual interaction between currents, waves and sediment transport by dynamically coupling the relevant modules in both two and three dimensions. Hence, full feedback on the bed level changes on the waves and flow calculation can be included.

The Hydrodynamic module –This module can simulate water level variations and flows in response to various forcing functions in lakes, estuaries and coastal regions. The Hydrodynamic (HD) Module is the basic computational component of the MIKE 21 and MIKE 3 Flow Model systems, providing the hydrodynamic basis for the Sediment Transport and Spectral Wave modules.

The Hydrodynamic module solves the two/three-dimensional incompressible Reynolds averaged Navier-Stokes equations subject to the assumptions of Boussinesq and hydrostatic pressure. Thus, the module consists of continuity, momentum, temperature, salinity and density equations. When used in three dimensions, the free surface is considered using a sigma coordinate transformation approach whereby the vertical layer is divided equally into a discrete number of layers.

The Spectral Wave module – This module simulates the growth, decay and transformation of wind-generated waves and swell in offshore and coastal areas and accounts for key physical phenomena including wave growth by wave action, dissipation, refraction, shoaling and wave-current interaction.

13.2.3 Coastal Process Models and Data Sources

The models outlined above, were used to assess the impact of the Proposed Development on the coastal processes and were developed from RPS' present-day West Coast Model (waves) and Irish Storm Surge Forecasting (ISSF) Model (tides) (Figure 13-1).

These models were created using flexible mesh technology and provide detailed information on the coastal processes around the Sound of Iona. The model uses mesh sizes varying from 7 km at the outer boundary of the model down to 20 m along the approach channel and around the harbour. The bathymetry of this model was developed using data gathered from a hydrographic survey of the Sound of Iona undertaken in 2020 by Aspect Surveys Ltd and supplemented by data from the Admiralty, European Marine Observation and Data Network and CMap. The extent, mesh structure and bathymetry of this model for the Sound of Iona are illustrated in Figure 13-2. The coverage of the scatter data used for interpolating the mesh for the tidal and wave models is included in Figure 13-3 and Figure 13-4.

The model used for the operational scenario was created using the proposed design for the Iona breakwater. It should be noted that the model does not consider the design elements below the seabed level, such as the base of the breakwater, as this does not affect the outcome of the coastal processes assessment. As such, the outline of the Iona breakwater in the figures in this chapter is used to show the location of the breakwater and outline of the main structure, rather than the outline of the structure below the seabed.

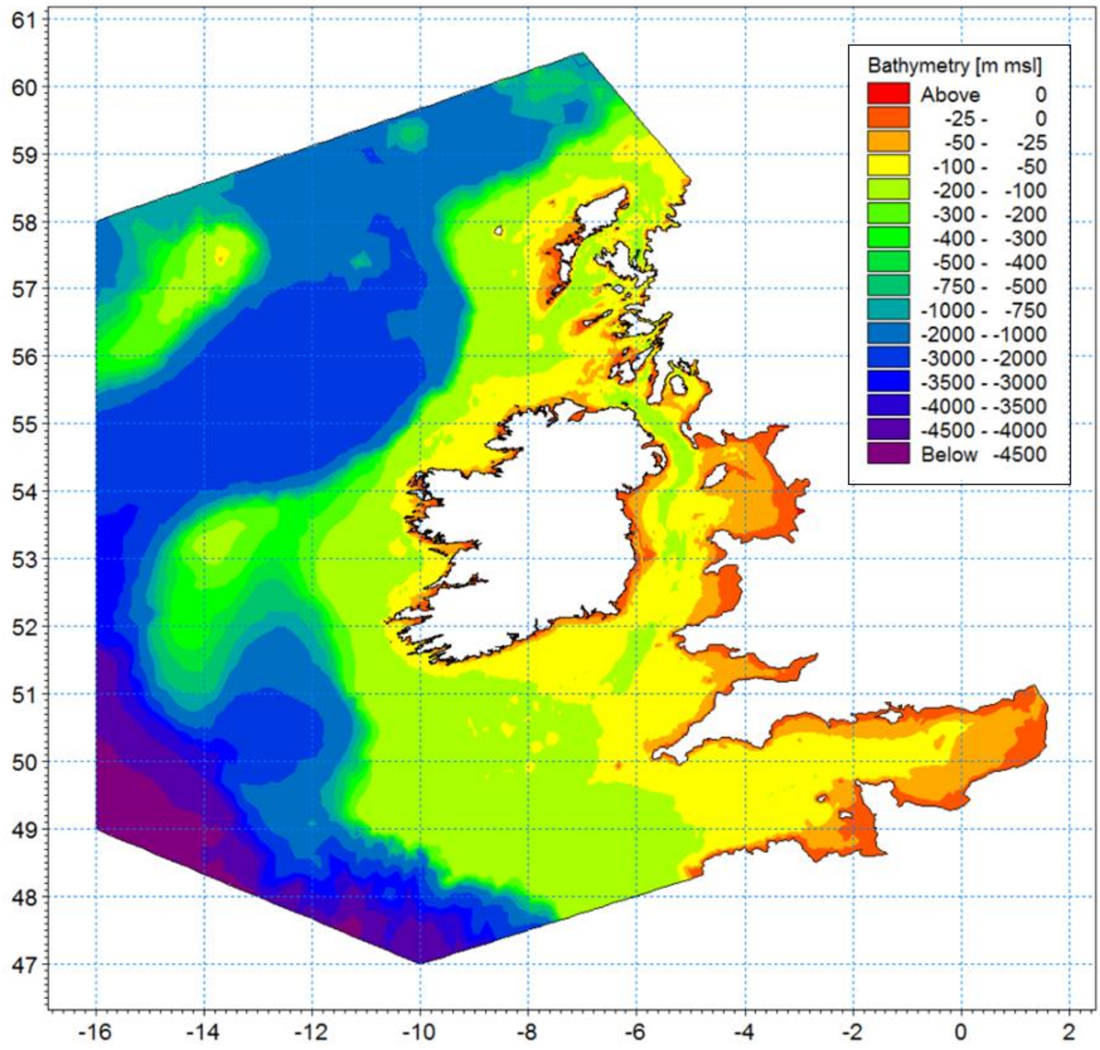


Figure 13-1 Extent of the Irish Storm Surge Forecast Model which includes the Study Area

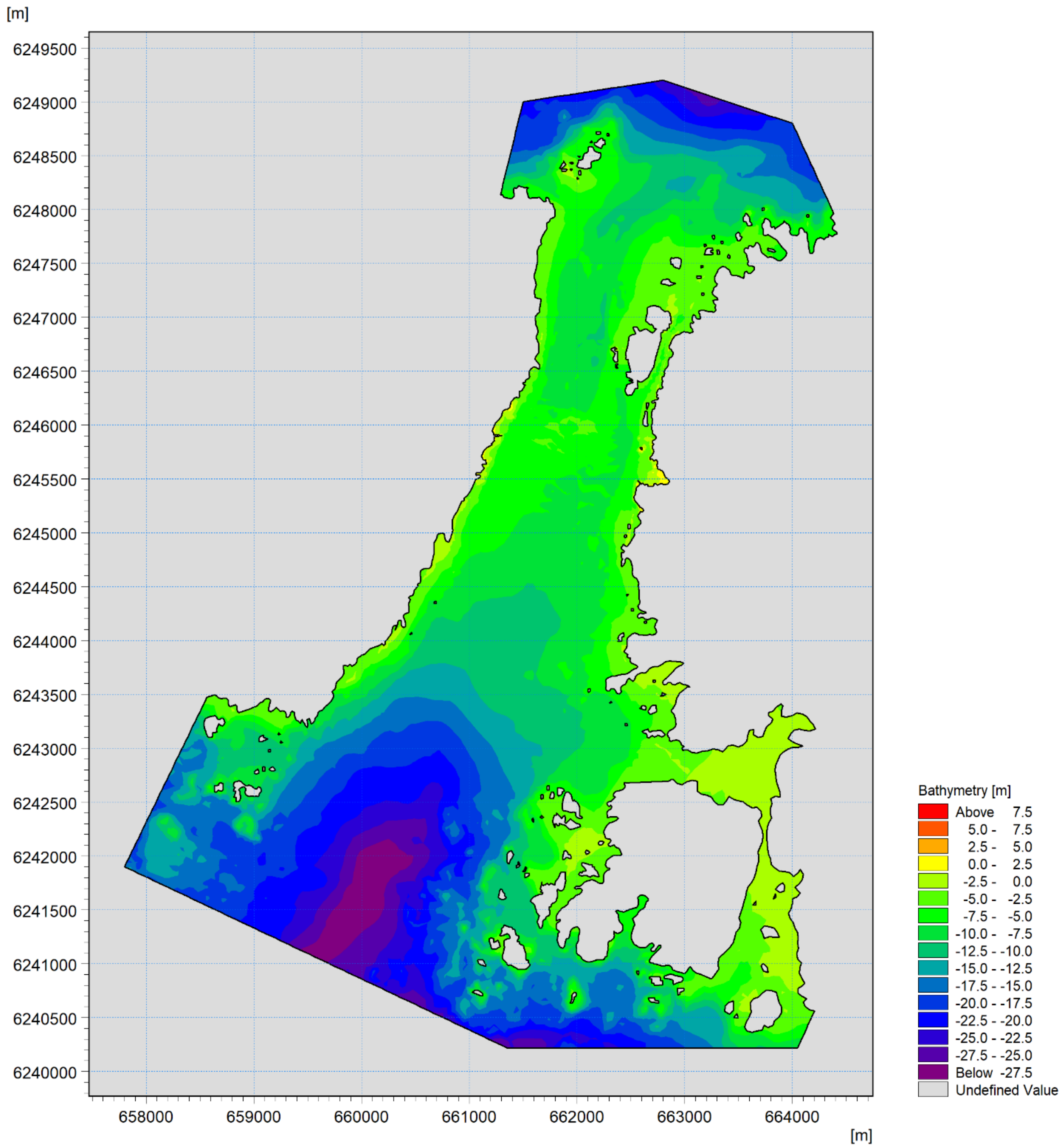


Figure 13-2 Extent and bathymetry of the Sound of Iona model

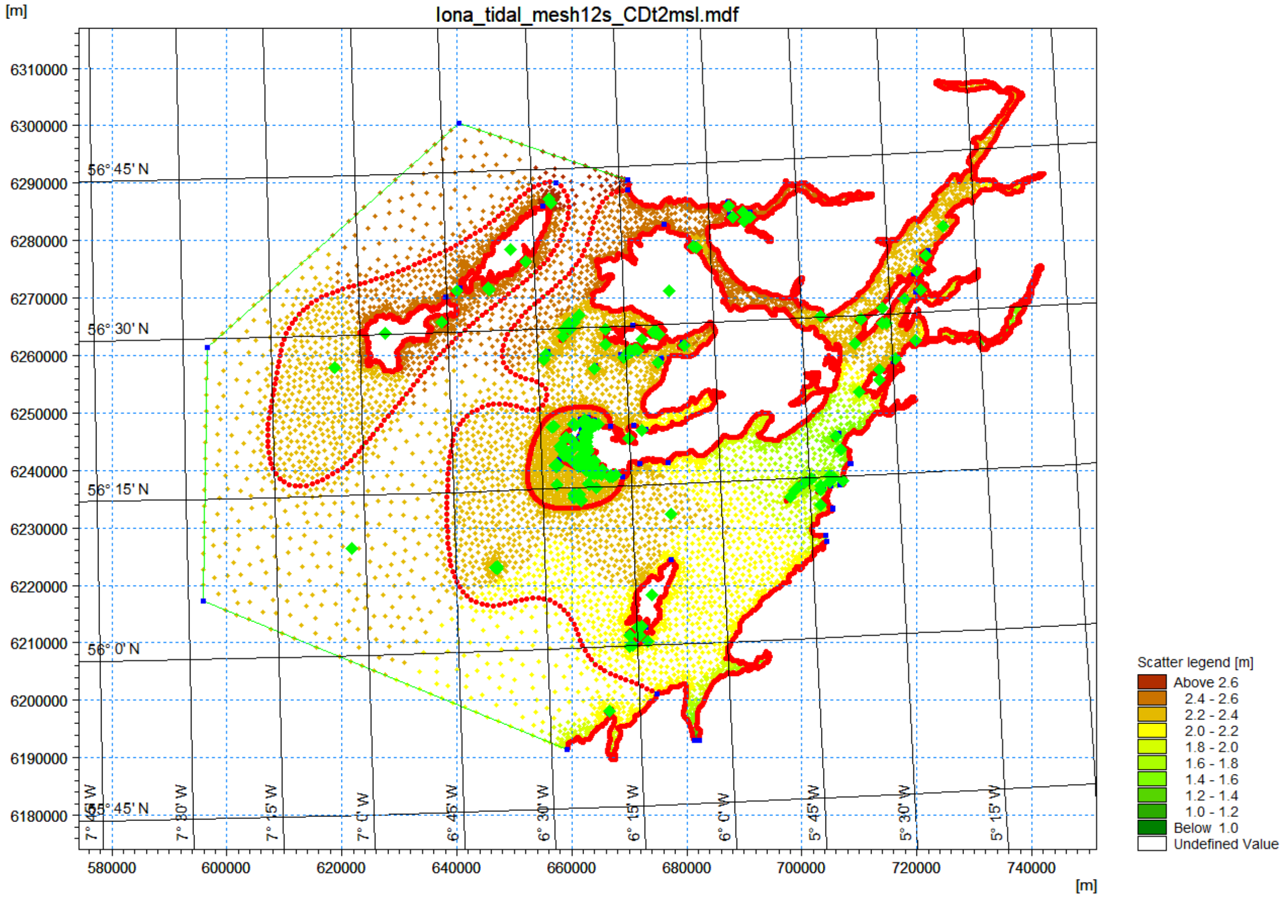


Figure 13-3 Scatter data coverage used for the tidal model bathymetry

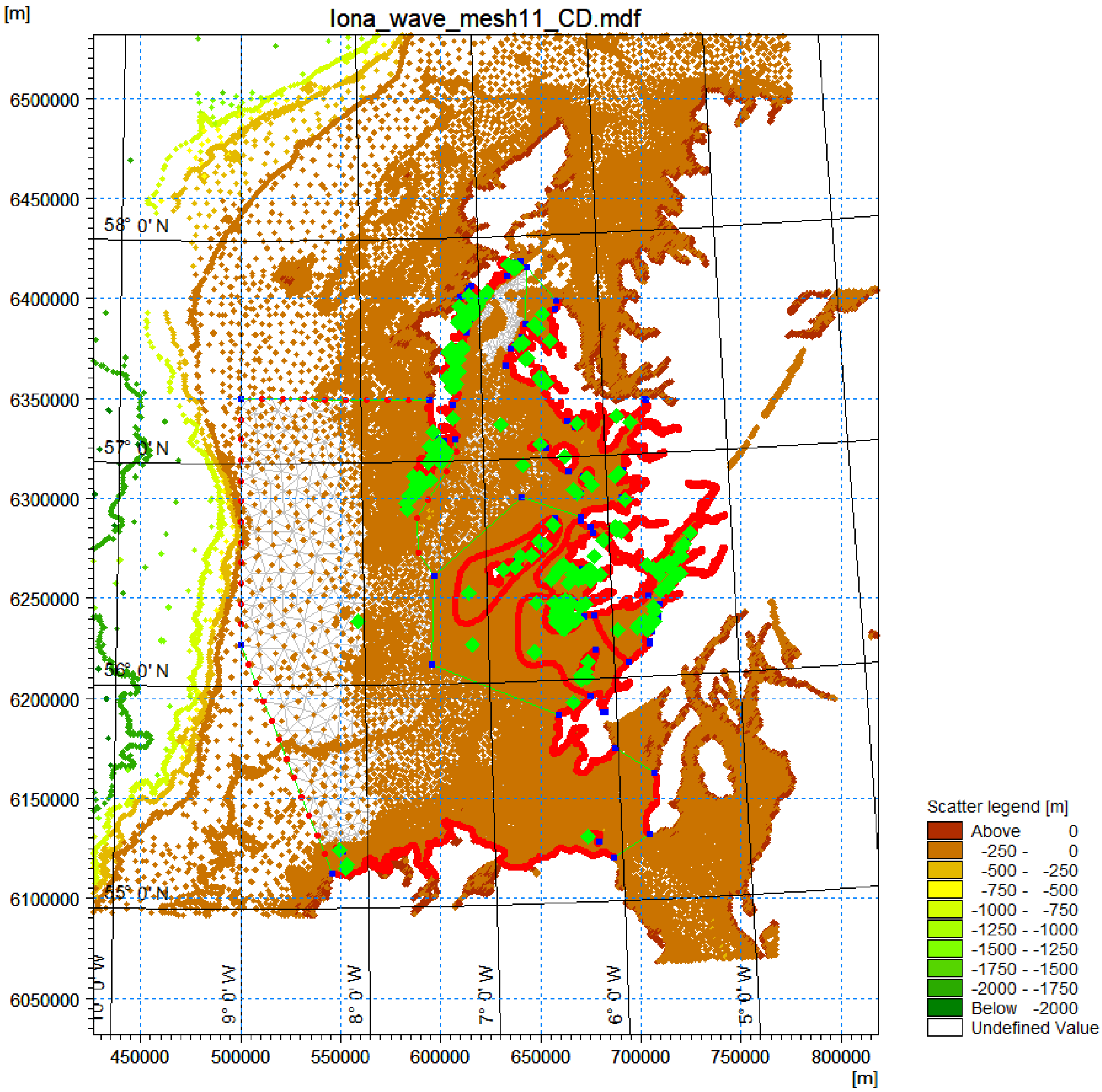
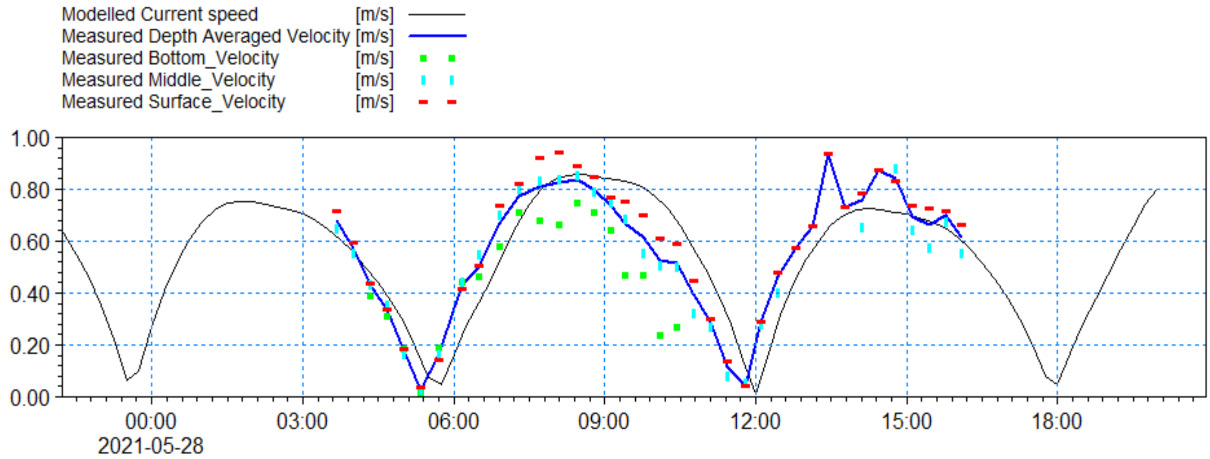


Figure 13-4 Scatter data coverage used for the wave model from the West Coast Model

The ISSF model was then updated to produce a 2D version of the model that represented the baseline scenario. The ISSF model was further updated to produce a second 2D version, representing the operational scenario with the Proposed Development in place. As such the post-project scenario model had updated bathymetry at the proposed breakwater and in the area of the dredging works. These 2D models were used to appraise the impact of the Proposed Development on the existing tidal regime, the inshore wave climate and the change in littoral currents in the area.

In addition to the Sound of Iona bathymetric survey, sediment samples were collected in the area for Particle Size Analysis (PSA). This supports the Marine Scotland Science (MSS) statement in the Scoping Opinion that further data collection was required for the validation of the assessment.

The tidal flows in and around the Sound of Iona were calibrated using the recorded acoustic doppler current profile (ADCP) data from the site. This data was collected by Environmental Tracing[25] during the Spring and Neap tides of May and June 2021. The model is seen to correlate well with both the current speed and direction for the spring tides (Figure 13-5). There is less correlation for the neap tide, however, it is less critical and considered adequate for the study. The ADCP sited offshore of Iona showed moderate tidal currents with the general direction of flow towards the north north-east during the flood tides and towards the south south-west during the ebb tide. Spring tidal current speeds are more than 0.8m/s on both flood and ebb tides. Lower current speeds were captured offshore of Fionnphort, with currents over 0.4 m/s towards the north-north-east during flood tide and similar magnitude currents towards the south south-west during the ebb. The model verification process confirmed that the present Sound of Iona model provides a very good representation of the baseline coastal processes in the area.



(n.b. x axis = time and y axis = tide height)

Figure 13-5 Comparison of model and recorded ADCP current direction at Iona during springs

13.2.3.1 Boundary Conditions

The UK Hydrographic Office states that the mean tidal range at the Secondary Port of Iona (closest measured / monitored location) is approximately 2.5 m with the following characteristics in metres referenced to Chart Datum (CD):

- Mean Low Water Springs (MLWS): +0.5
- Mean Low Water Neaps (MLWN): +1.5

[25] Environmental Tracing - https://environmentaltracing.com/

- Mean Sea Level (MSL): +2.4
- Mean High Water Neaps (MHWN): +3.0
- Mean High Water Springs (MHWS): +4.0
- Highest Astronomical Tide (HAT): +4.4

The geometry of the Sound of Iona means that relatively large tidal currents in excess of 0.8 m/s are experienced in the centre as a result of the water level gradient to the entrances to the north and south of the Sound. Tidal currents are similar on the western and eastern sides of the Sound.

The tidal flow simulations which form the basis of the study were undertaken using the MIKE21 FM flexible mesh modelling system. The FM Module is a 2D, depth-averaged hydrodynamic model which simulates the water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal areas. The water levels and flows are resolved on a mesh covering the area of interest when provided with bathymetry, bed resistance coefficient, wind field, hydrodynamic boundary conditions, etc.

The tidal model mesh extends from the northwest of Coll and Tiree in the Inner Hebrides to the north coast of Islay in the south and includes details of the various estuaries within the domain, including Loch Linnhe extending to Fort William and beyond. The additional model extent was also included to incorporate the construction of the Proposed Development. This enabled the same cell arrangement to be used for the baseline and post-construction assessment, therefore omitting the introduction of any numerical mesh effects into the assessment.

The tidal model was driven using boundary conditions extracted from the RPS Irish Sea Surge model which is used for live storm surge forecasting on behalf of the Office of Public Works (OPW) for the coast of Ireland (Figure 13-6). These boundaries were fully defined ‘flather’ boundaries for which both surface elevation and current vectors are specified. The tidal flows in and around the Sound of Iona were calibrated using the recorded ADCP data from the site.

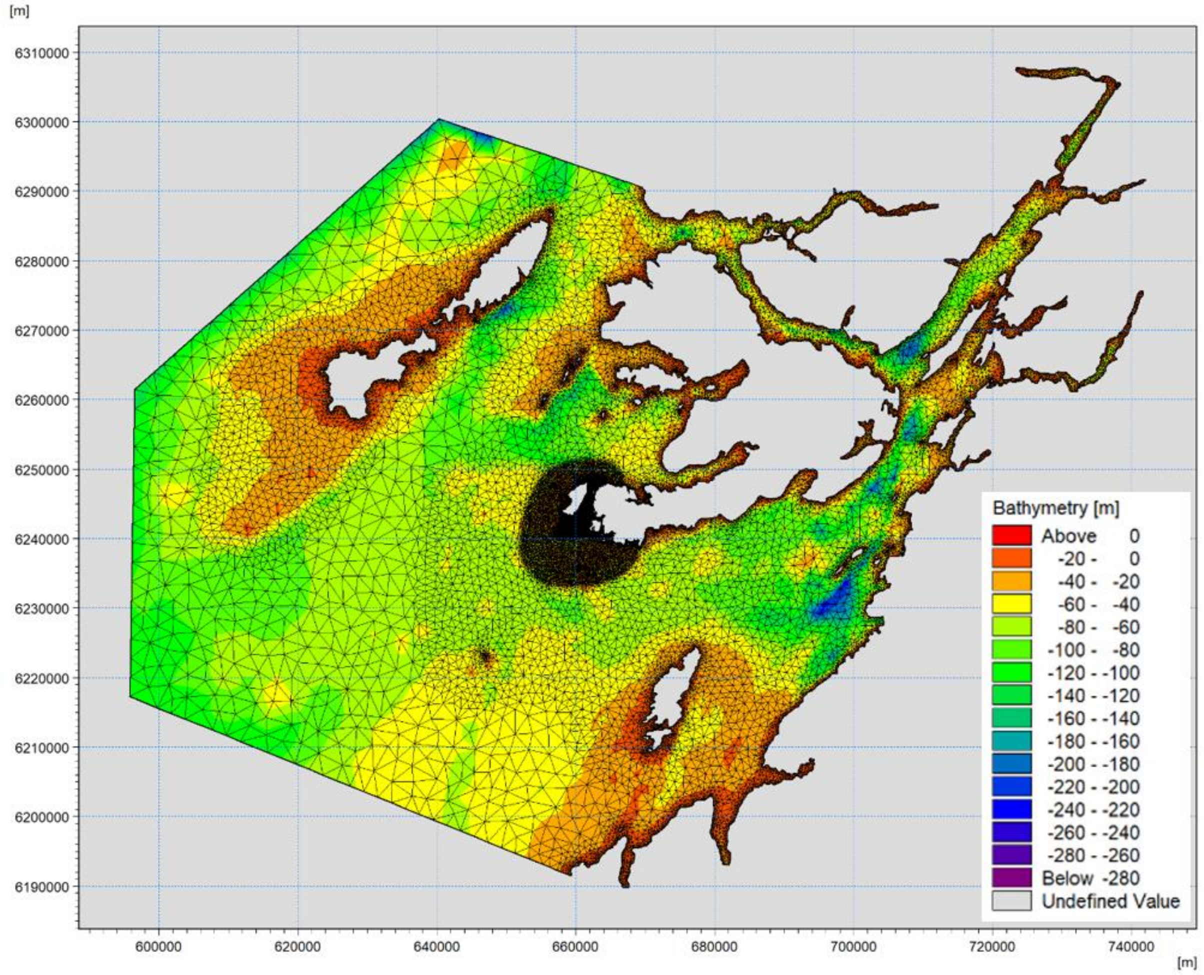


Figure 13-6 Extent and bathymetry of the ICPSS tidal surge model

An overall base wave model was developed to transform offshore waves from the Atlantic for storm directions from 210°-300° to the Sound of Iona. This model was also used to transfer waves generated over coastal waters such as the Sea of the Hebrides, the Minch and the North Channel, where Atlantic swell waves were not reaching the site, typically for storm directions from 300° to 360° and 180° to 210°. This model is shown in Figure 13-7.

A locally generated wave model was also developed to generate and transform waves over local fetches from the adjoining land and the mainland coast of Scotland to the site. This was undertaken for storm directions from west north-west through east northeast (285° to 60°) and also from the south-east to south (135° to 180°). Figure 13-8 shows the bathymetry of this local wave model for the waves generated over the areas immediately adjacent to the Sound of Iona. The mesh resolution in the vicinity of the Sound is shown in Figure 13-9, with an effective grid spacing of less than 20 metres in the central section of the Sound.

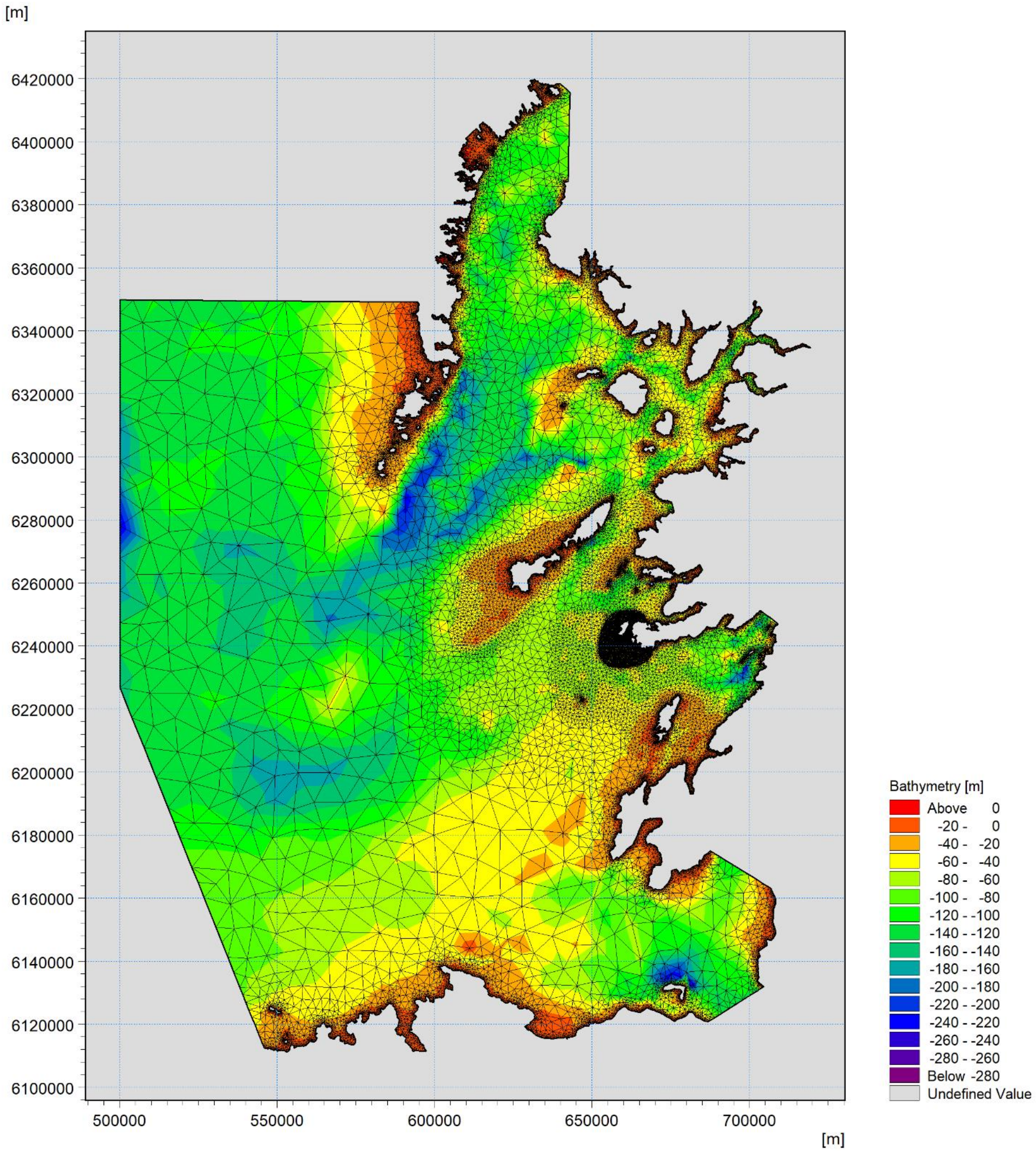


Figure 13-7 Bathymetry and mesh of the Overall Wave Model

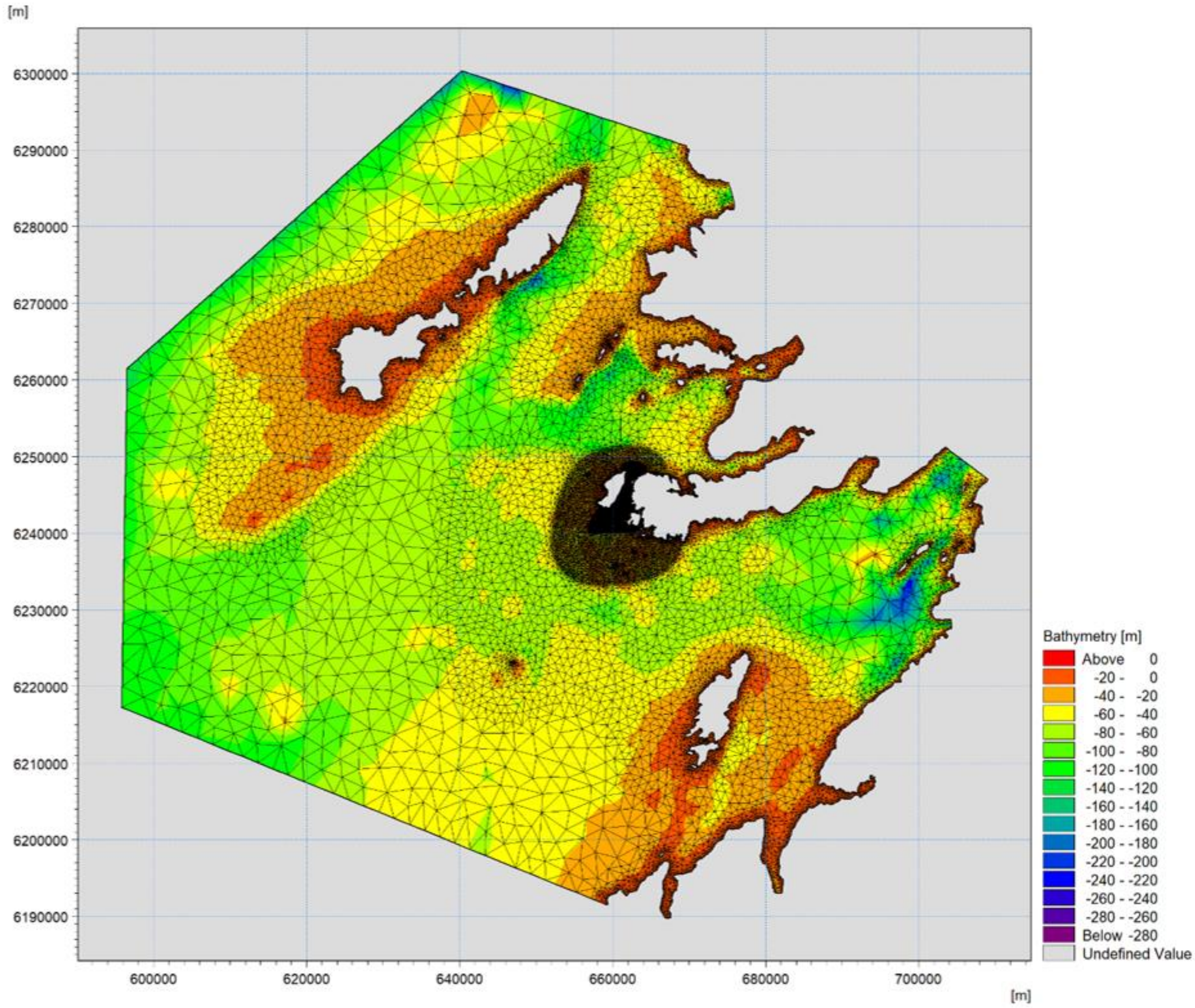


Figure 13-8 Bathymetry and Mesh of Local Wave Model

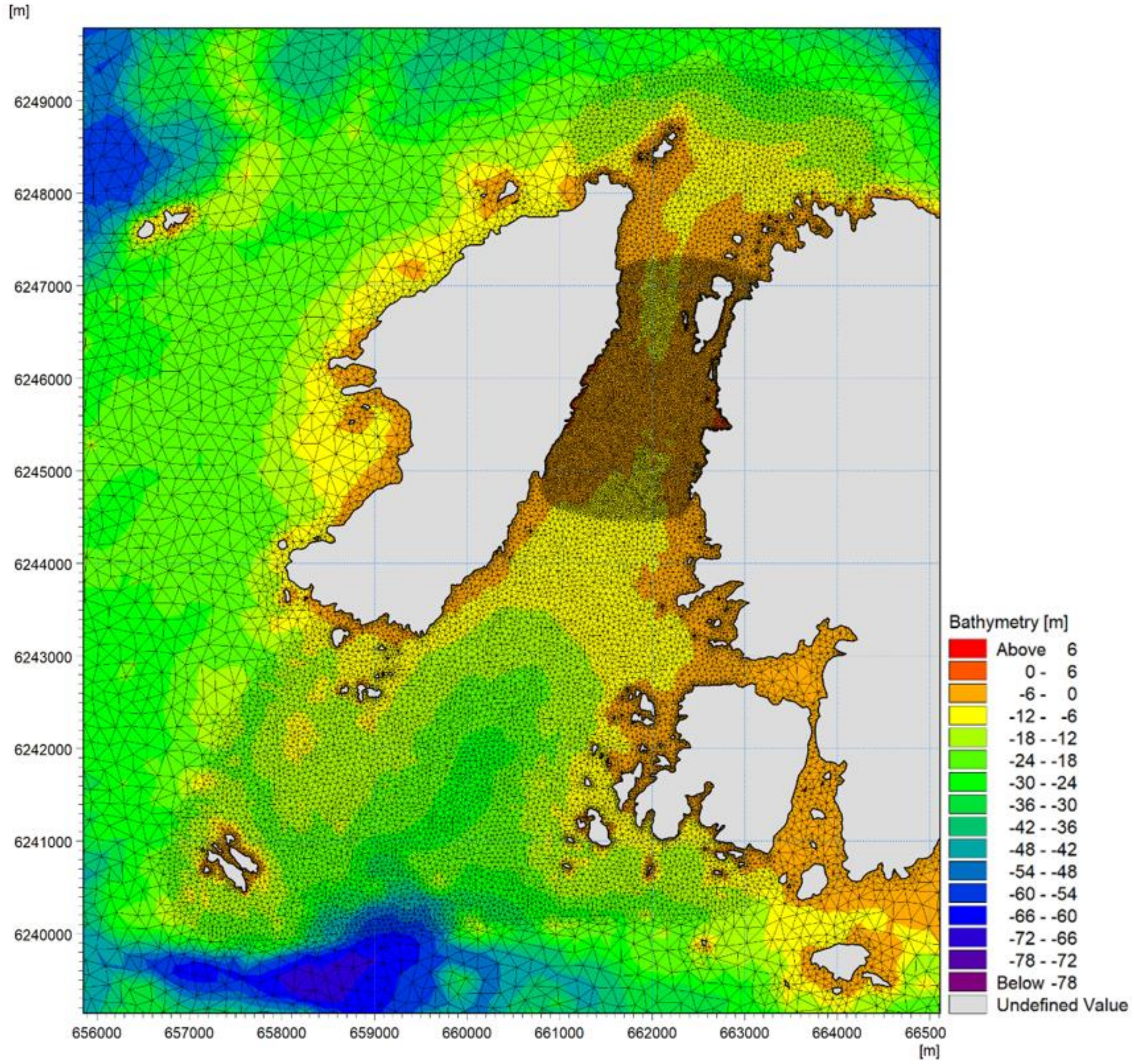


Figure 13-9 Model mesh resolution around the Sound of Iona

13.3 Baseline Scenario

13.3.1 Tidal Regime within the Sound of Iona

The MIKE 21 Hydrodynamic module described in Section 13.2.3 was used in conjunction with the baseline 2D model to derive baseline tidal regime information within the Sound of Iona.

Typical tidal flow patterns for a spring ebb and spring flood tide are presented in Figure 13-10 and Figure 13-11, respectively. The numerical model output demonstrates that tidal currents are greatly increased in the shallows between Iona and Fionnphort and around the island of Eilean nam Ban. These currents diminish rapidly as the tide flows into deeper waters to the north and south.

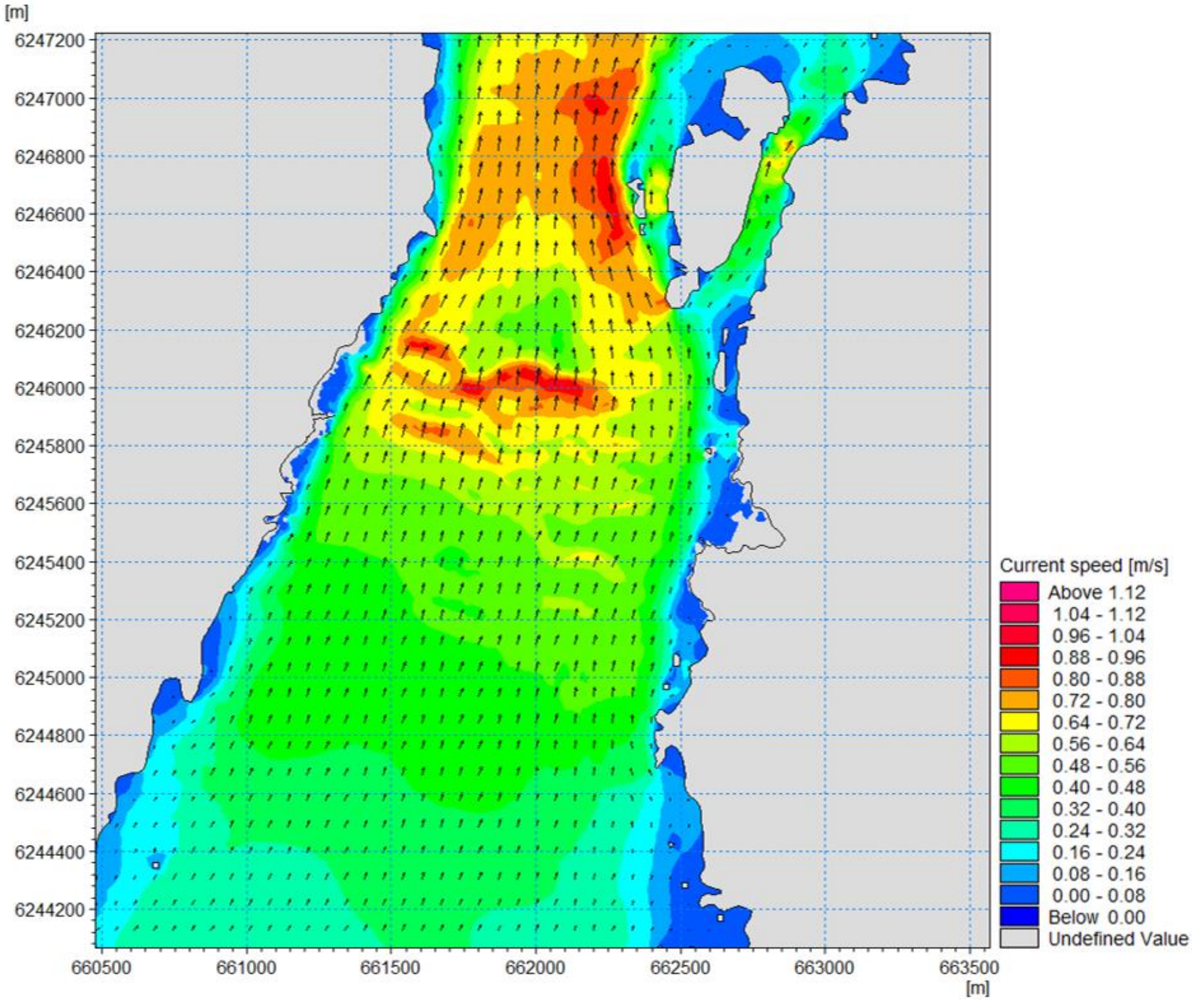


Figure 13-10 Tidal flow patterns – mid-flood

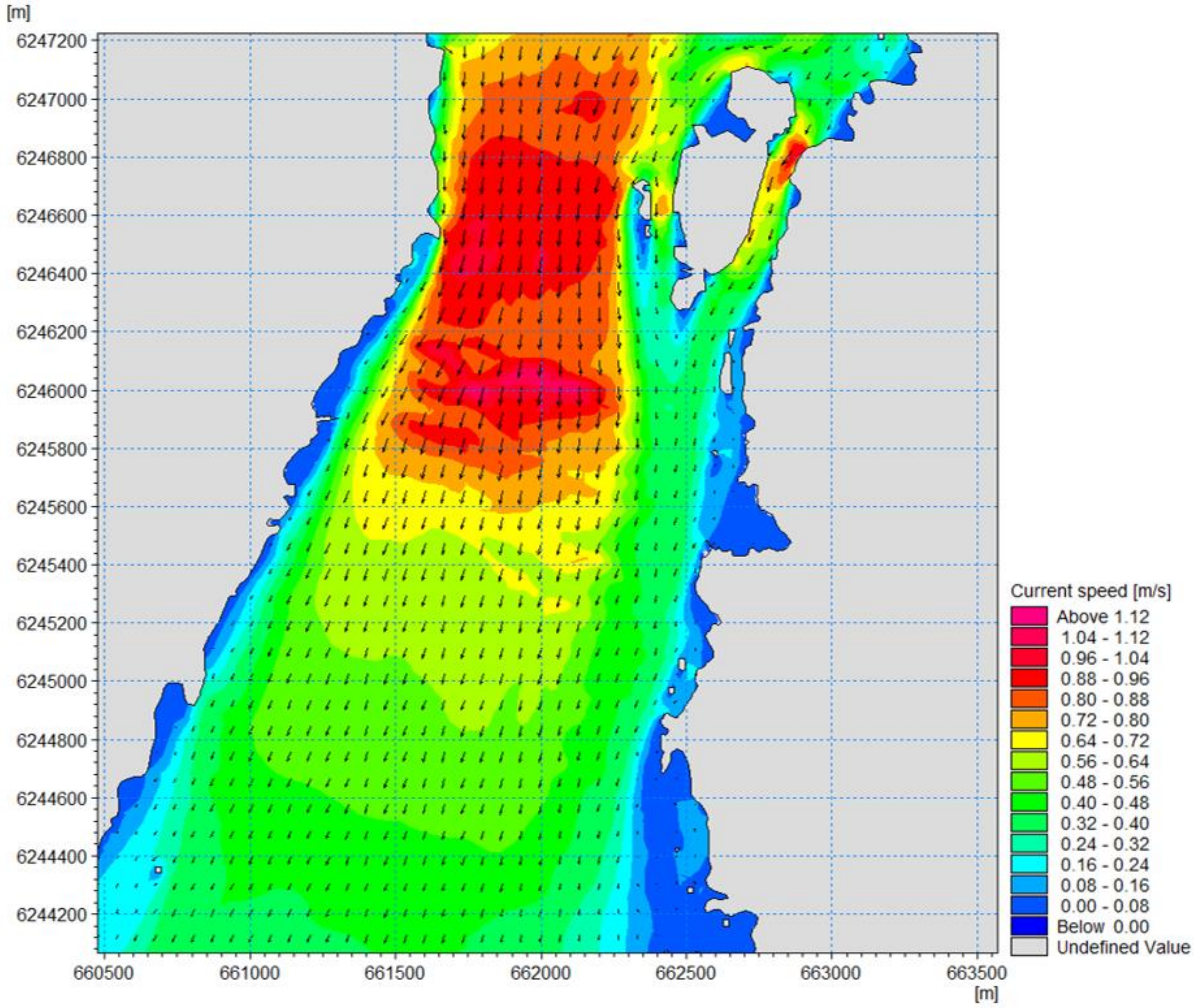


Figure 13-11 Tidal flow patterns – mid-ebb

Table 13-1 displays the return period values from the coastal flood boundary conditions for the UK. The point is extracted from the Sound of Iona and the levels are referenced to Ordnance Datum Newlyn. The previous study was carried out from 2017 to 2018 to develop and apply improved methods to update coastal extreme sea levels using a longer data record.

Table 13-1 Return period values from the coastal flood boundary conditions for the UK (Update 2018). The point is from the centre of the Sound of Iona (British National Grid Reference: X 129283, Y 723623)

Return period	**Level (m OD)**
1	2.81
5	3.05
10	3.18
50	3.43
100	3.54
200	3.65
500	3.81
1000	3.92

13.3.2 Wave Climate within the Sound of Iona

There is a dominance of south-westerly waves attributed to large Atlantic swells entering the Sound of Iona, however, smaller storms from the south, north and east also contribute to the wave climate within the sound. The prevailing wind conditions are also from the southwest.

To evaluate the potential changes in wave climate due to the Proposed Development, a comparative study was carried out. This meant that baseline wave climate was required; due to the comparative nature of the assessment, a full metocean study (the combined effect of the meteorology and oceanography) was not essential however representative sea-states were required.

Twenty-two years of data were obtained from the European Centre for Medium-range Weather Forecasting's (ECMWF's) operational dataset for locations on the north, east and south-western boundaries of the model domain. Extreme value analysis using peak over threshold was undertaken for the principal sectors to determine the extreme offshore wave climate for a range of return period events. Wave simulations were undertaken using the offshore wave climate as boundary conditions to determine the resultant wave climate at the site. This included the 1 in 1, 1 in 50 and 1 in 200 year return period offshore wave climate for every 15° directional sector from the south-east through south, west and north to 60°.

In addition to boundary wave data, it was necessary to analyse the wind field to include the contribution of local wind seas. For this, a basic wind speed for the area was taken from the British Standard Code of Practice for wind loads (BS CP3 prt2: 1972) and adjusted to represent various directional sectors and associated fetch lengths for a range of return periods.

The wave modelling was undertaken using the spectral wave model, MIKE21 SW for the overall and local meshes, to provide a full wave climate within the Sound of Iona. The model setups ensured that the detail of both locally generated wind waves and swell conditions from further afield were captured. The models resolve the wave field by simulating the wind generation of waves within the domain and the propagation of externally generated swell waves through the domain.

Flow data extracted from the tidal model discussed under Section 13.3.1 was introduced into the local wave model to determine the effects of wave-current interaction in the Sound of Iona. The tidal model and local wave model domain extents are similar, with the tidal model covering some additional estuaries omitted from the wave model. These estuaries were included in the tidal model to ensure the accurate simulation of flows and levels within the model domain, however, were not relevant to the local wind wave generation in the local wave model. When the flow data was included in the sample wave model simulations, the effects on wave climate were small in the Sound, with some minor reduction in significant wave heights noted. Therefore, it was concluded that for extreme wave simulations, the effects of wave-current interaction in the Sound could be ignored.

Results of the baseline scenario are also provided at the locations of the outer end and inner knuckle of the proposed Iona breakwater as shown in Table 13-2. This data was used for the design of the Proposed Development. The results are given for the most arduous storm directions in terms of wave heights, wave periods and wave directions for a water level of 4.65m CD (2.83m to OD Newlyn). Greater wave heights were determined at the outer end of the Iona Breakwater for waves approaching from the south, whilst the heights were reduced at the inner knuckle for waves from a more south south-east direction. It was found that the wave heights at the breakwater sites were not significantly affected by changes in water levels.

Table 13-2 Modelled Baseline Wave Climate at Iona Breakwater

	Outer end			Inner knuckle		
	Hm0	**Tp**	**MWD**	**Hm0**	**Tp**	**MWD**
1 in 1 year	2.233	13.75	190.1	1.600	13.77	166.4
	2.203	15.00	190.0	1.584	15.02	165.7
	1.771	8.47	191.0	1.290	8.49	171.6
	1.521	6.07	188.9	1.201	6.07	173.2
	0.918	4.51	38.6	0.762	3.19	51.4
1 in 50 year	2.885	17.43	190.0	2.086	17.45	166.2
	2.686	19.31	189.6	1.962	19.32	165.4
	2.557	10.07	190.2	1.880	10.08	170.0
	2.245	7.28	187.2	1.785	7.29	169.5
	1.387	3.54	39.9	1.152	3.37	54.9
1 in 200 year	3.058	17.11	190.3	2.203	17.13	167.3
	2.828	21.00	189.7	2.063	21.01	165.7
	2.847	10.36	190.2	2.101	10.37	170.1
	2.538	7.52	186.7	2.002	7.52	168.4
	1.573	3.72	40.2	1.302	3.55	56.2

Hm0 refers to the wave height, Tp refers to the peak wave period and MWD refers to the mean wave direction.

The following set of figures shows the wave climate for some of the key directions modelled. Figure 13-12 shows the significant wave height and mean wave directions for a 1 in 1 year return period event from the 240° sector which includes swell waves from the Atlantic Ocean on the approach to the Inner Hebrides, whilst Figure 13-13 shows the same event within the Sound of Iona. Figure 13-14 and Figure 13-15 show the Sound of Iona when subjected to a 1 in 200 year return period event from 210° and 315° respectively with no Atlantic swell waves.

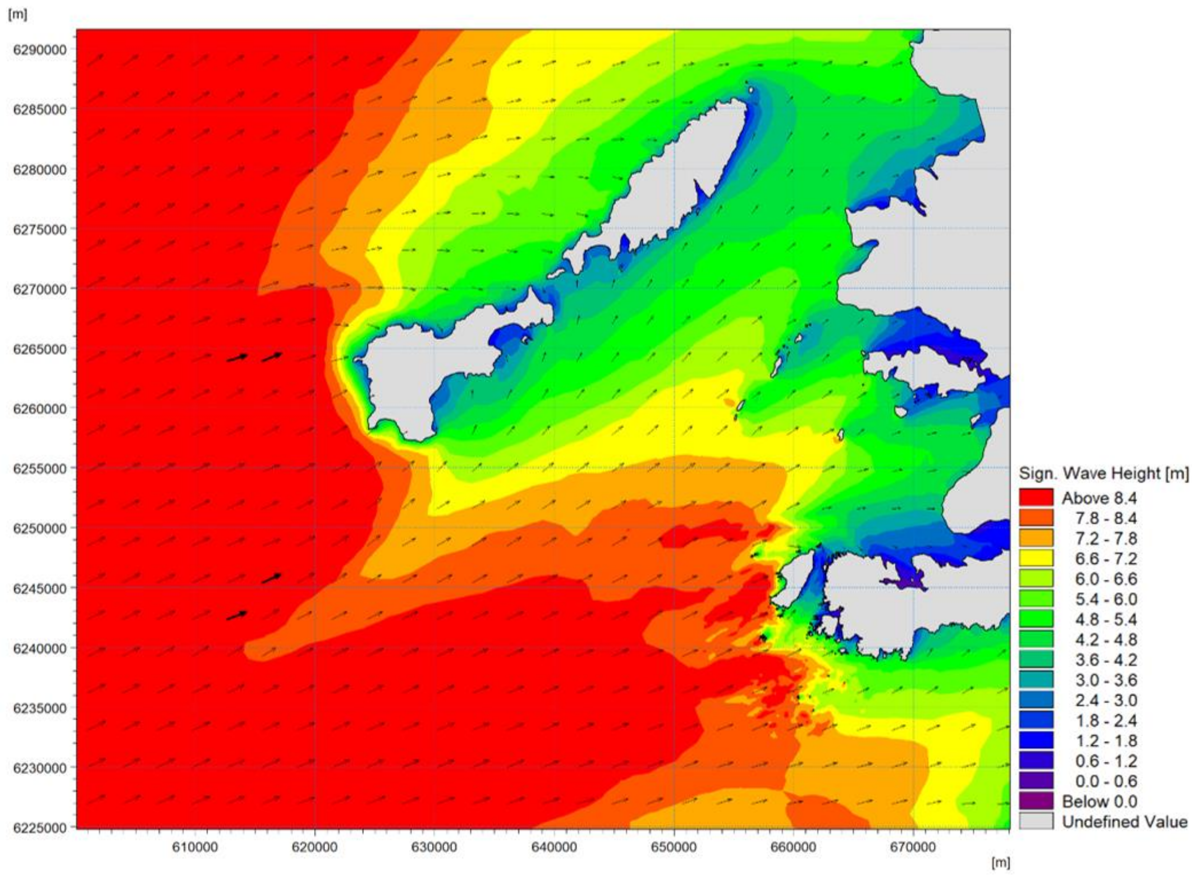


Figure 13-12 Significant wave heights and mean wave directions – 1 in 1-year storm from 240° including Atlantic swell waves

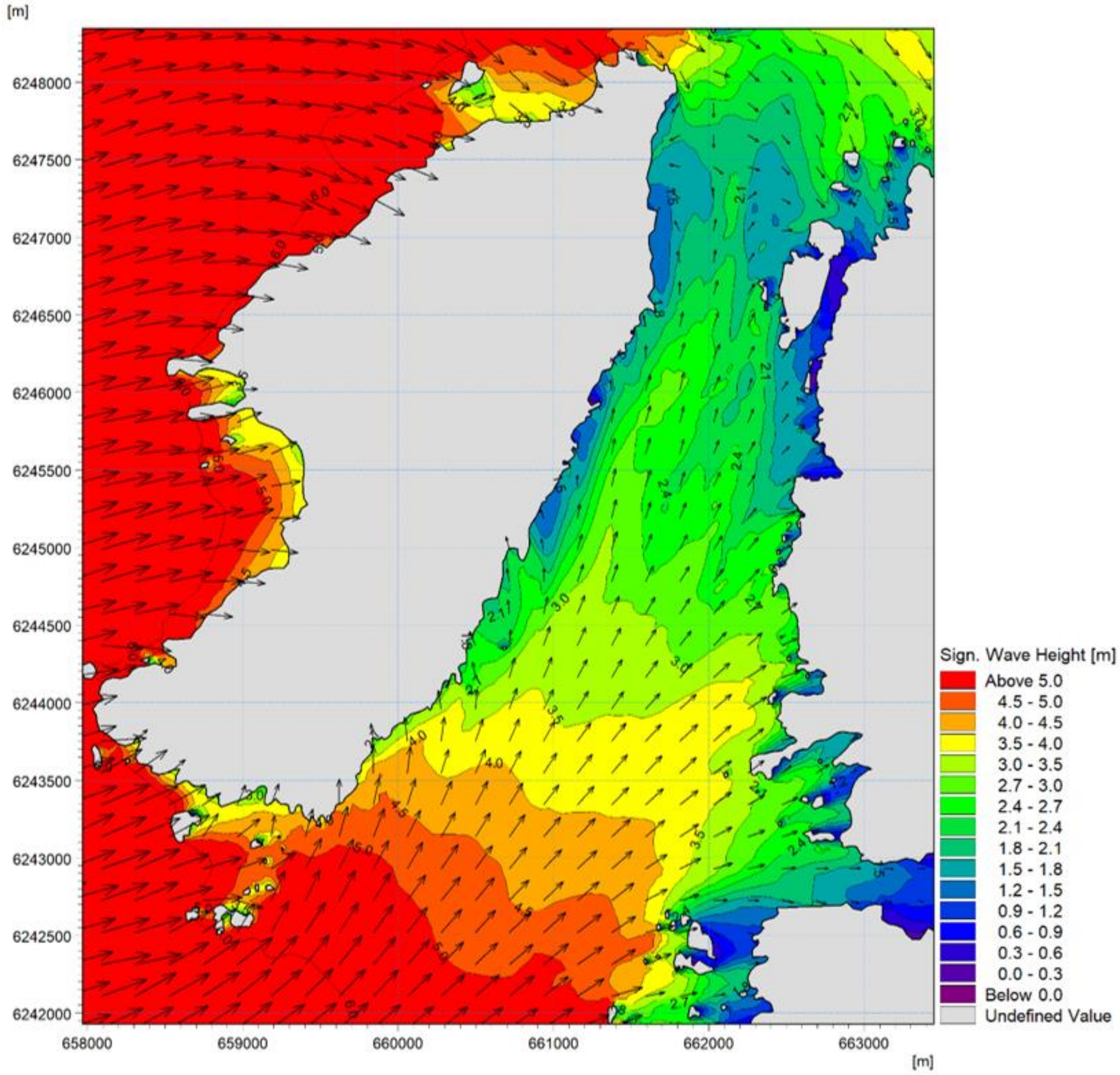


Figure 13-13 Significant wave heights and mean wave directions in the Sound of Iona – 1 in 1-year storm from 240° including Atlantic swell waves

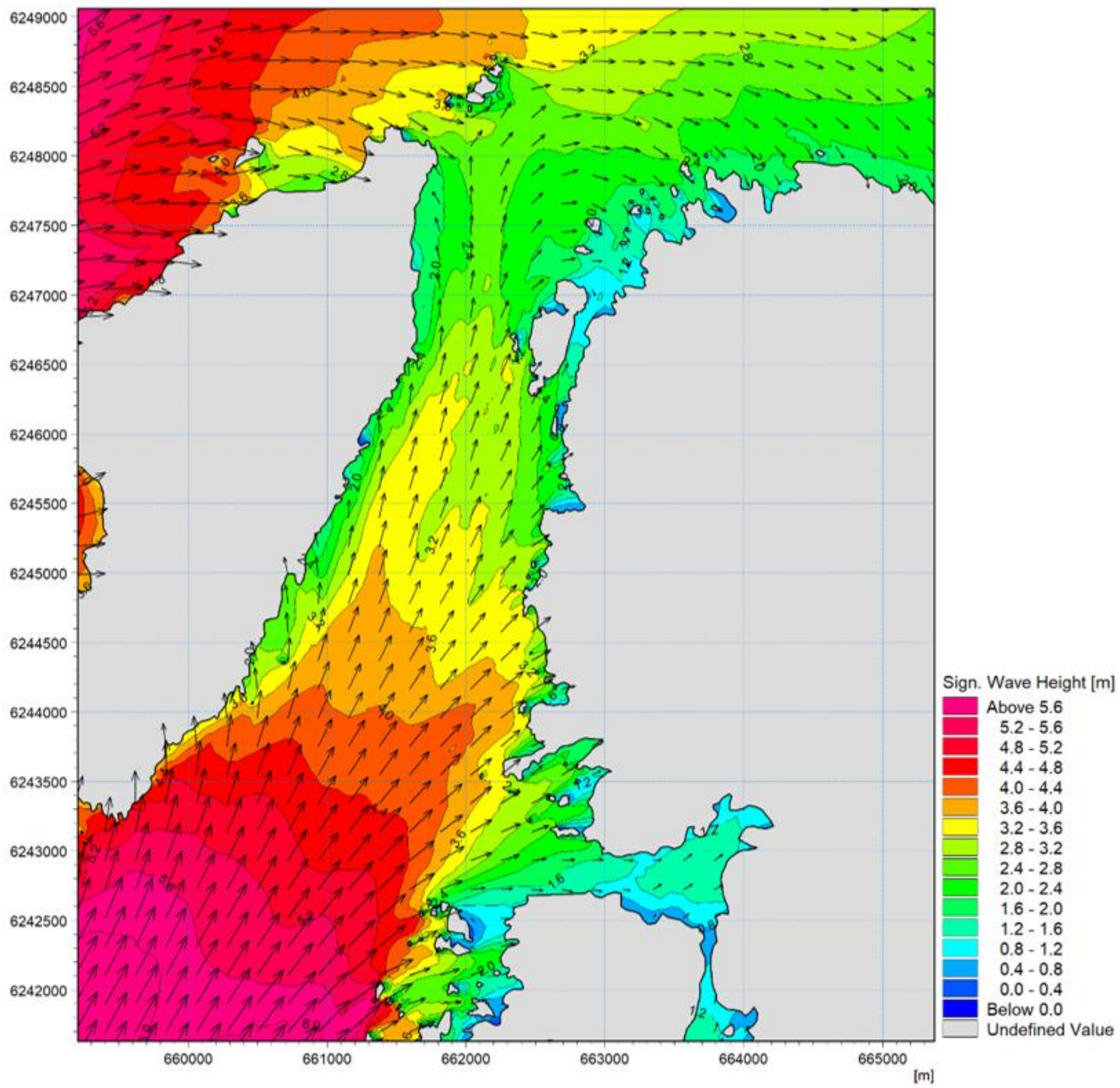


Figure 13-14 Significant wave heights and mean wave directions in the Sound of Iona – 1 in 200-year storm from 210° with no Atlantic swell waves

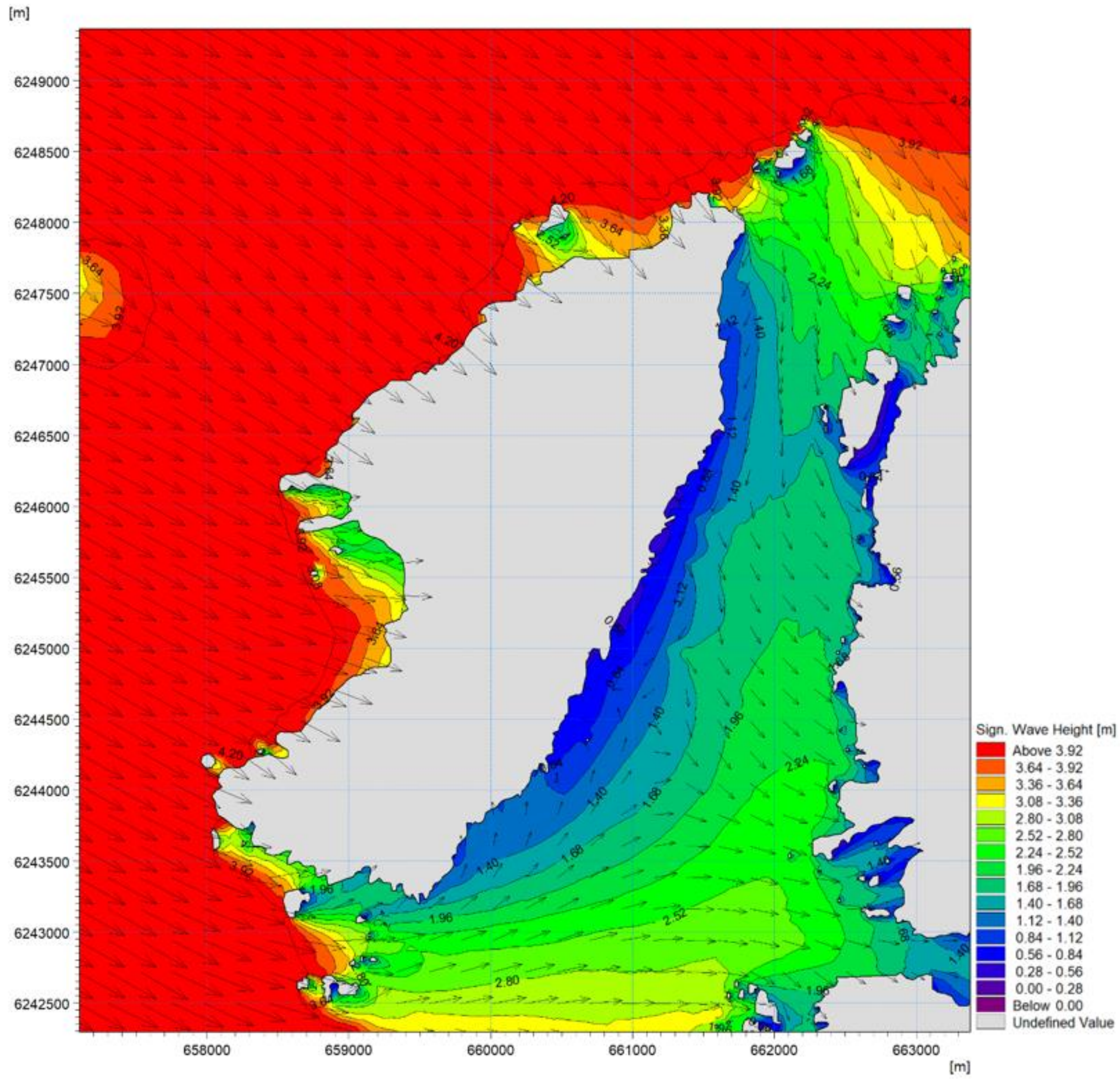


Figure 13-15 Significant wave heights and mean wave directions in the Sound of Iona – 1 in 200-year storm from 315° with no Atlantic swell waves

13.3.3 Littoral currents within the Sound of Iona

The MIKE suite facilitates the coupling of models. The depth-averaged hydrodynamic model, used for the tidal modelling, coupled with the spectral wave model, provides a full wave climate incorporating the impact of water levels and currents on waves and wave breaking. Using this, the littoral currents (i.e., those currents driven by tidal, wave and meteorological forces) were examined. This was undertaken using a mesh extracted from the original wave and tidal models and covers the Sound of Iona and its approaches. Mesh detail was included at the location of the Proposed Development to facilitate the same cell arrangement for the baseline and post-construction assessment, therefore omitting the introduction of any numerical mesh effects into the assessment.

Wave and tidal flow data were extracted from the results of the relevant simulations using the wave and tidal models discussed in previous sections. This data was used to drive the detailed coupled model of the Sound of Iona using four boundaries located at the northern end of the Sound, and a further four boundaries to the south.

The 1 in 1-year storm from 240° was simulated with the inclusion of spring tides and the resulting mid-flood and mid-ebb currents are presented in Figure 13-16 and Figure 13-18 respectively. These correspond with the (calm) tidal plots presented in Figure 13-17 and Figure 13-19. As expected, the presence of the northeast going waves increases the currents on the flood tide whilst reducing them on the ebb.

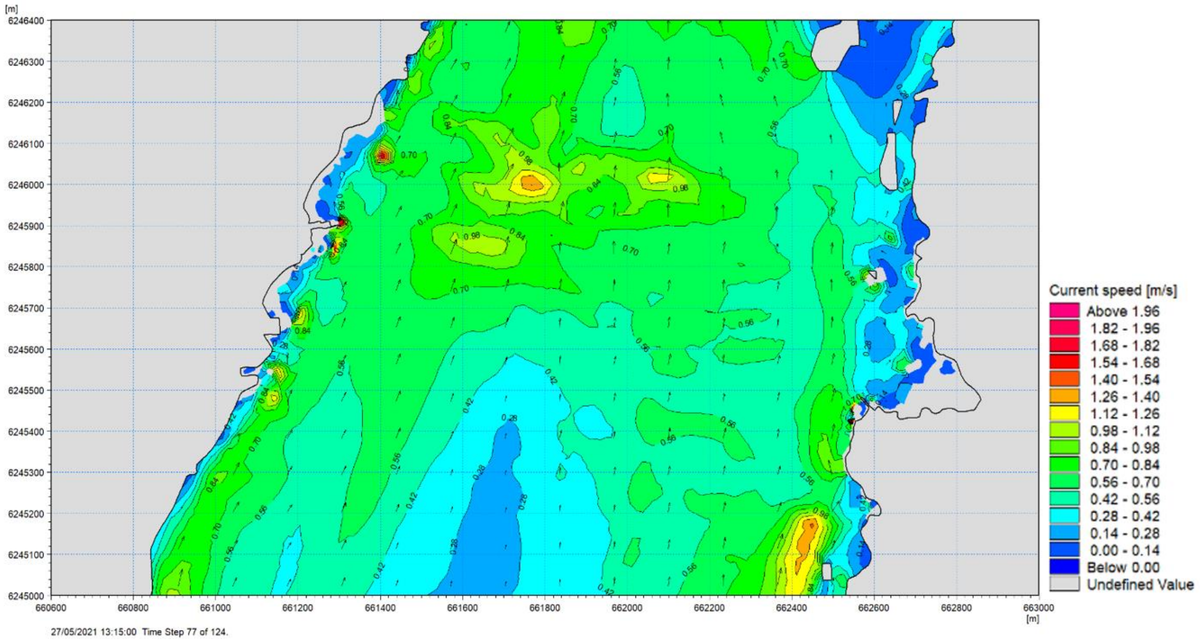


Figure 13-16 Littoral current 1:1 year storm from 240° - flood tide

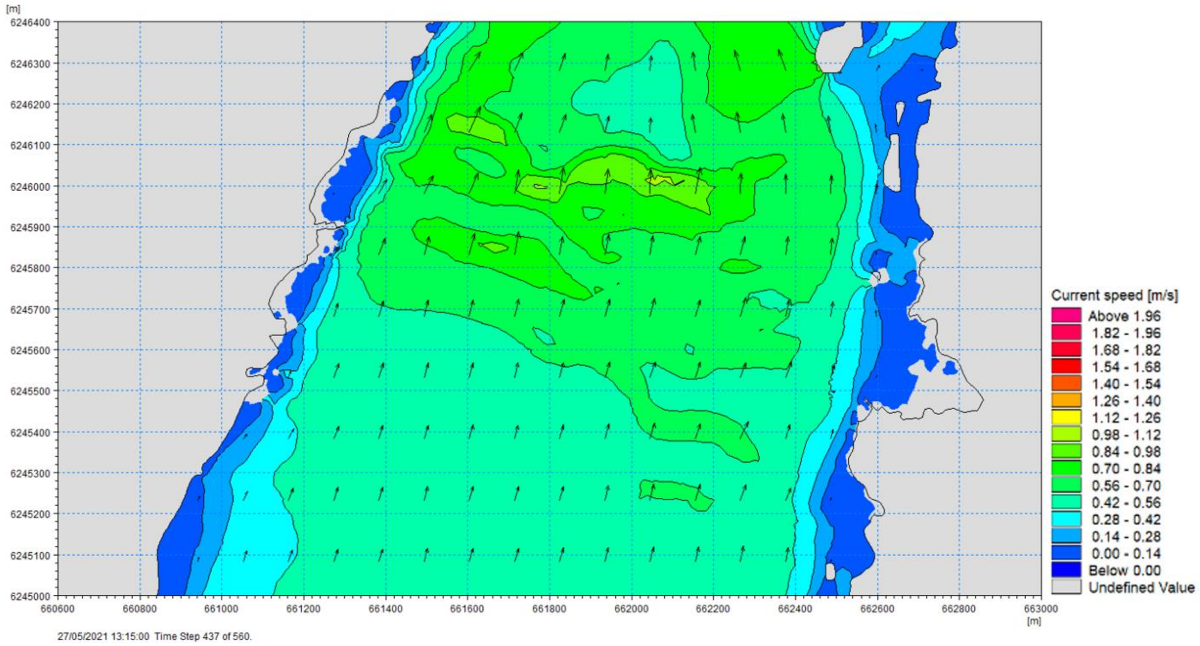


Figure 13-17 Tidal current - flood tide

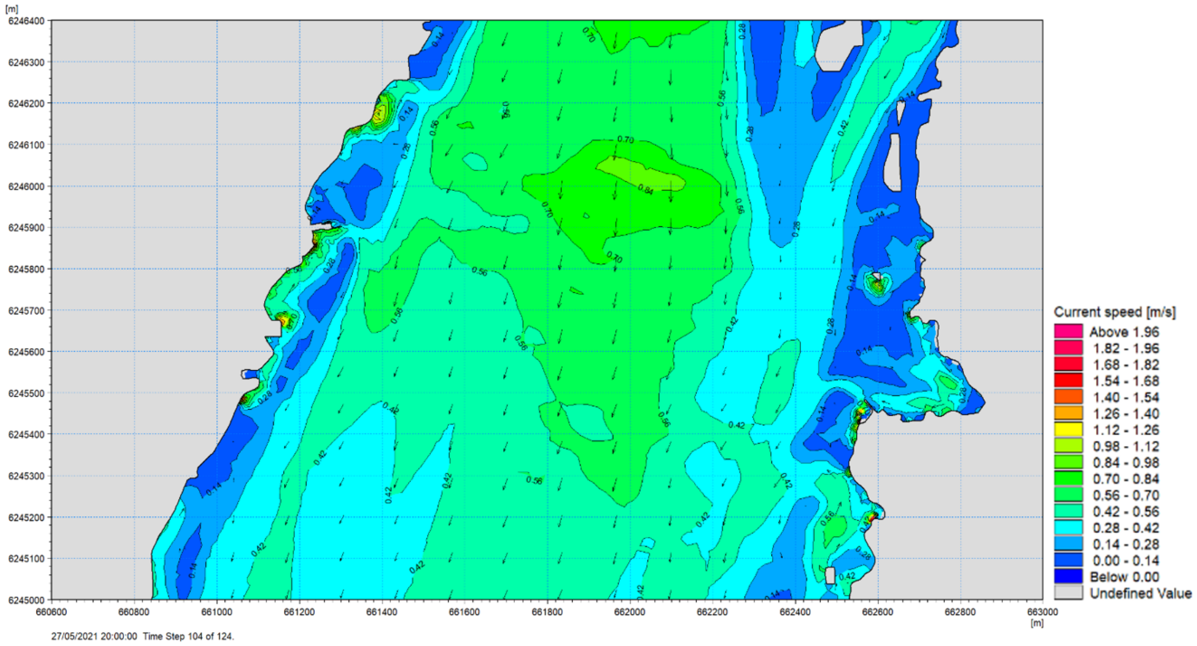


Figure 13-18 Littoral current 1:1 year storm from 240° - ebb tide.

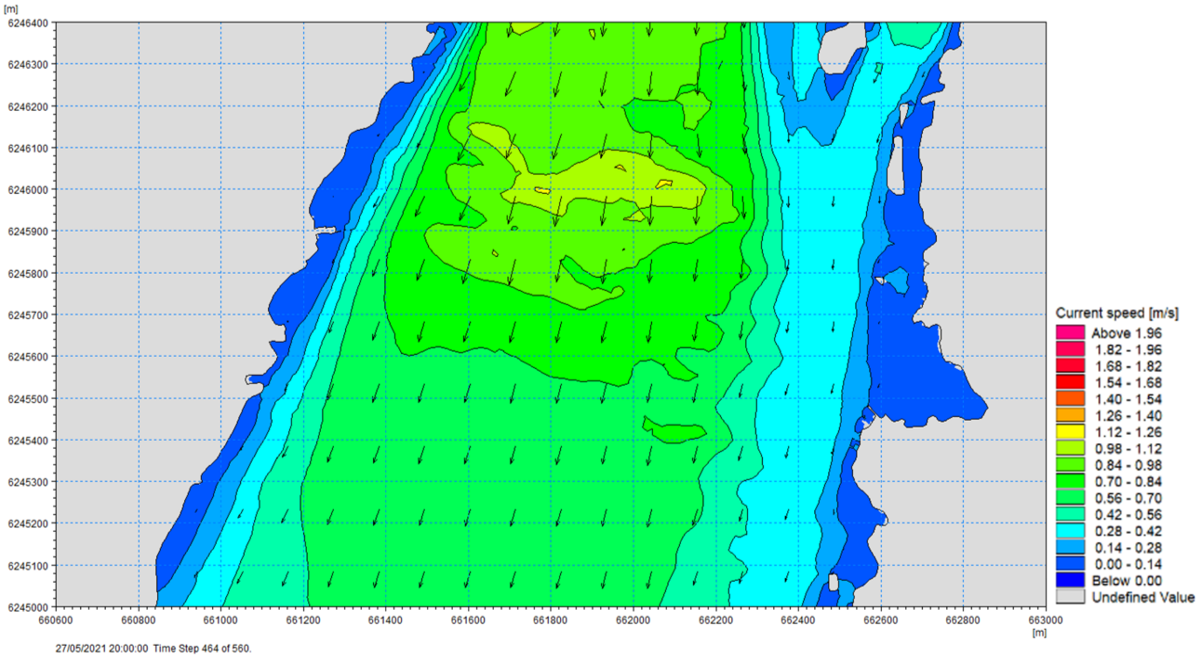


Figure 13-19 Tidal current - ebb tide.

13.3.4 Sedimentology within the Sound of Iona

Figure 13-20 and Figure 13-21 show the locations and results of the sediment grab samples and boreholes in the central section of the Sound and Iona, respectively. The area is composed mainly of fine to coarse sands and gravel, with minimal silts at the nearshore areas. As per the scoping response from Marine Scotland, an assessment of the sandwaves within the Sound of Iona must be included in the chapter. This is undertaken through assessing the sediment size from results obtained from the sediment grab samples and boreholes and through visual assessment of the sandwaves over time.

Figure 13-22 and Figure 13-23 demonstrate that there is limited migration of the sandwaves within the Sound of Iona with most of the sandwave crests not moving significantly within 6 years.

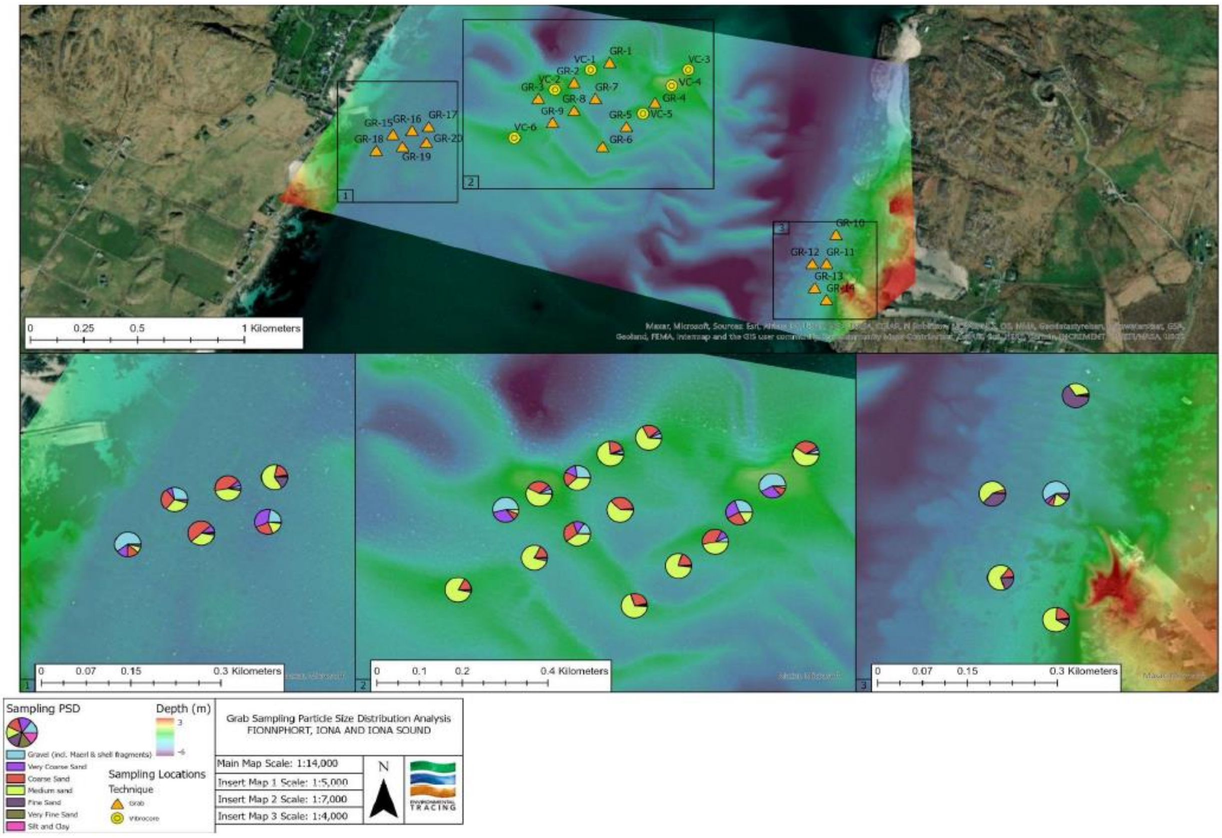


Figure 13-20 Percentage of grain sizes and locations from samples taken by Environmental Tracing Ltd in the Sound of Iona. The main sediment in Iona and the Sound of Iona are medium and coarse sands.

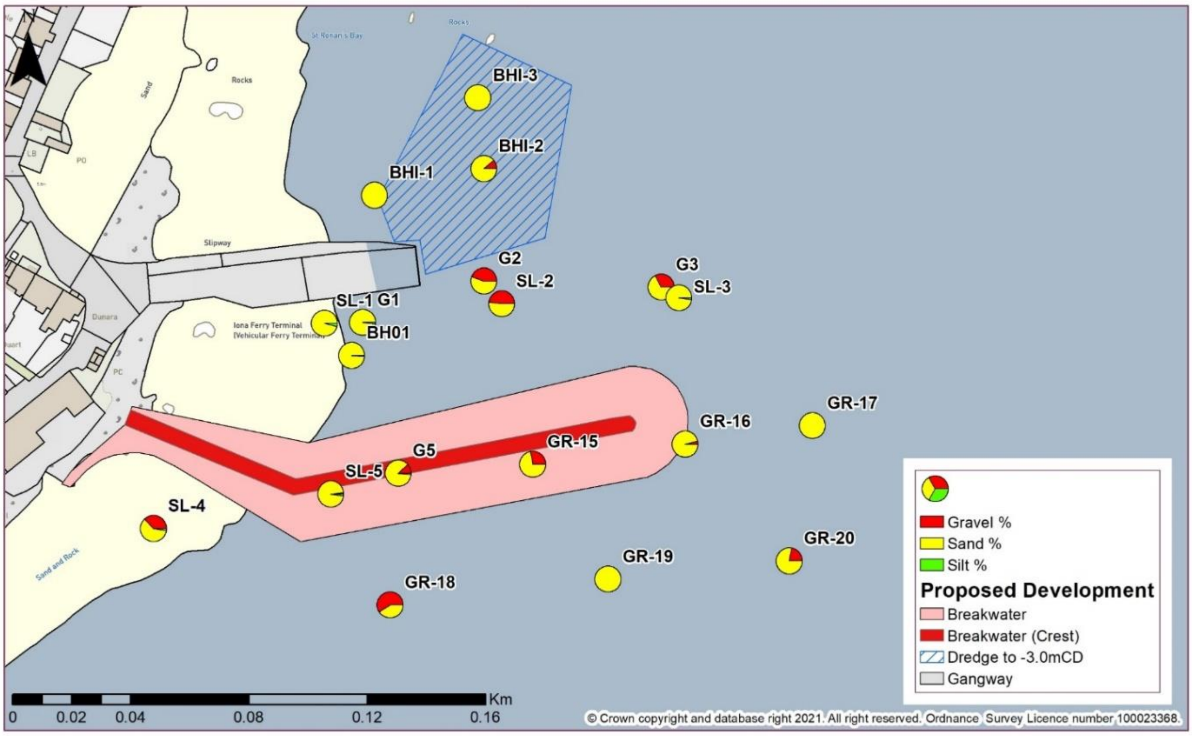


Figure 13-21 Percentage of grain sizes at the Iona breakwater site. The sediment samples comprise larger particles of sand and gravel rather than silts and clays

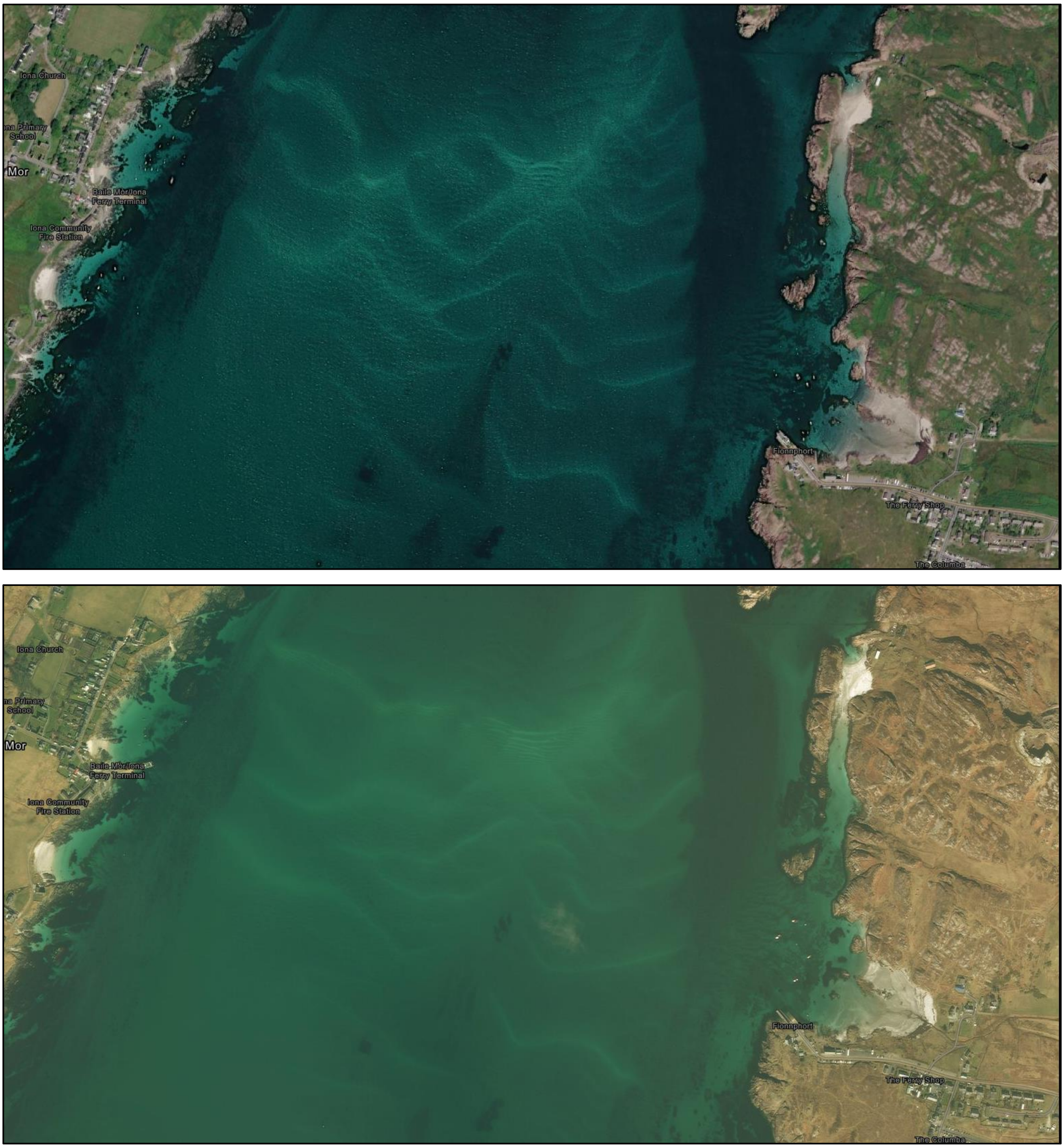


Figure 13-22 Sandwaves in the Sound of Iona in 2022 (top image) and 2016 (bottom image), demonstrating there is limited movement of the features. Source: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS

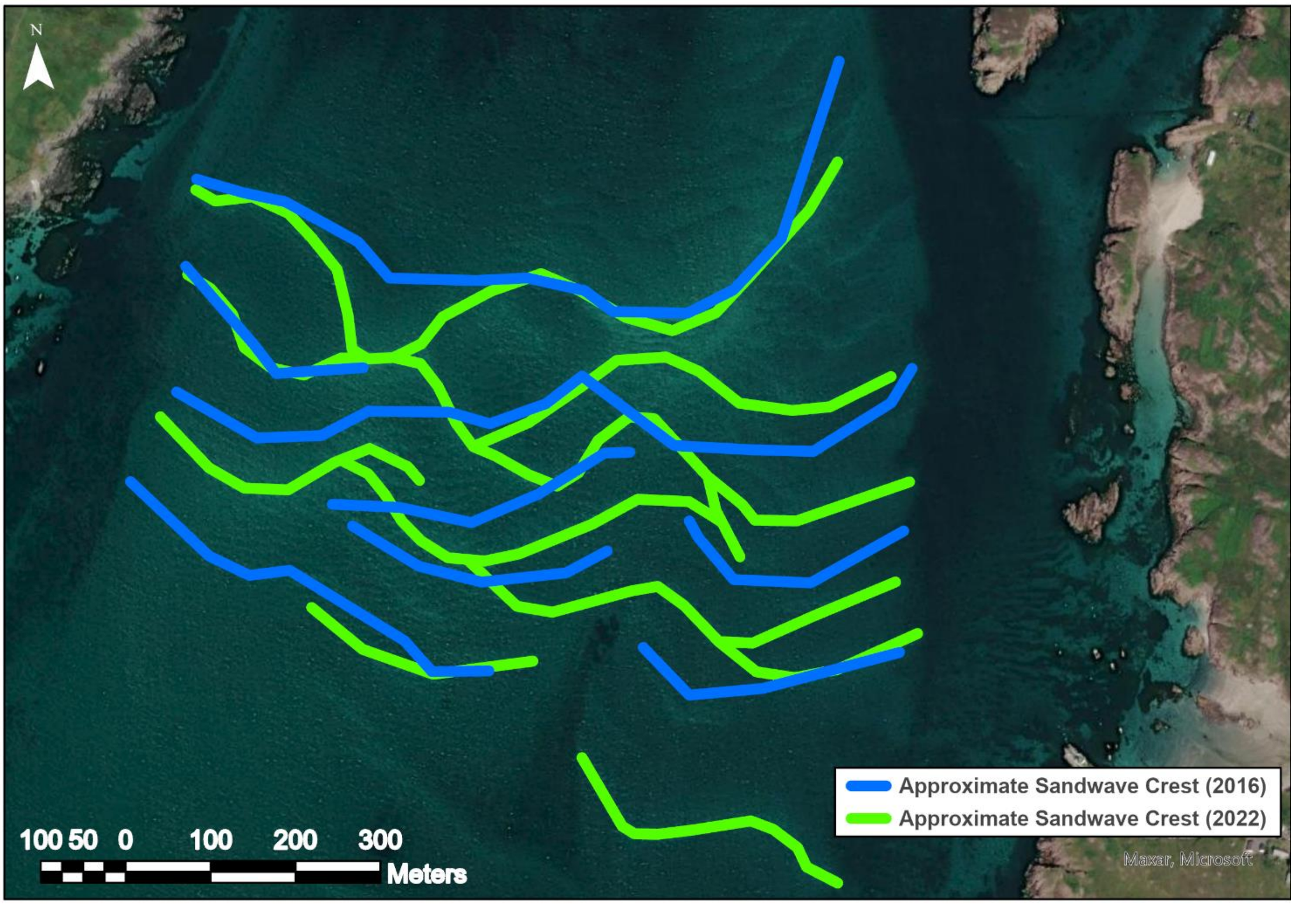


Figure 13-23 Sandwave movement analysis in the Sound of Iona in 2022 and 2016, demonstrating there is limited movement of the features.

13.4 Description of Likely Significant Effects

The impact on coastal processes arising from the Proposed Development is assessed in relation to the construction phase of the project and the subsequent operational phase. Various elements of construction and operation and the types of impacts on the tidal, wave and sediment transport regimes that they could potentially result in are identified for assessment in the following sections.

The assessment has been informed by a robust numerical modelling programme and, where applicable, hydrographic survey data and sediment sampling (see Section 13.2.3).

13.4.1 Assessment of Construction Effects

13.4.1.1 Potential Impacts as a result of dredging works

As described in Chapter 3, the Proposed Development would include dredging to accommodate the new navigation channel requirements at the Iona ferry slipway. The dredging operations will result in the removal of 1,225 m^3 of marine sediments.

The process of dredging unavoidably causes disturbance of sediment on the channel bed and dispersal of some material in the water column, however, due to the dredging area containing sand and gravel (Section 13.3.4) which has a larger particle size when compared to silt particles which are easily suspended in the water column, the impact of dredging would be low due to the immediate settlement of the sand and gravel particles from any overspill. Sand and gravels dumped at the licensed offshore dumping site are expected to remain at that site and not increase the background level of suspended sediments outside of the area. Within the working area, other activities such as the construction of the breakwater and the use of jack-up barges would have a minimal impact on the coastal processes. Changes in the coastal processes would become apparent as construction progresses, these changes in their entirety are assessed in the operational section below.

It should be noted that chemical sediment analysis found that the sediments to be dredged from the navigation channel are below the Marine Scotland Revised Action Levels (AL) 1 and 2.

13.4.2 Assessment of Operational Effects

13.4.2.1 Potential changes to the existing tidal regime

The potential for changes with the elements of the Proposed Development was assessed to consider the potential for operational phase impact. The MIKE 21 Hydrodynamic module described in Section 13.2 was used in conjunction with the Proposed Development 2D model to simulate the tidal regime in the Sound of Iona following the implementation of the Proposed Development. Typical tidal flow patterns for a spring ebb and spring flood tide from the operational simulation are presented in Figure 13-24 and Figure 13-25. Table 13-3 displays the change in water level at the point of high water during a spring tide. No change is observed in the centre of the Sound of Iona, whilst a very minor change of ±1cm is observed to the north and south of the breakwater at Iona.

Table 13-3 The change in sea level during a spring high water at 3 locations in the Sound of Iona

Location Name	X (UTM 29)	Y (UTM 29)	Existing Water Level (m MSL)	Proposed Water Level (m MSL)
Sound of Iona	661948	6245596	1.97	1.97
North of the Iona Breakwater	661345	6245903	1.98	1.99
South of the Iona Breakwater	661259	6245772	1.97	1.96

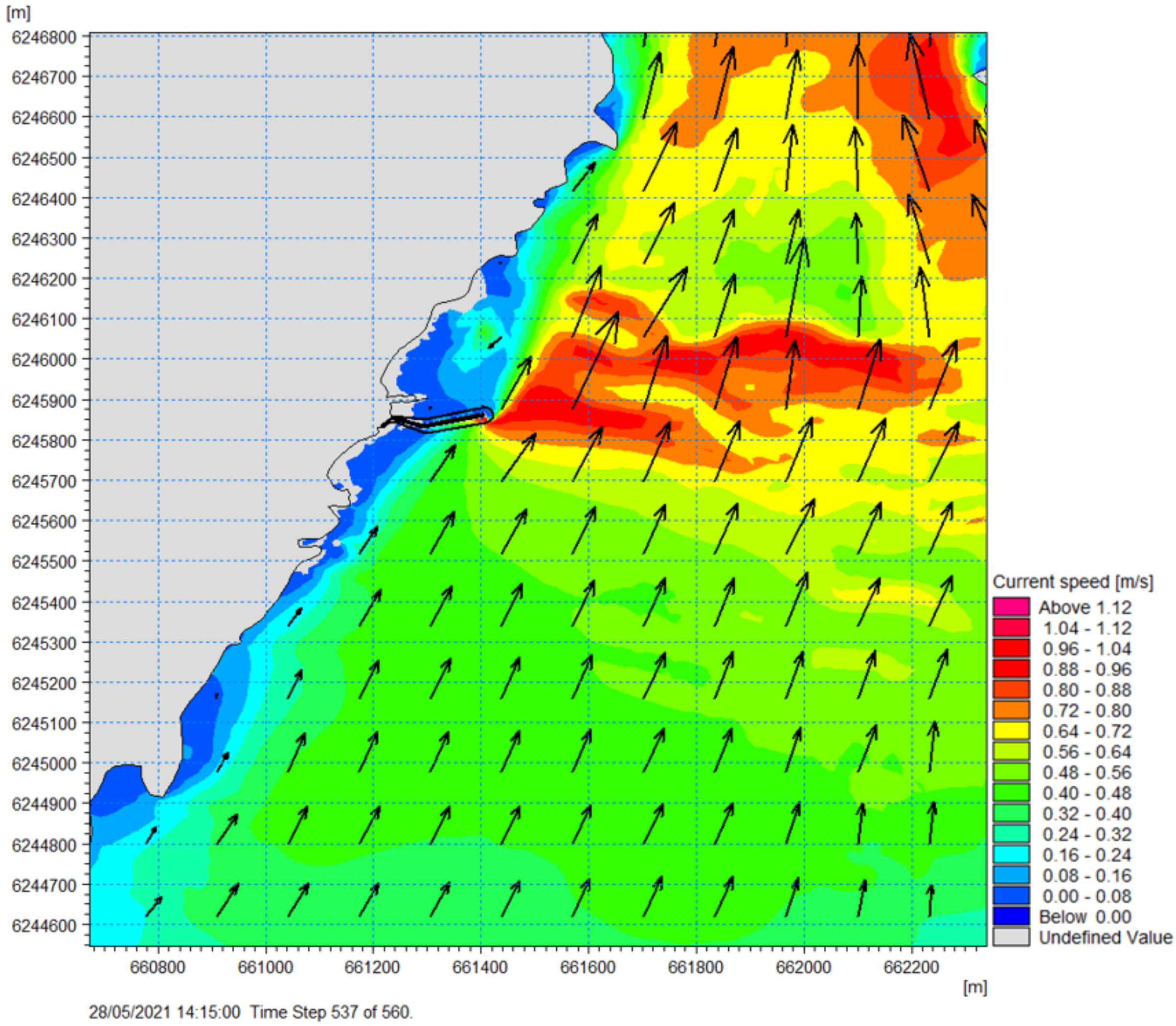


Figure 13-24 Typical spring flood tidal flow patterns as a result of the Proposed Development at Iona

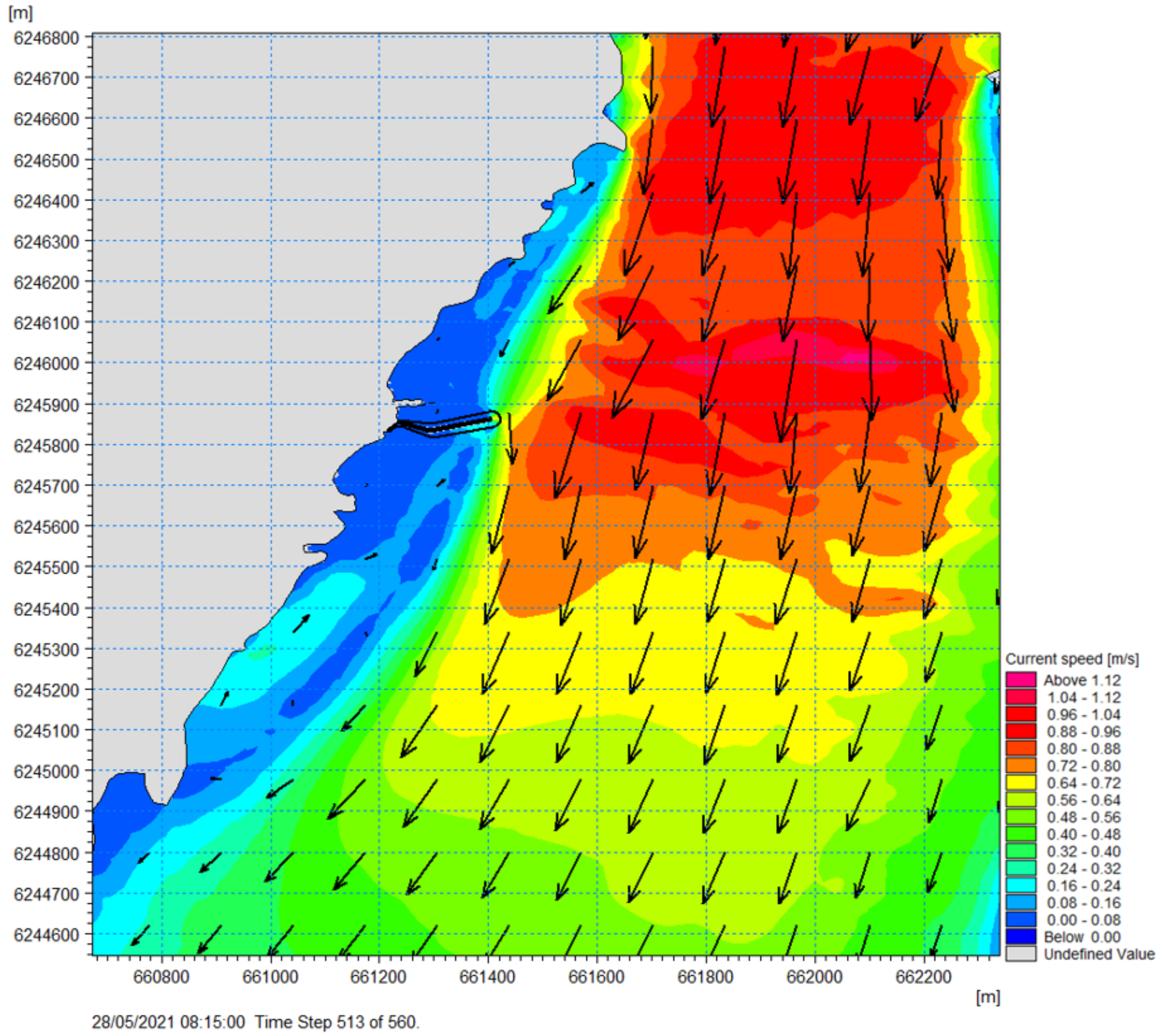


Figure 13-25 Typical spring mid-ebb flow patterns as a result of the Proposed Development at Iona

The difference between the baseline and operation flows for the flood and ebb tides are presented in Figure 13-26 and Figure 13-27.

Spring tides are periods of greatest current velocities. The outputs show that the current velocity remains substantially unchanged throughout most of the Sound of Iona. The maximum predicted change to the mid-ebb or flood current speeds is less than ±0.6m/s. The greatest changes are around the footprint of the works at Iona breakwater, with current speed reduced during the ebb tide behind the breakwater (velocity decreased by 0.66 m/s to 0.06 m/s). An increase in current velocity is also observed during the flood tide just outside the breakwater, with an increase of 0.3 m/s. This increase is not reciprocated outside the breakwater during the ebb tide, with increases below 0.12 m/s. Predicted changes in current speed reduce rapidly outside the works areas in the centre of the Sound of Iona and changes to mid-ebb or mid-flood current speeds are less than ±0.12m/s.

Therefore, the tidal regime is predicted to remain substantially unchanged during operation. Given the localised nature and small absolute magnitude of any predicted changes in tidal current velocity, it is unlikely that there will be any significant change in net scouring or deposition of sediments within the centre of the Sound of Iona. The risk of impact is determined to be negligible, and no mitigation is required.

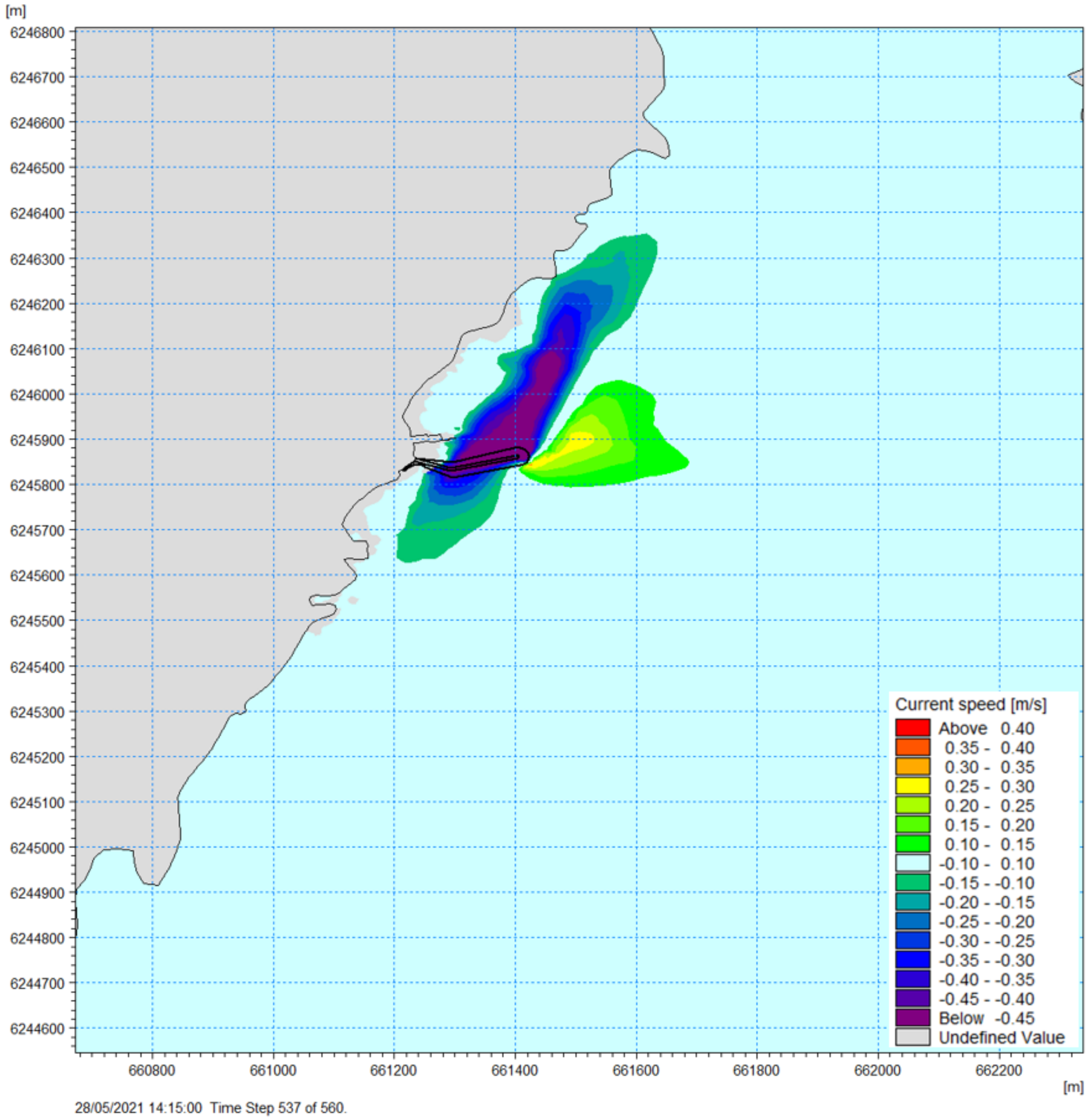


Figure 13-26 Difference in typical spring mid-flood flow patterns as a result of the Proposed Development at Iona

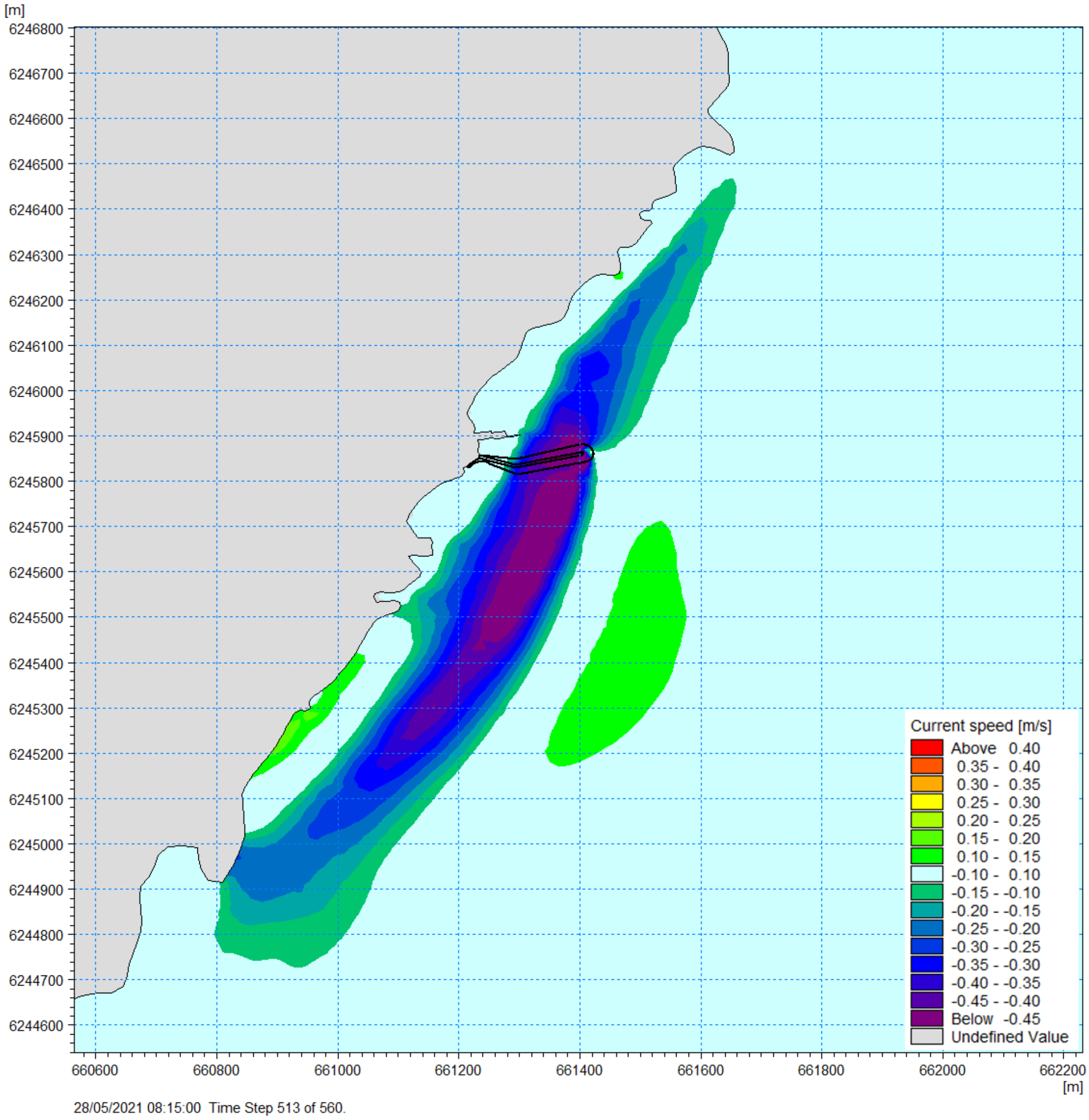


Figure 13-27 Difference in typical spring mid-ebb flow patterns as a result of the Proposed Development at Iona

13.4.2.2 Potential changes to the existing inshore wave climate

Operational phase impacts are also considered relating to potential alteration to the wave climate (and its associated possible impact on flood risk). The MIKE 21 Spectral Wave module described in Section 13.2 was used in conjunction with the operation scenario 2D model to re-run the offshore wave climate simulations in the Sound of Iona based on various wave directions as described in Section 13.3. The simulated inshore wave climate in the Sound of Iona during the operation of the Proposed Development is illustrated in the figures below for 1 in 1 year (Figure 13-28), 1 in 50 year (Figure 13-29), and 1 in 200 year (Figure 13-30) storm events at spring high tide from a 240° direction. Figure 13-31, Figure 13-32 and Figure 13-33 display the localised reduction in wave height behind the breakwater in a 1 in 1 year, 1 in 50 year, and 1 in 200 year event.

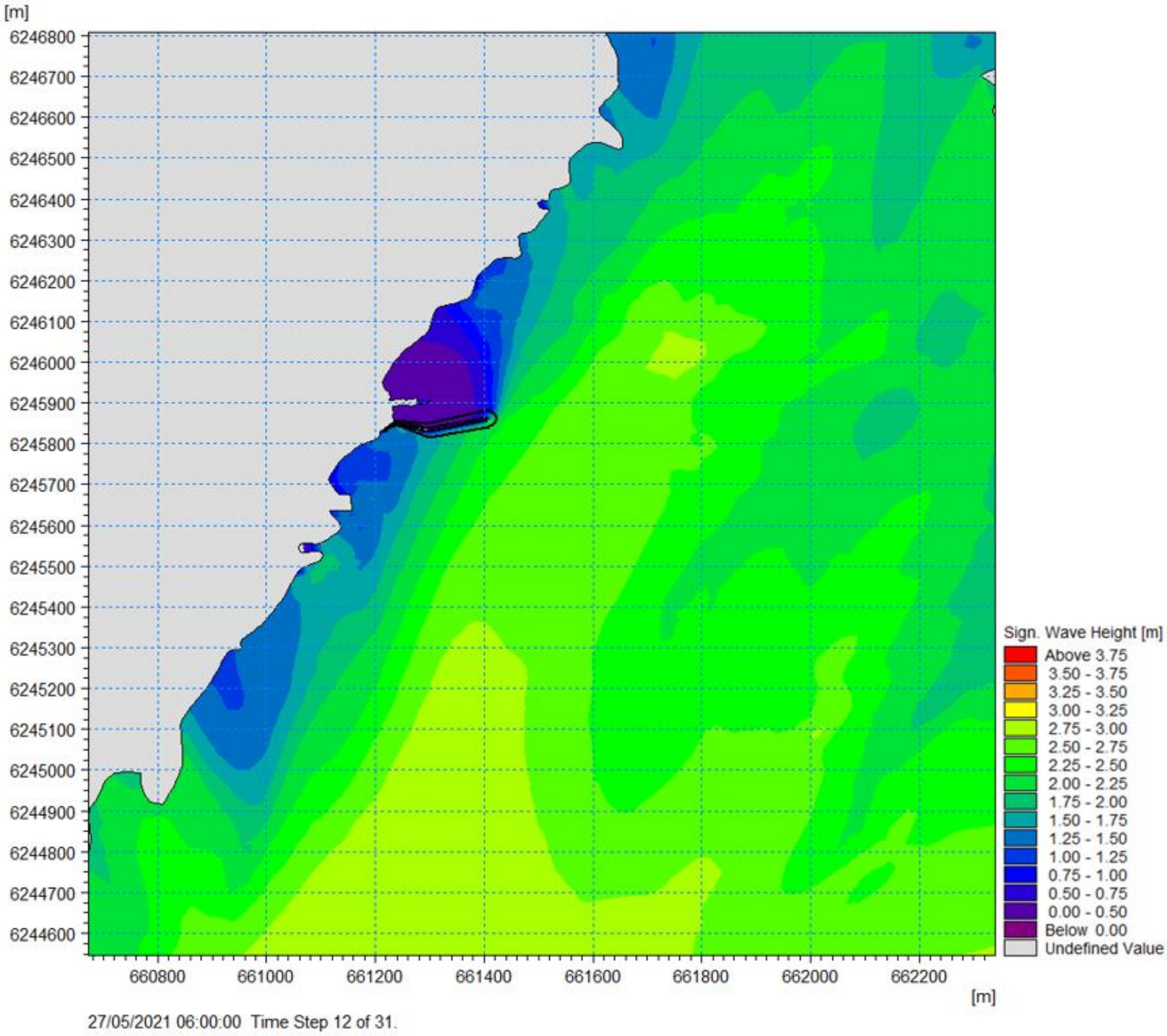


Figure 13-28 Post-construction wave climate 1 in 1 year storm 240° HW

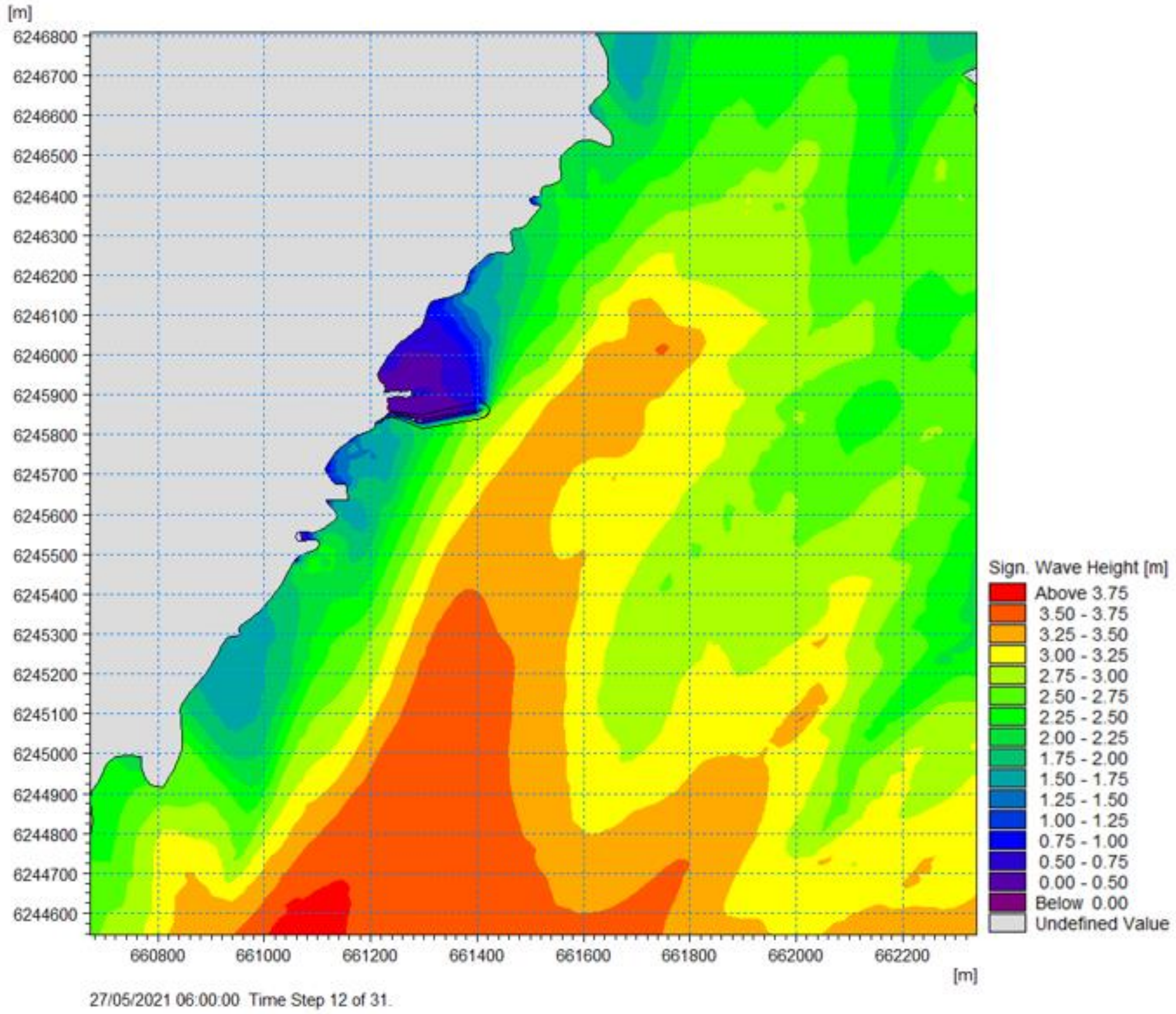


Figure 13-29 Post-construction wave climate 1 in 50 year storm 240° HW

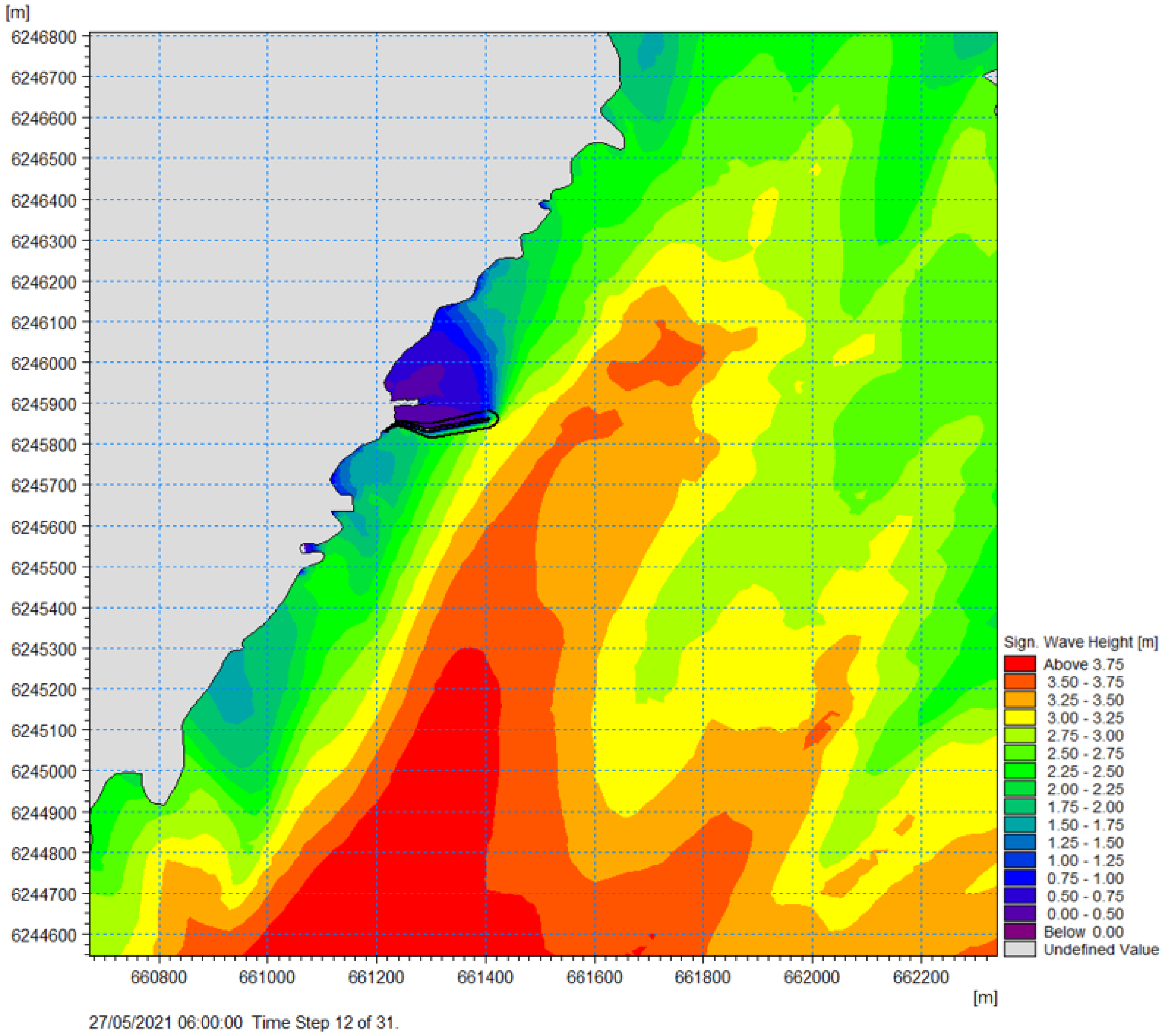


Figure 13-30 Post-construction wave climate 1 in 200 year storm 240° HW

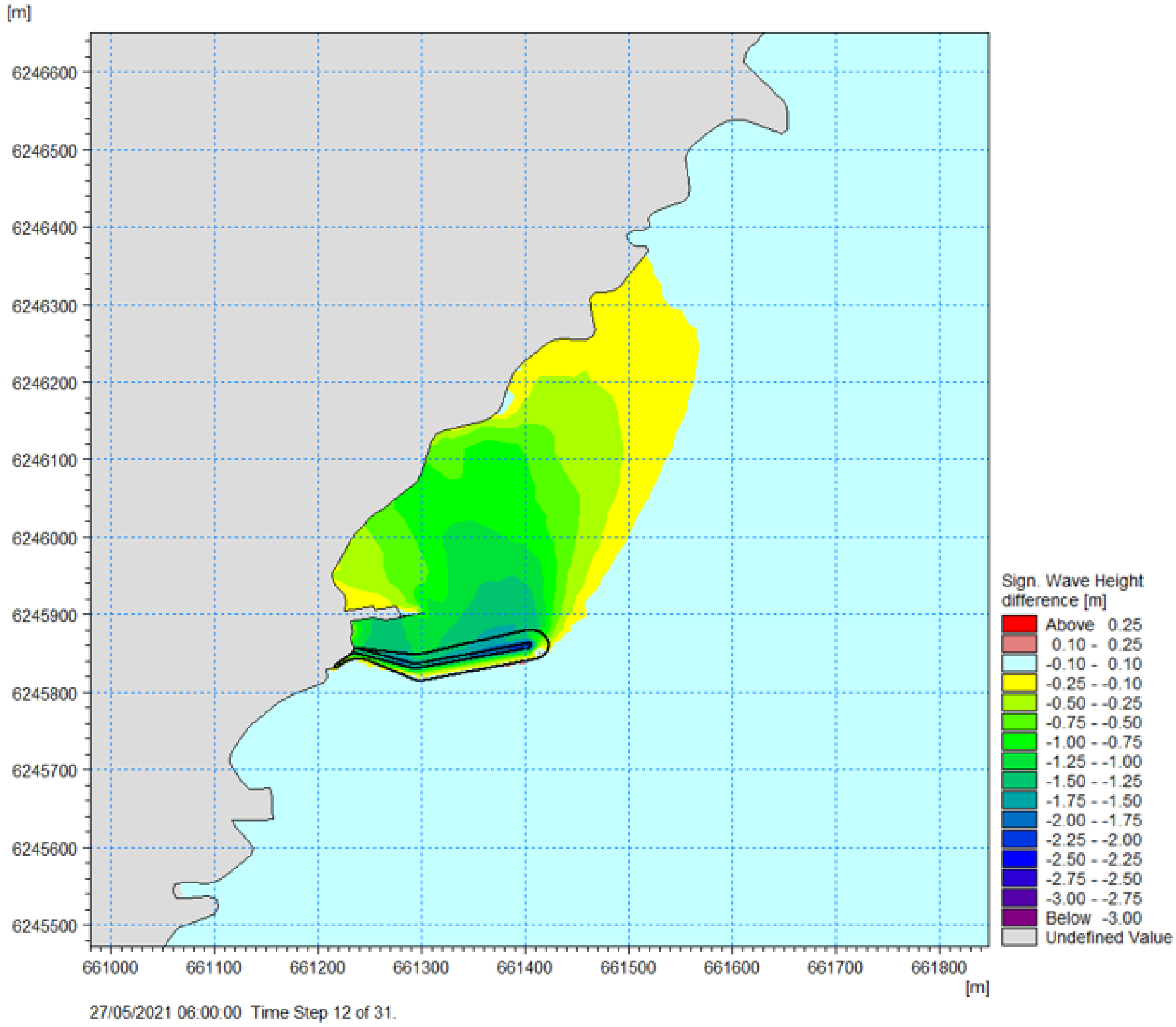


Figure 13-31 Baseline and operation comparison wave climate 1 in 1 year storm 240° HW

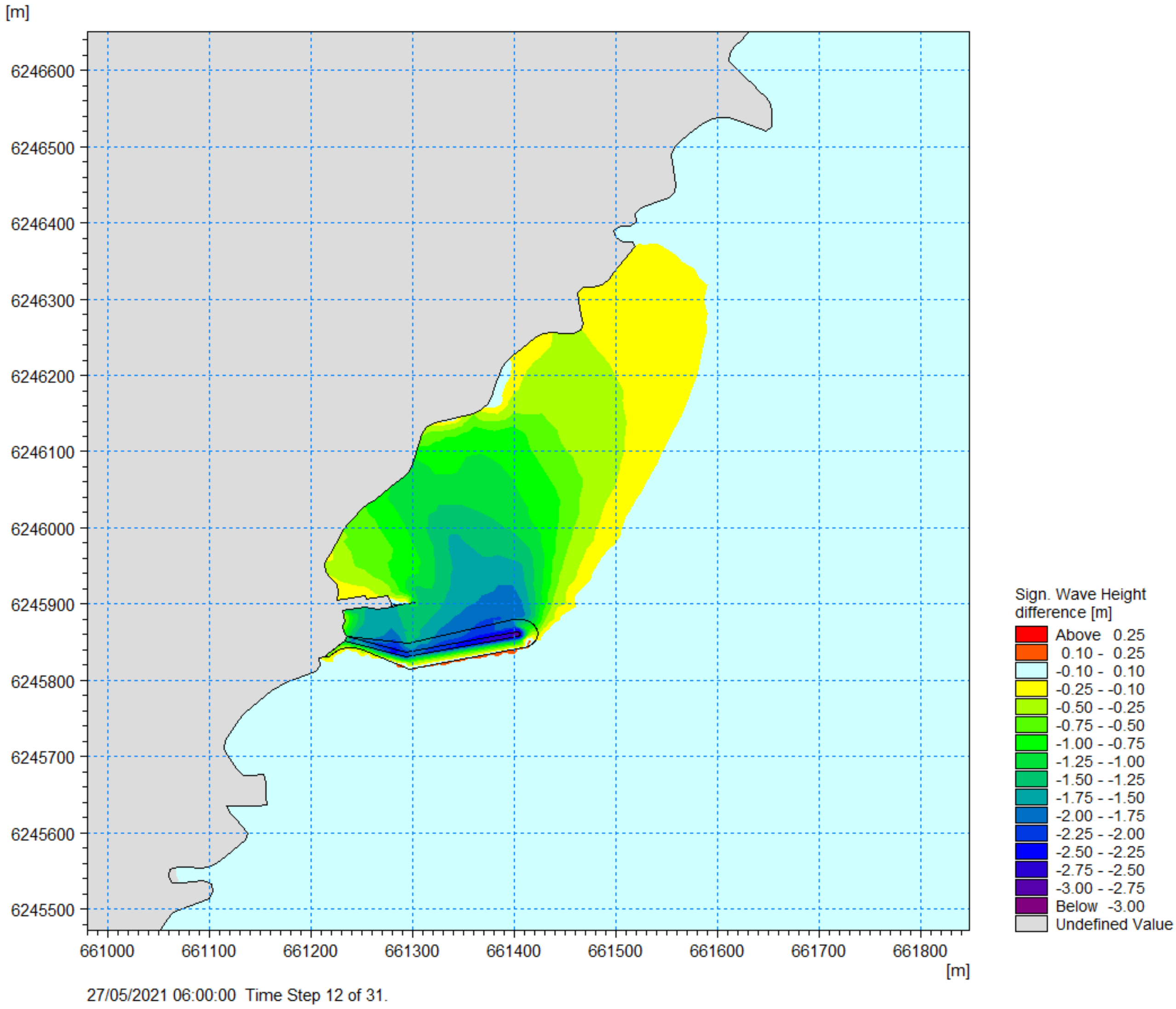


Figure 13-32 Baseline and operation comparison wave climate 1 in 50 year storm 240° HW

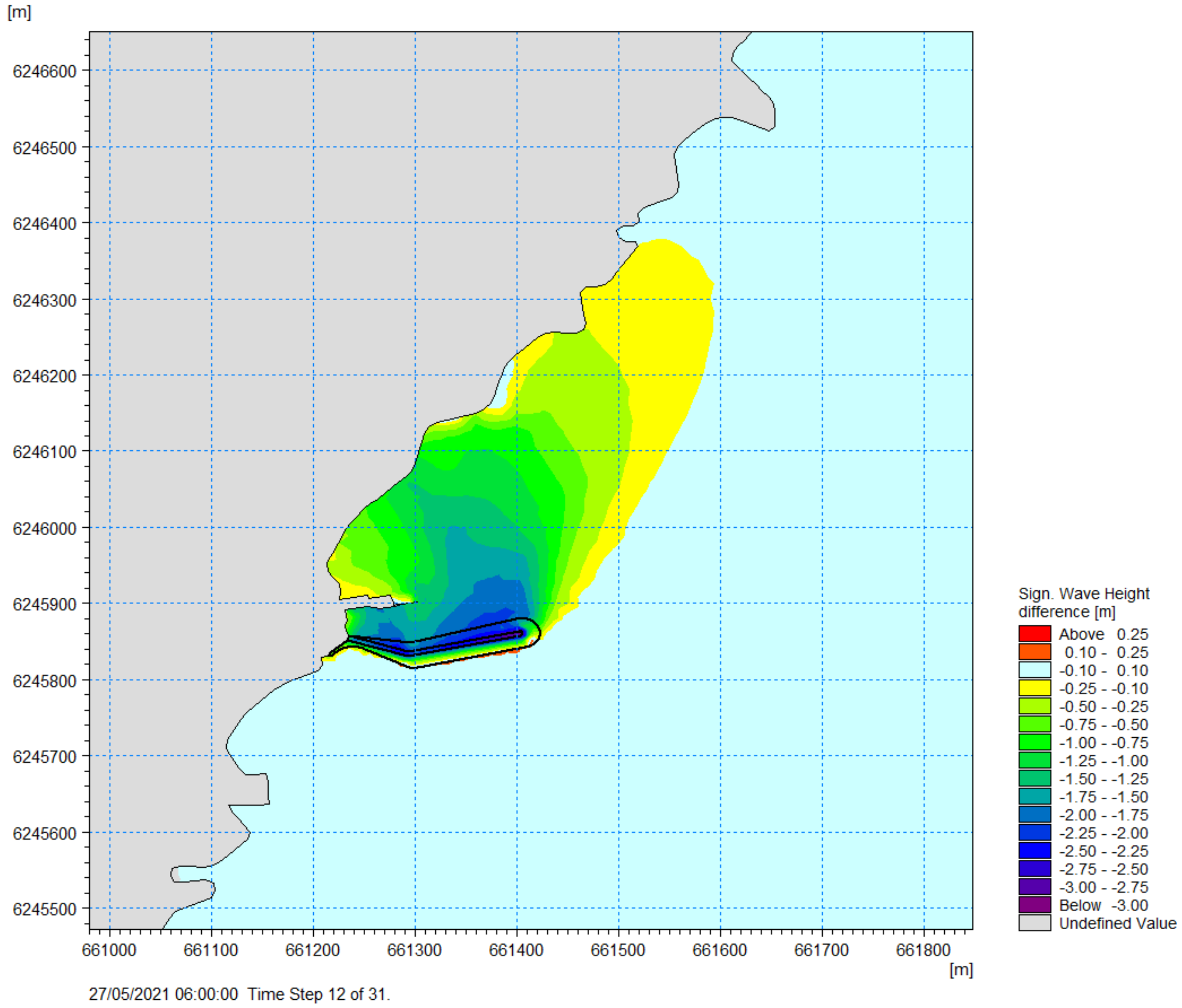


Figure 13-33 Baseline and operation comparison wave climate 1 in 200 year storm 240° HW

13.4.2.3 Potential changes to the existing littoral currents

The previous sections established the magnitude of the changes in tidal currents and wave conditions individually, however sediment transport regimes are driven by a combination of these factors. Although the modelling has demonstrated that the principal contribution comes from tidal currents, for the sake of completeness and to understand the impact upon sediment transport, the influence on littoral currents was examined.

The modelling was extended to include the post-construction scenario for the 1 in 1 year storm from 240°. The baseline littoral currents for mid flood and mid ebb were presented in Section 13.3.3 The post-construction littoral currents are shown in Figure 13-34 and Figure 13-35 for the flood and ebb tides respectively. The corresponding changes are presented in Figure 13-36 and Figure 13-37.

During the ebb tide, the tidal flow is in opposition to the wave climate and the resultant littoral current is reduced in magnitude. The presence of the structures has a limited influence on the reduced flow and there is little difference between changes in littoral current magnitude and the tidal flows alone due to the construction. During the flood tide, the outside of the breakwater exhibits an increase in littoral current by around 0.45 m/s, while an increase of 0.3 m/s is observed during the ebb tide. There are areas where littoral currents are reduced within the lee of the breakwater for both phases of the tide, both with a reduction of 0.6 m/s.

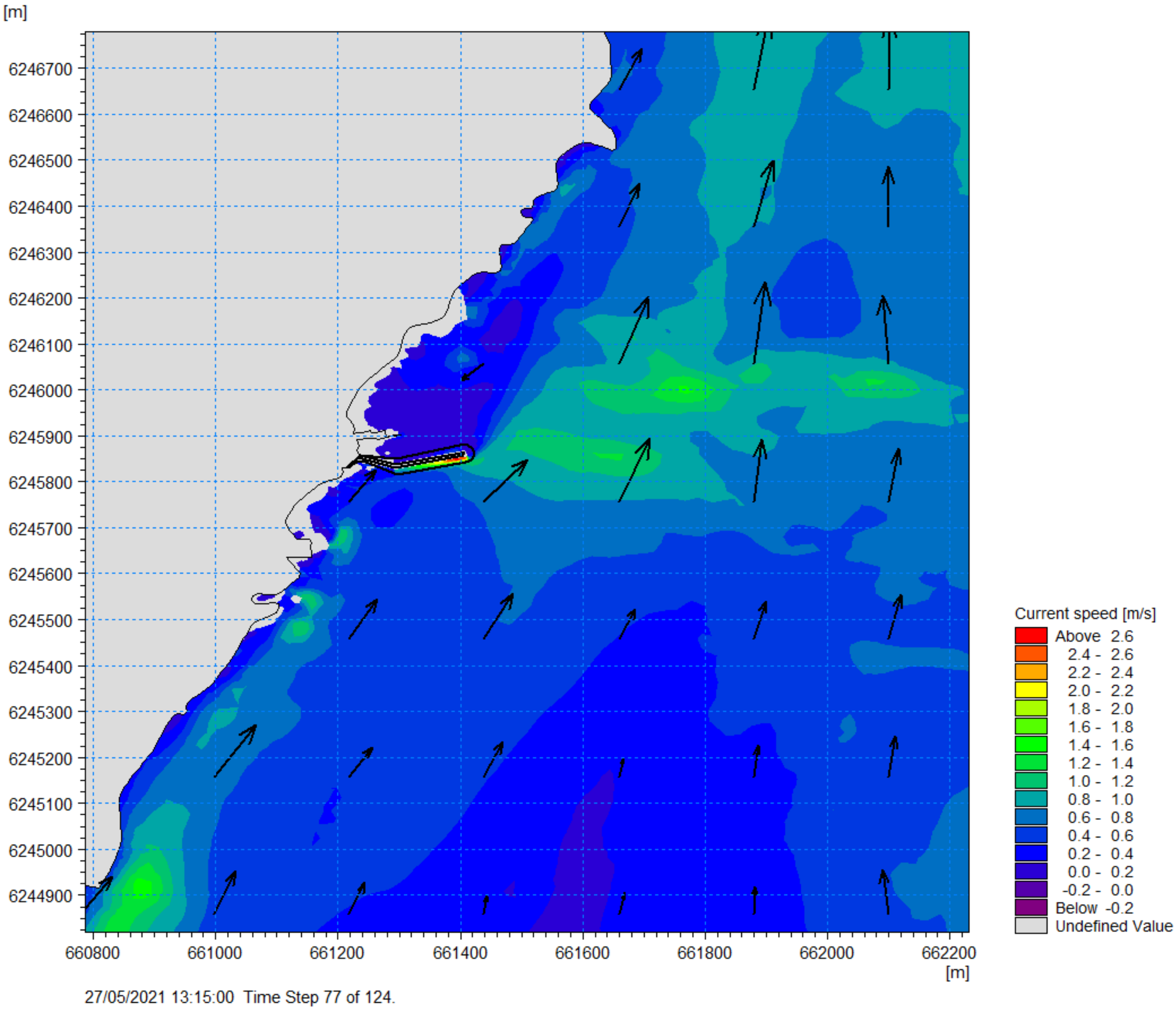


Figure 13-34 Post-construction littoral current 1 in 1 year storm from 240° - flood tide

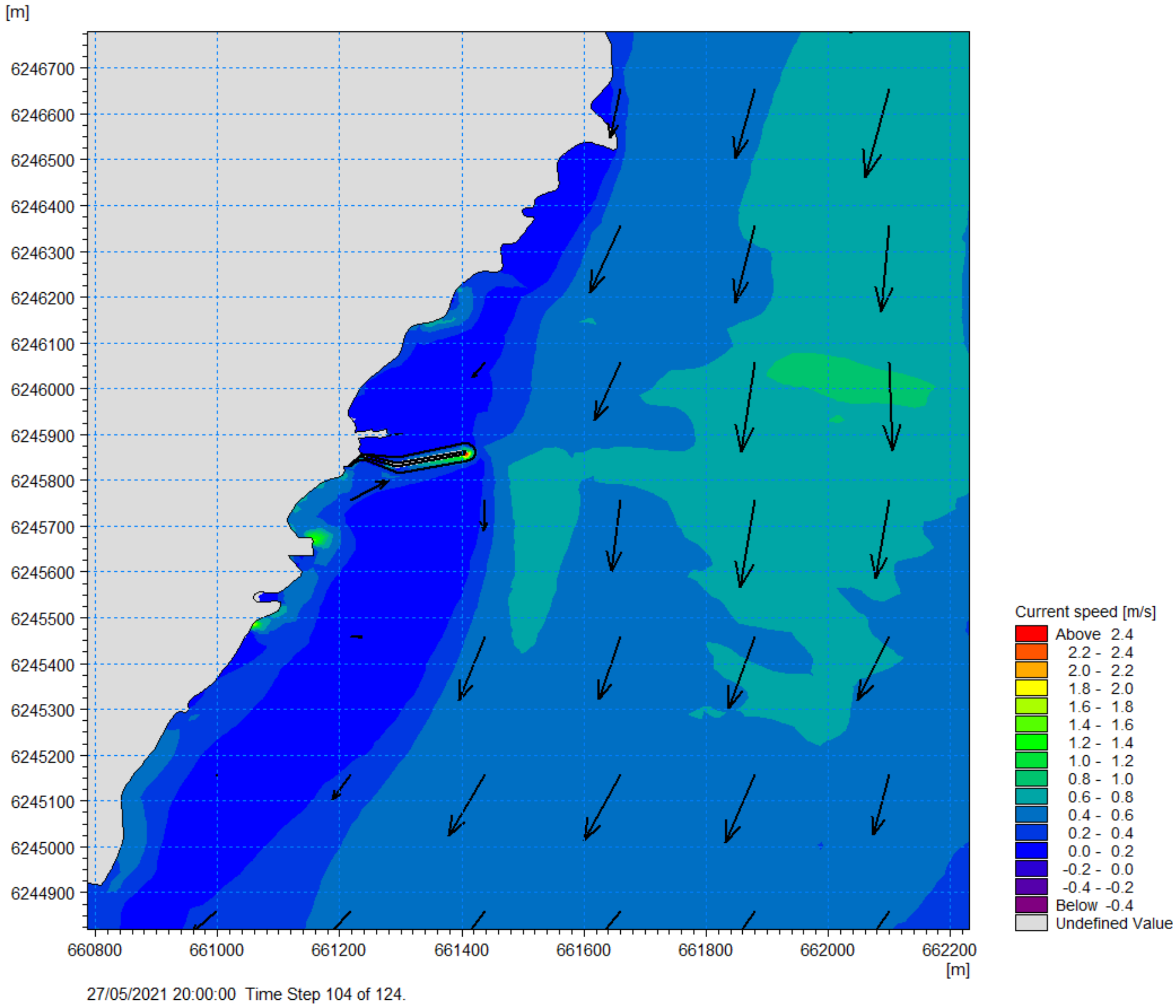


Figure 13-35 Post-construction littoral current 1 in 1 year storm from 240° - ebb tide

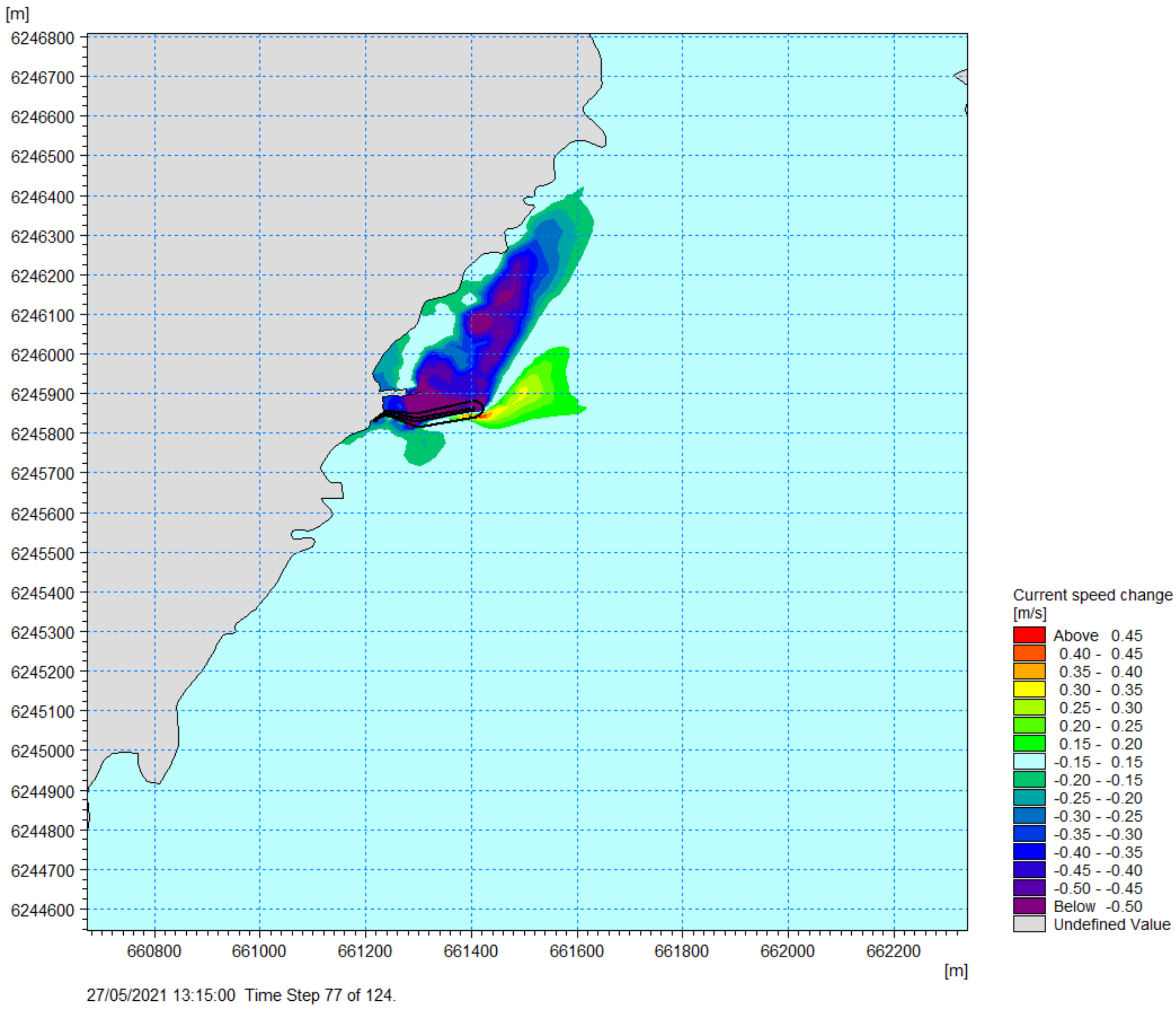


Figure 13-36 Comparison of baseline and post-construction littoral current 1 in 1 year storm from 240° - flood tide

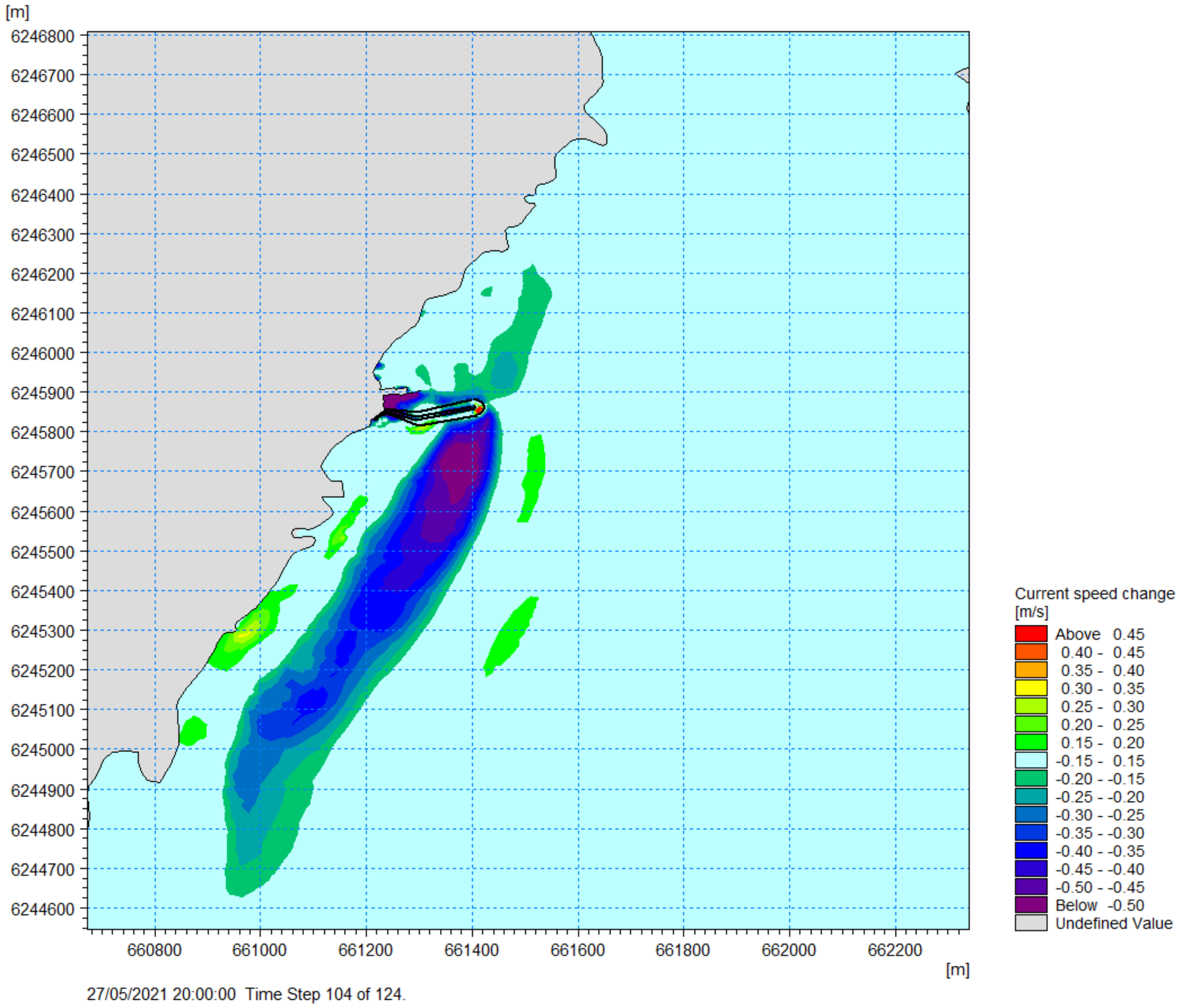


Figure 13-37 Comparison of baseline and post-construction littoral current 1 in 1 year storm from 240° - ebb tide

The potential for the greatest scour to occur around the ends of the proposed breakwater occur during flood tide when the greatest littoral current speeds occur due to the tidal flow and wave climate travelling in the same direction, from the south to the north of the Sound of Iona. The timestep in the modelling which yielded the greatest littoral current speeds around the breakwaters is included in the following figures. Figure 13-38 shows the maximum littoral current speeds in the vicinity of the Proposed Development for the post-construction scenario, the largest increase being located at the end of the breakwater. Figure 13-39 show the expected elevated littoral current speeds around the proposed Iona breakwater in more detail. The greatest scour current at the toe of the Iona breakwater is seen to have a current velocity of circa 1.5 m/s over the sea bed just clear of the breakwater rock armour slope.

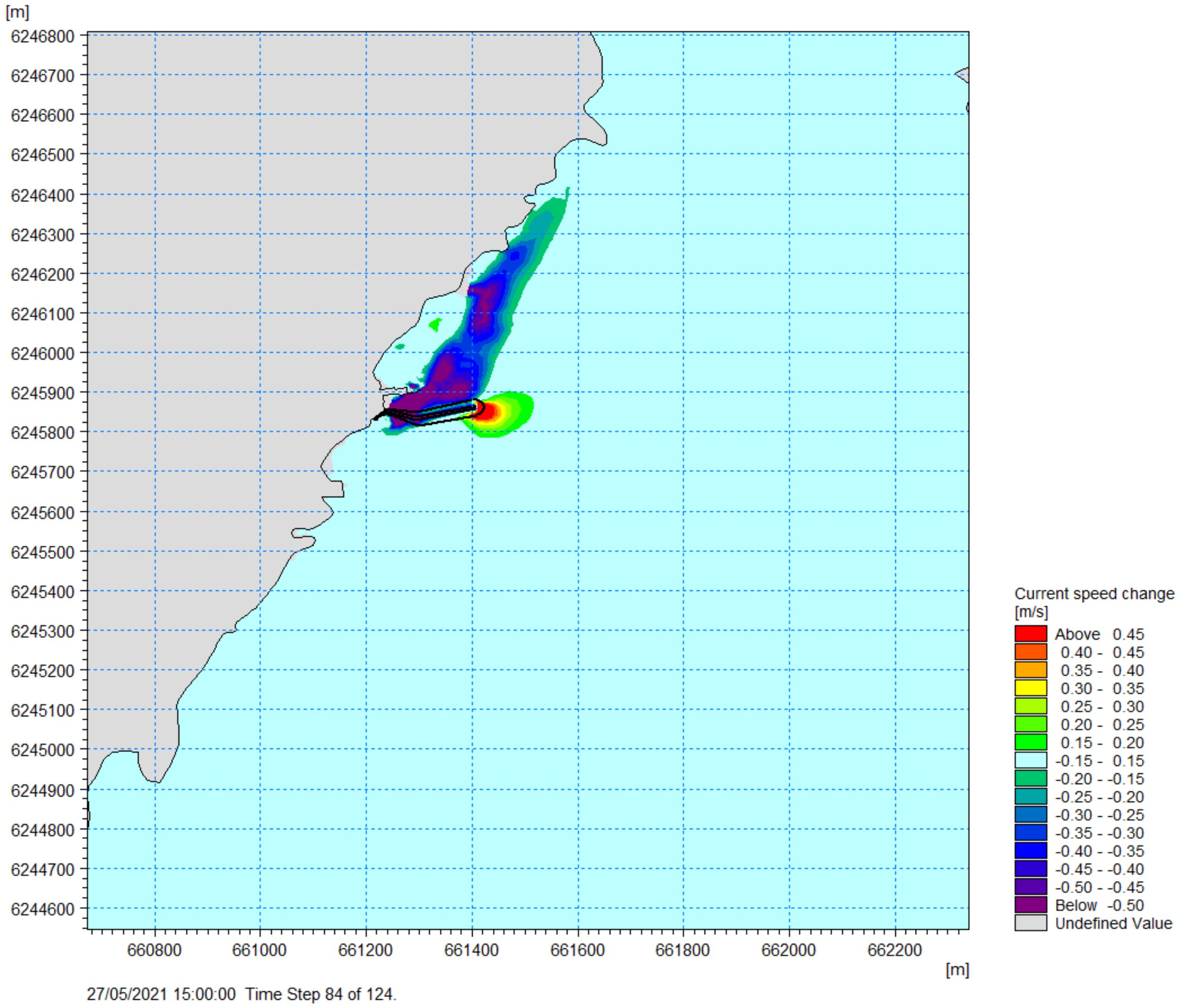


Figure 13-38 Post-construction Littoral current 1:1 year storm from 240° - maximum increase scour current at flood tide

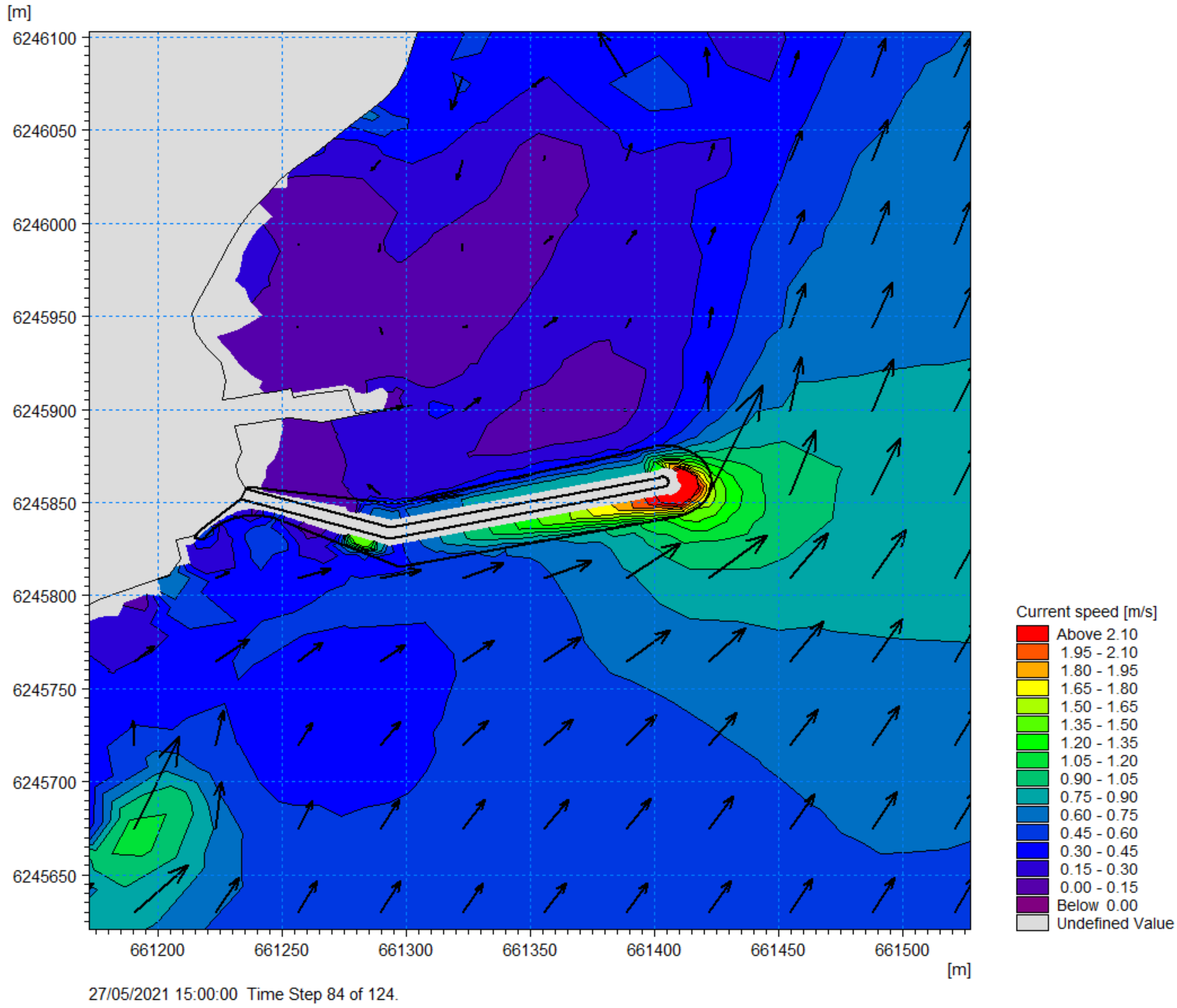


Figure 13-39 Post-construction Littoral current 1:1 year storm from 240° - maximum scour current velocity and direction at mid-flood spring tide at Iona Breakwater

13.4.2.4 Potential changes to the sediment transport regime

Due to the larger grain size evident from the sampling regime around the proposed breakwater (sands and gravels), there is limited potential for sediment transport around the breakwater. Any movement of sediment would likely occur during high energy storm events which allow larger sediment particles to be suspended. Due to the lower currents expected behind the breakwater, sediment disposition resulting from several high-energy events would be expected which would be mitigated by periodic dredging of the breakwater area in the future which is discussed further below.

Figure 13-40 and Figure 13-41 display the potential for sand transport during the mid-ebb and mid-flood tide around the proposed breakwater during a 1 in 1 year 240° storm. As expected, the suspended total load is expected to marginally increase around the breakwater during the flood tide, indicating the potential for erosion to occur during the storm. A slight decrease in sediment load rate is visible in the lee of the breakwater in both tides indicating sediment deposition is likely to occur in these locations, particular between the breakwater and the existing slipway. As the modelling represents a 1 in 1 year storm, the sand transport during typical spring and neap tides is expected to be far less and would not have a significant impact.

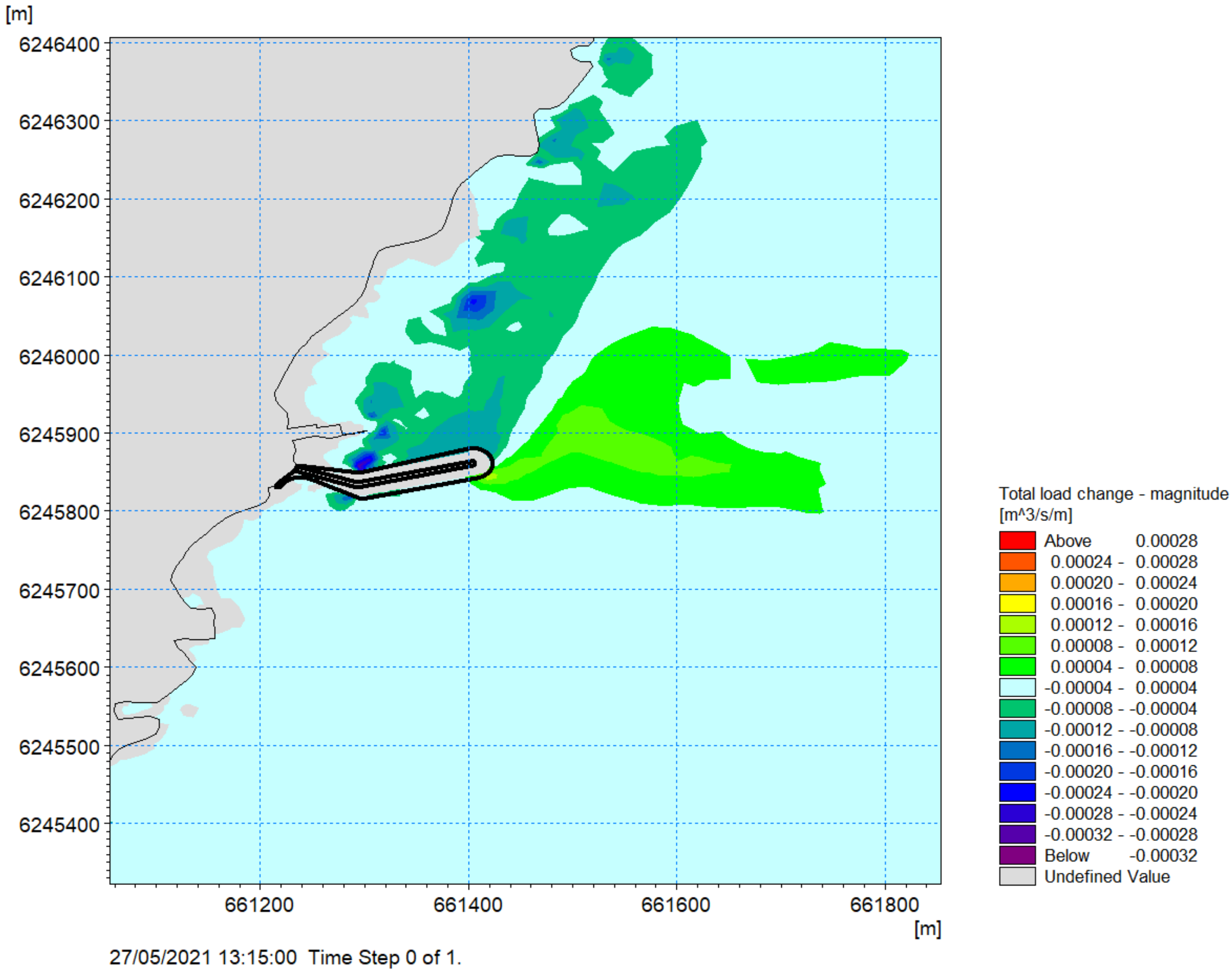


Figure 13-40 Comparison of baseline and post-construction sediment total load during a 1 in 1 year storm from 240° - flood tide

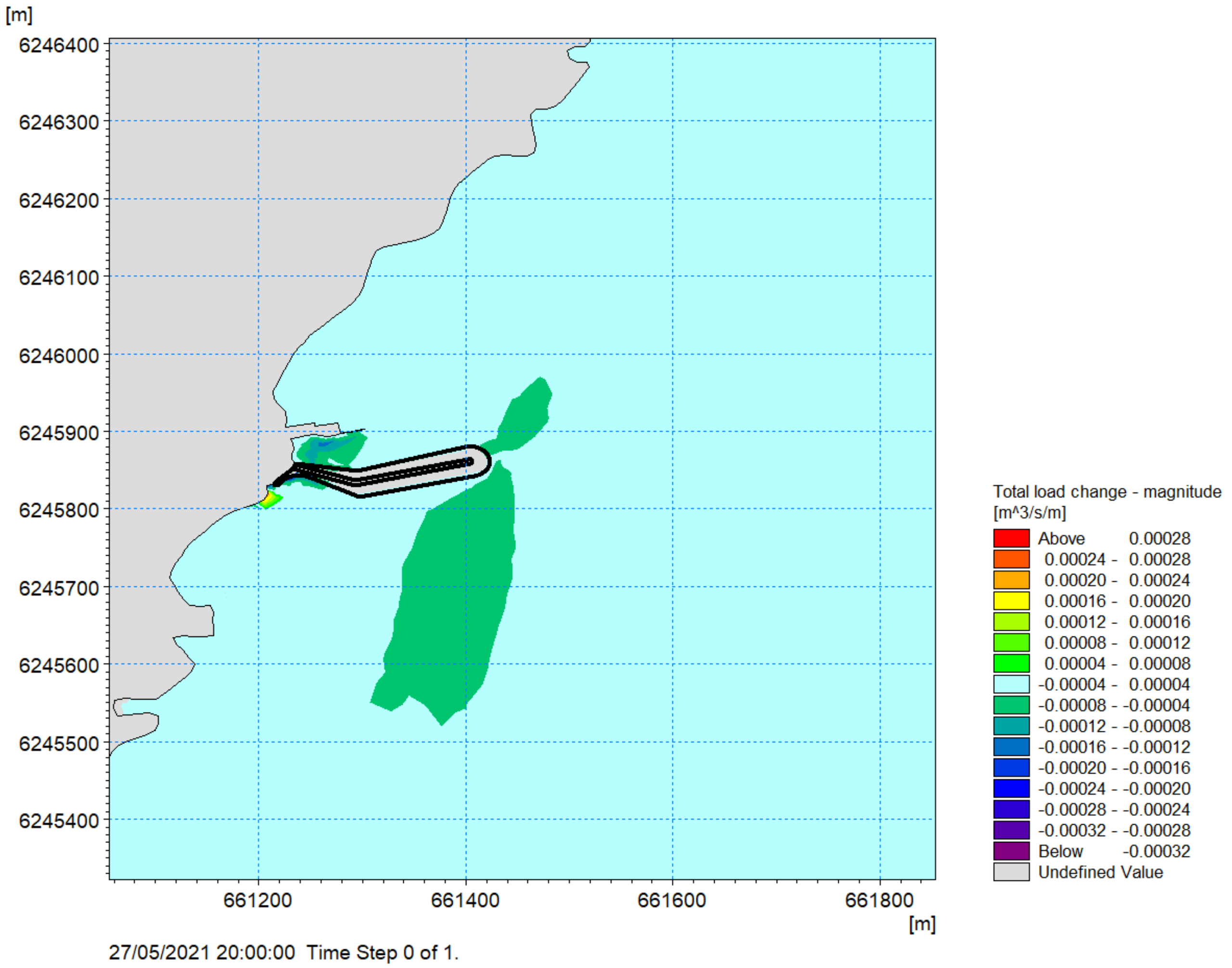


Figure 13-41 Comparison of baseline and post-construction sediment total load during a 1 in 1 year storm from 240° - ebb tide

As storm waves from the dominant south-westerly direction impact upon the proposed new breakwater at Iona, the effect of the structure is to diffract the waves around the end of the breakwater such that the waves in the lee of the structure are greatly reduced and bend around to come from an easterly direction. This effect is shown in Figure 13-42, taken from a Boussinesq wave disturbance model of a 1 in 1 year return period storm from 240°.

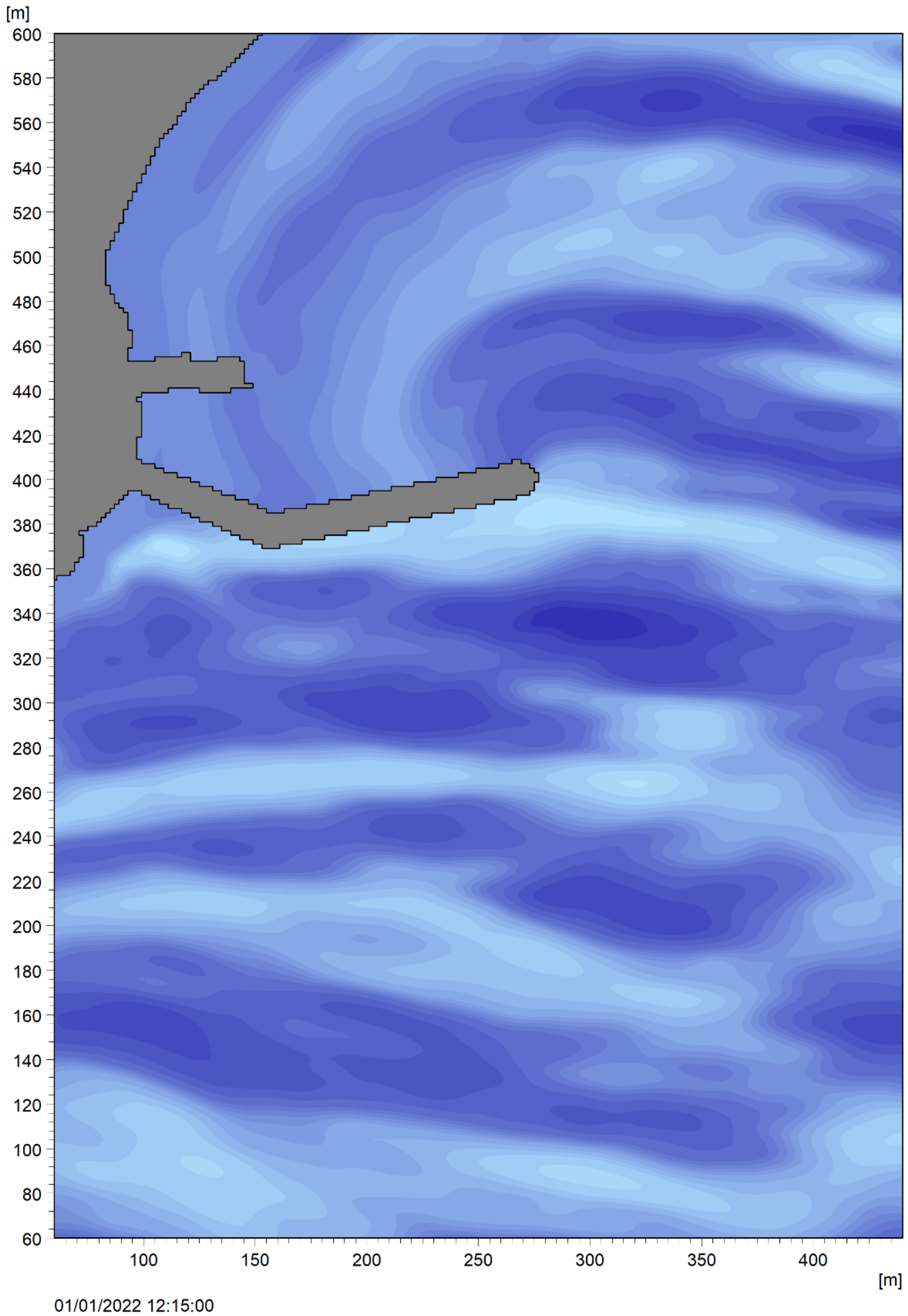


Figure 13-42 Typical wave disturbance patterns during 1 in 1 year return period storm from 240º at Iona

The effect of wave diffraction at the breakwater results in a steep gradient in the wave heights, and therefore in the wave energy, between the waves beyond the breakwater compared to those behind the breakwater. This energy difference results in a flow from the high energy area to the low energy area which forms an anticlockwise eddy circulation in the lee of the breakwater as shown by the purple arrow in Figure 13-43.

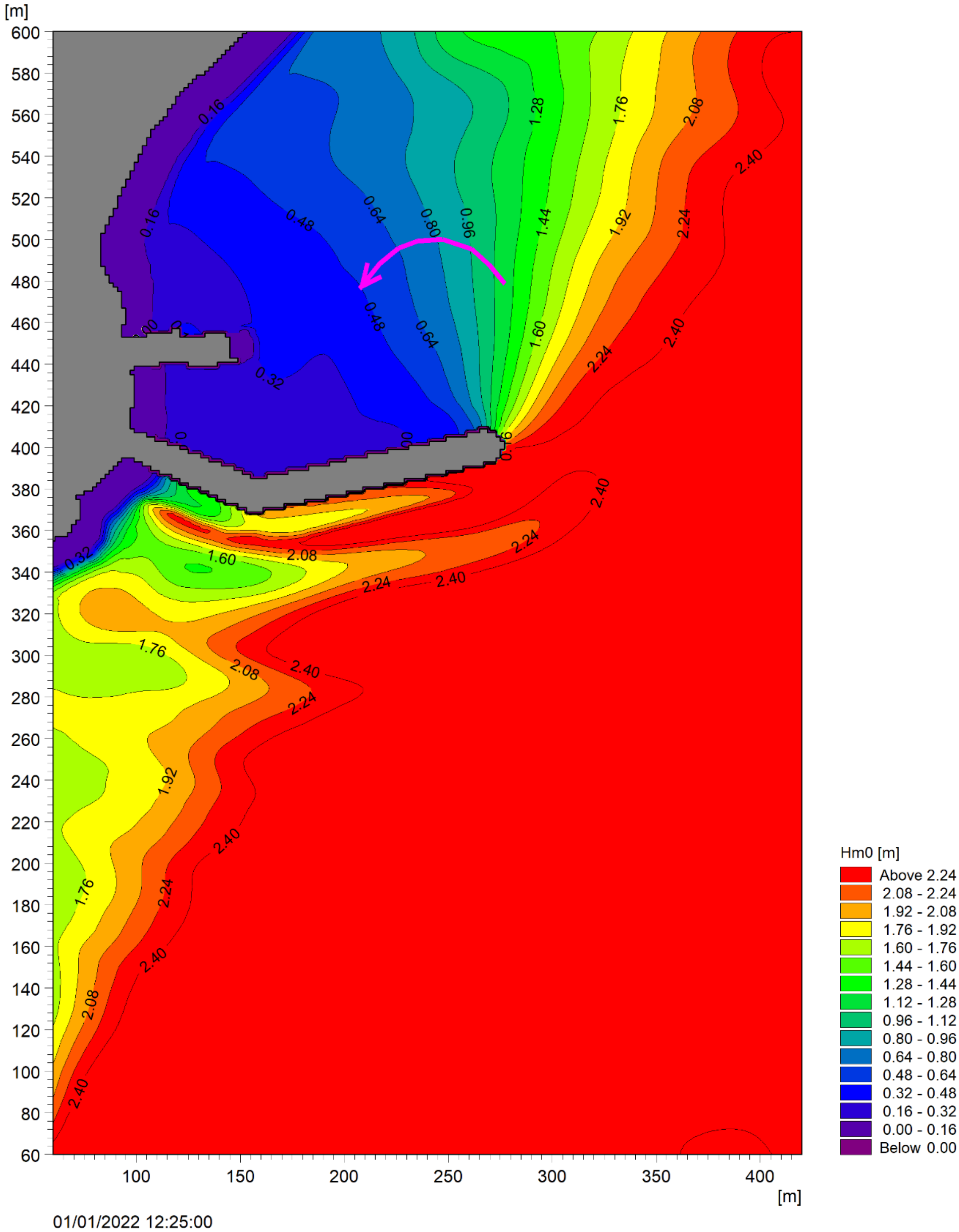


Figure 13-43 Storm wave height gradient will form an anticlockwise circulation behind the Iona breakwater

This anticlockwise eddy flow will result in sediment being carried into the lee of the breakwater which will tend to infill the proposed dredged pocket immediately to the east and northeast of the end of the slipway. Thus, it is expected that regular maintenance dredging of this pocket will be required to keep the approach to the slipway to the design depth. This infilling material is expected to be sand and hence there will be no significant sediment plume resulting from the maintenance dredging of bed material carried into the dredged pocket.

13.5 Mitigation Measures

13.5.1 Construction Phase Mitigation Measures

As the impacts associated within the working area upon the coastal processes are expected to be negligible, no mitigation measures are proposed during capital dredging and disposal operations.

13.5.2 Operational Phase Mitigation Measures

Scour protection is proposed as part of the operational phase of the Proposed Development to mitigate the impact of scour around the toe of the breakwater during periods of maximum flood velocity which would be expected during a 1 in 1 year 240° storm event during the flood tide.

Maintenance dredging would be required after construction is completed. The frequency of maintenance dredging would be established as part of the construction contract following the construction of the breakwater. Maintenance of the breakwater would be required as rock armour would move/adjust for a period of time. The defect period is expected to be 104 weeks during which the breakwater would be monitored, and any movement recorded and reported. After this, the breakwaters would be inspected as part of the seabed bathymetric surveys regime.

13.6 Potential Cumulative Effects

In line with the scoping response received from MSS, the cumulative effects of the Proposed Development along with other developments were considered quantitively in a numerical model. The potential development at Fionnphort would be most relevant as it most likely has the greatest possibility of creating in-combination effects upon the coastal processes within the Sound of Iona when the two developments are in operation. The same factors previously considered in this chapter, are considered for both developments present in the Sound of Iona.

13.6.1 Tidal Regime within the Sound of Iona

The tidal regime was assessed within the Sound of Iona during the presence of both schemes. As demonstrated in Figure 13-44 and Figure 13-45, the effect of each scheme on the tide is predominantly localised to each development. The Iona breakwater has the greatest influence on current velocity, experiencing a larger decrease in velocity during the ebb and flood tide in the lee of the breakwater. A slight increase of the ebb and flood current within the Sound of Iona is present, up to 0.12 m/s, with the very centre of the Sound experiencing a smaller increase between 0 – 0.06 m/s, as a result of both developments. The effects associated with both developments on the tidal regime are deemed negligible due to the small changes in current velocities in the centre of the Sound of Iona.

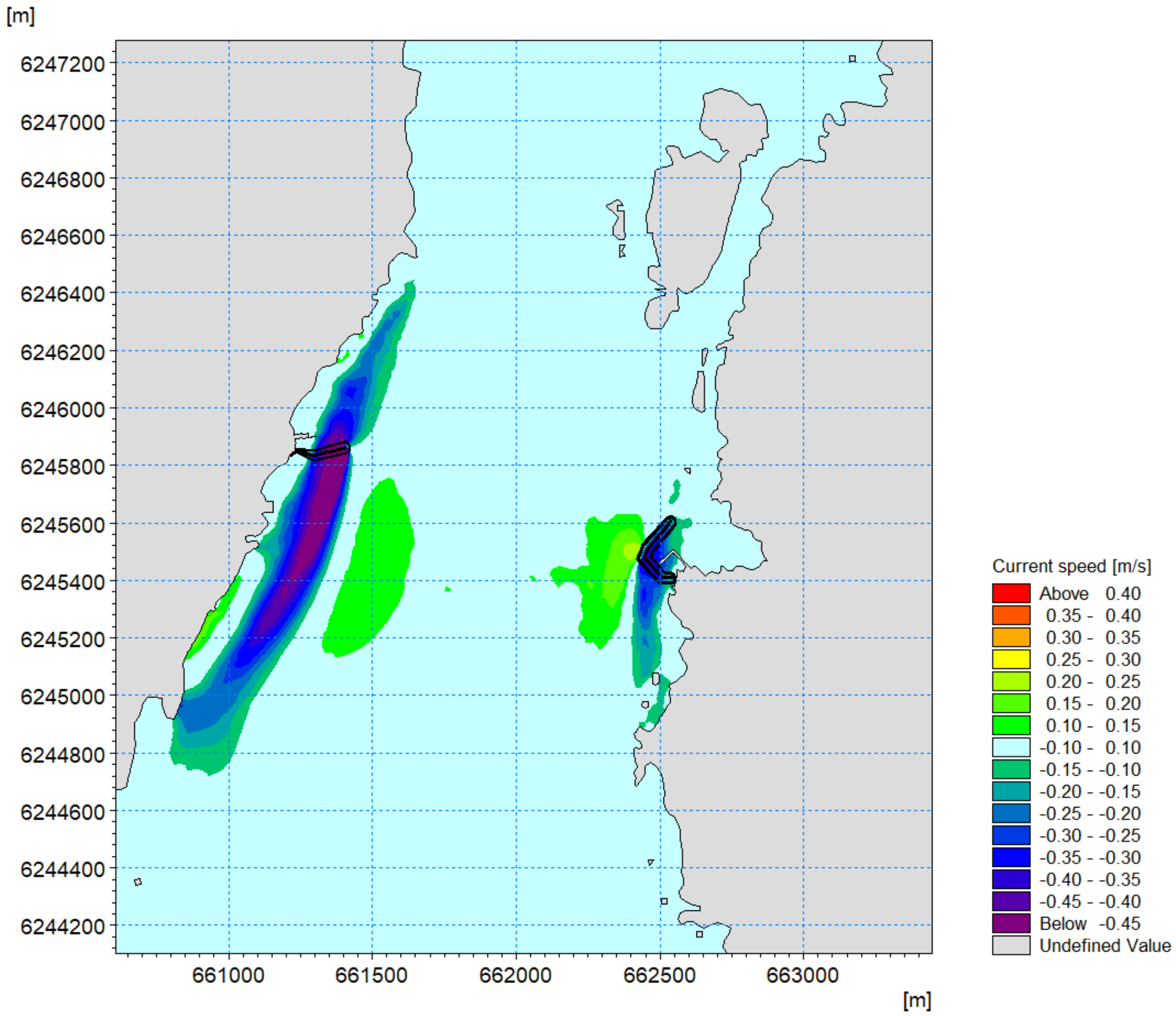


Figure 13-44 Difference in typical spring mid-ebb flow patterns as a result of the Proposed Developments at Iona and Fionnphort

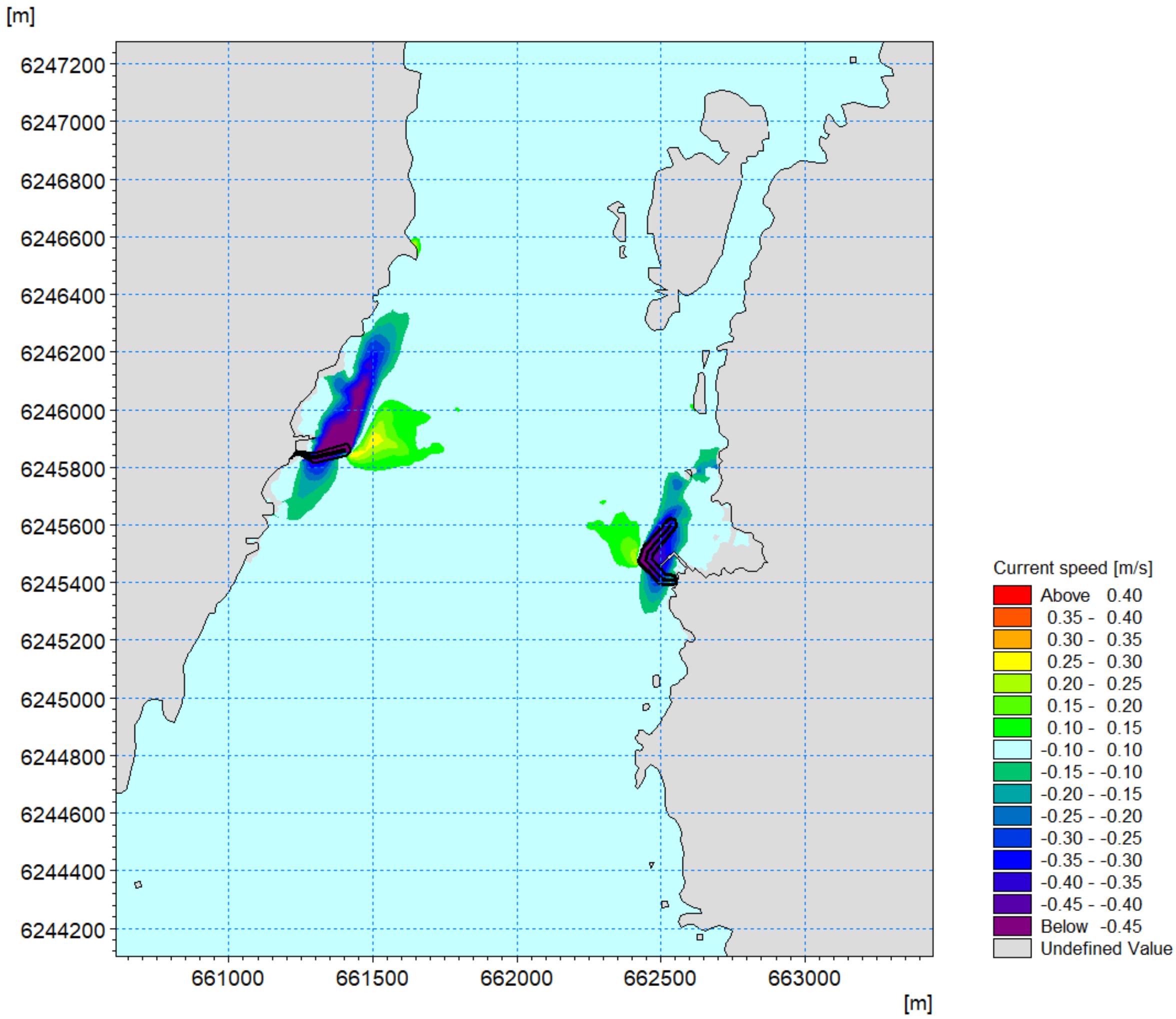


Figure 13-45 Difference in typical spring flood tidal flow patterns as a result of the Proposed Developments at Iona and Fionnphort

13.6.2 Wave climate within the Sound of Iona

As demonstrated in Figure 13-46, Figure 13-47 and Figure 13-48 below, both schemes reduce the significant wave height behind the respective breakwaters in storms with a direction of 240°. In terms of creating a cumulative effect on the wave climate, the reduction of wave height is localised to the breakwaters and no cumulative effect is expected resulting from the presence of both structures. The effects associated with both developments on the wave climate are deemed negligible due to the expected decreases behind the breakwaters only as per the design parameters for the Proposed Development.

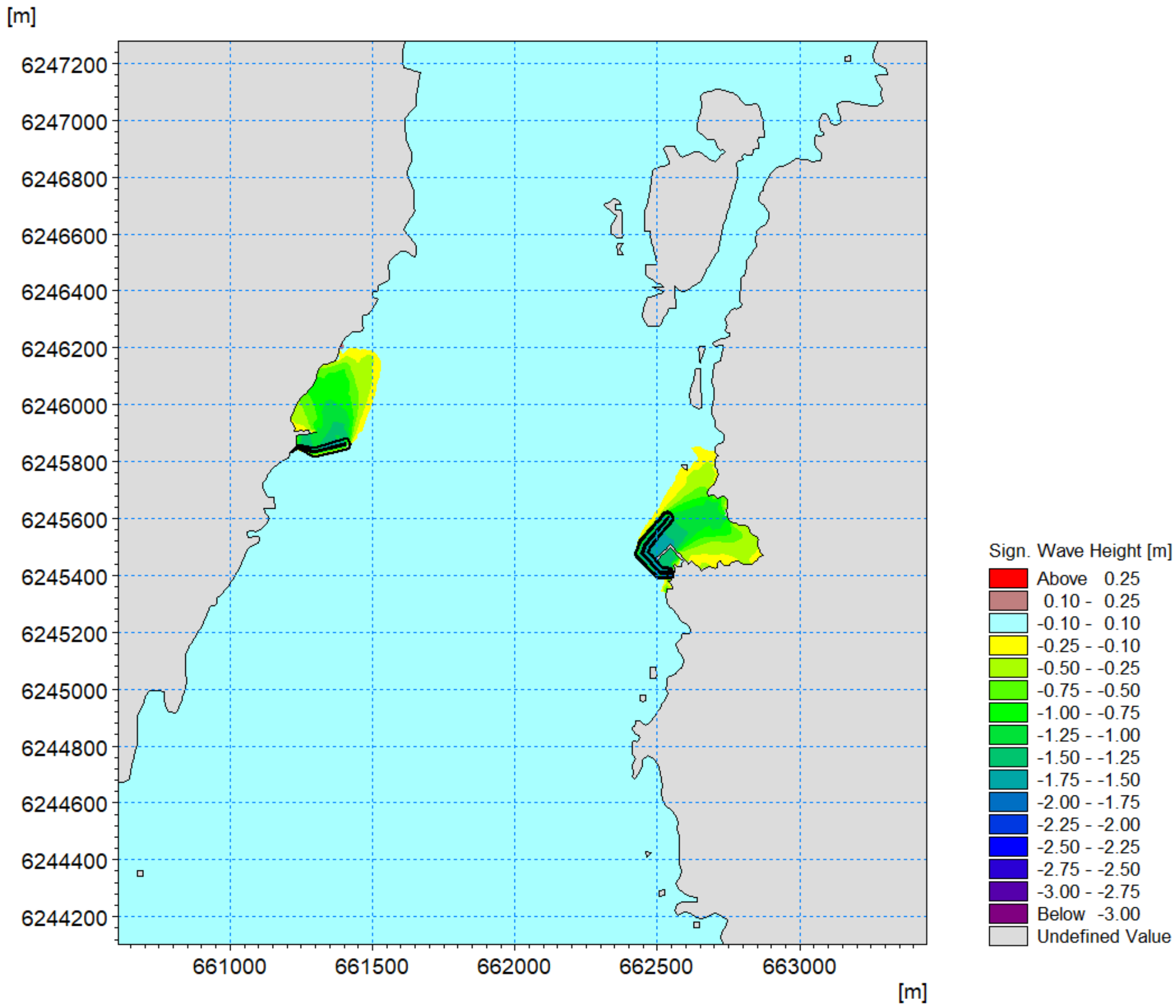


Figure 13-46 Difference in wave heights during a 1 in 1 year storm 240° HW

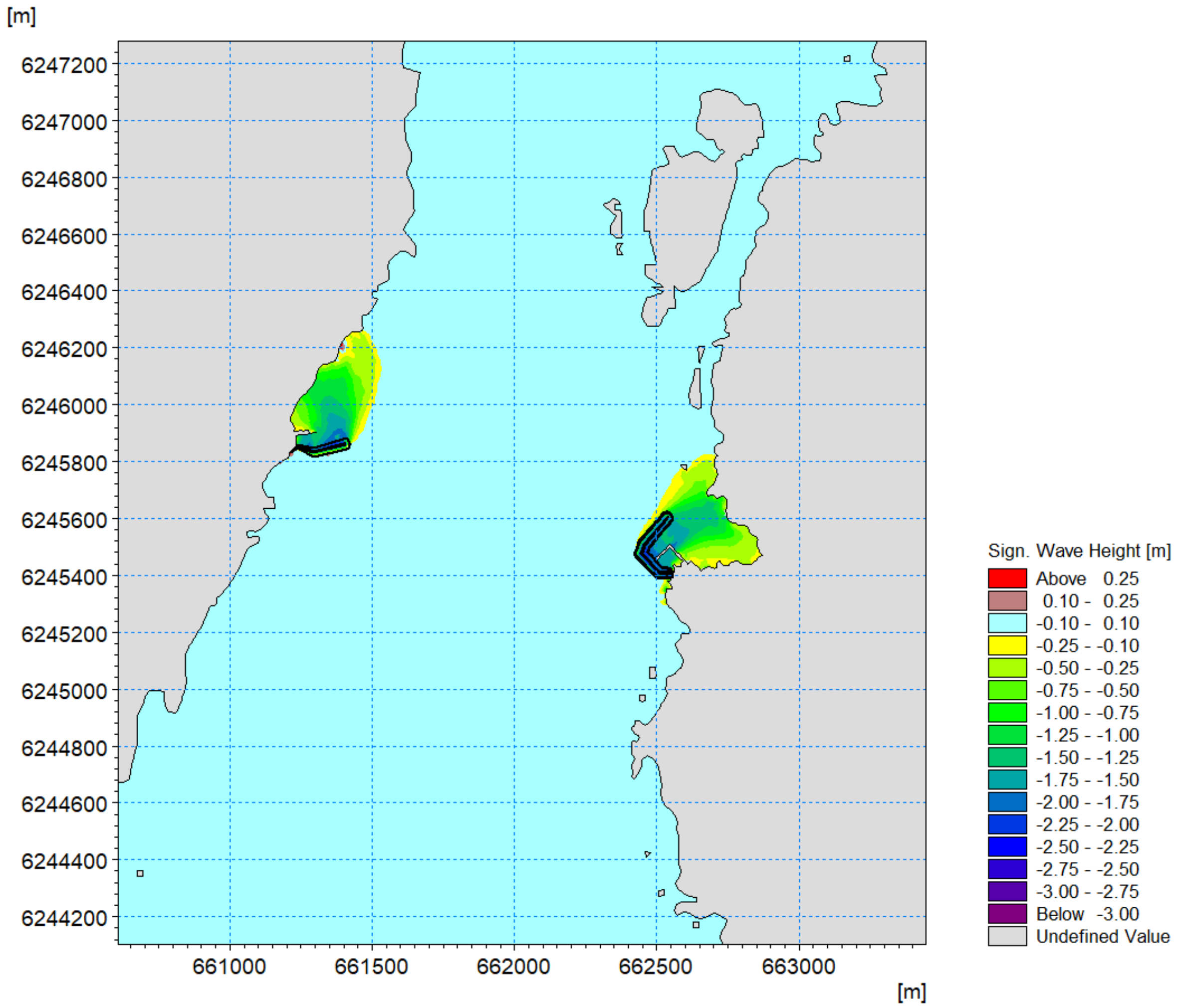


Figure 13-47 Difference in wave heights during a 1 in 50 year storm 240° HW

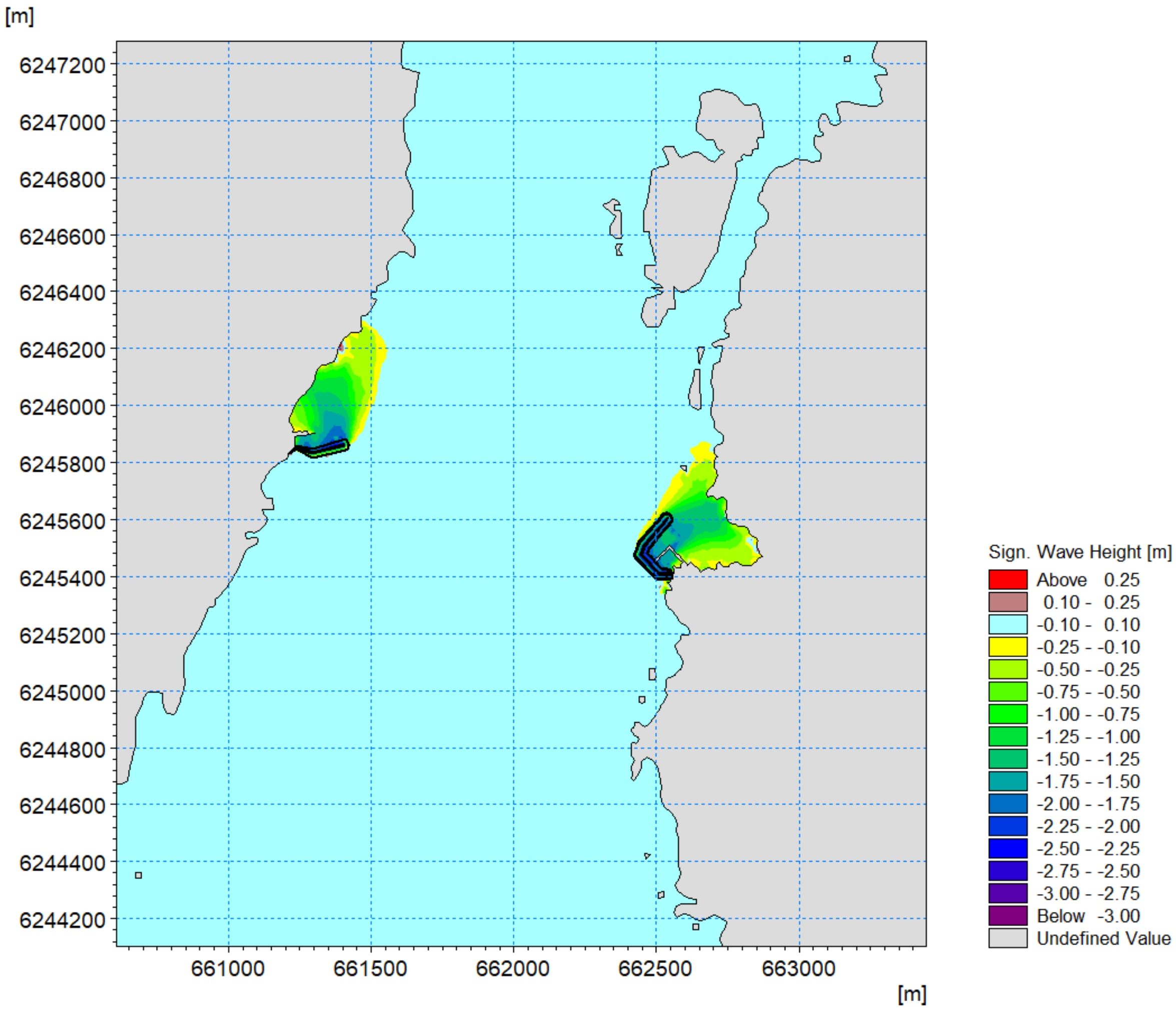


Figure 13-48 Difference in wave heights during a 1 in 200 year storm 240° HW

13.6.3 Littoral current within the Sound of Iona

The effect of the changing littoral currents within the Sound of Iona due to both developments is located primarily around the footprint of each development and does not result in any cumulative impact (Figure 13-49 and Figure 13-50). Within the centre of the Sound of Iona, there is a minor change in current velocities for both the ebb and flood tide during a 1 in 1-year storm, with an increase between 0 - 0.15 m/s. The effect associated with both developments on the littoral currents is deemed negligible due to the small changes in current velocities in the centre of the Sound of Iona.

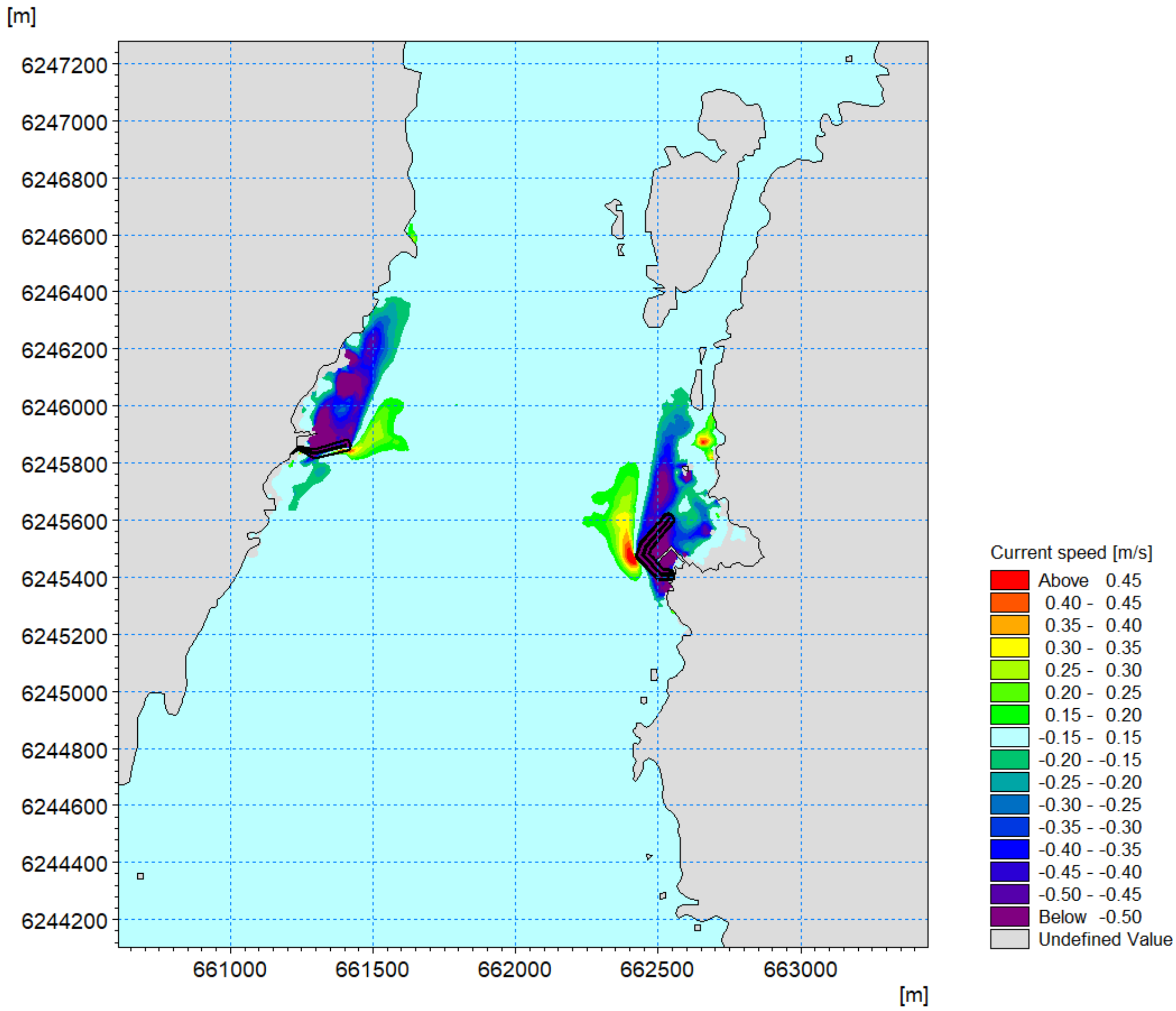


Figure 13-49 Change in littoral current 1 in 1 year storm from 240° - flood tide (post-construction minus baseline)

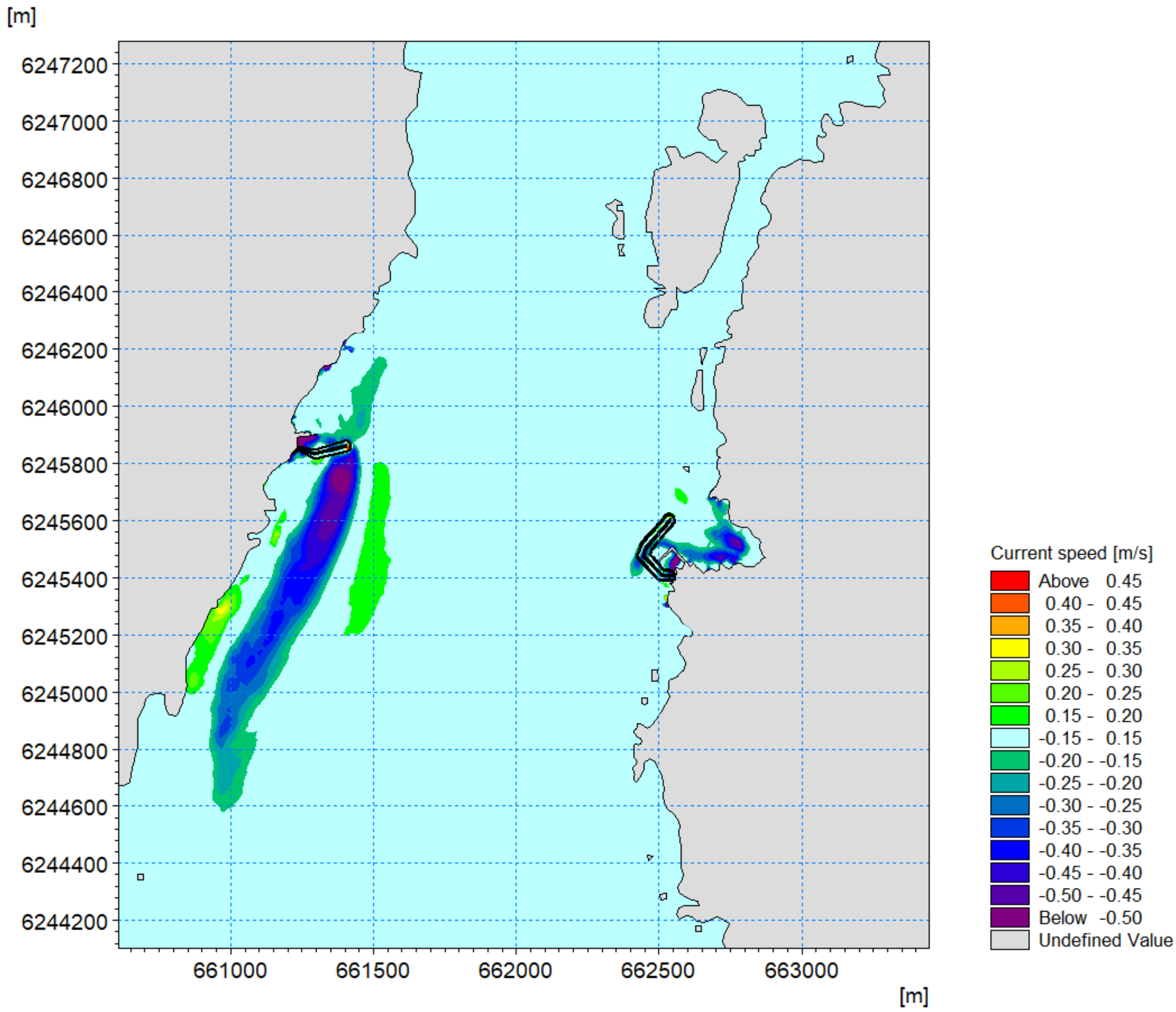


Figure 13-50 Change in littoral current 1 in 1 year storm from 240° - ebb tide (post-construction minus baseline)

13.6.4 Sedimentology within the Sound of Iona

As per the scoping response from Marine Scotland concerning the mobility of the sandwaves in the Sound of Iona due to both developments being operational, an assessment has been included in this section. In Section 13.3, it has already been established by sandwave analysis that there is limited movement of the sandwaves, which could be a result of the particle sizes and the net flow of the tidal current. As presented in Figure 13-51 and Figure 13-52, the change of the littoral current over the location of the sandwaves, when both developments are considered, is within a value of 0.15 m/s. As a result, the cumulative impact on the sedimentology within the Sound of Iona is expected to be negligible.

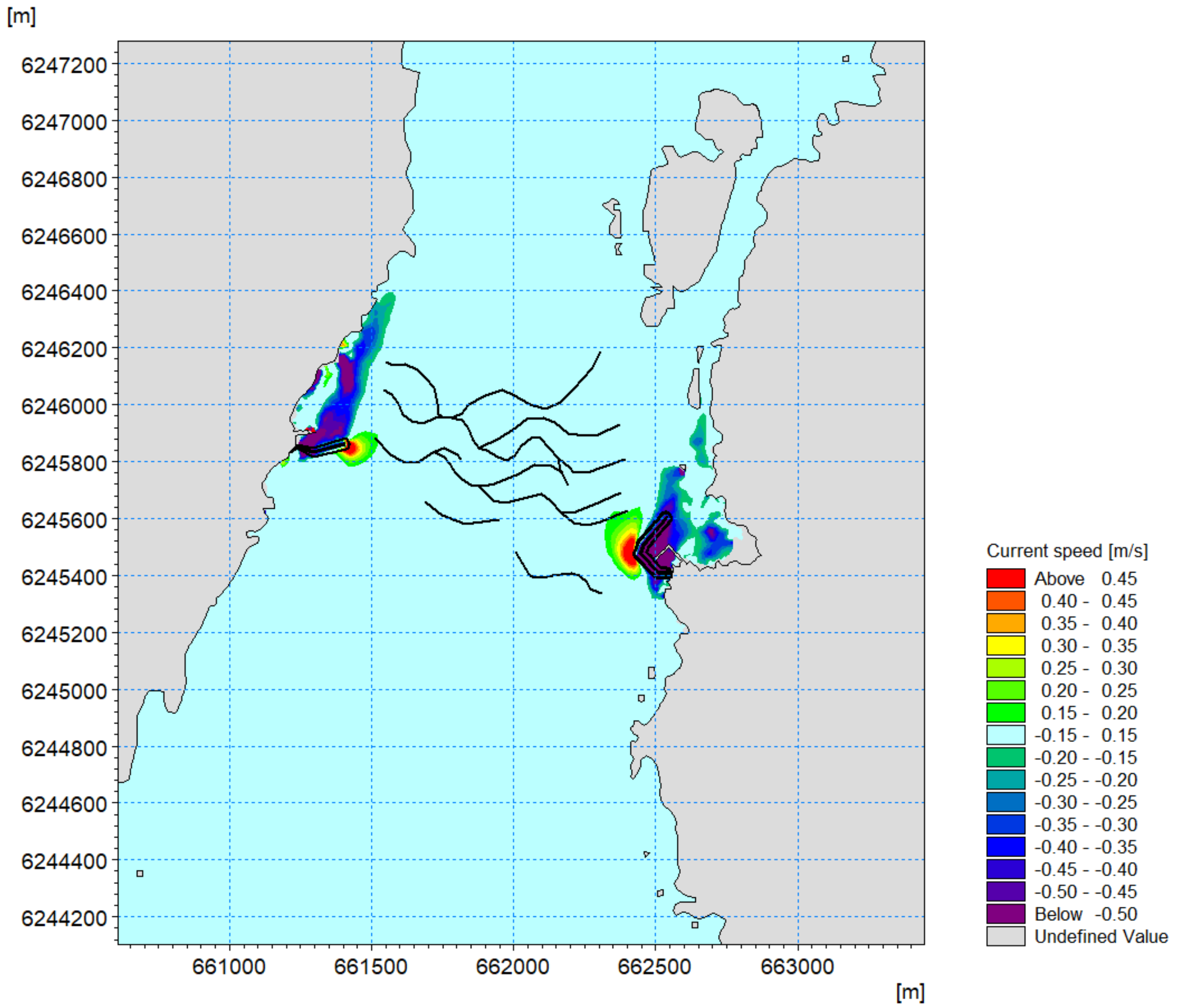


Figure 13-51 Post-construction Littoral current difference 1:1 year storm from 240° - mid- flood. The black lines show the location of sandwave crests within the Sound of Iona in 2022

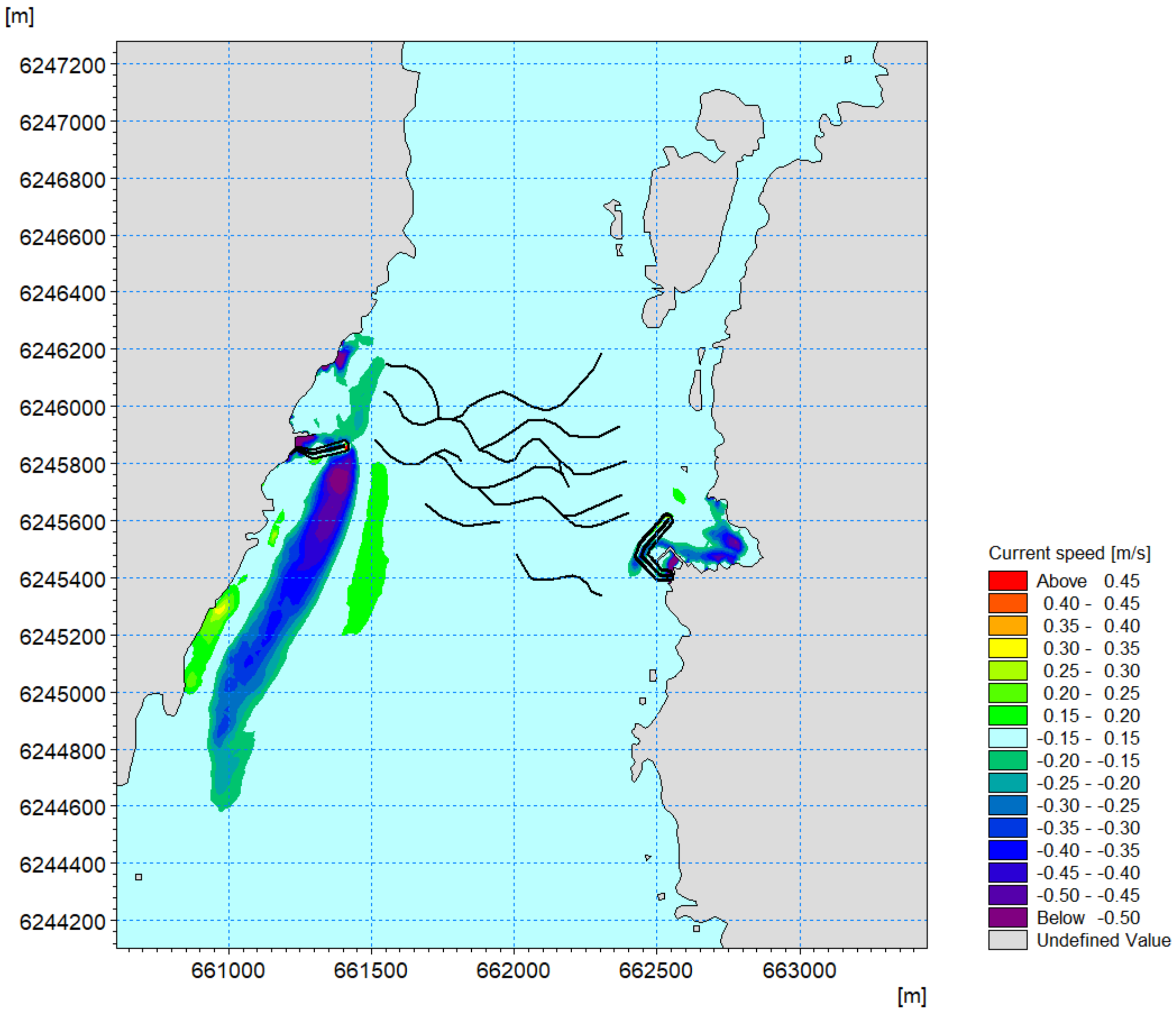


Figure 13-52 Post-construction Littoral current difference 1:1 year storm from 240° - mid- ebb. The black lines show the location of sandwave crests within the Sound of Iona in 2022

13.7 Residual Effects

In circumstances where the mitigation measures are fully implemented during the construction and operational phases as outlined in Section 13.5, the impact of the Proposed Development on the coastal processes within the Sound of Iona would consist of small-scale, low magnitude changes in the tidal regime, wave climate, littoral currents, and sedimentology.

The Proposed Development is therefore not expected to have a significant effect on coastal processes or make a significant change to the existing morphology.

13.8 Conclusions and Summary of Effects

The assessment of coastal processes was based on an extensive numerical modelling programme which was undertaken using RPS' in-house suite of MIKE coastal process modelling software developed by DHI. Baseline models were calibrated and verified against a range of project-specific hydrographic data and subsequently used to assess the construction and operational impacts of the Proposed Development.

The assessment concluded that dredging operations required for the Proposed Development would not result in any significant impact on water quality in terms of suspended sediments with mitigation measures in place. The assessment of disposal of dredge spoil arising from the Proposed Development at the potential licenced offshore disposal site concluded that the disposal operations would not likely result in any significant increases to the background level of suspended sediments and would not, therefore, impact the existing water quality in the area. This is due to the sediment particle size being large (sand and gravels) and settling quickly, rather than fine sediments such as silt and clay which would be suspended in the water column for a period of time and transported by tidal currents. Likewise, any overspill during the dredging of the slipway area would settle around the dredging area rather than being transported in the water column due to the larger particle sizes of sand and gravels established in recent sediment sampling.

The tidal regime in the Sound of Iona is predicted to remain substantially unchanged in the operational phase, and when considered in combination with the Fionnphort project. Minor local changes to the currents are expected around the breakwater such as an increase in the current velocity around the structure. The risk of impact to the existing tidal regime is, therefore, determined to be negligible and no mitigation is required.

The assessment of potential changes to the inshore wave climate found that the maximum change in wave heights in the Sound of Iona during storm events from the southwest did not exceed ±0.20m. These changes were confined primarily to the outer face of the breakwater, with a large decrease in wave height behind the breakwater as per the design specification. Minimal change in the wave height is observed elsewhere in the Sound of Iona from the Proposed Development, and when it is considered in combination with the Proposed Development at Fionnphort.

These changes to the wave climate behind the structure are considered significantly beneficial and would improve the safety and general operations of the ferry terminal at Iona. Furthermore, the change in risk of potential coastal flooding due to the Proposed Development at neighbouring sites is considered to be negligible and no mitigation is required.

As demonstrated in the assessment, the littoral currents within the Sound of Iona during a 240° 1 in 1-year event would not change by a significant amount. In terms of sediment transport, scour would be expected around the toe of the Iona breakwater during the flood tide during a 240° 1 in 1-year storm which requires scour protection with current velocities up to 1.5 m/s. As the change of littoral currents confined to the areas around Iona and Fionnphort, the cumulative effect upon the sandwaves within the Sound of Iona would be negligible. Periodic dredging may be required behind the Iona breakwater due to the reduced currents and accumulation of sediment over time as demonstrated by a reduction of total load in the sand transport modelling in Section 13.4.2.4.

On the basis that the appropriate mitigation measures are fully implemented during the construction and operational phases, the impact of the Proposed Development on coastal processes will be negligible.

14 POPULATION & HUMAN HEALTH

14.1 Introduction

This chapter outlines the population health assessment for the Proposed Development at the existing Iona Ferry Terminal, Iona, an island located west of Mull, on the west coast of Scotland.

Health is a *"state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity"* (World Health Organization, 1948). Mental health is a "*state in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community"* (World Health Organization, 2007). 'Population health' refers to the health outcomes of a group of individuals, including the distribution of such outcomes within the group (Kindig and Stoddart, 2003).

Health and wellbeing are influenced by a range of factors, termed the 'wider determinants of health'. Determinants of health span environmental, social, behavioural, economic and institutional factors. Determinants therefore reflect a mix of influences from society and environment on population and individual health.

This chapter assess potential impacts and likely significant effects (both adverse and beneficial) on population health associated with the construction and operation of the Proposed Development. Table 14-1 summarises the issues covered in this assessment and explains why some health determinants have been scoped out.

Table 14-1: Scope of health determinants based on the Institute of Environmental Management and Assessment (IEMA) guidance

Categories	Wider determinant of health	Scoped in/ out	Rationale
Health related behaviours	physical activity	OUT	The potential for effects is covered under 'open space, leisure and play' below. This issue is not separately assessed.
	risk taking behaviour	OUT	Construction: Conduct of the construction workforce is not expected to affect their own or the communities risk taking behaviours. Operation: Improved access to Mull and the mainland plays a role in behavioural choices and markets, both in supporting healthy choices and unhealthy behaviours. However, the change in access is unlikely to drive a significant population level health effect.
	diet and nutrition	OUT	Construction phase: the construction works are not expected to affect food production or limit food delivery access for Iona. Operation: Food options are influenced by access to Mull and the mainland. However, the change in access is unlikely to drive a significant population level health effect.
Social environment	housing	OUT	Construction: It is assumed that the non-local workforce will be housed off the island and best practice for construction management (e.g., transport of the construction workforce) will be implemented via the Construction Environmental Management Plan (CEMP). There is no expectation of a scale of workforce accommodation on Iona that could affect population health. Operation: The improved harbour facilities support the viability of the population, including the importing of material required to support new housing. However, the change is unlikely to drive significant population level health effects.
	relocation	OUT	No relocations are involved. This issue is therefore scoped out.
	open space, leisure and play	IN	Construction phase: There is the potential for construction to affect sea users including sea kayakers, who may be pushed further into more dangerous waters due to the Proposed Development and sail boats which are used for

Categories	Wider determinant of health	Scoped in/ out	Rationale
			leisure boating in the Sound of Iona. (Scoping Opinion para 5.21.5). This has been assessed in Chapter 6 (Navigation & Safety), Section 6.4.1.10 and Section 6.4.2.2. The risk of sea users being pushed into dangerous waters resulting in collisions has been identified to be of minor adverse significance. The corresponding population health effects of construction on open space, leisure and play have been scoped in for further assessment in this chapter. Operation phase: The Proposed Development will improve breakwaters in the sound of Iona making the waters potentially safer for recreational use.
	transport modes, access and connections	IN	Construction: There is the potential for temporary disruption during construction. This is not expected to prevent access to or from the island, so is scoped out. Operation: The Scottish Ministers highlight the positive impacts the Proposed Works may have, including the reduction in weather related disruption to the ferry service (Scoping Opinion para 5.21.4). This issue is therefore scoped in to discuss improved and safer access to the island, and improved ability for lifeline services to travel to and from Iona.
	community safety	OUT	Construction: Injury risk will be avoided through clearly marked or fenced work areas. Standard good practice measures would be followed, set out in the contractors Construction Environmental Management Plan (CEMP) which will include Traffic & Navigation Management Plan (TNMP) and a Method Statement (MS). Operation: The finished works are expected to improve community safety, including relating to embarking and disembarking during poor weather conditions, and would improve safety for ferry boat operators. It is noted that the Scottish Ministers highlight the positive impacts the Proposed Development may have, including the reduced health and safety risk to ferry boat operators (Scoping Opinion para 5.21.4). Assessment of operational health and safety risks of users of ferry boats and the pier does not fall within the scope of this planning application and will be addressed by relevant contractors. Community safety related to recreation, leisure and play, as well as access to lifeline services, are addressed elsewhere in the scope of this report (refer to Chapter 6: Navigation & Safety).
	community identity, culture, resilience and influence	OUT	Construction: The presence of a construction workforce has the potential to influence cultural norms and traditions, including use of Gaelic. The construction works visual impacts also have the potential to influence community identity through built form. However, a non-resident workforce is not expected to be large in number or be accommodated on the island and the construction works are limited to approximately 52 weeks. Furthermore, the outcomes of the works are likely to be viewed positively by the community, limiting the potential for adverse effects. This issue is therefore scoped out. Operation: The Proposed Development helps to safeguard the way of life for the people of Iona through for example, increasing access to training, jobs and income from Iona This includes safeguarding community culture and identity. This issue is partly assessed within Chapter 16: Cultural Heritage and is also covered under the related issue of opportunities for 'education and training', and 'employment and income'.
	social participation, interaction and support	OUT	The planning process is an opportunity for community involvement in decision making. This issue is however scoped out as it is not expected to be of a scale that would lead to the potential for significant adverse effects. Notwithstanding this, the importance of community participation and channels of communication during construction is noted and should be a feature of the CEMP.
Economic environment	education and training	IN	Construction: The development may include some construction upskilling opportunities. Whilst they may be limited in number their impact within a small community may be disproportionally beneficial if they can be appropriately targeted to vulnerable groups. Operation: The improvements will facilitate access to and from the island, which includes access to education and training opportunities on Mull and the mainland. This is likely to be beneficial for the Iona community.
	employment and income	IN	Construction: In a small island context even a small amount of employment may be influential to the population's health. The potential for local direct or indirect employment is scoped in. It is also noted that disruption to important

Categories	Wider determinant of health	Scoped in/ out	Rationale
			income streams for the island may be detrimental, including associated tourism and fishing. This issue is also considered. Operation: Scoped in during operation to discuss improved access to and from Iona facilitating wider forms of economic development such as through tourism (indirect effect).
Bio-physical environment	climate change mitigation and adaptation	OUT	Construction: The Proposed Development involves materials with embodied carbon and emissions of climate altering pollutants. However, these are not of a scale to result in likely significant population health effects. Construction effects are scoped out. Operation: The Proposed Development has the potential to increase resilience to climate change for the community of Iona. This is likely to be associated with avoiding adverse effects associated with climate change, including resilience to extreme weather events and maintaining economically viable access to markets and resources. Changes in access to Iona are discussed as part of other issues in the scope. Climate change is therefore scoped out.
	air quality	OUT	Construction: the Iona Community Council (ICC) have raised concerns regarding the effects of dust and debris on the local population. Within the CEMP the Applicant has committed to include a dust and emissions management plan, the Scottish Ministers advise that this must address ICC's concerns and include assessment of the effects of dust and debris on the local population as well as mitigation that will minimise the impacts. (Scoping Opinion para 5.21.3). Given this and noting that traffic via the road network will be minimal, this issue is therefore scoped out. Operation: as detailed in the EIA Scoping Report, the assessment of operational air quality impacts has been scoped out of the EIA, and therefore no further population and health assessment is considered necessary.
	water quality or availability	OUT	Based on the construction and operation activities described in Chapter 3 (Project Description), the Proposed Development is not anticipated to impact water quality during construction and operation. In addition, this is assessed in detail in Chapter 11. This issue is therefore scoped out.
	land quality	OUT	Based on the construction and operation activities described in Chapter 3 (Project Description), the Proposed Development is not anticipated to impact land quality during construction and operation. This issue is therefore scoped out.
	noise and vibration	IN	Construction: construction activities have the potential to result in noise nuisance, both during daytime and night-time, with associated health effects, and is therefore scoped in. Operation: As stated in Chapter 10 (Noise & Vibration) of the EIAR, assessment of operational noise impacts is scoped out due to there being no new noise sources that are likely to generate perceptible noise levels during operation. Assessment of health effects from operational noise is therefore scoped out.
	radiation	OUT	Based on the construction and operation activities described in Chapter 3 (Project Description), the Proposed Development is not anticipated to change risk of radiation. This issue is therefore scoped out.
Institutional and built environment	health and social care services	OUT	Construction: It is assumed that the non-local workforce will be housed off the island and will access healthcare and social services within their local area. It is therefore not expected that there would be any change in the provision or access of health and social services. Construction effects are therefore scoped out. Operation: The Scottish Ministers highlight the positive impacts the Proposed Development may have. These include potential benefits for services such as medical supplies (Scoping Opinion para 5.21.4). Beneficial changes to transport and access of health care goods and services are discussed under "transport modes and access". Therefore, a separate assessment is not considered necessary.
	built environment	OUT	The Proposed Development provides important new harbour infrastructure for the community of Iona. This infrastructure is likely to indirectly support a wider range of determinants of health as discussed above. This issue is not separately assessed.

Categories	Wider determinant of health	Scoped in/ out	Rationale
	wider societal infrastructure and resources	OUT	The Proposed Development will support climate change adaptation. This is discussed under the issues discussed above. This issue is not separately assessed.

14.2 Assessment Methodology

14.2.1 Legislation, Policy and Guidance

14.2.1.1 Legislation

The following legislation is relevant to the assessment of the effects on human health:

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 201 – sets the requirement to consider the likely significant direct and indirect effects on human health.
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) ("the 2017 MW Regulations") – sets the requirement to consider the likely significant direct and indirect effects on human health.
- Islands (Scotland) Act 2018 – sets out the requirements for National Islands Plan to include effects on human health.
- Health and Safety at Work etc. Act 1974 – primary piece of legislation covering occupational health and safety in Great Britain.

14.2.1.2 Policy

The National Islands Plan (December 2019) works in conjunction with The Islands (Scotland) Act 2018. The Plan provides a framework for action in order to meaningfully improve outcomes for island communities. The Plan has a duration of five years (2019-2024) and includes 13 Strategic Objectives. These objectives are underpinned by four key values: fairness, integration, environmental protection (green) and inclusiveness. The Strategic Objective related to health is Strategic Objective 7 Health and Social Care and Wellbeing. To improve and promote health and wellbeing, the objective states:

- Work with NHS Boards, Local Authorities and health and Social Care partnerships to ensure there is fair, accessible health and social care for those on the islands.
- Identify and promote good practice, especially as regards the improvement of services in islands and other remote areas.
- Ensure that health, social care and wellbeing services are available through the medium of Gaelic to support Gaelic speaking island communities
- Work with partners to consider a range of options to ensure that adequate mental health care is available, whilst taking into consideration the uniqueness of our island communities.

- Work with partners to eliminate unlawful discrimination, harassment and victimisation and take steps to assist with promoting equality and meeting people's different needs.

There is also wider Scottish policy that relates to health (Table 14-2):

Table 14-2: Health Policy

Policy referencing health	Description of current policies
National Planning Framework 3	Scottish Government's Strategy for Scotland's long term spatial development
Scottish Planning Policy	Health is mentioned numerous times throughout all Subject Policies
Cleaner Air for Scotland 2: Towards a better place for everyone	*"Human health improvements are not related solely to direct reductions in air pollution. Policies that improve air quality can potentially have multiple co-benefits for population health, for addressing inequality and for mitigating and adapting to climate change. A prime example is policy to promote active travel. Walking, wheeling and cycling increase physical activity, significantly reduce cardiovascular incidence and mortality, and have been shown to reduce all-cause mortality, even after controlling for other physical activity."*

14.2.1.3 Guidance

The following guidance (Table 14-3) is relevant to the assessment of the effects on human health:

Table 14-3: Health Guidance

Health Guidance	Description
Scottish Health and Inequality Impact Assessment Network (SHIIAN): Health Impact Assessment Guidance for Practitioners (August 2016)	Practicable guide for health impact assessment (HIA). It is intended primarily for people working in Scotland and identifies relevant Scottish resources.
Institute of Environmental Management and Assessment (IEMA) 2022 guidance on health in EIA series, effective scoping *Invalid source specified.* ***and determining significance*** *Invalid source specified.**.***	Practitioner guidance on the coverage of human health in EIA for England, Wales, Scotland, Northern Ireland and the Republic of Ireland. This includes methods for determining population health sensitivity, magnitude and significance. This is the key methods citation.
International Association for Impact Assessment (IAIA) and European Public Health Association. A reference paper on addressing Human Health in EIA *Invalid source specified.****, and academic discussion of the same*** *Invalid source specified.**.***	The publication explains EIA for public health stakeholders and sets out transparent assessment approaches.
International Association for Impact Assessment. Health Impact Assessment International Best Practice Principles, 2021*Invalid source specified.**.***	Confirms the relationship between HIA and EIA. Confirms the application of HIA principles when undertaking health in EIA.

14.2.2 Study Area

The following study areas are used in the assessment:

- The 'site-specific' study area is the intermediate zone[26] of Mull, Iona, Coll and Tiree.
- The 'local' study area is the local council area of Argyll and Bute.
- The 'national' area is Scotland (and beyond for climate related effects).

As study areas do not necessarily define the boundaries of potential health effects, particularly mental health effects, the health chapter uses study areas to broadly define representative population groups, including in relation to sensitivity, rather than to set boundaries on the extent of potential effects.

The health assessment has regard to the zones of influence defined by other EIAR chapters. Those chapters have provided data inputs to the health assessment. Those zones of influence are relevant and inform the health chapter's consideration of effect magnitude.

14.2.3 Baseline Methodology

Data from other EIAR chapters have been used to inform the population and health assessment. Data informs the health assessment by identifying potential receptors and community assets for these disciplines, such as schools, residential properties, walking and cycling routes, as well as tourism and recreational amenities. No bespoke baseline population or human health surveys have been undertaken as part of the assessment. The population and health analysis has been informed by project wide consultation.

The following data sources have informed the health baseline assessment:

- Public Health Scotland "ScotPHO" profile tool[27];
- National Records of Scotland mid-year population estimates[28];
- Scottish Index of Multiple Deprivation (SIMD) 2020[29]; and
- Google Earth Pro 2021 aerial and street level photography review.

14.2.4 Assessment Criteria and Assignment of Significance

14.2.4.1 General approach

This section sets out the methods for assessment of any likely significant population health effects of the Proposed Development.

The generic project-wide approach to the assessment methodology is set out in Chapter 1 of the EIAR. This section sets how the generic approach is refined to address the specific needs of the EIA health assessment.

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[26] Intermediate zones are a statistical geography that sit between data zones and local authorities, created for use with the Scottish Neighbourhood Statistics (SNS) programme and the wider public sector.

[27] https://www.scotpho.org.uk/

[28] https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates

[29] https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/

Namely criteria for sensitivity, magnitude and significance that inform a professional judgment and reasoned conclusion as to the public health implications of the Proposed Development.

The methodology outlined in this section follows the IEMA 2022 guidance, which sets out best practice for the consideration of health in EIA. The IEMA guidance was informed by the international consensus publication between impact assessment and public health practitioners, the IAIA/EUPHA Reference Paper 2020.

Where significant adverse population health effects are identified, including for vulnerable groups, then mitigation has been proposed to avoid or reduce the effects. Mitigation is secured as part of the Proposed Development design or development consent. In line with good practice the Proposed Development takes a proportionate approach to identifying opportunities to enhance beneficial population health effects, including for vulnerable groups.

Cumulative effects are considered, including inter-related effects of the Proposed Development. This analysis considers how the same geographic or vulnerable group populations may be affected by more than one change in relevant health determinants, for example the combined effects of changes in air quality and noise on population health outcomes.

Where proportionate, the need for monitoring has been considered, including relevant governance.

14.2.4.2 Determinants of health, risk factors and health outcomes

Health and wellbeing are influenced by a range of factors, termed the 'wider determinants of health'. Determinants of health span environmental, social, behavioural, economic and institutional factors. Determinants therefore reflect a mix of influences from society and environment on population and individual health.

Impacts of the Proposed Development that result in a change in determinants have the potential to cause beneficial or adverse effects on health, either directly or indirectly. The degree to which these determinants influence health varies, given the degree of personal choice, location, mobility and exposure.

A change in a determinant of health does not equate directly to a change in population health. Rather the change in a determinant alters risk factors for certain health outcomes. The assessment considers the degree and distribution of change in these pathways. The analysis of health pathways focuses on the risk factors and health outcomes that are most relevant to the determinants of health affected by the Proposed Development. As there are both complex and wide-ranging links between determinants of health, risk factors and health outcomes, it would not be proportionate or informative for an assessment to consider every interaction.

Typically, the change in a risk factor may need to be large, sustained and widespread within a population for there to be a significant influence on public health outcomes.

14.2.4.3 Population health approach and vulnerable groups

In line with guidance a population health approach has been taken (see Table 14-1). This is informed by discussion of receptors within the other technical chapters of the EIAR.

For each determinant of health, the health chapter identifies relevant inequalities through consideration of the differential effect to the 'general population' of the relevant study area and effects to the 'vulnerable population group' of that study area. The vulnerable population group is comprised of relevant sensitivities for that determinant of health.

The methods draw on the list of vulnerable population groups set out in the Institute of Public Health (IPH) 2021 guidance Part 3, Table 09. The following six broad population groups are used to inform a consistent narrative on potential health inequalities across the assessment; people falling into more than one group may be especially sensitive:

1. Young age: Children and young people (including pregnant women and unborn children).
2. Old age: Older people (particularly frail elderly).
3. Low income: People on low income, who are economically inactive or unemployed/workless.
4. Poor health: People with existing poor health; those with existing long-term physical or mental health conditions or disability that substantially affects their ability to carry out normal day-to-day activities.
5. Social disadvantage: People who suffer discrimination or other social disadvantage, including relevant protected characteristics or groups who may experience low social status or social isolation for other reasons.
6. Access and geographical factors: People experiencing barriers in access to services, amenities and facilities and people living in areas known to exhibit high deprivation or poor economic and/or health indicators. Island communities are acknowledged to face particular barriers.

The following general characterisations of how the 'general population' may differ from 'vulnerable group populations' were considered when scoring sensitivity. These statements are not duplicated in each assessment and apply (as relevant) to the issues discussed for both construction, operation and decommissioning.

- In terms of life stage, the general population can be characterised as including a high proportion of people who are independent, as well as those who are providing some care. By contrast, the vulnerable group population can be characterised as including a high proportion of people who are providing a lot of care, as well as those who are dependant.
- The general population can be characterised as experiencing low deprivation. However, the professional judgment is that the vulnerable group population experiences high deprivation (including where this is due to pockets of higher deprivation within low deprivation areas).
- The general population can be characterised as broadly comprised of people with good health status. Vulnerable groups, however, tend to include those parts of the population reporting bad or very bad health status.
- The general population tends to include a large majority of people who characterise their day-to-day activities as not limited. The vulnerable group population tends to represent those who rate their day-to-day activities as limited a little or limited a lot.
- Based on a professional judgement the general population's resilience (capacity to adapt to change) can be characterised as high whilst the vulnerable group population can be characterised as having limited resilience.

- Regarding the usage of affected infrastructure or facilities, the professional judgement is that the general population are more likely to have many alternatives to resources shared with the Proposed Development. For the vulnerable group population, the professional judgement is that they are more likely to have a reliance on shared resources (e.g., the road network).
- The general population includes the proportion of the community whose outlook on the Proposed Development includes support and ambivalence. The vulnerable group population includes the proportion of the community who are uncertain or concerned about the Proposed Development.

14.2.4.4 Temporal Scope

The temporal scope of the assessment is consistent with the period over which the Proposed Development will be carried out and therefore covers the construction, operational and decommissioning periods.

Where relevant EIAR chapters defined specific assessment years, the health chapter assessment used those same assessment years.

The temporal scope of the health chapter assessment used the following summary terms:

- 'Very short term' relates to effects measured in hours, days or weeks (e.g., effects associated with changes in exposure during weather conditions);
- 'Short term' relates to effects measured in months (up to 12 months duration) (e.g., activities near particular dwellings within the construction stage);
- 'Medium term' relates to effects of more than one year and up to five years (e.g., the entire construction stage); and
- 'Long term' relates to effects of more than five years (e.g., the long-term effects on population and health from the Proposed Development).

14.2.4.5 Determining Effect Significance

The assessment of EIA health significance is an informed expert judgement about what is important, desirable or acceptable for public health with regards to changes triggered by the Proposed Development. These judgements are: value dependant (underpinned by scientific data, but also informed by professional perspectives); and are context-dependent (judgements reflect relevant social, economic and political factors for the population)[30]

The determination of significance has two stages:

- Firstly, the sensitivity of the receptor affected, and the magnitude of the effect upon it are characterised. This establishes whether there is a relevant population and a relevant change to consider; and

[30] European Commission. 2017. Environmental Impact Assessment of Projects: Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU). European Union. Luxembourg. http://ec.europa.eu/environment/eia/pdf/EIA_guidance_Scoping_final.pdf

- Secondly, a professional judgement is made as to whether the expected change in a population's health outcomes would be significant in public health terms. This judgement is explained using an evidence-based narrative setting out reasoned conclusions.

Table 14-4, Table 14-5, Table 14-6 and Table 14-7 together summarise the assessment methodology that has been adopted for health sensitivity, magnitude, magnitude vs sensitivity, and significance, respectively. Terms in bold within these tables show indicative qualitative terminologies to indicate levels (e.g., high, medium, low or negligible) within the criteria described by the IPH 2021 guidance. This approach shows how the general EIA methods of using sensitivity and magnitude to inform a judgement of significance, are applied for human health. The approach uses professional judgement, drawing on consistent and transparent criteria for sensitivity and magnitude. It also references relevant contextual evidence to explain what significance means for public health in terms of a change in population health outcomes.

The EIA population health assessment uses qualitative analysis following the IPH 2021 guidance approach. This draws on qualitative and quantitative inputs from other EIA topic chapters. This is considered the most appropriate methodology for assessing wider determinants of health proportionately, consistently and transparently.

Table 14-4: Health sensitivity methodology criteria

Category/ Score	**Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories). The narrative explains that the population or sub-population's sensitivity is driven by:**
High	**high** levels of deprivation (including pockets of deprivation); **reliance** on resources shared (between the population and the project); existing **wide** inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or **concern**; people who are **prevented** from undertaking daily activities; **dependants**; people with **very poor** health status; and/or people with a **very low** capacity to adapt.
Medium	**moderate** levels of deprivation; **few alternatives** to shared resources; existing **widening** inequalities between the most and least healthy; a community whose outlook is predominantly **uncertainty** with some concern; people who are **highly limited** from undertaking daily activities; people providing or requiring **a lot of care**; people with **poor** health status; and/or people with a **limited** capacity to adapt.
Low	**low** levels of deprivation; **many alternatives** to shared resources; existing **narrowing** inequalities between the most and least healthy; a community whose outlook is predominantly **ambivalence** with some concern; people who are **slightly limited** from undertaking daily activities; people providing or requiring **some care**; people with **fair** health status; and/or people with a **high** capacity to adapt.
Very low	**very low** levels of deprivation; **no** shared resources; existing **narrow** inequalities between the most and least healthy; a community whose outlook is predominantly **support** with some concern; people who are **not limited** from undertaking daily activities; people who are independent (not a carer or dependant); people with **good** health status; and/or people with a **very high** capacity to adapt.

Table 14-5: Health magnitude methodology criteria

Category/ Score	**Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories). The narrative explains that the project change has:**
High	**High** exposure or scale; **long-term** duration; **continuous** frequency; severity predominantly related to **mortality** or changes in morbidity (physical or mental health) for very severe illness/injury outcomes; **majority** of population affected; **permanent** change; **substantial** service quality implications.
Medium	**Low** exposure or **medium** scale; **medium-term** duration; **frequent** events; severity predominantly related to moderate changes in **morbidity** or major change in quality-of-life; **large minority** of population affected; **gradual** reversal; **small** service quality implications.

Low	**Very low** exposure or **small** scale; **short-term** duration; **occasional** events; severity predominantly related to minor change in **morbidity** or moderate change in quality-of-life; **small minority** of population affected; **rapid** reversal; **slight** service quality implications.
Negligible	**Negligible** exposure or scale; **very short-term** duration; **one-off** frequency; severity predominantly relates to a minor change in **quality-of-life**; very few people affected; immediate reversal once activity complete; no service quality implication.

14.2.4.6 Significance of Effects

The assessment of significance is a professional judgement. That judgment is informed by the indicative matrix of sensitivity and magnitude set out in Table 14-6. Table 14-7 provides additional explanation of how contextual evidence also informs the significance conclusion and what the conclusion means for public health.

Table 14-6: Assessment Matrix (indicative)

	Sensitivity			
Magnitude of Impact	**High**	**Medium**	**Low**	**Very low**
High	Major	Moderate or major	Moderate or minor	Minor or negligible
Medium	Moderate or major	Moderate	Minor	Minor or negligible
Low	Moderate or minor	Minor	Minor	Negligible
Negligible	Minor or negligible	Minor or negligible	Negligible	Negligible

Where the matrix offers more than one significance option, professional judgement is used to decide which option is most appropriate.

Moderate and major effects are considered significant in terms of the EIA Regulations.

Table 14-7: Health significance methodology criteria

Category/ Score	**Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories)**
Major	The narrative explains that this is significant for public health because (most relevant statements used as appropriate): • Changes, due to the Proposed Development, have a **substantial** effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by **consensus** in consultation themes among stakeholders, particularly public health stakeholders. • Change, due to the Proposed Development, could result in a regulatory threshold or standard being **crossed** (if applicable). • There is likely to be a **substantial** change in the health baseline of the population, including as evidenced by the scientific literature showing there is a **causal** relationship between changes that would result from the Proposed Development and changes to health outcomes. • Health priorities for the relevant study area are of **specific** relevance to the determinant of health or population group affected by the Proposed Development.
Moderate	The narrative explains that this is significant for public health because (most relevant statements used as appropriate): • Changes, due to the Proposed Development, have an **influential** effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by **mixed views** in consultation themes among stakeholders. • Change, due to the Proposed Development, could result in a regulatory threshold or standard being **approached** (if applicable).

Category/ Score	Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories)
	• There is likely to be a **small** change in the health baseline of the population, including as evidenced by the scientific literature showing there is a **clear** relationship between changes that would result from the Proposed Development and changes to health outcomes. • Health priorities for the relevant study area are of **general** relevance to the determinant of health or population group affected by the Proposed Development.
Minor	The narrative explains that this is not significant for public health because (most relevant statements used as appropriate): • Changes, due to the Proposed Development, have a **marginal** effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by **no** consultation themes emerging among stakeholders. • Change, due to the Proposed Development, would be **well within** a regulatory threshold or standard (if applicable). • There is likely to be a **slight** change in the health baseline of the population, including as evidenced by the scientific literature showing there is only a **suggestive** relationship between changes that would result from the Proposed Development and changes to health outcomes. • Health priorities for the relevant study area are of **low** relevance to the determinant of health or population group affected by the Proposed Development.
Negligible	The narrative explains that this is not significant for public health because (most relevant statements used as appropriate): • Changes, due to the Proposed Development, are **not related** to the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by consultation for the Proposed Development having **no responses** on this issue among stakeholders. • Change, due to the Proposed Development, would **not affect** a regulatory threshold or standard (if applicable). • There is likely to be a **very limited** change in the health baseline of the population, including as evidenced by the scientific literature showing there is an **unsupported** relationship between changes that would result from the Proposed Development and changes to health outcomes. • Health priorities for the relevant study area are **not** relevant to the determinant of health or population group affected by the Proposed Development.

Ultimately a likely significant health effect is one that should be brought to the attention of the determining authority, as the effect of the Proposed Development is judged to provide, or be contrary to providing, a high level of protection to population health.

Where significant adverse effects are identified, mitigation is considered to reduce the significance of such effects. Similarly, enhancements are considered where significant and proportionate opportunities to benefit population health are identified.

14.2.5 Limitations of the Assessment

This assessment is based on publicly available statistics and evidence sources. No new primary research or bespoke analysis of non-public data was undertaken for the assessment.

In line with proportionate EIA coverage of the human health topic, comprehensive HIA methods, e.g., setting up of a steering group or generating new primary evidence, do not form part of the approach. The health chapter has been informed by wider consultation for the Proposed Development and good practice methods have been used to proportionately reflect HIA elements as appropriate to EIA; these include a wider determinants of health scope and consideration of vulnerable groups and health inequalities.

Such limitations do not affect the robustness of the assessment for EIA purposes.

14.3 Baseline Scenario

Different communities have varying susceptibilities to health impacts and benefits as a result of social and demographic structure, behaviour and relative economic circumstances.

The aim of the following information is to put into context the local health and socio-economic circumstance of local communities surrounding the Proposed Development, forming the basis to the assessment and any associated mitigation. Statistics have been analysed for the Mull, Iona, Coll and Tiree intermediate zone (used as the study area), using national (Scotland) averages as relevant comparators. Where information for Mull, Iona, Coll and Tiree is not available, data for the Argyll and Bute local council has been collected as a representative alternative geography.

It should be noted that the description of the whole population, and the populations within the local and wider study area, does not exclude the probability that there will be some individuals or groups of people who do not conform to the overall profile.

14.3.1 Demography, Socio-economic Circumstance and Deprivation

According to the Scotland 2011 census, in Iona there were 177 usual residents. There were 67 economically active residents in full time work in 2011, with only 3 residents unemployed at economically active age ranges. According to the Scottish Index of Multiple Deprivation 2020 for Mull, Iona, Coll and Tiree, overall deprivation was ranked 3664, which is 6th least deprived. Housing domain and geographic access to domain was ranked the 2nd most deprived and 10% most deprived respectfully. Health and Crime rank was ranked high, 9th least deprived and least deprived 10% respectively.

14.3.2 Life Expectancy and Physical Health

Table 14-8 indicates life expectancy, physical health and mortality statistics. The average life expectancy for males in Mull, Iona, Coll and Tiree is 76.93 compared to 77.16 for Scotland, therefore there was no real difference. For females, Mull, Iona, Coll and Tiree has a better average for life expectancy (85.45) compared to Argyll and Bute (81.69). For emergency patient hospitalisations, Mull, Iona, Coll and Tiree have a better average (5997.96) compared to Argyll and Bute (6552.94) and Scotland (7358.5).

Table 14-8 Life Expectancy, Physical Health and Mortality

Indicator	Year	Local Mull, Iona, Coll & Tiree	Regional Argyll & Bute	*Scotland*
		Life expectancy		
Life expectancy for males	2018	76.93	78.34	***77.16***
Life expectancy for females	2018	85.45	81.69	***81.14***
		Hospital admissions		
Emergency patient hospitalisations	2018-2020	5997.69	6552.94	***7358.5***
Coronary Heart Disease Patient Hospitalisations	2019/20-2021/22	262.18	246.11	***228.02***
Chronic Obstructive Pulmonary Disease Patient Hospitalisations	2018/19-2020/21	162.81	169.04	***230.89***
		Mortality		

Indicator	Year	Local Mull, Iona, Coll & Tiree	Regional Argyll & Bute	Scotland
Deaths all ages	2018/2020	1236.41	1087.71	***1166.3***
Early deaths from cancer, aged <75 years	2018-2020	171.6	137.97	***152.8***
Early deaths from coronary heart disease, aged <75 years	2018-2020	28.87	49.97	***50.57***
Key				
	Better than the Scotland average			
	Worse than the Scotland average			
	No different to the Scotland average			

14.3.3 Mental Health and Lifestyle Factors

Table 14-9 provides statistics on mental health and lifestyle factors. Child healthy weight in primary 1 in Argyll and Bute (66.82) was worse than Scotland (69.76) in 2020/21. In alcohol related hospital admissions in Mull, Iona, Coll and Tiree (254.6) was better than the Scotland average (621.29).

Table 14-9 Mental Health and Lifestyle Factors

Indicator	Year	Local Mull, Iona, Coll & Tiree	Regional Argyll & Bute	Scotland
Mental health				
Psychiatric Patient Hospitalisations	2018/19/2020/21	N/A	202.84	***242.8***
Deaths from Suicide	2016-2020	N/A	15.05	***14.07***
Lifestyle and behavioural risk factors				
Child healthy weight in primary 1	2020/21	79.17	66.82	***69.76***
Smoking prevalence ages 16-64	2019	N/A	17.5	***19.5***
Alcohol Related Hospital Admissions	2020/21	254.6	524.9	***621.29***
Key				
	Better than the Scotland average			
	Worse than the Scotland average			
	No different to Scotland average			

14.4 Description of Likely Significant Effects

14.4.1 Assessment of Construction Effects

14.4.1.1 Bio-physical environment

This section discusses changes to environmental conditions, in particular, *noise* during the construction of the Proposed Development, and related effects on population health.

This section therefore focusses on construction noise. Construction of the Proposed Development has the potential to result in noise nuisance from construction activities, particularly night-time noise that may be detrimental to population health where sleep is disturbed to a high degree. Changes in the distribution of daytime noise are also considered. As stated in Chapter 10 (Terrestrial Noise and Vibration), there is no potential for noise impacts from construction traffic as transport by road will be minimal, therefore no population and health effects are anticipated. This section has been informed by Chapter 10, which sets out relevant assessment findings and mitigation measures that have been taken into account.

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is noise generated by construction activities.
- The pathway is pressure waves through the air.
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of the Isle of Iona.
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people).
  - Old age vulnerability (older people).
  - Poor health vulnerability (people with existing poor physical or mental health).
  - Low-income vulnerability (people living in deprivation, including those on low incomes may have fewer resources to adapt, e.g., seek respite or install insulation furthermore, those who are economically inactive may spend more time in affected dwellings).
  - Access and geographical vulnerability (people for whom close proximity to the proposed changes increases sensitivity).

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Iona, and the vulnerable sub-population for this area. The latter is a comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

During construction, there is potential for noise to temporarily arise from construction works, road works and movement of construction related vehicles.

The literature highlights cardiovascular effects, annoyance and sleep disturbance (and consequences arising from inadequate rest) as being the main pathways by which population health may be affected. The literature also notes the potential for chronic noise to have a detrimental effect on learning outcomes (e.g., noise distracting and affecting communication within classrooms). Whilst the literature supports there being thresholds at which effects (such as annoyance and sleep disturbance) are likely, it also acknowledges the subjective nature of responses to noise. In this regard noise effects can be considered to have non-threshold effects, with characteristics other than sound levels also determining the influence on health outcomes. The assessment had regard to the population groups identified in the literature that may be particularly sensitive. For example, children, the elderly, the chronically ill, people with a hearing impairment, shift-workers and people with mental illness (e.g., schizophrenia or autism).

The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Section 14.2.4.3 of this report. The general population comprise those members of the community in *good* physical and mental health and with resources that enable a *high* capacity to adapt to change.

The sensitivity of the vulnerable group population is high. This reflects that the sub-population includes a high representation of *dependants*, both children, elderly and those receiving care due to poor health. This sub-population may experience existing *widening* inequalities due to living in areas with increasing noise and *moderate* deprivation, with *limited* capacity to adapt to changes. Vulnerability particularly relates to those living close to the construction activities, including those spending more time in affected dwellings, e.g., due to low economic activity, shift work or *poor* health. People who are *concerned* or have high degrees of *uncertainty* about construction noise and its effect on their wellbeing may be more sensitive to changes in noise.

As reported in Chapter 10 (Terrestrial Noise and Vibration), construction of the Proposed Development will involve two primary activities: construction of the breakwater and dredging. Construction noise is predicted to be within limits set to be protective of health and the environment in most cases. However, when considering a worst-case scenario, Chapter 10 identifies that there is potential for construction noise to exceed limits (both daytime and night-time) at a small number of individual receptors that are located closest to the construction activities, with the receptors most likely to be impacted being non-residential. These changes will be mitigated as set out in Chapter 10 section 10.6.1, which includes the use of silencers for mechanical plant and equipment. Residents will also be informed of the timing and duration of activities that may produce high noise. The residual effects reported in Chapter 10 are not anticipated to result in significant changes in population health outcomes.

The magnitude of change due to the proposed construction works is low. In terms of population health, the *small* scale of change in noise levels is likely to predominantly relate to a *minor* change in quality of life for a *large minority* of the community, and a *very minor* change in cardiovascular and mental wellbeing morbidity for the *small minority* of the community closest to construction activities. The changes would be of *short-term* duration and relate to *frequent* construction related noise exposures. Prolonged periods of construction noise at night or daytime disruption of educational activities at schools are not anticipated.

Construction noise impacts of the Proposed Development are considered to result in a minor adverse (not significant) effect on population health. This assessment conclusion reflects that although the scientific literature indicates a *clear association* between elevated and sustained noise disturbance and reduced health outcome, the changes would result in a very limited effect in the health baseline of the site-specific populations. The temporary and localised construction noise effects are not expected to affect health inequalities.

14.4.1.2 Social environment

This section considers the effects on *open space, leisure and play* during construction of the Proposed Development. Supporting people to be active is an important determinant of physical health. Time spent on or near blue space (i.e., outdoor environments that feature water) can positively affect mental wellbeing.

This section has been informed by Scoping Opinion para 5.21.5.

It is noted that leisure boating is a priority identified in the 2013 Sound of Iona Piers Development Framework and Masterplan (section 4.5). There is the potential for construction to affect sea users including sea kayakers and sail boats which are used for leisure boating and recreation in the Sound of Iona. This effect would possibly occur during dredging or when there is other disruption in the construction area. This change would mostly affect residents in the local community.

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is changes in access to the Sound of Iona due to construction.
- The pathway is disruptions to recreation generated by construction activities.
- Receptors are residents and recreational users of the Sound of Iona.

Furthermore, the potential effect is probable as the source-pathway-receptor relationship occurs under usual conditions of the construction phase of the Proposed Development.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of the Isle of Iona;
- The 'local' population of Argyll and Bute; and
- The sub-population vulnerable due to:
  - young age, specifically children who are overweight or who have low physical activity levels.
  - Poor health vulnerability (people with existing poor physical or mental health).
  - Social disadvantage (people who may have limited access to other forms of recreation).

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Iona, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Section 14.2.4.3 of this report. The general population comprise those members of the community in *good* physical and mental health and with resources that enable a *high* capacity to adapt to change such as selecting alternative forms of recreation or different sea routes to avoid any temporary disruption.

The sensitivity of the vulnerable sub-population is high. This reflects that the sub-population includes representation of dependants including children and people with existing poor physical or mental health. This sub-population may have fewer resources and less capacity to adapt to changes. The population may therefore be more reliant on recreation within the affected area with greater likelihood that any disruption or disturbance could affect physical activity behaviours.

The significance of the population health effect for this determinant of health is minor adverse (not significant). The professional judgment is that there would, at most, be a very slight adverse change in the health baseline for the local population. This conclusion reflects that physical activity is a local public health priority and the scientific literature on the benefits of physical activity to health is well established, however the level of change due to the Proposed Development is small and can be appropriately mitigated by standard good practice measures that minimise disruption and disturbance through a CEMP, such as designating and communicating safe routes through the Sound during construction. The change is unlikely to result in significant differential or disproportionate effects between the general population (low sensitivity) and the vulnerable sub-population (high sensitivity). Consequently, no widening of health inequalities would be expected, and no influence is expected on the ability to deliver local or national health policy.

14.4.1.3 Economic environment

This section considers the effects on *education and training*, and *employment and income* from construction of the Proposed Development. In a small island context, even minor changes to employment and income can be influential to the populations' health.

There is the potential for construction to include upskilling opportunities for the local population. Employment of the local population for construction of the Proposed Development is also possible. Upskilling has the potential to lead to increased employment and income, and both these determinants positively affect health and mental wellbeing. It is also noted that construction works have the potential to disrupt important income streams for the island, including tourism and fishing.

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is construction activities associated with the Proposed Development.
- The pathway is changes in training, employment and income due to construction.
- Receptors are residents and other people who rely on access to the Sound of Iona for income.

Furthermore, the potential effect is probable as the source-pathway-receptor relationship occurs under usual conditions of the construction phase of the Proposed Development.

- The population groups relevant to this assessment are:
- The 'site-specific' geographic population of the Isle of Iona and other fishermen from the surrounding area who rely on access to the Sound of Iona.
- The sub-population vulnerable due to:
    - Low income: People on low income, who are economically inactive or unemployed/workless.
    - Access and geographical factors: People experiencing barriers in access such as the ability to access training, employment and income outside the local area.

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Iona, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Section 14.2.4.3 of this report. The general population comprise those members of the community in employment with good socio-economic status and low levels of deprivation.

The sensitivity of the vulnerable sub-population is high. While unemployment on Iona remains low, as stated in the baseline profile, sub-populations are likely to be sensitive to changes in employment given the small size of the population and limited access to other training, employment and income opportunities.

The magnitude of change due to the Proposed Development is low. Changes in access to training, employment and income for local populations and sub-populations are likely to be more significant given the relative access to alternative opportunities. However, given the low unemployment on the isle, only a small minority of the population is likely to be affected. While changes in training and upskills can cause long-term effects, changes to employment and income would likely be short-term and reverse on completion of the construction work.

The significance of the population health effect for this determinant of health is minor beneficial (not significant). The professional judgment is that training and upskilling opportunities can be provided to the local community as well as prioritisation of employment for the construction workforce (as set out in the Construction Environmental Management Plan). These opportunities are likely to affect a small part of population and to last for a relatively short period of time, yet increased income can have beneficial health effects even in the short-term. Changes to income through fishing and tourism can also be mitigated through a CEMP by designating safe alternative transport through the Sound of Iona during construction. There is therefore expected to be limited changes from income associated with fishing and tourism. The change is unlikely to result in significant differential or disproportionate effects between the general population (low sensitivity) and the vulnerable sub-population (high sensitivity). Consequently, no widening of health inequalities would be expected, and no influence is expected on the ability to deliver local or national health policy.

14.4.2 Assessment of Operational Effects

14.4.2.1 Social environment

This section considers *transport modes, access and connections* and *open space, leisure and play.* The Proposed Development may improve safety of local residents and current users of the existing pier and slipway, as well as improved access to and from the Sound of Iona for lifeline services. This section has been informed by Chapter 3 (Project Description), Scoping Opinion para 5.21.4, as well as the EIA Scoping Report.

The Proposed Development will reduce wave heights in the vicinity of the breakwater, making recreational use of the water including for sea kayakers and boaters, potentially safer. Both real and perceived safety of recreational activities support people engaging in physical activity and can be beneficial to physical and mental health. Improved access on and off Iona can also improve access to future lifeline services and medical supplies. Time-critical injuries require lifeline services and are particularly relevant for more vulnerable populations (particularly children and elderly people). Improvements in lifeline services and medical supplies have the potential to improve physical and perceived access, particularly for old age populations, and can in turn reduce anxiety and stress leading to improved mental wellbeing.

The potential effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is the proposed breakwater infrastructure;
- The pathway is changes in access to the Sound of Iona, including safety (real and perceived) due to the proposed breakwater infrastructure; and
- The receptors are users of the pier and local residents of Iona.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The ‘site-specific’ geographic population of Iona;
- The ‘local’ population of Argyll and Bute; and
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as potentially more vulnerable to safety hazards);
  - Old age vulnerability (older people as potentially more vulnerable to safety hazards);
  - Poor health vulnerability (people with existing poor physical and mental health in relation to emergency service journey times); and
  - Access and geographical vulnerability (people who experience existing access barriers or who rely on the existing modes of access).

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Iona, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been considered and are listed in Section 14.2.4.3 of this report. The general population comprise those members of the community in good physical and mental health who are more able to mitigate safety hazards.

The sensitivity of the vulnerable sub-population is high. This reflects that the sub-population includes a high representation of dependants including children, elderly and those receiving care due to poor health. This population may be more sensitive to safety hazards and more reliant on lifeline services.

The magnitude of change due to the Proposed Development is high. Improvements to safety associated with the Proposed Development will be permanent and will affect all residents of the island, as well as visitors and those transporting goods and services to and from the island (including the transport of medical supplies). Improved safety of the pier and breakwater area will also encourage the continuation and uptake of water sports and other recreational activities in the area, which will support good physical and mental health, as well as have the potential to support tourism and provide indirect economic benefits in the area (the latter is discussed further in Section 14.4.2.2 below). Additionally, safe and improved access to the island will facilitate improved lifeline and emergency services, further supporting the health of the population. The benefits will therefore represent a *medium* scale of change relating to a *moderate* change in morbidity for a *small minority* of the local population with regards to the uptake of recreational activities, and the *majority* of the population with regards to increased access to lifeline services (given the small island context). The changes will be *long-term* in duration and relate to *one-off* effects when it comes to access of lifeline services, and *frequent* effects with regard to improved opportunities for recreational users and transport of goods and services.

Overall, operational impacts on transport modes; access and connections; and open space, leisure and play are considered to result in a moderate beneficial (significant) effect on population health. This assessment conclusion is supported by a strong evidence base in the scientific literature for a *causal* relationship between physical activity and good physical and mental health, and professional judgement on the effect of physical and perceived safety for the uptake of healthy behaviours.

14.4.2.2 Socio-economic conditions

This section considers the effects on *education and training* and *employment and income* from operation of the Proposed Development. In a small island context, even minor changes to employment and income can be influential to the populations' health.

There is the potential for the Proposed Development to improve access on and off Iona. This may indirectly affect access to education, training, and employment for Iona residents seeking opportunities on Isle of Mull and beyond. Improvements in the ferry service may also support income associated with tourism. This also aligns with the Sound of Iona Piers Development Framework and Masterplan policy to *"encourage a diverse, balanced mix of sectors to operate and develop sustainably with consideration of other interests and environmental capacity".* Changes in employment and income have the potential to positively affect health through increasing access to other health-supporting goods, services and activities, and secure employment can be a source of mental wellbeing. Improved access to education and training can improve access to employment and income but also has positive effects associated with physical health (through e.g., improved health literacy) and mental wellbeing (through e.g., increased self-efficacy).

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is improvements associated with the Proposed Development.
- The pathway is changes in access to/from Iona.
- Receptors are residents and other people who rely on access on and off Iona for education, employment and income.

Furthermore, the potential effect is probable as the source-pathway-receptor relationship occurs under usual conditions of the operation of the Proposed Development.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of the Isle of Iona.
- The sub-population vulnerable due to:
    - Low income: People on low income, who are economically inactive or unemployed/workless.

- Access and geographical factors: People experiencing barriers in access such as the ability to access employment and income outside the local area.

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Iona, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Section 14.2.4.3 of this report. The general population comprise those members of the community in employment with good socio-economic status and low levels of deprivation.

The sensitivity of the vulnerable sub-population is high. While unemployment on Iona remains low, as stated in the baseline profile, sub-populations are likely to be sensitive to changes in employment given the small size of the population and limited access to employment and income opportunities on the isle.

The magnitude of change due to the Proposed Development is low. There are likely to be beneficial changes in access to education, employment and income for local populations and sub-populations, given the relative lack of access to alternative opportunities. While unemployment on Iona is low, improved access to employment outside of the local area can lead some people to change jobs to higher-paid jobs. Changes in access to education and training opportunities can also lead to higher-paid jobs. Changes in education, employment and income have the potential to cause long-term benefits for health. Effects relate to a *small* scale of change that would be experienced by a *small minority* of the local population. The benefits of good quality employment and education contribute to quality-of-life, as well as being protective against adverse changes in morbidity (i.e., avoiding economic hardship or unemployment which are associated with poor physical and mental health outcomes). Changes will be *long-term* in duration and relate to *continuous* indirect effects associated with improved employment and educational opportunities.

The significance of the population health effect for this determinant of health is minor beneficial (not significant). The professional judgment is that improved access on and off Iona can lead indirectly to improvements in education, training, employment, job quality and income. This has the potential to be beneficial for health and wellbeing, although not significant at a population level. While the change is likely to affect only a small sub-set of the population, this has the potential to provide greater benefit to the vulnerable sub-population (high sensitivity), which can help to narrow health inequalities.

14.5 Mitigation Measures

14.5.1 Construction Phase

An outline Construction Environmental Management Plan (oCEMP) has been included as Appendix 20.1.

A CEMP will be produced by the successful contractor, which will outline how the effects of construction can be managed by good practice and environmental controls which are routinely and successfully applied on other similar development proposals.

The CEMP should also set out a clear plan for managing access to the Sound of Iona during construction. This would include designating safe alternative transport routes and appropriately communicating these to local populations (including through the use of Gaelic materials).

The CEMP should also set out a plan for engagement with the local population. This could include information on timings updates, affects to any services/deliveries/access and a complaints procedure. Engagement should be culturally appropriate, including provision of non-technical information and communication in Gaelic.

Opportunities to include the local population in construction of the Proposed Development can be beneficial for health. Actions to ensure positive outcomes include providing opportunities for training and upskilling as well as prioritisation of hiring for local populations.

14.5.2 Operational Phase

No further mitigation is proposed.

14.6 Potential Cumulative Effects

Consistent with the findings of relevant technical assessments on the EIA, including Chapter 10 (Noise and Vibration), no additional cumulative population and health effects are anticipated during construction and operation of the Proposed Development.

14.7 Residual Effects

14.7.1 Construction Phase

Following the implementation of suggested mitigation measures outlined in Section 14.5 above, no significant adverse residual effects on population and health (relating to bio-physical and social environment) are anticipated during construction of the Proposed Development.

Construction of the Proposed Development will result in beneficial residual effects (relating to education and training, employment and income), although these are not significant.

14.7.2 Operational Phase

Operation of the Proposed Development is anticipated to result in significant (moderate beneficial) residual population and health effects across multiple determinants of health. This includes improved transport modes; access and connections; and open space, leisure and play. Operation will also give rise to beneficial residual effects relating to education and training and employment and income, although these are not significant.

14.8 Conclusions and Summary of Effects

This assessment has been undertaken in accordance with relevant published guidance on assessment of population and health within Environmental Impact Assessment.

Construction of the Proposed Development has the potential to result in population and health impacts, both beneficial and adverse. Beneficial impacts relate to changes in opportunities for education and training, employment and income, and adverse impacts relate to changes in environmental conditions such as noise, and the social environment (in this case, effects on open space, leisure and play). Given the scale, duration and frequency of these impacts, and following appropriate mitigation, no significant effects on population and health are anticipated during construction.

Operation of the Proposed Development will result in improved and safer access to and from the Isle of Iona, as well as facilitating improved transport of goods and services, including lifeline services and medical supplies. It will also support the uptake of physical activity for the local population, through facilitating safer recreational water sports. Accordingly, operation of the Proposed Development is anticipated to result in significant (moderate beneficial) population and health effects relating to improved transport modes; access and connections; and open space, leisure and play. While improved access to the island will also indirectly benefit the local population through increased opportunities for education, training, employment and income, this will more greatly benefit vulnerable groups, and therefore these effects are not judged to be significant at a population level.

15 LANDSCAPE & VISUAL

15.1 Introduction

RPS was commissioned by Argyll & Bute Council to prepare a Landscape and Visual Impact Assessment (LVIA) in support of its Proposed Development at the existing Iona Ferry Terminal, located west of Mull, on the west coast of Scotland.

The purpose of this LVIA is to identify and assess the effects on landscape character, landscape features, visual receptors, and visual amenity as a result of the works described in the Planning Support Statement and project description contained therein.

This assessment has been prepared and reviewed by chartered landscape architects at RPS.

15.2 Assessment Methodology

15.2.1 General Approach

The methodology and approach to the assessment contained within this chapter has been derived and carried out in accordance with best practice guidance described in the following documents:

- Guidelines for Landscape and Visual Impact Assessment, Third Edition (The Landscape Institute and Institute of Environmental Management & Assessment, 2013) (GLVIA3);
- Technical Guidance Note 06/19 Visual Representation of Development Proposals (The Landscape Institute, 2019).

GLVIA3 recommends that an LVIA '*concentrates on principles and process*' and '*does not provide a detailed or formulaic 'recipe"* to assess effects, it being the '*responsibility of the professional to ensure that the approach and methodology adopted are appropriate to the task in hand*' (preface to the third edition).

The effects on the landscape resources and visual receptors (people) have been assessed by considering the proposed change in the baseline conditions (the impact of the development) against the type of landscape resource or visual receptor (including the importance and sensitivity of that resource or receptor). These factors are determined through a combination of quantitative (objective) and qualitative (subjective) assessment using professional judgement. The assessment methodology is summarised in Figure 15-1.

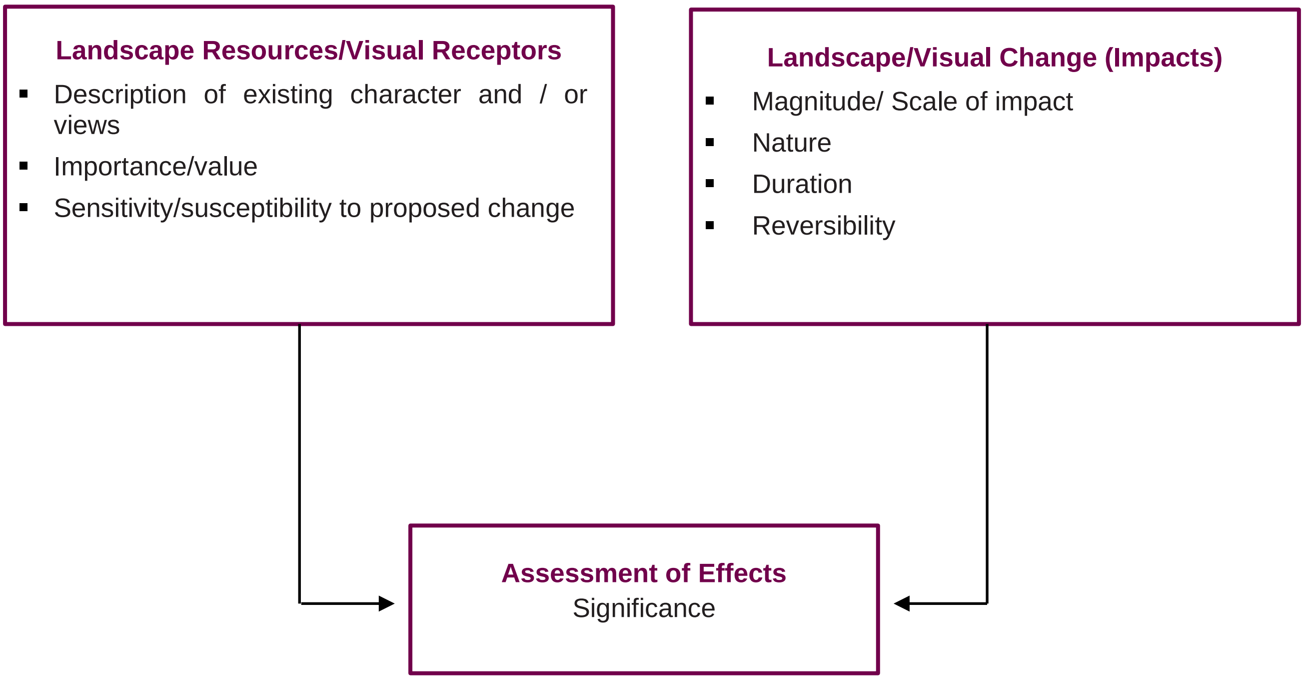

Figure 15-1 Assessment Methodology Summary

The LVIA considers the potential effects of the project upon:

- Individual landscape features and elements;
- Landscape character; and
- Visual amenity and the people who view the landscape.

15.2.2 Identification of Baseline Conditions

Baseline conditions has been identified and assessed through analysis of:

- Up to date digital copies of Ordnance Survey Discovery Series raster and OS vector maps;
- Aerial photography;
- Adopted Argyll & Bute Local Development Plan (LDP – March 2015);
- Proposed Local Development Plan (LDP2) (November 2019);
- NatureScot Landscape Character Assessment;
- Historic Environment Scotland – Inventory of Gardens and Designed Landscapes; and
- Drawings of the Proposed Development.

Site visits were undertaken in 2021 and 2022 to assess the existing environment, to establish the existing visual resource and to identify sensitive receptors, i.e., residential properties, scenic viewpoints. These site visits were also used to consider the potential effects on landscape character and visual impacts arising as a result of the Proposed Development.

15.2.3 Identifying Effects

Assessing the significance of an effect is a key component of the LVIA and involves an evidence-based process combining professional judgment on the nature of a landscape or visual receptor's sensitivity, their susceptibility or ability to accommodate change and the value attached to the receptor. It is important to note that judgments in this LVIA are impartial and based on professional experience and opinion informed by best practice guidance.

The effects of a Proposed Development are considered to be of variable duration and are assessed as being of either short-term, medium-term or long-term duration, and permanent or reversible. Effects are considered to be long-term during the operational phase of the development, whilst operations and infrastructure works apparent during the construction and initial operating period are considered to be temporary, short-term effects.

The reversibility of an effect is also variable. The effects on the landscape and visual resource that occurs during the construction period such as the use of construction machinery are considered to be reversible.

Where effects arise during the construction period, these are most likely to be as a result of: movement of construction machinery within the landscape; construction of new structures and construction activities within the site boundary all of which are considered to be short-term in duration.

To avoid repetition, the duration and reversibility of effects are not reiterated throughout the assessment.

15.2.4 Study Area

Using terrain-modelling techniques combined with the development specifications, a map was created which identified areas from which the Proposed Development may theoretically be visible (Figure 15-1).

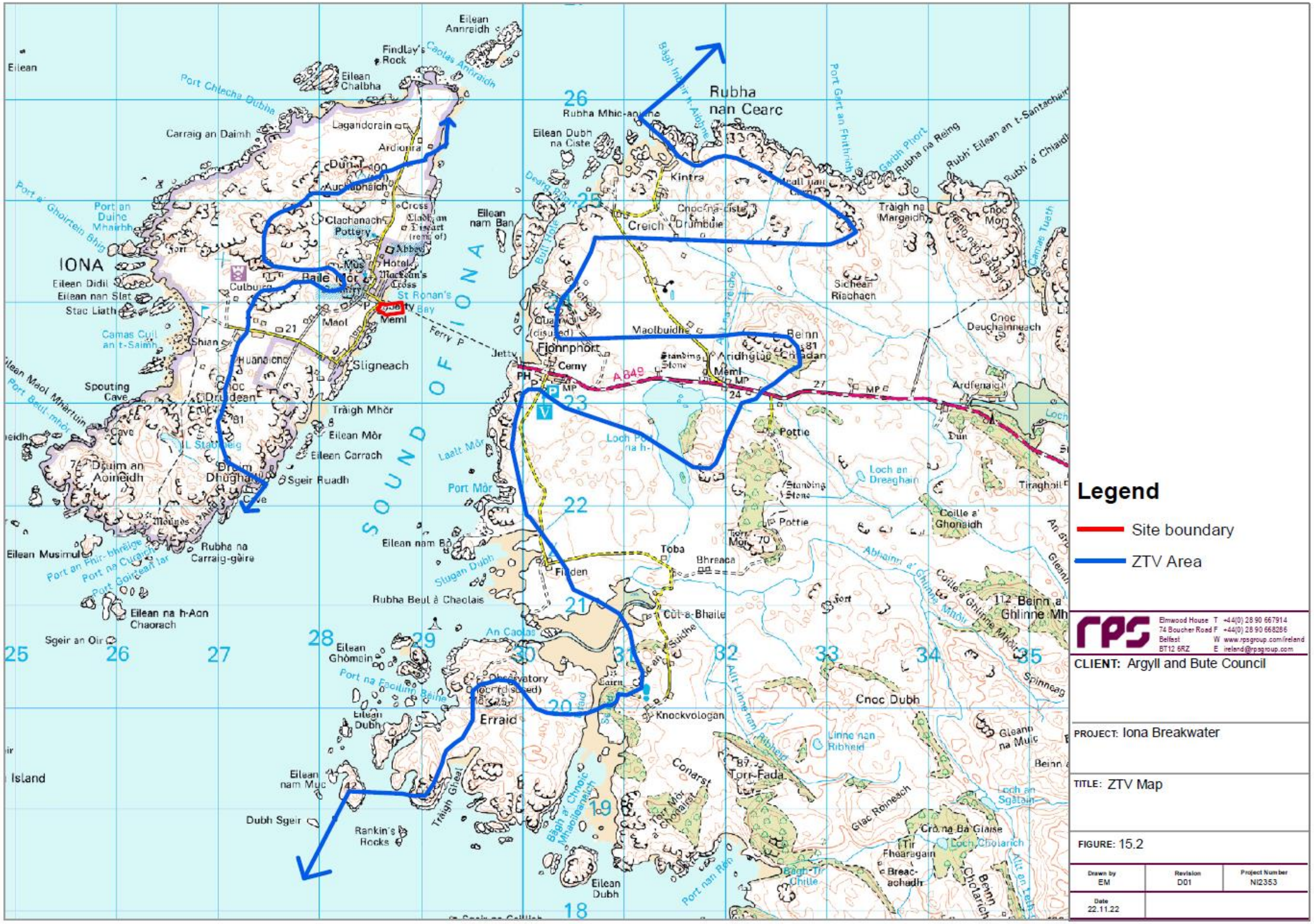

Figure 15-1 Zone of Theoretical Visibility (ZTV) Map

This Zone of Theoretical Visibility (ZTV) is the area within which views of the Proposed Development can theoretically be obtained, determined by the topography of the area only and is representative of a theoretical worst-case scenario in line with current guidance.

The ZTV forms the basis for the study area associated with the Proposed Development for both landscape and visual impact assessment. It is noted that the ZTV does not take into account local features such as roadside hedgerows, field boundary hedgerows, woodland planting, coniferous forestry or buildings. In practise the actual visibility of the Proposed Development is considerably less in extent than the theoretical one, since individual elements of the proposal are difficult to focus on at long distances and localised changes in topography, hedges, trees and woodland tend to restrict views.

The ZTV was assessed against the elements of the Proposed Development, the footprint, the receiving landscape and the perceptibility of elements of the Proposed Development particularly when viewed against surrounding topographical changes and vegetation cover. Survey and assessment established that vertical elements associated with the Proposed Development are not easily perceived within the wider landscape due to intervening topographical changes and vegetation cover.

15.2.5 Assessment Criteria

The objective of the assessment process is to identify and evaluate the predicted significant effects arising from a Proposed Development. Significance is a function of:

- The sensitivity of the affected landscape or visual receptors, determined through consideration of the susceptibility of the receptor to the type of change arising from the specific proposals and the value attached to the receptor; and
- The scale or Magnitude, derived from a consideration of the size/ scale, geographical extent, duration and reversibility of the Proposed Development.

These definitions recognise that landscapes vary in their capacity to accommodate different forms of development according to the nature of the receiving landscape and the type of change being proposed.

As with any new development, it is acknowledged that the introduction of a Proposed Development into the existing landscape or visual context could cause either a deterioration, improvement or neutral impact on the existing landscape or visual resource.

15.2.6 Landscape Impact Assessment

The LVIA firstly assesses how the Proposed Development would impact directly on any landscape features and resources. This category of effect relates to specific landscape elements and features (e.g., woods, trees, walls, hedgerows, watercourses) that are components of the landscape that may be physically affected by the Proposed Development, such as the removal or addition of trees and alteration to ground cover.

The LVIA then considers impacts on landscape character at two levels. Firstly, consideration is given to how the landscape character is affected by the removal or alteration of existing features and the introduction of new features. This is considered to be a direct impact on landscape character.

Secondly, the indirect impacts of the Proposed Development on the wider landscape are considered. The assessment of impacts on the wider landscape is discussed using the surrounding character areas identified in the relevant landscape character assessments. It is acknowledged there is an overlap between perception of change to landscape character and visual amenity, but it should be remembered that landscape character in its own right is generally derived from the combination and pattern of landscape elements within the view.

The significance of effects on landscape features and character is determined by considering both the sensitivity of the feature or landscape character and the magnitude of impact.

Consideration of the sensitivity of the landscape resource against the magnitude of impact caused by the Proposed Development is fundamental to landscape and visual assessment and these two criteria are defined in more detail below.

15.2.7 Landscape Sensitivity

The determination of the sensitivity of the landscape receptor is based upon an evaluation of the elements or characteristics of the landscape likely to be affected. The evaluation reflects such factors as its quality, value, contribution to landscape character and the degree to which the particular element or characteristic can be replaced or substituted.

GLVIA 3 at paragraph 5.39 states that:

> '…*landscape receptors need to be assessed firstly in terms of their sensitivity, combining judgments of their susceptibility to the type of change or development proposed and the value attached to the landscape."*

Susceptibility is defined by GLVIA 3 at paragraph 5.40 as:

> *"…the ability of the landscape receptor (whether it be the overall character or quality/ condition of a particular landscape type or area, or an individual element and/ or feature, or a particular aesthetic and perceptual aspect) to accommodate the Proposed Development without due consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies'* "

The value of a landscape receptor is determined with reference to the presence of relevant landscape designations, such Areas of Outstanding Natural Beauty (AONB) and their level of importance. For the purpose of this assessment, the value of the landscape has been categorised as either:

- **Very High**: Areas of landscape acknowledged through designation such as AONBs or other landscape based sensitive areas. These are of regional or national landscape significance;
- **High**: Areas that have a very strong positive character with valued and consistent distinctive features that gives the landscape unity, richness and harmony. These are of landscape scale significance within the district;
- **Medium**: Areas that exhibit positive character, but which may have evidence of alteration/degradation or erosion of features resulting in a less distinctive landscape. These may be of some local landscape significance with some positive recognisable structure; and

- **Low**: Areas that are generally negative in character, degraded and in poor condition. No distinctive positive characteristics and with little or no structure. Scope for positive enhancement.

As previously discussed, landscape sensitivity is influenced by a number of factors including susceptibility to change, value and condition. In order to assist with bringing these factors together, judgements regarding susceptibility and value have been used which define the landscape resource as being either, negligible, low, medium, high or very high. Table 15-1 defines the criteria that have guided the judgement as to the overall sensitivity of Landscape Resources.

Assessments of susceptibility and value of a particular landscape resource may be different and professional judgement will always be used to conclude on the judgement of sensitivity. For example, value may be high, and susceptibility may be low, and professional judgement will be used to determine whether sensitivity is high, low or in between, supported by narrative explanation.

Table 15-1 Landscape Sensitivity

Definition		Sensitivity
Landscape resource susceptibility	**Landscape resource value**	
Exceptional landscape quality, no or limited potential for substitution. Key elements / features well known to the wider public. Little or no tolerance to change	Nationally / internationally designated/ valued landscape, or key elements or features of national/ internationally designated landscapes. Little or no tolerance to change	Very High
Strong/ distinctive landscape character; absence of landscape detractors. Low tolerance to change.	Regionally/ nationally designated/ valued countryside and landscape features. Low tolerance to change.	High
Some distinctive landscape characteristics; few landscape detractors. Medium tolerance to change.	Locally/ regionally designated/ valued countryside and landscape features. Medium tolerance to change.	Medium
Absence of distinctive landscape characteristics; presence of landscape detractors. High tolerance to change	Undesignated countryside and landscape features. High tolerance to change	Low
Absence of positive landscape characteristics. Significant presence of landscape detractors. High tolerance to change	Undesignated countryside and landscape features. High tolerance to change	Negligible

15.2.8 Magnitude of Landscape Effect

The effect on landscape receptors and the overall judgement of the magnitude of landscape effect is based on combining judgements on 'size or scale, the geographic extent of the area influenced, and its duration and reversibility' (GLVIA3, paragraph 5.48),

Direct resource changes on the landscape character in the study area are brought about by the introduction of the Proposed Development and its impact on the key landscape characteristics. Judgements regarding the magnitude of landscape impact are indicated in Table 15-2 below.

Table 15-2 Magnitude of Landscape Impact

Definition	Magnitude of Impact
Total loss or addition or/ very substantial loss or addition of key elements / features / patterns of the baseline, i.e., pre-development landscape and/ or introduction of dominant, uncharacteristic elements with the attributes of the receiving landscape	Large
Partial loss or addition of or moderate alteration to one or more key elements / features / patterns of the baseline, i.e., pre-development landscape and / or introduction of elements that may be prominent but may not necessarily be substantially uncharacteristic with the attributes of the receiving landscape.	Medium
Minor loss or addition of or alteration to one or more key elements / features / patterns of the baseline, i.e., pre-development landscape and or introduction of elements that may not be uncharacteristic with the surrounding landscape.	Small
Very minor loss or addition of or alteration to one or more key elements / features / patterns of the baseline, i.e., pre-development landscape and/or introduction of elements that are not uncharacteristic with the surrounding landscape approximating to a 'no-change' situation.	Negligible
No loss, alteration or addition to the receiving landscape resource	No change

15.2.9 Visual Impact Assessment

As outlined in GLVIA 3 (Paragraph 6.1):

> '*An assessment of visual effects deals with the effects of change and development on the views available to people and their visual amenity'.*

The assessment of visual effects is an assessment of how the introduction of a Proposed Development will affect views within the study area. The Assessment of visual effects therefore needs to consider the following:

- Direct impacts of a Proposed Development upon views of the landscape through intrusion or obstruction;
- The reaction of viewers who may be affected, e.g., residents, walkers, road users; and
- The overall impact on visual amenity.

15.2.10 Sensitivity Of Visual Receptors

For visual receptors, judgements of susceptibility and value are closely interlinked. For example, the most valued views are likely to be those which people go and visit because of the available view. The value attributed to visual receptors also relates to the value of the view (e.g., a National Trail is nationally valued for its access, not necessarily for its views).

Paragraph 6.32 of the GLVIA refers to the susceptibility of different visual receptors to changes in views and states that susceptibility is mainly a function of:

> "…*the occupation or activity of different people experiencing the view at particular locations*" and "*the extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations*."

Other factors affecting visual sensitivity include:

- The location and context of the viewpoint;
- The expectations and occupation or activity of the receptor; and

- The importance of the view.

Judgements on the overall visual sensitivity/ susceptibility are provided in Table 15-3 and overall sensitivity of the visual resource is based on combining judgements on the sensitivity of the human receptor (e.g., resident, commuter, tourist, walker, recreationist or worker, and the numbers of viewers affected) and judgements on the visual resource value (e.g., views experienced from residential properties, workplace, leisure venue, local beauty spot, scenic viewpoint, commuter route, tourist route or walkers' route).

Table 15-3 Visual Receptor Sensitivity

Definition	Sensitivity
Visual Receptor Sensitivity	
Observers, drawn to a particular view, including those who have travelled to experience the views. Little or no tolerance to change	Very High
Observers enjoying the countryside from their homes or pursuing quiet outdoor recreation are more sensitive to visual change. Little tolerance to change	High
Observers enjoying the countryside from vehicles on quiet/ promoted routes are moderately sensitive to visual change. Medium tolerance to change	Medium
Observers in vehicles or people involved in frequent or infrequent repeated activities are less sensitive to visual change. High tolerance to change	Low
Observers in vehicles or people involved in frequent or frequently repeated activities are less sensitive to visual change. High tolerance to change	Negligible

15.2.11 Magnitude of Visual Effects

The magnitude of impact on the visual resource results from the scale of change in the view, with respect to the loss or addition of features in the view, and changes in the view composition. Important factors to be considered include: proportion of the view occupied by the Proposed Development, distance and duration of the view. Other vertical features in the landscape and the backdrop to the Proposed Development will all influence resource change. Judgements regarding the magnitude of visual impact are provided in Table 15-4.

Table 15-4 Magnitude of Visual Impact

Definition	Magnitude
Complete or very substantial change in view dominant involving complete or very substantial obstruction of existing view or complete change in character and composition of baseline, e.g., through removal of key elements	Large
Moderate change in view: which may involve partial obstruction of existing view or partial change in character and composition of baseline, i.e., pre-development view through the introduction of new elements or removal of existing elements. Change may be prominent but would not substantially alter scale and character of the surroundings and the wider setting. Composition of the view would alter. View character may be partially changed through the introduction of features which, though uncharacteristic, may not necessarily be visually discordant	Medium
Minor change in baseline, i.e., pre-development view - change would be distinguishable from the surroundings whilst composition and character would be similar to the pre change circumstances.	Small
Very slight change in baseline, i.e., pre-development view - change barely distinguishable from the surroundings. Composition and character of view substantially unaltered.	Negligible
No alteration to the existing view	No change

15.2.12 Significance of Effects

The purpose of this LVIA is to determine, in a transparent way, the likely significant landscape and visual effects of the Proposed Development. It is accepted that, due to the nature and scale of development, the Proposed Development could potentially give rise to some notable landscape and visual effects.

GLVIA3 identifies that:

> *"…a final judgment is made about whether or not each effect is likely to be significant. There are no hard and fast rules about what effects should be deemed 'significant' but LVIAs should always distinguish clearly between what are considered to be significant and non-significant effects."*

Significance can only be defined in relation to each particular development and its specific location. The relationship between receptors and effects is not typically a linear one. It is for each LVIA to determine how judgements about receptors and effects should be combined to derive significance and to explain how this conclusion has been arrived at.

The identification of significant effects would not necessarily mean that the effect is unacceptable in planning terms. What is important is that the likely effects on the landscape and visibility are transparently assessed and understood in order that the determining authority can bring a balanced, well-informed judgement to bear when making the planning decision.

The significance of effects on landscape, views and visual amenity have been judged according to the following six-point scale:

- Substantial;
- Major;
- Moderate;
- Minor;
- Negligible; or
- None .

This scale is presented in Table 15-5 below, which also contains a description of the significance of effect criteria.

Table 15-5 Significance of Effect Criteria

Significance of Effect	Landscape Resource	Visual Resource
None	Where the project would not alter the landscape character of the area.	Where the project would retain existing views.
Negligible	Where proposed changes would have an indiscernible effect on the character of an area.	Where proposed changes would have a barely noticeable effect on views/visual amenity.
Minor	Where proposed changes would be at slight variance with the character of an area.	Where proposed changes to views, although discernible, would only be at slight variance with the existing view.
Moderate	Where proposed changes would be noticeably out of scale or at odds with the character of an area.	Where proposed changes to views would be noticeably out of scale or at odds with the existing view.
Major	Where proposed changes would be uncharacteristic and/or would significantly alter a valued aspect of (or a high quality) landscape.	Where proposed changes would be uncharacteristic and/or would significantly alter a valued view or a view of high scenic quality.
Substantial	Where proposed changes would be uncharacteristic and/or would significantly alter a landscape of exceptional landscape quality (e.g., internationally designated landscapes), or key elements known to the wider public of nationally designated landscapes (where there is no or limited potential for substitution nationally).	Where proposed changes would be uncharacteristic and/or would significantly alter a view of remarkable scenic quality, within internationally designated landscapes or key features or elements of nationally designated landscapes that are well known to the wider public.

For the purposes of this assessment those effects indicated, in Table 15-6 below, as being Substantial or 'Major' to 'Substantial' are regarded as being significant. Effects of 'Minor' to 'Moderate' and lesser significance have been identified within the assessment, though are not considered significant. For those effects indicated as being of 'Moderate' or 'Moderate' to 'Major' the assessor has exercised professional judgement in determining if the effect is considered to be significant, taking account of site specific or location specific variables which are given different weighting in each instance according to location.

Table 15-6 Significance of effects matrix

Magnitude of Impact	Sensitivity				
	Negligible	Low	Medium	High	Very High
No Change	No Change	No Change	No Change	No Change	No Change
Negligible	Negligible	Negligible to Minor	Negligible to Minor	Minor	Minor
Small	Negligible to Minor	Negligible to Minor	Minor	Minor to Moderate	Moderate to Major
Medium	Negligible to Minor	Minor	Moderate	Moderate to Major	Major to Substantial
Large	Minor	Minor to Moderate	Moderate to Major	Major to Substantial	Substantial

A conclusion that an effect is 'significant' should not be taken to imply that the Proposed Development is unacceptable. Significance of effect needs to be considered with regard to the scale over which it is experienced and whether it is beneficial or adverse.

15.2.13 Cumulative Landscape and Visual Impact Assessment Methodology

The methodology for Cumulative Landscape and Visual Impact Assessment (CLVIA) has been based on Guidelines for Landscape and Visual Impact Assessment, Third Edition (The Landscape Institute and Institute of Environmental Management & Assessment, 2013) (GLVIA3).

The purpose of the CLVIA is to consider the landscape and visual impacts of the Proposed Development when viewed in context with other developments within the study area.

Cumulative effects consist of direct effects on the physical landscape and the character of the site containing the development, and indirect, perceived effects on the landscape character of areas within the study area from which the developments would be visible. GLVIA3 identifies effects as follows:

- **Cumulative effects** as "*the additional changes caused by a Proposed Development in conjunction with other similar developments or as the combined effect of a set of developments, taken together*" (SNH, 2012:4);
- **Cumulative landscape effects** as effects that *"can impact on either the physical fabric or character of the landscape, or any special value attached to it*" (SNH, 2012:10); and
- **Cumulative visual effects** as effects that can be caused by combined visibility, which *"occurs when the observer is able to see two or more developments from one viewpoint*" and/or sequential effects which *"occur when the observer has to move to another viewpoint to see different developments*" (SNH, 2012:11).

The significance of any identified cumulative landscape and visual effect has been assessed and has been based on the same combination of receptor sensitivity and predicted magnitude of impact described previously in order to identify the significance of cumulative effect.

15.2.14 Cumulative Baseline

The CLVIA, in line with GLVIA 3, considers the additional landscape and visual effects arising from the Proposed Development in combination with other consented, as yet unbuilt developments and Proposed Developments that are the subject of a valid planning application but have yet to be determined (GLVIA 3, Paragraph 7.13), which may give rise to cumulative landscape and visual effects.

A review of planning applications associated with other Proposed Developments has been undertaken to determine the likelihood for potential significant cumulative landscape and visual effects, taking consideration of the following criteria:

- Type and extent of identified proposal;
- The distance between the identified proposal and the Proposed Development;
- Likely visual influence of the identified proposal;
- Potential inter-visibility between the identified proposal and the Proposed Development;
- Potential for cumulative landscape effects on the physical fabric of the landscape or its scenic qualities; and

- The potential for combined, successive and sequential visual effects in the context of the Proposed Development.

There are two proposed projects in the vicinity of the Proposed Development. These are listed below and more detailed on the proposed projects is provided in EIAR Chapter 17:

- The Fionnphort Breakwater and Overnight Berthing Project; and
- British Telecom (BT) Cable installation – Iona to Fionnphort

15.3 Baseline Scenario

15.3.1 General Overview

The Proposed Development is located at the existing Iona Ferry Terminal which consists of a slipway and pier jutting out into the Sound of Iona. Iona is best known for Iona Abbey and other historic buildings on the island as well as its scenic and tranquil quality and is a popular visitor destination. Iona is known as an important gateway to Christianity in Scotland with St Columba and his followers who were said to have landed on the island in AD 563. The landscape of Iona consists of undulating moorland with frequent rocky hills and outcrops.

To the east of Iona is located the settlement of Fionnphort and the Ross of Mull that broadly consists of landscape similar to Iona with a coarse textured landscape with frequent rocky knolls over areas of flat moorland. The openness of the landscape on this part of the Ross of Mull allows extensive views from the Fionnphort coastal area towards the wider seascape including Iona and its distinctive features such as the Abbey.

A range of vessels operate from the existing pier at Iona including:

- Caledonian MacBrayne; Caledonian MacBrayne operate the MV Loch Buie between Fionnphort and Iona. This is a 30m long vessel with a draught of 1.6m.
- Crab/fishing vessel operators;
- Leisure boat operators; and
- Private boat owners.

The sound of Iona is less than a mile across, served by a short and frequent ferry linking Iona and Fionnphort. The CalMac Ferries Ltd. operated ferry takes about 10 mins per crossing and runs approximately every half hour in summer months and less regularly in winter. Visitors are not allowed to take cars on to Iona unless a special permit is granted.

The Proposed Development is located within Baile Mòr Conservation Area (including the existing slipway), which contains a number of heritage sites including St Mary's Abbey (Category A listed building) and the Iona Nunnery (scheduled monument). The Pilgrims' Way extends from Iona – Mull – Oban – Tyndrum – St Andrews. There are number of Core Paths as described below.

15.3.2 NatureScot Landscape Character Type

The Proposed Development is located within the Island Mixed Farmland Landscape Character Type (Type 49 – Landscape Character Assessment 2019).

15.3.2.1 Island Mixed Farmland (LCT 49)

NatureScot state that LCT49 forms the farmed fringe of the uplands on the island of Islay, Jura, Colonsay, Iona, Coll and Tiree. The Landscape Character Assessment details that the landform varies according to the underlying geology, but is typically undulating lowland, which becomes increasingly steep, uneven and rocky on the slopes leading to the upland moors. It is generally small-scale and complex. The slopes on the fringes of the lowland moors are typically shallow, but there are often rocky outcrops and areas of undulating terrain. These act as scale reference points in the landscape. The coastal landscape is also varied, with low cliffs, rocky outcrops, rock slabs and off-shore islands in areas of relatively elevated terrain, and narrow bays of sand or shingle at points where a river or burn meets the sea. It is an extremely diverse landscape, with a patchy mix of moorland, farmland, scrub, bog and woodland. Fields vary in size. They tend to be smaller on undulating terrain and in areas close to settlements, but many are extensive and there is a gradual transition to open, rough grazing on the fringes of the surrounding moorland. The fields are partially enclosed by a historic pattern of stone walls on higher slopes and by wire fencing elsewhere. The marginal landscape supports very small, scattered farming communities; and is peppered with early ecclesiastical sites, which retain a spiritual importance, such as the medieval monastery on Iona. It dominates the coastline and commands international renown as the cradle of Scottish or Celtic Christianity. The marginal landscape supports very small, scattered farming communities, with larger crofts in areas influenced by machair. Crofts are typically clustered in isolated groups at the end of long, narrow tracks. Smallholdings are commonly found in this landscape type. This landscape is described as relatively accessible and well-settled, and there are properties scattered in small groups along the network of narrow roads.

Key Characteristics of LCT 49 are identified by NatureScot include:

- Undulating, uneven landform with rocky outcrops on the lower margins of the upland moor;
- Indented rocky coastline with some small sandy bays;
- Diverse patchy mix of moorland, grassland, peaty marsh and woodland;
- Typically geometric fields, divided by broken stone walls on upper slopes and wire fences or straight drainage ditches on the glen floor;
- Some conifer plantations and deciduous woodland associated with larger farms and estates on sheltered glen slopes;
- Many scattered small settlements and isolated farms and cottages; and
- Archaeological sites.

15.3.3 Argyll & Bute Landscape Capacity Study - Landscape Character Type

The Proposed Development is located within the Boulder Moors LCT 11 in the Argyll & Bute Landscape Capacity Study 2009.

The key characteristics of this landscape character type are described as:

- Boulder strewn moorland;
- Rocky bays with off-shore islands;
- Peat bogs, moorland grasses and heather;
- Derelict stone cottages on windswept moorland. Modern development along the principal road; and
- Wind, rugged landscape.

The landscape capacity study lists the main landscape issues that need to be considered, with regard to development, within this landscape type are stated as;

- Take up opportunities for sensitive restoration and conservation of derelict farm buildings and cottages, particularly those in prominent positions which are an important part of the local cultural landscape.

The landscape capacity study identifies a number of Rural Opportunity Areas on Mull but none of these areas are in close proximity to the Proposed Development.

15.3.4 Seascape Character Area

The Proposed Development is identified within National Coastal Character Type - Deposition Coasts of Islands Coastal Character Type (CCT) (Type 12) in Guidance on Coastal Character Assessment (NatureScot 2017).

In the absence of a published Seascape Character Assessment at a tier down from the National level for the area potentially influenced by the Proposed Development, as part of this assessment a Seascape Character Area – Sound of Iona – has been identified by the LVIA completed for the Proposed Development to assist in the identification of the potential effects on seascape at the Proposed Development as described below.

15.3.4.1 Deposition Coasts of Islands (CCT 12)

The Coastal Character Assessment (2017) states that the physical characteristics of CCT 12 are crofting and farms are set back from the coast in an open, low lying, largely treeless and windswept landscape with views of the Atlantic Ocean or North Sea, although dunes can often screen views of open sea and coast inland. The area is described as sparsely settled, low-key land management and lack of coastal development that has an experiential character often wild, remote ‘edge of ocean’ feel with big breakers and low-lying exposure of island landscapes, with few sights of land in large scale sea views. The combination of mountains with coast is stated as providing particularly high scenic quality and drama. The document does not identify the sensitivity of the Deposition Coasts of Islands.

15.3.4.2 Sound of Iona Coastal Character Area

The Sound of Iona Coastal Character Area (CCA) consists of a narrow stretch of water that separates the island of Iona from the Ross of Mull in the southwest of Mull (Argyll & Bute). The Sound is approx. 5.5 km long and 1 km wide at its narrowest. The coastline on the Iona side is predominantly less rugged than on the Ross of Mull side with a smoother coastal topography that is aligned in a southwest to northeast axis. The Iona side of the Sound has small inlets and bays that are frequently sandy backed by small dunelands/machair. The coastal topography rises in the southern part of Iona to form high rocky hills and cliffs that do have a more rugged appearance similar to the coastline of the Ross of Mull. Settlement on Iona is confined to the central coastline of the island at Baile Mòr and immediately south of the harbour where scattered single croft dwellings follow small narrow laneways. The medieval monastery on Iona visually dominates the coastline locally and is recognised as the origins of Scottish or Celtic Christianity. The coastal character on Iona is generally small-scale and complex.

On the Ross of Mull the coastal topography is higher than on Iona but is typically undulating lowland, which becomes increasingly steep, uneven and rocky on the slopes leading to the upland moors further inland. The coastal landscape is also varied, with low cliffs, rocky outcrops, rock slabs and small off-shore islands/outcrops, and narrow bays of sand or shingle at points where a river or burn meets the sea. Like Iona the coastal character on Mull is generally small-scale and complex.

Fionnphort is the only other small settlement within this CCA and it is well screened from coastal views due its sheltered setting in the topography. There is an almost complete absence of visible settlement along the Ross of Mull coastline in the Sound of Iona. Where settlement is found it consists of crofts that are typically clustered in isolated groups at the end of long, narrow tracks.

15.3.5 Landscape Policies – Argyll & Bute Local Development Plan 2015

A review of the current, adopted Local Development Plan, has identified the following policies of relevance to this LVIA:

Policy LDP DM1 Development within the Development Management Zones: Encouragement shall be given to sustainable forms of development as follows*: (C) Within the Villages and Minor Settlements up to small scale*on appropriate sites.*

Policy LDP STRAT 1 Sustainable Development: *In preparing new development proposals, developers should seek to demonstrate the following sustainable development principles, which the planning authority will also use in deciding whether or not to grant planning permission: a) Maximise the opportunity for local community benefit; b) Make efficient use of vacant and/or derelict land including appropriate buildings; c) Support existing communities and maximise the use of existing infrastructure and services; d) Maximise the opportunities for sustainable forms of design including minimising waste, reducing our carbon footprint and increasing energy efficiency; e) Avoid the use of locally important good quality agricultural land; f) Utilise public transport corridors and active travel networks; g) Avoid the loss of important recreational and amenity open space; Chapter 1 Introduction 8 h) Conserve and enhance the natural and built environment and avoid significant adverse impacts on biodiversity, natural and built heritage resources;* ***i) Respect the landscape character of an area and the setting and character of settlements;*** *j) Avoid places with significant risk of flooding, tidal inundation, coastal erosion or ground instability; and k) Avoid having significant adverse impacts on land, air and water environment.*

Policy LDP 3 Supporting the Protection, Conservation and Enhancement of our Environment: *In all development management zones, Argyll & Bute Council will assess applications for planning permission with the aim of protecting conserving and where possible enhancing the built, human and natural environment.*

A development proposal will not be supported when it: (A) ***does not protect, conserve or where possible enhance biodiversity, geodiversity, soils and peat, woodland, green networks, wild land, water environment and the marine environment.*** *(B) does not protect, conserve or where possible enhance; (i)* ***the***

established character and local distinctiveness of the landscape and seascape in terms of its location, scale, form and design*; and (ii) the "Dark Skies" status of the Isle of Coll. (C) does not protect, conserve or where possible enhance the established character of the built environment in terms of its location, scale, form and design. (D) has not been ascertained that it will avoid adverse effects, including cumulative effects, on the integrity or special qualities of international or nationally designated natural and built environment sites. Further information and detail on matters relating to the natural environment, landscape, and the historic environment will be provided in Supplementary Guidance. (E) has significant adverse effects, including cumulative effects, on the special qualities or integrity of locally designated natural and built environment sites. Where there is significant uncertainty concerning the potential impact of a Proposed Development on the built, human or natural environment, consideration will be given to the appropriate application of the precautionary principle, consistent with Scottish Planning Policy*

Policy LDP 6 Supporting the Sustainable Growth of Renewables: *The Council will support renewable energy developments where these are consistent with the principles of sustainable development and it can be adequately demonstrated that there would be no unacceptable significant adverse effects, whether individual or cumulative, including on local communities, natural and historic environments,* ***landscape character and visual amenity****, and that the proposals would be compatible with adjacent land uses.*

Policy LDP 9 Development Setting, Layout and Design: *The Council will require developers and their agents to produce and execute a high standard of appropriate design in accordance with the following criteria: The design of developments and structures shall be compatible with the surroundings. Particular attention shall be given to massing, form and design details within sensitive locations such as National Scenic Areas, Areas of Panoramic Quality, Greenbelt, Very Sensitive Countryside, Sensitive Countryside, Conservation Areas, Special Built Environment Areas, Historic Landscapes and Archaeologically Sensitive Areas, Historic Gardens and* ***Designed Landscapes*** *and the settings of listed buildings and Scheduled Ancient Monuments. Within such locations, the quality of design will require to be higher than in other less sensitive locations and, where appropriate, be in accordance with the guidance set out in "New Design in Historic Settings" produced by Historic Scotland, Architecture and Place, Architecture and Design Scotland.*

15.3.6 Landscape Designations Argyll & Bute Local Development Plan 2015

As mentioned previously, the Proposed Development sites lies wholly within the Argyll & Bute Council Area covered by the LDP 2015. A review of the LDP 2015 and other relevant landscape related designations that may influence the assessment. Identified designations are listed below and are taken forward for detailed assessment.

15.3.6.1 National Scenic Areas

National Scenic Areas (NSA) purpose is both to identify the finest scenery in Scotland and to ensure its protection from inappropriate development. This is achieved through the planning system. For each NSA the landscape qualities that make each NSA special have been identified. The Proposed Development is not located with an area designated as NSA. The nearest NSA is located approximately 23 km away, on the northwest side of the Isle of Mull known as Loch na Keal NSA.

15.3.6.2 Area of Panoramic Quality

Iona coastline is designated as an Area of Panoramic Quality within the Plan. These are areas which are designated in terms of their landscape quality. Planning policy aims to protect these areas against development which would diminish their high scenic value.

15.3.6.3 Local Landscape Areas

Local Landscape Areas (LLA) are areas of regional importance in terms of their landscape quality as identified by the Local Development Plan. The island of Iona is identified as lying within an LLA.

15.3.6.4 Conservation Areas

Conservation Areas are areas of special architectural or historic interest which have a statutory basis under the Planning (Listed Building and Conservation Areas) (Scotland) Act 1997, the character or appearance of which the LDP identifies as desirable to preserve or enhance. As set out above the Proposed Development is located within Baile Mòr Conservation Area (including the existing slipway), which contains a number of heritage sites including St Mary's Abbey (Category A listed building) and the Iona Nunnery (scheduled monument).

15.3.7 Argyll & Bute Local Development Plan – Supplementary Guidance (adopted 2016)

The Council has adopted Supplementary Guidance which provides additional detail on the policies within the adopted Local Development Plan. Supplementary Guidance is a material consideration in determining applications for planning permission. A review of the adopted Supplementary Guidance has identified the following policies of relevance to this LVIA:

SG LDP ENV 13 Development Impact on Areas of Panoramic Quality (APQs): *Argyll & Bute Council will resist development in, or affecting, an Area of Panoramic Quality where its scale, location or design will have a significant adverse impact on the character of the landscape unless it is adequately demonstrated that: (A) Any significant adverse effects on the landscape quality for which the area has been designated are clearly outweighed by social, economic or environmental benefits of community wide importance*.

SG LDP ENV 14 Landscape: *Outwith National Scenic Areas and Areas of Panoramic Quality, Argyll & Bute Council will consider landscape impact when assessing development proposals, and will resist development when its scale, location or design will have a significant adverse impact on the character of the landscape unless it is demonstrated that: (A) Any such effects on the landscape quality are clearly outweighed by social, economic or environmental benefits of community wide importance; and (B) The Council is satisfied that all possible mitigation measures have been incorporated into the development proposal to minimise adverse effects*.

SG LDP ENV 15 Development Impact on Historic Gardens and Designed Landscapes: *In assessing proposals for development in, or adjacent to, gardens or designed landscapes particular attention will be paid to the impact of the proposal on: (A) The archaeological, historical or botanical interest of the site; (B) The site's original design concept, overall quality and setting; (C) Trees and Woodland and the site's contribution to local landscape character within the site including the boundary walls, pathways, garden terraces or water features; and, (D) Planned or significant historic views of, or from, the site or buildings within it.*

15.3.8 Landscape Policies – Proposed Argyll & Bute Local Development Plan 2

The landscape policies in the Proposed Argyll & Bute LDP 2 reflect those set out in the adopted 2016 LDP with the following:

Policy 10 Design – All Development: The design of any development must demonstrate an understanding of and appropriate response to the Proposed Development site and wider context including consideration of character.

Policy 20 Gardens and Designed Landscapes: There will be a presumption in favour of retaining, protecting, conserving and enhancing gardens and designed landscapes, either listed in the inventory of gardens and designed landscapes, or otherwise deemed to be of significant value.

Policy 71 Development Impact on Local Landscape Area (LLA): Argyll & Bute Council will resist development in, or affecting, a Local Landscape Area where its scale, location or design will have a significant adverse impact on the character of the landscape unless it is adequately demonstrated that: a) Any significant adverse effects on the landscape quality for which the area has been designated are clearly outweighed by social, economic or environmental benefits of community wide importance; and b) The proposal is supported by an LVIA and consistent with the relevant Argyll & Bute Landscape Capacity Assessment.

Policy 42 – Safeguarding Piers, Ports and Harbours: Development within established commercial harbour, port and pier areas will be supported where:

- It has been clearly demonstrated that the proposal requires a pier, port or harbourside location or is ancillary to activities taking place within that particular facility; and
- It has been clearly demonstrated that the proposal would not adversely affect the commercial viability or efficient operation of the facility for marine related uses.

15.3.9 Gardens and Designed Landscapes

The Inventory of Gardens and Designed Landscapes (GDL), under the remit of Historic Environment Scotland (HES) has prepared surveys of GDL's within Scotland. A review of the inventory held by HES has identified that no GDLs will be directly affected by the Proposed Development as there are none in proximity to the Proposed Development.

15.3.10 Visual Receptors

Core Paths and Recreational Routes

A number of Core Paths (Figure 15-2) lie within close proximity to the Proposed Development and have been identified from the available GIS information associated with the LDP. Identified Core Paths include:

- Core Path ID C044; North Beach Walk Iona 0.6km linear route to the north of the development site.
- Core Path ID C483; Baile Mòr to Culbuirg dunes, Iona, a 2.8km circular route south of the development site.
- Core Path ID C484 - Culbuirg Dunes to Port na Curaich, Iona a 2.4km linear route to the south-west of the site.

In addition to the Core Paths identified by the LDP a further walk known as St Columba's Way is a promoted long-distance walk that extends for approx. 200 miles from Iona – Mull – Oban – Tyndrum – St Andrews.

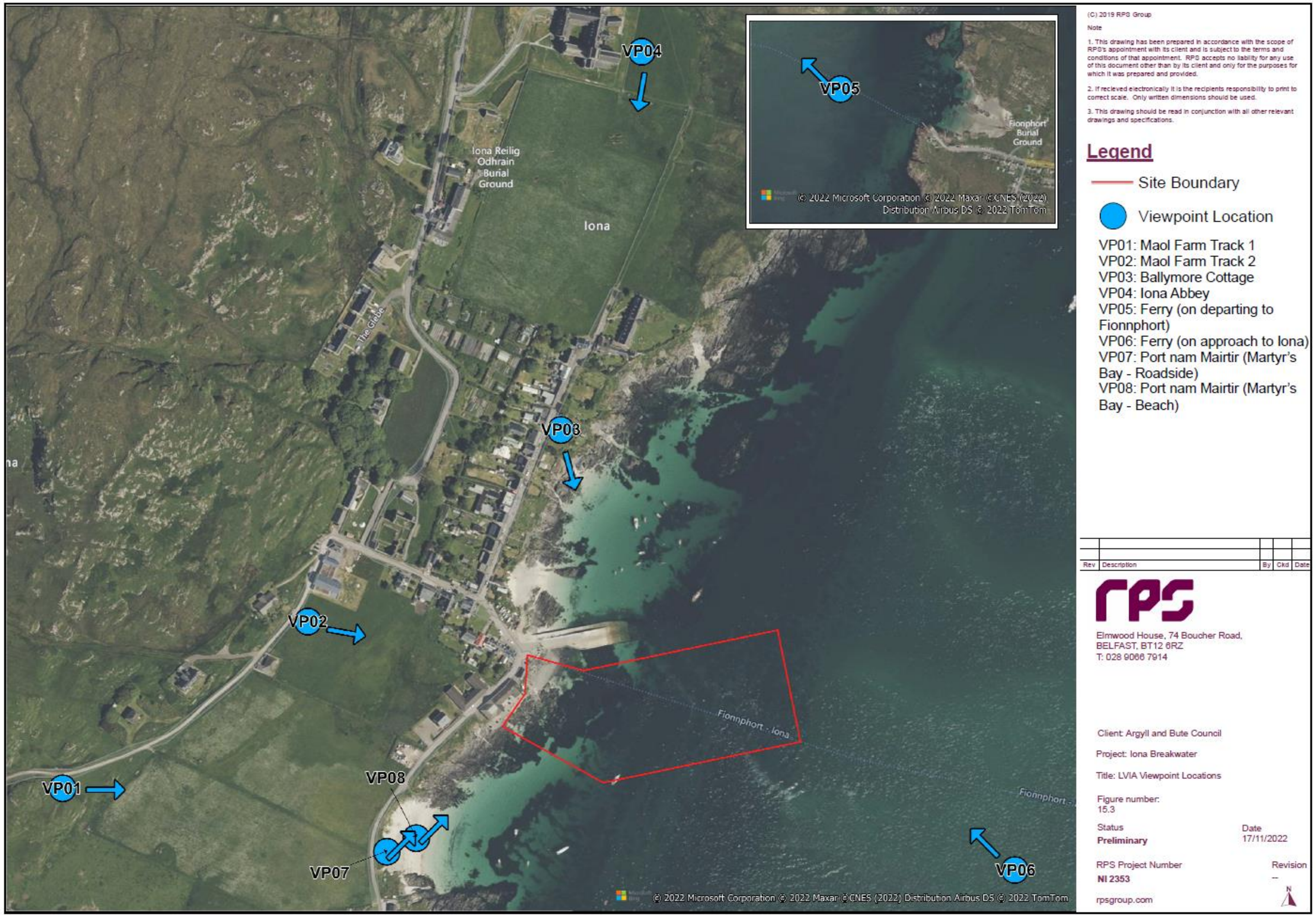

Figure 15-2 Core paths and viewpoint locations

Water Users

There are several mobile water-based receptors using the water along the coastline of the sound of Iona including ferry users, kayaks, pleasure boats and fishing vessels.

Roads

On Iona narrow access lanes extend north and south from Baile Mòr linking with the harbour area. It is important to note that visitor cars are not permitted on the island with the exception of blue badge holder with mobility issues who can apply for a permit.

The A849 runs in a west to east direction from Fionnphort across the Ross of Mull. This is the only Class A Road in proximity to the Proposed Development. South of Fionnphort a small access road runs off the A849 providing access to Fidden and Fidden Farm Campsite.

Viewpoints

A selection of representative viewpoints has been established via the EIA Scoping Response and feedback from Consultees that included the request for two additional viewpoints; view from ferry approach to the Island; and view from the Bay of Martyrs.

The eight viewpoints selected for use in the LVIA are as follows:

1. Maol Farm Track 1
2. Maol Farm Track 2
3. Ballymore Cottage
4. Iona Abbey
5. Ferry (on departing to Fionnphort)
6. Ferry (on approach to Iona)
7. Port nam Mairtir (Martyrs Bay - Roadside)
8. Port nam Mairtir (Martyrs Bay - Beach)

15.4 Likelihood of Effects

15.4.1 Construction Phase

The Proposed Development, as described in detail in EIAR Chapter 3, has the potential to affect the following landscape and visual resources during construction:

- Landscape/Seascape character of the Proposed Development site and the surrounding area;
- Landscapes designated for their special qualities or scenic beauty; and
- The visual amenity of people in the surrounding area.

During the construction phase the Proposed Development has potential to result in impacts that may be prominent though largely temporary in duration. The construction phase effects are taken forward for detailed consideration in the landscape & visual impact assessment below.

15.4.2 Operational Phase

The Proposed Development, as described in detail in EIAR Chapter 3, has the potential to affect the following landscape and visual resources during operation:

- Landscape/Seascape character of the Proposed Development site and the surrounding area;
- Landscapes designated for their special qualities or scenic beauty; and
- The visual amenity of people in the surrounding area.

The Proposed Development therefore has the potential to give rise to landscape and visual effects during the operational phase. Operational phase effects are taken forward for consideration in the detailed landscape and visual impact assessment below.

15.5 Description of Likely Significant Effects

15.5.1 Seascape/Landscape Character Effects

The Proposed Development is located within the Argyll & Bute Council area and the predicted landscape effect of the Proposed Development is set out in Table 15-7.

Table 15-7 Seascape/Landscape Character Effects

Island Mixed Farmland – LCT 49	
Sensitivity	This LCT forms the fringe of uplands and the island of Iona and is small scale and complex with open long-distance views. The Proposed Development consists of the proposal to locate a breakwater at the existing Iona Ferry Terminal. Taking account of the above characteristics the susceptibility of the LCT to the type of development proposed is judged to be high. This LCT includes parts of the landscape at Iona that have been designated as Areas of Panoramic Quality, Local Landscape Area and Conservation Area at Baile Mòr. Taking account of the above characteristics the value of the LCT to the type of development proposed is judged to be high. Based on the susceptibility and value attached to this LCT, the overall sensitivity of this LCT is judged to be high.
Magnitude of Change – Construction Phase	Sea based traffic and construction activities within proximity to the Proposed Development in the Sound of Iona will have a temporary, indirect effect upon coastal fringe areas of the LCT only. Away from the coastal fringe areas the construction activities will have limited to no influence on this LCT due to intervening topography. The predicted magnitude of change associated with the construction phase is considered to be medium, as activities will be temporary in nature and limited to a localised portion of this much wider LCT that will remain unaltered resulting in a small magnitude of change for the remaining LCT.
Magnitude of Change – Operational Phase	During the operational phase, the Proposed Development will form a new, noticeable feature in local views from the eastern coastline of Iona and will be less noticeable but still visible from the western coastal fringe Ross of Mull. The Proposed Development will alter the existing coastline, but magnitude of change is off set by the fact that it is located at the site of the existing harbour that is already a landscape feature itself and the rock used to construct the breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed and tideline etc. The Proposed Development is also read in the context with the settled area on the eastern side of Iona. Visibility of the Proposed Development will diminish rapidly further inland on both Iona and Ross of Mull within LCT 49, due to screening effects provided by existing topography resulting in a medium magnitude of change locally and small magnitude of change for the remaining LCT.
Significance of Effect during Construction Phase	Moderate to major, localised direct, temporary duration and considered to be significant, reducing to minor to moderate and not significant effects with increasing distance from the coastal fringe of this LCT.
Significance of Effect during Operational Phase	Moderate to major localised direct long-term duration and considered to be significant for localised coastal fringe areas at Sound of Iona, reducing to minor to moderate and not significant with increasing distance from the coastal fringe of this LCT.
Deposition Coast of Islands – CCT 12 – Seascape Character	
Sensitivity	This CCT is described as an open, low lying, largely treeless and windswept landscape with views of the Atlantic Ocean or North Sea, although dunes can often screen views of open sea and coast inland. The area is described as sparsely settled, low-key land management and lack of coastal development that has an experiential character often wild, remote 'edge of ocean' feel with big breakers and low-lying exposure of island landscapes, with few sights of land in large scale sea views. Taking account of the above characteristics the susceptibility of the CCT to the type of development proposed is judged to be high. This CCT includes parts of the landscape at Iona that have been designated as Areas of Panoramic Quality, Local Landscape Area and Conservation Area at Baile Mòr. The Coastal Character Assessment 2017 states that this CCT provides particularly high scenic quality and drama. Taking account of the above characteristics the value of the CCT to the type of development proposed is judged to be high. Based on the susceptibility and value attached to this CCT, the overall sensitivity of this CCT is judged to be high.
Magnitude of Change – Construction Phase	Sea based traffic and activities within proximity to the Proposed Development in the Sound of Iona will have a temporary, indirect effect upon coastal fringe areas of the CCT only. Away from the coastal fringe areas the construction activities will have no influence on this CCT due to intervening topography.

Island Mixed Farmland – LCT 49	
	The predicted magnitude of change associated with the construction phase is considered to be medium, as activities will be temporary in nature and limited to a small and localised portion of this much wider CCT that will remain unaltered resulting in a small magnitude of change for the remaining CCT.
Magnitude of Change – Operational Phase	During the operational phase, the Proposed Development will form a new, noticeable feature in local views from the eastern coastline of Iona and will be less noticeable but still visible from the western coastal fringe Ross of Mull. The Proposed Development will alter the existing coastline, but magnitude of change is off set by the fact that it is located at the site of the existing harbour that is already a landscape feature itself and the rock used to construct the breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed and tideline etc. The Proposed Development is also read in the context with the settled area on the eastern side of Iona. Visibility of the Proposed Development will diminish rapidly further inland on both Iona and Ross of Mull within this CCT, due to screening effects provided by existing topography resulting in a medium magnitude of change locally and small magnitude of change for the remaining CCT.
Significance of Effect during Construction Phase	Moderate to major, localised direct, temporary duration and considered to be significant, reducing to minor to moderate and not significant effects with increasing distance from the coastal fringe of this CCT.
Significance of Effect during Operational Phase	Moderate to major localised direct long-term duration and considered to be significant for localised coastal fringe areas at Sound of Iona, reducing to minor to moderate and not significant with increasing distance from the coastal fringe of this CCT.

Sound of Iona CCA – Local Seascape Character	
Sensitivity	This local CCA forms the fringe of uplands on western Ross of Mull and of the island of Iona and is small scale and complex with open long distance views. The Proposed Development consists of the proposal to locate a breakwater at the existing Iona Ferry Terminal. Taking account of the above characteristics the susceptibility of the CCA to the type of development proposed is judged to be high. This CCA includes parts of the landscape at Iona that have been designated as Areas of Panoramic Quality, Local Landscape Area and Conservation Area at Baile Mòr. Taking account of the above characteristics the value of the CCA to the type of development proposed is judged to be high. Based on the susceptibility and value attached to this CCA, the overall sensitivity of this CCA is judged to be high.
Magnitude of Change – Construction Phase	Sea based traffic and activities within proximity to the Proposed Development in the Sound of Iona will have a temporary, direct effect upon coastal fringe areas of the CCA only. Away from the coastal fringe areas the construction activities will have no influence on this CCA due to intervening topography. The predicted magnitude of change associated with the construction phase is considered to be high, as activities will be temporary in nature and limited to a small and localised portion of this much wider CCA that will remain unaltered
Magnitude of Change – Operational Phase	During the operational phase, the Proposed Development will form a new, noticeable feature in local views from the eastern coastline of Iona and will be less noticeable but still visible from the western coastal fringe Ross of Mull. The Proposed Development will alter the existing coastline, but magnitude of change is off set by the fact that it is located at the site of the existing harbour that is already a landscape feature itself and the rock used to construct the breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed and tide line etc. The Proposed Development is also read in the context with the settled area on the eastern side of Iona. Visibility of the Proposed Development will diminish rapidly further inland on both Iona and Ross of Mull within this CCA, due to screening effects provided by existing topography resulting in a medium magnitude of change locally and small magnitude of change for the remaining CCA.
Significance of Effect during Construction Phase	Moderate to major, localised direct, temporary duration and considered to be significant at the eastern coastal fringe of Iona, reducing to minor to moderate and not significant effects with increasing distance from this coastal fringe area elsewhere in this CCA.
Significance of Effect during Operational Phase	Moderate to major localised direct long-term duration and considered to be significant for localised eastern coastal fringe areas at Iona, reducing to minor to moderate and not significant with increasing distance from this coastal fringe area.

15.5.2 Landscape Designation Effects

15.5.2.1 National Scenic Areas

The Proposed Development is not located with an area designated as NSA. The nearest NSA is located on the northwest side of the Isle of Mull known as Loch na Keal NSA. No significant effects are predicted for any NSA.

15.5.2.2 Area of Panoramic Quality

Iona coastline is designated as an Area of Panoramic Quality (APQ) within the LDP. These are areas which are designated in terms of their landscape quality. Planning policy aims to protect these areas against development which would diminish their high scenic value.

The Proposed Development will form a new, noticeable feature in local views from the eastern coastline of Iona but will be less noticeable elsewhere but still visible from the western coastal fringe Ross of Mull however, from Ross of Mull it will be read as part of the Iona shoreline (see Viewpoint 5). The Proposed Development in views along the eastern Iona shoreline will visibly alter the existing coastline but magnitude of change is off set by the fact that it is located at the site of the existing harbour that is already a landscape feature itself and that the rock used to construct the breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed etc. Vessels coming and going to and from the Iona harbour will not change. Visibility of the Proposed Development will diminish rapidly further inland on both Iona and Ross of Mull within this designation, due to screening effects provided by existing topography resulting in a medium magnitude of change locally and small to negligible magnitude of change for the remaining APQ.

The significance of effect is predicted to be Moderate to major localised direct and long-term duration and considered to be significant for localised eastern coastal fringe areas at Iona, reducing to minor to moderate and not significant with increasing distance from this localised area.

15.5.2.3 Local Landscape Areas

Local Landscape Areas (LLA) are areas of regional importance in terms of their landscape quality as identified by the Local Development Plan. The island of Iona is identified as lying within an LLA.

The Proposed Development will form a new, noticeable feature in local views from the eastern coastline of Iona but will be less noticeable elsewhere along the eastern side of Iona and not visible beyond the localised area north and south of the existing harbour due to intervening topography. The Proposed Development in views along the eastern Iona shoreline will visibly alter the existing coastline but magnitude of change is off set by the fact that it is located at the site of the existing harbour that is already a landscape feature itself and that the rock used to construct the breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed etc. Vessels coming and going to and from the Iona harbour will not change. Visibility of the Proposed Development diminishes rapidly further inland on Iona within this designation, due to screening effects provided by existing topography resulting in a medium magnitude of change locally and small to negligible magnitude of change for the remaining LLA.

The significance of effect is predicted to be moderate to major localised direct and long term duration and considered to be significant for localised eastern coastal fringe areas at Iona, reducing to minor to moderate and not significant with increasing distance from this localised area.

15.5.2.4 Conservation Areas

Conservation Areas are areas of special architectural or historic interest which have a statutory basis under the Planning (Listed Building and Conservation Areas) (Scotland) Act 1997, the character or appearance of which the LDP identifies as desirable to preserve or enhance. As set out above the Proposed Development is located within Baile Mòr Conservation Area (including the existing slipway), which contains a number of heritage sites including St Mary's Abbey (Category A listed building) and the Iona Nunnery (scheduled monument).

The Proposed Development is located directly within the Baile Mòr Conservation Area and as such will alter the appearance of immediate surroundings at the existing slipway. The proposed breakwater will be a new and prominent feature in views from within the conservation area (see Viewpoints 1, 2 and 3). The magnitude of change is off set by the fact that the Proposed Development is located at the site of the existing harbour that is already a landscape feature itself within this conservation area and that the rock used to construct the breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed etc. Vessels coming to and going from the Iona harbour will not change.

The significance of effect is predicted to be moderate to major localised direct and long-term duration and considered to be significant for the Baile Mòr Conservation Area.

A summary of the predicted townscape/landscape and visual effect on landscape designations is provided in the summary Table 15-8.

Table 15-8 Summary of Predicted Landscape/Seascape and Designation Effects

Landscape/Seascape Character / Designation	Predicted Landscape & Visual Effects (Construction Stage)	Predicted Landscape & Visual Effects (Operational Stage)
Island Mixed Farmland – LCT 49	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance
Deposition Coasts of Islands - CCT 12	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance
Sound of Iona CCA	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance
National Scenic Areas	No change	No change
Area of Panoramic Quality	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance
Local Landscape Area	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance	Moderate to major localised, reducing to minor to moderate and not significant with increasing distance
Conservation Area	Moderate to major	Moderate to major

15.5.3 Visual Effects

15.5.3.1 Core Paths and Recreational Routes

There are four identified Core Paths namely:

- Core Path ID C044; North Beach Walk Iona 0.6km linear route to the north of the development site.
- Core Path ID C483; Ballie Mòr to Culbuirg dunes, Iona, a 2.8km circular route south of the development site.
- Core Path ID C484 - Culbuirg Dunes to Port na Curaich, Iona a 2.4km linear route to the southwest of the site.

Core Path ID C044 the North Beach Walk on Iona will have intermittent but direct views towards the Proposed Development that fade out with increased distance northwards due to intervening topography. The built environment on the north side of Baile Mòr breaks up views towards the Proposed Development. Where direct views are available the Proposed Development will appear as new and prominent feature in views albeit associated with the existing harbour and settlement at Baile Mòr (see Viewpoint 3). The viewer sensitivity is high. The predicted magnitude of change is large. The predicted significance of effect is Major to substantial and significant for direct views from Core Path ID C044.

Core Path ID C483 the Ballie Mòr to Culbuirg dunes walk on Iona extends south from the harbour area and locally in close proximity will have direct views towards the Proposed Development that fade out with increased distance southwards due to intervening topography to no view at all. The built environment on the south side of Baile Mòr does breaks up views towards the Proposed Development but where direct views are available the Proposed Development will appear as new and prominent feature in views albeit associated with the existing harbour and settlement at Baile Mòr (see Viewpoint 7). The viewer sensitivity is high. The predicted magnitude of change is large. The predicted significance of effect is Major to substantial and significant for direct views from Core Path ID C483. The remainder of this Core Path will have no significant effects.

Core Path ID C484 from the Culbuirg Dunes to Port na Curaich is located on the western side of Iona and will not have any direct views towards the Proposed Development due to intervening topography. The viewer sensitivity is high. The predicted magnitude of change is no change. The predicted significance of effect is no change for views from Core Path ID C044.

15.5.3.2 Viewpoints

A series of eight representative viewpoints have been selected to illustrate the existing visual context of the Proposed Development and as an aid to the visual impact assessment. All of the viewpoints have been located on publicly accessible roads, footways and verges as well as from the ferry approaches to Iona (Figure 15-2).

Views available from each of the selected viewpoint locations are presented in Volume III, Appendix 15.1: Photomontages, which should be read in conjunction with the following viewpoint assessments below.

Visual effects from the representative viewpoints considered in the LVIA are described in Table 15-8 to Table 15-15 below.

Table 15-8 Viewpoint 1; Maol Farm Track 1

Viewpoint 1 – Maol Farm Track 1			
Grid Ref	128188, 723902	**Existing Viewpoint Location**	Figure 15.3
Direction of View	90^0	**Approx Distance to Proposed Development**	0.425km

Description of existing view and potential receptors	This viewpoint is located at Maol Farm Track which is circa.425m south west of the Proposed Development. The existing view at this location is slightly elevated above the relatively flat topography along the coast offering clear views towards the harbour. The topography of the landscape offers uninterrupted views to Ross of Mull on the other side of the Sound of Iona. The settlement of Fionnphort is just visible in tyhe cnetre right of the view. There are a number of buidings clearly visible within this view that are located on the immediate southern side of Baile Mor. The existing harbour at Baile Mòr is not visible as it is screened by buildings but the existing ferry will be clearly visible from this viewpoint coming and going from Iona to Fionnphort. Livestock, overhead electrictiy lines on wooden posts and timber/ wire fences transverse through the landscape. This viewpoint is representative of recreational users travelling north along the track towards Baile Mòr.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are recreational receptors. The view is representative of views from a recognised stopping place or promoted walk, the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre of the view. Vessels transporting rock will be a large but transitory feature in views during construction. The construction activities will be partially screened by topography and existing buildings at Baile Mòr particulary ground level activities. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will appear as a new feature on the Iona coastline but occupying a small portion of the overall view. The new breakwater will be read with and in the context of urban built form at Baile Mòr. A small part of the visible sea is lost in the view but the western coastline of the Ross of Mull remains viisble in the view along with distant mountains and hills that draw the eye upwards. At nighttime the warning light on the breakwater will be noticeable but difficult to discern from adjacent lights associated with properties at Baile Mòr. The magnitude of visual change during construction is judged to be medium. The magnitude of visual change during operation will be small.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a moderate to major and not significant temporary, adverse visual effect during the construction phase.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a minor to moderate and not significant visual effect.

Table 15-9 Viewpoint 2; Maol Farm Track 2

Viewpoint 2 – Maol Farm Track 2			
Grid Ref	128407, 724031	**Existing Viewpoint Location**	Figure 15.3
Direction of View	110^0	**Approx Distance to Proposed Development**	210 m

Description of existing view and potential receptors	This viewpoint is located at Maol Farm Track which is circa.210m west of the Proposed Development. The existing view at this location is slightly elevated above the relatively flat topography along the coast offering clear views towards the harbour. The topography of the landscape offers uninterrupted views Ross of Mull in the distance. Fionnphort is visible in the distance on the opposite side of the Sound of Iona. There are a number of modern buidings clearly visible within this view that dominate the foreground. The closest building visible within this view is a 2 storey dwelling to the left which sits adjacent to the Cnoc a' Chalmain which is a Catholic House of Prayer. A break in the building line at Baile Mòr permits a partial view of the existing harbour area with the light columns at the slipway visible. The taller buildings to the left of the view obscure visibility of the coastline at Ross of Mull in this view direction. The existing ferry when crossing the Sound will be visible within this view. Livestock, overhead electrictiy lines on wooden posts and timber/ wire fences transverse through the landscape. This viewpoint is representative of recreational users travelling north along the track towards the harbour.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are recreational receptors. The view is representative of views from a recognised stopping place or promoted walk, the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre of the view but partially screened by the existing buildings at Baile Mòr with glimpse views only. Vessels transporting rock will be a large but transitory feature in views during construction. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will appear as a new feature on the Iona coastline but occupying a very small portion of the overall view. The new breakwater will be read with and in the context of more prominent urban built form at Baile Mòr in the foreground. A very small part of the visible sea is lost in the view but the western coastline of the Ross of Mull and view to Fionnphort remains viisble in the view along with distant mountains and hills on Mull and beyond. At nighttime the warning light on the breakwater will be noticeable but very difficult to discern from adjacent lights associated with properties at Baile Mòr and the existing lights at the harbour slipway. The magnitude of visual change during construction is judged to be small. The magnitude of visual change during operation will be small.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a minor to moderate and not significant temporary, adverse visual effect during the construction phase.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a minor to moderate and not significant visual effect.

Table 15-10 Viewpoint 3; Ballymore Cottage

Viewpoint 3 – Ballmore Cottage			
Grid Ref	128634, 724181	**Existing Viewpoint Location**	Figure 15.3
Direction of View	185^0	**Approx Distance to Proposed Development**	0.2km

Description of existing view and potential receptors	This viewpoint is located at Ballymore Cottage within the northern side of Baile Mòr which is circa.220m north of the Proposed Development. The existing view at this location is slightly elevated above the shoreline offering partial and glimpse views towards the harbour. The existing slipway is visible along with vehicles and lighting columns. The viewpoint also offers partly interrupted views of the southern portion of Ross of Mull in the distance. If the viewer turns their head to the left Fionnphort is visible in the distance on the opposite side of the Sound of Iona. The immediate foreground is filled with gardens associated with local dwellings at Baile Mòr. The existing ferry when crossing the Sound will be visible within this view. This viewpoint is representative of views available to residential receptors at this location in Baile Mòr towards the harbour.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are residential receptors. The view is representative of views from within the Baile Mòr Conservaion Area, the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the direct visibility of machinery and activities associated with the construction of the breakwater that will be located across much of the view. Vessels transporting rock will be a large but transitory feature in views during construction. The direct and open visibility available from this location will result in the majority of construction activities being visible from ground/sea level up. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will appear as a prominent new feature on the Iona coastline extending across the majority of the view. The new breakwater will be read with and in the context of the existing harbour and slipway at Baile Mòr in the foreground. A large part of the visible sea is lost in the view but the southern coastline of the Ross of Mull remains visible beyond the proposed breakwater. The photomontage illustrates visibility of the breakwater at a lower tide level. With higher tide levels the proposed breakwater will be less visible in the view. At nighttime the warning light on the breakwater will be noticeable and read with the existing lights at the harbour slipway. The magnitude of visual change during construction is judged to be large. The magnitude of visual change during operation will be large.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a major to substantial and significant temporary, adverse visual effect during the construction phase.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a major to substantial and significant visual effect.

Table 15-11 Viewpoint 4; Iona Abbey

Viewpoint 4 – Iona Abbey			
Grid Ref	128724, 724500	**Existing Viewpoint Location**	Figure 15.3
Direction of View	185^0	**Approx Distance to Proposed Development**	550m

Description of existing view and potential receptors	This viewpoint is located at within the grounds of Iona Abbey and is adjacent to the eastern side of the Abbey and Abbey Museum approximately 0.5km north of the Proposed Development. The view is taken looking south towards the harbour and is considered to be representative of direct views experienced by members of the public / tourists visiting Iona Abbey and Museum. The existing views available from this location are expansive and panoramic in nature over the Sound of Iona with views of Fionnphort and the more elevated land forming the Ross of Mull visible in the horizon. The immediate foreground is comprised of arable pastoral land, bounded by timber and wire post which spearates the field boundaries. There is little covering of hedgerows and trees within the immediate landscape in the foreground leaving views of the surrounding fields open. Due to the openess and topography of the land the existing harbour infrastructure and ferry are visible in the central portion of the view, forming a minor point of interest. However, buildings on the nortehrn side of Baile Mòr are prominent on shoreline breaking up views to the sea.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are tourist and recreational receptors. The view is representative of views from within the Iona Abbey complex, the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the direct visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre of the view. Vessels transporting rock will be a large but transitory feature in views during construction. The direct and open visibility available from this location will result in the majority of construction activities being visible from ground/sea level up but a distance of more than 0.5km that will lessen the prominence of activities. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will appear as a prominent new feature on the Iona coastline extending across the centre of the view. The new breakwater will be read with and in the context of the existing harbour and slipway and built form at Baile Mòr in the foreground. A small part of the visible sea is lost in the view but the southern coastline of the Ross of Mull remains visible beyond the proposed breakwater in the panoramic view and the eye remains drawn to the distant horizon. The photomontage illustrates visibility of the breakwater at a lower tide level. With higher tide levels the proposed breakwater will be less visible in the view. At nighttime the warning light on the breakwater will be noticeable and read with the existing lights at the harbour slipway and properties at Baile Mòr in the foreground. The magnitude of visual change during construction is judged to be medium. The magnitude of visual change during operation will be medium.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a moderate to major and not significant temporary, adverse visual effect during the construction phase due to the separation distance and existing urban/harbour context of the view.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a moderate to major and not significant visual effect due to the separation distance and existing urban/harbour context of the view.

Table 15-12 Viewpoint 5; Ferry (on departing Fionnphort)

Viewpoint 5 – Ferry (on departing Fionnphort)			
Grid Ref	129621; 723584	**Existing Viewpoint Location**	Figure 15.3
Direction of View	305^0	**Approx Distance to Proposed Development**	1000m

Description of existing view and potential receptors	This viewpoint is located at within the the Sound of Iona on the ferry crossing from Fionnphort approaching Iona approximately 1 km east of the Proposed Development. The view is taken looking west towards Iona and directly at Baile Mòr that is in the centre of the view and is considered to be representative of direct views experienced by the local community and tourists visiting Iona. The existing views available from this location are enclosed but panoramic in nature over the Sound of Iona with views of Iona filling the view and the higher ground on the island forming the horizon. The immediate foreground is comprised of open water extending to the eastern shoreline of Iona that appears well settled from this distance with numerous buildings visible across the full width of the view. The harbour and slipway at Baile Mòr is discernible in the centre of the view. The sandy Martyr's Bay is visible to the left of the harbour area. The distinctive Iona Abbey is prominent to the centre right of the view.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are the local community, tourist and recreational receptors. The view is representative of views from panoramic views within recognised designations including the the APQ and while not located in a specific designation the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the direct visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre of the view but distant. Vessels transporting rock will be a large but transitory feature in views during construction and read with other vessels using the harbour and Sound of Iona. The direct and open visibility available from this location will result in the majority of construction activities being visible from ground/sea level up but at distance of more than 1 km that will make the activities difficult to discern and be read with the background of buildings and settled appearance of this side of the island that will lessen the prominence of activities. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will be visible as new feature on the Iona coastline but not prominent as it is read as part of the settled rocky coastline and with the existing harbour. The existing harbour is already a minor landscape feature itself within this view and the rock used to construct the new breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed, tideline etc increasingly read more as a part of the eastern Iona coastline. No significant views are lost. The photomontage illustrates visibility of the breakwater at a lower tide level. With higher tide levels the proposed breakwater will be less visible in the view. At nighttime the warning light on the breakwater will be noticeable and read with the existing lights at the harbour slipway and properties at Baile Mòr in the background. The magnitude of visual change during construction is judged to be small. The magnitude of visual change during operation will be small.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a minor to moderate and not significant temporary, adverse visual effect during the construction phase.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a minor to moderate and not significant visual effect.

Table 15-13 Viewpoint 6; Ferry (on approaching Iona)

Viewpoint 6 – Ferry (on approach to Iona)			
Grid Ref	128999; 723780	**Existing Viewpoint Location**	Figure 15.3
Direction of View	305^0	**Approx Distance to Proposed Development**	265m

Description of existing view and potential receptors	This viewpoint is located at within the the Sound of Iona on the ferry crossing from Fionnphort approaching Iona approximately 250 m east of the Proposed Development. The view is taken looking westwards Iona and directly at Baile Mòr that is in the centre of the view and is considered to be representative of direct views experienced by the local community and tourists visiting Iona. The existing views available from this location are enclosed in character being cosntrained by the higher ground on the island that forms a rugged horizon. The immediate foreground is comprised of open water extending to the eastern shoreline of Iona that appears well settled from this distance with numerous prominent buildings visible across the full width of the view nestled below the rugged and rocky hills beyond. The harbour and slipway at Baile Mòr is clearly visible in the centre of the view.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are the local community, tourist and recreational receptors. The view is representative of views from panoramic views within recognised designations including the the APQ and while not located in a specific designation the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the direct visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre of the view and prominent due to the close proximity of the viewpoint. Vessels transporting rock will be a large but transitory feature in views during construction and read with other vessels using the harbour and Sound of Iona coming and going. The direct visibility available from this location will result in the majority of construction activities being visible from ground/sea level up and at close distance but these activities will be read with the close proximity background of buildings and settled appearance of this side of the island that will lessen the prominence of activities. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will be visible as new feature on the Iona coastline but read as part of the settled rocky coastline and at the location of the existing harbour. The existing harbour is already a large landscape feature itself within this view and the rock used to construct the new breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed, tideline etc increasingly read more as a part of the eastern Iona coastline. The view to the existing slipway will be lost from this angle to ferry approach along with the ground level view of some buildings at Baile Mòr but overall, no significant views are lost. The photomontage illustrates visibility of the breakwater at a lower tide level. With higher tide levels the proposed breakwater will be less visible in the view. At nighttime the warning light on the breakwater will be noticeable and read with the existing lights at the harbour slipway and properties at Baile Mòr in the background. The magnitude of visual change during construction is judged to be large. The magnitude of visual change during operation will be medium.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a major to substantial and significant temporary, adverse visual effect during the construction phase due to the existing urban/harbour context of the view.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a moderate to major and not significant visual effect due to the existing urban/harbour context of the view.

Table 15-14 Viewpoint 7; Port nam Mairtir (Martyrs Bay - Roadside)

Viewpoint 7 – Port nam Mairtir (Martyrs Bay - Roadside)			
Grid Ref	128462, 723830	**Existing Viewpoint Location**	Figure 15.3
Direction of View	60^0	**Approx Distance to Proposed Development**	175 m

Description of existing view and potential receptors	This viewpoint is located at the roadside immediately adjacent to Martyr's Bay which is circa.175m southwest of the Proposed Development. The existing view at this location is lowlying but just above the shoreline on the eastern Iona coast offering views towards the harbour. The existing slipway is visible in the centre of view along with vehicles and streetlights. The proximity to the shoreline offers largely uninterrupted views Ross of Mull and distant mountains and hills. If the viewer turned their head to the right Fionnphort would be visible in the distance on the opposite side of the Sound of Iona. There are a number of modern buidings clearly visible within this view that dominate the foreground along with vehicles. The buildings to the left of the view obscure visibility of the coastline of Mull and sea beyond the Sound of Iona. The existing ferry when crossing the Sound will be clearly visible within this view. This viewpoint is representative of views for the local community and recreational/tourist users exploring the island.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are local community and recreational/tourist receptors. The view is representative of views from a recognised stopping place and within a Conservation Area/APQ, the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre and left of the view. Some activities will be screened by the existing buildings at Baile Mòr and by the breakwater itself as it increases in size. Vessels transporting rock will be a large but transitory feature in views during construction depending on the haulage route. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater that will appear as a new feature on the Iona coastline occupying a large portion of the overall view due to the proximity of the viewpoint. The new breakwater will be read with and in the context of prominent urban built form and vehicle movements at Baile Mòr in the foreground. A portion of the visible sea is lost in the view along with the part of the shore of the western coastline of the Ross of Mull but the profile of the rugged topography on Ross of Mull and view to distant hills and mountains remains. Similarly if the viewer turns their head to the right the view to Fionnphort also remains viisble. The existing harbour is already a landscape feature itself within this view and the rock used to construct the new breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed, tideline etc. The photomontage illustrates visibility of the breakwater at a lower tide level. With higher tide levels there will be a smaller proportion of the proposed breakwater visible. At nighttime the warning light on the breakwater will be noticeable and associated with properties at Baile Mòr and the existing lights at the harbour slipway. The magnitude of visual change during construction is judged to be large. The magnitude of visual change during operation will be large.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a major to substantial and not significant temporary, adverse visual effect during the construction phase.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a Major to substantial and significant visual effect due to the proximity of the view.

Table 15-15 Viewpoint 8; Port nam Mairtir (Martyrs Bay - Beach)

Viewpoint 8 – Port nam Mairtir (Martyrs Bay - Beach)			
Grid Ref	128488, 723840	**Existing Viewpoint Location**	Figure 15.3
Direction of View	60^0	**Approx Distance to Proposed Development**	150 m

Description of existing view and potential receptors	This viewpoint is located on the beach at Martyr's Bay which is circa.150m southwest of the Proposed Development. The existing view at this location is lowlying and below the high tide mark on the eastern Iona coast offering views towards the harbour. The existing slipway is visible in the centre left of view along with streetlights and upper parts of vehicles parked at the slipway. The shoreline view offers largely uninterrupted views Ross of Mull and distant mountains and hills. If the viewer turned their head to the right Fionnphort would be visible in the distance on the opposite side of the Sound of Iona. There are a number of modern buidings prominent in the left of the view. The buildings to the left of the view along with the harbour slipway obscure visibility of the northeastern Iona coastline. The existing ferry when crossing the Sound will be clearly visible within this view. This viewpoint is representative of views for the local community and recreational/tourist users exploring the island.
Sensitivity	Receptors at this location are judged to be of a high susceptibility as they are local community and recreational/tourist receptors. The view is representative of views from a recognised stopping place and within a Conservation Area/APQ, the value of the view is judged to be high. Overall the sensitivity of the view is judged to be high.
Magnitude of Change	During the construction phase the main source of effect from this viewpoint will be the visibility of machinery and activities associated with the construction of the breakwater that will be located in the centre and left of the view. Some activities will be screened by the existing buildings at Baile Mòr and by the breakwater itself as it increases in size. Vessels transporting rock will be a large but transitory feature in views during construction depending on the haulage route. During the operational phase the main source of visual effect from this viewpoint will be the new breakwater itself that will appear as a new feature on the Iona coastline occupying a large portion of the overall view due to the proximity of the viewpoint. The new breakwater will be read with and in the context of prominent urban built form and vehicle movements at Baile Mòr in the left foreground of the view. A portion of the visible sea is lost in the view along with part of the shore and sklyine of the western coastline of the Ross of Mull and some views to distant hills and mountains. If the viewer turns their head to the right the view to Fionnphort will remains viisble. The existing harbour is already a partially visible landscape feature itself within this view and the rock used to construct the new breakwater will through time reflect the adjacent rocky shoreline through growth of seaweed, tideline etc. The photomontage illustrates visibility of the breakwater at a lower tide level. With higher tide levels there will be a smaller proportion of the proposed breakwater visible. At nighttime the warning light on the breakwater will be noticeable and associated with properties at Baile Mòr and the existing lights at the harbour slipway. The magnitude of visual change during construction is judged to be large. The magnitude of visual change during operation will be large.
Significance of Visual Effect during Construction Phase	Taking account of the temporary duration of the effects and the high sensitivity of the viewpoint the Proposed Development would result in a major to substantial and not significant temporary, adverse visual effect during the construction phase.
Significance of Visual Effect during Operational Phase	Operational effects will occur long-term but will gradually decrease as the Proposed Development becomes an established feature within the overall view in the context of the existing active harbour. Taking into account the high sensitivity of the viewpoint the Proposed Development will result in a major to substantial and significant visual effect due to the proximity of the view.

15.6 Mitigation Measures

15.6.1 Aims and Objectives

No specific landscape mitigation measures have been proposed as part of the Proposed Development. The design of the Proposed Development has “built-in” mitigation through steps such as optimising the new breakwater height to maintain as low a height as possible and the use of natural rock to form the breakwater. The minimal lighting required for safety has been provided.

15.6.2 Monitoring and Maintenance

No monitoring and maintenance measures are proposed in relation to landscape and visual effects.

15.7 Potential Cumulative Impacts

A review of planning applications associated with other Proposed Developments has been undertaken to determine the likelihood for potential significant cumulative landscape and visual effects, taking consideration of the following criteria:

- Type and extent of identified proposal;
- The distance between the identified proposal and the Proposed Development;
- Likely visual influence of the identified proposal;
- Potential inter-visibility between the identified proposal and the Proposed Development;
- Potential for cumulative landscape effects on the physical fabric of the landscape or its scenic qualities; and
- The potential for combined, successive and sequential visual effects in the context of the Proposed Development.

There are two proposed projects in the vicinity of the Proposed Development. These are listed below and fully detailed in EIAR Chapter 21:

- The Fionnphort Breakwater and Overnight Berthing Project; and
- BT Cable installation – Iona to Fionnphort

Fionnphort Breakwater and Overnight Berthing Project

The proposed Fionnphort Breakwater and Overnight Berth Project consists of the construction of a new rock armour breakwater, overnight berthing facilities and associated dredging. The proposed project is located c1.3km to the east of Iona, across the Sound. There is potential that this proposed project may be constructed in parallel with the construction phase of Proposed Development at Iona. Due to the separation distance of the two proposed projects and their location within existing harbours and settled areas while it will be possible to view both projects under construction within one combined view and sequentially the magnitude of impact will be small due to distance and immediate urban context at the two project sites. It is predicted that when the proposed Fionnphort Breakwater and Overnight Berth Project is cumulatively assessed with the Proposed Development that a minor to moderate and not significant cumulative effect will occur.

Cable installation – Iona to Fionnphort

The proposed locations for cabling works are located approximately 900m to the south of the site boundary of the Proposed Development. The proposed cable lengths are 2.6km. Burial of the cable is required (where sediments allow) to protect the optical fibre transmission path over the entire service life of the system and prevent interaction with the seabed and other sea users. Offshore the target burial depth will be to 1m below the seabed. From a landscape and visual perspective, the cable once installed will not be visible with no change in landscape and visual resource. It is predicted that when the proposed cabling once installed is cumulatively assessed with the Proposed Development that no significant cumulative effect will occur.

15.8 Conclusions and Summary of Effects

The Proposed Development is located within the extensive Island Mixed Farmland LCT 49 and Deposition Coasts of Islands CCT 12 for which moderate to major localised and direct long-term effects are considered to be significant for localised coastal fringe areas at Sound of Iona, reducing to minor to moderate and not significant with increasing distance from the coastal fringe of these LCT and CCT.

As part of this LVIA a local Sound of Iona Coastal Character Area has been described for which moderate to major localised and direct long-term effects are considered to be significant for localised areas at Iona, reducing to minor to moderate and not significant with increasing distance from the Iona harbour area.

The Proposed Development site is not located within a National Scenic Area. The Proposed Development is located within an Area of Panoramic Quality and a Local Landscape Area with moderate to major localised effects reducing to minor to moderate and not significant effects with increasing distance are predicted. The Proposed Development is also located within Baile Mòr Conservation Area with moderate to major effects predicted.

Views from a total of eight viewpoints have been assessed, for both construction and operational phases of the Proposed Development. Localised moderate to major visual effects are predicted to be experienced during the operational phase of the Proposed Development for portions of the overall view available in close proximity to the Proposed Development site. With longer distance the effects from viewpoints decrease to a level that results in no significant effects.

The assessment has also considered potential impacts on a number of Core Paths within the study area and has found that significant visual effects are predicted to be experienced by receptors on two Core Paths ID C044 the North Beach Walk on Iona and ID C483 the Ballie Mòr to Culbuirg dunes walk on Iona. A further Core Path ID C484 - Culbuirg Dunes to Port na Curaich will have no significant effects.

The assessment has considered cumulative effects, arising from the addition of the Proposed Development in combination with other proposed and potential developments within proximity. Predicted cumulative effects have been assessed as not significant.

16 CULTURAL HERITAGE

16.1 Introduction

This chapter considers the potential effects of the Proposed Development, during both its construction and operational phases, upon the historic environment. The assessment considers effects on World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Inventory Gardens and Designed Landscapes, Inventory Battlefields, Historic Marine Protected Areas, Protected Military Remains and non-designated archaeological sites and historic assets. The chapter is supported by a Cultural Heritage Baseline (see Volume III, Appendix 16.1) and Archaeological Assessment of Hydrographic Data (see Volume III, Appendix 16.2) and should be read in conjunction with these. In addition, the assessment is supported by visualisations and baseline photography contained in Chapter 15: Landscape and Visual Assessment.

16.2 Assessment Methodology

16.2.1 Planning Policy Context

Relevant planning policy is provided in the following documents, discussed in greater depth in Appendix 16.1:

- Marine Policy Statement 2011;
- Scotland’s National Marine Plan 2015;
- The National Planning Framework (NPF) for Scotland (Scottish Government, 2014a);
- Draft National Planning Framework 4 (Scottish Government, 2022);
- Scottish Planning Policy (SPP) paragraphs 135-151 (Scottish Government, 2014b); and
- Planning Advice Note PAN 2/2011: Planning and Archaeology (Scottish Government, 2011).

16.2.2 Relevant Guidance

The assessment, including baseline studies, has been undertaken in accordance with relevant guidance comprising:

- Standard and Guidance for Historic Environment Desk-Based Assessment (CifA, 2020);
- Environmental Impact Assessment (EIA) Handbook (Historic Environment Scotland (HES) & NatureScot, 2018);
- Principles of Cultural Heritage Impact Assessment in the UK (IEMA, 2021); and
- Managing Change in the Historic Environment: Setting (HES, 2016).

In keeping with Managing Change in the Historic Environment: Setting (ibid, 8), a staged approach has been adopted in respect of effects relating to setting:

- *Stage 1: identify the historic assets that might be affected by the Proposed Development*
- *Stage 2: define and analyse the setting by establishing how the surroundings contribute to the ways in which the historic asset or place is understood, appreciated and experienced*
- *Stage 3: evaluate the potential impact of the proposed changes on the setting, and the extent to which any negative impacts can be mitigated.”*

Stage 1 has been informed by site visits and forms part of the baseline study (Appendix 16.1). Stage 2 is presented in full in Appendix 16.1 and summarised here as relevant. Stage 3 is presented in this chapter.

In keeping with the EIA Handbook (HES & NatureScot, 2018), magnitude of impact has been determined in terms of the change in the affected assets' cultural significance.

16.2.3 Study Areas

In order to characterise the archaeological potential of the Proposed Development site, data have been gathered for the Proposed Development site and the surrounding 500 m (Figure 16-1). A 500 m study area was considered appropriate as records relating to features and finds beyond 500 m are unlikely to have any direct bearing upon the current assessment in respect of physical effects and, given the scale of the Proposed Development, it is unlikely to result in change in the setting of assets beyond 500 m.

The above study area is as set out in the Scoping Report. No requests for alternative study areas to be applied were received from consultees.

16.2.4 Baseline Methodology

A Cultural Heritage Baseline Assessment has been prepared for the Proposed Development site and is provided in Appendix 16.1. This draws upon the following sources:

- HES datasets and Statements of Significance;
- West of Scotland Archaeology Service (WoSAS) Historic Environment Record (HER);
- maps and charts held by the National Library of Scotland;
- UKHO data on wrecks and obstructions;
- Existing project bathymetry data;
- Site investigation data;
- satellite imagery of the site;
- grey literature; and
- Archaeological Assessment of Hydrographic Data (Appendix 16.2).

The desk-based research was augmented with a site visit which was undertaken in September 2021.

16.2.5 Consultation

Table 16-1 Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/Where Addressed
16th September 2021	**HES** Advised that cultural heritage should be scoped into the EIAR. Noted that: *'a desk-based assessment will be undertaken to inform the development of mitigation measures, and that the latter may entail a watching brief or the establishment of a protocol for archaeological discoveries for the construction phase. We are content with this proposed mitigation regarding direct impacts by the Proposed Development.'* Noted potential for adverse impacts upon the setting of several Scheduled Monuments, including St Mary's Abbey (SM12968), during the operation of the Proposed Development, stating: *'the development site lies between two small bays that played an important role in the way that pilgrims visited the monastic complex from the medieval period onwards, and the height of the breakwater may impede early views of the abbey for travellers landing at the Bay of Martyrs. We therefore advise that visualisations produced in support of the application should include views looking towards St Mary's Abbey from the waters just off Bay of Martyrs.'*	Baseline studies have been completed and these have concluded that the potential for hitherto unrecorded archaeology to be present is low. A protocol for the reporting of archaeological discoveries has been prepared (Appendix 16.2) The operational effects upon Scheduled Monuments have been assessed and visualisations have been prepared illustrating the predicted view from various points around the Proposed Development site, including from the vicinity of the abbey (VP04), the waters off the Bay of Martyrs (VP06) and across the Bay of Martyrs (VP07). These are presented in Appendix 15.1: Photomontages.

16.2.6 Assessment Criteria and Assignment of Significance

This assessment has been undertaken with reference to current guidance, which advises that an assessment should consider change in terms of cultural significance. The criteria used within this assessment are set out below (Table 16-2 to Table 16-4). Assessment is a matter for professional judgement, but the following guidelines are provided to assist consistency and transparency. All effects at 'moderate' or above levels have been considered significant in the context of the EIA Regulations.

Table 16-2 Sensitivity Criteria

Sensitivity	Criteria
High	Assets valued at an international or national level, e.g., World Heritage Sites, Scheduled Monuments, Category A Listed Buildings, Inventory Gardens And Designed Landscapes, Inventory Battlefields, Historic Marine Protected Areas, some Conservation Areas and non-designated assets that meet the relevant criteria for designation in the opinion of the assessor.
Medium	Assets valued at a regional level, e.g., Category B listed buildings, some conservation areas and non-designated assets of similar value in the opinion of the assessor.
Low	Assets valued at a local level, e.g., Category C listed buildings, some conservation areas and non-designated assets of similar value in the opinion of the assessor.

Table 16-3 Magnitude Criteria

Magnitude	Criteria
Major	Changes to the fabric or setting of a heritage asset resulting in the complete or near complete loss of its cultural significance, such that it may no longer be considered a heritage asset. (Adverse).
	Preservation of the asset in situ where it would be completely or almost completely lost in the do-nothing scenario or removal of elements of the setting that prevent the appreciation of the asset's cultural significance. (Beneficial).
Moderate	Changes to the elements of the fabric or setting of the heritage asset that contribute to its cultural significance such that this is substantially altered. (Adverse).
	Changes to key elements of the asset's fabric or setting that result in its cultural significance being preserved, where they would otherwise be lost, or restored. (Beneficial).
Minor	Changes to the elements of the fabric or setting of the heritage asset that contribute to its cultural significance such that this is slightly altered (Adverse).
	Changes that result in elements of the asset's fabric or setting that detract slightly from its cultural significance being removed (Beneficial).
Negligible	Changes to the fabric or setting of an asset that result in a barely perceptible change in its cultural significance.
Neutral/ No chage	Changes to fabric or setting that leave cultural significance unchanged.

Table 16-4 Matrix for Determination of Significant Effects

		Magnitude of change			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity	**High**	**<u>Major</u>**	**<u>Major/ Moderate</u>**	**<u>Moderate</u>**	Slight
	Medium	**<u>Major/ Moderate</u>**	**<u>Moderate</u>**	**<u>Moderate</u>**/ Minor	Minor
	Low	**<u>Moderate</u>**	**<u>Moderate</u>**/ Minor	Minor	Minor/ Negligible

Significant impacts are in **<u>bold and underlined</u>**

16.3 Baseline Scenario

The following section presents a brief summary of the results of the baseline study (see Volume III, Appendix 16.1) as relevant to the subsequent impact assessment.

16.3.1 Designated Heritage Assets

The Proposed Development site lies within the Iona Conservation Area (Figure 16-1).

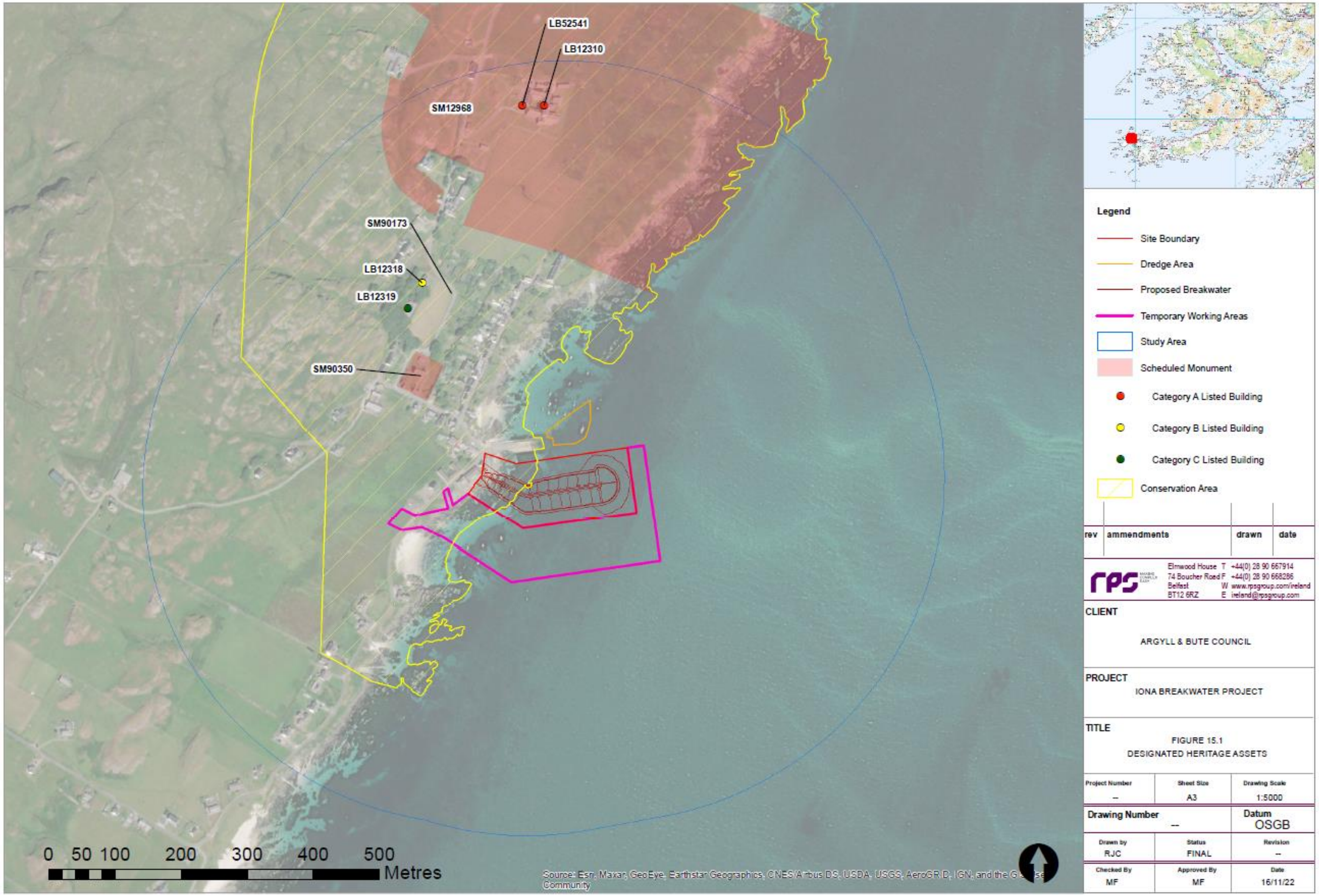

Figure 16-1 Designated Heritage Assets within a 500m buffer (illustrated by blue line polygon) of the Proposed Development site

There are three Scheduled Monuments in the 500 m study area (Figure 16-1):

- Iona Nunnery (SM90350) – 150 m to the north-west of the proposed breakwater;
- MacLean's Cross (SM90173) – 280 m to the north-west of the proposed breakwater;
- St Mary's Abbey, Iona, monastic settlement (SM12968) – 280m to the north of the proposed breakwater.

There are four Listed Buildings in the 50 0m study area (Figure 16-1):

- Iona Abbey (LB12310 – Category A) – 560 m to the north of the proposed breakwater;
- Iona Kirk (LB12318 – Category B) – 300 m to the north-west of the proposed breakwater;
- Iona Manse (LB12319 – Category C) – 280 m to the north-west of the proposed breakwater; and
- Replica of St John's Cross (LB52541 – Category A) – 550 m to the north of the proposed breakwater.

There are no Inventory Gardens and Designed Landscapes, Inventory Battlefields, Historic Marine Protected Areas or Protected Military Remains in the study area.

16.3.2 Non-Designated Heritage Assets and Archaeological Potential

The HER holds no entries regarding non-designated heritage assets within the Proposed Development site. However, a geophysical survey (Rose 2016) has recorded anomalies that extend into the Proposed Development site (Figure 16-2, inset). These have been interpreted as a revetting wall and a possible ditch surrounding a mound known as An Eala, that lies immediately to the south-east of the proposed temporary construction compound. The mound was the site of a cemetery thought to date to the Early Medieval period that was excavated in the 1960s (WoSAS 235). The indicative line of the Street of the Dead intersects with the compound area's western corner, but no anomalies that might relate to this have been recorded and on physical trace has been recorded in the area by intrusive works. It is considered that there is high potential for Early Medieval and Medieval features associated with An Eala to be present. Such remains are likely to be of local or regional importance owing to their potential yield archaeological data relating to Early Medieval or later funerary practices; the importance of the An Eala site as a whole is limited by the disturbance associated with the 1960s excavation. If it were not for this previous disturbance the mound might be considered of national importance. The potential for unrelated or extensive features of archaeological interest to be present here is low given the results of the previous geophysical survey.

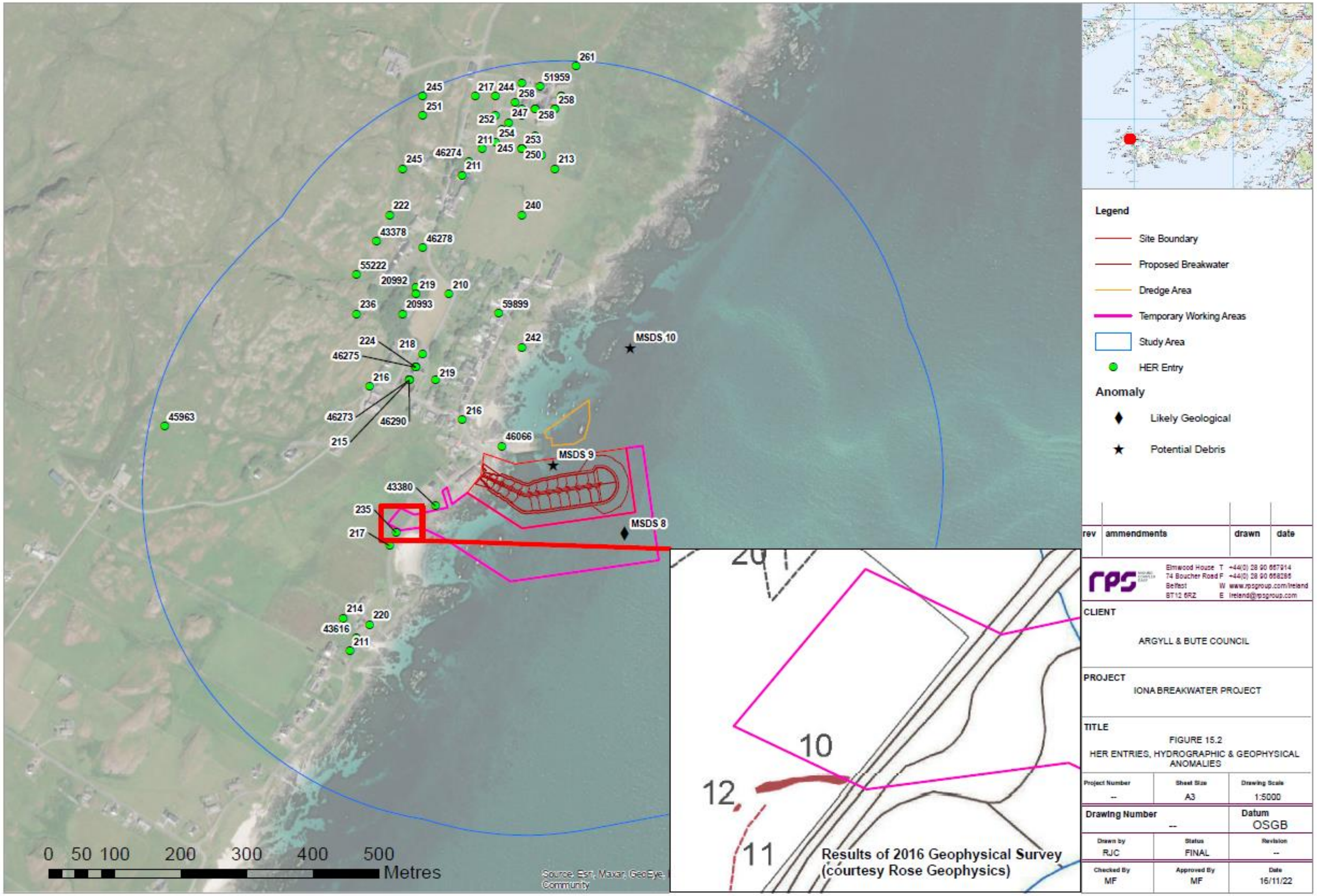

Figure 16-2 HER entries and hydrographic anomalies within a 500m buffer (illustrated by blue polygon) of the Proposed Development site

The review of bathymetric data has identified no anomalies within the construction footprint of the Proposed Development (refer to Volume III, Appendix 16.2 for detailed report). One anomaly is however close (Figure 16-2, MSDS9). This is considered most likely to be debris and unlikely to represent a heritage asset. If hitherto unrecorded marine heritage assets were present, it is most likely that they would be of local importance and low sensitivity, as they are most likely to survive in a fragmentary state owing to the relatively high energy environment and the rocky seabed. Their cultural significance would reside entirely in their archaeological interest and hence fabric.

No evidence of deposits of potential palaeoenvironmental interest has been recorded by the site investigation works.

16.3.3 Future Baseline Conditions

Baseline conditions in respect of relevant heritage assets are considered to be stable and unlikely to change substantively either as a result of ongoing activities or as a result of future climate change.

16.4 Embedded Mitigation Measures

No specific cultural heritage mitigation measures are embedded in the design of the Proposed Development. The design of the Proposed Development has “built-in” mitigation through steps such as optimising the new breakwater height to maintain as low a height as possible and the use of natural rock to form the breakwater. The minimal lighting required for safety has been provided.

The construction area will be surrounded by Heras fencing that will prevent accidental damage to heritage assets or ground disturbance outwith the limits of the works area.

The above have been factored into the assessment of effects.

16.5 Description of Likely Significant Effects

16.5.1 Assessment of Construction Effects

Potential impacts upon previously recorded archaeology are limited to the temporary construction compound. Here the stripping of topsoil for the compound may result in the disturbance of features associated with An Eala, in particular a revetting wall and possible ditch. The disturbance would be highly localised, affecting only a small proportion of the features’ total length; the greater part will be preserved in situ. It is concluded that this would represent an impact of minor magnitude. Assuming the features are of regional importance, this would represent a permanent adverse effect of **moderate** significance. This would be significant in the terms of the EIA Regulations.

There is low potential for hitherto unrecorded marine archaeology to lie within the construction footprint of the Proposed Development. If present, such assets would be removed or disturbed resulting in the loss of their archaeological value and hence cultural significance. This would represent an impact of Major magnitude. Assuming that they were of low sensitivity, this would represent a permanent adverse effect of **moderate** significance. This would be significant in the terms of the EIA Regulations.

Construction phase effects relating to setting have been scoped out; as these are temporary they have no lasting impact upon cultural significance and therefore have no potential to be significant.

16.5.2 Assessment of Operational Effects

As detailed in the Heritage Baseline Assessment, the operational phase of the Proposed Development will affect the following designated heritage assets:

- Iona Nunnery (SM90350) – 150m to the north-west of the proposed breakwater;
- MacLean's Cross (SM90173) – 280m to the north-west of the proposed breakwater;
- St Mary's Abbey, Iona, monastic settlement (SM12968 & LB12310) – 280m to the north of the proposed breakwater; and
- Replica of St John's Cross (LB52541 – Category A) – 550m to the north of the proposed breakwater.

This will occur as a result of visual change in their setting or, in the case of the Conservation Area, change within it affecting its appearance, character and visual change in its setting. A key aspect of the cultural significance of the abbey, nunnery and crosses is that they are not isolated features but part of a group that were at least in part intended to be experienced sequentially whilst moving from the pilgrims' landing point to the abbey. Consequently, for the purposes of this assessment, setting has been drawn widely and has not been defined entirely on the basis of intervisibility. Clearly, the above assets will not always be experienced in this sequence, but as features on an historic route this sequence is the focus of the assessment.

In all instances, there is no potential for the operational phase to affect the archaeological or architectural interest as these relate to the assets' fabric and short-range views will be unaffected. This is not repeated for each asset.

Whilst this assessment includes reference to viewpoints considered in the Landscape and Visual Impact Assessment (Chapter 15), the two assessments use different criteria and the nature of the impacts being considered are not the same. Consequently, it should be accepted that different conclusions may be reached. Furthermore, it should be noted that whilst the assets considered in the following sections are tourist attractions 'tourism and leisure factors… do not form part of an assessment of setting impacts' (HES 2016, 9). The receptors considered here are the cultural heritage assets themselves, any impact that the Proposed Development may have upon tourism is outside the remit of the cultural heritage assessment.

16.5.2.1 Iona Nunnery (SM90350)

Iona Nunnery is located approximately 150m to the north-west of the proposed breakwater. As a Scheduled Monument, the nunnery is of national importance, but with the abbey and crosses it forms a group of international importance. It is of high sensitivity.

Owing to trees and vegetation along the eastern boundary of the scheduled area, the Proposed Development will, at most, be glimpsed from the immediate environs of the nunnery. It will be partially visible from the road immediately to the south. It will appear in combination with the ruins of the nunnery from the sea, but these views do not contribute substantively to its significance; the nunnery although visible in these views is lost to the eye amongst the surrounding buildings (LVIA VP06). The Proposed Development will affect the experience of the approach to the nunnery as visitors will disembark next to the breakwater before walking the short distance to the nunnery. By dint of its scale and contrasting appearance with the existing built form and surrounding landscape, the breakwater is likely to be experienced as incongruous and intrusive and hence detracting from the overall aesthetic and, for some visitors, spiritual experience of visiting the nunnery as part of an extensive ecclesiastical site and as part of the pilgrims' walk to the abbey. This will represent an adverse impact. As the Proposed Development will be experienced at some remove from the nunnery and because the nunnery itself is experienced in a somewhat detached manner owing to its being enclosed, it is considered the impact will be of minor magnitude. The effect is considered to be of moderate significance. This is significant in the terms of the EIA Regulations.

16.5.2.2 MacLean's Cross (SM90173)

MacLean's Cross is located 280m to the north-west of the proposed breakwater. As a Scheduled Monument, the cross is of national importance, but with the abbey, nunnery and other cross it forms a group of international importance. It is of high sensitivity.

Owing to the built form and trees, the Proposed Development will not be visible from the cross or in combination with it. The Proposed Development will affect the experience of the approach to the cross as visitors will disembark next to the breakwater before walking through the village to the cross, which they will pass on their way to the abbey. There is no intervisibility between the cross and the Proposed Development and several minutes will pass between seeing the Proposed Development and arriving at the cross. Nevertheless, the Proposed Development is likely to be experienced as intrusive and incongruous and hence detracting from the overall aesthetic and, for some visitors, spiritual experience of visiting the cross as part of an extensive ecclesiastical site and as part of the pilgrims' walk to the abbey. As the Proposed Development will be experienced somewhat separately from the cross, it is considered that this will represent an adverse impact of minor magnitude. The effect is considered to be of moderate significance. This is significant in the terms of the EIA Regulations.

16.5.2.3 St Mary's Abbey, Iona, monastic settlement (SM12968 & LB12310)

St Mary's Abbey is located 280m to the north of the proposed breakwater. The scheduled area is extensive, with the abbey itself lying in its western part. As a Scheduled Monument and Category A Listed Building, the abbey is of national importance, but with the nunnery and crosses it forms a group of international importance. It is of high sensitivity.

There will be no intervisibility between the abbey itself and the Proposed Development, but from the eastern part of the scheduled area the breakwater will be visible (VP04). It is likely to be experienced as intrusive in these views detracting from the aesthetic experience of the abbey in a landscape that is almost entirely natural and which may be regarded as almost unchanged since Columban times.

The breakwater will be seen in combination with the abbey when approaching the island on the ferry (VP06). In these views the abbey is the single largest building, seen standing to the north of the village against the craggy backdrop of Dun I. Although not appearing directly in front of the abbey, the breakwater, by dint of its scale, proximity to the viewer and unnatural appearance, is likely to distract from the abbey and hence detract from its aesthetic appreciation.

On arrival to the island the Proposed Development is likely to be experienced as intrusive and incongruous and hence detracting from the overall aesthetic and, for some visitors, spiritual experience of visiting the abbey.

The Proposed Development will be prominent in views from Martyrs Bay and in these it will appear in combination with the upper parts of the abbey, which are visible above buildings on the southern edge of Baile Mòr. These views contribute to the cultural significance of the abbey owing to the historic relationship between the abbey and the bay. The view makes no contribution to the aesthetic appreciation of the abbey or its spiritual value; the buildings on the southern fringe of the village are appreciably modern and not in keeping with the earlier buildings in their style, materials and appearance and the abbey is somewhat lost behind them. The breakwater will be prominent in views from the bay, but this will represent a neutral change as it will not interfere with the appreciation of the historic relationship between the bay and the abbey.

Because the Proposed Development will be experienced at some remove from the abbey, it is concluded that this will represent an adverse impact of minor magnitude and an effect of moderate significance. This is significant in the terms of the EIA Regulations.

16.5.2.4 Replica of St John's Cross (LB52541 – Category A)

The replica of St John's Cross is located 550m to the north of the proposed breakwater. As a Category A Listed Building it is considered to be of high sensitivity, but as part of a group with the abbey, nunnery and other cross it forms a group of international importance. It is of high sensitivity.

The Proposed Development will not be visible from the cross and its immediate environs. The Proposed Development will affect the experience of the approach to the cross as visitors will disembark next to the breakwater before walking through the village to the cross, which stands next to the abbey. There is no intervisibility between the cross and the Proposed Development and several minutes will pass between seeing the Proposed Development and arriving at the cross. Nevertheless, the Proposed Development is likely to be experienced as intrusive and incongruous and hence detracting from the overall aesthetic and, for some visitors, spiritual experience of visiting the cross as part of an extensive ecclesiastical site and as part of the pilgrims' walk to the abbey. As the Proposed Development will be experienced somewhat separately from the cross, it is considered that this will represent an adverse impact of minor magnitude. The effect is considered to be of localised moderate significance. This is significant in the terms of the EIA Regulations.

16.5.2.5 Iona Conservation Area

The slipway lies within the Iona Conservation Area. The Conservation Area is considered to be regional importance and medium sensitivity.

The Proposed Development will be highly visible from the ferry during the approach to the island (VP06). Owing to it appearing out of scale with the existing built form in these views, it is likely to be experienced as intrusive and prominent. It will partially obscure several of the cottages in the vicinity of the jetty from view.

From the jetty and immediate environs, the breakwater will curtail views to the south and to some extent the east. These open views make an important contribution to the aesthetic experience of the Conservation Area. The breakwater is likely to be experienced as dominating from this area owing to its height and massing and intrusive and incongruous owing to its contrast with the small, largely 19th century buildings.

From the area to the north of the jetty (VP03), it will likewise affect southward views. From the beach these will be obscured completely whilst from the gardens and rear of the properties here it will appear as prominent in the middle distance; the sea will largely be obscured but the hills beyond will be visible above it. The breakwater's unnatural appearance will detract from the aesthetic experience of these views and will again contrast with the existing built form.

Similarly, the breakwater will be visible from the Conservation Area from the eastern fringe of the scheduled area (VP04). It will be prominent in these views and will appear incongruous in relation to the 19th century buildings and ruins visible in the foreground.

The breakwater will be visible from much of the open southern parts of the Conservation Area (VP02, 07 & 08). As discussed in relation to the abbey (above), the buildings at the southern fringe of the village are mostly modern and do not contribute to the aesthetic value of the village. From the higher parts of the Conservation Area, the breakwater will be seen between the buildings and will not detract greatly from the character of these views. However, the breakwater will dominate Martyrs Bay and detract from the aesthetic experience of these views and reducing their wild, undeveloped character.

The Proposed Development will have an adverse impact upon the character and appearance of the Conservation Area. Whilst the affected views are important to the cultural significance of the Conservation Area the impact is relatively localised, and therefore considered to be of moderate magnitude. This will constitute an effect of moderate significance. This is significant in the terms of the EIA Regulations.

16.6 Mitigation Measures

A reporting protocol has been developed to allow for the reporting and thereby appropriate recovery and recording of any cultural material encountered during the construction phase below the high-water mark (see Volume III, Appendix 16.2).

Potential construction impacts above the high-water mark can be avoided by relocating the compound or be mitigated through a programme of archaeological works. A programme of archaeological work would offset the physical loss or disturbance of features affected by allowing for them to be recorded appropriately, with reporting to an appropriate level. Such works must be undertaken in line with a Written Scheme of Investigation (WSI) agreed with WoSAS and approved by the Local Planning Authority.

16.7 Potential Cumulative Effects

A review of planning applications associated with other Proposed Developments has been undertaken to determine the likelihood for potential significant cumulative cultural heritage effects, taking consideration of the following criteria:

- Type and extent of identified proposal;
- The distance between the identified proposal and the Proposed Development;
- Likely visual influence of the identified proposal;
- Potential inter-visibility between the identified proposal and the Proposed Development;
- Potential for cumulative cultural heritage effects on the physical fabric of the landscape or its scenic qualities; and

- The potential for combined, successive and sequential visual effects in the context of the Proposed Development.

There are two proposed projects in the vicinity of the Proposed Development. These are listed below and fully detailed in EIAR Chapter 21:

- The Fionnphort Breakwater and Overnight Berthing Project
- Cable installation – Iona to Fionnphort

Fionnphort Breakwater and Overnight Berthing Project

The proposed Fionnphort Breakwater and Overnight Berth Project consists of the construction of a new rock armour breakwater, overnight berthing facilities and associated dredging. The proposed project is located c1.3km to the east of Iona, across the Sound.

Given the distance of the proposed project from the Proposed Development, there is no potential for cumulative effects relating to the physical fabric of cultural heritage assets.

Given the distance between the proposed project and the heritage assets on Iona, it is considered that Fionnphort and the proposed project does not form a part of their setting. There is therefore no potential for cumulative effects relating to setting.

Cable installation – Iona to Fionnphort

The proposed locations for cabling works are located approximately 900 m to the south of the site boundary of the Proposed Development. Given its distance from the Proposed Development, there is no potential for cumulative effects relating to the physical fabric of heritage assets. The proposed cable will not be visible and there is therefore no potential for cumulative effects relating to setting.

16.8 Residual Effects

16.8.1 Construction Phase

There is potential to avoid the risk of physical loss or disturbance of archaeology above the high-water mark through the relocation of the temporary construction compound. If this is not possible, a programme of archaeological works would offset the physical loss or disturbance of archaeology above the high-water mark by allowing the recovery of archaeological data and reporting to an appropriate level. This would reduce the level of loss but would not completely offset it. It is considered that the resultant residual effect would be of minor significance. This is not significant in the terms of the EIA Regulations.

The reporting protocol will allow the appropriate recovery and recording of any archaeological assets encountered during construction. This will allow their archaeological interest to be realised and prevent their physical loss. Some damage and hence loss of archaeological interest may still occur, but it is considered that with mitigation in place the impact would be of minor magnitude at worse. Assuming that if hitherto unrecorded assets were present, they would be of low sensitivity, this would represent an adverse effect of **minor** significance. This is not significant in the terms of the EIA Regulations.

16.8.1 Operational Phase

No mitigation is possible in respect of the identified operational phase effects. Consequently, the identified effects, which are of moderate significance, will not be reduced or offset and will remain significant in the terms of the EIA Regulations.

16.9 Conclusions and Summary of Effects

The Proposed Development lies in an area that has seen intensive activity from at least the Early Medieval period and probably earlier. The Early Medieval and Medieval activity has largely related to the importance of the island as a place of pilgrimage and near the Project Site are St Mary's Abbey, a Category A Listed Building and Scheduled Monument, Iona nunnery and MacLeans Cross, both Scheduled Monuments, and the Category A-listed Replica of St John's Cross.

Whilst intervisibility between these and the Proposed Development will be limited, it is considered that the appearance of the Proposed Development at the point of arrival on the island will detract from the experience of these assets, in particular their aesthetic and spiritual value. It is considered that the Proposed Development will have adverse effects of moderate significance on these assets. This is significant in the terms of the EIA Regulations.

The Proposed Development site lies at the fringe of the Baile Mòr Conservation Area and will be visible from a number of locations within it. This will have a localised impact upon its character and appearance and the contribution of the Conservation Area's setting. It is considered that the Proposed Development will have an adverse effect of moderate significance on the Conservation Area. This is significant in the terms of the EIA Regulations.

No heritage assets are recorded within the Proposed Development site below the high-water mark and given the results of the examination of bathymetry data and other data sources, it is considered that there is low potential for hitherto unrecorded heritage assets. This potential will be addressed through the implementation of a reporting protocol that will allow for the reporting and recording of any material of archaeological interest encountered.

A previous geophysical survey has identified features associated with an Early Medieval or Medieval cemetery that extend into the temporary construction compound area. These and any associated features present may be disturbed by construction works. This will be mitigated through a programme of archaeological works that will allow for appropriate recording. This will be secured by a planning condition.

Following implementation of the proposed mitigation in respect of physical construction effects, all potential effects will be of minor significance. This is not significant in the terms of the EIA Regulations.

17 WASTE

17.1 Introduction

This chapter assesses the waste management aspect of the Proposed Development.

Regulation 6(2) of The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 sets out the minimum information that is required in an Environmental Impact Assessment Report (EIAR). Regulation 6(2)(f) states than an EIAR must include at least:

> *"...any other information specified in Schedule 4 relevant to the specific characteristics of the works or of the types of works in question and to the environmental features likely to be significantly affected."*

Under Paragraph 5 of Schedule 4 of the Regulations, applicants are required to include in the Environmental Impact Assessment, *"A description of the likely significant effects of the works on the environment resulting from, inter alia: (c)…the disposal and recovery of waste."*

Effects from the forecast waste generation from the construction and operational phases of the Proposed Development have been assessed in the context of the effects on regional waste management treatment and landfill infrastructure capacity, legislation, policy and strategy targets. Mitigation measures are proposed to reduce the impact of waste generated by the Proposed Development.

17.1.1 Waste

Waste is defined as '*"any substance or object which the holder discards or intends or is required to discard"* under the Waste Framework Directive (European Directive 2006/12/EC as amended by Directive 2008/98/EC).

Once a substance has become waste it will remain waste until it has been fully recovered and no longer poses a potential risk to the environment or human health. From that moment onwards, the material ceases to be waste, and it is no longer subject to the same legislative controls.

This applies to waste used as aggregate or construction material in civil engineering applications. Waste recovery can be achieved when such waste is incorporated into a road, building or other infrastructure works, or in the case of inert waste, after processing if such a process is conducted following the criteria specified in the relevant quality protocols.

The principal objective of sustainable resource and waste management is to use material resources more efficiently, where the value of products, materials and resources are maintained in the economy for as long as possible and the generation of waste is minimised. To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy as set out in Scotland's Circular economy policy 'Making Things Last' (2016) (see Figure 17-1).

Figure 17-1 Circular Economy

The Waste (Scotland) Regulations 2011 and the Waste Management Licensing (Scotland) Regulations 2011 place a duty on all persons who produce, keep or manage waste to take all reasonable steps to apply the waste hierarchy (Figure 17-2). Therefore, where residual waste is generated, there is a requirement to deal with it in a way that follows the waste hierarchy and actively contribute to the development of sustainable waste management in Scotland and the ambition of a zero-waste society.

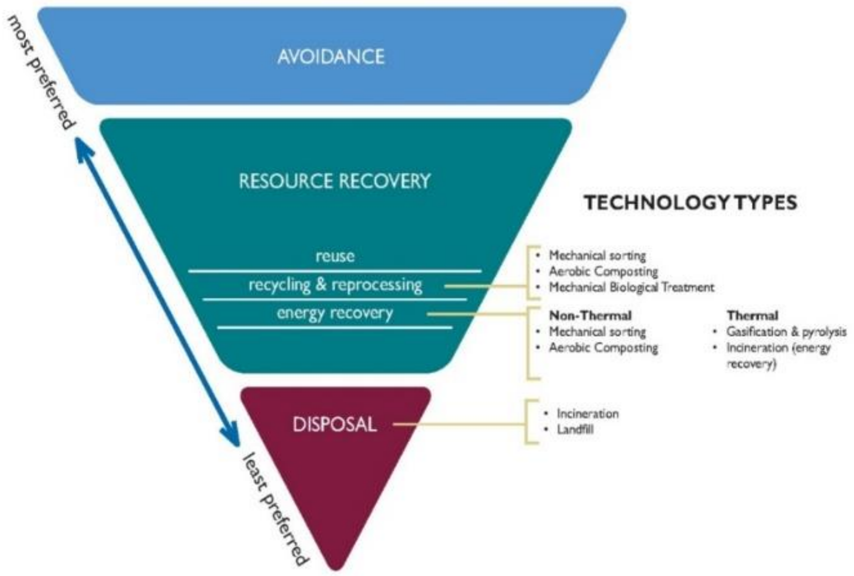

Figure 17-2 Waste Management Hierarchy[31]

17.2 Assessment Methodology

17.2.1 Assessment

A quantitative assessment of the potential effects in relation to waste will be undertaken. The assessment will comprise the following stages:

[31] The ‘waste hierarchy’ ranks waste management options according to what is best for the environment. It applies the following as a priority order in waste prevention and management policy— (a) prevention; (b) preparing for re-use; (c) recycling; (d) other recovery (for example energy recovery); and (e) disposal.

- A review of applicable legislation and policy;
- A review of the Proposed Development design, undertaken in consultation with the project design team to estimate the waste generation during the various phases of construction;
- Determination of waste arisings from the development once operational;
- Consideration of potential interactions between proposals and the current site conditions;
- Identification of possible impacts;
- Assessment of impacts;
- Identification of measures and solutions to avoid, reduce or remedy potential impacts; and,
- Assessment of residual impacts, taking account of mitigation measures.

An assessment will be made of the potential environmental effects that are associated with the production, movement, transport, processing, and disposal of arisings from site during the construction and operational phase of the Proposed Development.

17.2.2 Assessment Criteria

The Institute of Environmental Management and Assessment (IEMA) published guidance in March 2020 which sets out criteria for determining the value (sensitivity) of material resources and waste (including waste infrastructure).

The determination of significance, in most cases, will be the product of professional judgement of the Waste Topic Lead and EIA Co-ordinator, with specific regard to the sensitivity or importance (value) of receptors and the magnitude of impact on these receptors; and the extent to which primary, secondary and tertiary measures are expected to minimise impacts and effects. Table 17-1 shows the importance/ sensitivity matrix used for this assessment.

Table 17-1 Importance or Sensitivity Matrix Definitions[32]

Importance / Sensitivity of Resource or Receptor				
Across construction and or/operation phases, the baseline/future baseline (i.e., without development) or regional inert and non-hazardous landfill void capacity is expected to…				
Negligible	**Low**	**Medium**	**High**	**Very High**
Remain unchanged or is expected to increase through a committed change in capacity.	Reduce minimally: by <1% as a result of wastes forecast.	Reduce noticeably: by 1-5% as a result of wastes forecast.	Reduce considerably: by 6-10% as a result of wastes forecast.	Reduce very considerably (by >10%); end during construction or operations; is already known to be unavailable; or would require new capacity or infrastructure to be put in place to meet forecast demand.

17.2.3 Assignment of Magnitude

Where the construction phase is being assessed, the magnitude of impact is considered from the point at which the site access is gained, through site remediation, enabling works, and construction, to development commissioning.

Where the operational phase is being assessed, the magnitude of impact is assessed over the course of any one full and justifiably representative year within the first three years of commissioning. Table 17-2 shows definitions of magnitude of impacts used for this assessment.

Table 17-2 Magnitude of Impacts Definitions

Assessment of Magnitude				
Inert and Non-Hazardous Void Capacity				
No change	**Negligible**	**Minor**	**Moderate**	**Major**
Zero waste generation and disposal from the development	Waste generated by the development will reduce regional landfill void capacity baseline by <1%	Waste generated by development will reduce regional landfill void capacity baseline by 1-5%	Waste generated by the development will reduce regional landfill void capacity baseline by 6-10%.	Waste generated by the development will reduce landfill void capacity baseline by >10%.
Hazardous Void Capacity				
No change	**Negligible**	**Minor**	**Moderate**	**Major**
Zero waste generation and disposal from the development	Waste generated by the development will reduce national landfill void capacity baseline by <0.1%	Waste generated by development will reduce national landfill void capacity baseline by <0.1-0.5%	Waste generated by the development will reduce national landfill void capacity baseline by >0.5-1%	Waste generated by the development will reduce national landfill void capacity baseline by >1%.

[32] Assessing sensitivity of waste (Section 10.2.2) IEMA Guide to Materials and Waste Environmental Impact Assessment, March 2020.

17.2.4 Significance of Effects

The assessment of significance will be based on the matrix outlined in Table 17-3.

Table 17-3 Assessment of Significance Matrix[33]

Sensitivity (or value) of receptor	Magnitude of Impacts: No Change	Negligible	Minor	Moderate	Major
Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

17.2.1 Determining whether an effect is significant

Once the sensitivity of the receptor and the magnitude of impacts have been determined, Table 17-4 illustrates how it may be determined whether environmental effects are potentially significant.

Where a threshold is 'slight to moderate', i.e., transcends the significant effect / not significant effect boundary, professional judgement is used in combination with documented justification, to determine a final outcome. The cautious significance boundary applied responds to the need for developers and EIA practitioners to – in unison – continue to take an increasing responsibility for managing materials and wastes sustainably, with a view to incentivising sustainable resource management and (ultimately) a circular economy.

Table 17-4 Overall Significance of Effect[34]

Effect	Waste
Neutral	Not significant
Slight	
Moderate	Significant
Large	
Very Large	

17.3 Review of Legislation & Policy

A comprehensive legislative review has been undertaken as part of this assessment. This includes a review of applicable waste and environmental European Directives, National Regulations, National Policies and Strategies.

[33] IEMA Guide to Materials and Waste Environmental Impact Assessment, March 2020.

[34] IEMA Guide to Materials and Waste Environmental Impact Assessment, March 2020.

17.3.1 National and European Legislation

National and European Legislation of relevance includes:

- The Environmental Protection (Duty of Care) (Scotland) Regulations 2014.
- The Waste (Scotland) Regulations 2012.
- The Waste (Scotland) Regulations 2011.
- The Waste (Scotland) Regulations 2005.
- The Waste Management Licensing (Scotland) Regulations 2011.
- The Waste Batteries (Scotland) Regulations 2009.
- The Criteria and Procedures for The Acceptance of Waste at Landfills (Scotland) Direction 2005.
- The Criteria and Procedures for the Acceptance of Waste at Landfills (Mercury) (Scotland) Direction 2013.
- Environment Act 1995.
- Environmental Protection Act 1990.
- Environment Protection (Waste Recycling Payments) (Scotland) Regulations 2000.
- The Landfill (Scotland) Regulations 2003.
- The Landfill (Scotland) Amendment Regulations 2003.
- The Landfill (Scotland) Amendment Regulations 2013.
- The Special Waste Regulations 1996.
- The Controlled Waste Regulations 1992.
- The Special Waste Amendment (Scotland) Regulations 2004.
- The Special Waste Amendment (Scotland) Amendment Regulations 2004.
- Pollution Prevention and Control Act 1999.
- The Pollution Prevention and Control (Scotland) Regulations 2012.
- Waste and Emissions Trading Act 2003.
- The Landfill Allowances Scheme (Scotland) Regulations 2005.
- The Producer Responsibility Obligations (Packaging Waste) Regulations 2007.
- The End-of-Life Vehicles (Storage and Treatment) (Scotland) Regulations 2003.
- The Litter (Fixed Penalties) (Scotland) Order 2013.
- The Litter (Fixed Penalty Notices) (Scotland) Order 2014.

- The Controlled Waste (Fixed Penalty Notices) (Scotland) Order 2014.
- European Communities (Waste Directive) Regulations, 2011.
- Industrial Emissions Directive (2010/75/EU).
- Waste Framework Directive (2008/98/EC).

Other guidelines from Scottish Natural Heritage such as ‘A handbook on Environmental Impact Assessment’ (2013) have been referred to also in the preparation of this EIA Waste chapter.

Specifically in relation to the waste management requirements at port and harbour facilities the following were also considered:

- EU Directive 2000/59/EC on port reception facilities for ship generated wastes and cargo residues.
- Directive 2002/84/EC amending the Directives on maritime safety and the prevention of pollution from ships.
- Commission Directive 2007/71/EC of 13 December 2007 amending Annex II of Directive 2000/59/EC of the European Parliament and the Council on port reception facilities for ship-generated waste and cargo residues.
- Commission Directive (EU) 2015/2087 amending Annex II to Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues.
- Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements.
- Directive 2009/123/EC amending Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements.
- MARPOL 73/78, International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978.
- A guide to good practice – IMO Consolidated Guidance for port Reception Facility Providers and Users.
- The Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) Regulations 2003, as amended (SI No. 1809).

17.3.2 National and Regional Waste Policies and Strategies

The statutory basis for waste management policy in Scotland comes from the revised Waste Framework Directive (2008/98/EC) (rWFD). The main impact on waste management in Scotland arising from the revised WFD was the transposition and implementation of a new waste hierarchy and its application as a priority order in waste prevention, waste management licensing and waste policy.

- **The Zero Waste Plan**, launched in June 2010, set out actions to deliver important changes to how Scotland treats and manages waste. The Plan is an economic strategy and a resource strategy - not simply a waste strategy. It aims to maximise the value of all the material resources we use in our economy, helping to create new business opportunities as well as savings to existing businesses and local authorities in how they manage waste. To support this aim, the Pan includes ambitious recycling targets, including a 70% recycling rate for household and all other waste streams by 2025. Bills and legislation, such as the Waste (Scotland) Regulations 2012 and the single Use Carrier Bags Charge (Scotland) Regulations 2014 set in place statutory measures to support delivery of the Zero Waste Plan including:

- prevention;
- preparing for re-use;
- recycling;
- other recovery, e.g., energy recovery; and
- landfill diversion targets

In Scotland, the Scottish Government is responsible for the regulatory and legislative framework and for providing policy advice and guidance. The Scottish Environment Protection Agency can take enforcement action on large scale and hazardous fly-tipping and Local Authorities will investigate small scale incidents. Local Authorities and the Police can issue fixed penalty notices to offenders, they can also report incidents directly to the Procurator Fiscal for further action if the fine isn't paid.

- In addition to the Waste (Scotland) Regulations 2012 the Scottish Government launched a consultation, **'Safeguarding Scotland's Resources - A Programme for the Efficient Use of our Materials**', which acts as Scotland's Waste Prevention Programme, and sought views on a range of proposals to reduce waste and promote resource efficiency. This proposed an overall target of a 5% reduction in all waste by 2015, and a longer term vision of a 15% reduction in all waste by 2025.
- The **Environment Strategy for Scotland: Vision and Outcomes (2020)** provides an overarching framework for Scotland's existing environmental strategies and plans, including the Climate Change Plan, which will be reviewed over time to consider developments in international targets and policies. The Strategy outlines Scotland's long-term ambitions and priorities for action. The Strategy aims to deliver six shared outcomes which include 'We use and re-use resources wisely and have ended the throw-away culture' and 'Our thriving, sustainable economy conserves and grows our natural assets' which both support the transition to a circular economy.
- The **Circular Economy Bill** (in development) will establish a legislative framework to support the transition to a zero waste and circular economy. The Bill involves new enforcement powers for the offence of littering from vehicles, proposals to strengthen household recycling collections, tackle reliance on single-use items and set statutory targets in relation to circular economy. A consultation on proposals for a Circular Economy Bill took place between 30th May 2022 and 22nd August 2022.

- **Extended Producer Responsibility (EPR)** requires producers to bear responsibility for the environmental impacts of products they place on the market and provides an incentive to reduce these impacts. EPR focuses on the consideration of the whole lifecycle of a product or building by influencing design, maximising product lifespan through reuse, repair and durability and recyclability of products when they reach the end of their lives. 'Making Things Last – a Circular Economy Strategy for Scotland' was published in 2016 which aims to take a more comprehensive approach to EPR by encouraging reuse, repair and remanufacture as well as addressing the costs of recycling and disposal. Schemes such as UK Packaging EPR scheme, review of Waste Electrical and Electronic Equipment, Batteries and End of Life Vehicles Regulations, an EPR scheme for mattresses and a Deposit Return Scheme (DRS) for single-use containers are being considered or implemented.
- The **Deposit and Return Scheme Regulations (DRS) 2020** set out the legal requirements for drinks producers and retailers as part of a DRS which will be introduced in Scotland on 16th August 2023. DRS requires consumers to pay a deposit of 20p when they purchase a drink in a single-use container made of PET, steel, aluminium or glass who will then receive the deposit back when they return the empty single-use container to a return point. Under The Deposit and Return Scheme for Scotland Regulations (2020) retailers are required to operate a return point where sales of scheme products are made, deliver back deposits for the packaging and store the packaging for collection by/on behalf of producers.

17.3.3 Waste Management Plan

There is no specific Waste Management Plan in place for Iona Ferry Terminal. Iona Ferry Terminal is operated by Caledonian MacBrayne (CalMac) Ferries Ltd. who have an Environmental Strategy for 2021-2023 which outlines the company's aims and actions to minimise their impact on the marine and terrestrial environments in which they operate. The Strategy outlines four core priorities which align with Scotland's Environment Strategy, Scottish Government National Outcomes and the UN Sustainable Development Goals. One of the core priorities is *"we generate minimal waste and sustainably use materials".*

The CalMac Ferries Ltd. Environmental Strategy aims to achieve the Scottish Government recycling and landfill targets by 2025 of:

- Reducing total waste arisings by 15% against 2011 levels;
- Reducing food waste by 33% against 2013 levels;
- Recycling 70% of remaining waste; and
- Sending no more than 5% of remaining waste to landfill.

The Environmental Strategy aims to achieve this by applying the waste hierarchy and prioritising waste prevention. CalMac Ferries Ltd. will replace paper-based processes and communications with electronic, reduce plastic packaging sold through their retail outlets and implement a DRS. They aim to minimise food waste by better understanding the source of their food waste using technology. CalMac Ferries Ltd. set out to measure total waste arisings including food waste, the amount of material recycled and that sent to landfill on a monthly basis. The amount of packaging that is sold and returned as part of a DRS will be measured.

17.4 Baseline Scenario

17.4.1 Characteristics of Current Wastes

The Iona Ferry Terminal consists of a pier and a slipway. The source of current waste arisings is from the operation of the passenger ferry service from Fionnphort. Current wastes arising at the site are a typical mix of recyclable and residual material, accompanied by mixed litter generated from passenger footfall. Iona Port is operated by CalMac Ferries Ltd. who provide recycling facilities at all their port locations for customers to recycle on the go. All waste generated and/or received at Iona Ferry Terminal is currently managed and disposed by local authorities or licenced waste contractors. The management/ disposal route is at the discretion of the approved contractor.

17.4.2 Waste Management Infrastructure

The Scottish Environment Protection Agency (SEPA) ‘Scottish waste sites and capacity tool’ provides data about licensed and permitted waste management sites holding a Waste Management Licence (WML) or Pollution Prevention Control (PPC) permit issued by SEPA. It also provides the site’s annual capacity, which is the tonnage of waste a regulated site is licensed or permitted to handle in a given year and the remaining capacity for landfills.

Table 17-5 lists information on operational landfill sites in the vicinity of the development. This landfill site and capacity data is for reporting years 2014-2020 and was last updated in April 2022.

Table 17-6 lists information on waste management sites in the vicinity of the development. This waste management site and capacity data is for reporting years 2014-2020 and was last updated in April 2022.

Table 17-5 Capacity of Currently Authorised Landfills

Permit or Licence Number	Operator Organisation	Type of Site	Annual Capacity on Permit (tonnes)	Total Capacity of Permit (tonnes)	Remaining Capacity as at 31/12/2020	Estimated date for ceasing infill as at 31/12/2020 (tonnes)
11/12/2006	WILLIAM THOMPSON & SON LIMITED	Inert	240,000	2,400,000	250,000	01/10/2044
17/04/2012	W H MALCOLM LIMITED	Inert	500,000	7,200,000		
23/12/2019	CEMEX UK MATERIALS LIMITED	Inert	14,500	1,040,000		
30/03/2007	J & M MURDOCH & SON LIMITED	Non-Hazardous	90,000	552,750	277,500	25/01/2021
08/09/2004	BARR ENVIRONMENTAL LIMITED	Non-Hazardous	250,000	4,760,000	2,185,813	01/08/2022
20/02/2007	ARGYLL & BUTE COUNCIL	Non-Hazardous	1,000	27,000	12,829	01/12/2025
29/03/2007	SHANKS ARGYLL & BUTE LIMITED	Non-Hazardous	20,515	398,000	46,089	01/07/2026
30/03/2007	SHANKS ARGYLL & BUTE LIMITED	Non-Hazardous	36,500	720,000	151,600	01/12/2028
26/01/2011	BAE SYSTEMS PROPERTIES LIMITED	Non-Hazardous	100,000		73,920	01/12/2034
01/07/2005	LOCHIEL LOGISTICS LIMITED	Non-Hazardous	24,000	590,000	427,950	01/06/2040
10/10/2008	ARGYLL & BUTE COUNCIL	Non-Hazardous	8,230	90,000	21,000	01/12/2063
31/07/2009	ARGYLL & BUTE COUNCIL	Non-Hazardous	9,815	90,000	65,451	01/12/2063
29/03/2006	SMITH SKIP LIMITED	Non-Hazardous	75,000	750,000		

Table 17-6 Capacity of Waste Management Sites

Permit of Licence No	Operator Organisation	Site Activity	Licensed Waste Type	Waste Inputs to Site	Waste Treated / Recovered on Site	Waste Outputs from Site
PPC/A/1000116	STRAID FARM LIMITED	Landfill	Household / Commercial / Industrial / Special asbestos / Inert	74,967.78		
PPC/A/1038061	WH MALCOLM LIMITED	Landfill	Inert	9,865.49		
PPC/A/1004280	SHANKS ARGYLL & BUTE LIMITED	Landfill / Transfer station / Composting	Household / Commercial / Industrial / Inert	15,051.41	5,393.76	1,591.08
PPC/A/1004281	SHANKS ARGYLL & BUTE LIMITED	Landfill / Civic amenity / Transfer station / Composting	Household / Commercial / Industrial / Inert	21,596.60	4,798.14	1,366.57
PPC/A/1025163	ARGYLL & BUTE COUNCIL	Landfill / Civic amenity / Transfer station	Household / Commercial / Industrial / Inert	4,423.70	186.72	875.34
PPC/A/1008888	ARGYLL & BUTE COUNCIL	Landfill / Civic amenity / Transfer station	Household / Commercial / Industrial / Inert	569.02		543.82
PPC/A/1022141	ARGYLL & BUTE COUNCIL	Landfill / Civic amenity / Transfer station	Household / Commercial / Industrial / Inert	2,382.93	326	974.22
PPC/N/0050031	LOCHIEL LOGISTICS LIMITED	Landfill / Transfer station / Composting / Other treatment	Household / Commercial / Industrial / Special asbestos	20,368.58	12,820.52	3,054.80
PPC/W/0020026	BARR ENVIRONMENTAL LIMITED	Landfill / Transfer station / Composting	Household / Commercial / Industrial / Special asbestos / Inert	145,934.58	93,038.68	28,955.20
PPC/W/0020019	BARR ENVIRONMENTAL LIMITED	Landfill / Civic amenity / Composting	Household / Commercial / Industrial / Special asbestos	160,567.72	119,837.26	39,007.40
WML/W/0020038	GLASGOW CITY COUNCIL	Civic amenity / Transfer station	Household / Commercial / Industrial / Other special	21,167.02		28,062.15
WML/W/0020108	GLASGOW CITY COUNCIL	Civic amenity / Transfer station	Household	98,995.10		101,825.96
WML/W/0020036	GLASGOW CITY COUNCIL	Civic amenity / Transfer station	Household	67,058.27		69,978.73
WML/L/1084290	NORTH AYRSHIRE COUNCIL	Civic amenity	Household / Commercial / Industrial / Other special / Inert	1,870.71		1,870.71
WML/W/0022016	INVERCLYDE COUNCIL	Civic amenity / Transfer station	Household / Commercial / Industrial	32,207.63		40,203.91
WML/W/0020042	SHANKS ARGYLL & BUTE LIMITED	Civic amenity / Transfer station	Household / Commercial / Special asbestos / Inert	4,811.91		4,829.97

Permit of Licence No	Operator Organisation	Site Activity	Licensed Waste Type	Waste Inputs to Site	Waste Treated / Recovered on Site	Waste Outputs from Site
WML/W/0020056	NORTH AYRSHIRE COUNCIL	Transfer station / Other treatment	Household / Commercial	55,202.38		54,649.42
WML/L/1019190	KEENAN (RECYCLING) LIMITED	Transfer station / Composting	Household / Industrial	226.69		174.78
WML/N/0220307	OBAN SKIP HIRE LIMITED	Metal recycler / Transfer station	Household / Commercial / Industrial / Other special / Inert	2,332.51	1,671.66	1,399.95
WML/N/0220307	OBAN SKIP HIRE LIMITED	Metal recycler / Transfer station	Household / Commercial / Industrial / Other special / Inert	2,332.51	1,671.66	1,399.95
WML/N/0220313	OBAN SKIP HIRE LIMITED	Metal recycler / Transfer station	Household / Commercial / Industrial / Other special / Inert	214.69		194.58
PPC/A/1123280	JOHN R ADAM & SONS LIMITED	Metal recycler	Commercial	159,953.00	13,145.00	165,621.00
WML/L/1018833	EMR LIMITED	Metal recycler	Industrial	157,292.11	41,232.67	91,155.66
WML/L/1178417	DALES MARINE SERVICES (GREENOCK) LIMITED	Metal recycler	Industrial		271.76	662.4
WML/W/0220288	RESTRUCTA LIMITED	Other treatment	Household / Commercial	2,742.50	1,789.98	2,306.61
WML/L/1083066	WEEE SOLUTIONS LIMITED	Other treatment	Household / Commercial / Other special	3,518.67	2,527.72	2,884.92
WML/L/1159194	AYR ENVIRONMENTAL SERVICES OPERATIONS LIMITED	Other treatment	Industrial	1,136,002.00	897,188.00	26,467.00
PPC/A/1017440	SLG TECHNOLOGY LIMITED	Incineration	Industrial	2,470.00		
PPC/A/1110002	VIRIDOR (GLASGOW) LIMITED	Incineration / Other treatment	Household / Commercial / Industrial	166,233.39	123,094.33	56,436.94
WML/L/1099346	DOOCEY RECYCLING LIMITED	Other treatment	Commercial			10,401.16

17.5 Description of Likely Significant Effects

The predicted waste management impacts of the Proposed Development are assessed in accordance with Table 17-4. Potential effects of the Proposed Development associated with waste generation and management is considered for two distinct phases:

a) Construction Phase; and

b) Operational Phase.

17.5.1 Assessment of Construction Effects

Prior to the breakwater construction, dredging of approximately 1,225 m^3 of overburden material to -3.0m CD is required in a dredge pocket located to the northeast of the existing Iona slipway to accommodate the new navigation channel. Dredging will be undertaken using a backhoe dredger and the material will be deposited under a Marine Licence at a licenced offshore deposit site. The potential location for sea disposal is illustrated in Figure 3-8.

Existing private moorings and buoys from within the site boundary, working areas and dredging areas will be removed or relocated to a temporary location nearby.

A rock armour breakwater structure will be constructed 70 m to the south of the existing slipway. The construction of the breakwater will involve the installation of a geotextile membrane, c.149,812 tonnes of clean quarried rock, likely sourced from Glensanda Quarry. The breakwater toe will be reinstated to existing seabed level with site won seabed material. Surplus seabed material will be disposed of in accordance with the Marine Dredging Licence.

There is the potential for quantities of materials to be deposited in landfill sites rather than being reused or recycled unless site waste management plans are implemented and adhered to. The use of non-permitted waste contractors or unlicensed facilities could give rise to inappropriate management of waste and result in environmental impacts/ pollution. Therefore, it is essential that all waste materials are dealt with in accordance with regional policies, national legislation, and that site management procedures are in place to ensure the appropriate management of waste segregation, storage, handling, and transportation.

Typical waste materials arise from site management practices during the construction phase, for example, excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase. Typically, construction waste is ‘cleaner’ than demolition waste. Packaging waste can make up a significant part of this waste stream. In terms of waste arising from the site welfare facilities and site compound, general office waste such as paper, packaging and canteen waste will be collected in covered skips/large bins for disposal by a licensed waste contractor. Sewage from the temporary site toilets will be emptied under contract for disposal at an appropriate facility.

A number of different waste types are expected to be generated on site and are detailed in Table 17-7.

Table 17-7 Waste streams generated and associated management options and strategy

Work Stream	Waste	Waste Type	Waste Management Option	Waste Management Strategy
Dredging	Gravel & larger pockets of course material	Non-hazardous	Reuse on-site	Where feasible these dredged materials will be reused on-site.
	Sandy gravel and clay sediments	Non-hazardous	Disposal at offshore site	The majority of the dredged material will be disposed of at an authorised offshore disposal site. The proposed location (Figure 3-8) is situated in Portnahaven at the following central coordinate: 115785E, 647334N
	Drill cuttings	Non-hazardous	Disposal at offshore site	Drill cutting waste is likely to be generated during the dredging phase, however oil based drilling muds will not be used.
	Various waste oils & lubricants	Special	Treatment as Special waste Residual waste to Special waste facility	All Special waste must be source segregated before treatment and / or disposal and then independently moved to a secure collection point. It will then be collected by a specialist contractor and transferred
Construction	Concrete	Inert	Re-use on site Return to supplier Recycle on site Recover off-site Residual waste to landfill	Concrete will be batched on site. Care will be taken to ensure waste is minimised during this process. Investigations will be undertaken to identify if any excess concrete can be re-used in new batches. Awareness will be raised about the importance of effective handling. If additional concrete has to be delivered to the site a take-back scheme will be established for excess concrete with suppliers. Investigations will also be undertaken to determine whether concrete can be crushed on-site for use as aggregate of fill material where it is not possible to re-use it in its current form. Where this is not feasible the concrete waste shall be recovered off site
	Other inert	Inert	Recovered off-site where feasible Residual waste to landfill	All inert waste shall be segregated for off-site recycling or recovery.
	Metals	Non-hazardous	Recycle off-site	All metals shall be segregated for off-site recycling
	Plastics	Non-hazardous	Recycle off-site	Plastics shall be segregated for off-site recycling
	Paper & cardboard	Non-hazardous	Recycle off-site	Paper and cardboard shall be segregated for off-site recycling
	Timber	Non-hazardous	Recycle off-site	Storage pallets shall be returned where possible Wood waste will be segregated into a separate container so that off-site recycling can occur
	Glass	Non-hazardous	Recycle off-site	Glass will be segregated into a separate container so that off-site recycling can occur

Work Stream	Waste	Waste Type	Waste Management Option	Waste Management Strategy
	Mixed waste	Non-hazardous	Materials Recovery Facility (MRF)	Residual waste must be placed into a skip labelled mixed waste. Investigations shall be undertaken to identify potential recovery options for all waste.
	Paint tins	Special	Treatment as Special waste Recovery where feasible Residual waste to Special waste disposal facility	Empty paint tins arisings on site will be segregated in stockpiles on site away from all water courses and water bodies. All Special Waste must be source segregated before treatment and/or disposal and then independently moved to a secure collection point. It will then be collected by a specialist contractor and transferred for suitable treatment and/or disposal.
	Various waste oils & lubricants	Special	Treatment as Special Waste Residual waste to Special Waste Disposal Facility	All Special Waste must be source segregated before treatment and/or disposal and then independently moved to a secure collection point. It will then be collected by a specialist contractor and transferred for suitable treatment and/or disposal. Special waste shall be recycled where possible.

In terms of the overall impact (Table 17-3) of the construction phase of the Proposed Development, there is the potential to have a **Neutral or Slight** effect due to the increase in waste being generated and the potential for this waste to be sent to landfill over a short-term duration, however the intention will be to achieve a high rate of diversion from landfill through reuse, recycling and recovery throughout the construction phase.

17.5.2 Assessment of Operational Effects

Maintenance dredging will be required. However, the frequency of maintenance dredging will be established as part of the construction contract following the construction of the breakwater. Dredging material will be disposed of an authorised offshore disposal site (Figure 3-8) in accordance with the Marine Licence.

It is anticipated that the rock armour will adjust for a period of time which will be monitored for 104 weeks, and any movements will be recorded. After this, the breakwater will be inspected as part of the seabed bathymetric surveys regime and maintenance works will be undertaken as required.

The pier is used by CalMac Ferries Ltd. who operate a passenger ferry service with occasional vehicles being transported between the island of Mull and Iona. Crab/fishing vessel operators, leisure boat operators and private boat owners also use the facilities at the pier. The Proposed Development would support a slight increase in tourism using the ferry service and fishing/commercial vessels using the berthing opportunities which would result in a slight increase in litter and waste generation.

Waste management at the port is currently operated to best practice guidance and is managed and disposed by local authorities or licenced waste contractors. It is imperative that CalMac Ferries Ltd. Environmental Strategy and relevant policies and procedures are followed and that any additional waste that may arise are considered.

In terms of the overall impact (Table 17-3) of the operational phase on waste management, there is the potential to have a **Neutral or Slight** effect from a slight increase in waste sent to landfill associated with increased footfall from tourists using the ferry service and fishing and commercial vessels using the berthing facilities.

17.6 Mitigation Measures

In order to mitigate against the potential impacts that the Proposed Development could have on the production of waste during each phase, mitigation measures will be put in place to ensure that all waste is dealt with in a sustainable and legislatively compliant manner. These measures are set out below for the various phases of the development.

17.6.1 Construction Phase Mitigation Measures

17.6.1.1 Duty of Care

Contractors working on site during the works will have a duty of care and be responsible for the collection, control and disposal of all wastes generated by their works. Argyll & Bute Council and their appointed contractor will ensure that all waste materials leaving the site will be transported via road by a registered and licensed carrier and arrive at a licensed / permitted site. Waste will only be disposed or recovered through licenced operators and in accordance with national waste legislation.

17.6.1.2 Site Waste Management Plan (SWMP)

Construction waste will be managed as part of a SWMP, prepared and implemented by the appointed contractor for the duration of the construction works. The SWMP will contain procedures for the management of waste and assist with providing a complete audit trail. The SWMP will be a live document and will be subject to revision throughout the course of the construction phase.

The SWMP will:

- Include specific details on the projected waste types and subsequent management;
- Identify and capture the decisions made in the design process to reduce waste generation;
- Identify the methodologies for waste management at each stage of the project;
- Identify how the waste will be dealt with (i.e., disposal, re-use on/off site etc.); and
- Identify potential end markets e.g., reuse, recycling facilities, waste treatment facilities and disposal sites.

The SWMP will specify procedures for:

- On-site segregation of waste at source where practical;
- On-site segregation of waste materials into appropriate categories;
- On-site segregation of non-hazardous waste materials into appropriate categories such as:
  - Metals;
  - Timber.
- On-site segregation of any hazardous waste materials into appropriate categories such as:
  - Any contaminated soils;
  - Waste oil and fuels;
  - Paints, glues, adhesives and other known hazardous substances.

The SWMP will additionally specify:

- Measures to ensure monitoring and updating of records under Duty of Care requirements;
- Measures to avoid over-ordering and generation of surplus waste materials;
- Measures to ensure appropriate staff training and levels of awareness in relation to waste management;
- Measures and procedures to monitor waste flows on site;

- Steps to be taken with materials suppliers to reduce the amount of packaging or to participate in a packaging take-back scheme;
- Implement a 'just in time' materials delivery systems to avoid materials being stockpiled, which increases the risk of their damage and disposal as waste;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site. The waste storage area(s) will be assigned, and all construction staff provided with training regarding the waste management procedures on commencement of the project.

All waste leaving the site will be recycled, recovered or reused where possible, with the exception of those waste streams for which appropriate facilities are currently not available.

Waste streams will be collected by an appropriately licensed and permitted private waste contractor, appointed by the contractor for recycling, recovery or disposal at suitably licensed facilities.

17.6.1.3 Construction Environmental Management Plan (CEMP)

An oCEMP is included in Appendix 20.1. A CEMP will be prepared which should contain measures and procedures for the management of construction waste. Contractors will be contractually obligated to comply with the requirements of the CEMP and it should be adhered to by all parties with any involvement in construction, including main contractors, sub-contractors and visitors to the site.

The CEMP will address specific waste management requirements:

- Identifying how the waste will be dealt with (i.e., disposal, re-use on/off site etc.).
- All waste leaving site will be recycled, recovered or reused where possible, with the exception of those waste streams for which appropriate facilities are currently not available.
- On-site segregation of non-hazardous waste materials into appropriate categories
- Control measures and attention to materials quantity requirements to avoid over-ordering and generation of waste materials.
- Implement a 'just in time' materials delivery systems to avoid materials being stockpiled, which increases the risk of the damage and disposal as waste.
- All waste materials will be stored in skips or other suitable receptacles in designated storage areas within NIE compounds. The waste storage area(s) will be assigned, and all construction staff provided with training regarding the waste management procedures on commencement of the project.
- Ensure appropriate staff training and levels of awareness in relation to waste management.
- Waste streams will be collected by an appropriately licensed and permitted private waste contractor, appointed by the contractor for recycling, recovery or disposal at suitably licensed facilities.
- Monitoring and updating of records under Duty of Care requirements.

- Sewage effluent from the temporary site compound will be removed using a vacuum tanker by a suitable licensed waste contractor.

17.6.1.4 Construction Phase Monitoring

Records will be kept for each waste material which leaves the site, whether for reuse on another site, recovery, recycling or disposal. A system will be put in place to record the waste arising on site during the construction phase. The following should be recorded:

- Waste taken off-site for reuse;
- Waste taken off-site for recovery;
- Waste taken off-site for recycling; and
- Waste taken off-site for disposal.

For each movement of waste off-site a signed waste collection docket will be obtained from the waste contractor. This will be carried out for each material type. This system will also be linked with the delivery records. A signed waste acceptance docket will be issued for each movement of waste on-site.

If waste movements are not accounted for, the reasons for this shall be established in order to see if and why the record keeping system has not been maintained. Each material type will be examined in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved.

The contractor will be responsible for conducting an audit of the waste practices at the site during the construction phase of the development.

Upon completion of the construction phase a final report will be prepared summarising the outcomes of waste management processes adopted and the total recycling/ reuse/ recovery figures for the development.

17.6.2 Operational Phase Mitigation Measures

17.6.2.1 CalMac Ferries Ltd. Environmental Strategy

There is no specific Waste Management Plan in place for Iona Ferry Terminal. Waste management at Iona Ferry Terminal should continue to be managed in line with CalMac Ferries Ltd. Environmental Strategy for 2021-2023 with one of its core priorities being *“we generate minimal waste and sustainably use materials”.* CalMac Ferries Ltd. should continue to review and implement any required changes in the waste management to avoid and minimise the potential effects of passenger and ship generated wastes once the Proposed Development is operational. They should continue to encourage the responsible management of waste, including minimisation and recycling, at the point of generation on ships, reception in ports, transportation and disposal, and ensure that employees and users dispose of wastes responsibly in facilities provided.

17.7 Potential Cumulative Effects

A review of planning applications associated with other Proposed Developments has been undertaken to determine the likelihood for potential significant cumulative effects on waste, taking consideration of the following criteria:

- Type and extent of identified proposal;
- The distance between the identified proposal and the Proposed Development;
- Likely visual influence of the identified proposal;
- Potential inter-visibility between the identified proposal and the Proposed Development;
- Potential for cumulative cultural heritage effects on the physical fabric of the landscape or its scenic qualities and
- The potential for combined, successive and sequential visual effects in the context of the Proposed Development.

With regards to the potential for cumulative effects associated with waste, the proposed Fionnphort Breakwater and Overnight Berthing Project has been considered.

The source of current waste arisings associated with the Proposed Development is from the operation of the passenger ferry service from Fionnphort (the location of the proposed Fionnphort Breakwater and Overnight Berthing Project). Waste facilities are provided by CalMac Ferries Ltd. who provide recycling facilities at all their port locations for customers to recycle on the go. All waste generated and/or received at both the Iona Ferry Terminal and Fionnphort Ferry Terminal is currently managed and disposed by local authorities or licenced waste contractors. The management/ disposal route is at the discretion of the approved contractor.

CalMac Ferries Ltd. have in place, an Environmental Strategy for 2021-2023 which outlines the company's aims and actions to minimise their impact on the marine and terrestrial environments in which they operate. The Strategy outlines four core priorities which align with Scotland's Environment Strategy, Scottish Government National Outcomes and the UN Sustainable Development Goals. One of the core priorities is *"we generate minimal waste and sustainably use materials".* Waste management at the port is currently operated to best practice guidance and is managed and disposed by local authorities or licenced waste contractors. It is imperative that CalMac Ferries Ltd. Environmental Strategy and relevant policies and procedures are followed and that any additional waste that may arise are considered. Through continued adherence to this Environmental Strategy and relevant policies and procedures, there is not likely to be cumulative effects associated with waste arising from the Proposed Development with the proposed Fionnphort Breakwater and Overnight Berthing Project.

17.8 Residual Effects

17.8.1 Construction Phase Residual Impact

A carefully planned approach to waste management and adherence to a SWMP and CEMP during the construction phase will ensure that the waste effects on the environmental will be short term, imperceptible, and will not be significant. There is available capacity within the existing waste management infrastructure in the region to manage municipal and construction related waste from the Proposed Development works. Therefore, the impact of the construction phase in relation to waste management is predicted to be Neutral or Slight with the residual effect outcome being **Not Significant**. This is summarised in Table 17-8.

17.8.2 Operational Phase Residual Impact

From a waste management point of view, waste arisings at the site will return to the baseline situation as it is anticipated that due to recycling and reuse policies, procedures and CalMac Ferries Ltd. Environmental Strategy, waste will continue to be managed as per legal requirements. While there may be a minor increase in waste arisings, they are capable of being managed under the existing waste management arrangements. The impact of the operational phase in relation to waste management is predicted to be Neutral or Slight with the residual effect outcome being **Not Significant**. This is summarised in Table 17-8.

Table 17-8 Summary of Impacts

Phase	Receptor	Sensitivity of Receptor	Assessment of Magnitude	Predicted Effect	Adverse/ Beneficial	Permanent/ Temporary	Mitigation Measures	Residual Effect
Construction Phase	Landfill Void Space Capacity	Low	Negligible	Neutral or Slight	Adverse	Temporary	1.6.1	**Not Significant**
Operational Phase	Landfill Void Space Capacity	Low	Negligible	Neutral or Slight	Adverse	Permanent	1.6.2	**Not Significant**

By implementing the mitigation measures set out in this chapter and by managing wastes in accordance with the waste management hierarchy and best practice guidance, and the CEMP and SWMP, wastes generated during the distinct phases of the Proposed Development will have no adverse effect on waste management in the area.

17.9 Conclusions and Summary of Effects

The source of current waste arisings at the Proposed Development site is from the operation of the passenger ferry service from Fionnphort. Current wastes arising at the site are a typical mix of recyclable and residual material, accompanied by mixed litter generated from passenger footfall. Iona Port is operated by CalMac Ferries Ltd. who provide recycling facilities at all their port locations for customers to recycle on the go. All waste generated and/or received at Iona Ferry Terminal is currently managed and disposed by local authorities or licenced waste contractors. The management/ disposal route is at the discretion of the approved contractor.

During the construction phase of the Proposed Development, typical waste materials which may arise from site management practices may include, excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase. Typically, construction waste is ‘cleaner’ than demolition waste. Packaging waste can make up a significant part of this waste stream. In terms of waste arising from the site welfare facilities and site compound, general office waste such as paper, packaging and canteen waste will be collected in covered skips/large bins for disposal by a licensed waste contractor. Sewage from the temporary site toilets will be emptied under contract for disposal at an appropriate facility.

In terms of the overall impact of the construction phase of the Proposed Development, there is the potential to have a Neutral or Slight effect due to the increase in waste being generated and the potential for this waste to be sent to landfill over a short-term duration, however the intention will be to achieve a high rate of diversion from landfill through reuse, recycling and recovery throughout the construction phase.

During the operational phase, the pier will continue to be used by CalMac Ferries Ltd. who operate a passenger ferry service with occasional vehicles being transported between the island of Mull and Iona. Crab/fishing vessel operators, leisure boat operators and private boat owners also use the facilities at the pier. The Proposed Development may support a slight increase in tourism using the ferry service and fishing/commercial vessels using the berthing opportunities which may result in a slight increase in litter and waste generation.

Waste management at the port is currently operated to best practice guidance and is managed and disposed by local authorities or licenced waste contractors. It is imperative that CalMac Ferries Ltd. Environmental Strategy and relevant policies and procedures are followed and that any additional waste that may arise are considered.

In terms of the overall impact of the operational phase on waste management, there is the potential to have a Neutral or Slight effect from a slight increase in waste sent to landfill associated with increased footfall from tourists using the ferry service and fishing and commercial vessels using the berthing facilities.

It is concluded that the significance of the Proposed Development in relation to waste management is – **Not Significant**.

18 GREENHOUSE GAS ASSESSMENT

18.1 Introduction

This chapter of the EIAR presents the Greenhouse Gas (GHG) Assessment for the Proposed Development. It provides quantitative and qualitative estimates of likely GHG emissions associated with the pre-construction, construction, operation and decommissioning phases of the Proposed Development.

This GHG Assessment is based on a Life Cycle Assessment (“LCA”) approach and references the IEMA Environmental Impact Assessment Guide “Assessing Greenhouse Gas Emissions and Evaluating Their Significance” (“IEMA GHG Guidance”). As all GHG emissions are contributing to a global accumulation, the global climate is the ultimate receptor, and the impacts of climate change will impact all aspects of the Environmental Impact Assessment (EIA) directive (2011/92/EU as amended by 2014/52/EU). Although GHG emissions to the atmosphere are localised, the impacts are transboundary, meaning no matter where the emissions are released, the social, economic and environmental impacts will be felt on a global scale. GHG emissions associated with an infrastructure project (in this case a ferry and associated structures) can originate from the combustion of fossil fuels on-site for operating machinery, the manufacture and transport of materials and changes in land-use.

Throughout this assessment, the term carbon is referred to. This is used as shorthand for the carbon dioxide equivalent of all GHGs and is quantified as ‘tonnes of carbon dioxide equivalent’ (tCO_2e). Reporting emissions as CO_2e allows for the emissions of the six key GHG: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) to be expressed in terms of their equivalent global warming potential in mass of CO_2. This assessment will consider the whole life carbon of the Proposed Development scheme which encompasses capital and operational whole life carbon. Capital carbon refers to the GHG emissions associated with the construction of an asset and is more widely used within the infrastructure sector, having been previously referred to as embedded carbon. Operational carbon refers to the emissions associated with the operation and maintenance of the infrastructure.

This chapter should be read in conjunction with Volume III, Appendix 18.1 Scottish Greenhouse Gas Statistics 2021. This appendix summarises the results of the Scottish Greenhouse Gas Inventory for 1990-2021 which is compiled in line with international guidance from the Intergovernmental Panel on Climate Change (IPCC). The data is reported by source sector, such as energy supply, and greenhouse gas, such as carbon dioxide.

18.2 Legislation

18.2.1 Climate Change (Emissions Reduction Targets) (Scotland) Act 2019

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 amends the Climate Change (Scotland) Act 2009 and places the monitoring framework on a statutory footing, requiring individual sector by sector monitoring reports to be laid before the Scottish Parliament annually. Future reporting will occur under the requirements of the amended Climate Change (Scotland) Act.

Net-zero Emissions Target

The Scottish Ministers must ensure that the net Scottish emissions account for the net-zero emissions target year is at least 100% lower than the baseline (the target is known as the "net-zero emissions target"). The "net-zero emissions target year" is 2045. This act is in line with the principles set out in article 3 of the United Nations Framework Convention on Climate Change, contributing appropriately to the holding of the increase in global average temperature to well below 2°C above pre-industrial levels, and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

Interim Targets

The Scottish Ministers must ensure that the net Scottish emissions account for the year:

- 2020 is at least 56% lower than the baseline.
- 2030 is at least 75% lower than the baseline.
- 2040 is at least 90% lower than the baseline.

These reductions are relative to 1990 levels of carbon dioxide, methane and nitrous oxide and 1995 levels of hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.

Annual Targets

Table 18-1 below details the annual targets starting from 2020 and ending in 2045.

Table 18-1 Annual targets from 2020 to a net zero 2045

Year	Percentage reduction from the 1990/1995 baseline
2020 (interim target)	56%
2025	65.5%
2030 (interim target)	75%
2035	82.5%
2040 (interim target)	90%
2045	100% (net zero emission)

Reporting and Planning Duties

An annual target report sets out whether each annual emissions reduction target has been met. The latest report for the 2020 target year was published in June 2022.

The report must state:

- The emissions reduction target for the target year.
- Whether the emissions reduction target for the target year has been met.
- The percentage by which the net Scottish emissions account for the target year is lower than the baseline.

- The amount by which the net Scottish emissions account for the target year is lower or higher than the emissions reduction target for that year.
- The cumulative amount by which the net Scottish emissions accounts are lower or higher than the corresponding emissions reduction targets, calculated by adding each amount by which an account is lower or higher than the corresponding target for each year in the period beginning with 2018 and ending with the target year.

Climate Change Plan

The Scottish ministers must lay out a plan before the Scottish parliament.

This plan includes the sectors:

- Energy supply.
- Transport (including international aviation and shipping).
- Business and industrial process.
- Residential and public (in relation to buildings in those sectors).
- Waste management.
- Land use, land use change and forestry.
- Agriculture

Just Transition

The just transition principles are the importance of taking action to reduce net Scottish emissions of greenhouse gases in a way which:

- Supports environmentally and socially sustainable jobs.
- Supports low carbon investment and infrastructure.
- Develops and maintains social consensus through engagement with workers, trade unions, communities, non-governmental organisations, representatives of the interests of business and industry and such other persons as the Scottish Ministers consider appropriate.
- Creates decent, fair and high-value work in a way which does not negatively affect the current workforce and overall economy.
- Contributes to resource efficient and sustainable economic approaches which help to address inequality and poverty.

Appendix 18.1 Scottish Greenhouse Gas Statistics 2021 summarises the results of the Scottish Greenhouse Gas Inventory for 1990-2021 which is compiled in line with international guidance from the Intergovernmental Panel on Climate Change (IPCC). The data is reported by source sector, such as energy supply, and greenhouse gas, such as carbon dioxide.

18.3 Assessment Methodology

18.3.1 Introduction

‘Climate’ is generally understood to mean the weather conditions prevailing over a long period of time and climate change refers to changes in recorded long term climate trends. As a topic for the assessment within EIA, climate change is relatively new. Guidance is evolving and there is no prescribed way in which climate change should be incorporated into an ES/EIAR, however, some guidance has been prepared by IEMA, discussed further below, which sets out the two main approaches that can be taken to determine a project’s climate change impact.

These involve identifying:

- The vulnerability of the Proposed Development to climate change; and
- The direct and indirect influence on the Proposed Development on climate change.

The vulnerability of the Development to climate change considers effects on the Development as a receptor (this is referred to in IEMA Guidance as Climate Change Resilience and Adaptation). A high-level climate change risk and resilience assessment has been undertaken to identify the potential risks of climate change on the Development and to high design measures to increase its resilience and adaptation to climate hazards, such as extreme hot and cold weather, intense rainfall, high winds and storm events.

Direct and indirect effects consider effects on environmental receptors as a result of the Proposed Development. Direct and indirect emissions can be defined as follows:

- Direct GHG emissions are emissions from sources that are owned or controlled by the operator. Examples include vehicular emissions, plant use (such as generators) and independent onsite energy generation (oil, gas and diesel);
- Indirect GHG emissions are emissions that are a consequence of the construction of operational activities of the Development but are a result of procurement and / or activities controlled by another entity. Examples include energy generation and the manufacture of materials (known as ‘embodied’ carbon).

18.3.2 IEMA guidance, Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

IEMA guidance, Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance states that *“in the absence of any significance criteria or a defined threshold, it might be considered that all GHG emissions are significant and an EIA should ensure the project addresses their occurrence by taking mitigating action”.* As a result, we do not intend to assign a significance threshold to the Proposed Development.

The guidance has been prepared by IEMA with the intention of assisting EIA practitioners to make informed choices relating to GHG emission treatment within an EIA, *“The aim of this guidance is to assist practitioners with addressing greenhouse gas (GHG) emissions assessment and mitigation in statutory and non- statutory Environmental Impact Assessment (EIA).”*

It provides options for the treatment of GHG emissions within each stage of the assessment process by highlighting key issues. The effects of GHG emissions are included in the decision-making process as each project will influence climate change relative to the GHG emissions produced. The UK have GHG reduction targets, therefore it is important to limit the amount of GHG emissions from each project (including this project) to stay within this target. Early stakeholder engagement maximises the mitigation measures put in place from project inception, through each stage of the process. This is underpinned by four key principles:

- Early, effective and ongoing interaction;
- Appropriate stakeholder engagement;
- Consenting risk is managed; and
- A clear narrative.

Due cognisance has been taken of this guidance in this Proposed Development and has been employed through the assessment presented here.

18.3.3 Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation

The Guide to Climate Change Resilience and Adaptation (June 2020) provides an updated framework for the effective consideration of climate change resilience and adaption in the EIA process). This document is a revision of the 2015 IEMA guidance on Climate Change Resilience and Adaption in EIA and reflects lessons learnt from emerging practice.

A step by step method presented within this guidance is set out below and has been given due cognizant within this Chapter:

- Step 0 – Building climate resilience into the project by considering incorporating resilience during the designs stage and by identifying appropriate mitigation measures;
- Step 1 – Scoping for the EIA; e.g. identify the climate change projections for use in the assessment and identify key climatic variables relevant to the project;
- Step 2 – Defining the future (climate) baseline; define future conditions using selected climate change projections (i.e. increase in rainfall, increase in mean summer temperature and wind strength);
- Step 3 – Identifying and determining sensitivity of receptors;
- Step 4 – Reviewing and determining magnitude of the effect; consider probability and consequence to determine the magnitude of the effect;
- Step 5 – Determination of significance;
- Step 6 – Developing additional adaptation / EIA mitigation measures;
- Step 7 (Development permitted) – Monitoring and adaptive management by implementing mitigation measures.

EIA Reports produced in line with this guidance are to be proportionate in their approach and not include superfluous assessment that does not address likely material issues.

In lieu of a prescribed methodology, IEMA guidance on Climate Change Resilience and Adaptation (2020) has been prepared to assist practitioners with the effective consideration *"of both climate change resilience and adaptation in the EIA process"*.

The guidance stresses that climate change should be an integrated consideration within the EIA, by undertaking an assessment that is *"proportional to the evidence base available to support any assessment"* and focusses on impacts *"specific to project".*

18.3.4 GHG Emissions Assessment Methodology

There are different assessment methods for measuring and quantifying GHG emissions. Two key examples include:

- PAS 2080:2016[35] Carbon management in infrastructure which has been developed to enable a consistent approach to the managed reduction of GHG emissions associated with economic infrastructure by construction industry stakeholders including clients, designers, constructors and material suppliers.
- BS EN 15978:2011[36] Sustainability of construction works, Assessment of environmental performance of buildings, Calculation method which has been developed by CEN to enable a consistent approach to the environmental assessment of buildings including GHG emissions.

18.3.4.1 GHG Assessment and Proportionality

Projects vary by size and type, resulting in varying GHG emissions. An effective scoping exercise will ensure that a balance is struck between the amount of GHG emissions from the project to the effort committed to the GHG assessment. For example, the GHG assessment can show if the majority of the impacts occur during the construction phase and there are negligible impacts during the operational phase.

A qualitative GHG assessment can be carried out if it is justified and agreed with the stakeholders during the scoping stage. They are also acceptable where data is unavailable or where mitigation methods are agreed upon early.

18.3.4.2 Define Goal and Scope

The goal and scope of the assessment should include a range of different aspects:

- The goal of the GHG emissions calculation.
- Description of the system (i.e., built environment asset / development etc.) that is the subject of the assessment.
- The function of the system (i.e., its performance characteristics).

[35] PAS 2080:2016 Carbon Management in Infrastructure, The British Standards Institution (BSI)

[36] BS EN 15978:2011. Sustainability of construction works. Assessment of environmental performance of buildings.

- The system boundary to be applied.
- Allocation procedures (where used) for apportioning GHG emissions.
- The calculation methodology to be applied.
- How GHG emissions information will be interpreted and used in decision-making including how it should be used to inform.
- Mitigation response.
- Significance of impact of emissions.
- Communicating and reporting GHG emission impact within EIA.
- Data quality requirements.
- Assumptions, limitations and constraints.

The study review process, ensuring it is appropriate and proportionate to the intended use of the study.

18.3.4.3 Scoping the Boundaries of the GHG Emissions Assessment

Topics which will be included or excluded need to be identified. The scoping exercise of the GHG emissions assessment will consider aspects such as which life cycles to include, whether there should be a focus on assets construction or operation, if there are specific elements of the supply chain that must be included, and what an appropriate boundary condition or cut off point might be to excluding aspects from the assessment. The following sections provide a summary of scope and scale of assessment and guidance. Section 18.4.5 sets out the key assessment criteria for this project.

18.3.4.4 Study Boundaries

EIAs should apply system boundaries, use data that is consistent with and report using the modular approach. GHG emissions assessments typically cover all the life cycles to determine which need included. Projects will vary in size and hence so will the scale of GHG assessments in the spirit of delivering proportionate EIAs.

18.4 Inclusions

The study system boundary should reflect the system under study including its physical scope and life cycle stages relevant to the goal and scope of the assessment.

18.4.1.1 Cut off Rules (Exclusions)

Any activities that do not significantly impact the result of the quantification can be excluded. The input or output flows per module would be expected to be a maximum of 5% energy usage and mass. All inputs and outputs to a process for which data are available should be included.

18.4.1.2 Study Period

A reference study period shall be chosen as the basis for the GHG emissions assessment, and this should be based on the expected service life of the construction asset.

18.4.1.3 Calculation Data

To undertake a calculated GHG emissions assessment for an EIA it will be necessary to gather data on the activities occurring and the GHG emissions factors for these activities, for the system under study.

18.4.1.4 Study System Activity Data

Activity data includes information about the size, magnitude and physical nature of the system under study. It can take different forms and consists of information covering materials quantity, energy and water demand, waste generation, transportation distances and modes, and works techniques/technologies.

18.4.1.5 GHG Emissions Factors

GHG emission factors are a value for 'GHG emissions per unit of activity'. Examples of this are:

- *HGV: 0.13 kg CO_2e / t.km*
- *UK electricity grid: 0.41 kg CO_2e / kWh*
- *Concrete: X kg CO_2e / tonne*

GHG emissions factors vary in their scope and coverage and will be representative of a single, or multiple processes/activities, and can incorporate multiple life cycles. Care needs to be taken when selecting the correct factors for the system under study. It is often necessary to apply multiple GHG factors for the same activity if the assessment is being completed over a long time period, for example if the GHG emissions are expected to change.

18.4.1.6 Data Quality

To satisfy the goal and scope of the EIA, the data needs to be of appropriate quality by defining:

- Age.
- Geography.
- Technology mix represented by data.
- Methodology applied to gather or calculate the data.
- Competency of entity that developed the data.

18.4.1.7 Types of Data

Data types will vary depending on the project type and how detailed it is. In most cases, EIAs are based on design-stage information, hence activity data specific to the project should in theory be available from the engineering and design teams. If this is not available, an alternative would be to use generic or public information that is best representative of the project.

18.4.1.8 GHG Emissions Calculation Method

A measured or calculated, or a combination of these two methods are used to quantify the GHG emissions for a project. In almost all cases a calculated approach will be used because an EIA is completed in advance of supply chain mobilisation and associated construction works.

The structure of a quantification calculation for determining the GHG emissions associated with the construction works should be as follows:

GHG emission factor × Activity data = GHG emission or removal

Calculations may be taken at different scales reflecting specific activities, components or elements of construction. As a result, individual calculations should be completed to form a GHG emissions inventory for the quantification.

18.4.1.9 Study Uncertainty

Uncertainty should be considered and if it significantly affects the outcome of the study, additional steps should be used to reduce it and provide more confidence in results.

Uncertainty can be considered by:

- Testing upper and lower limits.
- Testing for different inclusions and exclusions.
- Modify study period.

If the scale of uncertainty provides findings are likely to change any decision based on the data, it should be appropriately reduced.

18.4.2 Sources of Information

A review was undertaken of the literature and data relevant to this assessment, relating to climate change and carbon and this was used to provide an overview of the future environment.

18.4.3 Site-Specific Surveys

No site-specific surveys have been undertaken to inform the climate change and carbon assessment.

18.4.4 Defining Magnitude and Sensitivity

Institute of Environmental Management and Assessment (IEMA, 2022) guidance states that; *"The crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050."*

In the deficiency of sector-based, or local emissions budgets, the UK Carbon Budgets can be used to contextualise the level of significance. As per IEMA (2022) guidance, all GHG emissions are classed as having the potential to be significant as all emissions contribute to climate change. In establishing the scope and boundary of emission assessment, it is standard accounting practice to exclude minor sources as these are not material. Inventories that exclude these minor sources are still considered complete for verification purposes. This exclusion of emission sources that are less than 1% of a given emissions inventory is based on a 'de minimis' (relatively minimal) contribution (BSI, 2019).

On this basis, where emissions from the Proposed Development are greater than 1% of the relevant annual UK Carbon Budgets the impact of the Proposed Development on the climate is considered to be major. This is summarised in Table 18-2 and

Table 18-3.

There is currently no published standard definition for receptor sensitivity of GHG emissions. The global climate has been identified as the receptor for the assessment. The sensitivity of the climate to GHG emissions is considered to be 'high' (IEMA, 2022). The rationale supporting this includes:

- Any additional GHG impacts could compromise the UK's ability to reduce its GHG emissions and therefore the ability to meet its future carbon budgets; and
- The importance of meeting the Paris Agreement goal of limiting global average temperature increase to well below 2°C above pre-industrial levels. Additionally, a recent report by the Intergovernmental Panel on Climate Change highlighted the importance of limiting global warming below 1.5°C (IPCC, 2021).

Table 18-2 Magnitude Criteria for Impact Assessment

Magnitude	Magnitude Criteria Description
Beneficial Reduction	Estimated emissions equate to a reduction of >0.1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
Negligible Change	Estimated emissions ± 0.1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
Small Increase	Estimated emissions equate to between 0.1 and 1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
Large Increase	Estimated emissions equate to >1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise

Table 18-3 Consequence Matrix for Impact Assessment

Magnitude of Emissions	Magnitude Criteria Description
Beneficial Reduction	Beneficial
Negligible Change	Minor Beneficial/Adverse
Small Increase	Moderate Adverse
Large Increase	Major Adverse

18.4.5 Climate Change Resilience

The identification and assessment of climate change resilience within EIA is an area of emerging practice. There is no single prescribed format for undertaking such assessments; therefore, the approach adopted to undertaking and reporting the assessment has drawn on good practice from other similar developments and studies.

The types of receptors considered vulnerable to climate change are:

- construction phase receptors (i.e., workforce, plant and machinery);
- the development's assets and their operation, maintenance and refurbishment (i.e., hardstand, structures and drainage, etc.); and,
- end-users (i.e., members of public and commercial operators etc.).

The 120-year design life of the Proposed Development includes its construction and operational phases. As the construction phase would be much shorter in duration than the operational phase, future climate change is less relevant to the assessment of construction impacts and effects. Accordingly, the construction assessment has followed a descriptive based approach. For the operational assessment, the likelihood and consequence of impacts and effects on receptors has been assessed based on a future time frame of operation.

Criteria used to determine the likelihood of an event occurring, based on its probability and frequency of occurrence, are detailed in Table 18-4 Measure of Likelihood for Climate Change Resilience Assessment.

Table 18-4 Measure of Likelihood for Climate Change Resilience Assessment (Source: DMRB)

Likelihood Category	Description (probability and frequency of occurrence)
Very High	The event[37] occurs multiple times during the lifetime of the project e.g. approximately annually, typically 120 events.
High	The event occurs several times during the lifetime of the project e.g. approximately once every five years, typically 20 events.
Medium	The event occurs limited times during the lifetime of the project e.g. approximately once every 15 years, typically 8 events.
Low	The event occurs during the lifetime of the project (once in 120 years).
Very low	The event may occur once during the lifetime of the project.

The consequence of an impact has been measured using the criteria detailed in Table 18-5 Measure of Consequence for Climate Change Resilience Assessment.

Table 18-5 Measure of Consequence for Climate Change Resilience Assessment (Source: DMRB)

Consequence of Impact	Description
Very Large Adverse	National level disruption lasting more than 1 week.
Large Adverse	National level disruption lasting more than one day but less than 1 week.
Moderate Adverse	Regional level disruption lasting more than one day but less than 1 week.
Minor Adverse	National level disruption lasting less than 1 day.
Negligible	Isolated disruption lasting less than 1 day.

The identification of likely significant effects on receptors has been undertaken using professional judgement by combining the measure of likelihood with the predicted consequence of impact, as shown in Table 18-6 'Significance Criteria for Climate Change Resilience Assessment'.

[37] * The event is defined as the climate event and the hazard occurring in combination.

Table 18-6 Significance Criteria for Climate Change Resilience Assessment

Consequence of Impact	Measure of Likelihood				
	Very Low	Low	Medium	High	Very High
Negligible	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
Minor	Not Significant	Not Significant	Not Significant	Significant	Significant
Moderate	Not Significant	Not Significant	Significant	Significant	Significant
Large	Not Significant	Significant	Significant	Significant	Significant
Very Large	Not Significant	Significant	Significant	Significant	Significant

The assessment also identifies and accounts for existing climate change resilience measures either already in place or in development for infrastructure and assets, for example, mitigation measures for potential flooding impacts.

18.4.6 Assessment Criteria and Assessment of Significance

18.4.6.1 Assessment of GHG Emissions

The main emissions sources of the Proposed Development that have been considered are:

- As with the majority of large civil engineering projects potential emissions to air are inevitable during the construction phase, arising from construction activities, transport of materials and the use of plant and equipment.
- other inputs, primarily electricity and heat load; and,
- The decommissioning of the Proposed Development. The decommissioning phase is not considered relevant due to the long design life of the assets and given that emissions with the end of the life of this type of asset are relatively small and therefore unlikely to be significant.

18.4.6.2 Assessment of Climate Risks

The assessment assumes the Development will be fully operational from 2025. In considering future climate change scenarios, managing climate change resilience and adaption, the IEMA guidance (2020) recommends the use of the UK Climate Projections (UKCP) Website (Met Office, 2018). The latest UKCP is UKCP18 which provides updated observations and climate change projections out to 2100 in the UK. Therefore, this assessment assumes projections for the 2100 as the most far-reaching projection and is considered to be appropriate for the design life of the Development.

18.4.6.3 Sensitive Receptors

Following identification of the future climate scenarios, the project receptors within the study area which are vulnerable to climate change may be identified as below:

- the construction process (e.g., workforce, plant, machinery etc);
- the assets and their operation, maintenance and refurbishment (e.g., structures, breakwater, utilities, etc); and,
- end-users (e.g., members of public, commercial operators etc).

18.4.7 Employed Assessment

Due to the level of uncertainty within the final Proposed Development design, the carbon assessment will provide an approximate range, rather than a definitive total, for the total carbon dioxide equivalent (CO_2e) emissions inventory. Conservative assumptions have been used to reflect a high emissions, 'realistic worst case scenario' when calculating the emissions.

The assessment boundaries define the scope of the inventory. The assessment boundary comprises the boundary (see Figure 3-5) of the Proposed Development and all components contained therein, including offshore activities. Emissions associated with activities during pre-construction (surveys), construction (embodied carbon, transportation of components to the Proposed Development and installation of components), operation and maintenance and decommissioning are included, to ensure all activities are captured in the carbon assessment.

Due to the stage of development of the industry and the availability of validated embodied carbon data, assumptions are developed for the source location of the components which form the Proposed Development and the materials constituting these components.

18.4.7.1 Emission scenarios associated with the Proposed Development.

Estimates (both qualitative and quantitative) were made of the following:

- Pre-construction emissions from vessels;
- Construction phase – including trips by vessel to the dredge deposit locations (please refer to Chapter 3, Figure 3-8 for location);
- Operations and maintenance – trips from the ferry and any estimated ferry maintenance;
- Decommissioning: emissions from vessels removing and transporting components to shore, following the operational period of the Proposed Development.

The following categories of emissions were excluded from the emissions inventory due to the complexity of estimation and the availability of data given the level of maturity of the industry. These emissions are likely to represent a very small part of the total emissions for this assessment, and therefore are likely to have a low potential to alter the outcome or value of the assessment:

- Emissions from manufacturing process of geotextile, site welfare fatalities, Heras fencing, safety buoys etc.
- Onshore transportation[38] (if any); and;
- Office activity and worker travel.

Emissions associated with activity beyond the return of components to shore for decommissioning at the end of the lifecycle of the Proposed Development are outwith the assessment boundary, however, it is considered that a high percentage of the material may be recycled.

[38] Transport of Material to site: Materials are expected to be transported to site by barge and installed from a barge. Transport by road will be minimal – there is no estimated impact on the road transport network.

18.5 Baseline Scenario

18.5.1 Scottish Greenhouse Gas Statistics 2021

18.5.1.1 Source Emissions

A measure of the actual emissions or removals in Scotland including international aviation and shipping. This measure can be used for UK and international comparisons. This is included to enable an assessment to be made in regard to the significance of the Proposed Development when considered on a national scale. There was 41.6 MtCO2e in 2020, down 49.2% from 1990 and down 2.4% from 2020.

18.5.1.2 Emissions for Reporting Against Targets

The Committee for Climate Change (CCC) recommended a new method of reporting emissions for the purposes of monitoring performance against targets for the June 2020, and future, publications. This is known as the GHG Account.

On this adjusted basis, the GHG account reduced by 49.9% between the baseline period and 2021.

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 specifies a target reduction of 51.0% reduction over the same period. Therefore, the interim target for 2021 has not been met.

18.5.2 The Greenhouse Gas Inventory

The Scottish Greenhouse Gas Emissions (2022) publication uses the results of the Scottish Greenhouse Gas Inventory for 1990-2021 which is compiled in line with international guidance from the IPCC. The data is reported by source sector, such as energy supply, and greenhouse gas, such as carbon dioxide.

“Scottish Greenhouse Gas Emissions 2021” includes data on two categorisations of greenhouse gas emissions.

- Estimated net source emissions. These are sometimes referred to as "territorial" emissions, as they are produced within a country's territory or economic sphere.
- GHG account. These are net source emissions which have been adjusted to remove the effect of successive revisions to the data over time. Section C contains results using this approach.

The publication does not include any information on consumption-based emission estimates, which refers to GHG emissions associated with the spending of Scottish residents on goods and services wherever in the world these emissions arise together with emissions directly generated by Scottish households, through private heating and motoring.

Table 18-4 below shows how to use the different categorisations of statistics on greenhouse gas emissions.

Table 18-4 Guidance on the use of Estimated Source Emissions and GHG Account (Source: Scottish Greenhouse Gas Emissions 2021)

	Estimated Source Emissions	GHG Account
Use for reporting progress against Scotland’s Climate Change Targets	×	✓
Can be compared with EU countries	✓	×

	Estimated Source Emissions	GHG Account
Can be compared with UK	✓	×
Includes International Aviation and Shipping	✓	✓
Includes North Sea Oil & Gas	×	×
Data on individual GHG	✓	×
Data on sectoral emissions	✓	×
Base Year	1990	Baseline Period (Variable)

18.5.2.1 Categories

For the purpose of reporting, GHG emissions are allocated into the following sections:

- Energy Supply: Emissions from fuel combustion for electricity and other energy production sources, and fugitive emissions from fuels (such as from mining or onshore oil and gas extraction activities). North Sea oil & gas emissions are not allocated to Scotland[40].
- Business: Emissions from fuel combustion and product use in industrial and commercial sectors, and F gas emissions from refrigeration and air conditioning in all sectors. Includes industrial off-road machinery.
- Industrial Processes: Emissions resulting from industrial processes, except for those associated with fuel combustion which are included in the Business sector.
- Transport (excluding International Aviation and Shipping): Emissions from domestic aviation, road transport, railways, domestic navigation, fishing and aircraft support vehicles.
- International Aviation and Shipping: This category is called "Exports" in some inventories. Includes emissions from international aviation and shipping.
- Public: Emissions from combustion of fuel in public sector buildings.
- Residential: Emissions from fuel combustion for heating/cooling and garden machinery and fluorinated gases released from aerosols/metered dose inhalers.
- Agriculture: Emissions from livestock, agricultural soils (excluding carbon stock changes which are included in the LULUCF sector), stationary combustion sources and off-road machinery.
- Waste Management: Emissions from waste disposed of to landfill sites, waste incineration, and the treatment of wastewater.
- Land Use, Land Use Change and Forestry (LULUCF) – Emissions/removals of CO_2 from changes in the carbon stock in forestland, cropland, grassland, wetlands, settlements and harvested wood products, and of other greenhouse gases from drainage (excl. croplands and intensive grasslands) and rewetting of soils, nitrogen mineralisation associated with loss and gain of soil organic matter, and fires. Because the impact of biomass harvest on carbon stocks in ecosystems is included in this sector, any emissions of CO_2 from

[40] Emissions of GHGs from offshore oil and gas exploration and production are classified within the Greenhouse Gas Inventory as "Unallocated" emissions and not attributed to any of the devolved administrations.

burning biomass (regardless of the country of origin) are excluded from other sectors to avoid double counting them.

18.5.3 Results – Net Sources of Scottish Greenhouse Gas Emissions

In 2021, Domestic transport (excluding International Aviation and Shipping) (10.9 $MtCO_2e$) was the largest source of net emissions, followed by Business (7.7 $MtCO_2e$), Agriculture (7.8 $MtCO_2e$), Residential (6.3 $MtCO_2e$) and Energy Supply (4.9 $MtCO_2e$).

Table 18-5 Scottish Greenhouse Gas Emissions by National Communications Category 2020 (Values in $MtCO_2e$)

NC Category	Carbon Dioxide	Methane	Nitrous Oxides	Fluorinated Gases	Total
Agriculture	1.2	4.6	2.0	0.0	7.8
Business	6.8	0.0	0.1	0.8	7.7
Energy Supply	4.4	0.4	0.0	0.0	4.9
Industrial Processes	0.4	0.0	0.0	0.0	0.4
International Aviation and Shipping	0.7	0.0	0.0	0.0	0.7
Land Use, Land Use Change and Forestry	-4.0	3.7	0.7	0.0	0.4
Public	0.9	0.0	0.0	0.0	0.9
Residential	6.1	0.1	0.0	0.1	6.3
Domestic Transport	10.8	0.0	0.1	0.0	10.9
Waste Management	0.0	1.4	0.1	0.0	1.5
Grand Total	27.5	10.2	3.0	0.9	41.6

18.5.3.1 Main Points

Carbon dioxide was the main greenhouse gas emitted or removed in most sectors, with the exceptions of the Agriculture and Waste Management sectors.

Methane was the main net gas emitted in the agriculture (4.6 MtCO2e), followed by nitrous oxide (2.0 MtCO2e) and carbon dioxide (1.2 MtCO2e).

Almost all emissions in the Waste Management sector were emitted in the form of methane (1.2 $MtCO_2e$).

All sectors exhibit a general downwards trend between 1990 and 2021:

- Energy Supply emissions have seen the largest decrease in GHG emissions (-16.8 MtCO2e, a reduction of 77.6%) followed by LULUCF (-5.7 MtCO2e, a reduction of 94.1%), Waste Management (- 5.0 MtCO2e, a reduction of 76.2 per cent), and Business (-4.2 MtCO2e, a reduction of 35.3 per cent). This is as a result of the change in electricity supply sector, with renewables on the increase, and fossil fuels and nuclear energy decreasing.
- Overall, the gigawatt-hours of electricity generated in Scotland decreased by 7.0 per cent between 2020 and 2021. Renewables were the single largest source of electricity generated in Scotland in 2021 at 57.0

per cent, followed by nuclear generation at 29.8 per cent with fossil fuel generation making up only 10.9 per cent of total electricity generation.

Full details of the Scottish Greenhouse Gas Statistics 2021 are detailed in Appendix 18.1.

18.5.4 Emissions in Dredging

The international emission legislation for the shipping industry has become increasingly stringent in recent years and will become even more stringent in future years. Increasing environmental awareness and social challenges like air quality, climate change and energy scarcity have resulted in the latest emission legislation as set forth in the IMO (International Maritime Organization). The emissions of a dredger are not only defined by the dredging installation, local circumstances and the crew, but also by the legislation itself. Legislation to restrict environmental impacts, such as turbidity and noise, is likely to influence efficiency and emissions. The vessel that will be employed for the construction phase dredging phase is a backhoe dredger. Full details will be presented by the appointed contactor and the dredging vessel will adhere to all relevant legislation with regards to emissions that are applicable at the time of operation.

18.6 Description of Likely Significant Effects

18.6.1 Emissions Inventory

The emissions inventory for the Proposed Development is divided into three phases:

- Development and emissions associated with pre-construction and construction vessels;
- Construction CO_2e - the emissions from construction vessels;
- Operational CO_2e - the emissions from vessels associated with operation and maintenance;
- Decommissioning CO_2e - the emissions from vessels associated with the removal of components, following the operational period of the Offshore Development.

The entire construction (including pre-construction) phase is 52 weeks. An outline method statement is provided in Section 3.3 of the Project Description, a summary is presented below.

18.6.2 Carbon Assessment

18.6.2.1 Pre-construction Phase

The main aspects of the pre-construction phase are likely to be:

1. Undertaking of site dilapidation survey and level surveys as required to show the condition of the surrounding area and roads prior to the start of the works.
2. Site welfare facilities, site compound and storage areas established within the area. The site boundaries on land around the site compound and storage areas shall be defined with Heras fencing. Working area over water shall be marked with indicative safety buoys deployed at approx. 10m centres to delineate.

Dredging Works:

1. Mobilisation of dredging plant to site.

2. Pre-dredge bathymetric survey.
3. Removal/relocation of existing private moorings and buoys from within the site boundary, working areas and dredging area and subsequent installation of the mooring at temporary locations nearby.
4. Dredge pocket to the northeast of the existing Iona slipway.
5. Post-dredge bathymetric survey.

18.6.2.2 Construction Phase

The main aspects of the construction phase are likely to be:

1. Mobilisation of plant and operations team to site.
2. Rock armour and materials for breakwater delivered to site by barge.
3. Formation of breakwater footprint.
4. Installation of secondary rock and primary rock to existing seabed level.
5. Installation of inner core & primary rock armour.
6. Disposal of surplus seabed material in accordance with Marine Dredging Licence.
7. Installation of rock armour along shore between existing slipway and south end of existing restaurant.

18.6.2.3 Operational Phase

The design life of the structure is 120 years in accordance with the UK National Annex to BS EN 1990:2002, Category 5. The total emissions from the vessels were divided by the operational lifetime of the Proposed Development of 30 years to calculate emissions per year. This is a conservative assumption as vessels are likely to become more efficient over the next 30 years.

18.6.2.4 Maintenance Phase

Maintenance dredging will be required after construction is completed. The frequency of maintenance dredging will be established as part of the construction contract following the construction of the breakwater. Maintenance of the breakwater will be required as rock armour will move/adjust for a period of time.

Defect period is expected to be 104 weeks during which the breakwater will be monitored, and any movement recorded and reported. After this, the breakwaters will be inspected as part of the seabed bathymetric surveys regime. Mains Electric is known to be present well to the north of the site and the proposed works will have no interference with these services.

18.6.2.5 Decommissioning Phase

Decommissioning considers the decommissioning and removal (for re-use, recycling, incineration with energy recovery, or disposal at a licensed site) of the infrastructure to the shore at the end of the Proposed Development's lifetime.

It is likely that the breakwater would be removed in reverse order to its installation. With an anticipated 120 year life span it could be assumed that any emission at this stage would be negligible due to advance in technology and use of clean engines.

As the Proposed Development's anticipated lifetime is up to 120 years from full commissioning, there may have been advances in technological capabilities for decommissioning and/or changes to legislation by this time, therefore decommissioning best practice and legislation will be applied at that time of the Proposed Development's decommissioning. Under international standards such as those published by the IMO, there is the potential to consider leaving components in situ, however it is understood that this would require a robust and compelling justification to be presented to Marine Scotland in order to be granted approval for partial removal of the Proposed Development.

18.6.3 Calculations and Emission Estimates

There is predicted to be a Negligible Change in emissions from the project throughout the phases of the scheme. Estimated emissions + 0.1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise. Table 18-6 details the estimates, carbon emission estimates and magnitudes.

Table 18-6 Scottish Greenhouse Gas Emissions by Gas by National Communications Category 2020. Values in $MtCO_2e$

Materials	Units	Approximate Estimate	Estimated Quantity + ~10% Contingency for Worst Case	tCO_2e	Magnitude of Emissions (Please refer to Table 18-2)
Permanent Construction Concrete	Tonnes	682	750	**Less than 0.1%**	**Negligible Change** - Estimated emissions + 0.1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
Dredging[41] – Prior to Construction (1 week)	M^3	1,225	1450	**Less than 0.1%**	
Dredging Trips (45 exposed sea journeys) by vessel to dredge deposit location (the closest open dredge deposit site is MA035 Portnahaven)[42] Estimated dredge tonnage is 2,550.	km	160 round trip (45 exposed sea journeys)	160 round trip (45 exposed sea journeys) + 10%	**Less than 0.1%**	
Rock Armour[43] Transport (50 Vessels[44] Movements)	Tonnes	149812	164793.20	**Less than 0.1%**	

[41] Self-contained self-propelled vessel with an excavator mounted on its bow

[42] The closest Open Dredge Deposit site is MA035 Portnahaven, just off the coast of the Isle of Islay, an approximate 80Km distance away from Iona, and 160Km round trip (45 exposed sea journeys)

[43] Glensanda Quarry (Aggregate Industries) in Oban has been identified as a quarry which will be capable of producing rock armour material to a grading sufficient for the application at Iona. The quarry is equipped with marine loading facilities. The actual source of rock will be determined by the successful Contractor following the tender stage of the project.

[44] While this will be contractor specific, we anticipate a typical vessel type for rock armour delivery could be similar to 4 no. Flat Top Barge – Mormaen 15 | Keynvor MorLift Ltd

Materials	Units	Approximate Estimate	Estimated Quantity + ~10% Contingency for Worst Case	tCO_2e	Magnitude of Emissions (Please refer to Table 18-2)
Rock Armour Core	Kg	3000	3300	**Less than 0.1%**	
Rock Armour – 2 no. layers on top of core	Kg	6000	6600	**Less than 0.1%**	

The licence authorises the use of the undernoted construction materials[45] required in connection with the licensed activity, subject to the indicative amounts as specified below:

Material to be used in permanent construction;

- Concrete – 682 tonnes
- Rock Armour Core – 3000kg
- Rock Armour (on top of Rock Armour Core) – 6000kg

It is important to note that the vessel movements associated with the pre-dredging activities, construction dredging, and rock armour placement are temporary and any emissions associated with those activities are also temporary.

18.6.3.1 Open Dredge Deposit Site

Transportation distance of dredge material is taken as a return journey to the nearest appropriate deposit site (160km) as identified by Marine Scotland. The closest Open Dredge Deposit site is MA035 Portnahaven, just off the coast of the Isle of Islay.

18.6.4 Climate Change Resilience – Construction Impacts

During the construction process, receptors may be vulnerable to a range of climate risks. These are addressed by the mitigation measures in Section 18.7. Potential impacts during the construction phase could include:

- Inaccessible construction site due to severe weather events (flooding, snow and ice, storms) restricting working hours and delaying construction;
- Health and safety risks to the workforce during severe weather events;
- Unsuitable conditions (due to very hot weather or very wet weather, for example) for certain construction activities; and,
- Damage to construction materials, plant and equipment, including damage, material storage areas and worksites, for example from stormy weather.

It is considered reasonable that construction contractors would be able to adapt working methods if necessary. For example, warmer winter conditions may extend the time certain construction activities such as concrete pouring can be carried out, while a greater chance of summer heatwave conditions may require adaptations

[45] From Marine License

such as shading work areas or increased attention to construction dust control measures. Effects are considered to be negligible and not significant.

18.6.5 Climate Change Resilience – Operational Impacts

The Proposed Development also has the potential to be impacted upon by a changing climate and, in particular, more frequent severe weather events, in the medium to longer-term. These are addressed by the mitigation measures in Section 18.7. Potential impacts on the Proposed Development during the operational phase include:

- Material and asset deterioration due to high temperatures;
- Health and safety risks to ferry users;
- Damage to access roads from periods of heavy rainfall; and
- Flood risk (surface, groundwater, fluvial and snow/ice melt) on the road network and damage to drainage systems with the potential for increased runoff from adjacent land contributing to surface water flooding.

The potentially significant risks identified are those associated with flooding, summer heatwave or drought conditions, and extreme weather. Increased maximum temperatures or sustained heatwave conditions can affect the thermal comfort and hence cooling and shade requirements for operational staff. This can be addressed through working practices such as maintaining hydration and appropriate PPE if working in direct sun.

In conclusion, with the incorporated mitigation measures, no significant climate change risks to the Proposed Development are considered likely.

18.7 Mitigation Measures

18.7.1 General Potential Measures

Carbon mitigation can best be achieved by taking a planned and focused approach following the principles of a carbon management hierarchy. It is common to set out a graded structure of interventions with more favourable options presented over others. These structures typically start with avoiding or reducing emissions where practical, before suggesting offset or sequester strategies. BS EN 14064: 201218 on GHG quantification and reporting provides an example list of carbon mitigation interventions such as:

- Energy demand and use management.
- Energy efficiency.
- Technology or process improvements.
- GHG capture and storage in, typically, a GHG reservoir.
- Management of transport and travel demands.
- Fuel switching or substation.
- Afforestation.

The IEMA GHG hierarchy19 provides a similar structure to PAS 2080 set out as avoid, reduce, substitute and compensate. They are as follows:

1. Do not build: evaluate the basic need for the project and explore alternative approaches to achieve the desired outcome/s.
2. Build less: realise potential for re-using and/ or refurbishing existing assets to reduce the extent of new construction required.
3. Design clever: apply low carbon solutions (including technologies, materials and products) to minimise resource consumption during the construction, operation, user's use of the project, and at end-of-life.
4. Construct efficiently: use techniques (e.g., during construction and operation) that reduce resource consumption over the life cycle of the project.
5. Offset and sequester: as a complimentary strategy to the above, adopt off-site or on-site means to offset and/or sequester GHG emissions to compensate for GHG emissions arising from the project.

18.7.2 Project Specific

Embedded mitigation and management plans are proposed to form part of the design to reduce the potential impact of the Proposed Development. These are detailed in the following bullet points:

- Operational Environmental Management Plan (OEMP) - An OEMP will be developed to guide ongoing operations and maintenance activities during the life-cycle of the Project. The OEMP will also set out the procedures for managing and delivering the specific environmental commitments as per each technical chapter for each receptor over the operational period.
- Adherence with the International Convention for the Prevention of Pollution from Ships (MARPOL) - All vessels will adhere to MARPOL requirements. Accordance with this will help to ensure that the potential for release of pollutants is minimised during operations.
- Adherence with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the 'BWM Convention').

18.7.3 Monitoring and Mitigation Requirements

There is no requirement for additional mitigation over and above the embedded mitigation, management plans and specific measures proposed for the Proposed Development.

18.7.4 Climate Change Resilience

With the design and mitigation measures proposed, the Development is considered to be resilient to projected climate change. The resilience of the Development to climate change impacts is qualitatively assessed, based on professional expertise and judgement.

18.7.5 Operation

No significant adverse effect on the development due to climate change during operation is predicted. No specific mitigation measures are therefore suggested.

18.7.6 Future Monitoring

As no significant effects have been identified for the climate assessment, no monitoring of significant effects is proposed.

18.8 Residual Impacts

The CEMP will outline how the effects of construction can be managed by good practice and environmental controls which are routinely and successfully applied on other similar development proposals. In most cases, residual effects during construction will be of a temporary nature however, given that the duration of construction could be up to 52 weeks, some effects could be regarded as being short term.

No significant residual effects have been identified in relation to climate change adaptation or emissions reduction.

18.9 Potential Cumulative Impacts

The cumulative impact of carbon emissions arising from global human activity is *High*. This is true to the nature of climate change as a global, cumulative problem. As committed developments have been assessed throughout this EIAR the potential inter-scheme cumulative effects during the operational phase of the development have already been considered.

It is assumed that all committed developments will be required to meet relevant standards for emissions reduction and to comply with related planning policy. On this basis, it is considered appropriate to assume that any applications that are consented include ‘reasonable’ measures to avoid, reduce and /or offset the generation of greenhouse gas emissions and therefore that no significant cumulative effects are anticipated.

18.10 Transboundary Impacts

Although GHG emissions to the atmosphere are localised, the impacts are transboundary, meaning no matter where the emissions are released, the social, economic and environmental impacts will be felt on a global scale.

18.11 Inter-related Impacts

Interrelated effects describe the potential interaction of multiple project impacts upon one receptor which may interact to create a more significant impact on a receptor than when considered in isolation. Interrelated effects may have a temporal or spatial element and may be short-term, temporary, or longer-term over the life-cycle of the Proposed Development. There are obvious interrelationships with the water environmental and coastal processes.

18.12 Conclusions

The assessment has been undertaken in accordance with published guidance on considering climate change in Environmental Impact Assessment and consequently reviews how climate change has been considered at all stages of project progression and assessment.

Construction and operation of the Development is likely to result in emissions of CO_2 from direct sources and indirect sources. It is not anticipated that the scale of projected climate change identified will fundamentally alter baseline conditions or the effects included in this EIAR. Overall, with the design and mitigation measures proposed, the development is considered to be resilient to projected climate change and similarly not add significantly to GHG emissions at a national level.

Construction and operation of the Development is likely to result in emissions of GHGs from direct sources and indirect sources. It is not anticipated that the scale of projected climate change identified will fundamentally alter baseline conditions or the effects included in this EIAR.

19 RISK OF MAJOR ACCIDENTS & DISASTERS

19.1 Introduction

This chapter of the EIAR describes the assessment undertaken of the potential risk of major accidents and disasters presented from the Proposed Development. The chapter aims to set out the methodology for the assessment of major accidents and disasters and the potential risks and likelihood of such events occurring during both the construction and operational phases. In addition to this, potential mitigation measures to reduce the risk of major accidents and disaster have also been explored, as well as the cumulative effects between the Proposed Development and other projects in the area, and residual effects that may still be experienced after mitigation measures have been applied.

19.2 Assessment Methodology

19.2.1 Guidance and Legislation

The assessment of Major Accidents & Disasters has been carried out with regard to the following guidance and legislation:

- Major Accidents and Disasters in EIA: A Primer (IEMA, 2020);
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland (SNH & HES, 2018); and
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017).

19.2.2 Study Area

The study area for the assessment of Major Accidents & Disasters covers the area in which works will be undertaken. This includes the Isle of Iona, including the settlement of Baile Mòr. The area also covers Fionnphort, the Ross of Mull, the Sound of Iona. However, it should be noted that the marine area that will be used as a dredge deposit location is not included in this study area. For the marine deposit areas please refer to Figure 3-8. Figure 19-1 shows the study area for the assessment of Major Accidents & Disasters.

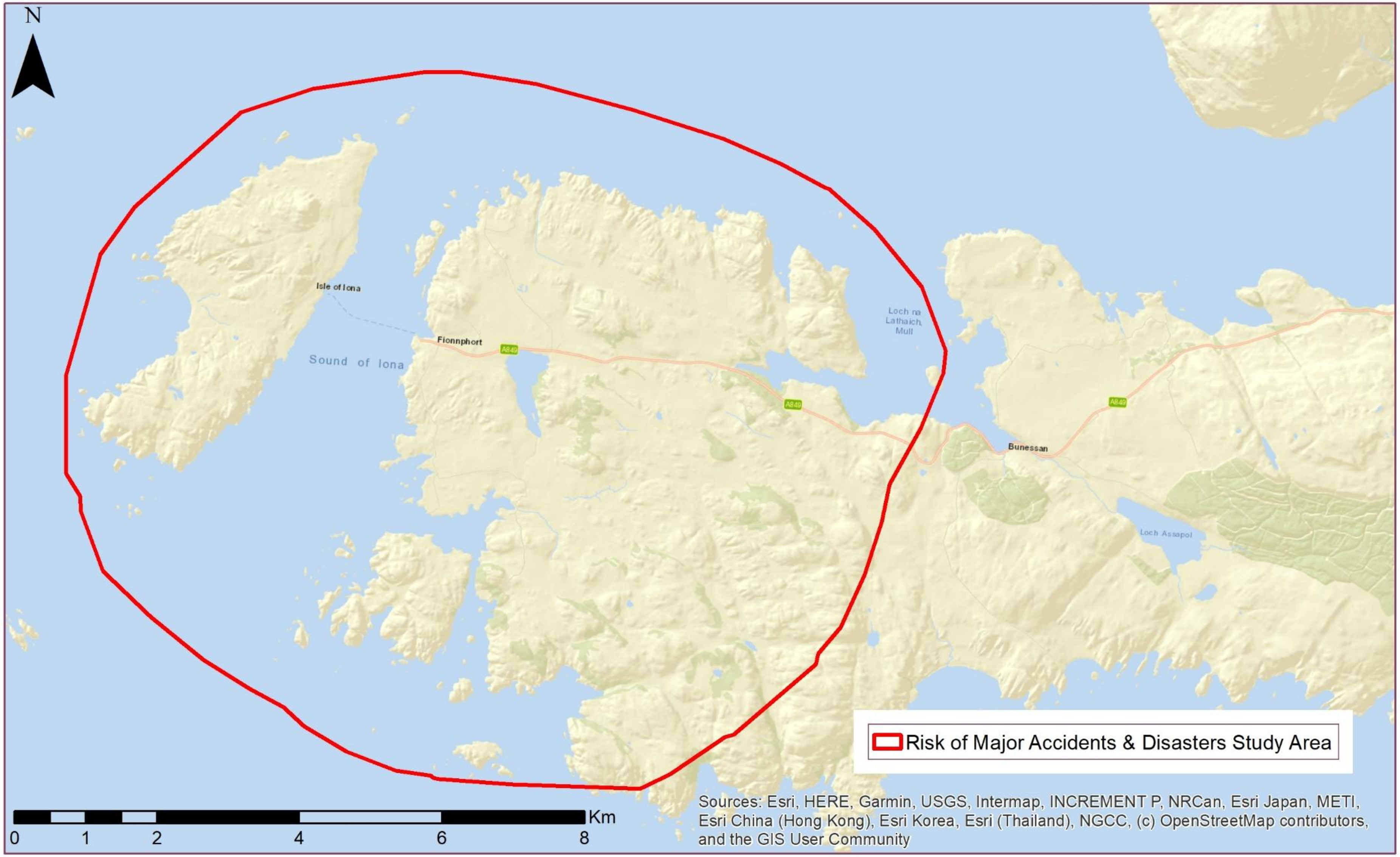

Figure 19-1 Risk of Major Accidents & Disasters Study Area

19.2.3 Desk Study

19.2.3.1 Receptor Identification

The receptors identified from the EIAR were taken forward for the assessment of Major Accidents & Disasters. They are:

- Navigation & Safety;
- Biodiversity (Terrestrial, Ornithology & Marine);
- Terrestrial Noise & Vibration;
- Water Quality;
- Flood Risk;
- Greenhouse Gases;
- Coastal Processes;
- Cultural Heritage;
- Landscape & Visual;
- Population & Human Health; and
- Waste.

Key receptors were further scrutinised through the examination of information presented in the EIAR, review of mapping and aerial photography, and identification of designated sites/ areas.

19.2.3.2 Hazard Identification

Various sources identified in the chapters of the EIAR were examined to identify the hazards that should be assessed. The identified hazards were grouped into high-level 'Risk Events' to ensure the assessment remained proportionate.

To consistently present the analysed information on potential hazards, a 'Hazard Identification Record' was created. The hazard identification record sets out the results of the review process undertaken, recording consultations with other EIA topics as an evidence trail, and providing any other comments that will assist in demonstrating how an outcome was reached. This helps provide the evidence base for the assessment and can be found in Volume III, Appendix 19.1.

19.2.3.3 Identifying the Reasonable Worst-Case Impact

It was important to identify the reasonable worst-case environmental impact for each of the grouped Risk Events. This was achieved through a qualitative assessment of the information presented in the EIAR, professional judgement and consultation with other EIA chapter authors.

19.2.3.4 Selecting Grouped Risk Events for Further Assessment

Grouped Risk Events were screened out of the assessment if they met the following criteria:

- There is no source-pathway-receptor linkage;
- The receptor is not within scope;
- The consequence does not meet the criteria of a significant environmental effect; or
- The consequence and likelihood of the risk is high to the extent that it is considered unacceptable (and therefore has been designed-out or managed/ mitigated)

All other grouped Risk Events were taken forward for further consideration.

19.2.3.5 Likelihood of a Risk Event Occurring

The possibility of the reasonable worst-case environmental impact occurring was evaluated considering:

- The likelihood of the measures already embedded into the design and best practice; and
- The likelihood that an environmental receptor is affected by the reasonable worst-case grouped Risk Event following primary and tertiary mitigation.

This highlighted any Risk Events where embedded, primary and tertiary mitigation measures (Section 19.5) would not provide sufficient mitigation to reduce the risk to an acceptable level. These identified Risk Events would likely require secondary mitigation measures.

19.2.3.6 Mitigation

For Risk Events where secondary mitigation was deemed to be necessary, the relevant chapter authors were consulted in order to develop mitigation measures to manage the risk to an acceptable level. It was important that secondary mitigation measures developed would bring the risk to below the significance criteria for a major accident or disaster.

Risk management options for Major Accidents & Disasters were identified within the broad categories shown in Table 19-1.

Table 19-1 Types of mitigation for Major Accidents & Disasters

Mitigation	Description
Eliminate	Adopt alternative processes to eliminate the source of the hazard or remove the receptor.
Reduce	Adapt proposed processes such that either the likelihood or the impact of the Risk Event can be reduced.
Isolate	Use physical measures to ensure that the Risk Event can be isolated from its pathway.
Control	Ensure that the appropriate control measures are in place so that a Risk Event can be managed appropriately.
Exploit	A risk may be exploited if it presents potential benefits or new opportunities (e.g. moving an asset related to the development further from a potential source of a hazard)

19.3 Baseline Scenario

This section outlines the current environmental conditions in the absence of the Proposed Development from the perspective of Major Accidents & Disasters. For this baseline scenario assessment, each of the receptors identified in Section 19.2.3.1 were examined individually to identify the key hazards that may exist in the study area.

19.3.1 Navigation & Safety

There are a number of different types of vessels that regularly travel through the Sound of Iona. These include the passenger ferry service that navigates between Fionnphort and Baile Mòr, fishing vessels, recreational vessels and tour boats. This means that there is a relatively high density of vessels navigating within the Sound of Iona.

There were a number of incidents recorded by the RNLI and MAIB between 2010 and 2019, meaning that a significant risk for navigational accidents within the Sound of Iona currently exists. For more detailed information on these incidents and on vessel density please see Chapter 6.

19.3.2 Biodiversity

In terms of terrestrial biodiversity, there are seven designated sites within 20 km of the Proposed Development, with the closest site Southeast Iona Local Nature Conservation Site (LNCS) approximately 1.4 km from the site. Due to the distance of these sites, there is not likely to be any indirect impacts relating to noise disturbance from ferry activities. It is possible that the shoreline near the ferry terminal at Baile Mòr may be used by <Red however, due to the disturbances caused by ferry terminal operations, it is unlikely that areas nearby the slipway are used as refugia by <Red . It was established that the Proposed Development site offers negligible potential for foraging, commuting and roosting bat species, with terrestrial habitats to the west offering moderate potential for roosting bats and low potential for foraging and commuting. The Proposed Development site offers no suitable habitat for reptiles. Habitats to the west have been assessed as having the potential to support common lizard and slow worms.

In terms of ornithology, three international sites with seabirds or migratory waterbirds as qualifying interest features within 30 km of the Proposed Development were identified. A fourth SPA, Cnuic agus Cladach Mhuile, was located within the 30 km search radius, designated for its breeding population of <Redacted>

A total of 16 bird species were recorded during the surveys undertaken between April and August 2021. All of these species recorded are common and widespread and regularly occur in the coastal waters of west Scotland either throughout the year, or during the breeding or non-breeding season. All species were recorded in very low or low numbers compared to their national breeding and wintering populations, revealing the site to be of local importance for these species.

In terms of marine biodiversity, the existing Iona slipway is located within both the Inner Hebrides and the Minches SAC and the Sea of the Hebrides MPA. This means that the existing risk of a major pollution event from ferry or other vessel operations has the potential to directly impact upon these sites and the species/ habitats listed under these designations.

For further information on the baseline scenario for Terrestrial Biodiversity, Marine Biodiversity and Ornithology please see Chapter 7 to Chapter 9, respectively.

19.3.3 Terrestrial Noise & Vibration

Currently, it is not expected that terrestrial noise and vibration presents any risk of major accidents and/or disasters to the surrounding environment of the Iona ferry terminal. A baseline noise monitoring survey consisting of attended and unattended noise measurements has been conducted within the vicinity of the Proposed Development site. Assessment of noise impacts associated with the construction, operation and decommission phases has been undertaken. Where potential impacts have been identified, appropriate mitigation measures have been proposed.

For further information on the baseline scenario for Terrestrial Noise & Vibration please see Chapter 10.

19.3.4 Water Quality

The Iona ferry terminal is located within the Sound of Iona which has a high overall WFD status. Furthermore, the connected waterbodies of West and South Mull also have a high overall status. There are designated sites within these waterbodies, in particular the Sea of the Hebrides MPA, the Inner Hebrides and the Minches SAC and the Cnuic agus Cladach Mhuile SPA. This means that any major pollution incident from vessel operations within the Sound of Iona has the potential to negatively impact on the WFD status of the waterbodies and therefore impact upon designated sites. However, it is unlikely that a major pollution incident will happen with the current baseline conditions, particularly with relevant pollution, prevention and control mitigation measures in place.

For further information on the baseline scenario for Water Quality please see Chapter 11.

19.3.5 Flood Risk

The Proposed Development site is currently at risk of coastal flooding, and this will still be the case with the Proposed Development. As the site is already operating for the same use there will be no new receptors introduced into the flood hazard area and therefore there is no increase to the overall flood risk which might contribute to a major accident and/ or disaster. Whilst the physical infrastructure of the Proposed Development will not be adversely impacted by flooding, mitigation measures are required for the users of the Proposed Development. Tidal warning will be the key mitigation measure for the operation of the site.

For further information on the baseline scenario for Flood Risk please see Chapter 12.

19.3.6 Coastal Processes

The Sound of Iona is relatively shallow with sandbanks in the vicinity of the ferry crossing between Fionnphort and Baile Mòr. There is also sediment action on the west and relatively large tidal currents experienced at the centre of the Sound of Iona. The predominant direction of high energy waves is from the southwest, attributed to large Atlantic swells entering the Sound, but smaller storms are also possible from the north and east. All these factors make channel navigation difficult for vessels within the Sound and increase the risk of collisions between vessels and the potential for running aground. However, it must be noted that the Proposed Development, with the relevant mitigations in place (i.e., those identified under Navigation & Safety), is anticipated to decrease the risk of any major accident and/ or disaster to both slipway users and ferry users.

For further information on the baseline scenario for Coastal Processes please see Chapter 13.

19.3.7 Population & Human Health

With regards to population and human health, there is potential for a major accident with regards to other sea users (such as kayakers) being pushed out to sea, causing an allision with other vessels. This has been assessed in Chapter 6 (Navigation & Safety), Section 6.4.1.10 and Section 6.4.2.2.

For further information on the baseline scenario for population & human health please see Chapter 14.

19.3.8 Landscape & Visual

Views from a total of eight viewpoints have been assessed for landscape and visual impacts from the Proposed Development. Localised moderate to major visual effects are predicted to be experienced during the operational phase of the Proposed Development for portions of the overall view available in close proximity to the Proposed Development site. With longer distance the effects from viewpoints decrease to a level that results in no significant effects. With regard to Major Accidents & Disasters, there is not expected to be any risk of major accidents and/or disasters relating to landscape and visual receptors during baseline operations of the ferry terminal.

For further information on the baseline scenario for landscape & visual please see Chapter 15.

19.3.9 Cultural Heritage

There are three scheduled monuments and four listed buildings within 500 m of the Proposed Development site There are also a number of non-designated sites within 500 m of the Proposed Development site. However, none of these are within the site boundary. Although adverse effects of moderate significance have been identified on the Cultural Heritage assets and setting of the Proposed Development site, the risk of Major Accidents & Disasters relating to cultural heritage receptors is considered to be low during the baseline scenario.

For further information on the baseline scenario for Cultural Heritage please see Chapter 16.

19.3.10 Waste

Currently it is not expected that operations and infrastructure present any risk of major accidents and/or disasters related to waste in the vicinity of the Iona ferry terminal. This is because the only current waste at the site is produced from the operation of the passenger ferry service from Fionnphort. The current waste is mainly made up of a typical mix of recyclable and residual material along with litter generated from passengers.

For further information on the baseline scenario for waste please see Chapter 17.

19.3.11 Greenhouse Gases

In Scotland, there have been significant reductions in greenhouse gas emissions between 1990 and 2020. Despite these reductions, domestic transport is the largest source of net emissions in Scotland. As a ferry service currently runs between the Iona and Fionnphort ferry terminals, operations currently contribute to greenhouse gas emissions in the domestic transport category however, any contributions from this small-scale operation are negligible when considered in nation-wide terms. Therefore, it is concluded that there is currently no specific risk of any major greenhouse gas related risks of major accidents and / or disasters in the area. It is important to note that any greenhouse gas emissions at the Iona ferry terminal will, in some way, exacerbate global climate change, thus contributing to global disasters (e.g., droughts, flooding etc.).

For further information on the baseline scenario for GHGs please see Chapter 18.

19.4 Description of Likely Significant Effects

This section first sets out the various grouped Risk Events that could lead to a potential major accident and/or disaster during the construction and operational phases of the Proposed Development. In addition, this section outlines the reasonable worst-case scenario for each of the identified grouped Risk Events and the likelihood of each grouped Risk Event occurring. Volume III, Appendix 19.1 shows the Hazard Identification Record.

19.4.1 Grouped Risk Events

Six grouped Risk Events were identified for both the construction and operational phases of the Proposed Development. The grouped Risk Events are as follows:

- Major boat / construction vessel collision / allision (either with existing infrastructure, new infrastructure, other vessels or running aground);
- Accident to the general public on or near the shoreline (e.g., people swimming etc.);
- Man overboard during construction;
- Major pollution or sedimentation event affecting nearby designated sites / areas;
- Major coastal flood event during construction of the Breakwater; and
- Scour of the toe of the breakwater leading to movement and/or damage that could cause a health & safety risk (e.g., vessel allision, risk to maintenance workers).

Major boat / construction vessel collision / allision (either with existing infrastructure, new infrastructure, other vessels or running aground)

The first grouped Risk Event identified was the risk of major boat or construction vessel collisions / allisions. Collisions are most likely during the construction phase due to increased construction vessel activity but may also occur following the completion of the breakwater. Collisions could occur between construction vessels, between construction vessels and ferry services and/or between construction vessels and recreational watersport vessels in the vicinity of the works. Allisions could occur between construction vessels and the shoreline (i.e., running aground) as well as contact with the existing slipway and new breakwater. Contact between ferry services and the new breakwater is also possible. The reasonable worst-case scenario identified for each of these potential events is the death and/or injury to a member of the public or a construction worker.

Accident to the general public on or near the shoreline (e.g., people swimming etc.)

Another grouped Risk Event is the possibility of an accident involving the general public on or near the shoreline the construction phase. Members of the public may be at risk of injury arising from activities in the site compound on the shoreline. An additional risk to the public is from construction vessel activities when swimming or undertaking other recreational activities (e.g., kayaking, sailing etc.) in the Sound of Iona. Individuals may also be at risk of falling into water from the shoreline if any material changes have occurred during construction. The reasonable worst-case scenario identified for this potential event is the death and/or injury to a member of the public.

Man overboard during construction

Another grouped Risk Event is the possibility of man overboard during the construction phase. Individuals falling into water from a construction vessel is possible and may cause significant harm to individuals and disrupt construction activities. The reasonable worst-case scenario identified for this potential event is the death and/or injury to a member of the public or a construction worker.

Major pollution or sedimentation event affecting nearby designated sites / areas

A major pollution or sedimentation event affecting nearby designated sites/ areas has also been identified as a grouped Risk Event. The works will take place within the Inner Hebrides and the Minches SAC as well as the Sea of the Hebrides MPA designated sites. The Inner Hebrides and the Minches SAC is designated for harbour porpoise and is considered to be one of the best supporting habitats for this species in the UK. The Sea of the Hebrides MPA is designated for supporting a range of marine species including <Redacted> and minke whale. Therefore, any major pollution or sedimentation event would likely have a direct impact on the species and habitats listed under these designations. A major pollution or sedimentation event also has the potential to impact upon a number of onshore designated sites within 30 km of the works including:

- Cnuic agus Cladach Mhuile SPA;
- Staffa SSSI;
- Treshnish Isles SPA and SSSI;
- Coll and Tiree SPA;
- North Colonsay and Western Cliffs SPA and SSSI;

- West Colonsay Seabird Cliffs SSSI; and
- Sleibhtean agus Cladach Thiriodh SPA.

While the potential to affect these sites exists, it is unlikely that there will be any major impacts following a major pollution or sedimentation event. The reasonable worst-case scenario identified for potential event is a severe long-term or permanent detrimental impact on sites and qualifying species / features.

Major coastal flood event during construction of the Breakwater

Another grouped Risk Event identified is the potential for a major coastal flood event to occur during the construction of the Breakwater. Without adequate planning, a high tide event could cause significant damage and disruption to construction activities on the Iona Breakwater and lead to a potentially serious situation. The reasonable worst-case scenario identified for this potential event is the death and/or injury to a construction worker.

Scour of the toe of the breakwater leading to movement and/or damage that could cause a health & safety risk (e.g., vessel allision, risk to maintenance workers)

The final grouped Risk Event is erosion and/or scour to the breakwater causing the structure to shift or become damaged over time. This could lead to a potential hazard as movement of heavy rocks and other construction materials could hamper vessel passage, causing a potential allision. Maintenance staff may also be at risk if they are required to walk along the breakwater as material may have moved or become loose over time due to coastal processes. The reasonable worst-case scenario identified for this potential event is the death and/or injury to a maintenance worker, vessel operator or a member of the public.

19.4.2 Significance of Effects

When determining the significance of effects for each of the grouped Risk Events, it was important to take the following into account:

- Sensitivity of the receptors
    - Vulnerability of the receptor
    - Recoverability of the receptor
    - Value / importance of the receptor
- Magnitude of effects
    - Geographic extent of effects
    - Duration of effects
    - Frequency of effects
    - Severity of effects
    - Reversibility of effects

Table 19-2 illustrates the matrix for categorisation of significance of impacts.

Table 19-2 General categorisation of the scale of significance

		Magnitude of change			
		Major	**Moderate**	**Minor**	**Negligible**
Sensitivity	**High**	Major	Major/ Moderate	Moderate	Minor
	Medium	Major/ Moderate	Moderate	Moderate/ Minor	Minor
	Low	Moderate	Moderate/ Minor	Minor	Minor/ Negligible

Note: Significant impacts are in dark shading

It is expected that most of the reasonable worst-case scenarios for the grouped Risk Events described in Section 19.4.1 would have a major significance were they to occur during construction or operation of the Proposed Development. Table 19-3 shows the sensitivity, magnitude and significance of each of the grouped Risk Events occurring and provides a reasoning for each categorisation.

Table 19-3 Sensitivity, Magnitude and Significance of Impacts

Grouped Risk Event	Sensitivity of Receptors	Reasoning / Rationale	Magnitude of Impact	Comments	Significance of Effect
Major boat/construction vessel collision / allision (either with existing infrastructure, new infrastructure, other vessels or running aground)	High	Death/injury of member of public or construction worker is high sensitivity due to the value/importance of the receptor being high and the fact that there is no recoverability of that receptor after the event occurs	Major	not reversible, long term, low frequency (likely), small extent (geographically), large extent (socially/personally)	Major
Accident to the general public on or near the shoreline (e.g., people swimming etc.)	High	Death/injury of member of public is high sensitivity due to the value/importance of the receptor being high and the fact that there is no recoverability of that receptor after the event occurs	Major	not reversible, long term, low frequency (likely), small extent (geographically), large extent (socially/personally)	Major
Man overboard during construction	High	Death/injury of a construction worker is high sensitivity due to the value/importance of the receptor being high and the fact that there is no recoverability of that receptor after the event occurs	Major	not reversible, long term, low frequency (likely), small extent (geographically), large extent (socially/personally)	Major
Major pollution or sedimentation event affecting nearby designated sites / areas	Medium	Impacts to designated sites and species is medium sensitivity due to the value/importance of the receptor being high. It is likely that the receptor will recover over time	Moderate	Large extent, potential long-term duration, low frequency, reversible	Major/Moderate
Major coastal flood event during construction of the Breakwater	Medium	While the value/importance is high and the recoverability of the receptor is not possible, death/injury of a construction worker is set as a medium sensitivity due to the vulnerability of the receptor	Major	not reversible, long term, low frequency (likely), small extent (geographically), large extent (socially/personally)	Major

Grouped Risk Event	Sensitivity of Receptors	Reasoning / Rationale	Magnitude of Impact	Comments	Significance of Effect
		being low as there is not a significant risk of a coastal flood event occurring during construction			
Scour of the toe of the breakwater leading to movement and/or damage that could cause a health & safety risk (e.g., vessel allision, risk to maintenance workers)	High	Death/injury of a construction worker is high sensitivity due to the value/importance of the receptor being high and the fact that there is no recoverability of that receptor after the event occurs	Major	not reversible, long term, low frequency (likely), small extent (geographically), large extent (socially/personally)	Major

19.4.3 Likelihood of Effects

It is expected that most of the grouped Risk Events will have a relatively low likelihood of occurring during construction and operation of the Proposed Development, particularly where mitigation measures are applied.

The risk of major accidents and/or disasters occurring relating to vessel collisions, accidents to the general public and man overboard are all considered unlikely during the construction and operation phases. This is because it is assumed that mitigation measures in place will be adequate to avoid such incidents.

The risk of a major pollution or sedimentation event is more likely to occur, due to the dredging activities and disposal at sea of dredged materials. Dredging activities could have a direct impact on designated sites in the vicinity of the site. Disposal of dredged material is unlikely to have any direct impacts on designated sites, however there may be indirect impacts in the short-term near the disposal area. The nearest designated site is the Oa SSSI on the coast of Islay (approximately 20km from Portnahaven), which is of special importance for its breeding <Redacted> However, suitable mitigation measures and plans will reduce the potential for these impacts.

Finally, the risk of a major coastal flooding event leading to a major accident and/or disaster is expected to be low. The Proposed Development site is currently at risk of coastal flooding, however, as the site is already operating for the same use there will be no new receptors introduced into the flood hazard area and therefore there is no increase to the overall flood risk which might contribute to a major accident and/ or disaster. Whilst the physical infrastructure of the Proposed Development will not be adversely impacted by flooding, mitigation measures are required for the users of the Proposed Development. Tidal warning will be the key mitigation measure for the operation of the site. The Floodline Warning Service and the Scottish Flood Forecast can be used. If an extreme event is forecast, any sailings from the ferry terminal are likely to be cancelled. The entire area is at risk of coastal flooding so it is likely to be closed and evacuated, which will ensure people are not at risk in the area.

19.5 Mitigation Measures

This section describes the various mitigation measures that may be applied in order to manage the risk of major accidents and/or disasters to a manageable level. The types of mitigation include:

- Primary mitigation – modifications to the location or design of the Breakwater made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.
- Secondary mitigation – actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the EIAR.
- Tertiary mitigation – actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative

requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.

The mitigation measures that have been proposed in the following sub-sections are those specified within the specialist topic chapters.

19.5.1 Primary Mitigation Measures

In order to reduce the risk of major accidents and/or disasters as listed in Section 19.4, the following primary mitigation measures are recommended:

- Lighting at the end of the Breakwater – to avoid contact between vessels and the breakwater during the operation phase.
- Scour protection – to reduce scour around the toe of the breakwater and avoid damage and movement of rock armour.
- Type and sources of construction materials – constructing the breakwater from clean quarried local rock should help reduce the risk of pollution during construction phase and reduce transport distances.
- Utilities infrastructure – avoidance of sewer, telecommunications, gas and electricity infrastructure during construction is key as well as incorporating any existing infrastructure into the project design to avoid any unnecessary risks.
- Safety fencing – to keep the general public away from construction areas or areas of potential danger.

19.5.2 Secondary Mitigation Measures

A number of secondary mitigation measures have also been recommended to reduce the risk of major accidents and/or disasters. This type of mitigation includes other practical measures that may be implemented in addition to the primary mitigation measures discussed in the previous section. These include:

- Safety Boat – to help avoid collisions between vessels and contact with the shoreline or infrastructure during the construction phase.
- Navigational Aids – to help avoid collisions between vessels and contact with the shoreline or infrastructure during both the construction and operation phase.
- Safety lighting – to help avoid collisions between vessels and contact with the shoreline or infrastructure during both the construction and operation phase.
- AIS coverage – to help avoid collisions between vessels during the construction phase.
- Weather forecasts and operational weather limits – to avoid hazardous conditions during construction.

- Updating ALRS and signalling directions – to help avoid collisions between vessels and contact with the shoreline or infrastructure during both the construction and operation phase.
- Pollution response equipment – to help quickly respond to a major pollution event during the construction phase.
- SEPA's Floodline Warning Service – to be aware and plan for coastal flood events during the construction phase. This service also includes information on tidal extremes and may also be useful during the operation phase.
- Ecological Clerk of Works (ECoW) – appointed to monitor the works in respect to biodiversity and species in the area.
- Correct and secure storage of fuels, oils and chemicals – must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity.

19.5.3 Tertiary Mitigation Measures

In addition to primary and secondary mitigation measures, tertiary mitigation is also recommended. These measures include legislative plans and processes and are not strictly practical measures.

- Marine Liaison Officer – to provide a point of contact for the marine works providing safety information to vessels in the area during the construction phase.
- Notices to mariners – to provide details of construction activities.
- Passage and operational planning – to provide details of altered routes during the construction and operation phase and scheduling construction activities to reduce disruption.
- Communicating with stakeholders – to inform locals of movement of buoyed areas during the construction phase.
- Navigation safety management process – to help manage vessel movements during the construction phase.
- Construction Environmental Management Plan (CEMP) (including pollution prevention measures).
- Operational Environmental Management Plan (OEMP) – to guide ongoing operations and maintenance activities during the life cycle of the Project. The OEMP will also set out the procedures for managing and delivering the specific environmental commitments as per each technical chapter for each receptor over the operational period.
- Environmental Management Plan (EMP)
- Ensure waste arisings from the construction phase (especially with sediment disposal) are dealt with in a sustainable and legislatively compliant manner

- Oil Spill Contingency Plan – to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner.
- The safe operation of refuelling activities shall be in accordance with PPG 7 "Safe Storage – The safe operation of refuelling facilities" (Environment Agency, 2011b).
- Adherence with the International Convention for the Prevention of Pollution from Ships (MARPOL) – to help to ensure that the potential for release of pollutants is minimised during operations.
- Site Waste Management Plan (SWMP) – will contain procedures for the management of waste and assist with providing a complete audit trail. The SWMP will be a live document and will be subject to revision throughout the course of the construction phase.
- Construction Phase Monitoring – records will be kept for each waste material which leaves the site, whether for reuse on another site, recovery, recycling or disposal. A system will be put in place to record the waste arising on site during the construction phase.

19.6 Potential Cumulative Effects

This section considers the cumulative effects on receptors that may arise when the Proposed Development is considered together with other proposed and ongoing developments in the area. These combined effects may increase the risk of major accidents and/or disasters occurring during and after construction. The relevant projects identified in the area are:

- The Fionnphort Breakwater and Overnight Berthing Project; and
- British Telecom (BT) Cable installation – Iona to Fionnphort.

Further details of these projects can be found in Chapter 21 of the EIAR.

19.6.1 Fionnphort Breakwater and Overnight Berthing Project

The Fionnphort Breakwater and Overnight Berthing Project is being developed alongside the Proposed Development. Therefore, it is likely that cumulative effects may be experienced when constructing the two projects. The Fionnphort Overnight Berthing Project is likely to have many of the same risks of major accidents and disasters as the Proposed Development. This means that the Risk Events described in this chapter may be exacerbated, depending on whether works are being carried out at the same time. However, there is potential that these can be mitigated through adherence to the mitigation measures proposed within the specialist topic chapters.

19.6.2 Cable Installation – Iona to Fionnphort

BTs installation of superfast broadband cables for the Ross of Mull and Iona is likely to get underway during the first half of 2023. While the cabling will be installed around 900 m south of the proposed Iona Breakwater, there is still likely to be some cumulative effects if the two projects are undertaken at the same time.

The most likely cumulative effect is the risk of collisions between construction vessels. This is possible due to increased vessel traffic in the Sound of Iona during the construction phase. The same logic applies to the risk of accidents to the general public and the risk of a man overboard.

The potential for a major pollution / sedimentation event is also another effect that may be pronounced by the two projects being undertaken at the same time. Due to both projects requiring dredging activities, it is more likely for a major sedimentation event to occur. Furthermore, due to increased vessel activity in the Sound of Iona during the construction phase there is an increased likelihood of a pollution event occurring.

However, there is potential that these can be mitigated through adherence to the mitigation measures proposed within the specialist topic chapters.

19.7 Residual Effects

Following the implementation of mitigation measures, residual effects are likely to be reduced. This means that each of the grouped Risk Events will have a minor chance of occurring during construction and operation of the Proposed Development. However, there will always be some level of risk of a major accident and/or disaster occurring even with all suitable mitigation measures in place.

19.8 Conclusions and Summary of Effects

The assessment of major accidents and disasters for the Proposed Development has found that there are a number of potential Risk Events during construction and operation including vessel collisions, man overboard, pollution/ sedimentation events and risks to the general public. These Risk Events could have potential for negative impacts on a number of receptors including biodiversity, water quality, coastal processes and population and human health.

A wide variety of mitigation measures have been identified to reduce the likelihood of Risk Events. These measures are designed to significantly reduce the potential for major accidents and disasters relating to the project. Despite mitigation measures, a (low level) risk of a major accident or disaster occurring will remain. However, it is determined that this risk is not likely to be significant in EIA terms.

There is potential for cumulative effects between the Proposed Development and the proposed Fionnphort Breakwater and Overnight Berthing Project and proposed British Telecom (BT) Cable installation between Iona and Fionnphort. Where these projects occur concurrently, this presents a cumulative risk for major accidents and disasters. However, through adherence to the mitigation measures proposed within the specialist topic chapters, it is determined that the likelihood of an event occurring would be low.

20 SUMMARY OF MITIGATION MEASURES

20.1 Mitigation Measures Arising from the Proposed Development

This EIAR assesses the likely significant impacts arising from the Proposed Development. Where required, mitigation measures are identified and described within individual topic chapters. These are measures which could avoid, prevent, reduce and, where possible, offset likely significant adverse effects upon the environment.

Table 20-1 summarises the mitigation measures and monitoring recommended within the EIAR.

Table 20-1 Summary of proposed mitigation measures per individual topic chapter

Potential Effects	Summary of Proposed Mitigation
CHAPTER 6: Navigation & Safety	
Ferry or tour boat allision (heavy contact) with the Proposed Development Dredger flooding whilst engaged in operations Dredge/construction plant impact with the Proposed Development during construction phase Recreational or fishing vessel allision with the Proposed Development Dredge/construction plant collision with recreational/fishing vessel Tug and tow collision with recreational/fishing vessel Tug and tow collision with ferry/tour boat Accident spill during marine works Heavy lift failure, or failure of lifting gear Small non-powered craft displaced by the Proposed Development: Ferry or tour boat allision with the breakwater: Small non-powered craft displaced by the breakwater	• Marine liaison officer – the marine liaison officer provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations. This is just to provide a central point of contact. • AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B (see Volume III, Appendix 6.1, Section 2.1 for definitions of AIS signals)). • Notices to mariners – issued by Argyll & Bute Council containing details about the construction works. These should be issued prior to any works (or any related activities such as diving or towage movements). • Availability of pollution response equipment – pollution response equipment should be available and carried by the contractors for use at Iona. The equipment should be appropriate for the type and scale of pollution that may occur. • Weather forecasting – a weather forecasting service should be regularly monitored to indicate any periods of upcoming adverse weather conditions. Appropriate actions should then be taken to mitigate any potential situations that may arise. These actions should be documented in the safety management system, detailing the specific weather conditions that will necessitate action(s). • Operational weather limits – including maximum wave and wind limits for construction activities should be detailed in the contractors 'Risk Assessment Method Statement'. • Promulgation of information – information on the Proposed Development and upcoming operations with associated vessel movements should be provided to local stakeholders. A website page (potentially on the Council's website) for the project, providing information and a method to contact the project would allow any vessels in the area to obtain information. • Aids to navigation, provision and maintenance of – aids to navigation should be provided after consultation and approval of the NLB. Marine works to be illuminated at night. The aids to navigation must be maintained to provide the availability of the aids to navigation required by the NLB with any out of service periods reported via the Local Aids to Navigation (LATON) system. • Safety boat – the safety boat should be appropriate for the wind and wave conditions in the area. It should be available on site and manned during construction operations in order to provide quick assistance if any incident was to occur. • Passage planning – CalMac should update their passage plan, both during the works and on completion of the works to recognise the altered route. • Operational planning – capital dredging should be scheduled, as far as possible, to avoid disruption to ferry operations.

Potential Effects	Summary of Proposed Mitigation
	• Review of available powers – Argyll & Bute Council should review their powers in relation to operating the port facility at Iona to determine whether further powers are required to ensure navigational safety. • Update ALRS volume 6 and Sailing Directions – updates to include new structures after completion of the marine works. • Shore side facility maintenance programme – to schedule the maintenance of the site, including the AtoN. • Communications – stakeholders should be informed of the need to move buoyed areas prior to construction and advised of other suitable locations. • Safety - Lighting - it is important that any marine works at night or at times of reduced visibility are sufficiently illuminated in accordance with the Health and Safety Executive (HSE) Approved Code of Practice (ACOP) 'Safety in Docks' (HSE, 2014). The guidance on illumination levels is drawn from the 'Safety and Health in Ports' code of practice published by the International Labour Organization; this states that: "On access routes for people, plant and vehicles and in lorry parks and similar areas, the minimum level of illumination should not be less than 10 lux. In operational areas where people and vehicles or plant work together, the minimum level of illumination should not be less than 50 lux". (ILA, 2016). This level of illumination must be balanced alongside the requirements provided in the British Standard Institute (BSI) publication 'Design of Road Lighting' BS5489.
CHAPTER 7: Terrestrial Biodiversity	
Temporary disturbance/ loss of habitat arising from activities within the terrestrial area of the Temporary Work Area (namely the establishment of a work compound and storage of rock)	• Production of an <Re Species Protection Plan (see Volume III, Appendix 7.2) and adherence to all recommendations made within. • Production of a Construction and Environmental Management Plan (CEMP). • An Ecological Clerk of Works (ECoW) will be appointed to monitor the works in respect to <Re activity. • No additional mitigation measures are required for the operational phase of the Proposed Development. The Environmental Management Plan (EMP) will manage the risks of all operational activities, facilities and cargo handled by the port and will include best practice measures to control pollution following standard guidelines such as the Environment Agency Pollution Prevention Guidelines. This will be considered sufficient to limit any potential impacts relating to pollution events.
Temporary disturbance/loss of habitat due to airborne noise and visual disturbance from construction activities	
Permanent loss of habitat arising from reclamation of seabed during the construction of a new rock armour breakwater to the south of the existing slipway	
Temporary effects on prey species due to underwater noise arising from construction activities (notably dredging and vessel noise), increased suspended sediment concentrations and sediment deposition.	
Long term increase in disturbance to habitat arising from increased levels of marine activity due to improved ferry services	
Long term increase in disturbance of habitat due to airborne noise and visual disturbance associated with the increase in terrestrial activity	

Potential Effects	Summary of Proposed Mitigation
Long term effects on prey species due to noise arising from vessels and potential for pollution events linked with increased levels of marine activity.	
CHAPTER 8: Marine Biodiversity	
Temporary disturbance/ loss of habitat arising from capital and maintenance dredging activity Increased suspended sediment concentrations and sediment deposition Resuspension of contaminated sediments Temporary disturbance/loss of habitat arising from the displacement/compaction of the seabed by anchors and jack-up barge spud legs Permanent habitat loss arising from placement of material on the seabed for the breakwater Underwater noise Disturbance and collision risk to marine mammals from increased vessel traffic during construction Changes in the hydrodynamic regime due to the presence of the breakwater	• Production of a CEMP - Control of pollution during construction will be set out in a CEMP. This will include best practice measures to prevent accidental spillage of chemicals during construction activities. • Production of an EMP - The EMP will manage the risks of all operational activities, facilities and cargo handled by the port and will include best practice measures to control pollution following standard guidelines such as the Environment Agency Pollution Prevention Guidelines. • Production of an Invasive and Non-Native Species (INNS) Management Plan - A document detailing how the risk of potential introduction and spread of INNS should be produced. The plan will outline measures to ensure vessels comply with the International Maritime Organization (IMO) ballast water management guidelines, it will consider the origin of vessels and contain standard housekeeping measures for such vessels as well as measures to be adopted if a high alert species is recorded. • Plant, equipment and material (where required) will follow the 'check, clean, dry method'. • The presence of sensitive features onboard the ship's navigation systems will aid the vessel master in placing either anchor or jack-up legs to avoid these sensitive features. • Production of a Seagrass Compensation and Monitoring Plan - to ensure that seagrass habitat is not permanently lost, compensation will be undertaken to ensure that the habitat is restored. An assessment has already been undertaken in the form of the intertidal and subtidal survey, with the extent of biotopes derived. This data will be used to inform the 'Seagrass Compensation and Monitoring Plan'.
CHAPTER 9: Ornithology	
Temporary disturbance/loss of habitat arising from activities within the terrestrial area of the Temporary Work Area (namely the establishment of a work compound and storage of rock) Temporary disturbance/loss of habitat due to airborne noise and visual disturbance from construction activities Permanent loss of habitat arising from reclamation of seabed during the construction of a new rock armour breakwater to the south of the existing slipway	• The most highly sensitive IOF are non-breeding populations and therefore measures to reduce disturbance around the nearshore area shall be undertaken as far as is practical during the period between September and April. • Methods to attenuate noise will be utilised, notably the use of sound walls and any modification of drilling rigs that would reduce noise levels. • Works undertaken in the vicinity of roosting birds or near occupied nests of sensitive species will be supervised by a suitably qualified and experienced Ecological Clerk of Works (ECoW) to determine if additional measures may be required.

Potential Effects	Summary of Proposed Mitigation
Temporary effects on prey species due to underwater noise arising from construction activities (notably dredging and vessel noise), increased suspended sediment concentrations and sediment deposition.	• Near-shore vessel-based activities should aim to reduce disturbance to foraging seabirds and waterfowl, particularly if works coincide with the winter period when <Re , <Reda and sea duck may be present.
Long term increase in disturbance to habitat arising from increased levels of marine activity due to improved ferry services	
Long term increase in disturbance of habitat due to airborne noise and visual disturbance associated with the increase in terrestrial activity	
Long term effects on prey species due to noise arising from vessels and potential for pollution events linked with potential increased levels of marine activity.	
CHAPTER 10: Terrestrial Noise & Vibration	
Worst case construction noise predictions exceed the 65 dB BS 5228 noise limit at a number of construction noise receptors during day-time hours.	• Mitigation in the form of timely and effective stakeholder consultation should be undertaken. This would ensure that residents are kept informed of on-going and future operations. For example, local residents would be informed by letter drop of proposed works, particularly where these are due to occur outside standard working hours. The letter would include details of proposed cause, start dates and duration of works to be carried out. • In order to minimise the likelihood of complaints, Argyll & Bute Council and affected residents should be kept informed of the works to be carried out and of any proposals for work outside normal hours. All complaints will be recorded by the appointed contractor. The appointed contractor will investigate the circumstances and ensure the necessary corrective measures are taken. • Night-time construction noise impact indicates that there is the potential for significant impact without mitigations. Screening at source of potentially affected receptors would ensure that the BS 5228 noise limit is achieved reducing impact to temporary minor adverse. • Construction mitigation measures will be put in place to ensure construction noise levels are attenuated and reduced where necessary. • Best practice measures will be employed to ensure that construction phase noise levels are reduced to the lowest possible levels. • BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures will be applied by the contractor where
Worst case construction noise predictions exceed the 45 dB BS 5228 noise limit at a number of construction noise receptors during night-time hours.	
Unmitigated construction noise daytime predictions in excess of 65 dB would be deemed to have a temporary moderate impact at four receptors of medium sensitivity, and temporary moderate / major impact at one receptor of high sensitivity	
Worst case construction noise predictions exceed the 45 dB night-time BS 5228 noise limit for all construction noise receptors during night-time hours. Unmitigated construction noise night-time predictions in excess of 45 dB would be deemed to be temporary moderate / major adverse impact at all medium and high sensitivity receptors	

Potential Effects	Summary of Proposed Mitigation
	appropriate during the construction phase of the Proposed Development. Construction best practice measures which will be implemented included below: ○ Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order ○ Careful selection of quiet plant and machinery to undertake the required work where available ○ Machines in intermittent use will be shut down in the intervening periods between work ○ Ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, temporary construction barriers or enclosures will be utilised around noisy plant and equipment ○ Handling of all materials will take place in a manner which minimises noise emissions ○ Audible warning systems will be switched to the minimum setting required by the Health & Safety Executive • Although recognised that the choice of dredgers is likely to be determined by the engineering requirements and the suitability of available equipment, dredging activities should be planned where possible to reduce the overall source noise level during the works – e.g., limiting night-time works directly adjacent to noise-sensitive properties etc. • Any dredger used for the works will be expected to be fitted with effective engine exhaust silencers, and there will be a requirement placed on the chosen dredger operator to ensure that all engine silencers are effective and reducing engine exhaust noise levels to the lowest reasonably practicable level. • Screening shall be provided nearest to those properties most likely to experience high noise levels from dredging, particularly during more sensitive night-time periods.
CHAPTER 11: Water Quality	
There is the potential for increased suspended sediment during the construction works of the breakwater and the dredging process	• SEPAs standing advice for “Construction Activities – Pollution Prevention” should be used. • Mitigation measures required to reduce the potential impacts from noise have been identified and included and the impacts of dredging and suspended solids on general marine life. These measures follow the Joint Nature Conservation Committee recommendations and guidance for minimising risk to marine wildlife (JNCC, 2010). • No losses of concrete (cement) to the waters will be permitted during the works.
Any sediment plumes generated during disposal are expected to be limited but may result in a temporary increase in turbidity	
The presence of physical alterations within a waterbody has the potential to impact on the hydromorphology of the waterbody	

Potential Effects	Summary of Proposed Mitigation
Dredging activities associated with the Proposed Development are likely to produce noise which is likely to disturb species in the area resulting in temporary, localised impact. There is potential for accidental oil/ fuel spillages on site due to increased vessel presence and associated fuel storage	• Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP2 shall be implemented to ensure safe storage of oils and chemicals. • The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b). • With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works. • An Oil Spill Contingency Plan which must be adhered to by all staff including those employed to carry out works. Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in a structured, logical and timely manner. • Given that there will be berthing of oil, gas and renewables supply vessels and associated refuelling, a full retention oil separator is recommended to mitigate for the potential impacts of fuel/ oil spillage or leakage. This is recommended to be maintained in accordance with the manufacturer's instructions by experienced personnel. • SEPA’s Standing Advice for Construction activities – pollution prevention has been consulted and will be adhered to. • The contractors Environmental Clerk of Works will be required to monitor mitigation measures and auditing of the contractor’s environmental controls will be undertaken by the client’s representative. • A ‘Seagrass Compensation and Monitoring Plan’ has been proposed to counter the direct habitat loss predicted to occur as a result of the Proposed Development. This will ensure that the loss of existing seagrass habitat is compensated ensuring no net loss of habitat.
CHAPTER 12: Flood Risk	
The existing slipway and pier are currently at risk of coastal flooding, and this will still be the case with the Proposed Development Minor local changes to the currents are expected around the breakwater such as an increase in the current velocity around the structure	• Contractor to sign up to SEPA’s Floodline flood warning service in order to get notified when the area is at risk of flooding. • Use the Scottish Flood Forecast by the Scottish Flood Forecasting Service (SFFS), which provides 3-day flood forecasts and is updated daily. • Tidal warning will be the key mitigation measure for the operation of the site. The Floodline Warning Service and the Scottish Flood Forecast as described above can be used.
CHAPTER 13: Coastal Processes	
Scour around the toe of the breakwater Sediment build-up to the northern side of the breakwater (infilling the dredged pocket)	• Scour protection is proposed as part of the operational phase of the Proposed Development to mitigate the impact of scour around the toe of the breakwater during periods of maximum flood velocity which would be expected during a 1 in 1 year 240° storm event during the flood tide.

Potential Effects	Summary of Proposed Mitigation
	• Maintenance dredging would be required after construction is completed. The frequency of maintenance dredging would be established as part of the construction contract following the construction of the breakwater.
CHAPTER 14: Population & Human Health	
Construction noise is predicted to be within limits set to be protective of health and the environment in most cases. However, when considering a worst-case scenario, Chapter 10 identifies that there is potential for construction noise to exceed limits (both daytime and night-time) at a small number of individual receptors that are located closest to the construction activities, with the receptors most likely to be impacted being non-residential. Disruption or disturbance to recreation could affect the vulnerable sub-population (dependents with children or people with existing poor physical or mental health) There is the potential for construction to affect sea users including sea kayakers and sail boats which are used for leisure boating and recreation in the Sound of Iona. This effect would possibly occur during dredging or when there is other disruption in the construction area. This change would mostly affect residents in the local community	• Mitigations measures related to noise impacts are included in Chapter 10. • A CEMP will be produced as part of application process. The CEMP will outline how the effects of construction can be managed by good practice and environmental controls which are routinely and successfully applied on other similar development proposals. • The CEMP should also set out a clear plan for managing access to the Sound of Iona during construction. This would include designating safe alternative transport routes and appropriately communicating these to local populations (including through the use of Gaelic materials). • The CEMP should also set out a plan for engagement with the local population. This could include information on timings updates, affects to any services/deliveries/access and a complaints procedure. Engagement should be culturally appropriate, including provision of non-technical information and communication in Gaelic. • Opportunities to include the local population in construction of the Proposed Development can be beneficial for health. Actions to ensure positive outcomes include providing opportunities for training and upskilling as well as prioritisation of hiring for local populations.
CHAPTER 15: Landscape & Visual	
No specific landscape mitigation measures have been proposed as part of the Proposed Development. The design of the Proposed Development has “built-in” mitigation through steps such as optimising the new breakwater height to maintain as low a height as possible and the use of natural rock to form the breakwater. The minimal lighting required for safety has been provided.	
CHAPTER 16: Cultural Heritage	
Stripping of topsoil for the compound may result in the disturbance of features associated with An Eala, in particular a revetting wall and possible ditch. The change in setting of heritage assets including Iona Nunnery, MacLean’s Cross, St Mary’s Abbey and Replica of St John’s Cross Change of appearance / character of Iona Conservation Area	• A reporting protocol has been developed to allow for the reporting and thereby appropriate recovery and recording of any cultural material encountered during the construction phase below the high-water mark. • Potential construction impacts above the high-water mark can be avoided by relocating the compound or be mitigated through a programme of archaeological works.

Potential Effects	Summary of Proposed Mitigation
	• A programme of archaeological work would offset the physical loss or disturbance of features affected by allowing for them to be recorded appropriately, with reporting to an appropriate level. • Works must be undertaken in line with a Written Scheme of Investigation (WSI) agreed with WoSAS and approved by the Local Planning Authority.
CHAPTER 17: Waste	
There is the potential for quantities of materials to be deposited in landfill sites The use of non-permitted waste contractors or unlicensed facilities could give rise to inappropriate management of waste and result in environmental impacts/ pollution Excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase The Proposed Development would support a slight increase in tourism using the ferry service and fishing/commercial vessels using the berthing opportunities which would result in a slight increase in litter and waste generation	• Argyll & Bute Council and their appointed contractor will ensure that all waste materials leaving the site will be transported via road by a registered and licensed carrier and arrive at a licensed / permitted site. Waste will only be disposed or recovered through licenced operators and in accordance with national waste legislation. • Site Waste Management Plan (SWMP). • Construction Environmental Management Plan (CEMP). • Construction Phase Monitoring.
CHAPTER 18: Greenhouse Gas Assessment	
Potential impacts during the construction phase could include: • Inaccessible construction site due to severe weather events (flooding, snow and ice, storms) restricting working hours and delaying construction; • Health and safety risks to the workforce during severe weather events; • Unsuitable conditions (due to very hot weather or very wet weather, for example) for certain construction activities; and • Damage to construction materials, plant and equipment, including damage, material storage areas and worksites, for example from stormy weather.	• Operational Environmental Management Plan (OEMP) - An OEMP will be developed to guide ongoing operations and maintenance activities during the life-cycle of the Project. The OEMP will also set out the procedures for managing and delivering the specific environmental commitments as per each technical chapter for each receptor over the operational period. • Adherence with the International Convention for the Prevention of Pollution from Ships (MARPOL) - All vessels will adhere to MARPOL requirements. Accordance with this will help to ensure that the potential for release of pollutants is minimised during operations. • Adherence with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the 'BWM Convention').

Potential Effects	Summary of Proposed Mitigation
Potential impacts on the Proposed Development during the operational phase include: • Material and asset deterioration due to high temperatures; • Health and safety risks to ferry users; • Damage to access roads from periods of heavy rainfall; and • Flood risk (surface, groundwater, fluvial and snow/ice melt) on the road network and damage to drainage systems with the potential for increased runoff from adjacent land contributing to surface water flooding.	
CHAPTER 19: Risk of Major Accidents & Disasters	
Major boat/construction vessel collision/allision (either with existing infrastructure, new infrastructure, other vessels or running aground) Accident to the general public on or near the shoreline Man overboard during construction Major pollution or sedimentation event affecting nearby designated sites Scour of the toe of the breakwater leading to movement and/or damage that could cause a health & safety risk	• Lighting at the end of the Breakwater – to avoid contact between vessels and the breakwater during the operation phase. • Scour protection – to reduce scour around the toe of the breakwater and avoid damage and movement of rock armour. • Type and sources of construction materials – constructing the breakwater from clean quarried local rock should help reduce the risk of pollution during construction phase and reduce transport distances • Utilities infrastructure – avoidance of sewer, telecommunications, gas and electricity infrastructure during construction is key as well as incorporating any existing infrastructure into the project design to avoid any unnecessary risks. • Safety fencing – to keep the general public away from construction areas or areas of potential danger. • Safety Boat – to help avoid collisions between vessels and contact with the shoreline or infrastructure during the construction phase. • Navigational Aids – to help avoid collisions between vessels and contact with the shoreline or infrastructure during both the construction and operation phase. • Safety lighting – to help avoid collisions between vessels and contact with the shoreline or infrastructure during both the construction and operation phase. • AIS coverage – to help avoid collisions between vessels during the construction phase. • Weather forecasts and operational weather limits – to avoid hazardous conditions during construction. • Updating ALRS and signalling directions – to help avoid collisions between vessels and contact with the shoreline or infrastructure during both the construction and operation phase. • Pollution response equipment – to help quickly respond to a major pollution event during the construction phase.

Potential Effects	Summary of Proposed Mitigation
	• SEPA's Floodline Warning Service – to be aware and plan for coastal flood events during the construction phase. This service also includes information on tidal extremes and may also be useful during the operation phase. • Ecological Clerk of Works (ECoW) – appointed to monitor the works in respect to biodiversity and species in the area. • Correct and secure storage of fuels, oils and chemicals – must be sited on an impervious base within a bund and secured. The base a.nd bund walls must be impermeable to the material stored and of adequate capacity • Marine Liaison Officer – to provide a point of contact for the marine works providing safety information to vessels in the area during the construction phase. • Notices to mariners – to provide details of construction activities. • Passage and operational planning – to provide details of altered routes during the construction and operation phase and scheduling construction activities to reduce disruption. • Communicating with stakeholders – to inform locals of movement of buoyed areas during the construction phase. • Navigation safety management process – to help manage vessel movements during the construction phase. • Construction Environmental Management Plan (CEMP). • Operational Environmental Management Plan (OEMP). • Environmental Management Plan (EMP). • Ensure waste arisings from the construction phase (especially with sediment disposal) are dealt with in a sustainable and legislatively compliant manner. • Oil Spill Contingency Plan – to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. • The safe operation of refuelling activities shall be in accordance with PPG 7 "Safe Storage". • Adherence with the International Convention for the Prevention of Pollution from Ships (MARPOL) – to help to ensure that the potential for release of pollutants is minimised during operations. • Site Waste Management Plan (SWMP). • Construction Phase Monitoring.

21 CUMULATIVE EFFECTS & ENVIRONMENTAL INTERACTIONS

21.1 Introduction

This chapter presents a summary of the assessment of cumulative effects which may arise from adjacent or nearby developments together with those predicted for the Proposed Development as well as the environmental interactions which have been examined within the individual technical assessment chapters (Chapters 6 –19).

21.1.1 Cumulative Effects

Cumulative effects address long-term changes that may result from the construction and operation of the Proposed Development in combination with other developments in the area.

Cumulative assessment is undertaken to ensure that the combined effects of the Proposed Development and other influences are assessed together, and not as individual aspects of the environmental assessment.

Cumulative effects are defined as changes to the environment that are caused by an action in combination with other actions, arising from:

- the interaction between existing and/or approved Projects in the same area; as required by Schedule 4 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and
- the interaction between the various impacts within a single Project.

The EU Guidance on the preparation of the Environmental Impact Assessment Report guidance states that it is important to consider effects, not in isolation, but cumulatively, as this may show that individually analysed impacts can become significant when they are added together, or with, other effects.

The coexistence of impacts may increase or decrease their combined impact. Impacts that are considered to be not significant, when assessed individually, may become significant when combined with other impacts.

Cumulative effects can occur at different temporal and spatial scales. The spatial scale can be local, regional or global, while the frequency or temporal scale includes past, present and future impacts on a specific environment or region.

The methodology for selecting the relevant Projects to be considered in-combination with the Proposed Development is presented in Section 21.2.

The experts leading each of the technical assessments (as presented in Chapters 6 –19), have defined significance thresholds and criteria for the cumulative effects assessment, using professional judgement and consideration of the relevant standards and guidelines via a collaborative approach, involving all the interested parties in the process of data collection and analysis, to determine whether in-combination effects give rise to additional levels of significance.

21.2 Assessment Methodology

The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the Proposed Development.

- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999);
- European Commission (EC) Guidance on the preparation of the Environmental Impact Assessment Report (2017);
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment Process in Scotland (SNH (now NatureScot) & HES, 2018);
- Scottish Planning Series Planning Circular: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017; and
- UK Planning Inspectorate (PINS) Advice Note 17: Cumulative effects assessment relevant to national significant infrastructure projects. Version 2, 2019.

The first step in determining cumulative effects comprised the identification of a list of other projects which may have the potential to overlap with the proposed redevelopment based on available information.

Other projects and plans that have been considered as part of this cumulative assessment have been identified through a desk study involving general internet searches and in particular, scrutiny of consenting authority websites.

The different developments considered as part of this cumulative assessment are those in close proximity to the Proposed Development and with the potential to interact with it. Those other projects whose impacts could foreseeably overlap with the construction or operation of the proposed redevelopment or where construction impacts may be consecutive but cumulative, were considered. The resulting selected developments comprise of:

- Projects in the area that are listed on the local planning authority website or Marine Scotland website;
- Projects at construction stage in the area;
- Projects that are at an advanced stage of planning; and
- Other Projects which have the potential to result in a cumulative impact.

The cut-off date for sourcing information on the other projects considered was 14th September 2022.

There are two proposed projects in the vicinity of the Proposed Development. These are listed below and summarised in the following sections:

- The Fionnphort Breakwater and Overnight Berthing Project; and
- British Telecom (BT) Cable installation – Iona to Fionnphort

21.2.1.1 Fionnphort Breakwater and Overnight Berthing Project

The proposed Fionnphort Breakwater and Overnight Berth Project consists of the construction of a new rock armour breakwater, overnight berthing facilities and associated dredging. The Proposed Development is located c1.3 km to the east of Iona, across the Sound (Figure 21-1).

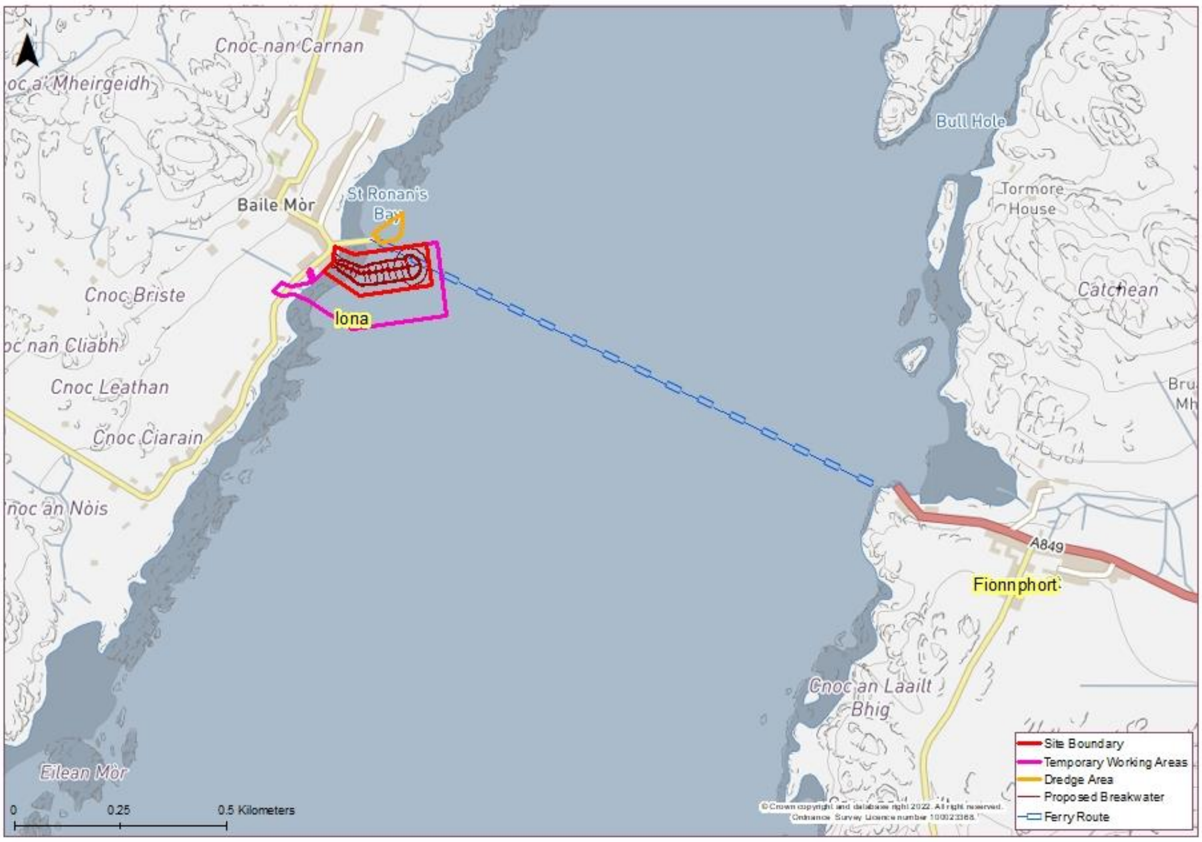

Figure 21-1 Location of proposed Fionnphort Project in relation to the Proposed Development

It is anticipated that the duration of the construction phase will be 52 weeks. This Proposed Development is in the final stages of design and so there is potential that this proposed project may be constructed in parallel with the construction phase of proposed Breakwater Project at Iona. The proposed Fionnphort development is likely to require some form of maintenance, such as maintenance dredging or maintenance of the breakwater and/ or berthing facility.

An EIA and HRA will be undertaken as part of the marine licencing application for the proposed Fionnphort Breakwater and Overnight Berthing Project, nonetheless it is likely that there would be potential for in-combination effects.

Although there is no spatial overlap between the two projects, given the proposed duration of the construction phase (52 weeks each), there is potential that the construction phase of both projects may occur concurrently. This has potential for in-combination effects.

21.2.1.2 BT cable installation – Iona to Fionnphort

BT are installing and operating 16 new telecommunication cables to extend superfast broadband coverage in three geographical regions of Scotland: Orkney; Shetland Islands; and the Inner Hebrides. The project is currently underway with the Shetland Islands cabling started in June 2022. Operations are scheduled to progress from Shetland to Orkney, via Fair Isle, then down the West coast. The delivery schedule for the fibre network installation on the Ross of Mull and Iona, remains the first half of 2023. The locations provided with the Marine Licence for this application are shown in Figure 21-2.

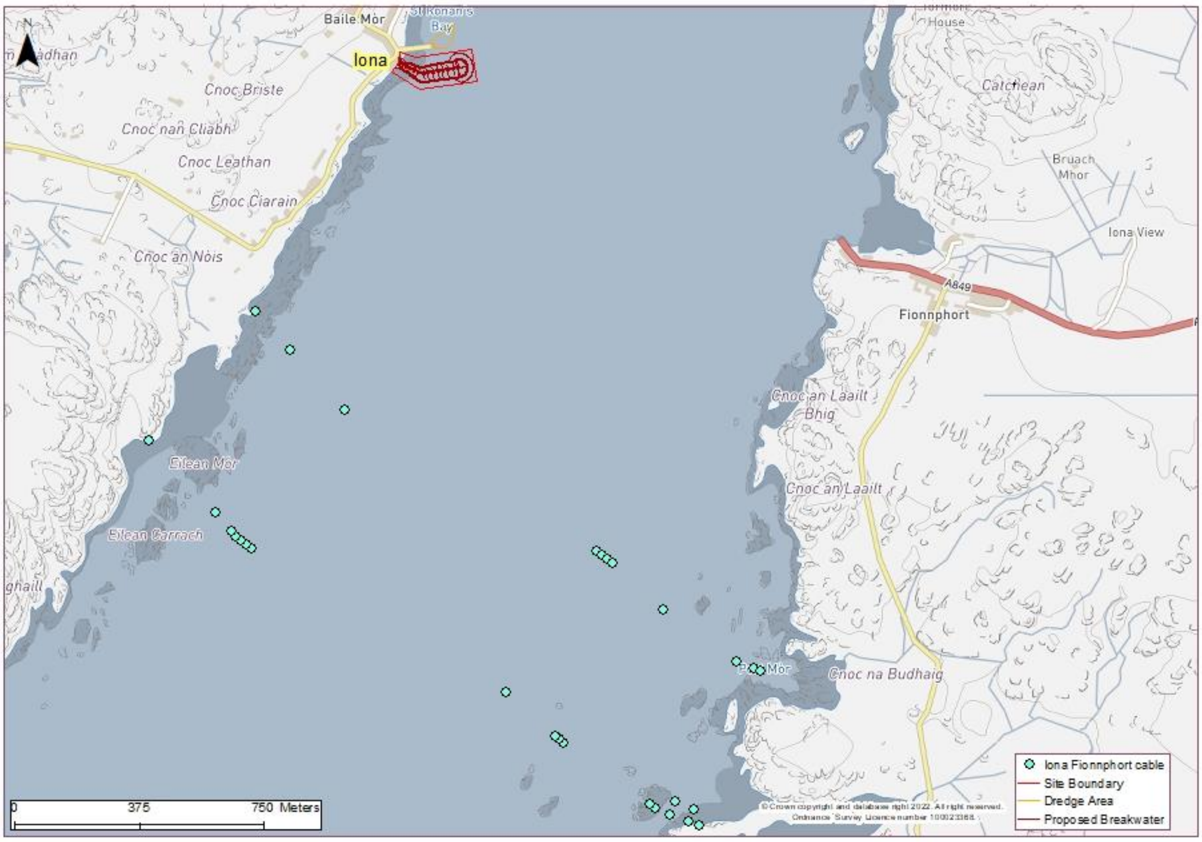

Figure 21-2 Proposed cabling location works in relation to the Proposed Development

The proposed locations for cabling works are located approximately 900 m to the south of the site boundary of the Proposed Development. The proposed cable lengths are 2.6 km. Burial of the cable is required (where sediments allow) to protect the optical fibre transmission path over the entire service life of the system and prevent interaction with the seabed and other sea users. Offshore the target burial depth will be to 1m below the seabed. Depths are subject to survey and other potential constraints. The cable types to be used for the R100 project are armoured fibre optic cables, which are a resilient cable type suitable for installation within Scottish waters. The cable system will be unrepeatered (an ‘unrepeatered system’ is a cable system without optical amplifiers due to the short overall length). The cable itself is between 25mm (single armour) and up to 46mm (rock armour) in diameter, depending on the level of cable armouring required. The optical fibres are contained within a gel filled stainless steel tube. This is surrounded by a polyethylene insulation layer. The construction of this core provides protection against water penetration and hydrogen. The core is further protected by layers of steel wire and an outer polypropylene yarn.

An Environmental Appraisal Report (EAR) was submitted to Marine Scotland on behalf of BT in November 2021. The Cable corridor between Iona and Mull (Fionnphort) is known as route 2.15 and passes across the Sound of Iona, between the bay of Port Mòr, south of Fionnphort and the eastern side of Iona. Section 5.3.7 of this AER notes that no Annex I habitats or PMFs have been recorded within 1 km of the cable corridor.

Although there is no spatial overlap between the projects, there is potential that the construction phase of the Proposed Development may coincide with the construction cabling works during the first half of 2023. This has potential for in-combination effects.

21.3 Assessment of Likely Significant Effects

21.3.1 Environmental Interactions between the Proposed Development and other Projects

When determining the significance of the cumulative effects of the Proposed Development and other existing and/or approved projects, consideration was given to the following factors:

- The Spatial and Temporal interactions between the Project and other projects;
- Identification of potential of cumulative effects by environmental topics and establish if a potential linkage exists using the source-pathway-receptor model;
- The type and duration of the impact - will it be temporary or permanent;
- The value and resilience of the receptor affected; and
- Mitigation measures that will be employed and the likelihood of their success

Table 21-1 provides a description of potential interactions between the Proposed Development and the other listed projects in the area which are deemed likely to have cumulative effects.

Table 21-1 Potential interactions between the Proposed Development and the other projects

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
Navigation & Safety: There is no potential for cumulative impacts on navigational safety during the operational phase due to the implementation of adequate risk controls that are needed to ensure marine safety. There will be no significant cumulative impacts during the construction phase.	N/A
Terrestrial Biodiversity: No information on the potential impacts of this work on <Red or habitats was available through the Marine Scotland website. There is the potential for cumulative impacts relating to disturbance for <Re using the Iona coastline. Given the distance between the sites, the presence of alternative foraging and commuting habitats for <Re to use along the coastline and inland and following implementation of the mitigation outlined in Section 7.5 and Appendix 7.2, it is considered that in-combination effects relating to <Re would be of negligible magnitude and their effects as of minor significance. In terms of the EIA Regulations this is deemed a non-significant effect.	Non-significant
Marine Biodiversity: The proposed project to be undertaken at Fionnphort, is likely to have the potential for cumulative effects. The main effects that require consideration are those that were identified to have significant effects on benthic receptors. The key effect to be considered within the assessment is 'Permanent habitat loss arising from the placement of material on the seabed for the breakwater' during the construction phase on benthic receptors. As there is likely to be a significant effect on seagrass, an agreement will be sought between the Iona Proposed Development and the Fionnphort project on the compensation/ mitigation strategy of the seagrass.	Significant
Ornithology: Two projects have been identified in the vicinity of the Proposed Development. These are listed below: • The Fionnphort Breakwater and Overnight Berthing Project No assessment has been made in respect to this development as yet, but it is anticipated that the impacts would be of a similar nature to the Proposed Development. Due to the distance and separation of the two developments by the Sound of Iona, it is unlikely that any in-combination effects on IOFs would occur. • Cable installation – Iona to Fionnphort The project involves the installation of fibre optic cable and is proposed in the first half of 2023. No information on the potential impacts of this work on birds was available through the Marine Scotland website. Given the distance between the sites and the presence of alternative foraging habitats along the coastline and inland, it is considered that that any in-combination effects would be negligible.	Non-significant
Terrestrial Noise & Vibration: Assumed worst case scenario that construction impacts of the Proposed Development may overlap with the construction of the Fionnphort Breakwater and Overnight Berthing Project, or cable installation – Iona to Fionnphort. Any cumulative construction noise or vibration impact is	Non-significant

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
predicted to be of local spatial extent, temporary duration, and intermittent. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be low.	
Water Quality: The Proposed Development at Fionnphort which could potentially give rise to in-combination effects from a water quality perspective was included for further assessment. Based on the modelling undertaken in the Coastal Processes chapter and the outputs of the MImAS assessment of both projects on the Sound of Iona costal water body, the cumulative impacts of both projects are unlikely to have a significant impact on during the construction and operational phases of the Proposed Developments. The potential for cumulative effects has been identified in Chapter 8 (Marine Biodiversity), due to the permanent long-term habitat loss experienced as a result of the structures' footprints during the operational phases. As there is likely to be a significant effect on seagrass, an agreement will be sought between the Iona Proposed Development and the proposed Fionnphort Project on the compensation/ mitigation strategy of the seagrass to ensure that the ecological status of the water body is not affected.	Non-significant
Flood Risk: There will be no cumulative impact on coastal flood risk when the Proposed Development is considered together with other Proposed Developments in the area.	N/A
Coastal Processes: In line with the scoping response received from MSS, the cumulative effects of the Proposed Development along with other developments were considered quantitively in a numerical model. The potential development at Fionnphort would be most relevant as it most likely has the greatest possibility of creating in-combination effects upon the coastal processes within the Sound of Iona when the two developments are in operation. In circumstances where the mitigation measures are fully implemented during the construction and operational phases, the impact of the Proposed Development on the coastal processes within the Sound of Iona would consist of small-scale, low magnitude changes in the tidal regime, wave climate, littoral currents, and sedimentology. The Proposed Development is therefore not expected to have a significant effect on coastal processes or make a significant change to the existing morphology.	Non-significant
Population & Human Health: No additional cumulative population and health effects are anticipated during construction and operation of the Proposed Development.	N/A
Landscape & Visual: The proposed Fionnphort Breakwater and Overnight Berth Project consists of the construction of a new rock armour breakwater, overnight berthing facilities and associated dredging. The proposed project is located c1.3km to the east of Iona, across the Sound. There is potential that this proposed project may be constructed in parallel with the construction phase of Proposed Development at Iona. Due to the separation distance of the two proposed projects and their location within existing harbours and settled areas while it will be possible to view both projects under construction within one combined view and sequentially the magnitude of impact will be small due to distance and immediate urban context at the two project sites. It is predicted that	Non-significant

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
when the proposed Fionnphort Breakwater and Overnight Berth Project is cumulatively assessed with the Proposed Development that a minor to moderate and not significant cumulative effect will occur. The proposed locations for cabling works are located approximately 900m to the south of the site boundary of the Proposed Development. The proposed cable lengths are 2.6km. Burial of the cable is required (where sediments allow) to protect the optical fibre transmission path over the entire service life of the system and prevent interaction with the seabed and other sea users. Offshore the target burial depth will be to 1m below the seabed. From a landscape and visual perspective, the cable once installed will not be visible with no change in landscape and visual resource. It is predicted that when the proposed cabling once installed is cumulatively assessed with the Proposed Development that no significant cumulative effect will occur.	
Cultural Heritage: The proposed Fionnphort Breakwater and Overnight Berth Project consists of the construction of a new rock armour breakwater, overnight berthing facilities and associated dredging. The proposed project is located c1.3km to the east of Iona, across the Sound. Given the distance of the proposed project from the Proposed Development, there is no potential for cumulative effects relating to the physical fabric of cultural heritage assets. Given the distance between the proposed project and the heritage assets on Iona, it is considered that Fionnphort and the proposed project does not form a part of their setting. There is therefore no potential for cumulative effects relating to setting. The proposed locations for cabling works are located approximately 900m to the south of the site boundary of the Proposed Development. Given its distance from the Proposed Development, there is no potential for cumulative effects relating to the physical fabric of heritage assets. The proposed cable will not be visible and there is therefore no potential for cumulative effects relating to setting.	Non-significant
Waste: With regards to the potential for cumulative effects associated with waste, the proposed Fionnphort Breakwater and Overnight Berthing Project has been considered. The source of current waste arisings associated with the Proposed Development is from the operation of the passenger ferry service from Fionnphort (the location of the proposed Fionnphort Breakwater and Overnight Berthing Project). Waste facilities are provided by CalMac Ferries Ltd. who provide recycling facilities at all their port locations for customers to recycle on the go. All waste generated and/or received at both the Iona Ferry Terminal and Fionnphort Ferry Terminal is currently managed and disposed by local authorities or licenced waste contractors. The management/ disposal route is at the discretion of the approved contractor. CalMac Ferries Ltd. have in place, an Environmental Strategy for 2021-2023 which outlines the company’s aims and actions to minimise their impact on the marine and terrestrial environments in which they operate. The Strategy outlines four core priorities which align with Scotland’s Environment Strategy, Scottish Government National Outcomes and the UN Sustainable Development Goals. One of the core priorities is “we generate minimal waste and sustainably use materials”. Waste management at the port is currently operated to best practice guidance	Non-significant

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
and is managed and disposed by local authorities or licenced waste contractors. It is imperative that CalMac Ferries Ltd. Environmental Strategy and relevant policies and procedures are followed and that any additional waste that may arise are considered. Through continued adherence to this Environmental Strategy and relevant policies and procedures, there is not likely to be cumulative effects associated with waste arising from the Proposed Development with the proposed Fionnphort Breakwater and Overnight Berthing Project.	
Greenhouse Gas Assessment: The cumulative impact of carbon emissions arising from global human activity is *High*. This is true to the nature of climate change as a global, cumulative problem. As committed developments have been assessed throughout this EIAR the potential inter-scheme cumulative effects during the operational phase of the development have already been considered. It is assumed that all committed developments will be required to meet relevant standards for emissions reduction and to comply with related planning policy. On this basis, it is considered appropriate to assume that any applications that are consented include 'reasonable' measures to avoid, reduce and /or offset the generation of greenhouse gas emissions and therefore that no significant cumulative effects are anticipated.	Non-significant
Risk of Major Accidents & Disasters: The Fionnphort Breakwater and Overnight Berthing Project is being developed alongside the Proposed Development. Therefore, it is likely that cumulative effects may be experienced when constructing the two projects. The Fionnphort Overnight Berthing Project is likely to have many of the same risks of major accidents and disasters as the Proposed Development. This means that the Risk Events described in this chapter may be exacerbated, depending on whether works are being carried out at the same time. However, there is potential that these can be mitigated through adherence to the mitigation measures proposed within specialist topic chapters. BTs installation of superfast broadband cables for the Ross of Mull and Iona is likely to get underway during the first half of 2023. While the cabling will be installed around 900m south of the proposed Iona Breakwater, there is still likely to be some cumulative effects if the two projects are undertaken at the same time. The most likely cumulative effect is the risk of collisions between construction vessels. This is possible due to increased vessel traffic in the Sound of Iona during the construction phase. The same logic applies to the risk of accidents to the general public and the risk of a man overboard. The potential for a major pollution / sedimentation event is also another effect that may be pronounced by the two projects being undertaken at the same time. Due to both projects requiring dredging activities, it is more likely for a major sedimentation event to occur. Furthermore, due to increased vessel activity in the Sound of Iona during the construction phase there is an increased likelihood of a pollution event occurring. However, there is potential that these can be mitigated through adherence to the mitigation measures proposed within the specialist topic chapters.	Non-significant

As identified in Table 21-1, the proposed project to be undertaken at Fionnphort, is likely to have the potential for cumulative effects with regards to 'Permanent habitat loss arising from the placement of material on the seabed for the breakwater' during the construction phase on benthic receptors.

At Iona, permanent long-term habitat loss will occur directly under the new breakwater structure (i.e., not including the temporary working area). The overall footprint of the breakwater is approximately 10,037 m^2, with approximately 149,812 tonnes of rock armour to be laid. The works will be carried out once but will remain in situ for up to 120 years for the design life and will be non-reversible.

At Fionnphort, permanent long-term habitat loss will occur directly under the new breakwater structure. The overall footprint of the breakwater is approximately 4,200 m^2 (this is based on the Fionnphort Scoping Report dated July 2021 and therefore may be subject to slight variation). The works will be carried out once but will remain in situ for up to 120 years for the design life and will be non-reversible.

The potentially combined permanent loss of habitat due to the breakwaters would be 7,000 m^2.

As such, a 'Seagrass Compensation and Monitoring Plan' has been proposed. Direct habitat loss is predicted to occur as a result of the Proposed Development, therefore to ensure that seagrass habitat is not permanently lost, compensation will be undertaken to ensure that the habitat is restored. An assessment has already been undertaken in the form of the intertidal and subtidal survey, with the extent of biotopes derived. This data will be used to inform the 'Seagrass Compensation and Monitoring Plan'.

As there is likely to be a significant effect on seagrass, an agreement will be sought between the Iona Proposed Development and the Fionnphort project on the compensation/ mitigation strategy of the seagrass. This approach should be agreed upon with Marine Scotland, its advisors, and in consultation with seagrass restoration projects, with reference to documents such as Seagrass restoration in Scotland - handbook and guidance (Kent *et al*., 2021) and Seagrass Restoration Handbook (Gamble *et al.*, 2021).

21.3.2 Environmental Interactions within the Proposed Development

This section of the EIAR determines the potential for environmental interactions within the Proposed Development, between specialist topic chapters.

Environmental factors are inter-related to some degree, and these interactions can exist on many levels. This section summarises the primary interactions between the environmental topics and provides a matrix to coherently display them.

Table 21-2 identifies the interacting topics which are then discussed further in the following sections.

Table 21-2 Proposed Development environmental interactions

	Navigation & Safety	Terrestrial Biodiversity	Marine Biodiversity	Ornithology	Terrestrial Noise & Vibration	Water Quality	Flood Risk	Coastal Processes	Population & Human Health	Landscape & Visual	Cultural Heritage	Waste	GHG Assessment	Risk of Major Accidents & Disasters
Navigation & Safety														
Terrestrial Biodiversity														
Marine Biodiversity														
Ornithology														
Terrestrial Noise & Vibration														
Water Quality														
Flood Risk														
Coastal Processes														
Population & Human Health														
Landscape & Visual														
Cultural Heritage														
Waste														
GHG Assessment														
Risk of Major Accidents & Disasters														

Navigation & Safety

During the construction phase of the Proposed Development there is potential for the interaction between Navigation & Safety with Marine Biodiversity, Population and Human Health and the Risk of Major Accidents and Disasters. These interactions and effects are fully assessed within Chapter 6, Section 6.4.1 and Chapter 19, Section 19.4.

Marine Biodiversity

During the construction phase of the Proposed Development there is potential for the interaction between Marine Biodiversity with Navigation & Safety, Water Quality, Coastal Processes and the Risk of Major Accidents and Disasters. These interactions and effects are fully assessed within Chapter 8, Section 8.7.2 and Chapter 19, Section 19.4.

Terrestrial Noise & Vibration

During the construction phase of the Proposed Development there is potential for the interaction between Terrestrial Noise & Vibration with Population & Human Health. These interactions and effects are fully assessed within Chapter 10, Section 10.4.2.

Water Quality

During the construction phase of the Proposed Development there is potential for the interaction between Water Quality with Coastal Processes, Marine Biodiversity and the Risk of Major Accidents and Disasters. These interactions and effects are fully assessed within Chapter 11, Section 11.3.1 and Chapter 19, Section 19.4.

Flood Risk

During the construction phase of the Proposed Development there is potential for the interaction between Flood Risk and the Risk of Major Accidents and Disasters. This interaction is fully assessed within Chapter 19, Section 19.4.

Coastal Processes

During the construction phase of the Proposed Development there is potential for the interaction between Coastal Processes with Marine Biodiversity and Water Quality. These interactions and effects are fully assessed within Chapter 13, Section 13.4.1.

Population & Human Health

During the construction phase of the Proposed Development there is potential for the interaction between Population & Human Health with Navigation & Safety and Terrestrial Noise and Vibration. These interactions and effects are fully assessed within Chapter 14, Section 14.4.1.

Landscape & Visual

The Proposed Development has the potential for interaction between Landscape & Visual effects with Cultural Heritage. These interactions and effects are fully assessed within Chapter 15, Section 15.5.

Cultural Heritage

The Proposed Development has the potential for interaction between Cultural Heritage and Landscape & Visual effects. These interactions and effects are fully assessed within Chapter 16, Section 16.5.

Risk of Major Accidents & Disasters

During the construction phase of the Proposed Development there is potential for the interaction between the Risk of Major Accidents & Disasters with Navigation & Safety, Marine Biodiversity, Water Quality and Flood Risk. These interactions and effects are fully assessed within Chapter 19, Section 19.4.

22 SUMMARY & CONCLUSIONS

The assessment presented within the EIAR has identified and documented impacts arising from the Proposed Development. These impacts have been assessed as to whether or not they are likely to result in significant effects. Where significant effects have been predicted, measures to avoid or mitigate these effects have been included so that, where possible, they are no longer significant.

The overall objective of the Proposed Development is to provide improved access facilities for the Iona ferry which operates across the Sound of Iona, between the two villages of Fionnphort and Iona. The Iona ferry, operated by CalMac, operates daily all year round. After traversing the Sound, the ferry holds its position at Iona using the weight of the ramp and the friction between the ramp and the slipway deck, however the slipway at Iona is currently very vulnerable to waves, particularly from the south, resulting in the ramp of the ferry rising and falling from the deck of the slipway. The instability of the ferry, as a result of swells, presents a risk to both ferry operators, passengers embarking and disembarking, vehicles and other slipway users.

During storm events or periods of intense wave action, the health and safety risk associated with the current berthing practice means that the ferry is not able to operate. Ferry users are therefore not able to access Iona, or in fact, may become trapped at Iona until the ferry is able to operate again. This presents issues such as lack of accommodation (visitor accommodation on Iona is limited to two hotels, a number of B&Bs, self-catering units, and a campsite), with tourists having to sleep in their vehicles[46] and subsequent reputational issues, with tourists unlikely to revisit after having a poor experience. In addition, there is no shelter or indoor waiting area for ferry passengers in times of unfavourable weather conditions. This often presents difficulties where the weather is either wet or windy.

The current berthing practice also has a negative impact on service provision to residents of Iona. These problems have had a direct impact on the lives of the people who live there. A day without a ferry operating, results in essential services to the island being affected – medical, educational, refuse collection, business delivery etc.

In addition to ferry operation, the Island and the Sound bring people visiting on holiday, including discernible increases in the total numbers of leisure yachts, which sail around Mull and Iona in the summer season berthing within the Sound as a safe overnight mooring. This is an opportunity for these visitors to eat locally as well as stock up on supplies.

The Proposed Development aims to address these issues by making the connection between the Isle of Mull and Iona safer, more efficient and more attractive to both ferry customers and leisure sailors. The Proposed Development is intended to make the ferry crossings more reliable and safer. It is not intended to increase the frequency of the ferry crossings and thereby no change in vessel traffic is expected as a result of the works.

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[46] BBC News Article 2021 - https://www.bbc.co.uk/news/articles/ce9n25zeyx1o

With adherence to a CEMP and with implementation of the mitigation laid out in the EIAR, most negative effects from the Proposed Development will generally not be significant. However, some significant negative effects may potentially be experienced by a number of receptors.

Given the remote nature of Iona, the landscape and visual setting will potentially be significantly affected by the Proposed Development. Moderate to major localised and direct long-term effects have been identified for a number of landscape and visual receptors. These are generally localised to coastal fringe areas and in close proximity to the breakwater and reduce to minor to moderate, and not significant, with increased distance from the Proposed Development.

In addition, although there will be no direct physical effects on cultural heritage, significant effects have been identified on the character and appearance, and the aesthetic and spiritual value of several heritage receptors. The island is considered as a place of pilgrimage and it is considered that the appearance of the Proposed Development at the point of arrival on the island will detract from the experience of the pilgrimage assets, in particular, their aesthetic and spiritual value. The Proposed Development site also lies at the fringe of the Baile Mòr Conservation Area and will be visible from several locations within it. This will have a significant but localised impact upon its character and appearance and the contribution of the Conservation Area's setting.

It is not possible to mitigate against these visual effects and changes in aesthetic value. A range of alternative designs have been previously assessed, as discussed within this EIAR, however to date, no alternative design has been identified, which provides the required level of protection, without compensating on other health and safety aspects (i.e., reduced visibility of overtopping waves), whilst also being as small in crest height and width as practicable.

As well as the above effects on visual and aesthetic settings, the Proposed Development has been assessed with respect to effects on marine environmental receptors. The assessment determined that 'Permanent habitat loss for the benthic habitat 'Zostera marina/angustifolia beds on lower shore or infralittoral clean or muddy sand A5.5331' (seagrass), arising from the placement of material on the seabed for the breakwater' was deemed of moderate significant effect. Seagrass is also a biological element contributing to water body status, under the WFD. To address the moderate significant effect of the temporary and permanent habitat loss, a 'Seagrass Compensation and Monitoring Plan' has been proposed to reduce the impact of the Proposed Development on seagrass receptors.

However, it should also be noted that minor positive effects associated with benthic ecology and fish and shellfish are anticipated due to the breakwater creating a hard habitat for colonisation and refuge. With the exception of the loss in footprint of seagrass currently present, the remaining biological elements are deemed to be of low vulnerability, high recoverability and local to international importance. Therefore, the assessment determined the significance of effect on the biological elements, other than seagrass (angiosperms) as minor (positive) and not significant in EIA terms.

Following implementation of the mitigation and/or compensation measures proposed, all other environmental effects have been deemed as not significant.

In addition to the above, a HRA has been undertaken as part of development consent, to determine the potential for the Proposed Development to have a LSE on designated sites in the UK national network of sites (‘European sites’). The potential for LSE could not be excluded at the screening stage for three European sites (Inner Hebrides and Minches SAC; Treshnish Isles SAC; and Eileanan agus Sgeiran Lios mor SAC.), without further evaluation, or the application of mitigation measures intended to reduce effects of the Proposed Development on the European sites concerned.

A subsequent assessment to inform a Stage 2 Appropriate Assessment of the implications of the Proposed Development on European sites allowed the introduction of measures intended to avoid or reduce the potential adverse effects of the Proposed Development on European sites. These measures ensure that the Proposed Development will not undermine the conservation objectives of the sites concerned, and as such will not adversely affect the integrity of any European site.

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