BRIMS
TIDAL ARRAY

openhydro
a DCNS company

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Environmental Statement

Volume 2-C

May 2016

Table of Contents

Table of Figures

Table of Tables

Acronyms

AA	Appropriate Assessment
AC	Alternating Current
ADBA	Archaeological desk-based assessment
ADCP	Acoustic Doppler Current Profiler
AfL	Agreement for Lease
AIF	Anticipated Impact Footprint
AIS	Automatic Identification System
AoS	Area of Search
ASCOBANS	Agreement on Conservation of Small Cetaceans of the Baltic and North Seas
ATBA	Area to be Avoided
B.P.	Before Present
BATNEEC	Best Available Technology Not Entailing Excessive Costs
BDMPS	Biologically Defined Minimum Population Size
BOCC	Birds of Conservation Concern
BPI	Burial Protection Index
BTAL	Brims Tidal Array Limited
BTO	British Trust for Ornithology
CAP	Common Agricultural Policy
CCGT	Combine Cycle Gas Turbine
CD	Chart Datum
CEMD	Construction Environmental Management Document
CfD	Contract for Difference
CHTDL	Cantick Head Tidal Development Limited
CIA	Cumulative Impact Assessment
CIRIA	Construction Industry Research and Information Association
CITES	Convention on International Trade in Endangered Species
CO_2	Carbon Dioxide

COWRIE	Collaborative Offshore Wind Research into the Environment
CPA	Coastal Protection Act
CRM	Collision Rate Model
CWMTA	Cape Wrath Military Training Area
DBA	Desk-based Assessment
DECC	Department of Energy and Climate Change
DfT	Department for Transport
DIO	Defence Infrastructure Organisation
DP	Dynamic Positioning
DP (vessel)	Dynamic Positioning (vessel)
DTI	Department of Trade and Industry
EC	European Commission
ECoW	Ecological Clerk of Works
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EGA	Expert Geomorphological Assessment
EIA	Environmental Impact Assessment
EMD	Environmental Management Document
EMEC	European Marine Energy Centre
EMF	Electro-Magnetic Field
EMMP	Environmental Mitigation Monitoring Plan
EMR	Electricity Market Reform
EPS	European Protected Species
ERCoP	Emergency Response Cooperation Plan
ERM	Encounter Rate Model
ES	Environmental Statement
ESAS	European Seabirds at Sea
ETA	Engineering Technology Applications Limited

ETI	Energy Technologies Institute
ETV	Emergency Towing Vehicle
EU	European Union
FAD	Fish Aggregation Device
FAO	Food and Agricultural Organisation
FCS	Favourable Conservation Status
FEPA	Food and Environment Protection Act
FRS	Fisheries Research Services
FSA	Formal Safety Assessment
GBS	Gravity Base Structure
GCR	Geological Conservation Review
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GVA	Gross Value Added
GW	Gigawatt (power)
GWDTE	Ground Water Dependent Terrestrial Ecosystem
HAT	Horizontal Axis Turbine
HDD	Horizontal Directional Drilling
HIE	Highlands and Islands Enterprise
HRA	Habitats Regulations Appraisal
HSE	Health and Safety Executive
HVAC	High Voltage Alternating Current
IAMMWG	Inter-Agency Marine Mammal Working Group
ICES	International Council for Exploration of the Sea
ICIT	International Centre for Island Technologies
IEEM	Institute of Ecology and Environment Management
IHO	International Hydrographic Organisation

IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative Reasons of Overriding Public Interest
IUCN	International Union for Conservation of Nature
IWC	International Whaling Convention
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LBAP	Local Biodiversity Action Plan
LCCA	Local Coastal Character Areas
LNCS	Local Nature Conservation Site
LSE	Likely Significant Effect
MAIB	Marine Accident Investigation Branch
MBES	Multibeam Echo-Sounder
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MDA	Military Danger Area
MEG	Marine Energy Group
MEHRA	Marine Environmental High Risk Area
MESH	Mapping European Seabed Habitats
MGN	Marine Guidance Notice
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMEA	Marine Modelling Enabling Action
MMFR	Mean Maximum Foraging Range
MMMP	Marine Mammals Management Plan
MNCR	Marine Nature Conservation Review
MoD	Ministry of Defence

MPAs	Marine Protected Areas
MRESF	Marine Renewable Energy Strategic Framework
MS	Marine Scotland
MSI	Maritime Safety Information
MSL	Mean Sea Level
MS-LOT	Marine Scotland Licensing Operations Team
MU	Management Units
MW	Megawatt (power)
NBN	National Biodiversity Network
NCI	Nature Conservation Importance
NCMPA	Nature Conservation Marine Protected Area
NGET	National Grid Electricity Transmission
NLB	Northern Lighthouse Board
NMR	National Monuments Record
NPF	National Planning Framework
NPPG	National Planning Policy Guidance
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NREAP	National Renewable Energy Action Plan
NSA	National Scenic Area
NSIP	National Significant Infrastructure Projects
NSP	Noise Sensitive Property
NTU	Normal Turbidity Unit
OBRC	Orkney Biodiversity Records Centre
OCT	Open-Centre Turbine
ODBOA	Orkney Dive Boat Owners Association
OFA	Orkney Fisheries Association
OFS	Orkney Fisherman’s Society

OIC	Orkney Islands Council
ORCA	Orkney Research Centre for Archaeology
OREI	Offshore Renewable Energy Installations
OS	Ordnance Survey
OSF	Orkney Sustainable Fisheries
PAC	Pre Application Consultation
PAM	Passive Acoustic Monitoring
PAT	Pop-up Archival Tags
PBD	Project Briefing Document
PBR	Potential Biological Removal
PEMP	Project Environmental Management Plan
PFOW	Pentland Firth and Orkney Waters
PHA	Preliminary Hazard Analysis
RAF	Royal Air Force
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
REE	Roving Eye Enterprises
REZ	Renewable Energy Zone
RIB	Rigid Inflatable Boat
RLG	Regional Locational Guidance
RNLI	Royal National Lifeboat Institution
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAMS	Scottish Association of Marine Science
SAR	Search and Rescue
SCADA	Supervisory Control And Data Acquisition
SEA	Strategic Environmental Assessment

SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SHEPD	Scottish Hydro Electric Power Distribution
SHE-T	Scottish Hydro Electric Transmission PLC
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMRU	Sea Mammal Research Unit
SMS	Safety Management System
SNH	Scottish Natural Heritage
SOPEP	Shipboard Oil Pollution Emergency Plans
SPA	Special Protection Area
SPFA	Scottish Pelagic Fisherman's Association
SPP	Scottish Planning Policy
SSB	Subsea Base
SSC	Suspended Sediment Concentrations
SSSI	Sites of Special Scientific Interest
STW	Scottish Territorial Waters
T	Tonnes
TCE	The Crown Estate
TEC	Tidal Energy Converters
THC	The Highland Council
TSS	Turbine Support Structure
TWh	Terawatt Hour
UFEN	UK Fisheries Economics Network
UKBAP	UK Biodiversity Action Plan
UNCLOS	United Nations Convention of the Law of the Sea
VMP	Vessel Management Plan
VMS	Vessel Monitoring System
VTS	Vessel Traffic Service

WANE	Wildlife and Natural Environment Licences
WCA	Wildlife and Countryside Act
WDC	Whale and Dolphin Conservation
WHS	World Heritage Site
ZTV	Zone of Theoretical Visibility

Shipping and Navigation

Chapter 15

15 SHIPPING AND NAVIGATION

15.1 INTRODUCTION

This chapter of the Environmental Statement (ES) considers the potential effects of the Brims Tidal Array Project (the Project) on shipping and navigation. It summarises the work undertaken in the Navigation Risk Assessment (NRA) carried out by Anatec Limited. Baseline data was collected for the area, including a total of 28 days maritime traffic survey data covering all vessel types and sizes. Consultation was also carried out on maritime activity in the area with a range of local and national stakeholders, including a hazard review workshop held on Orkney. This was used to inform the navigation impact (risk) assessment.

This chapter has linkages with, and should be read in conjunction with Chapter 16 Commercial Fisheries, Chapter 19 Socio-economics and Chapter 20 Recreation and Tourism.

15.2 STUDY AREA

The purpose of this impact assessment is to assess potential impacts on shipping and navigation in the vicinity of the Project and adjacent waters. The area of interest comprises the AfL boundary plus a 5 nautical mile (nm) buffer, presented in Figure 15.1. This area was chosen to encompass all the traffic potentially directly affected by the Project, including vessels to/from Scapa Flow and vessels rounding Hoy, as well as vessels from further afield, such as traffic transiting the Outer Sound of the Pentland Firth, which could in theory drift towards the site if they were set to the north (although it is noted the general tidal flows are east to west).

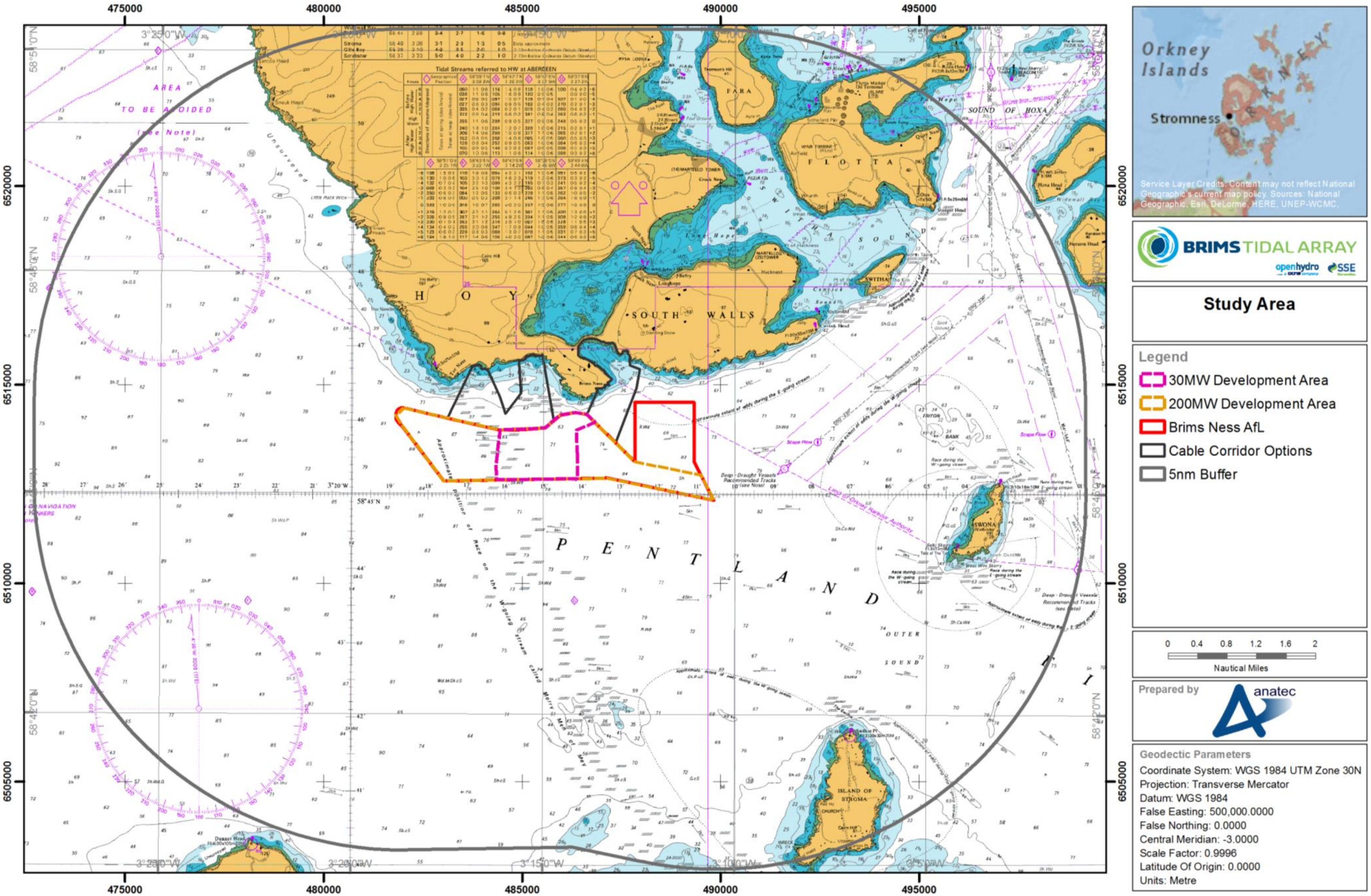

Figure 15.1: Study area

15.3 DESIGN ENVELOPE CONSIDERATIONS

The maximum 'worst case' project parameters that the Shipping and Navigation impact assessment considers are presented in Table 15.1. (Note: 1nm = 1.852km; $1nm^2 = 3.43km^2$).

Table 15.1: Design envelope parameters for shipping and navigation assessment

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment	Explanation of maximum Project parameters
Subsea tidal turbines (Stage 1)	30 x subsea turbines with minimum spacing between turbines of 80m and minimum under water clearance of 30m at LAT	Maximum number of turbines for Stage 1, with minimum spacing and under water clearance used in impact assessment and risk modelling
Area of turbine deployment area within AfL area (Stage 1)	$0.8nm^2$ ($2.9km^2$)	Maximum area in which subsea turbines are deployed for Stage 1
Inter-array cables (Stage 1)	32 x 33kV cables, with footprint of $0.02nm^2$ ($0.07km^2$)	Maximum number and footprint area of inter-array cables used in impact assessment ($1km^2 = 0.29nm^2$)
Export cables (Stage 1)	4 x export cables, surface laid which, with protection may occupy a total corridor width on the seabed of 20m. Length to depend on potential landfall option.	Maximum number and footprint area of export cables used in impact assessment
Subsea tidal turbines (Stage 1 & 2)	200 x subsea turbines with minimum spacing between turbines of 80m and minimum under water clearance of 30m at LAT	Maximum number of turbines for Stage 1 & 2, with minimum spacing and under water clearance used in impact assessment and modelling
Area of turbine deployment area within AfL area (Stage 1 & 2)	$2.5nm^2$ ($8.5km^2$)	Maximum area in which subsea turbines are deployed for Stage 1 & 2 ($1km^2 = 0.29nm^2$)
Inter-array cables (Stage 1 & 2)	208 33kV cables, with footprint of $0.1nm^2$ ($0.36km^2$)	Maximum number and footprint area of inter-array cables used in impact assessment ($1km^2 = 0.29nm^2$)
Export cables (Stage 1 & 2)	16 x export cables, surface laid which, with protection may occupy an 80m wide corridor on the seabed (5m per cable). Length to depend on potential landfall option	Maximum number and footprint area of export cables used in impact assessment
Export cable route (Stage 1 & 2)	Export cable from AfL area to Sheep Skerry (2.5km), or Moodies Eddy (2.6km) or Aith Hope (6.5km).	Consideration will be given to all options as the preferred route will be determined during detailed design.
Turbine design life	25 years	Maximum time for which the Project will be in place

15.4 LEGISLATIVE FRAMEWORK AND POLICY CONTEXT

EIA Regulations (Chapter 3 Policy and Legislation) are the only legislation directly relevant to this assessment. However, there are a number of guidance documents available which provide further detail on the aspects of the Shipping and Navigation environment that should be assessed and how the assessment should be undertaken. The primary guidance followed in the assessment is:

- Department of Energy and Climate Change (DECC) (in association with Maritime and Coastguard Agency (MCA)) Guidance on the Assessment of Offshore Wind Farms – Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREI) (DECC, 2013);
- MCA Marine Guidance Notice 371 (MGN 371 M+F) – Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response Issues, (MCA, 2008a); and
- MCA Under Keel Clearance Policy Paper – Guidance to Developers in Assessing Minimum Water Depth Over Tidal Devices (NOREL, 2014).

The guidance, which was predominantly prepared for the assessment of offshore wind farms, has been adapted where necessary for the Project, for example, to take account of under keel clearance.

Other forms of guidance used in this assessment are listed:

- MCA Marine Guidance Notice 372 (MGN 372 M+F) OREIs Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA, 2008b)[1];
- International Association of Marine Aids (IALA) Recommendation O-139 On The Marking of Man-Made Offshore Structures, Edition 2, (IALA, 2013);
- International Maritime Organisation (IMO), Guidelines for Formal Safety Assessment (FSA) (IMO, 2002);
- Royal Yachting Association (RYA) – The RYA's Position on Offshore Renewable Energy Developments: Paper 3 – Tidal Energy (RYA, 2013); and
- Offshore Renewable Energy Installations – Compliance with Search and Rescue Requirements (MCA, 2015).

It is also noted that part of the AfL area lies within the Orkney Harbour limits (as shown in Figure 15.1). Although no tidal devices are planned to be deployed within the harbour limits, the regulations and byelaws of the harbour authority will be followed for any activity taking place within their waters, such as vessel movements, cables, temporary wet storage areas and anchorages (where applicable).

[1] Note that MGN 371 was replaced by MGN 543 in February 2016. The NRA and associated Shipping and Navigation assessments were completed before this and so MGN 371 was used and referenced throughout the ES.

15.5 SUPPORTING SURVEYS AND STUDIES

A list of supporting studies relevant to the Shipping and Navigation impact assessment is presented:

- Navigation Risk Assessment Brims Tidal Array (Supporting Document: Anatec, 2015);
- Maritime Traffic Survey – Winter 2013 (Supporting Document: Anatec, 2014a);
- Maritime Traffic Survey – Summer 2014 (Supporting Document: Anatec, 2014b);
- Preliminary Hazard Analysis (PHA) Brims Tidal Array (Supporting Document: Anatec, 2013); and
- Traffic Survey during Geophysical Work (Supporting Document: Anatec, 2012).

15.6 DATA GAPS AND UNCERTAINTIES

The two 14 day maritime traffic surveys identified all vessels in the area of all types and sizes based on using a combination of AIS, radar and visual observations. The survey timetable was designed to encompass different seasons, (summer and winter) weather conditions (calm up to Beaufort 8) and tidal states (spring and neaps). The minimum four weeks data were collected as specified in MCA MGN 371.

It is recognised that small, inshore vessel activity (typically less than 12m length) can be variable through the year and dependent on other factors such as quotas and the migration of fish species (in the case of fishing vessels), as well as weather, tide and seasonal factors. To overcome this, long-term data sources have been used such as the Succorfish data set (Section 15.9.2) and Marine Scotland recreational shipping research (Section 15.9.8), combined with consultation with local stakeholders to inform an up-to-date baseline. In addition to this, Chapter 16 Commercial Fisheries uses long-term desk-based studies of fisheries data supplemented by consultation with fishermen. Therefore, it is considered that the best available data has been used in the assessment.

15.7 CONSULTATIONS

A complete list of feedback from all consultees is summarised in Supporting Document (Anatec, 2015). The key points raised by stakeholders regarding Shipping and Navigation are presented in Table 15.2.

Since the commencement of the Project, and throughout its evolution, consultation on shipping and navigation has been ongoing. Stakeholder consultation was initially carried out based on the original AfL area and OpenHydro technology, with meetings taking place in May 2012. Further meetings on the revised site and alternative technologies were held with Orkney Fisheries Association and Orkney Islands Council (OIC) Marine Services in July 2013.

Further consultation took place with the Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB), Royal Yachting Association (RYA) Scotland and Scottish Fishermen’s Association (SFA) on the final design envelope. Local stakeholders were consulted about this during the Hazard Review Workshop. Outputs from the Workshop were used in the impact assessment, with full details of the Workshop presented in the Navigational Risk Assessment (NRA) (Supporting Document: Anatec, 2015).

Table 15.2: Key issues raised by stakeholder during consultation

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Shipping and navigation – General Project Briefing Document (PBD) response – May 2012	MCA	ES should supply detail on the possible impact on navigational issues for both commercial and recreational craft NRA should be submitted in accordance with MGN 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing Tidal Arrays (and Wind Farms) NRA should relate to safe under keel clearance	EIA and NRA carried out in accordance with MGN 371 and 372 and the DTI/DfT/MCA Risk Assessment Methodology Under keel clearance assessment takes into account MCA Policy Paper	Entire ES and NRA. Specifically Section 15.12 Impacts considers possible impacts/risks to navigation, including the risk of allision.
Shipping and navigation – Fishing PBD response – May 2012	MS-LOT and MS Science	ScotMap data to be consulted	ScotMap data has been reviewed as part of the EIA and NRA	Baseline description, Section 15.9.7 Fishing vessel activity – ScotMap data reviewed
Shipping and navigation – Fishing PBD response – May 2012	MS Science	Data on fishing vessel activity show large amount of demersal vessels in the area. These vessels likely to be transiting rather than fishing	Long-term data sets used to characterise fishing in the area (survey, sightings and VMS)	Baseline description, Section 15.9.7 Fishing vessel activity
Shipping and navigation – General PBD response – May 2012	NLB	Marking and lighting recommendations will be made in a formal response through Marine Licensing process Discourage use of offshore surface piercing substation	Indicative feedback on marking and lighting obtained in consultation with NLB Offshore surface piercing elements have been removed from the design envelope	Section 15.3 Design Envelope Considerations. Section 15.11 Mitigation Measures – included as project design mitigation measure
Shipping and navigation – General	Orkney Islands Council (OIC) Marine Services	OIC Marine Services should be part of regulator group. Flotta Oil Terminal and Longhope RNLI additional contacts.	All organisations were included in the consultation and invited to the Hazard Review Workshop	Responses to consultation considered in entire assessment

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
PBD response – May 2012	(Harbour Authority)			
Shipping and navigation – Fishing PBD response – May 2012	Orkney Fisherman's Society (OFS) and Orkney Fisheries Association (OFA)	Stakeholders to be kept informed of changes in AfL area boundaries	This was done by the Project and during consultation on the NRA	n/a
Shipping and navigation – Passenger ferry PBD response – May 2012	NorthLink Ferries	Main concern over whether there will be an exclusion zone as the area is frequently transited in winter when there is heavy westerly swell Movement of the AfL area further west would be a positive change	No plans for operational safety zones, only temporary rolling zones during construction AfL area moved west from original position	Section 15.11 Mitigation Measures – Included as project design mitigation measure Chapter 5: Project Description
Shipping and navigation – General PHA Consultation – May 2012	MCA and DfT	Issues regarding under keel clearance and mariner's perception of risk Concern regarding cable burial depths	Under keel clearance risk assessment carried out in-line with MCA guidance Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation	Section 15.12 Impacts – Considers allision risk Section 15.12 Impacts – Considers vessel interaction with export cable
Shipping and navigation – General PHA Consultation – July 2013	OIC Marine Services	AfL area overlaps Harbour Limits Tanker draught in the vicinity could be up to 22m Potential for surface piercing structures to be fully considered in NRA	AfL area moved west from original position Under keel clearance risk assessment carried out in-line with MCA guidance Offshore surface piercing hubs removed from design envelope	Chapter 5: Project Description Baseline description, Section 15.9.6 Review of shipping activity Section 15.12 Impacts – Considers allision risk

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
				Section 15.3 Design Envelope Considerations – No surface piercing hubs considered, Section 15.11 Mitigation Measures – Included as project design mitigation measure
Shipping and navigation – Fishing PHA Consultation – July 2013	OFA	Hoy fishermen (based in Longhope) and Burray fishermen use creels in the area South of Brims area is quite exposed so not many fishermen would risk gear in the area	Noted and local fishermen involved in consultation and invited to Hazard Review Workshop	Responses to consultation considered in entire assessment
Shipping and navigation – Recreation PHA Consultation – July 2013	RYA Scotland, Orkney Dive Boat Operator's Association (ODBOA), Kirkwall Kayak Club	Description of recreational activity in the vicinity of the AfL area was given No significant recreational issues with the (original) AfL area	Noted and included in assessment	Baseline description, Section 15.9.8 Recreational vessel activity
Shipping and navigation – SAR PHA Consultation – July 2013	RNLI Stromness	Review of the call-out data in the vicinity of the AfL area	Noted and included in assessment	Baseline description, Section 15.9.9 Maritime incidents
Shipping and navigation – General Scoping response – September 2013	OIC Marine Services	Revised AfL area is partially inside the boundaries of the Orkney Harbour Limits Surface piercing devices or hubs near the main entrance to an oil/gas port will need to be assessed Future traffic should be assessed	BTAL have indicated they will not develop the part of the site within Harbour Limits (although one cable option may enter the Harbour Limits) Offshore surface piercing hubs removed from design envelope	Section 15.11 Mitigation Measures – Included as project specific mitigation measure Section 15.3 Design Envelope Considerations – No surface piercing hubs considered, Section 15.11 Mitigation Measures – Included as project design mitigation measure

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
		Lyness and Stromness are not individual ports but all part of Harbour Area for Scapa Flow.	Noted	Section 15.12 Impacts – Future traffic considered in impact assessment N/A
Shipping and navigation – General Scoping response – September 2013	MCA and NLB	Under keel clearance guidance paper provided by MCA should be considered	Noted	MCA Under Keel Clearance Policy Paper referred to in assessment
		NRA should be submitted in accordance with MGN 371	Entire ES and NRA carried out in accordance with MGN 371	Entire Environmental Statement (ES) and NRA
		Assessment should take into account under keel clearance	Considered in assessment	Section 15.12 Impacts – Considers under keel allision
Shipping and navigation – General Scoping response – September 2013	RYA Scotland	No issues if all devices were to have an adequate clearance of minimum 8m below LAT	Minimum design clearance has been finalised as 30m below LAT.	Chapter 5: Project Description
Shipping and navigation – General Navigation review – September 2014	NLB	Inclusion of surface piercing or floating devices would make the application more complicated	Offshore surface piercing hubs removed from design envelope	Section 15.3 Design Envelope Considerations – No surface piercing hubs considered, Section 15.11 Mitigation Measures – Included as project design mitigation measure
		Southeast and southwest corners of the site to be kept clear of elements providing insufficient under keel clearance for transit	Minimum design clearance has been finalised as 30m below LAT.	Section 15.11 Mitigation Measures – Included as project specific mitigation measure
		No concern regarding an array of seabed mounted devices upscaling from 30MW to 200MW		Section 15.12 Impacts – Considered in impact assessment

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Shipping and navigation – General Navigation review – September 2014	MCA	In the case of either surface piercing, floating or seabed mounted devices, the main differentiation would be whether traffic is rerouted around or through the site	Offshore surface piercing hubs and floating technology removed from design envelope	Section 15.3 Design Envelope Considerations – No surface piercing hubs or floating technology considered, Section 15.11 Mitigation Measures – Included as project design mitigation measure, Section 15.12 Impacts – Potential for vessel rerouting considered in impact assessment
		If transits through the site will be made, under keel clearance needs to be assessed in accordance with MGN 371	Considered in assessment	Section 15.12 Impacts – Considered under keel allision
		Attention to be paid to southeast corner of site which overlaps the deep draught channel for Scapa Flow	Noted	Section 15.11 Mitigation Measures – Included as project specific mitigation measure
Shipping and navigation – General Response to revised Project Description – June 2015	MCA	UKHO should be consulted to address how information on under keel clearance will be promulgated to the mariner	Noted	n/a
		When new devices are installed, changed or removed throughout the lifetime of the Project, information on device specific details should be promulgated to Kingfisher Information Services and to local vessels using the area	Noted	n/a
		Export cable routes, cable burial protection index and cable protection needs to be addressed. MCA would accept 5% reduction in surrounding depth	Noted	n/a

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
		referenced to Chart Datum MGN 371 Annex 2 Paragraph 6 iii requires that hydrographic surveys should fulfil the requirements of the International Hydrographic Organisation (IHO) Order 1a standard Emergency Response Cooperation Plan (ERCoP) to be in place prior to construction	BTAL to forward data to the MCA ERCoP to be in place prior to construction	n/a Section 15.11 Mitigation Measures – ERCoP Included as project design mitigation measure
Shipping and navigation – Fishing Scottish Fisheries Meeting – June 2015	Scottish Fishermen's Association (SFF) and Scottish Pelagic Fishermen's Association (SPFA)	Confirmed the position of the SFF that a subsea development becomes de facto excluded from fishing operations and requires mitigation.	Mitigation targeted at fishermen, both local users and transiting vessels from further afield, is planned.	Section 15.11 Mitigation Measures – Included as project design mitigation measure Section 15.11 Mitigation Measures – Included as specific mitigation measure Section 15.12 Impacts – Included as specific mitigation measure under several impacts
Shipping and navigation – Tankers visiting Flotta Terminal Telecon – August 2015	Flotta Marine Oil Terminal (Talisman-Sinopec)	Confirmed the draughts of tankers visiting the Terminal and main export destinations. Also expected changes over life of the Project.	Information included within assessment.	Section 15.12 Impacts

15.8 ASSESSMENT METHODOLOGY

The EIA process and methodology are described in detail in Chapter 7. The shipping and navigation impacts assessment methodology has been carried out in line with the IMO's Formal Safety Assessment (FSA) process and the DECC/MCA Guidelines (see NRA for full details). It therefore does not follow the methodology set out in Chapter 7. The assessment has been informed by a Hazard Review Workshop, which was carried out to identify and review the potential navigational hazards associated with the Project. Stakeholders representing the various types of vessel activity and emergency response organisations in the area were invited to ensure the review took into account local factors and benefitted from local knowledge and experience. Baseline data analysis and stakeholder consultation were also considered in the assessment. The ranking of risks associated with the various hazards was subsequently carried out based on the discussion at the Workshop and review of the baseline data and consultation. This was circulated to attendees after the meeting for feedback.

In addition, selected hazards were subject to a separate process of quantitative collision or allision risk modelling. All the quantified risk assessments were carried out using Anatec's COLLRISK software which conforms to the DECC guidance. Base case modelling (based on current traffic levels) and future case modelling (based on a conservative estimate of the potential growth in shipping movements) have been undertaken. Full details of the approach taken are provided in the NRA.

15.8.1 Assessment Criteria

Hazards (impacts) have been categorised using the frequency and consequence categories defined in Table 15.3 and Table 15.4 respectively. The categorisation was carried out by Anatec using professional judgement and experience based on the discussion at the Hazard Review Workshop involving local stakeholders, together with the baseline data analysis and other consultation. The draft rankings were then circulated to the workshop attendees, and other interested parties who were unable to attend, for further feedback and agreement. The methodology is centred around risks and controls, which is preferred by the MCA to ensure consistency with the NRA.

Table 15.3: Frequency bands for shipping and navigation hazards

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

Table 15.4: Consequence bands for shipping and navigation hazards

Rank	Description	People	Environment	Property	Business
		Definition			
1	Negligible	No injury	<£10k	<£10k	<10k
2	Minor	Slight injury(s)	Tier 1: Local assistance required	£10k-£100k	£10k-£100k
3	Moderate	Multiple moderate or Single serious injury	Tier 2: Limited external assistance required	£100k-£1M	£100k-£1M Local publicity
4	Serious	Serious injury or single fatality	Tier 2: Regional assistance required	£1M-£10M	£1M-£10M National publicity
5	Major	More than 1 fatality	Tier 3: National assistance required	>£10M	>£10M International publicity

The consequence scores are averaged (for a single impact there could be a range of consequences) and multiplied by the frequency to obtain an overall ranking (or score) which determined the hazard's position within the risk matrix shown in Table 15.5.

Table 15.5: Risk matrix for shipping and navigation

		Frequency				
		5	4	3	2	1
Consequence	5	HIGH	HIGH	HIGH	MODERATE	MODERATE
	4	HIGH	HIGH	MODERATE	MODERATE	LOW
	3	HIGH	MODERATE	MODERATE	LOW	LOW
	2	MODERATE	MODERATE	LOW	LOW	LOW
	1	MODERATE	LOW	LOW	LOW	LOW

Where:

Broadly Acceptable Region (Low Risk)	Generally regarded as acceptable and adequately controlled. Nonetheless the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
Tolerable Region (Moderate Risk)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are as low as is reasonably practicable (ALARP) and that risks are periodically reviewed to see if further controls are appropriate.
Unacceptable Region (High Risk)	Generally regarded as unacceptable whatever the level of benefit associated with the activity.

15.9 BASELINE DESCRIPTION

15.9.1 Introduction

The baseline description presents an assessment of the existing navigational features, metocean conditions and shipping activity recorded within and adjacent to the Project.

15.9.2 Sources of Baseline Data

The main desk based data sources used to identify the baseline navigational features and activity in the area of the Project are as follows:

- Maritime Traffic Survey Data – 2 x 14 Days AIS, radar and visual observations;
    - Winter 2013 (14 Days) (Supporting Document: Anatec, 2014a); and
    - Summer 2014 (14 Days) (Supporting Document: Anatec, 2014b).
- Maritime Traffic PHA Data – 2 x 28 Days AIS (Supporting Document: Anatec, 2013);
    - Summer 2010 (28 Days); and
    - Winter 2010 (28 Days).
- Maritime Traffic Geophysical Survey Data – 26 Days AIS and radar (Supporting Document: Anatec, 2012b);
- Admiralty Sailing Directions – North Coast of Scotland Pilot, NP 52 (UKHO, 2009);
- Recreational Vessel Data;
    - Clyde Cruising Club Sailing Directions and Anchorages – N & NE Scotland and Orkney Islands (Clyde Cruising Club Publications, 2010);
    - UK Coastal Atlas of Recreational Boating (2009) and Geographic Information Systems (GIS) Shapefiles (RYA, 2010);
    - Marine Scotland Shipping Study of the Pentland Firth and Orkney Waters (2012); and
    - Orkney Marinas (2015) Sailing directions.
- Fishing Data;
    - Sightings data for 2012-2014, from Marine Scotland Compliance (Marine Scotland Compliance, 2015a);
    - Satellite vessel monitoring system (VMS) data for 2012-2014, from Marine Scotland Compliance. (Satellites record the positions of fishing vessels of 15m length and over a minimum of every two hours) (Marine Scotland Compliance, 2015b);
    - Crown Estate Succorfish Data for October to December 2014, characterising the spatial distribution of the Orkney creel fishery (TCE, 2015); and
    - Marine Scotland ScotMap data for 2007-2011 (Marine Scotland, 2012).
- Maritime Incident Data;
    - Marine Accident Investigation Branch (MAIB) data for 2004-2013 (MAIB, 2013);
    - Royal National Lifeboat Institution (RNLI) data for 2001-2010 (RNLI, 2011); and
    - Additional RNLI data for 2011-2015 (RNLI, 2015).
- Offshore Renewables Shapefiles (TCE, 2014);
- Marine Environmental High Risk Areas (MEHRA) (DfT, 2006);
- UK Admiralty Charts:
    - 1954-0 Cape Wrath to Pentland Firth including the Orkney Islands (UKHO, 2014a); and
    - 2162-0 Pentland Firth and Approaches (UKHO, 2014b).

15.9.3 Existing Environment

The Brims AfL area lies just to the south of the IMO-adopted Area to be Avoided (ATBA) which surrounds most of Orkney (excluding the Pentland Firth and Scapa Flow). The ATBA was established to protect the sensitive coastline following the *Braer* incident. To avoid the risk of pollution and damage to the environment, all vessels over 5,000GT carrying oil or other hazardous cargoes in bulk, should avoid the area.

OIC Marine Services administers 29 Orkney Harbour Areas for which it is the Competent Harbour Authority. The Council exercises its jurisdiction through a Director of Marine Services. The AfL area is in proximity to the Limit of Orkney Harbours and the north eastern part of the AfL area (approximately 0.08nm^2) lies within it. Within 5nm of the AfL area there are four ports; Longhope and Lyness Pier on Hoy, and Sutherland Pier and Gibraltar Pier on Flotta. These are within the harbour limits of Scapa Flow. The local ferry berths overnight at Longhope Pier and the lifeboat is stationed on its own berthing pontoon. Sutherland Pier is used mainly by the tugs and workboats that serve the Flotta Oil Terminal. Lyness Pier recently underwent redevelopment of the quays and shore side facilities to enable it to be used as a hub for the assembly and maintenance of renewable energy devices. Lyness is amongst the locations under consideration as a mobilisation base for the Project. Marine Services operates a Vessel Traffic Service (VTS) from the Harbour Authority Building at Scapa. The VTS technology has been upgraded during 2011-12 and further radar scanners are planned to be added. However, the existing scanner at Sandy Hill provides good coverage of the Brims area. Pilotage is compulsory within the Competent Harbour Authority areas for passenger vessels over 65m in length, all other vessels over 80m overall length, all vessels under tow where the combined overall length of the towing vessel and the vessel being towed is over 65m, all vessels over 300GRT carrying persistent oils in bulk.

Approximately 0.9nm east of the AfL area are recommended tracks for deep-draught vessels. The channels and deep-water tracks between the Pentland Firth and Scapa Flow are those recommended by the Orkney Harbours Navigation Service for tankers under pilotage proceeding to or from the Flotta Oil Terminal. Due to possible tidal effects, vessels may need to steer noticeably different courses from those shown in order to maintain the recommended tracks. Radar surveillance of these channels is continuously maintained by VTS. Following consultation with OIC Marine Services, BTAL confirmed that no deployment of turbines will occur within the Limit of Orkney Harbours. However, if cable corridor option 1 is developed there will be export cables passing through this area.

Chart notes advise that laden tankers not bound to or from Flotta and Scapa Flow should not use the Pentland Firth in restricted visibility or adverse weather. At other times there may be a case for transiting with the tide to reduce the time spent in the Firth, although they should be aware of very strong tidal streams and sets within the area. Difficulties can be encountered when transiting either with or against the tide. Masters should ensure that a close watch is kept at all times on the course, speed and position of vessels.

Tor Ness on Hoy, approximately 0.5nm north of the AfL area, has been identified as a Marine Environmental High Risk Area (MEHRA) by the UK Government, i.e., an area of environmental sensitivity and at high risk of pollution from ships. The Government expects mariners to take note of MEHRAs and either keep well clear or, where this is not practicable, exercise an even higher degree of care than usual when passing nearby.

A submarine cable area lies north east of the AfL area, between the islands of South Walls and Flotta. Mariners are advised not to anchor or trawl in the vicinity of submarine cables. This area also contains fouling features in the form of wire hawsers. Several cables run west of the AfL area, from Hoy to Mainland Scotland. There are two water pipelines northeast of the AfL area, spanning Switha Sound between Hoy and Flotta. An oil pipeline crosses the Sound of Hoxa. There are oil pipelines in Scapa Flow. Mariners are also advised against anchoring and trawling in the vicinity of pipelines.

Tidal streams, with eddies and turbulence, run strongly through the Pentland Firth and in the approaches to Scapa Flow, which can be especially dangerous to smaller vessels if they do not time their passage accordingly. There is an eddy depicted within the northeastern extent of the AfL area which occurs during the east-going stream. The Merry Men of Mey, an extensive tidal race across the Pentland Firth between St John's Point and Tor Ness, runs during the west-going stream, crossing the western extent of the AfL area.

A summary of these features is presented in Figure 15.2.

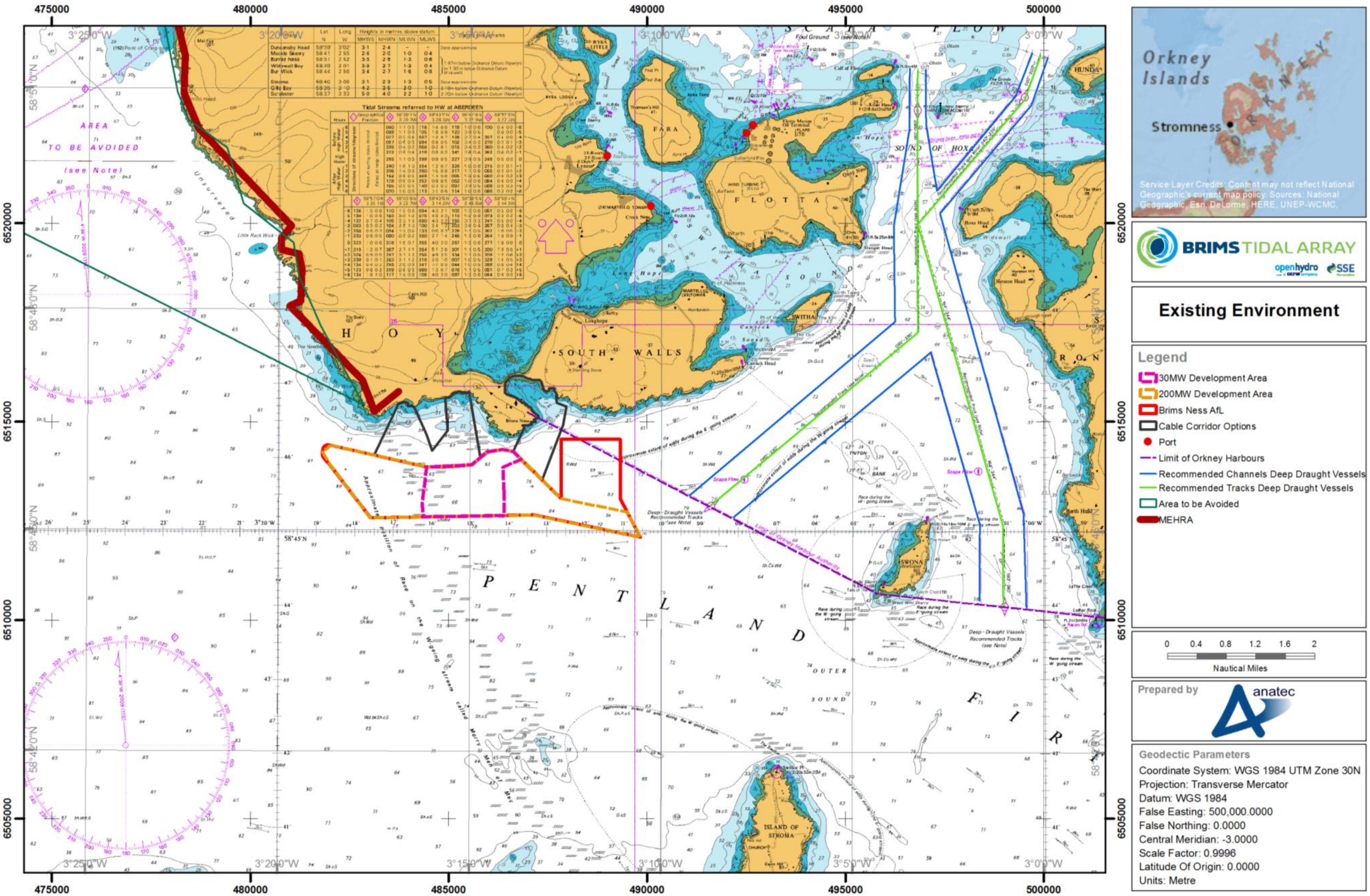

Figure 15.2: Existing environment

15.9.4 Metocean Data

Wind, wave and tidal data for the area were used as input to the risk modelling process. This is presented in Chapter 9 (Physical Processes) of the ES and in the NRA.

15.9.5 Maritime Traffic Survey

This section presents analysis of the maritime traffic data used for the Project. Data have been collected using radar, AIS and visual observations. It covers 2 x 14 day periods, one in winter 2013 and one in summer 2014. Full details of both of these surveys have been presented as independent Maritime Traffic Survey reports for winter 2013 (Supporting Document: Anatec, 2014a) and summer 2014 (Supporting Document: Anatec, 2014b). Further analysis of historical AIS data from 2010 was carried out in the PHA for the Project (Supporting Document: Anatec, 2013).

15.9.5.1 Vessels within 5nm Buffer

Vessel types within the 5nm buffer were analysed for the winter and summer periods. There was an average of 25 unique vessels per day in winter 2013, and 21 per day in summer 2014. The largest proportion of these was cargo vessels and tankers using the Outer Sound of the Pentland Firth and passing south of the AfL area.

The average vessel length in winter 2013 was 89m, and in the summer 2014 survey it was 86m. The longest vessel passing within the 5nm buffer, transiting eastbound through the Pentland Firth on 7 June 2014, was the cargo vessel *MSC Michaela* at 304m. Thirteen vessels in winter 2013 and 11 in summer 2014 were tracked with a draught of 10m or greater within the 5nm buffer, but these did not enter the AfL area. The deepest draught vessel tracked within the 5nm buffer was the 16.6m draught bulk carrier *Aquabeauty*, transiting the Outer Sound of the Pentland Firth on 30 November 2013, en route to Redcar.

In the winter 2013 survey, the most common destination was Flotta, which was the stated destination for 17 vessels. Other common destinations were Gills Bay and St Margaret's Hope, used by the *Pentalina* ferry, Aberdeen and Immingham. Within the summer 2014 survey, the most common destination was Scapa Flow, which was the stated destination for 16 vessels. Other common destinations were St Margaret's Hope and Gills Bay, Lyness and Immingham.

15.9.5.2 Vessels within AfL Area

During the winter 2013 survey, there were 20 vessels tracked intersecting the AfL area. The busiest day (24 November 2013) saw four vessels, but there were several days where no activity was recorded in the AfL area. Of the 20 vessels that passed through the AfL area, six were fishing vessels, five cargo vessels, four passenger vessels, one military, three classed as "other" and one unidentified.

In the summer 2014 survey, there were 21 vessels tracked through the AfL area over the 14 days. Again, the busiest day (4 June 2014) had four vessels, whilst several days had no recorded activity within the AfL area. Of the 21 vessels, 11 were cargo ships, eight were fishing vessels and two were recreational vessels. Plots of vessel tracks for the winter and summer periods in the vicinity of the Project, thematically mapped by vessel type, are presented in Figure 15.3 and Figure 15.4.

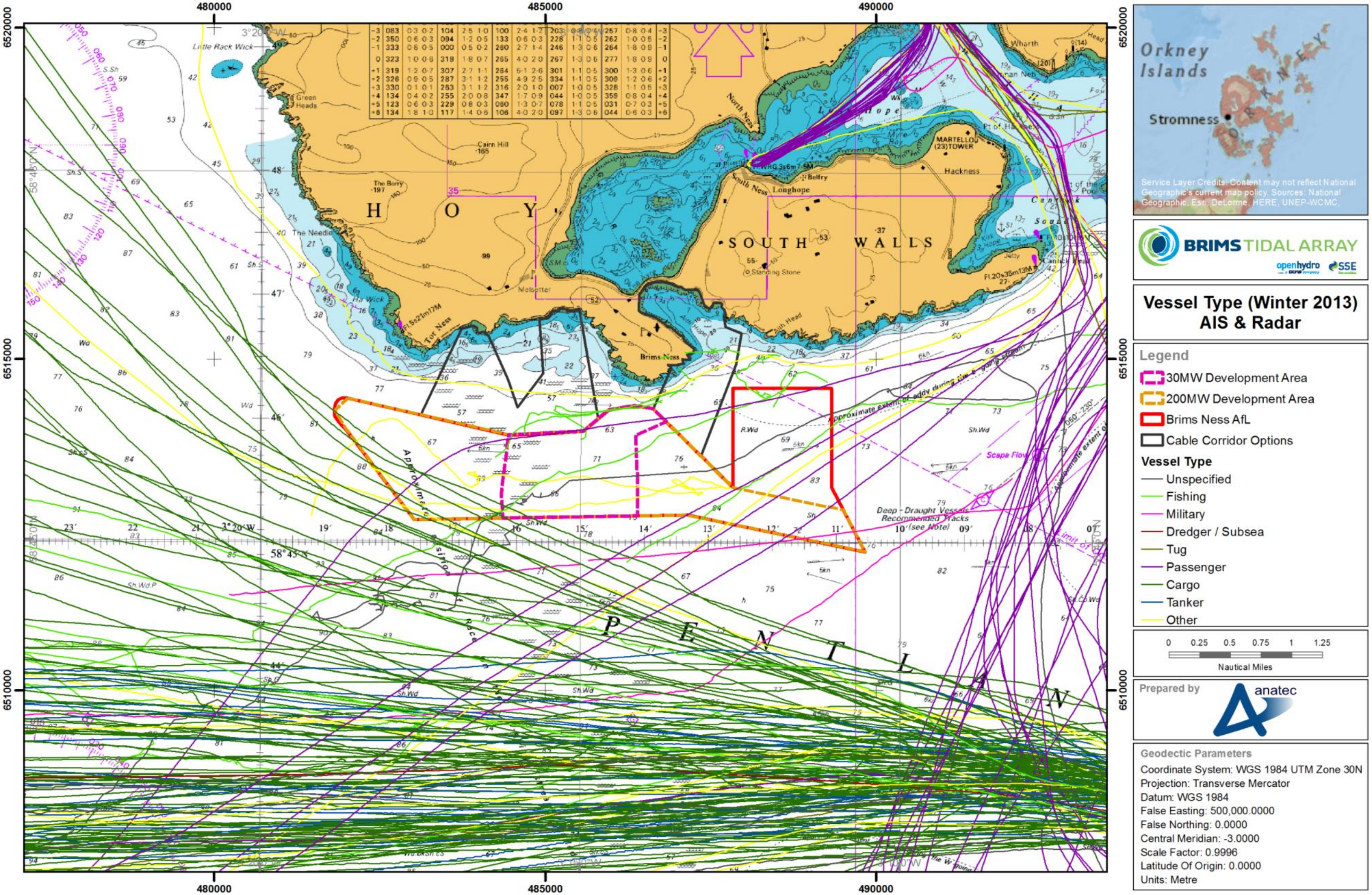

Figure 15.3: Vessel type (winter 2013) AIS and radar

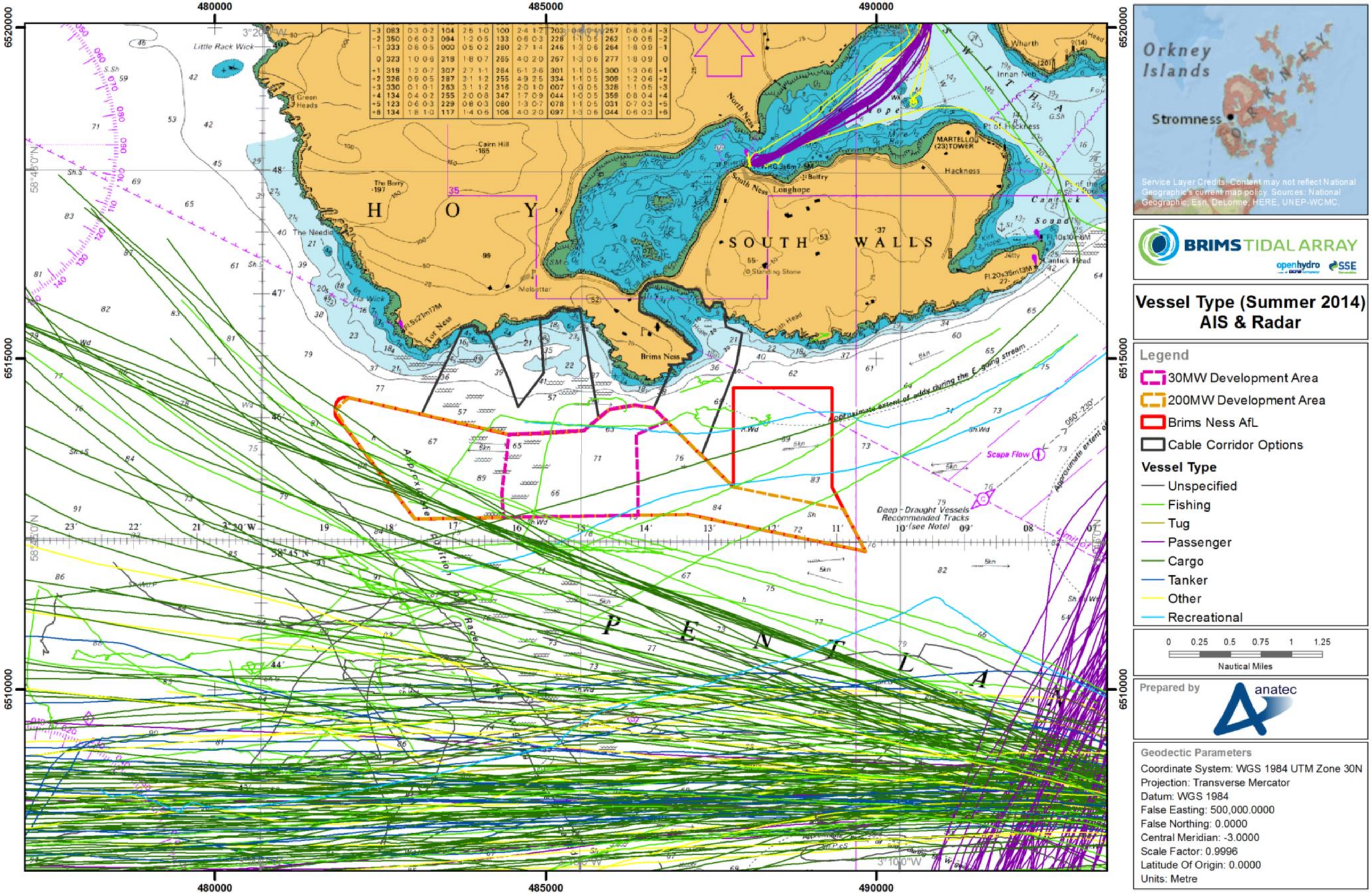

Figure 15.4: Vessel type (summer 2014) AIS and radar

In both periods, the longest vessel tracked was the 165m cargo vessel *Godafoss*. This vessel passed through the AfL area on 12 December 2013 and 7 June 2014, travelling to Rotterdam on both occasions. In terms of draught, in both periods, the deepest draught vessel was cargo vessel *Godafoss* (9.1m in winter 2013 and 8.9m in summer 2014), en route to Rotterdam on both occasions. The draught of the non-AIS vessel tracks were unspecified, however, these were visually identified as small vessels of less than 5m draught. Figure 15.5 presents draught distributions within the AfL area, with Figure 15.6 and Figure 15.7 displaying winter and summer vessel tracks in the vicinity of the Project, thematically mapped by draught.

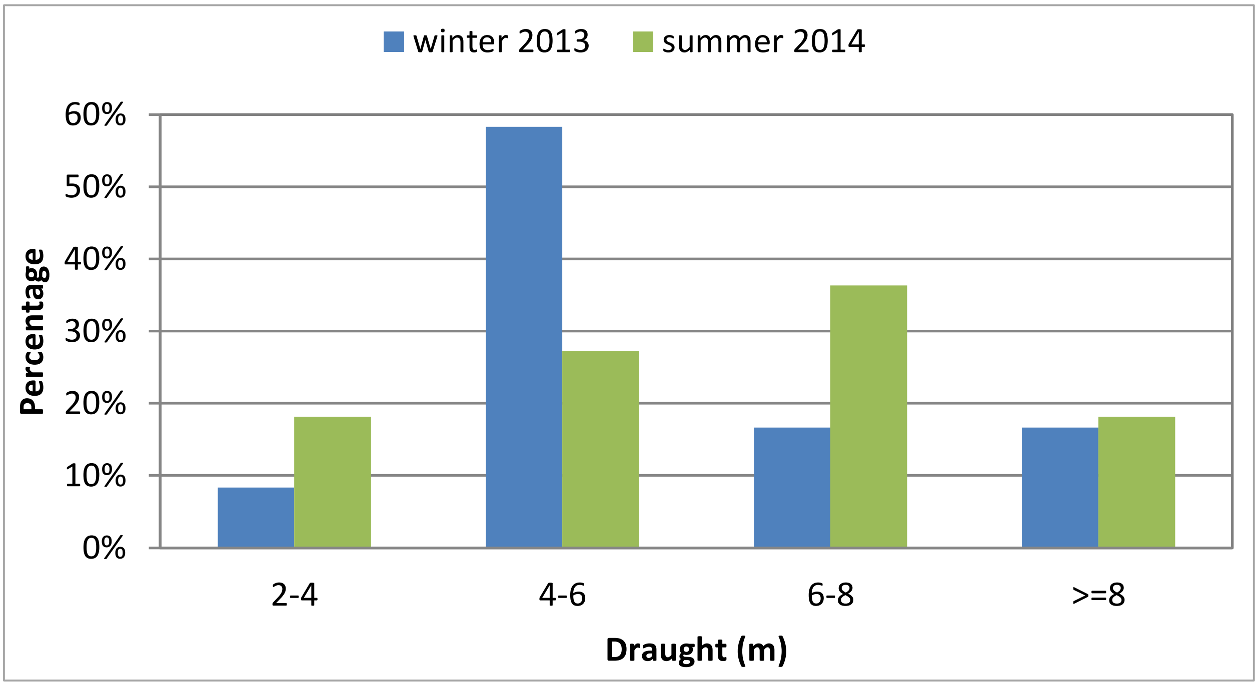

Figure 15.5: Vessel draught distribution

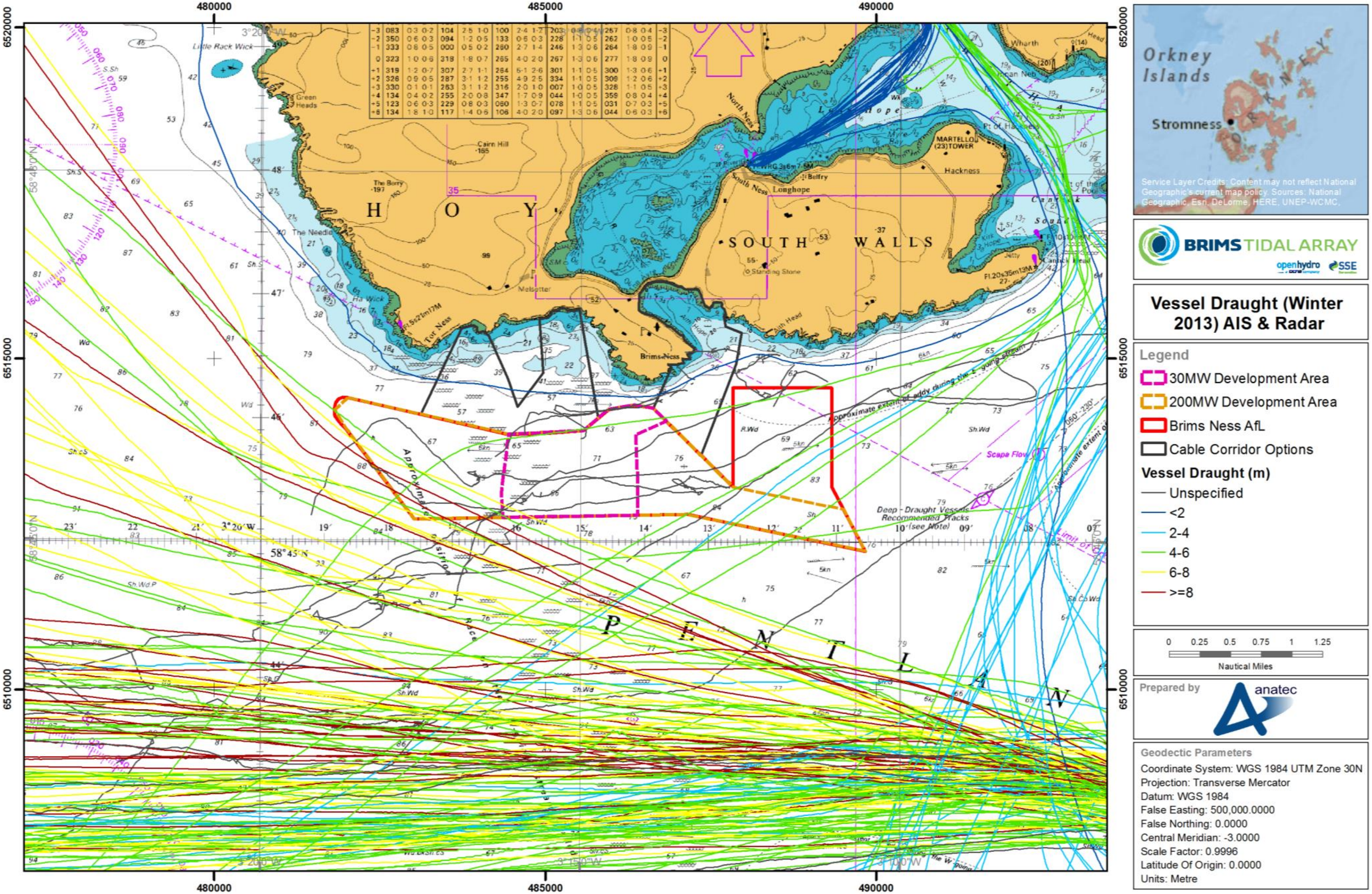

Figure 15.6: Vessel draught (winter 2013) AIS and radar

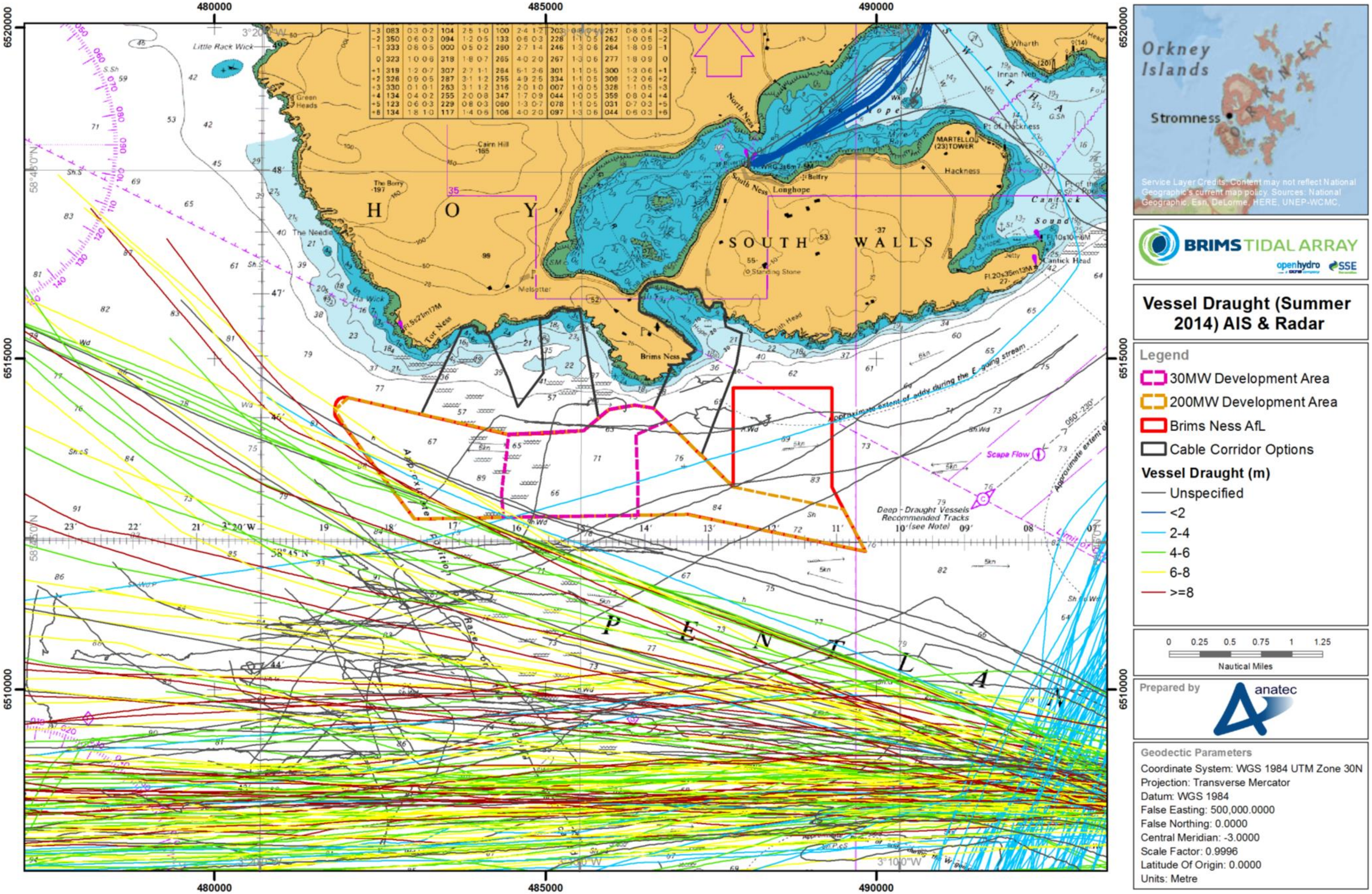

Figure 15.7: Vessel draught (summer 2014) AIS and radar

15.9.5.3 Visual Observations

In addition to the recorded AIS and radar data, visual recordings were made of a small number of vessel positions that on occasion were not continuously tracked by the radar, for example, due to clutter and the small size of the target, making them difficult to acquire. During the winter 2013 survey, there were a total of twenty visual observations. In summer 2014, there was a total of nine visual observations over the course of the survey.

15.9.6 Review of Shipping Activity

The majority of cargo vessels within the 5nm buffer were transiting the Outer Sound of the Pentland Firth, with some vessels also passing west of Hoy. A total of 16 cargo vessel tracks made by seven different vessels were recorded passing through the AfL area. All cargo vessels recorded in the AfL area travelled through the southwest corner and passed west of Hoy with the exception of *Fame* which transited through the eastern boundary on 4 June 2014. The most frequently recorded cargo vessel in the winter 2013 survey was *Selfoss*, which transited the AfL area twice, the first time travelling northwest to Reykjavik and the second time southeast to Immingham. Other cargo vessels which passed through the AfL area were *Dettifoss* and *Godafoss*, both travelling eastbound to Rotterdam, and *Laxfoss* transiting westbound to Reykjavik. During the summer 2014 survey the most frequently recorded cargo vessel was the *Ruby*, which transited the site five times, travelling west to Torshavn. Other cargo vessels travelling through the AfL area were *Selfoss* and *Godafoss* which were travelling to Reykjavik and Rotterdam respectively. Cargo vessels passing through the AfL area ranged in length from 15m to 165m and 3.9m to 9.1m draught.

All tankers were tracked using the Outer Sound of the Pentland Firth. None were recorded within the AfL area, with the closest passing 1nm south. However, previous surveys carried out during the Preliminary Hazard Analysis identified a number of tankers visiting Scapa Flow. Up-to-date tanker movement data for March to July 2015 (four months) also showed tankers visiting Scapa Flow for both ship-to-ship transfers and Flotta Marine Oil Terminal exports. These tanker movements were taken into account within the assessment.

Serco NorthLink's vessel *Hamnavoe*, which travels between Scrabster and Stromness, was the only passenger vessel which transited through the AfL area, doing so when transiting northbound during periods of bad weather in the winter 2013 survey when it used Cantick Sound four times rather than the normal route west of Hoy. The *Pentalina* is Pentland Ferries' passenger vessel, linking Gills Bay and St. Margaret's Hope. This vessel passed a minimum of 1nm from the AfL area when routeing west of Stroma and was recorded in both survey periods. In the summer 2014 survey only, *Pentland Venture* was tracked regularly between John O'Groats and Burwick, with the closest transit to the AfL area 4.2nm to the southeast. Finally, four cruise vessels were recorded in the summer data, the closest passage to the AfL area made at a distance of 1.7nm.

One military vessel, *HMS Northumberland*, was recorded in the 5nm buffer, also intersecting the southeast corner of the AfL area, in the winter 2013 survey (no military vessels were tracked during the summer 2014 survey). Information on the full extent of naval activity can be difficult to obtain, however, the Defence Infrastructure Organisation (DIO) were consulted about the Project and indicated their naval advisers had no objections provided details on the final layout and under water clearance were provided via UKHO prior to construction (which is a planned, standard mitigation measure).

There were three 'other' vessels recorded within the AfL area, all during the winter 2013 period. These were the recreational sea angling charter vessel *Welcome Home* based in Stromness, the Fisheries patrol vessel *Hirta* and a multipurpose support vessel *Helen Burnie*. Unspecified vessels were non-AIS targets that could not be visually identified due to poor visibility or darkness when they were recorded. One unidentified vessel passed through the AfL area.

15.9.7 Fishing Vessel Activity

This section analyses the fishing vessel activity in the vicinity of the Project based on the maritime traffic survey, the latest available surveillance data (satellite and sightings) within ICES Rectangle 46E6, and consultation with Marine Scotland Science and local stakeholders. Further analysis of fishing activity in the vicinity of the Project is presented in Chapter 16 Commercial Fisheries.

15.9.7.1 Fishing Surveillance Data

Data on fishing vessel sightings for 2012-2014 were obtained from Marine Scotland Compliance who monitors the fishing industry in Scottish waters through the deployment of patrol vessels and surveillance aircraft. A full analysis is presented in the NRA (including figures) with a brief summary given below.

No sightings were recorded within the AfL area. Within the ICES Rectangle, the main fishing methods were demersal trawling (32%), potter/creeler (24%) and scallop dredger (21%). In terms of nationality, 86% of fishing vessels were UK registered. Over half (60%) of the vessels sighted were steaming (transiting to/from fishing grounds), 30% were engaged in fishing, i.e., gear deployed, with the remaining vessels laid stationary. 35% of vessels were below 15m in length, which is the current limit for AIS carriage on fishing vessels.

Fishing satellite (VMS) data were analysed for 2012-2014, covering vessels 15m length and over, with positions received typically every 1-2 hours when at sea. Approximately 80% of vessels were tracked within the ICES Rectangle at speeds below 5 knots and may have been engaged in fishing (especially west of Orkney) or travelling at lower passage speeds due to tides, etc. The majority (93%) of vessels were UK registered. Within the AfL area, approximately 55% of vessel positions were at speeds above 5 knots and hence likely to be steaming on passage. The remaining 45% were travelling at speeds below 5 knots and hence may have been engaged in fishing (such as setting or retrieving creels) or transiting at lower speed near to shore. In terms of the nationality of vessels recorded within the AfL area, 90% were UK-registered, with the remaining 10% registered in Norway.

15.9.7.2 Crown Estate Succorfish Data

Orkney Sustainable Fisheries Limited (OSF) and The Crown Estate (TCE) developed a programme of work for collecting data for a dynamic description of inshore fishery patterns to best serve the planning, consenting and regulatory needs of the marine energy industry in the Pentland Firth and Orkney Waters (PFOW) region. The data describe the spatial distribution of the Orkney creel fishery. Twenty Orkney-based creel vessels have been equipped with a Succorfish electronic navigation system. This system is a combination of satellite and GPRS. The data show a number of fishing vessel positions in the near-shore area of the AfL area. These were recorded at a variety of speeds and hence likely to include vessels steaming on passage and engaged in fishing. Thirty-six vessel positions were recorded within the AfL area, with approximately 10% of these vessels recorded as below 5 knots. As part of Chapter 16 (Commercial Fisheries) additional longer term data have been analysed.

15.9.7.3 Marine Scotland ScotMap

ScotMap is a Marine Scotland project which provides spatial information on the fishing activity of Scottish registered commercial fishing vessels under 15m in overall length. Data were collected during face-to-face interviews with vessel owners and operators for the period 2007 to 2011. The final report and associated datasets have been published (Marine Scotland, 2014) and indicate that there are approximately 9 to 11 vessels operating in the western part of the AfL area, and approximately 14 to 15 vessels operating within the eastern section.

The main fishing method within the AfL area was identified as crab and lobster creel (pot) fishing (brown crab and/or velvet crab, green crab, spider/spiny crab, common lobster, crawfish, squat lobster), with approximately 7 vessels in operation to the west of the AfL area and approximately 10 vessels operating towards the east of the AfL area. Within the eastern part of the AfL area, a low number (one to three) of scallop divers were noted as in operation.

15.9.7.4 Fishing Survey Data

At the time of the winter 2013 survey, AIS carriage was mandatory for fishing vessels ≥ 18m length under EU Directive. This extended to 15-18m vessels at the time of the summer survey. A proportion of smaller fishing vessels also carry AIS voluntarily but may not broadcast continuously.

Fishing vessels within the AfL area were all recorded on radar. The majority of fishing vessels tracked passing within the AfL area in winter 2013 were steaming. *Caspian* was seen on two separate occasions, including once hauling pots on the eastern edge of the site. Other vessels identified in the winter 2013 survey included the *Guiding Light* (twice) and the *Samantha Jane*. During the summer 2014 period, all fishing vessels observed within the AfL area were steaming. *Samantha Jane* was the most frequently recorded, transiting the site on three occasions. *Kristrun II RE 477*, *Endurance FR111*, *Caspian*, *Guiding Light* and the unidentified '*RV87 Red Hulled White Wheelhouse*' were all recorded once. *Caspian* and *Samantha Jane* were both seen hauling pots between the site and the Brims Ness shore three times and once, respectively. Figure 15.8 presents the vessel tracks in proximity to the AfL area.

In addition to the fishing vessels recorded on AIS and radar, there were visual sightings of fishing vessels. Fishing vessel *Caspian* was recorded 16 times during the winter 2013 survey. The vessel moored in Aith Hope at night and went to Aith Head for fishing operations during the day. It was seen transiting towards Tor Ness on two occasions. *Guiding Light* was observed twice, mooring in Aith Hope on 23 November and leaving its mooring on 25 November. An unidentified fishing vessel was recorded twice, to the west of the AfL area. Visual observations during the summer 2014 survey were of *Caspian*, seen hauling creels three times. *Guiding Light* was seen three times, steaming through the AfL area and fishing west of Hoy. *Samantha Jane* was recorded twice, once engaging in fishing and once steaming. *Skua*, a small angling vessel, was seen engaging in fishing.

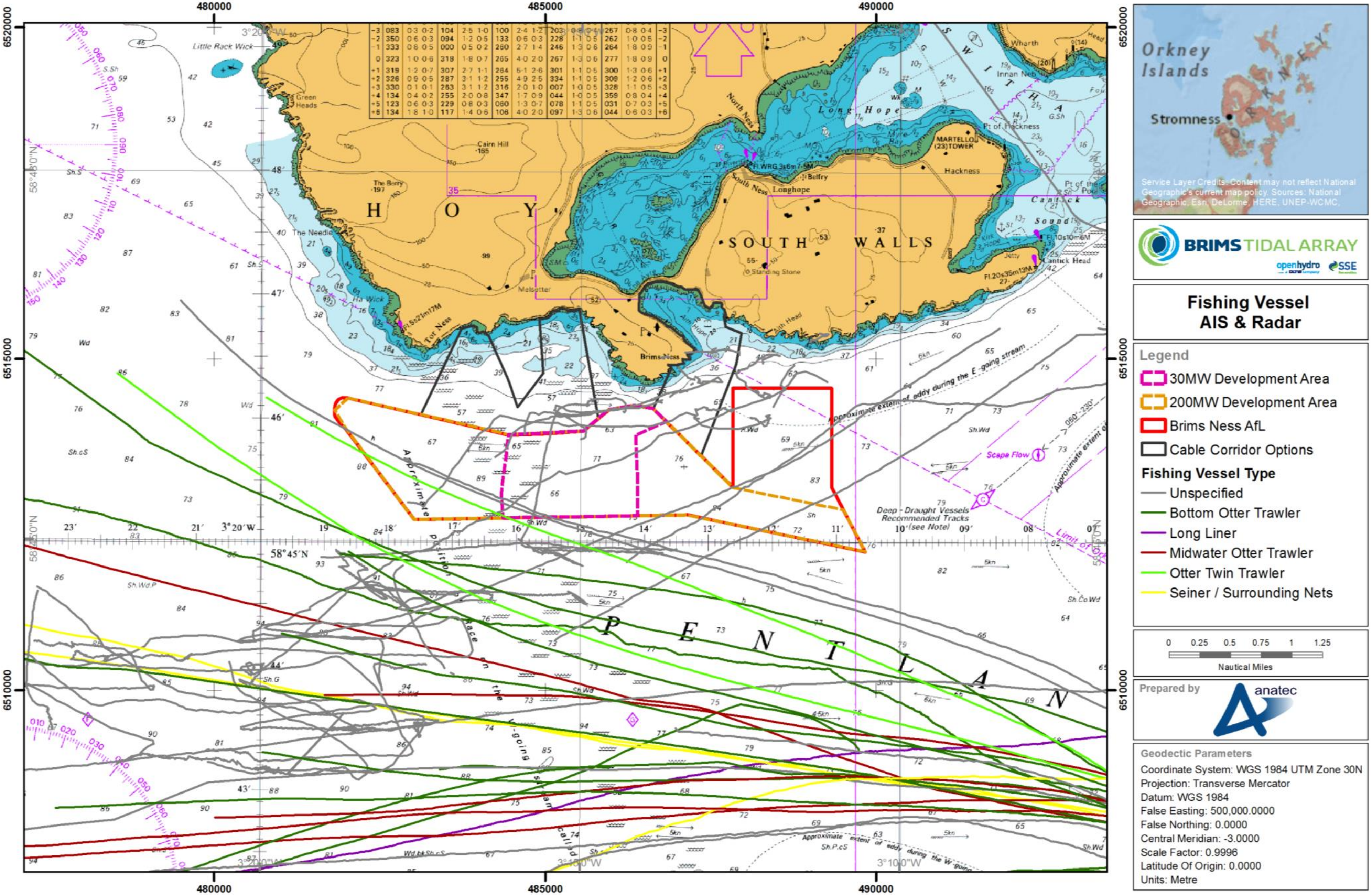

Figure 15.8: Fishing vessel AIS and radar

15.9.7.5 Consultation

Local fishermen and their representatives (e.g., Orkney Fisheries Association) as well as the Kirkwall Fisheries Officer were invited to the Hazard Review Workshop. This was used to confirm that fishing in the site is limited to a handful of local vessels using static gear, with fishing vessels using mobile gear highly unlikely to fish in this area. .

Feedback from Marine Scotland Science in the PBD response in May 2012 indicated that the majority of demersal vessels in the area are unlikely to be fishing and most are likely to be transiting through the Pentland Firth. This was confirmed at a meeting in June 2015 with the SFF and SPFA. It was also confirmed at this meeting that the minimum under water clearance of 20m below LAT (as proposed at the time of the meeting, now increased to 30m) should be ample for all fishing vessels in all conditions. Fishing vessels only tend to clip the southwest corner of the AfL area (if at all) when rounding Hoy, transiting to/from west Orkney so there should not be a significant issue even for construction or maintenance activity on site. Local consultation with fisheries stakeholders also took place as part of the Commercial Fisheries work (Chapter 16).

15.9.8 Recreational Vessel Activity

Recreational vessel activity in the vicinity of the Project is reviewed in this section, based on the maritime traffic survey, desktop information, and consultation with local recreational stakeholders.

15.9.8.1 RYA Coastal Atlas Data

The latest RYA Coastal Atlas data indicates that there is one light-use Cruising Route passing through the east part of the AfL area, running between Scrabster Harbour and various routes in the vicinity of Orkney. It should be noted that routes are indicative and the actual route taken will be highly variable, depending on the vessel (e.g., sail and/or engine), its skipper, the prevailing winds and tides, etc. The AfL area lies in close proximity of the North East Scotland Sailing Area and outside of general racing areas identified by the RYA. In terms of facilities, the nearest club and training centre (by sea) is the Pentland Firth Yacht Club, approximately 22nm southwest of the AfL area at Scrabster, and the closest marina is Scrabster Harbour.

15.9.8.2 Marine Scotland Shipping Study

Marine Scotland carried out a shipping study of the Pentland Firth and Orkney Waters (Marine Scotland, 2012) which RYA Scotland was heavily involved in. Within this study, it was identified that there is a low density of recreational activity in the vicinity of the Project and that the RYA light-use cruising route which passes through the AfL area is rarely used. The Marine Scotland study identified one anchorage area in use by recreational vessels, in Aith Hope to the north of the AfL area.

15.9.8.3 Recreational Survey Data

There were nine recreational vessels tracked during the summer 2014 survey period, with no recreational vessels identified during the winter 2013 survey. Figure 15.9 presents the recreational vessel tracks recorded during the surveys, within the 5nm buffer. Two sailing vessels, *Zuza* and *Coast Inn*, were recorded within the AfL area, both travelling northeast towards Scapa Flow. The majority of the recreational vessels were tracked entering or leaving Scapa Flow, to the east of the AfL area.

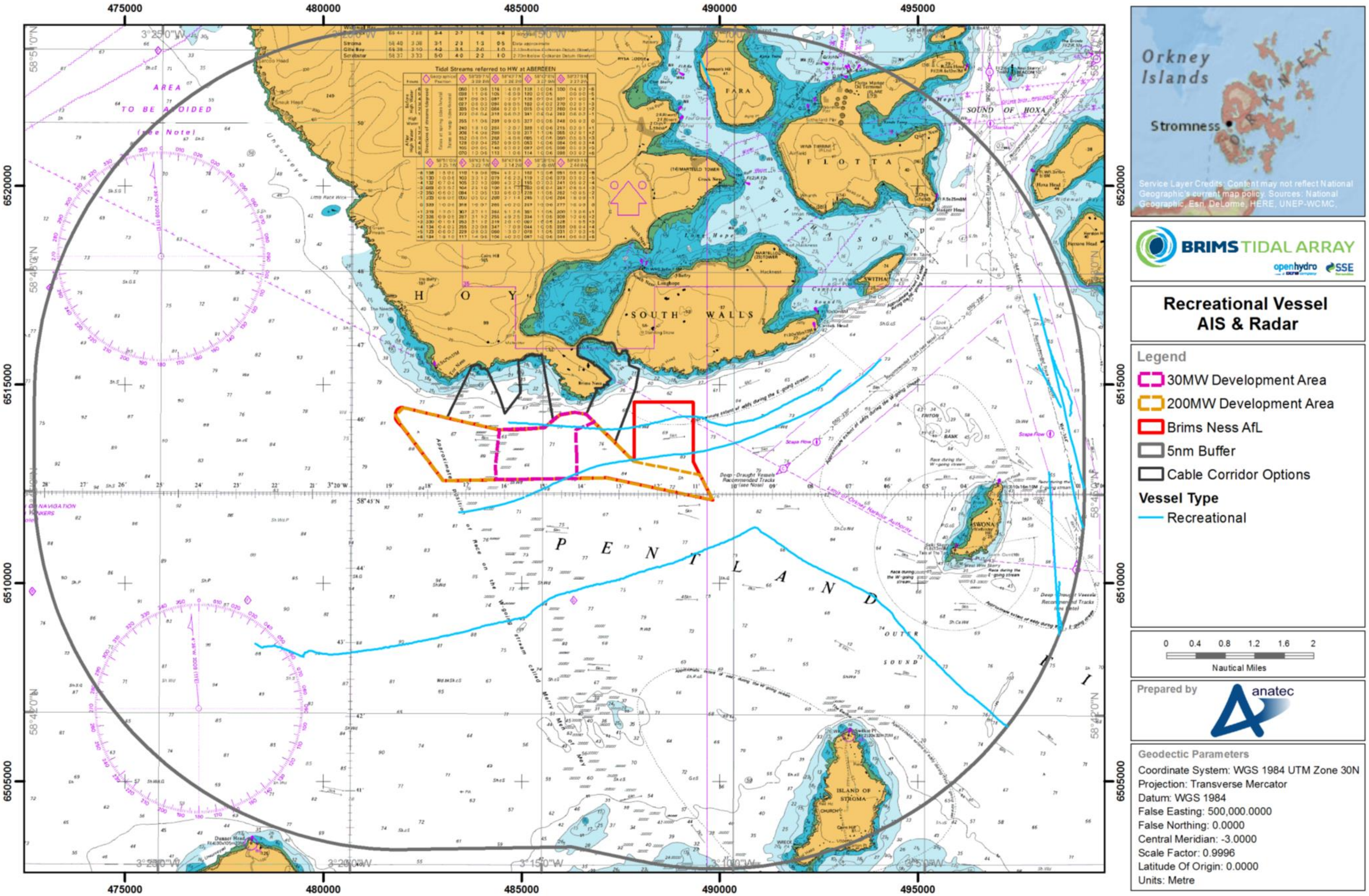

Figure 15.9: Recreational vessel AIS and radar

15.9.8.4 Consultation

Consultation was carried out with local recreational sailor, dive boat operators and kayakers during the NRA. The overall level of recreational vessel activity in the area is relatively low.

Recreational vessels can occasionally transit around Hoy to/from Stromness, taking about 10-12 hours. It can be done clockwise or anti-clockwise, depending on the tide. Clockwise is generally easier, but if the tides are not timed correctly then the Merry Men of Mey could be running on the ebb. It is recommended to reach Tor Ness around the ebb, crossing the Merry Men of Mey at slack water. Recreational craft tend to stay reasonably close to the shore to enjoy coastline features, typically a couple of cables (approx.350-400m). Transits are mainly carried out in summertime. Yachts during transit could also be solo sailors or groups. Other yachts could pass near the proposed area, e.g. vessels crossing the Pentland Firth, the closest which would be those crossing to/from Scrabster. Crossing from Orkney to Scrabster would normally be on the ebb tide and yachts would tend to pass west of Hoy. For the northbound crossing from Scrabster to Orkney, vessels could go west of Hoy or via Scapa Flow (in flood tide). On the latter route they would pass between Switha and South Walls and may cross the original AfL area. This is illustrated in the RYA Cruising Atlas as a 'light-use' cruising route. The move of the AfL area to the west has made this less of an issue.

The majority of the dive boats in Orkney (based on consultation with ODBOA, which has since been disbanded) mainly operate within Scapa Flow. There are a few wrecks in the Sound of Hoxa but this would be quite a long trip from Stromness. Most of the boats go as far as the wreck of the *James Barrie* trawler and no further. There is nothing much of interest to divers in the vicinity of the AfL area. It is very rare to go on a transit around Hoy for sightseeing. Most dive boats go as far as the Old Man of Hoy for this (although it is noted a recreational angling vessel based in Stromness was observed during one of the surveys). If crossing the Pentland Firth, this would be done further west or east of the AfL area. Aith Hope is a potential shelter for dive boats but it was not considered to be too important according to the consultation feedback, as it is not used frequently.

Kayakers do not pass near Brims very often. They may occasionally take a trip circumnavigating Hoy, or part of it, such as Houton to Rackwick Bay, or anti-clockwise from Rackwick into Aith Hope (and then carry the kayaks over the causeway into Longhope) or further round the south from South Walls. Such trips are most likely to take place during summer weekends, perhaps once or twice per year (up to 3-4 per year). Ideal conditions are high pressure, no wind and neap tides. In calm conditions, kayakers can go further out from shore to benefit from the tide but they can also stay close (within 100-200m) to avoid an opposing tide. There are likely to be fewer than ten people in the group for such trips. Some kayakers cross the Pentland Firth, e.g., Brough Ness to Duncansby Head can be done in 1.5 hours. Some groups come to Brough Bay in Caithness and cross the Pentland Firth. These may pass west of Hoy or into Scapa Flow.

15.9.9 Maritime Incidents

Maritime incidents recorded by the MAIB (2004-2013) and RNLI (2001-2010) within 5nm of the Project have been analysed. Supplementary analysis was also carried out on further RNLI data for the period January 2011-May 2015.

A total of 23 MAIB incidents were recorded in the Project study area over the 10 year period, corresponding to an average of just over two incidents per year. No incidents were noted within the AfL area. The closest incident occurred approximately 0.5nm north of the AfL area. On 9 July 2006 a machinery failure occurred on a single handed potter. An incident occurred 0.8nm west of the AfL area on 7 April 2005 when a fishing vessel's gear became entangled in the vessel's propeller.

Twenty-nine launches to 25 unique incidents were recorded by the RNLI in 2001 to 2010, averaging two to three per year. Longhope station responded to the majority (59%) of the incidents in the 5nm buffer, Thurso responded to 24% and Stromness responded to 17% of incidents. No incidents were recorded within the AfL area during the ten year period analysed. Three incidents occurred in close proximity to the AfL area, one at 0.5nm north of the AfL area, one at 0.7nm south and one 0.7nm southeast. The incident to the north was the machinery failure on a potter on 9 July 2006, and can be cross-referenced by date and time as the same incident as that represented in the MAIB dataset. The incident to the south occurred on 11 November 2006, when Longhope ALB responded and gave assistance to an ill crewman onboard a large tanker. The incident to the southeast occurred on 16 March 2008, when Stromness ALB assisted a passenger vessel which had a machinery failure.

Additional RNLI data, from January 2011 to May 2015, show a further 13 launches to 12 unique incidents in this time period. None of these were within the AfL area. Two were in the immediate vicinity, one 0.6nm northeast of the AfL area, and one 0.8nm northeast of the AfL area, both close to shore by Misbister Geo on South Walls. The incident 0.6nm northeast occurred on 5 January 2015, when Longhope RNLI responded to a commercial fishing vessel with machinery failure. The incident 0.8nm northeast occurred on 2 August 2013, when Kirkwall RNLI responded to a sailing yacht with engine which was stranded/grounded.

15.9.10 Emergency Response Overview

A review of the assets in the area of the Project identified that the closest SAR helicopter base is located at Inverness, operated by the Bristow Group, approximately 77nm south southwest of the AfL area. This is the base for two Augusta Westland AW189 helicopters which have a maximum cruise speed of 145 knots and operational range in excess of 200nm radius of action, which is well in range of the AfL area. The base will be operational 24 hours a day, but details of readiness times are unknown. The response time from the base at Inverness to the Project site will be 32 minutes plus the readiness time, which will be established during liaison on the ERCOP.

The RNLI maintains a fleet of over 340 lifeboats of various types at 236 stations around the coast of the UK and Ireland. The nearest RNLI stations in the vicinity of the Project, and the ones that responded to the historical incidents in the vicinity, are at Longhope (which has an all-weather lifeboat (ALB)), and Thurso (ALB) and Stromness (ALB). At each of these stations crew and lifeboats are available on a 24 hour basis throughout the year. The average response time declared by the RNLI for an ALB is 14 minutes. The time for an ALB from Longhope to reach the Project site would be approximately 30 minutes (including response time).

The MCA has one emergency towing vessel (ETV), *Herakles*, situated in Kirkwall about 3-4 hours steaming time from the AfL area (dependent on tide). However, this is on a temporary contract and is planned to cease operation in March 2016. There are three 55 tonne bollard pull tugs in Scapa Flow operated by Orkney Towage Company Limited., which (subject to availability) could reach the site within 1-2 hours. Towage Services is signatory to the CAST agreement (Coastguard Agreement for Salvage and Towage), and the MCA may call upon their services (subject to availability) to assist in salvage operations were a vessel is in danger of causing pollution, danger to other shipping or to assist in counter pollution duties. However, it was noted at the Hazard Review Workshop that these tugs are not equipped to deal with very large merchant vessels and it may not be possible to attach a tow line in adverse weather conditions.

15.10 POTENTIAL IMPACTS

Following establishment of the baseline conditions in the Project site, and an understanding of the Project activities, it is possible to assess the potential impacts from the Project. The range of impacts considered is based on impacts identified during the navigational PHA and NRA hazard review workshop and any further potential impacts that have been highlighted as the NRA has progressed (including the PBD and Scoping stages). A distinction is made between allision (a vessel striking a fixed device) and collision (a vessel striking another moving vessel). Direct and indirect impacts to be covered as part of the impact assessment for this receptor and the relevant phase of the Project are identified below.

The potential impacts identified for each phase of the Project are:

15.10.1 Construction and Installation

- Displacement of vessels due to avoidance of site/construction vessels leading to increased passing vessel-to-vessel collision;
- Collision between passing vessel and construction vessel either at site or en route;
- Dropped object (from work vessel) during construction activities at site; and
- Man overboard (from work vessel) during operations within the site.

15.10.2 Operation and Maintenance

- Passing vessel powered allision with submerged device;
- Passing vessel drifting allision with submerged device
- Displacement of vessels due to avoidance of site leading to increased passing vessel-to-vessel collision;
- Fishing gear interaction with subsea equipment within Project (e.g. device, foundation or inter-array cable);
- Vessel anchoring on or dragging anchor over subsea equipment within Project;
- Fishing gear interaction with export cable to landfall;
- Vessel anchoring on or dragging anchor over export cable to landfall;
- Loss of tidal device or part of device (e.g. component failure);
- Restricted search and rescue capability in an emergency situation or increased demand due to Project; and
- Restricted oil spill response in a pollution incident or increased demand due to Project.

15.10.3 Decommissioning

- Displacement of vessels due to avoidance of site/construction vessels leading to increased passing vessel-to-vessel collision;
- Collision between passing vessel and construction vessel either at site or en route;
- Dropped object during construction activities at site; and
- Man overboard during operations within the site.

15.11 MITIGATION MEASURES

15.11.1 Project Design Mitigation and General Mitigation

All Project Design Mitigation and General Mitigation measures are set out in Chapter 5 Project Description, Table 5.15 and

5.16 respectively. These are standard practice measures based on specific legislation, regulations, standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur.

A number of mitigation measures have been incorporated into the design of the Project as it has progressed to reduce the impact on various receptors. The relevant measures for shipping and navigation which have been adopted by BTAL are listed below.

- The AfL area has been revised, with 80% of the area for investigation shifted to the west, and the remaining 20% overlapping with the original site. Initial consultation identified this as a positive step to mitigate the risk of vessels using the western approaches to Scapa Flow, including tankers and the Scrabster-Stromness ferry (Project Design measure PD03);
- Floating devices were initially under consideration in the original design envelope, but were removed, which again was seen as positive mitigation by navigation stakeholders as it reduced the risk of allision as well as potential for loss of station (Project Design measure PD04);
- A deploy and monitor strategy will be adopted i.e. continual monitoring of activities during device deployment to ensure that adaptive management measures are applied where necessary from the commencement of construction (Project Design measure PD07);
- In June 2015, surface piercing hubs were removed from the Project design envelope, meaning that the entire project will be seabed mounted and will not contain any surface piercing element. This significantly reduces the potential for vessel allision, which had previously been identified as the main hazard at the stakeholder workshop, prior to this decision being taken (Project Design measure PD05); and
- Finally, in August 2015, it was confirmed that the planned minimum clearance of turbines below the water level at LAT (approximately chart datum) would increase from 20m to 30m (Project Design measure PD04).

15.11.2 Project Specific Measures

In addition to the above design measures, project specific mitigation measures will be applied at Brims to minimise navigational impacts as presented below. These are listed in the Table 15.6, and are considered as embedded mitigation in the rankings of each impact.

Table 15.6: Project specific measures

Ref	Mitigation Measure Description
SN01	The Brims site is located close to Scapa Flow which has three harbour tugs with the potential to tow a drifting vessel (dependent on vessel size and weather).
SN02	Orkney VTS will liaise with Coastguard and navigational warnings will be broadcast in an emergency.
SN03	Enhanced vessel selection and auditing of vessels working on site taking into account the strong tidal flows likely to be experienced
SN04	Liaison with Orkney Vessel Traffic Services
SN05	AIS to be fitted on all workboats working at the Project
SN06	Control system will produce an alert in the event of a failure of a device or a component part
SN07	The Project will be depicted on Admiralty Charts produced by the UKHO
SN08	Working vessels will comply with the International Collision Regulations

Ref	Mitigation Measure Description
SN09	Site personnel will be suitably equipped and trained for work offshore meeting RenewablesUK Health and Safety Executive (HSE) guidelines
SN10	When there are work vessel(s) on site, one vessel will be nominated as a guard vessel with appropriate procedures for traffic monitoring and collision risk management
	Construction
SN11	Fast rescue craft available during construction work
SN12	Avoid developing extreme SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area to help ensure safe passage.
SN13	Appointment of marine coordinator to manage work vessel movements
SN14	Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation. Burial is the preferred protection where seabed conditions allow.
SN15	Wet storage of devices/equipment (i.e., temporary storage in water not at their final locations) to be minimised.
SN16	Experience and lessons learned from incidents, accidents and near-misses at other marine renewables projects will be taken into account
SN17	HM Coastguard will be informed of work at the site to allow them to issue MSI broadcasts as appropriate
SN18	There will be adverse weather working policies and procedures for periods of construction and maintenance
SN19	Onshore control room to monitor the Project
SN20	Appropriate PPE will be worn by all working at the Project
SN21	Continuous watch by VHF including DSC
SN22	Periodic surveys of the cable will be carried out to ensure protection measures remain effective
SN23	Coordination with local harbour to carry out combined drills/ exercises

15.12 RESIDUAL IMPACTS

This section provides description of specific impacts, giving project specific details in order to demonstrate the scale of the impact. Standard industry practice is assumed as embedded mitigation. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review Workshop is presented specific to each impact and used to estimate the residual risk.

15.12.1 Construction and Installation

Work vessels will be required during construction and installation of the Project. These are detailed in Chapter 5 (Project Description).

15.12.1.1 Displacement of Vessels due to Avoidance of Project/Construction Vessels Leading to Increased Passing Vessel-to-Vessel Collision

Vessels being displaced and changing their passage to avoid the Project, or construction vessels working at the Project, increases congestion outside of the construction area, leading to increased vessel-to-vessel collision risk. The level of change from the baseline will depend on the extent of the displacement.

During construction it is standard practice to have temporary safety zones of up to 500m radius on a rolling basis covering only those areas of the total site in which such activities are actually taking place at a given time. This can be indicated by appropriate markings and lights being displayed by the work vessel as well as AIS broadcasts to indicate when the vessel is restricted in manoeuvrability. A guard vessel is normally also present to police the safety zone.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are noted as minor damage to vessels and minor injuries to crew members. The realistic worst case consequence may be penetration damage to a vessel, resulting in severe damage, and possible fatality.

For both Stage 1 and Stage 1 & 2, the frequency is considered remote due to the Project not causing a great deal of displacement of existing baseline routes. There will be greater displacement experienced over a longer period of time, for Stage 1 & 2, however it is not likely that this will increase the frequency rank. The consequence will depend on the vessels involved but on average is considered minor, with the same construction and installation vessels being used for both Stages of the Project. This gives an overall risk of low (broadly acceptable).

Table 15.7: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Remote	Minor	Low (broadly acceptable)
Stage 1 & 2	Remote	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented.

Table 15.8: Specific mitigation measures relating to shipping and navigation

Ref	Mitigation Measure Description
SN13	Appointment of marine coordinator to manage construction traffic movements
SN04	Liaison with Orkney VTS

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.1.2 Collision between Passing Vessel and Construction Vessel either at Project or En Route

During work at the site or en route to/from base ports, passing (third-party) vessels could collide with working vessels, for example, during construction and installation. At times these working vessels could be restricted in manoeuvrability.

During construction it is standard practice to have safety zones of up to 500m radius on a rolling basis covering only those areas of the total site in which such activities are actually taking place at a given time. This can be indicated by appropriate markings and lights being displayed by the work vessel as well as AIS broadcasts to indicate when the vessel is restricted in manoeuvrability. A guard vessel is normally also present to police the safety zone and provide early warning of a threat so that work vessel(s) can move off location if necessary to avoid collision.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are noted as.

For both Stage 1 and Stage 1 & 2, the frequency is considered remote due to the relatively low traffic levels in the AfL area and standard mitigation measures that will be put in place, such as compliance with COLREGS (The International Regulations for Preventing Collisions at Sea 1972) in open transit. The consequence will depend on the vessels involved but the average outcome is likely to be minor damage to vessels and minor injuries to crew members. The worst case consequence may be penetration damage to a vessel, resulting in severe damage, and possible vessel foundering and fatality. This gives an overall risk of low (broadly acceptable.

Table 15.9: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Remote	Minor	Low (broadly acceptable)
Stage 1 & 2	Remote	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk where practicable. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.10: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN13	Appointment of marine coordinator to manage construction traffic movements
SN04	Liaison with Orkney Vessel Traffic Services
SN03	Enhanced vessel selection and auditing of vessels working on site taking into account the strong tidal flows likely to be experienced
GM01	Circulation of information to local fishing organisations to ensure information is passed to local fishermen via a Fisheries Liaison Officer
GM01	Additional circulation of information to surrounding recreational marinas that may be called on before or during visits to Orkney
SN01	The Brims site is located close to Scapa Flow which has three harbour tugs with the potential to tow a drifting vessel (dependent on vessel size and weather)

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.1.3 Dropped Object during Construction Activities at Project

This hazard is that of an object used in construction of the Project is dropped. In the most likely case, a small object may be dropped and sink to the seabed. The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation.

For both Stage 1 and Stage 1 & 2, the frequency is considered reasonably probable. Due to there being a greater number of structures being constructed during Stage 1 & 2, the frequency is expected to be marginally higher, but would not be such that the rank changes. The expected (average) consequence is assessed as negligible, e.g., small object is dropped. This gives an overall risk of low (broadly acceptable).

Table 15.11: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Reasonably probable	Negligible	Low (broadly acceptable)
Stage 1 & 2	Reasonably probable	Negligible	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk where practicable. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.12: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN15	Wet storage of devices/equipment (i.e., temporary storage in water not at their final locations) to be minimised.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.1.4 Man Overboard during Operations within the Site

This hazard is that there is a man overboard during construction activities at the Project.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. The most likely consequence would be a man overboard during construction activities, and is recovered quickly with minor impact on operations. The realistic worst case may include the potential for loss of life, with a major impact on operations.

For both Stage 1 and Stage 1 & 2, the frequency is considered reasonably probable. The consequence is assessed as minor due to standard industry practice in place, such as appropriate PPE and training for site personnel. This gives an overall risk of tolerable (moderate).

Table 15.13: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Reasonably probable	Minor	Tolerable (moderate)
Stage 1 & 2	Reasonably probable	Minor	Tolerable (moderate)

The above assessment assumes standard industry practice has been applied to minimise this impact. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.14: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN11	Fast rescue craft available during construction work

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will reduce to low (broadly acceptable).

15.12.2 Operation and Maintenance

Impacts of the Project have been considered for the operation and maintenance phase of the Project.

15.12.2.1 Passing Vessel Powered Allision with Submerged Device

This hazard is that a vessel collides with an underwater device in the AfL area while transiting under command. Different vessel types (commercial shipping, fishing and recreational vessels) have been discussed separately but it is noted that the planned minimum clearance of 30m below the water level at LAT (approximately chart datum) means that only very deep-draught vessels (around 12m or higher – most notably tankers visiting Scapa Flow) would be at risk and only then in extreme conditions (combination of low tide and large waves) which increased their dynamic draught beyond 30m.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, stakeholder consultation and the MCA Policy Paper guidance on Under Keel Clearance (UKC). Most likely consequences for all vessel types are noted as minor damage to vessels or the tidal device, and minor injuries to crew members. The worst case consequence may be penetration damage to a vessel, resulting in severe damage, and possible fatality, but this is unlikely given that only large vessels could interact with the devices. It should be noted that, since the Hazard Review Workshop, the minimum Under Keel Clearance for the Project has been increased from 20m to 30m, and therefore the likelihood of collision is further decreased.

In the case of a commercial vessel, the frequency is considered extremely unlikely, due to the minimum clearance of 30m. This ranking applies to both Stage 1 and Stage 1 & 2. This gives an overall risk of low (broadly acceptable).

Table 15.15: Summary of risk – commercial shipping

Stage	Frequency	Consequence	Risk
Stage 1	Extremely unlikely	Minor	Low (broadly acceptable)
Stage 1 & 2	Extremely unlikely	Minor	Low (broadly acceptable)

In the case of a fishing or recreational vessel, the frequency is considered negligible, due to the minimum clearance of 30m, with baseline data and consultation showing no fishing or recreational vessels with deep enough draughts even in extreme conditions (all less than 10m). The consequence is considered minor. This gives an overall risk of low (broadly acceptable).

Table 15.16: Summary of risk – fishing vessels and recreational vessels

Stage	Frequency	Consequence	Risk
Stage 1	Negligible	Minor	Low (broadly acceptable)
Stage 1 & 2	Negligible	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk for commercial shipping, in particular, very large crude carriers visiting Scapa Flow, where practicable. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.17: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN12	Avoid developing extreme SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area to help ensure safe passage.
GM01	Circulation of information to local fishing organisations to ensure information is passed to local fishermen via a Fisheries Liaison Officer.
GM01	Additional circulation of information to surrounding recreational marinas that may be called on before or during visits to Orkney.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

In addition to the semi-quantitative risk rankings following the Hazard Review Workshop, the frequency of a vessel allision with a device was separately assessed using the COLLRISK software. This was based on the vessel traffic identified for the area, the range of draughts, wave heights and tidal heights that could be experienced. It was conservatively assumed that vessels would keep using their existing routes, i.e., no avoidance of the Brims site, even by deep-draughted vessel.

The model predicted a base case allision return period of approximately 1 in 54,600 years (Stage 1) and 1 in 3,500 years (Stages 1 & 2). The future case risk was also modelled assuming a conservative 50% increase in traffic, resulting in an allision return period of approximately 1 in 36,400 years (Stage 1) and 1 in 2,300 years (Stages 1 & 2).

15.12.2.2 Passing Vessel Drifting Allision with Submerged Device

This hazard is that a vessel loses power in the vicinity of the Project and drifts towards the subsea equipment under the influence of prevailing conditions (wind and tide). Different vessel types (commercial shipping, fishing and recreational vessels) have been discussed separately but it is noted that the planned minimum clearance of 30m below the water level at LAT means that only very deep-draught vessels (c. 12m and above) would be at risk and only in extreme conditions.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, stakeholder consultation and MCA guidance on under keel clearance. Most likely consequences for all vessel types are noted as minor damage to vessels or the tidal device, and minor injuries to crew members. The realistic worst case consequence may be penetration damage to a vessel, resulting in severe damage, and possible fatality, but this is unlikely given that only large vessels could interact with the devices.

In the case of a commercial vessel, the frequency of drifting into the site and having sufficient dynamic draught to interact with a subsea turbine at least 30m below LAT is considered negligible for both Stage 1 and Stage 1 & 2. The consequence is considered minor as only large vessels could potentially interact and personnel onboard should be aware of the danger (it is noted that drifting in this area would already be a hazard for the vessel due to proximity to land). This gives an overall risk of low (broadly acceptable)

Table 15.18: Summary of risk – commercial shipping

Stage	Frequency	Consequence	Risk
Stage 1	Negligible	Minor	Low (broadly acceptable)
Stage 1 & 2	Negligible	Minor	Low (broadly acceptable)

In the case of a fishing or recreational vessel, the frequency is considered negligible due to the minimum clearance of 30m. The overall risk is low (broadly acceptable)

Table 15.19: Summary of risk – fishing vessels and recreational vessels

Stage	Frequency	Consequence	Risk
Stage 1	Negligible	Minor	Low (broadly acceptable)
Stage 1 & 2	Negligible	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk where practicable. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented.

Table 15.20: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN12	Avoid developing SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area.
GM01	Circulation of information to local fishing organisations to ensure information is passed to local fishermen via a Fisheries Liaison Officer.
GM01	Additional circulation of information to surrounding recreational marinas that may be called on before or during visits to Orkney.
SN01	The Brims site is located close to Scapa Flow which has three harbour tugs with the potential to tow a drifting vessel (dependent on vessel size and weather).

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

Separate to the risk ranking based on the workshop, Anatec's COLLRISK software was used to model the drifting vessel allision risk with subsurface turbines. This is based on the premise that propulsion on a vessel must fail before a vessel will drift. The model takes account of the type and size of the vessel, number of engines and average time to repair in different conditions. Different weather and tidal states are simulated and the worst case result selected. As with powered allision, the modelling took account of factors listed in the MCA UKC Policy Paper guidance, including vessel draughts, wave heights and tidal heights.

The exposure times for a drifting scenario are based on the ship-hours spent in proximity to the Project, estimated based on the traffic levels and speeds. The exposure is divided by vessel type and size to ensure these factors, which are based on analysis of historical accident data have been shown to influence accident rates, are taken into account within the modelling.

Using this information, the base case annual drifting ship allision frequency with the devices was estimated to be approximately 1 in 14 million years (Stage 1) and 1 in 4 million years (Stages 1 & 2). The future case risk was also modelled assuming a conservative 50% increase in traffic, resulting in a drifting allision return period of approximately 1 in 9 million years (Stage 1) and 1 in 2.9 million years (Stages 1 & 2).

15.12.2.3 Displacement of Vessels due to Avoidance of Site Leading to Increased Passing Vessel-to-Vessel Collision

Vessels being displaced and changing their passage to avoid the Project has the potential to increase congestion outside of the Project site, leading to increased vessel-to-vessel collision risk. The level of change from the baseline will depend on the extent of the displacement. This has been significantly reduced by embedded mitigation introduced into the Project design during the NRA. The revised AfL area has been selected to avoid infringing the approach to the recommended route to/from Scapa Flow for deep draughted vessels. The planned minimum device clearance of 30m below the water level at LAT (approximately chart datum) means that only very deep-draught vessels would need to consider altering their passage and only in extreme wave conditions. Typically Vessel Masters are recommended to maintain a minimum under keel clearance of 10% to 50% of their static draught when passage planning, though this is dependent on local factors.

Therefore, only vessels upwards of 20m draught may perceive a risk. Others may still avoid the site as a precaution; clear charting of the available clearance will give mariners the necessary information to make decisions on passage planning.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. For both Stage 1 and Stage 1 & 2, the frequency is considered extremely unlikely due to the Project not causing significant displacement of existing routes due to the limited vessels potentially at risk. There is potentially a greater area of displacement experienced for Stage 1 & 2; however it is not considered that this will increase the frequency rank. The consequence will depend on the vessels involved but on average is considered as minor damage to vessels and minor injuries to crew members. The realistic worst case consequence may be penetration damage to a vessel, resulting in severe damage, and possible fatality.

This gives an overall risk of low (broadly acceptable) as summarised in the table below.

Table 15.21: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Extremely unlikely	Minor	Low (broadly acceptable)
Stage 1 & 2	Extremely unlikely	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.22: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN13	Appointment of marine coordinator to manage work vessel movements
SN02	Liaison with Orkney VTS
SN12	Avoid developing extreme SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area to help ensure safe passage.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.2.4 Fishing Gear Interaction with Subsea Equipment within Project (E.g. Device, Foundation or Inter-Array Cable)

Fishing gear could potentially interact with the tidal turbines, foundations or inter-array cables within the Project causing a snagging hazard.

Consultation indicated that fishermen may no longer fish in the Project after construction due to the risk of fishing gear snagging on the turbines and the potential loss of fishing gear, however, this cannot be ruled out due to commercial pressures.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are assessed as being loss of fishing gear with no injury to crew members. The worst case would be a fishing vessel snags and loses stability, resulting in foundering of vessel and potential loss of life.

For both Stage 1 and Stage 1 & 2, the frequency is considered reasonably probable. The greater number of structures in the case of Stage 1 & 2 may increase the frequency; however this will not increase the rank. The expected (average) consequence is assessed as minor. This gives an overall risk of tolerable (moderate) as summarised in Table 15.23 below.

Table 15.23: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Reasonably probable	Minor	Tolerable (moderate)
Stage 1 & 2	Reasonably probable	Minor	Tolerable (moderate)

The above assessment assumes standard industry practice has been applied to minimise this impact. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.24: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
GM01	Circulation of information to local fishing organisations to ensure information is passed to local fishermen

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will reduce but remain as moderate (tolerable).

15.12.2.5 Vessel Anchoring on or Dragging Anchor over Subsea Equipment within Project

A vessel may anchor over subsea equipment within the site, or a nearby vessel at anchor may drag its anchor over a subsea structure.

Consultation indicated that vessels are not likely to anchor in the vicinity of the Project due to the water depths, with the weight of anchor chain required to anchor in such depths presenting a safety risk.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are assessed as being minor damage to subsea structure, with minor impact on operations and negligible impact on vessel. The realistic worst case is determined to be major damage to subsea structure, with major impact on operations and vessel becoming snagged on the subsea equipment.

For both Stage 1 and Stage 1 & 2, the frequency is considered negligible. The consequence is assessed as minor. This gives an overall risk of low (broadly acceptable) as summarised in Table 15.25.

Table 15.25: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Negligible	Minor	Low (broadly acceptable)
Stage 1 & 2	Negligible	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. No project specific (enhanced) mitigation measures were identified as being necessary during consultation and at the Hazard Review workshop.

15.12.2.6 Fishing Gear Interaction with Export Cable to Landfall

Fishing gear could potentially snag on the export cable of the Project. The final cable route and protection measures are still to be decided therefore an initial (high-level) assessment was conducted with further work planned when the cable route has been finalised. The cable will be surface laid, with localised protection of either steel armour, rock dumping or concrete mattresses.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are assessed as being loss of fishing gear with no injury to crew members. The worst case is determined to be fishing vessel snags and loses stability, resulting in foundering of vessel and potential loss of life.

For both Stage 1 and Stage 1 & 2, the frequency is considered reasonably probable. The greater number of export cables in the case of Stage 1 & 2 may increase the frequency, however the ranking was assessed to remain the same. The expected (average) consequence is assessed as minor. This gives an overall risk of tolerable (moderate) as summarised in Table 15.26.

Table 15.26: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Reasonably probable	Minor	Tolerable (moderate)
Stage 1 & 2	Reasonably probable	Minor	Tolerable (moderate)

The above assessment assumes standard industry practice has been applied to minimise this impact. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below in Table 15.27.

Table 15.27: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
GM01	Circulation of information to local fishing organisations to ensure information is passed to local fishermen
SN14	Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation. Burial is the preferred protection where seabed conditions allow.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will reduce but has been kept as moderate (tolerable) as full details of protection measures are as yet unknown.

15.12.2.7 Vessel Anchoring on or Dragging Anchor over Export Cable to Landfall

A vessel may anchor over the export cable or a nearby vessel at anchor may drag its anchor over the export cable.

Consultation indicated that vessels are not likely to anchor in the vicinity of the Project due to the water depths, with the weight of anchor chain required to anchor in such depths presenting a safety risk.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are assessed as being no damage to the export cable and minor impact on operations, with no impact on the vessel. The realistic worst case is determined to be major damage to export cable, with major impact on operations and vessel becoming snagged on the export cable.

For both Stage 1 and Stage 1 & 2, the frequency is considered negligible. The consequence is assessed as minor. This gives an overall risk of low (broadly acceptable) as summarised in the table below.

Table 15.28: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Negligible	Minor	Low (broadly acceptable)
Stage 1 & 2	Negligible	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below in Table 15.29.

Table 15.29: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN14	Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation. Burial is the preferred protection where seabed conditions allow.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.2.8 Loss of Tidal Device or Part of Device (e.g. Component Failure)

This hazard is that a device or component part may break off and become a risk to vessels.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. Most likely consequences are assessed as component of tidal device breaks free and sinks to seabed, with negligible impact on vessel operations. The worst case is determined to be a component of the tidal device breaking free and being buoyant, thus presenting a collision risk, with moderate effect on vessel operations in the vicinity. The staged approach to the Project (deploy and monitor) and regular maintenance will help reduce this risk.

For both Stage 1 and Stage 1 & 2, the frequency is considered reasonably probable. The greater number of structures in the case of Stage 1 & 2 may increase the frequency; however the overall rank was assessed to remain the same. The consequence is assessed as minor. This gives an overall risk of low (broadly acceptable) as summarised in the table below.

Table 15.30: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Negligible	Minor	Low (broadly acceptable)
Stage 1 & 2	Negligible	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk where practicable. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below.

Table 15.31: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN02	Orkney VTS will liaise with Coastguard and navigational warnings will be broadcast in an emergency.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.2.9 Restricted Search and Rescue Capability in an Emergency Situation or Increased Demand due to Project

This impact addresses whether the Project could restrict search and rescue capability in an emergency situation or increase demand for SAR due to incidents at the site. The absence of surface piercing elements and the substantial under water clearance significantly mitigates this impact. Also the BTAL has participated in the recent tidal energy industry consultation with the SAR Authorities on potential issues and the final layout will be agreed with the MCA.

The presence of work vessels in the area could assist search and rescue activities, but they could also increase demand on rescue services if there were an incident at the site. The latter should only be the case in a more serious emergency which is beyond the capability of the emergency response resources put in place by the Project ('self-help').

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. For both Stage 1 and Stage 1 & 2, the frequency is considered extremely unlikely. The consequence is assess as minor. This gives an overall risk of low (broadly acceptable) as summarised in Table 15.32 below.

Table 15.32: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Extremely unlikely	Minor	Low (broadly acceptable)
Stage 1 & 2	Extremely unlikely	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. No project specific (enhanced) mitigation measures were identified as being necessary during consultation and at the Hazard Review workshop.

15.12.2.10 Restricted Oil Spill Response in a Pollution Incident or Increased Demand due to Project

There may be restricted oil spill response capability in a pollution incident due to the presence of the Project. In addition, the activities associated with the Project, such as work vessels at the site, could increase the demand on pollution response resources in the event of an incident.

It is expected any incidents would tend to be minor as there will only be very limited oil inventories used on-site, and most incidents could be dealt with by the Project.

The risk was ranked based on discussion at the Hazard Review Workshop, review of baseline data, and stakeholder consultation. For both Stage 1 and Stage 1 & 2, the frequency is considered extremely unlikely due to the absence of surface piercing elements. Most likely consequences are assessed as restricted oil spill response (i.e. impact on containment of spill or spraying of dispersants). This gives an overall risk of low (broadly acceptable) as summarised in Table 15.33 below.

Table 15.33: Summary of risk

Stage	Frequency	Consequence	Risk
Stage 1	Extremely unlikely	Minor	Low (broadly acceptable)
Stage 1 & 2	Extremely unlikely	Minor	Low (broadly acceptable)

The above assessment assumes standard industry practice has been applied to minimise this impact. The risk is already assessed as being low due to embedded mitigation in place; however it is best practice to apply additional mitigation to further reduce this risk where practicable. Additional project specific (enhanced) mitigation measures identified during consultation and at the Hazard Review workshop are presented below, which is aimed at ensuring an efficient response should there be an incident on-site.

Table 15.34: Specific mitigation relating to shipping and navigation

Ref	Mitigation Measure Description
SN23	Coordination with local harbour to carry out combined drills/exercises.

Based on applying the enhanced, project specific mitigation measures, in addition to following standard industry practice, the residual risk will remain as low (broadly acceptable).

15.12.3 Decommissioning

Impacts during decommissioning would be considered to be the same as those experienced during the construction and installation phase of the Project, except that the Project should be well-known to all vessels using the area by that time. The mitigation would be the same as that presented for construction and installation.

15.13 ACCIDENTAL AND UNPLANNED EVENTS

All accidental events relevant to navigation have been encompassed in the assessment.

15.14 SUMMARY

- The shipping and navigation chapter provides description of the baseline features based on data and consultation with relevant stakeholders for the Brims area;
- Maritime traffic surveys, consisting of AIS, radar and visual observations covering a two week period in winter 2013 and a two week period in summer 2014, were undertaken for the Project;
- In the winter survey there were 20 transits through the AfL area, of which six were fishing vessels, five cargo vessels, four passenger vessels, one military, three classed as “other” and one unidentified;
- In the summer period, there were 21 transits through the AfL area, of which 11 were cargo ships, eight were fishing vessels and two were recreational vessels;
- Potential impacts upon shipping and navigation associated with construction, installation, operation, maintenance and decommissioning of the Project have been assessed;
- The assessment identified a number of potential impacts, none of which were assessed to cause unacceptable risk. This takes into account embedded mitigation such as the minimum 30m under water clearance below LAT of devices which significantly mitigates the risk of vessel interaction with the devices;

- Based on the mitigation embedded in the Project design, and by applying standard industry practice and additional, project specific mitigation identified during consultation and at the Hazard Review Workshop all of the residual risks were assessed to be either broadly acceptable or tolerable (ALARP with mitigation); and
- Further consultation will be carried out with key stakeholders such as Marine Scotland, the MCA and NLB, to ensure control measures are implemented appropriately and to agree any further measures required.

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Commercial Fisheries

Chapter 16

16 COMMERCIAL FISHERIES

16.1 INTRODUCTION

This chapter of the Environmental Statement (ES) considers the potential effects of the Brims Tidal Array Project (the Project) on commercial fisheries g the construction, operation and maintenance (O&M), and decommissioning phases. It describes the existing environment with regard to current fishing practices, gear type and target species and also considers aquaculture.

To gain a better understanding of the baseline and potential impacts, considerations should be given to the following technical chapters; Chapter 15 Shipping and Navigation, Chapter 12 Fish Ecology, Chapter 11 Benthic Ecology and Chapter 19 Socio-economics.

16.2 STUDY AREA

The impact assessment will focus on the potential impacts of the Project may have on commercial fisheries within the Project site and adjacent waters. There is variation in the area over which impacts may occur. The area over which an impact may occur can vary significantly between target species based on their catch methods and the range over which fishing gear is deployed. Therefore, potential impacts have been set in the context of a wider study area over which gear used in the Project site are thought to range. A 12nm radius around the Project site is usually advised by the Scottish Fishermen's Federation (SFF) where the Project is likely to interact with mobile gears (demersal and to a lesser extent pelagic fisheries) (Pers. Comm., John Watt, SFF, 2014a). The study area of 12nm around the Project site is to allow for any possible interaction (and a subsequent displacement of fishing) over the course of a normal 4 to 5 hour trawl, assuming a vessel was trawling at the average speed of 2.5 to 3 knots. This area therefore takes into consideration the space required by a fishing vessel with pelagic or demersal gear deployed to avoid collision or entanglement with renewable energy devices.

A 12nm buffer is not relevant for the deployment of static gears where the range of interaction is likely to be less than 500m. Given the significantly less potential for interaction and the near-shore location of the proposed development, the Project study area for shellfish fisheries will be a 600m buffer around the AfL area and cable route corridors (as shown in Figure 16.1), based on the length of lines used by potting vessels highlighted during the consultation[2].

2 Based on discussion between Kenny Budge and Nick Murphy on 24th May 2011

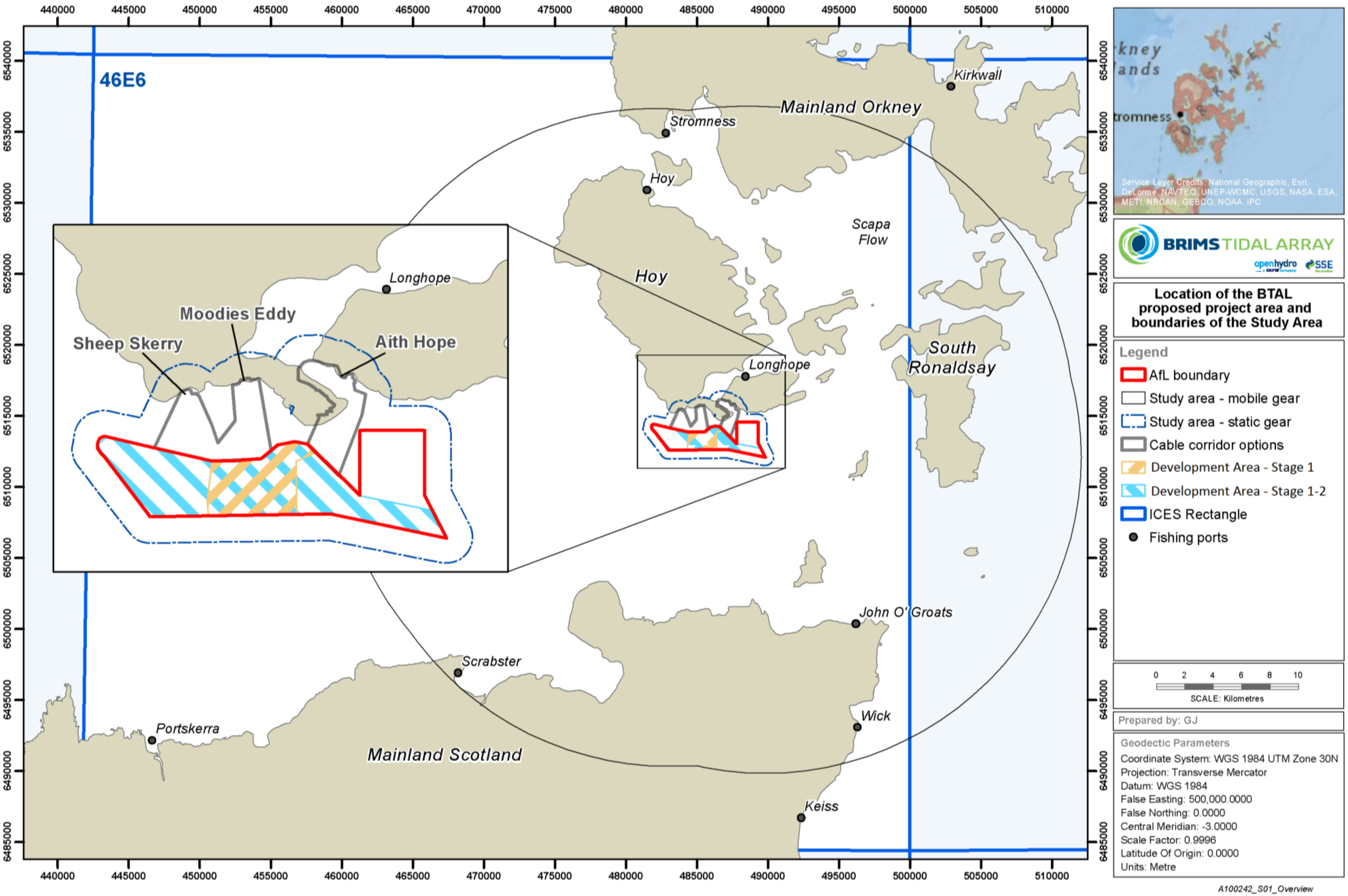


Figure 16.1: Location of the Project

16.3 DESIGN ENVELOPE CONSIDERATIONS

Table 16.1 and Table 16.2 detail the parameters of the Project that have been used in the commercial fisheries impact assessment. In cases where there are multiple options the worst case parameter has been used in the impact assessment.

Table 16.1: Design envelope parameters for commercial fisheries assessment Stage I

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment (Stage I)	Explanation of maximum Project parameters
TSS footprint – subsea gravity base	The footprint of the flat bottomed GBSs is 30m by 40m and therefore will have a maximum footprint of 1,200m^2 per gravity base.	Gravity base
TSS footprint	1,200m^2 per gravity base x 30 turbines in Stage I =36,000m^2	Gravity base
Minimum clearance between sea surface at LAT and turbine tip	30m	Subject to NRA consultation but 30m minimum should be considered the worst case.
Inter-array cable footprint	Stage 1 - 0.07km^2 (approximately 0.6% of total AfL area)	Based on 32 cables
Subsea cable connector hubs	Footprint of 37.5m^2 per hub x 2 hubs =75m^2	It is expected that a maximum of eight subsea cable connection hubs will be required in total for the Stage 1 and Stage 2 development. Gravity base foundations will be used for the subsea hubs.
Number of turbines/TSSs	Up to 30 turbines in Stage I	Turbine number dependent upon which technology is selected.
Maximum export cable corridor width	Maximum affected seabed width for up to 4 cables of 20m (5m for each cable including protection). Maximum width of corridor in which cables will be installed is 920m	Cable protection may be required along the full length of the export cable. This will be in the form of rock placement, concrete mattresses and/or grout bags. The total width of seabed directly affected by the 4 cables is estimated at 20m (5m per cable). Allowing for a spacing of 2-3 times water depth between each cable. Maximum depth is 100m therefore the maximum width of corridor in which cables will be installed is 920m (20m + (3 x 300m)).
Maximum export cable corridor length	Maximum length AfL to Aith Hope 6.5km	This is the longest proposed cable corridor.
Maximum export cable corridor footprint	5,980,000m^2 (6km^2)	-

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment (Stage I)	Explanation of maximum Project parameters
Duration of installation and construction activities	Installation of Stage 1 will take up to 24 months. Initial commissioning of the first installed turbines could take up to two months. Overall commissioning is expected to take six months.	Installation will commence in Q2 2019 and continue for 24 months to the end of Q1 2021 (there will be a year following Stage 1 installation of no construction activity). Commissioning of Stage 1 is expected to start at the end of Q2 2019 for completion at the end of Q4 2019.
Vessel activities during operation and maintenance	Routine inspections: these are expected to occur over one to two days every two years per turbine (based on 20 minute ROV inspections per turbine); and General maintenance: either at site (depending on weather conditions) or removal and re-deployment of turbines removed for general maintenance at onshore facility, every 5-10 years per turbine.	During operation it is likely that vessels will be present in the AfL area throughout the year. On average this is expected to be one vessel per day. However, there may be periods when there are more vessels e.g. two or three or no vessels depending on weather conditions and maintenance works required.

Table 16.2: Design envelope parameters for commercial fisheries assessment Stage 1 and 2

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment (Stage 1 and 2)	Explanation of maximum Project parameters
TSS footprint – subsea gravity base	The footprint of the flat bottomed GBSs is 30m by 40m and therefore will have a maximum footprint of 1,200m^2 per gravity base.	Flat bottomed gravity base.
TSS footprint (Stage 2)	240,000m^2 (30m x 40m = 1,200m^2 x 200)	Based on 200 devices using flat bottomed gravity bases.
Minimum clearance between sea surface at LAT and turbine tip	20m minimum clearance	Subject to NRA consultation but 20m minimum should be considered the worst case.
Inter-array cable footprint	Stage 1 & 2 - 0.36km^2 (approximately 3% of total AfL area)	Based on 208 cables
Subsea cable connector hub footprint	Footprint of 37.5m^2 per hub x 8 hubs = 300m^2	-

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment (Stage 1 and 2)	Explanation of maximum Project parameters
Number of turbines/ TSSs	Up to 200 turbines with a total capacity of 200MW	Turbine number dependent upon which technology is selected.
Maximum export cable corridor width	Maximum affected seabed width of 80m (5m for each cable including protection). Maximum width of corridor in which cables will be installed is 4,510m	Cable protection may be required along the full length of the export cable. This will be in the form of rock placement, concrete mattresses and/or grout bags. The total width of seabed directly affected by the 16 cables is estimated at 80m (5m per cable). Allowing for a spacing of 2-3 times water depth between each cable. Maximum depth is 100m therefore the maximum width of corridor in which cables will be installed is 4,580m (80m + (15 x 300m)).
Maximum export cable corridor length	Maximum length AfL to Aith Hope 6.5km	This is the longest proposed cable corridor.
Maximum export cable corridor footprint	29,250,000m^2 (29.25km^2)	-
Duration of installation and construction activities	Installation will take up to 3 years, beginning one year after the completion of Stage 1 installation. Initial commissioning of the first installed turbines could take up to 2 months. Overall commissioning is expected to take 2-3 years for Stage 2.	Stage 2 installation will begin in Q2 2021 and will end in Q2 2024. Commissioning of Stage 2 will commence Q2 2021 for completion by end of Q3 2023.
Vessel activity during operation and maintenance	Routine inspections: these are expected to occur over one to two days every two years per turbine (based on 20 minute ROV inspections per turbine); and General maintenance: either at site (depending on weather conditions) or removal and re-deployment of turbines removed for general maintenance at onshore facility, every 5-10 years per turbine.	During operation it is likely that vessels will be present in the AfL area throughout the year. On average this is expected to be one vessel per day. However, there may be periods when there are more vessels e.g. two or three or no vessels depending on weather conditions and maintenance works required.

16.4 LEGISLATIVE FRAMEWORK AND POLICY CONTEXT

There is no specific legislation which covers the scope of impact assessment on commercial fisheries. There are however several sets of guidance which are relevant to the Project:

- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments – guidelines based on outputs from a technical workshop organised by the UK Fisheries Economics Network (UFEN and Seafish, 2012) (Socio-economic assessment can be found in Chapter 19);
- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison (FLOWW, 2014); and
- Guidance on Commercial Fisheries Mitigation and Opportunities from Offshore Wind commissioned by Collaborative Offshore Wind Research into the Environment (COWRIE) (Blyth-Skyrme, 2010).

16.5 SUPPORTING SURVEYS AND STUDIES

The commercial fisheries baseline is based upon a comprehensive desk-based study supported by consultation with the fishing industry (as detailed in Table 16.4). Data sources used during the desk based study to determine the commercial fisheries baseline are detailed in Table 16.3.

Table 16.3: Summary of relevant data sources

Survey/study	Date of survey/study	Description
MMO landings values (£) and effort (time fished)	2009 - 2013	Vessel Monitoring System (VMS) based datasets for UK vessels > 15m were provided in GIS format (3 x 2nm). This included details at the International Council for the Exploration of the Sea (ICES) Statistical Sub-Rectangle level.
Marine Scotland landings value (£) and liveweight (tonnes)	2009 - 2013	Landings data for UK vessels landing from ICES Rectangle 46E6 (30 x 30nm) and for the period 2009 – 2013 were provided in spreadsheet format by Marine Scotland. These data included details on effort by month, species and gear type for all vessel sizes which the above source (greater resolution data) did not show.
ScotMap spatial data, compatible with GIS	2007-2011	Spatial information on fishing activity of Scottish registered commercial fishing vessels under 15m in overall length. This interview based data covers a period 2007 – 2011, 100% vessel coverage, and is aggregated to 5km grid squares. Includes monetary value and vessel number data on creel activity, *Nephrops* trawls, other trawls, dredges, divers and mackerel line fishing.
Marine Scotland seasonal landings of primary target species	2009 - 2013	Data on the monthly landings of the most targeted species in ICES rectangles 46E6 including value (£) and liveweight (tonnes).
Succorfish spatial data compatible with GIS	2013 - 2015	Spatial information on local fishing patterns from fishermen participating in the Orkney Fishery Research Project. Smaller vessels (< 15m length) used electronic VMS to indicate the location of fishing activity around Orkney.
Maritime Traffic Survey technical reports	2013-2014	Data on the number of fishing vessels utilising the Project site during two 14 day periods, one in winter 2013 and one in summer 2014.

In addition to these datasets, relevant sources of information were consulted to inform the background and baseline commercial fishing conditions in the Project site, including:

- 2013 vessel and employment statistical tables (Marine Scotland, 2015);
- UK Sea Fisheries Statistics 2013 (Marine Management Organisation, 2014);
- Scottish Government vessel register (Scottish Government, 2015); and
- Individual fishermen and their representatives during consultation.

16.6 DATA GAPS AND UNCERTAINTIES

Data from Marine Scotland and the Marine Management Organisation (MMO) can be used in-combination with ScotMap and Succorfish data to provide a baseline which reflects fishing activity within the Project and surrounding areas. There are however the following uncertainties.

The key uncertainty is associated with data regarding landings from ICES rectangle 46E6. The scale of ICES rectangles is much greater than the Project, therefore it cannot be assumed that fishing activity across the ICES rectangle is representative of fishing activity within the Project study area. However, it does give an indication of fishing activities in the wider area which can be used to inform consultation activities and interpretation of higher resolution data. A secondary uncertainty is associated with the Succorfish data which shows the spatial distribution of local fishing patterns. Some fishermen utilising the area are not involved with Succorfish so some fishing activity may be missing from the dataset. Furthermore, the VMS devices used on these smaller boats may not accurately describe fishing distribution because of failure to work or not emitting pings regularly enough to reflect the accurate movement of fishing vessels.

The use of ScotMap data and consultation with local fishermen has reduced these data gaps through the use of interviews and the provision of additional spatial data. There are also limitations with this data: although 100% vessel coverage was achieved, the information is aggregated to 5km squares which makes overlap with the Project study area difficult to extrapolate.

16.7 CONSULTATIONS

The key points raised by stakeholders regarding commercial fisheries are presented in Table 16.4. Local fishermen were identified by Fiona Matheson from the Orkney Fisheries Association. Every effort was made to engage with all identified fishermen utilising the Project site to gain their input to inform the baseline activity and therefore determine on the potential impact of the Project effectively.

Table 16.4: Key issues raised by stakeholder during consultation

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Succorfish data	Fishermen and Orkney Fisheries Association	Succorfish data should be used with caution; it was voluntary so not all vessels participated; sometimes it does not work, pings every 10 minutes and can go over land when going around corners	Data only used in conjunction with publicly available data (ScotMap) and data collected from fishermen during consultation	Chapter 16: Commercial Fisheries

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Dredging in cable export route	Fishermen	Concern for dredging over the export cable	This has been considered in the EIA – baseline suggests that the cable route corridors would not support dredging activity as the seabed is largely comprised if bedrock rather than soft sediments	Chapter 16: Commercial Fisheries
Creel activity close to Project site	Fishermen	Concern for fishing lines trailing into AfL or export cable route corridors and associated entanglement risk	Snagging and entanglement risks are considered in Chapter 15: Shipping and Navigation	Chapter 15: Shipping and Navigation
Herring fishery	Scottish Pelagic Fishermen's Association (SPFA) and the Scottish Fishermen's Federation (SFF)	Concerns regarding impacts on herring fishery (both exploitation and spawning grounds)	This has been considered in the EIA – baseline data indicates that herring fishery not active in or around the Project site	Chapter 12: Fish Ecology and Chapter 16: Commercial Fisheries

16.8 ASSESSMENT METHODOLOGY

The methodology was submitted for comment to MS-LOT to ensure a thorough baseline and approach to the assessment. Comments were received back on 9th July 2015 and where appropriate addressed during the preparation of this ES chapter.

16.8.1 Assessment Criteria

The impact assessment criteria for commercial fisheries is detailed in Table 16.5 and Table 16.6. Table 16.7 details the matrix used to assess the significance level and therefore whether the impact has the potential to be significant.

Table 16.5: Definitions for sensitivity of commercial fisheries

Sensitivity	Criteria
High	Fishing activity is located only within the Project study area. Fishing activity is of high intensity in the Project study area. Fishing activity relies on the resources in the Project study area.
Medium	Fishing activity is located within the Project study area most of the time. Fishing activity is of medium intensity in the Project study area. Fishing activity relies on resources in the Project study area for most of the time.
Low	Some fishing activity is located within the Project study area but most effort is expended outside the Project study area. Fishing activity is of low intensity in the Project study area. Fishing activity relies on resources from outside of the Project study area most of the time.
Negligible	Fisheries are not sensitive to change.

Table 16.6: Definitions for magnitude of effect for commercial fisheries

Magnitude	Criteria
High	Widespread total loss or very major alteration to the baseline conditions of commercial fisheries. Little or no recovery anticipated. Impact likely to occur.
Medium	Change to commercial fisheries in a localised area (confined to the Project footprint and immediate locality) for the Project duration, but no lasting change to baseline conditions. Good recovery potential following decommissioning (approximately 2 years). Impact will possibly occur.
Low	Change from baseline conditions measurable but within scale of natural variability, and confined to the Project footprint. Temporary alteration or effects on commercial fisheries confined to a small percentage of locally available fishing grounds, with rapid recovery likely. Impact unlikely to occur.
Negligible	No change or an imperceptible change to the baseline condition of commercial fisheries. Impact extremely unlikely to occur.
Positive	An enhancement of ecosystem or population parameter. An enhancement in the availability or quality of a resource to the extent of potentially benefitting the well-being of persons utilising that resource benefitting from it in some way.

Table 16.7: Assignment of impact significance for commercial fisheries based on sensitivity of receptor and magnitude of effect

Sensitivity of Receptor	Magnitude of effect			
	High	Medium	Low	Negligible
High	*MAJOR*	*MAJOR*	*MODERATE*	*MINOR*
Medium	*MAJOR*	*MODERATE*	*MINOR*	*MINOR*
Low	*MODERATE*	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*
Negligible	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*	*NEGLIGIBLE*

Any impact ≥ moderate is significant under EIA regulations.

16.9 BASELINE DESCRIPTION

16.9.1 Fishing Activity Overview

The available fishing effort and landings data (for vessels > 15m in length) for the area of the Pentland Firth surrounding the Project is summarised in Figure 16.2. These averaged annual data cover the period 2009 - 2013 and indicate that fishing effort and value of landings varies throughout the Project study area and surrounding waters. These data indicate effort and landings in the Project site is negligible compared to other areas within the Project study area. This general fishing pattern was also confirmed during consultation with the Scottish Fishermen's Federation (SFF) and the Scottish Pelagic Fishermen's Association. Most vessels that actively fished in the Project site between 2009 and 2013 were registered within the UK (Pers. Comm., David Turnbull, Marine Analytical Unit, Marine Scotland 2014b). Figure 16.3

indicates the relative value of the inshore fishery based on ScotMap data and Figure 16.4 highlights the number of vessels active in the area. The relative value highlights the amount of income from different fishing areas and is calculated by summing the percentage of income assigned to each cell for each fisherman who fishes in that cell. These figures demonstrate the relative importance of the inshore areas of the export cable corridor options. Data from consultation with fishermen corroborates the ScotMap data which also indicates that the most prominent gear utilised in the Project study area is static gear for crab and lobster.

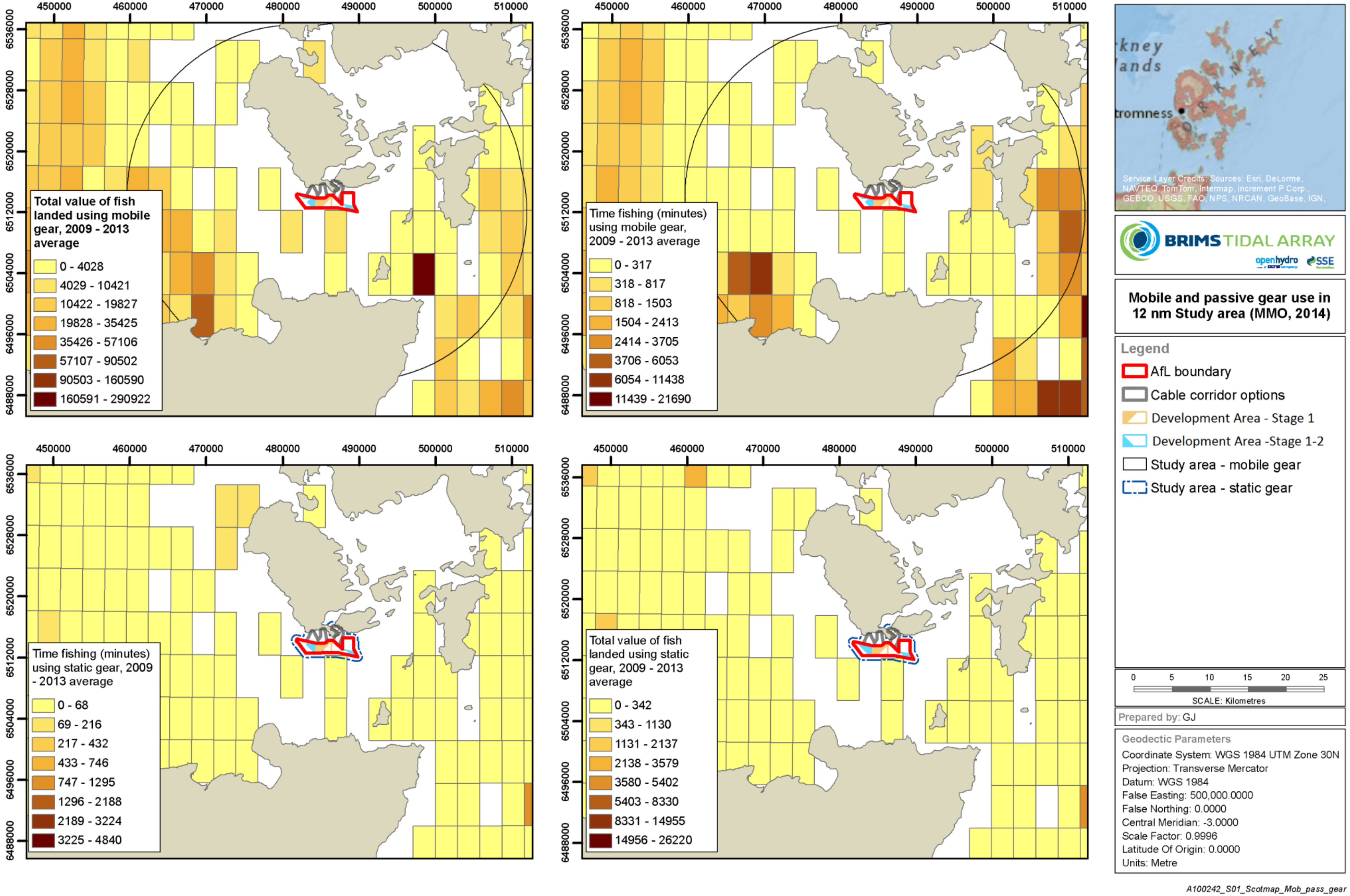


Figure 16.2: Mobile and passive gear use in 12nm Project study area (MMO, 2014)

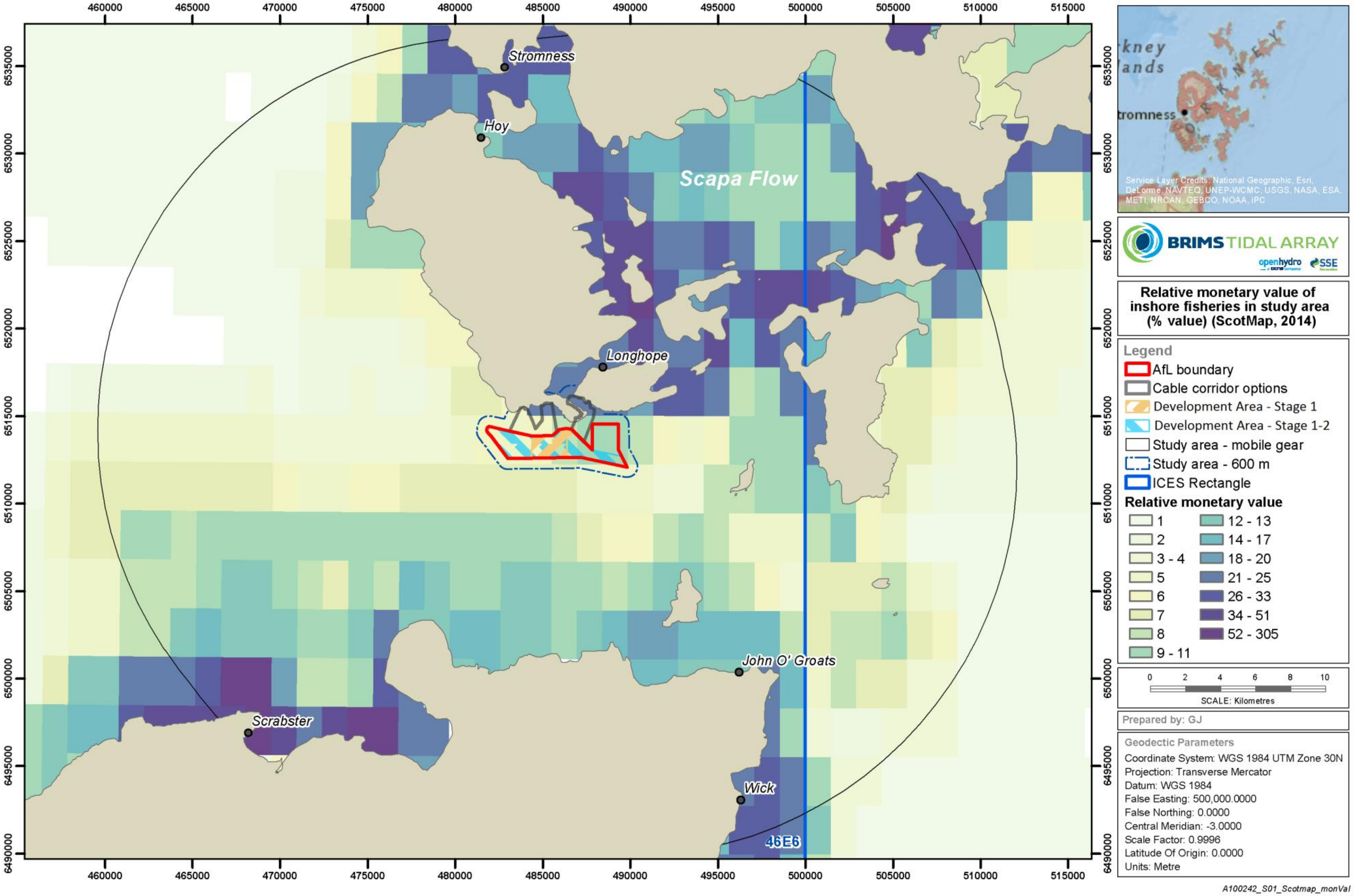


Figure 16.3: Relative monetary value of fishing activity in Project site and surrounding waters (ScotMap, 2014)

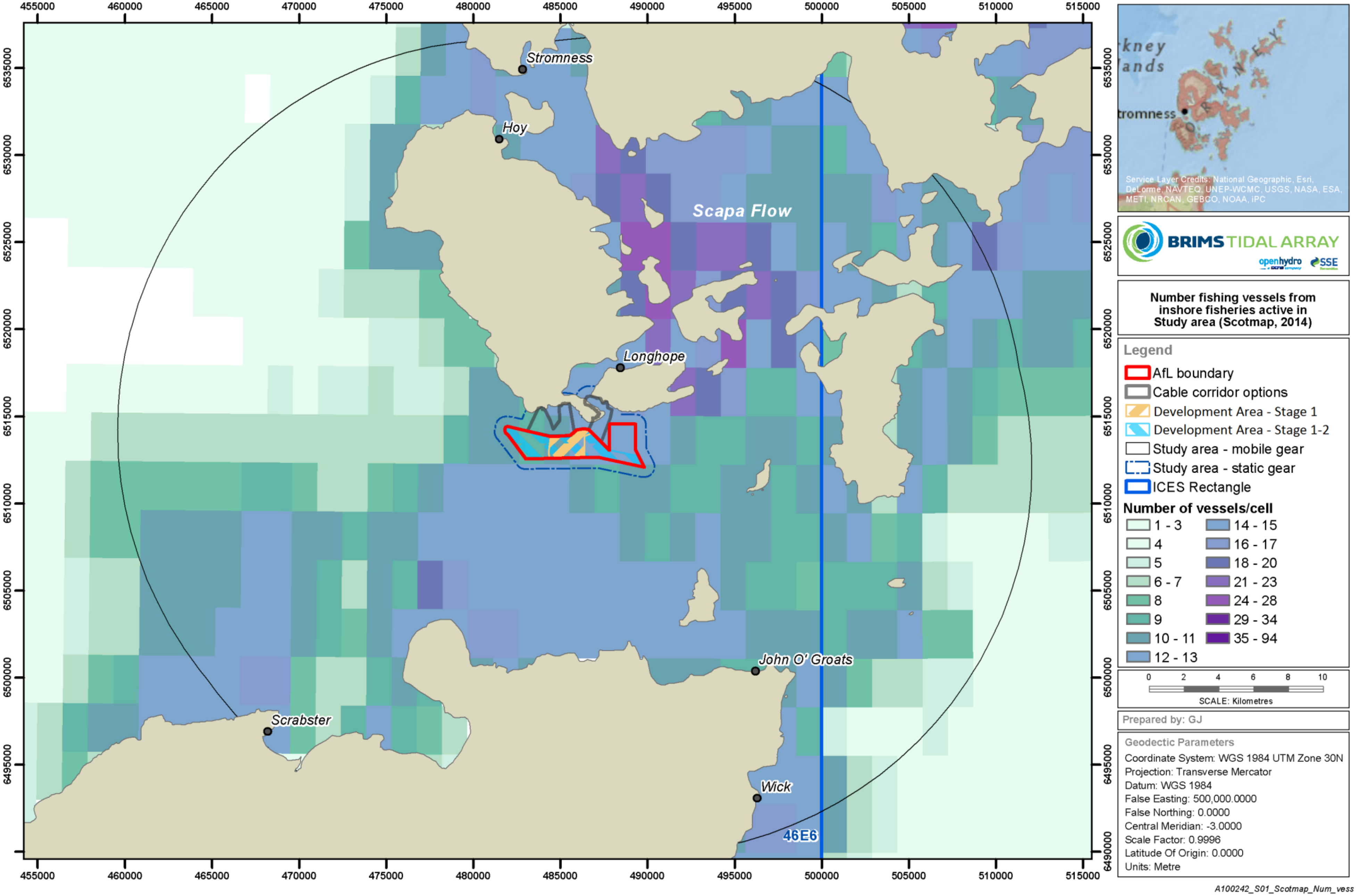


Figure 16.4: Number of fishing vessels active in Project study area and surrounding waters (ScotMap, 2014)

In ICES rectangle 46E6, the shellfish fishery is largest in terms of both economic value (£) and liveweight (tonnes). This is reflected in the species targeted from each rectangle, as shown in Table 16.8. The top five species landings values and weights have been highlighted in bold and are further discussed in the context of the relevant fishery in Section 16.9.2.

- Edible (brown) crab *Cancer pagurus* and lobster *Homarus gammarus* dominate the landings in ICES rectangle 46E6 across all vessel sizes, both separately accounting for 22% of the total value of landings and 29% and 3% of the liveweight landed respectively (Pers. Comm.: David Turnbull Marine Analytical Unit at Marine Scotland 2014). ScotMap data corroborates this, which highlights the use of pots and creels as dominant in the Project study area, as shown in Table 16.8.
- Herring *Clupea herrangus* are targeted by pelagic gear and account for 25% of landed weight, but only 7% of value landed.
- Monkfish *Lophius piscatorius*, typically targeted by demersal trawlers, accounts for 12% of value and 6% of landed weight from ICES rectangle 46E6.
- Scallops are caught with mobile gear in the 12nm Project Study area (although diving is common elsewhere in Orkney) and comprise 8% of the value of landings and 5% of landed weight from ICES rectangle 46E6.

Table 16.8: Species landed from ICES rectangle 46E6 from 2009-2013 (annual average) (Pers. Comm.: David Turnbull Marine Analytical Unit at Marine Scotland, 2014)

Species	Value (£)		Liveweight (tonnes)	
	Average	% of total	Average	% of total
Edible Crab	789,003	22	642	29
Lobster	787,165	22	72	3
Monkfish	415,854	12	130	6
Scallops	302,167	8	122	5
Velvet crab	290,166	8	120	5
Haddock	272,538	8	251	11
Herring	237,341	7	564	25
Cod	153,870	4	77	3
Nephrops	3,482	<1	<1	<1
Other	The remaining 7% of value and 11% liveweight is made up from landings of the following species (in descending order of value): periwinkles, megrim, whiting, green crab, squid, whelks, crawfish, saithe, razor clam, queen scallops, horse mackerel, mackerel, ling, spurdog, john dory, lemon sole, pollack, plaice, hake, tusk, skates and rays, witch, turbot, halibut, roes, gurnards (grey and red), spotted ray, other or mixed demersal, thornback ray, sea urchin, cuckoo ray, bass, white skate, unidentified dogfish species, red mullet, common skate, cockles, greater forked beard, gurnard and latchet, catfish, long nosed skate, other crustaceans, other flatfish, mixed clams, sole, conger eels, brill, eels, blonde ray, redfishes, octopus, dabs and Unid SD Squal shark and dogfish.			
Note: Values in bold indicate top five species landing values and weights.				

16.9.2 Description of Individual Fisheries

16.9.2.1 Crab and Lobster Fishery

Figure 16.5 illustrates the distribution of the creel fishery (crab and lobster). Analysis of these data for the Project site and surrounding waters out to 600m demonstrate that active small vessels fishing for crab and lobster are worth on average between £2,450 - £5,308 per year (ScotMap, 2014). Figure 16.5 shows that the Stage 1 area, the Sheep Skerry and Moodies Eddy cable routes have a lower average value of £2,450-£3,811 per year. The higher average value range of £3,811 - £5,308 corresponds with the western tip of the AfL and the eastern area of the AfL as shown in Figure 16.5. The value of these areas is averaged across all vessels active in the area, which is between 8 and 12 (ScotMap, 2014). The ScotMap data shows the average value across the cells used during data collection. Supplementary data, shown in Figure 16.6 highlights that fishing effort is unlikely to be evenly dispersed across the cell and is in fact concentrated close to shore, in the cable route corridors (Succorfish, 2015). Parts of the Stage 1 and Stage 2 areas are shown to support fishing activity six times from January to March 2014 (Succorfish, 2015).

Crab is targeted on a variety of substrates, lobsters are targeted on rocky, uneven ground and around wreck sites. Crab and lobster are not currently quota restricted, although all vessels landing over a particular weight (200kg of lobster, 750 kg of crab) must be licenced.

Edible crabs are generally targeted consistently throughout the year peaking slightly in December. Lobsters are targeted seasonally with landings increasing from June to December, peaking in August. Velvet crab landings fluctuate from year to year and the highest catches are recorded from April to June (Figure 16.7 and Figure 16.8). As a result of the limited size of vessels operating in the area, weather conditions are a significant factor in determining levels of activity in the winter months. In addition to full time vessels, there are also a number of part time vessels that will set a small number of creels in inshore areas during the summer months.

Fishing vessels, targeting crabs and lobsters with creels are known to utilise the Project study area operating out of Longhope (Table 16.3). The vessels target crab (edible and velvet crabs) and lobster seasonally from September to March, or are active all year round targeting edible crab and lobster. The vessels have two full-time crew members. Entanglement with structures in the tidal array was raised as a concern by the fishermen. This impact will be discussed in Chapter 15: Shipping and Navigation. The consultation process highlighted that the grounds of the AfL are not suitable for crab and lobster as the seabed is flat and lacks the rocky crevices typically utilised by the species. Analysis of the benthic surveys in Chapter 12: Fish Ecology corroborates this, in addition to there being very little loose sediment in the AfL which is used for burrowing.

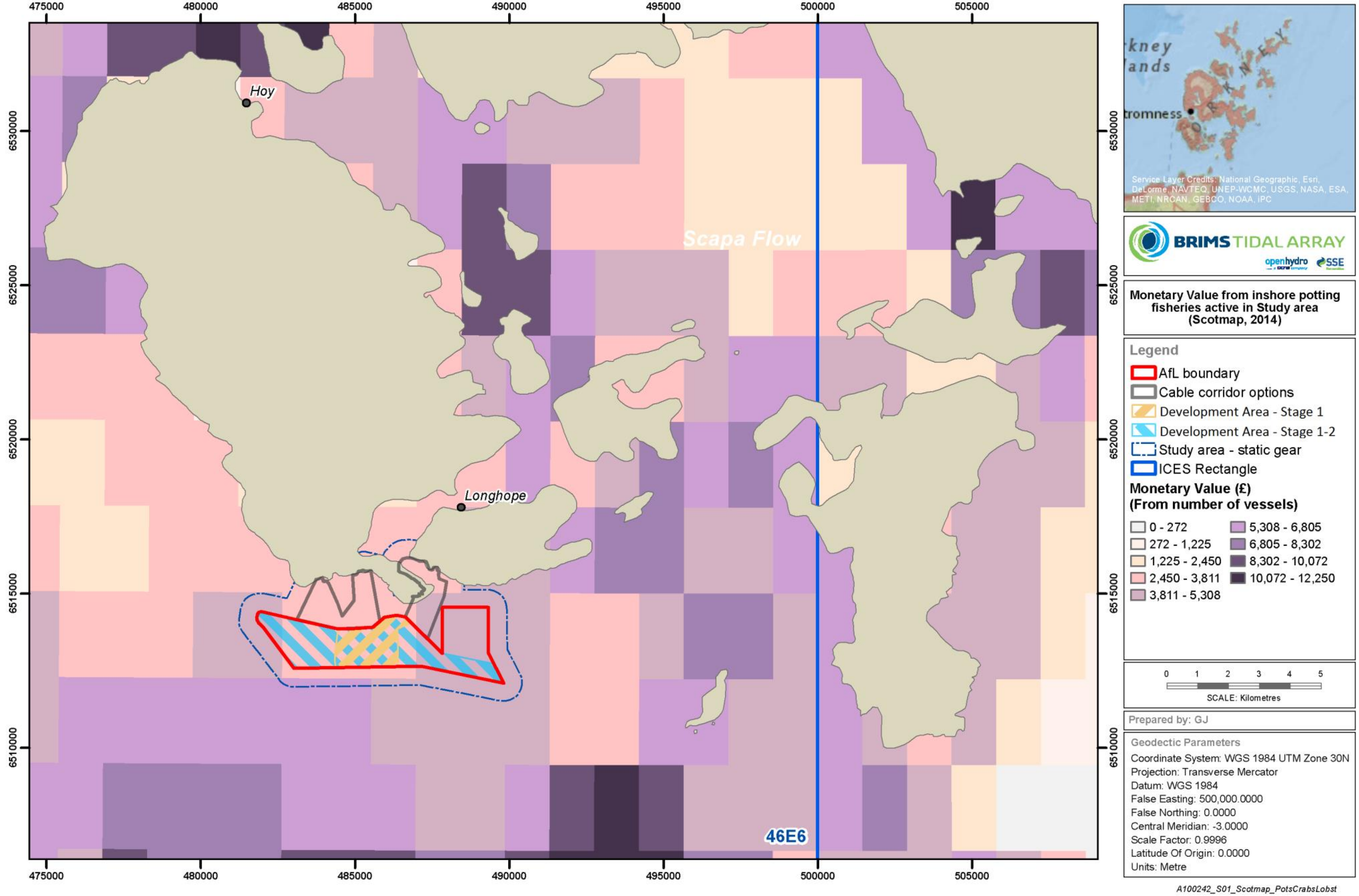


Figure 16.5: Potting activity in the Project study area and surrounding waters, based on annual average monetary value in £ (ScotMap, 2014)

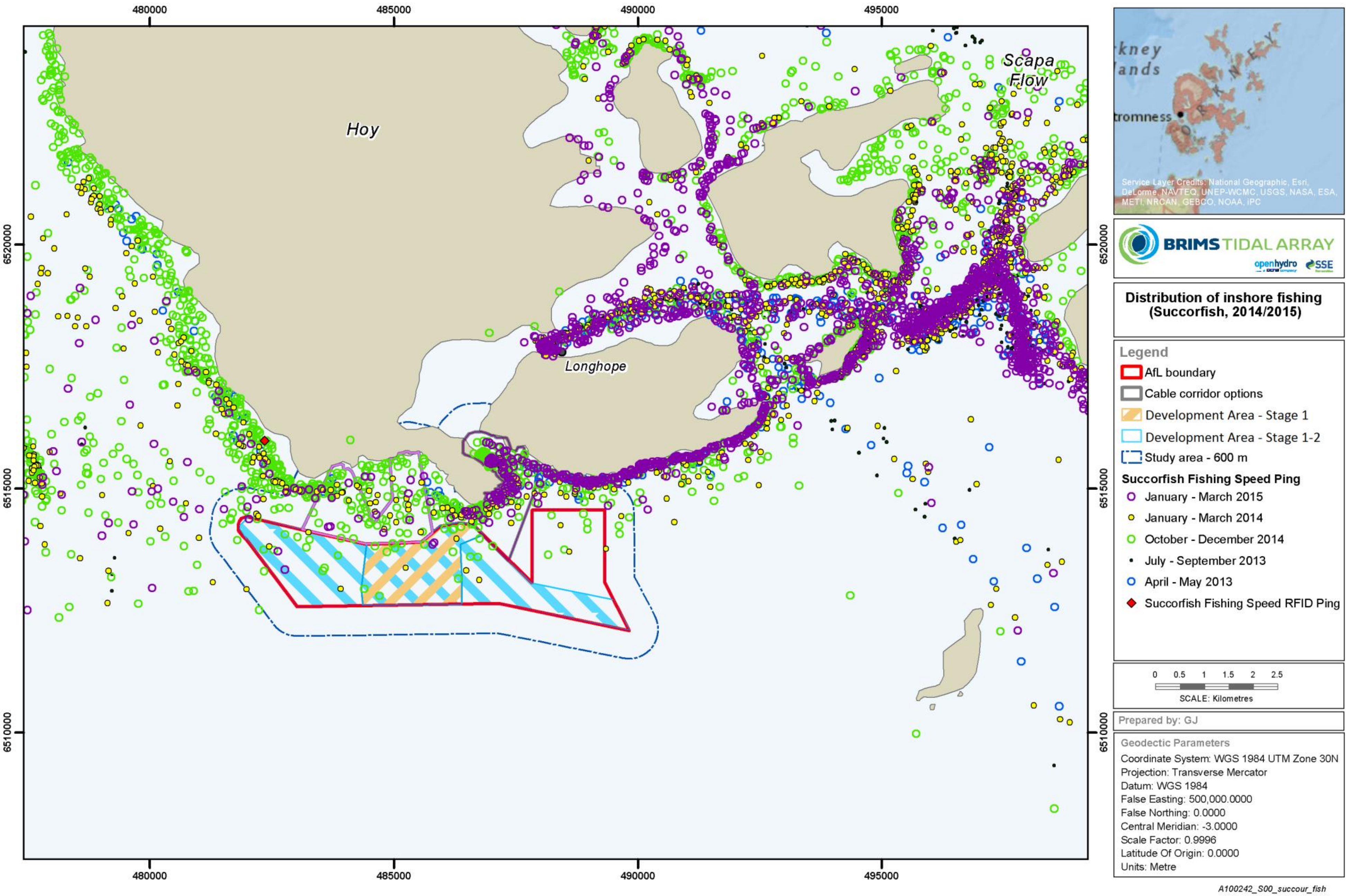
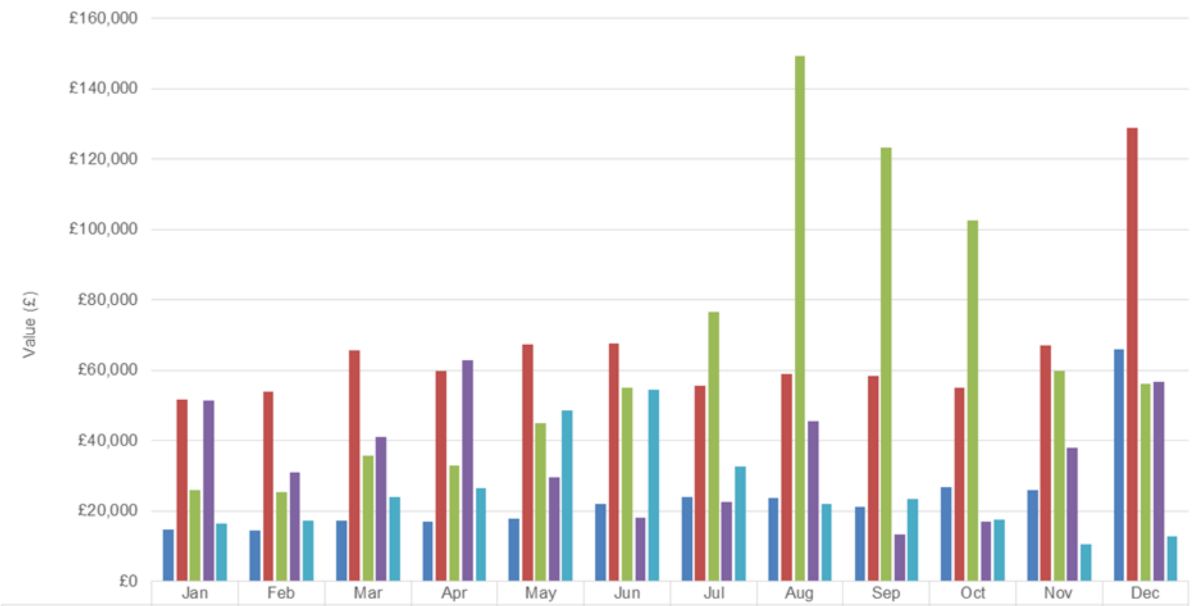
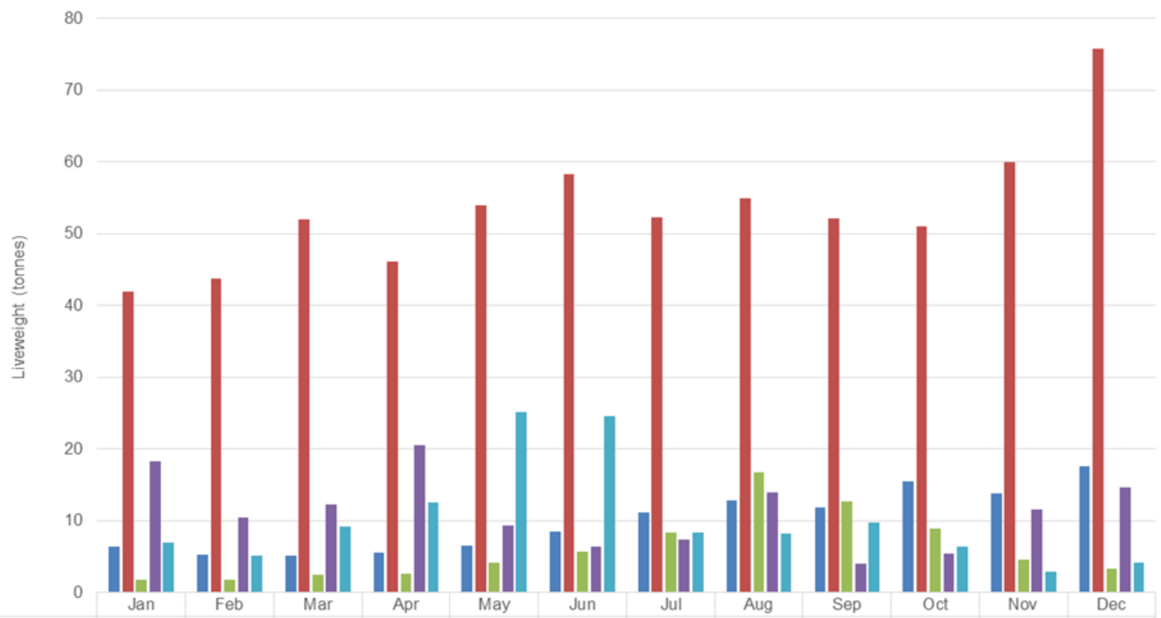


Figure 16.6: Fishing vessel activity in Project study area (Succorfish, 2015)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crabs (Velvet)	£14,784	£14,407	£17,173	£16,891	£17,791	£21,937	£23,871	£23,758	£21,198	£26,653	£25,787	£65,918
Crabs (C.P.)	£51,536	£53,834	£65,615	£59,748	£67,231	£67,530	£55,541	£58,980	£58,281	£54,939	£66,987	£128,781
Lobsters	£25,987	£25,237	£35,735	£32,956	£44,863	£54,869	£76,402	£149,393	£123,247	£102,454	£59,880	£56,141
Monks or Anglers	£51,316	£30,805	£40,952	£62,865	£29,504	£17,937	£22,513	£45,425	£13,227	£16,984	£37,839	£56,749
Scallops	£16,303	£17,128	£23,880	£26,560	£48,645	£54,322	£32,681	£22,016	£23,372	£17,525	£10,447	£12,791

Figure 16.7: Seasonal value (£) landings from ICES Rectangle 46E6 (all vessels sizes; average 2009-2013) (Pers. Comm.: David Turnbull Marine Analytical Unit, Marine Scotland 2014)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crabs (Velvet)	6	5	5	6	6	8	11	13	12	15	14	18
Crabs (C.P.)	42	44	52	46	54	58	52	55	52	51	60	76
Lobsters	2	2	2	3	4	6	8	17	13	9	5	3
Monks or Anglers	18	10	12	21	9	6	7	14	4	5	12	15
Scallops	7	5	9	12	25	25	8	8	10	6	3	4

Figure 16.8: Seasonal liveweight (tonnes) landings from ICES Rectangle 46E6 (all vessels sizes; average 2009-2013) (Pers. Comm.: David Turnbull Marine Analytical Unit, Marine Scotland 2014)

16.9.3 Herring Fishery

The herring fishery is the second most important fishery in the Project study area in terms of landed weight (comprising 25% of total weight landed in ICES rectangle 46E6), but not in terms of monetary value (7% of the value of landings from ICES rectangle 46E6).

Figure 16.2 illustrates the distribution of fishing using mobile gear within the Project study area and surrounding waters. No landings are reported from within the Project site, and consultation corroborates this fishery would not be impacted by the Project.

During consultation, the Scottish Pelagic Fishermen's Association confirmed that the herring fishery is unlikely to be impacted by the Project (Pers. Comm. Ian Gatt, SPFA, 2015). This is largely based on the absence of spawning herring, which are often targeted by herring fisheries. Whilst Coull *et al.,* (1998) indicates herring spawning activity in the area, more recent data suggested this is not the case (Ellis *et al.,* 2012). Even more recent data shows that juvenile herring may be present in the wider area, however the Project site was not surveyed (Aires *et al.,* 2014). The disparity is a result of spawning grounds being temporally and spatially variable; it is likely that the Project study area is not a herring spawning ground based on the most recent data (Ellis *et al.,* 2012; Aires *et al.,* 2014). This is supported by the habitat comparison carried out in Chapter 12: Fish Ecology and the fact that the area is not utilised by herring fishermen, as they traditionally target herring spawning areas. As a result herring fisheries are not likely to be impacted by the Project.

16.9.4 Demersal Fishery

Monkfish is the most important whitefish species landed in ICES rectangle 46E6 comprising 12% of landed value and 6% of landed weight. Figure 16.2 illustrates the distribution of fishing using mobile gear within the Project study area and surrounding waters. No landings are reported from within the Project site.

16.9.5 Other Shellfish Fisheries

ScotMap data shows that scallops are targeted by diving in the vicinity of the Project site. However, given the site location, it is likely that diving is not carried out within the Project study area and this result is a product of the data analysis: a 5 x 5km square overlaps the open water area of the proposal and the sheltered waters of Scapa Flow.

One of the skippers consulted dredges the Project study area for clams in the spring, and trawls for *Nephrops* during July and August. This skipper raised concerns for potential gear conflict with the cable/cable protection with dredging which is discussed in Chapter 15 Shipping and Navigation. The skipper did not voice concern regarding trawling for *Nephrops*. This corresponds with *Nephrops* trawling distribution data which indicates it is restricted to within Scapa Flow and does not occur within the Project site (ScotMap, 2014). It is likely that the *Nephrops* value shown in Table 16.8 is a result of effort within Scapa Flow, which is also within ICES rectangle 46E6.

16.9.6 Salmon and Sea Trout Fishery

There are no salmon or sea trout fisheries in Orkney. It is noted that Orkney has an important coastal sea trout rod fishery but the record of catches are poor. (Marine Scotland, 2015).

16.9.7 Aquaculture

There are no aquaculture sites located in the open water of the Project site and it is unlikely that vessels associated with aquaculture will transit through the Project site. There are 31 aquaculture sites around Orkney, and limitations of the technology mean that sites are restricted to sheltered waters (i.e. not overlapping with the more exposed waters of the Project site). The closest site is an Atlantic salmon farm, located 7.5km to the north of the Project site, within the sheltered waters of Scapa Flow. Maintenance vessels for this aquaculture site will use the port of Lyness, which is also located within Scapa Flow.

At present there are no active fish farms at the site of Aith Hope; however, it is recognised in the Locational Guidelines for the Authorisation of Marine Fish Farms in Scottish Waters as a category 3 site, meaning that the site is categorised amongst those that have the lowest risk of impacts from nutrient enhancement and benthic impact and is therefore an optimum area for fish farming. The site covers an area of 0.6km^2 (Scottish Government, 2010). It has authorisation for a fin fish farm licence (Marine Scotland and The Scottish Government, 2013) although there are no known proposed fish farm developments for the area at present.

16.9.8 Key Ports and Vessel Numbers

Longhope is the only harbour of interest to vessels fishing the Project site. There are four vessels registered in this harbour below 10m in length, and one vessel over 12m in length (as shown in Table 16.9). Catch is distributed by various means: they are transported by ship or truck to a buyer or sent to market; or, in the case of lobsters, from August onwards, these are stored in tanks until a better price is achieved for Christmas. A small business based at Longhope packs or stores the caught produce. The closest registered auction sites to the Project site are Scrabster Fish Market and Scrabster Seafoods Limited (Marine Scotland, 2014).

During the Navigational Risk Assessment (NRA) Supporting Document: Anatec (2015) carried out a marine traffic survey which showed the majority of fishing vessels observed in the AfL were steaming through it except one vessel which was observed hauling pots on the eastern edge of the site during the winter 2013 survey (Chapter 15: Shipping and Navigation).

Table 16.9: Number of vessels registered at Longhope Harbour (Scottish Government, 2015)

Home Port	Number of Vessels			Total
	<10m	10 – 12m	>12m	
Longhope (Hoy)	4	0	1	5

16.9.9 Summary

Within the Project study area the fisheries most likely to be affected are the crab and lobster fisheries. Fishing effort and fishing vessel presence is greater in the cable route corridors than in the AfL. Few fishermen are known to utilise the Project site for fishing and those that do primarily use creels to target brown and velvet crabs and lobsters although there is some dredging activity to target clams and trawler to target Nephrops. Much of the AfL is not suitable crab or lobster habitat so fishing here is limited and activity is largely concentrated in the cable route corridor areas. The impacts that will be assessed in the following sections include loss of access to fishing ground, obstruction to fishing transit routes and change in the abundance of targeted species. These impacts are discussed in detail in Section 16.10. Other impacts on fishermen are discussed in more relevant chapters including Chapter 19 Socio-economics, and Chapter 15 Shipping and Navigation.

16.10 POTENTIAL IMPACTS

The potential impacts identified for each phase of the Project are:

16.10.1 Construction and Installation

- Loss of access to fishing grounds; and
- Obstruction to regular fishing vessel routes.

16.10.2 Operation and Maintenance

- Loss of access to fishing grounds;
- Obstruction to regular fishing vessel routes; and
- Change in abundance of target species.

16.10.3 Decommissioning

- Loss of access to fishing grounds; and
- Obstruction to regular fishing vessel routes.

16.11 MITIGATION MEASURES

16.11.1 Project Design Mitigation and General Mitigation

All Project Design and General Mitigation measures are set out in Chapter 5 Project Description, Table 5.15, and 5.16 respectively. These are standard practice measures based on specific legislation, regulations, standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur.

16.11.2 Specific Mitigation

The following mitigation measures (Table 16.10) will be implemented specifically to minimise the impacts on local fishermen, particularly aiming to ensure fishing activity along the coast is disrupted as little as possible.

Table 16.10: Specific mitigation measures commercial fisheries

Ref	Mitigation Measure Description
CF01	Communication and liaison with fishermen by FLO and marine traffic coordinators will continue throughout Project and cable route corridor decision making process
CF02	Discussions will be held with local marine users in advance of any works commencing to review procedures associated with the construction stage to ensure that they address local concerns as far as possible (Mitigation Measure GM01 Chapter 5, Table 5.16)
CF03	Fishermen will be notified of the schedule works taking place, location of safety zones and partially installed infrastructure as discussed in Chapter 15: Shipping and Navigation (Mitigation Measure GM01 Chapter 5, Table 5.16)
CF04	FLOWW Guidelines will be used throughout Project
CF05	Cable route corridors Sheep Skerry and Moodies Eddy would result in the greatest project mitigation for commercial fisheries as these have smaller footprints and fishing intensity is lower within them.

16.12 RESIDUAL EFFECTS

16.12.1 Construction and Installation

16.12.2 Loss of Access to Fishing Grounds

During the construction and installation period it will be necessary to implement a safety zone of up to a 500m radius on a rolling basis around areas where installation activities are taking place at any given time in line with the guidance notes, *Applying for safety zones around offshore renewable energy installations* (DECC, 2011). This safety zone will minimise the risk of collision between installation vessels in the area and ensure the safety of all personnel involved in turbine installation (mitigation GM07, GM14, CF03). All vessels, including fishing vessels, will be temporarily excluded from safety areas. This rolling safety zone is likely to last for up to one years during Stage 1 installation and a further three years during Stage 2 installation with one year with no installation or commissioning activity in the middle. The safety zone will only be in place whilst works are taking place and the current schedule suggests works will be take place on the basis of suitable weather conditions from Q2 2019 to Q1 2020 for Stage 1 and Q2 2021 to Q2 2024 for Stage 2. As with the turbine deployment area, there may be a safety zone of 500m around the cable laying vessel(s) for the duration of their installation (mitigation CF05, GM04, CF03).

The fishing effort that takes place within the Project site is for crab and lobster and is considered of low sensitivity given the low intensity in the AfL, as there are few vessels that utilise the area. The magnitude of the effect is assessed as medium as areas of exclusion due to the safety zone, while localised, may endure for an extended time period (a total of up to four years from 2019 to 2024). The overall level of impact is therefore ranked as minor and not significant.

The sensitivity of the receptor in the cable route corridor is assessed as medium as fishing intensity is higher than in the AfL with fishing activity occurring here most of the time. The magnitude of the impact is assessed as low as the change is confined to the Project footprint and the effect will be temporary. No significant impact is considered likely as a result of the loss of access to fishing grounds during the construction and installation phase (Table 16.11).

Table 16.11: Summary of residual effects of the loss of access to fishing grounds on fishermen

<table>
<tr><th>Technology Option</th><th>Receptor</th><th>Sensitivity</th><th>Mitigation</th><th>Residual Magnitude</th><th>Summary</th><th>Residual Significance</th></tr>
<tr><td>AfL</td><td>Fishermen</td><td>Low</td><td>GM07
GM14
CF03</td><td>Medium</td><td>Not significant</td><td>Minor</td></tr>
<tr><td>Aith Hope</td><td>Fishermen</td><td>Medium</td><td rowspan="3">GM07
GM14
CF03</td><td>Low</td><td>Not significant</td><td>Minor</td></tr>
<tr><td>Moodies Eddy</td><td>Fishermen</td><td>Medium</td><td>Low</td><td>Not significant</td><td>Minor</td></tr>
<tr><td>Sheep Skerry</td><td>Fishermen</td><td>Medium</td><td>Low</td><td>Not significant</td><td>Minor</td></tr>
</table>

16.12.2.1 Obstruction to Regular Fishing Vessel Routes

The shipping intensity survey (Chapter 15: Shipping and Navigation) observed that the majority of fishing vessels in the Project site were steaming to or from fishing grounds (as opposed to actively fishing in the area). During the summer and winter vessel surveys (each survey lasting 14 days) fishing vessels passed through the AfL 11 times. During construction and installation, regions of the Project study area will be inaccessible to fishing vessels as 500m safety zones will be in place while installation is taking place (mitigation GM07, CF03). These safety zones are likely to occur on a rolling basis up to 500m around construction and installation activities. Fishing vessels will be excluded from various areas of the Stage 1 development for up to one year and the Stage 1 and 2 development area for up to three additional years. Fishermen will be required to transit around the safety zones for the duration of them being in place which may increase operational costs or direct them to fish in alternative fishing areas.

Once the turbines and cables are installed and operational, vessels will be able to transit the AfL and cable route corridors as before the development of the tidal array as there will be a minimum clearance distance of 30m between the turbines and the sea surface. Loaded fishing vessels may have a draft of up to 9m thus will be able to navigate across the Project site safely. There will therefore be no ongoing obstruction to fishing vessels transiting the Project site.

The sensitivity of the receptor is low as few vessels transit through the Project site (Chapter 15: Shipping and Navigation). The magnitude of the effect is assessed as medium as any diversion required will be small (few hundred metres) and short lived in any one location. The overall level of impact is minor and not significant.

Table 16.12: Summary of residual effects of the obstruction to regular fishing vessel routes on fishermen

Technology Option	Receptor	Sensitivity	Mitigation	Residual Magnitude	Summary	Residual Significance
AfL	Fishermen	Low	GM07 CF03	Medium	Not significant	Minor
Aith Hope	Fishermen	Low	GM07 CF03	Medium	Not significant	Minor

Technology Option	Receptor	Sensitivity	Mitigation	Residual Magnitude	Summary	Residual Significance
Moodies Eddy	Fishermen	Low		Medium	Not significant	Minor
Sheep Skerry	Fishermen	Low		Medium	Not significant	Minor

16.12.3 Impacts during Operation and Maintenance

16.12.4 Loss of Access to Fishing Grounds

Given that the final turbine layout is still to be determined based on preferred Turbine Support Structures (TSSs) and turbine technologies, for the purpose of this assessment the worst case will be assumed, i.e. that fishing activity will not take place in the Stage 1 (or Stage 1 and 2 once installed) area for the lifetime of the Project (25 years). This is likely to affect the fishermen who fish in the AfL. The fishermen were concerned about interaction of the devices with creel lines (mitigation CF01, CF04). Fishing will be excluded within approximately 600m of the devices due to the snagging risk (mitigation CF05, GM04) (discussed in Chapter 15: Shipping and Navigation).

As much of the cable route option substrate comprises hard rock there is limited opportunity for burial of the export cable. Cable protection measures therefore include rock placement, concrete mattresses or grout bags. Once the export cable has been installed creel fishing activities can resume and there will be no ongoing loss of access. Within the cable route corridor the sensitivity is described as negligible as is the residual magnitude. The impact is not significant within the cable route corridor.

On a regional basis the sensitivity of the crab and lobster fishery is considered low as very few vessels actively fish within the Stage 1 or Stage 2 regions of the AfL. The magnitude of the impact is considered medium as the impact will be localised to the Stage 1 and 2 regions of the AfL and effects will be confined to a small percentage of locally available fishing grounds. Fishing will not be practical in the Project site for a 25 year period, but will be able to recommence following decommissioning. There will be no enforced exclusion however fishermen are anticipated to remain clear of the devices for safety reasons (i.e. snagging risk). The residual significance is assessed as minor for the AfL The impact is therefore not significant (Table 16.13).

Table 16.13: Summary of residual effects of the loss of access to fishing grounds on fishermen

Technology Option	Receptor	Sensitivity	Mitigation	Residual Magnitude	Summary	Residual Significance
AfL	Fishermen	Low	CF01 CF04	Medium	Not significant	Minor
Aith Hope	Fishermen	Negligible	CF05 GM04	Negligible	Not significant	Negligible
Moodies Eddy	Fishermen	Negligible	CF05 GM04	Negligible	Not significant	Negligible
Sheep Skerry	Fishermen	Negligible	CF05 GM04	Negligible	Not significant	Negligible

16.12.4.1 Obstruction to Regular Fishing Vessel Routes

Once the turbines are installed and operational vessels will be able to transit the AfL and cable route corridors as before the development of the tidal array. There will therefore be no ongoing obstruction to fishing vessel transit routes (GM14, GM03, GM04, GM01, CF01 and CF04). Throughout the operational period of the tidal array there may be periods of restriction as maintenance activities are carried out. These will be temporary and fishermen will be notified accordingly, for example via FishSafe, allowing them to manage the risk independently.

The sensitivity of the receptor is negligible as the impact is extremely unlikely to occur as fishermen will be able to transit the area during the operational phase of the Project. The magnitude is therefore negligible and the impact is not significant (Table 16.14).

Table 16.14: Summary of residual effects of the obstruction to regular fishing vessel routes on fishermen

<table>
<tr><th>Technology Option</th><th>Receptor</th><th>Sensitivity</th><th>Mitigation</th><th>Residual Magnitude</th><th>Summary</th><th>Residual Significance</th></tr>
<tr><td>AfL</td><td>Fishermen</td><td>Negligible</td><td>GM14
GM03
GM04
GM01
CF01
CF04</td><td>Negligible</td><td>Not significant</td><td>Negligible</td></tr>
<tr><td>Aith Hope</td><td>Fishermen</td><td>Negligible</td><td rowspan="3">GM14
GM03
GM04
GM01
CF01
CF04</td><td>Negligible</td><td>Not significant</td><td>Negligible</td></tr>
<tr><td>Moodies Eddy</td><td>Fishermen</td><td>Negligible</td><td>Negligible</td><td>Not significant</td><td>Negligible</td></tr>
<tr><td>Sheep Skerry</td><td>Fishermen</td><td>Negligible</td><td>Negligible</td><td>Not significant</td><td>Negligible</td></tr>
</table>

16.12.4.2 Change in Abundance of Target Species

The main target species within the Project site are crab and lobster. Crab and lobster are typically found in areas of shallow reef, rock and boulder habitat (Neal & Wilson, 2008; Wilson, 2008). Potential impacts on crab and lobster as a result of smothering is assessed as not significant in the Fish Ecology Chapter 12. Changes to available habitat during operation are assessed as a positive impact due to the recoverability of the crab and lobster population in the absence of fishing pressures, as reported in the Fish Ecology Chapter 12. The change in abundance of crab and lobster discussed in this section will be assessed in the context of a loss of seabed (and therefore direct loss of animals and habitat) and its impacts to fish stocks.

There will be a reduction in available habitat as a result of the footprint of the TSS, the inter-array cables and the export cables. For the purpose of this assessment the worst case would be the installation of gravity subsea base structure which has a total footprint of 1,200m^2 per TSS and 2 subsea hubs covering 75m^2. In Stage 1 there will be a maximum of 30 turbines. This would result in direct habitat disturbance of 1.24% of the Stage 1 area and 0.32% of the total AfL. There may also be some disturbance as a result of the inter-array cables which are expected to cover a maximum area of 0.07km^2

which is approximately 2.41% of the Stage 1 area and 0.63% of the AfL. The total area of habitat altered during Stage 1 is therefore 3.66% of the Stage 1 area and 0.95% of the AfL (Table 16.15). The addition of Stage 2 of the Project will increase the total area of impact from 2.94km^2 to 8.66km^2.

Table 16.15: Disturbance of crab and lobster habitat associated with each Project Stage

Feature (worst case)	Area of single unit (m^2)	Number of Units	Total area covered (m^2)	% of Area Coverage	% AfL	% Project study area (AfL and cable routes plus 600m buffer)
Stage I						
Gravity subsea support structure	1,200	30	36,000	1.24	0.32	0.11
Inter-array cables	n/a	n/a	70,000	2.41	0.63	0.21
Subsea hubs	37.5	2	75	0.003	0.0007	0.0002
Total	n/a	n/a	1060750	3.655	0.951	0.320
Stage 2						
Gravity subsea support structure	1,200	200	240,000	2.82	2.16	0.73
Inter-array cables	n/a	n/a	360,000	4.24	3.24	1.10
Subsea hubs	37.5	8	300	0.004	0.003	0.0009
Total	n/a	n/a	600300	7.244	5.403	1.831

There are three cable route options for the Project. The shortest route option is to Sheep Skerry where the cable length to shore is 2,500m, the cable to Moodies Eddie is 2,600m and the cable length to Aith Hope is 6,500m. The area of seabed affected by each cable route option is detailed in Table 16.16. Aith Hope and Sheep Skerry have the largest area of impact whereby 130,000m^2 of habitat is affected by Stage 1 and 520,000m^2 is affected by Stage 1 and 2.

Table 16.16: Area of seabed disturbance resulting from the cable route options

	Stage I			Stage 1 and 2		
	Moodies Eddy	Aith Hope	Sheep Skerry	Moodies Eddy	Aith Hope	Sheep Skerry
Length (m)	2,600	6,500	2,500	2,600	6,500	2,500
Width per cable (m)	5	5	5	5	5	5
No. Export cables	4	4	4	16	16	16
Total area affected by cable (m^2)	52,000	130,000	50,000	208,000	520,000	200,000

Current evidence indicates that modification of engineered structures can influence diversity and potentially increase the abundance of commercially exploited species. Cable protection in terms of density of boulders and crevices could provide sheltered areas for crab and lobster (Broadhurst & Orme, 2014). Whilst there will be no protection associated with the turbines, the cables will be protected by rock dump, mattresses or grout bags which afford the cables scour protection, amongst other things. Limited by the amount of reef habitat refuge, territory, food and behavioural requirements, the new substrate may augment total stock size of crab and lobster.

Even though crab and lobster are sensitive to impacts on the seabed, fishing activity is low in both the AfL and the export cable corridors and therefore assessed as negligible sensitivity. Due to the spatially restricted nature of the inter-array cables and export cables and TSS, the impacts are localised. Given a good recovery potential following construction, it is unlikely that any change to the baseline condition of these species caused by the Project will be detectable against natural variations in population numbers and the impact magnitude is considered to be positive. The overall significance is negligible, therefore the impact is assessed as not significant. (Table 16.17).

Table 16.17: Summary of residual effects of the change in abundance of target species on fishermen

Technology Option	Receptor	Sensitivity	Mitigation	Residual Magnitude	Summary	Residual Significance
Gravity based turbine support structure	Fishermen	Negligible	-	Positive	Not significant	Negligible
Cable Burial	Fishermen	Negligible	-	Positive	Not significant	Negligible
Cable Protection	Fishermen	Negligible	-	Positive	Not significant	Negligible

16.12.5 Impacts during Decommissioning

Impacts during decommissioning are expected to be similar to those identified during construction and installation in terms of changes in the abundance and distribution of target species and temporary displacement from fishing grounds except for the fact that fishermen will not have been fishing in the area for a number of years prior to decommissioning commencing. Therefore, whereas with installation, there is predicted to be a progressive increase in the area of seabed from which fishing activities will be restricted with decommissioning, there is expected to be a gradual reduction in the total area in which fishing activities cannot take place as tidal turbines are removed. Once decommissioning is complete fishing will be able to resume across the entire Project site. This will have a negligible impact on the local fishing community because of the low fishing activity that currently exists.

16.13 ACCIDENTAL AND UNPLANNED EVENTS

The key accidental events that may affect fishermen during the Project are vessel collision, snagging of creels on devices or loss of creels overboard and immobilised vessel drifting into Project site, with or without trailing line or anchor, which are discussed in detail in Chapter 15 Shipping and Navigation. There are also spill risks, e.g. a spill from a work boat which in extreme circumstances could affect fishing through area closure.

16.13.1 Accidental Release of Chemical Contaminants from Devices or Vessels

There can be serious environmental impacts as a result of accidental chemical or hydrocarbon (e.g. fuel) release. The magnitude of this impact depends on the quantity and type of material spilled, sea state and weather conditions at the time of the spill. Each turbine may contain up to 1,000 litres of lubricant and other oils. Spills can affect local fish and shellfish populations typically targeted by fishermen.

To minimise the risk of an accidental release of contamination from vessels or devices there are vessel management plans and other measures in the Environmental Management Plan which are designed to control the activity of vessels and the operation of the turbines. These plans will also provide measures to manage any spillage should an incident occur. This limits the potential effects should an accidental release occur.

The highly energetic environmental conditions typically encountered in the Project site will tend to rapidly disperse and dilute spilled material. It is likely that any released material will be highly dispersed before reaching the seabed where the key target species, lobster and brown crab, occur. The potential magnitude of the impact associated with an accidental release is considered to be low.

Table 16.18: Summary of residual effects of the accidental release of chemical contaminants from devices or vessels on commercial fisheries

Infrastructure type	Receptor Sensitivity	Mitigation	Residual Magnitude	Residual Significance
Vessels	Medium	GM07 GM14	Low	Minor
Turbines	Medium	GM07 GM14	Low	Minor

16.14 SUMMARY

- The overall amount of fishing activity within the Project site is considered low;
- Activity in the cable route corridors is greater than in the AfL;
- The key fisheries that could be affected are crab and lobster fisheries utilising static gear (creels);

- On a regional basis there are unlikely to be significant impacts to commercial fisheries based on interviews and ongoing discussion with fishermen who utilise the Project site;
- Potentially higher impacts to small number of localised fishermen to be managed through further mitigation measures and ongoing communication and liaison;
- Although no significant impact has been identified, mitigation measures based on the FLOWW guidelines will be implemented to ensure this remains the case, including: continued communication and liaison with fishermen on the cable route option and communication on the presence of safety zones (e.g. via Notice to Mariners and FishSafe) during the construction and installation phase, and the use of a rolling safety zone as opposed to an exclusion zone of the entire cable route corridor; and
- Continued communication and liaison with fishermen throughout the Project will take place.

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Seascape, Landscape and Visual Impact Assessment

Chapter 17

17 SEASCAPE, LANDSCAPE AND VISUAL IMPACT ASSESSMENT

17.1 INTRODUCTION

This chapter of the Environmental Statement (ES) considers the potential landscape, seascape and visual effects of the Brims Tidal Array Project (the Project) in terms of the installation and operational phases for offshore works and facilities as defined by the Project technical definitions.

The aim of the Seascape, Landscape and Visual Impact Assessment (SLVIA) process is to identify, predict and evaluate significant effects on particular elements of the seascape, landscape and visual resources arising from the proposed the Project.

Landscape is defined in the European Landscape Convention (Council of Europe 2000) as ‘an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. The term does not mean just special or designated landscapes and it does not only apply to the countryside. Landscape can mean a small patch of urban wasteland as much as a mountain range and an urban park as much as an expanse of lowland plain. It results from the way that different components of our environment - both natural (the influences of geology, soils, climate, flora and fauna) and cultural (the historical and current impact of land use, settlement, enclosure and other human interventions) - interact together and are perceived by us.’

“Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape” SNH (2012b) defines seascape as relating ‘to the visual and physical conjunction of land and sea which combines maritime, coast and hinterland character.’

As the offshore aspects of the Project will not result in any permanent infrastructure above water, no photomontages have been produced for this aspect of the Project. The presence of vessels in the seascape during installation and ongoing operations and maintenance will be temporarily visible, however for periods of up to 36 months for the full build out of the Project. Photomontages have not been produced due to their temporary nature, however the impact of vessels have been considered relative to particular theoretical viewpoints and in the context of existing seascape and landscape character.

Three landfall sites have been considered. This assessment has addressed the potential landscape, seascape and visual effects for all three options; Aith Hope, Moodies Eddy and Sheep Skerry. The final landfall location will be decided during detailed design.

The assessment was undertaken by Roz Maclennan of Horner + Maclennan Landscape Architects and Mike Wood, Landscape Architect.

17.2 STUDY AREA

Taking into account current guidance on other development types, and on discussions at scoping and pre-application stages with SNH and OIC, it was concluded that on a realistic and pragmatic basis the proposed the Project is unlikely to result in significant seascape, landscape or visual effects beyond a 10km radius from the centre of the site. The study area shown in Figure 17.1 was therefore selected.

17.3 DESIGN ENVELOPE CONSIDERATIONS

In line with the Rochdale Envelope approach, this assessment considers the maximum ('worst case') project parameters. Identification of the worst case scenario for each receptor (i.e. EIA receptor) ensures that effects of greater adverse significance would not arise should any other development scenario be taken forward in the final scheme design. Table 17.1 describes the detail of the Project parameters that have been used in this assessment and explains why these are considered to be worst case.

Table 17.1: Design envelope parameters for SLVIA assessment

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment	Explanation of maximum Project parameters
Twin Hull Barge (Open Hydro)	58x35x10m high	Stage 1 - 24 month period. One movement to and from mobilisation base per turbine – up to 30 turbines. Stage 2 - 36 month period. One movement per turbine – up to 170 turbines.
DP construction vessel (Other Device)	124x23x44m high	Stage 1 - 24 month period. One movement to and from mobilisation base per turbine – up to 30 turbines. Stage 2 - 36 month period. One movement to and from mobilisation base per turbine – up to 170 turbines.
Jack up Barge (all cable routes)	60x32x50m high	Stage 1 - 14 days (2019). One movement to and from mobilisation base per day. Stage 2 - 56 days (2020-21). One movement to and from mobilisation base per day.
Cable installation vessel (all cable routes)	145.5x24x47m high	Stage 1 - 2019/2020. One movement to and from mobilisation base per cable – 4 cables. Stage 2 - 2020-2021. One movement to and from mobilisation base per cable – 12 cables.

17.4 LEGISLATIVE FRAMEWORK AND POLICY CONTEXT

17.4.1 Relevant Legislation

The EIA Regulations are the only legislation directly relevant to this assessment.

17.4.2 Policy and Guidance

The methodology for the landscape, seascape and visual assessment has been agreed with Orkney Islands Council (OIC) and Scottish Natural Heritage (SNH). It takes into account best practice methodologies and the undernoted policy and landscape/seascape characterisation guidance:

- SNH; Handbook on Environmental Impact Assessment 2011; Appendix 1; SLVIA assessment (SNH, 2013);
- SNH; Guidance on Landscape/Seascape Carrying Capacity for Aquaculture (SNH, 2008);
- Orkney Islands Council; A Sustainable Energy Strategy for Orkney, September 2009 (OIC, 2009);
- Orkney Islands Council; Orkney Local Development Plan, April 2014 (OIC, 2014);
- Scottish Natural Heritage (SNH) and The Countryside Agency; Landscape Character Assessment for England and Scotland, 2002 (SNH, 2002);
- The Landscape Institute and the Institute of Environmental Assessment; Guidance for Landscape and Visual Impact Assessment, third edition, (TLI-IEMA, 2013);
- SNH Visual Representation of Wind Farms, December 2014 (SNH, 2014);
- SNH; Policy Statement No 02/03 – Wildness in Scotland's Countryside, (SNH, 2002);
- SNH; Assessing the Impacts on Wild Land – Interim Guidance, (SNH, 2007);
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- Land Use Consultant; SNH Orkney Landscape Character Assessment Review No 100, (LUC, 1998);
- SNH; The siting and design of aquaculture in the landscape: visual and landscape considerations, (SNH, 2011);
- Historic Scotland; An Inventory of Gardens and Designed Landscapes (HS 2015);
- Scottish Government; Scottish Planning Policy, June 2014 (Scottish Government, 2014);
- SNH Policy Statement No. 05/01; SNH's Landscape Policy Framework (SNH, 2005b);
- SNH; Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape: Guidance for Scoping an Environmental Statement, March 2012 (SNH, 2012b);
- Stanton, C. 1998. Caithness and Sutherland landscape character assessment. Scottish Natural Heritage Review No 103 (Stanton, C, 1998); and
- SNH Commissioned Report No. 103. An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms (SNH, 2005a).

17.5 DATA GAPS AND UNCERTAINTIES

It is not confirmed which of the cable landfalls is likely to be selected and for this reason the assessment is based on a worst case scenario.

17.6 CONSULTATIONS

A complete list of feedback from all consultees is summarised in Supporting Document (BTAL, 2015a). The key points raised by stakeholders regarding seascape, landscape and visual receptors are presented in Supporting Document (MS-LOT, 2014).As well as these key points, an extensive consultation process removed the consideration of surface piercing devices meaning that only subsea devices would be considered for the Project. The removal of surface piercing elements is one of the main elements resulting from consultation that has had a bearing on SLVIA.

Table 17.2: Key issues raised by stakeholder during consultation

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Onshore elements	OIC	Want to see assessment of onshore elements tying in with offshore elements	The assessment has taken the approach of applying for offshore permission only. The onshore elements, such as substations and overhead lines will be assessed as a separate future project	Chapter 21 Overview of Onshore Impacts
Viewpoint selection	OIC	Liaise with SNH and OIC over viewpoint selection	ZTV mapping informed the selection of proposed VPs Proposed viewpoints were sent to SNH and OIC as co-ordinates and a map on 14th May 2015. These were agreed prior to survey with SNH/OIC on the 11th June 2015	Refer to Section 2, Confirmation of scope
Hinterland and coastal zone	SNH	Make sure the definition of seascape takes account of the hinterland and coastal zone. This includes comments on the sensitivity of coastlines used in Table 2.1 of the methodology	Table 2.1 of the methodology and the preceding text was amended to make it clearer that our understanding of the coastline and the proposed methodology do take SNH's comments into account. The revised methodology was sent to SNH and OIC on the 14th May 2015. Both viewpoints and methodology were agreed by the 11th June 2015 prior to work commencing	Section 17.7.1.3
Remoteness	SNH	Take account of the potential impact on remoteness in South Walls and Brims	Has been covered in the assessment	Section 17.9
Onshore elements	SNH	Assess the effects of overhead lines and the substation on Melsetter House	As above the decision has been made to submit a substation application separately. This separate application will assess these effects	Chapter 21 Overview of Onshore Impacts
Viewpoints	SNH	Consider the addition of the school as a viewpoint	The school was added as an additional viewpoint	Section 17.9
Methodology	MS-LOT	Consider whether photomontages are appropriate with the reduction in the design envelope removing permanent marine landscape and visual impacts.	Photomontages were considered unnecessary given that there are no permanent visual impacts associated with the Project.	Section 17.7
Impact assessment	SNH	As nothing is likely to be visible due to subsurface devices being installed, SNH do not consider there is any requirement for SLVIA for the marine components of this application.	Due to the likely extended visual presence of vessels, these components have been assessed for effects on seascape, landscape and visual amenity but no photomontages have been produced to ensure approach is proportionate to impacts concerned.	Section 17.11

17.7 ASSESSMENT METHODOLOGY

17.7.1 Assessment Criteria

17.7.1.1 Overview Methodology

The methodology for the current study is based primarily on “Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape” (SNH, 2012b) which outlines a coherent approach building on a number of earlier existing sources including “Guidance for Landscape/Seascape Capacity for Aquaculture” (SNH, 2008).

These in turn are founded on the principles of landscape and visual assessment established in the seminal series of guidance publications produced under the joint auspices of the Landscape Institute and Institute of Environmental Management and Assessment. A third edition of these has recently been published: “Guidelines for Landscape and Visual Assessment 3rd Edition” (TLI-IEMA, 2013) Landscape Institute and Institute of Environmental Management and Assessment 2013 (GLVIA3), and this updated guidance is reflected in the methods outlined below. GLVIA3 stresses that the definition of landscape from the European Landscape Convention includes seascapes and marine environments; accordingly the fundamental process of assessment is unaltered.

The methodology varies from the guidance in that no photomontages have been produced, based on advice from SNH and MS-LOT during gatecheck (see 17.6 Consultations). As there are no permanent or long-term significant effects anticipated from the Project proposals, this approach is deemed proportionate to the impacts concerned.

In summary, this process includes the following key stages:

- Definition of Study Area;
- Confirmation of Scope;
- Description of Baseline;
- Assessment of Effects;
- Design input and Mitigation; and
- Reporting of significant residual effects.

17.7.1.2 Stage 1: Definition of Study Area

The Study Area on which the SLVIA focuses is shown on Figure 17.1, extending to include all areas from within which significant seascape, landscape and visual effects (as defined by EIA Regulations) are most likely to occur (this area will change as final sites are identified). The boundary which defines the Study Area was selected on a realistic and pragmatic basis, based on Zone of Theoretical Visibility (ZTV) mapping. It is noted that specific guidance in SNH (2012b, p22) states that “where wave and tidal structures lie at sea level, the extent of visual influence will be considerably less than that of a windfarm”.

The Study Area boundary has been provisionally determined as: 10km radius from the edge of the Project site boundary which will lie within the Agreement for Lease (AfL) area. To ensure that the worst case options were considered, the study area has been taken as a 10km radius from the Project AfL.

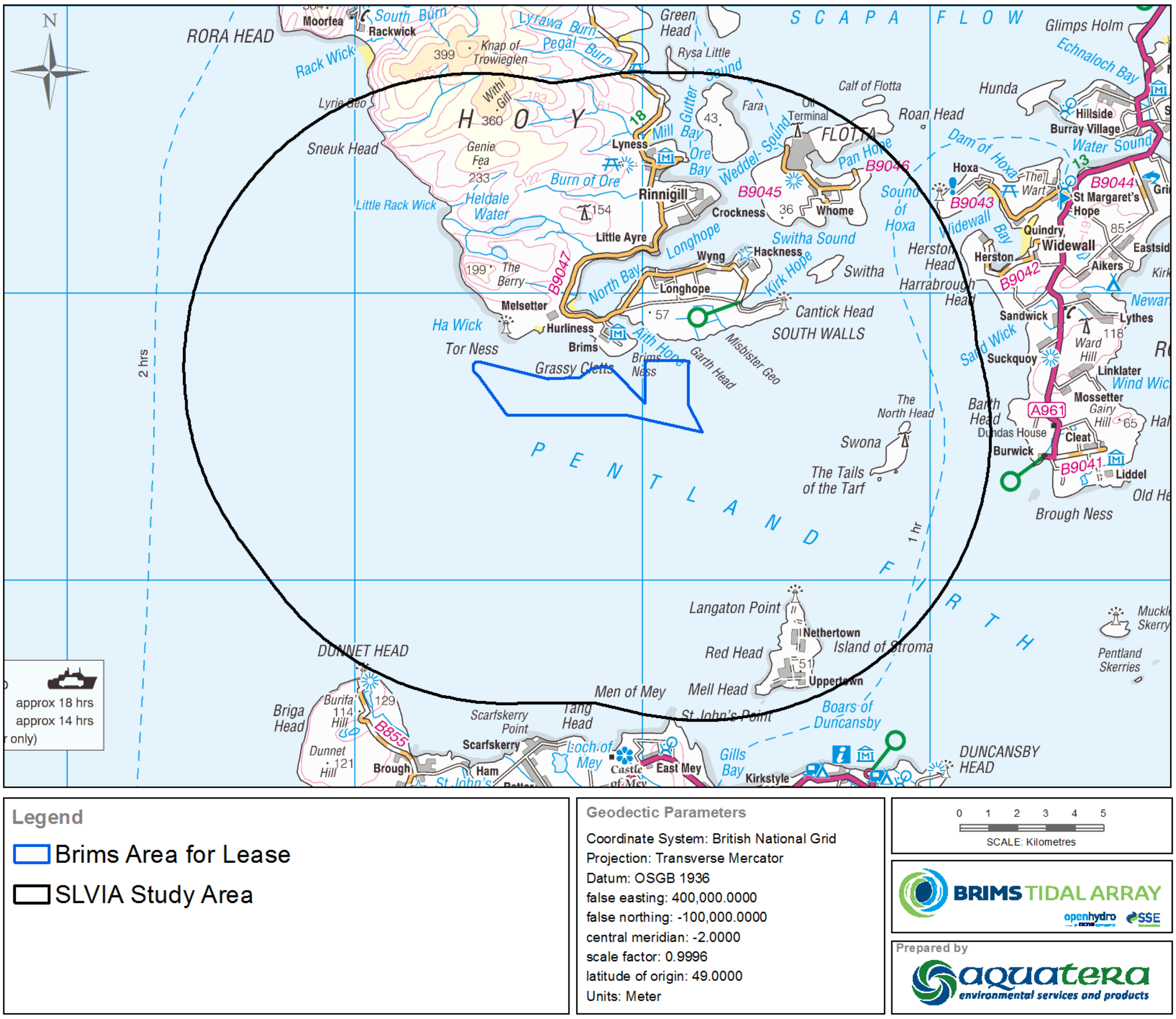

Figure 17.1: SLVIA Study Area

17.7.1.3 Stage 2: Confirmation of Scope

This stage includes:

- Liaison with SNH and OIC over the selection of viewpoints;
- Making sure the definition of seascape takes account of the hinterland and coastal zone; and
- Assess the potential impacts on remoteness in South Walls and Brims.

The finalised methodology and proposed viewpoints were sent to SNH and OIC on the 14 May 2015. Both SNH and OIC were happy with the methodology and selection of viewpoints and suggested the addition of a viewpoint at the Community School. This information was received via e-mail on the 11 June 2015. Subsequent changes to the Project description meant that any permanent visual structure was removed from the final design, meaning that impacts on the setting of cultural heritage assets were scoped out. In light of this, three viewpoints that had been selected solely for the assessment of cultural heritage assets and covered by other nearby viewpoints were dropped.

17.7.1.4 Stage 3: Description of Baseline

This stage includes:

- A desk study to establish the existing conditions, including the seascape, landscape and visual resources of the study area, and initial mapping of Zones of Theoretical Visibility (ZTVs) for the Project components;
- Field survey work, initially at strategic/reconnaissance level and later at detailed level, to verify the important seascape, landscape, and visual characteristics of the area highlighted by the desk study; and
- Identification of key seascape, landscape, and visual receptors.

17.7.1.5 Seascape Baseline

Baseline seascape character will be described by reference to:

- Seascape Character Types: as already identified at national level, derived from SNH Commissioned Report No.103 (SNH, 2005a);
- Coastal Character Areas (CCAs): to be identified in accordance with the method in SNH Commissioned Report No.215 (SNH, 2008), reflecting both a consistency in overall character at a broad scale or known geographical area; and
- Local Coastal Character Areas (LCCAs): to be identified in accordance with the method in SNH Commissioned Report No.215 (SNH, 2008), by further subdivision of CCAs into areas of distinct coastal character, by examining coastal characteristics and issues which may include: maritime influences, character of the coastal edge and immediate hinterland, and experience of wildness.

The key seascape receptors (the components of the seascape that are likely to be affected by the proposal) will be identified from the above descriptions and will include:

- Overall seascape character and key characteristics;
- Particular coastal elements and features; and
- Specific aesthetic or perceptual qualities.

17.7.1.6 Landscape Baseline

- Baseline landscape character will be described by reference to the Landscape Character Types identified in the existing published SNH assessment report (LUC, 1998);
- Designated landscapes within the Study Area will be identified and described. These include National Scenic Areas (NSAs), Local Landscape Areas (LLAs) and Historic Gardens and Designed Landscapes (HGDLs); and
- The landscape baseline information will reflect a full understanding of the historic characteristics of the landscape, in consultation with the cultural heritage specialists ORCA, and information included in Section 17.8 below.

The key landscape receptors (the components of the landscape that are likely to be affected by the proposal) will be identified from the above descriptions and will include:

- Overall landscape character and key characteristics;
- Individual landscape elements or features; and
- Specific aesthetic or perceptual qualities.

The scale of mapping to be used in the assessment process has been determined as 1:50,000, in accordance with guidance in SNH (2008).

17.7.1.7 Visual Baseline

The baseline studies for visual effects will establish:

- The area in which the Project will be visible;
- The different groups of people who may experience views of the Project (visual receptors);
- The viewpoints where they will be affected; and
- The nature of the views at those points.

The key visual receptors are the people within the area who will be affected by the changes in views and visual amenity and will include:

- People living in the area (residents);
- People working in the area (on sea and land);
- People travelling through the area on roads, ferries, or by air;
- People visiting the area (including tourists); and
- People engaged in recreation.

Viewpoints which fall within the ZTVs and Cumulative ZTVs (CZTVs) which are representative of these different groups will be identified and selected. They will be selected in accordance with criteria in GLVIA3 (TLI-IEMA, 2013) and specific guidance in SNH 2012 (2012b), (p.4.15) as agreed with MS and statutory consultees, principally OIC and SNH. The selection criteria for viewpoints will include the following:

- The full range of different types of views, e.g. popular hilltops, footpaths and other recreational routes, key transport routes (on and offshore where relevant), minor roads where the tidal array will be the focus of the view, settlements, cultural and recreational foci, and so on;
- Views from areas of high landscape or scenic value; both designated and non-designated, including NSAs, AGLVs, GDLs, SAWLs, tourist routes and local amenity spaces;
- A full representation of views from a range of distances out to the edge of the 10km study area, aspects, landscape character types and visual receptors; to include coastal views looking out to the coast and back, as well as across water to opposing shores;

- All aspects of the proposed the Project, i.e. illustrate it "in the round" to help in the design development and assessment processes. This will also enable assessment of a range of light conditions e.g. side-lit, back-lit and front-lit;
- Visual composition. For example focussed or panoramic views, simple or complex;
- The variety of images that the tidal array and associated infrastructure (in particular the onshore infrastructure) will present from coastal areas as well as important coastal hilltops and landmarks including, for example, where the whole tidal array is visible as well as places where partial views occur;
- A range of distances and elevations out to the edge of the 10km study area;
- Sequential views along specific routes; and
- Viewpoints which are already important vantage points within the landscape, for example local visitor attractions, scenic routes, or places with cultural landscape associations.

Key Design Viewpoints, as suggested in SNH (2012b) will be selected and agreed from the above list.

17.7.1.8 Stage 4: Assessment of Effects

The assessment of effects includes:

- Identification and evaluation of potential effects on seascape. 'Seascape effects are effects on seascape as a resource and affect seascape receptors as defined in the baseline study'. (SNH 2012b);
- Identification and evaluation of potential landscape effects. Landscape effects are effects on landscape as a resource and affect landscape receptors as defined in the baseline study;
- Identification and evaluation of potential visual effects. Visual effects are effects on views and visual amenity as experienced by people and affect visual receptors as defined in the baseline study; and
- Identification and evaluation of cumulative effects. Cumulative effects may occur to the seascape, landscape, or visual resource and are defined as "the additional changes caused by a proposed the Project in conjunction with other similar developments or as the combined effect of a set of developments, taken together." (SNH 2012c). In keeping with guidance, this section does not include consideration of 'any effects on the settings and views for historic buildings…and other heritage assets' (TLI-IEMA, 2013, p.77), which are covered in Chapter 18 Marine Archaeology and Cultural Heritage.

17.7.1.9 Sensitivity to Change of Seascape

The relative sensitivity of the seascape within the Local Coastal Character Areas is specific to the proposed change and depends upon a range of criteria which take account of the coastal edge, its immediate hinterland, and the seaward extent to the horizon, viewed from both landward and seaward perspectives. The published guidance (SNH 2012c, SNH 2008, TLI-IEMA, 2013) has been referred to in developing and applying the criteria. For the purposes of this assessment the following definitions have been applied as noted in Table 17.3. It is stressed that in the assessment of a specific receptor/effect, the actual criteria applied may differ from the Typical Criteria noted below. In all cases a clear explanation of the reasons for the judgement of sensitivity will be given, which is reached by combining the judgement of susceptibility to change with the judgement of value.

Table 17.3: Definitions for sensitivity of seascape receptors

Sensitivity	Criteria
High	Susceptibility to Proposed Change Seascapes where coastline or hinterland landscapes has distinctive physical characteristics including shape, enclosure, fragmentation, and specific historic, cultural, geological features. Seascapes with striking/expansive views, diverse visual composition and aesthetic qualities which are predominantly intact. Value Seascapes located within and which contribute to hinterland landscapes of high value, recognised at international to local level. Seascapes with a high degree of relative wildness*. Seascapes where there is evidence of value associated with natural heritage, recreational activity, cultural associations, or other special interests.
Medium	Susceptibility to Proposed Change Seascapes where coastline or hinterland landscape has relatively unremarkable physical characteristics including linear shape, large-scale, and little fragmentation. Seascapes with relatively simple visual composition and aesthetic qualities which are partly intact. Seascapes where settings of key views include some developed features and shipping or other maritime activity. Value Seascapes with a degree of relative wildness*, which may be compromised by factors including existing development and accessibility. Seascapes with few specific features of natural heritage, cultural associations, or other special interest.
Low	Susceptibility to Proposed Change Seascapes comprising well-settled and readily accessible coastlines and hinterlands where the Project is prominent. Seascapes where coastline or hinterland landscape has physical characteristics which can readily accommodate proposed the Project type. Seascapes with simple visual composition. Seascapes where aesthetic qualities are largely compromised by existing the Project. Seascapes with prominent and frequent shipping or other maritime activity. Value Seascapes where relative wildness* is considered to be very limited. Seascapes with no specific features of natural heritage, cultural associations, or other special interest.
Negligible	Susceptibility to Proposed Change Seascapes comprising urban coastlines and hinterlands dominated by the Project. Seascapes where coastline or hinterland landscape has physical characteristics which can readily accommodate proposed the Project type. Seascapes where visual composition is very simple or is such that proposed the Project type can be readily accommodated. Seascapes with very few intact aesthetic qualities. Seascapes with seaward views dominated by shipping or other maritime activity. Value Seascapes where relative wildness* is considered to be extremely limited or absent. Seascapes with no specific features of natural heritage, cultural associations, or other special interest.

*The level or degree of relative wildness will be assessed taking account of the existing SNH methodology as set out in "Mapping Scotland's Wildness Phase 1 – Identifying Relative Wildness Non –Technical Methodology, revised October 2012". The reasons for the judgements on levels of wildness will be clearly set out and justified in the assessment. We intend to support these judgements by building on the existing methodology, using more detailed datasets and additional parameters, which we believe will give a more accurate assessment in the specific context of this Study Area.

17.7.1.10 Magnitude of Change to Seascapes

The magnitude of change to seascapes is assessed in terms of 3 sets of criteria (TLI-IEMA, 2013):

- Size or scale;
- Geographical extent; and
- Duration and reversibility.

For the purposes of this assessment the following definitions have been applied as noted in Table 17.4. It is stressed that in the assessment of a specific receptor/effect, the actual criteria applied may differ from the Typical Criteria noted below. In all cases a clear explanation of the reasons for the judgement of magnitude will be given.

Table 17.4: Definitions for magnitude of effect for seascape receptors

Sensitivity	Typical Criteria
High	Size or Scale High proportion of seascape unit affected High proportion of seascape elements affected. Substantial change/complete loss, or fundamental change to key characteristics of seascape. Geographical Extent Large number of seascape units affected in the majority of the study area; large area affected of the seascape unit(s) within which the Project will sit; considerable change to the immediate setting; considerable/fundamental change to the site of the proposed the Project. Duration and reversibility Long term, or permanent change to seascape (25 or more years) Change difficult or impossible to remove or reinstate
Medium	Size or Scale Moderate proportion of seascape unit affected Moderate proportion of seascape elements affected. Material change to key characteristics of the seascape. Geographical Extent Several seascape units affected over part of the study area; medium area affected of the seascape unit(s) within which the Project will sit; noticeable change to the immediate setting; noticeable change to the site of the proposed the Project. Duration and reversibility Medium term change to seascape (5-24 years) Change that can be partially removed or reinstated.

Sensitivity	Typical Criteria
Low	Size or Scale Small proportion of seascape unit affected Small proportion of seascape elements affected. Discernible changes to key characteristics of the seascape. Geographical Extent Few seascape units affected over a small part of the study area; small area affected of the seascape unit(s) within which the Project will sit; insignificant change to the immediate setting; insignificant change to the site of the proposed the Project. Duration and reversibility Short term change to seascape (up to 5 years) Change that can be fully removed and reinstated
Negligible	Size or Scale Changes which are not discernible or have no effect on the integrity of seascape elements or seascape unit. Geographical Extent Few seascape units affected over part of the study area; very small area affected of the seascape unit(s) within which the Project will sit; imperceptible change to the immediate setting; imperceptible change to the site of the proposed the Project.

17.7.1.11 Landscape Sensitivity to Change

The relative sensitivity of the landscape character within each character area is specific to the proposed change and is assessed in terms of 2 sets of criteria (TLI-IEMA, 2013):

- Susceptibility to the change; and
- Value of the receptor.

For the purposes of this assessment the following definitions have been applied as noted in Table 17.5. It is stressed that in the assessment of a specific receptor/effect, the actual criteria applied may differ from the Typical Criteria noted below. In all cases a clear explanation of the reasons for the judgement of sensitivity will be given.

Table 17.5: Definitions of sensitivity for landscape receptors

Sensitivity of receptor	Typical Criteria
High	Susceptibility to Proposed Change Landscapes of high quality and condition. Few if any of the key characteristics of the landscape relate well to the proposed the Project Value Landscapes located within and which contribute to the value of landscapes designated or recognised at international, national, regional or local level e.g. National Scenic Area, World Heritage Site Historic Gardens and Designed Landscapes, SLLC, AASL. Landscapes with a high degree of relative wildness*. Landscapes where there is evidence of high value associated with natural heritage, recreational activity, cultural associations, or other special interests.
Medium	Susceptibility to Proposed Change. Landscapes of moderate quality and condition. Some of the key characteristics of the landscape relate well to the proposed the Project. Value. Landscapes may be locally valued but with no explicit designation or recognition of value. Landscapes dominated by agricultural or other man-modified land uses, although with some degree of relative wildness*. Landscapes where there is evidence of some value associated with natural heritage, recreational activity, cultural associations, or other special interests.
Low	Susceptibility to Proposed Change. Landscapes of low or poor quality and condition, attributes poorly-managed, in poor condition and state of repair. Settled landscapes, with complex land use patterns where built elements and structures are already a strong part of the landscape character. Landscape intrinsically able to accommodate proposed change with many of the key characteristics relating well to the proposed the Project, or unlikely to be diminished. Value. Landscapes with few specific features of natural heritage, cultural associations, or other special interest.
Negligible	Susceptibility to Proposed Change. Heavily developed, industrial landscapes. Landscapes of very low or very poor quality and condition, attributes very poorly-managed, in very poor condition and state of repair. None of the key characteristics are likely to be diminished by the proposed change. Value. Landscapes with no specific features of natural heritage, cultural associations, or other special interest.

* The level or degree of relative wildness will be assessed taking account of the existing SNH methodology as set out in "Mapping Scotland's Wildness Phase 1 – Identifying Relative Wildness Non –Technical Methodology, revised October 2012". The reasons for the judgements on levels of wildness will be clearly set out and justified in the assessment. We intend to support these judgements by building on the existing methodology, using more detailed datasets and additional parameters, which we believe will give a more accurate assessment in the specific context of this Study Area.

17.7.1.12 Magnitude of Landscape Change

The magnitude of change to landscapes is assessed in terms of 3 sets of criteria (TLI-IEMA, 2013):

- Size or scale;
- Geographical extent; and
- Duration and reversibility.

For the purposes of this assessment the following definitions have been applied as noted in Table 17.6. It is stressed that in the assessment of a specific receptor/effect, the actual criteria applied may differ from the Typical Criteria noted below. In all cases a clear explanation of the reasons for the judgement of magnitude will be given.

Table 17.6: Definitions for magnitude of effect for landscape receptors

Magnitude of change	Typical Criteria
High	Size or Scale High proportion of landscape unit affected High proportion of landscape elements affected. Substantial change/complete loss of, or fundamental change to key characteristics of landscape. Geographical Extent Large number of LCTs affected in the majority of the study area; large area affected of the LCT(s) within which the Project will sit; considerable change to the immediate setting; considerable change to the site of the proposed the Project. Duration and reversibility Long term, or permanent change to landscape (25 or more years) Change difficult, or impossible to remove or reinstate
Medium	Size or Scale Moderate proportion of landscape unit affected Moderate proportion of landscape elements affected. Material change to key characteristics of the landscape. Geographical Extent Several LCTs affected over part of the study area; medium area affected of the LCT(s) within which the Project will sit; noticeable change to the immediate setting; noticeable change to the site of the proposed the Project. Duration and reversibility Medium term change to landscape (5-24 years) Change that can be partially removed or reinstated.

Magnitude of change	Typical Criteria
Low	Size or Scale Small proportion of landscape unit affected Small proportion of landscape elements affected. Discernible changes to key characteristics of the landscape. Geographical Extent Few LCTs affected over a small part of the study area; small area affected of the LCTs(s) within which the Project will sit; insignificant change to the immediate setting; insignificant change to the site of the proposed the Project. Duration and reversibility Short term change to landscape (up to 5 years) Change that can be fully removed and reinstated
Negligible	Size or Scale Changes which are not discernible or have no effect on the integrity of landscape elements or landscape unit. Geographical Extent Very few LCTs affected over part of the study area; very small area affected of the LCTs (s) within which the Project will sit; imperceptible change to the immediate setting; imperceptible change to the site of the proposed the Project.

17.7.1.13 Sensitivity of Visual Receptors to Change

All visual receptors are people. The relative sensitivity of the visual receptors is specific to the proposed change and is assessed in terms of two sets of criteria (TLI-IEMA, 2013):

- Susceptibility of visual receptors to the proposed change; and
- Value attached to views experienced by receptors.

For the purposes of this assessment the following definitions have been applied as noted in Table 17.7. It is stressed that in the assessment of a specific receptor/effect, the actual criteria applied may differ from the Typical Criteria noted below. In all cases a clear explanation of the reasons for the judgement of sensitivity will be given.

Table 17.7: Definitions for sensitivity for visual receptors

Sensitivity of receptor	Typical Criteria
High	Susceptibility to Proposed Change Users of outdoor recreational facilities (including national routes, local Core Paths and other recreational footpaths, cycle routes or rights of way) Visitors to important mountain summits, landmarks, heritage assets, or other attractions, where views are an essential contributor to the experience. Special interest groups to whom landscape setting is important. Residents of communities/settlements where views are an important contributor to the landscape setting enjoyed by residents in the area. Travellers on the inter-island ferries. Value Attached to Views High value placed on the View: recognised viewpoint marked on maps, views within landscapes designated at regional or local level, views from recognised scenic routes/designated tourist routes, views of (or from) landscape or built features with important physical, cultural or historic attributes. View protected at local or regional level by Development Plan
Medium	Susceptibility to Proposed Change People engaged in outdoor sports or recreation where appreciation of the landscape setting contributes to the experience People at places of work, whose attention may be focused on their activity rather than the wider landscape. but where the setting is recognised as an important contributor to the quality of working life Travellers on road, rail, or other transport routes excluding the inter-island ferries. Value Attached to Views Some evidence of value placed on view, view may contribute to setting of activity
Low	Susceptibility to Proposed Change People at places of work, whose attention may be focused on their activity rather than the wider landscape. People engaged in outdoor sports or recreation which does not involve or depend on appreciation of views of the landscape. Value Attached to Views No evidence of value placed on view.
Negligible	Susceptibility to change of viewers and value attached to views are of a level not considered relevant to the assessment.

* Where agreed with the Planning Authority

17.7.1.14 Magnitude of Change to Views and Visual Amenity

The magnitude of change to views and visual amenity experienced by the receptor is assessed in terms of 3 sets of criteria (TLI-IEMA, 2013):

- Size or scale;
- Geographical extent; and
- Duration and reversibility.

For the purposes of this assessment the following definitions have been applied as noted in Table 17.8. It is stressed that in the assessment of a specific receptor/effect, the actual criteria applied may differ from the Typical Criteria noted below. In all cases a clear explanation of the reasons for the judgement of magnitude will be given.

Table 17.8: Definitions for magnitude of effect for visual receptors

Magnitude of change	Definition
High	Size or Scale Development will be the dominant feature in the view. High proportion of the Project visible, no significant screening effects. Strong contrast with key visual characteristics of the baseline view e.g. scale, horizontality, composition. Duration of view not curtailed by physical parameters. Geographical Extent Angle of view to the Project coincides with focus of receptor activity/viewpoint/road alignment, etc. Short distance from viewpoint to the Project Development occupying a high proportion of the view. Duration and Reversibility Long term/permanent change to view (25 or more years) Change difficult, or impossible to remove or reinstate
Medium	Size or Scale Development will be a noticeable component of the view Development partially screened by topography, vegetation, etc. Some conflicts with key visual characteristics of the baseline view e.g. scale, horizontality, composition. Duration of view relatively short. Time to absorb or contemplate view curtailed by physical parameters. Geographical Extent Angle of view to the Project does not coincide with focus of receptor activity/viewpoint/road alignment, etc. Moderate distance from viewpoint to the Project Development occupying part of the view. Duration and Reversibility Medium term change to view (5-24 years) Change that can be partially removed or reinstated.

Magnitude of change	Definition
Low	Size or Scale Development is a minor component of view Development substantially screened by topography, vegetation, etc. Development compatible with key visual characteristics of the baseline view e.g. scale, horizontality, composition. Duration of view short or transient. Glimpse or interrupted views Geographical Extent Angle of view predominantly away from the Project Long distance from viewpoint to the Project Development occupying a small part of the view. Duration and Reversibility Short term change to view (up to 5 years) Change that can be fully removed and reinstated
Negligible	Changes which are not discernible.

17.7.1.15 Environmental Consequence: Seascape, Landscape and Visual Effects

The sensitivity of the receptor and the magnitude of effect are combined to define the environmental consequence of the effect.

A clear explanation of how each judgement has been reached will be given in narrative form in the text, supported by reference to an impact matrix. It is important to note that with regard to Seascape, Landscape and Visual effects this matrix has been used as a guide only. The matrix is not used as a prescriptive tool, and the analysis of specific effects must make allowance for the exercise of professional judgement. Therefore, in some instances, a particular parameter may be considered as having a determining effect on the analysis at the expense of the matrix. It should also be noted that likelihood of impact is not considered a relevant parameter for landscape, seascape and visual effects and has not been included in the assessment.

The impact matrices will need to show consistency throughout the EIA. However, there may be individual chapters that need to be addressed slightly differently.

For the purposes of the SLVIA methodology, the impact matrix is presented in Table 17.9.

Table 17.9: Assignment of impact significance for SLVIA based on sensitivity of receptor and magnitude of effect

Magnitude of effect	Sensitivity of Receptor			
	High	Medium	Low	Negligible
High	*MAJOR*	*MAJOR*	*MODERATE*	*MINOR*
Medium	*MAJOR*	*MODERATE*	*MINOR*	*MINOR*
Low	*MODERATE*	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*
Negligible	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*	*NEGLIGIBLE*

17.7.1.16 Significance of Landscape, Seascape and Visual Effects

Again, the determination of the level of significance of the effect will need to be consistent throughout the EIA. However, there may be individual chapters that need to be addressed slightly differently. The table of significance of effects is shown in Table 17.10.

Table 17.10: Determination of significance of effect

Consequence	Significance	
Major	Highly significant and requires immediate action. Effects to be avoided rather than managed.	Significant effect under EIA Regulations
Moderate	Requires additional control measures and/or management.	
Minor	May require some management to ensure remains within acceptable levels	Insignificant effect under EIA Regulations
Negligible	Difficult to detect or measure.	
Neutral	No action required.	
Positive	To be encouraged.	

17.7.1.17 Nature of the Effect

Determination of the nature of the effect is essentially a matter of judging whether the key seascape, landscape or visual characteristics are strengthened, weakened or not affected as a result of any changes brought about by the Project. Therefore, the effect of a Project can be adverse or beneficial, or there can be no effect.

The following system of categorisation is used for the nature of the effect:

- Adverse: key characteristics of the landscape or quality of the visual experience weakened by the introduction of the Project;
- Neutral/No Effect: key characteristics of the landscape or quality of the visual experience not affected by the introduction of the Project; and

- Beneficial: key characteristics of the landscape or quality of the visual experience strengthened by the introduction of the Project.

17.7.1.18 Cumulative Seascape Landscape and Visual Effects

The Methodology for the assessment of Cumulative Seascape and Landscape Effects will accord with key guidance in:

- Landscape Institute and Institute of Environmental Management and Assessment 2013 "Guidelines for Landscape and Visual Assessment 3rd Edition" (TLI-IEMA, 2013, Chapter 7 pp120-134);
- SNH 2012b "Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape" (in particular pp33-35); and
- SNH 2012c "Assessing the cumulative impact of onshore wind energy developments" (in particular pp10-21).

Outputs will be in accordance with the Advice Note included at Annex 2 of SNH 2012b.

Cumulative effects will be defined as "the additional changes caused by a Project in conjunction with other similar developments or as the combined effect of a set of developments, taken together." (SNH 2012c) p4)

The assessment will include cumulative effects associated with the Project proposal in-combination with a list of developments to be agreed with statutory consultees which will include:

- Existing Project, either built or under construction;
- Approved Project, awaiting implementation; and
- Proposals awaiting determination within the planning process with design information in the public domain.

A checklist list will be provided with the list of projects to be assessed to explain the reasons for inclusion: e.g. setting the Projects against a "menu" of priorities, including distance from the proposal, certainty of construction, etc. The relevant receptors (landscape character areas, designated landscapes, designed landscapes, visual receptors, including sequential routes through the study area) will also be listed.

The projects may include the following categories of the Project:

- Buildings;
- Onshore windfarms;
- Offshore windfarms;
- Waterfront and coastal development;
- Existing marker buoys;
- Aquaculture;
- Cable and pipelines;
- Oil and gas infra-structure;
- Marine aggregate extraction;
- Dredging and sea disposal; and

- Tourism and recreation.

The cut-off date for the list of projects to be included in the assessment was agreed with MS-LOT as 12 June 2015.

17.7.1.19 Stage 5 Design Input and Mitigation

The assessment of environmental effects is regarded as an integral part of the design process. Design iteration and mitigation, including input to siting and layout, has been informed iteratively by on-going assessment of seascape, landscape and visual effects, resulting in an optimised design solution.

In this regard, specific guidance in SNH (2012b) with respect to Layout and Design, and Siting and Design has been taken into account.

17.7.1.20 Stage 6 Reporting Of Significant Residual Effects

The assessment report (Environmental Statement or as agreed) will refer exclusively to the residual effects taking into consideration all mitigation measures (project design, general and specific).

17.8 BASELINE DESCRIPTION

17.8.1 Introduction

In this section the existing conditions of the landscape, seascape and visual resources of the study area are described to provide a basis against which changes can be assessed.

This stage includes:

- A desk study to establish the existing conditions, including the seascape, landscape and visual resources of the study area, and initial mapping of Zones of Theoretical Visibility (ZTVs) for the Project components;
- Field survey work, initially at strategic/reconnaissance level and later at detailed level, to verify the important seascape, landscape, and visual characteristics of the area highlighted by the desk study; and
- Identification of key seascape, landscape, and visual receptors.

17.8.2 Seascape Baseline

Baseline seascape character will be described by reference to:

- Seascape Character Types: as already identified at national level, derived from SNH Commissioned Report No.103 (SNH, 2005a);
- Coastal Character Areas (CCAs): to be identified in accordance with the method in SNH Commissioned Report No.215 (SNH, 2008), reflecting both a consistency in overall character at a broad scale or known geographical area; and
- Local Coastal Character Areas (LCCAs): to be identified in accordance with the method in SNH Commissioned Report No.215 (SNH, 2008), by further subdivision of CCAs into areas of distinct coastal character, by examining coastal characteristics and issues which may include: maritime influences, character of the coastal edge and immediate hinterland, and experience of wildness.

The key seascape receptors (the components of the seascape that are likely to be affected by the proposal) will be identified from the above descriptions and will include:

- Overall seascape character and key characteristics;
- Particular coastal elements and features; and
- Specific aesthetic or perceptual qualities.

17.8.3 Landscape Baseline

17.8.3.1 Settlement Pattern

Settlement on Hoy is dispersed along the road network on the south east coast of Hoy with concentrations of houses at Lyness, Longhope and Brims.

17.8.3.2 Communications and Infrastructure

The B9047, which hugs the lower lying ground near the coast, is the main road extending along the eastern coast of Hoy around North Bay and Longhope to Kirk Hope on South Walls. The Houton Ferry berths overnight at Longhope and makes regular crossings from Lyness via Flotta to the Orkney Mainland. The Gills Bay – St Margaret's Hope ferry service runs through the eastern portion of the study area – normally passing to the east of Stroma and Swona but sometimes to the west.

17.8.3.3 Project Site

The site is located some 1km off the southern coast of Hoy between just west of Tor Ness and east of Aith Hope. There are three proposed alternative cable corridors:

- From the western portion of the Project site in to Sheep Skerry;
- From the mid-western portion of the Project site in to the shore between Sands Geo and Broad Geo; and
- From the mid-eastern portion of the Project site in to The Ayre through Aith hope.

17.8.3.4 Forces for Change

Forces for change are those that are currently affecting the character of the landscape resource and which may, consequently, affect the perception of the Project in the future.

- Industry - Any future local industrial development, not included in this proposal, is likely to be limited to the Lyness and Longhope harbour areas. Future renewables development may impact on the wider landscape and seascape;
- Tourism – Hoy is a nationally known tourist/visitor destination but it is unlikely that tourism development would be anything other than low key;
- Agriculture - Agriculture within the region will continue to be influenced by the provision of subsidies and grants through Common Agricultural Policy (CAP) and other funding mechanisms. It is not clear how current or future changes in subsidies or agricultural policy will affect the local landscape but historically such changes as far as they affect the landscape, are likely to be minor; and,

- Housing and settlement –Numerous initiatives and development programmes – including tourism and renewables development – are in place to sustain the local economy and population. It is not envisaged that there will be any significant housing development within the study area with any settlement development comprising single house renewals or additions.

17.8.4 Summary

Within the study area there are:

- Twenty seven Local Coastal Character Types;
- Eleven Landscape Character Types;
- One National Scenic Area;
- One Garden and Designed Landscape; and
- One Wild Land Area.

Fourteen viewpoints were identified and agreed with OIC and SNH as being representative of the visual amenity of the study area and all the proposed development has the potential to result in effect on the visual amenity experienced at these locations. These are the key receptors of potential SLVIA effects described in Section17.9.

A full and detailed description of the baseline can be found in (Supporting Document: Aquatera, 2015e), which incorporates figures and Zones of Theoretical Visibility.

17.9 POTENTIAL EFFECTS

Potential effects were identified through scoping and examination of the Zone of Theoretical Visibility Maps for each of the components of the Project.

The potential effects identified for each phase of the Project are:

17.9.1 Construction and Installation

- Device specific installation vessels and support vessels;
- Cable installation vessels; and
- Jack up barge for landfall works.

17.9.2 Operation and Maintenance

- Device specific installation vessels; and
- RIBs and support vessels.

17.9.3 Decommissioning

- Device specific installation vessels and support vessels;
- Cable installation vessels; and
- Jack up barge.

As there will be no sea surface piercing components, the landscape and visual impact assessment focuses on the construction and installation phase of the Project, identifying the worst case scenario.

The matrix shown at Table 17.9 is not used as a prescriptive tool, and the analysis of specific effects must make allowance for the exercise of professional judgement. Therefore, in some instances, a particular parameter may be considered as having a determining effect on the analysis at the expense of the matrix.

Although effects considered not significant at this stage are generally not investigated further, for some effects further mitigation maybe required to ensure that the effect remains insignificant. For those effects predicted to be significant at this stage the potential mitigation measures to be adopted are investigated to determine whether the significance of the effect can be reduced.

17.10 MITIGATION MEASURES

17.10.1 Project Design Mitigation and General Mitigation

All Project Design and General Mitigation measures are set out in Chapter 5 Project Description, Tables 5.15 and 5.16 respectively. These are standard practice measures based on specific legislation, regulations, standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur.

Project Design mitigations PD04 and PD05 provide details of the design features that have been adopted that minimise the potential effects on landscape and visual receptors. In summary the design of the Project has been altered resulting in the reduction of effect on SLV receptors. The use of surface piercing devices and surface piercing offshore cable hubs were removed from the design.

These design changes, which came about after extensive consultation means that there are no permanent visual structures and therefore no permanent impact on SLV receptors. As such, the only impacts on SLV receptors would be from vessels used during Project installation, maintenance and decommissioning.

17.10.2 Specific Mitigation

Due to the nature of the impacts on the receptors there are no specific mitigation measures associated with SLVIA.

17.11 RESIDUAL EFFECTS

17.11.1 Introduction

This section assesses the residual impacts on landscape, seascape and visual receptors within the study area taking account of the mitigation measures which have been integrated into the design of the Project.

The assessment focuses on the likely significant effects of the Project, which are considered to relate exclusively to offshore impacts during the Construction and Installation, and Decommissioning phases of the Project, as addressed below.

17.11.1.1 Offshore Effects

As there is no permanent visible offshore infrastructure, there are very few effects associated with the operation of the Project. All effects assessed will be temporary in nature, and relate exclusively to the visibility of vessels within the study area. The period of time over which these temporary effects will be experienced is dependent on the duration of the specific operation referred to. As has been noted, where the duration cannot be precisely specified at this time, the longest (worst case) option has been assessed. It should also be noted that the effects will not necessarily be continuous over the period referred to, and will be experienced only during specific vessel movements, or the time during which a vessel is moored, e.g. at a device location. The frequency of these movements is referred to in the assessments. Given the frequency of shipping and navigation movements in the study area (Chapter 15 for detail), it is stressed that fundamentally, the effects relate to a common and familiar visual attribute of the baseline, and that any significant temporary effects are therefore likely to arise only where the size of a vessel and its proximity to land is such that abnormal contrasts of scale could occur.

17.11.1.2 Effects during Construction and Installation Phase

During this phase, temporary effects will occur related to technical operations associated with:

- Installation of TSSs
- Installation of turbines;
- Installation of cables, including cable protection and stability measures; and
- Landfall activities.

17.11.1.3 Effects during Maintenance Phase

During this phase, temporary effects will occur related to technical operations associated with:

- Preventative maintenance including work by small work class tugs, ROVs, and RIBs; and
- General maintenance, including the use of large DP crane vessels twin hulled barge and other support vessels.

These vessel movements would involve around one vessel movement per day over the period of the Project, limited to the offshore elements of the Project. Judged against the baseline of vessel movements in the Pentland Firth, these maintenance operations are therefore not likely to be significant and have not been considered further in the assessment.

17.11.1.4 Effects during Decommissioning Phase

Decommissioning of the offshore facilities will involve the removal of all devices and associated cables. The process will in effect be a reversal of the construction and installation phase and therefore effects would be equivalent to those identified from the construction and installation phase. The endpoint of the decommissioning process will be the return of the site to the pre-development (i.e. as existing) condition. Therefore there will be no residual landscape, seascape or visual effects.

17.11.2 Assessment of Seascape Effects

This section assesses the effects of the Project on the seascape character of the Local Coastal Character Areas within the study area as identified and described in the baseline section above (Section 17.8).

Under the definitions as set out in the methodology the effects are confined to the Local Coastal Character Areas which fall within the Zones of Theoretical Visibility of either or both of the Project sites.

Local Coastal Character Areas within the study area which are not affected are:

- LCCA 1: Green Head to Ruberry;
- LCCA 2: Ruberry to The Point;
- LCCA 12: West Rysa Little;
- LCCA 13: East Rysa Little;
- LCCA18: The jetty to Tween the Wicks;
- LCCA19 Tween the Wicks to Quoy Ness; and
- LCCA 25 East Swona.

The effects on the remaining 21 LLCAs (Table 17.11) are described and summarised as follows:

- All effects would be temporary for a period of up to 36 months for the full Stage 2 build-out, but will be intermittent/not continuous;
- Most LCCAs have partial to very little visibility and for the majority of which the casual observer would be unaware of construction vessels;
- Often low visibility or no views of Stage 1, some partial views in Stage 2, particularly for vessels associated with devices other than OpenHydro;
- Visibility of the jack up barge for the cable route is likely to be greatest, however over a very short-term and temporary period (14 days in Stage 1 and 56 days in Stage 2);
- The majority of views are in a back drop of existing maritime activity;
- Most views are at distance, often in excess of 5km, with some localised; and therefore
- The magnitude of effect is low or negligible for all impacts on seascape character; therefore environmental consequence is minor or negligible and not significant for any LCCAs.

Table 17.11: Summary of effects on LCCAs

LCCA	Sensitivity of receptor	Magnitude of effect	Environmental consequence	Significance
LCCA 5: North Ness to South Ness LCCA 6 Point of Hackness to Crowtaing LCCA 7: Crowtaing to Cantick Head LCCA 8: Cantick Head to Aith Head LCCA 9: Aith Head to Brims Ness LCCA 10: Brims Ness to Tor Ness LCCA 11: Tor Ness to Geo of the Lane LCCA 22: North Switha LCCA 23: South Switha LCCA 24 West Swona LCCA 26: West Stroma LCCA 28: St John's Point	High	Low or Negligible	Minor direct or indirect	Not significant

LCCA	Sensitivity of receptor	Magnitude of effect	Environmental consequence	Significance
LCCA 3: The Point to Crock Ness LCCA 4: Crock Ness to North Ness and South Ness and South Ness to Crowtaing LCCA 16: Innan Neb to the Pier LCCA 20: Quoy Ness to House Geo LCCA 21: House Geo to Innan Neb LCCA 27: East Stroma	Medium	Low to Negligible	Minor to Minor indirect	Not significant
LCCA 14: West Fara LCCA 15: East Fara LCCA 17: The Pier to the Jetty	Low	Negligible	Negligible indirect	Not significant

17.11.2.1 Summary of Significant Seascape Effects

There are 28 Local Coastal Character Types within the study area. None of these will accrue any significant direct or indirect effects.

17.11.3 Assessment of Landscape Effects

Under the definitions as set out in the methodology the effects are confined to the Landscape Character Types which fall within the Zones of Theoretical Visibility of the Project sites.

All of the eleven LCTs (Table 17.12) fall within some or all of the ZTVs for the various elements and options of the Proposed Development. The assessment of effects on LCTs is presented below and in Table 17.12:

- In most cases key characteristics of the LCT are not affected:
- Some close range views but most only with partial visibility and often in excess of 5km;
- The increase in marine traffic and activity would not be apparent or particularly noticeable to the casual observer in most cases;
- All effects would be temporary for a period of up to 36 months for the full Stage 2 build-out, but will be intermittent/not continuous;
- Visibility of the jack up barge for the cable route is likely to be greatest, however over a very short-term and temporary period (14 days in Stage 1 and 56 days in Stage 2);
- It is not considered likely that the introduction of additional maritime traffic would be likely to impinge on the enjoyment of the landscape and/or ornithology;
- The magnitude of effect is low or negligible for all LCTs; and therefore
- The environmental consequence is minor or negligible and indirect, therefore not significant for all LCTs.

Table 17.12: Summary of effects on LCTs

LCT	Sensitivity of receptor	Magnitude of effect	Environmental consequence	Significance
LCT 5: Cliff Landscapes LCT 7: Moorland Hills	High	Negligible	Minor indirect	Not significant
LCT 1: Holms LCT 2: Whaleback Island Landscapes LCT 3: Low Island Pastures LCT 4: Inclined Coastal Pastures LCT 6: Low Moorland LCT 9: Sweeping Moorland LCT 10: Open Intensive Farmland LCT 12: Small Farms and Crofts	Medium	Low to Negligible	Minor indirect to Negligible indirect	Not significant
LCT 8: Urban and Rural Development	Negligible	Negligible	Negligible indirect	Not significant

17.11.3.1 Assessment of Effects on Landscape Designations

Under the definitions as set out in the methodology the effects are confined to the Landscape Designations which fall within the Zones of Theoretical Visibility of the Project sites.

The following Landscape Designations fall within some or all of the ZTVs for the various elements and options of the Proposed Development. The assessment of effects on Landscape Designations is presented below and in Table 17.12:

- The Project infrastructure would not be discernible to the casual observer in most cases;
- Vessels would be seen only from areas of high ground in the hinterland of Hoy and in the context of other maritime activity in the Pentland Firth, it is considered that the changes to the wild land qualities would not be particularly noticeable;
- The Special Qualities of the NSA would not be affected;
- Low visibility in Stage 1 for most sites and the majority of visibility relates to the cable corridor installation in many cases, which is over a very short-term and temporary period (14 days in Stage 1 and 56 days in Stage 2);
- The landform around Brims is likely to conceal much of the water surface based construction activity associated with the offshore devices and the Moodies Eddy and Sheep Skerry cable installations;
- The magnitude if effect is likely to be low to negligible for all Landscape Designations; and therefore
- The environmental consequence is minor for all Landscape Designations.

Table 17.13: Summary of effects on Landscape Designations

Landscape designation	Sensitivity of receptor	Magnitude of effect	Environmental consequence	Significance
Hoy and West Mainland NSA Melsetter House Garden and Designed Landscape Wild Land Area 41: Hoy Flotta South Coast and West Hill LLA Lyrawa and Pegal LLA North Bay, Walls LLA South Walls South Coast LLA	High	Low to Negligible	Minor indirect	Not significant

17.11.3.2 Summary of Significant Landscape Effects

None of the eleven Landscape Character Types would experience any significant effects. The NSA, Wild Land Area and Local Landscape Areas would also not accrue significant effects.

17.11.4 Assessment of Visual Effects

Visual effects are assessed on a total of 14 specific Viewpoints identified and located in the supporting baseline material. Detailed assessment tables and the location of viewpoints are presented in the SLVIA Supporting Document (Supporting Document: Aquatera, 2015e).

Assessment of other receptor categories, including settlements, roads, and ferry routes is not presented independently for the purposes of this study. Rather, these categories have been included by the selection of viewpoints, which was specifically designed to be representative of all categories of receptor likely to experience significant effects.

The assessment is based on the visibility of the Project throughout the ZTV area and analysis of possible visual impacts from the viewpoints chosen, based on expert judgement following the desk study and field analysis, and subsequently agreed with SNH and OIC.

Visual effects can be summaries as follows:

- These elements would form minor components in the view, would be seen in the context of other vessels and occupy a negligible proportion of the view in most cases;
- For Stage 1 there would be no installation vessels visible from many of the identified viewpoints. During Stage 2 both installation vessels would be seen depending on device type;
- All effects would be temporary for a period of up to 36 months for the full Stage 2 build-out, but will be intermittent/not continuous;
- Visibility of the jack up barge for the cable route is likely to be greatest, however over a very short-term and temporary period (14 days in Stage 1 and 56 days in Stage 2);
- High sensitivity views are all in excess of 5km. Medium sensitivity viewpoints have closer views but minor proportions;

- For Stage 1 and 2 OpenHydro and Stage 1 other device, the vessels associated with device installation will not be visible (twin hull barge and construction vessel respectively). The construction vessel associated with Stage 2 other device would be seen when installing in small sections of the Project site;
- The magnitude of effect is low to negligible for all viewpoints; and therefore
- The environmental consequence is minor to negligible for all viewpoints.

Table 17.14: Summary of effects on Visual Effects

Viewpoint	Sensitivity of receptor	Magnitude of effect	Environmental consequence	Significance
Viewpoint 1: Hoxa Head, South Ronaldsay Viewpoint 2: Gills Bay Ferry Viewpoint 3: Viewpoint, Flotta Viewpoint 6: Viewpoint Wee Fea, Hoy Viewpoint 9: Heldale Mast near Binga Fea Viewpoint 12: Dunnet Head Viewpoint 14: Rackwick	High	Low/Negligible	Minor/Negligible	Not significant
Viewpoint 4: Minor Road North of Aithsdale Viewpoint 5: Brims, Hoy Viewpoint 7: The Ayre Viewpoint 8: Longhope Viewpoint 11: Coastal Track, South Walls Viewpoint 10: Melsetter Hill Viewpoint 13: North Walls School	Medium	Negligible to Low	Minor	Not significant

17.11.4.1 Summary of Significant Visual Effects

None of the 14 selected viewpoints would experience significant effects.

17.11.5 Summary of Residual Impacts

As the effects described above relate to construction operations, these will all be temporary and not significant therefore there will therefore be no residual effects.

17.12 SUMMARY

This SLVIA has assessed the residual onshore and offshore effects of the Project. The combination of inherent compatibility and sensitive design result in no effects which are considered to be significant.

The Project was not considered to have significant residual cumulative impacts in conjunction with the agreed list of additional existing or planned projects.

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Marine Archaeology and Cultural Heritage

Chapter 18

18 MARINE ARCHAEOLOGY AND CULTURAL HERITAGE

18.1 INTRODUCTION

This chapter of the Environmental Statement (ES) considers the potential effects of the Brims Tidal Array Project (the Project) on the marine historic environment and proposes mitigation and management strategies that will ensure there are no significant impacts on marine cultural heritage assets.

The chapter provides a summary description of the baseline marine historic environment (a full and detailed description can be found in Supporting Document (ORCA Marine and SULA Diving, 2014). This is followed by an assessment of the importance or sensitivity of the identified historic environment assets, and the magnitude and significance of any potential impacts on them resulting from the construction, operation and maintenance, and decommissioning phases of the Project. Potential mitigations are proposed that result in no significant residual effects on the marine historic environment by the Project.

Analysis and interpretation of datasets from a number of different specialist reports and surveys have contributed to the assessment of the marine historic environment:

- Osiris Hydrographic & Geophysical Projects Limited (Osiris Projects) – seabed survey data (multi-beam echosounder (MBES), side scan sonar (SSS), Magnetometer and sub-bottom profiler (SBP)) obtained by Osiris Projects on behalf of SSE Renewables and OpenHydro (Supporting Document: Osiris 2014);
- Roving Eye Enterprises (REE) and Triscom (TE) – seabed survey data (MBES) obtained on behalf of Aquatera Limited;
- ORCA Marine and SULA Diving – baseline description, including desk-based assessment (DBA) and analysis of Osiris Projects seabed survey data - BTAL *Marine Historic Environment Technical Baseline Report* (ORCA Marine and SULA Diving 2015, (Supporting Document: ORCA Marine and SULA Diving, 2014); and
- Royal HaskoningDHV - Brims Tidal Array Environmental Statement Chapter 9: Physical Processes.

18.2 STUDY AREA

The AfL area was initially awarded to Cantick Head Tidal Development Limited in 2008. The boundary of this area was subsequently revised in 2013, relocating 80% of the original area to the west. The site name was therefore revised to more accurately reflect the Project location.

The location of the Project site, which comprises the Agreement for Lease (AfL) area and associated cable corridor areas of search for the Aith Hope, Moodies Eddy and Sheep Skerry options, is illustrated in Figure 1.1. The Project study area comprised the Project site and the immediate surrounds to ensure that wrecks with unverified positions which could be located within the Project site were identified.

18.3 DESIGN ENVELOPE CONSIDERATIONS

In accordance with the established principles of the Design Envelope and advice provided by MS-LOT in the EIA Scoping Opinion (Supporting Document: MS-LOT, 2014), BTAL has applied a "worst case" design envelope approach to the assessment of the different impacts associated with the Project. The approach is detailed in Chapter 5, Project Description.

In finalising the design envelope, BTAL considered comments made by Marine Scotland and their statutory advisors in the Scoping Opinion received in 2013 (Supporting Document: MS-LOT, 2014) as well as comments made in a review of the draft Project Description that was submitted in early 2015. The Project Envelope has therefore been significantly refined relative to that proposed in Scoping and the parameters relevant to the marine historic environment are presented in Table 18.1.

Therefore, for this chapter's assessment it has been assumed that the offshore tidal generators (preferred technology: open-centre turbines (OCT)), inter-array cables, possible offshore hub(s) or substation, and export cable to shore may impact the marine historic environment. Even though the indicative layout seems to show that the turbine locations will avoid cultural heritage assets and geophysical anomalies, we have assumed that direct impact could be anywhere in the AFL area and cable corridor, since the layout could change, and the physical impact on the seabed of the different turbines, hubs and support structures varies according to their design, and the export cable route is not finalised. These potential impacts are addressed by appropriate mitigation strategies, with avoidance being incorporated into the final design that will be developed post-consent.

BTAL plan to build the Project in two Stages, with Stage 1 consisting of up to 30MW and 30 turbines with construction expected to begin in 2019 and Stage 2 being built out in stages with planned delivery of the fully commissioned 200MW Project in 2023 (see Section 5.4 – Development Strategy). As part of the worst case approach, this chapter assesses the Project's full extent, rather than separating out the phases.

Therefore, the Design Envelope approach provides a robust assessment of all likely significant effects on the marine historic environment that allows for final design changes and use of any of the turbines and support structures proposed in Chapter 5, Project Description.

Table 18.1: Design envelope parameters for marine historic environment assessment

Project parameters relevant to the assessment		Maximum Project parameters for the impact assessment	Explanation of maximum Project parameters
TSS Parameters			
Gravity base structure including subsea base	Design (SSB)	Three point structure	
	Total footprint (contact with seabed)	37.5m^2	
	Design (GBS)	Steel structure with flat rock bottom that sits on seabed	
	Total footprint	30m x 40m = 1,200m^2	Potential for compression of seabed sediments (which are mostly absent) and objects (if present) over this area
Drilled monopile	Number of piles	1 per device	
	Footprint of pile(s)	5 to 7m^2	
	Total footprint of TSS (monopile with transition piece)	20m^2	Potential for destruction/damage of seabed sediments (which are mostly absent) and any objects (if present) over this area
	Pile diameter	2.5 – 2.8m	
	Pile depth	11 to 12m	Potential for destruction/damage of seabed sediments (which are mostly absent) and objects (if present) to this depth
Drilled pin pile tripod	Number of piles	3	
	Footprint of each pin pile	1.3m^2	Footprint for each pin pile
	Total footprint of all pin piles	4m^2	Footprint for three pin piles
	Total footprint of TSS	154m^2	Total area covered by pin pile tripod Only sections of tripod connected to the piles will be in direct contact with the seabed. Potential for destruction/damage of

Project parameters relevant to the assessment		Maximum Project parameters for the impact assessment		Explanation of maximum Project parameters
				seabed sediments (which are mostly absent) and any objects (if present) over this area
	Pile diameter	1.3m		
	Pile depth	5m		Potential for destruction/damage of seabed sediments (which are mostly absent) and objects (if present) to this depth
Array layout parameters				
Number of turbines (Stage1)		30		
Number of turbines (Stage1 & 2)		200		Dependant on rated output of selected turbines
Area of Crown Estate AfL area (total)		11.1km^2		
Area of turbine deployment within AfL area		2.9km^2 for Stage 1; 8.5km^2 for Stage 1 and Stage 2 combined.		This will depend on selected turbines and array configuration. Potential for destruction/damage of seabed sediments (which are mostly absent) and any objects (if present) over this area, either directly or possibly indirectly by scouring and hydrodynamics.
Minimum cross flow spacing		80m		Cross flow spacing depends on selected turbine, but there will be a minimum spacing between turbines of 80m.
Minimum down flow spacing		150m		Minimum down flow spacing between turbines will be 150m.
Turbine configuration		Turbines will be arranged in rows perpendicular to the direction of the prevailing tidal flow.		
Number of turbines per row		Between 2 to 15 turbines per row		This will depend on selected turbine type and rating, resource availability within the AfL area and seabed conditions. Number of turbines per row will vary on a row by row basis
Total number of rows		Between 10 to 40 rows depending on number of turbines per row		Depends on turbine type and rating, resource availability and seabed conditions
Parameters for inter-array cabling		Stage 1	Stage 1 & 2	
Number of inter-array cables		42	208	Worst case based on one cable per turbine

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment		Explanation of maximum Project parameters
Cross sectional area of inter-array cables	$500mm^2$	$500mm^2$	Maximum
Footprint of inter-array cables	$0.07km^2$ (approximately 0.6% of total AfL area)	$0.36km^2$ (approximately 3% of total AfL area)	Potential for compression of seabed sediments (which are mostly absent) and objects (if present) over this area. Potential for movement of cables across seabed,
Cable armour	Cables to include anchoring and armoured coating	Cables to include anchoring and armoured coating	Potential for compression of seabed sediments (which are mostly absent) and objects (if present) over this area
Parameters for connection hubs	Stage 1	Stage 1 & 2	
Dimensions of subsea cable connection hub	Length: 15m Diameter: 7m Volume: $577m^3$)	Length: 15m Diameter: 7m Volume: $577m^3$)	
Footprint of subsea cable connection hub	$37.5m^2$	$37.5m^2$	Gravity base foundation will be used. Potential for compression of seabed sediments (which are mostly absent) and objects (if present) over this area
No. of subsea hubs	4	16	
Parameters for inter-array and export cables, export cable route and landfall	Stage 1	Stage 1 & 2	
Number of export cables	Maximum 4 cables	Maximum 16 cables	
Cable armour	Cables to include armoured coating	Cables to include armoured coating	
Area directly affected by cable (corridor width per cable)	5m per cable including protection	5m per cable including protection	
Area directly affected by cable (corridor width for all cables)	20m affected area (cable corridor)	80m affected area (cable corridor)	Potential for compression of seabed sediments (which are mostly absent) and objects (if present) over this area

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment		Explanation of maximum Project parameters
Diameter of cable	500mm (max. diameter)	500mm (max. diameter)	
Length of cable route to be surface laid	Maximum 100% cable will be surface laid	Maximum 100% cable will be surface laid	Will depend on seabed conditions along cable route. In areas of hard bedrock cable will be surface laid.
Length of cable route to be buried	Unknown	Unknown	Will depend on seabed conditions along cable route. May be option for cable burial in areas of soft sediment. Potential for destruction/damage of seabed sediments and objects (if present).
Depth of cable burial	Approximately 1m depth (minimum)	Approximately 1m depth (minimum)	Cable burial will only be feasible in areas of softer sediment
Cable trench dimensions (for sections of export cable where burial possible)	1m depth (minimum) by 2m width	1m depth (minimum) by 2m width	Cable burial will only be feasible in areas of softer sediment. Potential for destruction/damage of seabed sediments and objects (if present) to this depth and width
Cable protection and stabilisation measures	Rock placement Concrete mattresses Grout bags	Rock placement Concrete mattresses Grout bags	Assuming 100% of export cable corridor and all inter-array cabling will be protected. Potential for compression or disturbance of seabed sediments (which are mostly absent) and objects (if present) over this area
Length of cable route requiring protection and stability measures	Maximum 100% of cable length	Maximum 100% of cable length	Cable protection will be required along all sections of cable that are surface laid
Method to be used to bring cables ashore at landfall	Open Cut Trench or Horizontal Directional Drill (HDD)	Open Cut Trench or Horizontal Directional Drill (HDD)	Potential for destruction/damage of seabed sediments, unknown archaeology and objects (if present) by the works
Width of cable corridor at landfall	Maximum 20m (maximum affected area for 4 cables)	Maximum 80m (maximum affected area for 16 cables)	Depends on number of cables to be brought ashore and method of installation at the landfall. Extent of potential damage.

18.4 LEGISLATIVE FRAMEWORK AND POLICY CONTEXT

There are international legally binding conventions, EU Directives, UK and Scottish legislation, policy frameworks and guidance to consider in relation to the historic environment.

18.4.1 International/EU Legislation and Policy

- The *United Nations Convention of the Law of the Sea (UNCLOS)* was ratified by the UK in 1997. Article 303 stipulates that 'states have a duty to protect objects of an archaeological and historical nature found at sea and shall co-operate for this purpose'.
- The *European Convention on the Protection of the Archaeological Heritage* (revised), known as the Valletta Convention, was ratified by the UK government in 2,000. This contains provisions for the protection of archaeological heritage both underwater and on land, preferably in situ, but with provisions for appropriate recording and recovery if disturbance is unavoidable.
- The UK has agreed to abide by the Annex to the *UNESCO Convention on the Protection of the Underwater Cultural Heritage* 2001. As such the rules of the Annex will be considered in deciding any licence applications. Rule 1 of the Annex stipulates that 'The protection of underwater cultural heritage through in situ preservation shall be considered as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorized in a manner consistent with the protection of that heritage, and subject to that requirement may be authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage'.
- Various EU EIA directives have been incorporated in UK and Scottish legislation, all of which include the requirement to address impacts on the historic environment.

18.4.2 UK Legislation and Policy

- The *Merchant Shipping Act* 1995 requires that all recovered wreck landed in the UK is reported to the Receiver of Wreck, whether recovered from within or outside UK waters and even if the finder is the owner.
- The *Protection of Wrecks Act* 1973 is in two sections. Section 1 provides protection for designated wrecks which are deemed important by virtue of their historical, archaeological or artistic value. Approximately 62 wrecks around the coast of the UK have been designated under this section of the Act. Each wreck has an exclusion zone around it and it is an offence to tamper with, damage or remove any objects or part of the vessel or to carry out any diving or salvage operations within this exclusion zone. In Scotland the administration of this Act and associated licences is the responsibility of Historic Scotland. Section 1 of the *Protection of Wrecks Act* was repealed in Scotland on the 1st November 2013 and the 8 wrecks around the coast of Scotland designated under this section of the Act are now protected by Historic Marine Protected Areas (HMPAs) as defined in the *Marine (Scotland) Act* 2010.
- The *Protection of Military Remains Act* 1986 has the principal concern to protect the sanctity of vessels and aircraft that are military maritime graves. The purpose of this safeguard is not primarily archaeological, but the Ministry of Defence liaises closely with the Department for Culture, Media and Sports and Historic Scotland in the process of site designation. Any aircraft lost while in military service is automatically protected under this Act, which is of concern if aircraft are discovered during the proposed works.
- Her Majesty's Government *UK Marine Policy Statement* (2011) states heritage assets should be conserved through marine planning in a manner appropriate and proportionate to their significance. Many heritage assets with archaeological interest are not currently designated as scheduled monuments or protected wreck sites but are demonstrably of equivalent significance. The absence of designation for such assets does not necessarily indicate lower significance and the marine planning authority should consider them subject to the same policy principles as

designated heritage assets (include those outlined) based on information and advice from the relevant regulator and advisors.

18.4.3 Scottish Legislation and Policy

- The *Marine (Scotland) Act* 2010, Section 64 confirms that in assessing effects on or licensing activities in the marine environment, the marine environment includes any features of archaeological or historic interest.
- The *Marine (Scotland) Act 2010*, Section 73, defines a marine historic asset as any of the following:
    - A vessel, vehicle or aircraft (or a part of a vessel, vehicle or aircraft);
    - The remains of a vessel, vehicle or aircraft (or a part of such remains);
    - An object contained in, or formerly contained in, a vessel, vehicle or aircraft;
    - A building or other structure (or part of a building or structure);
    - A cave or excavation; and
    - A deposit or artefact (whether or not formerly part of a cargo of a ship) or any other thing which evidences, or groups of things which evidence, previous human activity.
- The *Scottish Historic Environment Policy* (SHEP) 2011 outlines the principles that underpin the designation of HMPAs, including that marine historic assets from all parts of the Scottish marine protection area are equally worthy of study and consideration for statutory protection.
- *Scottish Planning Policy* (SPP) 2014 states that authorities should protect archaeological sites and monuments (and a range of other historic assets) as an important, finite and non-renewable resource and preserve them in situ wherever possible. Where preservation in situ is not possible, authorities should ensure that developers undertake appropriate excavation, recording, analysis, publication and archiving before and/or during development. If archaeological discoveries are made during any development, they should be reported to the authority to enable discussion on appropriate mitigation measures.
- The *Scottish Government's Planning Advice Note (PAN 2/2011): Planning and Archaeology* state that for all developments, the principles (in SPP 2014 and SHEP 2011) of preservation in situ, or mitigation where necessary equally apply to sites on land or underwater.
- Historic Scotland's *Operational Policy Paper HP6 1999: Conserving the Underwater Heritage* outlines Historic Scotland's interests in the areas of development control, protection, management, training, archaeological fieldwork and research concerning underwater archaeology. Much of this is superseded by later legislation and policy reviewed above.
- The Scottish Government's *Planning Scotland's Seas: Scotland's National Marine Plan* (March 2015) recognises that there are environmental and economic effects along with spatial constraints caused by the existence of marine cultural heritage. As well as the designated marine heritage assets there are likely to be a number of undesignated sites of demonstrably equivalent significance, which are yet to be fully recorded or await discovery. It is recommended that Historic Marine Planning Partnerships and licensing authorities should seek to identify significant historic environment resources at the earliest stages of planning or development process and preserve them in situ wherever feasible. Where this is not possible licensing authorities should require developers to archaeologically record the assets before it is lost.

18.5 SUPPORTING SURVEYS AND STUDIES

The following supporting surveys and studies containing information relating to the marine historic environment were consulted for this chapter:

- BTAL Marine Historic Environment Technical Baseline Report (ORCA Marine and SULA Diving 2015);
- Brims Tidal Array, Orkney: Geophysical Survey. Volume 2c: Results report, April 2014;
- Brims Tidal Array Project – Sheep Skerry Multibeam Survey, July 2015: Method Statement and Risk Assessment. July 2015;
- Royal HaskoningDHV: Brims Tidal Array Environmental Statement Chapter 9: Physical Processes;
- Strategic Environmental Assessment of the North Sea Area SEA5 (Flemming 2004);
- Strategic Environmental Assessment of Continental Shelf Area SEA4 (Flemming 2003);
- Scottish Marine Renewables: Strategic Environmental Assessment (Faber Maunsell & Metoc 2007); and
- UKCS Offshore Oil and Gas and Wind Energy Strategic Environmental Assessment: Archaeological Baseline (Astill, Dirth, Gribble 2008).

The principal reference sources examined for the baseline desk-based assessment were:

- The National Monuments Record of Scotland, using the Canmore database website;
- Statutory lists, registers and designated areas, including List of Scheduled Ancient Monuments, Designated Wrecks and Historic Marine Protected Areas;
- UK Hydrographic Office (UKHO) wreck register and relevant nautical charts;
- Heath/Ferguson private wreck database, which contains material not published by Ferguson (see Ferguson 1991) and has been added to by Heath and Ferguson as new discoveries of wreck sites have been made;
- Larn, R & Larn, B 1998 *The Ship Wreck Index of Great Britain & Ireland Vol.4 Scotland* (SIBI); and
- Whittaker IG 1998 *Off Scotland: a comprehensive record of maritime and aviation losses in Scottish waters*, Edinburgh.

Other readily available archaeological and historical reports, databases and publications were consulted for information about the study area; including Marine Historic Environment Technical Baseline Report (Supporting Document: ORCA Marine and SULA Diving, 2014).

18.6 DATA GAPS AND UNCERTAINTIES

The data sources consulted during the DBA and the geophysical survey data analysed are considered sufficient for an adequate baseline assessment on which to base a robust impact assessment, even though there were some minor limitations to:

- Interpretation of some of the anomalies identified;
- Some uncertainties in the location of some of the shipwrecks – identified as UV (unverified) or PA (position approximate); and
- The geophysical datasets (it was physically impossible for geophysical surveys to be conducted right to the shore; the general quality of the MBES data for the Sheep Skerry survey was not as high as the data for the rest of the study area, so there may be anomalies that are not visible due to poor resolution; no SSS, Magnetometer or SBP surveys have yet been conducted in the Sheep Skerry export cable corridor.

However, OpenHydro have committed to undertake additional appropriately detailed geophysical surveys in advance of cable works to inform detailed design prior to construction (Shane Quill, Email 16/07/2015 re. Sheep Skerry Multibeam), which will resolve the limitations to the geophysical datasets.

18.7 CONSULTATIONS

A complete list of feedback from all consultees is summarised in Supporting Document (BTAL, 2015a. The key points raised by stakeholders in response to the Environmental Scoping Report (Supporting Document: BTAL, 2013*)*, provided in The Brims Tidal Array Scoping Opinion (Final) (April 2014) regarding the marine historic environment are presented in Table 18.2.

Table 18.2: Key issues raised by stakeholder during consultation

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Marine Archaeology and Cultural Heritage	OIC	Assessment of impact on archaeology during all phases of Project for all associated infrastructure to be included in EIA.	Impact on marine archaeology assessed for all phases of marine development (Construction and Installation, Operations and Maintenance, Decommissioning), informed by Project Description, statutory requirements, industry standards and guidance, and Stakeholder responses.	Sections 18.10 and 18.12.
Marine Archaeology and Cultural Heritage	OIC	EIA to include reference to any shipwrecks or submerged prehistoric landscapes in the proposed area.	Shipwrecks and marine historic environment assets included.	Section 18.9 and Marine Historic Environment Technical Baseline Report.
Marine Archaeology and Cultural Heritage	OIC	Recommended that geotechnical and geophysical data should be assessed.	Geophysical data assessed by ORCA Marine and SULA Diving. No geotechnical data available: however, most of **Project site** is exposed bedrock and therefore unnecessary.	Section 18.9 and Marine Historic Environment Technical Baseline Report.
Marine Archaeology and Cultural Heritage	OIC	Recommended that advice from an appropriately experienced marine archaeologist should be gained prior to the finalisation of survey design.	ORCA Marine (UHI Archaeology Institute) commissioned to provide advice as part of Baseline Assessment and EIA/ES	Sections 18.11 and 18.13
Marine Archaeology	OIC	Avoidance of archaeologically sensitive	Avoidance is a recommended mitigation strategy.	Section 18.11

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
and Cultural Heritage		sites/ areas is recommended.		
Marine Archaeology and Cultural Heritage	OIC	Consultation of the County Archaeologist and Historic Scotland.	Historic Scotland and Orkney County Archaeologist consulted (see below)	
Marine Archaeology and Cultural Heritage	OIC Archaeologist	No queries on methodology	Noted	Section 18.8
Marine Archaeology and Cultural Heritage	OIC Archaeologist	There are some significant assets that could be in the Project site, since their locations are unverified. There is also potential for unknown archaeology to be in the sediments in Aith Hope and west of Sheep Skerry, and the dunes onshore.	Noted. These have been identified in the baseline surveys, and included in the impact assessment.	Section 18.9 and Marine Historic Environment Technical Baseline Report.
Marine Archaeology and Cultural Heritage	OIC Archaeologist	Expects appropriate surveys to be conducted to help identify if any unknown or unverified assets are present.	OpenHydro have commissioned desk-based and geophysical surveys and are committed to further detailed surveys in advance of final design details	Section 18.9, 18.11 and Marine Historic Environment Technical Baseline Report.
Marine Archaeology and Cultural Heritage	OIC Archaeologist	Mitigation strategies should address issues of potential impact on unknown or unverified assets, preferably by avoidance, if any cultural heritage assets are identified.	Noted. Surveys have reduced the risk of unverified assets being impacted to Low. Mitigation strategies have been formulated to reduce or eliminate significant impacts.	Sections 18.10
Marine Archaeology and Cultural Heritage	Historic Scotland	Content with the level of information supplied for preferred and alternative technologies.	Noted	
Marine Archaeology and Cultural Heritage	Historic Scotland	Requested clarification as to what stage BTAL will be seeking archaeological assessment of geotechnical and geophysical data.	Geophysical data assessed. No geotechnical data available: however, most of Project site is exposed bedrock and therefore unnecessary.	Section 18.9 and Marine Historic Environment Technical Baseline Report.
Marine Archaeology and Cultural Heritage	Historic Scotland	Recommended that advice from an appropriately experienced marine archaeologist should be	ORCA Marine (UHI Archaeology Institute) commissioned to provide	

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
		gained prior to the finalisation of survey design.	advice as part of Baseline Assessment and EIA/ES	
Marine Archaeology and Cultural Heritage	Historic Scotland	Welcomed inclusion of information on potential impacts on both known wreck sites and for unknown archaeological features including paleo-landscapes in the scoping report.	Noted	
Marine Archaeology and Cultural Heritage	Historic Scotland	Welcomed information on the location and extent of the areas of search proposed for offshore, landfall and onshore elements of the Project.	Noted	

18.8 ASSESSMENT METHODOLOGY

18.8.1 Assessment Criteria

In addition to the government legislation and policy outlined in the Legislation and Policy Framework section above, the following codes of practice, professional guidance and standards directly relevant to the assessments of impacts have informed the assessment criteria:

- The Joint Nautical Archaeology Policy Committee and Crown Estate's (2006) *Maritime Cultural Heritage & Seabed Development: JNAPC Code of Practice (The Crown Estate and JNCC, 2006)*http://www.jnapc.org.uk/jnapc_brochure_may_2006.pdf;
- Wessex Archaeology Limited (January 2007) *Historic Environment Guidance for the Offshore Renewable Energy Sector*, commissioned by COWRIE Limited (project reference ARCH-11-05);
- Gribble, J and Leather, S for EMU Limited. (2011) *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*, commissioned by COWRIE Limited (project reference GEOARCH-09);
- English Heritage (2013) *Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes* (*Plets et al.,* 2013);
- The Crown Estate (2014) *Protocol for Archaeological Discoveries: Offshore Renewables Projects*, Wessex Archaeology Limited for The Crown Estate;
- The Crown Estate (2010) *Model clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects,* Wessex Archaeology Limited (Ref 73340.05) for The Crown Estate; and
- The Chartered Institute for Archaeologists (CIfA) Codes, Standards and Guidance.

The importance (sensitivity) of each heritage asset or feature summarised in Table 18.3 incorporates the guidelines used by statutory authorities and agencies such as the Scottish Government and Historic Scotland, outlined in the *Scottish Historic Environment Policy* (SHEP 2011); *Planning Advice Note (PAN2/2011) Planning and Archaeology*; the *Marine (Scotland) Act* 2010; *English Heritage Designation Selection Guide: Ships and Boats, Prehistory to Present* (English

Heritage, 2012); and Wessex Archaeology's three-part *Assessing Boats and Ships 1860 – 1950* (Wessex Archaeology, 2011a) and *Assessing Boats and Ships 1914-1938 (Wessex Archaeology (2011b)*. Features for which further information is unavailable are recorded as being of uncertain importance.

The weight given to historic environment considerations depends on a number of factors including:

- The relative rarity of the feature concerned;
- The completeness of the feature/whether it is a particularly good example of its type;
- The historical or cultural associations of the feature;
- The value given to the feature by the local community;
- The potential value of the feature as an in situ educational or research resource; and
- The potential value of retaining the feature for tourism or place-making.

It should be noted that a site that has not been statutorily designated can still be of high importance.

Anomalies recorded in the analysis of the geophysical data (MBES, SSS, Magnetometer and SBP) were initially assigned a 'level of geophysical potential' assessed on the potential for the anomaly identified to be anthropogenic. This methodology is summarised in Table 18.4. Note that although classed as 'high', 'medium' and 'low', levels of geophysical potential do not imply an historical value to the anomalies – an anomaly may be of high geophysical potential (i.e. it looks anthropogenic) but may not be of historical importance.

Table 18.3: Definitions for importance (sensitivity) of the marine historic environment asset

Importance (Sensitivity)	Criteria
High	Archaeological and historical sites, submerged prehistoric landscapes and deposits, wrecks, wreck cargos, or areas of international or national importance, including world heritage sites, designated wrecks (designated under UK or Scottish legislation) or Historic Marine Protected Areas (HMPAs). Shipwrecks dating to the prehistoric, Norse and Medieval periods, which are very rare; wreck cargos which contain rare artefacts or artefacts representative of a particular area or time period; and vessels, including aircraft lost in international conflicts which may have involved large losses of life. Shipwrecks involved in national or international trade, which were lost before 1913, a period during which the shipping industry was a major element in Britain's world influence, particularly if their cargo survives, or the remains provide evidence of changes in construction technology or vessel design would also be considered of high importance.
Medium	Archaeological and historical sites, wrecks, wreck cargos and areas of regional importance. This would involve shipwrecks, shipwreck cargos, anchorages and fishing areas from before 1913 that would have been involved in regional industry and trade. Wrecks and cargos considered representative of the changes in naval engineering or support the identification and preservation of the diversity of vessels from this period are considered of medium importance.
Low	Locally important sites, wrecks, wreck cargos or areas. Shipwrecks dating from after 1913 relating to fishing, ferrying or other coastwise trade. Wreck cargos of limited intrinsic, contextual or associative characteristics, or that are commonly recovered are considered of low importance.

Importance (Sensitivity)	Criteria
Negligible	Features that have been recorded but assessed as having no archaeological or historical interest, such as recent wrecks, or those wrecks whose structure or cargos have been so damaged that they no longer have any historical merit.
Uncertain	Features that cannot be identified without detailed work, but potentially of some interest. Also, for example, if the date of construction or rarity of a vessel is not known, but is potentially of some interest. Findspots, which may represent an isolated find, or could represent the location of a hitherto unknown site. Unidentified geophysical anomalies are also of uncertain importance and have been divided up further in Table 18.4.

Table 18.4: Definitions for level of geophysical potential

Level of Geophysical Potential	Criteria
High	Anomaly looks anthropogenic (atypical in its context); or there is identifiable cultural material; or it is in the area of a known archaeological site, or another anomaly identified to be of high potential.
Medium	Anomaly lies in an area of intensive human activity such as near ports or areas of peat and other features relating to submerged landscapes. It would also be considered for an anomaly that is possibly anthropogenic, but which has no definite identification.
Low	Anomaly is likely to be a natural formation such as a sand dune or bedrock formation. It could also be a processing error of the geophysical data.

The magnitude of any potential adverse direct and indirect impacts on marine cultural heritage caused by the Project proposals are determined using the criteria outlined in Table 18.5. It should be noted that these categories are guideline criteria only, since assessments of magnitude are matters of professional judgement.

Table 18.5: Definitions for magnitude of effect for marine historic environment

Magnitude	Criteria	
	Direct	Indirect
High	Works would result in the complete loss of the site, or the loss of an area, features or evidence fundamental to the historic character and integrity of the site, severance of which would result in the complete loss of physical integrity.	The removal of, or a fundamental and irreversible change to, the relationship between a marine heritage asset or environment and a historically relevant seabed context. Major change that removes or prevents appreciation of characteristics key to a heritage asset, or permanent change to or removal of surroundings of a less sensitive asset or seabed context. A noticeable change to a key relationship between a marine heritage asset or environment and a highly sensitive, valued or historically relevant seabed context over a wide area or an intensive change to a less sensitive or valued asset or seabed context over a limited area.
Medium	Works would result in the loss of an important part of the site or some important features and evidence, but not areas or features fundamental to its historic character and integrity. Severance would affect the integrity of the site, but key physical relationships would not be lost.	Noticeable change to a non-key relationship between a marine heritage asset or environment and a historically relevant seabed context. Relationship, asset, or context tolerant of moderate levels of change. Small changes to the relationship between a heritage asset and a historically relevant seabed context over a wide area or noticeable change over a limited area.
Low	Works or the severance of the site would not affect the main features of the site. The historic integrity of the site would not be significantly affected.	Minor changes to the relationship between a heritage asset or environment and a historically relevant seabed context over a wide area or minor changes over a limited area. Relationship, asset, or context considered tolerant of change.
Negligible	Works or the severance of the site would be confined to a relatively small, peripheral and/or unimportant part of the site. The integrity of the site, or the quality of the surviving evidence would not be affected.	Changes to a historically relevant seabed context that cannot be discerned or perceived in relation to the heritage asset or environment.
Unknown	Ground breaking works over features that have not been fully interpreted would reduce the chance of interpretation in the future. In the event of significant features this would constitute impact of high magnitude; for sites of lesser significance it is less problematical. Nevertheless, it remains an issue where features have not been or could not be interpreted.	Changes to a seabed context, where it is uncertain how these contribute to our understanding of the site because the feature or asset itself could not or has not been understood or interpreted.
Positive	An enhancement to the baseline condition of the asset.	An enhancement to the seabed context of a heritage asset or environment. An enhancement to preservation conditions of a heritage asset or environment.

The significance of potential impacts of the Project on the marine historic environment have been assessed taking into account the importance (sensitivity) or level of geophysical potential of each identified marine cultural area, site or feature and the magnitude of the impact (Table 18.6).

Table 18.6: Assignment of impact significance for marine historic environment assets based on Importance (sensitivity) of receptor and magnitude of effect

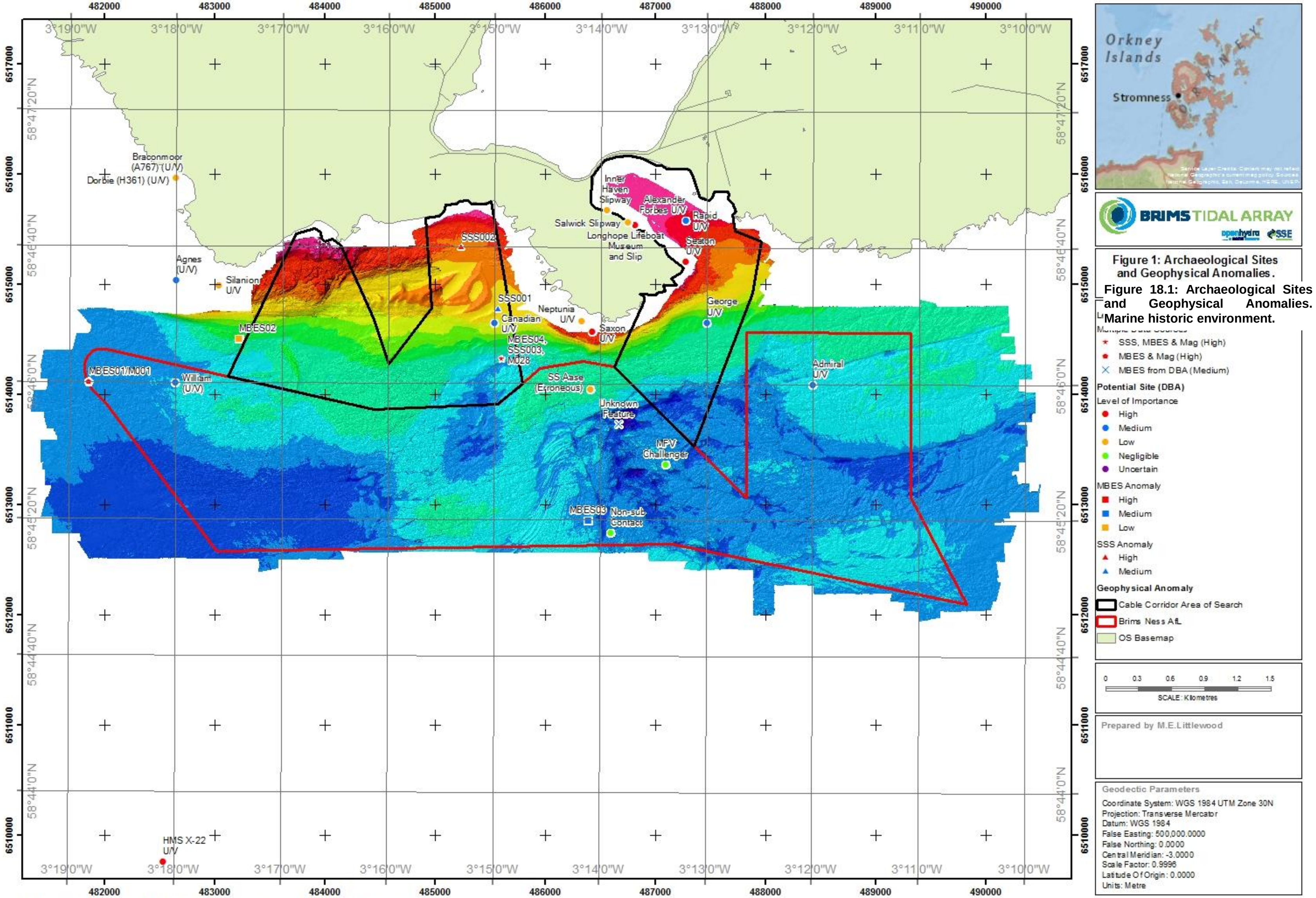
Importance (Sensitivity) of Receptor	Magnitude of effect				
	High	Medium	Low	Negligible	Unknown
High	*MAJOR*	*MAJOR*	*MODERATE*	*MINOR*	*UNCERTAIN/ MAJOR*
Medium	*MAJOR*	*MODERATE*	*MINOR*	*MINOR*	*UNCERTAIN/ MODERATE*
Low	*MODERATE*	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*	*UNCERTAIN/ MINOR*
Negligible	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*	*NEGLIGIBLE*	*UNCERTAIN/ NEGLIGIBLE*
Uncertain	*UNCERTAIN/ MAJOR*	*UNCERTAIN/ MODERATE*	*UNCERTAIN/ MINOR*	*UNCERTAIN/ NEGLIGIBLE*	*UNCERTAIN/ NEGLIGIBLE*
Positive	*POSITIVE*	*POSITIVE*	*POSITIVE*	*POSITIVE*	*POSITIVE*

18.9 BASELINE DESCRIPTION

18.9.1 Introduction

The baseline description for the marine historic environment was informed by desk-based assessment (DBA) and was supplemented by the analysis of subsea geophysical data (MBES, SSS, Magnetometer and SBP) supplied by Osiris Projects and the MBES data supplied by REE/TE.

The results of this work are fully reported in the *Marine Historic Environment Technical Baseline Report* (Supporting Document: ORCA Marine and SULA Diving 2014). This is summarised below and illustrated on Figure 18.1. Each identified marine historic environment asset and geophysical anomaly is located with its name or reference number on Figure 18.1. Their importance is depicted by colour coding.



*Note that though classed as 'high', 'medium' and 'low', levels of geophysical potential do not imply a historical value to the anomalies - an anomaly may be of high geophysical potential (i.e. it looks anthropogenic) but may not be of historical importance.

U/V = Position shown is tentaive, derived from an unverified location of loss cited by Whittaker (1998)

Figure 18.1: Archaeological sites and geophysical anomolies within the marine historic environment

18.9.2 Shipwrecks

Sixteen potential shipwreck sites were identified in the Project study area by DBA, one of which, the SS *Aase* described as having been wrecked “off Brims”, is actually located off Brims Ness in Caithness not Hoy (Caithness Sub Aqua Club, Pers. Comm.). It is not included in any further total numbers of shipwrecks and potential impacts to the site are not considered.

The positions of fourteen of the remaining fifteen wrecks identified by DBA are tentative, derived from the unverified (U/V) location of loss in Whittaker (1998). Thus although four of the sites (*Silanion, Neptunia, Saxon* and HMS *X-22*) are depicted as being outside the Project site there is the potential that some remains could be within the AfL area or the area of search for the export cable corridor. Conversely, although the remaining eleven sites are shown to be within these areas they may not be, because of their unverified location of loss.

Three of the potential shipwreck sites are considered to be of high importance – the HMS *X-22* because it is a rare vessel and a war grave (the submarine sank in World War II with the loss of all hands) and the *Saxon* and *Seaton,* because they resulted in high loss of life, and there is the potential that some of the crew went down with the ship. It is likely that the *Saxon* and the *Seaton* are the same vessel, with the records for the Seaton created as result of a clerical error in Shipping Intelligence entries (Canmore: 260614) (RCAHMS, 2015).

Seven of the sites – the *Canadian*, the *Admiral*, the *George*, the *Alexander Forbes*, the *Rapid,* the *Agnes* and the *William*) would be considered of medium importance if their remains are well preserved as they could provide insight into fishing, ferrying and other coastwise trade.

Four of the sites – the *Silanion,* the *Neptunia,* the *Braconmoor (A767)* and the *Dorbie (H361)* – are considered of low importance as they were lost after 1913, their cargos are considered to be of local importance and there are good historical records of the methods of their construction. Both vessels have unverified positions outside the Project site.

The MFV *Challenger* is considered of negligible importance as it is a modern vessel of no historical interest.

18.9.3 Unknown Marine Historic Environment Assets

There is a high probability for unknown, unrecorded vessels to have sunk in the Project site – constructed from materials that do not give strong geophysical or magnetic returns or which are buried beneath the surface of the seabed. This is more likely in the embayment of Aith Hope as it was historically used as a harbour, and there are shallow sandy deposits towards the head of the bay where material could be buried.

The likelihood for encountering unknown, unrecorded vessels across the rest of the AfL area and within the proposed cable corridors to Moodies Eddy and Sheep Skerry is reduced by the nature of the seabed - bedrock and shallow mobile sediments - and the tidal conditions neither of which are conducive to good preservation of submerged cultural heritage. Thus there is a low potential for the Project to impact on unknown significant remains.

18.9.4 Maritime Infrastructure

There are three slipways in the Aith Hope export cable corridor. One is a slipway dating to 1906, which is associated with the Longhope Lifeboat Museum and therefore considered of high importance (sensitivity). The other two are slipways on the inter-tidal zone (Inner Haven and Salwick Slipways) which date to the early 20th century and are considered of low importance.

18.9.5 Non-Sub Contacts

A Non-sub Contact is a sonar contact detected during wartime submarine searches that are not submarines. The identity of these contacts is unclear – they have the potential to be shipwrecks or other anthropogenic features, or they can be natural.

One Non-sub contact was identified by the DBA. It is considered to be of negligible importance as it is likely to have been a natural rather than anthropogenic feature.

18.9.6 Aviation Losses

There are no known aircraft sites within the Project site, however seven aircraft are recorded as having crashed in this area of the Pentland Firth and it remains a possibility that one or more of them could be within the Project site. If identified these would be considered of high importance as they are all war losses and would be automatically protected under the *Protection of Military Remains Act* 1973.

18.9.7 Unexploded Ordnance

There are no reports of unexploded ordnance in the Project site.

18.9.8 Geophysical anomalies

Four multi-beam echosounder (MBES), three side scan sonar (SSS) and two Magnetic anomalies were noted during the assessment of the geophysical data. These are shown on Figure 18.1. These anomalies were found to be of high, medium and low geophysical potential:

- High geophysical potential (anthropogenic);
    - Two MBES (MBES01 and MBES04);
    - Two SSS (SSS002 and SSS003 – Osiris Project's SSS anomalies S043 and S214 respectively);
    - Two Magnetic (MAG01 and MAG02 – Osiris Project's Magnetic anomalies M001 and M028 respectively));
- Medium geophysical potential (possibly anthropogenic);
    - One MBES (MBES03) from Project survey data;
    - One MBES Anomaly (Unknown Feature) identified by previous studies;
    - One SSS (SS001 – Osiris Projects SSS anomaly S019); and
- Low geophysical potential (not considered anthropogenic) – the remaining MBES anomaly MBES02.

Anomalies MBES04, SSS03 and MAG02 all relate to a single location to the southeast of the Moodies Eddy export cable corridor, and may represent the remains of the *Canadian*, a rigged ship which would be considered of medium importance (sensitivity) if found.

All remaining SSS and Magnetic anomalies recorded by Osiris Projects in their assessment of the SSS and Magnetometer data appear to correlate with natural geology and are considered to be of low geophysical potential.

The anomalies of high or medium geophysical potential identified above are considered to be of uncertain importance because their exact nature could not be identified and thus have the potential to represent significant remains – perhaps of unlocated wrecks of high or medium importance.

18.9.9 Submerged Landscapes

The Project is located in an area considered to have low potential for the preservation of submerged cultural landscapes or materials. The geophysical data show the area comprises exposed bedrock with shallow sandy areas of mega ripples. No evidence of submerged cultural-historical material or palaeo-landscape features was observed in the assessment of the sub-bottom profiler (SBP) images for the Moodies Eddy or Aith Hope corridors.

18.9.10 Baseline Summary

Fifteen potential shipwreck sites (the positions of fourteen of which are unverified), one Non-sub contact and one geophysical anomaly were identified by DBA. Four MBES, three SSS and two magnetic anomalies were observed during the assessment of the geophysical data provided by Osiris Projects and REE/TE. All but one (MBES02) were considered anthropogenic. MBES04, SSS03 and MAG02 all relate to a single location to the southeast of the Moodies Eddy export cable corridor, which may represent the remains of the *Canadian*, a rigged ship which would be considered of medium importance (sensitivity) if found. No evidence of palaeo-landscape features were observed in the SBP data. No confirmed aircraft crash sites were found within the Project site, although seven aircraft are reported to have crashed in this part of the Pentland Firth and it remains a possibility that one or more of them may be within the Project site.

18.10 POTENTIAL IMPACTS

Potential impacts relevant to the marine historic environment were identified using project-specific parameters, scoping responses and *Historic Environment Guidance for Wave and Tidal Energy (*Firth 2013), produced for English Heritage, Historic Scotland & CADW) as potentially being associated with the proposed development.

The potential impacts identified for each phase of the Project are:

18.10.1 Construction and Installation

- The deployment of Turbine Support Structures (TSS);
- The deployment of the gravity base foundations for the cable connection hubs;
- The excavation of any trenches for the deployment of the export cable along the route and at landfall;
- The laying and anchoring of inter-array cables and export cables and any associated armour or cable protection and stabilisation methods; and
- The deployment of installation vessel anchors.

18.10.2 Operation and Maintenance

- The deployment of maintenance vessel anchors;
- The disturbance of sediment around and forming the context of the site (scouring) in response to potential changes in sediment dynamics; and
- The deposition of sediment around and forming the context of the site in response to potential changes in sediment dynamics.

18.10.3 Decommissioning

- The removal of Turbine Support Structures (TSS);
- The removal of the gravity base foundations for the cable connection hubs;
- The removal of inter-array cables and export cables and any associated armour or cable protection and stabilisation methods; and
- The deployment of vessel anchors.

18.11 MITIGATION MEASURES

18.11.1 Project Design Mitigation and General Mitigation

All Project Design and General Mitigation measures are set out in Chapter 5 Project Description, Tables 5.15 and 5.16 respectively. These are standard practice measures based on specific legislation, regulations, standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur.

The mitigation measures will be informed by results from a geophysical survey of the Project site that will be carried out to inform detailed design.

18.11.3 Specific Mitigation

The following mitigation measures will be implemented specifically to minimise the impacts on the marine historic environment.

Table 18.7: Specific mitigation measures marine archaeology and cultural heritage

Ref	Mitigation Measure Description
MA01	Where avoidance is not possible, sites of potential archaeological or cultural heritage importance affected by the Project will be examined in more detail by drop down camera or Remote Operated Vehicle (ROV) under archaeological direction. The data from the investigation will be assessed by a marine archaeologist.
MA02	Depending on the results from the examination an appropriate management and mitigation strategy will be developed in consultation with the statutory authorities (Marine Scotland, Historic Scotland, and Orkney Islands Council). This will include specific measures that are considered to be appropriate and practical for a site of this challenging and highly dynamic nature such as: Layout redesign to avoid highly sensitive remains; and Where avoidance is not possible, targeted very high resolution remote sensing survey to identify and record any remains.
MA03	The difficult conditions in the Pentland Firth mean that the requirement for more detailed archaeological investigations such as sampling of any identified palaeo-landscape deposits, intrusive works, wreck recovery or archaeological excavations will need to be considered on a case by case basis in close consultation with the statutory authorities if the need arises.
MA04	A written scheme of investigation will be produced, to include cross-referencing with construction and environmental management plans, and inductions on any marine historic environment assets to avoid. This will be agreed with relevant consultees prior to commencement of works.
MA05	An reporting protocol for the accidental discovery of cultural remains in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects,

Ref	Mitigation Measure Description
	http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects.pdf This will be agreed with relevant consultees prior to commencement of works.

18.12 RESIDUAL EFFECTS

Significant potential impacts on the marine historic environment were only predicted during the construction and installation phase. None were predicted for the subsequent operations, maintenance and decommissioning phases.

Implementation of the above management and mitigation strategies (Table 18.7) for potentially significant direct impact on known cultural heritage (even if the location is unverified) during construction and installation (Section 18.12.1.1), will eliminate, reduce or manage any significant impacts to an acceptable level, resulting in no significant residual impacts (Table 18.8, Table 18.9, and Table 18.10).

18.12.1 Construction and Installation

During construction and installation direct impacts to cultural material on the seabed could be caused by the installation of TSS and gravity base foundations for cable connection hubs. The deployment of monopile and drilled pin pile tripods are considered to have greater potential impact on marine cultural heritage as they penetrate the surface resulting in complete destruction of any cultural heritage beneath and in the immediate vicinity of the piles. In contrast, gravity base foundations are considered to have less potential impact on marine cultural heritage as they do not penetrate the surface. Any damage caused to marine cultural heritage as a result of this technology would be from compression.

Direct impacts to cultural material on the seabed could also be caused by the excavation of any trenches for sections of the export cable along the cable route and at landfall – which would result in the removal of marine cultural heritage or removal of material that forms the context of the site. It is expected that the potential impacts from Horizontal Direction Drill (HDD) techniques to bring the export cable ashore will be less than those for open cut trench methods as less material would be removed from the seabed. The long HDD method, which does not require open cut methods to install the cable across the beach, is considered to have less impact than short HDD as any cultural material on the inter-tidal zone would not be removed.

The laying and anchoring of surface-laid inter-array and export cables and their associated armour or cable protection and stabilisation methods also have the potential to cause direct impacts to cultural material on the seabed. Installation of rock placement, concrete mattresses, grout bags and armoured cabling (which is likely to be heavier) could cause direct damage to marine cultural heritage through compression.

Finally, direct impacts to cultural material by compression could be caused by the dropping of vessel anchors onto cultural heritage during construction and installation.

18.12.1.1 Potential Direct Damage to or Destruction of Known Marine Historic Environment Assets

In line with the Design Envelope approach, it was assumed that there could be major direct impact on sites in the AfL area and, as the specific route of the export cable and the export cable landfall have not yet been determined, on sites within the area of search for the export cable corridors. The significance of the impact takes into account the importance (sensitivity) of the receptor and the magnitude of the impact to determine the potential consequence.

No sites with statutory designations, no aircraft and no submerged landscape deposits have been identified that will be impacted. One shipwreck site of negligible importance (MFV *Challenger*) with a confirmed position within the AfL area could be impacted; however the consequence of any impact is considered minor and therefore not significant. There are three slipways on the edge of the Aith Hope export cable corridor that could be impacted. The consequence of these impacts would be considered significant if they were not avoided.

The residual significance of direct impacts for geophysical anomalies of high or medium geophysical potential identified in the Technical Baseline Report (ORCA Marine and SULA Diving 2014) is summarised in Table 18.8. These anomalies are considered to be of uncertain importance and have the potential to be significant until proven otherwise. Impacts on the anomaly of low geophysical potential (MBES02) are not considered as this anomaly is not considered to be anthropogenic.

In line with the Design Envelope approach that assumes all sites in the AfL area and the area of search for the export cable corridors could be impacted, it is predicted that there could be significant impacts on eight anomalies within the Project site. However, it may be possible to avoid them when designing the locations of the TSS's, cable connection hubs and routing of the inter-array and export cables (see mitigation measures in Table 18.7).

Implementation of the above management and mitigation strategies (Table 18.7) for direct impact on known cultural heritage during construction and installation, will eliminate, reduce or manage any significant impacts to an acceptable level, resulting in no significant residual impacts (Table 18.8).

Table 18.8: Residual impacts for direct impacts on cultural heritage during construction and installation

Site	Importance (Sensitivity) of receptor	Magnitude of impact	Consequence	Significance
Longhope Lifeboat Museum and Slip	High	Low	Minor	Not Significant
Inner Haven Slipway	Low	Negligible	Minor	Not Significant
Salwick Slipway	Low	Negligible	Minor	Not Significant
MBES01	Uncertain	Negligible	Uncertain/ Negligible	Not Significant
MAG01	Uncertain	Low	Uncertain/ Minor	Not Significant
MBES04	Uncertain	Low	Uncertain/ Minor	Not Significant
SS002	Uncertain	Negligible	Uncertain/ Negligible	Not Significant
SS003	Uncertain	Low	Uncertain/ Minor	Not Significant

Site	Importance (Sensitivity) of receptor	Magnitude of impact	Consequence	Significance
MAG02	Uncertain	Negligible	Uncertain/ Negligible	Not Significant
Unknown Feature	Uncertain	Negligible	Uncertain/ Negligible	Not Significant
MBES03	Uncertain	Negligible	Uncertain/ Negligible	Not Significant
SS001	Uncertain	Negligible	Uncertain/ Negligible	Not Significant

18.12.1.2 Potential Direct Damage to or Destruction of Unknown Marine Historic Environment Assets

The general positions of 14 shipwreck sites are based on unverified locations of loss cited in Whittaker (1998). It is possible that these sites could be within the Project site. In line with the Design Envelope approach, it has been assumed that there could be a major direct impact on these sites.

The likelihood of direct impact on these possible shipwrecks is considered low since they were not specifically observed in the assessment of the geophysical data. If they are present, it is likely their remains will have been an identified anomaly, which can be avoided, and the potential impacts on geophysical anomalies have been assessed under Section 18.12.1.1.

The residual significance of possible direct impacts on shipwreck sites within unverified locations is summarised in Table 18.9. Impacts on the Non-sub contact identified during the DBA are not considered as this feature is not considered to be anthropogenic.

Seven aircraft are recorded by Whittaker (1998) and Sturtivant (1995) as having crashed into this area of the Pentland Firth and it remains a possibility that one or more of them could be located within the Project site. In line with the Design Envelope approach, it has been assumed that there could be a major direct impact on these sites. The residual significance of any possible direct impacts, though unlikely, on aircraft sites within unverified locations is summarised in Table 18.9.

The likelihood of direct impact on these possible aircraft remains is considered low since they were not specifically observed in the assessment of the geophysical data. If they are present, it is likely their remains will have been an identified anomaly, and the potential impacts on geophysical anomalies have been assessed under Section 18.12.1.1.

As a maritime nation with a reliance on marine based trade and exchange there have been countless shipwrecks around UK water from all periods - many of which remain unreported. The Pentland Firth has a well-deserved reputation as a channel to be navigated with care. Tide surges through the Firth between the Atlantic and the North Sea can reach up to 12 knots (22km/h) (Dacre et al n.d.: 2). Throughout history it has been an important and well-used seaway, both through and across the Firth. As such there is a high probability for unknown, unrecorded vessels to have sunk within the Project site. Remains of these vessels and their associated artefacts may not be visible in the geophysical data – constructed from materials that do not provide strong geophysical or magnetic returns, or that are buried beneath the seabed.

However, the likelihood of encountering unrecorded wreck remains (ships or aircraft) or submerged palaeo-environmental and landscape remains is low due to the nature of the seabed and the tidal conditions across the Project site. The seabed within most of the Project site comprises primarily outcropping bedrock and shallow mobile sediments (C13007_Vol2c_rev01: 9, 14, 18), neither of which are conducive to the preservation of cultural remains and submerged landscapes. Therefore there is no predicted significant direct impact on unrecorded cultural remains or submerged landscapes.

Implementation of the above management and mitigation strategies (Tables 18.7) for direct impact on unknown cultural heritage during construction and installation, will eliminate, reduce or manage any significant impacts to an acceptable level, resulting in no significant residual impacts (Table 18.9).

Table 18.9: Residual impacts for direct impacts on cultural heritage with no verified location during construction and installation

Site	Importance (Sensitivity) of receptor	Magnitude of impact	Consequence	Significance
Seaton	High	Negligible	Minor	Not Significant
Saxon	High	Negligible	Minor	Not Significant
HMS X-22	High	Negligible	Minor	Not Significant
Admiral	Medium	Negligible	Minor	Not Significant
George	Medium	Negligible	Minor	Not Significant
Alexander Forbes	Medium	Negligible	Minor	Not Significant
Rapid	Medium	Negligible	Minor	Not Significant
Canadian	Medium	Negligible	Minor	Not Significant
Agnes	Medium	Negligible	Minor	Not Significant
William	Medium	Negligible	Minor	Not Significant
Silanion	Low	Negligible	Negligible	Not Significant
Neptunia	Low	Negligible	Negligible	Not Significant

Site	Importance (Sensitivity) of receptor	Magnitude of impact	Consequence	Significance
Braconmoor (A767)	Low	Negligible	Negligible	Not Significant
Dorbie (H361)	Low	Negligible	Negligible	Not Significant
Junkers Ju8 of Kg30	High	Negligible	Minor	Not Significant
Avro Tutor I K3305	High	Negligible	Minor	Not Significant
Fairey Swordfish W5924. 782 squadron (sqdn.)	High	Negligible	Minor	Not Significant
Blackburn Roc L3177 771 sqdn.	High	Negligible	Minor	Not Significant
Fairey Albacore I X9174 831 sqdn.	High	Negligible	Minor	Not Significant
Supermarine Walrus X9481, 700 sqdn Fleet Air Arm	High	Negligible	Minor	Not Significant
Supermarine Walrus L2329 700 sqdn Fleet Air Arm	High	Negligible	Minor	Not Significant

18.12.1.3 Potential Indirect Damage to or Destruction of Known and Unknown Marine Historic Environment Assets

No indirect impacts to either known or unknown marine historic environment assets are predicted during the construction and installation phase of the Project.

18.12.2 Operations and Maintenance

18.12.2.1 Potential Direct Damage to or Destruction of Known and Unknown Marine Historic Environment Assets

During operation and maintenance it is possible that direct impacts to cultural material on the seabed could be caused by maintenance vessels dropping anchors on the seabed during routine inspections or preventative maintenance or by the removal of devices for general maintenance.

However, it is anticipated that as the devices are likely to be located in deep water, maintenance vessels are more likely to moor up rather than anchor. It is also predicted that the removal of the device and its associated TSS will have no damaging impact further to any that occurred in the construction and installation phase is predicted. As such no direct impacts on known or previous unrecorded marine cultural heritage are predicted.

There is potential that movement of the inter-array cable could expose areas of seabed which could affect sites of cultural heritage interest (if present). However, such movement is considered to be very unlikely due to the cables being anchored to the seabed. In order to ensure that there are no adverse effects on cultural heritage sites from the inter-array cables, the principal mitigation is to consider the presence of cultural heritage material in advance of cable installation and position cable anchors in locations which will avoid impacts where possible.

18.12.2.2 Potential Indirect Damage to or Destruction of Known and Unknown Marine Historic Environment Assets

The potential for indirect impacts to cultural material on the seabed as a result of scouring or sediment deposition during operations and maintenance was evaluated but these were not considered significant Potential impacts of the Project on the seabed are evaluated in Chapter 9: Physical Processes and found to be negligible/ not significant in all cases.

18.12.3 Decommissioning

18.12.3.1 Potential Direct Damage to or Destruction of Known and Unknown Marine Historic Environment Assets

There is an insignificant risk of potential impacts on marine archaeology or cultural heritage during decommissioning on the basis that any wrecks or anomalies of archaeological importance will have either been avoided as part of Project design (siting of TSSs, inter-array and export cables) and therefore will not be directly impacted during decommissioning, or where avoidance was not possible will already have been impacted after being investigated and recorded prior to installation.

18.12.3.2 Potential Indirect Damage to or Destruction of Known and Unknown Marine Historic Environment Assets

There are no indirect impacts on known and unrecorded marine cultural heritage predicted during decommissioning.

18.12.4 Summary of Residual Impacts

The implementation of the mitigation measures outlined in Section 18.11 above, with avoidance of known sites where possible incorporated into the Project design as the primary strategy, will eliminate or minimise impacts on the marine historic environment to a level that is not significant The instigation of a reporting protocol for the accidental discovery of cultural remains will minimise impact on unknown sites.

Drilled monopile TSS, drilled pin pile tripod TSS, the excavation of trenches for the burial of the export cable on route or at landfall and the use of either long or short HDD could have a direct destructive impact on marine cultural heritage as a result of the penetration or removal of marine cultural heritage. Gravity base structures, cable armouring and cable protection through rock placement, concrete mattresses and grout bags could have a direct destructive impact on marine cultural heritage as a result of compression of any remains.

Table 18.10: Summary of residual effects of the direct impacts on marine cultural heritage

Technology Option	Receptor	Importance (Sensitivity)	Mitigation	Residual Magnitude	Summary	Residual Significance
Gravity base structures (GBS) (including sub-sea base) TSS	Wrecks and anthropogenic anomalies Compression of cultural material during construction and installation.	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets.	Negligible	If marine cultural heritage assets are avoided they will not be directly damaged by GBS. If avoidance is not possible, an alternative mitigation strategy would need to be agreed and adopted.	Not Significant
Drilled monopile TSS	Wrecks and anthropogenic anomalies. Destruction of cultural material during construction and installation.	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets; MA05: Instigation of a reporting protocol for marine cultural heritage.	Low	If marine cultural heritage assets are avoided they will not be directly damaged by the monopile. If avoidance is not possible, an alternative mitigation would need to be agreed and adopted. Reporting protocol will ensure identification of any unknown cultural heritage assets during drilling.	Not Significant
Drilled pin pile tripod TSS	Wrecks and anthropogenic anomalies Destruction of cultural material during construction and installation.	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets; MA05: Instigation of a reporting protocol for marine cultural heritage.	Low	If marine cultural heritage assets are avoided they will not be directly damaged by the pin piles. If avoidance is not possible, an alternative mitigation strategy would need to be agreed and adopted. Reporting protocol will ensure identification of any unknown cultural heritage assets during drilling.	Not Significant
Long-HDD	Wrecks and anthropogenic anomalies Destruction of cultural material during	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets;	Negligible	If marine cultural heritage assets are avoided they will not be directly damaged by the drilling.	Not Significant

Technology Option	Receptor	Importance (Sensitivity)	Mitigation	Residual Magnitude	Summary	Residual Significance
	construction and installation.		MA05: Instigation of a reporting protocol for marine cultural heritage.		If avoidance is not possible, an alternative mitigation strategy would need to be agreed and adopted. Reporting protocol will ensure identification of any unknown cultural heritage assets during drilling.	
Short-HDD	Wrecks and anthropogenic anomalies Destruction of cultural material during construction and installation.	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets; MA05: Instigation of a reporting protocol for marine cultural heritage.	Negligible	If marine cultural heritage assets are avoided they will not be directly damaged by the drilling. If avoidance is not possible, an alternative mitigation would need to be agreed and adopted. Reporting protocol will ensure identification of any unknown cultural heritage assets during drilling.	Not Significant
Open Cut Trench	Wrecks and anthropogenic anomalies Destruction of cultural material during construction and installation.	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets; MA05: Instigation of a reporting protocol for marine cultural heritage.	Low	If marine cultural heritage assets are avoided they will not be directly damaged by the excavation of the trench. If avoidance is not possible, an alternative mitigation strategy would need to be agreed and adopted. Reporting protocol will ensure identification of any unknown cultural heritage assets during excavation.	Not Significant
Cable Armouring	Wrecks and anthropogenic anomalies Compression of cultural material during construction and	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets;	Negligible	If marine cultural heritage assets are avoided they will not be directly damaged by the compression from the cable.	Not Significant

Technology Option	Receptor	Importance (Sensitivity)	Mitigation	Residual Magnitude	Summary	Residual Significance
	installation and operation.				If avoidance is not possible, an alternative mitigation strategy would need to be agreed and adopted.	
Cable protection measures: Rock protection, concrete mattresses and grout bags	Wrecks and anthropogenic anomalies Compression of cultural material during construction and installation and operation.	Uncertain/High	PD14, MA04: Avoidance of marine cultural heritage assets;	Negligible	If marine cultural heritage assets are avoided they will not be directly damaged by the compression from the cable protection measures. If avoidance is not possible, an alternative mitigation strategy would need to be agreed and adopted.	Not Significant

18.13 ACCIDENTAL AND UNPLANNED EVENTS

Strategies for accidental or unplanned impacts on marine cultural heritage are addressed within the Section 18.11 Mitigation Measures above. The highest risk would be disturbing an unknown wreck, or dragging through an avoided feature during an unplanned or accidental event. Overall the likelihood of such events will be minimised through general HSE management systems and the residual risk of an incident leading to damage is rather small. Consequently the likelihood of impact is considered low to negligible.

18.14 SUMMARY

- No sites with statutory designations, no aircraft and no submerged landscape deposits have been identified that will be impacted.
- The likelihood of direct impact on shipwrecks with unverified locations is considered low since they were not specifically identified in the assessment of the geophysical data, unless they are the identified anthropogenic anomalies.
- Four multi-beam echosounder (MBES), three side scan sonar (SSS) and two Magnetic anomalies were identified. Three of these anomalies were in the same location and may represent the remains of the Canadian, a shipwreck of medium importance (MBES04, SSS03 and M028).
- There is a low potential for the Project to impact on unknown, unrecorded vessels that may have sunk in the Project site as the seabed and tidal conditions are not conducive to good preservation of submerged cultural heritage.
- Significant potential impacts on the marine historic environment were only predicted during the construction and installation phase. None were predicted for the subsequent operations, maintenance and decommissioning phases.
- Avoidance of known sites incorporated into the Project Design is considered the primary strategy to eliminate or minimize impacts on the marine historic environment.
- The instigation of a reporting protocol for the accidental discovery of cultural remains is recommended to minimize impact on unknown sites.
- Implementation of the suggested management and mitigation strategies will eliminate, reduce or manage any significant impacts to an acceptable level, resulting in no significant residual impacts.

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Socio-economics

Chapter 19

19 SOCIO-ECONOMIC

19.1 INTRODUCTION

This chapter of the Environmental Statement (ES) considers the potential socio-economic benefits and effects of the Brims Tidal Array Project (the Project) on the local regional and national area. The key considerations for this receptor are where the construction activity will be based, where the commissioning of the tidal turbines occurs and where the Operations and Maintenance (operation and maintenance) base is located. Locations for these activities will be finalised during the detailed design phase of the Project, and for the purposes of this study the effects on a national, regional and local scale have been assessed.

On a national scale Scotland has a range of ports and construction facilities that could host the construction activity and the operation and maintenance for the Project. The National Renewable Infrastructure Plan (Scottish Government, 2011b) completed in 2010-11 gives an assessment of the Scottish ports with regard to support of the marine renewable industry, (see Figure 19.3).

The construction and operation of any marine energy development will have a number of socio-economic benefits such as:

- Job opportunities;
- Improved infrastructure;
- Improved services;
- Business opportunities in local supply chain; and
- Better communications.

In addition, there may be impacts on other marine users as well as onshore activities and interests, which have socio-economic effects such as:

- Congestion at Piers;
- Congestion on Ferries;
- Noise and lighting pollution; and
- Availability of accommodation.

There will also be some wider effects on services such as housing, education and roads infrastructure. The benefits of improvements to these services are assessed within this chapter.

There may also be impacts on Commercial Fisheries (Chapter 16), Recreation and Tourism (Chapter 20), Shipping and Navigation (chapter 15) and Seascape, Landscape and Visual Impact Assessment (Chapter 17). These chapters are cross referenced in this chapter and should also be consulted to have a full understanding of the potential social and economic benefits and impacts of this Project.

19.2 STUDY AREA

The national study area is defined at this stage as any port or construction base in Scotland. The assessment gives indications of the impacts that may affect any port or base that is chosen for the construction or operation and maintenance parts of the Project.

The regional study area for this assessment includes the areas local to each of the potential construction bases and operation and maintenance bases closest to the site. Therefore the study area includes the county of Orkney, including the local areas of Stromness and Hoy, and part of the county of Caithness, including the local area of Scrabster and Thurso (see Figure 19.1).

For the regional assessment Orkney and Caithness have been assessed as the catchment. Other ports within the Highlands and Islands such as Lerwick, Nigg or Invergordon could be considered, but as they are over 100km from the site they are covered in the national assessment.

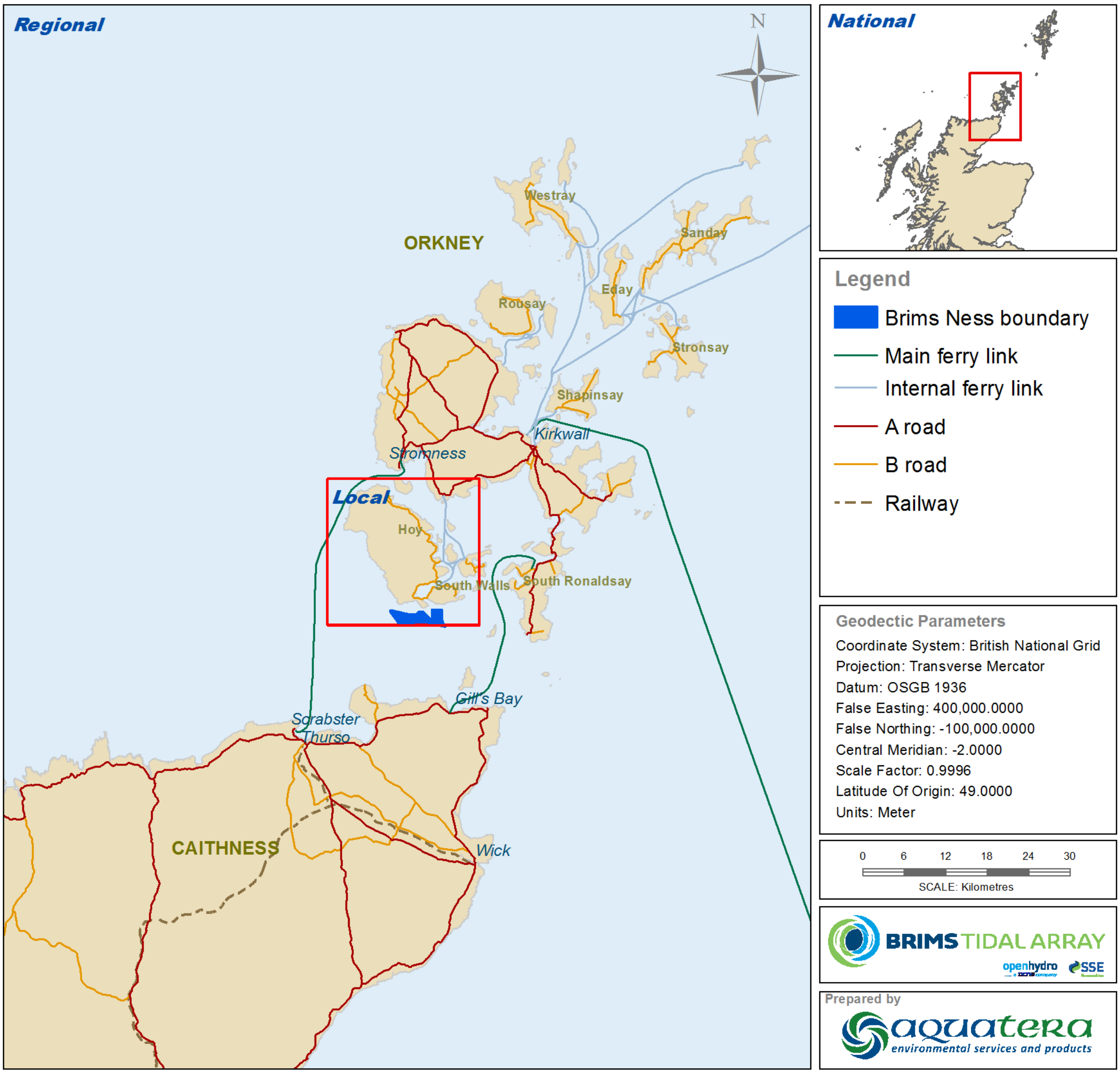

Figure 19.1: Study areas for National, regional and local definitions

19.3 DESIGN ENVELOPE CONSIDERATIONS

The Project has taken a design envelope approach to consenting which is described in Chapter 5 Project Description. The approach differs from the normal assessment methodology to better reflect the implications of the Project on the socio economic issues nationally, regionally and locally. The process requires that for each relevant (socio-economic) receptor the ‘worst case’ for negative and ‘best case’ for positive design envelope parameter is identified and assessed. The design envelope parameters pertinent to socio-economic assessment are presented in Table 19.1.

Table 19.1: Design envelope parameters for socio-economic assessment

Project parameters relevant to the assessment	Definition of project parameters for the impact assessment	Explanation of project parameters	Outcomes that define the full design envelope	
			Positive	Negative
Project phasing and capacity	Stage 1: 30MW Stage 2: 170MW Stage 1 and Stage 2: 200MW	Maximum capacity installed during each Stage of the Project, with Stage 2 being built in a number of stages as defined in the Project Description	Full Stage1 & 2 is built - most jobs and economic advantage	Only Stage1 is built – less jobs and economic advantage
Project construction timescales	Stage 1: Up to 2 years Stage 2: Up to 4 years	Maximum timescales, depending on the number, capacity and type of turbine	Project built within timescales – brings new grid connection within a short timescale , also ensures jobs created within a short timescale	Project delay – new grid connection takes longer, which will reduce the positive impact
Project operation and maintenance timescales	Stage 1: Up to 25 years Stage 2: Up to 25 years	As defined in the Project Description	If the Project is lengthened and/or repowered economic benefit will be increase	If shortened economic benefit will be reduced
Type and origin of vessels	The types of vessels that will be used within the Project are listed in Section 5.8.3. They range from Dynamic positioning vessels used in the Oil and gas industry to RIBs	The type and number of vessels used as well as their origins are all variables that the technology selection, design process and contracting strategy will determine	Local and regional vessels used to deploy and maintain equipment and lay cables	Imported vessels from national or international areas
Project decommissioning strategy	The approach to use of the site at the end of its planned operation lifespan	Possible repowering or reuse of the site or alternatively clearance of all materials from the site to leave site as close as possible to pre-operations condition	Repowering or redevelopment of the site leading to ongoing capital and operations spend along with revenues, and associated economic benefit	Removal of all equipment leaving a clear site, leading to a short-term task related increase in jobs but no long-term benefit
Turbine layout	Stage 1: up to 30 turbines Stage 1 and Stage 2: up to 200 turbines in total	The layout of the turbines can influence the degree to which our sea users and particularly creel fishermen can use areas	Layout takes into account existing sea use and displaces the	Layout does not take account of other sea user interests and

Project parameters relevant to the assessment	Definition of project parameters for the impact assessment	Explanation of project parameters	Outcomes that define the full design envelope	
			minimum amount of fishing activity and avoids displacing any fishing	displaces a greater amount of fishing activity
Turbine type	Short list of candidate technologies	Different technologies may have different levels of socio-economic benefit, especially in terms of employment levels	Higher level of local and to an extent regional employment	Lower levels of local and to an extent regional employment
Employment numbers	Construction: Stage 1 – 180 Stage 2 – 1020 Operations and Maintenance: Stage 1 - 25 (incl. indirect and induced) Stage 2 - 144 (incl. indirect and induced)	Employment figures based on guidance from Scottish government (see Section 19.8.1)	Employment levels are realised with an appropriate level of localisation of opportunities and employment terms are comparable with or better than those in the existing employment market	Employment levels are lower than planned, localisation of employment is not, or is poorly achieved, terms are worse than existing local practises
Construction and Installation base	Undefined at this stage therefore National, regional and local locations assessed.	The support base use by the Project will lead to major short and longer term economic opportunities but also may lead to some disturbance impacts	The facility is located close to the host community and disturbance is minimised	The facility is located away from the host community
Operations and maintenance base	Undefined at this stage therefore National, regional and local locations assessed.	The support base use by the Project will lead to major long-term economic opportunities but also may lead to some disturbance impacts	The facility is located close to the host community	The facility is located away from the host community

19.4 LEGISLATIVE FRAMEWORK AND POLICY CONTEXT

The 2011/92/EU EIA Directive and the Scottish Government guidance on EIA for Marine renewable energy requires consideration of socio economic effects within the EIA process.

A revised EIA Directive (2014/52/EU [2]) came into force on 15 May 2014. Member states are required to transpose the Directive into national laws by 16 May 2017.

The EIA Directive is transposed into UK law through a series of regulations. The EIA regulations which apply to a particular development are dependent on project type and location. The key regulations that apply to offshore marine projects in Scotland are listed below:

- The Marine Works (EIA) Regulations 2007 (as amended) are the key regulations that transpose the directive into UK law;
- The Town and Country Planning (EIA) (Scotland) Regulations 2011;
- The Electricity Works (EIA) (Scotland) Regulations 2,000; and,
- The Harbour Works (EIA) Regulations 1999.

A report (ABPmer, 2012) produced for The Crown Estate (TCE) outlines an approach on the preparation of a generic socio-economic methodology for the assessment of marine projects in the Pentland Firth and Orkney Waters (PFOW) strategic area, which is reflected in this assessment.

Orkney Islands Council (OIC) Local Development Plan (adopted in April 2014) (OIC, 2015a) sets out the local issues that affect development and the council's plans for development. There is a key issues report open now (OIC, 2015b) that is under consultation for the next plan. These have been consulted during the assessment.

Caithness and Sutherland Local Development Plan is a similar document to the OIC plan and forms part of the overall Highland regional plan (IoHDT, 2015.

19.5 SUPPORTING SURVEYS AND STUDIES

The chapter has been compiled by Aquatera who have used their local knowledge and published data to inform the assessment. Relevant supporting studies are detailed below:

- Navigational Risk Assessment (Supporting Document: Anatec, 2015);
- Socio-economic methodology and baseline for Pentland Firth and Orkney Waters Wave and Tidal Developments (ABP, 2012); and
- Brims Underwater Noise Assessment Report Shipping and Navigation (Supporting Document: Xodus, 2015).

19.6 DATA GAPS AND UNCERTAINTIES

The Project is technology neutral to provide the BTAL with the opportunity to keep the Project flexible and cost effective as well as ensuring the best technology at the time of construction can be selected to meet the Project timescales and objectives.

Because some of the key project decisions remain to be taken including choice of turbine and choice of key suppliers, the location of the related economic impact is unknown. The workforce requirements have been broadly estimated (Section 19.8.1) throughout the assessment as they are closely related to the technology choice but may well vary depending on the decisions made.

Demographic information is available at a national level and at a regional/county level for Orkney and Caithness; however, information at a local scale, e.g. Hoy or Scrabster, is limited.

19.7 CONSULTATIONS

In August 2013 a scoping report was submitted to Marine Scotland for a scoping opinion. The responses received from this process relating to socio-economic issues are presented below. During the following assessment process a further consultation exercise was also carried out with a variety of stakeholders specific to the potential socio-economic benefits and impacts. The organisations consulted included:

- European Marine Energy Centre (EMEC);
- Highlands and Islands Enterprise (HIE);
- Orkney Islands Council Economic Development;
- Orkney Islands Council Housing Services;
- Orkney Ferries;
- Orkney Sailing Club; and
- Orkney Marinas;
- Orkney Harbour Authority;
- Hoy Development Trust;
- Hoy Community Council;
- Scrabster Harbour Trust;
- Dive Boat operator.

The key points raised by stakeholders during Scoping and subsequent consultation are presented in Table 19.2. It will be noted that some of the issues raised during scoping have been addressed during the later consultation stage and suitable cross referencing has been provided.

Table 19.2: Summary of stakeholder consultation responses from the scoping opinion

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
1	Transport	OIC	Consult Orkney Ferries on capacity for increased transport demand.	Consulted on within Table 19.3. Orkney ferries agreed that this would be considered favourably.	See Line 29 – 33
2	Services	OIC	Pressure on education and community services to be addressed as potential impact, including consultation with OIC Education and Housing.	Consulted on within Table 19.3. The education and housing services supported the opportunity for increased population.	See Line 64 – 71
3	Other	OIC	Break down the impacts between impacts on Hoy and impacts on Orkney.	Additional consultation undertaken see Table 19.3. Impacts broken down into Local(Hoy), Regional (Orkney and Caithness) and National (Scotland)	Section 19.7
4	Fisheries	OFA	It is important to understand the inter-connected dynamics of catching, processing, and onward shipping of crab and lobster in Orkney and how a symbiotic relationship exists between disparate parts of the whole which sustain the collective Orkney fishing industry model.	Relatively low numbers of fishermen using the site would have a limited effect on industry within the whole Orkney context. Impacts were considered minor within fisheries assessment.	Commercial Fisheries Chapter 16
5	Fisheries	OFA	Address the potential to leech personnel from other local industries thereby destabilising them.	Consultation with OIC economic development & HIE.	Section 19.7
6	Other Renewables	MS-LOT	Published policy statement “Securing a Renewable Future: Scotland’s Renewable Energy”, and the subsequent reports from the Forum for Renewables Development Scotland (FREDS), all of which highlight the manufacturing potential of the renewables sector. The application should include relevant economic information connected with the Project, including the potential number of jobs, and economic activity associated with the procurement, construction operation and decommissioning of the Project.	This is covered in the assessment.	Section 19.12

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
7	Other	MS-LOT	Scoping Report (SR) seems to scope out positive socio-economic effects. It would give a more holistic picture to assess and present these.	This is covered in the assessment.	Section 19.10
8	Other	MS-LOT	The listed 'Potential Impacts' (p67-68) are useful but slightly contextual. Greater priority should be allocated and more explicit reference made, to: the gross direct and net additional employment, gross direct and net additional GVA. Both of these should be presented separately for the construction, operation and maintenance and decommissioning phases. They should also be reported at a range of appropriate geographic scales.	This is covered in the assessment.	Listed in Table 19.12 Section 19.12
9	Employment	MS-LOT	To assist with the above, it would be helpful to see a clear definition of the labour market catchment area.	Catchment areas for the Project defined as national scale and then the Orkney & Caithness regional boundary and Hoy as local area.	Section 19.9
10	Employment	MS-LOT	Background info on the industry structure and employment structure would be useful.	Covered in the baseline description.	Section 19.9
11	Employment	MS-LOT	Clear consideration and use of the concepts of additionally, displacement and leakage should also be demonstrated. Ditto regarding economic multipliers.	Covered in the assessment methodology.	Section 19.8
12	Other	MS-LOT	Other benefits might include: possible carbon savings; benefits to other marine users and interests; increased knowledge; clustering benefits; and energy security.	This is covered in the assessment	19.12.
13	Fisheries	MS-LOT	Fisheries impacts might include consequential impacts to processors.	Impacts were considered minor within fisheries assessment.	Commercial Fisheries Chapter 16

Table 19.3: Summary of stakeholder consultation responses from the consultation

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
14	Transport	Hoy CC	Minor concerns about capacity and space on the interisland ferry.	Consulted Orkney Ferries who would increase capacity to meet demand.	See Line 29 – 33
15	Transport	Hoy CC	Island roads could suffer with increased traffic.	Road improvements where required. Covered in the assessment	Section 19.12
16	Employment	Hoy CC	Business on the island will benefit and possibly attracting business to the island.	Positive impact.	Section 19.12
17	Employment	Hoy CC	Local jobs created would be advantage.	Positive impact.	Section 19.12
18	Education	Hoy CC	Longer term increase in population would be benefit and attract pupils to the local school.	Positive impact.	Section 19.12
19	Quality of life	Hoy CC	Upgrading of some services such as medical and retail would be an advantage and attract people to island.	Positive impact.	Section 19.12
20	Quality of life	Hoy CC	Communications would need to be improved (broadband) which would benefit the whole island.	Positive impact.	Section 19.12
21	Transport	Hoy DT	Some minor concerns about local bookings on the ferries if full with construction traffic.	Consulted Orkney Ferries who would increase capacity to meet demand.	See Line 29
22	Other	Hoy DT	Could be some light or noise pollution if they work long hours.	This would be controlled by planning conditions.	N/A
23	Transport	Hoy DT	The roads might be put under pressure if increased traffic.	Road improvements will be undertaken where required.	Section 19.12
24	Services	Hoy DT	Local businesses could supply services to the base.	Positive impact.	Section 19.12
25	Employment	Hoy DT	Employment of local people would be crucial.	The Project has the potential to increase employment opportunities locally in a range of disciplines. Covered in the assessment.	Section 19.12

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
26	Employment	Hoy DT	Encouraging longer term residences that could take people into the island with families.	The Project has the potential to increase employment opportunities locally in a range of disciplines. Covered in the assessment	Section 19.12
27	Services	Hoy DT	Could add more housing and school provision to the island.	OIC housing department are willing to look at more provision.	Section 19.12
28	Transport	Hoy DT	Tourism might benefit from extra ferry service options and capacity.	Consulted Orkney Ferries who would increase capacity to meet demand.	Section 19.12
29	Transport	Orkney Ferries	Could be some capacity issues requiring timetable and capacity changes.	Orkney Ferries would increase capacity to meet demand.	See Line 36
30	Transport	Orkney Ferries	Maybe some conflict with locals and tourists if ferries are difficult to book on.	Orkney Ferries would increase capacity to meet demand.	See Line 29 – 33
31	Transport	Orkney Ferries	Houton parking area can be congested.	OIC Harbours willing to make improvements if required.	See Line 34 – 38
32	Transport	Orkney Ferries	Increase ferry options for locals.	Orkney Ferries would increase capacity to meet demand.	See Line 29 – 33
33	Transport	Orkney Ferries	Increased fees for Orkney ferries.	Positive impact. Covered in section 1.12	Section 19.12
34	Transport	Orkney Harbour authority	Could be some issues with conflict for space on ferries. Possibility of adding another ferry onto the route.	Consulted Orkney Ferries who would increase capacity to meet demand.	Section 19.11.1 Table 19.6
35	Other Renewables	Orkney Harbour authority	Could be some minor competition for space with other renewable projects if they develop.	This can be mitigated by management.	See Line 50
36	Other Renewables	Orkney Harbour authority	Pier extension could be built to give added space or possibly upgrade west pier or develop Rinnigil.	OIC and HIE are willing to look at extra infrastructure if required.	See Line 48 - 56

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
37	Other Renewables	Orkney Harbour authority	Extra activity will increase harbour income and lease income for laydown areas.	Positive impact. Covered in section 1.12	Section 19.12
38	Services	Orkney Harbour authority	Improvements required would benefit other users.	Positive impact. Covered in section 1.12	Section 19.12
39	Other	Orkney marinas	Visiting yachts do not often use the route in past Cantick although again no hard evidence to support this assumption.	This implies minimal impact on visiting yachts.	Recreation and tourism, Chapter 20
40	Other	Orkney marinas	Berthing at Lyness is not very safe and only really done for short periods.	This implies limited impact on visiting yachts of any restrictions at the Lyness pier.	Recreation and tourism, Chapter 20
41	Services	Orkney marinas	A pontoon berth at Lyness pier adjacent to the linkspan would allow yachts to visit more safely and not conflict with working pier.	OIC and HIE are willing to look at extra infrastructure if required.	See Line 50
42	Services	Orkney marinas	OIC and Orkney Marinas have already supported Longhope as an area for new berths.	No action required.	N/A
43	Other Renewables	EMEC	No conflicts with other users that is not manageable. The quay side and associated grounds will be well used but can be managed efficiently to avoid any conflicts.	OIC harbours already manage a relatively complex port structure.	See Line 35
44	Other Renewables	EMEC	Some of the resource required could be shared with other developers or supply chain companies.	OIC and HIE are willing to look at extra infrastructure if required	Section 19.12
45	Education	EMEC	The operations will be good to showcase renewables to key stakeholders to enhance the marine renewable industry as a whole.	Positive impact. Covered in section 1.12	Section 19.12

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
46	Employment	EMEC	People with the relevant skills and ability used on the Project will become a pool of skilled people for other companies to possibly draw on.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
47	Services	EMEC	Ensure site plans are completed to optimise the quayside laydown sites.	In consultation Established OIC and HIE are willing to look at extra infrastructure if required.	See Line 50
48	Other Renewables	HIE	Any minor conflicts between renewable projects or oil based activity would be manageable.	OIC and SHT already manage a relatively complex port structure.	See line 35
49	Employment	HIE	There could be some displacement from other industries to better paid jobs.	Underemployment in Orkney and Caithness businesses can be utilised to minimise displacement.	Section 19.12
50	Services	HIE	There could be some space conflicts if Scrabster is chosen as the base. This port has a range of operations already using the laydown areas and key space.	HIE are willing to look at extra infrastructure if required.	See Line 50 - 56
51	Services	HIE	HIE would be willing to develop the ports and other infrastructure to mitigate any issues.	HIE are willing to look at extra infrastructure if required.	See Line 50 - 56
52	Employment	HIE	There is plenty of capacity within the supply chain in Orkney and Caithness to support a range of jobs so displacement would be minimal.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
53	Employment	HIE	HIE would welcome the influx of high value jobs particularly due to the area being a low wage economy.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
54	Services	HIE	There could be very good opportunities for the local supply chain in particular the marine sector.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
55	Services	HIE	Caithness has a strong engineering base and as Dounreay is decommissioned this could see a	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
			skilled workforce being freed up to and looking for jobs.		
56	Employment	HIE	There is a research project underway at the moment that shows a number of young people wanting to return to the area. So a project of this size could support this aspiration by providing the quality of employment required.	The results of the survey when released will be monitored for relevant opportunities	N/A
57	Services	OIC Ecc Dev	Any minor conflicts between renewable projects or oil based activity would be manageable.	OIC harbours already manage a relatively complex port structure.	See Line 35
58	Services	OIC Ecc Dev	The OIC and HIE would be willing to develop the ports and other infrastructure to mitigate any issues.	OIC and HIE are willing to look at extra infrastructure if required.	See Line 50 - 56
59	Employment	OIC Ecc Dev	There is a relatively high level of underemployment within the local supply chain which would mitigate the displacement to a degree.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
60	Employment	OIC Ecc Dev	OIC would welcome the influx of high value jobs particularly because Orkney is a low wage economy.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
61	Services	OIC Ecc Dev	There could be very good opportunities for the local supply chain in particular the marine sector.	The Project has the potential to increase employment opportunities locally in a range of disciplines.	Section 19.12
62	Other	OIC Ecc Dev	New business could be attracted to the Project with associated benefits.	Positive impact. Covered in section 1.12	Section 19.12
63	Transport	OIC Ecc Dev	There could also be some increased use of air services leading to better transport options.	Positive impact. Covered in section 1.12	Section 19.12
64	Services	OIC Housing	Some limited concerns about the council’s ability to provide housing for the workforce.	BTAL will discuss the housing options with the OIC at an early stage in the Project.	Section 19.12

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
65	Services	OIC Housing	Could be some competition for council house but there is a good stock of houses in Hoy and other parts of mainland Orkney.	OIC are willing to look at extra housing.	Section 19.12
66	Services	OIC Housing	Council could provide more housing such as modular units which have already been looked at for Hoy and other island locations. Funding these would need more detailed investigations.	OIC are willing to look at extra housing.	Section 19.12
67	Other	OIC Housing	The Project could regenerate the housing schemes on the island with people having a good economic base to afford housing costs.	OIC are willing to look at extra housing.	Section 19.12
68	Services	OIC Housing	The Project could support the increased supply of council housing stock for the island or mainland which in turn increases revenue for the OIC.	OIC are willing to look at extra housing.	Section 19.12
69	Other	OIC Housing	Hoy in particular is designated a fragile area and the OIC has a commitment to sustaining the islands this project will support that commitment.	There is a responsibility to support increased housing.	Section 19.12
70	Services	OIC Housing	The longer term operation and maintenance phase would allow the opportunity for more permanent housing and family properties.	OIC has commitment to sustain the islands.	Section 19.12
71	Education	OIC Housing	This phase would also have positive implications for the school on Hoy and possibly the Halls of residence in Kirkwall for children going to the secondary school.	Positive impact. Covered in section 1.12	Section 19.12
72	Services	Scrabster Harbour Trust	There could be some conflict for space as the port is busy.	This can be mitigated by management. The Port has capacity to cope with up to 4,000 vessel visit per year (there were 2,000 in 2014).	Section 19.12
73	Infrastructure	Scrabster Harbour Trust	Additional infrastructure will be required for either base.	The additional infrastructure required would enhance the port facilities. HIE are willing to	See Line 50

Ref	Topic	Stakeholder	Comment	Response/Action taken	Section cross reference
				support additional infrastructure for this type of project.	
74	Education	Scrabster Harbour Trust	Increased population will require additional services.	The education roles have reduced in Caithness over the last few years so any inward migration would help support the education service and other essential services.	Section 19.12
75	Quality of Life	Scrabster Harbour Trust	One of our key target areas is marine renewables so this project would support this target.	This project supports this aspiration if the base is located at Scrabster.	Section 19.12
76	Infrastructure	Dive boat operator	There needs to be space at pier for 2 – 3 dive boats to berth during season and in middle of the day.	Can be mitigated by good harbour management.	Section 19.12
77	Services	Dive boat operator	There could be opportunities for work in the low diving seasons.	Positive opportunity.	Section 19.12

It can be seen from the table above that the comments from the consultation were largely positive. The majority of respondents would welcome the Project, although the actual socio-economic impact for individuals or organisations will depend on the location of the various elements of Project infrastructure.

The key socio economic benefits that the consultation highlighted were:

- Increased employment opportunities;
- Supply chain business opportunities;
- Increased population;
- Infrastructure improvements; and
- Service improvements

The main concerns were:

- Congestion at the Lyness pier; and
- Capacity issues for passengers and freight on the Lyness to mainland Orkney ferry.

19.8 ASSESSMENT METHODOLOGY

The methodology described in ABPmer (2012) was followed for this assessment (Design envelope Section 19.3). This approach describes the potential interactions between development projects and the socio-economic environment, and recommends approaches for assessing potential benefits as well as potential impacts.

In order to understand the magnitude of the potential benefits and impacts, it was necessary to understand the extent of and approach to Project activities. As outlined previously, many of these decisions are still to be made and some are also related to the choice of energy generation and installation technology, these decisions will have a profound influence upon the required supply chain services and the estimated work force to be employed.

The design envelope approach taken as described in Chapter 5 and Section 19.3 guide the assessment methods and process.

Many of the benefits arising from the Project are closely related to the size of the workforce and where that workforce is distributed. The further assumptions made to estimate the workforce is discussed further below in Section 19.8.1.

General EIA methodology is covered within the ES chapter (Chapter 7 EIA Scope & Methodology). There are no standard significance criteria for socio-economic effects. For the purpose of this assessment each impact has a discussion on the relative impact on the receptor and its positive or negative significance. The assessment matrix approach is not appropriate for this section as there are significant positive effects that do not easily fit that type of assessment. Professional judgment and experience is used within the methodology to assess the impact and describe the consequences and possible mitigation.

19.8.1 Workforce Estimates

It is important to make some estimates of the workforce requirements to feed into the different aspects of the assessment this section outlines the assumptions and calculations that have been used to make these estimates.

19.8.1.1 Construction and Installation

The design of the tidal devices for the Project will be confirmed at the detailed design stage. This assessment has estimated the workforce based on the Marine Energy supply chain survey carried out by Sgurr Energy for the Scottish Government in 2009 (Sgurr Energy, 2009) which used a factor of 20 jobs per megawatt to estimate the workforce requirements for manufacturing, construction and installation. This is consistent with estimates used in the MeyGen project in Caithness. For this it has been further assumed that 50% of the CAPEX was allocated to manufacturing of the turbines and 30% for foundations and installation. The final 20% covers the cabling and onshore infrastructure. For this Project, we have also assumed that 30% of these jobs would be applied locally during the construction and installation phase for the offshore infrastructure which is again consistent with the MeyGen project predictions. (See MeyGen Limited (2012) paragraph 21.101). This would equate to 180 jobs for Stage 1 and 1020 jobs for Stage 2 (see 1.4) potentially available. These figures are broad estimates used to give a basis for assessment but may vary from the eventual outcome.

Table 19.4: Employment estimates for the Projects construction

Stage	MW	Total employees (20 per megawatt)	Local Construction & Installation (30%)
1	30	600	180
2	170	3400	1020

19.8.1.2 Operation and Maintenance

The operation and maintenance phase workforce is difficult to estimate at this stage. The MeyGen project (MeyGen, 2012) estimated between 27 – 30 onshore jobs and 20- 22 offshore jobs during operations and maintenance, giving a median of around 50 jobs for an 86MW project, or 0.58 jobs per MW. Using this factor, operation and maintenance employment for this Project are calculated in Table 19.4.

Table 19.5: Employment estimates for operation and maintenance of the Project

Stage	MW	Employees/MW	Total jobs
1	30	0.58	17.4
2	170	0.58	98.6

19.9 BASELINE DESCRIPTION

19.9.1 Introduction

Scotland has for a number of years supported the development of marine renewables in particular with the enhanced Renewable Obligations Certificate (ROC) scheme giving this sector the prospect of 5 ROCs per MW which was the highest rate of subsidy of any renewable energy technology. This has now been adopted by the UK government and the system is being transferred to Contracts for Difference (CfD) but with a similar level of support. This has led the country to have the highest level of activity in this sector in the world. (See Chapter 2 Need for the Project). The benefits that this industry will bring to the country are mostly socio economic which is the driver for the governments support.

Caithness and Orkney local authorities are taking a proactive approach to the Project of the industry and have invested in local infrastructure to support its growth. The Caithness port improvements in 2012 were all geared towards attracting more renewable projects. Equally Orkney Islands Council have completed upgrades to three of their major ports (Hatston, Lyness and Stromness) again to attract projects to the islands. The local supply chain and development agencies have also invested in improvements to support the industry. To date this has mostly been developed around EMEC and BTAL coming to their facilities but the medium to longer term objectives have always been towards commercialisation of the industry and the community is expecting to benefit from this initial investment.

The topics covered within the baseline description are:

- Economics;
- Demographics;
- Ports and Harbours;
- Transport;
- Communications;
- Quality of life; and
- Policy.

19.9.2 Economics

19.9.2.1 National

The economic situation nationally has recently seen steady growth both in the UK economy and the Scottish economy. The OECD economic survey completed in 2014 (OECD, 2015) showed after a period of subdued growth after the 2008 down turn the growth in the UK picked up to 2.6% in 2014, the strongest performance among the G7 countries that year. The Scottish economy has seen slower growth but the Scottish government website (Scottish Government, 2015) states a stronger growth (0.6%) for the first quarter of 2015. On an annual basis, comparing the latest quarter (2015 Q1) with the same quarter in the previous year (2014 Q1), GDP grew 2.8%(Scottish Government, 2015).

The continued downward pressure on oil prices is having a different effect on different areas of the economy. Lower oil prices boost consumption as well as production in energy-intensive sectors, but squeeze investment and profitability in the oil and gas sector and the wider supply chain.

The employment rate has also shown a steady recovery nationally with Scotland slightly ahead of the UK figures (Figure 19.2).

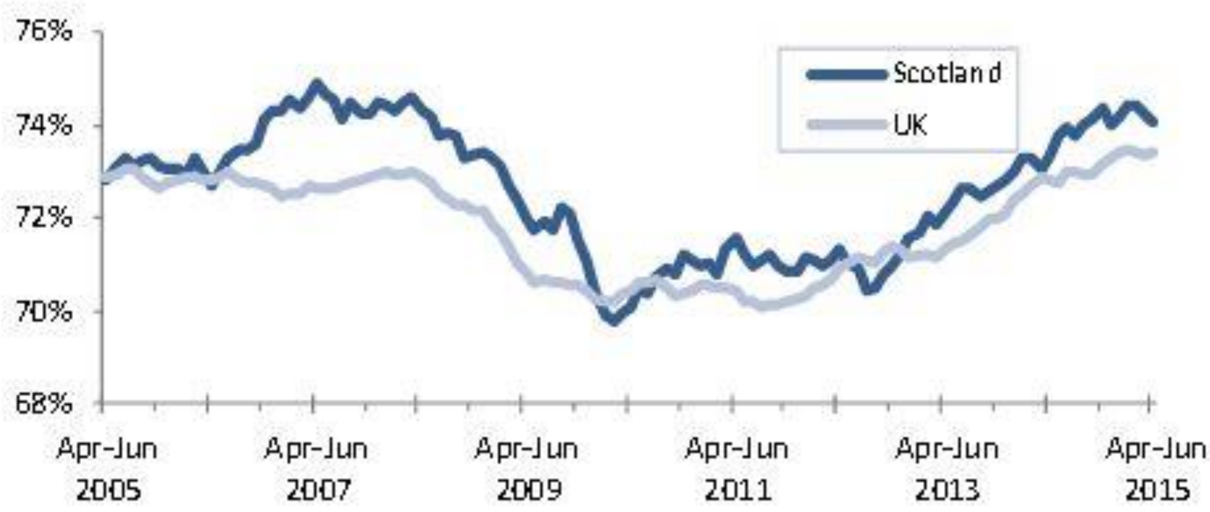

Figure 19.2: UK and Scottish employment figures 2005 – 2015 (Scottish Government, 2015)

19.9.2.2 Regional

The total GVA within the region rose in 2013 which are the latest figures available (Table 19.6) with Orkney's total reaching a 5 year high. Caithness figures are more stable.

Table 19.6: Total regional GVA 2008 – 2013 (ONS, 2013)

Region	GVA £million (workplace GVA allocated to region where it takes place)					
	2008	2009	2010	2011	2012	2013
Highlands and Islands	7,876	7,829	7,978	8,340	8,211	8,469
Caithness & Sutherland and Ross & Cromarty	1,376	1,265	1,348	1,339	1,281	1,319
Eilean Siar (Western Isles)	412	411	387	415	419	418
Orkney Islands	312	324	350	354	367	385
Shetland Islands	461	460	501	496	487	524

The regional statistics shown in Table 19.7 show Orkney and the Highland region, which includes Caithness, have a lower level of GVA per head and lower wages (see section 19.12.3.3 Wage Inflation).

Table 19.7: The GVA regional comparisons (ONS, 2013)

Economic Statistics	Totals	
	GVA £ per head(2012)	Gross wage & salaries per head(2012)
Scotland	49,359	21,102
Orkney	40,710	16,908
% difference v Scottish	17.5	19.9
Highland	38,666	16,375
% difference v Scottish	21.6	22.4

19.9.2.3 Local

There is very limited information on the Hoy economic situation. The Orkney figures quoted above would be the closest breakdown of statistics. The area has a population of around 400 and is predominantly a farming area. Tourism also plays an important role with over 11,000 visitors in 2013 (Chapter 20 Recreation and Tourism). A number of islanders commute daily to the mainland of Orkney for employment travelling on either the ferry from Lyness to Houton or the North Hoy to Stromness route.

19.9.3 Demographics

The demographics of the more rural and remote areas are always a high priority for these communities. They have less impact nationally but will normally feature high on any councils list of key performance indicators. It is therefore important to discuss these factors within this assessment.

The economic and demographic conditions of Scotland, Hoy, mainland Orkney and Scrabster in Caithness are outlined below. These areas are distinctly different in population, transport links and economy.

19.9.3.1 National

The Scottish population at 30 June 2014 was 5,347,600 (NRS, 2014), an increase of 19,900 from the previous year. This rise in Scotland's population has been similar over the last ten years but should be seen in the context of the relative stability of the population over the last 50 years. The population last reached a peak of 5.24 million in 1974 before falling to 5.06 million in mid-2000 and then rising to a new high over the last 14 years. This stability is seen in the figure in Table 19.8 of the economically active working population which has also remained fairly constant and similar to the UK figures.

19.9.3.2 Regional

Caithness

The population of Caithness has shown a smaller increase than the figures for the wider highland region and Scottish figures.

Table 19.8: Population comparisons from census information (2011) (ONS, 2013)

Total Population	2001	2011	% CHANGE
Caithness and Sutherland	38,462	39,732	+3.3
Highlands and Islands	433,524	466,112	+7.5
Scotland	5,062,011	5,295,403	+4.6

The main population centres in Caithness are the ward of Thurso, with a population of approximately 9,074 (2011), and the ward of Wick with a population of approximately 8,200.

Caithness and Sutherlands unemployment rate is 3.8% (ONS, 2015) compared to Scottish national figures of 6.2% and Orkney figures of 2.6%.

Traditional industries such as farming, quarrying and fishing account for approximately 13% of employment (Foundation Scotland, 2013). The largest employment sector, however, is public administration, education and health. The energy, water and manufacturing sector employs a relatively greater proportion of employees in Caithness and Sutherland than in the Highland Region as a whole. Many of the jobs in this sector are directly or indirectly related to decommissioning activity at Dounreay. Dounreay was in the past the largest employer in Caithness but since it stopped generating in 1994 it has entered a decommissioning phase. This still requires a reasonably large work force, and the value of the decommissioning work to the local economy is estimated at approximately £80 million a year. Decommissioning is due to be completed by 2025. The economy is dominated by the Dounreay plant and its supply chain. According to the Dounreay site restoration webpage “One in five jobs in Caithness is located at Dounreay, and estimates suggest one in every three jobs in Caithness is associated indirectly with the facility” (DSRL, 2015).

The Highland council, HIE and the Nuclear Decommissioning Agency (NDA) are all aware of this dependence and are working to develop new businesses within the area such as renewables and this has supported the recent upgrades to Scrabster harbour see quotes below:

“A Caithness-based marine energy sector will bring opportunities for the Dounreay workforce to transition from decommissioning work into new sustainable industry” (Dounreay News, 2010).

“The structure of employment in Caithness and Sutherland will change in the longer term as Dounreay is decommissioned. Emerging industries, such as wave and tidal energy developments in the Pentland Firth, tourism and financial and business services are expected to become increasingly important” (HIE, 2011).

“Scrabster harbour has invested in upgrades to support the offshore oil industry and renewables and is actively seeking work within these offshore sectors” (pers. comm. Scrabster Harbour trust).

Orkney

The population of Orkney is 21,590 (in 2014), an increase of 0.1% since 2013. The main population centres in Orkney are the Kirkwall, with a population of approximately 9,200, and the Stromness with a population of approximately 1,900.

Orkney has developed an increasingly diverse economy over the past fifty years. Construction of the Flotta oil terminal and improved aviation and maritime links to and from Mainland Orkney has enabled a thriving export market to grow. Although agriculture remains one of most prolific industries on the Islands, Orkney's economy has diversified from its agricultural roots and now has a thriving tourism industry along with a successful craft industry. The success of the renewable energy sector has also diversified Orkney's economy and both onshore wind and the marine renewables sector have provided income and employment for the Islands (OIC, 2011).

Unemployment rates in Orkney fall consistently below the Scottish national average; however those claiming job seekers allowance continues to rise as the county's population continues to swell. The largest increase in those claiming job seekers allowance has been seen in the 18-24 years age bracket. Despite this the percentage of economically active people claiming job seekers allowance still remains half of that on mainland Scotland (OIC, 2011).

Orkney has constantly had a higher rate of economically active people than Scotland or the UK (Table 19.8). The economically active distribution also differs from the national statistics as seen in Table 19.10 shown for Orkney and comparator areas. Orkney has a much higher proportion of self-employed people than the rest of Scotland which is linked to a large number of small businesses.

Table 19.9: Economically active as % of (estimated) working age population (16-64) (ONS, 2013)

Year	Orkney (%)	Scotland (%)	GB (%)
2006	81.8	77.8	76.7
2007	86.0	77.5	76.5
2008	83.7	77.4	76.7
2009	87.6	77.4	76.7
2010	81.5	77.0	76.2
2011	84.2	77.0	76.3
2012	85.9	76.9	76.9
Mean	84.4	77.3	76.6

Table 19.10: Economically active people aged 16 to 74 by council area, Scotland, 2011 (%) (ONS, 2013)

Economically Active People aged 16 to 74 by Council area, Scotland, 2011 (%) 2011	Employee: Full-time	Employee: Part-time	Self-employed	Un-employed	Full-time Student
Orkney	16.5	37.5	15.2	2.4	2.0
Shetland	17.4	47.6	9.0	2.0	2.0
Eilean Siar	15.2	39.4	10.1	4.2	1.8
Highland	15.2	39.5	11.0	4.0	1.9
Argyll & Bute	14.0	36.8	12.1	4.1	1.8
Scotland	13.3	39.6	7.5	4.8	3.7

Stromness

Stromness is Orkneys second largest town with a population of around 1,900. The area has a concentration of renewable business due in part to the development of The International Centre for Island Technology (ICIT) as an outreach centre for Herriot Watt University which has post-graduate degrees in renewable energy development and marine renewable development, as well as the basing of EMEC in the town. The town has a very active harbour with the Northlink ferry Hamnavoe which travels to the Scottish mainland daily, a large inshore fishing fleet, aquaculture support vessels and an increasing number of renewable support vessels. Copland dock is a recent addition (2013) to the harbour and has opened up the east shore of the town for more commercial development.

Hoy

The island of Hoy has a population of 419 (NRS, 2014). The island has two distinct communities one in the north and the larger population in the south of island which are separated by hill ground and undeveloped low ground. The two main settlements on the island, Longhope and Lyness, are located in the southern end of the island. The southern end of the island which is closest to the intended development was developed as a military base during the two world wars which served the large Naval presence in Scapa Flow. This has left a large number of abandoned and derelict buildings. This semi industrial past has left the community with a willingness to develop industry within the area.

The Island of Hoy Development Trust (IoHDT) was formed in 2006 to take forward the sustainable development of the island. The Trust's main focus is to reverse population decline (particularly of families and young people), secure sustainable employment opportunities and provide key social and recreational services (IoHDT, 2015).

There is no specific economic information for the island. However, most islanders are employed in farming, fishing and tourism.

19.9.4 Ports and Harbour Requirements

According to the Project description (Chapter 5), the requirements for any potential operations base for the Project would include the following:

- Deep water quay or slipway;
- Large laydown areas;
- Heavy lift facilities (crane) e.g. 200 tonnes to lift turbines from water or off deployment/maintenance vessels;
- Open air bays for routine minor maintenance, supported by mobile cranes, forklifts, cherry pickers;
- Good road access to allowing for the unrestricted access of large component parts including the nacelles where required;
- Covered bays with overhead crane for major maintenance; and
- Spare part storage, offices, restrooms, canteen etc.

In addition to these facilities there is a need for suitable vessel berthing facilities when vessels are not engaged in operations. These are likely to be associated with the traditional port locations where crews can access onshore facilities, maintenance options and vitilling.

19.9.4.1 National Facilities

With regard to the national options there are a number within Scotland that could be used for the Project, as shown in Figure 19.3.

The National Renewables infrastructure plan (NRIP) Phase 2 report (Scottish Government, 2011b) identified the need for more port infrastructure to support offshore renewables. Since then there have been a number of key investments to support the industry as it develops such as improvements in Scrabster, Orkney, Invergordon, Lerwick, Nigg, Leith and Ardersier. Scotland has set itself the task of attracting marine renewable projects and the Scottish Government has provided incentives in the form of Renewable Obligation Certificates (ROC), reduced business rates in some port areas and support for infrastructure investments to support this objective.

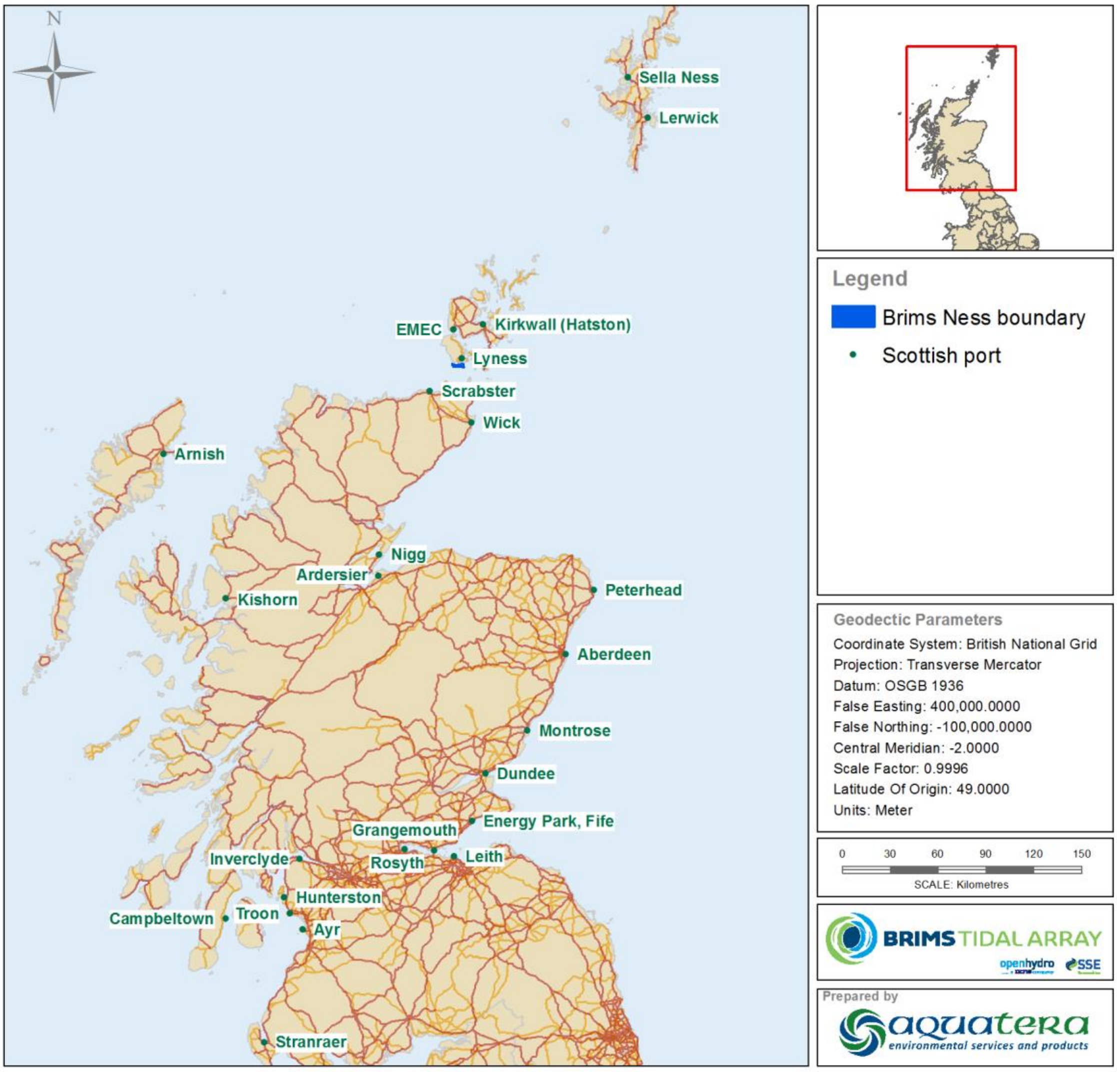

Figure 19.3: Port infrastructure around Scotland

19.9.4.2 Regional Facilities

There are a number of harbours located with 70km of the Brims Ness site: The map below (Figure 19.4) shows there position and the distance in sea km from the site boundary.

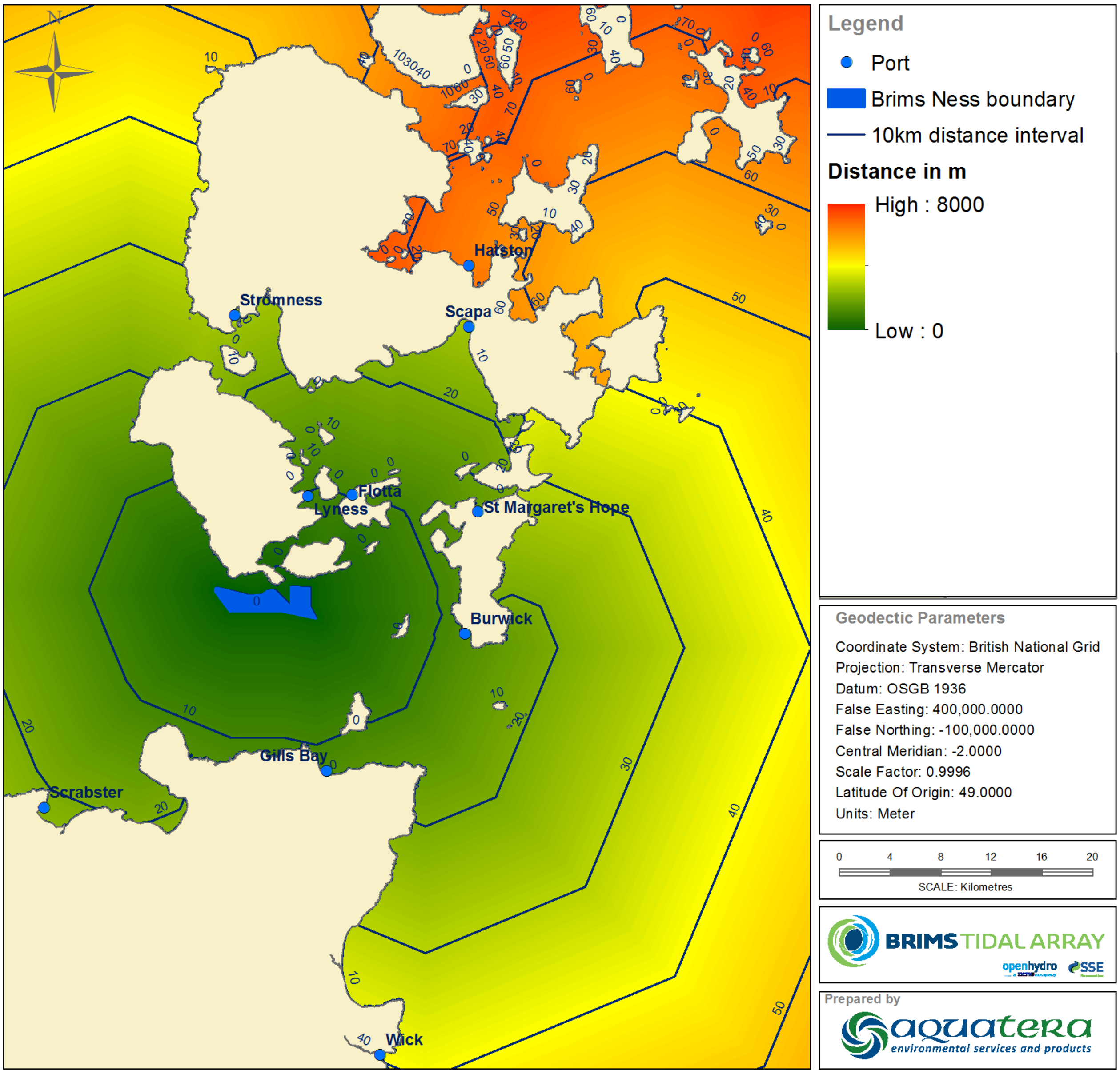

Figure 19.4: Study area showing distance by sea from the Project AfL

Within the region the detail of the individual ports has been described in Table 19.11 against the requirements in Section 19.9.

Table 19.11: Characteristics of ports within 70km of the Project.

Ports requirements (project description)	Distance from site by sea route	Depth (Below chart Datum)	Maximum available length	Laydown areas	Heavy lift facilities	Other facilities	Road access
Lyness	< 10km	4 - 8m	170m	14 hectares (35 acres) designated for marine renewables support. 4,000m^2 of hard standing on quayside plus additional 35,000m^2.	Heavy lift areas constructed as part of refurbishment. May be limited by ferry capacity to take large crane.	General storage areas and for development - 14.2 hectares and plans to provide steel-framed buildings, secure compounds and office and communication facilities as the site develops	Conventional/ Ro-Ro Linkspan. Sea access only
Scrabster	20km	7.5m	180m	Harbour area - 10.42 hectares Scrabster Farm development area - 14ha	On-site mobile cranes from 35-350T; Heavy lift pad up to 1,000T	5,515m^2 (50kN/m^2 UDL). 45 units of HB loading. Tractor and Forklift “B” Axle load. Five high fully laden container stacks.	Access to A 9 trunk road
Stromness	20km	5.5m	148m	10 hectares of development land	Locally available craneage up to 220T	Range of further facilities available in the industrial estate located within 500m of the pier. Further services located in town of Stromness	Access to mainland Orkney road network
Hatston	70km	5-10.5m	385m	10 hectares of development Land	Locally available craneage up to 220T	Offices for lease nearby and designated as an enterprise area therefore favourable business rates etc.	Access to mainland Orkney road network. Aberdeen ferry terminal located on the pier

Ports requirements (project description)	Distance from site by sea route	Depth (Below chart Datum)	Maximum available length	Laydown areas	Heavy lift facilities	Other facilities	Road access
Scapa	20km	3 – 6m	80m	Minimal developed options	Minimal developed options	Some options in Kirkwall relatively close (2 Miles)	Access to mainland Orkney road network
Gills Bay	10km	4m	130m	Gills Harbour Limited (GHL) have 2.8 hectares of undeveloped land available	Minimal developed options	Minimal developed options	Access to A 9 trunk road
Wick	40km	4.2m	85m			Various buildings related to harbour activities including the former fish mart which is planned for conversion into a multi user facility	Access to A 9 trunk road
St Margaret's Hope	10m	N/A	N/A	Minimal	Minimal	Various buildings and some maintained companies based	Access to mainland Orkney road network
Burwick		3 – 4m	N/A	Minimal	Minimal	No building associated with harbour may be some options as yet not developed	Access to mainland Orkney road network
Sutherlands pier, Flotta		3 -5m	100m	Oil terminal close by may be some limited options	Minimal	Oil terminal close by may be some limited options	Access to mainland roads via ferry service

19.9.4.3 Lyness Pier

Lyness Pier on Hoy, a former naval base, has been recognised by the local council and development agencies as having the potential to attract industry and in the past has been considered as a decommissioning base, container port and fish processing hub. The Orkney Islands Council (OIC) has invested £2.98 million in redeveloping the pier to upgrade the facilities for the renewable industry. Specifications of the site are given in Table 19.11, the area has already been involved in marine renewable activity with both the Pelamis devices and the Wello Oy penguin device using the pier as a shore base over the last three years for the devices when not deployed at the EMEC site at Billacroo. The pier is also used by numerous dive boats and local fish farm boats and the Ro-Ro berth is used by the local ferry.

19.9.4.4 Copland's Dock and Stromness Harbour

Copland's Dock (100m quayside edge) is situated within Stromness Harbour adjacent to Stromness Pier. This facility provides additional capacity for the marine renewable energy industry in Orkney with up to 3,200m^2 of quayside hard standing. The site includes an adjacent 10 hectares of development land at Garson marked for potential storage and supply chain support, support for Orkney's local inshore fishing industry and public use. Current uses include docking of NLB vessels, as a landing pier for larger offshore creel vessels and for larger vessels during poor weather conditions.

19.9.4.5 Scrabster Harbour

Scrabster Harbour is an important port for the international fishing industry due to its proximity to various fishing grounds and active fish market. Scrabster Harbour Trust (SHT, 2015) with support from the Scottish government has undertaken a harbour redevelopment programme to facilitate marine renewable energy expansion and to provide logistical support to future oil and gas developments in the Atlantic frontier. Phase 1 of the development programme was completed in 2012. Associated facilities include additional harbour infrastructure with 190 metres of new berthing face with a depth of up to 7.5 metres at Chart Datum and a new Inner Basin 130 metres long with a depth of 4.5 metres. The development provides 11,500 square metres of quayside area and a heavy lift pad with 1,000 tonnes capacity.

This redevelopment of the Old Fishmarket Pier was the first phase of the three-part Port Development Plan announced in 2007. The other two elements of the plan are still being finalised but include: development of the land owned at Scrabster Farm (14 hectares) and the development of the deepwater basin (Phase 2).

Current use includes local and national fisheries, ferry services (including several daily lifeline services to Stromness in Orkney operated by Northlink Ferries), cruise boats, renewables and the oil and gas industry. The harbour is earmarked for potential use by MeyGen in support for their consented tidal development in the Inner Sound and recent signing of a business agreement with NorSea Group of Norway to utilise the port as a base servicing the oil and gas industry (SHT, 2015).

Scrabster harbour trust during consultation explained that the harbour is busy but has the capacity to cope with up to 4,000 vessel visits per year this is almost double the numbers that visited in 2014. Carful management ensures the port operates efficiently.

19.9.4.6 Hatston Harbour

Hatston has the majority of facilities required for the construction base as well as the operations base. It has been developed as part of the OIC three port strategy and is primarily focused on servicing EMEC tidal test site at the falls of Warness near the island of Eday. The port is located over 70km from the site through some difficult exposed sea routes so can be scoped out of this assessment for this reason.

19.9.4.7 Scapa

The harbour at Scapa in Orkney would have the facilities required for some of the service vessels but it is relatively narrow and has no laydown areas associated with it. It is does have access to Kirkwall but only 80m for quay access and 3 – 6 meters of draft so is very limited even for service vessels.

19.9.4.8 St Margaret’s Hope

This harbour is owned and operated by a local trust. It presently is the home port for the Pentland ferries operation. The port does have some space and smaller work vessels and fishermen work form the port. It does have some entrance restrictions in certain tides and has a draft limit of approximately 5m. Pentland ferries have recently bought a freight vessel to complement their passenger service which will add to the congestion within the harbour so it is considered this port would be not be suitable for the Construction or operation and maintenance phases of the Project other than for smaller vessels carrying out support tasks such as crew transfer operations.

19.9.4.9 Burwick

This small pier is on the south coast of South Ronaldsay and has been used as a base for small fishing vessels. There was a breakwater and linkspan constructed for the original short sea crossing for Pentland ferries but the pier was only briefly used for this route. There is very little space and as with St Margaret’s Hope it would only be viable for small boat work such as crew transfer or small component delivery.

19.9.4.10 Sutherlands Pier, Flotta.

Sutherlands pier is on the island of Flotta. It is relatively close to the site and has been used by the Flotta oil terminal for deliveries and some heavy lifts. It is mainly used for workboats and barges supporting the Flotta oil terminal. This pier has limited facilities associated with it and no laydown areas. In addition, the conflicts with the oil terminal traffic would scope it out as a base.

19.9.4.11 Gills Bay

Gills Bay in Caithness is situated 5km west of John O’Groats on the north east coast of mainland Scotland. The harbour lies within a sheltered bay of the Pentland Firth and is currently used as the mainland terminal for Pentland Ferries which services the Orkney ferry route from Gills Bay to St Margaret’s Hope. Gills Harbour Limited (GHL) own the harbour and have property extending approximately 7 acres, with greenfield sites available in proximity to the quayside. The harbour has been identified as an area suitable for development to support marine renewables.

19.9.4.12 Wick Harbour

Wick Harbour Authority (WHA, 2015) is developing its harbour to support the marine renewable energy industry. Wick has diversified from traditional fishing activities, and has recently (2009) completed a Marina facility and is seeking to attract new business from the development of wave, tidal, offshore wind, and oil exploration in the Pentland and Moray Firths. The Harbour has a total Quay length of 1366m with a maximum vessel length of 85m and consists of three basins. The River Harbour is the main commercial quay.

Based on this assessment, Hatston and Wick Harbours can be scoped out due to distance from the site. Gills bay and Scapa do not have the required laydown areas or quay space to support significant project infrastructure. Therefore, the three locations that currently are suitable to serve as a potential operations base for the development are Lyness, Copland's Dock in Stromness, and Scrabster Harbour. Some of the other locations identified could be used as service bases for smaller craft.

19.9.5 Transport

The Project will rely on good transport links to support both the construction phase and Operation and Maintenance phases of the Project.

19.9.5.1 National

Scotland has developed good support to the main ports and construction facilities. The majority of larger components for the marine renewable industry travel by sea on larger vessels or barges of different types. This allows for relatively easy transport. There is a supply chain of smaller components and people that require road, rail or air transport routes. Scotland in general is well served by these routes and has good links to Europe and beyond. The nature of these relatively new marine renewable devices is that they may have components manufactured in different areas or countries with final assembly being carried out locally. There are a number of bases that can facilitate this within Scotland (Figure 19.3).

19.9.5.2 Regional

Within the region there two main airports, Wick in Caithness and Kirkwall in Orkney. They have regular daily flights to Aberdeen, Edinburgh, Inverness and Glasgow. The flight times are between 40 minutes to 1 hour to these other Scottish airports.

The ferry routes are also daily between the mainland Scotland and Orkney. The four routes are:

- Year round passenger and freight services from Aberdeen to Hatston in Orkney, (Northlink);
- Year round freight services from Aberdeen to Hatston in Orkney (Streamline);
- Year round passenger and freight services from Scrabster to Stromness (Northlink);
- Year round passenger and freight services from Gill's Bay to St Margaret's Hope (Pentland ferries); and
- Seasonal passenger service from John O'Groats to Burwick (John O'Groats Ferries).

The interisland ferries run by Orkney Ferries Limited also have year round daily services to Hoy. The service can have some capacity issues but since the 2013 lengthening of the Thorsvoe this has become minimal. The route is well used by tourists although the season is relatively short and the ferry route is around 40 minutes each way giving a good range of options. Orkney ferries also have a spare ferry (the Hoyhead) that they use for covering breakdowns and refits which could be used for providing an extra service.

The Flotta oil terminal has a dedicated fleet of passenger carrying vessels which take the shift workers from Houton to Flotta and back each day. This dedicated service has had some routes to Lyness for specific pickups and during the construction of the terminal there was a dedicated service to Lyness to take workers to the Flotta facility.

19.9.6 Communications

The construction and Operation and Maintenance bases will require good communication links increasingly these are more and more vital to the systems used. Broadband connections of good speed and band width are required. The nature of the more rural and remote areas is that these connections are often not as strong as within more developed areas. The national picture is relatively good throughout Scotland and with the government development agencies making broadband connectivity a priority this is continually improving.

Orkney has recently benefited from some of these upgrades with high speed broadband being rolled out through the Digital Scotland programme in some areas. A number of exchanges in Orkney are now accepting orders for the new fibre connections including Stromness and Kirkwall. Hoy is not currently being progressed. The Digital Scotland website suggests for Hoy *"Digital Scotland is evaluating options to extend fibre broadband coverage in this area"* (Digital Scotland, 2015).

Caithness has also a range of roll out timescales but the area around Scrabster is well connected with customers being advised they can upgrade as and when they place an order.

19.9.7 Summary

The key factor influencing the socio-economic effects of the Project will be the location of the Operation and Maintenance and construction base. Within the region marine renewables is seen by all the local authorities and stakeholder agencies as a growth industry and they are all trying to attract projects to be based within their area. The UK government has awarded the Pentland Firth and Orkney waters (PFOW) Marine Energy Park status which is a designation which has been developed to support the industry to locate within these areas.

19.9.8 Quality of Life - Policy

19.9.8.1 National

The Scottish Government is committed to promoting the increased use of renewable energy sources. This commitment recognises renewables' potential to support economic growth. Scotland's first Minister wants renewable sources to generate the equivalent of 100 per cent of Scotland's gross annual electricity consumption by 2020 (SG, 2015).

The 2020 Route map for Renewable Energy in Scotland explains that "*These technologies (wave and tidal) can make a huge contribution to Scotland's longer term renewable energy and carbon reduction targets"*

19.9.8.2 Regional

Orkney Island Council's Local Development Plan (OIC, 2015a) lists renewable energy as a key component of their sustainable strategy. The policy states "*The challenge of tackling climate change positively also brings with it opportunities. Orkney is well placed to harness renewables technologies which can provide energy, employment and inward investment.*"

Highland council has set out in its vision for marine renewables (Highland Council, 2015) *"marine renewables sector covering wave, tidal and offshore wind energy is expected to expand significantly in the Caithness and North Sutherland area over the next 20 years. We want to maximise the potential economic benefits and employment opportunities that this could bring to the area. This is reflected as a key priority for the Caithness and North Sutherland Regeneration Partnership, of which we (Highland council) are a key partner.*

19.9.8.3 Local

The local policies towards marine renewables will follow the Orkney Islands council commitments listed above. During the consultation exercise both the Hoy Community Council and Hoy Development Trust support the Project as a positive addition to the economic viability of the island (Table 19.2, Line 14 – 28).

19.10 POTENTIAL BENEFITS AND IMPACTS

19.10.1 Introduction

Within this assessment benefits are defined as the advantages to a particular geographical area of having the Project located within it. The impacts are the issues that this location will have if the Project is based there.

The potential impacts and benefits have been identified initially through Scoping, followed by further investigation during a stakeholder consultation exercise carried out to discuss the socio-economic impacts.

Table 19.12: Potential benefits and impacts

Benefits/Impacts	Source
Potential Benefits	
Local employment and business opportunities	Scoping and Consultation covered within Table 19.2
Improvements to local infrastructure	Scoping and Consultation covered within Table 19.2
Benefits to other marine users	Scoping and Consultation covered within Table 19.2
Quality of life	Scoping and Consultation covered within Table 19.2
Increased Knowledge	Scoping opinion and APBmer methodology
Clustering effect	Scoping opinion, consultation and APBmer methodology
Energy security	Scoping opinion and APBmer methodology
Possible carbon savings	Scoping opinion and APBmer methodology
Potential Impacts	
Displacement of existing employment	Scoping and Consultation covered within Table 19.2
Pressure on local infrastructure and services	Scoping and Consultation covered within Table 19.2

Benefits/Impacts	Source
Pressure on existing housing and accommodation	Scoping and Consultation covered within Table 19.2
Commercial fisheries impacts	Scoping and Consultation covered within Table 19.2 and Commercial Fisheries Chapter 16

Each of these issues is assessed below.

19.10.2 Premitigation and Optimisation Benefits and Impacts

The following tables define the outcomes that should be expected for each project parameter in a positive (Table 19.14) and negative scenario (Table 19.16). Table 19.15 and Table 19.17 shows the national, regional and local implications of these impacts. The impacts are categorised using the parameters in Table 19.13.

Table 19.13: Categories of impacts

Impact category	Description
Highly positive	Large improvements in economic conditions
Positive	Strong improvements in economic conditions
Minimal	Slight improvements in economic conditions
None	No change on economic conditions
Negative	Slight decline in economic conditions
Highly Negative	Large decline in economic conditions
N/A	Not appropriate

Table 19.14: Positive scenario

Project parameter relevant to the assessment	Outcomes that define the full design envelope
Project phasing and capacity	Phase 1 & 2 are built - most jobs and economic advantage
Project construction timescales	Project built within timescales – brings new grid connection within a short timescale , also ensures jobs created within a short timescale
Project operation and maintenance timescales	If lengthened and/or repowered economic benefit will be increased
Type and origin of vessels	Local and regional vessels used to deploy and maintain equipment and lay cables
Project decommissioning Strategy	Repowering or redevelopment of the site leading to ongoing capital and operations spend along with revenues, and associated economic benefit
Turbine layout	Layout takes into account existing sea use and avoids displaces the minimum amount of fishing activity
Turbine type	Higher level of local and to an extent regional employment

Project parameter relevant to the assessment	Outcomes that define the full design envelope
Employment numbers	Employment levels are realised with an appropriate level of localisation of opportunities and employment terms are compatible with or better than those in the existing employment market
Construction and Installation base	The facility is located close to the host community and disturbance is minimised
Operations and maintenance base	The facility is located close to the host community

Table 19.15: National regional and local impacts under positive scenario

Impact category	Local	Regional	National
Local employment and business opportunities	Highly positive	Highly positive	Highly positive
Improvements to local infrastructure	Highly positive	Highly positive	N/A
Benefits to other marine users	Highly positive	Highly positive	N/A
Quality of life (defined Section 19.12.3.2)	Highly positive	Highly positive	N/A
Increased Knowledge	Highly positive	Highly positive	Positive
Clustering effect	Highly positive	Highly positive	N/A
Energy security	Positive	Positive	Positive
Possible carbon savings	Positive	Positive	Positive
Displacement of existing employment	Minimal	Minimal	N/A
Pressure on local infrastructure and services	Minimal	Minimal	N/A
Pressure on existing housing and accommodation	Minimal	Minimal	N/A
Commercial fisheries impacts	Minimal	Minimal	N/A

Table 19.16: Negative scenario

Project parameter relevant to the assessment	Description
Project phasing and capacity	Only Stage 1 is built – less jobs and economic advantage
Project construction timescales	Project delay – new grid connection takes longer, which will reduce the positive impact
Project operation and maintenance timescales	If shortened economic benefit will be reduced
Type and origin of vessels	Imported vessels from national or international areas
Project decommissioning Strategy	Removal of all equipment leaving a clear site, leading to a short-term task related increase in jobs but no long-term benefit
Turbine layout	Layout does not take account of other sea user interests and displaces a greater amount of fishing activity

Project parameter relevant to the assessment	Description
Turbine type	Lower levels of local and to an extent regional employment
Employment numbers	Employment levels are lower than planned, localisation of employment is not, or is poorly achieved, terms are incompatible with or worse than existing local practises
Construction and Installation base	The facility is located away from the host community
Operations and maintenance base	The facility is located away from the host community

Table 19.17: National regional and local impacts under negative scenario

Impact category	Local	Regional	National
Local employment and business opportunities	Minimal	Positive	Positive
Improvements to local infrastructure	Minimal	Minimal	N/A
Benefits to other marine users	Minimal	Minimal	N/A
Quality of life (Defined Section 19.12.3.2)	None	None	N/A
Increased Knowledge	None	None	N/A
Clustering effect	None	None	None
Energy security	None	None	None
Possible carbon savings	Minimal	Minimal	Minimal
Displacement of existing employment	None	None	N/A
Pressure on local infrastructure and services	None	None	N/A
Pressure on existing housing and accommodation	Negative	None	N/A
Negative	Negative	Minimal	N/A

19.11 MITIGATION MEASURES

All Project Design Mitigation and General Mitigation measures are set out in Chapter 5 Project Description, Table 5.15 and 5.16 respectively. .These are standard practice measures based on specific legislation, regulations, standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur.

There are some limited mitigation measures suggested within this assessment due to the largely positive nature this Project has on employment and other service benefits. The best form of mitigation is planning. Once the construction and operation and maintenance bases have been chosen this will allow for detailed planning. A number of the questions and concerns of consultees will be resolved through the internal and external planning processes which will be undertaken as the Project develops.

19.11.1 Specific Mitigation

The following mitigation measures will be implemented specifically to minimise the impacts on socio-economic receptors (Table 19.18).

Table 19.18: Specific mitigation measures for socio-economics

Ref	Mitigation Measure Description
SE01	BTAL will liaise with the relevant planning authorities, to avoid congestion and pressure on existing housing and accommodation.
SE02	BTAL will work with relevant planning authorities to develop appropriate mitigation for any potential conflicts with existing uses of ports.
SE03	BTAL will consult with local ferry operators and an additional ferry service would be added for construction traffic to ease congestion on local and tourist traffic if required
SE04	BTAL will discuss with ports authorities the best way to ease congestion in the vicinity of the Project, including consideration of infrastructure upgrades in the locality
SE05	BTAL will work with the relevant harbour authorities when planning major operations to fit into general harbour management

19.12 RESIDUAL EFFECTS

The mitigation suggested is focussed around communication and stakeholder engagement that BTAL will undertake to ensure that each of theimpatcs identified are resolved satisfactorily prior to each phase of the Project. The design envelope is at this stage very broad and there will need to be ongoing discussion with the stakeholders as the different options are finalised. The Project has the potential to have a significant positive benefit to any community that is chosen as the Construction base or the Operation and Maintenance base and these benefits, such as employment and upgraded infrastructure, require to be managed and communicated clearly which is the key mitigation that BTAL will undertake.

19.12.1 Local Employment and Business Opportunities

This is the key positive impact for the Project and includes the development of the supply chain around the Project. There are already been some positive benefits with local firms delivering aspects of the EIA and completing the survey work required. Local accommodation providers will also have had some minor benefits with the Project partners requiring accommodation on the island of Hoy and Orkney mainland.

Work undertaken by Aquatera (2012) and others in 2012 indicated that there has been upwards of £300 Million (Table 19.19) of investment in the Orkney projects and supporting infrastructure. The Orkney community has invested upwards of £45M some of which is public money and some private investment. Since these figures were collated the MeyGen project in Caithness has been consented and is now being built which would add substantially to these figures. This investment supports upwards of 200 jobs although 2015 has seen a slight downturn in the Orkney figures.

Table 19.19: Investment in Orkney on marine renewables and renewable infrastructure projects (Aquatera, 2012)

Area	Gross investment to date in Orkney (2012)	Orkney investment to date (2012)	Orkney contribution (%)
Marine (wave)	£100M	£5M	5%
Marine (tidal)	£140M	£10M	7%
Ports	£20M	£10M	50%
Vessels	£15m	£15m	100%
New grid	£25M	£5M	25%
Total	£300M	£45M	15%

These investment levels have been achieved during the research and development and testing Stage of Marine renewables. This Project will be one of the first commercial projects to be commissioned so the overall benefits the Project brings will be substantial.

19.12.1.1 Construction and Installation

Chapter 5 Project Description states that turbine installation including the turbine support structure for Stage 1 (up to 30 turbines) will take place over one year. Then for Stage 2 (85 to 170 turbines) installation will take place over an additional 3 years. This will require a construction workforce to be on site for four years in total. The construction of the devices will involve commissioning as much of the turbines and associated components onshore as possible.

The Project requires offshore construction work with the associated vessel requirements. This will increase the opportunities for local marine companies and their employees in each location depending on the types of vessels used.

There could be local benefit in supplying goods and services to the construction base, vessels and commissioning contractors and this could also attract new companies to be based close to the construction base.

The individual harbour authorities or Trusts will benefit from the lease of the onshore construction base, harbour dues and pilotage fees.

To estimate net additional direct employment impacts, a series of factors must be applied to the base direct employment figure. These are assessed for the regional bases and may need some adjustments if the base is designated outside the region.

The dead weight[3], effect is given to be 0% as without the Project there would be no equivalent employment created through any other means. Since permanent high value employment of this type is limited in Orkney and Caithness, and few of these

3 Benefits that would have occurred anyway without the intervention of the Project

permanent jobs would pass outside the local or wider labour market to elsewhere, the leakage[4] is taken to be at a low level and given a factor of 10%. It is also assumed that the displacement[5] effect would be limited given the nature of the supply chain and its development it therefore is also given a value of 10%. These figures are similar to the assessment completed for the MeyGen (MeyGen, 2012) project which is relatively close to the Project and is assessing the same catchment area.

The Project needs also to assess the multiplier effect that estimates the indirect and induced jobs that would arise from the Project. Since there is no direct multiplier for these operations, the multiplier used is the Scottish government established Type II for "machinery and equipment" of 1.8 (this is the same as for "fabricated metal" which would be another similar category).

Based on these assumptions, the total local direct jobs from Stage 1 is estimated as 14 and for Stage 2 as 80. Adding indirect and induced jobs[6], the total is 25 jobs for Stage 1 and 144 jobs for Stage 2 (see Table 19.4).

The GVA estimated from Scottish Government statistics (SG, 2012) is estimated for construction/ civil engineering as £52,876 per employee and applying this to the job estimates gives a GVA of £1.3m for Stage 1 and £7.6m for Stage 2 (Table 19.20).

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4 The proportion of outputs that benefit those outside of the intervention target area or group

5 The proportion of intervention benefits accounted for by reduced benefits elsewhere in the target area

6 (Scottish government, 2015) defines the direct, indirect and induced as "*an increase in final demand for a particular product, we can assume that there will be an increase in the output of that product, as producers react to meet the increased demand; this is the direct effect. As these producers increase their output, there will also be an increase in demand on their suppliers and so on down the supply chain; this is the indirect effect. As a result of the direct and indirect effects the level of household income throughout the economy will increase as a result of increased employment. A proportion of this increased income will be re-spent on final goods and services: this is the induced effect.*"

Table 19.20: GVA estimates for the Project

	Number of jobs	Local employment factors			Total Local Direct Jobs	Total Direct, indirect and induced jobs	Total GVA
Factor values		Dead weight (0)	Leakage (-10%)	Displacement (-10%)		Employment multiplier = 1.8	GVA per employment estimate = £52976
Stage 1	17.4	0	-1.74	-1.56	14	25	£1.3m
Stage 2	98.6	0	-9.86	-8.87	80	144	£7.6m
TOTAL	116					169	£8.9m

Gross Value Added (GVA)

To give an understanding of the value to the economy of the Project it is standard practice to estimate the increase in GVA that the Project will bring to the area. The GVA calculations for the Project are based on the percentages used for the workforce estimates and are shown in Table 19.21 (SG, 2012).

Table 19.21: GVA estimates for different Capex investments (ETI-UKERC, 2010) (MeyGen, 2012)

CAPEX Estimates	Capex per MW	Brims Stage 1	Brims Stage 2
	Industry average	30MW	170MW
Minimum	£4m	£120m	£680m
Median	£5.5m	£165m	£935m
Maximum	£7m	£210m	£1,190m

The median figure is used as this Project is being built almost ten years after the report therefore there should be some efficiency savings although this is taking place in a relatively remote area. These give the estimated GVA figures shown in Table 19.22.

Table 19.22: The local content estimates using the median figures

GVA estimates				
Stage	MW	GVA	Construction & Installation	Totals locally
1	30	£165m	30%	£49.5m
2	170	£935m	30%	£280.5m

National Context

The National impact is highly dependent on the choice of Operation and Maintenance base and the location of the construction and installation works. Within the national context wherever the bases are located the benefits of increased employment and GVA will be similar. The numbers of jobs and levels of GVA are broad estimates at this stage and will only be refined when technology choices are confirmed.

The Scottish economy has grown more slowly than the UK as a whole according to Scottish Government statistics (Scottish Government, 2015). When rounded to one decimal place, at 2014 Q3 annual GDP growth in Scotland was 0.2 percentage points lower than in the UK. At 2014 Q4, annual GDP growth in Scotland was 0.1 percentage points lower than in the UK therefore an investment of this kind would be welcomed.

Regional Context

Regionally the ports within Orkney, in particular Lyness and Stromness, have the potential to become the service base for the Project. The port of Scrabster could also act as construction and maintenance base (See Section 19.9.4.65).

Scrabster

The area would also benefit from the increased workforce and its associated base. Scrabster has better transport links for travelling workers so there would be less displacement of staff from other businesses or these would be more readily replaced therefore less issues for the businesses. Caithness and Sutherland has a higher unemployment rate (3.4% 2013) than Orkney and is just below the Scottish national average (HIE, 2011). This will suggest more opportunities for local employees. It also has a relatively skilled engineering workforce due to the presence of the Dounreay nuclear facility and its decommissioning.

Lyness

If the construction base is located at Lyness this would have a large effect on the local employment. The population of Hoy is around 400 people therefore even for Stage 1 the influx of 180 construction jobs and the associated service base infrastructure will positively impact on the area. Direct and indirect employment will lead to a wide range of employment opportunities. There is the possibility of leakage from other businesses and this will have an associated impact on these businesses. The employment opportunities on Hoy at the moment are relatively small and a number of islanders have had to leave the island seeking work (Consultation with Hoy Community Council Table 19.3).There is a high likelihood that a number of workers would commute from the mainland similar to the Flotta Oil terminal situation.

Stromness

Stromness is a busier port than Lyness but has recently had a new pier constructed to support the renewable industry. There are already a number of regular users such as aquaculture support vessels and inshore fishing vessels. There is around 10 hectares of laydown area that is available for development. The impact of a construction base would have a positive effect on the community and would benefit the local businesses that service the base. There could be some workforce leakage to the Project putting some pressure on other local businesses. Orkney in general has a very low unemployment rate (1.3% compared to Scottish national average of 3.8% (2012)) therefore the predominant source for the local workforce would be from displacement from other employment (OIC, 2011).

Summary

Nationally this is a significant project and it fits into the Scottish and UK governments plans to develop a high value marine renewable industry within the UK and the focus on the PFOW area as a preferred area for this investment.

Regionally the local job market within Hoy is limited and therefore either designation could have a very significant positive impact for the local community. The improvements already carried out at Lyness and the renewable companies already using the port have increased the work activity around the port and have already had a positive impact. Pelamis Limited employed six people in Hoy and three in Stromness.

Stromness is a town of approximately 2,000 people (NRS, 2014) so the benefit or impact of any associated jobs would be less but still significant.

This would also be true for Scrabster which has a relatively small resident population but is within 2 miles of Thurso which has a population of over 7,000 (NRS, 2014). These jobs would however be relatively skilled and support a reasonable income level which would impact on the areas involved.

19.12.1.2 Operation and Maintenance

The Project will mostly be controlled remotely during the operational phase. Maintenance will involve a dedicated vessel servicing the site with more vessels used on a planned basis for larger maintenance operations. The Operation and Maintenance base is likely to be based within the region and therefore the Project could involve locally based vessels working from Lyness, Stromness, Scrabster, or possibly smaller vessels based at Scapa or Gills Bay. This would support local employment.

The planned maintenance will include turbines being overhauled onshore or on a barge moored alongside a pier. Operations may be limited by vessel draft restrictions for some operations at these ports. During the consultation (Table 19.3) both OIC and HIE suggested that they may support infrastructure improvements for the Project. The turbines will be removed for maintenance on a planned basis estimated to be every 5-10 years. In practice this is likely to be a continuous routine process which would require a permanent workforce and vessel support team.

Whichever port is selected the planned maintenance will require vessels and onshore staff to work on the devices to overhaul and re-install. It is stated in the Project description that on average throughout the year there will be one vessel per day on site. Table 19.23 gives details of the types of vessels that could be used on site. It may be that a range or combination of these will be required. There could also be the need for extended hours of work during a period of good weather and favourable tidal conditions so the numbers might increase to cover shift working.

Table 19.23: Vessels to be used during maintenance

Vessel type	Crew	Operations
RIB	3	Observations, crew transfer, mooring support, safety standby
Multi cat	6- 7	General towing, minor lifting, Mooring deployment, diving support, ROV operations, Gantry barge support, survey work
ROV support	4-5	ROV operational base, other survey work, crew transfer
Tug	8-10	General Towing, gantry barge support, mooring deployment
Gantry barge*	8- 10	Heavy lifting (600T), Cable laying, Mooring deployment, device transport and deployment
Deployment barge*	8- 10	Heavy lifting, Specialist maintenance, deployment and transport of devices
DP vessel	20 – 60	Heavy lifting (600T), device transport and deployment, cable laying, ROV operations, Mooring deployment,

**require other support vessels such as tugs or multi cats*

The onshore operations will, over time, become streamlined and timescales reduced but there will be a planned series of events. The maintenance period is suggested as between 5-10 years. Regular inspections and cable surveys will also be undertaken regularly.

There will also be a service supply chain that could provide opportunities for local companies and services industries to expand the operations. The GVA calculations in Table 19.6 above estimate that the increased local GVA for the operation and maintenance is £49.5M for Stage 1 and £280.5M for Stage 2.

19.12.1.3 Decommissioning

This process would take place over a similar time period and create a number of the same opportunities as the construction phase depending on the procedures employed and the turbines used. The same level of impact as construction and installation are likely to occur at each port.

The impact on the local economies of each area will be largely positive whichever port is used as a base. The region in general has relatively low levels of unemployment but can be vulnerable to emigration of workforce if jobs are not available and finding workers for new jobs can be challenging. Therefore the sensitivity to changes employment opportunities is high. The need for new employment opportunities. The need for backfilling jobs lost in other sectors e.g. Flotta, Dounreay. The opportunities the Project takes to the area for increased business has been welcomed by all consultees and therefore the sensitivity is low. The numbers of the workforce required will have a beneficial effect whichever port is finally selected as will the downstream business that will service the Project. The magnitude of the Project will be highly positive and the overall significance is also highly positive.

19.12.2 Improvements to Infrastructure

19.12.2.1 Construction and Installation

National

Establishment of the operations base could result in improvements to existing port facilities, which would in turn benefit other marine users. A number of Ports around Scotland have the facilities required or would be willing to make improvements to support the Project. There is then the issue of transporting the devices to the site and the cost effectiveness of this operation will need to be a key part of the decision making process for the eventual construction base location.

Regionally Scrabster already has some facilities such as heavy lift craneage and road access, and Lyness has large laydown areas and open air bays but both would require some dedicated building work to cover some of the requirements for this Project. Stromness is less well developed as far as laydown areas but has easy access to all services available on the Orkney mainland. Within each port there may be opportunities for additional contracts for using facilities depending who builds and owns them.

The construction base will require the transport of goods to the site. This may well be done by sea transport for larger items but will still require a steady amount of smaller freight traffic. This will likely lead to increased and improved services in whichever port is chosen and these improvements can benefit a range of users, including locals and tourists.

Regional

There will be almost certainly be some local activity within the region which ever port is defined as the construction or operations base. The proximity to the site and the need to work within weather windows will require vessels to use the regional ports. There may need to be some improvements made to the ports to accommodate even the lower level of activity that would be required if the main ports are designated outside the region. If the ports in the region are selected for the bases then the following points apply.

Lyness

Lyness is already marketed by the OIC and HIE as a renewables base and development area. Both organisations explained during consultation that they would be willing to support enhanced facilities to attract business to the site. These enhancements would also have the potential to be shared by other new business or would leave a legacy of facilities after the construction phase is complete. The opportunity to lengthen the pier which may be needed as part of the Project was also supported by the OIC marine services during consultation as they see the opportunity to attract more marine operations to Lyness.

If it is based on Hoy this may require extra sailings of the ferry which could benefit the island and may justify an additional ferry as suggested in the consultation with Orkney ferries. This situation has already arisen during the construction of the port improvements carried out by the local council so a similar situation would possibly occur. There could be some competition for space and bookings but this could be alleviated with careful planning of the haulage and timetabling. The amount of equipment needed if coming by road to either Scrabster or through mainland Orkney will be easily provided for by existing transport routes including the Pentland Firth ferry crossings so there will be no impact on the level of service.

Stromness

Stromness is linked more closely to the national transport links with a daily ferry from the port to Scrabster on the mainland and links to the Aberdeen direct ferry services. The construction and installation could well increase the traffic on these routes but would not have a significant overall impact. The Stromness pier at Copland's dock was designed to be easily extended to the south and this Project depending on the detailed requirements may support this extension leaving a lasting benefit to the facilities. The development of a laydown area and associated building etc. that the Project would require would be a substantial improvement to the facilities as at the moment the area suggested has not been developed.

Scrabster

Scrabster has good links to a trunk road network and therefore any increased haulage for the service base will have minimal impact and would not necessitate any improvements in the links. There is also good sea access for any shipped in freight so again no need for any improvements. Scrabster is in the process of designing a Phase 2 development at the port which would involve a new dock and more pier space. This would substantially improve the facilities provided by the port. The development of a laydown area, buildings and associated infrastructure that the Project would require would be a substantial improvement to the facilities as at the moment the area suggested has not been developed.

19.12.2.2 Operation and Maintenance

The operational phase will require few facilities as the turbines are intended to be controlled remotely and will run automatically and unmanned.

This phase will require good pier facilities, vessels and an onshore base. These facilities will have some residual effects as there may be the opportunity to use the facilities for other projects during quieter times.

The decision on the service and construction base is again key to this impact. The local ferry service has a reasonable capacity but during the height of the tourist session suffers from some under capacity on some sailings. The changes suggested by Orkney ferries in the consultation (Table 19.3) offer the possibility of more frequent ferries or an increased capacity that would benefit a range of ferry users including local's tourists and business traffic.

The operation and maintenance base. if developed on Hoy, will require some increase in ferry capacity but this would be easily managed or mitigated with increased ferry sailings and would only be an issue during the summer months when tourists are using the service. If either Stromness or Scrabster are chosen the Project will have some transport requirements but they would have a minimal impact.

19.12.2.3 Decommissioning

This process, if required, would create the similar opportunities as the construction phase although the improved infrastructure would be a permanent feature and residual benefit to the area. There may be opportunities to attract new business to follow on from the Project.

19.12.2.4 Summary of Residual Impacts

The impact on the local infrastructure of each area will also be largely positive. Each area has plans to support and attract marine renewable business to their facilities and are willing to develop there ports and other facilities for the Project. The local communities also support new business. The Project will have a positive impact with the opportunity for a legacy of improved infrastructure and facilities giving an overall highly positive significance.

19.12.3 Benefits to other Marine Users

Other marine users would also benefit from the enhanced facilities that would be built for the Project. Additional quay space and onshore facilities could be used by other businesses and the build-up of the supply chain and increased expertise that the Project would bring could also be useful to other marine based business.

19.12.3.1 Impacts

The impact on other marine users will for the most part be positive. There could be some minor conflicts for space from time to time but the harbour authorities within each port suggested during consultation that this was not significant and can easily be mitigated by good port management. Each area has plans to support and attract marine renewable business to their facilities and are willing to develop their ports and other facilities for the Project. The impact has a low sensitivity as these are working ports and their users understand the concept of port management. The magnitude of the Project will be highly positive with the opportunity for a legacy of improved infrastructure and facilities that will benefit all marine users again giving an overall highly positive significance.

19.12.3.2 Quality of life

Some of the potential benefits resulting from bringing new high value jobs to an area include:

- Wage inflation;
- Increase in population which would benefit the economy as well as attract pupils to local schools;
- Attracting younger people into the area;
- Additional housing and school provision;
- Upgrading medical and retail service;
- Improved communications; and
- Grid connections.

19.12.3.3 Wage Inflation

At this stage of the Project it is not easy to define wage rates and the potential for increases and/or leakage but using the statistics from the Scottish Government's National Statistics Office from 2012 (ONS, 2013) we can estimate that if the national picture is followed Orkney wages are already nearly 20% lower than the national average and in Caithness they are 22% lower. The closest comparative category within the statistics (specialist construction activities) shows a much lower difference but the key fact that is that nationally these wages are 27% higher than the average Orkney salary or 30% higher than the average highland salary (£23,313 compared to £16,908 for Orkney or £16,375 for Highland). There has been a suggestion that more recently wage levels in Orkney have risen higher than other areas in the UK but the trends would still suggest that the Project will still support higher wages and some leakage (Table 19.24).

Table 19.24: GVA and wage estimates for national and regional areas (ONS, 2013)

Economic Statistics	Totals		Specialised Construction Activities	
	GVA £ per head(2012)	Gross wage & salaries per head(2012)	GVA per head(2012)	Gross wage & salaries per head(2012)
Scotland	49,359	21,102	47,200	23,313
Orkney	40,710	16,908	46,275	20,698
% difference v Scottish	17.5	19.9	2	11.2
Highland	38,666	16,375	52,701	22,898
% difference v Scottish	21.6	22.4	+11	1.8

19.12.3.4 Decommissioning

The majority of the improvements would not be removed after decommissioning so they would leave a legacy of improved buildings, quay space, buildings and any other improvements that were required for the Project. The Project could also be repowered depending on technology and renegotiations of consents etc. which would allow for continuing use of the infrastructure.

19.12.3.5 Population Increase

Construction and Installation

Regionally and locally the increase in population that this Project will involve will have an impact in each of the areas involved. The impact is likely to be positive in each location as they have relatively low populations and the economic stimulus that the population increase would give would outweigh any issues that might occur with a short-term increase in the population.

Operation and Maintenance

The operational phase will provide less immediate economic impact but will be over a longer time period (25 year life cycle). The workforce for this stage is more likely to set up a permanent residence which would be a real positive outcome for all the areas concerned as they are all looking to encourage people to set up homes within the area. This is particularly true in relatively remote and rural locations where even one family can make a significant difference to the local populations etc.

Decommissioning

The population will increase during the decommissioning stage to the construction levels and then go back to numbers similar to present levels.

There is also the option of repowering the Project rather than decommissioning which would extend indefinitely the lifetime of the Project. This would be subject to renegotiations with relevant parties and further consents and licence applications.

19.12.3.6 Change in Population Distribution

Nationally the population change is insignificant but would be welcome due more to the economic activity that the increased population brings rather than the numbers themselves. It is recognised that increased numbers require more services but these would be dealt with on a more local basis. The impact regionally will be more pronounced and some service provision may be required to support the increase.

Construction and Installation

Within the region it should be possible to absorb the numbers required particularly for Phase 1 without dedicated accommodation so the workforce would be more widely distributed. This may also be the case on mainland Orkney as there are a large number of accommodation providers although there would be some pressure during the height of the summer season (July and August). The situation on Hoy would be more significant but with a good ferry service this could be mitigated by spreading the workforce. The option of a dedicated construction Camp could also mitigate the situation.

Operation and Maintenance

The numbers involved in this stage although not defined will have little impact nationally and even on a regional basis they would be insignificant. It is anticipated that a large portion of the workforce would not necessarily be accommodated on Hoy. Therefore the population distribution would not change significantly. It is hoped by the Hoy community that some of the workforce will be encouraged to stay on the island giving a positive improvement in population.

Decommissioning

The impacts of decommissioning will increase the numbers to levels close to the construction and installation phase of the Project once the decommissioning is complete the population will reduce back to the pre-project numbers.

19.12.3.7 House Price Inflation

Nationally this will have no impact.

Construction and Installation

During consultation (Table 19.3 Line 64 – 71) the OIC Housing and Economic development sections suggested they would be willing to look at temporary housing provision if required.

Operation and Maintenance

There are a range of house types in each area and a number of areas designated for house building so there would be minimal impact on house prices. There is a stock of around 30 council houses on Hoy and a good stock of land for building. This would mitigate any threatened increase in house prices. There is equally a range of options for council housing on the mainland of Orkney as well as building options. The OIC and housing association have land available in a number of areas for building.

Decommissioning

There are a range of house types in each area and a number of areas designated for house building so there would be minimal impact on house prices.

19.12.3.8 Attracting Younger People into the Area

Rural areas typically have problems attracting young people to stay or come to the area mostly due to the lack of good employment opportunities. This Project has the opportunity to offer long-term jobs which should encourage young people to the area.

19.12.3.9 Additional Housing and School Provision

With an increased working population this would support housing development and also if families are encouraged to migrate to the area this would enhance the school roll. This last point is particularly relevant to the Lyness site as the school roll is small and faces pressure to close some departments. The consultation responses from the OIC Housing and Education department (Table 19.3, Line 70-71), Hoy Community Council (Table 19.3, Line 18) and Hoy Development Trust (Table 19.3, Line 26-27) all supported the attraction of more families to the area. The Scrabster Harbour Trust also suggested (Table 19.3, Line 74) that the school roll has been falling in recent years so any increases in school aged population would be welcomed.

19.12.3.10 Upgrading Medical and Retail Service

The increased population would have a similar effect on a range of services such as medical and retail facilities by creating demand for services this helps to secure them and could well lead to enhancement which is again often critical for smaller more rural communities but is equally true for slightly larger areas such as Thurso and Orkney mainland.

19.12.3.11 Improved Communications

A key area of development in recent years is the upgrading of broadband and communication in general. HIE have seen this as a priority throughout the Highlands and Islands and although there is a desire to feed this into all areas regardless of population the commercial reality is that a project of this size would speed up the provision as it would be required for their operations.

19.12.3.12 New Grid Connections

Any new grid connection to Orkney will require a business case to be made by SSE to Ofgem. The grid connection will only be built if this business case is accepted and the funding allowed. This requires a volume of committed grid capacity of which this Project is one of the larger developments. The Orkney grid is at capacity and for any more development of renewables generation a new cable to the mainland is required therefore economic benefit from renewables within Orkney will benefit from this Project committing to grid upgrades.

Impacts

The impact on the quality of life is a highly individual receptor. During consultation all the regional and local consultees gave a positive response to the Project with the option to attract people to the area supporting services such as schools and housing a real befit to their own lives. This would be echoed within any area that was offered this opportunity particularly any rural or remote areas. The improved services that have been identified have also been well supported through the consultation (Table 19.2 and Table 19.3). Overall the Project is assessed as having a significant positive effect on the quality of life for the community at whichever port or construction site is chosen as the construction or Operation and Maintenance base.

19.12.3.13 Increased Knowledge

The increased knowledge of having new early stage devices and the development of an early stage array will increase the knowledge bank and attract interest to come and learn from the Project. The knowledge gained from Stage 1 will also help refine and develop Stage 2 and potentially other projects planned by BTAL.

19.12.3.14 Clustering

Clustering of direct supply chain, educational institutes and wider associated suppliers and business is a positive benefit for the host communities around an industrial operation. Clustering has certainly enhanced the work at EMEC and the development of a commercial project close to operations will again have a positive impact on the area and industry.

19.12.3.15 Energy Security

Energy security is supported with each tidal power project that becomes commercial this Project aims to develop 200MW of tidal energy which will be the largest development to date. This has a positive impact on diversity of supply as well as increasing low carbon generation. Nationally it has been recognised as important by both the Scottish and UK governments. Regionally and locally the diversification of energy supply into marine renewables allows the high penetration of wind projects in the area with their inherent intermittency to become more balanced.

19.12.3.16 Possible Carbon Savings

One of the key outcomes of this Project and similar renewable energy projects is the reduction in greenhouse gas (GHG) emissions by displacing the generation of electricity from fossil fuels e.g. electricity from gas-fired combined cycle gas turbine (CCGT) power stations (Power Engineering International, 2015). As a reliable and predictable source of clean renewable energy, tidal energy offers significant potential in terms of carbon offsetting. Energy production from tidal resources is not affected by weather conditions and, with water being 830 times denser than air, for the same electricity output tidal turbines can be much smaller than equivalent wind turbines. In February 2013, RenewableUK published a paper on Wave and Tidal Energy in the UK (RenewableUK, 2013); Conquering Challenges and Generating Growth. This paper suggests that, in the UK, 18TWh/year of tidal stream energy resources area assessed as being economically recoverable with current technologies. To set this in context this is approximately 5% of the current UK annual electricity demand (350TWh/year). The paper also notes that, based on DECC's calculated carbon saving of 0.43kg of CO_2 per kWh for wave and tidal electricity generating assets, there is potential for the deployment of 100MW to displace 131,850 tonnes of CO_2 per year.

Therefore carbon savings for this Project are:

- 30MW – 39,555T CO_2 Equivalent; and
- 170MW – 224,145T CO_2 Equivalent.

Total savings for the 200MW is 263,700 CO_2 Equivalent.

Impacts

The carbon savings identified help Scotland and the UK meets the targets for carbon reduction they also support the local and regional area in becoming lower carbon economies which both areas support within their development plans.

19.12.4 Displacement of Existing Employment

The Project will require a significant workforce and the high wage rate may encourage some people to move employment to the Project this will have some localised impact on some business but in general the impact is assessed as Low. During consultation HIE and the OIC confirmed that there is enough capacity within the business and labour force within Orkney and Caithness to cope with this impact and suggested that the residual impact would be low. The Orkney Fisheries Association (OFA) suggested that this might be an issue during scoping but as the fisheries assessment showed that the impact would only affect a small number of fishermen the overall impact on the industry would be minor.

19.12.4.1 Impacts

The areas all have relatively low unemployment but there is capacity within the workforce to take on more work (Table 19.3 Line 52 & 59). There will inevitably be some displacement but the impact will not be significant. Regionally all new jobs will be welcomed and although some companies may suffer from displacement the under capacity within the businesses will minimise this impact.

19.12.5 Pressure on Local Infrastructure and Services

19.12.5.1 Construction and Installation

National

Nationally the Project is likely to be based in or around a port facility. These are serviced deliberately for this type of operation. With the growth in Marine renewables any area that is considered for the Project is likely to develop the infrastructure and services to suit the Project. There may be some initial impact on the services but these will depend on the base chosen but they will be of low significance.

Regional

If the base is in Scrabster there would again be a requirement for a construction base to be built but there would be a lot more opportunities to support the short-term visitors to the site. The Orkney mainland could host the construction base with the workforce travelling to Hoy each day using the ferry or dedicated transport. There would be more facilities on the mainland for the workforce and less of an impact on the tourist accommodation. The tourist season is relatively short in Orkney and this is exacerbated in the isles so the guaranteed occupancy by construction teams may be more beneficial than the more uncertain tourist trade for the summer season for some businesses.

The location of the construction base may give some conflict between other port users such as fishermen, oil supply vessels and other renewable projects. But during local consultation (Table 19.3) which should hold true for any port this can easily be mitigated by good port management.

Locally

This phase of the Project could have an impact on locally available accommodation discussed above (Section19.12.5). The numbers involved may add some pressure to the available accommodation. There are options such as an accommodation camp or hotel ship that have been used in other locations The OIC would be willing to discuss these options with BTAL and decide on the best solution to the accommodation provision. There may be a need for additional bed spaces for people visiting the site so accommodation providers locally would be well placed to provide this.

Operation and Maintenance

There would be some increase in the use of locally based utility services if the service vessels are based locally or within Orkney waters. This would include fuel and water stores as well possibly shore side electricity supplies. Upgrades to these services were already included within the latest upgrade to the area in 2013. The Scrabster port was also upgraded in 2013 so the Port infrastructure is a sufficient capacity.

Decommissioning

This process would create the same opportunities as the construction phase and would have the same level of impact.

Impacts

There may be some initial pressure on the ferry services on Hoy if Lyness is chosen as the construction base but Orkney Harbours and Orkney Ferries both suggested (Table 19.3 Line 29 - 38) that increased capacity and timetables would be an option which would mitigate this pressure which gives it an overall low sensitivity and a low magnitude therefore a negligible significance. There would be no issues for Scrabster or Stromness if they were the chosen base for the Project so the overall sensitivity to this receptor negligible as is the magnitude of the effect. This gives a negligible significance for this impact.

19.12.6 Pressure on Existing Housing and Accommodation

19.12.6.1 Construction and Installation

This impact would depend on the method of housing the potential construction workforce for the Project. One option is for the bulk of the employees to be accommodated in temporary housing this would reduce the pressure on local housing. The OIC Housing Department during consultation (Table 19.3 Line 68) suggested that if this was the case they may be able to support this type of construction. The Housing department has a responsibility to support the development of housing within the islands within Orkney. Other areas may also be willing to support this type of accommodation.

If this option is not used then there may be some pressure on the local housing provision particularly during Stage 2.

There would be also be some pressure on holiday type accommodation as even with the option of a construction camp not all the employees would be housed within the temporary accommodation and the range of short-term visitors to the Project would require space. This would easily be absorbed within Thurso and mainland Orkney as holiday accommodation is rarely at full capacity and the year round nature of this type of accommodation is often considered more valuable. There may be very specific times during the year that there would be some booking issues but this would be localised and have a minor impact. The increased visitor numbers are more likely to have a positive impact by increasing usage and potential income. Hoy itself has limited accommodation options but also a relatively short tourist season so would welcome more visitors particularly during the winter months when visitor numbers are very low.

19.12.6.2 Operation and Maintenance

The numbers involved during this phase would be relatively easily absorbed within each area and would be positively encouraged by any area involved particularly in within the region and Hoy in particular. There is an aspiration from the Hoy development trust (Table 19.3 Line 16-20) and the Hoy Community Council (Table 19.3 Line 21-28) to encourage permanent residences to encourage the use of the school and other services. The OIC housing department (Table 19.3 Line 65-67) would be willing to consider building more council housing to support this workforce if they chose to locate in Hoy. The Orkney mainland and Caithness already have an adequate supply of housing to support the Project requirements.

19.12.6.3 Impacts

There may be some initial pressure on housing during the early stages of construction. If the option of a construction base is supported then the impacts will be minimal. If this option is not followed there may be impacts on accommodation for the construction phases of the Project particularly Stage 2.

Regionally during the height of the tourism season there may be some issues particularly in Hoy. This would be mitigated by using some accommodation slightly further away and as it would only be of a temporary nature the sensitivity for Lyness would be considered medium due to the limited accommodation available and the possibility of a ferry journey for extra capacity. The magnitude of the impact would be low due to the temporary nature of the impact. This gives a significance of minor for Hoy. The sensitivity for Scrabster or Stromness is considered negligible due to the amounts of accommodation available and the option of the temporary workforce would be housed within a construction camp of some type. This gives a negligible significance for this impact for these areas.

19.12.7 Commercial Fisheries Impacts

19.12.7.1 Loss of Income due to Restrictions to Fishing Grounds Resulting from any Restrictions/Exclusion Zones

Impacts on fisheries are disc used in (Chapter 16 Commercial Fisheries). The numbers are relatively small but for the particular fishermen that use the site this could result in a loss of area and therefore income. The fisheries data gathered as part of the Commercial Fisheries chapter estimates the impact to be between £2,450 - £5,308 per year (ScotMap, 2014). The level of the activity would have a negligible impact on the wider industry within Orkney.

Construction and Installation

This could have a similar impact as above as there will be a 500m safety zone to be imposed around the particular construction activity taking place. The Project intends to minimise as much as possible the time they impact on the inshore (cable corridor) section of the construction and would liaise with the local fishermen regarding timing.

Operation and Maintenance

For the purposes of this assessment a worst case scenario is assumed. It is possible that the area will have restrictions for shellfish fishing for the whole duration of the Project.

Decommissioning

The return of the area after decommissioning could lead to a phase reintroduction of fishing activity with ultimately the area should return to the same level of production that exists today.

The commercial fisheries are dealt with in the Commercial Fisheries Chapter (Chapter 16).

Impacts

The sensitivity of this impact will be high for the low numbers of fishermen based in Hoy that use the fishing grounds within the site and negligible for other fishermen. The sensitivity is considered low overall. The magnitude of the effect is assessed as medium as areas of exclusion due to the safety zone, while localised, may endure for an extended time period (a total of up to five years from 2019 to 2024. The overall level of impact is therefore ranked as minor and not significant.

19.13 SUMMARY

Key finding of the socio-economic assessment:

- The majority of socio economic impacts from the Project are positive. This is true nationally, regionally and locally;
- The impacts will be more significant in the more rural areas but the majority are positive impacts;
- The consultees (Table 19.3) within the assessment were all supportive of the Project and some were willing to consider using their resources to help mitigate any issues;
- The positive comments received all assume that the construction or operations base will come to their locality. This expectation needs to be managed during the decision making process;
- The Project fits into the national aspirations as well as regional and local economic development strategies;
- There would be a lasting benefit from the Project in which ever area the construction or the Operation and Maintenance base is located these benefits will be larger in the more rural and remote areas;
- There will be significant business opportunities for the supply chain from the Project.

19.14 REFERENCES

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Recreation and Tourism

Chapter 20

20 RECREATION AND TOURISM

20.1 INTRODUCTION

This chapter of the Environmental Statement (ES) considers two separate but related topics: the potential impacts on recreational interests in the onshore and offshore area relevant to the Brims Tidal Array Project (the Project) and the potential impacts on the interests that drive tourism in Orkney with particular focus on the local area of Hoy.

Recreational interests include those of recreational boaters who may use the Project site. Concerns related to navigation, including activity by recreational users, are also addressed in Chapter 15 Shipping and Navigation and the Navigational Risk Assessment (NRA).

The activity of tourists and recreational users may also be affected by the visibility of the Project. Impacts related to the visual impact of the Project are addressed in Chapter 17 Seascape, Landscape, and Visual Impact Assessment.

Finally, this chapter addresses impacts on recreational users and tourists as well as on the infrastructure supporting these activities. However, the consequences of these impacts on the economic welfare of the community are discussed in more detail in Chapter 19 Socio-economics.

20.2 STUDY AREA

The study area for recreation includes the Project site extending to potential onshore landfalls, as well as all potential operations bases and likely offshore transportation corridors between these and the Project site (see Figure 20.1).

For tourist activities, the study area includes Hoy, with a focus on South Hoy and South Walls locally and in a wider context any potential construction and operation and maintenance bases that could be located in the study area (i.e. Lyness, Stromness and Scrabster). The Project is assumed to have a limited visibility envelope as it does not involve any surface piercing structures, although construction activities may last for a duration of several years with visual impacts associated with construction vessels. The scope of visual impact is therefore confined to the local area of South Hoy and South Walls.

Figure 20.1: Study area for recreation and tourism

20.3 DESIGN ENVELOPE CONSIDERATIONS

The Project has taken a design envelope approach. The basis of the design envelope is to apply a “worst case” approach to the assessment of the different impacts associated with the Project. With this in mind the maximum “worst case” Project parameters considered for the assessment of recreation and tourism are presented in Table 20.1. Additional factors potentially affecting recreation and tourism include the choice of the construction and operation and maintenance bases and the location of the export cable landfall.

Table 20.1: Design envelope parameters for recreation and tourism assessment

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment	Explanation of maximum Project parameters
Project phasing and capacity	Stage 1: 30MW Stage 2 : 170MW Stage 1 and Stage 2: 200MW	Maximum capacity installed during each Stage of the Project, with Stage 2 being built in a number of stages as defined in the Project Description.
Project construction timescales	Stage 1: Up to 2 years Stage 2: Up to 4 years	Maximum timescales, depending on the number, capacity and type of turbine.
Export cable laying and landfall construction timescales	Stage 1: up to 3 weeks Stage 2: up to 12 weeks	
Project operation and maintenance timescales	Stage 1: Up to 25 years Stage 2: Up to 25 years	As defined in the Project Description.
Project decommissioning timescales	Stage 1: Up to 2 years* Stage 2: Up to 2 years* * unless the site is repowered to extend the duration of the existing lease	As per the Energy Act 2004 and the requirement of The Crown Estate (TCE) AfL.
Maintenance activity and scheduling	On average over 25 years, one vessel per day	It is likely that vessels involved in maintenance activities will be present in the AfL area throughout the year. There may be periods when there are more vessels e.g. two or three or no vessels depending on weather conditions and extent/type of maintenance works required.
General arrangement: Turbine numbers	Stage 1: 30 turbines Stage 2: 170 turbines Stage 1 and Stage 2: 200 turbines	An indicative layout has been defined in the Project Description based upon these maximum Project parameters and this has been used as the basis for the impact assessment. It is acknowledged that the final arrangements will depend on the turbine type, rating and numbers, resource availability and seabed conditions.
Construction and Installation base	Undefined at this stage therefore Lyness, Scrabster and Stromness assessed.	

Project parameters relevant to the assessment	Maximum Project parameters for the impact assessment	Explanation of maximum Project parameters
Operations and maintenance base	Undefined at this stage therefore Lyness, Scrabster and Stromness assessed.	
Location of export cable landfall	Aith Hope, Moodies Eddy or Sheep Skerry	

20.4 LEGISLATIVE FRAMEWORK AND POLICY CONTEXT

- SNH - A Handbook on Environmental Impact Assessment' (February 2006) Appendix 5; and
- Orkney Islands Council Core Paths Plan, Supplementary Guidance (April 2011) (OIC, 2015a) under the Land Reform (Scotland) Act 2003.

20.5 SUPPORTING SURVEYS AND STUDIES

The following studies and assessments were consulted to inform the assessment:

- Socio-economic methodology and baseline for Pentland Firth and Orkney Waters Wave and Tidal Developments (ABPmer, 2012): Appendix B contains baseline information gathered up to 2011 for marine recreational activities and tourism within the study area that has been utilised in this assessment;
- Shipping Study for Pentland Firth and Orkney Waters (Anatec and Halcrow, 2012); and
- Navigational Risk Assessment (NRA) (Supporting Document: Anatec, 2015).

20.6 DATA GAPS AND UNCERTAINTIES

There is limited publicly available information on recreation and tourismassociated with ports and harbours. Furthermore, it is difficult to accurately identify the location of offshore activities, particularly those likely to interact with the Project site such as sailing vessels, the majority of which do not carry AIS. Consultation with relevant stakeholders, including local dive boat operators, kayak clubs and sailing associations, to inform this assessment, Chapter 19: Socio-economics, Chapter 15 Shipping and Navigation and the NRA (Supporting Document: Anatec, 2015) have served to address these information gaps (see Section 20.7 Consultations).

20.7 CONSULTATIONS

A request for Scoping Opinion was submitted to OIC and Marine Scotland in 2013. Comments relating to tourism and recreational resources were received from Orkney Islands Council and The Royal Yachting Association (RYA) and are detailed in Table 15.2.

In June 2015 and August 2015, interviews to inform the assessment were conducted with a number of local recreation and tourism stakeholders and key points raised are listed in Table 15.2. Stakeholders include:

- Orkney Sailing Club;
- Orkney Marinas;
- Orkney Harbours;
- Hoy Development Trust;
- Hoy Community Council;
- Dive boat operators;
- Scrabster Harbour trust; and
- Orkney Sea Angling Association.

Feedback from all stakeholders gathered throughout pre-application consultation for associated chapters, i.e. Chapter 19 Socio-economics (Table 19.2 and Table 19.3); Chapter 15 Shipping and Navigation (Table 15.2); and the NRA (Supporting Document: Anatec, 2015), is detailed within respective chapters and those which have relevance to recreation and tourism receptors are also summarised in Table 20.2.

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Table 20.2: Key issues raised by stakeholder during consultation

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Scoping				
Recreation	Orkney Islands Council	Take full account of any impact on core paths, during both the construction and operational phases, which shows any potential impacts to the paths or rights of way or by impacting the visual quality of the area. The continuity of these coastal routes should be maintained, addressed through development location and design considerations. Opportunities for enhancement should also be assessed, including path improvement works and visitor interpretation.	Noted and included in the assessment. Any impacts relating to visibility of the Project components from core paths i.e. during construction are assessed in the SLVIA and summarised here where appropriate.	Section 20.12.1.2
Data sources	OIC	Shipping Study for PFOW identified as data source for coastal and marine recreational activities.	Noted and included in the assessment.	Section 20.9
Recreational boating	RYA	Recreational boating should also include operators of dive and sea angling vessels, and Pentland Firth Yacht Club in Scrabster.	Consulted during assessment.	Section 20.9. and Section 20.12.1.1

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Recreational boat traffic	RYA	While the recent PFOW shipping study showed low levels of recreational traffic across the site, recent port developments at Scrabster and increased recreational interest in the waters to the north west of Scotland may result in increased use of this route in the future, particularly in conditions of deteriorating weather. Recreational impacts should not be scoped out of the study.	Consultation was undertaken with RYA, Orkney Sailing Club and Orkney Marinas. The area is normally avoided and therefore only limited numbers of recreational boat traffic are likely to come into the area. There is no impediment to yachts as there are no surface piercing structures. Potential for disruption to infrequent sailing activity in the near-shore area during construction.	Chapter 15: Shipping and Navigation, Section 20.12.1.1
Recreational sailing	RYA	The cable route and landfall are unlikely to have an adverse impact on recreational sailing.	Noted, however temporary disturbance considered during construction and decommissioning phases.	Section 20.12.1.1
Post Scoping				
Tourism	Orkney Harbours	Potential conflict during construction phase with tourists wishing to board ferries.	Orkney Ferries have suggested that extra sailings could be timetabled. Consultation will continue with Orkney Ferries throughout the Project in order to ensure that disruption to tourists and Orkney Ferries is minimised.	Chapter 19. Socio-economics, Section 20.12.1.4
Tourism	Community Council; Hoy Development Trust	Potential benefit to tourism if ferry capacity increased as a result of Project construction.	Positive benefit. No action required.	Chapter 19. Socio-economics
Tourism	Orkney ferries	Early morning and evening most popular times for tourists using ferries	Assessed in study.	Chapter 19. Socio-economics.

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Recreation	Orkney dive boat operator	No diving takes place in Project site Concerned over congestion at Lyness Pier during summer season and at lunchtimes each day (particularly as current wave device occupying significant stretch of pier) There could be opportunities for business outside the diving season Hoy would benefit from more people and business's which could give more services for our customers	Construction, operation and maintenance requirements will be determined pre-construction and will consider the current use of the port. A construction management plan will be developed and consider options to reduce disruption to other port users as far as practicable.	Section 20.9, Section 20.12.1.1., Chapter 19. Socio-economics.
Recreation	Orkney Sailing Club/Orkney Marinas	It is thought that the Pentland Firth is mostly avoided by recreational yachts due to the strong tidal conditions although no hard evidence to support this assumption.	As there are no surface piercing structures as part of the operational Project, there are no significant impacts expected on recreational yachts. There will be an effect during construction, but normal vessel management and safety procedures will be implemented to mitigate any safety concerns and minimise disruption.	Chapter 15: Shipping and Navigation for full details.
Recreation	Orkney Sailing club/Orkney Marinas	Visiting yachts do not often use the route in past Cantick although again no hard evidence to support this assumption There are some that will go around Hoy, it would therefore be important to leave an inshore corridor for these yachts/boats Berthing at Lyness is not very safe and only really done for short periods	Further consultation and data analysis has shown that the Project site may seldom be used by recreational yachts. As there are no surface piercing structures as part of the operational Project and access will be available in the inshore area following construction, there are no significant impacts expected on recreational yachts.	Chapter 15: Shipping and Navigation for full details.

Topic	Stakeholder	Comment	Response/Action taken	Section cross-reference
Recreation	Orkney Sailing Club/Orkney Marinas	A pontoon berth at Lyness pier adjacent to the linkspan would allow yachts to visit more safely and not conflict with working pier The site markers and any sea structures should have AIS transmitters to be easily seen	Construction, operation and maintenance requirements will be determined pre-construction and will consider the current use of the port. A Construction Management Plan will be developed and consider options to reduce disruption to other port users as far as practicable.	Chapter 19 Socio-economics.
Recreation	Orkney Sea angling Association	Only use the Project site 3 or 4 times per year and mostly in the near-shore area, outwith the AfL boundary. There may be minor issues when construction vessel on site but acknowledge that navigational notification, lighting, marking etc. would provide sufficient information to avoid area.	Assessed in study.	Section 20.9 and Section 20.12.1.1. ,NRA (Supporting Document: Anatec, 2015)
Tourism	Orkney Tourism Group	Orkney Tourism Group supports this project as we have found that innovation attracts visitors and boosts the local economy. There is a concern that the ferry and timetable will be disrupted.	Consultation with Orkney Ferries has confirmed that additional capacity would be provided to meet demand.	

20.8 ASSESSMENT METHODOLOGY

20.8.1 Assessment Criteria

General EIA methodology is covered within the ES chapter (Chapter 7 EIA Scope and Methodology). There are no standard assessment criteria for recreation and tourism effects. For the purpose of this assessment significance is presented here through the description of specific criteria relating to sensitivity and magnitude which has been developed through consultation with key stakeholders and professional judgement (Table 20.3, Table 20.4 and Table 20.5).

Table 20.3: Definitions for sensitivity of recreation and tourism

Sensitivity	Criteria
High	Area or harbour with high levels of recreational use Harbour with limited capacity for recreational vessels or where the safety of recreational vessels is a concern Onshore recreational site with high use Tourist site of national or international status or high visitor numbers/users
Medium	Area or harbour with moderate levels of recreational use Harbour with some capacity for recreational vessels Onshore recreational site with moderate use Tourist site of regional status or moderate visitor numbers
Low	Area or harbour with low levels of recreational use Harbour with sufficient capacity for recreational vessels Onshore recreational site with low use Tourist site of local status or medium visitor numbers/users
Negligible	Area or harbour with little or no recreational use Onshore recreational site with little or no use Tourist site with few visitor numbers/users

Table 20.4: Definitions for magnitude of effect for recreation and tourism

Sensitivity	Criteria
High	Long-term or permanent obstruction to recreational use Long term of permanent obstruction to tourist site Results in a dramatic change in tourist visits or recreational uses; the number of visitors or users changes by 15% or more as a result of the Project
Medium	An obstacle that creates a nuisance to recreational users that must be avoided Results in a moderate change in tourist visits or recreational uses; the number of visitors or users changes by 5-15%
Low	Short term, temporary obstacle to recreational use that can easily be avoided There is a change in tourism visits or recreational users, but less than 5% and barely noticeable.
Negligible	A noticeable activity that does not create any obstacle or obstruction to recreational users No noticeable change in tourist visits or recreational uses
Positive	Results in an increase in tourist visits or recreational uses

Table 20.5: Assignment of impact significance for recreation and tourism based on sensitivity of receptor and magnitude of effect

Sensitivity of Receptor	Magnitude of effect			
	High	Medium	Low	Negligible
High	*MAJOR*	*MAJOR*	*MODERATE*	*MINOR*
Medium	*MAJOR*	*MODERATE*	*MINOR*	*MINOR*
Low	*MODERATE*	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*
Negligible	*MINOR*	*NEGLIGIBLE*	*NEGLIGIBLE*	*NEGLIGIBLE*

Any impact assessed as moderate or above is considered to be significant under EIA regulations.

20.9 BASELINE DESCRIPTION

20.9.1 Introduction

This baseline assessment presents information about 1) the recreational resources and activities that occur within the Study Area and what is known about the extent of recreational use, and 2) about the primary tourism resources and facilities in the Study Area and their use.

Hoy is Orkney's second largest island with a population of approximately 400, the majority of whom live in the low-lying south of the island around the villages of Lyness and Longhope on South Walls. The island is visited by tourists regularly during the spring and summer months. The 2013 tourism survey indicated the numbers as around 8% of the total visitors which suggests 11425 visitors. 37% (4284) which stayed overnight and 63% (7141) visiting for the day.

There are numerous places of interest, particularly relating to cultural and natural heritage. Formal and informal recreational activities are undertaken both by visiting tourists, residents of mainland Orkney and those residing in the local area.

20.9.2 Onshore Recreation

The scenery, coastline, history and wildlife of Orkney provide a major focus for much of the outdoor recreation in the county. The main types of onshore recreation to occur in the study area along the general coastline and beach may include a number of different activities, including but not limited to walking, beach combing, beach games, rock pooling, kite flying, sunbathing, artwork, picnicking, swimming, dog walking, etc. Although these activities may occur anywhere along the coast, a beach is the usual focus for these activities. Aith Hope is a popular beach spot for locals and the annual Boxing Day swim occurs here. There are also beaches visited by locals and tourists at Kirk Bay and at the Melsetter Dunes.

20.9.2.1 Walking

Walking is popular along the coastline and there are numerous published routes in the study area (see). As part of their role as access authorities, Orkney Islands Council have a specific duty to develop core paths. Core paths within the study area include coastal paths to Tor Ness and around the Brims Ness peninsula, as well as along the southern coast of South Walls (see Figure 20.2). Walks popular with locals include the walk past the Melsetter Dunes to the lighthouse at Tor Ness and continuing on up to The Berry, Brims Ness and The Hill of White Hamars and Snelsetter on South Walls.

The Hoy Ramblers organises more formal walking activities with trekking and rambling days in Hoy on a regular basis.

20.9.3 Offshore Recreation

The waters around Orkney are regularly utilised for various types of recreation; particularly sailing, diving, angling, sea kayaking, surfing, kite boarding, power boating and other boat based activities. Sailing, diving and angling are important contributors to the local economy and draw large numbers of visitors to the islands throughout the year.

20.9.3.1 Piers, Slipways and Anchorages

There are numerous piers and slipways throughout the study area used by those engaged in offshore recreational activities, including piers at Lyness and Longhope, Gibraltar and Sutherland piers on the western side of Flotta, a number of piers in Stromness and at Scrabster. According to local sailors, there are anchorages in Kirk Bay as well as Aith Hope. The Aith Hope anchorage has moorings for local fishing boats in the summer and is also used as an occasional anchorage for yachts crossing the Pentland Firth as it is well sheltered except in southeast winds. Aith Hope also provides a potential shelter for dive boats, however is not considered an important port. Lyness Pier is frequently berthed by at least one dive boat during the summer months during daily diving tours in Scapa Flow (Section 20.7). Piers and anchorages within the Study Area are displayed in Figure 20.3.

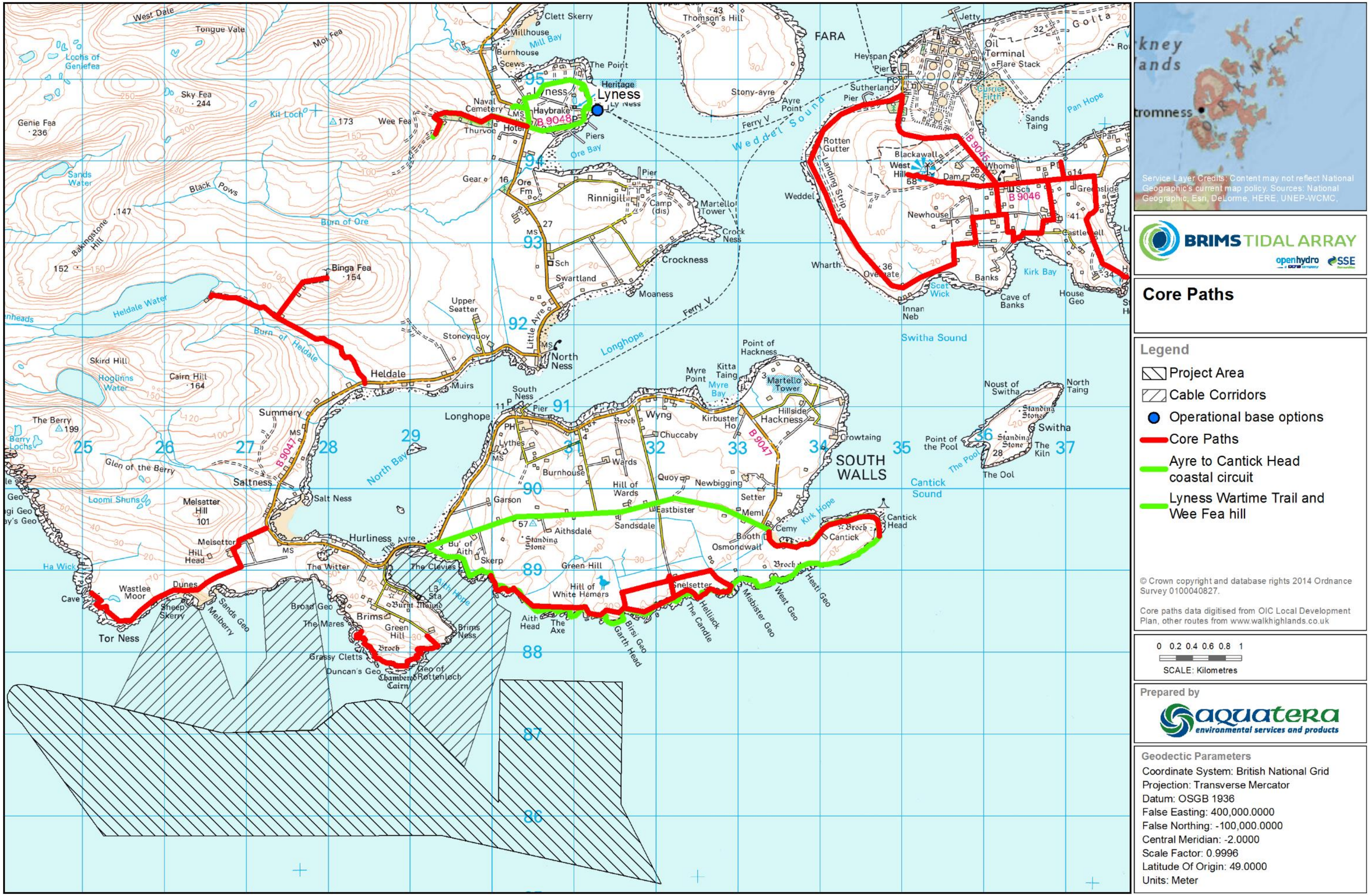

Figure 20.2: Core paths and other walking routes in the Study Area

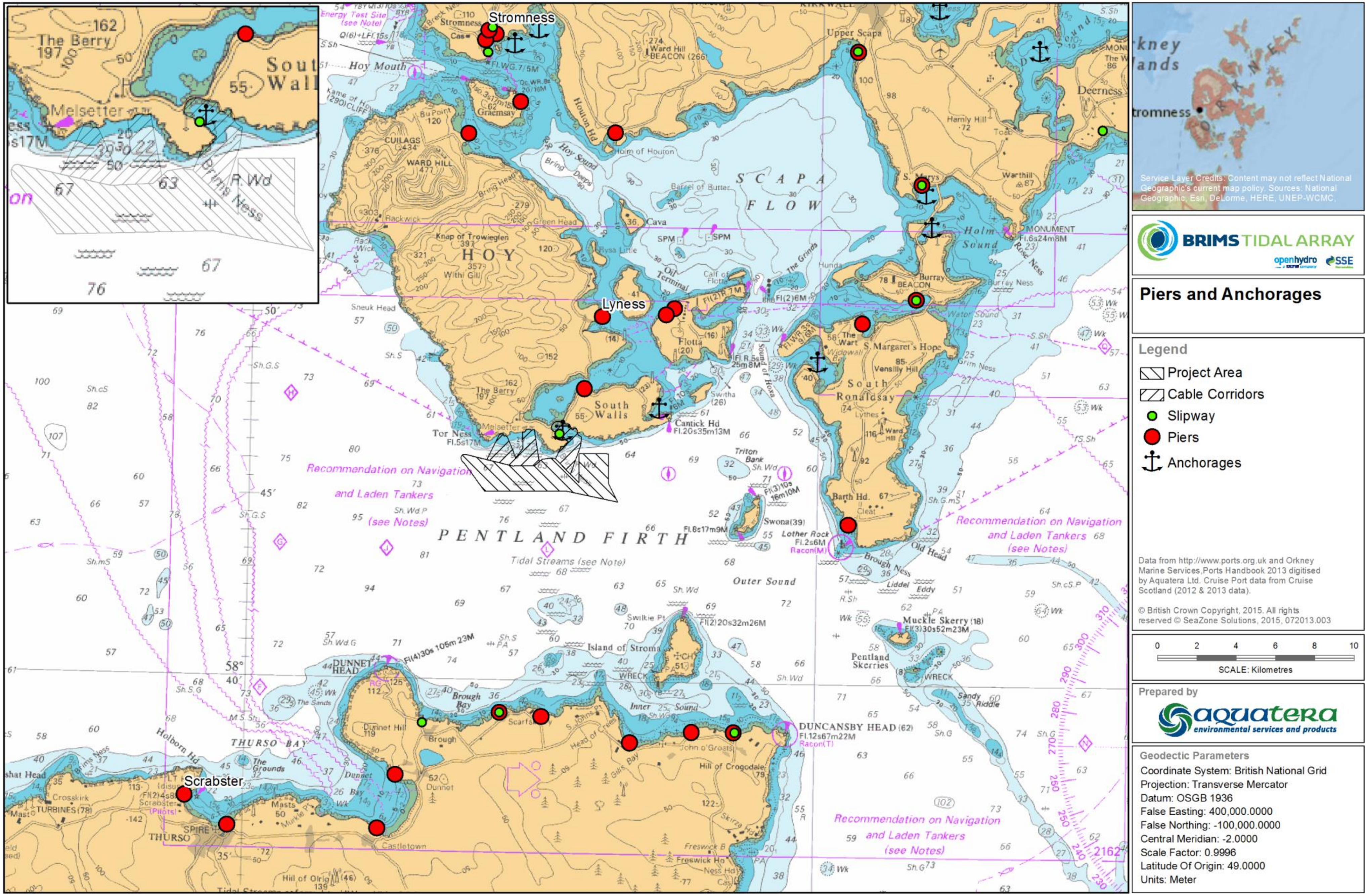

Figure 20.3: Piers, slipways and anchorages in the Study Area

20.9.3.2 Marinas

There are three marinas in Orkney (Kirkwall, Stromness and Westray) and two on the north coast of Scotland (Scrabster and Wick). All are popular with visiting and local boats (particularly yachts) and it is common for vessels to travel between them. The current capacities at each of the three marinas located in Orkney are: 95 berths in Kirkwall; 72 berths in Stromness; and 17 berths in Westray. Wick marina has 70 berths and represents the most northerly marina on the Scottish mainland. The exact capacity of Scrabster harbour for accommodating visiting yachts is unclear.

892 vessels called at the three Orkney marinas, Scrabster harbour and Wick marina in 2011 (Anatec and Halcrow 2012). June and July were generally the busiest months of the year for all five locations. According to data from Orkney Marinas, there has been a slight increase in the number of vessels using the Orkney marinas since 2008. The statistics do not separate out recreational vessels from commercial or semi commercial but a large proportion are recreational.

20.9.3.3 Recreational Boat Activity

The study area is not in an area of high recreational vessel activity (See Chapter 15: Shipping and Navigation). According to RYA data, there is a light recreational cruising route that passes near to the eastern end of the Project site (see Figure 20.4).

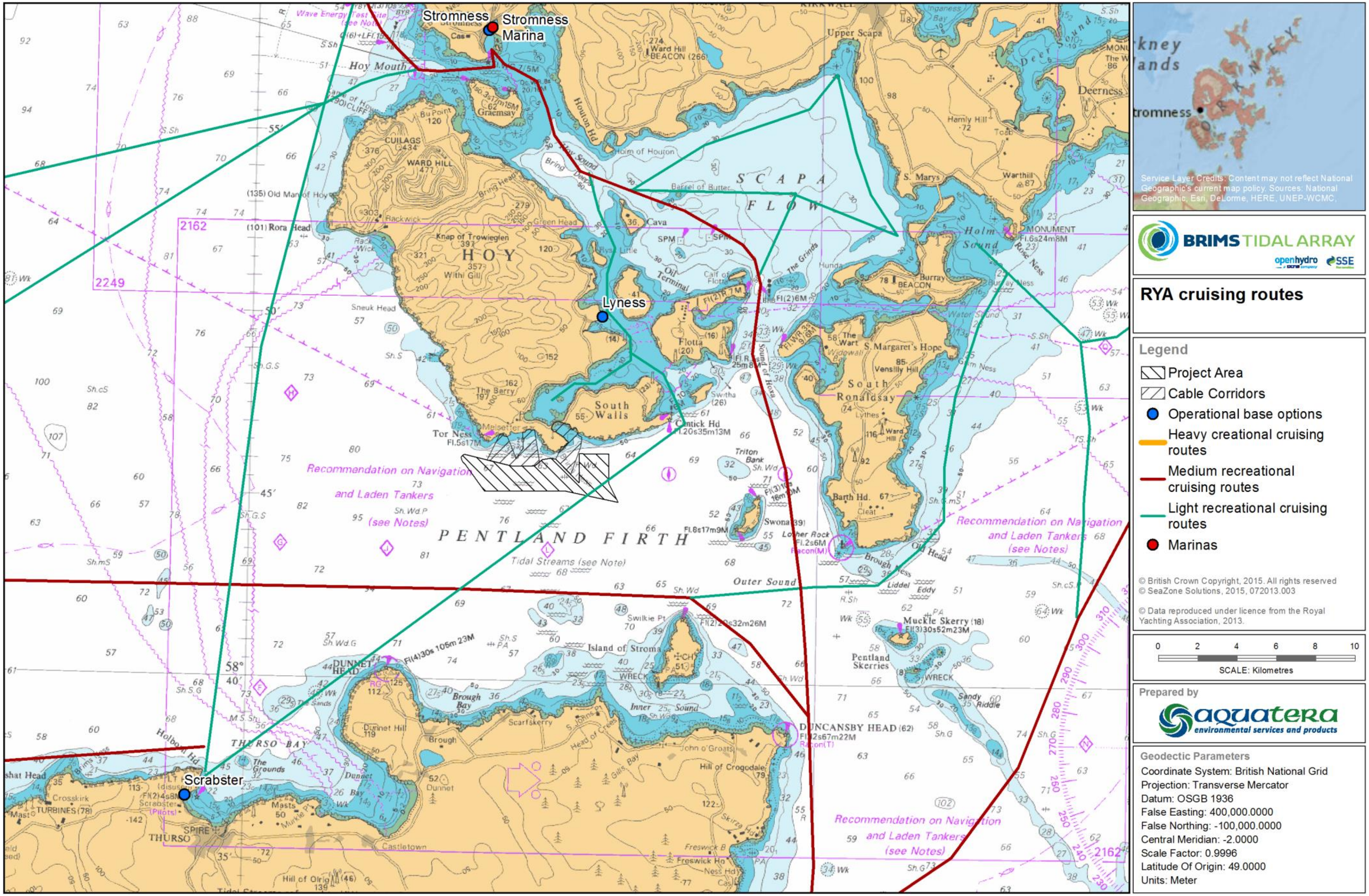

Figure 20.4: Recreational cruising routes (RYA)

Stromness, Scrabster and Lyness are all utilised by recreational sailors. There is a marina in Stromness Harbour (see Section 20.9.3.2). In 2010 and 2011 between 200 and 250 yachts visited this marina. The majority of this use was between May and August (Anatec and Halcrow 2012).

Fewer yachts use Scrabster Harbour, with between 40 and 70 yachts utilising this harbour in 2010 and 2011. Yachts made up 15-20% of non-fishing traffic in Scrabster Harbour during this time period.

According to the Orkney Sailing Club, although there is some recreational use of Lyness pier, berthing at Lyness is not very safe and is only really carried out for short periods (see Figure 20.3).

The Pentland Firth Shipping Study conducted by Marine Scotland (Anatec and Halcrow, 2012) examined AIS data for the Pentland Firth and included available data for recreational vessels. Using this data, Anatec and Halcrow (2012) further characterise RYA recreational vessel routes as lanes rather than centre-lines. These vessel corridors can be seen in Figure 20.5.

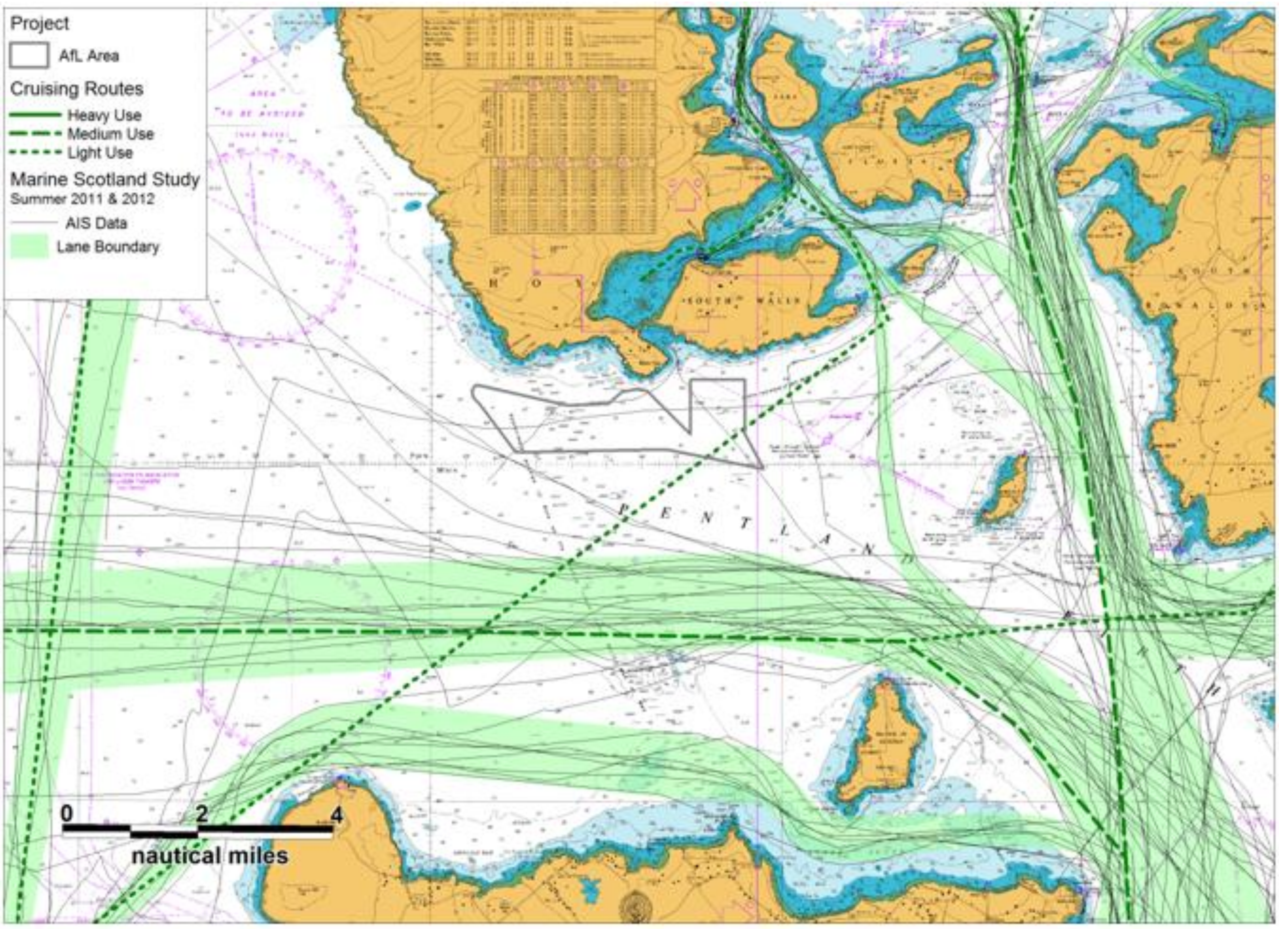

Figure 20.5: Vessel corridors in the study area based on AIS data (from Anatec and Halcrow 2012)

This map offers some insight into actual vessel routes, showing that vessels may deviate considerably from the RYA cruising routes and therefore do not necessarily follow a prescribed route. However the 'Light Use' route within the AfL itself appears not to be used significantly during the study period (Summer 2011 and 2012). It should however be noted that fewer than 20% of recreational sailing vessels visiting the PFOW marinas carried AIS (Anatec and Halcrow, 2012).

There are a number of sailing clubs within the study area including the Longhope Sailing Club, the Stromness Sailing Club and the Pentland Firth Yacht Club. A number of regattas are organised by the various club throughout the summer. The Longhope and Stromness regattas are normally held annually in July.

20.9.3.4 SCUBA Diving

Scuba diving is a popular activity in the Study Area. In particular Scapa Flow is recognised as within the top five dive sites around the world. The scuttled German fleet from the First World War attracts many visitors from all around the world every year. Most recreational diving in Orkney occurs in Scapa Flow around wreck sites. Information provided by Orkney Island Council indicates that Cantick Head, to the east of the AfL area, is a scenic dive site. However, following liaison with local dive boat operators it can be concluded that neither Switha nor Cantick Head have been regularly dived in recent years and the nearest preferred dive spot in the area is off Stranger Head on Flotta. Further consultation with a local operator also confirmed that no recreational diving is likely to take place in the Project site and the ODBA confirm that the majority mainly operate within Scapa Flow (see Figure 20.6). Wrecks and other dive sites in the study area are shown in Figure 20.6.

Figure 20.6: Dive sites in the Study Area

20.9.3.5 Canoeing and Kayaking

Kayaking and canoeing are popular activities in the Study Area, and there are a number of clubs in the region: Orkney Sea Kayaking Association, Kirkwall Kayak Club, Caithness Kayak Club, East Sutherland Kayak Club and the Pentland Canoe Club. It is recognised that sea kayaking and canoeing is generally not limited to any particular locations throughout the Study Area, beyond remaining generally closer to shore for safety reasons. Canoeists and kayakers may use slipways and piers, but are not limited to this infrastructure. It is anticipated that there is very little in the way of kayaking in the vicinity of the AfL area due to local hydrographic conditions and the risks associated with the marine environment in this highly dynamic area. Kayakers may occasionally take trips circumnavigating Hoy, or part of it, which are most likely to take place during summer months and in calm conditions (high pressure, no wind and neap tides). Kayakers would likely navigate close to the coast or may make use of tides further out if conditions enable (Supporting Document: Anatec, 2015).

20.9.3.6 Angling

Recreational angling in the study area includes fishing for cod, pollack, ling and mackerel. Conger eel is fished among the wrecks. Skate is also found in the area and is the target of some chartered fishing. Orkney Islands Sea Angling Association runs sea angling competitions from May to October. They also operate their own boat *MV Welcome Home* which can be hired out.

Consultation with the local Sea Angling Association indicates that the Project site is fished infrequently, only 3-4 times per year, and generally in the near-shore area outside the AfL boundary (Figure 20.1).

There are a number of companies offering boat charters for both fishing and wildlife watching/scenic boat trips. In addition some of the diving boats can be chartered for fishing trips when they are not busy with diving trips.

20.9.4 Tourism

Tourism is a mainstay industry in Orkney employing 1405 people full time in Orkney in 2014 (STEAM report, 2009-2014) (OIC, 2015b). This is approximately 7% of the local workforce in 2014. The Orkney Visitor Survey 2012/13 estimated that there were 142,816 visitors to Orkney during 2012-2013, including holiday visitors, those visiting friends and relatives, and business tourism. Of these 65% were on holiday and the remainder either on business or visiting friends and relatives.

Holiday makers travel to Orkney for a number of reasons, however, by far the most popular reasons for travel was sightseeing or touring (53%) and to enjoy the coastal scenery and beaches.

Orkney also receives visits from a large number of cruise liners throughout the year; in 2014 alone Orkney saw approximately 64,000 cruise liner passengers (OIC Marine Services & OIC, 2015).

In Scotland most tourist activity occurs in the spring and summer months. In 2009 58% of the visitors to Orkney came between July and September.

Hoy is the most visited island, not connected to the Mainland, with 8% of visitors in 2013 travelling to Hoy, and 3% staying overnight (OIC Marine Services & OIC, 2015).

20.9.4.1 Transport

There is an airport located in Kirkwall with daily flights to Aberdeen, Inverness, Edinburgh and Glasgow. These flights to the mainland are offered by Flybe and Loganair operates scheduled services under a Flybe franchise. Flybe also runs a flight to Sumburgh, Shetland, the Fair Isles and Bergen, Norway. In addition they run an inter-island service with flights to Sanday, Westray, Papa Westray, Eday, North Ronaldsay and Stronsay. In 2011/12, 158,616 passengers passed through Kirkwall Airport and in the period of 2012/13 passenger numbers increased by 3.5% to 164,228 (OIC, 2013).

Harbours with ferry services in the study area include:

- Stromness has a daily service to and from Scrabster on the Scottish mainland. In 2012, there were 138,546 passengers recorded on this service (OIC, 2013). There is also a service from Stromness to Graemsay and Moaness in Hoy;
- Houton in Orphir has a daily service to and from Flotta, Lyness and Longhope in Hoy. In 2012, there were 11,314 single passenger journeys to Flotta, and 70,338 to Lyness (OIC, 2013);
- The Pentalina ferry runs between St Margaret's Hope in South Ronaldsay and Gills Bay on the Scottish mainland; and
- Hoy is reached via a passenger ferry from Stromness going to Moaness in North Hoy (19,176 passengers recorded in 2012 (OIC, 2013)), or via a car/passenger ferry travelling between Houton on the Mainland and Lyness on Hoy. Between Stromness and Moaness there are four ferries per day Monday to Friday and two ferries on Saturday and Sunday throughout the year, with an additional sailing on Friday evenings during the summer. Between Houton and Lyness, there are six ferries per day Monday to Friday throughout the year, with an additional three ferries on Saturday. No ferries run on Sunday in the winter, but between May and September there are up to five ferries running on a Sunday.

The Hoy Hopper bus operates from May until September and picks up passengers from Kirkwall Travel Centre for Houton Pier to connect with the ferry to Hoy. There are two minibus taxi services available on the island.

20.9.4.2 Accommodation and Services

According to Orkney Islands Council (2015), overall tourist bed occupancy rates in hotels and bed and breakfasts in Orkney varies from 65% in the peak tourist season, between July and September, to approximately 16% during in December. In comparison the occupancy rates for self-catering accommodation on Orkney range from 75% in the August to 4% in December.

According to the Orkney Tourism Group (2015), there are a total of 355 rooms available in hotels, guesthouses and B&Bs and an additional 484 rooms available in self-catering accommodation on mainland Orkney.

Currently there is one main leasing agent in Orkney. As of 21th August 2015 this leasing agent had six houses available on its books across Orkney none of which were located in Hoy. The leasing agent estimates that 8-10% of the properties on their books at any one time are leased to contractors working on the island. Other leasing options are regularly available throughout Orkney through estate agents and private landlords.

There are two hotels on Hoy (Hoy Hotel at Lyness (1 Single plus 4 twins) and Stromabank at Longhope (2 doubles plus 2 twins, with a pavilion building of another 2 doubles and 1 twin), several B&Bs (Quoydale at Moaness and Wild Heather at

Lyness), self-catering cottages (around 10-12), Rackwick bothy, Hoy Centre hostel in north Hoy (sleeps 32) and Rackwick Hostel (sleeps 8).

On Hoy there are options of bar and dining at five venues: the Hoy Hotel, Lyness; the Royal Hotel, Longhope; the Scapa Flow Museum, Lyness; the Stromabank Hotel, Longhope; and Beneth'ill Café, Moaness, some of which have seasonal availability.

20.9.4.3 Tourist Sites and Events

The main tourist destinations on Hoy are shown on Figure 20.7. There are a number of tourist attractions on Hoy, including the popular walking and climbing destinations of The Old Man of Hoy and St. John's Head and Rackwick Beach on North Hoy. Attractions on the southern half of the island and South Walls include the following:

- Scapa Flow Visitor Centre and Museum - Located near the Lyness ferry terminal, the museum is centred around the former fuel oil pumping station at Lyness Naval Base and illustrates the importance of Scapa Flow as a base for the British fleet throughout history. The museum is open March - October and admission is free and there is a café on site open from Easter-October. There are no berths set aside for recreational craft at Lyness; however is used, such as by local dive boat operators;
- Lyness Naval Cemetery – Located near Lyness pier, the final resting place of heroes from some of the most famous incidents in modern naval history – the Battle of Jutland (1916); HMS Hampshire sunk by a mine off Birsay (1916); explosion of the Vanguard off Flotta (1917) and the Royal Oak torpedoed in Scapa Flow (1939);
- Martello Towers and Longhope Battery - Two towers, constructed between 1813 and 1815 and built as protection for the Baltic convoys. They were renovated in 1866 and were used during World War I. The only close anchorage is in Kirk Bay or by berthing at Longhope followed by a two mile walk;
- Longhope Lifeboat Station Museum: Situated at Brims in South Walls, Longhope Lifeboat station opened in 1834. It was from here that the Longhope lifeboat left on its fatal voyage. The lifeboat station has been converted to a museum;
- The current lifeboat station, established in 1874, is located at Longhope and during the summer months a shop run by the Longhope Lifeboat Guild is open Wed, Thurs & Friday;
- Cantick Head is a headland at the end of the Walls peninsula to the east of the Project site. Cantick Head Lighthouse, cottages and buildings are Grade B listed and of architectural and historical interest. The viewpoint outside the lighthouse is an attraction for both visitors and locals with sea and landscape views to the surrounding isles to the south and a spot known for sighting marine and bird wildlife. First lit in 1858 it was built by David Stevenson to mark the southern entrance to Scapa Flow;
- Melsetter House is a private home overlooking the bay of Longhope. The current house was renovated in the late 1890's, incorporating an earlier property dating back to at least the 16th Century, by the famous architect William Richard Lethaby. The house, chapel and gardens are of historical interest and open to visitors by appointment and can be reached from Longhope or by anchoring and taking the dinghy to North Bay.;
- Wee Fea Viewpoint offers a panorama of the South Isles; and
- Hill of White Hamars Scottish Wildlife Trust Reserve and working sheep farm extends over approximately 1.7km along the shoreline from the east of Helliack to the west of Rise Geo and 1km inland. The reserve is noted for its scenery, attractive coastal cliffs and coastal geological features and opportunities to see cliff-nesting seabirds and a range of wild flowers in spring, including the endangered Scottish primrose.

Figure 20.7: Tourist destinations in the Study Area

Outside of Hoy, but within the Project site are the following sites of interest:

- The Italian Chapel located in Lamb Holm which may be reached by anchoring or going alongside in St Mary's Bay and take the dinghy over to Lamb Holm; and
- Stromness with a number of tourist sites including the Ness Battery, the Stromness Museum and the town of Stromness itself going back to the 16th Century. Stromness marina provides access to all of these.

Some key events taking place on Hoy include the following:

- Gable End Theatre: The Gable End is a 75-seat community theatre, hosting plays, live music events and other entertainment throughout the year;
- Hoy half marathon in June every year (attracts around 200 runners each year);
- Longhope Regatta held on a Saturday in July; and
- Longhope Triathlon – has been held the last two years in September.

In 2015, there were a number of tour guides advertising tour services in Hoy, including:

- Explore Orkney (http://www.exploreorkney.com/index.php);
- Orkney Uncovered (http://orkneyuncovered.co.uk);
- Odin Tours (http://www.odintoursoforkney.com);
- Orkney Tailor-made Tours (http://orkney-tailor-made-tours.co.uk);
- Orkney Archaeology Tours (http://www.orkneyarchaeologytours.co.uk); and
- Orkney Aspects Tour Guide (http://www.orkneyaspects.co.uk).

20.9.5 Summary

Popular recreational activities within the Project site include both onshore recreation such as walking, with several coastal paths in the Project vicinity, and offshore activities especially sailing and diving. There are some sailing routes passing near to the Project site, and piers at Lyness and Scrabster may be used for recreational boats. There is a marina in Stromness.

Tourism is a mainstay of the Orkney economy and Hoy is the most visited island after mainland Orkney. There are two ferry services to Hoy, a passenger ferry between Stromness and Moaness, and a Roro ferry between Houton and Lyness. There are also a number of popular tourist attractions on Hoy, including the Scapa Flow Visitor Centre at Lyness and the Longhope Lifeboat museum at Brims Ness.

There are a number of accommodation providers on Orkney providing hotel, bed and breakfast and self-catering accommodation providing more than 800 rooms. During the summer months, the occupancy rate of this accommodation is around 65%.

20.10 POTENTIAL IMPACTS

The potential impacts identified for each phase of the Project are:

20.10.1 Construction and Installation

20.10.1.1 Recreation

- Disruption or severance to offshore recreation during construction activities; and
- Disruption to onshore recreation during construction works.

20.10.1.2 Tourism

- Industrialisation of the local seascape reducing tourists' visual amenity during construction works;
- Disruption to tourism activities during construction works; and
- Increased pressure on local temporary accommodation during construction and installation activities.

20.10.2 Operation and Maintenance

20.10.2.1 Recreation

- Disruption or severance to offshore recreation during operation or maintenance activities.

20.10.2.2 Tourism

- Additional topic of interest creating a new draw for tourists.

20.10.3 Decommissioning

Impacts during commissioning are expected to be similar to those occurring during construction of the array, or to have less of an impact as a result of mitigation measures implemented as part of Project construction.

20.11 MITIGATION MEASURES

20.11.1 Project Design Mitigation and General Mitigation

The Project design envelope has been evolving throughout project development and the consultation process. Since the Project Briefing Document (PBD) was issued the AfL area has shifted west from a key shipping channel, which includes an important route for recreational boating traffic and passenger ferries, to reduce potential disruption or risks to vessel navigating between the Pentland Firth and Scapa Flow.

The Project design envelope has been defined to remove floating devices and surface piercing electrical hubs to reduce potential disruption to navigation and has been particularly important in mitigating potential impacts to recreational craft, especially sailing craft that have limited control. Furthermore, devices have been selected that will maintain under keel clearance to ensure safe transit of the area when the Project becomes operational.

These mitigation measures are discussed in greater detail in the NRA (Supporting Document: Anatec, 2015). All Project Design and General Mitigation measures are set out in Chapter 5 Project Description Table 5.15 and 5.16 respectively

These are standard practice measures based on specific legislation, regulations, standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur.

20.11.2 Specific Mitigation

The following mitigation measures will be implemented specifically to minimise the impacts on tourism and recreation (Table 20.6).

Table 20.6: Specific mitigation measures for recreation and tourism

Ref	Mitigation Measure Description
RT01	As part of BTALs proposed community commitment initiatives there may be opportunities to provide a permanent display or public information boards which would provide information about the Project to local communities and visitors to the area. This could have a positive impact on local tourism by encouraging people to visit the area to learn about the Project.
RT02	There may be dedicated accommodation provided for construction workers in order to reduce added pressure on local residential and tourist accommodation.
RT03	In order to minimise impacts to any walking routes, including the core path network, during construction access to and along the core paths will be maintained along the construction corridor using diversions where required. Consultation with key stakeholders will be continued during the detailed design phase to ensure that all are up to date on any diversion that may be put in place in relation to existing paths.
RT04	The contractor will adopt Best Practicable Means, as defined in Section 72 of the Control of Pollution Act 1974 as a means of controlling noise from construction sites.
RT05	BTAL will consult with local ferry operators and an additional ferry service would be added for construction traffic to ease congestion on local and tourist traffic if required.

20.12 RESIDUAL EFFECTS

20.12.1 Construction and Installation

20.12.1.1 Disruption or Severance to Offshore Recreation during Construction Activities

The construction period for the installation of all devices may last for a period of up to four years. The duration of export cable laying and landfall activities for Stage 1 is expected to be relatively short, with a maximum of approximately three weeks; while Stage 2 cable laying activities are expected to be carried out within up to 12 weeks. The export cable may be routed from the AfL area to a landfall location at one or more of up to three locations: Sheep Skerry, Moodies Eddie or Aith Hope. Potential bases for construction vessels include Lyness, Stromness and Scrabster in the Study Area.

Offshore recreational users that could potentially be impacted by these construction works, through disruption to activities and restricted access to piers, include local and visiting sailing boats, local dive boat operators, local recreational angling vessels and local or visiting canoers and kayakers.

Piers, Slipways and Anchorages

There is little recreational activity based out of Lyness Harbour. The Scapa Flow Museum is a destination visited by yachts and dive boats berth at Lyness. However, berthing at Lyness is not very safe and only done for short periods. Although the harbour is little used by recreational boats, given that there is limited space and an issue of safety for recreational boats, it is considered to be of medium sensitivity. The impact of construction on the level of activity at Lyness Harbour would be a medium magnitude of change, particularly during Stage 2. It is likely that this level of activity would result in less use of Lyness harbour by recreational boats, and possibly avoidance for the duration of construction.

There is little recreational activity based at Scrabster, as this port has high use as a commercial harbour and there is no dedicated recreational marina. There would be a moderate level of change in levels of activity within this busy harbour, particularly during Stage 2. Additional commercial use of Scrabster Harbour would not have a significant effect on recreational users as this is already a highly commercial harbour with this infrastructure required to maintain this commercial activity. There are also plans for potential expansion at this port to support marine energy development (see Chapter 19 Socio-economics). Therefore, there are not expected to be any significant impacts on recreational activities if the Scrabster harbour option is chosen for the Project and is considered to be of low sensitivity.

Commercial diving boats operating within the Study Area are based in Stromness Harbour and at the marina in Stromness Harbour. Because there is high recreational activity from all recreational crafts at Stromness Harbour, recreational use of this harbour is considered to be of high sensitivity. However, there is a dedicated dock (Copeland's Dock) for marine renewables activity in Stromness where Project activity could be based. Therefore, there would not be any conflicts anticipated with use of pier space, thus low sensitivity, and any impacts would be limited to increased traffic within the harbour (assessed in the NRA). Activity during Stage 1 of the Project is considered to result in a moderate increase on current activity levels; however activity during Stage 2 would have result in a large increase. This would be managed by the harbour master to ensure that conflicts were avoided.

As part of the Marine Licence, a navigation safety plan and vessel management plan will be prepared and agreed with stakeholders. This plan will address potential impacts of navigation between ports and the Project site and address mitigation where needed (See Chapter 15: Shipping and Navigation for reference). Other measures will include those to avoid or reduce disturbance to other harbour users, issuing prior notification of activities, and in particular, most piers used by recreational craft are likely to be unsuitable and avoided. The impact magnitude is therefore assessed as low and overall impact on recreational users of piers, slipways and anchorages is concluded to be minor.

Recreational Boat Activity

Navigational data and feedback received through consultation with stakeholders for the NRA (See Chapter 15: Shipping and Navigation and NRA Supporting Document) indicate that the Project site itself is not within an area of high recreational use. Strong tidal conditions in the area deter many recreational users. According to the RYA, there is a sailing route classified as light recreational use that passes through the south eastern corner of the Project site. However it is recognised that the nature of routes taken by sailing boats and any other recreational users is highly variable and dependent on factors including tide, swell and wind conditions. Recent port developments at Scrabster and increased recreational interest in the waters to the north west of Scotland may result in increased use of this route in the future, particularly in conditions of deteriorating weather (RYA, Scoping Opinion (2013) in Section 20.7).

According to Orkney Sailing Club, some yachts will circumnavigate Hoy, particularly during summer months and generally within the near-shore area. Construction activities could lead to disruption of such activity if there are obstacles to navigation between the array and the land during construction. The main potential for conflicts would be during the installation of the export cables and construction of the landfall. Consultation for the NRA concludes that such vessel activity is relatively low overall.

Due to the short duration of export cable laying and landfall construction activities which will be taking place during favourable weather conditions, and the ability of boats to manoeuvre around obstructions, it is unlikely that the cable laying and landfall construction will cause significant disturbance to sailing activity during Stage 1. The potential disruption to offshore recreation is somewhat longer. However, it is still the case that the cable laying would most likely be taking place during favourable weather conditions and therefore recreational craft should be able to safely navigate the area (discussed in greater detail in Chapter 15: Shipping and Navigation and the NRA). Installation of the devices will result in an obstruction for recreational boaters in the AfL, however this area is expected to have even lower use than the near-shore area and will therefore result in a negligible disruption to activities.

SCUBA Diving

Consultation with local diving companies indicates that although there are some diving sites near the Project site, none have been regularly dived in recent years and the nearest preferred dive spot in the area is off Stanger Head on Flotta. Further consultation with a local operator also confirmed that no recreational diving is likely to take place in the Project site and the ODBA confirm that the majority mainly operate within Scapa Flow. The sensitivity of recreational diving to disruption within the Project site during construction activities is considered negligible due to the absence of diving in this area.

At least one known dive boat operator may make use of the local pier at Lyness during the summer months, which is believed to currently have limited availability. The impact on the local harbour infrastructure is assessed in Chapter 19 Socio-economics and concludes an overall positive effect as there will likely be plans to develop ports and other facilities for the Project if necessary. Mitigation includes measures to avoid disruption to other harbour users and notification of intended construction activities and duration (Mitigation measure GM07 Table 5.16.).

Canoeing and Kayaking

It is anticipated that there is very little in the way of kayaking in the vicinity of the AfL area due to local hydrographic conditions and the risks associated with the marine environment in this highly dynamic area and only occasional activity expected in the near-shore area. Sensitivity of these recreational activities is therefore considered to be negligible.

Disturbance to such activity is likely to be of greatest magnitude during the installation of the export cables to the landfall area, which will likely be of low magnitude given the short-term obstacle that this activity would incur. Mitigation will include notification of construction activities and clear navigational marking to enable safe passage of the construction area.

Angling

Consultation with local recreational angling interests confirms that the Project site is unlikely to be fished and particularly not within the AfL. Any disruption to fishing activity during the laying of export cables to the landfall construction area is likely to be highly localised and temporary in nature. The sensitivity of angling activities is therefore considered negligible and magnitude of change assessed as low. Prior notification of construction activities will be circulated to mitigate disruption to sea anglers.

Noise Disturbance

The proposed construction timetable for Stage 1 is expected to last two years and for Stage 2, up to four years (subject to available weather windows). Any offshore recreational activities through the area would be transient, and any recreational vessels would not be expected to be within the range of noise from the Project for a significant duration. Furthermore, noise levels are not expected to be significant given that no pile driving activities are proposed within the Project envelope.

Any disturbance would be short-term, temporary and of minor magnitude, so that construction activities will not result in any significant noise disturbance.

Summary

The overall level of offshore recreational activity within the Project site is considered to be relatively low in comparison to the wider Study Area and the main use being for recreational crafts transiting the Project site; therefore is of low sensitivity. Most activity in the area is likely to be restricted to the near-shore area and not within the AfL area. Disruption to such activity is expected to be temporary in duration, resulting in temporary displacement from the area or as an obstacle to navigation that can be avoided, and consequently an impact of low magnitude. The overall significance of impact is therefore assessed as negligible.

20.12.1.2 Disruption to Onshore Recreation during Cable Construction Works

The proposed construction timetable for Stage 1 is expected to last two years and for Stage 2, up to four years (subject to available weather windows). The main interaction as a result of project construction activities is likely to result in disturbance to onshore recreation.

There are walking routes on land near the Project site, in particular, along the coast at Tor Ness, Brims Ness and Aith Head. These are core paths designated by OIC, and as such are considered to be of local value. There is a beach at Sheep Skerry, this area is accessed through private land and although it receives some recreational use, it is relatively low. There is a popular local beach at Aith Hope, which is frequently used by locals for general recreational activities. In addition, Aith Hope to Cantick Head walking route is accessed from the east side of Aith Hope. These areas are considered to have low to medium sensitivity to disruption.

There is the potential for construction noise to be heard by walkers on these routes or when using the local beaches, and therefore to create a nuisance to this recreational activity. It is also a possibility that the activity associated with the construction, including noise, will attract recreational users to these areas. Nevertheless, the worst case considers that noise creates a nuisance and that fewer people use these paths or beaches as a result. However, any disturbance would be short-term and temporary, so that impacts are expected to be low in magnitude.

This impact will have a minor significance due to the low number of people that will use the walking route past the construction sites and limited noise levels anticipated. Noise management measures proposed will ensure that this impact remains low.

20.12.1.3 Industrialisation of the Local Seascape Reducing Tourists' Visual Amenity during Construction Works

The worst case scenario considers that there is a potential for reduction in tourism as a result of the reduced visual amenity during construction including cable landfall construction works. However, assessment of this impact (Chapter 17: Seascape, Landscape and Visual Impact Assessment) has shown that this is unlikely to be a significant impact. It is also possible that there could be an increase in visitors to the island as a result of the Project construction. The impact of industrialisation of the landscape on tourists' visual amenity is therefore not assessed further in this section.

20.12.1.4 Disruption to Tourism Activities during Construction Works

Potential disruption to tourism activities during construction works could occur during landfall installation activities which are not considered in this offshore assessment and are therefore scoped out. Disruption to the use of piers and anchorages for recreational (and tourism) purposes is discussed in Section 20.12.1.1.

20.12.1.5 Increased Pressure on Local Temporary Accommodation during Construction and Installation Activities

It is not known how large the construction work force will be, however it is anticipated that during construction there could be nearly 200 construction workers during Stage 1 and more than 1,000 construction workers during Stage 2 (See Chapter 19: Socio-economics). This workforce would reside in the area for up to two years for Stage 1 of the Project and up to four years for Stage 2. While existing available accommodation may be able to house up to 200 additional workers, this would reduce availability of tourist accommodation and potentially significantly impact tourist numbers in Orkney or Thurso/Scrabster. There is currently not sufficient existing capacity for more than 1,000 additional construction workers expected for Phase 2. However it is likely that many of the workforce would live on the construction vessels and would therefore only require port facilities for berthing overnight.

BTAL will liaise with Orkney Islands Council during the detailed design phase in order to discuss and agree the best approach to be taken to accommodate workers. As a result, use of existing accommodation would be limited to short-term visits by a limited number of staff not based at the site, and pressure on existing tourist accommodation is not expected to be significant.

This impact will have some effect due to the numbers involved. However some of the workers are likely to be local residents, which will decrease the pressure on local facilities. During operation and maintenance activities there may again be some pressure on local accommodation at the height of the tourist season but number of workers are likely to be negligible in comparison with some workers potentially being permanently located in the area or based on maintenance vessels. The sensitivity and magnitude are considered low giving a negligible significance.

20.12.2 Operation and Maintenance

20.12.2.1 Disruption or Severance to Offshore Recreation during Operation or Maintenance Activities

Although the array will be marked on charts there will be no exclusion zone for recreational boats, and recreational boats will be able to traverse the area of the tidal array. The turbines will be controlled remotely via an onshore control system. Therefore, there are not expected to be any impacts on recreation as a result of the presence or operation of the array.

It is likely that vessels involved in maintenance activities will be present in the AfL area throughout the year. On average this is expected to be one vessel per day. However, there may be periods when there are more vessels e.g. two or three or no vessels depending on weather conditions and extent/type of maintenance works required. Impacts on recreation as a result of maintenance activities are therefore expected to be similar to those occurring during construction, although there will be fewer vessels at one time, and the activity will be spread out over the 25 year period. This is not expected to result in any disruption outside of what recreationists experience as a result of normal vessel traffic, and therefore no impacts are anticipated.

20.12.2.2 Additional Topic of Interest Creating a New Draw for Tourists

It is likely that the site will act as a topic of interest for tourists in Hoy, creating an added influx or tourism to the area. No tourist sites are expected to have any restricted access as a result of operation or maintenance activities for the array.

Once the Project is operational, there will be little evidence of its presence outside of the occasional maintenance activity. However, the Orkney Tourism Group believes that the Project could have a benefit on the community as they have found that innovation attracts visitors a well as boosts the local economy. As a further benefit, BTAL would develop public information boards describing the Project, possibly located near the Brims Lifeboat Museum or at Lyness Harbour.

Table 20.7 provides a summary of residual effects.

Table 20.7: Summary of residual effects on tourism and recreation

Impact	Receptor	Sensitivity	Mitigation	Residual Magnitude	Summary	Residual Significance
Disruption or severance to offshore recreation during construction activities	Offshore recreational use of the Project site	Low	GM07, GM01 Vessel management and communication	Low	Small numbers of vessels may need to avoid area	Negligible
	Stromness harbour	Low	Harbour management and planning	Low	Recreational vessel will need to avoid Copland's dock during busy times	Negligible
	Lyness harbour	Medium	Harbour management and planning	Low	Some vessels will need to plan ahead for visits to ensure space	Minor
	Scrabster harbour	Low	Harbour management and planning	Low	Some vessels will need to plan ahead for visits to ensure space	Negligible
Increased pressure on existing local temporary accommodation	Local temporary accommodation	High	RT02 Construction base to be used for majority of accommodation	Negligible	Some minor disruption may be noticed during height of tourist season	Minor

Impact	Receptor	Sensitivity	Mitigation	Residual Magnitude	Summary	Residual Significance
Disruption tor severance to offshore recreation during operation and maintenance	Offshore recreational use of the Project site	Low	Vessel management and communication	Low	There is minimal use of this area	Negligible
Development creating new draw for tourists	Tourism	n/a	RT01 Information boards.	Positive	A growing number of visitors are interested in seeing renewable projects	Benefit

20.13 ACCIDENTAL AND UNPLANNED EVENTS

Any accidental or unplanned events likely to impact recreation and tourismare likely to be focused around unintended impacts to navigation and are discussed in Chapter 15 Shipping and Navigation and the NRA.

20.14 SUMMARY

- Recreational activity in the Project site is relatively low compared to the wider Study Area. The area has limited recreational appeal due to the harsh nature of the site for any sporting activity and the more dramatic coast lines within the study area.
- Impacts on offshore recreational activity are likely to be limited to the construction phases of the Project and are considered low. There may be some exclusions during the construction phase of the operation that would require recreational vessels to avoid the site but due to the limited numbers of vessels that this will affect the impact will be negligible.
- Impacts on onshore recreational activity is likely to be limited to noise during the construction phase, however this is expected to be minor or negligible due to the low noise levels anticipated, temporary nature and low recreational use of the coastal area.
- There may be some localised pressure on temporary accommodation services however it is anticipated that additional accommodation will be provided offshore or on vessels for construction workers, therefore the impact significance is considered to be minor.
- The Project may have an overall positive effect on tourism, as an additional topic of interest and the Project could have a benefit on the community as innovation attracts visitors a well as boosts the local economy.

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Overview of Onshore Impacts

Chapter 21

21 OVERVIEW OF ONSHORE IMPACTS

21.1 INTRODUCTION

This chapter has been prepared to provide further information on the onshore components of the Brims Tidal Array Project (the Project), which will be the subject of a separate planning process and associated Environmental Impact Assessment (EIA). These onshore components include the export cable(s) landfall (above MLWS, underground cable (from landfall to a local substation) and the substation.

Although the location and specific design of the onshore components are still to be finalised, based on work undertaken to date it is possible to provide a high level indication of the potential impacts that are likely to require more detailed assessment as part of the onshore components EIA.

Any wider grid reinforcement works needed to connect the Project to the existing grid will be the responsibility of the transmission system operator Scottish Hydro Electric Transmission Limited (SHE-T). Within this chapter, an overview of the current status of wider network reinforcement works is provided. These works are not considered as part of the onshore components; however they are discussed here as the Project is one of those supported by these infrastructure upgrades.

21.2 CONSENTING STRATEGY

In this application, BTAL is applying for both Marine Licence and Section 36 consents through Marine Scotland, and is providing a robust ES which fully satisfies the EIA Regulations for such an application for the offshore components up to MHWS. This ES arises out of a full EIA of the following components:

- All offshore aspects of the Project including tidal turbines and turbine support structures;
- Electrical infrastructure - inter-array and export cables, and subsea cable connection hubs; and
- Landfall for export cables (up to Mean High Water Springs (MHWS)).

In addition to the components described above, onshore infrastructure landward of the export cable landfall will also be required to connect the Project to the electricity transmission network. This will comprise:

Onshore Project Works

- Cable landfall above Mean Low Water Springs (MLWS), and transition pit;
- Onshore underground cable route;
- Temporary works including construction compound(s) and laydown areas to facilitate landfall works;
- Possible road access improvements; and
- Onshore substation.

Network reinforcement works will also be required to connect the Project to the electricity transmission network. These will be the responsibility of SHE-T. Section 1.6 discusses the consenting strategy for the offshore and onshore components of the Project.

At this stage in the consenting process, as the grid connection point is still to be confirmed (see section 21.4), it has not been possible to progress the design of the onshore components in sufficient detail to enable a full EIA to be carried out. Once the grid connection point has been confirmed, the planning and associated EIA will be progressed for the onshore components identified above (see Section 21.6). Planning permission for these onshore components will be sought through OIC, under the Town and Country Planning (Scotland) Act 1997.

Further information on the policy and legislation underpinning the offshore and onshore components is available in Chapter 3 Policy and Legislation.

21.3 ONSHORE COMPONENTS

The planning application for the onshore comonents will be supported by a full EIA and will take into account (as appropriate) environmental impacts of both the offshore (as presented in this ES) and onshore components of the Project, including:

- Cable landfall above Mean Low Water Springs (MLWS), and transition pit;
- Onshore underground cable route, from the landfall point of the tidal arrays export cables to the SHE-T substation;
- Temporary works including temporary compound and laydown areas to facilitate the cable landfall works;
- Possible road access improvements; and
- Onshore substation

21.4 WIDER TRANSMISSION NETWORK REINFORCEMENTS

BTAL have received a grid connection offer from National Grid; under the terms of this offer the connection point for the Project will be at a new 132/33kV substation on South Hoy or South Walls. On behalf of National Grid, SHE-T is currently undertaking design studies for infrastructure to upgrade the electricity transmission connection between Orkney and the UK network. An initial design for this upgrade involved a subsea connection to the Bay of Skaill on mainland Orkney, with a circuit serving renewable generation throughout the islands, including a connection point for the Project.

Due to recent changes in the location and scale of generation projects across Orkney, SHE-T has been undertaking a re-design process to better suit the current demand. The grid connection point and design of the grid reinforcement works associated with the Project are being reviewed as part of this process. These network reinforcement works will be subject to a full stakeholder consultation, environmental impact assessment and planning permission process at the appropriate time.

BTAL are not directly involved in the design and planning aspects of the wider network reinforcements. It is not possible for BTAL to attempt a meaningful assessment of this proposed infrastructure as a development for cumulative impact purposes and BTAL has not sought to do so. This is the responsibility of SHE-T.

21.5 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

A full EIA will be undertaken for the onshore components of the Project, with appropriate documentation prepared in accordance with the relevant EIA and planning legislation. Information on the scope of the onshore EIA was included in the Brims Tidal Array Environmental Scoping Report (Supporting Document: BTAL, 2013) and the Scoping Opinion received from MS-LOT (Supporting Document: MS-LOT, 2014). This scope will be defined in more detail through further consultation with OIC, Marine Scotland and other key stakeholders.

21.6 HABITATS REGULATIONS APPRAISAL (HRA)

In line with the requirements of the Habitats Directive, the onshore components will also be screened as part of the HRA process to determine whether the onshore components of the Project are likely to have an adverse effect on the integrity of a Natura 2000 site and therefore are subject to an Appropriate Assessment.

21.7 DEVELOPMENT OF THE ONSHORE PROJECT

The location and design of the onshore components will be informed through consultation with SHE-T during the current design process for the wider network reinforcements. Since the initiation of the Project, BTAL have been in discussion with SHE-T regarding the onward transmission network reinforcements and the potential location of infrastructure required to connect the Project to the network.

Based on the initial discussions with SHE-T and relevant stakeholders, a desk-based study of constraints close to the proposed cable landfall locations and ecological surveys carried out in 2012, an onshore cable area of search was defined (Figure 21.1). Please see the Scoping Report (Supporting Document: BTAL, 2013).

Through the studies undertaken in preparation of the Offshore ES, a further potential landfall location was identified at Sheep Skerry (Figure 21.2). An onshore cable corridor area of search from this new landfall location will be defined during development of the onshore components.

The offshore ES includes an assessment of impacts at the landfall locations up to MHWS (as shown in Figure 21.2). Through the studies undertaken in the preparation of the offshore ES, information on the baseline environment of the onshore area was obtained for a number of topic areas. Once the location of the onshore substation has been confirmed, this information will be used to inform the design and scope of the EIA for the onshore components, which will include further consultation with relevant stakeholders (see Section 21.10 below).

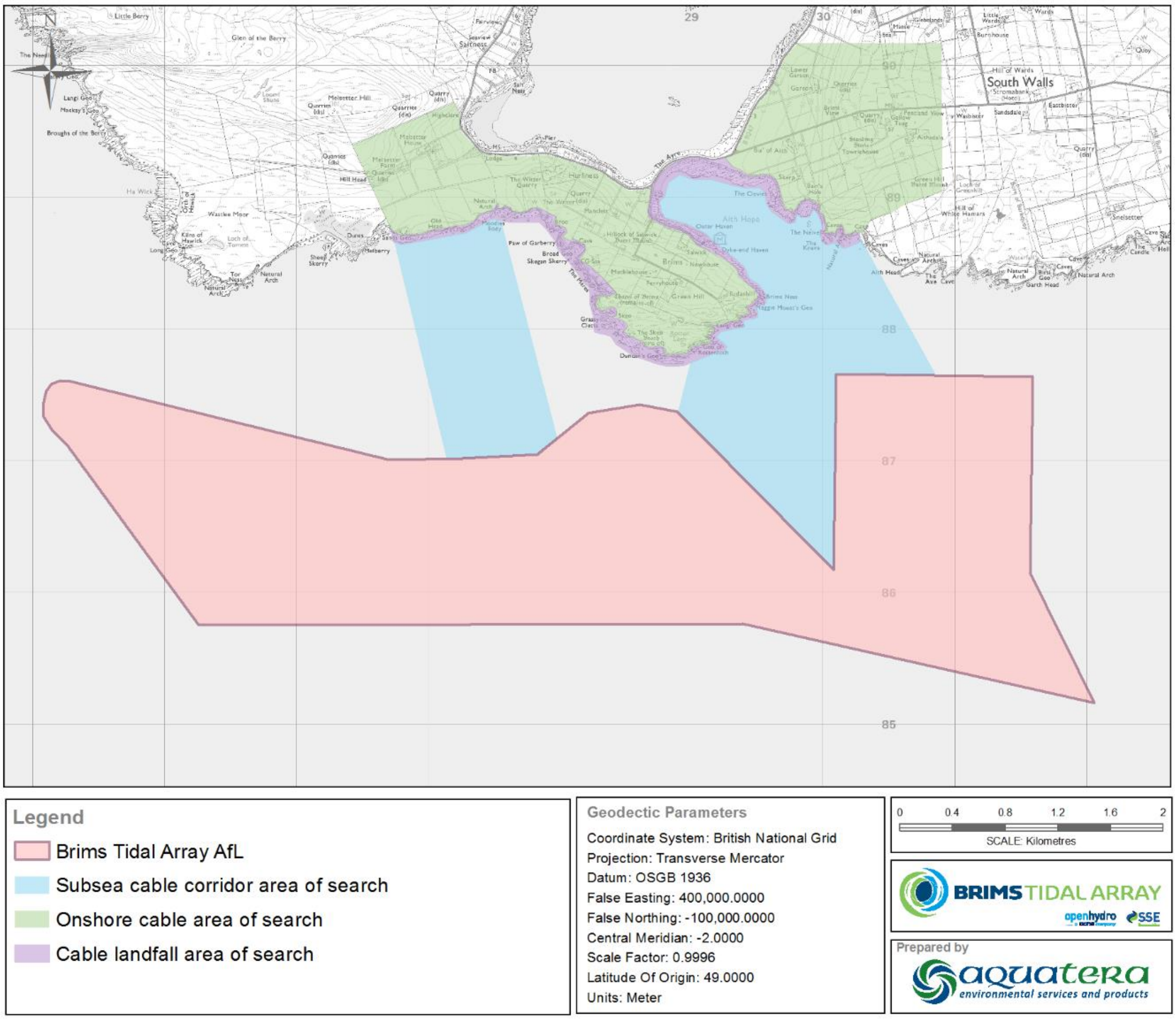

Figure 21.1: AfL Area including onshore Area of Search as defined during Scoping

21.8 ONSHORE COMPONENTS

21.8.1 Cable Landfall (Above MLWS)

The proposed landfalls of Sheep Skerry, Moodies Eddy and Aith Hope were identified following a geotechnical engineering study which looked at a number of possible landfall options in the vicinity of Hoy and South Walls (see Figure 21.2). The proposed landfalls were identified as having potential for cables to be installed using either Open Cut Trench technique or Horizontal Directional Drilling (HDD). Further detail on both of these landfall techniques is provided in Chapter 5 Project Description. Depending on the outcome of more detailed engineering and environmental studies and discussions with stakeholders, the preferred landfall location will be identified (note that only one landfall location will be chosen).

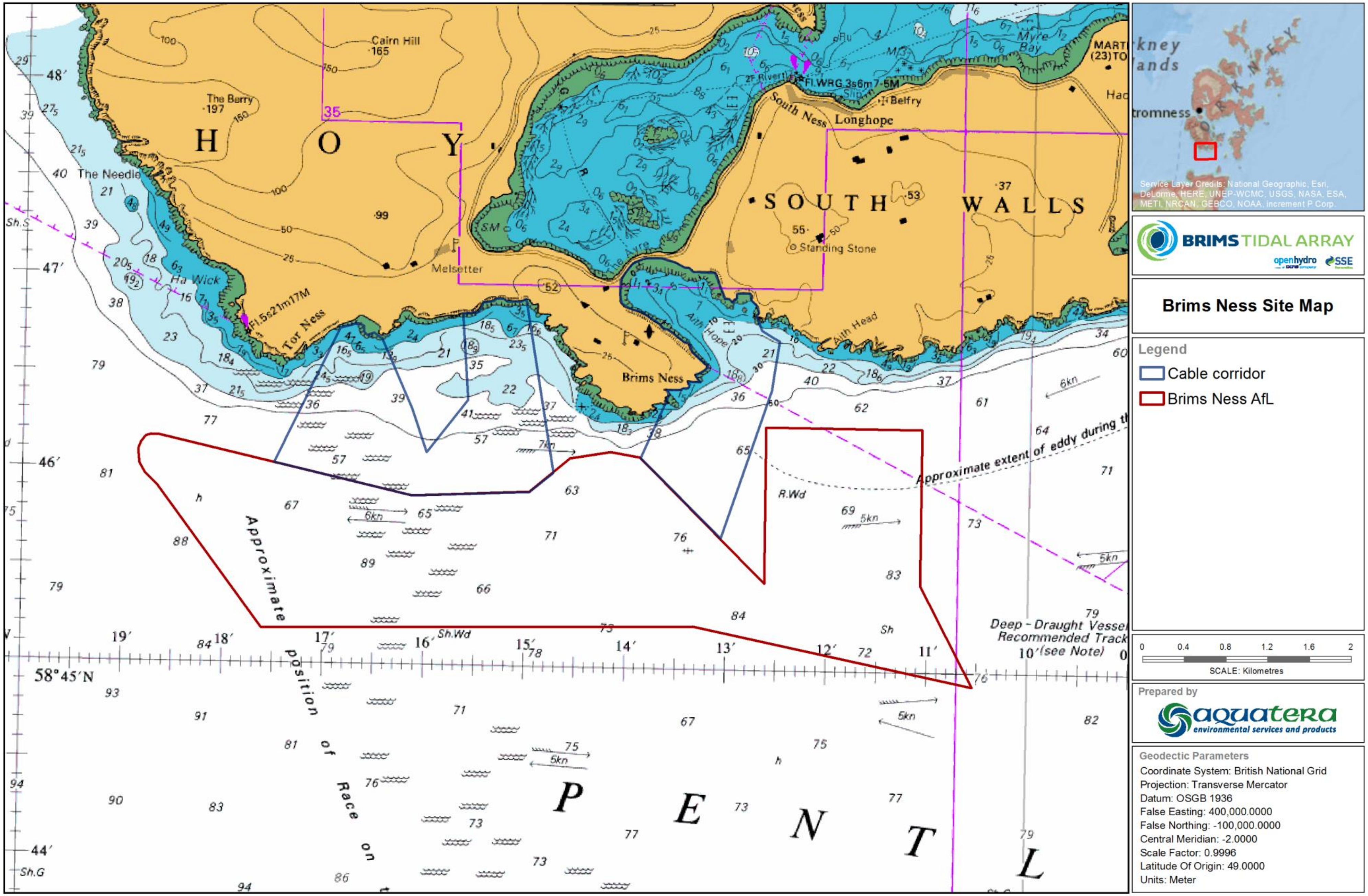

Figure 21.2: Project AfL and cable corridor options

21.8.2 Onshore Cable Route

The onshore cable from the landfall to the onshore substation will be entirely underground. When identifying an onshore cable route, a number of possible route options will be considered which are likely to involve both greenfield routes (routing cable across open land) and road routes (placing the cables in the existing road or running the cables along road verges where possible), or a combination of both. Final cable route selection will depend on the eventual location of the onshore substation, the preferred landfall location, site characteristics and local environmental sensitivities.

21.8.3 Temporary Works (Construction Compounds and Storage Areas)

There will be a requirement for onshore access, equipment laydown, working areas and construction compounds as part of the onshore works. Information on the location, footprint and design of these will be provided as part of the onshore application.

21.8.4 Possible Access Improvements

The majority of the roads in the onshore Project study area around Hoy and South Walls are narrow (single vehicle). A large number of roads also have steep gradients and weight restrictions. Consequently, roads may need to be upgraded in some locations in order for heavy plant and equipment to gain access to the landfall and/or local substation site. There may also be a requirement for some junction realignments to facilitate the movement of large and heavy loads.

21.9 LEGISLATION

In addition to the onshore planning permission and EIA/HRA requirements described in the introduction, the onshore components of the Project will also be required to take account of relevant planning policy set out in strategic planning documents, Planning Policy Statements (PPSs) and local development plans.

Planning permission will be required from Orkney Islands Council (OIC) through the Town and Country Planning (Scotland) Act 1997 for the cable landfall area and the onshore cable corridor. Please see Section 3.5.1 for some more detail on those terrestrial planning requirements.

21.10 SCOPING AND CONSULTATION

Once the location of the onshore substation is confirmed, and as the planning and associated EIA for the onshore components progresses, further consultation will be carried out with relevant stakeholders.

21.11 POTENTIAL ENVIRONMENTAL IMPACTS AND BASELINE

The following section provides a high level description of the potential impacts of the possible key environmental receptors within the study area that could be affected by the various onshore components as previously highlighted in the BTAL Scoping Report (Supporting Document: BTAL, 2013).

The relevant impacts associated with the area required for the onshore cable route, substation, onshore access, equipment laydown, working areas and construction compounds will be assessed as part of the planning and associated EIA for the onshore components.

Although there is yet to be sufficient detail to undertake an EIA for the onshore components, based on the original EIA Scoping, it is possible to identify an initial list of environmental receptors that may be impacted as a result of the construction, operation and decommissioning of the onshore aspects of the Project. These are summarised in Table 21.1. This table also provides an indication of the likely assessment strategy once the onshore **Project site** is defined and the EIA can be undertaken. The Scoping Report also outlines the anticipated baseline in the area of search on Hoy and South Walls for the relevant receptors and will be reviewed as part the assessment process for the onshore elements.

Table 21.1 Potential impacts and EIA strategy from the onshore components

Receptor	Potential Impacts during construction, operation and decommissioning	EIA Strategy	Potential for significant impacts?
Air quality and climate	Generation of dust during construction activities at the landfall (in particular if using OCT techniques), installation of underground cable and substation construction. Dust may also be generated from works to improve local access (road upgrades) and from temporary storage areas. Exploitation of renewable energy sources can replace the need for fossil fuel burning.	Desk study to identify potential impacts on local receptors. Due to the temporary nature of the construction activities air quality monitoring will not be required to inform the baseline. Focus of the assessment will be on identifying suitable mitigation measures to reduce potential impacts from dust during construction and to incorporate these within the onshore Project Construction Environmental Management Plan (CEMP).	Unlikely – all impacts on air quality will be temporary and can be avoided / reduced through implementation of appropriate / recognised standard practice mitigation
Onshore archaeology and cultural heritage	Potential for known and unknown assets and features to be disturbed or destroyed during installation of cables at the landfall (above MHWS), underground cables, and substation construction. Potential for permanent above ground infrastructure to impact historical setting.	Desk based study, including consultation with relevant stakeholders to establish the baseline description of archaeology and cultural heritage interests. The results of the desk based assessment and consultation will inform the need for a walkover survey to identify as yet undiscovered archaeological features that could be impacted by the Project and to assess the importance of historic interests identified in the desk study. Desk based impact assessment utilising the result of the desk based study and walkover survey (if necessary). Agreement of appropriate mitigation strategy to be implemented as part of the onshore Project Construction Environmental Management Document (CEMD).	Limited – there is potential for archaeological remains to be present in the onshore **Project site**. However, potential significant impacts can be avoided / prevented through avoidance of known sites and implementation of appropriate measures to manage / record the discovery of unknown sites.

Receptor	Potential Impacts during construction, operation and decommissioning	EIA Strategy	Potential for significant impacts?
Terrestrial habitats and ecology	Disturbance to / small losses of habitats (including protected areas) and possible disturbance and / or displacement of protected species and breeding birds due to construction activities at the landfall (OCT/HDD working area), working strip for installation of underground cable and substation construction area. There may also be habitat disturbance / loss from works to improve local access (road upgrades) and temporary storage areas. Permanent loss of small areas of land at substation.	Baseline studies will include desk study and Phase 1 Habitat Survey to identify any areas of potential important habitat for protected species or breeding birds. Depending on results from desk study and Phase 1 Habitat Survey it may be necessary to carry out species specific surveys e.g. breeding bird surveys, bat surveys, otters etc. Impact assessment will report findings from surveys and identify any required mitigation measures.	Limited – Surveys have already been carried out throughout the islands of Hoy and South Walls to determine any potential for impacts on protected species/breeding birds in these areas. Where protected species/breeding birds are present BTAL will develop an appropriate mitigation strategy in consultation with relevant stakeholders to ensure significant impacts do not occur. In the event that not all impacts can be avoided a Wildlife Licence may be required. This would be determined in consultation with relevant stakeholders.
Landscape and visual amenity	Construction impacts on landscape character and visual amenity associated with activities at the landfall (presence of HDD/OCT equipment), cable installation, substation construction and presence of temporary storage areas. Impacts on landscape character and visual amenity from the long-term presence of the substation. Note: No overhead lines are proposed, therefore no long-terms impacts are anticipated in this regard	The impact assessment will be carried out in accordance with the recognised Guidelines for Landscape and Visual Assessment (GLVIA) prepared by the Landscape Institute and IEMA, third edition (2013). This will include establishing the Zone of Theoretical Visibility (ZTV), agreeing viewpoints with the relevant stakeholders, photomontages, wireframes etc. The assessment will also take into account relevant design guidance and advice with regard to development in rural locations in particular any specific requirements for landscaping / screening.	Due to the character of the area there is potential that the Project could have an impact on local landscape character and visual amenity associated with the construction and presence of the substation. BTAL will work closely with a range of stakeholders to look at options for minimising potential impacts of any substation structures where possible through consultation and design in order to ensure that significant impacts do not occur.

Receptor	Potential Impacts during construction, operation and decommissioning	EIA Strategy	Potential for significant impacts?
Population and human health (including noise and EMF)	Potential impact on local residents / visitors due to noise and vibration generated from construction activities at the landfall (HDD /OCT), cable installation, substation construction, upgrades to local roads and from use of temporary storage areas. Potential for localised EMF from underground cables and local substation. Possible noise from operational substation	Desk study to identify sensitive receptors and baseline noise survey where required to determine background noise levels in the local area. Given background noise levels are expected to be low due to the rural nature of the area, any change in these noise levels will potentially be more noticeable than in a less rural location. Impact assessment carried out based on results from noise survey – using recognised standard practice guidance for noise levels at construction. Assessment will identify suitable mitigation measures to reduce potential impacts from noise during construction. These mitigation measures will be incorporated within the onshore Project Environmental Management Plan (PEMP).	Unlikely – construction activities will be temporary and short-term and the anticipated footprint of the Project will be relatively small reducing the potential for any significant impacts from noise during construction. Impacts from operation are also expected to be minor or insignificant for noise as the substation will be sited at appropriate distances from residential properties. Current evidence strongly suggests that the potential for EMF from substations and buried cables is negligible and is not expected to have any significant impacts on human health.
Hydrology, geology and hydrogeology	Potential impacts on the hydrology, geology and hydrogeology from construction activities at the landfall (HDD /OCT), cable installation, substation contraction, upgrades to local roads and from use of temporary storage areas.	Baseline desk study plus site visit to identify potential areas of geological importance and groundwater sensitivity. Impacts assessment based on desk study. Assessment will identify suitable mitigation measures to reduce potential impacts on hydrology, geology and hydrogeology during construction. These mitigation measures will be incorporated within the onshore Project Construction Environmental Management Plan (CEMP).	Unlikely – any potential impacts on geological features and groundwater aquifers can be avoided through project design (avoidance of these areas) and implementation of industry best practice mitigation to minimise the potential for aquifers to be breached during construction or any accidental releases of pollutants to groundwater sources.

Receptor	Potential Impacts during construction, operation and decommissioning	EIA Strategy	Potential for significant impacts?
Socio-economics, tourism and recreation	Potential for disruption / disturbance to tourists and recreational users in vicinity of landfall, onshore cable route, substation construction area and temporary storage areas. Potential for minimal disruption to tourists and other recreational users from the operation and maintenance of the substation.	Update to existing socio-economic assessment. Desk study informed by results from the landscape and visual assessment. Also undertake consultation with onshore recreational uses and other key stakeholders to determine potential socio-economic impacts and impacts on recreation and tourism.	Potential positive impacts through creation of local employment opportunities (reflected in update to socio-economic assessment if necessary) Possible impacts on visitors to area – these will mitigated as part of the landscape and visual assessment discussed above to ensure these impacts are not significant.
Traffic and transport	Potential for impacts on local traffic movements, localised congestion and alterations in volumes of traffic on local roads due to : > Transportation of heavy plant and equipment on local roads required for landfall activities (HDD/OCT), cable installation and substation construction > Movement of substation electrical equipment (e.g. transformers) on local roads – abnormal loads > Road upgrades to improve access to landfall / local substation site Possible slight increase in local traffic movements from workers involved in substation maintenance	Impact assessment would take into account requirements of guidelines outlined in (Department of Transport et al., 1993; Institution of Highways and Transportation, 1994; and Institute of Environmental Assessment, 1993). This is likely to involve a desk study (review of existing traffic flow data, where available) and site visit. Due to the rural nature of the area and existing low levels of local traffic a Traffic Impact Assessment (TIA) including traffic surveys where required (baseline) will be undertaken to inform the assessment.	Unlikely – any potential impacts on local traffic flow and volumes of traffic will be temporary and will be mitigated via the implementation of a Traffic Management Plan. Traffic movements during operation are expected to be minimal.

21.12 POTENTIAL CUMULATIVE AND IN-COMBINATION IMPACTS

The potential cumulative and in combination impacts that may result from the Brims Tidal Array Project (the Project) onshore components will ultimately be influenced by the final proposed location for the onshore local substation and its proximity to other projects in the area.

Potential cumulative and in combination impacts with other onshore projects will be considered as part of the onshore components EIA. This will include a review of operational, consented and proposed projects in the planning system. These will be assessed in more detail as part of the onshore components EIA but potential impacts are likely to include:

- Potential cumulative impacts during the construction phase (activities at the landfall and cable installation):
  - Loss of terrestrial habitats and land;
  - Disturbance / displacement of terrestrial ecology;
  - Disturbance and / or destroy of terrestrial archaeology and cultural heritage features;
  - Disruption to traffic flows and increased volumes of traffic;
  - Impacts on landscape and visual amenity from construction activities and presence of construction equipment, heavy plant and temporary storage areas; and
  - Noise disturbance to local population and visitors to the area.

It is noted that proposals for other large scale developments in the area may develop prior to submission of the onshore components EIA. All projects will therefore be reviewed and, if necessary, any new projects taken into account as part of the cumulative and in-combination assessment.

Cumulative impacts associated with the offshore Project are expected to be minimal. The main potential receptors with regard to potential cumulative impacts would be seascape, landscape and visual amenity, ornithology and local recreation and tourist activities. The offshore EIA has concluded that there would be no significant impacts on any of these receptors. Again, this will be reviewed and assessed in the onshore components EIA.

21.13 SUMMARY

This chapter outlines the potential impacts likely to be encountered by BTAL when seeking to consent the onshore components identified in the consenting strategy. This does not form part of the current consenting process, rather, it illustrates the strategy BTAL intend to take once clarity on the wider network reinforcements have been received from SHE-T and the onshore planning processes can progress. BTAL and SHE-T will work closely together at that stage to ensure that all elements of the Project and of the SHE-T project are captured by the respective, or combined, EIAs. To minimise the potential for significant impacts to occur, BTAL will continue to consult with all key stakeholders throughout the design of the onshore components and associated EIA to ensure all potential concerns and issues are identified and addressed accordingly. This will include seeking appropriate advice and guidance with regard to the siting and design of the onshore cable route and carrying out more detailed assessment of the potential cumulative impacts associated with the offshore components of the Project based on the information presented in this offshore ES.

Cumulative Impact Assessment

Chapter 22

22 CUMULATIVE IMPACT ASSESSMENT

22.1 CIA SCOPE AND METHODOLOGY

22.1.1 CIA Methodology

The requirement to assess cumulative effects was originally set out in the European Environmental Impact Assessment (EIA) Directive 85/337/EEC (since amended by further Directives) and by the EC Habitats Directive 92/43/EEC. EIA regulations have been enacted into law relation to various consents and permits which required cumulative or in-combination effects to be taken into account. 'Cumulative impacts', according to European Commission (EC) guidelines (Walker and Johnston 1999), should mean 'impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project'.

These interactions are assessed through Cumulative Impact Assessment (CIA). In this case, cumulative impacts are those arising from interactions with similar projects i.e. other marine renewable developments while in-combination impacts are considered to be those arising as a result of interactions between the Brims Tidal Array Project (the Project) and other non-wet renewables projects for example, pier developments or oil and gas developments. Depending on the specific nature of potential cumulative and in-combination impacts, assessment might be necessary for the different phases of the Project e.g. construction and installation, operation and maintenance, and decommissioning.

The approach to CIA for the Project was informed by recent guidance document produced by The Crown Estate (AMEC and Aquatera, 2013). Particular CIA guidelines, where relevant, were be used by technical authors to carry out topic-specific assessments, as relevant to identified CIA receptors. The EIA process will determine whether or not the proposed development will have an impact on each receptor. This process will also inform decisions with regards to the Projects to include and scope out of the CIA.

The general principle for the cumulative impact assessment was as follows:

- Identification of a list of projects and proposals to be considered in the Project CIA;
- Identification of a list of list of relevant receptors;
- Initial screening of potential cumulative and in-combination impacts; and
- Where potential cumulative and in-combination impacts are identified, assessment of significance of cumulative and in-combination effect.

22.1.1.1 Projects and Proposals to be considered in the Project CIA

The following types of Projects are considered within the CIA:

- Tidal energy projects;
- Wave energy projects;
- Offshore wind energy projects;
- Offshore infrastructure projects;
- Oil and gas developments;
- Aquaculture (new applications/reviews);

- Dredging;
- Coastal developments;
- Onshore infrastructure projects; and
- Onshore wind energy projects.

Activities not subject to licensing/consent (such as fishing) are not be included in the CIA as they are an ongoing activity and as such, impacts from fishing activity should form part of the baseline conditions for CIA rather than an activity/project for inclusion in the CIA.

BTAL in consultation with Marine Scotland - letter, 18th June 2015 - has identified a list of other plans and projects which in concurrence with the development of the Project may result in cumulative or in-combination impacts. This list of projects is provided in Table 22.1 and a map showing their location in Figure 22.1.

The general principle for the CIA was to consider only those projects that have sought a scoping opinion. In most cases operational projects should be included in the baseline of the principal project, but this is discussed and agreed with the regulators on a case-by-case basis and in this case the Beatrice Demonstrator Offshore Windfarm has been included. EMEC's test sites have also been included in this list of projects as although the test site is operational there are ongoing construction activities at these sites as developers deploy and redeploy their test devices.

Table 22.1: List of projects and proposals to be considered in the Project CIA

Project title	Description	Status	Reference in Figure 22.1
EMEC Billia Croo Wave Energy test site	Wave energy test berths	Operational	W1
EMEC Scapa Flow	Scaled Wave Test Site	Operational	W2
Lashy Sound Tidal Array	30MW tidal energy development	Scoping Opinion received in Dec 2014, no ES available. Phase 1 construction expected 2016-19 Phase 2 construction expected 2020	T1
Westray South Tidal Array	200MW tidal energy development	Scoping Opinion received in Jan 2012, no ES available Construction in 2016 according to scoping (but EIA delayed)	T2
EMEC Fall of Warness Tidal Test Site	Tidal energy test berths	Operational	T3
EMEC Shapinsay Sound	Scale tidal test site	Operational	T4
MeyGen Inner Sound	400MW tidal energy development	Phase 1 (86MW) Consented Constructing 2015/16	T6
Beatrice Offshore Windfarm	664MW offshore windfarm development	Consent awarded August 2014 Construction expected from 2016	OW1

Project title	Description	Status	Reference in Figure 22.1
Beatrice Demonstrator Offshore Windfarm	10MW offshore wind demonstrator	Operational	OW1
Moray Firth Offshore Windfarm	1116MW offshore windfarm development	Consent awarded March 2014 Phase 1 construction expected 2017-19 Phase 1 construction expected 2019-21	OW1
Hywind Pilot Park Project	5 floating offshore wind turbines up to 30MW	ES submitted March 2015 Construction expected 2016-17	OW2
Orkney to Caithness Interconnector	220kV interconnector cable	ES submitted Unknown construction schedule	C1

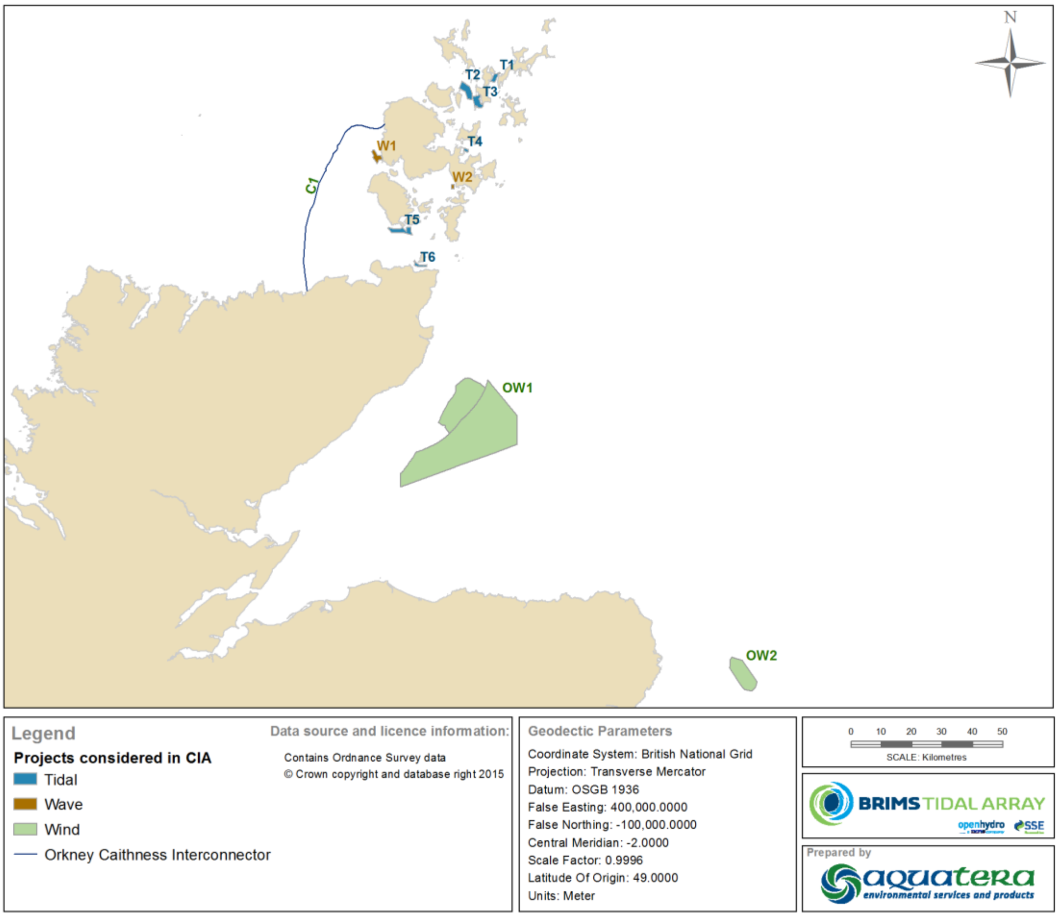

Figure 22.1: Location of Projects considered in the Cumulative Impact Assessment

22.1.1.2 Identification of Receptors to be considered in the CIA Process

The S-P-R model (as shown in Figure 22.2), highlighted in the recent guidance document by AMEC and Aquatera (2013) is a useful approach to identifying of receptors to be considered in the CIA Process. The S-P-R model can also be viewed as a "fire triangle". The removal of any one of the source, pathway, or receptor will remove any potential impact.

Once the relevant projects (sources) and receptors have been identified, possible pathways linking the two will be identified, the pathways between the source and the receptor will help determine the spatial extent and thus whether there will be any potential for cumulative and in-combination impacts.

22.1.1.3 Initial Screening of Potential Cumulative and In-combination Impacts

The individual Chapter authors considered which of these projects could result in potential cumulative impacts with the Project. Where no pathway exists between a source (other than the Brims Tidal Array Project) and a receptor, cumulative effects can be ruled out. This decision was based on the results of the specific impact assessment together with the expert judgement of the specialist consultant undertaking the impact assessment.

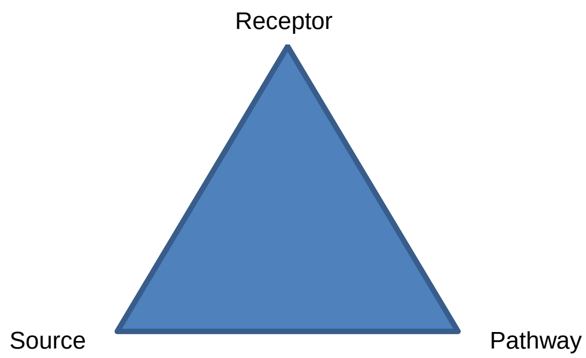

Figure 22.2: Process to determine which receptors to include in the CIA process

22.2 GEOLOGY

Subject to the final design and construction and deployment programmes for this development and the other projects, all of the potential impacts the geology are likely to be limited in area, low in magnitude but permanent and it is therefore anticipated that no significant cumulative impacts will occur.

22.3 PHYSICAL PROCESSES

22.3.1 Cumulative Impact Assessment

Cumulative impacts have been assessed through consideration of the extent of influence of changes or effects upon physical processes arising from the Project alone and those arising from the Project cumulatively or in-combination with other developments and other seabed activities in the vicinity.

In terms of physical processes, the only other development from the list of proposed Cumulative Impact Assessment (CIA) projects agreed with Marine Science which could, potentially, have a cumulative impact with the Proejct is the MeyGen Inner Sound Tidal Array. Phase 1 (86MW) of the total 400MW project has already been consented, with subsequent phases planned to follow.

All other projects, including the proposed Orkney to Caithness Interconnector, are sufficiently remote that there is no realistic potential for significant potential cumulative and/or in-combination impacts during operation, operation and maintenance or decommissioning phases.

22.3.2 Discussion of Potential Cumulative and In-combination Impacts

The potential cumulative effects are associated with changes to the tidal regime during the operation phase, when both schemes will be extracting tidal energy. Other changes during this phase, and any changes during the construction and decommissioning phases, are not likely to result in potential cumulative or in-combination effects because they are of limited magnitude, localised and temporary.

To assess the potential, or otherwise, for cumulative effects in respect of the tidal regime, Figure 22.3 shows the maximum potential ‘zone of influence’ on the tidal regime arising from each project individually and based upon the results of numerical modelling undertaken specifically for each project. It can clearly been seen that there is no overlap in each project’s ‘zone of influence’ (Table 22.2).

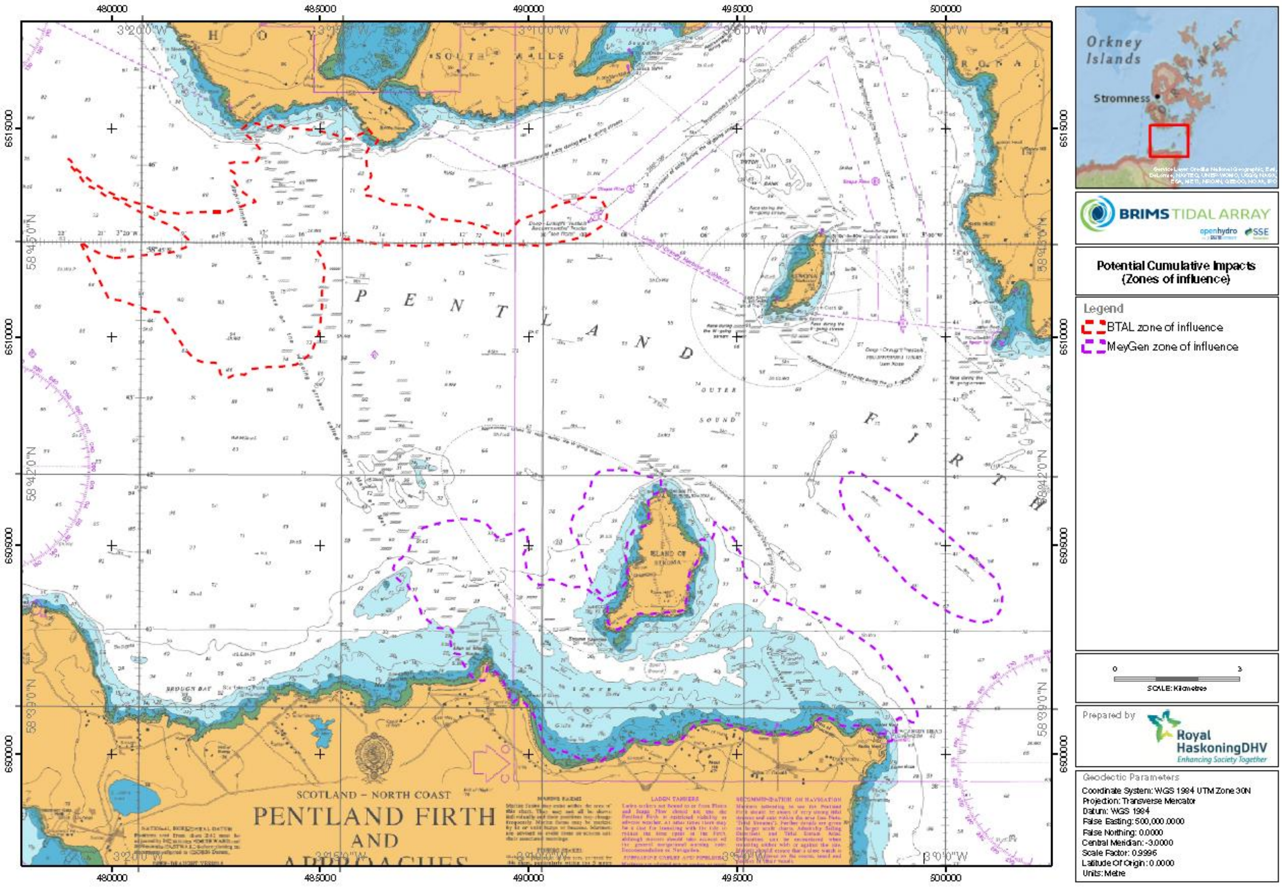

Figure 22.3: Potential cumulative impacts (zones of influence)

Table 22.2 Summary of potential cumulative and in-combination impacts

Project	Phase	Impact mechanisms	Potential for cumulative and/or in-combination impacts
MeyGen Inner Sound Tidal Array	Operation	Changes to the tidal regime	No cumulative or in-combination effects

22.4 COASTAL AND TERRESTRIAL ECOLOGY

There are a number of projects in the area that have been considered as part of the Cumulative Impact Assessment (CIA) (Table 22.1). Subject to the final design and construction and deployment programmes for this development, all of the potential impacts to the coastal ecology are likely to be limited in both area and duration. This is due to the small footprint area affected by the Project and the fact that there are no other projects in the immediate vicinity. No significant impacts are anticipated on coastal and terrestrial ecology. For these reasons, it is anticipated that there will be no significant cumulative impacts to the coastal and terrestrial ecology.

22.5 BENTHIC ECOLOGY

The list of projects initially considered in the CIA is provided in Table 22.1 and a map showing their location in Figure 22.1. Only the MeyGen Inner Sound development was identified as having potential cumulative impacts relevant to benthic ecology from modification or loss of benthic habitats. However, subject to the final design and construction and deployment programmes for this Project and the other projects, all of the potential impacts to benthic ecology are likely to be limited in area and duration and it is therefore anticipated that no significant cumulative impacts will occur.

22.6 FISH ECOLOGY

22.6.1 Cumulative Impact Assessment

BTAL in consultation with Marine Scotland has identified a list of other plans and projects which in concurrence with the development of the Project may result in cumulative or in-combination impacts on fish ecology. The list of these projects including their location and vicinity to the Project together with project status and construction timescales, where known, are detailed in Table 22.1 and Figure 22.1.

Consideration has been given to the information currently available on all the Projects and it has been concluded that the following projects may have the potential to result in cumulative or in-combination impacts on fish ecology:

- Orkney to Caithness Interconnector; and
- MeyGen Inner Sound.

22.6.2 Discussion of Potential Cumulative and In-combination impacts

Potential cumulative and in-combination impacts associated with the MeyGen Inner Sound and Orkney Caithness Interconnector projects for each of the following phases of the Project are detailed in the subsections below.

22.6.2.1 Construction and Installation

Substratum loss

The installation of all three projects will result in localised substratum loss. However, as MeyGen is currently being installed, habitat recovery is likely to be underway by the time the Project construction commences. In addition, habitat availability for species, even those with strong habitat preferences, is not restricted to the Pentland Firth, therefore any displacement due to loss of substrata is unlikely to impact species significantly.

Smothering

There is unlikely to be any cumulative and in-combination impacts as a result of smothering from the discharge of drill cuttings due to the distance between the projects and the high velocity nature of the tidal stream within the Pentland Firth. Any drill cuttings or sediment disturbance is likely to be dispersed quickly and therefore not significantly impact spawning grounds or demersal species.

Accidental Spills

For all projects, the likely risk of a major spill during installation is low and will be limited by ensuring that installation activities only occur during suitable weather windows. Any vessels over 400GT used during the installation phases will also be required to have on board SOPEPs which will include procedures to ensure any impacts are minimised in the unlikely event of a major spill event. Given that it is extremely unlikely for an accidental event to occur for any of the projects at the same time, the potential for any cumulative significant impacts is very low.

Noise

No cumulative impacts from the construction and installation noise of all three projects are anticipated. Any components of the three projects that are being undertaken at the same time are expected to be highly localised (within 100s of meters of the largest construction vessels) and therefore not significant.

22.6.2.2 Operation and Maintenance

During the operation and maintenance of the Projects, the main potential cumulative impacts are related to collision risk and barrier to movement.

Collision Risk

Most species present within the Project site have very large geographical coverage, extending around the north coast of Scotland into the North Sea and Atlantic Ocean. Potential impacts on most species are considered to be negligible. However, Atlantic salmon are considered to be sensitive due to migration routes through the Pentland Firth. Collision Risk Modelling has been carried out to assess this impact (Xodus Group, 2016). When considered in combination with MeyGen the proportion of the adult Atlantic population predicted to collide with the turbines is 0.027% per year. Impacts form both developments are therefore not anticipated to be significant.

Barrier to movement

In relation to physical barrier to movement, no other project is present in the same cross sectional area of the Pentland Firth therefore the maximum developed cross-sectional area[7] remains at 0.9%. With regards to collision risk, the chance of encounter (and resulting collision) between salmon and turbines based on studies and modelling carried out for other tidal EIA projects including MeyGen cumulative impacts are not anticipated to be significant.

EMF

Cumulative effects with regards to EMF emitted by cables are of relevance to electro-sensitive species. Emissions from the Project combined with the MeyGen development are considered to be small scale and the use of EMF screens will limit the potential for significant EMF. Emissions from the interconnector are considered to be larger due to the scale of the Project, however installation of the interconnector will be through trenching and the implementation of EMF screens. This will therefore limit the impact on fish ecology. Cumulative impacts on fish ecology from EMF are not expected to be significant.

22.6.2.3 Decommissioning

A number of the impacts that may occur during decommissioning (e.g. noise emissions, seabed impact) could act cumulatively with other developments however uncertainty in schedules for decommissioning is too high to determine the cumulative impacts. As an approximate guide, it could be assumed that two other sites may decommission at the same

7 Area of the Pentland Firth taken from Brims Ness, Hoy to Tang Head, Caithness

time as the Project and therefore the decommissioning impacts will be of a similar or lesser magnitude to the cumulative impacts during construction.

Table 22.3 summarises the CIA impacts.

Table 22.3 Summary of potential cumulative and in-combination impacts for fish ecology

Project	Phase	Impact mechanisms	Potential for cumulative and/or in-combination impacts
Orkney to Caithness Interconnector And MeyGen Inner Sound Tidal Array	Construction and Installation	substratum loss	No significant cumulative or in-combination effects
		smothering	No significant cumulative or in-combination effects
		accidental spills	No significant cumulative or in-combination effects
		underwater noise	No significant cumulative or in-combination effects
	Operations and maintenance	collision risk	No significant cumulative or in-combination effects
		barrier to movement	No significant cumulative or in-combination effects
		EMF	No significant cumulative or in-combination effects
	Decommissioning	As for construction and installation	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts

22.7 MARINE MAMMALS AND BASKING SHARK

22.7.1 Cumulative Impact Assessment

Table 22.1 outlines the plans and projects identified by BTAL and agreed in consultation with Marine Scotland and SNH to be considered in the assessment of cumulative and in-combination effects for the Project. The current status and expected timescales based on publically available information is also provided. Projects which were operational at the time of defining the existing environment for the Project are not considered further.

Due to the localised impacts associated with the Project and the limited population level effects on species with wide ranging reference populations (i.e. cetaceans and basking shark), the Project is not considered likely to contribute to any discernible cumulative impacts at a population level with projects and plans outside the Pentland Firth and Orkney Waters.

All reasonably foreseeable new plans and projects within the Orkney and North Coast seal MU have potential to impact cumulatively, particularly on the Orkney and North Coast harbour and grey seal MU populations.

The following projects are therefore considered further in the cumulative and in-combination impact assessment:

- Lashy Sound Tidal Array;
- Westray South Tidal Array;
- MeyGen Inner Sound; and
- Orkney to Caithness Interconnector.

22.7.2 Discussion of Potential Cumulative and In-combination impacts

22.7.2.1 Potential Cumulative and In-combination Impacts during Construction and Installation

Underwater Noise

During construction, underwater noise associated with construction vessels and drilling foundations may cause cumulative disturbance impacts if the construction periods overlap. Sequential construction activities may result in marine mammals being displaced around the Pentland Firth and Orkney Waters but, given the ranges of marine mammal species and the small scale of potential disturbance impacts from each project, no discernible population level cumulative impact is predicted.

For projects that have a construction period that potentially overlaps with the Project construction period, there is potential for disturbance to lead to marine mammal displacement from a number of areas. The construction of MeyGen Phase 1 is currently underway, therefore is not expected to overlap with construction of the Project and there is insufficient information about the potential timing of construction for any subsequent MeyGen phases in order to undertake an assessment of the cumulative impacts. SSE-PD (2013) concludes that it is considered unlikely that cable installation for the Orkney to Caithness interconnector would produce noise at a level that would cause a behavioural reaction in marine mammals. The cumulative impact assessment for construction is therefore focussed on the Lashy Sound Tidal Array and Westray South Tidal Array.

There is insufficient information on Westray South Tidal Array in relation to the construction impacts in the absence of an available ES. However, as the scoping report (SSE Renewables 2011) shows that the plans are similar to the Project, in order to include the Westray project and provide a conservative impact assessment, it is assumed that the impacts will be similar to the Project. Lashy Sound also does not have an available ES but the scoping report (Scotrenewables Tidal Power Limited 2014) shows that the design envelope is not comparable to the Project, as a result this project cannot be included in the assessment.

The distance by sea between Westray South Tidal array and the AfL area is approximately 70km. The maximum disturbance ranges are estimated to be 14km and in the context of the wider area of the Pentland Firth and Orkney Waters, the cumulative impact magnitude is deemed to remain negligible and therefore the impact significance is minor for cetaceans, due to their medium sensitivity, and negligible for pinnipeds and basking shark, due to their low sensitivity. An overview of species sensitivity, the magnitude for each relevant project, the cumulative magnitude and resultant cumulative impact significance is provided in Table 22.7.

Collision with Vessels

As with construction noise, it is assumed for the sake of this assessment, that the construction vessel traffic required for the Westray Tidal Array will be comparable to the Project. There is insufficient information about Lashy Sound Tidal Array construction vessels and no assessment was made of vessel collision risk for the Orkney to Caithness Interconnector. As outlined above, the construction of MeyGen Phase 1 is currently underway and is not expected to overlap with construction of the Project. In addition, there is insufficient information about the potential timing of construction for any subsequent MeyGen phases to allow assessment of the cumulative impacts.

The predicted numbers of vessels and associated vessel movements at the AfL area are low in the context of existing vessel traffic. The cumulative increase in vessels associated with Westray Tidal Array is still deemed to be of negligible magnitude in the context of existing traffic levels and the likelihood of a collision with cetaceans, grey seal or basking sharks. For harbour seal, any collision leading to a fatality could have an impact at a population level and so there is potential for a medium magnitude. Based on the species sensitivities, the impact will remain of minor significance. An overview of species sensitivity, the magnitude for each relevant project, the cumulative magnitude and resultant cumulative impact significance is provided in Table 22.7.

Disturbance at Seal Haul Out Sites

Given the distance of the Project from designated seal haul out sites (over 5km) as well as from the Lashy Sound Tidal Array (approximately 75km) and Westray South Tidal Array (approximately 70km) it is not likely that there will be a discernible cumulative impact on important seal haul out sites.

As outlined above, the construction of MeyGen Phase 1 is currently underway and is not expected to overlap with construction of the Project, there is insufficient information about the potential timing of construction for any subsequent MeyGen phases in order to undertake an assessment of the cumulative impacts, and no assessment was made of disturbance at seal haul out sites for the Orkney to Caithness Interconnector. An overview of species sensitivity, the magnitude for each relevant project, the cumulative magnitude and resultant cumulative impact significance is provided in Table 22.7.

Indirect Effects on Prey Species

Chapter 12 Fish Ecology shows that no significant cumulative impacts on fish species are predicted, therefore the indirect cumulative impact on marine mammals is deemed to be negligible.

22.7.2.2 Potential Cumulative and In-combination Impacts during Operation and Maintenance

Underwater Noise

Underwater noise from operational devices at MeyGen Phase 1 is predicted to cause strong avoidance to approximately 8m for pinnipeds, 63m for odontocetes (toothed whales/ dolphins), and 266m for mysticetes (baleen whales). Mild avoidance is predicted at 80m for pinnipeds, 1,300m for odontocetes (toothed whales/ dolphins), and 4,900m for mysticetes (baleen whales) (based on noise modelling by Subacoustech using the dB_{ht}(species) method[8], Xodus 2011). No quantification of the number of animals potentially disturbed is provided for MeyGen. Operation of Phase 1 and 2 of the Project is predicted to have a possible disturbance range of up to 4,000m for all marine mammals (Xodus 2015). For the purposes of this assessment it is assumed that Westray South may have similar disturbance, but there is insufficient information for Lashy Sound.

The population consequences of disturbance are uncertain, however as these are conservative modelling estimates for mild disturbance, which do not take into consideration the high levels of ambient noise, it is predicted that the cumulative impact will be of negligible magnitude in the context of the Pentland Firth and Orkney waters, in particular the Orkney and

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[8] *The dB_{ht}(Species) underwater noise modelling by Subacoustech provides a scale comparable to the dB(A) scale used for rating the behavioural effects of sound in humans 75dB_{ht} is used to indicate mild avoidance and 90dB_{ht} for strong avoidance. .*

North Coast harbour and grey seal MU. An overview of species sensitivity, the magnitude for each relevant project, the cumulative magnitude and resultant cumulative impact significance is provided in Table 22.7.

Collision with Operational Tidal Devices

The results using the avoidance rates shown in Table 13.28 based on the ERM estimates for the 3-blade turbines (Table 13.31) are provided in Table 22.4 along with the estimated collision risk for the projects identified. SNH provided the latest collision risk assessment for MeyGen based on Phase 1a with 6 devices, however this uses the ERM from EMEC (2014b) which has since been superseded by SNH (2015) (used in the BTAL assessment). In addition the MeyGen ERM uses the SMRU seal density estimates and the SCANS density estimates which, as discussed previously are shown to be one to two orders of magnitude greater than all site specific surveys for EMEC, MeyGen and BTAL.

An assumption is made that Westray may be comparable to the Project based on information in the scoping report. There is insufficient information to include Lashy Sound Tidal Array. Table 22.5 provides the predicted cumulative collision risk from Table 22.4 in the context of the reference populations. In addition, the cumulative impact of 220 grey seal shooting licences was taken into consideration in the cumulative PCoD modelling (Table 22.6).

Table 22.4: Cumulative collision risk with operational devices

Project	Harbour porpoise	Harbour seal	Grey seal	Minke whale
BTAL Project (ERM for 200 OCT devices)	22	3	20	1
MeyGen (10 devices)	2	8	55-223*	4
Westray South (inferred from the BTAL Project assessment)	22	3	20	1
Total	**46**	**14**	**95-263**	**6**

*The MeyGen collision risk estimate for grey seal using the U dive profile is 55 individuals and the V dive profile is 223, however as discussed previously these are based on highly conservative density estimates.

Table 22.5: Population level cumulative collision risk with operational devices

Species	Sensitivity	Reference population	Estimated number of potential collisions	Percentage of reference population	Magnitude	Significance
Grey seal	Medium	20,682	95-263	0.46-1.27%	Medium	Moderate
Harbour seal	Medium	1,938	14	0.72%	Medium	Moderate
Harbour porpoise	Medium	227,298	46	0.02%	Medium	Moderate
Minke whale	Medium	23,528	6	0.03%	Medium	Moderate

Due to the high number of grey seal collisions predicted in the MeyGen collision risk modelling the proportion of the reference population is between 0.46% and 1.27%. The grey seal PBR for the Orkney and North Coast MU is 1,240, with

220 licences granted and therefore a potential cumulative impact on 95 to 263 individuals is likely to have a low/medium magnitude of effect. The results from interim PCoD modelling indicate that there is a medium probability that the additional risk associated with the cumulative collision risk (along with the 220 shooting licences) could result in a 1% decline in the population based on the extremely conservative MeyGen collision risk estimate using the V dive profile and SMRU seal density estimates.

The potential cumulative impact on 14 harbour seals is over the PBR of 11 individuals (also based on the extremely conservative MeyGen collision risk estimate using SMRU seal density estimates), however the interim PCoD modelling indicates that the probability of the cumulative impact causing an additional risk of population decline is extremely low (Table 22.6).

Table 22.6: Predicted additional risk of population decline from the total cumulative collision risk (see Table 13.35)

Year	Total cumulative collision risk		
	Probability of 1% decline	Probability of 2% decline	Probability of 5% decline
Grey seal Orkney and North coast population			
1	0.156	0.085	0.014
6	0.391	0.175	0.001
12	0.471	0.172	0
18	0.54	0.171	0
Harbour seal Orkney and North coast population			
1	0.022	0.056	0.046
6	0	0	0.035
12	0	0	0
18	0	0	0
Harbour porpoise North Sea population			
1	0.002	0.001	0
6	0.002	0.002	0
12	0.006	0.003	0
18	0.004	0.001	0
Harbour porpoise West Scotland population			
1	0.016	0.013	0.003
6	0.031	0.019	0.004
12	0.046	0.023	0
18	0.064	0.021	0
Minke whale Celtic and Greater North Seas population			
1	0.003	0.003	0
6	0.007	0.003	0
12	0.005	0.001	0
18	0.008	0	0

Collision with Vessels

The MeyGen ES (Xodus 2011) states that vessels associated with operation and maintenance are planned to be on-site for minor maintenance once every two years per turbine (six turbines) and for major maintenance, once every ten years per turbine. Unplanned maintenance may be required between these times. It is assumed that the operation and maintenance vessel traffic required for Westray South will be comparable to the Project in order to provide an assessment of the potential cumulative impacts. There is insufficient information about Lashy Sound Tidal Array construction vessels.

The predicted numbers of vessels and the associated vessel movements at the Project site are low in the context of the existing vessel traffic. The cumulative increase in vessels associated with other projects is still deemed to be negligible in the context of existing traffic levels and the likelihood of a collision and therefore the impact will remain minor. An overview of species sensitivity, the magnitude for each relevant project, the cumulative magnitude and resultant cumulative impact significance is provided in Table 22.7.

22.7.2.3 Potential Cumulative and In-combination Impacts during Decommissioning

The uncertainty in schedules for decommissioning is too high to determine the cumulative impacts. As an approximate guide, it could be assumed that two other sites may decommission at the same time as the Project and therefore the decommissioning impacts will be of a similar or lesser magnitude to the cumulative impacts during construction.

Table 22.7: Overview of cumulative and in-combination impact assessment

	BTAL Project	Westray South Tidal Array	Lashy Sound Tidal Array	MeyGen Inner Sound	Orkney – Caithness Interconnector	Cumulative magnitude	Sensitivity	Cumulative impact significance
Construction and Installation								
Underwater noise	Negligible magnitude and significance for all species.	Assumed similar to the Project	No information	Construction not overlapping	SSE (2013) states no impact	Negligible	Low for grey seal, harbour seal and basking shark. Medium for harbour porpoise, minke whale and white- beaked dolphin	Negligible magnitude and significance for all species.
Collision with vessels	Negligible magnitude for all species. Negligible significance for small cetaceans, grey seal and harbour seal. Minor significance for minke whale and basking shark	Assumed similar to the Project	No information	Construction not overlapping	Not assessed	Negligible	Medium for small cetaceans, grey seal and harbour seal. High for minke whale and basking shark	Negligible for small cetaceans, grey seal and harbour seal. Minor for minke whale and basking shark
Disturbance at seal haul out sites	Low magnitude and negligible significance	Assumed similar to the Project	No information	Construction not overlapping	Not assessed	Low	Low	Negligible
Indirect effects on prey species	Negligible magnitude and significance for marine mammals and no impact for basking shark	Chapter 12 Fish Ecology shows that no significant cumulative impacts on fish species are predicted.				Negligible	Medium for harbour seal and harbour porpoise. Low for grey seal, minke whale and basking shark	Negligible for all marine mammal species

	BTAL Project	Westray South Tidal Array	Lashy Sound Tidal Array	MeyGen Inner Sound	Orkney – Caithness Interconnector	Cumulative magnitude	Sensitivity	Cumulative impact significance
Operation and Maintenance								
Underwater noise	Negligible magnitude and significance for all species	Assumed similar to the Project	No information	No quantification of the number of animals. Mild avoidance is predicted at 80m for pinnipeds, 1,300m for Odontocetes and 4,900m for Mysticetes	SSE (2013) states no impact	Negligible	Low for grey seal, harbour seal and basking shark. Medium for harbour porpoise, minke whale and white- beaked dolphin	Negligible for all species
Collision with operational devices (with avoidance)	Stage 1 & 2: 20 grey seal, 3 harbour seal, 22 harbour porpoise, 1 minke whale	Assumed similar to the Project	No information	2 harbour porpoise, 8 harbour seal, 55-223 grey seal and 4 minke whale	N/A	Medium all species	Medium for all species	Moderate
Collision with vessels	Negligible magnitude for all species. Negligible significance for small cetaceans, grey seal and harbour seal. Minor for all minke whale and basking shark	Assumed similar to the Project	No information	Planned maintenance once every two years per turbine (six turbines) and for major maintenance, once every ten years per turbine. Unplanned maintenance may be required between these times.	Not assessed	Negligible	Medium for small cetaceans, grey seal and harbour seal. High for minke whale and basking shark	Negligible for small cetaceans, grey seal and harbour seal. Minor for minke whale and basking shark

22.7.3 Summary of Potential Cumulative and In-combination Impacts

Table 22.7 provides an overview of the cumulative and in-combination impact assessment as described previously in this section. The results of this assessment are summarised in Table 22.8.

Table 22.8: Summary of potential cumulative and in-combination impacts

Projects	Phase	Impact mechanisms	Potential for cumulative and/or in-combination impacts
MeyGen Inner Sound tidal array; Lashy Sound tidal array; Westray South tidal array; and Orkney to Caithness interconnector.	Construction and Installation	Underwater Noise	No significant cumulative or in-combination effects
		Disturbance at Seal Haul Out Sites	No significant cumulative or in-combination effects
		Collision with Vessels	No significant cumulative or in-combination effects
		Indirect Effects on Prey Species	No significant cumulative or in-combination effects
	Operations and maintenance	Underwater Noise	No significant cumulative or in-combination effects
		Collision with Vessels	No significant cumulative or in-combination effects
MeyGen Inner Sound tidal array; Lashy Sound tidal array; Westray South tidal array;	Operations and maintenance	Collision with Operational Tidal Devices	Potentially significant cumulative collision risk with operational tidal turbines for all species of marine mammal and basking shark.
MeyGen Inner Sound tidal array; Lashy Sound tidal array; Westray South tidal array; and Orkney to Caithness interconnector.	Decommissioning	As construction and installation	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts

22.8 ORNITHOLOGY

22.8.1 Cumulative Impact Assessment

The EIA Regulations require that the Project is assessed for cumulative impacts with other projects or plans. Guidance on assessing cumulative effects (King *et al.,* 2009; Renewable UK 2013; The Crown Estate 2011, MacArthur Green 2013) has been followed.

In considering cumulative effects it is necessary to identify any effects that are minor in isolation but which may be more significant additively. Projects at EIA scoping stage and beyond were considered. Projects have been omitted where it is considered that progress is unlikely to occur in the future e.g. wave projects that have been through Scoping but have either had technology provider issues or cancelled their grid connection agreements with National Grid. Advice was received from MS-LOT and SNH regarding the finalised list of developments which should be considered in the Brims Tidal Array cumulative impact assessment (letter, 18 June 2015). The projects requiring inclusion are listed in Table 22.1.

22.8.2 Projects to be considered in CIA

This section describes other works that might be taking place in the vicinity of the Project that could result in cumulative and in-combination impacts. Depending on the specific nature of potential cumulative and in-combination impacts the different stages of the Project for Stage 1 and 1&2 are considered separately. The assessment has been based on Crown Estate guidelines (MacArthur Green 2013).

The species receptor populations for the CIA were those identified during the EIA as of high or medium priority and – based on breeding season foraging range - at risk of potential cumulative impacts from a pre-defined list of marine developments (Table 22.9). These receptor populations are initially included for cumulative impacts due either to the comparatively high abundance of individuals in the AIF or their relatively high predicted vulnerability to tidal energy developments combined with the presence of breeding individuals (shag, black guillemot). Kittiwake is scoped out of the CIA entirely as the Project is considered to have a negligible impact on the species due to low to very low vulnerability levels to all relevant impact sources. Red-throated diver is similarly scoped out as the species' short foraging range means the regional breeding population (birds on Hoy) relevant to the Project does not overlap with any other project.

Proposed developments at Westray South (200MW) and Lashy Sound (30MW) have not yet submitted ES documents and therefore no data is available for these projects. However, based on proposed MW capacity an attempt is made to approximate possible impacts from these projects.

Table 22.9: Projects initially included in CIA assessment in relation to key seabird receptors

Project title	Location	Distance from the Project	Included in species assessment (priority receptors only)	Project status & data availability
MeyGen Inner Sound (tidal)	Pentland Firth	13km	Shag, common guillemot, razorbill, black guillemot, puffin	Under construction. ES submitted, quantitative data available
EMEC Scapa Flow (wave)	Orkney	24km	Shag, common guillemot, razorbill, black guillemot, puffin	Operational. Long term monitoring data available,

Project title	Location	Distance from the Project	Included in species assessment (priority receptors only)	Project status & data availability
				though no existing review of impact effects
EMEC Billia Croo (wave)	Orkney	29km	Common guillemot, razorbill, puffin	Operational. Long term monitoring data available, though no existing review of impact effects
Orkney to Caithness Interconnector	Offshore Orkney/Caithness	35-40km	Common guillemot, razorbill, puffin	ES submitted, quantitative data available
Shapinsay Sound (tidal)	Orkney	62km	Common guillemot, razorbill puffin	Operational. Long term monitoring data available, though no existing review of impact effects
Beatrice Demonstrator OWF	Moray Firth	63km	Common guillemot, razorbill, puffin	Operational. ES submitted, quantitative data available
Beatrice OWF	Moray Firth	63km	Common guillemot, razorbill, puffin	Consented. ES submitted, quantitative data available
EMEC Fall of Warness (tidal)	Orkney	71km	Common guillemot, razorbill, puffin	Operational. Long term monitoring data and collision risk output available.
Moray Firth OWF	Moray Firth	71km	Common guillemot, razorbill, puffin	Consented. ES submitted, quantitative data available
Westray South (tidal)	Orkney	76km	Common guillemot, razorbill, puffin	Scoping stage. No data available
Lashy Sound (tidal)	Orkney	78km	Common guillemot, razorbill, puffin	Scoping stage. No data available
Hywind OWF	Buchan Deep	184km	None (out of range)	ES submitted, quantitative data available

22.8.3 Refining the Assessment Scope

Table 22.10 identifies the combinations of impacts and development stages for which cumulative assessment for each receptor will be presented.

The physical presence of the tidal array in isolation is not considered likely to cause displacement impacts for any receptors - particularly as the Project will not contain any surface-piercing elements – and all receptors are considered of very low to low vulnerability to displacement (Furness *et al.,* 2012). At worst – visibility allowing - the immediate underwater vicinity of individual turbine devices might be avoided, although it is probably unlikely that such a zone would extend beyond several tens of meters. Any potential impact is considered to be sufficiently localised and temporally short-lived that it is particularly unlikely the Project would significantly contribute to a cumulative effect on any receptor.

Similarly, disturbance, and direct habitat loss are impact sources considered to be so localised and of such a limited magnitude and significance for the Project in isolation that it is inconceivable these would significantly contribute to a cumulative effect on any receptor.

Cumulative accidental contamination is considered for red-throated diver, shag and black guillemot for all development stages on account of these receptors' likely sensitivity, small regional populations and short foraging ranges – resulting in a potentially large spatial impact magnitude in case of an accident. Collision risk is considered to only be of relevance during operation for common guillemot, razorbill and puffin.

Table 22.10: Cumulative impacts assessed for each receptor

Development Stage	Disturbance	Displacement	Accidental contamination	Direct habitat loss	Collision
Construction and Installation	-	-	Shag, black guillemot, all other receptors	-	-
Operation and Maintenance	-	-	Shag, black guillemot, all other receptors	-	Common guillemot, razorbill, puffin
Decommissioning	-	-	Shag, black guillemot, all other receptors	-	-

22.8.4 Cumulative Accidental Contamination

Red-throated diver, shag and black guillemot are considered to have high sensitivity in relation to contamination as all have small regional populations, spend a lot of time on the sea surface and the latter two species are relatively sedentary year-round, the remaining receptors are deemed to have moderate to low sensitivity as their respective background populations are much larger.

The impact on seabird populations from accidental release of contaminants caused by the Project alone is rated as of negligible magnitude. This was concluded on the basis that the various good practice procedures that will be set up will make the occurrence of an accidental release very unlikely and were an incident to occur it would be quickly contained. A similar conclusion applies to all the other developments considered in this CIA. Although each development alone presents a very small risk, it is considered that the cumulative risk of an accidental release of contaminants event occurring must be several times greater. However, given all the embedded mitigation measures, any accidental contaminant release that may occur would at most be a rare event (once every few years at most), likely localised and quickly dispersed due to the strong tidal flows and is likely to be of a scale that affects less than 1% of seabird species regional receptor populations (or cause less than a 1% change in the annual adult mortality rate). Therefore this effect is judged as a potential long-term impact of negligible magnitude. It is concluded that the cumulative impact of accidental release of contaminants is a long-term effect of negligible significance.

22.8.4.1 Mitigation

The cumulative impact assessment identifies that accidental release of contaminants has greater potential than any other impact to cause adverse effect on seabird populations. This conclusion highlights the paramount importance that all measures designed to prevent accidental release are strictly adhered to and that projects have the appropriate contingency plans and equipment in place for dealing with incidents. Furthermore, these protocols should be subject to regular review and the risks to birds periodically reassessed in light of operational experience.

22.8.4.2 Residual Impact

As the risks of accidents can never be entirely eliminated and the accidental release of contaminants has the potential to kill large numbers of seabirds, it is judged that the residual cumulative impact remains an effect of negligible significance for all seabird receptor populations across all development stages (Table 22.11).

Table 22.11: Summary of cumulative residual effects of accidental contamination

Impact	Receptor	Sensitivity	Mitigation/good practice	Residual Magnitude	Residual Significance
Accidental contamination, Stage 1 and Stage 1 & 2	Red-throated diver	High	Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. Ref OR01	Negligible	Negligible
	Shag	High		Negligible	Negligible
	Kittiwake	Low		Negligible	Negligible
	Common guillemot	Moderate		Negligible	Negligible
	Razorbill	Moderate		Negligible	Negligible
	Black guillemot	High		Negligible	Negligible
	Puffin	Moderate		Negligible	Negligible
	All other seabirds	Negligible		Negligible	Negligible

22.8.5 Cumulative Collision Risk

In assessing cumulative collision risk for the Project all offshore wind farm developments and the Orkney to Caithness Interconnector (Table 22.9) have been ruled out as no collision impacts have been predicted from any of these to the receptors under consideration. Furthermore none of the three receptors (guillemot, razorbill, and puffin) are considered susceptible to collision risk from wave devices (MacArthur Green 2013). This reduces the potential scope of projects to be included to tidal developments in the Pentland Firth and Orkney. Of these, no data are available for Westray South (200MW) or Lashy Sound (30MW), although on the basis of proposed MW capacity the former has the same size as Project Stage 1 & 2, and the latter the same size as Project Stage 1. It is therefore possible that predicted impacts for these two projects will be roughly similar to the corresponding Project Stages.

One particular problem in comparing collision risk estimates is the difference in methodology used between projects. Collision rate estimates for MeyGen Inner Sound were based on exposure time modelling and are therefore not collision rates as such, whereas no modelling results were available for Shapinsay Sound. A recent report on the Fall of Warness tidal test site did however use both ERM and the CRM models as used for the Project (EMEC 2014), allowing for direct comparison of outputs.

Taking into account distances between the Project and other developments only MeyGen Inner Sound is closest in terms of spatial similarity of regional populations (Table 22.9). All other relevant developments are situated 60-80km away and therefore only partially overlap with the population definitions underpinning this assessment.

An overview of collision estimates for Brims and EMEC - Fall of Warness is provided in Table 22.12. For projects where modelling has predicted collision rates, the information presented in Table 22.12 is for an avoidance rate of 98%. This avoidance rate value was chosen for assessment purposes following advice from SNH (letter to Marine Scotland 14 December 2015). Overall, direct comparison with the EMEC estimates (not corrected for age class) for the auk species shows that these contribute very little cumulatively to Project estimates. For Lashy Sound and Westray South it is assumed that potential (proxy) impacts are of the same order of magnitude as the corresponding Project Stages in terms of MW capacity. In other words, the theoretical impact of Lashy Sound could be of similar size as that estimated for Project Stage 1, whereas the same applies to Westray South in relation to Project Stage 1 & 2. Due to differences in modelling approach no direct comparison can be made with the MeyGen exposure time estimates, although collision rates required to trigger a population decline were specified in the ES (footnote, Table 22.12). The assessment concluded that such rates were highly unlikely for the three auk species, particularly in light of the low peak abundance for these species on site. The consented capacity for MeyGen Inner Sound is 86MW (61 turbines), twice the number of turbines proposed for Project Stage 1.

Table 22.12: Worst case annual collision estimates (Brims, EMEC – Fall of Warness) and considerations for other projects.

Project	Annual collision estimates (bird per year) at 98% avoidance or mean individual annual exposure time (MeyGen)		
	Guillemot	Razorbill	Puffin
Project (Stage 1)	53	0.15	0
Project (Stage 1 & 2)	351	1.0	0
EMEC - Fall of Warness	9	0.1	0.5
Westray South	Same MW capacity as Project Stage 1 and 2		
Lashy Sound	Same MW capacity as Project Stage 1		
MeyGen Inner Sound	Twice the number of turbines compared to Project Stage 1		
Note: the MeyGen ES notes that to trigger regional population declines, minimum annual collision rates would have to equate to 1.6 birds/second (guillemot), 0.7 birds/second (razorbill) and 0.028 birds/second (puffin). These were considered unrealistically high rates, and thus unlikely to occur. Brims estimates have been corrected for age class (collisions reflect breeding adults only), those for EMEC have not (EMEC 2014).			

Common guillemot

Guillemot has a MMFR of 84km (standard deviation 50km; Thaxter *et al.,* 2012) and therefore the Westray South and Lashy Sound project lie within range of the Project (Table 22.9). However, given the distance of nearly 80km from BTA, it is unlikely that the majority of (proxy) collision estimates from these projects contribute substantially to a cumulative effect on the regional population. It is much more likely that the vast majority of collisions potentially that could occur at those developments involve birds from the nearby, large colonies in north Orkney.

At 98% avoidance, the impact on the regional population for the Project in isolation was assessed as one of negligible magnitude and significance. Cumulative estimates for Project Stage 1, EMEC, MeyGen Inner Sound (possibly equating to twice the estimate for Project Stage 1) and unknown – yet likely to be relatively small – collision estimates from Westray South and Lashy Sound could conceivably increase the impact magnitude to a low magnitude effect (guide of 1-5% change in mortality rate). This would result in an impact of negligible significance.

For Project Stage 1 & 2 the theoretical cumulative impact is more substantial, and could change the negligible magnitude effect predicted for the Project in isolation to a higher level (i.e. to a low magnitude level). Assuming a cumulative low effect magnitude, the overall impact would be of negligible significance.

Use of a more precautionary avoidance rate to asses the collision risk posed by these projects, could result in an increase in magnitude of the cumulative effect predicted. For example for Stage 1 & 2, if a 90% avoidance rate was used (i.e. five times more precautionary than a 98% rate), a medium magnitude level cumulative effect would be predicted and the overall impact would be of minor significance.

Razorbill

Razorbill has the shortest foraging range of the three auk species under consideration (MMFR: 48km, standard deviation: 35km; Thaxter *et al.,* 2012). Therefore, Westray South and Lashy Sound lie at the very upper range of the species' likely mean maximum foraging range in relation to the Project (Table 22.9). Thus it is very unlikely that the majority of (proxy) collision estimates for these projects would involve birds from the regional population defined for the Project.

At 98% avoidance, cumulative estimates for Project Stage 1, EMEC, MeyGen Inner Sound (possibly equating to twice the estimate for Project Stage 1) and unknown – yet likely to be very small – collision estimates from Westray South and Lashy Sound would be very unlikely to increase the negligible impact magnitude determined for the Project in isolation to a higher magnitude effect (i.e. to a low magnitude level: guide of 1-5% change in mortality change). This would result in an impact of negligible significance.

For Project Stage 1 & 2 the theoretical cumulative impact is like to be slightly greater, and could increase the negligible impact magnitude determined for the Project in isolation to a higher magnitude effect (i.e. to a low magnitude level). Even if this were the case, a cumulative low magnitude effect would result in an impact of negligible significance. In reality this is considered unlikely given the precautionary parameters used for the modelling.

Use of a more precautionary avoidance rate to asses the collision risk posed by these projects, could result in an increase in magnitude of the cumulative effect predicted. For example for Stage 1 & 2, if a 90% avoidance rate (i.e. five times more precautionary than a 98% rate) was used, a low magnitude level cumulative effect would be predicted and the overall impact would be of negligible significance.*Puffin*

Indicative collision estimates for the Project (both Stages) equate to zero annual collisions for puffin. Therefore, no cumulative effect is likely to occur and the negligible (equating to no change) impact magnitude determined for the Project in isolation remains valid.

Stage 1

The assessment considered three receptors (common guillemot, razorbill, and puffin) in relation to cumulative collision risk from the MeyGen Inner Sound and EMEC – Fall of Warness/Westray South/Lashy Sound projects. Given the low peak abundance levels and unlikely occurrence of population level effects at the former (MeyGen), and the (directly comparable) very small collision estimates for the latter (EMEC), and in light of the impact zones of the other two projects only partially overlapping with the respective Brims' regional population, it is considered unlikely that a significant cumulative effect would arise to the point of increasing the assessed significance level for the Project in isolation. Therefore, cumulative effects of operation and maintenance collisions on all three receptors remained unaltered from the previous (in isolation) evaluation of negligible significance for Stage 1.

Stage 1 & 2

Using the same reasoning as for Stage 1 above, the assessment considered that for guillemot a cumulative effect cannot truly be ruled out on the basis of lack of data for Westray South and Lashy Sound and the incompatibility with modelling results for the MeyGen project. However, it is considered unlikely that any cumulative effect would extend beyond negligible significance.

For razorbill it is considered that although the same issues in relation to data apply, predicted collisions for the Project and likely estimates for other projects are so small that any cumulative effect is likely to be insignificant.

Lastly, for puffin it is considered there is no likely cumulative effect as predicted collision rates for the Project equate to zero.

Therefore, cumulative effects of operation and maintenance collisions for razorbill and puffin remain unaltered from the previous (in isolation) evaluation of negligible significance for Stage 1 & 2. For guillemot the cumulative effect of collisions is evaluated as of negligible significance for Stage 1 & 2 (Table 22.13).

Table 22.13: Summary of cumulative residual effects of collision risk to diving birds

Impact	Receptor	Sensitivity	Mitigation/good practice	Residual Magnitude	Residual Significance
Collision risk to diving seabirds (Stage 1)	Common guillemot	Negligible	PD04 (increasing minimum surface clearance of turbine-swept area)	Negligible	Negligible
	Razorbill	Low		Negligible	Negligible
	Puffin	Negligible		Negligible	Negligible
Collision risk to diving seabirds (Stage 1 & 2)	Common guillemot	Negligible		Low	Negligible
	Razorbill	Low		Negligible	Negligible
	Puffin	Negligible		Negligible	Negligible

22.8.6 In-combination Impacts

There is likely to be some overlap of construction activities at Brims while the first phase of the MeyGen Inner Sound development will already be operational. Similarly, Project Stage 1 could be operational while the second MeyGen phase is under construction. Both scenarios could lead to in-combination impacts on receptors from combined construction and operation and maintenance activities. Due to the highly localised nature of activities on each development site any potential cumulative impact is judged to be of negligible significance.

In-combination impacts with other projects during construction, operation and maintenance and decommissioning are considered exceedingly unlikely given the small scale of the BTA, the relatively low site importance for ornithological receptors and the very limited spatial magnitude of predicted impacts. The potential for such impacts is therefore not considered further and assessed as of negligible significance.

22.8.7 Summary of Potential Cumulative and In-combination Impacts

Project	Phase	Impact mechanisms	Species	Potential for cumulative and/or in-combination impacts
MeyGen Inner Sound EMEC Scapa Flow EMEC Billia Croo Orkney to Caithness Interconnector Shapinsay Sound Beatrice Demonstrator OWF Beatrice OWF EMEC Fall of Warness Moray Firth OWF Westray South Lashy Sound	Construction and Installation	Accidental contamination	Shag, black guillemot, all other receptors	No significant cumulative or in-combination effects
	Operation and Maintenance	Accidental contamination	Shag, black guillemot, all other receptors	No significant cumulative or in-combination effects
	Decommissioning	Accidental contamination	Shag, black guillemot, all other receptors	No significant cumulative or in-combination effects

Project	Phase	Impact mechanisms	Species	Potential for cumulative and/or in-combination impacts
MeyGen Inner Sound Shapinsay Sound EMEC Fall of Warness Westray South Lashy Sound	Construction and Installation	Collision Risk	Common guillemot, razorbill, puffin	No significant cumulative or in-combination effects
	Operation and Maintenance	Collision Risk	Common guillemot, razorbill, puffin	No significant cumulative or in-combination effects
	Decommissioning	Collision Risk	Common guillemot, razorbill, puffin	No significant cumulative or in-combination effects

22.9 SHIPPING AND NAVIGATION

The only potential shipping and navigation cumulative impact that could arise from construction and maintenance activity if work vessels for Brims are using ports also being used by other developments, e.g., Lyness and/or Scrabster. This could lead to congestion in and around the ports. However, this is not considered to be a significant impact and can be managed (if necessary) through liaison between BTAL and with the Port Authorities.

Having considered the information presently available in the public domain on the projects for which there is a potential for cumulative impacts, and due to the localised nature of potential impacts associated with this Project, it is considered that from a shipping and navigation perspective there will be no significant cumulative impact from any of these projects.

22.10 COMMERCIAL FISHERIES

Cumulative impacts are most likely to occur during construction phases when safety zones will be in place. As the projects listed are at various stages of development, from scoping to operation, it is unlikely that there will be multiple construction phases taking place at the same time. Furthermore, the proposed area for the Project is fished by local fishermen who, it is understood, do not travel long distances to fishing grounds. It is likely that the areas affected by other projects in the surrounding area are beyond the grounds typically fished by vessels utilising the Project site. Cumulative impacts are therefore not anticipated to be significant for the Project.

22.11 SLVIA

It was agreed with OIC and SNH that the only relevant project for inclusion in the cumulative assessment is the MeyGen tidal turbine project, located within the Pentland Firth some 7km distant from the Project (Section 17.6).

Examination of the ZTV for the MeyGen project identifies very limited overlapping theoretical visibility with the ZTVs for the various components and options for Brims. Areas with overlapping visibility are limited to small areas on the west coast of Stroma, the southern tip of Swona and areas at Dunnet Head and St John’s Point as well as areas of the Pentland Firth including the Gills Bay to St Margaret’s Hope ferry route. None of the seascape, landscape or visual receptors within these locations will experience significant adverse effects as a result of Brims in isolation due to the distances involved. It is therefore concluded that there will be no significant cumulative seascape, landscape or visual effects resulting from the addition of Brims to the MeyGen development.

22.12 MARINE HISTORIC ENVIRONMENT

It is not considered that there is any potential for cumulative or in-combination impacts on the marine historic environment as the Project is too far away from any others to produce cumulative an in-combination impacts.

The following codes of practice, professional guidance and standards directly relevant to the assessments of impacts have informed the assessment criteria:

- Oxford Archaeology & George Lambrick Archaeology and Heritage (2008) *Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy*, commissioned by COWRIE Limited (project reference CIARCH-11-2006).

22.13 SOCIO-ECONOMICS

This assessment of cumulative effects considers the socio economic impacts that will arise from the Project combined with existing baseline trends along with any future planned projects. For each project the distance to port from any particular site will play an important role in keeping the costs down and also being able to take advantage of weather windows on site. This could become a factor in site choice within the region as the ports assessed for the Project will be the same as available for other projects being developed in the region. The following sites have the potential of developing cumulative impacts on the Project:

- EMEC Billia Croo Wave Energy test site;
- EMEC Scapa Flow;
- MeyGen Inner Sound;
- Pentland firth cable route;
- Beatrice Offshore Windfarm;
- Beatrice Demonstrator Offshore Windfarm;
- Moray Firth Offshore Windfarm; and
- Orkney to Caithness Interconnector.

The key regional construction and O & M options that have been identified within the socio economic assessment are Lyness in Orkney, Stromness in Orkney and Scrabster in Caithness. The capacity of each area to absorb more than the Project is described below.

Lyness

This is a key port development for Orkney as such the Orkney Islands Council (OIC) have been promoted the port for any offshore renewables project. The site although recently upgraded is still a relatively open and undeveloped site with a large area (14 Ha) of land available adjacent to the pier designated by the OIC as development land. Lyness has already supported a number of projects related to the EMEC wave test site at Billia Croo near Stromness. Both OIC and HIE suggested in consultation that they would be willing to support in principal building infrastructure including new pier space to ensure any large project does not impinge on other projects.

Stromness

This port has equally already been involved in supporting renewable operations related to the EMEC site. It is a smaller port and laydown area and a relatively busy port with Fishing vessels, Ferries and recreational craft all competing for space. The recent completion of the pier at Copland's dock has enhanced the port and therefore allowed for more capacity.

Scrabster

This port is the busiest for larger vessels and has a more built up area adjacent to the Piers. The Scrabster harbour trust has laydown area designated on a farm close to the Port that could be developed for other projects. This port has already been used as a service base for the MeyGen Inner Sound project and is also advertising its capability for other offshore projects. It has been planning a new reconstruction development that would include building more pier space and some land reclamation which would increase its capability but as yet the design is not finalised and funding is not in place. The port being on the mainland has road transport links with the A9 truck road feeding through to central Scotland.

The list below highlights the impacts assessed within the socio economic assessment (Chapter 19) that have the potential to have cumulative or in-combination impact effects:

- Local employment and business opportunities;
- Improvements to local infrastructure;
- Effects upon other marine users;
- Clustering effect;
- Displacement of existing employment;
- Pressure on local infrastructure and services ; and
- Pressure on existing housing and accommodation.

22.13.1 Discussion of Potential Cumulative and In-combination Impacts

The following sections consider the various possible cumulative or in-combination impacts associated with these plans and projects in terms of the impact categories already assessed for the Project.

22.13.1.1 Local employment and business opportunities

Construction and Installation

The increased level of activity that more than one project would bring to each area would increase the employment and business opportunities within each area and therefore the socio economic benefits. These benefits are substantial although not fully defined for any of the projects due to their stage of development. Stromness being a smaller port would find it harder to host more than one larger project but due to the distance from MeyGen or Beatrice this is unlikely to be required.

Operation and Maintenance

Each area would welcome the operation and maintenance activity and all three bases would be able to support these types of operation and enhanced benefits.

22.13.1.2 Decommissioning

The uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts. If decommissioning of two or more sites happened simultaneously they may require similar operations to the construction phase and so impacts would be similar.

22.13.1.3 Improvements to local infrastructure

All phases of the Project would provide improved infrastructure and the areas involved would benefit from these improvements.

22.13.1.4 Effects upon other marine users

Construction and Installation

Each area has identified that the ports require good space and pier management to ensure conflicts between marine users are minimised. This would need to be enhanced if more than one project uses the port. Each port suggested during consultation that this management is possible and with good planning and communications they can cope with significantly more activity. There are a number of ports within the region as identified in the socio economic assessment that are close by and have facilities that can be used to support some overspill and temporary berthing to enhance port management.

Operation and Maintenance

The issues for longer term O & M activities will easily be mitigated with good port management.

Decommissioning

The uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts. If decommissioning of two or more sites happened simultaneously they may require similar operations to the construction phase and so impacts would be similar.

22.13.1.5 Clustering effect

All phases of the Project will support positive benefit from the clustering around the Project. This will only increase if more than one project is co-located.

22.13.1.6 Displacement of existing employment

The displacement of employment within the local area could be enhanced with more projects using the same port and this may increase competition between projects for key staff. The timing and build out programmes for the projects would determine the level of impact. There would be significantly less impact during the operation and maintenance phase of the Project due to the reduction in numbers of people required.

22.13.1.7 Pressure on local infrastructure and services

The pressure on the local infrastructure would be enhanced if more than one project was developed in the same port but the consultation process brought out that infrastructure upgrades would be welcomed and that the local authorities and development agency were willing to financially support these upgrades. The operation and maintenance phase of the Project would have much less impact on local infrastructure and services.

22.13.1.8 Pressure on existing housing and accommodation

The pressure on housing and accommodation increased if more than one project was developed in the same port but the consultation process brought out that housing could be provided for large numbers of employees. There are options available such as work camps that could be used to provide temporary accommodation if this became an issue and the local authority may support the building of this type of accommodation.

The operation and maintenance phase of the Project would have much less impact on housing.

22.13.2 Summary of Potential Cumulative and In-combination Impacts

Project	Phase	Impact mechanisms	Potential for cumulative and/or in-combination impacts
EMEC Billia Croo Wave Energy test site EMEC Scapa Flow MeyGen Inner Sound Pentland firth cable route Beatrice Offshore Windfarm Beatrice Demonstrator Offshore Windfarm Moray Firth Offshore Windfarm Orkney to Caithness Interconnector	Construction and Installation & Operation and Maintenance	Socio-Economics - Local employment and business opportunities	Potentially significant positive cumulative and in-combination effects
	Decommissioning		Uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts
	Construction and Installation & Operation and Maintenance	Socio-economics - Improvements to local infrastructure	Potentially significant positive cumulative and in-combination effects
	Decommissioning		Uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts
	Construction and Installation & Operation and Maintenance	Socio-economics - Effects upon other marine users	No significant cumulative or in-combination effects
	Decommissioning		Uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts
	Construction and Installation & Operation and Maintenance	Socio-economics - Clustering effect	Potentially significant positive cumulative and in-combination effects
	Decommissioning		No significant cumulative or in-combination effects
	Construction and Installation & Operation and Maintenance	Socio-economics - Displacement of existing employment	No significant cumulative or in-combination effects
	Decommissioning		Uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts

Project	Phase	Impact mechanisms	Potential for cumulative and/or in-combination impacts
	Construction and Installation & Operation and Maintenance	Socio-economics - Pressure on local infrastructure and services	No significant cumulative or in-combination effects
	Decommissioning		Uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts
	Construction and Installation & Operation and Maintenance	Socio-economics - Pressure on existing housing and accommodation	No significant cumulative or in-combination effects
	Decommissioning		Uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts

22.14 RECREATION AND TOURISM

No cumulative impacts are expected on tourism or recreational interests in terms of disruption to activities as these impacts are likely to be highly localised, and as those associated with the Project are mostly restricted to the construction phase, are temporary in nature. The potential cumulative impacts on tourists' visual amenity are assessed in Chapter 17 Seascape, Landscape and Visual Impact Assessment.

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Environmental Mitigation, Monitoring and Management

Chapter 23

23 ENVIRONMENTAL MITIGATION, MONITORING AND MANAGEMENT

23.1 INTRODUCTION

The purpose of this chapter is to present the proposed approach to developing a Project Environmental Management Plan (PEMP) for the Brims Tidal Array Project (the Project). The PEMP will be developed in consultation with the regulator, statutory consultees and relevant stakeholders post-consent. Mitigation and monitoring measures identified throughout the ES are also collated into a Project Commitments Register which will sit within the PEMP.

23.2 ENVIRONMENTAL STEERING GROUP

It is proposed to establish a steering group to oversee the development of the PEMP, review its implementation and act as the 'adaptive management group' for the Project. The Brims Tidal Array Environmental Steering Group (ESG) would include (as a minimum) representatives from the following organisations as well as nominated specialist advisors:

- BTAL;
- Marine Scotland;
- Scottish Natural Heritage (SNH); and
- Scottish Environment Protection Agency (SEPA).

23.3 DEVELOPING THE PEMP

The PEMP will be developed by BTAL in consultation with the ESG. Ultimate approval will come from the licensing authority, Marine Scotland. The PEMP will be developed as follows:

- Following consent, the ESG will be convened and Terms of Reference issued;
- A proposed structure and outline content will be produced by BTAL and circulated to the ESG;
- A kick-off meeting will be held with the ESG and other invited stakeholders to agree the structure, content and development plan for the PEMP;
- The PEMP will be produced by BTAL in consultation with the ESG and other stakeholders and submitted to the ESG for comment;
- A second ESG meeting will be held to discuss the content of the PEMP; and
- BTAL will revised the PEMP based upon comments/feedback received during the second meeting and submit a draft version to Marine Scotland for distribution to stakeholders for approval.

The PEMP will be a working document. Any amendments will be made in consultation with the ESG, stakeholders and ultimately approved by the regulator.

23.4 STRUCTURE AND CONTENT OF THE PEMP

Following consent, a proposed structure and outline PEMP will be produced by BTAL and issued to the ESG. It is proposed that an overarching PEMP will be produced which will then be used in conjunction with a series of Environmental Management Documents which contain environmental and health and safety management controls, licence/consent conditions and supporting information in relation to specific requirements. It is proposed that the following structure is adopted for the overarching PEMP:

- Project overview; description of relevant works i.e. construction works;
- Organisation; chart outlining the organisation of the team including all sub-contractors and links to the regulator and ESG;
- Project programme; key Project dates and build out schedule;
- Contact details; for key personnel e.g. General Site Manager, CDM Coordinator, Fisheries Liaison Officer;
- BTAL Environmental Policy; aims and performance indicators;
- PEMP objectives; purpose, aims and objectives;
- PEMP scope; overview of works covered by PEMP;
- PEMP structure; description of PEMP format and overview of related documents;
- Environmental impacts; overview of environmental impacts/considerations relevant to the PEMP;
- Consents and legislative requirements; a summary of the licence/consent requirements and link to relevant EMP;
- Roles and responsibilities; description of the roles and responsibilities of the Project team (including all sub-contractors);
- Communications and routine reporting; description of the Project team's internal communications and reporting plan and the team's communication and reporting plan with the regulator, the ESG and other stakeholders;
- Training procedures; an overview of the training procedures implemented by the team including; inductions, site briefings, tool-box talks, formal training and education etc.;
- Incident reporting procedures; building upon the definition of roles, responsibilities and communications plan, a full description of how details of any environmental incidents will be communicated through the Project team and to the regulator will be provided;
- Monitoring targets;
- Inspection and audit procedures;
- Non-conformance, corrective and preventive actions/procedures; mechanisms for detecting and non-conformances along with an overview of how appropriate corrective and preventive measures will be implemented, documented and reported will be provided;
- Liaison with external authorities; an description of BTAL's agreed liaison plan with the regulator and other stakeholders will be provided including a communications plan, visit/inspection protocols etc;
- PEMP review and adaptive management process; a description of the PEMP review and consultation procedures will be provided; and
- Environmental Management Documents; specific environmental management documents will be included as appendices to the PEMP and be made available as stand-alone documents including, but not limited to:

- Construction Environmental Management Document;
- Marine Mammal Management/Protection Plan;
- Species Protection Plan for otter;
- Marine Pollution Contingency Plan;
- Invasive Non-native Species Management Plan;
- Reporting Protocol for the Discovery of Marine Archaeology; and
- Waste Management Plan.

Each Environmental Management Document would include, as a minimum, the following information:

- Objectives;
- Summary of potential impacts;
- Summary of relevant licence/consent conditions and requirements;
- Description of each control measure including the relevant consent requirement(s)/best practice measure(s), responsibility, timing, reporting requirement(s), communications plan, contingency plan; and
- Project Commitments Register.

23.5 PEMP REVIEW AND CONSULTATION

The PEMP will be developed in consultation with and approved by the ESG; and ultimately the licensing authority. Upon approval, the PEMP will be implemented as described in Section 23.4. Due to the novel nature of the technology proposed for deployment and the scale and duration of the Project, it is proposed that an adaptive management approach is taken to the environmental management of the Project; particularly during the build-out and operation of Stage 1. Consultation and stakeholder engagement is at the heart of any environmental management programme; particularly where strategic research and information sharing is critical to the success of a project and nascent industry. An overview of BTAL's approach to PEMP review and consultation, underpinned by adaptive management, is presented in Figure 23.1.

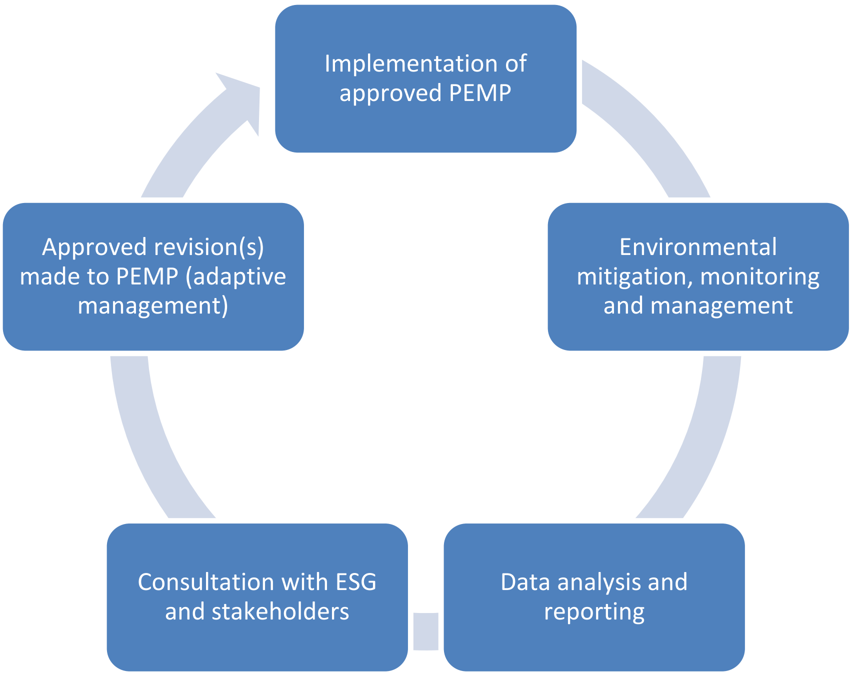

Figure 23.1: Overview of BTAL's approach to PEMP review and consultation

As shown, a cycle of data gathering, analysis, reporting, consultation and adaptive management is proposed. At this time, it is proposed that Environmental Monitoring Reports are submitted to the ESG and stakeholders every six months from the commencement of construction. This approach ensures that no impact will go unchecked for more than six months, following which, any necessary additional mitigation measures/environmental safeguards can be implemented. Similarly, mitigation/monitoring measures deemed no longer necessary can be reduced or ceased.

An adaptive management approach offers the regulator, along with its advisors, the ESG and stakeholders the opportunity to undertake routine reviews of environmental monitoring data and to ensure that the PEMP is reviewed and updated as necessary based on the best available scientific information.

This approach offers the same protection and safeguarding measures for protected species as that afforded by a 'Staged' consent and is in line with the overarching principles of the survey, deploy and monitor approach (Marine Scotland, 2012) as the Project team, regulator and stakeholders have the opportunity to learn continuously as the Project is built out; meeting on a regular basis to ensure that the best and most appropriate environmental mitigation and monitoring measures are implemented.

23.6 MITIGATION AND MONITORING MEASURES

Table 23.1, Table 23.2 and Table 23.3 present an overview of the mitigation and monitoring measures identified through the impact assessment process and detailed in the ES. Where the EIA has identified potentially significant impacts that cannot be avoided, mitigation measures have been proposed. Such measures should remove, reduce or manage the effect to a point where the residual significance of that impact is reduced to an acceptable level. Mitigation measures have also been recommended in some cases where impacts have been assessed as being not significant in order to ensure that the impacts remain so.

These measures will be incorporated into the PEMP and relevant EMPs as appropriate. Further monitoring measures will be developed post-consent in consultation with the ESG and stakeholders based upon the best available technology and environmental understanding. Any guidance regarding the good/best practice approaches available will be adopted and implemented as appropriate and as agreed with the ESG and the regulator. BTAL is committed to strategic environmental research and sits on the Steering Group of the Offshore Renewables Joint Industry Programme for Ocean Energy.

Table 23.1: Project design mitigation measures

Code	Mitigation
All Stages	
PD01.	The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance
PD02.	To minimise risk of pollution, any necessary cooling systems will be closed circuit systems using water with non-toxic antifreeze or other type of non-toxic coolant. Lubricants used will be either mineral oils or bio-compatible/ bio-degradable oils with low ecotoxicity
PD03.	The AfL area has been revised, with 80% of the area for investigation shifted to the west, and the remaining 20% overlapping with the original site. Initial consultation identified this as a positive step to mitigate the risk of vessels using the western approaches to Scapa Flow, including tankers and the Scrabster-Stromness ferry. The barrier effect of the tidal array equates to only 0.9% of the cross sectional area of the Pentland Firth therefore this positioning minimises potential impacts of the barrier effect on fish.
PD04.	Floating devices were initially under consideration in the original design envelope, but were removed, in order to reduce the risk of collision as well as potential for loss of station. This design was also changed from a minimum clearance of turbines below the water level to LAT (approximate chart datum) of 20m to 30m.
PD05.	In June 2015, surface piercing technologies including hubs were removed from the Project design envelope, meaning that the entire Project will be seabed mounted and will not contain any surface piercing element. This significantly reduces the potential for vessel collision, which had previously been identified as the main hazard at the NRA stakeholder workshop, prior to this decision being taken. It also mitigates the disturbance of birds, visual landscape and physical processes.
PD06.	The maximum installed capacity and maximum limit to the number of turbines will reduce the potential effects arising from the turbines and TSS.
PD07.	A deploy and monitor strategy will be adopted i.e. continual monitoring of activities during device deployment to ensure that potential impacts identified and adaptive management measures are applied appropriately from the commencement of construction. A Project Environmental Management Plan will be developed in consultation with relevant stakeholders which will include mitigation and monitoring measures to ensure there are no significant environmental effects from the Project.
PD08.	The construction and installation, operation and maintenance and decommissioning timescales provide a time limit for the maximum duration of effects.
PD09.	Protection against the effect of EMF may include armour protection (possible double armour or interlocking armoured shells). The use of these methods will increase the distance between marine species sensitive to EMF and the EMF source.

Code	Mitigation
PD10.	The introduction of Project components and artificial substrates including TSS gravity bases will provide artificial refuges for fish or shellfish species.
PD11.	During operation, smaller vessels may be used for maintenance purposes. This will therefore reduce underwater noise levels and associated potential impacts.
PD12.	All TSS (and turbines) will be installed over a period of approximately 4 years, resulting in intermediate sediment release/disturbance during installation and allowing sufficient time for any sediment to disperse. In addition, the location of the Project is such that strong tidal currents will provide quick dispersion of any sediment released/disturbed over the installation period proposed.
PD13.	Construction vessels will not be operating continuously during the installation Stages therefore reducing disturbance and potential injury to sensitive fish species.
PD14.	All sites of high importance and, where possible all sites of any potential archaeological or cultural heritage importance will be avoided through Project design e.g. placement of TSSs and location of inter-array cables and export cable routes. Geophysical anomalies identified from only a single type of response may be given an avoidance buffer of 20m, while anomalies identified from several types of survey (such as MBES04, SSS03 and M028, which may represent the remains of the Canadian) and known wrecks may be given an avoidance buffer of 50m. This is in order to take account of a potential debris scatter field around a wreck, or a multiple response representing the tip of a wreck that extends further than the core location of the anomaly.
Construction	
None	
Operation and Maintenance	
PD15	All turbines will be fitted with on-board monitoring systems to check turbine performances and identify any damage, anomalies or faults
Decommissioning	
None	

Table 23.2: General mitigation measures

Code	Description
All Stages	
GM01.	BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate.
GM02.	The construction and operation of the Project will be undertaken in line with the description of ES, however over the duration of detailed technical design an engineering change notification system will be implemented to ensure coherence with ES technical description. If any part of the detailed design is assessed by BTAL to potentially result in technical differences to those reported in the ES, a process of consultation will be initiated with relevant statutory consultees to determine level of material changes and appropriate actions.
GM03.	An Ecological Clerk of Works will be appointed to audit site activities and will advise on implementation of mitigation.
GM04.	BTAL will collate an Environmental Management Document (EMD) to guide on-going operations and maintenance activities during the lifetime of the Project. The EMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the operational period.
GM05.	The Pollution Control Plan will form part of the wider EMD to manage the potential for accidental pollution, management of materials on site and response for any pollution events
GM06.	BTAL will develop a Supplier Evaluation procedure which will be implemented prior to tender/contracting potential sub-contractors, which will include an environmental performance evaluation as part of the selection process. Contractors will be contractually required to take account of and implement the relevant committed mitigation measures as well as other recognised construction best practice measures including those adopted by BTAL.
GM07.	A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works.
GM08.	A Project risk register will be updated and maintained via dedicated workshops between various engineering disciplines, to ensure the potential for accidental events are identified and managed in advance for all operations and control actions identified.
GM09.	Any vessels required from international waters, or exceeding the thresholds set out in IMCA guidance will be audited to ensure that they have a Ballast Management Plan, with up to date records prior to operations on site.
GM10.	An Emergency Response Cooperation Plan (ERCoP) will be prepared for the Project following the template provided by the MCA in MGN 371. This will be submitted to the MCA for approval prior to construction
GM11.	Large vessels (> 400GRT) will have Shipboard Oil Pollution Emergency Plans (SOPEPs) which will include a response strategy to reduce potential impacts in the unlikely event of a large accidental release.

Code	Description
GM12.	Supervisory control and data acquisition (SCADA) system to be carried out continuously and will alarm if abnormal measurements are received indicating a potential problem
Construction	
GM13.	BTAL will submit a Cable Laying Strategy and method statement to Marine Scotland with details of: Geophysical survey outputs; Planned deployment corridor and micro-siting options; Cable protection measures; and Method Statement including minimum depths and protection.
GM14.	BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures.
GM15.	Temporary Safety Zones will be established during construction and maintenance activities to limit non-project vessels from entering these areas. The extent and duration of the Safety Zones will be agreed with the NLB and MCA prior to application (maximum 500m radii) and communicated through the issue of Notice to Mariners.
GM16.	A detailed geophysical survey of the Sheep Skerry cable corridor will include a magnetometer survey of the proposed area to identify any metallic contacts, where contacts are identified these will be avoided in the first instance, if there is a likelihood of direct impact, measures will be made to avoid contact with the feature.
GM17.	A Landfall Installation Plan will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore
Operation and Maintenance	
GM18.	There will be appropriate inspection and maintenance procedures in place for all elements of the Project
Decommissioning	
None	

Table 23.3: Specific mitigation and monitoring measures

EIA chapter	Ref	Mitigation Measure Description
Chapter 9, Physical Processes	**All Stages**	
	PP01	Selection of infrastructure and installation approaches which best suit the physical environment in which they will be located rather than installation of worst case scenario across the whole AfL. Hence the actual impact will be within the bounds of those worst case scenarios which have been assessed in this chapter.
	PP02	Planning and implementing the construction and installation, operation and maintenance, and decommissioning works so that there is maximum cost-effectiveness, whilst minimising potential impacts. For example this may be achieved through the Staged installation of TSS or the Staged maintenance of turbines over a period of time.
	PP03	A Landfall Installation Plan (Mitigation Measure GM17 Table 5.16) will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore.
	Construction	
	None	
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 10 Coastal and Terrestrial Ecology	**All Stages**	
	None	
	Construction	
	CTE01	Reinstatement of sensitive habitats (UK BAP or LBAP) will be reinstated following best practice guidance. Material removed from the terrestrial/intertidal habitat should be stored and replaced within the same terrestrial/intertidal habitat following the cable installation works
	CTE02	A pre-construction survey for otter will be carried out 8-10 weeks prior to works commencing. If any otter shelters are located, further protection measures will be discussed and agreed with SNH/Marine Scotland and implemented, including the possible need for a European Protected Species (EPS) licence if there is potential for disturbance to otter.
	CTE03	Mammal exit ramps will be provided for potential hazards such as steep-sided exposed trenches or holes when contractors are off site (i.e. at night time). Temporarily exposed pipe systems will be capped when contractors are off site to prevent otters from gaining access.
	CTE04	If works are due to take place during the bird breeding season (April to August inclusive), a pre-construction breeding bird survey will be undertaken by a suitably qualified ECoW to ensure no nests are present on site or adjacent to the site before works commence.
	CTE05	If works are likely to be required during the bird breeding season (April to August inclusive) use of appropriate measures (to be agreed with SNH) to deter birds from

EIA chapter	Ref	Mitigation Measure Description
		breeding on site before construction commences should be implemented at the earliest opportunity before nest building begins. Possible deterrent measures include use of reflective tape or ribbons on posts.
	CTE06	Any nesting birds will be noted and works will be programmed to avoid disturbance. An exclusion zone or other alternative approaches to avoid damage or destruction to nests will be devised and agreed as appropriate with SNH. Exclusion zones around active nest sites will be clearly demarcated at the earliest opportunity to protect nesting birds from disturbance. Any nests will be monitored on a weekly basis by the ECoW to determine when the nesting bird ceases usage of the nest and therefore when it is safe to commence works in the area.
	CTE07	If a cable landfall location is chosen on South Walls, within the Aith Hope AoS, construction activities will be timed to have commenced before the arrival of Greenland barnacle geese in mid-October.
	CTE08	Where works are to be undertaken during the bird breeding season (April to August inclusive), the Ecological Clerk of Works will be present until the works are completed or until it is clear that no breeding birds would be adversely affected by the works.
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 11, Benthic Ecology	**All Stages**	
	BE01	Pre-construction cable route surveys will be conducted prior to determining the final cable route option and will confirm whether any sensitive habitats are present. BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat.
	BE03	Marine standard anti-fouling coatings on turbines and associated infrastructure will only be used where necessary.
	Construction	
	BE02	Management measures will be in place to ensure that any rock placement that is required will be kept to a minimum to reduce seabed disturbance.
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 13: Marine Mammals	**All Stages**	
	MM01	A vessel management plan (Mitigation measure GM07) will be developed in consultation with SNH and Marine Scotland which will aim to develop a standard transit route and range of vessel speeds for traffic to and from the AfL area with the aim of minimising collision risk.
	Construction	

EIA chapter	Ref	Mitigation Measure Description
	None	
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 14: Ornithology	**All Stages**	
	OR01	Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits
	Construction	
	OR02	Installation activities will only take place during suitable weather windows.
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 15 Shipping and Navigation	**All Stages**	
	SN01	The Brims site is located close to Scapa Flow which has three harbour tugs with the potential to tow a drifting vessel (dependent on vessel size and weather).
	SN02	Orkney VTS will liaise with Coastguard and navigational warnings will be broadcast in an emergency.
	SN03	Enhanced vessel selection and auditing of vessels working on site taking into account the strong tidal flows likely to be experienced
	SN04	Liaison with Orkney Vessel Traffic Services
	SN05	AIS to be fitted on all workboats working at the Project
	SN06	Control system will produce an alert in the event of a failure of a device or a component part
	SN07	The Project will be depicted on Admiralty Charts produced by the UKHO
	SN08	Working vessels will comply with the International Collision Regulations
	SN09	Site personnel will be suitably equipped and trained for work offshore meeting RenewablesUK Health and Safety Executive (HSE) guidelines
	SN10	When there are work vessel(s) on site, one vessel will be nominated as a guard vessel with appropriate procedures for traffic monitoring and collision risk management
	Construction	
	SN11	Fast rescue craft available during construction work
	SN12	Avoid developing extreme SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area to help ensure safe passage.
	SN13	Appointment of marine coordinator to manage work vessel movements

EIA chapter	Ref	Mitigation Measure Description
	SN14	Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation. Burial is the preferred protection where seabed conditions allow.
	SN15	Wet storage of devices/equipment (i.e., temporary storage in water not at their final locations) to be minimised.
	SN16	Experience and lessons learned from incidents, accidents and near-misses at other marine renewables projects will be taken into account
	SN17	HM Coastguard will be informed of work at the site to allow them to issue MSI broadcasts as appropriate
	SN18	There will be adverse weather working policies and procedures for periods of construction and maintenance
	SN19	Onshore control room to monitor the Project
	SN20	Appropriate PPE will be worn by all working at the Project
	SN21	Continuous watch by VHF including DSC
	SN22	Periodic surveys of the cable will be carried out to ensure protection measures remain effective
	SN23	Coordination with local harbour to carry out combined drills/ exercises
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 16: Commercial Fisheries	**All Stages**	
	CF01	Communication and liaison with fishermen by FLO and marine traffic coordinators will continue throughout Project development and cable route corridor decision making process
	CF04	FLOWW Guidelines will be used throughout the Project lifetime
	CF05	Cable route corridors Sheep Skerry and Moodies Eddy would result in the greatest Project mitigation for commercial fisheries as these have smaller footprints and fishing intensity is lower within them.
	Construction	
	CF02	Discussions will be held with local marine users in advance of any works commencing to review procedures associated with the construction stage to ensure that they address local concerns as far as possible (Mitigation Measure GM01)
	CF03	Fishermen will be notified of the schedule works taking place, location of safety zones and partially installed infrastructure as discussed in Chapter 15: Shipping and Navigation (Mitigation Measure GM01)
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
	All Stages	

EIA chapter	Ref	Mitigation Measure Description
Chapter 18: Marine Archaeology and Cultural Heritage	**MA01**	Where avoidance is not possible, sites of potential archaeological or cultural heritage importance affected by the Project will be examined in more detail by drop down camera or Remote Operated Vehicle (ROV) under archaeological direction. The data from the investigation will be assessed by a marine archaeologist.
	MA02	Depending on the results from the examination an appropriate management and mitigation strategy will be developed in consultation with the statutory authorities (Marine Scotland, Historic Scotland, and Orkney Islands Council). This will include specific measures that are considered to be appropriate and practical for a site of this challenging and highly dynamic nature such as: Layout redesign to avoid highly sensitive remains; and Where avoidance is not possible, targeted very high resolution remote sensing survey to identify and record any remains.
	MA03	The difficult conditions in the Pentland Firth mean that the requirement for more detailed archaeological investigations such as sampling of any identified palaeo-landscape deposits, intrusive works, wreck recovery or archaeological excavations will need to be considered on a case by case basis in close consultation with the statutory authorities if the need arises.
	MA04	A written scheme of investigation will be produced, to include cross-referencing with construction and environmental management plans, and inductions on any marine historic environment assets to avoid. This will be agreed with relevant consultees prior to commencement of works.
	MA05	A reporting protocol for the accidental discovery of cultural remains in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects, http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects.pdf This will be agreed with relevant consultees prior to commencement of works.
	Construction	
	None	
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 19: Socio-economics	**All Stages**	
	None	
	Construction	
	SE01	BTAL will liaise with the relevant planning authorities, to avoid congestion and pressure on existing housing and accommodation.
	SE02	BTAL will work with relevant planning authorities to develop appropriate mitigation for any potential conflicts with existing uses of ports.
	SE03	BTAL will consult with local ferry operators and an additional ferry service would be added for construction traffic to ease congestion on local and tourist traffic if required

EIA chapter	Ref	Mitigation Measure Description
	SE04	BTAL will discuss with ports authorities the best way to ease congestion in the vicinity of the Project, including consideration of infrastructure upgrades in the locality
	SE05	BTAL will work with the relevant harbour authorities when planning major operations to fit into general harbour management
	Operation and Maintenance	
	None	
	Decommissioning	
	None	
Chapter 20: Recreation and Tourism	**All Stages**	
	RT01	As part of BTALs proposed community commitment initiatives there may be opportunities to provide a permanent display or public information boards which would provide information about the Project to local communities and visitors to the area. This could have a positive impact on local tourism by encouraging people to visit the area to learn about the Project.
	Construction	
	RT02	There may be dedicated accommodation provided for construction workers in order to reduce added pressure on local residential and tourist accommodation.
	RT03	In order to minimise impacts to any walking routes, including the core path network, during construction access to and along the core paths will be maintained along the construction corridor using diversions where required. Consultation with key stakeholders will be continued during the detailed design Stage to ensure that all are up to date on any diversion that may be put in place in relation to existing paths.
	RT04	The contractor will adopt Best Practicable Means, as defined in Section 72 of the Control of Pollution Act 1974 as a means of controlling noise from construction sites.
	RT05	BTAL will consult with local ferry operators and an additional ferry service would be added for construction traffic to ease congestion on local and tourist traffic if required.
	Operation and Maintenance	
	None	
	Decommissioning	
	None	

23.7 REFERENCES

Marine Scotland. (2012). Survey, Deploy and Monitor licensing policy guidance. [online] Available at: http://www.gov.scot/Topics/marine/Licensing/marine/Applications/SDM.

Summary of Key Impacts

Chapter 24

24 SUMMARY OF KEY IMPACTS

This chapter of the ES provides a summary table of the assessment of impacts described in Chapters 8 to 22. The tables below provide an overview of potential impacts of the Brims Tidal Array Project (the Project) upon receptors, the mitigation measures to be applied to the Project, and the resultant residual impacts of the Project. These are detailed by Stage of the Project construction and installation, operations and maintenance, and decommissioning Stages.

Chapter 8: Geology and Hydrology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
All Stages	None	None	-
Construction and Installation	Contamination of soils, surface water or groundwater from spills	None	Minor
	Disturbance or loss of features of geological interest	None	Minor
Operation and Maintenance	Disturbance of loss of features of geological interest	None	Minor
Decommissioning	Contamination of soils, surface water or groundwater from spills	None	Minor
	Disturbance or loss of features of geological interest	None	Minor

Chapter 9: Physical Processes			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
All Stages	None	Selection of infrastructure and installation approaches which best suit the physical environment in which they will be located rather than installation of worst case scenario across the whole AfL. Hence the actual impact will be within the bounds of those worst case scenarios which have been assessed in this chapter. (PP01)	-
		Planning and implementing the construction and installation, operation and maintenance, and decommissioning works so that there is maximum cost-effectiveness, whilst minimising potential impacts. For example this may be achieved through the Staged installation of TSS or the Staged maintenance of turbines over a period of time. (PP02)	-

Chapter 9: Physical Processes			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
		A Landfall Installation Plan (Mitigation Measure GM17) will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore. (PP03)	-
Construction and Installation	Changes in suspended sediment concentrations due to installation activities	None	Not Significant
	Changes in sediment deposition due to installation activities	None	Not Significant
	Changes in tide, wave and sediment regimes due to presence of installation vessels	None	Not Significant
Operation and Maintenance	Changes in tidal regime due to presence of Project infrastructure	None	Not significant
	Changes in wave regime due to presence of Project infrastructure	None	Not significant
	Changes in sediment regime due to presence of Project infrastructure	None	Not significant
	Changes in morphology due to footprint of Project infrastructure	None	Not significant
	Changes in tide, wave and sediment regimes due to presence of maintenance vessels	None	Not significant
Decommissioning	Changes in suspended sediment concentrations due to removal activities.	None	Not significant
	Changes in sediment deposition due to removal activities.	None	Not significant

Chapter 9: Physical Processes			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
	Changes in tide, wave and sediment regimes due to presence of decommissioning vessels	None	Not significant

Chapter 10: Coastal and Terrestrial Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact Significance**
All Stages	Accidental release of chemical contaminants from devices or vessels	The Pollution Control Plan will form part of the wider EMD to manage the potential for accidental pollution, management of materials on site and response for any pollution events (GM05) BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14)	Minor

Chapter 10: Coastal and Terrestrial Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact Significance**
	Accidental introduction of invasive species from vessel operations	Any vessels required from international waters, or exceeding the thresholds set out in IMCA guidance will be audited to ensure that they have a Ballast Management Plan, with up to date records prior to operations on site. (GM09)	Minor
Construction and Installation	Physical disturbance of terrestrial habitats during cable landfall installation- Sheep Skerry (Open cut trench and HDD)	Reinstatement of sensitive habitats (UK BAP or LBAP) will be reinstated following best practice guidance. Material removed from the terrestrial/intertidal habitat should be stored and replaced within the same terrestrial/intertidal habitat following the cable installation works (CTE1)	Minor
	Physical disturbance of terrestrial habitats during cable landfall installation- Moodies Eddy (Open cut trench and HDD)	None	No potential impact
	Physical disturbance of terrestrial habitats during cable landfall installation- Aith Hope (Open cut trench and HDD)	Reinstatement of sensitive habitats (UK BAP or LBAP) will be reinstated following best practice guidance. Material removed from the terrestrial/intertidal habitat should be stored and replaced within the same terrestrial/intertidal habitat following the cable installation works (CTE1)	Minor
	Physical disturbance of intertidal habitats during cable landfall installation- Sheep Skerry (Open cut trench and short HDD)	Reinstatement of sensitive habitats (UK BAP or LBAP) will be reinstated following best practice guidance. Material removed from the terrestrial/intertidal habitat should be stored and replaced within the same terrestrial/intertidal habitat following the cable installation works (CTE1)	Minor
	Physical disturbance of intertidal habitats during cable landfall installation- Moodies Eddy (Open cut trench and short HDD)	None	No potential impact
	Physical disturbance of intertidal habitats during cable landfall installation- Aith Hope (Open cut trench)	Reinstatement of sensitive habitats (UK BAP or LBAP) will be reinstated following best practice guidance. Material removed from the terrestrial/intertidal habitat should be stored and replaced within the same terrestrial/intertidal habitat following the cable installation works (CTE1)	Minor

Chapter 10: Coastal and Terrestrial Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact Significance**
	Physical disturbance of intertidal habitats during cable landfall installation- All (Long HDD)	None	No potential impact
	Disturbance of otters during landfall installation- Sheep Skerry; Moodies Eddy; and Aith Hope (Open cut trench and HDD)	A pre-construction survey for otter will be carried out 8-10 weeks prior to works commencing. If any otter shelters are located, further protection measures will be discussed and agreed with SNH/Marine Scotland and implemented, including the possible need for a European Protected Species (EPS) licence if there is potential for disturbance to otter. (CTE02) Mammal exit ramps will be provided for potential hazards such as steep-sided exposed trenches or holes when contractors are off site (i.e. at night time). Temporarily exposed pipe systems will be capped when contractors are off site to prevent otters from gaining access. (CTE03) An ECoW will be appointed to audit site activities and will advise on implementation of mitigation. (GM03)	Minor
	Disturbance to breeding birds due to cable landfall installation activities- Sheep Skerry (Open cut trench and HDD)	If works are due to take place during the bird breeding season (April to August inclusive), a pre-construction breeding bird survey will be undertaken by a suitably qualified ECoW to ensure no nests are present on site or adjacent to the site before works commence. (CTE04) If works are likely to be required during the bird breeding season (April to August inclusive) use of appropriate measures (to be agreed with SNH) to deter birds from breeding on site before construction commences should be implemented at the earliest opportunity before nest building begins. Possible deterrent measures include use of reflective tape or ribbons on posts. (CTE05) Any nesting birds will be noted and works will be programmed to avoid disturbance. An exclusion zone or other alternative approaches to avoid damage or destruction to nests will be devised and agreed as appropriate with SNH. Exclusion zones around active nest sites will be clearly demarcated at the earliest opportunity to protect nesting birds from disturbance. Any nests will be monitored on a weekly basis by the ECoW to determine when the nesting bird ceases usage of the nest and therefore when it is safe to commence works in the area. (CTE06) An ECoW will be appointed to audit site activities and will advise on implementation of mitigation. (GM03)	Minor

Chapter 10: Coastal and Terrestrial Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact Significance**
	Disturbance to breeding birds due to cable landfall installation activities- Moodies Eddy –(Open cut trench)- Herring gull	If works are due to take place during the bird breeding season (April to August inclusive), a pre-construction breeding bird survey will be undertaken by a suitably qualified ECoW to ensure no nests are present on site or adjacent to the site before works commence. (CTE04) If works are likely to be required during the bird breeding season (April to August inclusive) use of appropriate measures (to be agreed with SNH) to deter birds from breeding on site before construction commences should be implemented at the earliest opportunity before nest building begins. Possible deterrent measures include use of reflective tape or ribbons on posts. (CTE05) Any nesting birds will be noted and works will be programmed to avoid disturbance. An exclusion zone or other alternative approaches to avoid damage or destruction to nests will be devised and agreed as appropriate with SNH. Exclusion zones around active nest sites will be clearly demarcated at the earliest opportunity to protect nesting birds from disturbance. Any nests will be monitored on a weekly basis by the ECoW to determine when the nesting bird ceases usage of the nest and therefore when it is safe to commence works in the area. (CTE06) An ECoW will be appointed to audit site activities and will advise on implementation of mitigation. (GM03)	Negligible
	Disturbance to breeding birds due to cable landfall installation activities- Moodies Eddy –(HDD)	None	No potential Impact
	Disturbance to breeding birds due to cable landfall installation activities- Aith Hope – HDD- Arctic tern	If works are due to take place during the bird breeding season (April to August inclusive), a pre-construction breeding bird survey will be undertaken by a suitably qualified ECoW to ensure no nests are present on site or adjacent to the site before works commence. (CTE04) If works are likely to be required during the bird breeding season (April to August inclusive) use of appropriate measures (to be agreed with SNH) to deter birds from breeding on site before construction commences should be implemented at the earliest opportunity before nest building begins. Possible deterrent measures include use of reflective tape or ribbons on posts. (CTE05) Any nesting birds will be noted and works will be programmed to avoid disturbance. An exclusion zone or other alternative approaches to avoid damage or destruction to nests will be devised and agreed as appropriate with SNH. Exclusion zones around active nest sites will be clearly demarcated at the earliest opportunity to protect nesting birds from disturbance. Any nests will be monitored on a weekly basis by the ECoW to determine when the nesting bird ceases usage of the nest and therefore when it is safe to commence works in the area. (CTE06) An ECoW will be appointed to audit site activities and will advise on implementation of mitigation. (GM03)	Minor
	Disturbance to breeding birds due to cable landfall installation activities- Aith Hope – Open cut trench	None	No potential impact

Chapter 10: Coastal and Terrestrial Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact Significance**
	Disturbance to foraging Barnacle geese due to cable landfall installation activities- Sheep Skerry	None	No potential impact
	Disturbance to foraging Barnacle Geese due to cable landfall installation activities- Moodies Eddy	None	No potential impact
	Disturbance to foraging Barnacle Geese due to cable landfall installation activities- Aith Hope (Open cut trench and HDD)	If a cable landfall location is chosen on South Walls, within the Aith Hope AoS, construction activities will be timed to have commenced before the arrival of Greenland barnacle geese in mid-October. (CTE07)	Minor
Operation and Maintenance	None	None	No potential impact
Decommissioning	None	None	No potential impact

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	Accidental release of chemical contaminants from devices or vessels	BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat. (BE01) Marine standard anti-fouling coatings on turbines and associated infrastructure will only be used where necessary (BE03)	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01)	
Construction and Installation	Increased suspended sediment and turbidity from seabed drilling for monopiles and drilled pin TSS	BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) All TSS (and turbines) will be installed over a period of approximately 4 years, resulting in intermediate sediment release/disturbance during installation and allowing sufficient time for any sediment to disperse. In addition, the location of the Project is such that strong tidal currents will provide quick dispersion of any sediment released/disturbed over the installation period proposed. (PD12)	Minor
	Increased suspended sediment and turbidity from installation of cable installation on seabed including cable protection	BTAL will submit a Cable Laying Strategy and method statement to Marine Scotland with details of: Geophysical survey outputs; Planned deployment corridor and micrositing options; Cable protection measures; and Method Statement including minimum depths and protection. (GM13)	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01) BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat. (BE01) Management measures will be in place to ensure that any rock placement that is required will be kept to a minimum to reduce seabed disturbance. (BE02)	
	Increased suspended sediment and turbidity from cable landfall installation	A Landfall Installation Plan will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore. (GM17)	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	
	Substrate/habitat loss/damage from cable landfall installation: Aith Hope/Sheep Skerry	A Landfall Installation Plan will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore. (GM17) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	Minor
	Substrate/habitat loss/damage from cable landfall installation: Moodies Eddy	A Landfall Installation Plan will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore. (GM17) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	Negligible
Operation and Maintenance	Substrate/habitat loss/damage from installation of TSS (flat base GBS)	BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees. The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14)	Minor
	Substrate/habitat loss/damage from installation of Inter-array cables (including protection)	BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes;	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees. The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	
	Substrate/habitat loss/damage from installation of Subsea hubs	BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees. The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14)	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Substrate/habitat loss/damage from installation of Export Cables (including protection)	BTAL will submit a Cable Laying Strategy and method statement to Marine Scotland with details of: Geophysical survey outputs; Planned deployment corridor and micrositing options; Cable protection measures; and Method Statement including minimum depths and protection. (GM13) BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees. The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat. (BE01) Management measures will be in place to ensure that any rock placement that is required will be kept to a minimum to reduce seabed disturbance. (BE02)	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	
	Seabed scour around support structures and subsea hubs	None	Minor
	Seabed scour around Inter-array cables and export cables (including protection)	BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat. (BE01) Management measures will be in place to ensure that any rock placement that is required will be kept to a minimum to reduce seabed disturbance. (BE02) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	Minor
	Seabed scour around vessel moorings	A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) During operation, smaller vessels will be used for maintenance purposes. This will therefore reduce underwater noise levels and associated potential impacts. (PD11)	Minor
	Colonisation of subsea infrastructure	Marine standard anti-fouling coatings on turbines and associated infrastructure will only be used where necessary. (BE03)	Minor
	Impact to benthic communities from EMF and thermal load arising from the cables during operation	BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat. (BE01)	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		Protection against the effect of EMF may include armour protection (possible double armour or interlocking armoured shells). The use of these methods will increase the distance between marine species sensitive to EMF and the EMF source. (PD09)	
	Changes in water flow rates leading to downstream change in benthic habitat	The maximum installed capacity and maximum limit to the number of turbines will reduce the potential effects arising from the turbines and TSS. (PD06)	Minor
Decommissioning	Increased suspended sediment and turbidity from seabed drilling for monopiles and drilled pin TSS	BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) All TSS (and turbines) will be installed over a period of approximately 4 years, resulting in intermediate sediment release/disturbance during installation and allowing sufficient time for any sediment to disperse. In addition, the location of the Project is such that strong tidal currents will provide quick dispersion of any sediment released/disturbed over the installation period proposed. (PD12)	Minor
	Increased suspended sediment and turbidity from installation of cable installation on seabed including cable protection	BTAL will submit a Cable Laying Strategy and method statement to Marine Scotland with details of: Geophysical survey outputs; Planned deployment corridor and micrositing options;	Minor

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
		Cable protection measures; and Method Statement including minimum depths and protection. (GM13) BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures; Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01) BTAL will take all necessary actions to avoid any sensitive habitats identified (e.g. alteration of cable routes). Should disturbance of the habitat be unavoidable BTAL shall undertake consultation with key stakeholders, SNH and MSS, to assess the potential impact significance and agree the best practicable options to minimise impacts to the habitat. (BE01) Management measures will be in place to ensure that any rock placement that is required will be kept to a minimum to reduce seabed disturbance. (BE02)	

Chapter 11: Benthic Ecology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Increased suspended sediment and turbidity from cable landfall installation	A Landfall Installation Plan will be developed in consultation with SNH and Marine Scotland which will help minimise potential adverse effects on morphology, habitats and species at the shore. (GM17) The cable locations (route corridors), numbers (bundling) and installations methods have been designed to minimise disturbance to the seabed, commercial fisheries, and any potential sites of archaeological or cultural heritage importance. (PD01)	Minor

Chapter 12: Fish Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
All Stages	Accidental release of chemical contaminants from devices or vessels	BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01)	Negligible
Construction and Installation	Substratum loss; flat gravity base TSS; spawning grounds (lemon sole)	None	Minor
	Substratum loss; flat gravity base TSS; nursery grounds	None	Negligible
	Smothering; drilled monopile TSS; Lemon Sole, Sandeel, Crab And Lobster	All TSS (and turbines) will be installed over a period of approximately 4 years, resulting in intermediate sediment release/disturbance during installation and allowing sufficient time for any sediment to disperse. In addition, the location of the Project is such that strong tidal currents will provide quick dispersion of any sediment released/disturbed over the installation period proposed. (PD12)	Minor
	Effects of noise and vibration; all options - construction vessels or cable lay vessels; lethal/injury effects from noise	Construction vessels will not be operating continuously during the installation Stages therefore reducing disturbance and potential injury to sensitive fish species. (PD13)	Negligible

Chapter 12: Fish Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
	Effects of noise and vibration; all options - construction vessels; behavioural response from noise	Construction vessels will not be operating continuously during the installation Stages therefore reducing disturbance and potential injury to sensitive fish species. (PD13)	Minor
Operation and Maintenance	Smothering; drilled monopile TSS; lemon sole, sandeel, crab and lobster	None	Minor
	Electromagnetic fields (EMF); all options –inter-array and export cables; elasmobranchs	Protection against the effect of EMF may include armour protection (possible double armour or interlocking armoured shells). The use of these methods will increase the distance between marine species sensitive to EMF and the EMF source. (PD09)	Minor
	Collision risk (turbines); operational turbines; pelagic and bentho-pelagic species including Atlantic salmon	Floating devices were initially under consideration in the original design envelope, but were removed, in order to reduce the risk of collision as well as potential for loss of station. This design was also changed from a minimum clearance of turbines below the water level to LAT (approximate chart datum) of 20m to 30m. (PD04)	Minor
	Changes to available habitat; shellfish populations	The introduction of Project components and artificial substrates including TSS gravity bases will provide artificial refuges for fish or shellfish species. (PD10)	Positive (minor)
	Barrier to movement; Atlantic salmon	A deploy and monitor strategy will be adopted i.e. continual monitoring of activities during device deployment to ensure that potential impacts identified and adaptive management measures are applied appropriately from the commencement of construction. A Project Environmental Management Plan will be developed in consultation with relevant stakeholders which will include mitigation and monitoring measures to ensure there are no significant environmental effects from the Project. (PD07)	Minor
	Effects of noise and vibration; noise induced injury	None	Negligible
	Effects of noise and vibration; disturbance of fish	During operation, smaller vessels will be used for maintenance purposes. This will therefore reduce underwater noise levels and associated potential impacts. (PD11)	Negligible
Decommissioning	Substratum loss; flat gravity base TSS; spawning grounds (lemon sole)	None	Minor
	Substratum loss; flat gravity base TSS; nursery grounds	None	Negligible

Chapter 12: Fish Ecology			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
	Smothering; drilled monopile TSS; Lemon Sole, Sandeel, Crab And Lobster	All TSS (and turbines) will be installed over a period of approximately 4 years, resulting in intermediate sediment release/disturbance during installation and allowing sufficient time for any sediment to disperse. In addition, the location of the Project is such that strong tidal currents will provide quick dispersion of any sediment released/disturbed over the installation period proposed. (PD12)	Minor
	Effects of noise and vibration; all options - construction vessels or cable lay vessels; lethal/injury effects from noise	Construction vessels will not be operating continuously during the installation Stages therefore reducing disturbance and potential injury to sensitive fish species. (PD13)	Negligible
	Effects of noise and vibration; all options - construction vessels; behavioural response from noise	Construction vessels will not be operating continuously during the installation Stages therefore reducing disturbance and potential injury to sensitive fish species. (PD13)	Minor

Chapter 13: Marine Mammals			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	Accidental contamination from vessels during construction, operation and maintenance, and decommissioning; Harbour seal and Grey seal	A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) The Pollution Control Plan will form part of the wider EMD to manage the potential for accidental pollution, management of materials on site and response for any pollution events. (GM05)	Minor
	Accidental contamination from vessels during construction, operation and maintenance, and decommissioning; Cetaceans and Basking shark		Negligible
Construction and Installation	Underwater noise; installation of unshrouded devices – increased vessels	None	Negligible
	Collision with vessels; installation of unshrouded devices – increased vessels; Small cetaceans, Grey seal, Harbour seal	A vessel management plan (Mitigation measure GM07) will be developed in consultation with SNH and Marine Scotland which will aim to develop a standard transit route and range of vessel speeds for traffic to and from the AfL area with the aim of minimising collision risk. (MM01) A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Negligible
	Collision with vessels; installation of unshrouded devices – increased vessels; Minke Whale, Basking shark	A vessel management plan (Mitigation measure GM07) will be developed in consultation with SNH and Marine Scotland which will aim to develop a standard transit route and range of vessel speeds for traffic to and from the AfL area with the aim of minimising collision risk. (MM01) A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Minor

Chapter 13: Marine Mammals			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Disturbance of seals at haul out sites	A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Negligible
	Indirect effects on prey species; Harbour seal, Harbour porpoise, Grey seal, Minke whale, White-beaked dolphin	None	Negligible
	Indirect effects on prey species; Basking shark	None	No potential impact
Operation and Maintenance	Underwater noise	None	Negligible
	Collision with operational tidal devices; unshrouded 3-blade or shrouded OCT, Stage 1; Harbour porpoise, Minke whale, Basking shark	A monitoring programme will be agreed with SNH and MS. This will form an adaptive management plan allowing mitigation to be implemented if required. BTAL will collate an Environmental Management Document (EMD) to guide on-going operations and maintenance activities during the lifetime of the Project. The EMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the operational period. (GM04) BTAL will prepare a Construction Environmental Management Document (CEMD) which will describe the: Construction Method Statements (including scope, frequency and hours) and construction processes; Site Lighting, Marking and designation strategy during construction; Detailed site layout, and micro-siting options; Description of vessel routes; Safety and emergency response procedures;	Minor
	Collision with operational tidal devices; unshrouded 3-blade or shrouded OCT, Stage 1 & 2; Harbour porpoise, Minke whale, Basking shark		Minor
	Collision with operational tidal devices; unshrouded 3-blade or shrouded OCT, Stage 1; Grey seal, Harbour seal		Moderate

Chapter 13: Marine Mammals			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Collision with operational tidal devices; unshrouded 3-blade or shrouded OCT, Stage 1 & 2; Grey seal, Harbour seal	Construction team and management; and Project schedule, duration and phasing. The CEMD will include but not be limited to: a Water Protection Plan; an Ecological Management Plan; Species Protection Plan and a Post Construction Restoration Plan. The CEMD will be agreed with Orkney Islands Council, Marine Scotland, and other relevant consultees The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14)	Moderate
	Collision with vessels; Small cetaceans, Grey seal and Harbour seal	A vessel management plan (Mitigation measure GM07) will be developed in consultation with SNH and Marine Scotland which will aim to develop a standard transit route and range of vessel speeds for traffic to and from the AfL area with the aim of minimising collision risk. (MM01)	Negligible
	Collision with vessels; Minke whale, Basking shark	A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Minor
	Electromagnetic fields; Marine Mammals	None	Negligible
	Electromagnetic fields; Basking shark	None	Minor

Chapter 13: Marine Mammals			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Disturbance at haul out sites	A vessel management plan (Mitigation measure GM07) will be developed in consultation with SNH and Marine Scotland which will aim to develop a standard transit route and range of vessel speeds for traffic to and from the AfL area with the aim of minimising collision risk. (MM01) A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Negligible
	Indirect effects on prey species; Harbour seal, Harbour porpoise, Basking shark	None	Minor
	Indirect effects on prey species; Grey seal, Minke whale, White-beaked dolphin	None	Negligible
Decommissioning	Underwater noise; Grey seal, Harbour seal, Basking shark	None	Negligible
	Underwater noise; Harbour porpoise, White-beaked dolphin, Minke whale	None	Minor
	Collision with vessels	A vessel management plan (Mitigation measure GM07) will be developed in consultation with SNH and Marine Scotland which will aim to develop a standard transit route and range of vessel speeds for traffic to and from the AfL area with the aim of minimising collision risk. (MM01) A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Minor

Chapter 14: Ornithology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	None	Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits (OR01)	-
Construction and Installation	Direct disturbance	Best practice measures in relation to vessel management to be agreed with MSS/SNH A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Negligible
	Disturbance (cliff-nesting breeding birds)	Best practice measures in relation to disturbance of cliff-breeders to be agreed with MSS/SNH	Negligible
	Accidental contamination	Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits (OR01) Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) Large vessels (> 400GRT) will have Shipboard Oil Pollution Emergency Plans (SOPEPs) which will include a response strategy to reduce potential impacts in the unlikely event of a large accidental release. (GM11)	Negligible

Chapter 14: Ornithology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
Operation and Maintenance	Direct disturbance	Best practice measures in relation to vessel management to be agreed with MSS/SNH A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Negligible
	Indirect impacts caused by hydrodynamic changes to surrounding seabed habitats and associated prey species	None	Negligible
	Accidental contamination	Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits (OR01) Installation activities will only take place during suitable weather windows. (OR02) Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) Large vessels (> 400GRT) will have Shipboard Oil Pollution Emergency Plans (SOPEPs) which will include a response strategy to reduce potential impacts in the unlikely event of a large accidental release. (GM11) BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01)	Negligible

Chapter 14: Ornithology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Direct habitat loss	None	Negligible
	Collision risk to diving birds	Floating devices were initially under consideration in the original design envelope, but were removed, in order to reduce the risk of collision as well as potential for loss of station. This design was also changed from a minimum clearance of turbines below the water level to LAT (approximate chart datum) of 20m to 30m. (PD04)	Negligible Low (Common Guillemot for Stage 1 & 2)
Decommissioning	Direct disturbance	Best practice measures in relation to vessel management to be agreed with MSS/SNH Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07)	Negligible

Chapter 14: Ornithology			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Accidental contamination	Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits (OR01) Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) Large vessels (> 400GRT) will have Shipboard Oil Pollution Emergency Plans (SOPEPs) which will include a response strategy to reduce potential impacts in the unlikely event of a large accidental release. (GM11)	Negligible

Chapter 15: Shipping and Navigation			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	None	None	-
Construction and Installation & Decommissioning	Displacement of vessels due to avoidance of project/construction vessels leading to increased passing vessel-to-vessel collision	Appointment of marine coordinator to manage work vessel movements. (SN13)	Low (broadly acceptable)
	Collision between passing vessel and construction vessel either at the Project or en route	Appointment of marine coordinator to manage work vessel movements. (SN13) Liaison with Orkney Vessel Traffic Services. (SN04) Enhanced vessel selection and auditing of vessels working on site taking into account the strong tidal flows likely to be experienced. (SN03) BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01) The Brims site is located close to Scapa Flow which has three harbour tugs with the potential to tow a drifting vessel (dependent on vessel size and weather). (SN01)	Low (broadly acceptable)
	Dropped object during construction activities at the Project	Wet storage of devices/equipment (i.e., temporary storage in water not at their final locations) to be minimised. (SN15)	Low (broadly acceptable)
	Man overboard during operations within the site	Fast rescue craft available during construction work (SN11)	Tolerable (moderate)

Chapter 15: Shipping and Navigation			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
Operation and Maintenance	Passing vessel powered collision with submerged device	Avoid developing extreme SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area to help ensure safe passage. (SN12) BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01)	Low (broadly acceptable)
	Passing vessel drifting collision with submerged device	BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01) Avoid developing SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area. (SN12) Circulation of information to local fishing organisations to ensure information is passed to local fishermen via a Fisheries Liaison Officer. The Brims site is located close to Scapa Flow which has three harbour tugs with the potential to tow a drifting vessel (dependent on vessel size and weather). (SN01)	Low (broadly acceptable)
	Displacement of vessels due to avoidance of site leading to increased passing vessel-to-vessel collision	Appointment of marine coordinator to manage work vessel movements. (SN13) Orkney VTS will liaise with Coastguard and navigational warnings will be broadcast in an emergency. (SN02) Avoid developing extreme SE corner of site where large tankers to/from Scapa Flow may transit. Alternatively, have additional under water clearance in this area to help ensure safe passage. (SN12)	Low (broadly acceptable)

Chapter 15: Shipping and Navigation			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Fishing gear interaction with subsea equipment within the Project site (e.g. Device, foundation or inter-array cable)	BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01)	Tolerable (moderate)
	Vessel anchoring on or dragging anchor over subsea equipment within the Project	None	Low (broadly acceptable)
	Fishing gear interaction with export cable to landfall	BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01) Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation. Burial is the preferred protection where seabed conditions allow. (SN14)	Tolerable (moderate)
	Vessel anchoring on or dragging anchor over export cable to landfall	Appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation. Burial is the preferred protection where seabed conditions allow. (SN14)	Low (broadly acceptable)
	Loss of tidal device or part of device (e.g. Component failure)	Orkney VTS will liaise with Coastguard and navigational warnings will be broadcast in an emergency. (SN02)	Low (broadly acceptable)
	Restricted search and rescue capability in an emergency situation or increased demand due to the Project	None	Low (broadly acceptable)
	Restricted oil spill response in a pollution incident or increased demand due to the Project	Coordination with local harbour to carry out combined drills/ exercises. (SN23)	Low (broadly acceptable)

Chapter 16: Commercial Fisheries			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	Accidental release of chemical contaminants from devices or vessels	Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14)	Minor
Construction and Installation **&** **Decommissioning**	Loss of access to fishing grounds	Best practice vessel protocols, exclusion of non-project vessels from site, contingency plans and specialist facilities to deal with incidents. A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: Number and individual vessel details; Operation of ducted propellers; and Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) Fishermen will be notified of the schedule works taking place, location of safety zones and partially installed infrastructure as discussed in Chapter 15: Shipping and Navigation (Mitigation Measure GM01 Chapter 5, Table 5.16)	Minor
Operation and Maintenance	Loss of access to fishing grounds; AfL	Communication and liaison with fishermen by FLO and marine traffic coordinators will continue throughout the Project development and cable route corridor decision making process. This will be used to promptly answer any queries from fishermen. (CF01) FLOWW Guidelines will be used throughout the Project. (CF04)	Minor

Chapter 16: Commercial Fisheries			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Loss of access to fishing grounds; Aith Hope, Moodies Eddy, Sheep Skerry	CF05 GM04	Negligible
	Obstruction to regular fishing vessel routes	The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures. (GM14) An ECoW will be appointed to audit site activities and will advise on implementation of mitigation. (GM03) BTAL will collate an Environmental Management Document (EMD) to guide on-going operations and maintenance activities during the lifetime of the Project. The EMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the operational period. (GM04) BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01) Communication and liaison with fishermen by FLO and marine traffic coordinators will continue throughout the Project and cable route corridor decision making process. This will be used to promptly answer any queries from fishermen. (CF01) FLOWW Guidelines will be used throughout the Project. (CF04)	Negligible
	Change in abundance of target species	None	Negligible

Chapter 17: Seascape Landscape and Visual Impact Assessment			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	None	None	-
Construction and Installation & Decommissioning	Effects on Seascape (Local Coastal Character Areas) LCCA 1: Green Head to Ruberry LCCA 2: Ruberry to the Point LCCA 12: West Rysa Little LCCA 13: East Rysa Little LCCA 18: The jetty to Tween the Wicks LCCA 19: Tween the Wicks to Quoy Ness LCCA 25: East Swona	None	No potential impact
	Effects on Seascape (Local Coastal Character Areas) LCCA 14: West Fara LCCA 15: East Fara LCCA 17: The Pier to the Jetty	None	Negligible Indirect
	Effects on Seascape (Local Coastal Character Areas) LCCA 5: North Ness to South Ness LCCA 27: East Stroma LCCA 28: St John’s Point	None	Minor
	Effects on Seascape (Local Coastal Character Areas) LCCA 3: The Point to Crock Ness LCCA 4: Crock Ness to North Ness and South Ness and South Ness to Crowtaing LCCA 6: Point of Hackness to Crowtaing LCCA 7: Crowtaing to Cantick Head LCCA 8: Cantick Head to Aith Head LCCA 11: Tor Ness to Geo of the Lane LCCA 16: Innan Neb to the pier LCCA 20: Quoy Ness to House Geo LCCA 21: House Geo to Innan Neb LCCA 22: North Switha LCCA23: South Switha LCCA 24: West Swona	None	Minor Indirect

Chapter 17: Seascape Landscape and Visual Impact Assessment			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	LCCA 26: West Stroma		
	Effects on Seascape (Local Coastal Character Areas) LCCA 9: Aith Head to Brims Ness LCCA 10: Brims Ness to Tor Ness	None	Minor Direct
	Effects on Landscape (Landscape Character Types) LCT 8: Urban and Rural Development	None	Negligible Indirect
	Effects on Landscape (Landscape Character Types) LCT 1: Holms LCT 2: Whaleback Island Landscapes LCT 3: Low Island Pastures LCT 4: Inclined Coastal Pastures LCT 5: Cliff Landscapes LCT 6: Low Moorland LCT 7: Moorland Hills LCT 9: Sweeping Moorland LCT 10: Open Intensive Farmland LCT 11: Small Farms and Crofts	None	Minor Indirect
	Effects on Landscape Designations Hoy and West Mainland NSA Melsetter House Garden and Designed Landscape Wild Land Area 41: Hoy Flotta south coast and West Hill LLA Lyrawa and Pegal LLA North Bay, Walls LLA South Walls south coast LLA	None	Minor Indirect
	Effects on Visual Receptors (Viewpoints) VP1: Hoxa Head VP2: Gills Bay Ferry VP3: Viewpoint, Flotta VP11: Coastal Track, South Walls	None	Minor / Negligible

Chapter 17: Seascape Landscape and Visual Impact Assessment			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Effects on Visual Receptors (Viewpoints) VP10: Melsetter Hill VP12: Dunnet Head VP14: Rackwick	None	Minor
	Effects on Visual Receptors (Viewpoints) VP4: Minor Road north of Aithsdale, South Walls VP5: Brims, Hoy VP6: Viewpoint Wee Fea, Hoy VP7: The Ayre VP8: Longhope VP9: Heldale Mast near Binga Fea VP13: North Walls School	None	Moderate/Minor
Operation and Maintenance	Presence of maintenance vessels	In June 2015, surface piercing technologies including hubs were removed from the Project design envelope, meaning that the entire Project will be seabed mounted and will not contain any surface piercing element. This significantly reduces the potential for vessel collision, which had previously been identified as the main hazard at the NRA stakeholder workshop, prior to this decision being taken. It also mitigates the disturbance of birds, visual landscape and physical processes. (PD05)	Not significant

Chapter 18: Marine Archaeology and Cultural Heritage			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	None	-	-
Construction and Installation	Potential direct damage to or destruction of known marine historic environment assets	All sites of high importance and, where possible all sites of any potential archaeological or cultural heritage importance will be avoided through Project design e.g. placement of TSSs and location of inter-array cables and export cable routes. Geophysical anomalies identified from only a single type of response may be given an avoidance buffer of 20m, while anomalies identified from several types of survey (such as MBES04, SSS03 and M028, which may represent the remains of the Canadian) and known wrecks may be given an avoidance buffer of 50m. This is in order to take account of a potential debris scatter field around a wreck, or a multiple response representing the tip of a wreck that extends further than the core location of the anomaly. (PD14) Where avoidance is not possible, sites of potential archaeological or cultural heritage importance affected by the Project will be examined in more detail by drop down camera or Remote Operated Vehicle (ROV) under archaeological direction. The data from the investigation will be assessed by a marine archaeologist. (MA01) Depending on the results from the examination an appropriate management and mitigation strategy will be developed in consultation with the statutory authorities (Marine Scotland, Historic Scotland, and Orkney Islands Council). This will include specific measures that are considered to be appropriate and practical for a site of this challenging and highly dynamic nature such as: Layout redesign to avoid highly sensitive remains; and Where avoidance is not possible, targeted very high resolution remote sensing survey to identify and record any remains. (MA02) The difficult conditions in the Pentland Firth mean that the requirement for more detailed archaeological investigations such as sampling of any identified palaeo-landscape deposits, intrusive works, wreck recovery or archaeological excavations will need to be considered on a case by case basis in close consultation with the statutory authorities if the need arises. (MA03) A written scheme of investigation will be produced, to include cross-referencing with construction and environmental management plans, and inductions on any marine historic environment assets to avoid. This will be agreed with relevant consultees prior to commencement of works. (MA04) An reporting protocol for the accidental discovery of cultural remains in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects, http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects.pdf This will be agreed with relevant consultees prior to commencement of works. (MA05)	Not significant

Chapter 18: Marine Archaeology and Cultural Heritage			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Potential direct damage to or destruction of unknown marine historic environment assets	Where avoidance is not possible, sites of potential archaeological or cultural heritage importance affected by the Project will be examined in more detail by drop down camera or Remote Operated Vehicle (ROV) under archaeological direction. The data from the investigation will be assessed by a marine archaeologist. (MA01)	Not significant
	Potential indirect damage to or destruction of known and unknown marine historic environment assets	Where avoidance is not possible, sites of potential archaeological or cultural heritage importance affected by the Project will be examined in more detail by drop down camera or Remote Operated Vehicle (ROV) under archaeological direction. The data from the investigation will be assessed by a marine archaeologist. (MA01)	No potential impact
Operation and Maintenance	Potential direct damage to or destruction of known and unknown marine historic environment assets	None	No potential impact
	Potential indirect damage to or destruction of known and unknown marine historic environment assets	None	Not significant
Decommissioning	Potential direct damage to or destruction of known and unknown marine historic environment assets	None	Not significant
	Potential indirect damage to or destruction of known and unknown marine historic environment assets	None	No potential impact

Chapter 19: Socio-economics			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
All Stages	Increased knowledge	None	Positive impact
	Clustering effect	None	Positive impact
	Energy security	None	Positive impact
	Possible carbon savings	None	Positive impact
	Quality of life	None	Positive impact
Construction and Installation	Local employment and business opportunities	None	Positive impact
	Benefits to other marine users	None	Positive impact
	Displacement of existing employment	None	Minor impact
	Pressure on local infrastructure and services	BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01) BTAL will liaise with the relevant planning authorities, to avoid congestion and pressure on existing housing and accommodation. (SE01) BTAL will work with relevant planning authorities to develop appropriate mitigation for any potential conflicts with existing uses of ports. (SE02) BTAL will consult with local ferry operators and an additional ferry service would be added for construction traffic to ease congestion on local and tourist traffic if required.(SE03) BTAL will discuss with ports authorities the best way to ease congestion in the vicinity of the Project, including consideration of infrastructure upgrades in the locality (SE04) BTAL will work with the relevant harbour authorities when planning major operations to fit into general harbour management (SE05)	Minor impact

Chapter 19: Socio-economics			
Stage	Description of Impact	Mitigation Measure(s) (code)	Residual Impact
	Pressure on existing housing and accommodation	BTAL will liaise with the relevant planning authorities, to avoid congestion and pressure on existing housing and accommodation. (SE01)	Not significant
	Commercial fisheries impacts	None	Minor impact
Operation and Maintenance	Improvements to local infrastructure	None	Positive impact
	Benefits to other marine users	None	Positive impact
Decommissioning	Local employment and business opportunities	None	Positive impact
	Benefits to other marine users	None	Positive impact

Chapter 20: Recreation and Tourism			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
Construction and Installation	Disruption or severance to offshore recreation during construction activities; offshore recreational use of the Project area, Stromness Harbour, Scrabster Harbour, Sheep Skerry, Moodies Eddy	A Vessel and Navigational Safety Management Plan will be developed for construction and operational Stages of the Project setting out: • Number and individual vessel details; • Operation of ducted propellers; and • Vessel routes, working ports and frequency of operations. This will be agreed with relevant consultees prior to commencement of works. (GM07) BTAL will follow best practice in terms of communication and awareness. All planned shipping movements, operations at sea and seabed fixtures will be described and broadcast to the fishing community through channels such as Notices to Mariners (the UK Hydrographic Office weekly updates), the Kingfisher Fortnightly Bulletin, FishSAFE, Fishermen's Awareness Charts, the International Cable Protection Committee (http://www.iscpc.org), via Fisheries Liaison Officer and any other forms of communication identified as appropriate. (GM01) Vessel management and communication Harbour management and planning	Negligible
	Disruption or severance to offshore recreation during construction activities; Lyness harbour, Aith Hope	Harbour management and planning	Minor
	Increased pressure on local temporary accommodation during construction and installation activities	There may be dedicated accommodation provided for construction workers in order to reduce added pressure on local residential and tourist accommodation. (RT02) Construction base to be used for majority of accommodation	Minor
Operation and Maintenance	Disruption or severance to offshore recreation during operation or maintenance activities	Vessel management and communication	Negligible

Chapter 20: Recreation and Tourism			
Stage	**Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
	Development creating new draw for tourists	As part of BTALs proposed community commitment initiatives there may be opportunities to provide a permanent display or public information boards which would provide information about the Project to local communities and visitors to the area. This could have a positive impact on local tourism by encouraging people to visit the area to learn about the Project. (RT01) Information boards.	Benefit
Decommissioning	None	None	-

Chapter 22: Cumulative Impact Assessment			
Stage	**Receptor - Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
All Stages	Geology	None	No significant cumulative or in-combination effects
	Physical processes	None	No significant cumulative or in-combination effects
	Coastal and Terrestrial Ecology	None	No significant cumulative or in-combination effects
	Benthic Ecology	None	No significant cumulative or in-combination effects
Construction and Installation	Fish Ecology - substratum loss	None	No significant cumulative or in-combination effects
	Fish Ecology - smothering	None	No significant cumulative or in-combination effects
	Fish Ecology - accidental spills	None	No significant cumulative or in-combination effects
	Fish Ecology - underwater noise	None	No significant cumulative or in-combination effects
Operation and Maintenance	Fish Ecology - collision risk	None	No significant cumulative or in-combination effects
	Fish Ecology - barrier to movement	None	No significant cumulative or in-combination effects
	Fish Ecology - EMF	None	No significant cumulative or in-combination effects
Decommissioning	Fish Ecology - As construction and installation	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
Construction and Installation	Marine mammals - Underwater Noise	None	No significant cumulative or in-combination effects
	Marine mammals - Disturbance at Seal Haul Out Sites	None	No significant cumulative or in-combination effects
	Marine mammals - Collision with Vessels	None	No significant cumulative or in-combination effects

Chapter 22: Cumulative Impact Assessment			
Stage	**Receptor - Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
	Marine mammals - Indirect Effects on Prey Species	None	No significant cumulative or in-combination effects
Operation and Maintenance	Marine mammals - Underwater Noise	None	No significant cumulative or in-combination effects
	Marine mammals - Collision with Operational Tidal Devices	None	Potentially significant cumulative collision risk with operational tidal turbines for all species of marine mammal and basking shark.
	Marine mammals - Collision with Vessels	None	No significant cumulative or in-combination effects
Decommissioning	Marine mammals - As construction and installation	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
Construction and Installation	Birds - Accidental contamination	None	No significant cumulative or in-combination effects
Operation and Maintenance	Birds - Accidental contamination	None	No significant cumulative or in-combination effects
Decommissioning	Birds - Accidental contamination	None	No significant cumulative or in-combination effects
Construction and Installation	Birds (Common guillemot, razorbill, puffin) - Collision Risk	None	No significant cumulative or in-combination effects
Operation and Maintenance	Birds (Common guillemot, razorbill, puffin) - Collision Risk	None	No significant cumulative or in-combination effects
Decommissioning	Birds (Common guillemot, razorbill, puffin) - Collision Risk	None	No significant cumulative or in-combination effects
All Stages	Shipping and Navigation	None	No significant cumulative or in-combination effects
All Stages	Commercial fisheries	None	No significant cumulative or in-combination effects
All Stages	Seascape and Landscape	None	No significant cumulative or in-combination effects
All Stages	Marine Historic Environment	None	No significant cumulative or in-combination effects
All Stages	Socio-economics	None	No significant cumulative or in-combination effects
Construction and Installation & Operation and Maintenance	Socio-Economics - Local employment and business opportunities	None	Potentially significant positive cumulative effects

Chapter 22: Cumulative Impact Assessment			
Stage	**Receptor - Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
Decommissioning	Socio-Economics - Local employment and business opportunities	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
Construction and Installation & Operation and Maintenance	Socio-economics - Improvements to local infrastructure	None	Potentially significant positive cumulative effects
Decommissioning	Socio-economics - Improvements to local infrastructure	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
Construction and Installation & Operation and Maintenance	Socio-economics - Effects upon other marine users	SE02, SE04	No significant cumulative or in-combination effects
Decommissioning	Socio-economics - Effects upon other marine users	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
Construction and Installation & Operation and Maintenance	Socio-economics - Clustering effect	None	Potentially significant positive cumulative effects
Decommissioning	Socio-economics - Clustering effect	None	No significant cumulative or in-combination effects
Construction and Installation & Operation and Maintenance	Socio-economics - Displacement of existing employment	None	No significant cumulative or in-combination effects
Decommissioning	Socio-economics - Displacement of existing employment	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
Construction and Installation & Operation and Maintenance	Socio-economics - Pressure on local infrastructure and services	SE02, SE03, SE04	No significant cumulative or in-combination effects
Decommissioning	Socio-economics - Pressure on local infrastructure and services	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts

Chapter 22: Cumulative Impact Assessment			
Stage	**Receptor - Description of Impact**	**Mitigation Measure(s) (code)**	**Residual Impact**
Construction and Installation & Operation and Maintenance	Socio-economics - Pressure on existing housing and accommodation	SE01	No significant cumulative or in-combination effects
Decommissioning	Socio-economics - Pressure on existing housing and accommodation	None	Uncertainty in schedules for decommissioning is too high to determine the cumulative impacts
All Stages	Recreation and Tourism	None	No significant cumulative or in-combination effects