Broadshore Hub

Broadshore OFFSHORE WIND | Sinclair OFFSHORE WIND | Scaraben OFFSHORE WIND

Broadshore Hub
Wind Farm Development Areas

Scoping Report (Appendices)

Date: 8th January 2024

Document Number: BFR_HUB_CST_REP_0002

Revision Number: 1

Classification: Public

BlueFloat ENERGY
Renantis
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Revision History

Rev.	Prepared By	Checked by	Approved by	Description	Date
1	Royal HaskoningDHV	Elouise Smith	Brian McGrellis	Submission to MD-LOT	08/01/2024

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Broadshore Hub

Broadshore OFFSHORE WIND

Sinclair OFFSHORE WIND

Scaraben OFFSHORE WIND

Appendix 1: Figures

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480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

6480000 6460000 6440000 6420000 6400000 6380000

N

Caithness

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Wick

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A9

Moray Firth

B9040

Buckie

Laich of Moray

Banff

B9031

Fraserburgh

A90

A950

A941

Keith

A97

371 m

Peterhead

A947

0 10 20 km

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Broadshore Hub

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Broadshore WFDA Boundary
- Sinclair WFDA Boundary
- Scaraben WFDA Boundary

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:500,000

Figure Title:
Broadshore Hub WFDAs Scoping Boundary

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0001

Figure 1.1

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

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N

B870 A882 Wick A99 A9

Moray Firth

B9040 Buckie A98 B9031 Fraserburgh

Laich of Moray

Fochabers A98 A952

A941 Keith A97 Peterhead

B9001 A952

0 10 20 km

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Broadshore Hub

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Broadshore WFDA Boundary
- Scaraben WFDA Boundary
- Sinclair WFDA Boundary
- Proposed Alternative Sinclair WFDA Boundary

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS

Scale @ A3
1:500,000

Figure Title: Proposed Alternative Sinclair WFDA Boundary

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0029

Figure 1.2

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

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N

B870 A882 Wick A99 A9

Moray Firth

B9040 Buckie Laich of Moray Banff B9031 Fraserburgh A90 A950 A941 Keith A97 371 m Peterhead A947 A948 Huntly

0 10 20 km

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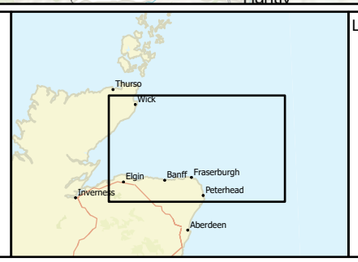

Legend:

Broadshore Hub WFDAs Scoping Boundary

Marine Geology, Oceanography and Physical Processes Study Area (10 km)

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:500,000

Figure Title:
Marine Geology, Oceanography and Physical Processes Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0004

Figure 5.1

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)

Bathymetry Depth (m)

- 150 - 200
- 100 - 150
- 90 - 100
- 80 - 90
- 70 - 80
- 60 - 70
- 50 - 60
- 40 - 50

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: EMODnet 2023, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title: Bathymetry of the Marine Geology, Oceanography and Physical Processes Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0005

Figure 5.2

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)

Quaternary lithologies

- Diamict
- Firm to hard interbedded
- Firm to hard mud
- Sand and gravel
- Soft Mud
- Soft interbedded
- Undifferentiated

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Coordinate System: WGS 1984 UTM Zone 30N

Source: BGS 2023,Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title: Shallow (Quaternary) Geology of the Marine Geology, Oceanography and Physical Processes Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0006

Figure 5.3

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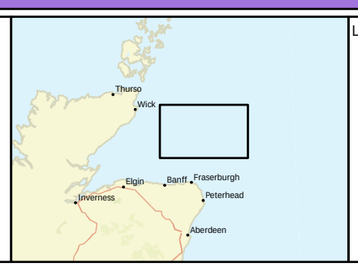

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)

Spring Peak Flow (m/s)

- 0.11 - 0.25
- 0.26 - 0.50
- 0.51 - 0.75

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Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: ABPmer 2023, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title: Peak Flow for a Mean Spring Tide across the Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0007

Figure 5.4

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6480000 6460000 6440000

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0 5 10 km

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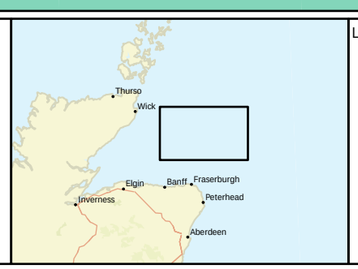
Broadshore Hub



Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)

Annual Mean Significant Wave Height (m)

- 1.26 - 1.50
- 1.51 - 1.75
- 1.76 - 2.00
- 2.01 - 2.25

REV	DATE	STATUS	DRW	CHK	APR
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Coordinate System: WGS 1984 UTM Zone 30N

Source: ABPmer 2023, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title: Annual Mean Significant Wave Height across the Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0008

Figure 5.5

540000 560000 580000 600000 620000

6480000 6460000 6440000

N

0 5 10 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)

Seabed Sediments

- Gravelly sand
- Mud
- Muddy sand
- Sand
- Sandy gravel
- Sandy mud
- Slightly gravelly sand

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: BGS 2023, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title: Seabed Sediments across the Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0009

Figure 5.6

540000
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10 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)

Average suspended sediment concentrations (mg/l)

- 0.601 - 0.8
- 0.801 - 1
- 1.001 - 2

REV	DATE	STATUS	DRW	CHK	APR
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Coordinate System: WGS 1984 UTM Zone 30N

Source: Cefas 2023, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

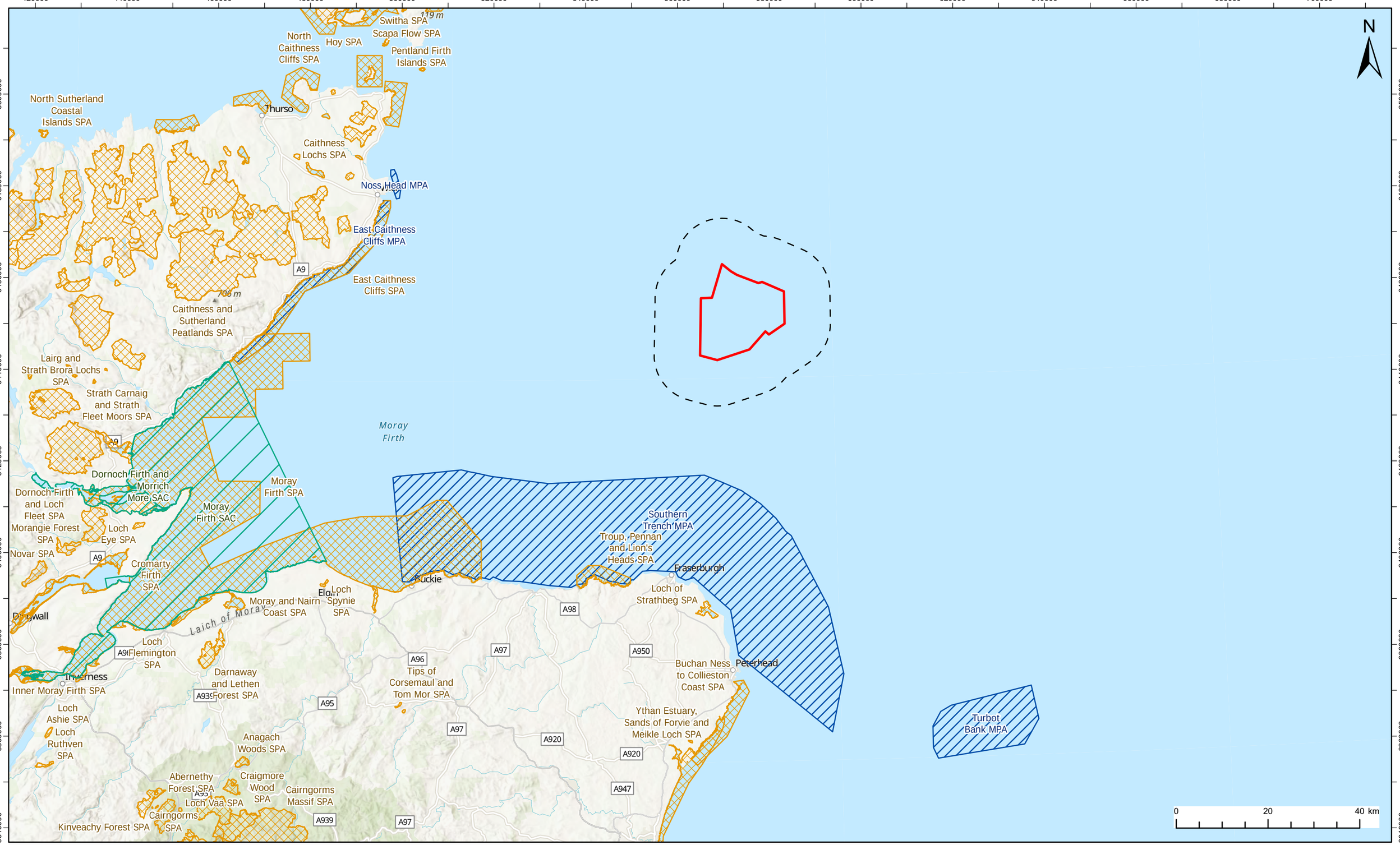
Figure Title: Average Suspended Sediment Concentrations across the Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0010

Figure 5.7



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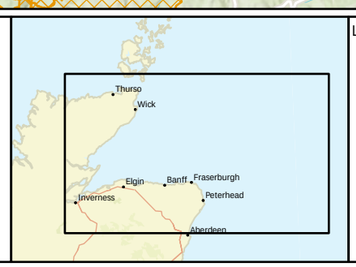

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Geology, Oceanography and Physical Processes Study Area (10 km)
- Marine Protected Areas (MPA)
- Special Protection Areas (SPA)
- Special Areas of Conservation (SAC)

REV	DATE	STATUS	GC	HF	JM
Rev 1	18/12/2023	Final	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

Figure Title: Designated Sites

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0028

Figure 5.8

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

6480000 6460000 6440000 6420000 6400000 6380000

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B870 A882 Wick A99 A9

Moray Firth

B9040 Buckie Banff B9031 Fraserburgh A90 A950 Laich of Moray res A941 371 m Keith A97 A947 A948 Peterhead athspey Huntly

0 10 20 km

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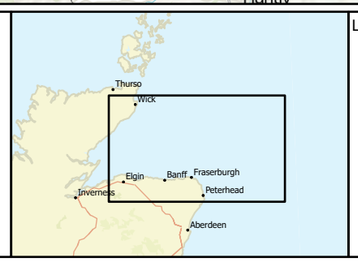


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Benthic Study Area (10 km)

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:500,000

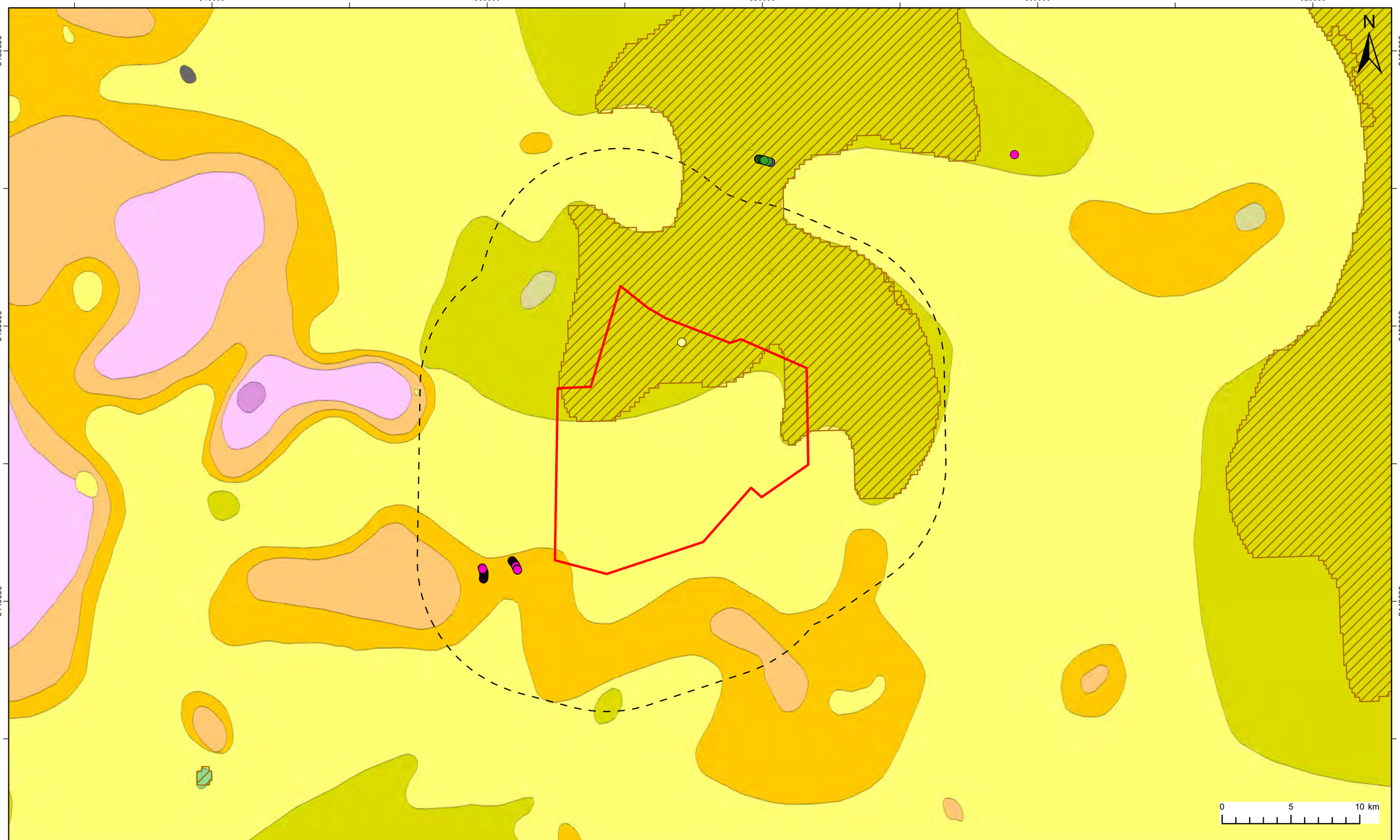
Figure Title: **Benthic Study Area**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0002

Figure 6.1



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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Benthic Study Area (10 km)
- Offshore deep sea muds

GeMS Habitat Points

- Offshore circalittoral mixed sediment
- Burrowed mud
- Offshore deep sea muds
- Offshore subtidal sands and gravels

Seabed Sediments (BGS)

- Gravelly sand
- Mud
- Muddy sand
- Sand
- Sandy gravel
- Sandy mud
- Slightly gravelly sand

Rev 1	18/12/2023	Final	GC	HF	JM
REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title:
Benthic Habitats (BGS) within the Benthic Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0003

Figure 6.2

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6480000 6460000 6440000

N

0 5 10 km

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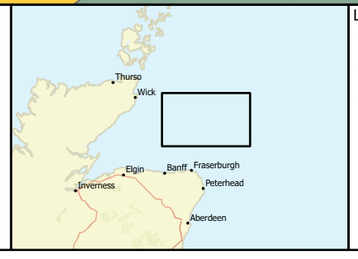

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Benthic Study Area (10 km)

GeMS - Priority Marine Features

- Burrowed mud or Inshore deep mud with burrowing heart urchins
- Offshore deep sea muds
- Offshore deep sea muds

EUSeaMap (2021) Broadscale Habitat Map

- A5.15: Deep circalittoral coarse sediment
- A5.27: Deep circalittoral sand
- A5.37: Deep circalittoral mud
- A5.45: Deep circalittoral mixed sediments
- A5: Sublittoral sediment

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Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title:
Benthic Habitats (EUNIS) within the Benthic Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0026

Figure 6.3

560000

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N

0 5 10 km

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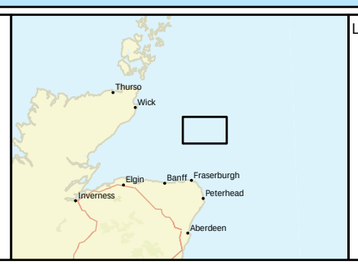

Legend:

- Broadshore Hub WFDAs Scoping Boundary

Benthic Sampling Locations

- Drop-down Camera/Grab Sample Location
- Drop-down Camera/Grab/Chemical Sample Location
- Drop-down Camera/Grab/Chemical/ Water Sample Location

- Offshore deep sea muds

GeMS Habitat Points

- Offshore circalittoral mixed sediment
- Offshore subtidal sands and gravels

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REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS

Scale @ A3

1:125,000

Figure Title:

Provisional Benthic Survey Sampling Locations

Project:

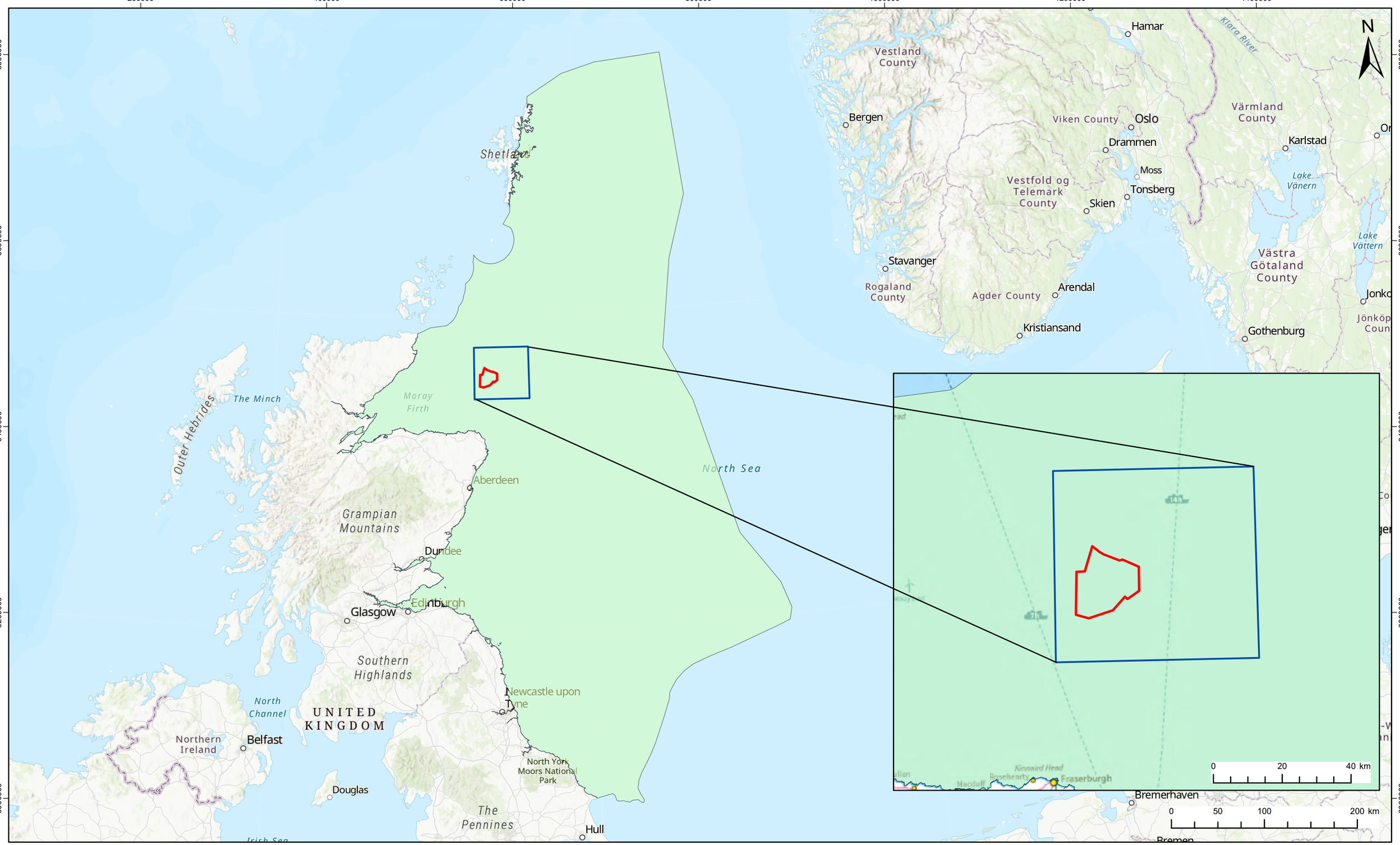
Broadshore Hub WFDAs

Report:

Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0022

Figure 6.4



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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Fish and Shellfish Study Area (ICES Rectangle 45E9)
- Northern North Sea Study Area (based on Northern North Sea CP2 Reporting Region)

REV	DATE	STATUS	DRW	CHK	APR
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Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, FAO, NOAA, USGS, Contains OS data © Crown Copyright and database right 2022, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS

Scale @ A3
1:3,700,000

Figure Title:
Fish and Shellfish Study Area and Northern North Sea Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0025

Figure 7.1

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

6480000 6460000 6440000 6420000 6400000 6380000

B870 A882 Wick A99 A9 B9040 Buckie Banff B9031 Fraserburgh Laich of Moray A941 Keith A97 A950 A90 Peterhead A947 A948 Huntly 371 m Moray Firth

N

0 10 20 km

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Legend:

Broadshore Hub WFDAs Scoping Boundary

Grey Seal Mean at-sea Density per 25 km²

- 0.000 - 0.002
- 0.002 - 0.010
- 0.010 - 0.025
- 0.025 - 0.050
- 0.050 - 0.100
- 0.100 - 0.250

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3

1:500,000

Figure Title: Grey Seal Densities

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0026

Figure 8.1

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

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N

B870 A882 Wick A99 A9 B9040 Buckie Banff B9031 Fraserburgh Laich of Moray A941 Keith A97 A950 A90 A947 A948 Peterhead Huntly 371 m Moray Firth

0 10 20 km

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Legend:

Broadshore Hub WFDAs Scoping Boundary

Harbour Seal Mean at-sea Density per 25 km²

- 0.000 - 0.001
- 0.001 - 0.005
- 0.005 - 0.010
- 0.010 - 0.025
- 0.025 - 0.050
- 0.050 - 0.100

REV	DATE	STATUS	DRW	CHK	APR
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Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3

1:500,000

Figure Title: Harbour Seal Densities

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0027

Figure 8.2

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10 km

Legend:
- Broadshore Hub WFDAs Scoping Boundary
- Offshore Aerial Survey Area
- Scaraben WFDA Boundary
- Sinclair WFDA Boundary
- Sinclair and Scaraben Development Area at time of survey
- 4 km Buffer around Sinclair and Scaraben WFDAs Aerial Survey Area
- Broadshore Development Area at time of survey
- 4 km Buffer around Broadshore WFDA Aerial Survey Area

REV	DATE	STATUS	DRW	CHK	APR
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Source: HiDef, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:200,000

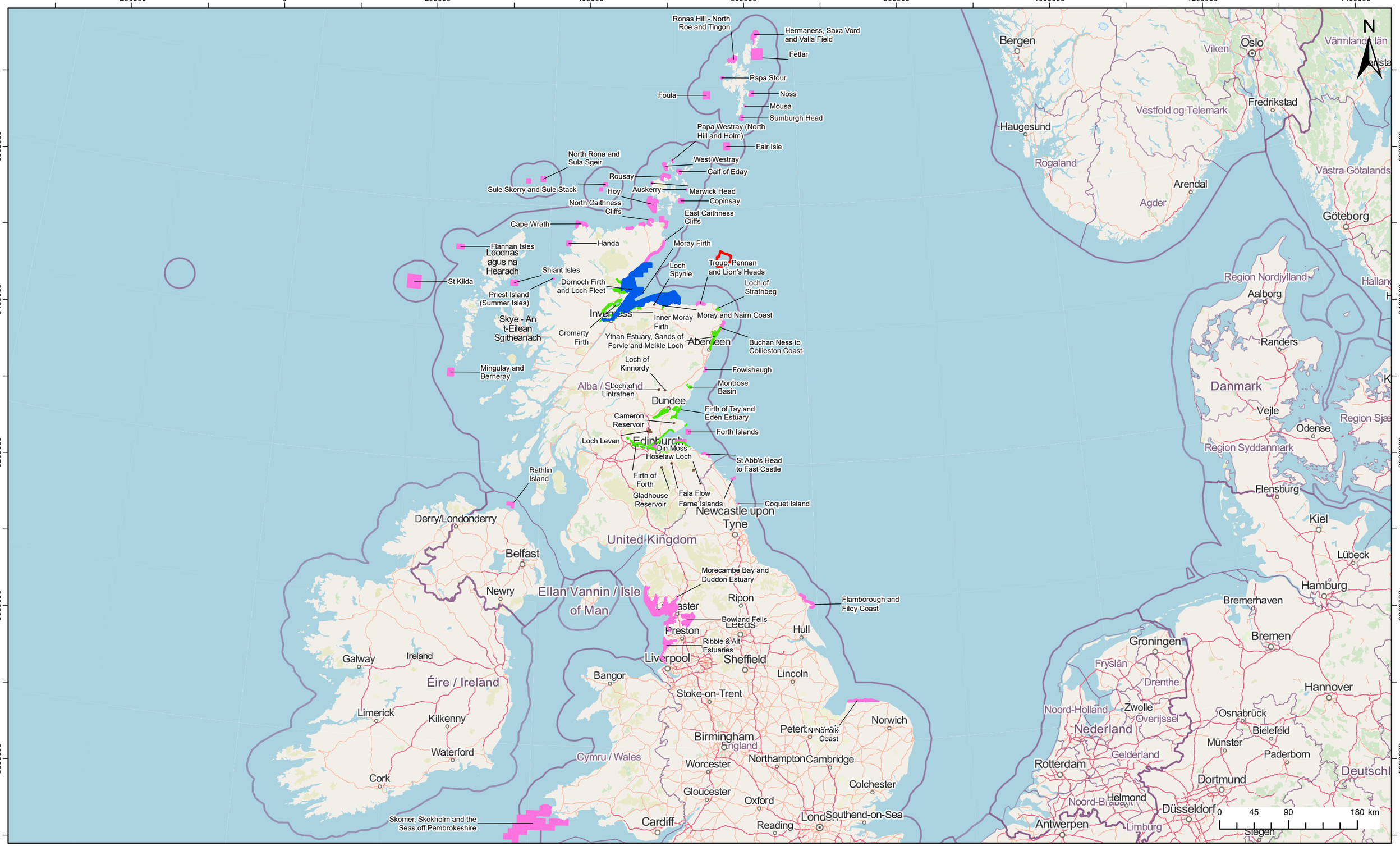
Figure Title: **Offshore Aerial Survey Area**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0017

Figure 9.1



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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Breeding Seabird Colony Sites
- Migratory Non-Seabird Sites (Estuarine)
- Migratory Non-Seabird Sites (Inland Waterbodies)
- Marine SPAs

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri

Scale @ A3

1:4,500,000

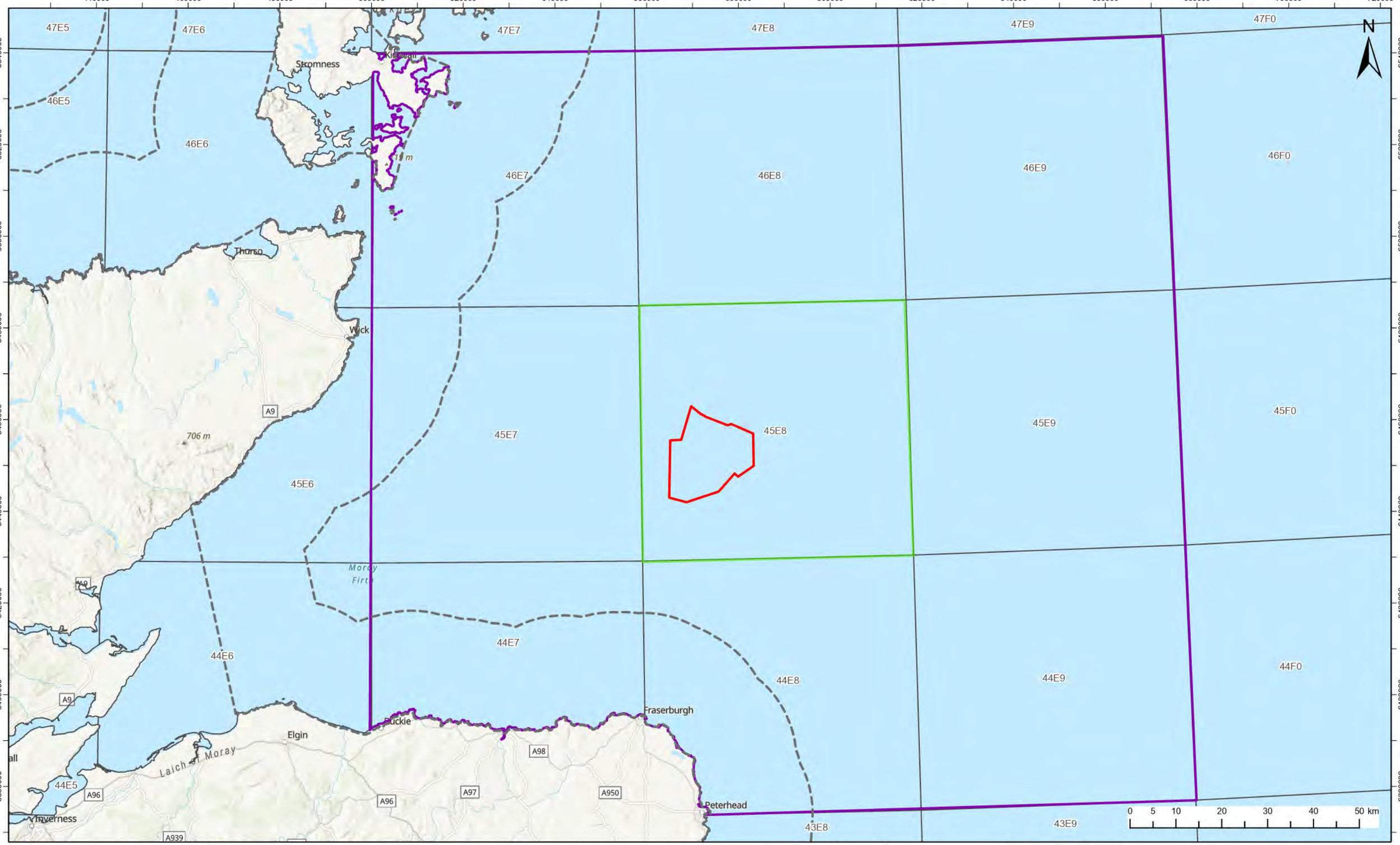
Figure Title: Location of Special Protection Areas (SPAs)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0024

Figure 9.2



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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

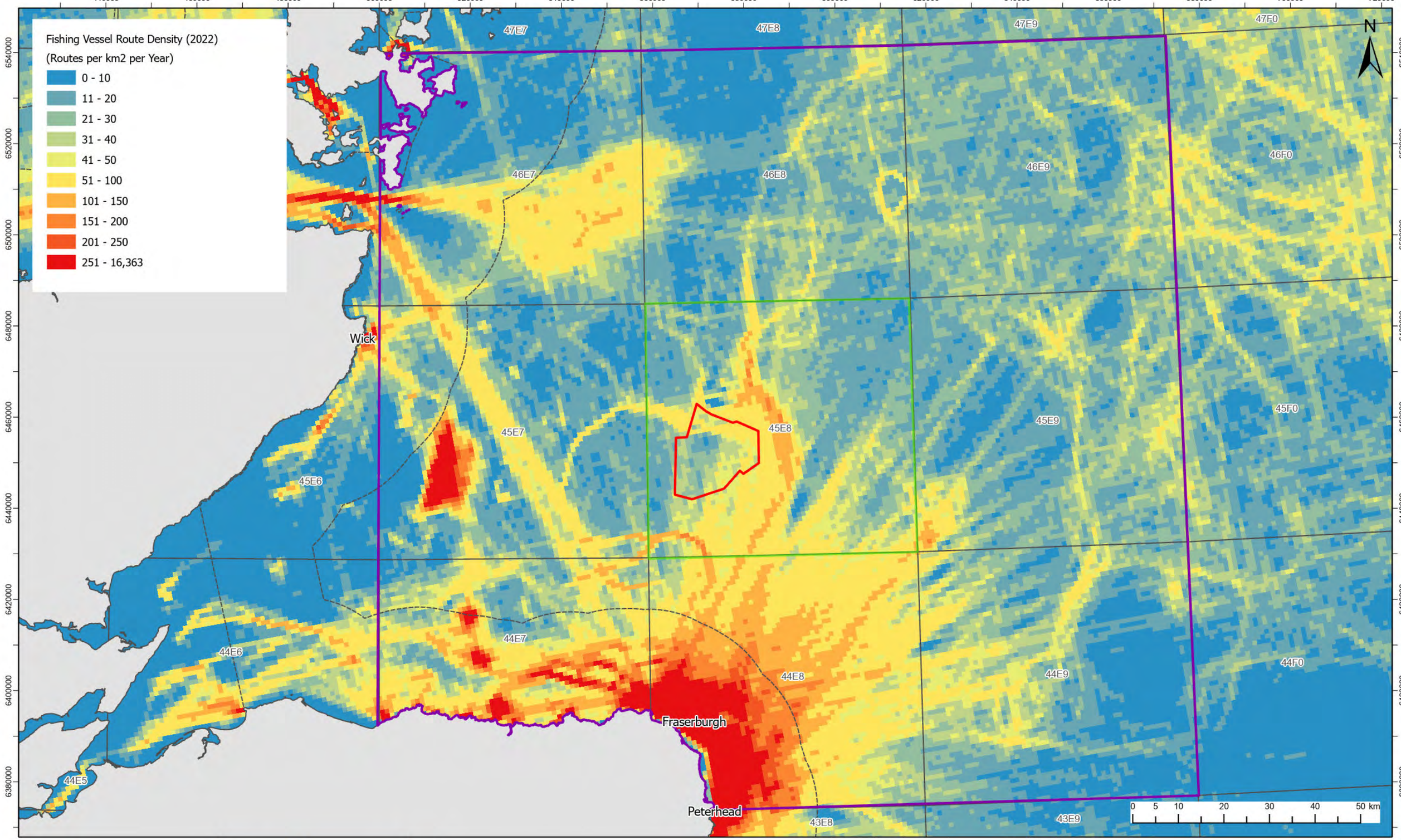
Figure Title:
Commercial Fisheries Local and Regional Study Areas

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0071

Figure 10.1



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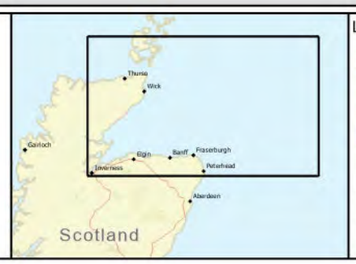

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

Figure Title:
Fishing Vessel Route Density Routes per km² per Year (2022)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0072

Figure 10.2

Demersal Otter Trawl (EU and UK vessels

Average Annual Surface Swept Area Ratio

- 0.0 - 0.6
- 0.7 - 1.3
- 1.4 - 1.9
- 2.0 - 2.6
- 2.7 - 3.2
- 3.3 - 3.9
- 4.0 - 4.5
- 4.6 - 5.1
- 5.2 - 5.8
- 5.9 - 6.4
- 6.5 - 7.1
- 7.2 - 7.7
- 7.8 - 8.4
- 8.5 - 9.0
- 9.1 - 23.2

440000 460000 480000 500000 520000 540000 560000 580000 600000 620000 640000 660000 680000 700000 720000

6540000 6520000 6500000 6480000 6460000 6440000 6420000 6400000 6380000

47E7 47E8 47E9 47F0 46E7 46E8 46E9 46F0 45E7 45E8 45E9 45F0 45E6 44E7 44E8 44E9 44F0 44E6 44E5 43E8 43E9

N

0 5 10 20 30 40 50 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

Figure Title: **Demersal Otter Trawl Average Swept Area Ratio for EU and UK Vessels 12m and Over (2016-2020)**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0073

Figure 10.3

440000 460000 480000 500000 520000 540000 560000 580000 600000 620000 640000 660000 680000 700000 720000

6540000 6520000 6500000 6480000 6460000 6440000 6420000 6400000 6380000

47E5 47E6 47E7 47E8 47E9 47F0

46E5 46E6 46E7 46E8 46E9 46F0

45E6 45E7 45E8 45E9 45F0

44E5 44E6 44E7 44E8 44E9 44F0

43E8 43E9

Wick

Moray Firth

Fraserburgh

Peterhead

19 m

N

0 5 10 20 30 40 50 km

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Scotland

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Broadshore Boundary
- Scaraben WFDA Boundary
- Sinclair WFDA Boundary
- Proposed Revised Sinclair WFDA Boundary
- Nephrops Grounds
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, USGS

Scale @ A3
1:750,000

Figure Title:
Nephrops Grounds and Revised Sinclair Boundary

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0079

Figure 10.4

Demersal Otter Trawl 2020 (UK vessels ≥15m)
First Sales Value
Total value, £
£0.02 - £5,000.00
£5,000.01 - £10,000.00
£10,000.01 - £25,000.00
£25,000.01 - £50,000.00
£50,000.01 - £75,000.00
£75,000.01 - £595,000.00

47E7 47E8 47E9 47F0
46E7 46E8 46E9 46F0
45E7 45E8 45E9 45F0
45E6
44E6 44E7 44E8 44E9 44F0
44E5
43E8 43E9

19 m
60

440000 460000 480000 500000 520000 540000 560000 580000 600000 620000 640000 660000 680000 700000 720000
6540000 6520000 6500000 6480000 6460000 6440000 6420000 6400000 6380000

N

0 5 10 20 30 40 50 km

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Legend:
- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

Figure Title: **UK Demersal Otter Trawl Vessel Monitoring System Data for Vessels 15m and Over (2020)**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0074

Figure 10.5

Dredge (EU and UK vessels ≥12m)

Average Annual Surface Swept Area Ratio

- 0.0 - 0.1
- 0.2 - 0.5
- 0.6 - 0.8
- 0.8 - 1.0
- 1.1 - 2.0
- 2.1 - 2.5
- 2.6 - 3.8

N

0 12.5 25 50 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:720,000

Figure Title: **Dredge Average Swept Area Ratio for EU and UK Vessels 12m and Over (2016-2020)**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0075

Figure 10.6

Dredge 2016 (UK vessels ≥15m)

First Sales Value

Total value, £

- £0.91 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £280,000.00

N

0 5 10 20 30 40 50 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

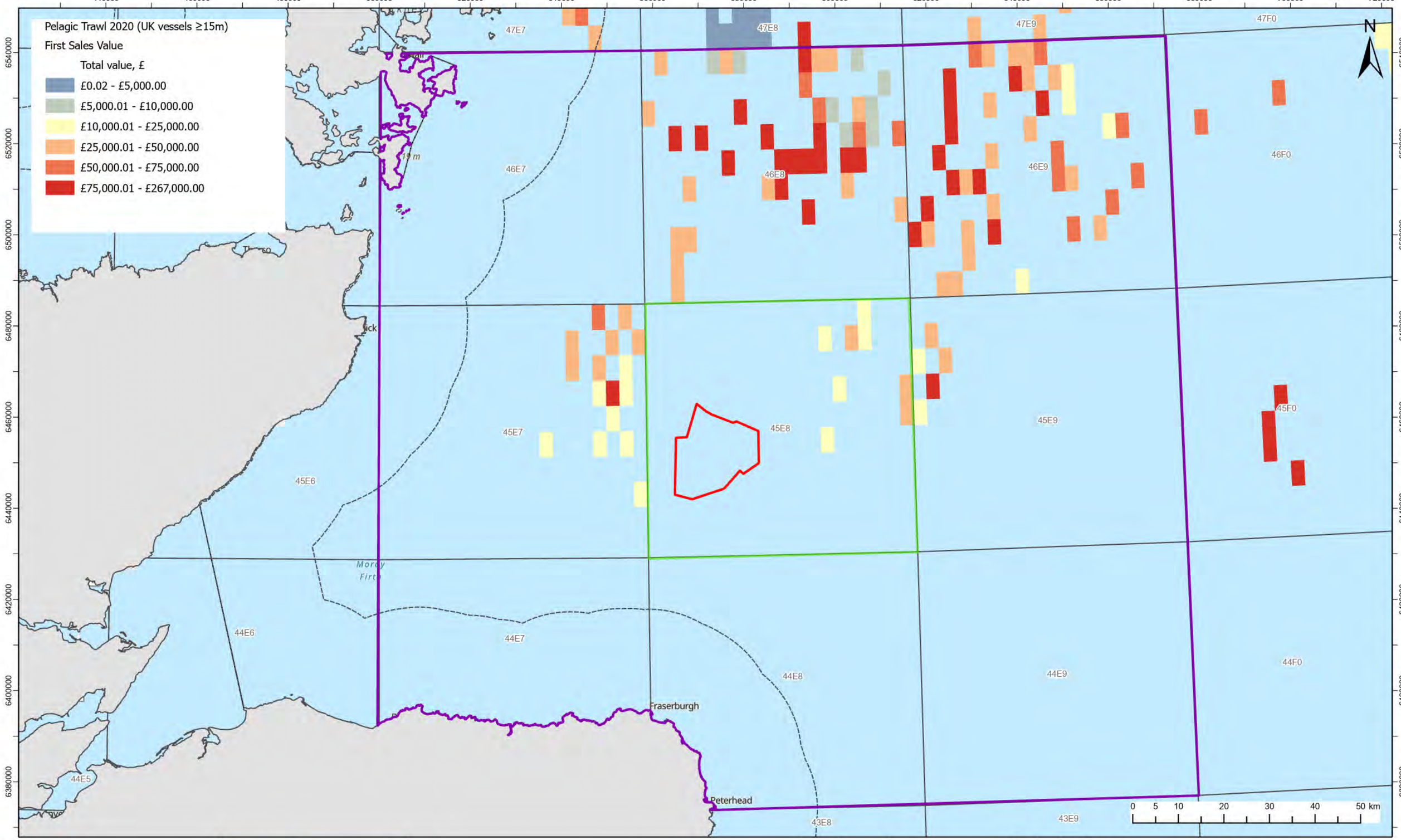
Figure Title:
UK Dredge Vessel Monitoring System Data for Vessels 15m and Over (2016)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0076

Figure 10.7



Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

Figure Title:
UK Pelagic Trawl Vessel Monitoring System Data for Vessels 15m and Over (2020)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0077

Figure 10.8

Potting 2020 (UK vessels ≥15m)

First Sales Value

Total value, £

- £0.01 - £5,000.00
- £5,000.01 - £10,000.00
- £10,000.01 - £25,000.00
- £25,000.01 - £50,000.00
- £50,000.01 - £75,000.00
- £75,000.01 - £145,000.00

440000 460000 480000 500000 520000 540000 560000 580000 600000 620000 640000 660000 680000 700000 720000

6540000 6520000 6500000 6480000 6460000 6440000 6420000 6400000 6380000

47E7 47E8 47E9 47F0

46E7 46E8 46E9 46F0

45E7 45E8 45E9 45F0

45E6

44E6 44E7 44E8 44E9 44F0

44E5

43E8 43E9

Moray Firth

Fraserburgh

Peterhead

N

0 5 10 20 30 40 50 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Commercial Fisheries Local Study Area
- Commercial Fisheries Regional Study Area
- International Council for the Exploration of the Seas Statistical Rectangles (Including Codes)
- 12 nm Limit

REV	DATE	STATUS	DRW	CHK	APR
P01	17/11/2023	Suitable for information	FN	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

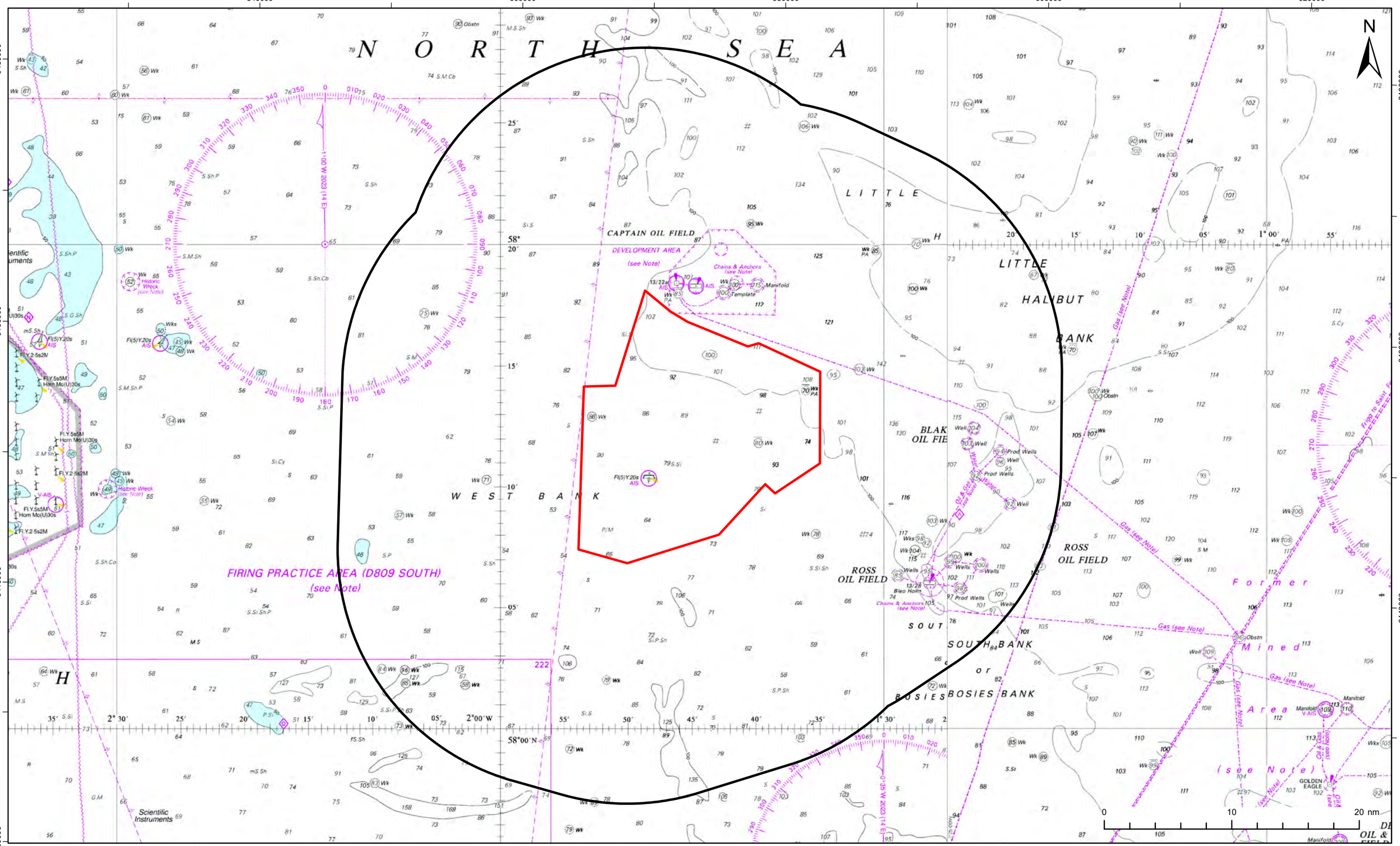
Figure Title:
UK Potting Vessel Monitoring System Data for Vessels 15m and Over (2020)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0078

Figure 10.9



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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Shipping and Navigation Study Area (10 nm buffer)

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 World Mercator

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Scale @ A3
1:500,000

Figure Title:
Overview of the Shipping and Navigation Study Area

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0091

Figure 11.1

520000 560000 600000 640000

6480000 6440000

N

FIRING PRACTICE AREA (D809 CENTRAL) (see Note)

FIRING PRACTICE AREA (D809 SOUTH) (see Note)

WETREP (see Note)

N O R T H S E A

CAPTAIN OIL FIELD DEVELOPMENT AREA (see Note)

LITTLE HALIBUT BANK

ATHENA OIL FIELD

Oil Field Decommissioning (2018-21) (see Note)

ROSS OIL FIELD

SOUTH BANK

BOSIES BANK

GOLDEN EAGLE OIL & GAS FIELD

ETTRICK OIL & GAS FIELD

BUZZARD

JACKY OIL FIELD

BEATRICE OIL FIELD

W E S T B A N K

F I R T H

S M I T H B A N K

T R E N C H

Offshore Wind Farm

Moray East Offshore Wind Farm (2023-2025) Under Construction (see Note)

Scientific Instruments

Recommendation on Navigation and Laden Tankers (see Notes)

Mined Area

Gas (see Note)

Chains & Anchors (see Note)

Manifold

Wells

Prod Wells

Gas Field Decommissioning (see Note)

58°20'N

58°00'N

0 20 40 nm

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Key Aid to Navigation
- Oil and Gas Infrastructure
- Charted Wreck or Obstruction
- Pipeline
- Cable
- Captain Oil Field Development Area
- Firing Areas

Other Offshore Wind Farms

- Beatrice
- Moray East
- Moray West

Rev 1	18/12/2023	Final	GC	HF	JM
REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 World Mercator

Source: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS

Scale @ A3
1:750,000

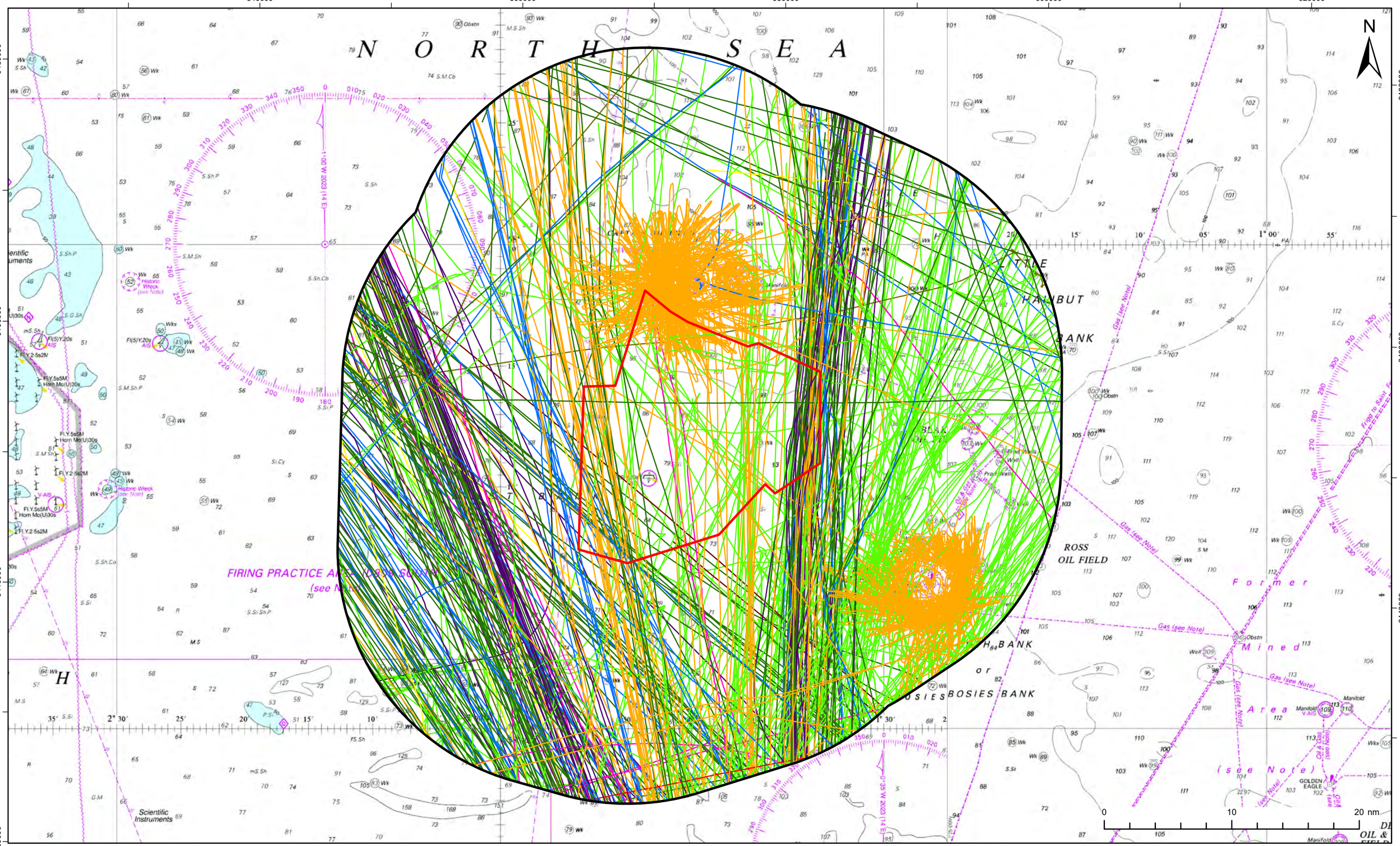
Figure Title:
Navigational Features in Proximity to the Broadshore Hub WDFAs

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0092

Figure 11.2



Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Shipping and Navigation Study Area (10 nm buffer)

Vessel Type

- Unspecified
- Fishing
- Military
- Dredger/Underwater Ops
- Tug
- Passenger
- Cargo
- Tanker
- Other
- Recreational
- Oil and Gas

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 World Mercator

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Scale @ A3 1:500,000

Figure Title: **28 Days of AIS Data by Vessel Type (Winter and Summer 2023) within the Shipping and Navigation Study Area**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0093

Figure 11.3

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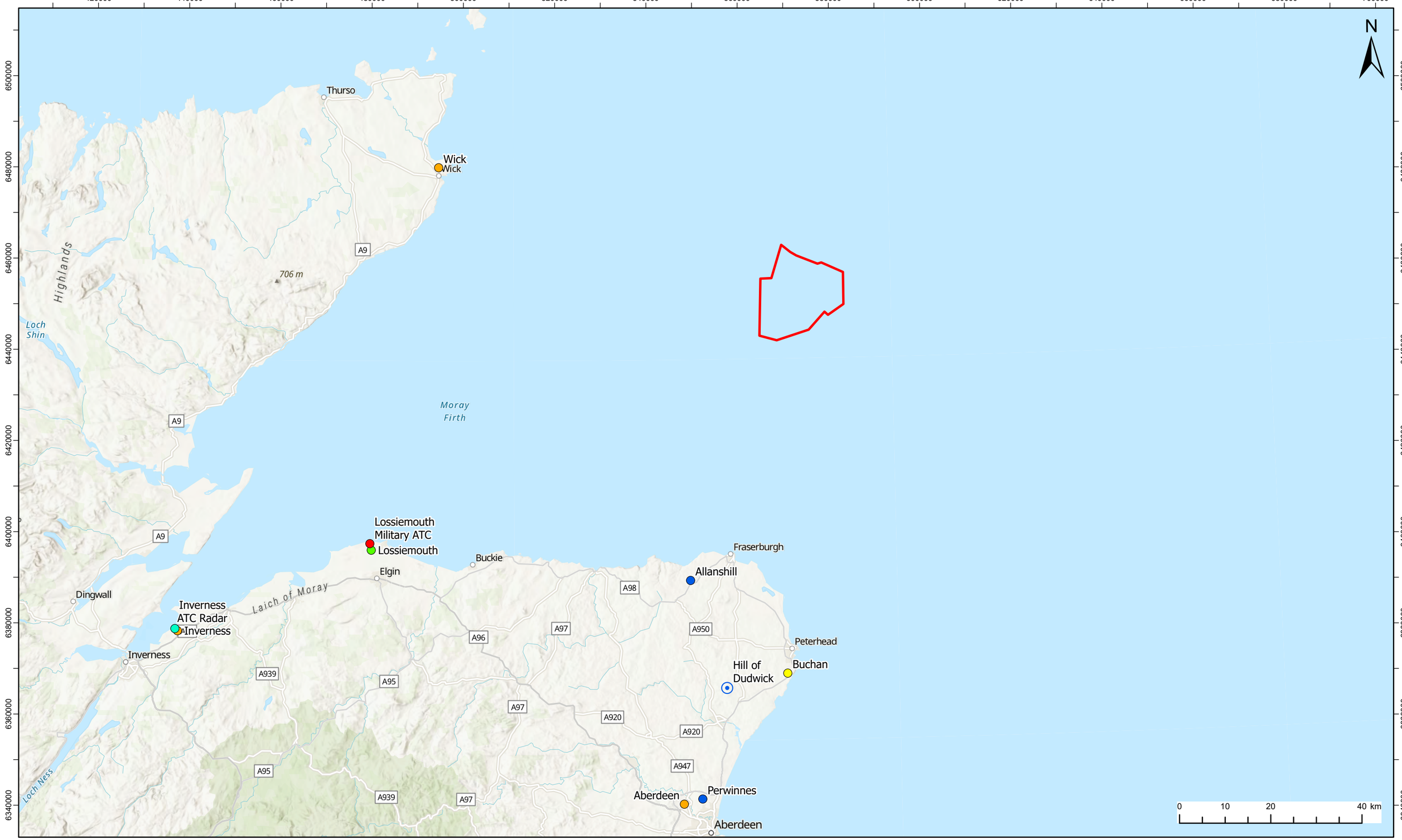

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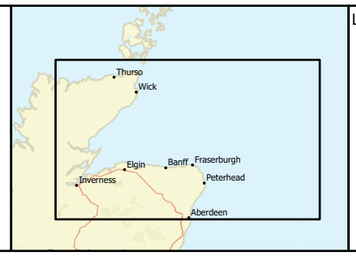


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Civil Air Traffic Control (ATC) Radars
- Civil Airports
- Air Defence Radars
- Military Airfields
- Military Air Traffic Control (ATC) Radars
- NERL Radars
- Weather Radars

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

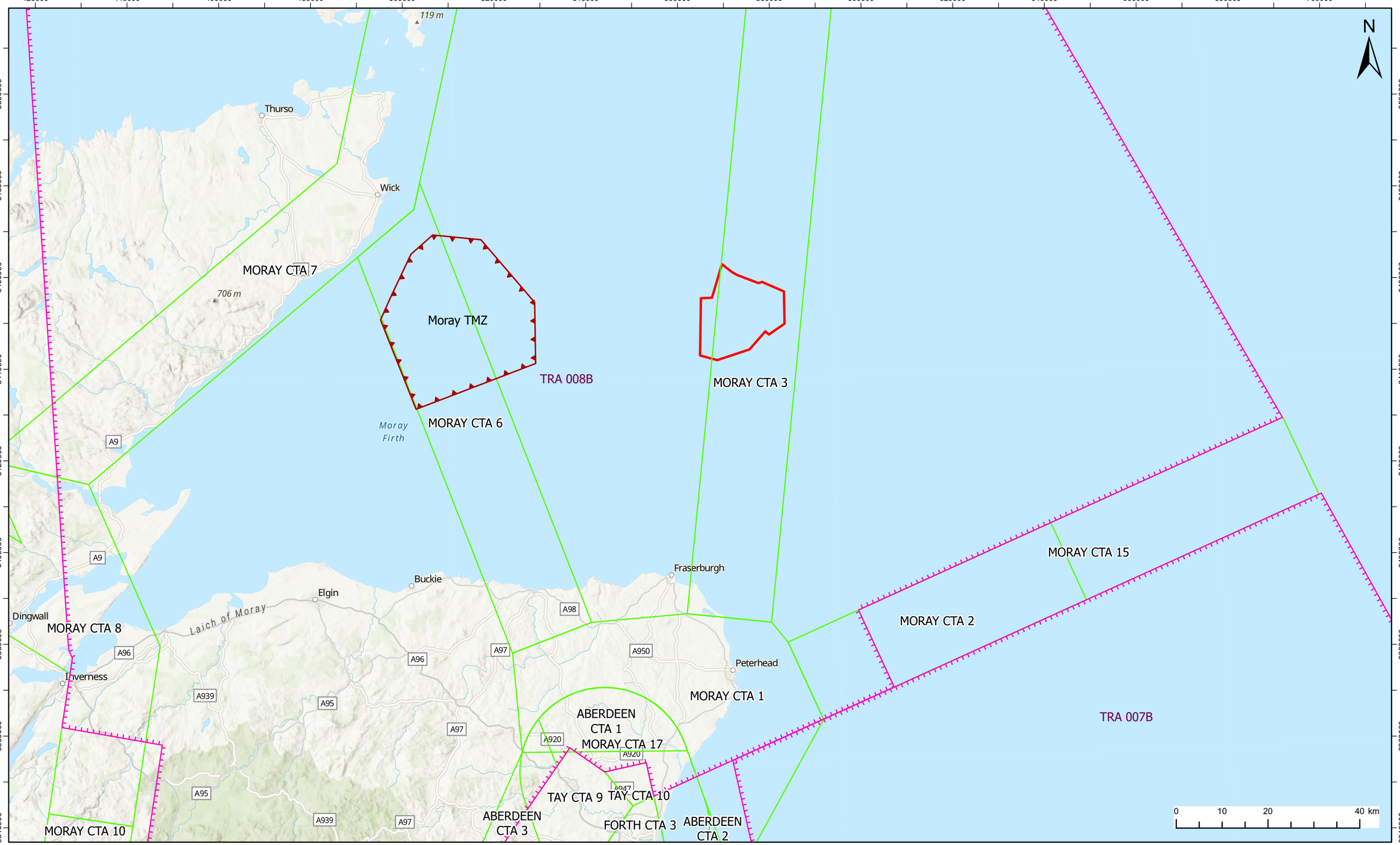
Figure Title:
Aviation and Radar Study Area - Airports and Radars

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0061

Figure 12.1



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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Moray Control Area (CTA)
- Moray Firth Transponder Mandatory Zone (TMZ)
- Temporary Reserved Area (TRA)

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

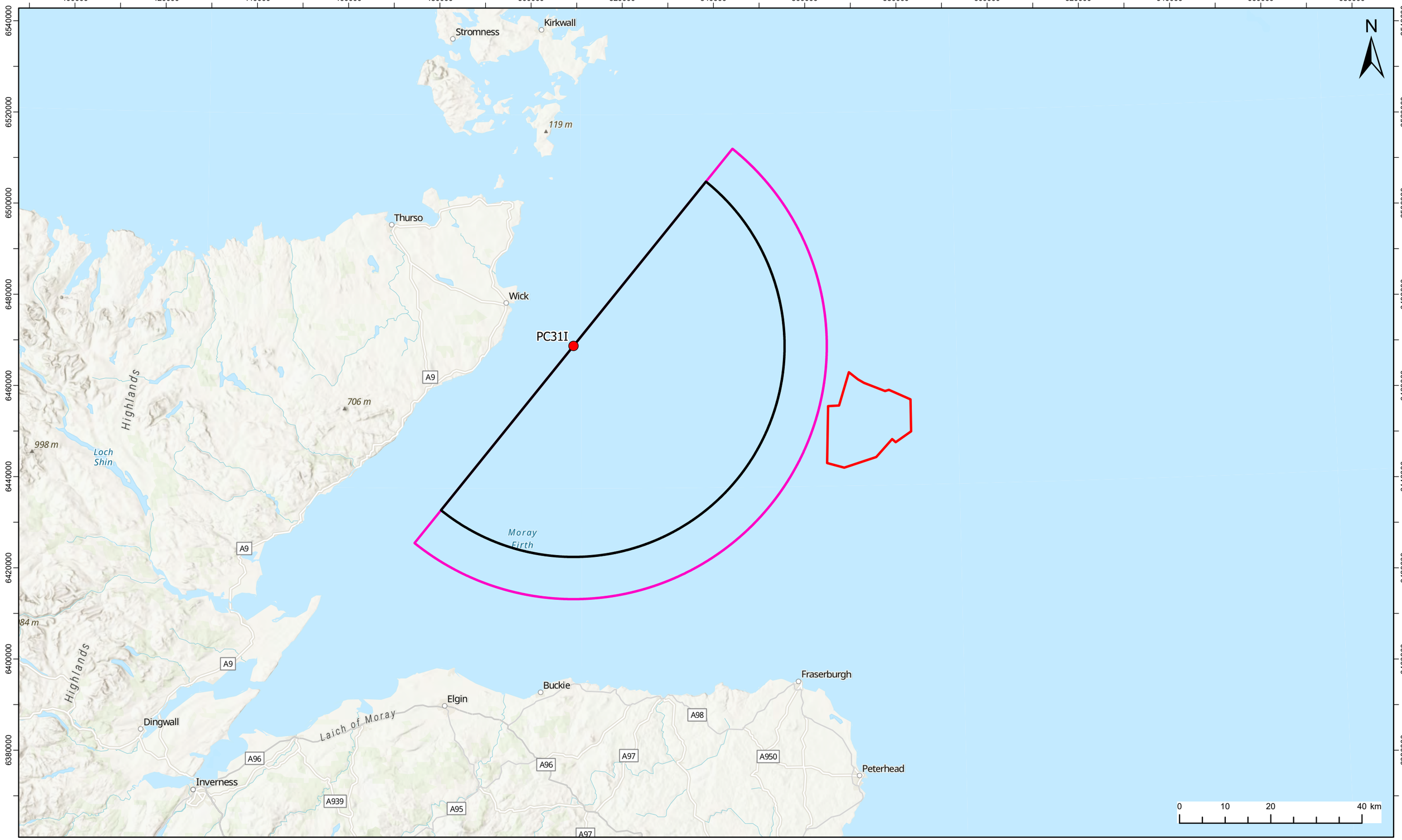
Figure Title: **Civil Airspace**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0062

Figure 12.2



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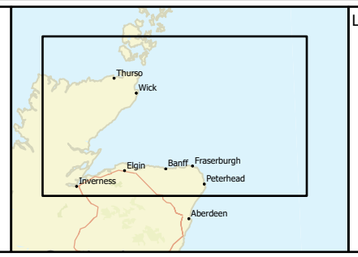


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Wick Intermediate Approach Fix (IF)
- Wick Terminal Arrival Altitude (TAA) 5 nm
- Wick Terminal Arrival Altitude (TAA) 25 nm

REV	DATE	STATUS	GC	HF	JM
Rev 1	18/12/2023	Final	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

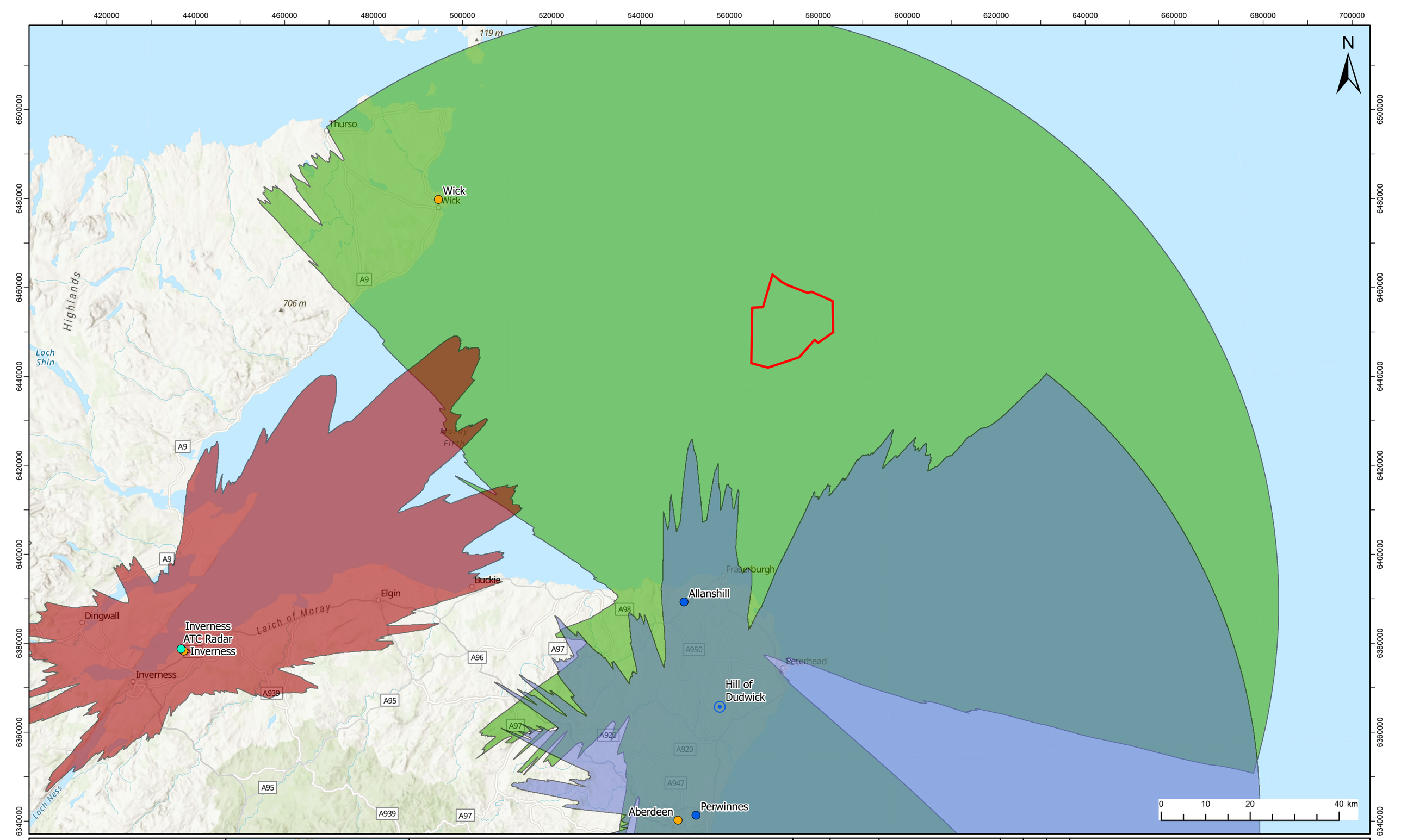
Figure Title: **Wick Airport TAA**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0063

Figure 12.3



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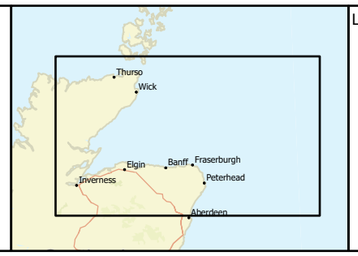


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Allanshill RLoS 400 m
- Perwinnes RLoS 400 m
- Inverness RLoS 400 m
- Civil Airports
- Civil ATC Radars
- Weather Radars
- NERL Radars

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

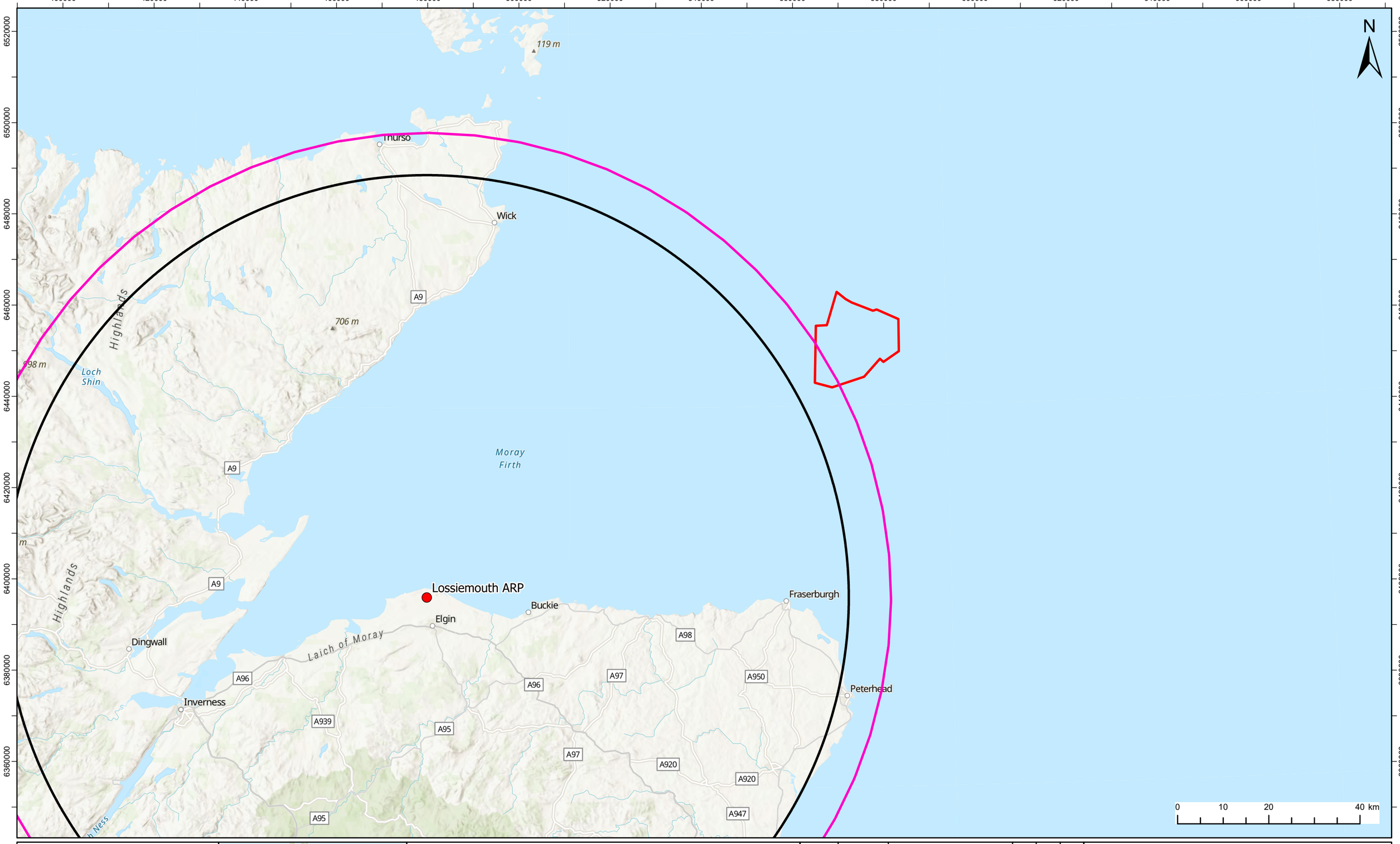
Figure Title:
Civil Air Traffic Control (ATC) and NERL Radar Line of Sight (RLoS)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0064

Figure 12.4



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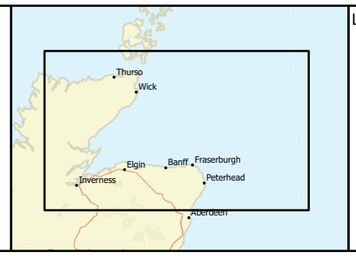


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Lossiemouth Aerodrome Reference Point (ARP)
- Lossiemouth Air Traffic Control (ATC) SMAA 5nm Buffer Zone
- Lossiemouth ATC SMAA

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

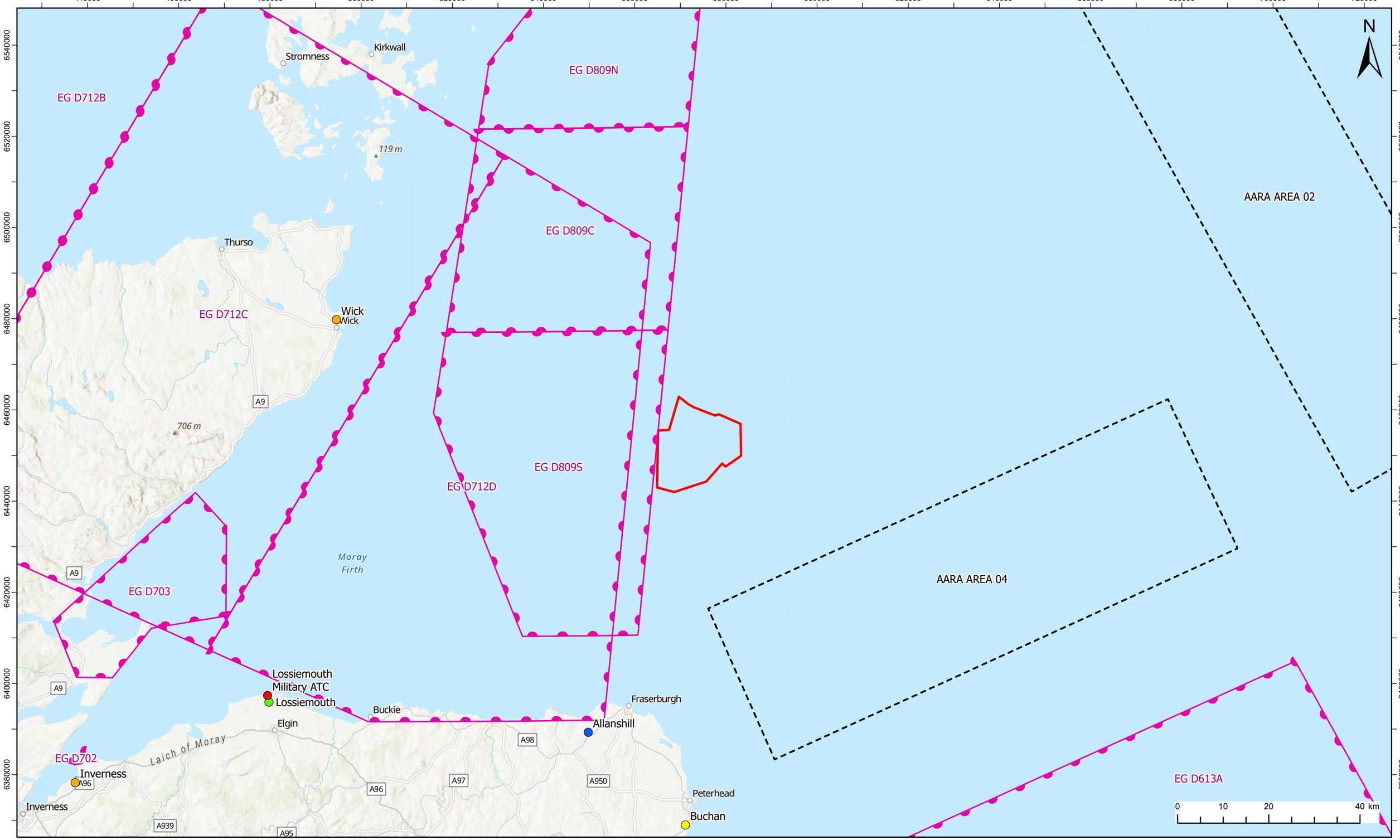
Figure Title:
Lossiemouth Surveillance Minimum Altitude Area (SMAA)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0070

Figure 12.5



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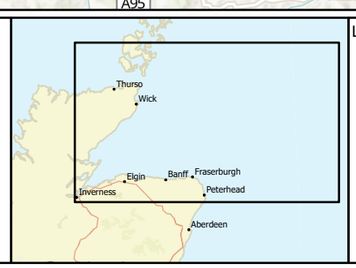


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Danger Areas
- Air to Air Refuelling Areas (AARAs)
- Military Airfields
- Air Defence Radars
- Military Air Traffic Control (ATC) Radars
- Civil Airports
- NERL Radars

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

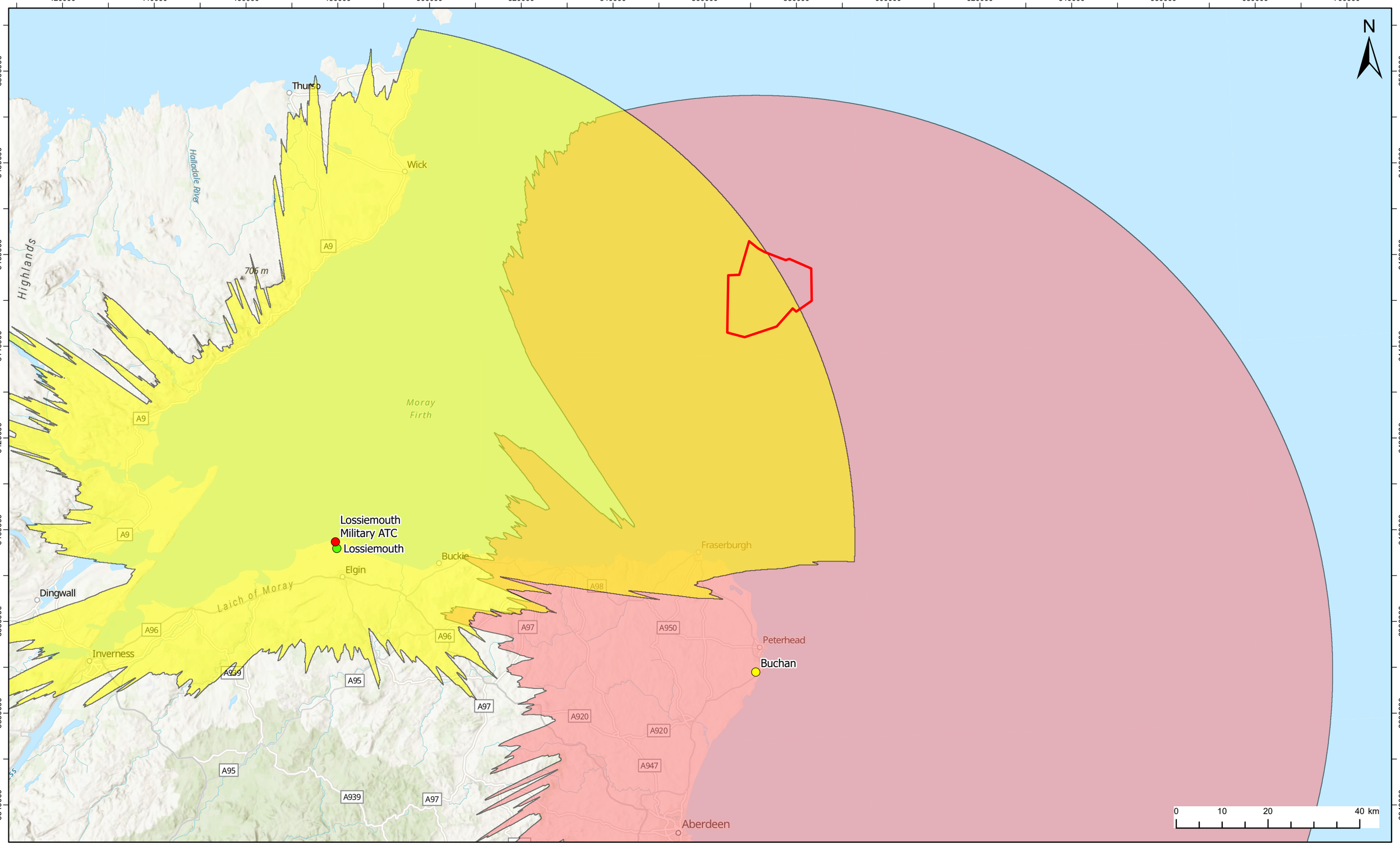
Figure Title:
Danger Areas and Restricted Zones

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0065

Figure 12.6



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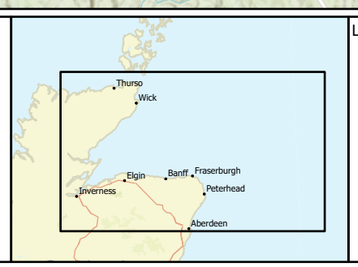


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Buchan RLoS 400 m
- Lossiemouth RLoS 400 m
- Military Airfields
- Air Defence Radars
- Military ATC Radars

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

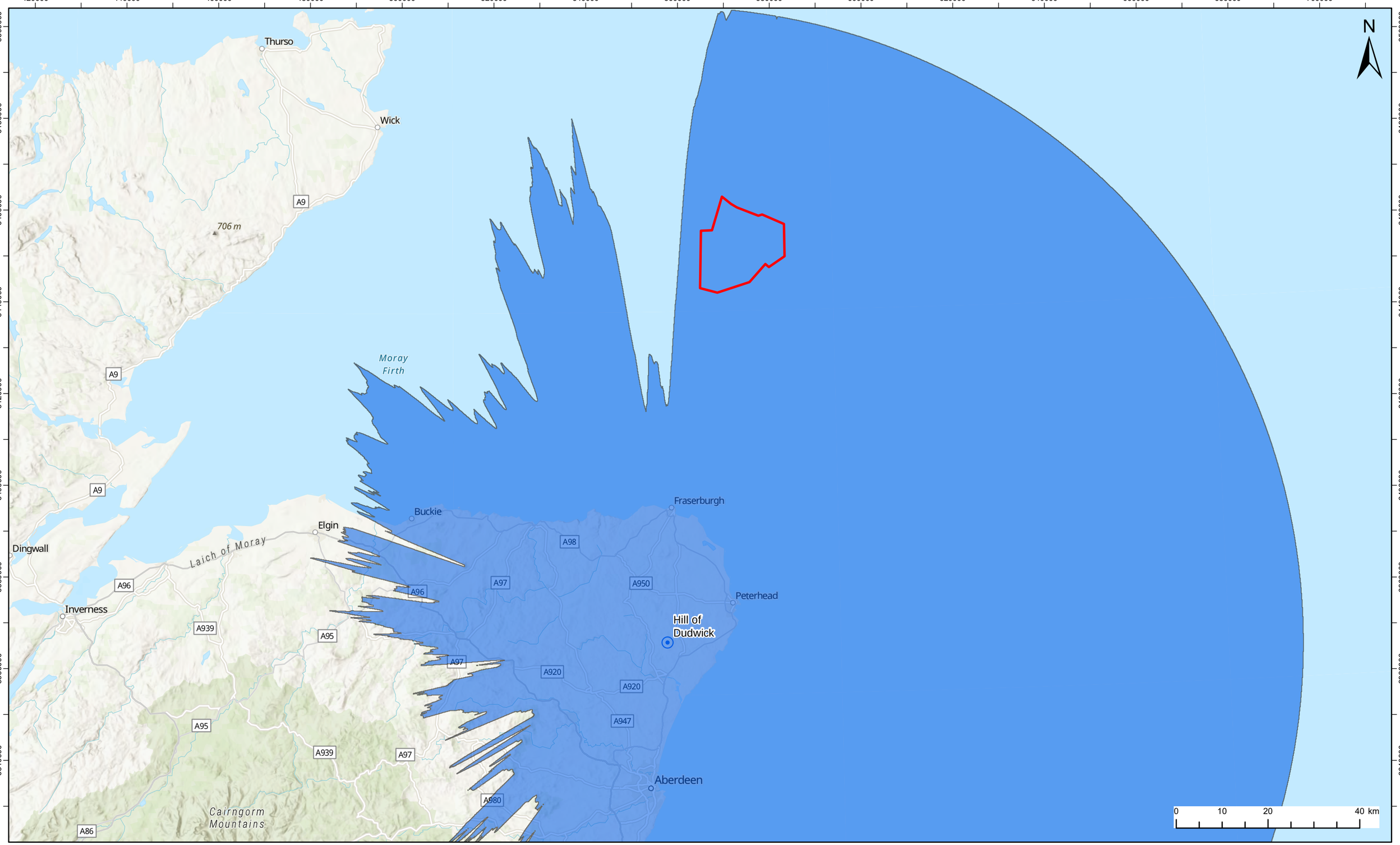
Figure Title:
Military Air Traffic Control (ATC) and Air Defence Radar Line of Sight (RLoS)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0066

Figure 12.7



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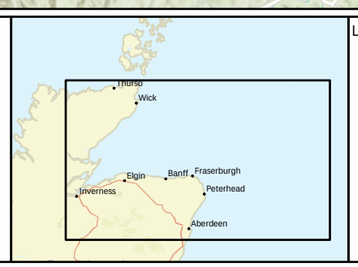


Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Hill of Dudwick RLoS 400 m
- Weather Radars

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:750,000

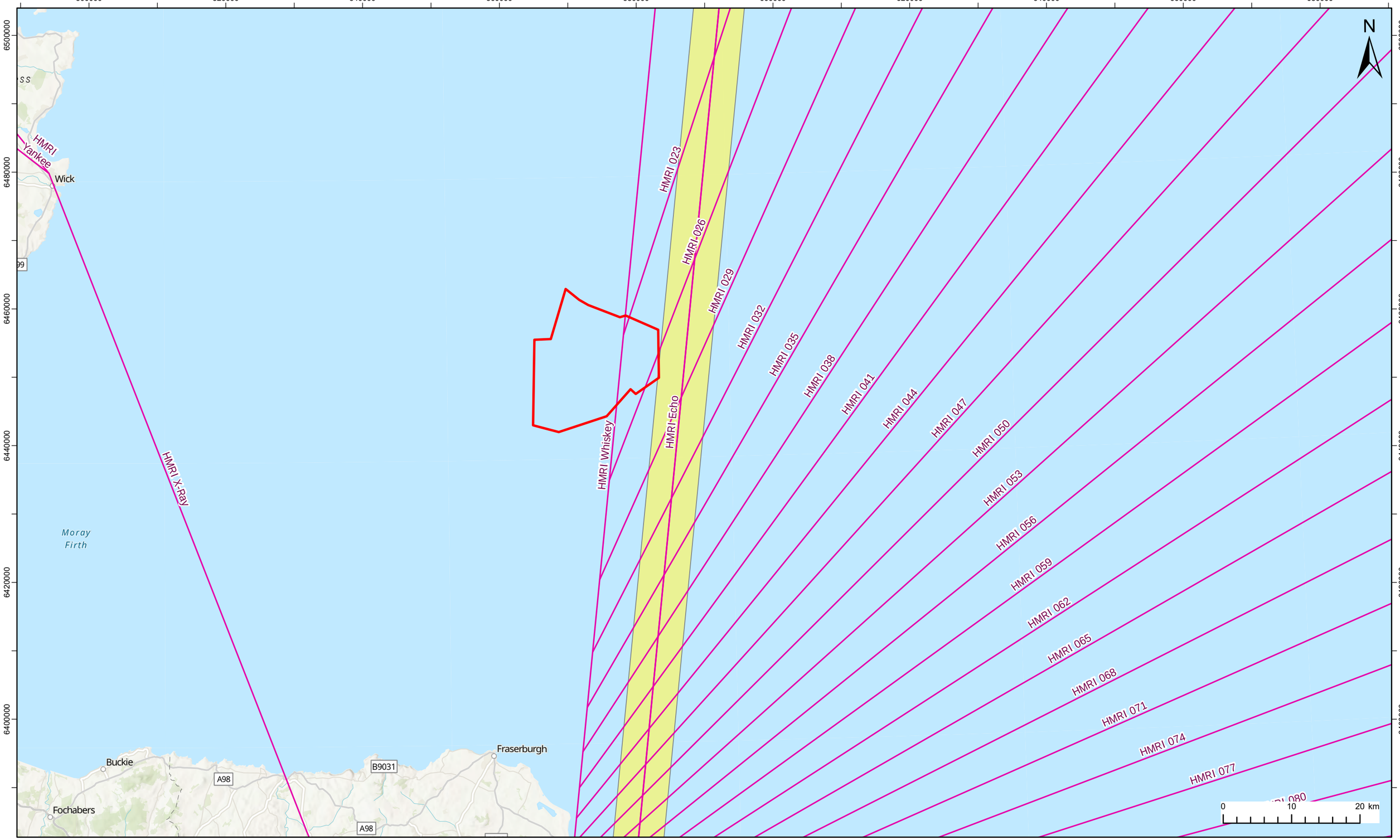
Figure Title: Hill of Dudwick Radar Line of Sight (RLoS)

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0067

Figure 12.8



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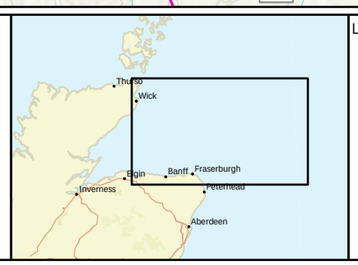

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- HMRI Echo 2 nm buffer
- HMRI Centrelines

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, TomTom, Garmin, FAO, NOAA, USGS

Scale @ A3
1:500,000

Figure Title:
Helicopter Main Routing Indicators (HMRI) Routes

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0068

Figure 12.9

540000
560000
580000
600000
620000
6480000
6460000
6440000
N
CAPTAIN WPPA
CAPTAIN BLPA
CAPTAIN FPSO
ROSS
0
5
10 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Broadshore 9 nm Buffer Zone
- Active Oil and Gas Platforms and Helidecks

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Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

Figure Title: Active Oil and Gas Helidecks

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0069

Figure 12.10

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

6480000 6460000 6440000 6420000 6400000 6380000

B870 A882 Wick A99 A9

Moray Firth

B9040 Buckie Banff B9031 Fraserburgh

Laich of Moray

A90 A950 A941 Keith A97 371 m Peterhead A947 A948

Huntly

N

0 10 20 km

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Infrastructure and Other Users Study Area (10 nm)

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3 1:500,000

Figure Title: **Marine Infrastructure and Other Users Study Area**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0013

Figure 13.1

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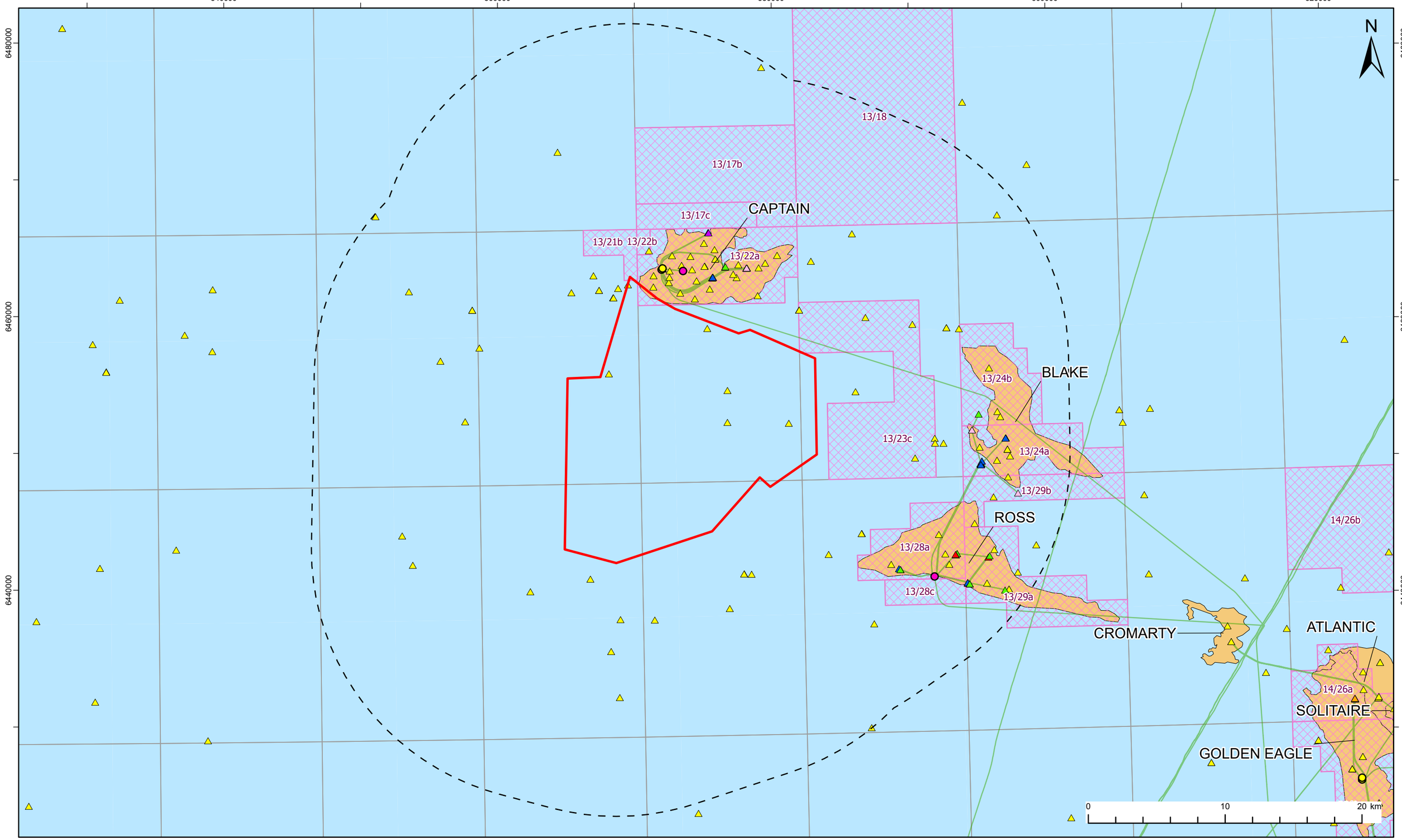

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Infrastructure and Other Users Study Area (10 nm)
- Licensed Blocks
- Oil/Gas Fields
- Unlicensed Blocks
- Pipelines

Wells

- Abandoned Phase 1
- Abandoned Phase 2
- Abandoned Phase 3
- Completed (Operating)
- Completed (Shut In)
- Drilling
- Plugged

Surface Infrastructure

- Floating Production Storage and Offloading (FPSO)
- Platform

Rev 1	18/12/2023	Final	GC	HF	JM
REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source: NTSA, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, Ordnance Survey, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Scale @ A3
1:250,000

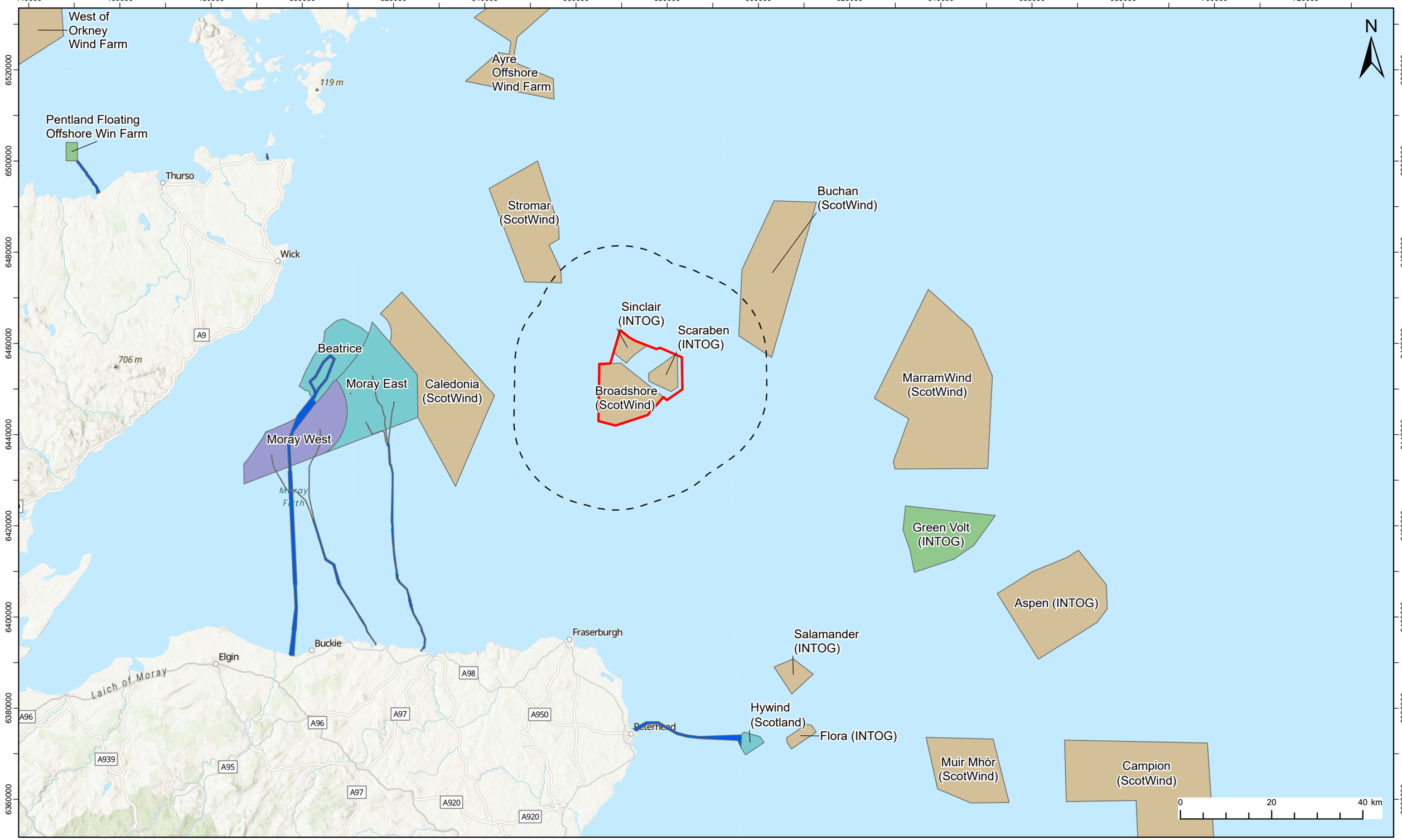
Figure Title:
Oil and Gas Infrastructure

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0014

Figure 13.2



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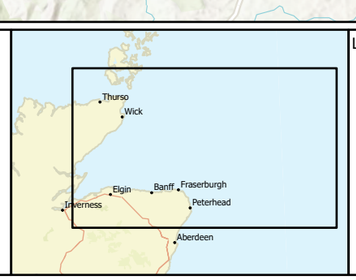

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Infrastructure and Other Users Study Area (10 nm)
- Offshore Wind Farm Cable Corridors

Offshore Wind Farm Developments

- Pre Planning (pre application)
- In Planning (consent submitted)
- Operational
- Under Construction

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Crown Estate Scotland, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, USGS

Scale @ A3
1:750,000

Figure Title:
Offshore Wind Farm Developments

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0015

Figure 13.3

480000 500000 520000 540000 560000 580000 600000 620000 640000 660000

6480000 6460000 6440000 6420000 6400000 6380000

Caithness

A882

Wick

A99

Moray Firth

Acorn CCS Project

N

040

Buckie

f Moray

Banff

B9031

Fraserburgh

A90

A950

A941

Keith

A97

0 10 20 km

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Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Infrastructure and Other Users Study Area (10 nm)
- Carbon Capture Storage (CCS) Licence Area

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Crown Estate Scotland, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3
1:500,000

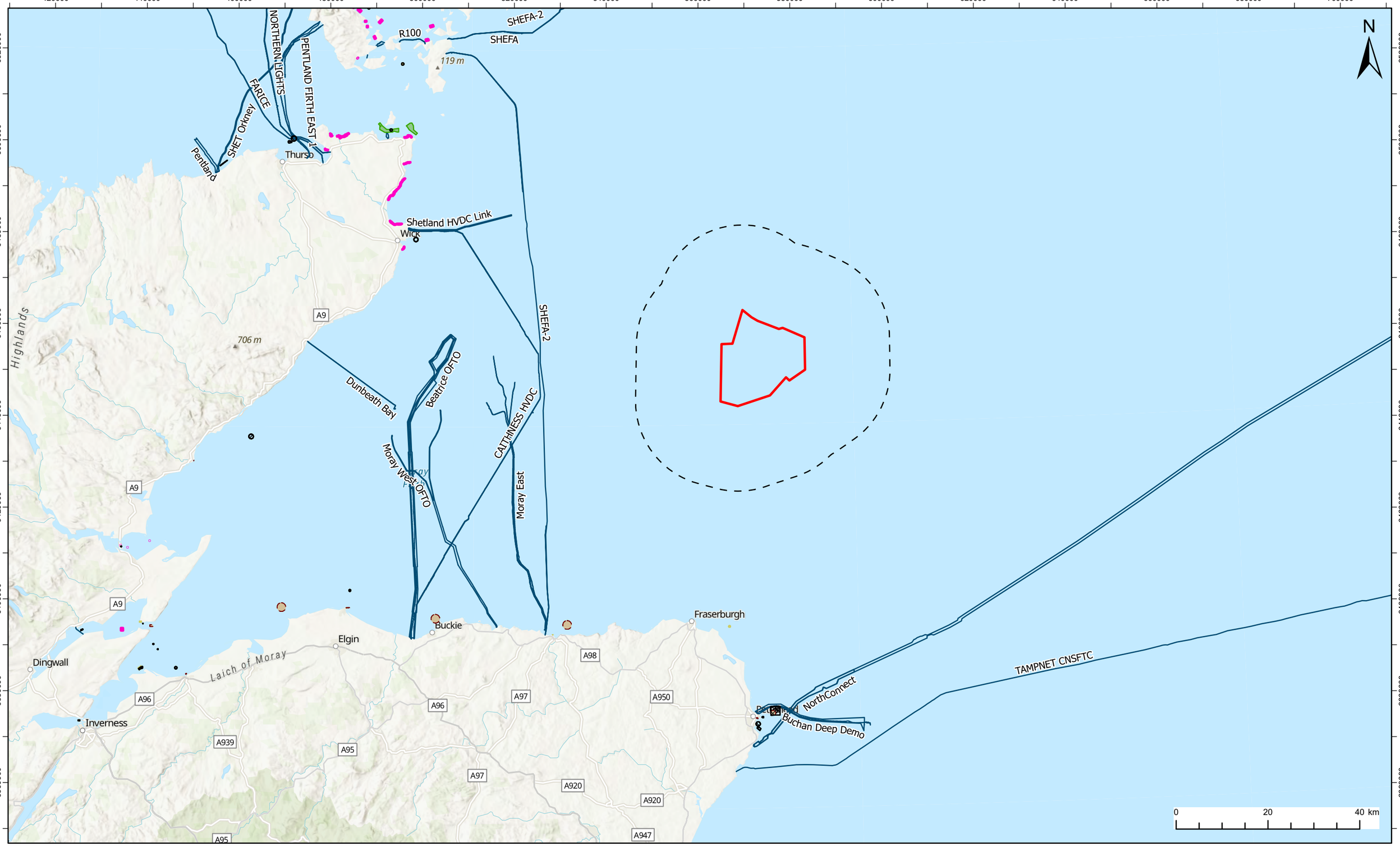
Figure Title:
Carbon Capture and Storage

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0016

Figure 13.4



Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Marine Infrastructure and Other Users Study Area (10 nm)
- Aquaculture Leases
- Tidal Projects
- Subsea Cables

Disposal Sites

- Closed
- Disused
- Open

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Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Crown Estate Scotland, UKHO, CEFAS, Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3

1:750,000

Figure Title: **Other Infrastructure**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0020

Figure 13.5

560000

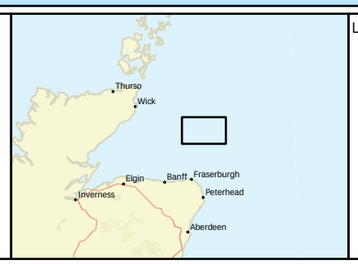
580000

6460000

6440000

N

0 5 10 km



Legend:

- Broadshore Hub WFDAs Scoping Boundary
- Maritime Records - Canmore 2023
  - Obstruction (Possible)
  - Wreck
- Maritime Records - UKHO 2023
  - Other
  - Foul ground
  - Non-dangerous wreck

Rev 1	18/12/2023	Final	GC	HF	JM
REV	DATE	STATUS	DRW	CHK	APR

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS

Scale @ A3

1:125,000

Figure Title: Marine Archaeology and Heritage UKHO and Canmore Data

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0012

Figure 14.1

460000 480000 500000 520000 540000 560000 580000 600000 620000 640000 660000 680000

6520000 6500000 6480000 6460000 6440000 6420000 6400000 6380000

N

Ayre Offshore Wind Farm

Stromar Offshore Wind Farm

Buchan Offshore Wind Farm

Marram Offshore Wind Farm

Caledonia Offshore Wind Farm

Beatrice Offshore Wind Farm

Moray Offshore Wind Farm (West)

Moray Offshore Wind Farm (East)

10 km

20 km

30 km

40 km

50 km

60 km

0 20 40 km

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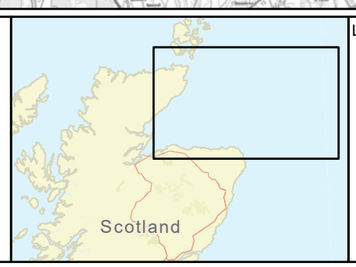

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- 10 km Radii
- 60 km SLVIA Study Area
- Operational
- Scoping
- Under construction

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Coordinate System: WGS 1984 UTM Zone 30N

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Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS

Scale @ A3
1:600,000

Figure Title:
SLVIA Study Area and Locations of Other Offshore Wind Farms

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDV_HUB_CST_FGR_0081

Figure 15.1

460000 480000 500000 520000 540000 560000 580000 600000 620000 640000 660000 680000

6520000 6500000 6480000 6460000 6440000 6420000 6400000 6380000

N

Aberdeen to Kirkwall

Aberdeen to Lerwick

10 km

20 km

30 km

40 km

50 km

60 km

1 2 3 4 5 6

Notes:
The ZTV is calculated to a blade tip height of 400 m above Ordnance Datum applied across the Broadshore Hub WFDAs Scoping Boundary and from a viewing height of 2 m above ground level.

The terrain model assumes bare ground and no buildings and is derived from OS Terrain 50 height data.

Earth curvature and atmospheric refraction have been taken into account. The ZTV was calculated using ArcPro 3.1.3.

0 20 40 km

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Broadshore Hub

Scotland

Legend:

- Broadshore Hub WFDAs Scoping Boundary
- 10 km Radii
- 60 km SLVIA Study Area
- **Zone of Theoretical Visibility**
- Proposed Turbines Theoretically Visible
- Ferry Route
- Viewpoints

1: Troup Head
2: Pennan
3: New Aberdour
4: Rosehearty War Memorial
5: Kinnaird Head, Fraserburgh
6: St Combs

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Rev 1	18/12/2023	Final	HC	TH	PM

Coordinate System: WGS 1984 UTM Zone 30N

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Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS

Scale @ A3
1:600,000

Figure Title:
Blade Tip Zone of Theoretical Visibility

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDV_HUB_CST_FGR_0082

Figure 15.2

Notes:
The ZTV is calculated to a blade tip height of 400 m above Ordnance Datum applied across the Broadshore Hub WFDAs Scoping Boundary and from a viewing height of 2 m above ground level.

The terrain model assumes bare ground and no buildings and is derived from OS Terrain 50 height data.

Earth curvature and atmospheric refraction have been taken into account. The ZTV was calculated using ArcPro 3.1.3.

540000 560000 6400000

N

40 km 50 km 60 km

Aberdeen to Kirkwall

North Aberdeenshire Coast SLA

North East Aberdeenshire Coast SLA

1 Troup Head
2 Pennan
3 New Aberdour
4 Rosehearty War Memorial
5 Kinnaird Head, Fraserburgh
6 St Combs

FRASERBURGH ROSEHEARTY Pitsligo Castle Pittulie Sandhaven KINNAIRD HEAD Fraserburgh Bay Cairnbulg Point Inverallochy St Combs Inzie Head Troup Head Pennan Head Quarry Head Head of Garness Gamrie Bay Crovie Gardenstown Pennan Towie Silverford Dubford Greenskares Longmanhill Cushnie Minnonie Netherbrae Bracklamore Hill of Fishrie Gorrachie Milltown of Craigston Craigston Castle Plaidy Fintry New Byth Garmond Glasslaw Craigmaud Ladysford Hillhead of Auchentumb Newburgh Mormond Hill Mormond Stag Mormond Horse Knowhead New Pitsligo Strichen Bonnykelly Adziel North Ugie Water New Leeds Whitewell Rathen Cairness Fiddler's Green Loch of Strathbeg Old Rattray Industrial Estate Crimond Blackhill Gas Terminal St Fergus Moss Leys Backfolds Peathill Percyhorner Mid Ardlaw Coburty Boyndlie Tyrie Memsie Cairnbulg Castle Gowanhill Lonmay Crimonmogate Woodhead Windyheads Hill Castle (ruins of) A98 A90 A952 A981 A950 B9093 B9032 B9107 B9031 B9105

0 2.5 5 km

Scotland

Legend:
- 10 km Radii
- 60 km SLVIA Study Area
- Special Landscape Areas (SLAs)
- Ferry Route

Zone of Theoretical Visiblity
- Proposed Turbines Theoretically Visible

Viewpoints
1: Troup Head
2: Pennan
3: New Aberdour
4: Rosehearty War Memorial
5: Kinnaird Head, Fraserburgh
6: St Combs

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Coordinate System: WGS 1984 UTM Zone 30N

Scale @ A3
1:100,000

Figure Title:
Proposed Viewpoint Locations

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDV_HUB_CST_FGR_0083

Figure 15.3

Broadshore Hub

Broadshore OFFSHORE WIND

Sinclair OFFSHORE WIND

Scaraben OFFSHORE WIND

Appendix 2: Nature Conservation Marine Protected Area (NCMPA) Screening

BlueFloat ENERGY

Renantis

PARTNERSHIP

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Contents

Figures

Tables

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1 Introduction

1. As set out in **Chapter 2: Policy and Legislative Context** of the **Broadshore Hub Wind Farm Development Areas (WFDAs) Scoping Report**, Nature Conservation Marine Protected Areas (NCMPAs) in Scotland are designated under the Marine (Scotland) Act 2010 within 12 nautical miles (nm), and under the Marine and Coastal Access Act 2009 in offshore waters between 12 nm and 200 nm. NCMPAs are designated to protect biodiversity and heritage, with specific focus on protected features (species, habitats, large scale features or geomorphological features).

2. Under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009, provisions are made for the relevant public authority (in this instance the Scottish Ministers whose powers are exercised through the Marine Directorate Licensing Operations Team; MD-LOT) to consider whether a licensable activity is capable of affecting (other than insignificantly) a protected feature in a NCMPA or any ecological or geomorphological process on which the conservation of any protected feature in a NCMPA is dependant. Subject to the exception noted in paragraph 3 below, MD-LOT must not grant authorisation for the licensable activity where there is a significant risk of hindering the achievement of the conservation objectives of the NCMPA.

3. Where the organisation seeking authorisation to undertake a licensable activity cannot satisfy MD-LOT that there is no significant risk of the activity hindering the conservation objectives, MD-LOT may still grant a licence to undertake the activity where MD-LOT is satisfied that:

   - There are no other means of proceeding that would create a substantially lower risk;
   - The benefit to the public clearly outweighs the risk of damage to the environment; and
   - Measures will be undertaken of equivalent environmental benefit to the damage which will or is likely to occur.

4. In order to assess whether there is any significant risk of the licensable activity (in this case, the development of the Broadshore Hub WFDAs, as described in **Chapter 3: Project Description** of the **Broadshore Hub WFDAs Scoping Report**) hindering the achievement of the conservation objectives of a given NCMPA, an NCMPA Assessment should be completed. Methodology for the NCMPA Assessment is also detailed in **Chapter 4: Approach to Scoping and EIA** of the **Broadshore Hub WFDAs Scoping Report**.

5. The NCMPA assessment consists of two stages:

   - Stage 1 - Initial Screening (further details provided in **Section 1.1**); and.
   - Stage 2 - Main Assessment (further details provided in **Section 1.2**).

6. This NCMPA Screening Report, covering Stage 1, has been prepared and submitted for consideration alongside the **Broadshore Hub WFDAs Scoping Report**, in line with the guidance provided in the Marine Scotland *Nature Conservation Marine Protected Areas: Draft Management Handbook* (2013 In the absence of the updated version, NatureScot advised at the Scoping Workshop for the Broadshore Hub WFDAs held on the 13th September 2023, that the NCMPA Screening should clearly present any overlap of the Broadshore Hub WFDAs infrastructure or activities with features of MPAs and consideration should be given to impacts on the features' conservation objectives.

7. This NCMPA Screening Report has linkages with the following chapters of the **Broadshore Hub WFDAs Scoping Report**:

- **Chapter 6: Benthic Ecology;**
- **Chapter 7: Fish and Shellfish Ecology;**
- **Chapter 8: Marine Mammals; and**
- **Chapter 9: Offshore Ornithology.**

8. This appendix has been prepared by Royal HaskoningDHV.

1.1 Stage 1: Screening

9. The initial screening will focus on what can reasonably be predicted as a consequence of the Broadshore Hub WFDAs and whether it is 'capable of affecting (other than insignificantly)', a protected feature of a NCMPA.

10. As per the Draft Management Handbook, the screening will use information that is currently available and consider aspects such as the scale, timing and duration of proposed activities/developments. These considerations will include proposals for developments or activities outside the boundary of a NCMPA.

11. The consideration of 'capable of affecting' results in removing from further consideration all proposals/functions which are not in any way connected to the protected feature(s). A capability that is both remote (in terms of likelihood of occurrence) and hypothetical should not be the basis of a conclusion that further assessment is required. This can be determined by considering whether the activity will exert pressures which the protected feature(s) are sensitive to (Marine Scotland, 2013).

12. Where the conclusion of the screening is that there is 'capability of affecting', the focus will then be on considering whether the proposed development or activity will affect the protected features of a NCMPA, other than insignificantly. Consideration of the degree of pressure that could be exerted by the activity on a spatial basis should help to establish what level of effect might occur (Marine Scotland, 2013).

13. It is proposed that 'insignificance' will be determined for the Broadshore Hub WFDAs through the assessments made in the Broadshore Hub WFDAs EIA Report chapters.

14. Where the conclusion is that the Broadshore Hub WFDAs and any associated activities is capable of affecting, other than insignificantly the protected features of a NCMPA, then Stage 2: Main Assessment must be carried out, in consideration of the conservation objectives of the NCMPA.

1.2 Stage 2: Main Assessment

15. The NCMPA Main Assessment stage focuses on determining whether the Broadshore Hub WFDAs or associated activities pose a significant risk of hindering the achievement of objectives of a NCMPA, which is carried out on a case-by-case basis. The NCMPA Main Assessment will focus on the potential impact on the achievement of the conservation objectives of the protected features, in contrast to the screening which focuses on the protected features.

16. The NCMPA Main Assessment will build on the initial screening, and will consider aspects such as scale, timing and duration of the proposed activities or developments. The NCMPA Main Assessment will also include consideration of cumulative effects with other activities in line with EIA requirements (please refer to **Chapter 4: Approach to Scoping and EIA** in the **Broadshore Hub WFDAs Scoping Report**).

17. Conservation objectives for NCMPA features describe the desired conditions of the NCMPA feature. Therefore, the objective for each given feature that is:

- Already in favourable condition, is to remain in this condition; and
- Not already in favourable condition, is to be brought into this condition, and subsequently remain in this condition.

18. If required, the NCMPA Main Assessment will be presented as a standalone report alongside the Broadshore Hub WFDAs EIA Report. The NCMPA Main Assessment will consider whether the Broadshore Hub WFDAs could potentially affect these objectives (other than insignificantly) for each NCMPA screened into the assessment, and whether the Broadshore Hub WFDAs and associated works could impact the condition of the features within the NCMPA.

1.3 Identification of Relevant NCMPA

19. In order to determine the zones of influence (ZoI) associated with the works during the construction, operation and decommissioning phases of the Broadshore Hub WFDAs, the Applicants propose to apply the screening criteria as detailed in **Sections 1.3.1** to **1.3.4** below.

20. **Figure A2.1** shows the Broadshore Hub WFDAs Screening Boundary and NCMPAs considered. **Table 1.1** provides a summary of all NCMPAs considered in this NCMPA Screening and their features.

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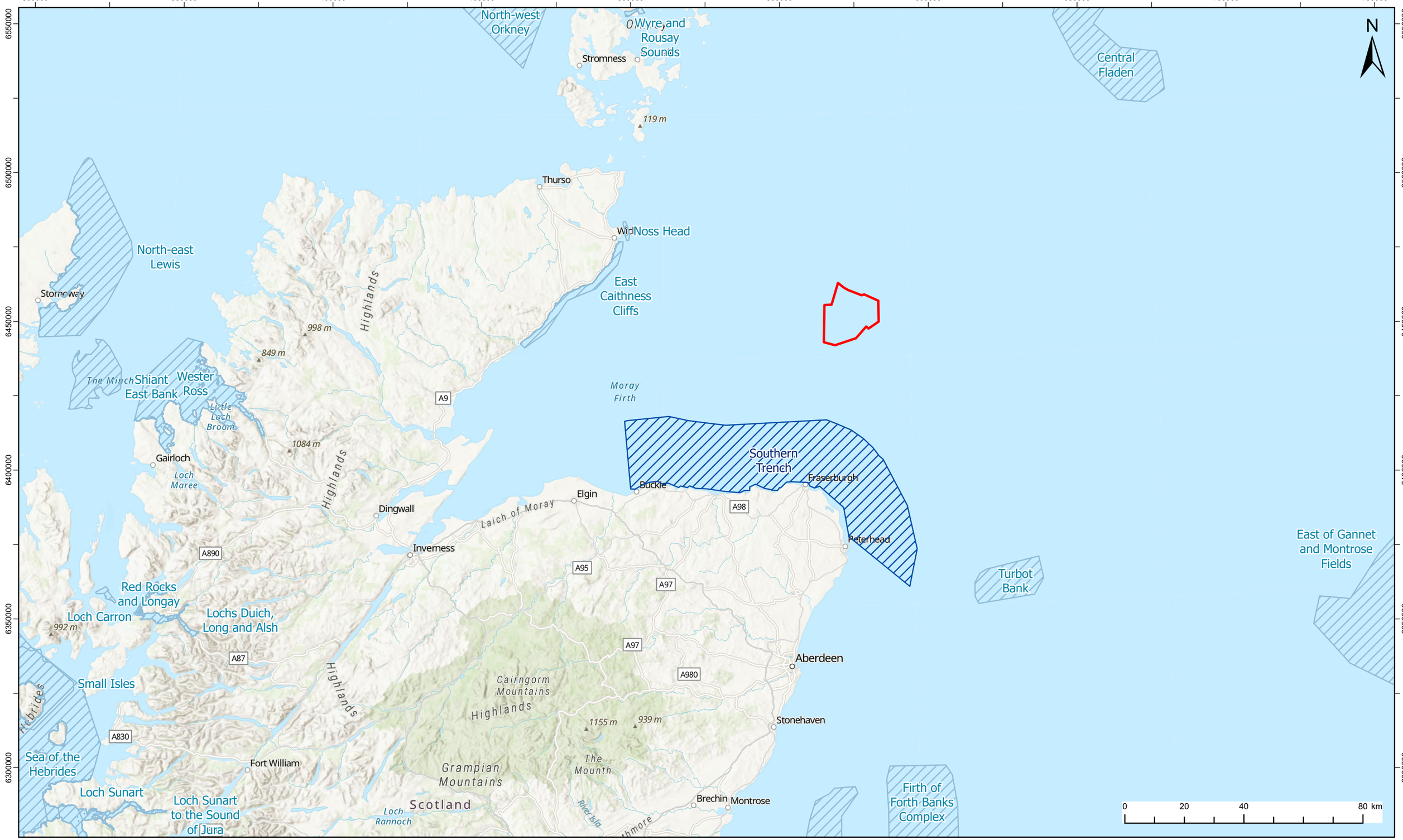

Legend:

- NCMPA Screening Boundary
- Marine Protected Areas (MPA) Screened In
- Marine Protected Areas (MPA) Screened Out

REV	DATE	STATUS	DRW	CHK	APR
Rev 1	18/12/2023	Final	GC	HF	JM

Coordinate System: WGS 1984 UTM Zone 30N

Source: Esri, CGIAR, N Robinson, NCEAS, USGS, Esri UK, Esri, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Scale @ A3

1:1,150,000

Figure Title: **Broadshore Hub WFDAs NCMPA Screening Boundary and NCMPAs**

Project: Broadshore Hub WFDAs

Report: Scoping Report

Drawing No.: RHDHV_HUB_CST_FGR_0023

Figure A2.1

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Table 1.1: Summary of all NCMPAs Considered in this NCMPA Screening Report and their Features

NCMPA	Distance from Broadshore Hub WFDAs	Protected feature(s)
Southern Marine Trench	24 km	Minke whale *Balaenoptera acutorostrata*
		Burrowed mud
		Fronts
		Shelf deeps
		Quaternary of Scotland (moraines and sub-glacial tunnel valleys)
		Submarine mass movement (side scars)
East Caithness Cliffs	70 km	Black guillemot *Cepphus grylle*
Turbot Bank	89 km	Sandeels *Ammodytes spp.*
North-east Lewis	233 km (across land) 253 km (by sea)	Risso's dolphin *Grampus griseus*
		Sandeels *Ammodytes spp.*
		Quaternary of Scotland
		Marine Geomorphology of the Scottish Shelf Seabed
Sea of the Hebrides	295 km (across land) 360 km (by sea)	Minke whale
		Basking shark *Cetorhinus maximus*
		Marine Geomorphology of the Scottish Shelf Seabed
		Fronts

1.3.1 Benthic Habitats/Species and Geodiversity Features

21. The closest NCMPA to the Broadshore Hub WFDAs designated for benthic habitats/species and geodiversity features is the Southern Marine Trench NCMPA (**Table 1.1**), where the following are protected features: fronts, shelf deeps, Quaternary of Scotland and submarine mass movement.

22. The ZoI for benthic habitats/species and geodiversity features is defined by the distance over which impacts from the offshore infrastructure associated with the Broadshore Hub WFDAs may occur, and the location of the receptors that may be affected by these impacts. Such impacts could include increased suspended sediment concentrations or changes to the hydrodynamic regime. The ZoI is defined by a 10 km wide buffer around the Broadshore Hub WFDAs, which is considered

sufficiently precautionary to capture all sites likely to be in the ZoI from direct and indirect effects associated with construction activities.

23. No NCMPAs that are designated for benthic habitats/species and geodiversity features are located within a 10 km wide buffer around the Broadshore Hub WFDAs (**Table 1.1**), and therefore, as there is no potential pathway for impact, no NCMPAs that are designated for these features are screened in.

1.3.2 Fish

24. The closest NCMPA to the Broadshore Hub WFDAs designated for fish features is the Turbot Bank NCMPA (**Table 1.1**), where sandeels are a protected feature.

25. The greatest ZoI for fish and shellfish receptors arises from underwater noise associated with pile driving. Sensitivity to noise varies between fish species (Popper et al., 2014), and noise levels vary according to the dimensions of the piles and the environment within which the underwater sound propagates (e.g. sediment type, water depth) (Dahl et al., 2014; 2015). The underwater sound modelling for the Broadshore Hub WFDAs has not been completed at this stage and therefore the ZoI specific to the Broadshore Hub WFDAs is not yet known. Given these uncertainties, the screening distance for the fish and shellfish will be based on a conservative appraisal of the worst case monopile pile driving impact ranges (temporary threshold shifts (TTS) in hearing or behavioural disturbance effects) for the most sensitive hearing groups of fish (fish that have a swim bladder that is involved in hearing), considered as stationary receptors, for recent offshore wind farm projects (**Table 1.2**). It should be noted that Broadshore Hub WFDAs plan to use smaller diameter pin piles and will therefore likely have lower impact ranges than the larger diameter monopiles referenced in **Table 1.2**.

Table 1.2: Worst Case Monopile Pile Driving Noise Impact Ranges for Recent Offshore Wind Farm Projects

Project and Parameters	Worst Case Modelled Maximum Impact Range	Reference
Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects 16 m diameter monopile Maximum blow energy 5,500 kJ	39 km	Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects (2023) ES Appendix 10.2 – Underwater Noise Modelling Report (Revision C) (Clean)
Hornsea Project Four 15 m diameter monopile Maximum blow energy 5,000 kJ	38 km	Hornsea Project Four (2021) Environmental Statement: Volume A4, Annex 4.5: Subsea Noise Technical Report Part 1
Norfolk Vanguard 15 m diameter monopile Maximum blow energy 5,000 kJ	58 km	Norfolk Vanguard (2018) Environmental Statement Appendix 5.3 - Underwater Noise Modelling
East Anglia ONE North 15 m diameter monopile	39 km	East Anglia ONE North Limited (2019) Environmental Statement -

Project and Parameters	Worst Case Modelled Maximum Impact Range	Reference
Maximum blow energy 4,000 kJ		Appendix 11.4 - Underwater Noise Assessment
Moray West 15 m diameter monopile Maximum blow energy 5,000 kJ	12 km	Moray West (2018) Environmental Impact Assessment Report - Technical Appendix 9.2: Underwater Noise Modelling
Berwick Bank 2 x 5.5m diameter pin piles piled concurrently Maximum blow energy 4,000 kJ	7km	Berwick Bank Wind Farm (2022) Environmental Impact Assessment Report. Volume 2, Chapter 9: Fish and Shellfish Ecology

26. Given these reported impact ranges for other projects as detailed in **Table 1.2**, an appropriately conservative NCMPA screening range for the Broadshore Hub WFDAs has been set at 75 km. Following the outputs of noise modelling undertaken for the Broadshore Hub WFDAs, this ZoI may be updated.

27. No NCMPAs that are designated for fish and shellfish species are located within 75 km of the Broadshore Hub WFDAs (**Table 1.1**), and therefore there is no pathway for effect from underwater noise. No NCMPAs that are designated for fish and shellfish species are screened in on this basis.

1.3.3 Marine Mammals

28. The closest NCMPA to the Broadshore Hub WFDAs designated for marine mammals features is the Southern Marine Trench NCMPA (**Table 1.1**), where minke whale is a protected feature.

29. The ZoI for marine mammals is defined with reference to their Management Unit (MU), as defined by the Inter-Agency Marine Mammal Working Group (IAMMWG) for cetaceans.

30. The following NCMPAs fall within the wider cetacean MU's:

- Southern Marine Trench NCMPA (minke whale);
- North-east Lewis NCMPA (Risso's dolphin); and
- Sea of the Hebrides NCMPA (minke whale).

31. Where MUs for a given species extend over a very large scale (e.g., minke whale and Risso's dolphin over the Celtic and Greater North Sea MU) the assessment will focus in on the appropriate SCANS-IV (Small Cetaceans in European Atlantic waters and the North Sea) Blocks (NS-E and CS-K) which overlaps the Broadshore Hub WFDAs.

32. The Southern Marine Trench NCMPA, which is designated for minke whale, falls within this ZoI (**Table 1.1**), and will be screened in for assessment. No other NCMPAs designated for marine

mammal features fall within the ZoI (North-east Lewis and Sea of the Hebrides NCMPA's fall outside the relevant SCANS survey blocks). Following the outputs of noise modelling undertaken for the Broadshore Hub WFDAs EIA Report, this ZoI may be updated.

1.3.4 Ornithology

33. The closest NCMPA to the Broadshore Hub WFDAs designated for ornithology features is the East Caithness Cliffs NCMPA (**Table 1.1**), where black guillemot is a protected feature under the criterion 'Aggregations of breeding birds'.

34. The nearest distance between the Broadshore Hub WFDAs and the NCMPA is 70.3 km, whereas black guillemot have strongly inshore foraging ecology during the breeding season with a mean-maximum foraging range (+ 1 standard deviation (SD)) of less than 10 km (4.8±4.3 km, Woodward et al. 2019). As such, there is no potential connectivity between the black guillemot protected feature of the NCMPA and the Broadshore Hub WFDAs during the breeding season.

35. Similarly, there is no potential connectivity between the black guillemot protected feature of the NCMPA and the Broadshore Hub WFDAs during the non-breeding season. Furness (2015) defines the Biologically Defined Minimum Population Scale (BDMPS) of black guillemot during the non-breeding season as "birds found within 20 km of a specific [breeding] site," and considers 10-15 km to represent "exceptionally large" dispersal distances for the species.

36. These buffers are considered sufficiently precautionary to rule out indirect effects associated with the construction, operation and decommissioning of the Broadshore Hub WFDAs. Black guillemot is not expected to occur within or in proximity to the Broadshore Hub WFDAs and therefore this feature and the East Caithness Cliffs NCMPA is screened out of further assessment.

37. No other NCMPAs are relevant to screen in, as NCMPAs in Scotland designated for ornithology features are at the time of writing only designated for black guillemot (no other ornithological species) and of further distance than the East Caithness Cliffs NCMPA, and therefore outside the ZoI for this species.

1.3.5 Summary of NCMPA's Screened In and Out

38. In line with the descriptions in **Sections 1.3.1** to **1.3.4** above, **Table 1.3** provides a summary of the NCMPAs and features screened in/out for further assessment. Only the Southern Marine Trench NCMPA for minke whale is screened in.

Table 1.3: Summary of NCMPAs Screened In or Out

NCMPA	Protected Feature(s)	Screened In (✓) or Out (x)
Southern Marine Trench	Minke whale *Balaenoptera acutorostrata*	✓
	Burrowed mud	X
	Fronts	X
	Shelf Deeps	X
	Quaternary of Scotland (moraines and sub-glacial tunnel valleys)	X
	Submarine mass movement (side scars)	X
Turbot Bank	Sandeels *Ammodytes spp.*	X
East Caithness Cliffs	Black guillemot *Cepphus grylle*	X
North-east Lewis	Risso's dolphin *Grampus griseus*	X
	Sandeels *Ammodytes spp.*	X
	Quaternary of Scotland	X
	Marine Geomorphology of the Scottish Shelf Seabed	X
Sea of the Hebrides	Minke whale	X
	Basking shark *Cetorhinus maximus*	X
	Marine Geomorphology of the Scottish Shelf Seabed	X
	Fronts	X

39. Note that for NCMPAs (Turbot Bank, East Caithness Cliffs, North-east Lewis and Sea of the Hebrides) which have been screened out, given the lack of connectivity from the Broadshore Hub WFDAs to their features, it is considered that there is no potential for the Broadshore Hub WFDAs to contribute to any cumulative effects upon these NCMPAs.

2 NCMPA Screening – Southern Marine Trench NCMPA

40. In line with the screening methodology outlined in **Section 1.3**, the Southern Marine Trench NCMPA is the only NCMPA screened in for assessment, on the basis of the Broadshore WFDAs Hub being capable of affecting (other than insignificantly) a protected feature of the site.

41. The Southern Marine Trench NCMPA was first designated in 2020 and lies in the Outer Moray Firth off the coast of Aberdeenshire. The Southern Marine Trench NCMPA, which covers an area of 2,536 km^2, is designated to protect four biodiversity features (burrowed mud, fronts, minke whale and shelf deeps) and two geodiversity features (Quaternary of Scotland and Submarine Mass Movement) (NatureScot, 2020).

42. The NCMPA is host to a wide range of marine life and features a front (where dynamic mixing zone of warm and cold waters takes place) which attracts shoals of herring, mackerel and cod to the area. The NCMPA is named after the Southern Marine Trench, which is 58 km long, 9 km wide and 250 m deep trench that runs parallel to the coast. The soft sands covering much of the seabed in the trench also provide abundant habitat for sandeels, which in turn draws predators such as minke whale to the area (NatureScot, 2020).

43. In line with the methodology outlined in **Section 1.3**, all features have been screened out, except minke whale (see **Table 1.3**). Based on the ZoI identified, it is considered that the Broadshore Hub WFDAs and associated works is capable of affecting, other than insignificantly, the protected features of the NCMPA.

44. **Table 1.2** sets out the proposed impacts to be considered for minke whale in the NCMPA Main Assessment, for construction, operation and maintenance and decommissioning respectively. These align with the impacts identified for minke whale in **Chapter 8: Marine Mammals** of the **Broadshore Hub WFDAs Scoping Report,** with the exception of changes to prey availability, as it is not expected that the Broadshore Hub WFDAs will influence prey availability within the Southern Trench NCMPA. Please refer to **Chapter 8: Marine Mammals** for further information.

Table 2.1: Potential Impacts to be Considered for Minke Whale in the NCMPA Main Assessment

Potential impact	Construction	Operation and Maintenance	Decommissioning
Underwater noise during unexploded (UXO) clearance	✓	x	x
Underwater noise during geophysical surveys	✓	x	x
Underwater noise during substructure installation	✓	x	x
Underwater noise from other activities (for example rock placement and cable laying)	✓	✓	✓
Underwater noise and presence of vessels	✓	✓	✓
Underwater noise from operational WTGs and floating turbine substructure moorings on the seabed	x	✓	x
Collision risk with vessels	✓	✓	✓
Direct entanglement	x	x	x
Secondary entanglement	x	✓	x
Changes in water quality	x	x	x
Changes to prey availability	x	x	x
Electromagnetic fields (EMF) - direct effects	x	x	x

45. The overarching conservation objectives of the Southern Marine Trench NCMPA, with respect to minke whale, are detailed in **Table 1.3**.

3 Summary

46. In consideration of the ZoI outlined for benthic habitats/species and geodiversity features, fish, marine mammals and ornithology features in **Section 1.3**, this NCMPA Screening has screened in the Southern Marine Trench NCMPA for minke whale, to be taken forward for NCMPA Main Assessment alongside the Broadshore Hub WFDAs EIA Report. The summary of the screening is provided in **Table 3.1.**

Table 3.1: NCMPA Screening Summary and Conservation Objectives

NCMPA	Protected Feature(s)	Type	Conservation Objective	Condition	Justification for Screening Feature In
Southern Marine Trench	Minke whale	Mobile species	• Maintain in favourable condition. • Minke whale in the Southern Marine Trench NCMPA are not at significant risk from injury or killing. • Conserve the access to resources (e.g. for feeding) provided by the NCMPA for various stages of the minke whale life cycle. • Conserve the distribution of minke whale within the site by avoiding significant disturbance. • Conserve the extent and distribution of any supporting feature upon which minke whale is dependent. • Conserve the structure and function of supporting features, including processes to ensure minke whale are healthy and not deteriorating.	Favourable (NatureScot, 2020)	Southern Marine Trench NCMPA within ZoI identified for minke whale for the Broadshore Hub WFDAs

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4 References

Dahl, P. H., de Jong, C. A. F., & Popper, A. N. (2015). The Underwater Sound Field from Impact Pile Driving and Its Potential Effects on Marine Life. *The Journal of the Acoustical Society of America*, *11*(2), 18–25.

Dahl, P. H., Reinhall, P. G., Popper, A. N., Hastings, M., & Ainslie, M. (2014). Underwater sound from pile driving, what is it and why does it matter. *The Journal of the Acoustical Society of America*, *135*, 2312. https://doi.org/10.1121/1.4877620

Furness, R.W., 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). *Natural England Commissioned Reports*, (164).

NatureScot (2020). Southern Trench MPA (NC) – Conservation and Management Advice. Available at: https://sitelink.nature.scot/site/10477

NatureScot (2014). East Caithness Cliffs MPA (NC) – Assessment Against the MPA Selection Guidelines. Available at: https://sitelink.nature.scot/site/10408

Marine Scotland (2013). Nature Conservation Marine Protected Areas: Draft Management Handbook

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., Coombs, S., Ellison, W. T., Gentry, R. L., Halvorsen, M. B., Løkkeborg, S., Rogers, P. H., Southall, B. L., Zeddies, D. G., & Tavolga, W. N. (2014). Sound Exposure Guidelines. In A. N. Popper, A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. J. Carlson, S. Coombs, W. T. Ellison, R. L. Gentry, M. B. Halvorsen, S. Løkkeborg, P. H. Rogers, B. L. Southall, D. G. Zeddies, & W. N. Tavolga (Eds.), *ASA S3/SC1.4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI* (pp. 33–51). Springer International Publishing. https://doi.org/10.1007/978-3-319-06659-2_7

Woodward, I., Thaxter, C.B., Owen, E. and Cook, A.S.C.P., 2019. Desk-based revision of seabird foraging ranges used for HRA screening. *BTO research report*, (724), pp.2019-202.

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Broadshore Hub

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Appendix 3: Mitigation Register

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Contents

Tables

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1 Introduction

1. This appendix provides a summary of proposed embedded mitigation and consent plans for the Broadshore Hub Wind Farm Development Areas (WFDAs) Scoping Report, as detailed in each technical chapter of the Broadshore Hub WFDAs Scoping Report (**Chapters 5 to 19**). The potential impacts and mitigation proposed are based on the Broadshore Hub WFDAs boundaries and should the boundaries change, this will be reflected in the EIA. If any changes are considered to change the Scoping Opinion, this will be highlighted in the EIA Report.

2. As set out in **Chapter 4: Approach to Scoping and EIA**, three types of mitigation will be identified and used within the Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report:

   - **Primary mitigation**: modifications to the location or design made during the pre-application phase that are an inherent part of the Broadshore Hub WFDAs. These measures are treated as an inherent part of the Broadshore Hub WFDAs. This includes the adoption of methods and equipment for seabed preparation which have been designed to minimise the potential for sediment suspension and dispersal.
   - **Secondary mitigation**: actions that will require further activity in order to achieve the anticipated outcome. The effectiveness of such measures will be assessed within the EIA Report and appropriate mitigation will be secured by a consent condition. This may include seasonal restrictions on certain construction activities being undertaken to minimise impacts on a migratory species.
   - **Tertiary mitigation**: actions that would occur with or without input from the EIA. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are standard practices used to manage commonly occurring environmental effects. These measures are treated as an inherent part of the Broadshore Hub WFDAs. This includes development and adherence to management plans, such as a Marine Pollution Contingency Plan and Environmental Management Plan.

3. Primary and tertiary mitigation are considered to be 'embedded' mitigation as they are incorporated as part of the Broadshore Hub WFDAs' design.

4. The assessment of the likely significant environmental effects for the pre-mitigation scenario presented within the Broadshore Hub WFDAs EIA Report will take embedded mitigation (i.e. primary and tertiary mitigation) into account in determining the magnitude of change. As a result, potential effects which might arise prior to the implementation of embedded mitigation do not need to be identified as potential effects as there is no potential for these potential effects to arise (Institute of Environmental Management and Assessment; IEMA, 2016).

5. **Table 1.1** below collates and summarises the embedded mitigation commitments set out within **Chapters 5 to 19** of the Broadshore Hub WFDAs Scoping Report.

6. It is expected that the Scoping Opinion and ongoing stakeholder engagement will further refine and develop the proposed primary, secondary and tertiary mitigation measures as the EIA process

progresses. This Mitigation Register is therefore considered to be a live document which will be updated accordingly throughout the EIA process.

Table 1.1: Mitigation Register and Mitigation Type: Primary (P), Secondary (S) or Tertiary (T)

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Where seabed preparation is required (e.g. seabed levelling), methods and equipment that have been designed to minimise potential for sediment suspension and dispersal will be adopted.	✓	✓	✓													P
A detailed Cable Burial Risk Assessment (CBRA) will be prepared where inter-array cables are buried to confirm the extent to which cable burial can be achieved	✓					✓	✓								✓	P
Compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78	✓	✓	✓											✓	✓	T
Development of, and adherence to, an Environmental Management Plan (EMP)	✓	✓	✓	✓										✓	✓	T
Development of and adherence to an Invasive Non-Native Species Management Plan (INNSMP)		✓	✓													T
Implementation of soft-start and ramp-up measures for piling, to be set out in a Piling Strategy (PS)			✓	✓												P/T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Development of, and adherence to Fisheries Management and Mitigation Strategy (FMMS)						✓										T
Development of, and adherence to, a Marine Pollution Contingency Plan (MPCP)	✓	✓	✓	✓	✓	✓	✓								✓	T
Development of, and adherence to, a Cable Plan (CaP)	✓	✓	✓			✓			✓	✓					✓	T
Adherence to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR)		✓	✓	✓	✓											T
Adherence to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management Convention, 2004)		✓	✓													T
Development of Unexploded Ordnance (UXO) Threat and Risk Assessment			✓	✓					✓	✓					✓	T
Preferred use of low noise UXO clearance techniques where possible and use of UXO mitigation hierarchy			✓	✓											✓	P
Development of, and adherence to, a Marine Mammal Mitigation Protocol (MMMP)				✓												T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
The Scottish Marine Wildlife Watching Code (Scottish Natural Heritage (SNH), 2017) approach will be followed			✓	✓												T
Appointment of a Fisheries Liaison Officer (FLO) during the construction phase						✓										T
Development of, and adherence to, a Navigational Safety Plan (NSP)						✓	✓		✓						✓	T
Advance warning and accurate location details of construction, maintenance and decommissioning operations, associated Safety Zones and advisory passing distances will be given via Notices to Mariners and Kingfisher Bulletins						✓	✓		✓						✓	T
Development of, and adherence to, a Lighting and Marking Plan (LMP)						✓	✓	✓	✓						✓	T
Adherence to best practice guidance with regards to fisheries liaison and procedures in the event of interactions between the Broadshore Hub WFDAs and fishing activities (e.g., FLOWW, 2014; 2015)						✓										T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Participation in any fisheries working group to assist with liaison between the Applicants and the fishing community						✓										S
Application for and use of Safety Zones						✓	✓		✓						✓	P
Dropped objects on the seabed during works associated with the Broadshore Hub WFDAs which may pose a hazard will be reported in line with Marine Directorate-Licensing Operations Team procedures						✓	✓		✓						✓	T
All offshore infrastructure associated with the Broadshore Hub WFDAs will be appropriately marked on UK Hydrographic Office Admiralty charts						✓	✓		✓						✓	T
The Applicants will ensure compliance with Marine Guidance Note 654 and its annexes, where applicable, including completion post consent of Search and Rescue (SAR) Checklist in consultation with the Maritime and Coastguard Agency (MCA)							✓	✓							✓	T
Development of a Navigational Risk Assessment						✓	✓								✓	T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Development of, and adherence to, an Emergency Response Cooperation Plan (ERCoP)						✓	✓	✓	✓						✓	T
The Applicants will ensure compliance with the Regulatory Expectations on Moorings for Floating Wind and Marine Devices (MCA and Health and Safety Executive, 2017)						✓	✓		✓						✓	T
Development of, and adherence to, a Development Specification and Layout Plan (DSLP)						✓	✓		✓						✓	T
Where appropriate, guard vessels will be used to ensure adherence with Safety Zones or advisory passing distances						✓	✓		✓						✓	P
Marine coordination will be implemented to manage project vessels throughout construction, maintenance, and decommissioning periods						✓	✓		✓						✓	T
There will be a minimum blade tip clearance of at least 22 m Above Mean Sea Level					✓		✓								✓	P/T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Broadshore Hub WFDAs vessels will ensure compliance with international marine regulations as adopted by the Flag State, including the COLREGs (International Maritime Organisation; IMO, 1972/77) and SOLAS (IMO, 1974)						✓	✓		✓						✓	T
Development of, and adherence to, a Vessel Management Plan (VMP)				✓		✓	✓		✓						✓	T
Appropriate marking of the Broadshore Hub WFDAs on aeronautical charts. This will include provision of the positions and heights of structures to CAA, Ministry of Defence, and Defence Geographics Centre								✓							✓	T
Aviation lighting and marking, as described in the LMP, will be installed in accordance with Article 223 of the UK ANO 2016 which sets out the mandatory requirements to be followed for lighting of offshore Wind Turbine Generators (WTGs)								✓							✓	P/T
The layout of the WTGs in the Broadshore Hub WFDAs, will be finalised in discussion with the MCA and NLB in order to ensure the specific WTG layout is compatible with potential SAR activity							✓	✓	✓						✓	P/T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Failures of the lighting and marking in the Broadshore Hub WFDAs will be appropriately reported and rectified as soon as practicable. Interim hazard warnings (i.e. Notice to Mariners) will be put in place as required.						✓	✓	✓	✓						✓	T
The implementation of Archaeological Exclusion Zones (AEZs) around sites identified as having a known important archaeological potential to mitigate the potential impacts from offshore infrastructure										✓						T
Archaeological input into specifications for and analysis of future preconstruction geophysical surveys within the Broadshore Hub WFDAs										✓						T
Archaeologists to be consulted in the preparation of any preconstruction Remotely Operated Vehicle or diver surveys and in monitoring/checking of data, if appropriate based upon the findings of the archaeological assessment of geophysical survey data.										✓						T

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
All anomalies of possible archaeological potential will be reviewed against the final layout and design. If they are likely to be impacted, these anomalies would undergo further archaeological investigation. Should these anomalies prove to be of archaeological importance then future AEZs may be implemented following consultation with Historic Environment Scotland										✓						T
Archaeological input into specifications for and analysis of future preconstruction geotechnical surveys and a provision for sampling, analysis and reporting of recovered cores, if appropriate. The results of all geoarchaeological investigations to be compiled in a final report which includes a sediment deposit model										✓						T
Commitment to preparation and agreement on an Offshore Written Scheme of Investigation (WSI) and Protocol of Archaeological Discoveries (PAD)										✓						T
Micro-siting of station keeping system to avoid known heritage assets (AEZs) where possible										✓						T
Adherence to Supply Chain Development Statement												✓				P

Mitigation Measure	Marine Geology, Oceanography & Physical Processes (Ch. 5)	Benthic Ecology (Ch. 6)	Fish & Shellfish Ecology (Ch. 7)	Marine Mammals (Ch. 8)	Offshore Ornithology (Ch. 9)	Commercial Fisheries (Ch. 10)	Shipping & Navigation (Ch. 11)	Aviation & Radar (Ch. 12)	Marine Infrastructure & Other Users (Ch. 13)	Marine Archaeology & Cultural Heritage (Ch. 14)	Seascape, Landscape & Visual (Ch. 15)	Socioeconomics, Tourism & Recreation (Ch. 16)	Climate Change (Ch. 17)	Offshore Air Quality (Ch. 18)	Major Accidents & Disasters (Ch. 19)	Mitigation Type (Primary (P), Secondary (S) or Tertiary (T))
Development and adherence to a Decommissioning Programme	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	T
Engagement with NSTA and respective oil and gas operators regarding structured risk assessment approach regarding decommissioned oil and gas wells within the Broadshore Hub WFDAs	✓	✓														

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7. A summary of the management plans which the Applicants commit to developing pre-construction in support of each of the Broadshore Hub WFDAs are listed in **Table 1.2** below. The Applicants will discuss with MD-LOT and agree which plans, in outline form, will be included in the applications.

Table 1.2: Management Plans

Management Plan	Description
Cable Plan	Contains details on environmental sensitivities and design considerations to mitigate, as far as possible, the effects of export or inter-array cable laying and associated protection during installation and operation of the Broadshore Hub WFDAs.
Construction Method Statement	Describes how tasks and activities will be constructed safely.
Decommissioning Programme	Gives details of all aspects of the Broadshore Hub WFDAs, from the associated effects the infrastructure will have on the surrounding environment to the current known methods to undertake the decommissioning.
Development Specification and Layout Plan	Sets the final design and layout parameters associated with the Broadshore Hub WFDAs
Emergency Response Cooperation Plan	Ensures the co-operation with the Maritime and Coastguard Agency by detailing the design parameters of the Broadshore Hub WFDAs, emergency contact details, and processes to be followed.
Environmental Management Plan	Outlines how the construction activities for the Broadshore Hub WFDAs will avoid, minimise or mitigate effects on the environment and surrounding area.
Fisheries Management and Mitigation Strategy	Details approach to undertaking pre-construction, construction, and operational works in co-operation with existing commercial fisheries activities, developed in consultation with fishing representatives
Invasive Non-Native Species Management Plan	Details mitigation measures to minimise the introduction and transfer of invasive non-native species
Lighting and Marking Plan	Sets out the marine and aviation navigational lighting and marking measures to be applied during the construction and operation of the Broadshore Hub WFDAs
Marine Mammal Mitigation Protocol	Sets out the protocol of how potential impacts to marine mammals during construction activities would be mitigated to meet any relevant licence conditions associated with the marine mammals.
Marine Pollution Contingency Plan	Details appropriate measures and procedures to be undertaken in the event of a pollution incident
Navigational Safety Plan	Describes measures put in place by the Broadshore Hub WFDAs related to navigational safety, including information on Safety Zones, charting, construction buoyage, temporary lighting and marking, and means of notification of Broadshore Hub WFDAs activity to other sea users (e.g., via Notice to Mariners).
Piling Strategy	Details piling methods and programme and includes the mitigation measure to be taken to reduce effects on noise sensitive species.

Management Plan	Description
Protocol of Archaeological Discoveries	Provides procedures for reporting and investigation unexpected archaeological discoveries found during site investigations and construction.
Vessel Management Plan	Provides the management and coordination of vessels to mitigate the impact of vessels.
Written Scheme of Investigation	A method statement that clearly details the process and approach to undertaking heritage works associated with the Broadshore Hub WFDAs' construction.

2 References

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW, (2015). FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds.

Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW, (2014). FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison. January 2014.

Institute of Environmental Management and Assessment (IEMA) (2016) Environmental Impact Assessment Guide to Delivering Quality Development Available at: https://www.iema.net/download-document/7014 .

MCA and HSE (2017). Regulatory expectations on moorings for floating wind and marine devices. Available at: https://assets.publishing.service.gov.uk/media/5a822d33ed915d74e623631c/Regulatory_expectations_on_mooring_devices_from_HSE_and_MCA.PDF

Scottish Natural Heritage (SNH) (2017). Scottish Marine Wildlife Watching Code. Available at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/scottish-marine-wildlife-watching-code

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Broadshore Hub

Broadshore OFFSHORE WIND

Sinclair OFFSHORE WIND

Scaraben OFFSHORE WIND

Appendix 4: Marine Mammals Existing Environment

BlueFloat ENERGY

Renantis

PARTNERSHIP

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Contents

Tables

Plates

1 Existing Environment

1. This appendix is complementary to the Broadshore Hub Wind Farm Development Areas (WFDAs) Scoping Report and should be read in conjunction with **Chapter 8: Marine Mammals** of the **Broadshore Hub WFDAs Scoping Report**. It details the existing environment for marine mammals and presents the scoping of marine mammal species. This appendix has been prepared by Royal HaskoningDHV.

1.1 Study Area

2. As highly mobile marine predators, the status and activity of marine mammals known to occur within or adjacent to the Broadshore Hub WFDAs will be considered in the context of their Management Unit (MU) population for each species shown below in **Section 1.2.**

1.2 Site-specific Surveys

3. Site-specific offshore aerial surveys are being conducted for both marine mammals and seabirds. Offshore aerial surveys commenced in March 2022 and will be completed in February 2024, with a single survey carried out in each calendar month (i.e. a total of 24 months). The survey, undertaken by HiDef Aerial Surveying Limited (HiDef) (refer to **Chapter 9: Offshore Ornithology** of the **Broadshore Hub WFDAs Scoping Report** for further details on the offshore aerial survey). collects high resolution aerial digital still imagery for marine megafauna (combined with ornithology surveys).

4. The offshore aerial survey area adopted within this Scoping Report comprises:

- The Broadshore WFDA aerial survey area, being the Broadshore WFDA (134 km^2) plus a 4 km buffer, totalling 367 km^2; and
- Sinclair and Scaraben WFDAs aerial survey area (being a preliminary area defined prior to the Sinclair and Scaraben WFDA boundaries being further refined as part of the INTOG seabed lease application process[1]) (141 km^2) plus a 4 km buffer, totalling 396 km^2.

5. For the purposes of this Broadshore Hub WFDAs Scoping Report, baseline data from the offshore aerial survey area are presented separately for the Broadshore WFDA aerial survey area and Sinclair and Scaraben WFDAs aerial survey area (**Figure 9.1** in **Appendix 1** of the **Broadshore Hub WFDAs Scoping Report**).

[1] Whilst the Sinclair and Scaraben WFDA boundaries were subsequently refined, the Sinclair and Scaraben WFDAs aerial survey area was maintained for completeness.

6. The results of the offshore aerial surveys for March 2022 to February 2023 are set out in **Table 1.1**.

Table 1.1: Species Recorded During the HiDef Aerial Surveys Between March 2022 to February 2023[2]

Species	Broadshore WFDA Aerial Survey Area - Number of Individuals	Sinclair and Scaraben WFDAs Aerial Survey Area – Number of Individuals
Harbour porpoise	51	42
White-beaked dolphin	27	17
Grey Seal	1	2
Unidentified seal species	7	2
Dolphin species	-	1
Seal/small cetacean species	-	1
Total	**86**	**65**

7. The Broadshore Hub WFDAs Environmental Impact Assessment (EIA) Report will be informed by the full two years of survey data. For marine mammals, it is important to consider the individuals that it would not be possible to detect using observer-based survey or aerial survey techniques, due to the time marine mammals spend below the water surface, and therefore are undetectable. In order to account for this, the density and abundance estimates are corrected to account for the time that each species spends below the water surface (and therefore would not be detected in the aerial surveys).

8. Correction factors for availability bias are based on the known dive behaviours of each species. For harbour porpoise, correction factors are based on the data presented in Voet et al. (2017) or Teilmann et al. (2007; 2013), and use different factors for each season, and for submerged and surfacing individuals. For harbour porpoise, these corrections will be undertaken by HiDef as part of the analysis and reporting process.

9. For other species, correction factors for availability bias are less well understood. If required to correct the density estimates for other species (i.e. if there is sufficient data), a review of available correction factors will be undertaken through the EIA process. The review will include data from the Sea Mammal Research Unit (SMRU) (2011) for both seal species, Rasmussen et al. (2013) for white-beaked dolphin, Mate et al. (1994) for Atlantic white-sided dolphin *Lagenorhynchus acutus*, and Mate et al. (1995) for bottlenose dolphin *Tursiops truncatuss*, and Small Cetaceans in European Atlantic Waters and the North Sea (SCANS-II) and SCANS-III (Hammond et al., 2013).

[2] The buffers for the Broadshore WFDA and the Sinclair and Scaraben WFDAs overlap, and therefore a small number of marine mammals identified within the Broadshore WFDA could also be within the Sinclair and Scaraben WFDAs.

10. The results of the aerial surveys would also be adjusted to account for those individuals that could not be identified to species level (i.e. those that are identified as seal species). This is referred to as species apportioning in the survey reporting. The standard method of apportioning would be to assume a proportion of the individuals in each species group would be each species within that group, based on the proportion of each of those species that had already been identified[3].

11. While a density and abundance estimate would be derived for each species recorded during the surveys, these would only be used within the EIA where that species has been sighted regularly and the quality of density estimates is considered sufficient. This is due to potential limitations on the estimates, including the low confidence in any density and abundance estimate from very few sightings[4]. The proposed use of the site-specific density estimates (if sufficient data is collected) is described in **Section 1.4.1** for cetacean species, and **Section 1.4.2** for seal species.

1.3 Data and Information Sources

12. **Table 1.2** lists the data sources that will be used to inform the baseline assessment within the Broadshore Hub WFDAs EIA Report. This list is not exhaustive, and a full review of all potential data sources and information for marine mammals in the vicinity of the Broadshore Hub WFDAs will be incorporated into the baseline review provided within the Broadshore Hub WFDAs EIA Report. This will include the latest research from the Cetacean Research & Rescue Unit, the Scottish Association for Marine Science (SAMS) and the SMRU.

Table 1.2: Summary of Key Data and Information Sources for Marine Mammals

Dataset	Year(s)	Description
Site-specific aerial surveys	March 2022 – February 2024	Digital aerial surveys of the Broadshore Hub WFDAs. Further described in **Section 1.2**.
Small Cetaceans in the European Atlantic and North Sea (SCANS-III): Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys (Hammond et al., 2021).	Survey undertaken in Summer 2016	Density and abundance estimates for cetacean species in the European Atlantic and North Sea.

[3] For example, species apportioning for those individuals categorised as 'seal species' in **Table 1.1** would be 100% apportioned to being grey seal, as no other seal species have been identified (to date) within the surveys. When analysing the results, consideration will be given to the proportion of unidentified individuals and how representative/reliable the proposed distribution of the data is.

[4] For example, based on the currently available data (**Table 1.1**), there would be sufficient numbers of harbour porpoise and white-beaked dolphin to provide density and abundance estimates with relatively good confidence, however there would not be for grey seal, as only one (plus seven unidentified seal species) have been sighted.

Dataset	Year(s)	Description
SCANS-IV: Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys (Gilles et al., 2023)	Survey undertaken in summer 2022	Density and abundance estimates for cetacean species in the European Atlantic and North Sea.
East Coast Marine Mammal Acoustic Study (ECOMMAS)	2013 – 2016	Passive acoustic (Cetacean-Porpoise Detectors (CPODs)) data at 30 locations on the east coast. Deployed for four months (summer) in 2013 and 2014, and eight months (April to November) in 2015 and 2016.
Revised Phase III data analysis of Joint Cetacean Protocol (JCP) data resources (Paxton et al., 2016).	Data from a range of sources, analysed and reported on in 2015 and 2016	Density mapping for the most common cetacean species in UK waters.
Distribution maps of cetacean and seabird populations in the North-East Atlantic (Waggitt et al., 2019).	Data from a range of sources, analysed and reported on in 2019	Density mapping for the most common cetacean species in European and North-East Atlantic waters for each month.
POSEIDON project (Planning Offshore Wind Strategic Environmental Impact Decisions) [if available].	Various	Density mapping tools for marine mammals and seabirds.
The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area (Heinänen and Skov, 2015).	Utilised data sources covering the years between 1994 and 2011	Data was used to determine harbour porpoise Special Area of Conservation (SAC) sites. Provides information on harbour porpoise in the North Sea area.
ORCA surveys on ferry routes from Aberdeen (ORCA, 2023).	Data currently available up until April 2023	Provides information on species in the Northern North Sea ferry routes (trained volunteers).
Sea Watch Foundation volunteer sightings off North-East Scotland and South Grampion and South-East Scotland (Sea Watch Foundation, 2023).	Public sightings database	Provides information on species in North-East Scotland and South Grampian and South-East Scotland regions (volunteer sightings).
Management Units for cetaceans in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG), 2023).	Data from a range of sources, analysed and reported on in 2023	MU areas and abundance estimates for the most comment cetacean species in the UK.
Management Units for cetaceans in North Atlantic waters (North Atlantic Marine	Various	Provides additional information on cetacean MUs not included in IAMMWG (2022).

Dataset	Year(s)	Description
Mammal Commission (NAMMCO), 2020).		
Special Committee on Seals (SCOS) annual reporting of scientific advice on matters related to the management of seal populations (SCOS, 2022).	2022	Updated data and information on grey and harbour seals in the UK. Includes the most recent haul-out counts and population estimates for each seal Management Unit (MU) in the UK.
Aerial surveys of seals in Scotland during the harbour seal moult, 2016-2019 (Morris et al., 2021)	2016 to 2019	Fifth full August count of harbour seals in Scotland.
Seal telemetry data (Carter et al., 2022; Sharples et al., 2008; Russel and McConnell, 2014).	Aerial surveys between 1987 – 2010 and tracking data between 2005 – 2019	Provides the results of seal tagging studies in the UK and Europe, to provide an indication of seal movements.
UK seal at sea density estimates and usage maps (Carter et al., 2022).	1991-2019	Provides grey and harbour seal density estimates for UK waters, and for each seal designated SAC.
Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters (Hague et al., 2020).	Various	Provides a baseline review for all ScotWind sites (including the Broadshore WFDA)
Offshore Wind Farms marine mammal site data (e.g. Thompson et al., 2014; Brookes et al., 2013).	Various	Relevant information from other offshore wind farms (e.g. Moray East, Moray West, and Beatrice Offshore Wind Farms EIA characterisation surveys and Moray Firth Marine Mammals Monitoring Programme Moray Firth Regional Advice Group (MFRAG) reporting).

1.4 Densities of Marine Mammal Species

13. The following section provides an initial review of the baseline data sources available for marine mammals at the Broadshore Hub WFDAs. It should be noted that a further review of any additional or more appropriate sources will be undertaken as part of the EIA process.

15. A review of the SCANS-IV survey and the data review by Waggitt et al. (2019) indicates the following cetacean species that could be present in or around the Broadshore Hub WFDAs are:

- Cetaceans:
  - Harbour porpoise;
  - Bottlenose dolphin;
  - White-beaked dolphin;
  - Atlantic white-sided dolphin;
  - Common dolphin *Delphinus delphis*;
  - Risso's dolphin *Grampus griseus*;
  - Killer whale *Orcinus Orca*;
  - Long-finned pilot whale *Globicephala melas*; and
  - Minke whale *Balaenoptera acutorostrata*.
- Pinnipeds:
  - Grey seal; and
  - Harbour seal *Phoca vitulina*.

16. Other marine mammal species that have been recorded in the North-East region of Scotland include sperm whale *Physeter macrocephalus* and fin whale *Balaenoptera physalus* (e.g. Reid et al., 2003). However, these species are likely to be in lower numbers and less frequent than the key species listed above. The results of the full desk-based assessment complemented by site-specific surveys would be used to determine the species to be taken forward for further assessment. Depending on the results of the baseline assessment, some marine mammal species listed above may be scoped out of further assessment.

1.4.1 Cetacean Species

17. Distribution maps of cetacean species within the North-East Atlantic were produced by Waggitt et al. (2019). These maps indicate that harbour porpoise and white-beaked dolphin are relatively common off the east coast of Scotland, while Risso's dolphin and minke whale are relatively common in the summer months in particular. Killer whale, bottlenose dolphin, common dolphin, Atlantic white-sided dolphin and long-finned pilot whale are present but in much lower densities. Fin whale, sperm whale and striped dolphin are shown to be rare in the area. The density estimates from these maps are presented in **Table 1.3.**

18. The SCANS-IV Survey was undertaken in summer 2022, across the North-East Atlantic. In relation to the Broadshore Hub WFDAs, harbour porpoise was the most commonly sighted species. White-beaked dolphin and minke whale were also sighted in relative high number in Survey Blocks NS-E and CS-K, while Risso's dolphin were only rarely sighted in these blocks. Bottlenose dolphin, Atlantic white-sided dolphin, common dolphin and long-finned pilot whale were not sighted in Survey Blocks NS-E and CS-K (**Plate 1.1**).

19. **Table 1.3** below shows the densities of cetacean species recorded in the SCANS-IV Survey Blocks NS-E and CS-K. No bottlenose dolphin, common dolphin, killer whale, or long-finned pilot whale were detected in either Survey Block NS-E and CS-K (Gilles et al., 2023).

Plate 1.1: Area covered by SCANS-IV and adjacent surveys[5] (Gilles et al., 2023)

[5] Pink blocks were surveyed by air; blue blocks were surveyed by ship. Blocks coloured green were surveyed by the Irish ObSERVE2 project.

Table 1.3: Cetacean Annual Density Estimates for Broadshore Hub WFDAs Scoping Boundary

Species	Waggitt et al., (2019) Density Estimates for the Broadshore Hub WFDAs Scoping Boundary and for SCANS-IV Survey Blocks	SCANS-IV Density Estimates (Gilles et al., 2023)	
	Broadshore Hub WFDAs (/km^2)	Density in Survey Block NS-E (/km^2)	Density in Survey Block CS-K (/km^2)
Harbour porpoise	0.280 *(summer density = 0.321; winter density = 0.238)*	**0.5156** (CV = 0.208)	0.2813 (CV = 0.354)
Bottlenose dolphin	**0.003**	-	-
White-beaked dolphin	0.099 *(summer density = 0.118; winter density = 0.081)*	**0.1775** (CV = 0.383)	0.1352 (CV = 0.608)
Atlantic white-sided dolphin	**0.025** *(summer density = 0.029; winter density = 0.022)*	0.0146 (CV = 1.028)	-
Risso's dolphin	0.0016 *(summer density = 0.002; winter density = 0.001)*	0.0376 (CV = 0.972)	**0.0702** (CV = 0.974)
Common dolphin	**0.028** *(summer density = 0.039; winter density = 0.018)*	-	-
Killer whale	**0.0013**	-	-
Long-finned pilot whale	**0.002** *(summer density = 0.001; winter density = 0.003)*	-	-
Minke whale	0.011 *(summer density = 0.014; winter density = 0.009)*	**0.0121** (CV = 0.724)	0.0116 (CV = 0.794)

20. As detailed in **Section 1.2**, the site-specific aerial surveys may also be used to derive density estimates for cetacean species, in particular harbour porpoise. If the quality of site survey generated density estimates is considered sufficient, the estimates will be considered alongside other data sources when assessing potential effects within the WFDA boundaries. The worst-case density would be used as a precautionary approach, whether that is from the site-specific surveys or from desk-based data sources (such as those presented in **Table 1.3** above). However, for far-field impacts, and for those that extend past the boundary of Broadshore Hub WFDAs (e.g. for the potential for disturbance from piling), wider density estimates to cover the full area of effect would be used (e.g. Waggitt *et al*., 2020 or Gilles *et al*., 2023).

1.4.2 Seal Species

21. Carter et al. (2022) provides habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. The habitat preference approach predicted distribution maps provide estimates per species, on a 5 km x 5 km grid, of relative at-sea density for seals hauling-out in the British Isles. It is important to note that Carter et al*.,* (2022) provides *relative density* (i.e. percentage of at-sea population within each 5 km x 5 km grid square), whereas previous usage maps (e.g. Russell et al. 2017) have presented *absolute density* (i.e. number of animals).

22. The grey seal relative density map (as shown in **Figure 8.1** in **Appendix 1** of the **Broadshore Hub WFDAs Scoping Report;** Carter et al., (2022) shows the mean predicted relative density for the Broadshore Hub WFDAs are relatively average for the UK and Republic of Ireland (RoI), with increased relative density closer to shore. For harbour seal (as shown in **Figure 8.2** in **Appendix 1** of the **Broadshore Hub WFDAs Scoping Report**; Carter et al., 2022), the mean predicted relative density within the Broadshore Hub WFDAs is very low, with increased densities close to shore, particularly around Dornoch Firth and the Inner Moray Firth, with relatively high densities of harbour seal.

23. The grey and harbour seal density estimates for the Broadshore Hub WDFAs have been calculated from the seal at sea usage maps (Carter et al*.,* 2022) based on the 5 km x 5 km grids that overlap with the Broadshore Hub WFDAs, and corrected against the total UK and RoI population estimates. The total grey seal population in the British Isles is 178,262, and the total harbour seal population is 48,419 (**Table 1.5,** SCOS, 2022). These total population estimates are corrected to determine the total number of each species that may be at-sea at any time, using a correction factor of 0.8616 for grey seal, and 0.8236 for harbour seal (Russell et al., 2015). There are therefore approximately 153,591 grey seals, and 39,878 harbour seals, based on the corrected values and most recent haul-out counts for the UK. These are the at-sea population estimates used with the Carter et al. (2022) data to calculate density estimates, which are presented in **Table 1.4** below.

Table 1.4: Grey and Harbour Seal Density Estimates for Broadshore Hub WFDAs Scoping Boundary (Carter et al., 2022)

Species	Broadshore Hub WFDAs Scoping Boundary (/km^2)
Grey seal	0.215
Harbour seal	0.00009

24. As noted in **Section 1.2**, the site-specific aerial surveys would also be used to derive density estimates (if sufficient data for seal species is collected). Based on the first year of site survey, it is anticipated that insufficient data for seal species will be collected, however this will be re-assessed following completion of the second year of surveys. For potential effects within the Broadshore Hub WFDAs itself, the worst-case density would be used as a precautionary approach, however, for far-field impacts, and for those that extend past the boundary of Broadshore Hub WFDAs, the wider density estimates for the full area of effect would be used (e.g. for the potential for disturbance from piling) using wider density mapping (e.g. Carter et al., 2022).

1.5 Management Units and Population Estimates of Marine Mammal Species

25. As highly mobile marine predators, the status and activity of marine mammals known to occur within or adjacent to the Broadshore Hub WFDAs would be considered in the context of their MU population. For cetacean species, this would be based on IAMMWG (2023), and for seal species this would be based on the latest estimates from the SCOS reporting (at the time of writing, this is SCOS, 2022).

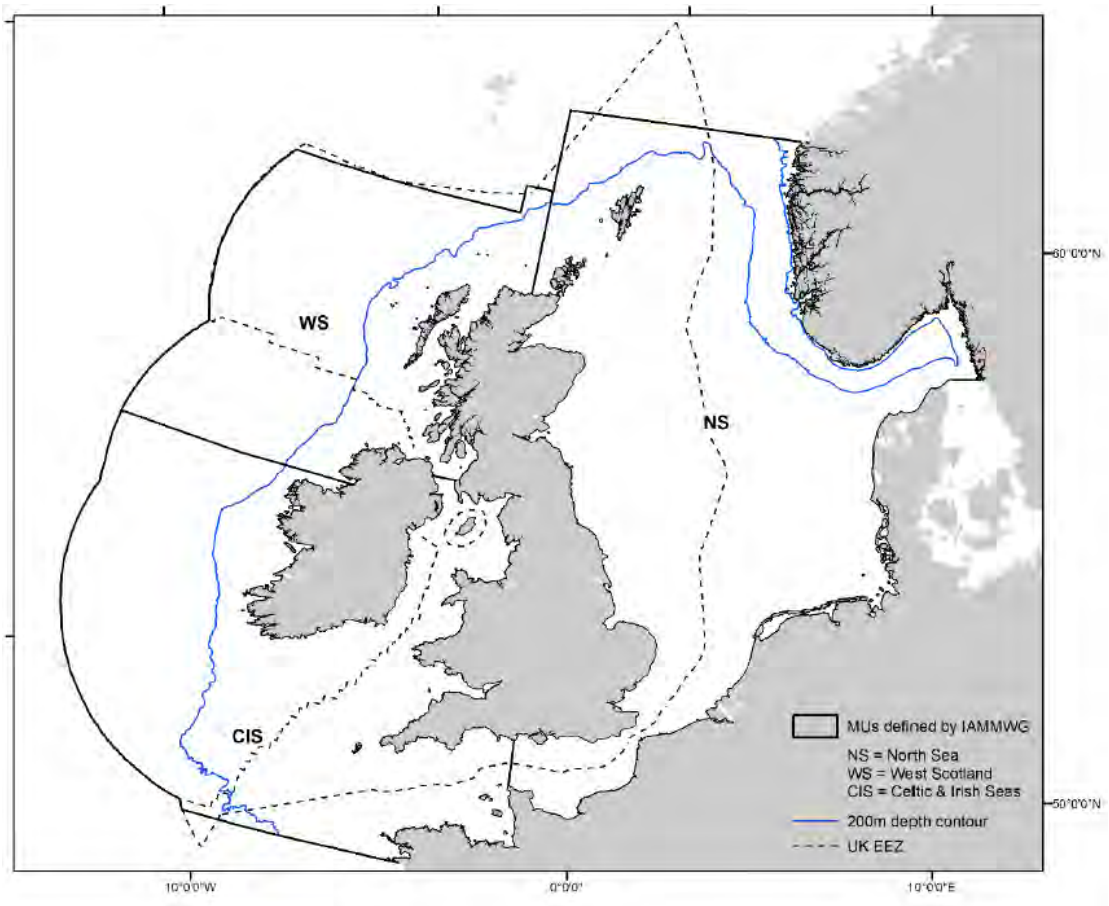
1.5.1 Cetacean Species

26. The harbour porpoise is listed on Annex II of the Habitats Directive which lists species whose conservation requires the designation of SAC.

27. MUs provide an indication of the spatial scales at which any impact should be assessed for cetacean species (IAMMWG, 2023). MUs, and the latest population estimate for each marine mammal species, have been determined based on the most relevant information, and scale at which potential impacts could occur.

28. For harbour porpoise, the relevant MU is the North Sea (NS) MU (**Plate 1.2**; IAMMWG, 2023). Within the NS MU, there is an estimated abundance of 346,601 harbour porpoise (Coefficient of Variation (CV) = 0.09; 95% CI = 289,498 – 419,967) (IAMMWG, 2023), however, the SCANS-IV survey provides an update to this MU population estimate for which all impact assessments will be based on (presented in **Table 1.6**).

Plate 1.2: The MUs for Harbour Porpoise (IAMMWG, 2023)

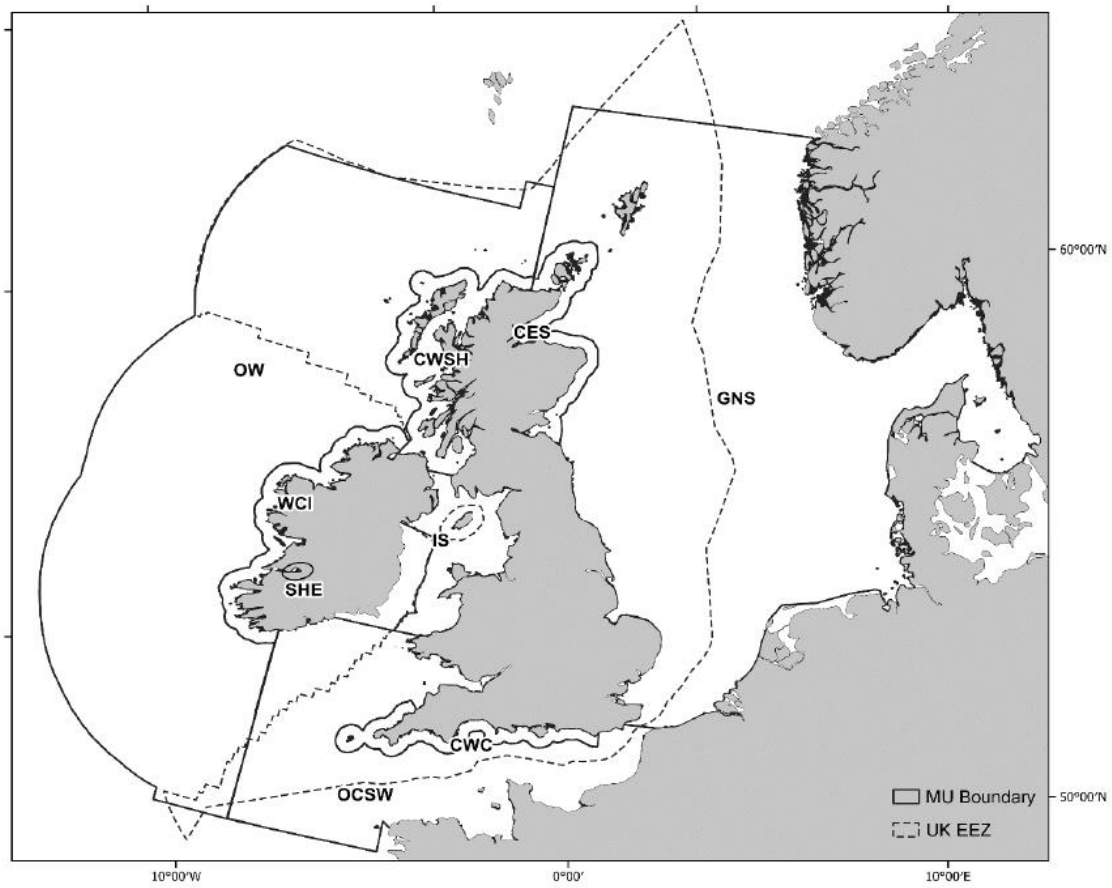


29. For bottlenose dolphin, there are seven MUs within the North-East Atlantic (**Plate 1.3**; IAMMWG, 2023). The relevant MUs are the Coastal East Scotland and Greater North Sea (GNS). The reference population estimates for these MUs are provided in **Table 1.6**.

30. Studies into the movement patterns of bottlenose dolphins associated with the Moray Firth (Coastal East Scotland MU) population show that they are a coastal population (Quick et al., 2014). As the Broadshore Hub WFDAs are within the GNS MU, and approximately 47 km from Fraserburgh[6], any bottlenose dolphin present are most likely to be from the Greater North Sea (GNS) MU, however, there is potential for individuals to be from the Moray Firth population given its close proximity. Therefore, bottlenose dolphin will be assessed as part of the Coastal East Scotland population as well as the GNS MU.

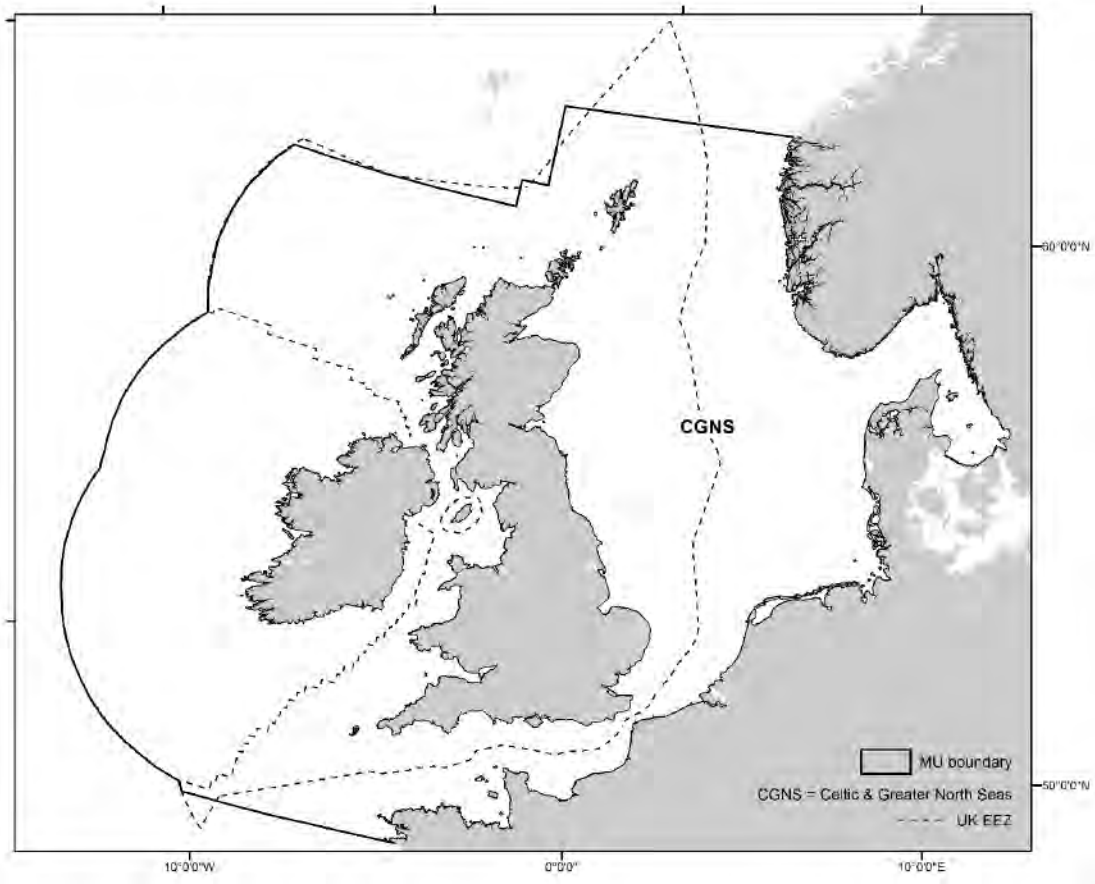
[6] For additional context, the Broadshore Hub WFDAs are 25km from the CES MU.

Plate 1.3: The MUs for Bottlenose Dolphin (IAMMWG, 2023)



31. For white-beaked dolphin, Atlantic white-sided dolphin, common dolphin, Risso's dolphin and minke whale, there is just one MU that covers the North-East Atlantic; the Celtic and Greater North Seas (CGNS) MU (**Plate 1.4**; IAMMWG, 2023). The population for these species within the CGNS MU are shown in **Table 1.6**.

Plate 1.4: The MUs for White-Beaked Dolphin, Atlantic White-Sided Dolphin, Common Dolphin, Risso's Dolphin and Minke Whale (Right) (IAMMWG, 2023)



32. There are no defined MUs in IAMMWG (2023) for killer whale, therefore the population estimate is based on the North-East Atlantic population (NAMMCO, 2020; **Table 1.6**).

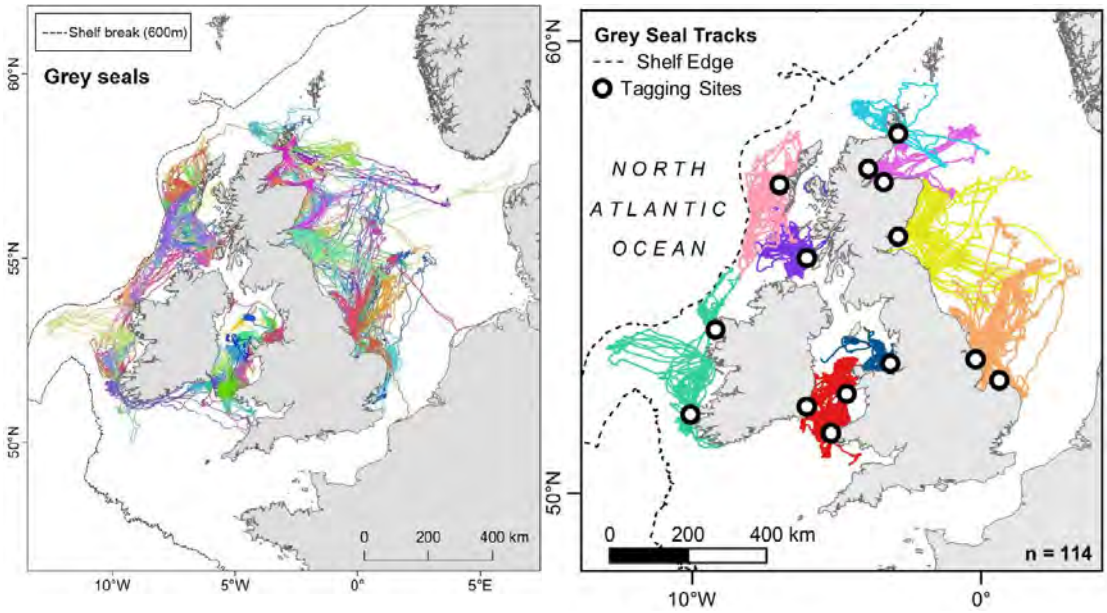
1.5.2 Seal Species

33. Grey seals are likely to be present in and around the Broadshore Hub WFDAs Scoping Boundary (SCOS, 2022; Carter et al., 2022).

34. Harbour seal are likely present in lower number around the Broadshore Hub WFDAs, as harbour seal densities in the area are generally lower than for grey seal (SCOS, 2022; Carter et al., 2022).

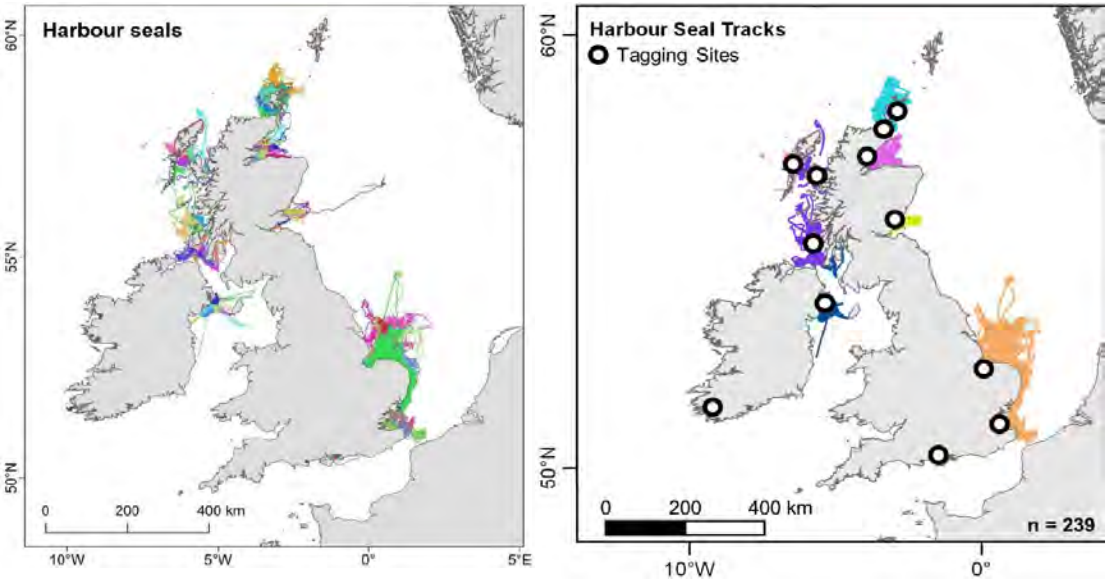
35. For seals, it is also necessary to take into account their movements in the area. Grey seal have foraging ranges of up to 448 km (Carter et al., 2022). Global Positioning System (GPS) tracking data from tagged grey seal indicate there is the potential for presence in and around the Broadshore Hub WFDAs, with individuals from North and East Scotland, North-East England (NEE), with no connection from the Broadshore Hub WFDAs to West Scotland or Shetland (**Plate 1.5**). Therefore, the North Coast and Orkney (NCO), Moray Firth (MF), East Scotland (ESc) and NEE MUs would encompass the spatial area where grey seal may have connectivity with the Broadshore Hub WFDAs.

Plate 1.5: Left = GPS tracking data for grey seal (n=114) (Carter et al., 2020); Right = GPS tracking data for grey seal, cleaned to remove erroneous location estimates, and trips between regions during the breeding season (n=114) (Carter et al., 2022)



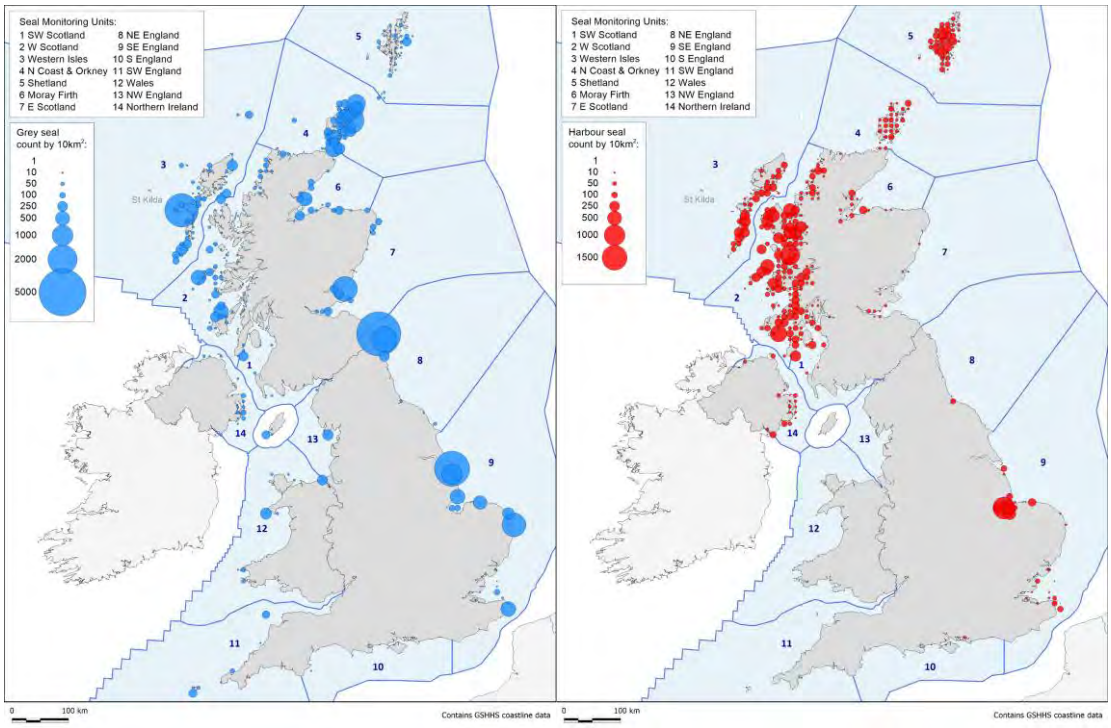
36. Harbour seal have foraging ranges of up to 273 km (Carter et al., 2022), and the GPS tracking data from tagged harbour seal indicate there is limited potential for presence in the Broadshore Hub WFDAs (**Plate 1.6**). There is no connection from the Broadshore Hub WFDAs to NEE, West Scotland, or Shetland. Therefore, the NCO, MF, and ESc MUs would encompass the spatial area where harbour seal may have connectivity with the Broadshore Hub WFDAs.

Plate 1.6: Left = GPS tracking data for harbour seal (n=239) (Carter et al., 2020); Right = (Carter et al., 2022)



37. The UK seal MUs are provided in SCOS (2023) (**Plate 1.7**). The Broadshore Hub WFDAs lies at the point where MUs 4 NCO, 6 MF and 7 ESc meet, and therefore all three MUs are relevant for both species. The Broadshore WFDA is located in the MF MU, the Sinclair WFDA is located in both the NCO and MF MUs, and the Scaraben WFDA is located within all three MUs.

Plate 1.7: Seal MUs and August distributions of grey seal (blue) and harbour seal (red) around the UK (SCOS, 2022)



38. Both species of seals are counted in August. **Table 1.5** below provides the latest counts for both species. In order to generate an abundance estimates for seals, it is necessary to take account of those individuals that were not available to count during the August counts, therefore, a correction factor is applied to the counts to generate a population estimate. The correction factor for grey seal is 0.2515 (Russell and *Carter,* 2021), and for harbour seal is 0.72 (Lonergan et al., 2013).

Table 1.5: August Counts of Grey and Harbour Seal, and the Corrected Abundance Estimates

Species	MU	Count (latest count as presented in SCOS, 2022)	Year of latest count	Correction factor	Total abundance estimate
Grey seal	NCO	8,599	2016-2019	0.2515	34,191
	MF	1,856	2021	0.2515	7,380
	ESc	2,712	2021	0.2515	10,783
	NNE	6,517	2021	0.2515	25,913
	Total for NCO, MF & Esc only	**13,167**	**-**	**-**	**52,354**
	Total for the wider population (NCO, MF, Esc & NEE)	**19,684**	**-**	**-**	**78,267**
	Total UK and RoI	***44,833***	**-**	***0.2515***	***178,262***
Harbour seal	NCO MU	1,405	2016-2019	0.72	1,951
	MF MU	690	2021	0.72	958
	ESc MU	262	2021	0.72	364
	Total for NCO, MF, Esc	**2,357**	**-**	**-**	**3,273**
	Total UK and RoI	***34,862***	**-**	***0.72***	***48,419***

39. For both grey seal and harbour seal, assessments will be undertaken based on the three MUs of relevance for the Broadshore Hub WFDA (i.e. the NCO, MF and ESc MUs). In addition, to account for grey seal movement into the NEE, an assessment will be undertaken of a wider population to account for seals within the NEE MU (i.e. the wider population estimate will be assessed as the NCO, MF, ESc and NEE MUs).

1.5.3 Summary of Reference Populations

40. **Table 1.6** summarises the relevant MU and abundance estimates (reference populations) for marine mammal species that could be present in and around the Broadshore Hub WFDAs.

Table 1.6: MU and Abundance Estimates (Reference Populations) for Marine Mammal Species[7]

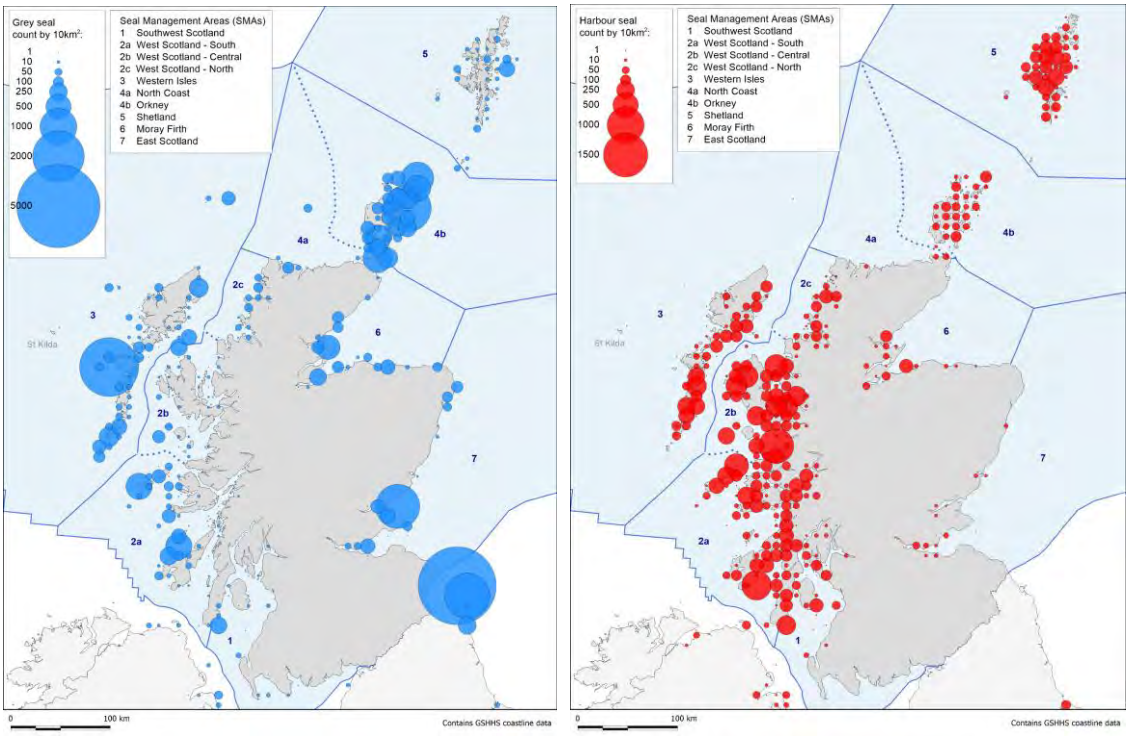
Species	Management Unit (MU)	Abundance (reference population)	Source
Harbour porpoise	NS MU	338,918 (95% CI = 243,063 – 476,203)	Gilles et al., (2023)
Bottlenose dolphin	GNS MU	2,022 (CV = 0.75; 95% CI = 548 – 7,453)	IAMMWG (2023)
	Coastal East Scotland MU	224 (CV = 0.02; 95% CI = 214 – 234)	IAMMWG (2023); Arso Civil et al. (2021)
White-beaked dolphin	CGNS MU	43,951 (CV = 0.22; 95% CI = 28,439 – 67,924)	IAMMWG (2023)
Atlantic white-sided dolphin	CGNS MU	18,128 (CV = 0.61; 95% CI = 6,049 – 54,323)	IAMMWG (2023)
Risso's dolphin	CGNS MU	12,262 (CV = 0.46; 95% CI = 5,227 – 28,764)	IAMMWG (2023)
Common dolphin	CGNS MU	102,656 (CV = 0.29; 95% CI = 58,932 – 178,822)	IAMMWG (2023)
Killer whale	North Atlantic	15,056 (CV = 0.29; 95% CI = 8,423– 26,914)	NAMMCO (2020)
Minke whale	CGNS MU	20,118 (CV = 0.18; 95% CI = 14,061 – 28,786)	IAMMWG (2023)
Grey seal	NCO, MF & ESc MUs	52,354	SCOS (2022)
	NCO, MF, ESc & NEE MUs (as the wider reference population)	78,267	SCOS (2022)
Harbour seal	NCO, MF & ESc MUs	3,273	SCOS (2022)

[7] Grey seal and harbour seal MUs to be confirmed following confirmation of the Broadshore Hub WFDAs' boundaries

1.6 Seal Haul-Out Sites

41. There are haul-out sites for grey and harbour seal in the Moray Firth and along the north-east coast of Scotland (**Plate 1.8**; SCOS, 2022), therefore there is the potential for foraging seal to be in the offshore areas. The nearest major grey seal sites are at Orkney, approximately 75 km from the Broadshore Hub WFDAs, and in the Dornoch Firth, approximately 118 km from the Broadshore Hub WFDAs. There are also smaller grey seal sites along the coast between Fraserburgh and the Inner Moray Firth, with the closest being Fraserburgh (approximately 47 km from the Broadshore Hub WFDAs). The closest harbour seal sites are Orkney, Loch Fleet (approximately 127 km from the Broadshore Hub WFDAs), and Findhorn (approximately 113 km from the Broadshore Hub WFDAs).

Plate 1.8: Map of (i) Grey Seal (Blue) and (ii) Harbour Seal (Red) Distribution by 10 km Squares Haul-Out Counts Obtained from the Most Recent Aerial Surveys Carried out During the Harbour Seal Moult in August 2016-2021 (SCOS, 2022)



1.7 Protected Sites

42. Designated sites for marine mammals in the North-East Scotland region and east coast of Scotland include the Moray Firth SAC for bottlenose dolphin, Isle of May SAC, Berwickshire and North Northumberland Coat SAC and Faray and Holm of Faray SAC for grey seal and Dornoch Firth and Morrich More SAC for harbour seal. Information on species' movements, including seal tagging studies, will be reviewed to determine the potential for connectivity of marine mammals from designated sites and the Broadshore Hub WFDAs as part of the Habitats Regulation Appraisal (HRA) screening (**Broadshore Hub WFDAs HRA Screening Report;** BlueFloat | Renantis Partnership, 2024).

43. In addition, the Southern Trench Nature Conservation Marine Protection Area (NCMPA) has been designated for minke whale, and further information on this site is provided below. Within the Broadshore Hub WFDAs consent applications, the Southern Trench NCMPA will be considered and assessed as part of the EIA process. The Southern Trench NCMPA is also screened in **Appendix 2: NCMPA Screening Report** of the **Broadshore Hub WFDAs Scoping Report.**

1.7.1 Southern Trench Nature Conservation Marine Protected Area

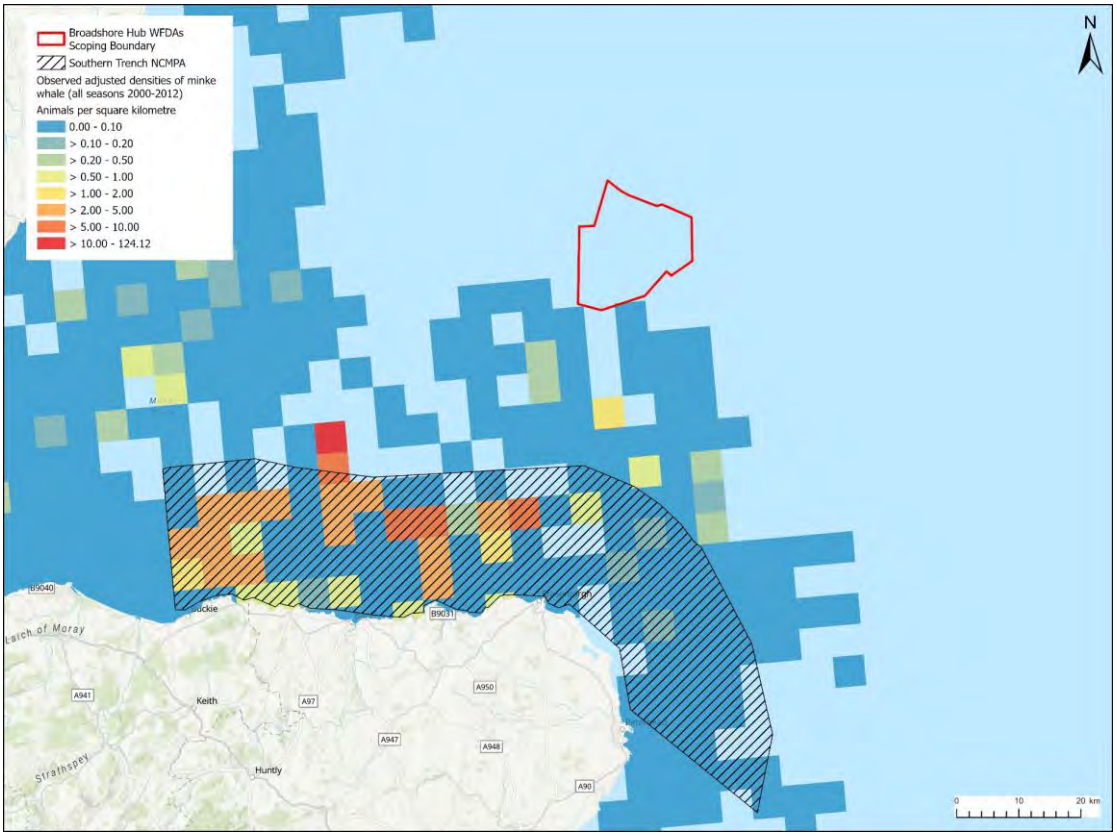
44. The Southern Trench NCMPA is located on the east coast of Scotland in the outer Moray Firth and is designated to protect minke whale, burrowed mud, fronts, shelf deeps, Quaternary of Scotland and Submarine Mass Movement. Fronts in the Southern Trench are created by mixing of warm and cold waters, which creates an area of high productivity, attracting a number of predators to the area. Minke whale are attracted by the fish species brought to the area by the fronts, as well as the abundance of sandeels in the soft sands. NatureScot advise that, in order to conserve minke whale, the risk of injury and death should be minimised, access to resources within the site should be maintained, and supporting features should also be conserved.

45. The Conservation Objectives of this site are to conserve the features, specifically to ensure *"Minke whale in the Southern Trench MPA are not at significant risk from injury or killing, conserve the access to resources (e.g. for feeding) provided by the MPA for various stages of the minke whale life cycle, and conserve the distribution of minke whale within the site by avoiding significant disturbance"*. The supporting features of the minke whale is also protected under these Conservation Objectives.

46. Minke whale are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Paxton et al., 2014; 2016; NatureScot, 2020). They often prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to 15 individuals) while feeding.

47. The data for which this NCMPA was designated on shows that minke whale are present in higher number in the northern area of the NCMPA, with densities of up to more than 10 per km^2 (**Plate 1.9**; Paxton et al., 2014). Based on this data, within 20km of the Broadshore Hub WFDAs, the minke whale densities range from 0 to 1.094 individuals per km^2.

Plate 1.9: Adjusted Densities of Minke Whale Within the Southern Trench NCMPA (Paxton et al., 2014)



48. Minke whale density estimates will be derived from more recently available data sources (such as SCANS-IV or Waggitt et al., (2019)), and the worst-case of these, with the Paxton et al., 2014 reporting, will be used for any assessments specific to the Southern Trench NCMPA. In addition, the Applicants (i.e. Broadshore Wind Farm Limited, Sinclair Wind Farm Limited and Scaraben Wind Farm Limited) will engage with other ScotWind developers to seek alignment on the approach to minke whale density estimates.

49. In order to determine an abundance estimate of minke whale within the Southern Trench NCMPA, the density estimates as described above can be used to determine the number of minke whale present for each season.

1.9 Summary of Marine Mammal Species Scoping

50. As noted above, a full assessment of the baseline conditions will be undertaken through the EIA process, and will inform, alongside the results of the site-specific aerial surveys, the species to be taken forward for further assessment in the Broadshore Hub WFDAs EIA Report. However, it is expected that the key species taken forward for assessment would be:

- Harbour porpoise;
- Bottlenose dolphin;
- White-beaked dolphin;
- Minke whale;
- Grey seal; and
- Harbour seal.

51. Other marine mammal species that have been recorded in the area, although in lower number than those listed above, include Atlantic white-sided dolphin, Risso's dolphin, common dolphin, killer whale, and long-finned pilot whale. It is intended to scope these species out, however, if the results of the site-specific surveys confirm sightings within the Broadshore Hub WFDAs, then the assessment will include these additional species. It should be noted that should any of these species be scoped in following scoping submission, it may not be possible to undertake a quantitative assessment due to lack of data on some of these species.

52. Assessments will not be undertaken for other cetacean species that are considered to be rare or infrequent within the Broadshore Hub WFDAs, as the potential for these cetacean species to be impacted is considered unlikely.

1.10 References

Arso Civil, M., Quick, N., Mews, S., Hague, E., Cheney, B. J., Thompson, P. M., & Hammond, P. S. (2021). *Improving understanding of bottlenose dolphin movements along the east coast of Scotland. Final report*. Report number SMRUC-VAT-2020-10 provided to European Offshore Wind Deployment Centre (EOWDC).

BlueFloat | Renantis Partnership (2024). Broadshore Hub Wind Farm Development Areas Habitats Regulations Screening Report.

Brookes, K.L., Bailey, H. and Thompson, P.M., (2013). Predictions from harbor porpoise habitat association models are confirmed by long-term passive acoustic monitoring. The Journal of the Acoustical Society of America, 134(3), pp.2523-2533.

Carter, M.I., Boehme, L., Duck, C.D., Grecian, J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C., Moss, S., Thompson, D. and Thompson, P., (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS, OESEA-16-76, OESEA-17-78.

Carter, M.I.D., Boehme, L., Cronin, M.A., Duck, C.D., Grecian, W.J., Hastie, G.D., Jessopp, M., Matthiopoulos, J., McConnell, B.J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M. and Russell, D.J.F. (2022). Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management. Front. Mar. Sci. 9:875869.

Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., FernándezMaldonado, C., Geelhoed, S.C.V., Kyhn, L., Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N.L., Owen, K., Saavedra, C., Vázquez-Bonales, J.A., Unger, B., Hammond, P.S. (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. https://tinyurl.com/3ynt6swa

Hague, E.L., Sinclair, R.R. and Sparling, C.E., (2020). Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters. Scottish Marine and Freshwater Science.

Hammond P.S., Macleod K., Berggren P., Borchers D.L., Burt L., Cañadas A., Desportes G., Donovan G.P., Gilles A., Gillespie D., Gordon J., Hiby L., Kuklik I., Leaper R., Lehnert K, Leopold M., Lovell P., Øien N., Paxton C.G.M., Ridoux V., Rogano E., Samarraa F., Scheidatg M., Sequeirap M., Siebertg U., Skovq H., Swifta R., Tasker M.L., Teilmann J., Canneyt O.V. and Vázquez J.A. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation 164, 107-122.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M., Teilmann, J., Vingada, J., and Oien, N. (2021).

Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research. Available from: https://scans3.wp.st-andrews.ac.uk/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf

Heinänen, S. and Skov, H. (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No.544 JNCC, Peterborough.

IAMMWG. (2023). Review of Management Unit boundaries for cetaceans in UK waters (2023). JNCC Report 734, JNCC, Peterborough, ISSN 0963-8091. https://hub.jncc.gov.uk/assets/b48b8332-349f-4358-b080-b4506384f4f7

Lonergan, M., Duck, C., Moss, S., Morris, C. & Thompson, D. (2013). Rescaling of aerial survey data with information from small numbers of telemetry tags to estimate the size of a declining harbour seal population. Aquatic Conservation-Marine and Freshwater Ecosystems 23 (1):135-144.

NatureScot. (2020). Conservation and Management Advice: Southern Trench Possible MPA. December 2020.

Mate, B. R., Stafford, K. M., Nawojchik, R., & Dunn, J. L. (1994). Movements and dive behavior of a satellite-monitored Atlantic white-sided dolphin (*Lagenorhynchus acutus*) in the Gulf of Maine. Marine Mammal Science, 10(1), 116-121.

Mate, B. R., Rossbach, K. A., Nieukirk, S. L., Wells, R. S., Blair Irvine, A., Scott, M. D., & Read, A. J. (1995). Satellite-monitored movements and dive behavior of a bottlenose dolphin (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science, 11(4), 452-463.

Morris, C.D., Duck, C.D., and Thompson, D. (2021). Aerial surveys of seals in Scotland during the harbour seal moult, 2016-2019. NatureScot Research Report 1256.

NAMMCO- North Atlantic Marine Mammal Commission. (2020). Estimates of Cetacean Abundance in the North Atlantic of Relevance to NAMMCO. NAMMCO Scientific Publications 11. https://doi.org/10.7557/3.5732

Palmer, K. J., Brookes, K., & Rendell, L. (2017). Categorizing click trains to increase taxonomic precision in echolocation click loggers. The Journal of the Acoustical Society of America, 142(2), 863-877.

Paxton, C., Scott-Hayward, L., and Rexstad, E. (2014). Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, white-beaked dolphin and basking shark. Scottish Natural Heritage Commissioned Report No. 594., Scottish Natural Heritage Commissioned Report No. 594

Paxton, C.G.M., Scott-Hayward, L., Mackenzie, M., Rexstad, E. and Thomas, L. (2016). Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources with Advisory Note, JNCC Report 517, ISSN 0963-8091: https://hub.jncc.gov.uk/assets/01adfabd-e75f-48ba-9643-2d594983201e

Quick, N.J., Arso Civil, M., Cheney, B., Islas Villanueva, V., Janik, V., Thompson, P. and Hammond, P.S., (2014). The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside the Moray Firth SAC.

Rasmussen, M. H., Akamatsu, T., Teilmann, J., Vikingsson, G., & Miller, L. A. (2013). Biosonar, diving and movements of two tagged white-beaked dolphin in Icelandic waters. Deep Sea Research Part II: Topical Studies in Oceanography, 88, 97-105.

Reid, J.B, Evans, P.G.H. and Northridge, S.P. (2003). Atlas of cetacean Distribution in North west European waters. JNCC, Peterborough.

Russell D. J. F. and Carter M. I. D. (2021). "Estimating the Proportion of Grey Seals Hauled Out During August Surveys," in SCOS Briefing Paper 21/02 (University of St Andrews: Sea Mammal Research Unit). Scientific Advice on Matters Related to the Management of Seal Populations: 2022 Natural Environment Research Council Special Committee on Seals (SCOS). Scientific Advice on Matters Related to the Management of Seal Populations: 2022 (st-andrews.ac.uk)

Russell, D.J.F. and McConnell, B.J. (2014). Seal at-sea distribution, movements and behaviour. Report to DECC. URN: 14D/085. March 2014 (final revision).

Russell, D. J. F., McClintock, B. T., Matthiopoulos, J., Thompson, P. M., Thompson, D., Hammond, P. S., (2015). Intrinsic and extrinsic drivers of activity budgets in sympatric grey and harbour seals. Oikos 124, 1462–1472. Doi:10.1111/oik.01810.

Russell, D.J.F, Jones, E.L. and Morris, C.D. (2017) Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25, 25pp. DOI: 10.7489/2027-1.

Special Committee on Seals (SCOS) (2022) Scientific Advice on Matters Related to the Management of Seal Populations: 2022 Natural Environment Research Council Special Committee on Seals (SCOS). http://www.smru.st-andrews.ac.uk/files/2023/09/SCOS-2022.pdf

Sharples R.J., Matthiopoulos, J. and Hammond, P.S. (2008) Distribution and movements of harbour seals around the coast of Britain: Outer Hebrides, Shetland, Orkney, the Moray Firth, St Andrews Bay, The Wash and the Thames, Report to DTI July 2008.

SMRU (2011). Utilisation of space by grey and harbour seals in the Pentland Firth and Orkney waters. Scottish Natural Heritage Commissioned Report No. 441.

Teilmann, J., Larsen, F. and Desportes, G. (2007). Time allocation and diving behaviour of harbour porpoises (Phocoena phocoena) in Danish and adjacent waters. Journal of Cetacean Research and Management 9(3): 201-210.

Teilmann, J., Christiansen, C.T., Kjellerup, S., Dietz, R. and Nachman, G. (2013). Geographic, seasonal and diurnal surface behaviour of harbour porpoise. Marine Mammal Science 29(2): E60-E76.

Thompson, P. M., Brookes, K. L., and Cordes, L. S. (2014) Integrating passive acoustic and visual data to model spatial patterns of Occurrence in coastal dolphins. – ICES Journal of Marine Science, 72: 651–660.

Voet H., Rehfisch M., McGovern S. and Sweeney S. (2017). Marine Mammal Correction Factor for Availability Bias in Aerial Digital Still surveys. Case Study: Harbour porpoise (Phocoena phocoena) in the Southern North Sea. APEM Ltd.

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T., (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269.

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Appendix 5: Approach to Marine Mammals Underwater Noise Modelling

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1 Overview

1. This appendix is complementary to the Broadshore Hub Wind Farm Development Areas (WFDAs) Scoping Report and sets out the approach to underwater noise modelling for marine mammals. This appendix covers the:

   - Approach to underwater noise modelling; and
   - Approach to assessment for injury and disturbance from underwater noise for marine mammals.

2. This appendix should be read in conjunction with **Chapter 8: Marine Mammals** of the **Broadshore Hub WFDAs Scoping Report**. This appendix has been prepared by Royal HaskoningDHV.

2 Approach to Underwater Noise Modelling

3. Underwater noise modelling is required in order to provide a robust assessment of underwater noise associated with the construction, operation and maintenance, and decommissioning of the Broadshore Hub WFDAs. The modelling will be used to inform the assessment of potential impacts from underwater noise on both marine mammal and fish species (please see **Chapter 7: Fish and Shellfish Ecology** in the **Broadshore Hub WFDAs Scoping Report**).

4. The underwater noise modelling will include the following activities, with the focus of the modelling report being impact piling:

- Impact piling;
- Non-impact piling substructure installation options;
- Other underwater noise generating activities;
- Unexploded Ordnance (UXO) clearance;
- Geophysical survey equipment;
- Vessel noise;
- Cable laying and burial/protection activities; and
- Seabed preparation activities (such as boulder clearance).; and
- Operational turbines (both floating and fixed bottom substructures currently being considered).

5. The underwater noise modelling will incorporate current international best practice guidance, thresholds and criteria, including Southall et al. (2019) for marine mammal species, and Popper et al. (2014) for fish species. Any other literature that may be identified should be included as appropriate.

6. Existing data from previous measurements of (other) offshore wind farm construction noise will be used along with detailed acoustic propagation models to predict the possible sound levels as a function of distance around the sound source. Knowledge of the local seabed properties and bathymetry will be incorporated to provide realistic propagation scenarios for the study area. Where necessary, information obtained from noise data measured for existing UK and other European offshore wind farm projects will be included.

7. A suitable range of frequencies will be modelled to allow the transmission loss to be predicted for potential sources. This will include the primary frequency ranges of interest for each source which overlap with the hearing sensitivity frequency range for key marine species.

8. Subacoustech Environmental Limited (Subacoustech) will undertake the underwater noise modelling, using the latest version of their INSPIRE model. An initial underwater noise modelling exercise has been undertaken with Subacoustech using the INSPIRE Light model, which will be utilised to inform the design process.

9. The following recent underwater noise modelling guidance documents will be considered within the underwater noise modelling report, although as the INSPIRE model used by Subacoustech does not use an energy conversion factor, as per the focus of Wood et al. (2023), this document is not directly applicable[1] and will not lead to or require any modifications as a consequence of its conclusions:

- Energy Conversion Factors in Underwater Radiated Sound from Marine Piling: Review of the method and recommendations (Wood et al., 2023); and
- Reducing Uncertainty in Underwater Noise Assessments for Offshore Wind (ORJIP Offshore Wind, 2023).

10. The Applicants are also aware of the ORJIP project on the range dependent nature of impulsive noise – analysis of existing data and development of method for incorporation into noise impact assessments (RaDIN), this project is underway and will be referenced if published in time to inform the Broadshore Hub WFDAs EIA Report.

11. It is anticipated the underwater noise modelling will incorporate the following:

- A number of impact piling scenarios to be considered:
  - Monopile, jacket pile, and anchor piles, with the:
    - Maximum pile diameter;
    - Maximum hammer energy;
    - Starting hammer energy (e.g. 10% maximum hammer energy); and
    - A single pile per day, multiple piles per day (sequential piling), and multiple pile locations at the same time (simultaneous piling).
- Source levels for the required hammer energies[2];
- Transmission loss/propagation which includes the effects of bathymetry, frequency- dependent absorption, and frequency dependent interaction with the surface and seabed based on specific site characteristics (e.g. substrate type);
- Received noise levels relative to estimated ambient noise levels;
- A number of piling locations within the Broadshore WFDA, the Sinclair WFDA and the Scaraben WFDA;

[1] NatureScot's consultation response for the Scoping Opinion for the Buchan Offshore Wind Farm noted that the Wood et al., 2023 report is likely to be less relevant to the INSPIRE model (MD-LOT, 2023).

[2] Subacoustech's approach to source level modelling correlates blow energy, along with water depth and pile diameter, with a large dataset of field measurements to estimate apparent source levels.

- Cumulative weighted Sound Exposure Criteria (SEL_{cum}) scenarios will be completed assuming a fleeing receptor. Swim speeds will be based on best practice, and are expected to include:
  - 1.4 m/s for harbour porpoise (Scottish Natural Heritage (SNH) [now NatureScot], 2016);
  - 1.52 m/s for dolphin species (Bailey and Hastie (unpublished data as presented in Moray Offshore Windfarm (West) Ltd, 2023);
  - 2.1 m/s for minke whale (SNH, 2016); and
  - 1.8 m/s for seal species (SNH, 2016).
- The piling soft-start and ramp-up for the SEL_{cum} scenarios will be defined and agreed prior to the commencement of the underwater noise modelling.

12. The underwater noise modelling will result in noise maps around the source, over an area sufficient to demonstrate decay of the sound level such that it is not deemed to have adverse effect on marine fauna based on the relevant hearing thresholds. This will be presented in terms of the chosen acoustic metrics and will show noise contours indicating zones of impact where thresholds for injury or behavioural response may be exceeded. In addition to the results for each threshold, 5 dB contours will be used to inform the dose response curve assessment, as described in **Section 3.1**.

2.1 Underwater Noise Thresholds

13. Southall et al. (2019) presents unweighted peak Sound Pressure Level (SPL) criteria (SPL_{peak}) for single strike, weighted Sound Exposure Level (SEL) criteria for single strike (SEL_{ss}) and cumulative (i.e. more than a single sound impulse) weighted Sound Exposure Level criteria (SEL_{cum}) for permanent threshold shift (PTS), where unrecoverable reduction in hearing sensitivity may occur (**Table 2.1**). The weighted thresholds take account of the differences in hearing range of each species group.

14. Southall et al. (2019) also include criteria based on SPL_{peak}, which are unweighted and do not take species sensitivity into account. It is important to note that they are different criteria and as such they should not be compared directly. All decibel SPL values are referenced to 1 µPa and all SEL values are referenced to 1 μPa^2s. Assessments will be based on the criteria with the greatest predicted impact ranges.

15. Those calculated for SEL_{cum} tend to give the greatest ranges as they account for exposure to the noise for the full period of the activity. For the cumulative noise criteria (SEL_{cum}), the calculations assume that a marine mammal flees from the noise source at a constant speed and the resultant contours give the position that a receptor must be from the pile at the start of the piling process, in order to avoid receiving the relevant exposure criterion.

16. Noise sources (and the thresholds) are categorised as either impulsive or non-impulsive (Southall et al., 2019):

- Impulsive (single or multiple pulsed) - high peak sound pressure, short duration, fast rise-time and broad frequency content at source. Explosives, impact piling and seismic airguns are considered impulsive noise sources.
- Non-impulsive - continuous non-pulsed sound. Vessel engines, sonars, vibro-piling, drilling and other low-level continuous noises are considered non-impulsive. However, a non-impulsive noise does not necessarily have to have a long duration.

17. When reviewing the results of the underwater noise modelling for impulsive noise sources (e.g. impact piling), it is important to note that as sound travels through the water column, the interactions with the seafloor and absorption means that the sound waves will lose their 'impulsivity' over distance. Within a few kilometres, the sound waves would lose their impulsive shape (and act as a non-impulsive source of noise) (e.g. Hastie *et al*., 2019). Therefore, for any of the results under the impulsive criteria that are in the tens of kilometres, the results are highly likely to be an overestimation.

Table 2.1: Southall et al. (2019) Thresholds and Criteria for PTS used in the Underwater Noise Modelling and Assessments

Species	Species group	SPL_{peak} Unweighted (dB re 1 µPa) Impulsive	SEL_{ss} and SEL_{cum} Weighted (dB re 1 μPa^2s)	
			Impulsive	Non-impulsive
Harbour porpoise	VHF cetacean	202	155	173
Bottlenose dolphin White-beaked dolphin Atlantic white-sided dolphin Common dolphin Risso's dolphin Killer whale Long-finned pilot whale	HF cetacean	230	185	198
Minke whale	LF cetacean	219	183	199
Grey seal Harbour seal	PCW	218	185	201

18. There are currently no agreed thresholds or criteria for modelling the disturbance of dolphin, whale and seal species from underwater noise.

3 Approach to Assessments for Disturbance from Underwater Noise

19. Marine Scotland (2020) guidance specifies disturbance as occurring if the activity is likely "*to significantly affect the local distribution or abundance of the species to which it belongs*." The relevant European Commission guidance (2007) suggests that a disturbance must significantly impact the local distribution or abundance of a species, including temporary impacts. The JNCC et al. (2010) guidance proposes that "*any action that is likely to increase the risk of long-term decline of the population(s) of (a) species could be regarded as disturbance under the Regulations*."

20. To assess the potential for disturbance it is necessary to consider the likelihood that exposure of the animal(s) elicits a response which is likely to generate a significant population-level effect. Assessment of population-level impacts from a temporary disturbance is made complicated by the highly variable nature of the introduced disturbance (e.g. the complex nature of sound and its propagation in the marine environment) and the variability of behavioural response in different species and individuals.

3.1 Dose Response Curves

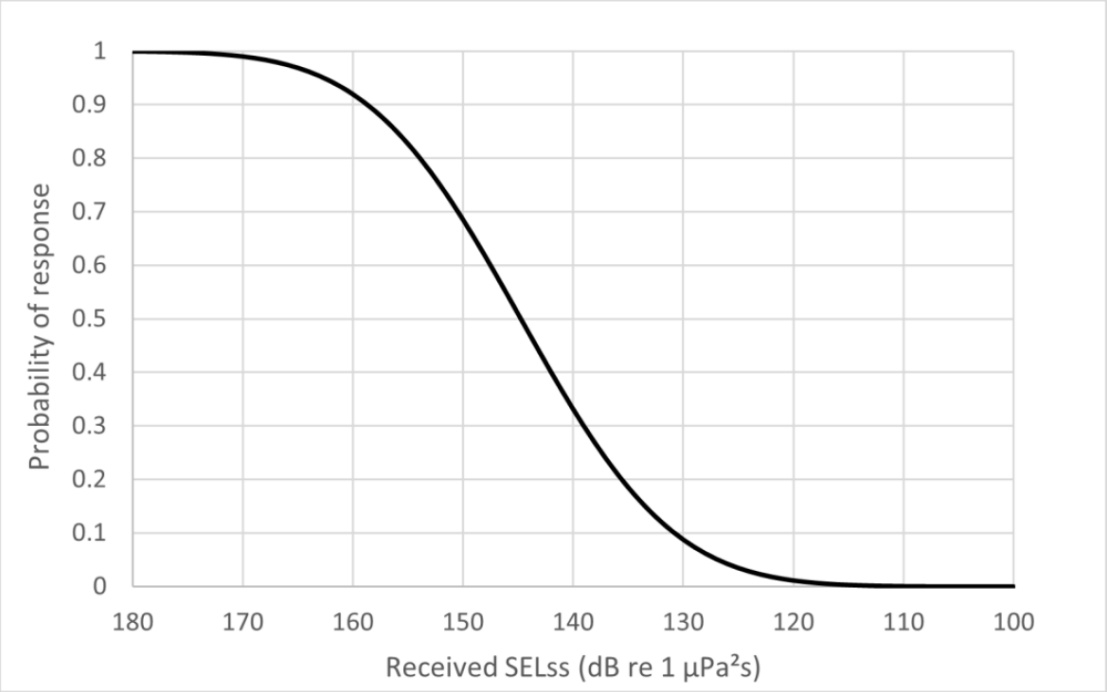
21. Where sufficient scientific evidence exists, current best practice is to apply a species-specific dose-response assessment rather than the fixed behavioural threshold approach.

22. The application of a dose-response curve allows for an evidence-based estimate which accounts for the fact that the likelihood of an animal exhibiting a response to a stressor or stimulus will vary according to the dose of stressor or stimulus received (Dunlop et al., 2017). Therefore, unlike the traditional threshold assessments commonly used, a dose-response analysis assumes that not all animals in an impacted area will respond (with behavioural disturbance response in this case). For the purposes of this assessment, the dose is the SEL_{SS}. The use of SEL_{ss} in a dose-response analysis, where possible, is considered to be best practice in the latest guidance provided by Southall et al. (2021).

23. To estimate the number of animals disturbed by piling, SEL_{ss} contours at 5 dB increments (generated by the noise modelling) will be overlain on the relevant species density surfaces (such as Carter *et al*., 2022 for both grey and harbour seal, or Waggitt *et al*., 2019 or Gilles *et al*., 2023 for harbour porpoise) to quantify the number of animals receiving each 5 dB SEL_{ss} contour, and subsequently the number of animals likely to be disturbed based on the corresponding dose-response curve.

24. The dose-response relationship used for harbour porpoise was developed by Graham et al., (2017) using data collected on harbour porpoises during Phase 1 of piling at the Beatrice Offshore Wind Farm. This dose response relationship is displayed in **Plate 3.1**. Following the development of this dose-response relationship, further study revealed that the responses of harbour porpoises to piling noise diminishes over the construction period (Graham et al., 2019). Therefore, the use of the dose-response relationship related to an initial piling event for all piling events in this assessment can be considered conservative.

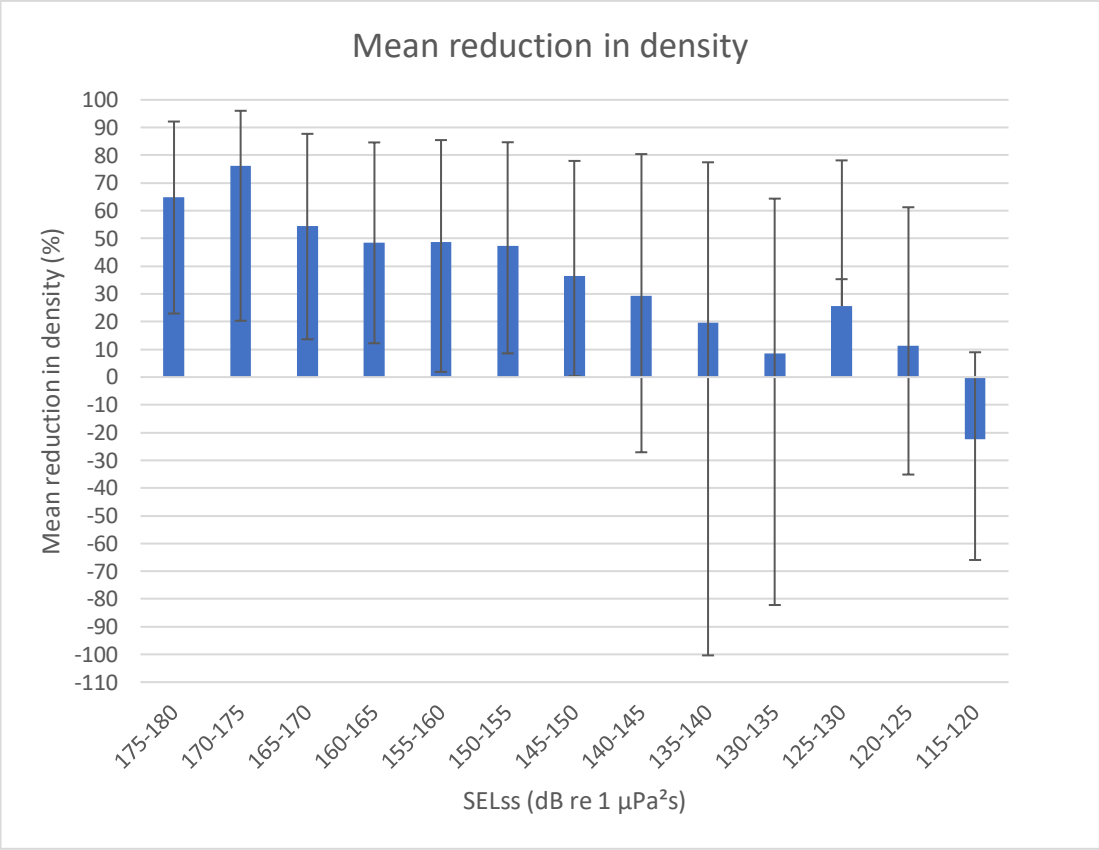
Plate 3.1: Dose-Response Relationship Developed by Graham et al. (2017) to be used for Harbour Porpoise in the Broadshore Hub WFDAs EIA Report



25. While it would be possible to use the harbour porpoise dose response curve for other cetacean species (such as minke whale and dolphin species), due to the differences in hearing abilities of these species' groups, and due to harbour porpoise being a more sensitive species to underwater noise disturbance, the use of this dose response curve for other species groups may overestimate the potential for effect. However, as there is an absence of species-specific dose-response data for dolphins or whale species, while over-precautionary, the Graham *et al*., (2019) dose response curve will be applied to all cetacean species. The Environmental Impact Assessment (EIA) Report will highlight the over-precautionary nature of this dose response curve.

26. For both harbour seal and grey seal, a dose-response relationship that is derived from harbour seal telemetry data collected during several months of piling at the Lincs Offshore Wind Farm has been used (Whyte et al., 2020). As seen in **Plate 3.2**, the greatest SEL_{SS} considered in the Whyte et al., (2020) study was 180 dB re 1 μPa^2s. The assessment will therefore conservatively assume that at SEL_{SS} > 180 dB re 1 μPa^2s, all seals will be disturbed. The dose-response curve for harbour seal has been used for grey seal, as both species have similar hearing audiograms.

Plate 3.2: Dose-Response Behavioural Disturbance Data for Harbour Seal Derived From the Data Collected and Analysed by Whyte *et al*. (2020)



3.2 Population Modelling

27. Population modelling will be undertaken to determine the population level consequences of disturbance due to piling at the Broadshore Hub WFDAs, and to determine whether the number of animals disturbed (as assessed in the methods described in **Section 3.1** and **Section 8.7.6.2** in **Chapter 8: Marine Mammals** in the **Broadshore Hub WFDAs Scoping Report**) would cause a population level effect.

28. Population modelling for the Broadshore Hub WFDAs will be carried out according to best practice, using the best available scientific information, and the latest expert elicitation results (e.g. Booth and Heinis, 2018).

29. The Interim Population Consequences of Disturbance (iPCoD) model will be used to undertake population modelling. iPCoD modelling will be undertaken for harbour porpoise, bottlenose dolphin, minke whale, grey seal, harbour seal, where a potential for a significant disturbance impact is identified. It is currently not possible to undertaken iPCoD modelling for other species.

30. The demographic parameters for each species will be based on the latest available information and will follow best practice for iPCoD modelling (e.g. Sinclair et al., 2020). The populations of marine mammal species will be based on the reference populations for each species, as set out in **Chapter 8: Marine Mammals**.

3.2.1 Determination of Significance

31. There are currently no specific potential biological removal limits in place for population modelling, and therefore, there are currently no specific thresholds to determine whether a population level effect would be significant in EIA terms.

32. Evans and Arvela (2012) advise that an annual population decline of more than 1% on average over a 12-year period represents unfavourable conservation status. Booth et al., 2016 undertook a study into the use of the iPCoD model for assessing population level effects of offshore wind farm piling in the North Sea. The study assumed that the harbour porpoise population could already be experiencing an annual decline of 1% (in reference to the Evans and Arvela (2012) threshold noted above), and therefore a threshold of an additional 1% annual decline could be used to determine whether the construction works of offshore wind would result in a disturbed population.

33. Recent Natural Resource Wales (NRW) guidance on this topic concluded that a significant population level of effect would be present in the case of a continued 1% annual decline within a population (NRW, 2023) for a six year period (in line with Favourable Conservation Status reporting periods). It is proposed that the NRW guidance would be used to determine the potential for a significant population level effect at the Broadshore Hub WFDAs, and will take into account any further information or guidance that becomes available through the EIA process.

34. Full details on the approach to impact assessment and determining significance is provided in **Chapter 8: Marine Mammals** in the **Broadshore Hub WFDAs Scoping Report**.

3.3 Summary of Marine Mammal Disturbance Assessments

35. The approach to the assessment to disturbance effects would be as follows:

- For impact piling:
  - The dose response curve from Graham *et al*. (2017) would be used to determine the potential for disturbance for harbour porpoise, dolphin species, and minke whale.
  - The dose response curve from Whyte *et al*. (2020) would be used to determine the potential for disturbance for grey seal and harbour seal.
- For other noise impacts:
  - For noisy activities other than piling, the disturbance assessments would be based on a literature review of responses of marine mammal species to certain activities (e.g. Benhemma-Le Gall et al., 2021; Frankish *et al*., 2023).

36. While the current approach for the disturbance assessments is to use the Graham et al. (2017) dose response curve for all cetacean species, and to use the Whyte *et al*. (2020) curve for seal species, the EIA will also consider emerging data from other sources, either to further contextualise the conservative nature of this approach or, where possible, replace this proxy with species-specific data if they become available. The EIA Report will identify where this has been the case and justify the use of such data.

4 References

Bailey, H., Senior, B., Simmons, D., Rusin, J., Picken, G. and Thompson, P.M., 2010. Assessing underwater noise levels during pile-driving at an offshore windfarm and its potential effects on marine mammals. Marine pollution bulletin, 60(6), pp.888-897.

Benhemma-Le Gall, A., Graham, I.M., Merchant, N.D. and Thompson, P.M. (2021) Broad-Scale Responses of Harbor Porpoises to Pile-Driving and Vessel Activities During Offshore Windfarm Construction. Front. Mar. Sci. 8:664724. Doi: 10.3389/fmars.2021.664724

Booth, C., Donovan, C., Plunkett, R. & Harwood, J. 2016. Using an interim PcoD protocol to assess the effects of disturbance associated with US Navy exercises on marine mammal populations. Final Report to the US Office of Naval Research

Booth, C.G, & Heinis, F. (2018). Updating the Interim PcoD Model: Workshop Report – New transfer functions for the effects of permanent threshold shifts on vital rates in marine mammal species. Report Code SMRUC-UOA-2018-006, submitted to the University of Aberdeen and Department for Business, Energy and Industrial Strategy (BEIS), June 2018 (unpublished).

Carter, M.I.D., Boehme, L., Cronin, M.A., Duck, C.D., Grecian, W.J., Hastie, G.D., Jessopp, M., Matthiopoulos, J., McConnell, B.J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M. and Russell, D.J.F. (2022). Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management. Front. Mar. Sci. 9:875869.

Dunlop, R. A., Noad, M. J., McCauley, R. D., Scott-Hayward, L., Kniest, E., Sladel., … & Cato, D. H. (2017). Determining the behavioural dose–response relationship of marine mammals to air gun noise and source proximity. Journal of Experimental Biology, 220(16), 2878-2886.

European Commission (2007). Guidance document on the strict protection of animal species of community interest under the Habitats Directive 92/43/EEC.

Evans, D., & Arvela, M. (2012). Assessment and reporting under Article 17 of the Habitats Directive. Explanatory Notes & Guidelines for the period 2007-2012. Available from: https://circabc.europa.eu/sd/a/2c12cea2-f827-4bdb-bb56-3731c9fd8b–0/Art–7 - Guidelines-final.pdf

Frankish, C.K., von Benda-Beckmann, A.M., Teilmann, J., Tougaard, J., Dietz, R., Sveegaard, S., Binnerts, B., de Jong, C.A. and Nabe-Nielsen, J., 2023. Ship noise causes tagged harbour porpoises to change direction or dive deeper. Marine Pollution Bulletin, 197, p.115755.

Graham, I. M., Farcas, A., Merchant, N. D., and Thompson, P. (2017). Beatrice Offshore Wind Farm: An interim estimate of the probability of porpoise displacement at different unweighted single-pulse sound exposure levels. Prepared by the University of Aberdeen for Beatrice Offshore Windfarm Ltd. 5

Graham, I. M., Merchant, N. D., Farcas, A., Barton, T. R., Cheney, B., Bono, S., & Thompson, P. M. (2019). Harbour porpoise responses to pile-driving diminish over time. Royal Society Open Science, 6(6), 190335. https://doi.org/10.1098/rsos.190335

Hastie, G., Merchant, N.D., Götz, T., Russell, D.J., Thompson, P. and Janik, V.M., 2019. Effects of impulsive noise on marine mammals: investigating range-dependent risk. Ecological Applications, 29(5), p.e01906.

JNCC, Natural England and Countryside Council for Wales (2010). The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Available at: https://assets.publishing.service.gov.uk/media/5dea1d35e5274a06dee23a34/Draft_Guidance_on_the_Protection_of_Marine_European_Protected_Species_from_Injurt_and_Disturbance.pdf

Marine Directorate (2023). Scoping Opinion – Buchan Offshore Wind Farm. Available at: https://marine.gov.scot/node/24720

Marine Scotland (2020). Guidance for Scottish Inshore Water for the protection of Marine European Protected Species from injury and disturbance. https://www.gov.scot/publications/marine-european-protected-species-protection-from-injury-and-disturbance/

Moray Offshore Windfarm (West) Ltd. (2023). Piling Strategy (Revised) Document Name: 8460005-DBHA04-MWW-PLN-000003, Revision: 3. Available from: https://marine.gov.scot/sites/default/files/8460005-dbha04-mww-pln-000003_moray_west_revised_piling_strategy_19042023.pdf

NRW (2023). NRW's Position on Assessing the effects of Hearing Injury from Underwater Noise on Marine Mammals.

ORJIP for Offshore Wind (2023). Reducing uncertainty in underwater noise assessments. Available at: https://ctprodstorageaccountp.blob.core.windows.net/prod-drupal-files/2023-10/ORJIP_ReCon-Final-Report_.pdf

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B. and Løkkeborg, S., (2014). ASA S3/SC1. 4 TR-2014 Sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-Accredited standards committee S3/SC1 and registered with ANSI. Springer.

Sinclair, R. R., Sparling, C. E., & Harwood, J. (2020). Review Of Demographic Parameters and Sensitivity Analysis To Inform Inputs And Outputs Of Population Consequences Of Disturbance Assessments For Marine Mammals. Scottish Marine and Freshwater Science, 11(14), 74. https://doi.org/10.7489/12331-1

Scottish National Heritage (SNH) (2016). Assessing collision risk between underwater turbines and marine wildlife. SNH guidance note.

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L., (2019). Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2), pp.125-232.

Southall, B.L., Nowacek, D.P., Bowles, A.E., Senigaglia, V., Bejder, L. and Tyack, P.L. (2021). Marine Mammal Noise Exposure Criteria: Assessing the Severity of Marine Mammal Behavioural Responses to Human Noise. Aquatic Mammals, 47(5), 421-464.

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T., (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269.

Whyte, K. F., Russell, D. J., Sparling, C. E., Binnerts, B., and Hastie, G. D. (2020). Estimating the effects of pile driving sounds on seals: Pitfalls and possibilities. The Journal of the Acoustical Society of America, 147(6), 3948-3958.

Wood, M.A., M.A. Ainslie, and R.D.J. Burns. 2023. Energy Conversion Factors in Underwater Radiated Sound from Marine Piling: Review of the method and recommendations. Document 03008, Version 1.2. Technical report by JASCO Applied Sciences for Marine Scotland. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/research-and-analysis/2023/10/energy-conversion-factors-underwater-radiated-sound-marine-piling-review-method-recommendations-2/documents/energy-conversion-factors-underwater-radiated-sound-marine-piling-review-method-recommendations/energy-conversion-factors-underwater-radiated-sound-marine-piling-review-method-recommendations/govscot%3Adocument/energy-conversion-factors-underwater-radiated-sound-marine-piling-review-method-recommendations.pdf

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Appendix 6: Apportioning Breeding Season Impacts to SPA Seabird Populations

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1 Introduction

1. This appendix accompanies **Chapter 9: Offshore Ornithology** of the **Broadshore Hub Wind Farm Development Areas (WFDAs) Scoping Report**. It presents an overview and details of the findings of the element of this scoping exercise which is specific to informing the apportionment of breeding season impacts associated with the Broadshore Hub WFDAs to the qualifying features of breeding seabird colony Special Protection Areas (SPAs). This appendix has been prepared by Royal HaskoningDHV.

2. The potential impacts of offshore wind farms on the qualifying features of breeding seabird colony SPAs may be concentrated on qualifying features from a relatively small number of these SPAs during the breeding season. This is because the foraging ranges of breeding seabirds are constrained by the colony location during the breeding season, when the birds from these colonies must attend nests and provision chicks. By contrast, the distribution of seabirds from these SPAs is not constrained in this way during the non-breeding periods, and during these periods these populations may be widely distributed across large expanses of sea and oceanic waters (Furness, 2015).

3. Consequently, for offshore wind farms located in regions of high importance for breeding seabirds (such as north-east Scotland), the largest project alone effects on individual seabird SPA populations are likely to be associated with the breeding season. Given this, breeding season apportionment can be used to identify those SPA seabird populations on which the predicted effects from the Broadshore Hub WFDAs are likely to be greatest, and so provide an early indication of the populations which may be of particular concern in this respect. For the purposes of the **Broadshore Hub WFDAs Scoping Report**, the breeding season apportionment was focused on the following six species:

   - Gannet;
   - Herring gull;
   - Kittiwake;
   - Guillemot;
   - Razorbill; and
   - Puffin.

4. This was on the basis that there are important SPA populations of each of these species with connectivity (and for which the potential for a likely significant effect cannot be excluded) to the Broadshore Hub WFDAs (as detailed in the **Broadshore Hub WFDAs Habitats Regulations Appraisal (HRA) Screening Report**), they include the species for which likely significant effects is concluded that are recorded in highest abundance on the Offshore Aerial Survey Area during the first year of surveys (see **Broadshore Hub WFDAs Scoping Report** and **Broadshore Hub WFDAs HRA Screening Report**) and include species for which there are SPA populations with connectivity for which predicted levels of impact from the in-combination effects of existing projects

have been considered sufficient to mean that an Adverse Effect on Integrity (AEoI) cannot be excluded (ABPmer, 2019; RPS and Royal HaskoningDHV, 2022).

5. The apportionment calculations undertaken to support this scoping exercise follow the approach of the NatureScot (2018) interim guidance, which derives a weighting on the basis of colony population size, distance to the development and the extent of sea around the colony (see below). The MS Apportioning Tool (Butler et al., 2020) provides an alternative method for apportioning the breeding season impacts from offshore wind farms for kittiwake, guillemot and razorbill, based upon the use of tracking data. However, consultation with NatureScot[1] revealed that this method could not be made available at the current time, with this apportioning tool unlikely to become readily accessible until the Cumulative Effects Framework (CEF) tool is published.

[1] NatureScot email of 27th June 2023 re Apportioning question for NatureScot for Bellrock and Broadshore

2 Methodology

6. Apportioning to seabird populations that are qualifying features of SPA breeding colonies was undertaken for the six species identified above using the approach detailed in the NatureScot Interim Guidance (NatureScot, 2018). Thus, populations from SPA colonies that are identified as having connectivity with the Broadshore Hub WFDAs (see **Tables 7.1** and **7.2** in **the Broadshore Hub WFDAs HRA Screening Report**) and from non-SPA colonies that are within mean-maximum foraging range + 1 Standard Deviation (SD) (Woodward et al., 2019) of the Broadshore Hub WFDAs were included in the apportioning calculations.

7. The NatureScot (2018) approach uses three weighting factors to estimate the contribution of the different SPA and non-SPA colonies to the population of adult birds occurring within the Broadshore Hub WFDAs during the breeding season (and hence the proportional allocation of predicted impacts to each of these colonies). These factors are:

- The colony population size (of breeding adult birds);
- The distance of the centre of the colony by sea (i.e. circumventing land masses) from the centre of the Broadshore Hub WFDAs; and
- The proportion of sea within the area encompassed by a circle of radius equal to the defined foraging range (see above) around the colony site.

8. Colony population sizes were derived from the most recent counts in the Seabird Monitoring Programme (SMP) database (British Trust of Ornithology (BTO), 2023). It should be noted that the colony counts from the SMP database are of individuals counted on land. For Guillemot and Razorbill, an availability correction of 1.34 has been applied to the SMP colony count data, to give a more accurate estimated number of breeding adults (ICOL, [2]). By-sea distance to each colony and proportion of foraging range as sea around each colony were both calculated using GIS. By-sea distances were squared (Distance^2), and the reciprocal was calculated for the proportion of foraging range as sea (1/Proportion of foraging range as sea). For each species, the values of each of the three weighting factors were summed, with the weighting for each colony calculated using the following equation:

> *Weighting = (Colony population size/Sum of colony population size) x (Sum of Distance^2/Colony Distance^2) x ((1/Proportion of foraging range as sea)/Sum of (1/Proportion of foraging range as sea)).*

9. Colony weightings were then expressed as a percentage of the sum of weighting values, to provide the percentage apportioning estimate for each breeding colony population. Outputs of apportioning for each of the six species are presented in **Section 3**.

[2] Email of 8th December 2017 from Marine Scotland - Licensing Operations Team to Inch Cape Offshore Limited (ICOL) (IC02-INT-EC-OFA-001-RRP-RPT-003 – Available at: https://www.inchcapewind.com/wp-content/uploads/2021/06/IC02-INT-EC-OFA-001-RRP-RPT-003_Ornithology-Habitats-Regulations-Appraisal_For-Information_A_2.pdf

3 Apportioning Results

10. The species-specific apportioning results are presented in **Table 3.1** through **Table 3.6** below, and as detailed in **Sections 3.1** to **3.6** In these tables species are treated as representing a 'SPA population' if they are either a qualifying feature of the SPA in their own right or are a named component of a breeding seabird assemblage qualifying feature of the SPA.

3.1 Gannet

11. The apportioning calculations for gannet (**Table 3.1**) suggest that during the breeding season 69.5% of the adult gannets present on the Broadshore Hub WFDAs derive from SPA populations. The Forth Islands SPA makes the greatest contribution of any colony population, accounting for approximately 33% of the adult gannets present. Other SPA populations make much smaller contributions (all less than 10%). The relatively high contribution of non-SPA populations is attributable to the Troup Head colony which is estimated to account for 27% of the adult gannets on the Broadshore Hub WFDAs. Although the Troup Head breeding population is small compared to those at the SPA colonies, the proximity of this colony to the Broadshore Hub WFDAs results in a high apportionment value.

Table 3.1: Apportioning of Gannet Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Forth Islands SPA	150,518	246.9	60,939.9	1.420	0.5092	33.3%
St Kilda SPA	120,580	434.8	189,085.8	1.193	0.1104	7.2%
Noss SPA	27,530	220.2	48,505.7	1.178	0.0971	6.4%
Hermaness, Saxa Vord and Valla Field SPA	51,160	299.3	89,562.5	1.162	0.0964	6.3%
Sule Skerry and Sule Stack SPA	18,130	183.5	33,661.2	1.139	0.0891	5.8%
Fair Isle SPA	9,942	148.3	21,989.9	1.175	0.0771	5.0%
North Rona and Sula Sgeir SPA	22,460	266.8	71,171.6	1.133	0.0519	3.4%
Flamborough and Filey Coast SPA	26,784	459.6	211,250.5	1.658	0.0305	2.0%
(Non-SPA Colonies)	(27,920)	(64.2 - 462.0)	-	-	-	(30.5%)
Totals	455,024	**-**	1,227,696.5	18.585	1.5275	**-**

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3.2 Herring Gull

12. The three SPA herring gull colonies with potential connectivity to the Broadshore Hub WFDAs are Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Head SPA and East Caithness Cliffs SPA (**Table 3.2**). These are estimated to contribute 36.3%, 20.4% and 11.0%, respectively, of the adult herring gulls occurring in the Broadshore Hub WFDAs during the breeding season. Non-SPA colonies are estimated to comprise approximately 32% of the adult herring gulls in the Broadshore Hub WFDAs, with two colonies (i.e. Portsoy to Cullen (17%) and Rosehearty to Bay of Cullen (12.3%)) accounting for the vast majority of the non-SPA contribution. All other colonies with connectivity contribute less than 1% each.

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Table 3.2: Apportioning of Herring Gull Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Buchan Ness to Collieston Coast SPA	4,154	89.9	8,087.4	1.362	0.3151	36.30%
Troup, Pennan and Lion's Heads SPA	1,098	64.2	4,121.6	1.474	0.1769	20.40%
East Caithness Cliffs SPA	1,292	92	8,465.8	1.393	0.0957	11.00%
(Non-SPA Colonies)	(2,138)	(59.1 - 85.1)	-	-	-	(32.20%)
Totals	8,682	-	81,976.4	20.962	0.8674	-

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3.3 Kittiwake

13. Over 20 SPA colonies for kittiwake are identified as having potential connectivity with the Broadshore Hub WFDAs during the breeding season and the apportioning calculations suggest that over 90% of the adult kittiwakes present in the Broadshore Hub WFDAs during this period derive from SPA populations (**Table 3.3**). Of these SPA populations, the Troup, Pennan and Lion's Head SPA, East Caithness Cliffs SPA and Buchan Ness to Collieston Coast SPA account for the vast majority of the birds and contribute 32.0%, 26.5% and 13.7% of the adult kittiwakes found in the Broadshore Hub WFDAs, respectively. The individual contributions of the other SPA colonies are considerably smaller, with none estimated to account for more than 7%, and most less than 1%, of the adult kittiwakes present in the Broadshore Hub WFDAs during the breeding season.

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Table 3.3: Apportioning of Kittiwake Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity (Non-SPA Sites not Listed Individually)

Colony Site	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Troup, Pennan and Lion's Heads SPA	27,038	64.2	4,121.6	1.369	1.1597	32.0%
East Caithness Cliffs SPA	48,468	92.0	8,465.8	1.301	0.9615	26.5%
Buchan Ness to Collieston Coast SPA	22,590	89.9	8,087.4	1.377	0.4967	13.7%
Fowlsheugh SPA	28,078	149.5	22,341.3	1.495	0.2427	6.7%
North Caithness Cliffs SPA	11,142	109.0	11,872.3	1.251	0.1517	4.2%
Forth Islands SPA	13,676	246.9	60,939.9	1.684	0.0488	1.3%
West Westray SPA	4,834	144.1	20,773.5	1.165	0.0350	1.0%
St Abb's Head to Fast Castle SPA	10,300	255.5	65,254.7	1.667	0.0340	0.9%
Copinsay SPA	1,910	94.6	8,949.2	1.204	0.0332	0.9%
Cape Wrath SPA	7,284	200.8	40,324.7	1.255	0.0293	0.8%
Farne Islands SPA	8,804	286.2	81,887.5	1.632	0.0227	0.6%
Handa SPA	7,498	234.4	54,957.4	1.270	0.0224	0.6%

Colony Site	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Marwick Head SPA	2,886	143.0	20,443.3	1.196	0.0218	0.6%
Sumburgh Head SPA	2,406	186.9	34,920.4	1.057	0.0094	0.3%
Rousay SPA	966	135.7	18,406.3	1.182	0.0080	0.2%
Hoy SPA	608	122.1	14,896.2	1.223	0.0064	0.2%
Fair Isle SPA	896	148.3	21,989.9	1.096	0.0058	0.2%
North Rona and Sula Sgeir SPA	1,424	266.8	71,171.6	1.171	0.0030	0.1%
Calf of Eday SPA	292	129.3	16,718.5	1.167	0.0026	0.1%
Foula SPA	850	216.1	46,686.2	1.051	0.0025	0.1%
Noss SPA	236	220.2	48,505.7	1.032	0.0006	0.0%
(Non-SPA Colonies)	(39,997)	(58.7 - 291.5)	-	-	-	(9.1%)
Totals	242,183	-	4,680,687.0	149.659	3.6292	-

3.4 Guillemot

14. The apportioning calculations suggest that during the breeding season approximately 96% of the adult guillemots present in the Broadshore Hub WFDAs derive from SPA populations (**Table 3.4**). The East Caithness Cliffs SPA makes the greatest contribution of any colony population, accounting for 44.5% of the adult guillemots present. The Troup, Pennan and Lion's Head SPA contributes 18.5% of the adult guillemots present, whilst the Fowlsheugh SPA, Buchan Ness to Collieston Coast SPA and North Caithness Cliffs SPA each contribute between 7 – 9%. The individual contributions of the other SPA populations with potential connectivity are small (at less than 3%).

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Table 3.4: Apportioning of Guillemot Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity (Non-SPA Colonies not Listed Individually)

Colony Site	Colony Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
East Caithness Cliffs SPA	199,966	96	9,216.0	1.609	0.6852	44.5%
Troup, Pennan and Lion's Heads SPA	38,790	64.2	4,121.6	1.542	0.2848	18.5%
Fowlsheugh SPA	93,570	149.5	22,341.3	1.660	0.1365	8.9%
Buchan Ness to Collieston Coast SPA	39,553	89.9	8,087.4	1.343	0.1289	8.4%
North Caithness Cliffs SPA	52,123	109.0	11,872.3	1.327	0.1143	7.4%
West Westray SPA	43,035	144.1	20,773.5	1.103	0.0448	2.9%
Copinsay SPA	12,033	94.6	8,949.2	1.151	0.0304	2.0%
Hoy SPA	16,345	122.1	14,896.2	1.202	0.0259	1.7%
Marwick Head SPA	13,391	143.0	20,443.3	1.136	0.0146	0.9%
Calf of Eday SPA	7,402	129.3	16,718.5	1.098	0.0095	0.6%
Rousay SPA	7,921	135.7	18,406.3	1.117	0.0094	0.6%
(Non-SPA colonies)	(31,766)	(81.8 - 146.6)	-	-	-	(3.6%)
Totals	555,895.46	-	570,636.9	52.302	1.5399	-

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3.5 Puffin

15. The apportioning calculations suggest that during the breeding season over 84% of the adult puffins present on the Broadshore Hub WFDAs derive from SPA populations, with most of this being largely attributable to two SPA colonies (**Table 3.5**). Thus, the Sule Skerry and Sule Stack SPA and the Forth Islands SPA are estimated to contribute 41% and 32.5% of the adult puffins, respectively. The individual contributions of the other SPA populations with potential connectivity are substantially smaller at 0.3 - 4%.

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Table 3.5: Apportioning of Puffin Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Sule Skerry and Sule Stack SPA	95,484	183.5	33,661.2	1.220	0.4098	41.0%
Forth Islands SPA	92,281	246.9	60,939.9	1.816	0.3257	32.5%
North Caithness Cliffs SPA	3,053	109.0	11,872.3	1.289	0.0393	3.9%
Fair Isle SPA	6,666	148.3	21,989.9	1.082	0.0388	3.9%
Foula SPA	6,351	216.1	46,686.2	1.038	0.0167	1.7%
Cape Wrath SPA	2,244	200.8	40,324.7	1.293	0.0085	0.9%
Hoy SPA	361	122.1	14,896.2	1.244	0.0036	0.4%
Noss SPA	1,174	220.2	48,505.7	1.023	0.0029	0.3%
(Non-SPA Colonies)	(13,658)	(64.2 - 262.0)	-	-	-	(15.5%)
Totals	2,21,272	-	3,145,861.9	120.057	1.0005	-

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3.6 Razorbill

16. The apportioning calculations suggest that during the breeding season approximately 78% of the adult razorbills present in the Broadshore Hub WFDAs derive from SPA populations (**Table 3.6**). The East Caithness Cliffs SPA makes the greatest contribution of any colony population, accounting for approximately 47% of the adult razorbills present. The Troup, Pennan and Lion's Head SPA contributes approximately 16% of the adult razorbills present, whilst the Fowlsheugh SPA contributes approximately 10%. The individual contributions of the other SPA populations with potential connectivity are small (at approximately 4% or less).

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Table 3.6: Apportioning of Razorbill Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	Colony Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
East Caithness Cliffs SPA	40,430	96.0	9,216.0	1.569	0.7115	46.9%
Troup, Pennan and Lion's Heads SPA	6,364	64.2	4,121.6	1.541	0.2459	16.2%
Fowlsheugh SPA	18,844	149.5	22,341.3	1.671	0.1457	9.6%
North Caithness Cliffs SPA	4,796	109.0	11,872.3	1.330	0.0555	3.7%
West Westray SPA	3,117	144.1	20,773.5	1.106	0.0172	1.1%
Fair Isle SPA	2,580	148.3	21,989.9	1.043	0.0126	0.8%
(Non-SPA colonies)	(27,632)	(71.4 - 154.0)	-	-	-	(21.6%)
Totals	103,762.42	-	758,781.0	70.743	1.5163	-

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4 Implications of the Apportionment Findings

17. As would be expected from the location of the Broadshore Hub WFDAs, the apportionment exercise highlights the likely importance of breeding seabird colony SPAs on the north-east coast of the Scottish mainland in terms of the potential project alone effects. Thus, for four of the six species considered, the East Caithness Cliffs SPA and the Troup, Pennan and Lion's Head SPA are identified as being amongst the two to three SPAs with the highest apportionment values (see **Figure 9.2** in **Appendix 1** of the **Broadshore Hub WFDAs Scoping Report**). These are also two of the closest breeding seabird colony SPAs to the Broadshore Hub WFDAs.

18. In some cases, the apportionment values for the East Caithness Cliffs SPA and the Troup, Pennan and Lion's Head SPA suggest that as much as 25 – 50% of the project-alone effects would be attributed to the populations from one or other of these two SPAs (whilst for kittiwake the values are close to 30% for each of these two SPAs). The Buchan Ness to Collieston Coast SPA, Fowlsheugh SPA, North Caithness Cliffs SPA, Forth Islands SPA and Sule Skerry and Sule Stack SPA are also highlighted as being relatively important in terms of the apportionment, although in these cases the estimated values tend to be lower or else relatively high values are restricted to one or two species only (e.g. for the Forth islands SPA in relation to gannet and puffin).

19. For several of the SPA populations associated with high apportionment estimates, the predicted in-combination effects from existing projects have been identified as being of sufficient scale to prevent a conclusion of no AEoI. Thus, the ScotWind plan-level HRA considered that this is potentially the case for kittiwake at the East Caithness Cliffs SPA and Fowlsheugh SPA, for gannet at the Forth Islands SPA and for razorbill at the Fowlsheugh SPA (ABPmer 2019). More recently, the assessment for the Berwick Bank Wind Farm (RPS and Royal HaskoningDHV, 2022) concluded that there was a potential AEoI for in-combination effects (under at least some of the impact scenarios considered) for:

- Kittiwake at the East Caithness Cliffs SPA; Troup, Pennan and Lion's Head SPA; Buchan Ness to Collieston Coast SPA; and Fowlsheugh SPA;
- Guillemot at the Fowlsheugh SPA;
- Razorbill at the East Caithness Cliffs SPA and Fowlsheugh SPA; and
- Puffin at the Forth Islands SPA.

20. The apportionment estimates that have been calculated in this appendix for the purposes of informing the **Broadshore Hub WFDAs Scoping Report** may be subject to change prior to preparing the subsequent offshore ornithology assessment for the Broadshore Hub WFDAs. This could arise as a result of updated colony count data becoming available (noting that effects of the recent outbreak of Highly Pathogenic Avian Influenza (HPAI) on colony population sizes could vary between sites, so affecting the apportionment) and any changes that may be made

to the Broadshore Hub WFDAs boundaries, whilst there may also be a requirement to undertake breeding season apportionment for kittiwake, guillemot and razorbill using the MS Apportioning Tool (Butler et al., 2020). The consequences of the former on the apportionment results reported here are uncertain, however (based on previous experience of the MS Apportioning Tool), it is likely that the latter would result in a higher proportion of the impacts being assigned to a smaller number of colony populations, with the apportionment values likely to increase amongst those colony populations which are closer to the Broadshore Hub WFDAs.

5 References

ABPmer (2019). Sectoral Marine Plan for Offshore Wind Energy. Strategic Habitats Regulations Appraisal (HRA): Screening and Appropriate Assessment Information Report - Final. https://www.gov.scot/binaries/content/documents/govscot/publications/impact-assessment/2019/12/draft-sectoral-marine-plan-offshore-wind-energy-habitat-regulations-appraisal/documents/sectoral-marine-plan-offshore-wind-energy-strategic-habitat-regulations-appraisal-screening-appropriate-assessment-information-report-final/sectoral-marine-plan-offshore-wind-energy-strategic-habitat-regulations-appraisal-screening-appropriate-assessment-information-report-final/govscot%3Adocument/sectoral-marine-plan-offshore-wind-energy-strategic-habitat-regulations-appraisal-screening-appropriate-assessment-information-report-final.pdf

British Trust for Ornithology (2023). Seabird Monitoring Programme (SMP). Available at: https://app.bto.org/seabirds/public/index.jsp

Butler, A., Carroll, M., Searle, K., Bolton, M., Waggitt, J., Evans, P., Rehfisch, M., Goddard, B., et al. (2020). Attributing seabirds at sea to appropriate breeding colonies. Scottish Marine and Freshwater Science 11(8). Marine Scotland Science.

Furness, R.W. (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, No.164

NatureScot (2018). Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs. NatureScot. https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations

RPS and Royal HaskoningDHV (2022). Berwick Bank Wind Farm: Report to Inform Appropriate Assessment. Available at: https://marine.gov.scot/sites/default/files/221220_-_eor0766_berwick_bank_wind_farm_-_riaa_part_3_spa_assessment_-_signed.pdf

Woodward, I., Thaxter, C. B., Owen, E. and Cook, A. S. C. P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report No. 724.

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Annex A: SPA and Non-SPA Breeding Season Apportioning Results

Table A1: Apportioning of Gannet Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	SPA for Herring Gull	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Forth Islands SPA	Yes	2014	150,518	246.9	60,939.9	1.420	0.5092	33.3%
Troup, Pennan and Lion's Head SPA	No	2019[3]	9,650	64.2	4,121.6	1.214	0.4126	27.0%
St Kilda SPA	Yes	2013	120,580	434.8	189,085.8	1.193	0.1104	7.2%
Noss SPA	Yes	2019	27,530	220.2	48,505.7	1.178	0.0971	6.4%
Hermaness, saxa vord and valla field SPA	Yes	2014	51,160	299.3	89,562.5	1.162	0.0964	6.3%
Sule Skerry and Sule Stack SPA	Yes	2013 / 2018	18,130	183.5	33,661.2	1.139	0.0891	5.8%
Fair Isle SPA	Yes	2021	9,942	148.3	21,989.9	1.175	0.0771	5.0%
North Rona and Sula Sgeir SPA	Yes	2013	22,460	266.8	71,171.6	1.133	0.0519	3.4%

[3] SMP whole-colony count value of 246 individuals in 2021 not used in apportioning as assumed to be erroneous.

Colony Site	SPA for Herring Gull	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Flamborough and Filey Coast SPA	Yes	2017	26,784	459.6	211,250.5	1.658	0.0305	2.0%
West Westray SPA	No	2021	2,768	144.1	20,773.5	1.133	0.0219	1.4%
Foula SPA	No	2021	4,886	216.1	46,686.2	1.140	0.0173	1.1%
Flannan Isles SPA	No	2013	10,560	361.6	130,769.0	1.175	0.0138	0.9%
Marwick Head SPA	No	2021	18	143.0	20,443.3	1.130	0.0001	0.0%
Mingulay and Berneray SPA	No	2021	30	462.0	213,481.0	1.290	0.0000	0.0%
St Abb's Head to Fast Castle SPA	No	2019	8	255.5	65,254.7	1.445	0.0000	0.0%
Totals	**-**	**-**	**455,024**	**-**	**1,227,696.5**	**18.585**	**1.5275**	**-**

Table A2: Apportioning of Herring Gull Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	SPA for Herring Gull	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Buchan Ness to Collieston Coast SPA	Yes	2019	4,154	89.9	8,087.4	1.362	0.3151	36.30%
Troup, Pennan and Lion's Heads SPA	Yes	2017 / 2021	1,098	64.2	4,121.6	1.474	0.1769	20.40%
East Caithness Cliffs SPA	Yes	2015 / 2018	1,292	92.0	8,465.8	1.393	0.0957	11.00%
Loch of Strathbeg SPA	No	2018	0	64.8	4,192.6	1.334	0.0000	0.0%
Portsoy to Cullen	N/A	2017	1,194	82.7	6,835.3	1.874	0.1475	17.0%
Rosehearty to Bay of Cullen	N/A	2017	740	68.6	4,707.2	1.510	0.1069	12.3%
Macduff	N/A	2019	56	73.6	5,412.9	1.598	0.0074	0.9%
Banff	N/A	2019	52	75.2	5,657.6	1.628	0.0067	0.8%
St Fergus	N/A	2021	50	69.8	4,876.0	1.339	0.0062	0.7%
Portsoy - Whitehills	N/A	2017	16	78.7	6,196.5	1.741	0.0020	0.2%
Caithness - Wick Bay to Freshwick Bay	N/A	2018	22	83.2	6,916.9	1.294	0.0019	0.2%
Whitehills	N/A	2017	6	76.0	5,774.6	1.663	0.0008	0.1%
Sandhaven	N/A	2017	2	59.1	3,487.5	1.366	0.0004	0.0%

Colony Site	SPA for Herring Gull	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Cruden Bay and Blackhill	N/A	2021	0	85.1	7,244.6	1.387	0.0000	0.0%
Totals	**-**	**-**	**8,682**	**-**	**81,976.4**	**20.962**	**0.8674**	**-**

Table A3: Apportioning of Kittiwake Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Troup, Pennan and Lion's Heads SPA	Yes	2017 / 2021	27,038	64.2	4,121.6	1.369	1.1597	32.0%
East Caithness Cliffs SPA	Yes	2015	48,468	92.0	8,465.8	1.301	0.9615	26.5%
Buchan Ness to Collieston Coast SPA	Yes	2019	22,590	89.9	8,087.4	1.377	0.4967	13.7%
Fowlsheugh SPA	Yes	2018	28,078	149.5	22,341.3	1.495	0.2427	6.7%
North Caithness Cliffs SPA	Yes	2015 / 2016	11,142	109.0	11,872.3	1.251	0.1517	4.2%
Forth Islands SPA	Yes	2019 / 2021 / 2022	13,676	246.9	60,939.9	1.684	0.0488	1.3%
West Westray SPA	Yes	2017 / 2023	4,834	144.1	20,773.5	1.165	0.0350	1.0%
St Abb's Head to Fast Castle SPA	Yes	2016 / 2018 / 2021	10,300	255.5	65,254.7	1.667	0.0340	0.9%
Copinsay SPA	Yes	2015	1,910	94.6	8,949.2	1.204	0.0332	0.9%
Cape Wrath SPA	Yes	2000 / 2017	7,284	200.8	40,324.7	1.255	0.0293	0.8%
Farne Islands SPA	Yes	2019	8,804	286.2	81,887.5	1.632	0.0227	0.6%
Handa SPA	Yes	2018	7,498	234.4	54,957.4	1.270	0.0224	0.6%
Marwick Head SPA	Yes	2023	2,886	143.0	20,443.3	1.196	0.0218	0.6%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Sumburgh Head SPA	Yes	2017 / 2018 / 2021	2,406	186.9	34,920.4	1.057	0.0094	0.3%
Rousay SPA	Yes	2016 / 2021	966	135.7	18,406.3	1.182	0.0080	0.2%
Hoy SPA	Yes	2016 / 2017	608	122.1	14,896.2	1.223	0.0064	0.2%
Fair Isle SPA	Yes	2021	896	148.3	21,989.9	1.096	0.0058	0.2%
North Rona and Sula Sgeir SPA	Yes	2021	1,424	266.8	71,171.6	1.171	0.0030	0.1%
Calf of Eday SPA	Yes	2018	292	129.3	16,718.5	1.167	0.0026	0.1%
Foula SPA	Yes	2021	850	216.1	46,686.2	1.051	0.0025	0.1%
Noss SPA	Yes	2022	236	220.2	48,505.7	1.032	0.0006	0.0%
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	No	2023	1,150	105.5	11,130.3	1.416	0.0189	0.5%
Pentland Firth Islands SPA	No	2021	353	93.8	8,798.4	1.231	0.0064	0.2%
Firth of Forth SPA	No	2007	2,310	283.6	80,429.0	1.693	0.0063	0.2%
Sule Skerry and Sule Stack SPA	No	2018	100	183.5	33,661.2	1.206	0.0005	0.0%
Ramna Stacks and Gruney SPA	No	2018 / 2019	160	281.8	79,388.7	1.018	0.0003	0.0%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Fetlar SPA	No	2018	124	272.6	74,310.8	1.016	0.0002	0.0%
Papa Stour SPA	No	2021	50	237.7	56,487.0	1.032	0.0001	0.0%
Auskerry SPA	No	2016	0	103.9	10,799.4	1.186	0.0000	0.0%
Mousa SPA	No	2015	0	202.9	41,172.5	1.045	0.0000	0.0%
Papa Westray (North Hill and Holm) SPA	No	2021	0	144.7	20,938.1	1.152	0.0000	0.0%
Priest Island SPA	No	2017	0	285.7	81,630.2	1.309	0.0000	0.0%
Girdle Ness to Hare Ness	N/A	2017	4,186	125.0	15,614.9	1.456	0.0504	1.4%
Catterline to Inverbervie	N/A	2017	4,184	154.0	23,717.3	1.503	0.0342	0.9%
Portsoy to Cullen	N/A	2017	1,032	81.9	6,714.0	1.383	0.0274	0.8%
Findon Ness - Hare Ness	N/A	2017	2,354	129.0	16,639.9	1.464	0.0267	0.7%
Burn of Daff	N/A	2017	2,186	132.6	17,577.4	1.471	0.0236	0.7%
Hopeman Bay	N/A	2019	1,120	112.4	12,629.5	1.384	0.0158	0.4%
Lunan Bay to Arbroath	N/A	2018	2,214	189.6	35,948.5	1.558	0.0124	0.3%
Berwick to Scottish Border	N/A	2000	3,054	269.0	72,383.5	1.662	0.0091	0.2%
Fraserburgh	N/A	2021	162	58.7	3,441.1	1.354	0.0082	0.2%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
North Sutor to Shandwick	N/A	2022	846	144.3	20,823.4	1.381	0.0072	0.2%
Carr Craig, Eyebroughy and Haystack	N/A	2021 / 2022	2,352	273.4	74,772.1	1.741	0.0071	0.2%
Melvich to Duncansby Stacks SSSI	N/A	2022	500	109.7	12,044.6	1.244	0.0067	0.2%
Westray	N/A	2002	758	133.5	17,817.4	1.169	0.0064	0.2%
Newtonhill - Hall Bay	N/A	2017	596	135.1	18,257.8	1.475	0.0062	0.2%
Stonehaven to Wine Cove	N/A	2018 / 2021	621	144.9	20,991.8	1.491	0.0057	0.2%
Montrose to Lunan Bay	N/A	2017	740	182.0	33,113.2	1.544	0.0045	0.1%
Eyemouth to Burnmouth	N/A	2018	1,418	261.9	68,589.3	1.662	0.0044	0.1%
Stronsay	N/A	2018 / 2019	315	110.2	12,148.4	1.179	0.0039	0.1%
Faraid Head/ Balnakeil	N/A	2019 / 2021	656	191.1	36,524.3	1.256	0.0029	0.1%
Horse of Copinsay	N/A	2015	144	94.9	9,005.3	1.202	0.0025	0.1%
Rousay - South East	N/A	2018	254	129.9	16,887.0	1.184	0.0023	0.1%
Caithness - Wick Bay to Freshwick Bay	N/A	2018	90	82.2	6,759.9	1.265	0.0022	0.1%
Rosehearty to Bay of Cullen	N/A	2017	56	69.7	4,859.3	1.374	0.0020	0.1%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Peterhead	N/A	2021	66	79.4	6,303.7	1.373	0.0019	0.1%
South Ronaldsay	N/A	2016 / 2021	102	97.2	9,443.2	1.224	0.0017	0.0%
Hall Bay to Craigeven Bay	N/A	2017	158	139.1	19,344.3	1.482	0.0016	0.0%
Portknockie	N/A	2018	62	85.8	7,365.3	1.382	0.0015	0.0%
Stoer Headland	N/A	2019	514	251.1	63,030.5	1.281	0.0013	0.0%
Droman to Geodha Ruadh na Fola	N/A	2019 / 2021	327	217.8	47,445.7	1.260	0.0011	0.0%
Butt of Lewis to Gress - Lewis	N/A	2019 / 2023	502	278.2	77,401.6	1.246	0.0010	0.0%
Seahouses	N/A	2019	412	291.5	84,973.7	1.646	0.0010	0.0%
Sanday - Stove to Kettletoft	N/A	2017	102	123.8	15,337.9	1.170	0.0010	0.0%
Hoy and Southwalls	N/A	2019	66	106.0	11,232.7	1.229	0.0009	0.0%
North Sutherland Islands	N/A	2021	141	167.1	27,909.5	1.262	0.0008	0.0%
Costa Head	N/A	2018	104	140.2	19,657.9	1.188	0.0008	0.0%
West Burra - Shetland	N/A	2014 / 2016	260	208.3	43,405.2	1.044	0.0008	0.0%
Heylor to Stenness	N/A	2019	354	256.6	65,850.2	1.025	0.0007	0.0%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
No Ness to Levenwick and Boddam to Virkie	N/A	2021	198	197.7	39,088.6	1.050	0.0007	0.0%
Green Holms	N/A	2018	64	120.6	14,552.1	1.182	0.0007	0.0%
Eye Peninsula - Lewis	N/A	2019	334	288.8	83,387.7	1.270	0.0007	0.0%
Eynhallow	N/A	2018	76	133.6	17,842.1	1.186	0.0007	0.0%
Skeld, Westerwick and Culswick	N/A	2006 / 2016	228	220.2	48,492.4	1.039	0.0006	0.0%
Smoo to Melvich	N/A	2019 / 2021	100	161.0	25,917.0	1.260	0.0006	0.0%
Scapa Bay to St. Marys	N/A	2021	46	108.6	11,788.4	1.206	0.0006	0.0%
Fitful	N/A	2012	132	189.2	35,789.0	1.058	0.0005	0.0%
St. Ninian's Isle	N/A	2017 / 2018	134	198.6	39,430.6	1.051	0.0005	0.0%
Holm	N/A	2018	28	98.5	9,706.2	1.207	0.0004	0.0%
Shapinsay (Coastal)	N/A	2016 / 2021	34	110.7	12,256.9	1.193	0.0004	0.0%
South Sutor	N/A	2022	50	145.0	21,024.2	1.384	0.0004	0.0%
Sumburgh to Peerie Voe of Spiggie	N/A	2016 / 2021	101	191.2	36,550.4	1.057	0.0004	0.0%
Yell - East Coast	N/A	2018	178	268.6	72,133.8	1.017	0.0003	0.0%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Maywick to St. Ninians Isle	N/A	2014	84	201.5	40,607.7	1.049	0.0003	0.0%
Sumburgh Head Quarries	N/A	2019	70	187.7	35,244.4	1.057	0.0003	0.0%
Bressay	N/A	2019	92	216.1	46,699.1	1.036	0.0003	0.0%
Bigton to Maywick	N/A	2016	76	200.5	40,186.1	1.049	0.0003	0.0%
Huxter to Brindister	N/A	2017 / 2021	103	238.6	56,919.4	1.032	0.0002	0.0%
Vaila	N/A	2016	88	223.1	49,790.0	1.038	0.0002	0.0%
Fetlar	N/A	2019	128	272.3	74,159.2	1.015	0.0002	0.0%
Ronas Hill - North Roe and Tingon - CLIFF NESTERS ONLY	N/A	2019	102	265.5	70,482.8	1.023	0.0002	0.0%
Deerness	N/A	2018 / 2019	10	101.6	10,317.5	1.198	0.0001	0.0%
Whalsay	N/A	2001	64	240.8	57,995.7	1.023	0.0001	0.0%
Fetlar - Shetland	N/A	2002	82	274.6	75,419.8	1.015	0.0001	0.0%
Yesnaby - Ness Point, Stromness	N/A	2021	12	130.5	17,037.8	1.207	0.0001	0.0%
Walls to Dales	N/A	2016 / 2019	39	226.2	51,148.8	1.037	0.0001	0.0%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Horse Island, Colsay, Little and Ladies Holm to Fitful Head	N/A	2021	24	185.4	34,389.7	1.060	0.0001	0.0%
Rerwick Head to Mirkady Point	N/A	2019	6	107.5	11,557.8	1.197	0.0001	0.0%
Newton Hill	N/A	2017	4	137.7	18,956.2	1.480	0.0000	0.0%
Uyea	N/A	2012	24	279.6	78,195.3	1.014	0.0000	0.0%
Maywick to Scalloway	N/A	2016	10	204.5	41,833.0	1.047	0.0000	0.0%
Yesnaby to Marwick (West Mainland)	N/A	2018	2	136.1	18,513.4	1.202	0.0000	0.0%
Brough of Birsay	N/A	2018	2	146.6	21,483.9	1.192	0.0000	0.0%
Sandvoe to Uyea	N/A	2019	8	277.3	76,893.9	1.019	0.0000	0.0%
North Mainland 22 - Black Hill to Boat Geo South	N/A	2021	4	249.3	62,164.5	1.028	0.0000	0.0%
Fethaland to North Roe	N/A	2019	4	276.1	76,255.8	1.018	0.0000	0.0%
Dale to Huxter	N/A	2021	1	229.9	52,858.7	1.035	0.0000	0.0%
Aith to Brae	N/A	2017	0	251.0	63,015.6	1.028	0.0000	0.0%
Cape Wrath (West)	N/A	2017	0	209.7	43,965.4	1.256	0.0000	0.0%

Colony Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Fishtown of Usan to River North Esk	N/A	2018	0	178.5	31,853.3	1.538	0.0000	0.0%
Muckle Roe	N/A	2016	0	254.6	64,818.7	1.027	0.0000	0.0%
Out Skerries	N/A	2021	0	253.6	64,324.4	1.018	0.0000	0.0%
Reawick	N/A	2016	0	221.8	49,193.6	1.036	0.0000	0.0%
Ronas Hill to Uyea	N/A	2019	0	273.5	74,815.2	1.020	0.0000	0.0%
Sanday	N/A	2017	0	127.3	16,210.4	1.162	0.0000	0.0%
St Abbs to Eyemouth	N/A	2018	0	257.3	66,205.6	1.664	0.0000	0.0%
Switha	N/A	2019	0	103.1	10,627.6	1.225	0.0000	0.0%
Ulsta to Whalefirth (Yell)	N/A	2021	0	270.6	73,226.4	1.018	0.0000	0.0%
Unst – south-west	N/A	2019 / 2021	0	283.7	80,489.9	1.014	0.0000	0.0%
Vementry Region	N/A	2017	0	246.3	60,650.9	1.029	0.0000	0.0%
Yell	N/A	2019	0	273.3	74,705.5	1.018	0.0000	0.0%
Yell - Whale Firth to Gloup	N/A	2021	0	288.3	83,094.8	1.014	0.0000	0.0%
Totals	**-**	**-**	**242,183**	**-**	**4,680,687.0**	**149.659**	**3.6292**	**-**

Table A4: Apportioning of Guillemot Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
East Caithness Cliffs SPA	Yes	2015 / 2018	149,228	199,966	96	9,216.0	1.609	0.6852	44.5%
Troup, Pennan and Lion's Heads SPA	Yes	2017 / 2021	28,948	38,790	64.2	4,121.6	1.542	0.2848	18.5%
Fowlsheugh SPA	Yes	2018	69,828	93,570	149.5	22,341.3	1.660	0.1365	8.9%
Buchan Ness to Collieston Coast SPA	Yes	2019	29,517	39,553	89.9	8,087.4	1.343	0.1289	8.4%
North Caithness Cliffs SPA	Yes	2015 / 2016	38,898	52,123	109.0	11,872.3	1.327	0.1143	7.4%
West Westray SPA	Yes	1999 / 2002 / 2017 / 2023	32,116	43,035	144.1	20,773.5	1.103	0.0448	2.9%
Copinsay SPA	Yes	2015 / 2023	8,980	12,033	94.6	8,949.2	1.151	0.0304	2.0%
Hoy SPA	Yes	2016 / 2017	12,198	16,345	122.1	14,896.2	1.202	0.0259	1.7%
Marwick Head SPA	Yes	2023	9,993	13,391	143.0	20,443.3	1.136	0.0146	0.9%
Calf of Eday SPA	Yes	2018	5,524	7,402	129.3	16,718.5	1.098	0.0095	0.6%
Rousay SPA	Yes	2016 / 2018	5,911	7,921	135.7	18,406.3	1.117	0.0094	0.6%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Pentland Firth Islands SPA	No	2002 / 2021	444	595	93.8	8,798.4	1.251	0.0017	0.1%
Auskerry SPA	No	2016	182	244	103.9	10,799.4	1.106	0.0005	0.0%
Papa Westray (North Hill and Holm) SPA	No	2021	176	236	144.7	20,938.1	1.091	0.0002	0.0%
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	No	2023	34	46	105.5	11,130.3	1.433	0.0001	0.0%
Costa Head	N/A	2018	5,076	6,802	139.1	19,348.9	1.124	0.0078	0.5%
Yesnaby to Marwick (West Mainland)	N/A	2018	4,422	5,925	136.1	18,513.4	1.146	0.0072	0.5%
Melvich to Duncansby Stacks SSSI	N/A	2022	2,245	3,008	109.7	12,044.6	1.298	0.0064	0.4%
Deerness	N/A	2018 / 2019	1,889	2,531	101.6	10,317.5	1.133	0.0055	0.4%
North Sutor to Shandwick	N/A	2018	1220	1635	144.3	20,823.4	2.387	0.0037	0.2%
Hoy and Southwalls	N/A	2016 / 2019	1,246	1,670	106.0	11,232.7	1.234	0.0036	0.2%
Horse of Copinsay	N/A	2015	1,072	1,436	94.9	9,005.3	1.145	0.0036	0.2%
Holm	N/A	2018 / 2021	935	1,253	98.5	9,706.2	1.161	0.0029	0.2%
Findon Ness - Hare Ness	N/A	2017	1,177	1,577	128.5	16,502.2	1.520	0.0029	0.2%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
South Ronaldsay	N/A	2016 / 2021	658	882	97.2	9,443.2	1.220	0.0022	0.1%
Stronsay	N/A	2018	751	1,006	110.8	12,278.1	1.103	0.0018	0.1%
Caithness - Wick Bay to Freshwick Bay	N/A	2018	232	311	81.8	6,692.6	1.389	0.0013	0.1%
Burn of Daff	N/A	2017	347	465	132.6	17,577.4	1.547	0.0008	0.1%
Westray	N/A	2002	442	592	133.5	17,817.4	1.103	0.0007	0.0%
Newtonhill - Hall Bay	N/A	2017	311	417	135.1	18,257.8	1.568	0.0007	0.0%
Girdle Ness to Hare Ness	N/A	2017	222	297	126.0	15,886.9	1.503	0.0006	0.0%
Brough of Birsay	N/A	2017	268	359	146.6	21,483.9	1.130	0.0004	0.0%
Portknockie	N/A	2018	49	66	85.8	7,365.3	1.862	0.0003	0.0%
Switha	N/A	2019	82	110	103.1	10,627.6	1.220	0.0002	0.0%
Shapinsay (Coastal)	N/A	2016 / 2021	96	129	110.9	12,302.8	1.122	0.0002	0.0%
Flotta & Calf of Flotta	N/A	2019	64	86	104.1	10,838.0	1.208	0.0002	0.0%
Yesnaby - Ness Point, Stromness	N/A	2016	36	48	132.0	17,422.5	1.153	0.0001	0.0%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Birsay Cliffs - Point of Buckquoy to Loop of Cruie	N/A	2021	24	32	144.3	20,823.7	1.128	0.0000	0.0%
Newton Hill	N/A	2017	3	4	137.7	18,956.2	1.580	0.0000	0.0%
Stromness Area, Hundland	N/A	2016	3	4	133.7	17,877.6	1.149	0.0000	0.0%
Totals	**-**	**-**	**4,14,847**	**555,895.46**	**-**	**5,70,636.9**	**52.302**	**1.5399**	**-**

Table A5: Apportioning of Puffin Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Sule Skerry and Sule Stack SPA	Yes	2018	95,484	183.5	33,661.2	1.220	0.4098	41.0%
Forth Islands SPA	Yes	2013 / 2021 / 2022	92,281	246.9	60,939.9	1.816	0.3257	32.5%
North Caithness Cliffs SPA	Yes	2015 / 2016	3,053	109.0	11,872.3	1.289	0.0393	3.9%
Fair Isle SPA	Yes	2015	6,666	148.3	21,989.9	1.082	0.0388	3.9%
Foula SPA	Yes	2016	6,351	216.1	46,686.2	1.038	0.0167	1.7%
Cape Wrath SPA	Yes	2017 / 2018	2,244	200.8	40,324.7	1.293	0.0085	0.9%
Hoy SPA	Yes	2016 / 2017	361	122.1	14,896.2	1.244	0.0036	0.4%
Noss SPA	Yes	2017	1,174	220.2	48,505.7	1.023	0.0029	0.3%
Pentland Firth Islands SPA	No	2016	4,546	93.8	8,798.4	1.161	0.0710	7.1%
Copinsay SPA	No	2015 / 2016	1,263	94.6	8,949.2	1.215	0.0203	2.0%
Auskerry SPA	No	2016	446	103.9	10,799.4	1.187	0.0058	0.6%
Buchan Ness to Collieston Coast SPA	No	2019	182	89.9	8,087.4	1.411	0.0038	0.4%
East Caithness Cliffs SPA	No	2015	189	92.0	8,465.8	1.340	0.0035	0.4%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Handa SPA	No	2022	860	234.4	54,957.4	1.324	0.0025	0.2%
Sumburgh Head SPA	No	2021 / 2022	631	186.9	34,920.4	1.039	0.0022	0.2%
Fowlsheugh SPA	No	2018	178	149.5	22,341.3	1.606	0.0015	0.2%
Troup, Pennan and Lion's Heads SPA	No	2017	30	64.2	4,121.6	1.413	0.0012	0.1%
Rousay SPA	No	2016	114	135.7	18,406.3	1.183	0.0009	0.1%
Calf of Eday SPA	No	2018	57	129.3	16,718.5	1.162	0.0005	0.0%
West Westray SPA	No	2017	38	144.1	20,773.5	1.161	0.0003	0.0%
Papa Westray (North Hill and Holm) SPA	No	2019	30	144.7	20,938.1	1.146	0.0002	0.0%
Marwick Head SPA	No	2016 / 2017	6	143.0	20,443.3	1.205	0.0000	0.0%
Papa Stour SPA	No	2021	0	237.7	56,487.0	1.025	0.0000	0.0%
St Abb's Head to Fast Castle SPA	No	2016 / 2019	0	255.5	65,254.7	1.746	0.0000	0.0%
East Mainland - Orkney - Tysties	N/A	2016	986	94.7	8,968.3	1.215	0.0158	1.6%
Westray - Rapness	N/A	2016	1,534	135.9	18,465.6	1.161	0.0114	1.1%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Melvich to Duncansby Stacks SSSI	N/A	2015 / 2016 / 2022	213	111.8	12,492.8	1.282	0.0026	0.3%
Sumburgh to Peerie Voe of Spiggie	N/A	2016 / 2017 / 2021	634	193.1	37,275.2	1.038	0.0021	0.2%
Droman to Geodha Ruadh na Fola	N/A	2019	396	215.9	46,614.9	1.300	0.0013	0.1%
Hoy and South Walls - Tysties	N/A	2016	97	107.7	11,604.3	1.257	0.0012	0.1%
Portsoy to Cullen	N/A	2017	32	82.1	6,732.3	1.446	0.0008	0.1%
Eynhallow	N/A	2018	87	133.6	17,842.1	1.192	0.0007	0.1%
Faraid Head/ Balnakeil	N/A	2018 / 2019 / 2021	119	191.0	36,498.6	1.299	0.0005	0.1%
Westray and adjacent Holms - Tysties	N/A	2016	56	145.7	21,225.7	1.152	0.0004	0.0%
South Ronaldsay	N/A	2016 / 2021	24	99.7	9,932.2	1.248	0.0004	0.0%
Bigton to Maywick	N/A	2016	110	200.5	40,186.1	1.033	0.0003	0.0%
Green Holms	N/A	2018	33	120.6	14,552.1	1.183	0.0003	0.0%
Horse Island, Colsay, Little and Ladies Holm to Fitful Head	N/A	2016 / 2021	93	189.8	36,018.5	1.039	0.0003	0.0%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Switha	N/A	2019	21	103.1	10,627.6	1.252	0.0003	0.0%
Birsay Cliffs - Point of Buckquoy to Loop of Cruie	N/A	2021	38	144.3	20,823.7	1.199	0.0003	0.0%
St. Ninian's Isle	N/A	2016	72	198.6	39,430.6	1.034	0.0002	0.0%
Findon Ness - Hare Ness	N/A	2015 / 2017	19	129.0	16,639.9	1.551	0.0002	0.0%
Costa Head	N/A	2018	27	139.1	19,348.9	1.193	0.0002	0.0%
Papa Westray - Tysties	N/A	2016	25	146.5	21,466.9	1.147	0.0002	0.0%
Smoo to Melvich	N/A	2016	21	145.7	21,216.1	1.306	0.0002	0.0%
Lunan Bay to Arbroath	N/A	2018	26	188.7	35,609.5	1.707	0.0001	0.0%
Shapinsay (Coastal)	N/A	2016	12	111.1	12,338.3	1.199	0.0001	0.0%
Maywick to Scalloway	N/A	2016	46	203.6	41,470.1	1.032	0.0001	0.0%
Horse of Copinsay	N/A	2016	8	94.9	9,005.3	1.212	0.0001	0.0%
Vaila	N/A	2016	45	223.1	49,790.0	1.029	0.0001	0.0%
Yell Sound Islands	N/A	2018	50	260.3	67,768.5	1.017	0.0001	0.0%
Flotta & Calf of Flotta	N/A	2019	6	104.1	10,838.0	1.248	0.0001	0.0%
Catterline to Inverbervie	N/A	2017	10	154.0	23,717.3	1.623	0.0001	0.0%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Burn of Daff	N/A	2017	7	132.6	17,577.4	1.562	0.0001	0.0%
Skeld, Westerwick and Culswick	N/A	2016	28	219.5	48,169.6	1.029	0.0001	0.0%
Sumburgh Head Quarries	N/A	2017	20	187.7	35,244.4	1.039	0.0001	0.0%
Caithness - Wick Bay to Freshwick Bay	N/A	2018	3	82.2	6,759.9	1.299	0.0001	0.0%
Sanday	N/A	2017	8	127.1	16,146.3	1.157	0.0001	0.0%
Yesnaby to Marwick (West Mainland)	N/A	2018	8	136.5	18,638.5	1.216	0.0001	0.0%
Huxter to Brindister	N/A	2017	26	242.1	58,620.2	1.024	0.0001	0.0%
Loch of Vaara (Twatt)	N/A	2019	19	250.4	62,707.4	1.023	0.0000	0.0%
Walls to Dales	N/A	2016	15	224.8	50,523.5	1.029	0.0000	0.0%
Brough of Birsay	N/A	2017	5	146.6	21,483.9	1.200	0.0000	0.0%
Newtonhill - Hall Bay	N/A	2017	3	135.1	18,257.8	1.569	0.0000	0.0%
Muckle Roe	N/A	2016	15	254.6	64,818.7	1.020	0.0000	0.0%
Deerness	N/A	2016 / 2018	2	103.0	10,610.8	1.205	0.0000	0.0%
Laxo to Housabister	N/A	2017/21	12	238.0	56,621.0	1.020	0.0000	0.0%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
No Ness to Levenwick and Boddam to Virkie	N/A	2017 / 2018 / 2021	8	198.9	39,555.9	1.032	0.0000	0.0%
Ireland to Maywick	N/A	2016	8	202.9	41,161.6	1.032	0.0000	0.0%
Sandness	N/A	2019	10	231.4	53,551.6	1.027	0.0000	0.0%
Rysa Little and Cava	N/A	2018	2	114.3	13,056.6	1.240	0.0000	0.0%
Newton Hill	N/A	2017	2	137.7	18,956.2	1.577	0.0000	0.0%
Stenness to Hillswick	N/A	2019	9	256.4	65,742.7	1.019	0.0000	0.0%
Housabister to Catfirth	N/A	2017	7	232.1	53,892.9	1.021	0.0000	0.0%
Rerwick Head to Mirkady Point	N/A	2016	1	103.2	10,652.8	1.214	0.0000	0.0%
South Walls	N/A	2016	1	105.9	11,210.2	1.255	0.0000	0.0%
Scalloway Islands South	N/A	2017	5	215.2	46,320.5	1.029	0.0000	0.0%
Gulberwick to Fladdabister	N/A	2021	5	215.8	46,590.8	1.026	0.0000	0.0%
Stronsay	N/A	2018	1	108.4	11,741.5	1.178	0.0000	0.0%
North Sutherland Islands	N/A	2021	2	169.2	28,627.9	1.310	0.0000	0.0%
Muckle Roe to Ura Firth	N/A	2016	5	253.9	64,461.6	1.020	0.0000	0.0%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Stonehaven to Wine Cove	N/A	2018 / 2021	1	144.9	20,991.8	1.597	0.0000	0.0%
Heylor to Stenness	N/A	2019	5	260.4	67,825.9	1.019	0.0000	0.0%
West Burra - Shetland	N/A	2016	2	208.1	43,290.8	1.030	0.0000	0.0%
Scalloway Islands	N/A	2017	2	219.1	48,010.0	1.027	0.0000	0.0%
Bressay	N/A	2019	1	215.8	46,568.9	1.025	0.0000	0.0%
Bressay - North	N/A	2019	0	225.9	51,010.4	1.022	0.0000	0.0%
Cape Wrath (West)	N/A	2017	0	209.7	43,965.4	1.297	0.0000	0.0%
Cunningsburgh to Sandwick	N/A	2018	0	209.8	44,020.4	1.028	0.0000	0.0%
Eyemouth to Burnmouth	N/A	2018	0	262.0	68,642.1	1.740	0.0000	0.0%
Girdle Ness to Hare Ness	N/A	2017	0	125.2	15,662.9	1.539	0.0000	0.0%
Peerie Voe of Spiggie to St. Ninian's	N/A	2016	0	196.5	38,631.3	1.035	0.0000	0.0%
South Ronaldsay (West)	N/A	2016	0	101.1	10,215.0	1.248	0.0000	0.0%
Stoer Headland	N/A	2019	0	250.4	62,693.3	1.338	0.0000	0.0%
Stromness Area, Hundland	N/A	20161/ 2018	0	133.7	17,871.0	1.221	0.0000	0.0%

Site	SPA for the Species?	Year of Colony Count	Colony Population (Individual Adults)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Tarbet, Badcail Bay and Edrachillis Bay	N/A	2021	0	244.9	59,980.6	1.338	0.0000	0.0%
Whalsay: East Skerries and Holms	N/A	2018	0	245.7	60,367.7	1.017	0.0000	0.0%
Whalsay: Western Islands	N/A	2018	0	242.9	59,020.3	1.018	0.0000	0.0%
Yesnaby - Ness Point, Stromness	N/A	2016	0	132.5	17,554.3	1.223	0.0000	0.0%
Totals	**-**	**-**	**221,272**	**-**	**3,145,861.9**	**120.057**	**1.0005**	**-**

Table A6: Apportioning of Razorbill Present Within the Broadshore Hub WFDAs to Breeding Colonies with Connectivity

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
East Caithness Cliffs SPA	Yes	2015 / 2018	30,172	40,430	96.0	9,216.0	1.569	0.7115	46.9%
Troup, Pennan and Lion's Heads SPA	Yes	2017 / 2021	4,749	6,364	64.2	4,121.6	1.541	0.2459	16.2%
Fowlsheugh SPA	Yes	2018	14,063	18,844	149.5	22,341.3	1.671	0.1457	9.6%
North Caithness Cliffs SPA	Yes	2015 / 2016	3,579	4,796	109.0	11,872.3	1.330	0.0555	3.7%
West Westray SPA	Yes	1999 / 2002 / 2017 / 2023	2,326	3,117	144.1	20,773.5	1.106	0.0172	1.1%
Fair Isle SPA	Yes	2021	1,925	2,580	148.3	21,989.9	1.043	0.0126	0.8%
Buchan Ness to Collieston Coast SPA	No	2019	5,823	7,803	89.9	8,087.4	1.360	0.1356	8.9%
Hoy SPA	No	2016 / 2017	2,182	2,924	122.1	14,896.2	1.214	0.0246	1.6%
Copinsay SPA	No	2015 / 2023	745	998	94.6	8,949.2	1.169	0.0135	0.9%
Pentland Firth Islands SPA	No	2002 / 2021	382	512	93.8	8,798.4	1.257	0.0076	0.5%
Marwick Head SPA	No	2017 / 2023	743	996	143.0	20,443.3	1.138	0.0057	0.4%
Rousay SPA	No	2016 / 2018	458	614	135.7	18,406.3	1.117	0.0038	0.3%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	No	2023	162	217	105.5	11,130.3	1.459	0.0029	0.2%
Auskerry SPA	No	2016	90	121	103.9	10,799.4	1.125	0.0013	0.1%
Calf of Eday SPA	No	2018	101	135	129.3	16,718.5	1.102	0.0009	0.1%
Papa Westray (North Hill and Holm) SPA	No	2021	30	40	144.7	20,938.1	1.095	0.0002	0.0%
Catterline to Inverbervie	N/A	2017	2794	3,743.96	154.0	23,717.3	1.714	0.0280	1.8%
Findon Ness - Hare Ness	N/A	2017	929	1,244.86	129.0	16,639.9	1.555	0.0120	0.8%
South Ronaldsay	N/A	2000 / 2016 / 2021	527	706.18	97.2	9,443.2	1.228	0.0095	0.6%
Holm	N/A	2018 / 2021	502	672.68	98.5	9,706.2	1.177	0.0084	0.6%
Caithness - Wick Bay to Freshwick Bay	N/A	2018	289	387.26	82.2	6,759.9	1.379	0.0082	0.5%
Deerness	N/A	2002 / 2018 / 2019	474	635.16	101.6	10,317.5	1.154	0.0073	0.5%
Melvich to Duncansby Stacks SSSI	N/A	2015 / 2022	394	527.96	103.8	10,784.5	1.302	0.0066	0.4%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Costa Head	N/A	2018	658	881.72	139.1	19,348.9	1.127	0.0053	0.4%
Flotta & Calf of Flotta	N/A	2018	267	357.78	104.1	10,838.0	1.221	0.0042	0.3%
Girdle Ness to Hare Ness	N/A	2017	297	397.98	125.0	15,618.7	1.533	0.0040	0.3%
Switha	N/A	2019	231	309.54	103.1	10,627.6	1.230	0.0037	0.2%
Rosehearty to Bay of Cullen	N/A	2017	81	108.54	71.4	5,101.3	1.612	0.0035	0.2%
Stonehaven to Wine Cove	N/A	2018 / 2021	280	375.2	144.9	20,991.7	1.657	0.0031	0.2%
Yesnaby to Marwick (West Mainland)	N/A	2018 / 2019	335	448.9	136.1	18,513.4	1.152	0.0029	0.2%
Hoy and Southwalls	N/A	2016 / 2019	182	243.88	106.0	11,232.7	1.243	0.0028	0.2%
North Sutor to Shandwick	N/A	2018	174	233.16	144.3	20,823.4	2.214	0.0026	0.2%
Shapinsay (Coastal)	N/A	2016 / 2021	166	222.44	110.9	12,302.8	1.140	0.0021	0.1%
Scapa Bay to St. Marys	N/A	2021	152	203.68	108.6	11,788.4	1.173	0.0021	0.1%
Newtonhill - Hall Bay	N/A	2017	161	215.74	135.1	18,257.8	1.599	0.0020	0.1%
Burn of Daff	N/A	2017	148	198.32	132.6	17,577.4	1.577	0.0018	0.1%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Portsoy to Cullen	N/A	2017	46	61.64	81.9	6,714.0	1.763	0.0017	0.1%
Newton Hill	N/A	2017	140	187.6	137.7	18,956.2	1.611	0.0016	0.1%
Horse of Copinsay	N/A	2015	92	123.28	94.9	9,005.3	1.164	0.0016	0.1%
Yesnaby - Ness Point, Stromness	N/A	1999 / 2016 / 2021	116	155.44	132.0	17,424.4	1.164	0.0011	0.1%
Westray	N/A	2002	112	150.08	133.5	17,817.4	1.106	0.0010	0.1%
Strathlene to Portknockie	N/A	2017	28	37.52	87.2	7,612.4	1.818	0.0009	0.1%
Smoo to Melvich	N/A	2016 / 2019	103	138.02	153.8	23,648.9	1.398	0.0008	0.1%
Portknockie	N/A	2018	19	25.46	85.8	7,365.3	1.805	0.0006	0.0%
Rerwick Head to Mirkady Point	N/A	2019	40	53.6	107.5	11,557.8	1.150	0.0006	0.0%
Stromness Area, Hundland	N/A	2016	56	75.04	133.7	17,870.9	1.156	0.0005	0.0%
Birsay Cliffs - Point of Buckquoy to Loop of Cruie	N/A	2021	59	79.06	144.3	20,823.7	1.131	0.0004	0.0%
Stronsay	N/A	2018	14	18.76	110.1	12,114.1	1.112	0.0002	0.0%
Brough of Birsay	N/A	2017	20	26.8	146.6	21,483.9	1.132	0.0001	0.0%

Site	SPA for the Species?	Year of Colony Count	Raw Colony Population	Corrected Population (Individual Adults Using 1.34 Correction Value)	Distance by Sea to Broadshore WFDAs Centroid (km)	Distance Squared (km)	1/Proportion of Foraging Range as Sea	Weight for SPA	Proportional Weight of SPA
Sanday	N/A	2017	11	14.74	127.1	16,146.3	1.097	0.0001	0.0%
Hall Bay to Craigeven Bay	N/A	2017	5	6.7	139.1	19,344.3	1.624	0.0001	0.0%
South Sutor	N/A	2017	3	4.02	145.0	21,024.1	2.229	0.0000	0.0%
Totals	**-**	**-**	**77,435**	**103,762.42**	**-**	**758,781.0**	**70.743**	**1.5163**	**-**