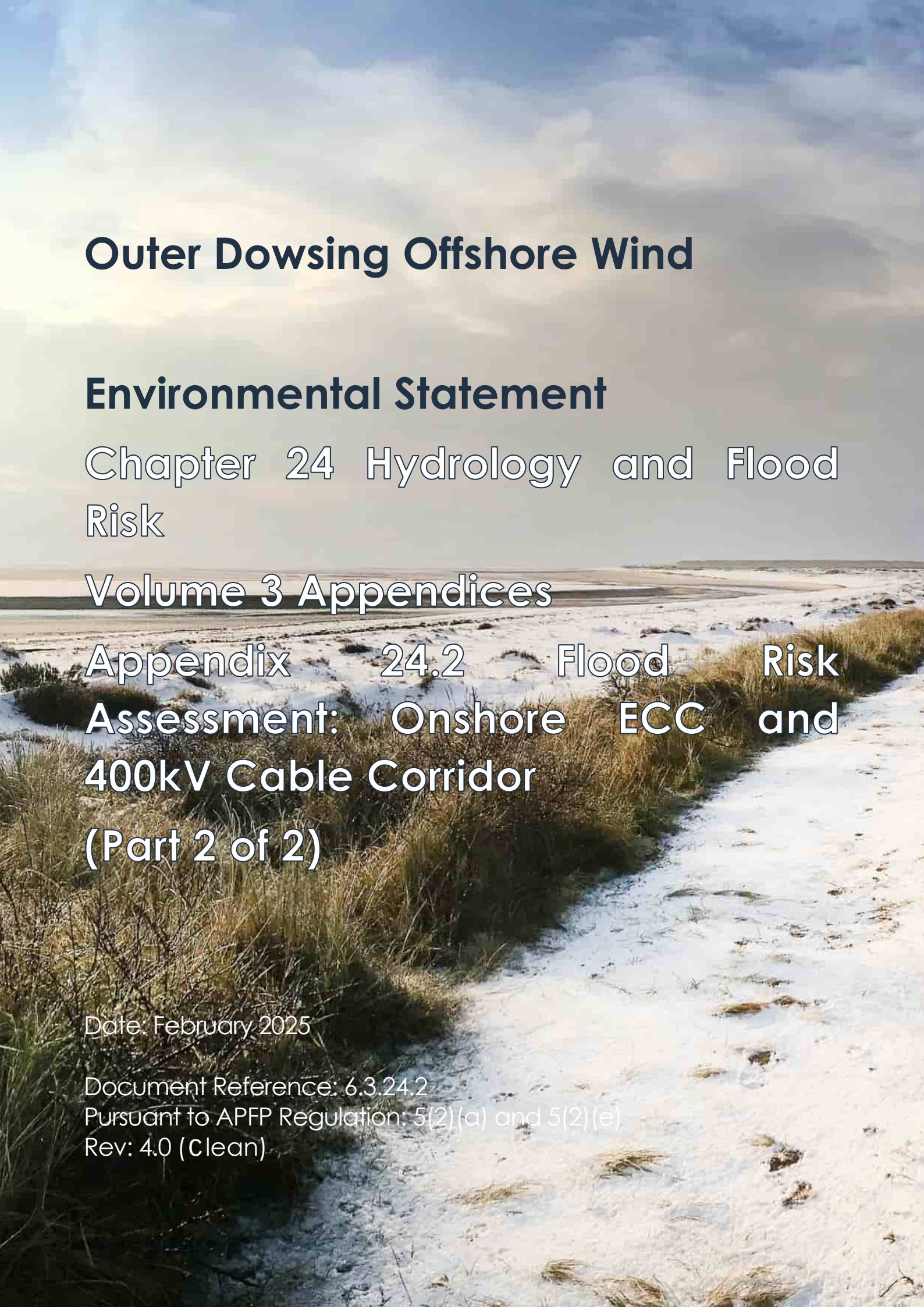


Outer Dowsing Offshore Wind

Environmental Statement

Chapter 24 Hydrology and Flood Risk

Volume 3 Appendices

Appendix 24.2 Flood Risk Assessment: Onshore ECC and 400kV Cable Corridor (Part 2 of 2)

Date: February 2025

Document Reference: 6.3.24.2
Pursuant to APFP Regulation: 5(2)(a) and 5(2)(e)
Rev: 4.0 (Clean)

Company:	**Outer Dowsing Offshore Wind**	Asset:	**Whole Asset**
Project:	**Whole Wind Farm**	Sub Project/Package:	Whole Asset
Document Title or Description:	Appendix 24.2 Flood Risk Assessment: Onshore EC and 400kV Cable Corridor (Part 2 of 2)		
Internal Document Number:	PP1-ODOW-DEV-CS-REP-0195_04	3rd Party Doc No (If applicable):	N/A

Rev No.	Date	Status / Reason for Issue	Author	Checked by	Reviewed by	Approved by
1.0	March 2024	DCO Application	SLR	GoBe	Shepherd and Wedderburn	Outer Dowsing
2.0	June 2024	Response to Section 51 Advice	SLR	Outer Dowsing	Shepherd and Wedderburn	Outer Dowsing
3.0	September 2024	Procedural Deadline 19th September	SLR	Outer Dowsing	Shepherd and Wedderburn	Outer Dowsing
4.0	February 2025	Examination Deadline 4	SLR	Outer Dowsing	Shepherd and Wedderburn	Outer Dowsing

24.4.4 Flooding from Groundwater

80. As detailed in Section 24.2.3, the British Geological Survey (BGS, 2023) mapping indicates that segments ECC 1 -3 and the north of ECC 4 of the onshore ECC is underlain by chalk and sandstone bedrock deposits which are considered to have high permeability and a high level of storage and water transmission.

81. The majority of the superficial deposits along the onshore ECC consist of Tidal Flat Deposits which are considered to have low permeability. The Devensian Till Deposits are considered to have variable permeability depending on their specific properties and composition. The onshore ECC crosses areas of low-lying land particularly along segments ECC 5 – 9, which are closer to the coastline and may have shallow groundwater linked to the coast.

82. The BGS Groundwater Flooding Susceptibility mapping, accessed via data from Envirocheck (November 2022 and March 2023), shows that the majority of the ECC lies within an area not susceptible to groundwater flooding.

83. The effect that the onshore ECC will have on groundwater flooding once operational is not considered to be significant due to all ground conditions being reinstated following construction. However, it should be noted that perched groundwater may be present within the superficial geology along the onshore ECC and this water may be encountered during construction works. Cable construction mitigation measures outlined in Section 24.7.1 will be implemented as part of a CoCP to manage activities and mitigate against this risk for the construction phase.

84. The risk of flooding via this source will not be a concern for the operation and decommissioning phase of the Project and as such is not considered further.

24.4.5 Flooding from Sewers and Water Mains

85. As outlined in Section 24.2, the majority of land crossed by the onshore ECC is agricultural land and is unlikely to have significant formal sewerage infrastructure. Utilities data acquired from Anglian Water indicates that there are various areas of the route in which sewer and mains water utilities are present. Where sewer and mains networks are present it is considered that failure or surcharge (blocked or collapsed sewer or burst main) of the utility networks would result in the limited emergence of flood water at the surface along the onshore ECC route, which would progress in accordance with the topographic gradient and be infiltrated to ground or pass to local surface water drainage features.

86. The potential risk of flooding from this source is unlikely and any flooding would result in localised flood extents that would be similar in nature to the surface water flood risk discussed in Section 24.4.3. Due to the nature of the Project proposals and the unlikely nature of this type of flooding, flooding from sewers in the vicinity of the onshore ECC is not anticipated to have any impact during the life of the Project.

87. The risk of flooding from sewers is therefore concluded to be low and is not considered further.

24.4.6 Flooding from Reservoirs, Canals, or other Artificial Sources

88. Environment Agency Flood mapping (EA, 2023) indicates that the majority of the onshore ECC does not lie within an area at risk of flooding from reservoirs.

89. A small area along the onshore ECC within segment ECC 11, adjacent to Wyberton Marsh Pumping Drain, is shown to lie within an area at risk of reservoir flooding during both 'wet day' and 'dry day' scenarios. The ‘dry-day’ scenario predicts the flooding that would occur if the failure occurred when rivers are at normal levels. The ‘wet day’ scenario predicts how much worse the flooding might be if a river is already experiencing an extreme natural flood. This risk is thought to be associated with Wyberton Marsh Pumping Station. Flooding from the risk of failure of pumping stations is considered within Section 24.4.7 below.

90. There is also another small area of the onshore ECC, within segment ECC 9, which is shown to lie within an area at risk of reservoir flooding during a 'wet day' scenario This risk is associated with Birkwood Hall reservoirs located approximately 15km northwest of the onshore ECC.

91. Reservoirs are regularly inspected by registered panel engineers and as such the risk of failure or breach is considered to be extremely unlikely. The risk of flooding from reservoirs will therefore not be considered further.

92. There are no canals or other artificial sources within or in the immediate vicinity of the onshore ECC and therefore the risk of flooding from this source will not be considered further.

24.4.7 Flooding from Infrastructure Failure

24.4.7.1 Flood Defences

93. Coastal flood defences are located along the Lincolnshire coastline. These defences run parallel to the coastline and protect the land in which the proposed onshore ECC lies. At

landfall, the beach forms part of the defences and forms part of the Environment Agency Saltfleet to Gibraltar Point Strategy, which currently involves annual nourishment of the beach. ODOW's landfall overlaps with the Environment Agency's beach maintenance area. ODOW has engaged with the Environment Agency and a works management agreement is proposed to avoid ODOW's construction activities having any impact upon the Environment Agency's coastal defence maintenance works.

94. Environment Agency maintained defences are also present along Main Rivers within the onshore ECC:

- Willoughby High Drain - natural high ground;
- Steeping River – embankments and walls;
- The Lymn - natural high ground;
- Wainfleet Relief Channel - embankments; and
- The Haven – embankments.
- River Welland - engineered high ground, embankments.

95. These defences are regularly inspected and maintained by the Environment Agency, however, there is a residual risk of failure which will be considered in Section 24.5.

There are also numerous non-Environment Agency maintained defences located within the onshore ECC (i.e. IDB or private defences).

24.4.7.2 Pumping Stations

96. The IDBs maintain a number of pumping stations that serve the land which is crossed by the onshore ECC. Failure of a pumping station would have the potential to increase flood risk locally, effectively creating an increase in fluvial flood risk. The IDBs undertake regular inspections and carry our regular maintenance and servicing of all assets under their care, including pumping stations. The likelihood of failure is considered to be low, and any failure would be immediately notified to the relevant IDB via telemetry or alarm for inspection and repair. This is the case for the northern end of the ECC, which is close to but does not cross the Main Drain, which discharges into the North Sea via the Anderby Sluice.

24.4.7.3 Culverts

97. Several culverts were observed during site visits, primarily along ordinary watercourses and field drainage channels. In the event of blockage through vegetation growth, littering or failure there is potential for the water flow to be affected or reduced. The pre-existing risk of culvert blockage can be mitigated through regular maintenance regimes to ensure that these structures are cleaned regularly. The site construction techniques will aim to

preserve the current state of the ordinary watercourses within the onshore ECC and thus will not increase the current flood risk for the Project.

98. While the local fluvial and tidal flood defences provide a high standard of protection there is inherently a residual risk of failure from these structures, including culverts, around the onshore ECC. This is therefore considered further within Section 24.5.

24.4.7.4 Cable Installation

99. Whilst most of the cable route will be constructed using open-cut methods, trenchless techniques such as HDD will be used to pass beneath obstructions such as the coastal sand dunes at the landfall, and significant watercourses and flood defences along the length of the ECC. Through ongoing consultation, the Environment Agency has raised concerns that such trenchless techniques could cause an unnatural risk of flooding by creating a flowpath along which water could flow in the event of an installation or equipment failure.

100. Volume 1, Chapter 24: Onshore Hydrology, Hydrogeology and Flood Risk (document reference 6.1.24) outlines embedded mitigation to manage this construction method and includes specific measures to avoid increasing flood risk when drilling under defences and when stockpiling materials (Document Reference 8.1: Outline Code of Construction Practice). This includes the construction of a temporary bund around the HDD rig at the landfall to prevent flooding in the event that a failure results in the ingress of water into the cable conduit.

24.4.8 Flood Risk Summary

101. A summary of the potential sources of flooding and the flood risk arising from them is presented in Table 24.5.

Table 24.5 Potential Sources of Flooding

Potential Source of Flooding	Significant Flood Risk at the Site (Y/N)
Rivers or Fluvial Flooding	Y
Sea or Tidal Flooding	Y
Surface Water or Pluvial Flooding	N
Groundwater	N
Sewers	N
Reservoirs, Canals, and other Artificial Sources	N
Infrastructure Failure	Y- residual risk of Tidal/Fluvial Flooding

102. A detailed assessment of the existing baseline flood risks detailed in Table 24.5 is undertaken further in Section 24.5.

24.5 Detailed Assessment of Flood Risk

103. The flood risk screening provided in Section 24.4 has demonstrated that the onshore ECC is potentially at risk of flooding from tidal and fluvial sources, and infrastructure failure is also identified as a residual risk.

104. Flood risk analysis contained within this section is for the onshore ECC. An FRA for the OnSS is provided as a separate document (Document reference 6.3.24.3).

24.5.1 Flooding from the Sea or Tidal Flooding

105. As discussed in Section 24.4.2, the onshore ECC is at risk of flooding from tidal sources due to the residual risk of failure of flood defences along the Lincolnshire coastline. The extent of flooding in the event of a flood defence failure can be different than that which is indicated on Environment Agency flood risk mapping, therefore additional assessments and modelling has been conducted by the Environment Agency to determine the potential outcome of these events.

106. As part of a data request, the Environment Agency has provided breach and overtopping modelling for the coastline adjacent to the onshore ECC. This modelling was published by Mott MacDonald in December 2010 (Mott MacDonald, 2010) as part of the Northern Area Tidal Modelling project. The Northern Area Tidal Modelling project covers the coastline from Whitton, west of the Humber Bridge, to Terrington on the Wash between the River Nene and the River Great Ouse.

24.5.1.1 Defence Failure by Overtopping

107. The Northern Area Tidal Modelling study focuses on flood risk from seawater overtopping of the sea defences from a combination of tides, tide surges and waves along the coastline between Humber Estuary to the Wash.

108. The overtopping depth mapping shows for a 1 in 200 chance scenario (0.5% AEP event), the majority of the onshore ECC does not lie within an area at risk of flooding from failure of defences by overtopping. There is a small section slightly north and south of The Haven that is at potential risk, with flood depths of less than 0.5 m predicted. A small area at landfall, on the landward side of coastal defences, is also noted to be at risk of flooding during this scenario.

109. The overtopping depth mapping for a 1 in 1,000 chance scenario (0.1% AEP event), shows a similar pattern in terms of the potential risk of flooding, with slightly increased depths and extents in the vicinity of The Haven.

110. The overtopping mapping depth for a 1 in 200 chance scenario plus climate change (CC) (2115) (0.5% AEP event + CC) shows the majority of the onshore ECC lies within an area at risk of flooding from failure of defences by overtopping, with the exception being an area to the north of the A52 reach near Wainfleet All Saints. The flood depths do not exceed 1 m, apart from in areas around The Haven and the Wash, which reach depths of up to 3 m.

111. The overtopping hazard mapping shows certain areas the ECC crosses areas that have higher hazard ratings. These areas relate to the northeastern and southwestern areas where the ECC crosses the Haven, and to the east of Hobhole Drain. The northern and southern areas of the River Welland at Fosdyke Bridge also have higher hazard ratings than surrounding areas. The Environment Agency's overtopping flood hazard mapping is shown in Figure 24.2.8

550000 555000 560000

375000 370000 365000

ECC 1
ECC 2
ECC 3
ECC 4

Thoresthorpe, Asserby Turn, Asserby, Bilsby, Moat Fm, Dryby Fm, Moat Ho, Hall, The Grange, Thurlby, Huttoft, Poplar Fm, Wold Sea Fm, Manor Fm, The Manor, Anderby, Moggs Eye, Anderby Creek, Bank Ho, Bilsby Field, Farlesthorpe Fen, Mumby, Manor Ho, Langham Fm, Wolla Bank, Chapel Six Marshes, Farlesthorpe, School Fm, Mill Hill, Cumberworth, Mickleberry Hill, Authorpe Row, Nelson Villa, Chapel Point, Mawthorpe, Elsom Fm, Bonthorpe, Cherry Fm, Chapman's Fm, Croft Fm, Helsey, Cumberworth Ings, Manor Fm, Willoughby, Tumuli, Poplar Fm, Listoft, Chapel St Leonards, Hotel, Hogsthorpe, Wks, Burtoft Beck, Willoughby High Drain, Hogsbeck Ho, Sloothby, Howlet Hall, Slackholme End, Hope Fm, Abbey Fm, Animal Farm, Sloothby Ings, Wyche, Habertoft, Welbourne Fm, Bridge Fm, Ingoldmells, Addlethorpe, Welton le Marsh, Boothby Hall, Boothby Grange, Ingoldmells Point, Manor Fm, White House Fm, Holiday Village, Stadium, Whitehouse Fm, Marsh House Fm, Corner Fm, Trapot Hall, Cherry Tree Fm, Orby, Orby Marsh, Fir Tree Fm, Ashington End, Field House Fm, Black House Fm, Landing Strip, Home Fm, Willow Lodge, Elmstead Fm, Winthorpe, PC Lookout Station, England Coastal Path, Bratoft, Burgh Marsh, Burgh le Marsh, Jockhedge, Bratoft Corner, South View Hotel, SKEGNESS, Golar Farm, PC Marine Zoo, Lloyd's Fm

N

Legend

- Order Limits
- Onshore Segment Break
- Landfall Trenchless Works Area
- Transition Joint Bay Area

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

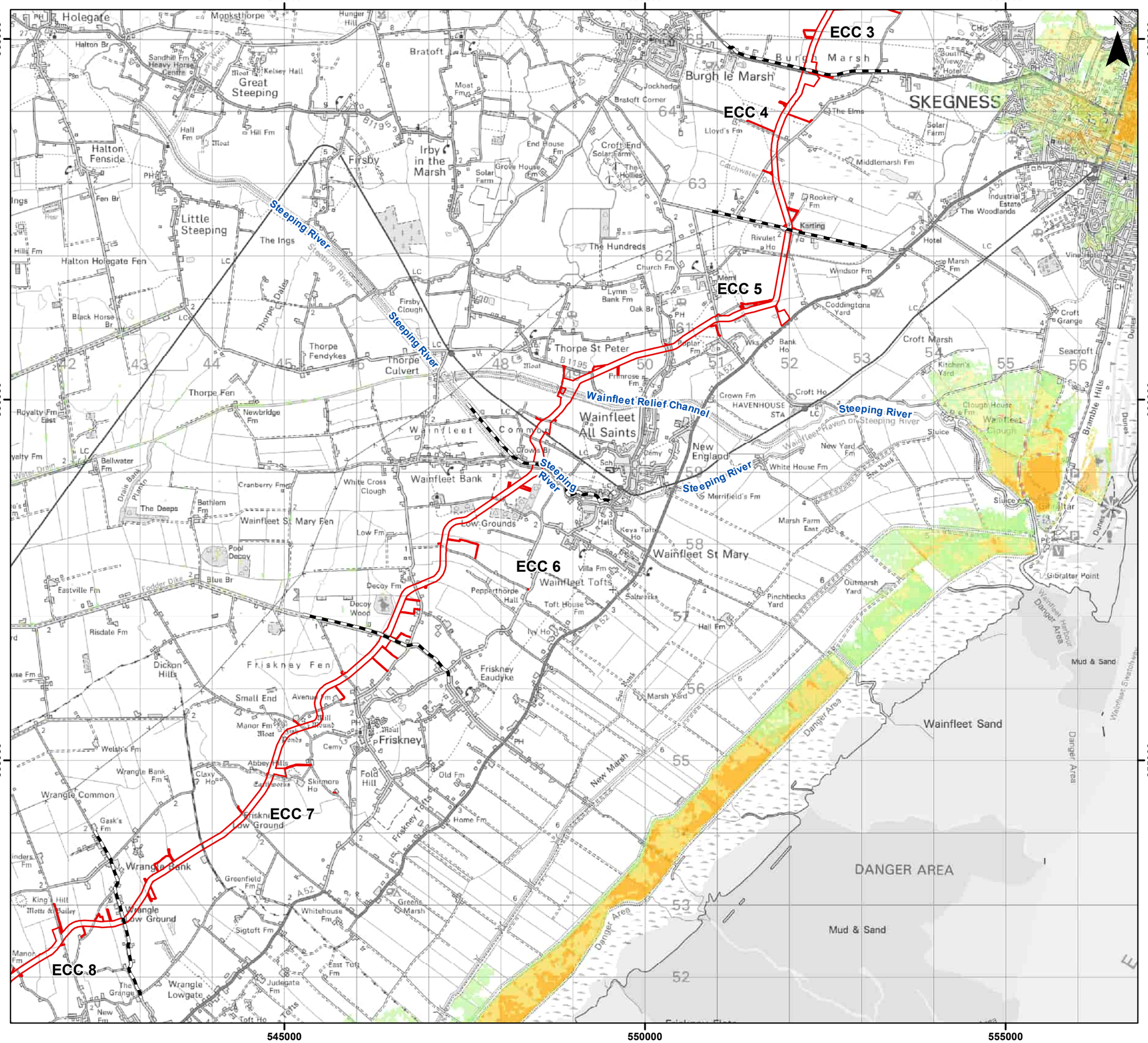
Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.5% AEP

Figure 24.2.8.1 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR



Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Sources:

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.5% AEP

Figure 24.2.8.2 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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Revision: 0.1

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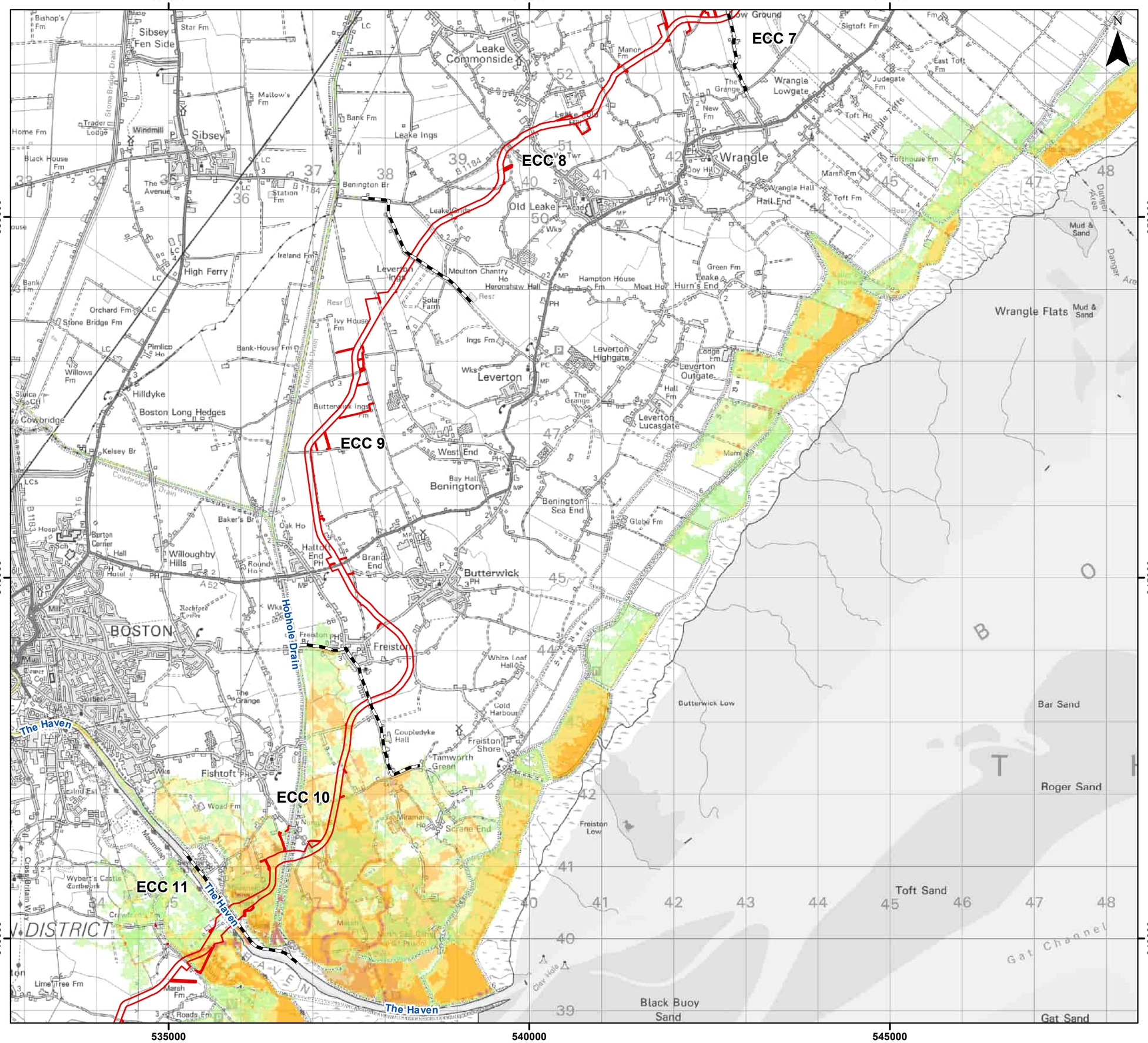

Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.5% AEP

Figure 24.2.8.3 (A)

OUTER DOWSING OFFSHORE WIND

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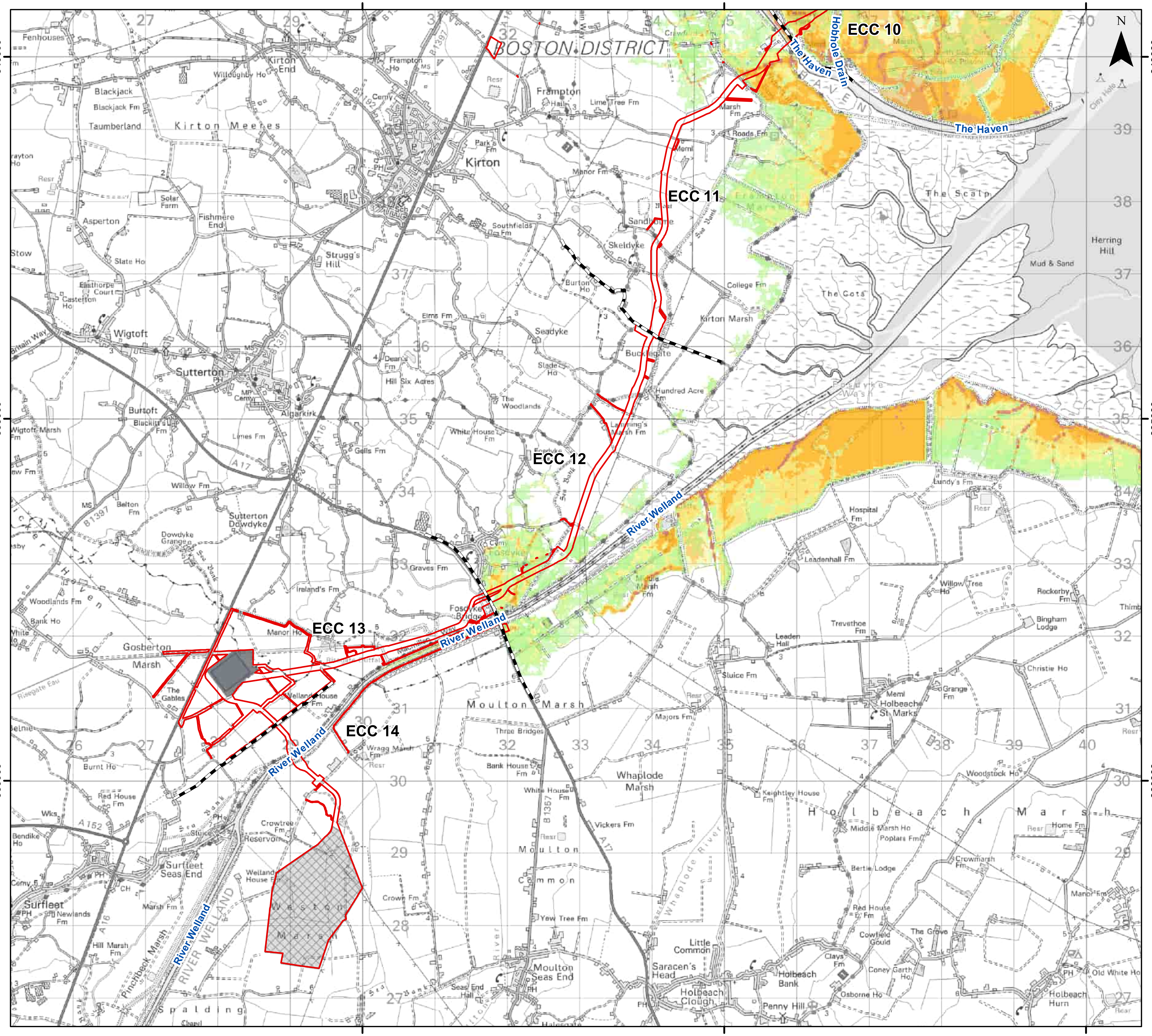

Legend

- Order Limits
- Onshore Segment Break
- Onshore Substation (OnSS) Footprint
- Connection Area
- Area not Included in Export Cable Corridor Flood Risk Assessment

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Sources:
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Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.5% AEP

Figure 24.2.8.4 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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Revision: 0.1

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550000 555000 560000

375000 370000 365000

N

ECC 1

ECC 2

ECC 3

ECC 4

Legend

- Order Limits
- Onshore Segment Break
- Landfall Trenchless Works Area
- Transition Joint Bay Area

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.1% AEP

Figure 24.2.8.1 (B)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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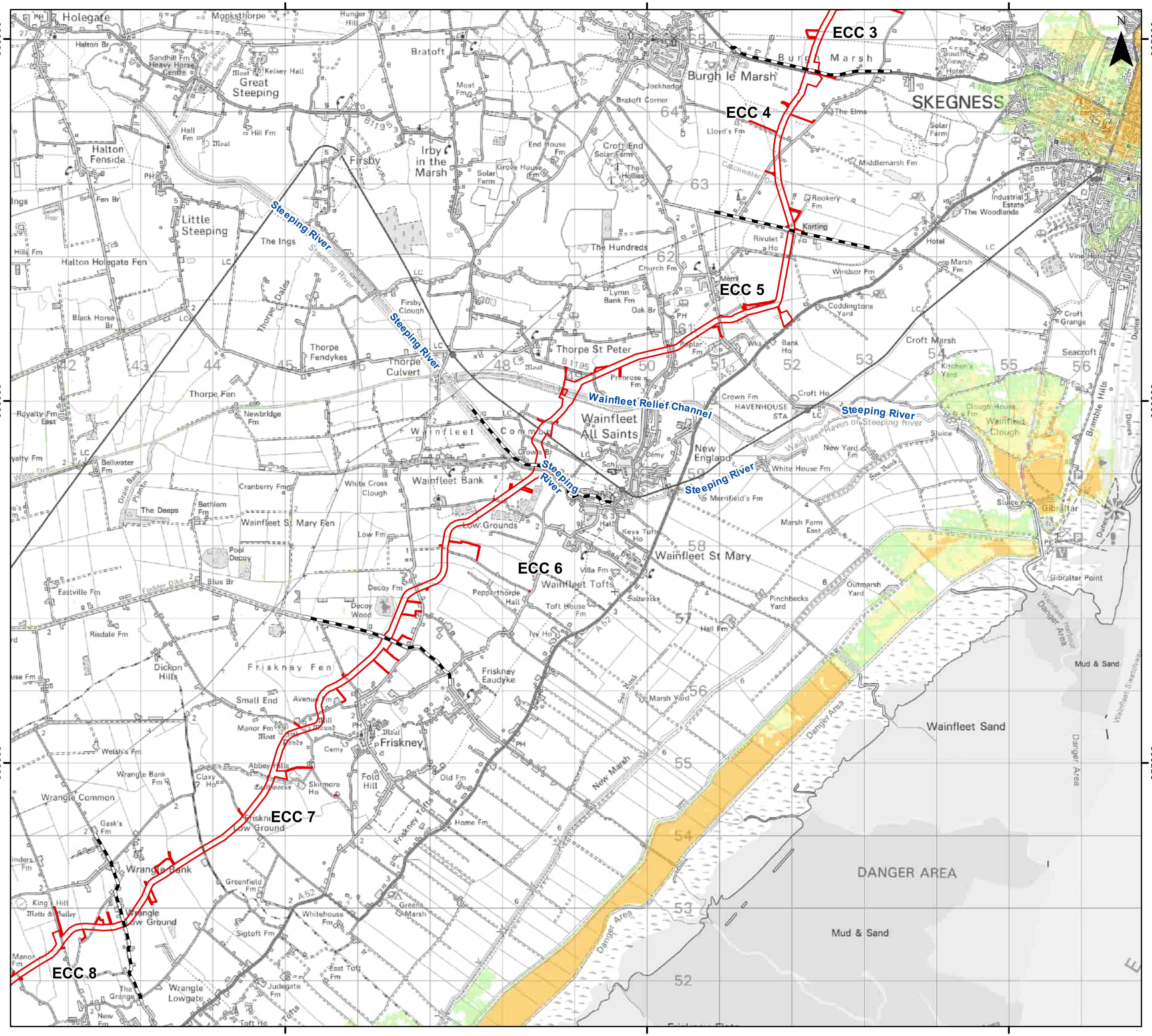
Revision: 0.1

SLR



Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Sources:
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Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.1% AEP

Figure 24.2.8.2 (B)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR

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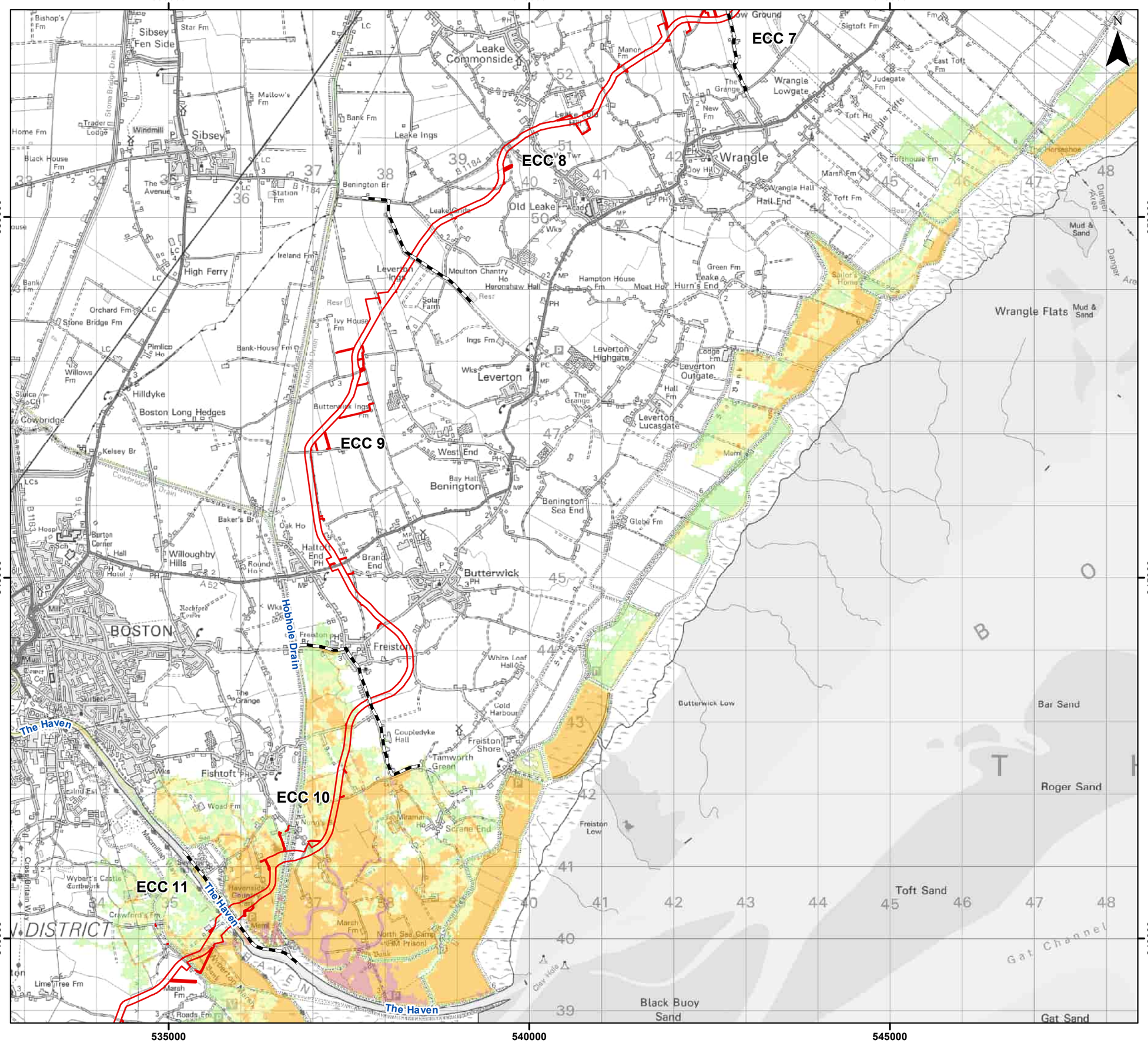


Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

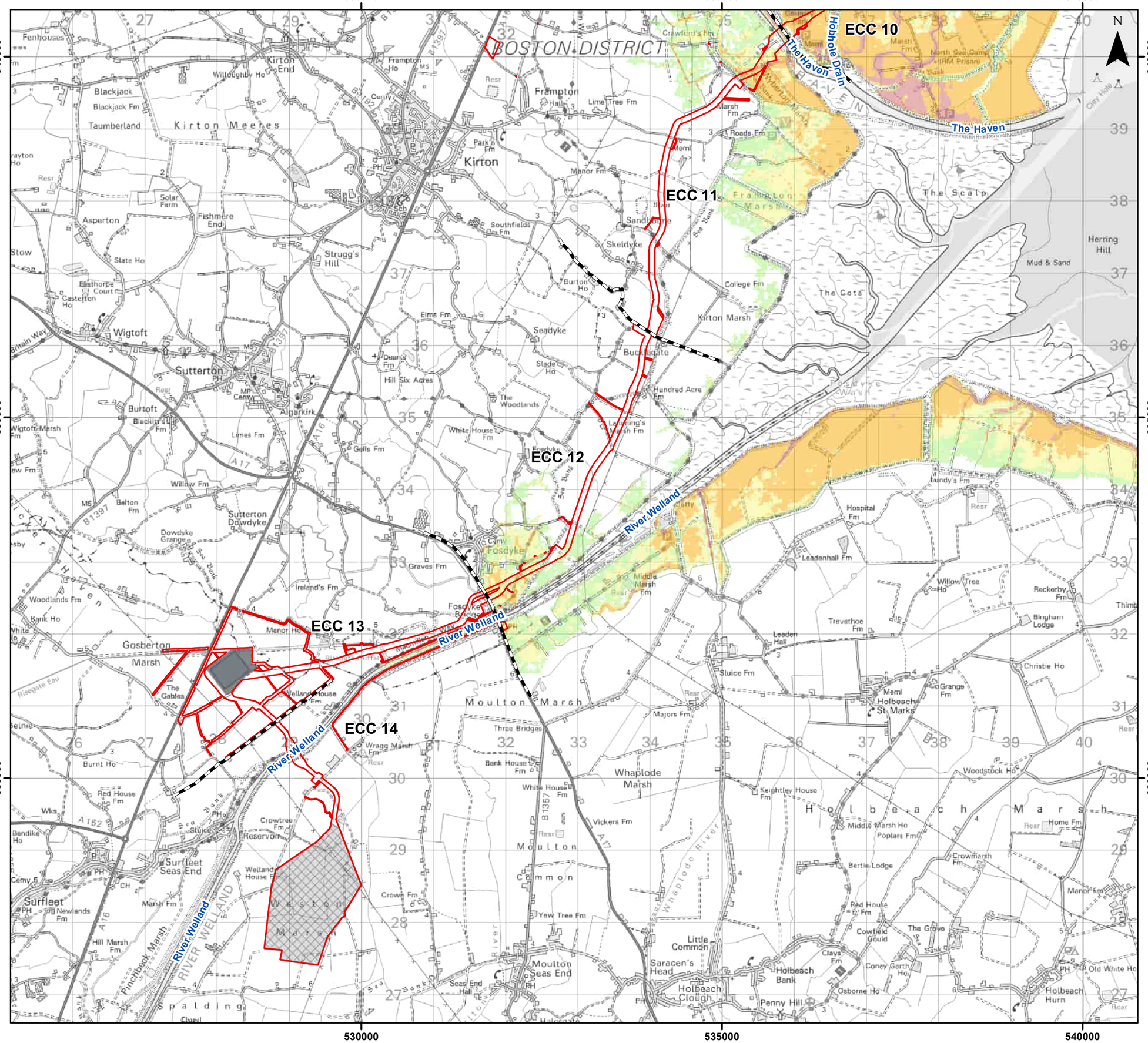
Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.1% AEP

Figure 24.2.8.3 (B)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR



Legend

- Order Limits
- Onshore Segment Break
- Onshore Substation (OnSS) Footprint
- Connection Area
- Area not Included in Export Cable Corridor Flood Risk Assessment

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Overtopping Flood Hazard Mapping 0.1% AEP

Figure 24.2.8.4 (B)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR

24.5.1.2 Defence Failure by Breach

112. In total, 102 breach locations were specified by the Environment Agency along the coastline as part of the Northern Area Tidal Modelling project. The density of the breach locations is higher along the coastline in the urban areas. This study includes breach locations along the tidal Witham Haven.

113. The breach depth mapping indicates the risk of flooding for a 1 in 200 chance scenario (0.5% AEP event), the majority of the onshore ECC lies within an area at risk of flooding from failure of defences by breach, with the exception being an area to the north of the A52, from Low Road to Broadgate, which is not at risk of flooding. The flood depths along the majority of the onshore ECC do not exceed 1 m depth apart from in some localised places of lower ground, where depths reach up to 2 m: landfall and an area around Hogsthorpe, the area around Friskney Tofts, The Haven and surrounding areas (Fishtoft and Frampton), and the Fosdyke area to the north of the River Welland. The breach mapping also indicates the extent of flooding for a 1 in 1,000 chance scenario (0.1% AEP event), which shows a similar pattern of flood risk with slightly increased depths.

114. The breach depth mapping for a 1 in 200 chance plus CC scenario (2115) (0.5% + CC AEP event), indicates that a larger proportion of the onshore ECC lies within an area at risk of flooding from failure of defences by breach, with only a small, isolated area near Wainfleet All Saints not being within an area at risk. There is also an increase of potential flood depths along the ECC, with the majority of flood depths being between 1.5 m to 2 m apart from some areas to the north of the A52 which reach less than 1 m.

115. The breach hazard mapping shows certain areas the ECC crosses that have higher hazard ratings. These areas relate to the northeastern and southwestern areas where the ECC crosses the Haven. The northern and southern areas of the River Welland where the ECC runs parallel to the watercourse also have higher hazard ratings than surrounding areas. The southern bank of the River Welland, where the 400KV cable crosses the River Welland also has a higher hazard rating than surrounding areas.

116. There is also an area near the landfall, to the east of the ECC at Chapel St Leonards that is within a higher hazard rating than other areas. The Environment Agency breach flood hazard mapping is shown in Figure 24.2.9.

550000 555000 560000

375000 370000 365000

ECC 1

ECC 2

ECC 3

ECC 4

N

Legend

- Order Limits
- Onshore Segment Break
- Landfall Trenchless Works Area
- Transition Joint Bay Area

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

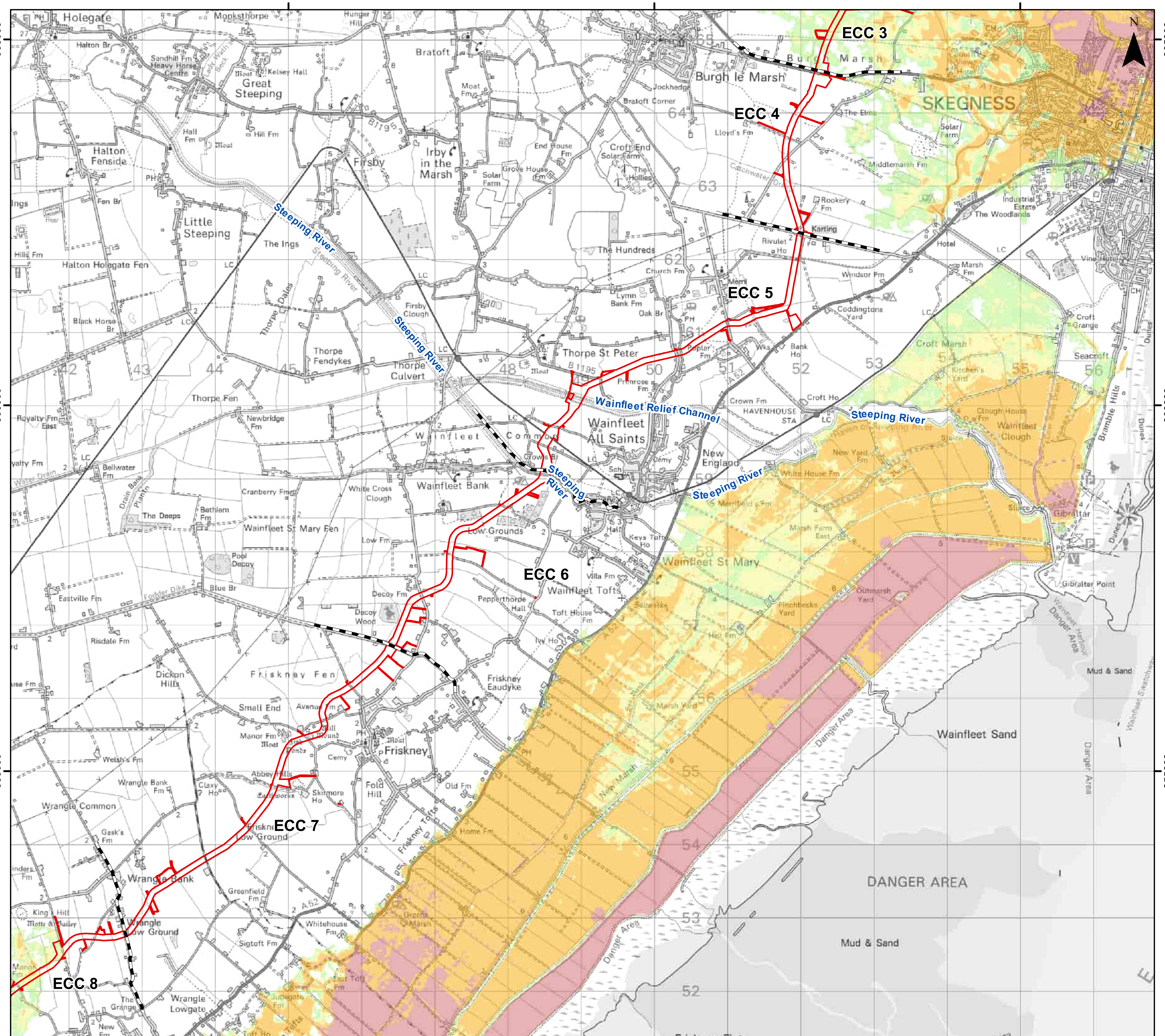
Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.5% AEP

Figure 24.2.9.1 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR



Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Sources:

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.5% AEP

Figure 24.2.9.2 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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Revision: 0.1

SLR

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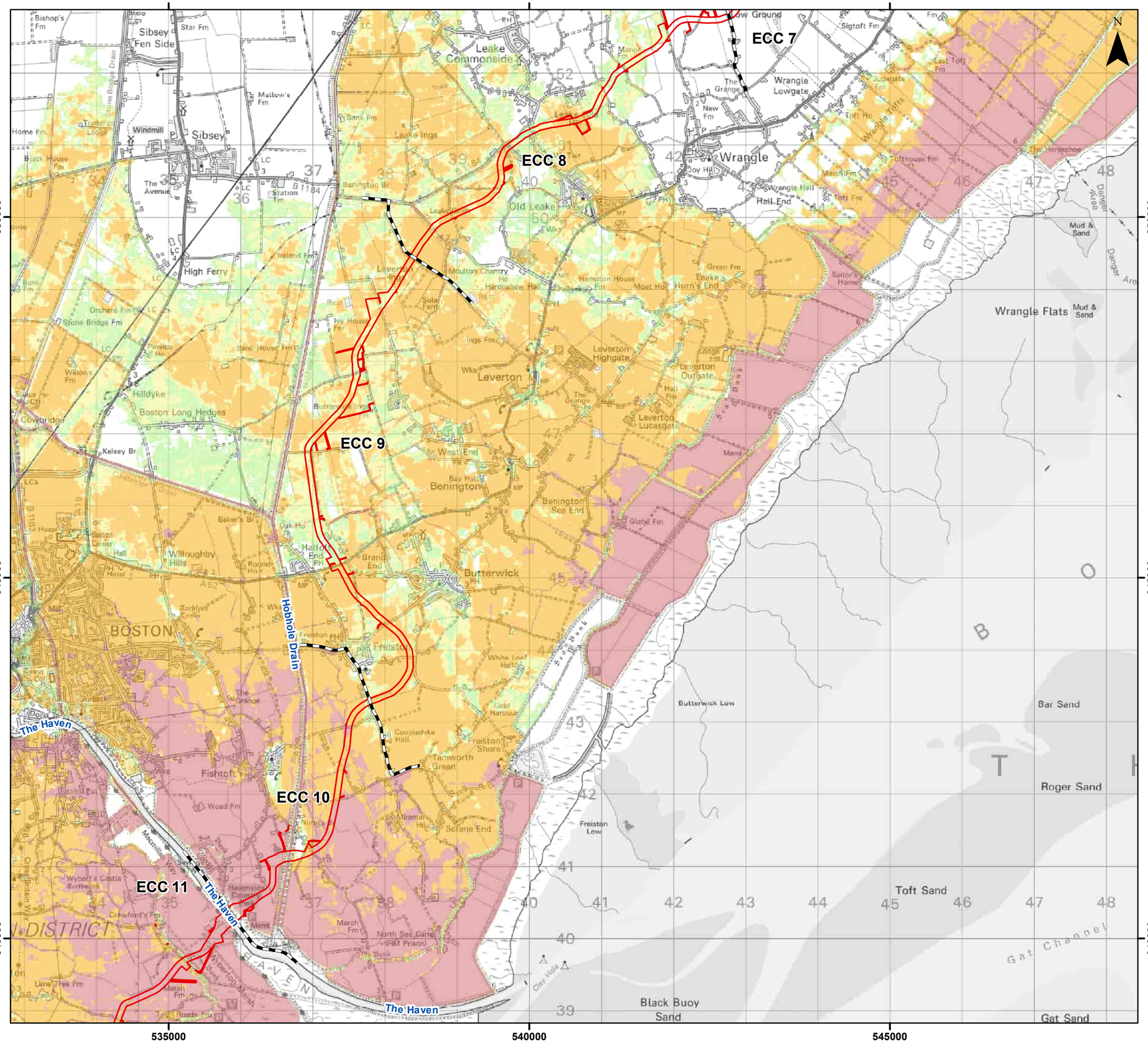

Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Sources:

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.5% AEP

Figure 24.2.9.3 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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Revision: 0.1

SLR

530000 535000 540000

340000 335000 330000

ECC 10
ECC 11
ECC 12
ECC 13
ECC 14

BOSTON DISTRICT
Kirton Meeres
Moulton Marsh
Whaplode Marsh
Holbeach Marsh
The Haven
Hobhole Drain
River Welland
River Glen
Kirton
Frampton
Sutterton
Wigtoft
Gosberton Marsh
Surfleet
Moulton
Holbeach
Fosdyke
The Scalp
Mud & Sand
The Cots
Kirton Marsh
Frampton Marsh
Herring Hill
North Sea Camp (HM Prison)

N

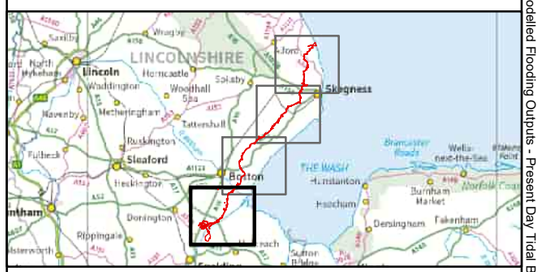
Legend

- Order Limits
- Onshore Segment Break
- Onshore Substation (OnSS) Footprint
- Connection Area
- Area not Included in Export Cable Corridor Flood Risk Assessment

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area



Coordinate System: British National Grid

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Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.5% AEP

Figure 24.2.9.4 (A)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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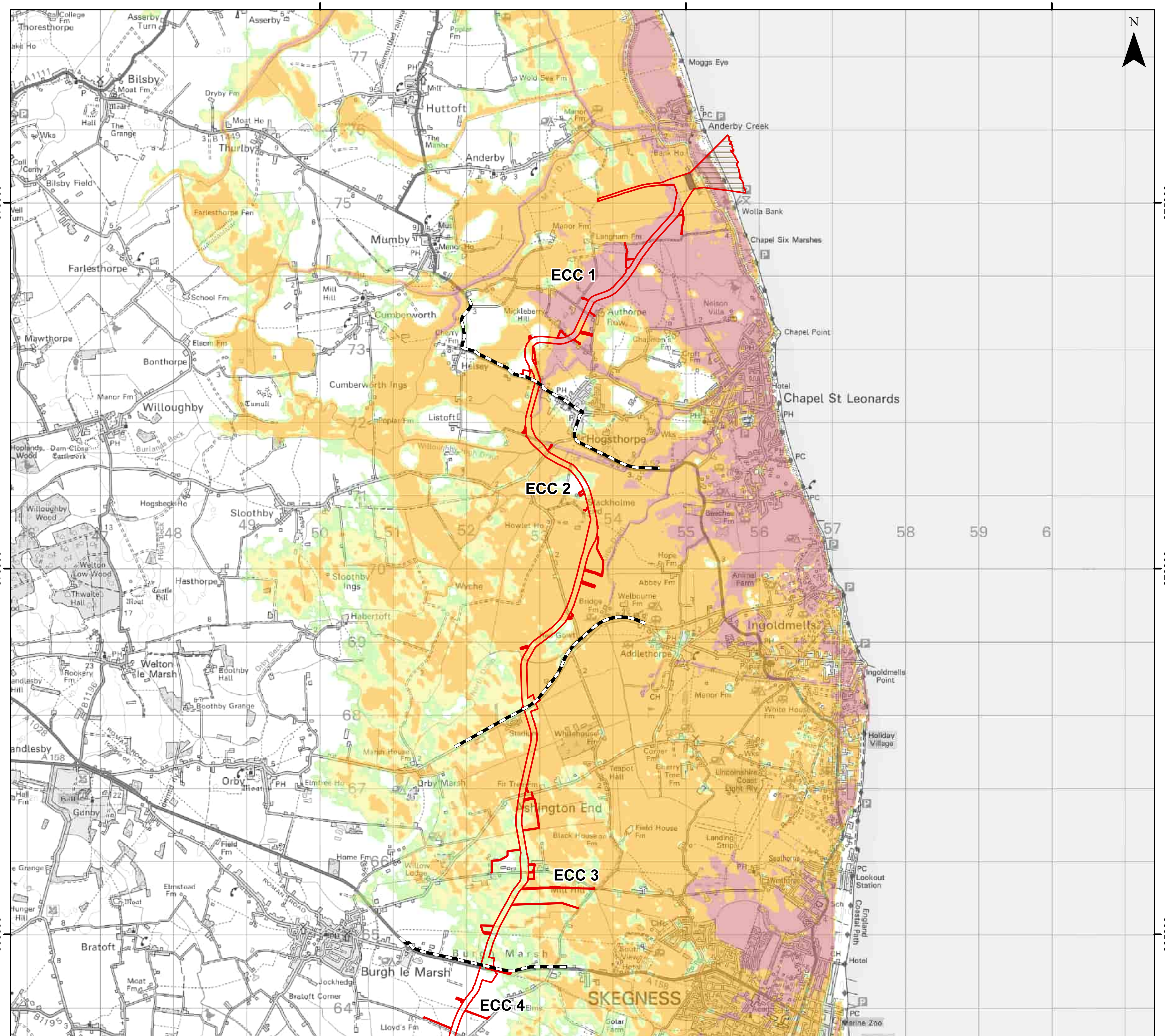
SLR



Legend

- Order Limits
- Onshore Segment Break
- Landfall Trenchless Works Area
- Transition Joint Bay Area

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

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Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.1% AEP

Figure 24.2.9.1 (B)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR

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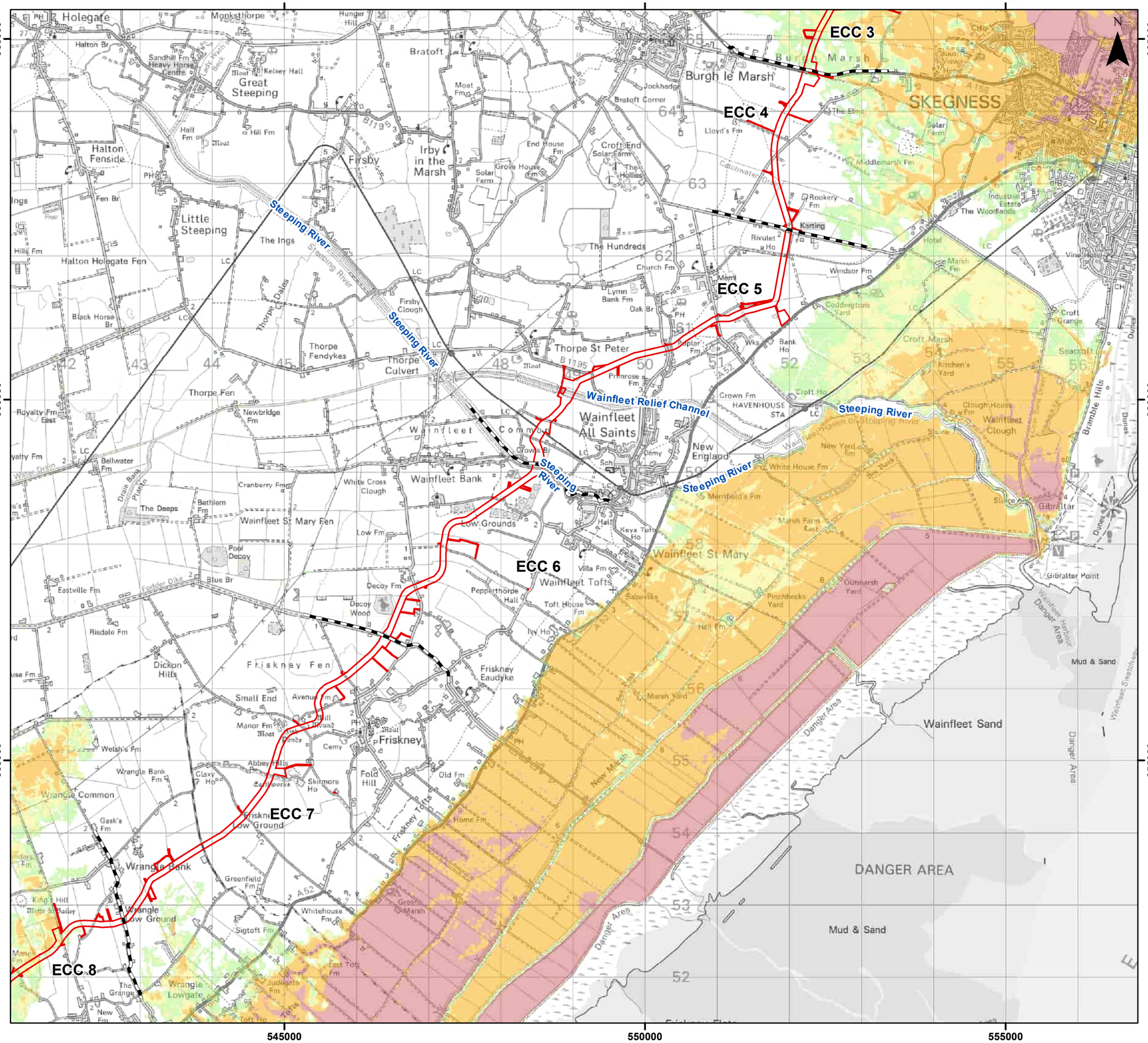


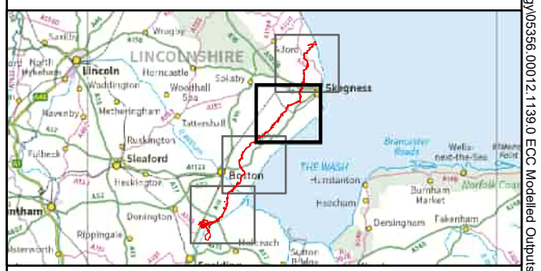
Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area



Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.1% AEP

Figure 24.2.9.2 (B)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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SLR

535000 540000 545000

350000

345000

340000

ECC 7

ECC 8

ECC 9

ECC 10

ECC 11

Hobhole Drain

The Haven

Wrangle Flats Mud & Sand

Bar Sand

Roger Sand

Toft Sand

Black Buoy Sand

Gat Sand

Butterwick Low

Freiston Low

Gat Channel

Danger Area

BOSTON

DISTRICT

HAVEN

N

Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.1% AEP

Figure 24.2.9.3 (B)

OUTER DOWSING OFFSHORE WIND

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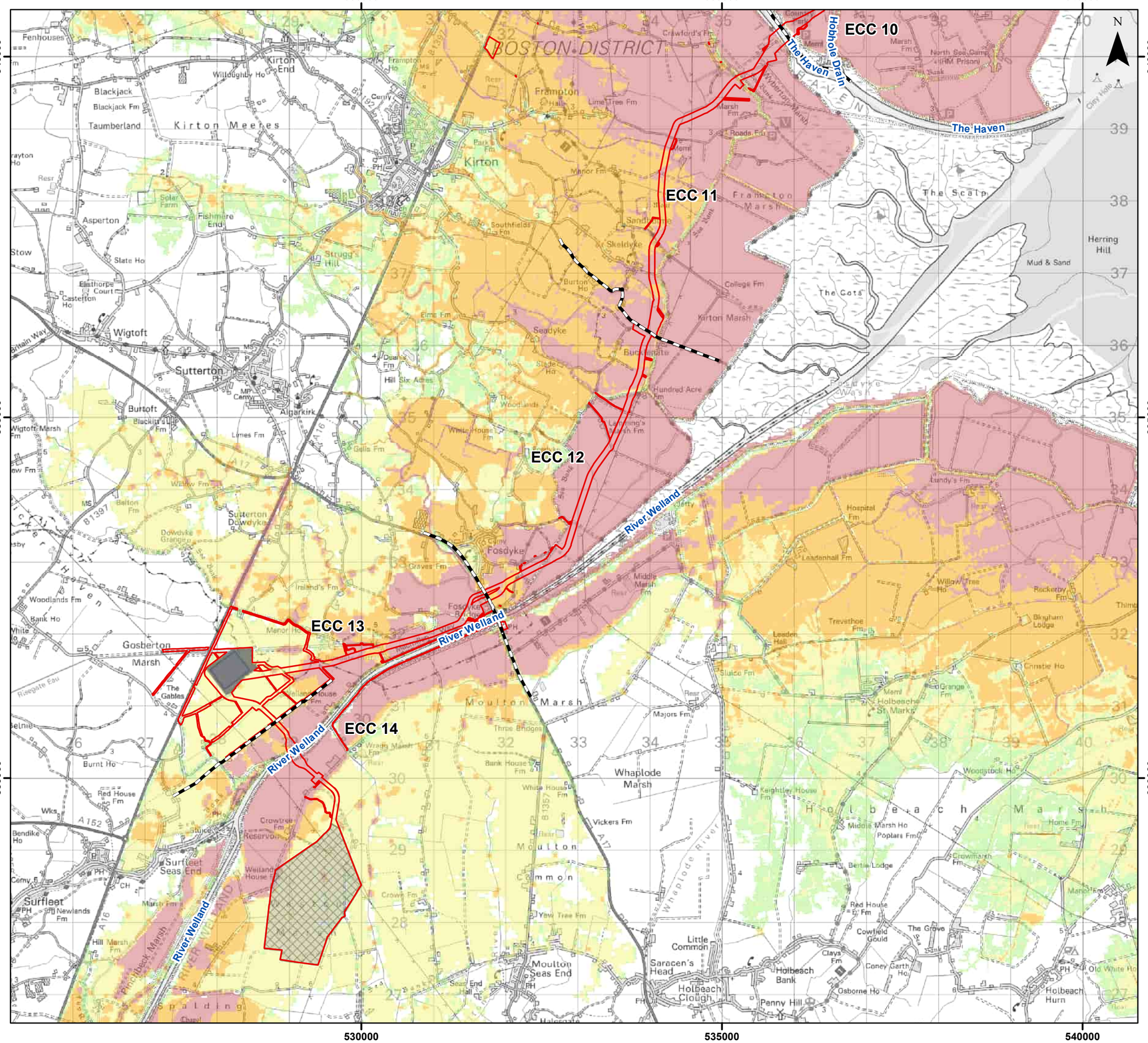

Legend

- Order Limits
- Onshore Segment Break
- Onshore Substation (OnSS) Footprint
- Connection Area
- Area not Included in Export Cable Corridor Flood Risk Assessment

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Sources:

Coordinate System: British National Grid

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Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency Coastal Flood Defence Breach Flood Hazard Mapping 0.1% AEP

Figure 24.2.9.4 (B)

OUTER DOWSING OFFSHORE WIND

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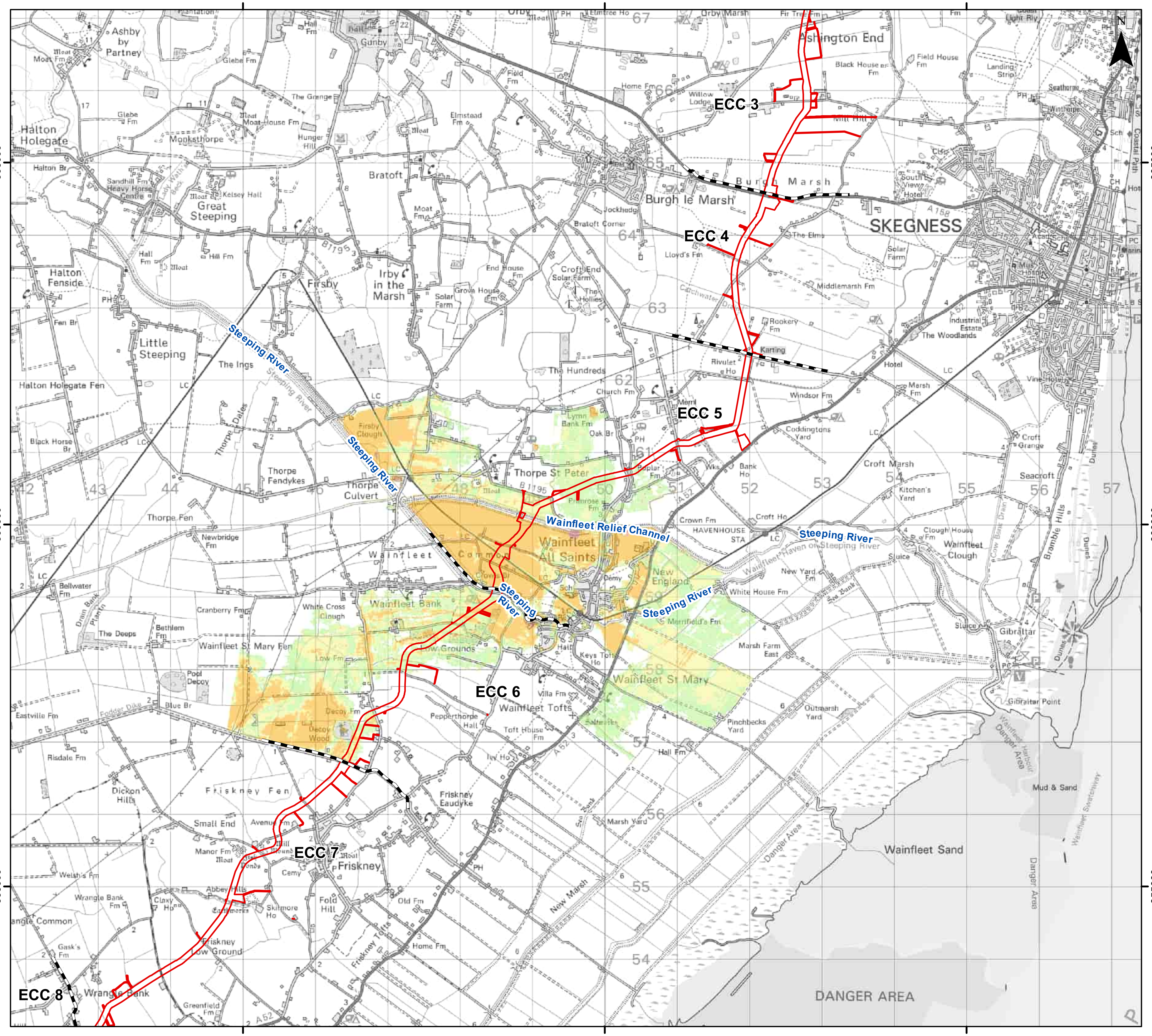

Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.5% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

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Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency River Steeping Flood Defence Breach Flood Hazard Mapping 0.5% AEP
Figure 24.2.9 (C)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
Produced By: JRS
Revision: 0.1

SLR

Document Path: P:\05356 - GoBe Consultants Ltd\00012 GTR4 Outer Dowsing\Tech\GIS\Dwgs\Wking\2024 07 Rel Reps\Hydrology\05356.00012.1138.0 ECC Modelled Outputs - Steeping River Fluvial.mxd

545000 550000 555000

365000 360000 355000

ECC 3
ECC 4
ECC 5
ECC 6
ECC 7
ECC 8

Steeping River
Wainfleet Relief Channel

Ashington End
Burgh Marsh
Burgh le Marsh
SKEGNESS
Halton Holegate
Ashby by Partney
Great Steeping
Little Steeping
Halton Fenside
Irby in the Marsh
Firsby
Bratoft
Thorpe St Peter
Wainfleet All Saints
Wainfleet Tofts
Wainfleet St Mary
Friskney
Friskney Eaudyke
Wainfleet Sand
DANGER AREA

Legend

- Order Limits
- Onshore Segment Break

Environment Agency Flood Hazard Mapping 0.1% AEP

- <= 0.75
- 0.75 - 1.25
- 1.25 - 2
- > 2

Note:
ECC FRA does not include an assessment of the National Grid Substation within the Connection Area

Coordinate System: British National Grid

0 1 2 km

Scale: 1:50,000

A3 Page Size

Environmental Statement

Environment Agency River Steeping Flood Defence Breach Flood Hazard Mapping 0.1% AEP
Figure 24.2.9 (D)

OUTER DOWSING OFFSHORE WIND

Date: 13/09/2024
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24.5.1.3 Temporary Noise Bund Hydraulic Modelling

117. As discussed in Section 24.4.2, a detailed hydraulic modelling report (Noise Bund Hydraulic Modelling Report (document reference: 15.7, version 3)) has been undertaken to clarify the flood risk impacts from the installation of a temporary noise bund at landfall during the construction phase of the Project.

118. The hydraulic modelling was undertaken for both baseline and proposed development scenarios for overtopping and breach of defences. Two breach scenarios were considered; Breach 1 (breach of coastal dunes) and Breach 2 (breach of both coastal dunes and Roman Bank). For planning purposes, the hydraulic modelling for the temporary noise bund has considered the 1in 200 year (0.5% AEP) event, plus an allowance for climate change. In order to check sensitivity to more extreme events, the hydraulic modelling has also considered the 1 in 1000 year (0.1% AEP) event, plus an allowance for climate change.

119. During the overtopping scenarios, the peak flood extents do not reach the noise bund location during the 0.5% AEP event or the 0.1% AEP plus climate change event. This is shown in Figure 3-1 of Noise Bund Hydraulic Modelling Report (document reference: 15.7, version 3).

120. For the Breach 1 scenario (breach of dunes), flood water reaches the location of the noise bund for both the 0.5% AEP and 0.1% AEP plus climate change (up to 2030) scenarios. This is shown in Figure 3-2 of the Noise Bund Hydraulic Modelling Report (document reference: 15.7, version 3)

121. For the Breach 2 scenario, in the event of a breach of both the coastal dunes and Roman Bank, flood water reaches the location of the noise bund for both the 0.5% AEP and 0.1% AEP plus climate change (up to 2030) scenarios. This is shown in Figure 3-3 of the Noise Bund Hydraulic Modelling Report (document reference: 15.7, version 3).

122. As shown in Figure 3-7 of the Noise Bund Hydraulic Modelling Report (document reference 15.7, version 3), during the proposed development the 0.1% AEP plus climate change Breach 2 scenario (worst-case), increases in flood levels are noted to the east and north of the noise bund location. The area of the floodplain where increases in flood level are observed local to the noise bund, these differences are between -10mm to 10mm. It is considered this difference is negligible and therefore will not increase flood risk to any sensitive receptors. A slight reduction in depths is noted to the west of the site. There are no sensitive receptors in the areas of increased flood depths, with the majority of the areas being agricultural fields.

123. In some areas of the modelled floodplain away from the site, in the 0.1% AEP plus climate change Breach 2 scenario, small increases in flood levels between 15mm to 60mm are observed due to the installation of the noise bund. However, it is important to note that these increases are low, are only found in-channel of local water features, and are largely more than 2.5km away from the noise bund. It is not anticipated that these effects will lead to an increase in risk of flooding for any sensitive receptors.

124. It should be emphasised that these changes in flood depths are for the 0.1% AEP + climate change event, where both flood defences are breached, and therefore is an extreme residual risk scenario.

125. It is therefore not proposed that any additional mitigation measures, other than those outlined in Section 24.7.1, are necessary in regard to the noise bund and flood risk.

24.5.2 Flooding from Fluvial Sources

126. As discussed in Section 24.4.1, parts of the onshore ECC could be at risk of fluvial flooding. As part of a data request, the Environment Agency has provided fluvial modelling for River Steeping and Willoughby High Drain, as discussed below.

24.5.2.1 River Steeping

127. The Environment Agency has provided fluvial modelling for the River Lymn-Steeping catchment. This modelling was published by JBA in October 2009 (JBA, 2009) as part of the River Lymn-Steeping Flood Map Improvements Study. The study covers the fluvial River Lymn-Steeping and six of its tributaries (Rain Beck, Double Dike, Partney Beck/Langton Beck, Lady Wath's Beck, Firsby Sewer and Cowcroft Drain) and Wainfleet Relief Channel.

128. The fluvial extent mapping indicates that for the 1 in 100 chance defended scenario (1% AEP event), the onshore ECC is not at risk of flooding from the River Lymn-Steeping. For the 1 in 1,000 chance defended scenario (0.1% AEP event), a small area of the onshore ECC between Collision Lane and Wainfleet Road is at risk of flooding from this source.

129. For the 1 in 100 chance defended scenario plus 20% CC (1% AEP + 20% CC event), there is a small area of the onshore ECC, between Collision Lane and Wainfleet Road which is at risk of fluvial flooding.

130. The fluvial hazard mapping shows higher hazard ratings in the area between Steeping River and Wainfleet Relief Channel, which the ECC crosses.

24.5.2.2 Willoughby High Drain at Wolla Bank

131. The Environment Agency has provided fluvial modelling for Willoughby High Drain at Wolla Bank, where the cable reaches landfall. The fluvial mapping shows that the onshore ECC is not at risk of flooding in this location up to and including the 0.1% AEP + 65% CC event.

24.5.2.3 Willoughby High Drain at Hogsthorpe

132. The Environment Agency has also provided fluvial modelling for Willoughby High Drain at Hogsthorpe. The fluvial mapping shows that the onshore ECC at this location is not at risk of fluvial flooding for the majority of events, except the 1 in 1,000 chance scenario (0.1% AEP event) and the 1 in 1,000 chance scenario plus 25% CC (0.1% AEP + 25% CC event).

24.5.3 Summary of Detailed Assessment of Flood Risk

133. In summary, the onshore ECC is at risk of flooding from breach and overtopping of defences during tidal scenarios, and also limited areas of fluvial risk.

134. The potential changes in flood severity associated with climate change will gradually increase the residual risk along the onshore ECC associated with a breach and overtopping of defences, however, once constructed there will be no surface features in areas at risk and very limited need for personnel to visit the onshore ECC. Arrangements for safe access to the onshore ECC during the construction and operational phases are outlined in Section 24.7.

135. The regular maintenance and management of flood defences by the Environment Agency further assists to reduce the likelihood of flooding. Trenchless construction techniques will be used at the landfall area and to cross other flood defence infrastructure along the onshore ECC, so that the existing flood defences are not compromised, to assist with protecting sensitive features, and to minimise the extent of direct interaction with coastal or estuarine features. The nature of construction techniques to be adopted are outlined in Chapter 3 (document reference 6.1.3). Considering this, the flood risk to the onshore ECC in the event of a breach, overtopping, or fluvial event caused by this Project is likely to be very limited and would only occur during or following a severe weather scenario.

24.6 Sequential and Exception Test

136. As discussed in Section 24.3.1 the majority of the onshore ECC lies within Flood Zone 3a. As detailed in Section 24.1.5 the Project proposals are considered to be 'Essential Infrastructure'.

24.6.1 Sequential Test

137. With reference to the NPPF, the Sequential Test gives preference to locating new development in areas at lowest risk of flooding (i.e. Flood Zone 1). The Environment Agency Flood Map for Planning and Strategic Flood Risk Assessments (SFRAs) are geared to providing the basis for applying this test.

138. The Sequential Test requires developers to:

"…demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed."

139. Details of the sequential test and site selection are addressed in Volume 1, Chapter 6.1.4: Site Selection and Consideration of Alternatives (document reference: 6.1.4).

24.6.2 Exception Test

24.6.2.1 Part One

140. The first part of the Exception Test requires that the Project must demonstrate wider sustainability benefits to the community that outweigh flood risk.

141. The Project is a Nationally Significant Infrastructure Project (NSIP), which is a 1.5 Gigawatt (GW) offshore windfarm off the Lincolnshire Coast. Once completed it will be one of the UK's largest offshore windfarms. It is anticipated to generate renewable electricity equivalent to the annual electricity consumption of over 1.6 million households and will play a critical role in achieving the UK Government's ambition to deliver 50 GW of offshore wind by 2030 and to achieve net zero by 2050. The Project will displace the equivalent of nearly 2 million tonnes CO_2 emissions per year of operation through the generation of renewable electricity.

142. Based on the above, it is therefore considered that the first part of the Exception Test is passed.

24.6.2.2 Part Two

143. To satisfy the second part of the Exception Test, it must be demonstrated that the Project will be safe for its lifetime taking into account the vulnerability of its users and that it will not increase flood risk elsewhere, and, where possible, will reduce flood risk overall.

144. During the operational phase of the onshore ECC, the Project will not be at risk of flooding, and will not increase flood risk elsewhere. The onshore ECC will only be at potential risk of flooding during the construction phase, which could lead to a temporary increase in flood risk elsewhere during this phase. It is proposed that this is managed through appropriate mitigation measures outlined in Section 24.7.1.

145. It is therefore considered that the second part of the Exception Test is passed.

24.7 Flood Risk Mitigation

146. From the analysis of flood risk discussed in Section 24.4 and Section 24.5, flooding of the onshore ECC from any source is considered to be low or negligible due to the nature of the Project, where infrastructure will be buried underground. There is a residual risk of flooding to the onshore ECC from overtopping or a tidal breach of flood defences, however as the cables will be buried underground and not vulnerable to flooding, this risk would only affect the construction and decommissioning phases.

147. Mitigation measures contained within this section are for the onshore ECC. The FRA for the OnSS is provided as a separate document (Document reference 6.3.24.3) which outlines mitigation measures for the OnSS location.

24.7.1 Construction Phase

24.7.1.1 Flood Response

148. The main risk of flooding to the onshore ECC is derived from the residual risk existing from tidal flood defence overtopping or failure and the risk of tidal flooding to any landfall activities on the seaward side of coastal defences during the construction phase. Flood response planning is required for improving the awareness of personnel working on the site for an incoming tidal event and will be beneficial for the areas of the onshore ECC at residual risk from tidal flood defence failure which encompasses the proposed landfall area and the onshore ECC.

149. The full extent of the onshore ECC lies within 'Flood Alert' and 'Flood Warning' areas for coastal flooding and potential flooding from tidally influenced watercourses inland from the coast. It is recommended that the Principal Contractor signs up to the Environment Agency’s 'Floodline' flood warning service for general awareness of an oncoming tidal event in relation to the onshore ECC. The flood response should form part of a wider Emergency Flood Response Plan for the onshore ECC showing which 'Flood Alert' and 'Flood Warning' areas relate to the different segments of the onshore ECC and should include details of actions to be carried out should a warning or alert be received. These actions may include the removal or securing of sensitive plant or equipment and evacuation of personnel from the work area.

150. An Emergency Flood Response Plan for the construction phase will be submitted as part of the final CoCP.

24.7.1.2 Third Party Assets

151. The Environment Agency has a responsibility for inspecting and maintaining the surrounding flood defence infrastructure on a regular basis and the IDBs have responsibility for a number of pumping stations and watercourse crossings along the onshore ECC. Any signs of damage or degradation to third party assets, particularly after an extreme tidal flood event should be reported to the Environment Agency or relevant IDB immediately.

152. In addition to this, the Principal Contractor is expected to liaise with the Environment Agency and relevant IDBs, particularly during the construction phase, where it is expected that the onshore ECC will involve trenchless techniques under flood defences or managed watercourses. This is to ensure the viability of the defences and water channels during the construction works. All works that cross flood defences or Main Rivers will require pre-construction approval of details from the Environment Agency and any works crossing IDB managed watercourses will require approval from the respective IDB.

153. Regular maintenance and clearing of debris from culverts along ordinary watercourses are essential and may require consultation with IDBs during the construction phase to ensure that no blockages are present. All flood defences, watercourses and drainage culverts will be inspected for damage or debris following a flood event. Remedial clearing of gullies and clean-up of debris from working areas may also be required. These maintenance and management measures should be formally incorporated into the site maintenance and management programme with records demonstrating compliance being kept.

24.7.1.3 Surface Water Drainage

154. Prior to commencement of the construction works, a number of surveys and studies will be undertaken to inform the Project of the final design including ecological surveys, geotechnical investigations and drainage assessments.

155. Surface water drainage requirements during construction will be dictated by the final Surface Water Drainage Strategy and will be designed to meet the requirements of the NPPF, NPS EN-1 and NPS EN-5, with runoff limited, through the use of SuDS and infiltration techniques where feasible, which can be accommodated within the onshore ECC area. An outline of the measures to be included in this plan is included in the

application as the Outline Surface Water Drainage Strategy (Document Reference 8.1.5), appended to the Outline CoCP (Document Reference 8.1).

156. The final Surface Water Drainage Strategy will be developed according to the principles of the SuDS discharge hierarchy. Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- Into the ground (infiltration);
- To a surface water body;
- To a surface water sewer, highway drain or another drainage system; or
- To a combined sewer.

157. During construction works there are a number of smaller agricultural land drains and watercourses, along the onshore ECC route, that may be only seasonally wet. Trenched crossings will potentially be used for these watercourse crossings. It will be necessary to ensure that flow along the watercourse is maintained and there is no increase in flood risk as a result of the temporary works.

158. There is a risk of surface water flooding from these smaller agricultural land drains and watercourses and/or the flow routes into them being affected by construction of the onshore ECC. Embedded mitigation measures to intercept and collect flow will be implemented along the onshore cable route to ensure there is no increase in flood risk to off-site receptors. This will typically include pre-construction land drainage and the temporary installation of interceptor drainage ditches parallel to the cable trenches and soil storage areas to provide interception of surface water runoff.

159. The final Surface Water Drainage Strategy will be developed, agreed with regulators, submitted to discharge a requirement of the DCO and implemented to minimise water within the working areas, ensure ongoing drainage of surrounding land and that there is no increase in surface water flood risk. This will assess the current and proposed runoff rates, volume of storage required and the proposed approach for discharge of water from each location.

24.7.1.4 Construction Activities

160. Construction activities along the onshore ECC will include earthwork excavations, the trenching of cables, trenchless cable installation and the introduction of temporary watercourse crossings for the construction haul road.

161. The stockpiling of soils that are excavated to facilitate the trenching works will be managed through a Soil Management Plan, secured by a DCO Requirement. . An Outline Soil Management Plan (Document Reference 8.1.3), has been submitted as part of the DCO. The placement of stockpiles will be such that the stockpiles are set back from existing watercourses as required by the Environment Agency or IDB. Stockpiling will be managed to not present any alterations to local hydrological regimes or present a continuous barrier to overland flow, with regular breaks being created within the stockpiles.

162. Section 24.5.1 and 24.5.2 outline areas along the ECC and 400kV cable that are shown to have hazard class ratings for residual tidal and fluvial flood risk. Stockpiling and other works in all hazard areas will be minimised or avoided where possible in order to mitigate against any increased risk and allow flood flow through and within flood cells, particularly around populated areas (e.g. Wainfleet). Detail with regard to stockpiling and phasing of work will be finalised post-consent. The exact positioning and size of stockpiles will not be known until post-consent detailed design. Stockpiling will be for earth removed from cable trenches locally, and therefore there will be no net loss of volumetric floodplain storage.

163. The temporary noise bund at landfall has been hydraulically modelled, as detailed in the Noise Bund Hydraulic Modelling Report (15.7) and assessed in Section 24.5.1.3 and no mitigation is considered necessary. The noise bund will be formed from soil that is stripped from the working area of the landfall site and as such will be covered under the Outline Soil Management Plan (SMP) (document reference 8.1.3)..

164. Temporary culverts will be the primary method to allow the haul road to cross watercourses and will be installed subject to agreement of the design by the relevant regulatory authority with responsibility for the watercourse being crossed. At some locations, it may be necessary to install temporary bridges where the watercourse is unsuitable for culverting or if this is specifically required by the relevant authority. Where it is necessary for the haul road to cross a main river, a temporary bridge will be installed. Temporary bridges will also be used where the haul road crosses over secondary flood defences and associated drains. Design of each crossing will include consideration of the flow capacity of the channel to be crossed and the routing of exceedance flows should the crossing point become blocked. Temporary culverts and bridge structures will be removed once the cable installation works is completed. The

introduction of temporary culverts and bridge crossings will be designed to not alter hydrological regimes and will not increase flood risk locally. The size and design of culverts will be a matter or pre-construction approval by the relevant IDB.

24.7.2 Operational Phase

24.7.2.1 Cable Resilience

165. The onshore ECC will comprise of buried cables. Link boxes will be present along the cable route in addition to the TJBs at landfall and cable termination at the substation. All elements of the proposed onshore ECC are resilient to water and would not be affected by flooding of land along the onshore ECC corridor. The buried cables (including the link boxes) will be resilient to and not affected by any groundwater and therefore will remain operational.

24.8 Conclusions

166. Based on the information available, the assessment of flood risk at the onshore ECC for the Project finds that it is at risk of tidal flooding (residual risk) through failure of tidal flood defence infrastructure and fluvial flooding. With reference to Environment Agency mapping, the majority of the onshore ECC is indicated to be located within Flood Zone 3a. As the coastal extent of the onshore ECC benefits from the protection of several flood defences, the risk of tidal flooding is reduced, however there is still a residual risk, albeit at a very low probability of flooding via a tidal flood defence failure scenario.

167. Flood risk from all other potential sources is not considered to be significant. The construction methods promote the protection of the current states of the watercourses within the onshore ECC. This includes trenchless construction and trenching methods for smaller watercourses. Trenchless construction will be used at the landfall, so that the existing sea defences are not compromised.

168. No flood risk to the ECC infrastructure is considered likely as the electricity cables will be buried, and are therefore considered resilient to flooding.

169. It is recommended that the Principal Contractor subscribes to the Environment Agency’s 'Floodline' flood warning service to raise awareness of impending tidal event. All flood defences, watercourses and drainage culverts will be inspected for damage or debris following a flood event. Remedial clearing of gullies and clean-up of debris from working areas may also be required.

170. On the basis of well-maintained flood defences, it can be concluded that the onshore ECC is protected from flooding up to and including the 0.5% AEP event. This means that provided flood defences remain effective, the risk of flooding at the onshore ECC site will be equivalent to areas designated as Flood Zone 1, with some limited fluvial risk around watercourses.

171. In conclusion, based on the information outlined within this FRA, the perceived level of flood risk to, and caused by the construction, maintenance, and operation of the onshore ECC is low, and the Project would be safe, without increasing flood risk elsewhere.

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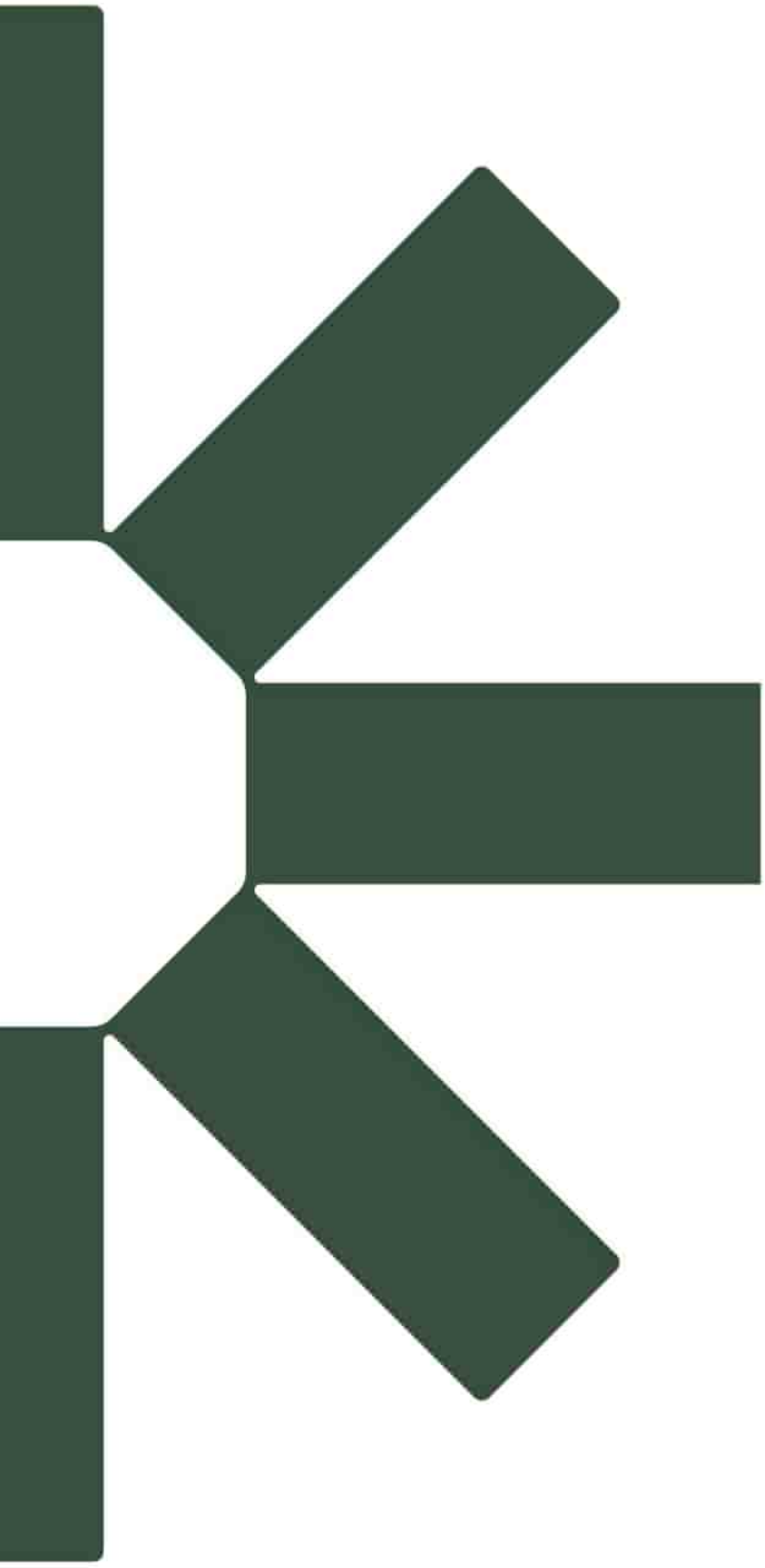

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