Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Volume 4

Annex 3-1: Water Framework Directive Assessment

June 2018, Revision A

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Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm Volume 4

Annex 3-1: Water Framework Directive

June 2018

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Table of Contents

3 Water Framework Directive Assessment

3.1 Background

3.1.1 This annex has been prepared by GoBe Consultants Ltd. to present the findings of the Water Framework Directive (WFD) assessment for the potential impacts of the proposed Thanet Extension Offshore Wind Farm (Thanet Extension). This assessment details the assessment for the transitional and coastal WFD waterbodies. A separate WFD assessment has been included for onshore waterbodies, and is incorporated within Volume 3, Chapter 6: Ground Conditions, Flood Risk and Land Use.

3.1.2 This annex should be read in conjunction with the relevant chapters of Thanet Extension Environmental Statement (ES). This assessment has drawn upon information and assessments provided in:

- Volume 2, Chapter 1: Project Description (Offshore) (Document Ref: 6.2.1);
- Volume 2, Chapter 2: Physical Processes (Document Ref: 6.2.2);
- Volume 2, Chapter 3: Marine Water Quality and Sediment Quality (Document Ref: 6.2.3);
- Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Document Ref: 6.2.5);
- Volume 2, Chapter 6: Fish and Shellfish (Document Ref: 6.2.6);
- Volume 2, Chapter 14: Offshore Designated Sites (Document Ref: 6.2.14);
- Volume 3, Chapter 1: Project Description (Onshore) (Document Ref: 6.3.1);
- Volume 3, Chapter 6: Ground Conditions, Land Use and Flood Risk (Document Ref: 6.3.6);
- Volume 4; Annex 6.3: Underwater Noise Assessment (Document Ref: 6.4.6.3);
- Report to Inform Appropriate Assessment (Document Ref: 5.2); and
- HRA Screening Assessment. (Document Ref: 5.2.1).

3.1.3 The following sections of this document include:

- A summary of relevant legislation and planning policy;
- A description of the methodology for the assessment, including details of the study area and the approach to the assessment of effects;
- A summary of consultation with stakeholders;
- A review of baseline (existing) conditions;
- An assessment of the likely effects for the construction, Operations and Maintenance (O&M) and decommissioning phases of the project, taking into account the measures proposed; and
- Identification of any further mitigation measures or monitoring required in relation to likely significant effects.

3.2 Legislation

3.2.1 The following section provides information on the legislative context of relevance when undertaking an assessment of potential effects in relation to the WFD.

Water Frame Directive

3.2.2 The European Union (EU) WFD (2000/60/EC) was established in 2000 in order to provide a single framework for the protection of surface waterbodies (including rivers, lakes, coasts (up to 1 nautical mile (nm)) and estuaries) and groundwater. Each waterbody has an assigned ecological status (see section 3.9 of this annex). The ecological status is assigned by considering the biological, hydromorphological, chemical and specific chemicals. The different statuses are:

- High;
- Good;
- Moderate;
- Poor; or
- Bad.

3.2.3 The current WFD status for each water body is set out in the 2015 River Basin Management Plans (RBMPs). There are eight RMBPs which covers watercourses and coastal water bodies in England and Wales. The South East RBMP encapsulates the proposed development. This assessment aims to ensure that the proposed development complies with the relevant RMBP's (the South East RBMP) statutory objectives for protected areas and water bodies. The South East RBMP is available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/500473/South_East_RBD_Part_1_river_basin_management_plan.pdf

3.2.4 Monitoring of the aquatic environment in relation to physical, chemical and biological parameters started in 2006 with a view to ensuring a 'good ecological status' of all surface waterbodies. Chemical and biological Environmental Quality Indicators are used and a programme of measures is implemented in order to improve surface waters that do not meet the required status.

3.2.5 The WFD's objective of a "Good chemical status" is defined in terms of compliance with all the quality standards established for chemical substances at European level. The Directive also provides a mechanism for renewing these standards and establishing new ones by means of a prioritisation mechanism for hazardous chemicals. This will ensure at least a minimum chemical quality, particularly in relation to very toxic substances.

3.2.6 The WFD's objective of a "Good ecological status" also requires certain chemical conditions. The chemical requirements include the achievement of environmental quality objectives for discharged Priority Substances and for any other substances liable to cause pollution and identified as being discharged in significant quantities.

3.2.7 The WFD seeks to reduce Priority Substances (20 are Priority Substances and 13 are Priority Hazardous Substances = 33 in total) in the marine environment through the use of the Environmental Quality Standards Directive (EQSD) for discharges and outfalls. Priority substances include benzene, nickel and lead.

3.2.8 Using the Environment Agency (EA) 'Clearing the Waters for All' guidance (Environment Agency, 2016), a WFD assessment of the potential for Thanet Extension to have a significant non-temporary effect on WFD parameters at waterbody level has been carried out. This has been undertaken based on Thanet Extension information detailed within Volume 2, Chapter 1: Project Description (Offshore) (Document Ref: 6.2.1) and Volume 3, Chapter 1: Project Description (Onshore) (Document Ref: 6.3.1).

3.2.9 This assessment is reliant on identifying those effects that are non-temporary. For the purposes of this assessment, non-temporary is defined as:

"Non-temporary: A period of time that is greater than the recommended monitoring period interval as stated by the WFD (2000/60/EC)."

3.2.10 Different monitoring periods are defined for different parameters under WFD. In this assessment, the monitoring period interval is aligned with that of the river basin management plan which is understood to be six years.

Shellfish Waters

3.2.11 The WFD, incorporates the Shellfish Waters Directive which aims to protect and improve water quality and support the growth of healthy shellfish (bivalve and gastropod molluscs) and contribute to good quality edible shellfish.

3.2.12 The original Directive 'Council Directive 79/923/EEC of 30 October 1979 on the quality required of Shellfish Waters (SFWs) as amended by Council Directive 91/692/EEC (further amended by Council Regulation 1882/2003/EC)', known as the Shellfish Waters Directive, was designed to protect the aquatic habitat of bivalve and gastropod molluscan species of shellfish. It sets out standards for various parameters that should be monitored in designated shellfish areas. It has since been superseded by 'Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters'.

3.2.13 The Directive establishes parameters applicable to designated SFWs, as well as indicative values, mandatory values, reference methods of analysis and the minimum frequency for taking samples and measurements. These parameters are set for pH, temperature, salinity and the presence or concentration of certain substances (dissolved oxygen, hydrocarbons, metals, organohalogenated substances, etc.).

3.2.14 The competent authorities for each Member State must take samples from the waters to verify their conformity with the criteria set by the Directive. The following proportions of samples must conform to the established values:

- 100% of the samples for the parameters 'organohalogenated substances' and 'metals';
- 95% of the samples for the parameters 'salinity' and 'dissolved oxygen';
- 75% of the samples for the other parameters; and
- No evidence of harm to the shellfish from organohalogenated compounds.

3.2.15 Additionally, the Directive stipulates that a discharge should not cause increase of suspended solids to exceed 30% above background levels, as shellfish can be adversely affected by the smothering effects of sediment settling.

Bathing waters

3.2.16 The European Union's revised Bathing Water Directive (rBWD) (2006/7/EC) came into force in March 2006 and replaces the current Bathing Water Directive (cBWD) (76/1160/EEC). The rBWD provides more stringent standards than the cBWD and places an emphasis on providing information to the public.

3.2.17 The rBWD has four different classifications of performance, these are:

- Excellent – the highest, cleanest class;
- Good – generally good water quality;
- Sufficient – the water meets minimum standards; and
- Poor – the water has not met the minimum required standards.

3.2.18 The EA measures, monitors and reports the number of certain types of bacteria, which may indicate the presence of pollution, mainly from sewage or animal faeces. *Escherichia coli* (*E.coli*) and Intestinal Enterococci (IE) are bacteria that indicate the presence of faeces. An increase in the concentrations of these bacteria indicates a decrease in water quality. Table 3.1 presents the microbiological standards for the different classifications.

3.2.19 The EA collect approximately 20 samples from each Bathing Water (BW) each year during the Bathing Season (15th May to 30th September in England). An overall classification for the BW is then determined by creating a distribution from the monitoring data for the last four years (4 years x 20 samples = distribution of 80 samples). A separate distribution is calculated for both *E.coli* and IE. The 95th and 90th percentiles values from each distribution are calculated. This then enables the determination of the classification for each bacterium for the BW. Therefore, activities from Thanet Extension have the potential to affect the BWs classifications for up to four years after the proposed activities commence.

3.2.20 If the classification for each type of bacteria is different then the overall compliance of the BW is the lowest classification achieved. For example, if *E.coli* were performing at Good but IE was performing at the Sufficient classification then the BW would be classified as performing as Sufficient.

3.2.21 The status of the BWs within 2 km of the proposed development is presented in section 3.9 of this annex.

Table 3.1: rBWD classifications

Classification	*E.coli*		IE	
	no. per 100 ml	percentile*	no. per 100 ml	percentile*
Excellent	250	95	100	95
Good	500	95	200	95
Sufficient	500	90	185	90
Poor	> 500	90	> 185	90

*A percentile is a measure used in statistics indicating the value below which a given percentage of observations in a group of observations fall.

3.3 Requirements

3.3.1 Consideration of the WFD (2000/60/EC) is required for any Development Consent Order (DCO) application and specifically for Nationally Significant Infrastructure Projects (NSIPs) in coastal and estuarine areas, which have the potential to cause deterioration in the ecological and chemical status of a waterbody or to compromise improvements which might otherwise lead to a waterbody meeting its WFD objectives. The WFD aims to protect and enhance waterbodies within Europe and covers all estuarine and coastal waters out to 1 nm, see Figure 3.1. The information presented herein is provided in support of a DCO application made to the Planning Inspectorate (PINS).

3.4 Consultation

3.4.1 A formal Scoping Opinion was sought from PINS following submission of the Scoping Report (VWPL, 2016). Ongoing consultation post-scoping has been important in the evolution of the project and the parameters for assessment. As part of the Environmental Impact Assessment (EIA) process, ongoing consultation has been undertaken with various statutory and non-statutory authorities, under the auspices of Thanet Extension Evidence Plan (Marine Ecology Technical Review Panel).

3.4.2 In response to Thanet Extension Scoping Report (VWPL, 2016), PINS issued a Scoping Opinion (PINS, 2017). The Secretary of State (SoS) identified a number of issues that could not be scoped out of the assessment at this stage, based on a review of the Scoping Report. The draft WFD assessment was submitted as an annex to the Preliminary Environmental Information Report (PEIR) for section 42 consultation.

3.4.3 The consultation responses relating to WFD which are addressed in this assessment include are presented in Table 3.2.

Table 3.2: Summary of consultation relating to marine water and sediment quality

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
Scoping Opinion	As part of the assessment of water quality affects as outlined in Table 2.5 (in the Scoping Report), the SoS would expect to see specific consideration of the proposed development's construction effects upon bathing waters.	The impacts of the proposed activities for Thanet Extension are considered for all BWs with 2 km of the red line boundary. The key findings are presented in Volume 2, Chapter 3: Marine Water and Sediment Quality; Sections 3.10 to 3.14. A full assessment of the impacts on BWs for the proposed activities for Thanet Extension are presented in paragraph 3.10.27 *et seq.*
	The release of contaminated sediments during construction not scoped out; further analysis of contaminated sediments to be considered.	The release of sediments for all activities including construction will be considered in this assessment in Volume 2, Chapter 3: Marine Water and Sediment Quality; Section 3.10.
	An assessment of the accidental release of contaminants during the construction, O&M and decommissioning phases have been scoped out but in order to provide confidence to the assessment the Environmental Statement (ES) should specify with details the measures to be employed and how they are secured by the DCO.	A full assessment on water quality due to the accidental release of contaminants for all stages of the development are considered in Volume 2, Chapter 3: Marine Water and Sediment Quality; Sections 3.10 to 3.14. Information about the proposed prevention measures are outlines in Volume 2, Chapter 3: Marine Water and Sediment Quality; Section 3.15.
	Reference is made to potential release of contaminants from the former hoverport in landfall option 1 (Pegwell Bay) being considered as part of the onshore assessment of water resources (Section 3.4 of the Scoping Report) and the SoS would also expect to see specific consideration of this as part of	The potential release of contaminant from the former Hoverport is considered in Volume 2, Chapter 3: Marine Water and Sediment Quality; Section 3.9.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	the offshore marine water and sediment quality assessment.	
	The SoS considers that 'changes to water quality' during construction, O&M and decommissioning remain scoped in to the EIA process.	The potential for changes in water quality are assessed for each of the stages of the development (construction, O&M and decommissioning) in Volume 2, Chapter 3: Marine Water and Sediment Quality; Sections 3.10 to 3.14.
	Cumulative effects. The SoS does not agree that marine water and sediment quality effects during construction can be scoped out of the EIA. In particular, these should be considered in conjunction with the other activities as listed in Section 2.14.1 of the Scoping Report.	Cumulative effects resulting from the proposed activities from Thanet Extension are presented in Volume 2, Chapter 3: Marine Water and Sediment Quality; Section 3.13.
Evidence Plan	Proposed that the WFD assessment should be a standalone document and include priority habitats (including saltmarsh). Sediment disturbance and potential impacts on BWs may need to be assessed.	The impacts of the proposed activities for Thanet Extension are considered for all BWs with 2 km of the red line boundary. The key findings are presented in Volume 2, Chapter 3: Marine Water and Sediment Quality; Sections 3.10 to 3.14 of this chapter. A full assessment of the impacts on BWs for the proposed activities for Thanet Extension are presented in paragraph 3.10.27 *et seq.*
	EA requested that invasive non-native species are considered in the assessment, in particular the stepping stone effect from North to South Kent.	A full assessment of invasive non-native species spread or introduction as a result of the proposed activities for Thanet Extension are presented in paragraph 3.10.34.
S42	The Environment Agency confirmed they have no comments on the WFD annex.	N/A
	Natural England confirmed they have no comments on the WFD annex.	N/A

3.5 Project description

3.5.1 This WFD assessment focuses on those elements of Thanet Extension relevant to the offshore/ coastal areas designated for WFD consideration. As such, the construction activities of relevance relate to the proposed activities below Mean High Water Spring (MHWS). An assessment of inland WFD waterbodies is presented in Volume 3, Chapter 6: Ground Conditions, Flood Risk and Land Use (Document Ref 6.3.6). Full detail of the proposed offshore activities is presented in Volume 2, Chapter 1: Project Description (Offshore) (Document Ref: 6.2.1).

3.5.2 A summary of the project description is provided here, to provide a broad overview of the project (drawing on the Project Description Chapters).

3.5.3 Thanet Extension will comprise of Wind Turbine Generators (WTGs) and all infrastructure required to transmit the power generated by the WTGs to the national grid network via the grid connection location at Richborough. It will also comprise any onshore and offshore infrastructure required to operate and maintain the Offshore Wind Farm (OWF) and associated infrastructure.

Thanet Extension will have a maximum of 34 offshore WTGs, which will generate up to 340 MW of power. The project will also have up to four offshore export cables and one Offshore Substation (OSS) (if required) as part of the electricity transmission system. The onshore export cables will be buried for the entirety of the onshore export cable route. A geographical overview of the proposed development and the existing Thanet Offshore Wind Farm (TOWF) is presented in Figure 3.1.

3.5.4 The key components of Thanet Extension are likely to include:

- WTGs;
- OSS (if required);
- Foundations (for WTGs, and OSS if required);
- Subsea inter-array cables linking the individual WTGs;

- Subsea export cables from the OWF to shore;
- Scour protection around foundations and on inter-array and export cables (if required);
- Four Transition Joint Bays (TJBs);
- Up to four onshore export cable circuits (up to 220 kV); and
- One onshore substation including onshore Horizontal Directional Drilling (HDD) infrastructure from substation to National Grid, comprising of four ducts (one per cable circuit).

3.5.5 The general OWF site information is shown in Table 3.3 below.

3.5.6 Of specific relevance to the WFD assessment are those components with the potential for an effect-receptor pathways between the project and WFD waterbodies, as a result of the minimum distance from the array to the coastal waterbodies (approximately 4 km). Therefore, the relevant components are limited to the export cables. The export cables are used for the transfer of power from the offshore substations to the onshore substation. Up to four export cables will be required for Thanet Extension. The offshore export cables shall be located within the Offshore Export Cable Corridor (OECC) and will make landfall in Pegwell Bay. The exact location and orientation of the OECC and landfall shall be determined during an iterative route planning process following the granting of the DCO. The offshore cables will be located wholly within the OECC as presented in Figure 3.1.

3.5.7 The assessment presented in this document covers:

- Screening;
- Scoping stage of the assessment; identifying all potential risks to the relevant receptors associated with the proposed activity/ activities; identifying those receptors which may require further assessment; and
- The impact assessment for parameters which cannot be screened out.

Table 3.3: Basic site information

Parameter	Maximum design envelope
Total site area (array) (km^2)	73
Total OECC area (km^2)	28
Shortest distance from array area to shore (km)	8
Site capacity (MW)	340
Maximum number of WTGs	34
Number of OSS (if required)	1
Onshore cable corridor (approximate length (km))	2.5

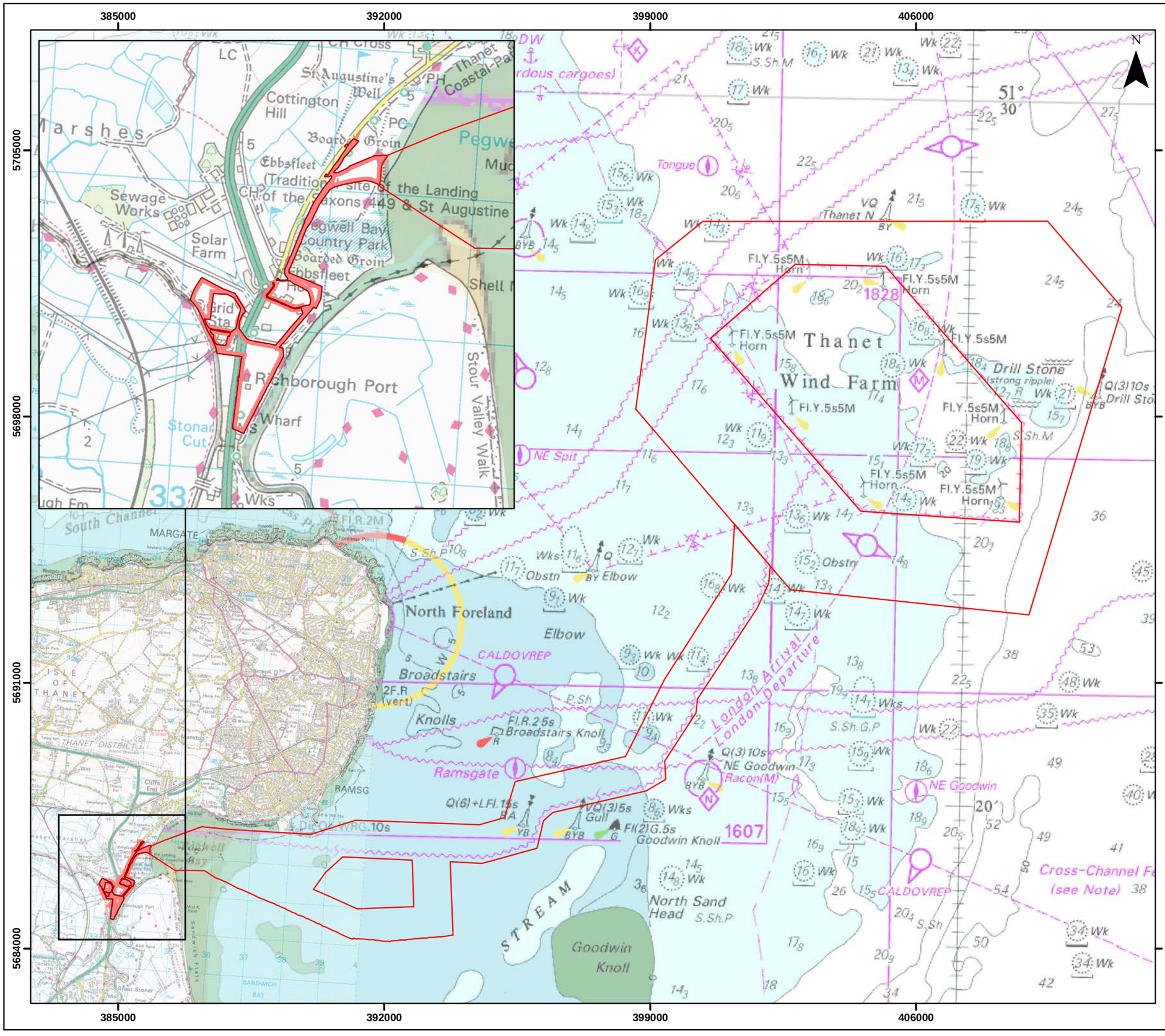

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Figure 3.1

Thanet Extension Development Area.

Legend

- Offshore Red Line Boundary
- Onshore Red Line Boundary

1:100,000 0 1 2 km 0 0.55 1.1 nm

Drg No	TEOW_WFD_Fig.3.1			**Figure 3.1**
Rev	0.1	Date	25/05/2018	
By	RM	Layout	N/A	

3.6 Assessment Methods

3.6.1 The EA is currently aiming to achieve "Good status" in at least 60% of waters by 2021 and in as many waters as possible by 2027. "Good status" comprises two parts. The first is "Good ecological status" (or "Good ecological potential", for waterbodies classed as heavily modified or artificial). The second is "Good chemical status". "Good ecological status/ potential" includes biological, hydromorphological and physicochemical quality elements and specific pollutants. "Good chemical status" concerns a series of Priority Substances, including priority hazardous substances. The WFD also requires that relevant protected area objectives are achieved (EA, 2015).

3.6.2 This WFD Assessment has been undertaken following the latest EA (2016) Clearing the Waters for All guidance for assessing impacts in estuarine (transitional) and coastal waters for the WFD. The guidance has been followed for screening, scoping and impact assessment. Based on the EA (2016) guidelines, a WFD assessment can have up to three stages, with the need to undertake later stages of the assessment dependent on the outcomes of the preceding stages. The three stages are Screening, Scoping and Impact Assessment are described in further detail in the sections below.

Screening

3.6.3 According to the EA Clearing the Waters for All guidance (EA, 2016), Thanet Extension is categorised as a new project (i.e. one which has started after 1st January 2009). As a result, Thanet Extension assessment is not required to include the screening stage and therefore is required to commence at the scoping stage. However, initial screening information is necessary as part of the scoping stage and, therefore, this stage is still often completed in practice in order to inform the WFD scoping. Additionally, screening the construction and O&M activities of projects enables a high level initial assessment of those activities that could impact on compliance parameters within WFD waterbodies.

3.6.4 Screening has been undertaken in this assessment to inform the scoping phase. Screening is presented section 3.9 of this report. Proposed activities of the proposed development are presented in Table 3.8.

Scoping

3.6.5 The scoping stage identifies the receptors that are potentially at risk from the proposed activity and therefore may need impact assessment. At the scoping stage, it is necessary to identify all potential risks to each receptor associated with the proposed activity/ activities. The receptors are:

- Hydromorphology;
- Biology – habitats;
- Biology – fish;
- Water quality;
- Protected areas; and
- Invasive Non-Native Species (INNS).

Impact assessment

3.6.6 Following the Scoping stage, if it is determined that the impact assessment stage is required, the EA (2016) guidance sets out that an impact assessment should be undertaken for each receptor identified as being at risk from the activity. The impact assessment should consider what (if any) pressures the activity may create on the marine environment and specifically the receptors identified. The key aim of the impact assessment is to determine whether there is potential for deterioration in the status of the waterbody receptor.

3.6.7 Deterioration is defined as when the status of a quality element reduces by one class. For example, biological quality elements move from "Good" to "Moderate status". If a quality element is already at the lowest status, then any reduction in its condition counts as deterioration. According to the EA (2016) guidelines, temporary effects due to short-duration activities like construction or maintenance are not considered to cause deterioration if the waterbody would recover in a short time without any restoration measures. Where relevant, mitigation measures should be included to avoid or minimise risks of deterioration.

3.6.8 If the activity may cause deterioration, either of the quality element or supporting habitat, an explanation must be provided of how this deterioration could occur, including consideration of whether the impact is:

- Direct and immediate – it will happen at the same time and place as the activity; or
- Indirect – it will happen later or further away, including in other linked waterbodies.

3.6.9 Where the activity may cause deterioration, alternatives should be considered to minimise the impact, including changes to the materials or substances used, the size, scale or timing of the activity or methods of working and/ or how equipment or services are used.

3.6.10 In addition to assessing the potential for deterioration of the current status of a waterbody, the impact assessment must consider the risk of jeopardising "Good status". Every waterbody has a target status that it is expected to achieve, with an expected date by when this should be achieved. Where the status of a waterbody or quality element is less than good, the impact assessment should consider whether the activity may jeopardise the waterbody achieving to "Good status" in the future. These may include activities which reduce the effectiveness of improvement activities taking place or prevent improvement activities taking place in the future. Details of these improvement activities, or measures, can be found in the River Basin Management Plans (RBMPs).

3.7 Assessment Criteria

3.7.1 This assessment will consider each stage of activity (construction, O&M and decommissioning) of Thanet Extension. Those proposed activities to be considered in terms of their potential impacts on each receptor are as defined in paragraph 3.6.5.

3.7.2 Hydromorphology in this assessment is defined as the physical characteristics of the waterbody, including the size, shape, structure; and for marine bodies the flow and quantity of water and sediment.

3.7.3 Biological habitats (both those designated as higher and lower sensitivity habitats) will be considered if the footprint of activities is any of following:

- 0.5 km² or larger;
- 1% or more of the waterbody's area;
- Within 500 m of any higher sensitivity habitat; or
- 1% or more of any lower sensitivity habitat.

3.7.4 The impacts resulting from the proposed activities on water quality will be assessed for:

- Whether it could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (approximately 14 days);
- Is in a waterbody/ waterbodies with a phytoplankton status of moderate, poor or bad; or
- Whether the waterbody/ bodies have a history of harmful algae.

3.7.5 The impacts will also be considered on WFD protected identified BWs, SFWs and nutrient sensitive areas. As part of the DCO application for Thanet Extension a Habitats Regulation Assessment (HRA) (Report to Inform Appropriate Assessment (RIAA) (Document Ref: 5.2) and its annexes (Document Refs: 5.2.1 and 5.2.2)) has being undertaken to assess the potential impacts on Special Areas of Conservation (SAC), Special Areas of Protection (SPA) and Ramsar sites, and their associated features. This document, which has been considered and agreed under the auspices of the EIA evidence plan, has been referred to where the WFD assessment requires consideration of designated sites.

3.8 Data Sources

3.8.1 The following data sources have been collated and used to inform the assessment:

- EA Bathing Water Classifications;
- The MAGIC interactive mapping tool[1]; and
- Natural England marine evidence database.

3.9 Screening

WFD Waterbodies

3.9.1 WFD bodies for both onshore and offshore have been considered in this assessment. As required under the EA (2016) guidance waterbodies were identified based on the following criteria:

- Any offshore designated site, of relevance to the WFD, within 2 km of the project boundary;
- Any WFD waterbody within 2 km of the project boundary; and
- Any priority habitat within 500 m of the project boundary.

3.9.2 The proposed OWF area and proposed OECC lie within the Kent North waterbody (GB650704510000), and the Stour (Kent) waterbody (GB520704004700) see Figure 3.2.

3.9.3 The screened-in WFD waterbodies and their types are:

- Kent North (Coastal); and
- Stour (Kent) (Transitional).

Protected Areas

3.9.4 All screened-in protected areas are presented in Figure 3.3. Further information about the reasons and features of the designated sites can be found in Volume 2, Chapter 8: Offshore Designated Sites (Document Ref 6.2.8).

[1] Multi-Agency Geographical Information for the Countryside
http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx

3.9.5 As required under the EA (2016) guidance the following designations have been considered in this WFD assessment:

- SAC;
- SPA;
- BWs;
- SFWs; and
- Nutrient Sensitive Waters.

3.9.6 The following sites described below are within 2 km of the project boundary.

Thanet Coast SAC

3.9.7 The Thanet Coast SAC is situated to the west of the OECC and the northern OECC section leading to the landfall partially overlaps with the SAC. Annex I habitats are the primary selection for this site. These primary habitats include:

- Reefs; and
- Submerged or partially submerged sea caves.

Sandwich Bay SAC

3.9.8 The Sandwich Bay SAC is located at the landfall locations of the OECC as shown in Figure 3.3 Annex I habitats are the primary selection for this site. These primary habitats include:

- Embryonic shifting dunes;
- "Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)";
- "Fixed coastal dunes with herbaceous vegetation (grey dunes)"; and
- Dunes with Salix repens ssp. argentea (Salicion arenariae).

Southern North Sea cSAC

3.9.9 The Southern North Sea candidate SAC (cSAC) partially overlaps with the boundary of the array area, with the eastern section of the array area being within the cSAC (see Figure 3.3). A cSAC is a site that has been proposed to the European Commission (EC) as a SAC, but has not yet been adopted. Therefore, this cSAC is not considered within this WFD, as it falls outwith the relevant waterbodies by more than 2 km. However, an assessment of this designated site has been considered with the same protections as a full SAC in the RIAA (Document Ref: 5.2).

Thanet Coast and Sandwich Bay SPA

3.9.10 The Thanet Coast and Sandwich Bay SPA overlaps with both landfall locations of the OECC, see Figure 3.3. The primary designation for this site is to support populations of European importance of migratory species (Turnstone *Arenaria interpres*) (JNCC, 2017).

Bathing and Shellfish Waters

3.9.11 The screened-in BWs within 2 km of the project boundary are:

- Ramsgate Western Undercliffe BW;
- Ramsgate Sands BW; and
- Sandwich Bay BW.

3.9.12 The screened-in SFWs within 2 km of the project boundary are:

- Stour Estuary (Kent) SFW.

3.9.13 All screened-in site BWs and SFWs are presented in Figure 3.4.

Status of relevant waterbodies

3.9.14 The current status of all of the screened-in WFD waterbodies and protected area (BWs and SFWs) are presented in Table 3.4 and Table 3.5 respectively.

The higher and lower sensitivity biological habitat status for the screened-in WFD waterbodies are presented in Table 3.6 and Source: Natural England marine evidence database

3.9.15 Table 3.7 respectively.

Proposed Activities and associated potential impacts

3.9.16 The proposed activities throughout the lifetime of Thanet Extension which may impact on WFD waterbodies are outlined in detail in Volume 2, Chapter 1: Project Description (Offshore) (Document Ref: 6.2.1) and Volume 3, Chapter 1: Project Description (Onshore) (Document Ref: 6.3.1). The potential impacts associated with the proposed activities are presented in Table 3.8.

370000 380000 390000 400000 410000

5700000 5690000 5680000 5670000

N

Kent North

STOUR (KENT)

Kent South

Thanet Wind Farm

Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors

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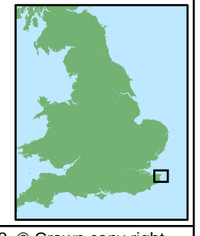
Figure 3.2

WFD Waterbodies in Proximity to Thanet Extension and Assessment Buffers.

Legend

- Offshore Red Line Boundary
- WFD - Transitional Waterbodies
- WFD - Coastal Waterbodies
- 2 km Buffer
- 500 m Buffer
- 1 nm Buffer

Datum: ETRS 1989
Projection: UTM31N

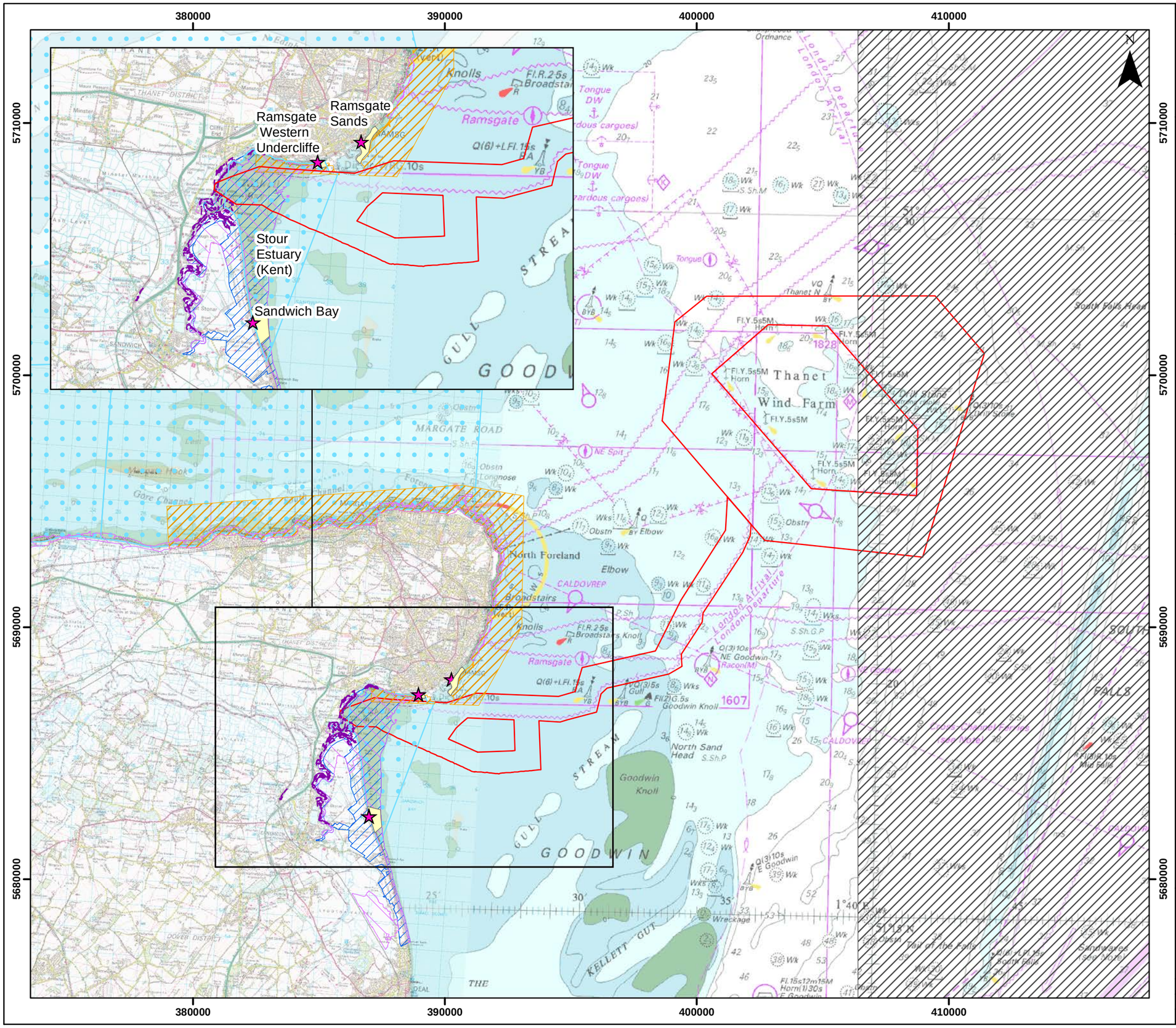


1:150,000 0 1.5 3 km 0 0.85 1.7 nm

Drg No	TEOW_WFD_Fig.3.2			Figure 3.2
Rev	0.1	Date	25/05/2018	
By	PN	Layout	N/A	

THANET EXTENSION OFFSHORE WIND FARM

Figure 3.3
Identified Protected Areas to be Assessed in Scoping.



Legend

- Offshore Red Line Boundary
- BW Monitoring Locations
- BW Designated Polygons
- Saltmarsh Extents (Environment Agency)
- Sandwich Bay SAC
- Thanet Coast SAC
- Thanet Coast and Sandwich Bay SPA and Ramsar Site
- Southern North Sea cSAC (Winter Area)
- WFD - Shellfish Waters

Datum: ETRS 1989
Projection: UTM31N

1:150,000 0 1.5 3 km 0 0.85 1.7 nm

Drg No	TEOW_WFD_Fig.3.3			**Figure 3.3**
Rev	0.1	Date	25/05/2018	
By	PN	Layout	N/A	

Table 3.4: Current status of the identified waterbodies

Waterbody	Kent North	Stour (Kent)
ID	GB650704510000	GB520704004700
Type	Coastal	Transitional
Distance from OECC (km)	0.0	0.0
Distance from array (km)	6.0	14.7
Overall Current Status	Moderate	Poor
Current Status (Ecological)	Moderate	Poor
Current Status (Chemical)	Good	Good
Target Status	Moderate (2015)	Moderate (2027)
Is the waterbody heavily modified (HMWB)?	Yes	Yes
Reason for HMWB	Coastal Protection	Flood Protection
Hydro-morphology status	-	Supports Good
WFD phytoplankton classification	Good	Poor
History of harmful algae	Not Monitored	No

Table 3.5: Current status of the identified BWs and SFWs

Waterbody	Ramsgate Western Undercliffe	Ramsgate Sands	Sandwich Bay	Stour Estuary (Kent)
ID	UK12900	UK12850	UK13000	123
Type	BW	BW	BW	SFW
Distance from OECC (km)	0.1	0.2	0.6	0.0
Distance from array (km)	14.2	12.4	18.5	14.1
Current Classification	Excellent	Good	Excellent	Not currently classified *

Source: Natural England marine evidence database

*As defined in Cefas Classification zone maps

Table 3.6: Higher sensitivity habitats in the identified waterbodies

Waterbody	Biology: higher sensitivity habitats (hectares (ha))			
	Chalk reef (ha)	Mussel beds, including blue and horse mussel (ha)	Saltmarsh (ha)	Subtidal kelp beds (ha)
Kent North	12225.03	58.61	0.80	516.72
Stour (Kent)	-	0.02	120.21	-

Source: Natural England marine evidence database

Table 3.7: Lower sensitivity habitats in the identified waterbodies

Waterbody	Biology: lower sensitivity habitats				
	Cobbles, gravel and shingle (ha)	Intertidal soft sediment (ha)	Rocky shore (ha)	Subtidal rocky reef (ha)	Subtidal soft sediments (ha)
Kent North	10852.22	1709.85	7528.28	2741.26	25184.67
Stour (Kent)	-	396.86	8.05	-	15.67

Source: Natural England marine evidence database

Table 3.8: Potential Impacts from Thanet Extension

Potential effect
Construction
Effects on sediments and sedimentary structures Construction would not alter the geology of the site, particularly the strata which are below the level at which construction activity would occur. There would, however, be localised scour effects in the immediate vicinity of any cable protection required in terms of bed formations. A full assessment of this is presented in Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2).
Accidental Pollution There is a risk of pollution being accidentally released from vessels and machinery used by the project, including construction and installation vessels and from the construction process itself. Such pollution can affect the sediment and water quality, with potential implications for the benthos.
Effects on suspended sediment concentrations and transport There would be short-term increases in suspended sediment levels as a result of ground preparation, cable laying and WTG foundation installation. The methods used for installation would affect the amount of sediment which is displaced, but it is considered that the impacts would be localised and not spread at a significant level outside the footprint of the OWF and therefore not have an impact on morphological conditions.
Resuspension of EQS substances (including bacteria) from sediments There would be short-term increases in suspended sediment and potential EQS substances (if present in sediments) levels as a result of ground preparation, cable laying and WTG foundation installation.
Short-term reduction of saltmarsh habitats Depending on the selected method of export cable installation there may be a permanent reduction of saltmarsh habitat where the cable makes landfall. It is important to note that the location of the potential sea wall extension at the landfall is in an area that is rarely inundated by tidal water and as such it is dominated by *Spartina* and grasses.
O&M
Accidental Pollution There is a risk of pollution being accidentally released from vessels and machinery used by the project, including construction and installation vessels and from the construction process itself. Such pollution can affect the sediment and water quality, with potential implications for the benthos.
Resuspension of EQS substances (including bacteria) from sediments during O&M Should scour occur in the OECC around cable protection this would result in a release of suspended sediment into the water column. EQS substances may be present in the suspended sediments. Scour is considered only for the O&M phase. However, the degree of sediment disturbance will be much reduced when compared to the construction phase.
Potential reduction of saltmarsh habitats Depending on the selected landfall option there may be a permanent loss of saltmarsh habitat.
Effects to hydrodynamic regime (waves and tidal currents) No structures in WFD waterbody (such as cable crossings and the possible extension to the sea wall (under the landfall Option 2) expected to affect the hydrodynamic regime. The extension to the sea wall is in an area that is sufficiently elevated above the wider intertidal area, and is sufficiently small in extent (18.5m at its widest), such that it will not result in an effect on hydrodynamic regime (paragraph 2.10.59, Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2)).
Turbid Wakes An increase in suspended sediment concentrations (SSC) in the wakes of individual WTGs foundations are associated with OWFs including TOWF. The WTGs themselves are not situated within the waterbody however it is possible that these wakes may occur for the entire tidal ellipse distance, approximately 13 km under spring tides, therefore these turbid wakes may be present in the WFD water bodes for some periods of time. These wakes may affect water clarity in the WFD waterbodies.
Potential Artificial Reef Creation It is likely that the manmade structures placed on the seabed, such as at cable crossings, will be colonised by a range of marine species resulting in a localised increase in biodiversity. These structures also have the potential to act as artificial reefs however they may also facilitate the spread of non-native species.

Habitat Loss

Depending on the landfall option selected there may be some temporary and/ or permanent habitation loss. Therefore, to be precautionary this assessment considers the worst-case – Option 2 – Above Ground, see Volume 3, Chapter 1: Project Description – Onshore (Document Ref 6.3.1) for more details.

Option 2 includes, up to four cable trenches will be installed across the intertidal, between Mean Low Water Springs (MLWS) and the edge of the saltmarsh. Up to four trenches will be installed through the saltmarsh. The extension of the sea defences seawards to accommodate the TJB, will result in the permanent loss of part of the saltmarsh habitat in this area (Option 2 only). Option 2 is considered the worst-case in terms of saltmarsh habitat.

The total maximum area of permanent saltmarsh loss due to the sea defences works is predicted to be 1.4 km^2. This equates to 0.13% of the saltmarsh habitat within the study area (including the River Stour). Given that this habitat is widespread and common throughout the area, this represents a very small footprint compared to the overall extent. While the impacts will be permanent, the impacts will be localised.

3.9.17 Table 3.10 provides a summary of the scoping results being considered in the impact assessment.

Table 3.9: Scoping assessment

Activity	Scoped in for impact assessment?	Risk issue(s)
Section 1: Hydromorphology		
Hydromorphology		Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a waterbody at high status	No	As noted above the extension to the sea wall is such that it will not impact the hydromorphology of the water body. The only project infrastructure that could result in effects on hydromorphology (i.e. WTG foundations) are outside the 2 km screening distance for inclusion within the WFD assessment. Furthermore, effects associated with WTG foundations are assessed as not significant in EIA terms (Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2)).
Could significantly impact the hydromorphology of any waterbody	No	N/A – as above
Is in a waterbody that is heavily modified for the same use as your activity	No	Both of the waterbodies are heavily modified for Coastal Protection and Flood Protection (Kent North and Stour (Kent) respectively). However, these waterbodies have not been modified for the purpose of renewable energy. Therefore, no further consideration of the potential impacts associated with the project is required.
Section 2: Biology		
Habitats		Biology habitats risk issue(s)
0.5 km^2 or larger	Yes	The installation of Thanet Extension project parameters of relevance to the WFD assessment (i.e. within 2 km of the waterbody) results in an interaction of approximately 13.2 and 2.5 km^2 for Kent North and Stour (Kent), respectively.
1% or more of the waterbody's area	Yes	Assessment undertaken using Geographical Information System (GIS) software to determine percentage area of the Kent (North) WFD waterbody intersected by the project boundary. The proposed OECC encompasses more than 1% of both the Kent (North) (approximately 3%) and Stour (Kent) (approximately 46%). It is noted however that the direct effects will be considerably smaller in extent than this (i.e. each cable trench will be 10 m wide rather than the OECC width of approximately 1 km). The potential effect in relation to the waterbody and specific higher and lower sensitivity receptor is therefore considered in paragraph 3.10.2 *et seq*.
Within 500 m of any higher sensitivity habitat	Yes	Saltmarsh is within 500 m of the project boundary (see Figure 3.3). This habitat will be assessed in the impact assessment within the Stour (Kent) waterbody. Furthermore, areas of subtidal kelp beds and subtidal chalk reef are identified in the Kent North waterbody.
1% or more of any lower sensitivity habitat	No	The OECC crosses areas of intertidal soft sediment in the Stour waterbody, and areas of subtidal soft sediment, and subtidal rocky reef within the Kent North waterbody. As noted below in paragraph 3.10.2 *et seq.* the interaction with the features is all below the 1% threshold.
Fish		Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	No	N/A

Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	No	The proposed activities for Thanet Extension will not cause a physical barrier to prevent fish from entering the Stour estuary or their migration patterns. There will be no physical barriers placed within the either WFD waterbody. The presence of the export cable buried in the seabed will not affect current speeds and will worst-case result in a minor reduction in terms of total water depth at cable crossings. Therefore, in terms of changes to water depth and changes in currents (both tidal and non-tidal) are not considered to be significant and are not considered to impact on normal fish behaviour, such as, movement, migration or spawning. The minimum distance between the SELcum (186 dB re 1 µPa^2s) contour for piling within the array and the Kent (North) waterbody is approximately 4.2 km (approximate 2.2 nm). Volume 2, Chapter 6: Fish and Shellfish (Document Ref: 6.2.6) presents full details of the noise modelling undertaken to determine the potential impacts of noise and vibration on fish receptors as a result of the proposed activities for Thanet Extension. There will not therefore be a significant non-temporary effect at the scale of the waterbody, and as such there is not predicted to be a deterioration in the status of this waterbody receptor (fish). There will not be any outfalls or discharges and so the proposed activities are not expected to cause a reduction in the dissolved oxygen in the water column. Therefore, this will not be taken forward as a consideration of the impact assessment.
Could cause entrainment or impingement of fish	No	N/A
Section 3: Water quality		
Water Quality		Water Quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	Yes	There would be short-term increases in suspended sediment levels as a result of ground preparation and cable laying. The methods used for installation would affect the amount of sediment which is displaced, but it is considered that the impacts would be localised and not spread at a significant level outside the footprint of the project boundary and therefore will not have an impact on morphological conditions. This may affect water clarity and potentially nutrient and microbial patterns during the construction period. It is not anticipated that temperature or salinity will be affected as a result of any of the proposed activities for Thanet Extension. Therefore, these parameters will not be taken forward to the WFD impact assessment. Should scour occur in the OECC, this would result in a release of suspended sediment into the water column. In addition, turbid wakes may result in a change of suspended sediment concentrations throughout the water column. EQS substances may be present in the suspended sediments.
Is in a waterbody with a phytoplankton status of moderate, poor or bad	Yes	The Stour (Kent) is currently achieving Poor status for phytoplankton. Both Kent (North) and Kent (South) waterbodies are currently achieving Good Status. Therefore, only the Stour (Kent) waterbody will be assessed for phytoplankton.
Is in a waterbody with a history of harmful algae	No	This has not been monitored for the coastal waterbodies and the Stour (Kent) waterbody does not have a history of harmful algae, see Table 3.4.
Release of chemicals which are on the EQSD list	No	N/A – the proposed activities will not discharge chemicals listed under the EQSD. Therefore, the project will not have a mixing zone for these chemicals.

Disturbance of sediment with contaminants above Cefas Action Level 1	Yes	Contaminant analysis was undertaken by Fugro EMU (Fugro, 2017; Volume 4, Annex 5.1 (Document Ref: 6.4.5.1)) in the Kent North waterbody (sample CR10). The results of the metals analysis showed that metal concentrations in sediment samples were below the marine sediment quality guidelines for most of the metals included in the analysis. The only exception was arsenic (60.1 mg/kg dry weight), concentrations of which was below the Clean Seas Environment Monitoring Programme (CSEMP) (2012) guideline levels for Effects Range Medium (ERM), but above the Effects Range Low (ERL), and between Cefas Action Level 1 and 2 (AL1; AL2). Site specific sampled have also been undertaken by MESL Ltd., in the summer of 2017, in the Pegwell Bay subtidal area (within the Kent (North) waterbody). No samples were found to exceed the Cefas Action Level 1 standards. Therefore, sample CR10 may be for a localised area of arsenic potentially from a point source. Samples taken within the intertidal area, during the MESL surveys, were assessed for PCBs and determined to be below the limit of detection.
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if the chemicals released are on the Environmental Quality Standards Directive (EQSD) list.	N/A	The proposed activities will not discharge chemicals listed under the EQSD. Therefore, the project will not have a mixing zone for these chemicals.
Section 4: WFD protected areas		
WFD protected areas		Protected areas risk issue(s)
Within 2 km of any WFD protected area?	Yes	• BWs - Ramsgate Western Undercliffe, Ramsgate Sands and Sandwich Bay. • SFWs - Stour Estuary (Kent). • Natura 2000 Habitats - Thanet Coast SAC, Sandwich Bay SAC and Thant Coast and Sandwich Bay SPA.
Section 5: Invasive non-native species (INNS)		
INNS		INNS risk issue(s)
Potential to introduce or spread INNS	Yes	It is likely that the manmade structures placed on the seabed will be colonised by a range of marine species resulting in a localised increase in biodiversity. These structures also have the potential to act as artificial reefs however they may also facilitate the spread of non-native species if these species are already present. The structures and associated vessels during construction will not in and of themselves act as a vector for INNS. During the Nemo ecology surveys (Nemo Link, 2013) only one non-native species was identified during the subtidal benthic survey. The slipper limpet *Crepidula fornicata* was identified within the sample from Trawl B03-002. *C. fornicata* is a gastropod mollusc introduced to Europe in 1872, and has since spread throughout the south and south-east of the UK. The species is known to compete with other filter-feeding invertebrates for food and space, and in waters containing high suspended fines, it encourages deposition of mud (Eno et al., 1997). For these reasons, *C. fornicat*a is considered a pest on commercial oyster beds. The amphipod crustacean *Corophium spp*., and the molluscs *Ensis spp*. and *Mya spp*. were also identified, thus the presence of the non-native species *Corophium sextonae*, *Ensis americanus* and *Mya arenaria* could not be eliminated. The common cord-grass *Spartina anglica*, identified around the proposed northern landfall side during the TOWF intertidal survey, is a non-native hybrid species that arose from a crossing between the native small cord-grass *S. maritime* and the introduced smooth cord-grass *S. alterniflora. S.anglica* was planted in the past to aid the stabilisation of intertidal mudflats, but is generally considered to be a negative conservation feature and several attempts have been made to control its spread (JNCC, 2011).

Table 3.10: Summary of the scoping assessment

Receptor	Potential risk to receptor?	Waterbody/ bodies identified/ Protected Area	Note the risk issue(s) for impact assessment
Hydromorphology	No	N/A	N/A

Biology: habitats	Yes	• Saltmarsh Habitat (see Figure 3.3);
		• Stour (Kent) (Transitional); and
		  ○ Saltmarsh; and
		  ○ Intertidal soft sediments.
		• Kent North (Coastal).
		  ○ Saltmarsh;
		  ○ Intertidal soft sediments;
		  ○ Subtidal kelp beds;
		  ○ Subtidal chalk reef; and
		  ○ Subtidal soft sediment.
			Cable installation will result in direct and indirect effects upon the features identified.

Biology: fish	No	• Kent North (Coastal); and • Stour (Kent) (Transitional).	N/A
Water quality	Yes	• Kent North (Coastal); and • Stour (Kent) (Transitional).	• Water Clarity; • Nutrients; • Microbial properties; and • Phytoplankton (Stour (Kent) only).
Protected areas	Yes	• Thanet Coast SAC; • Sandwich Bay SAC; • Southern Northern Sea cSAC; • Thant Coast and Sandwich Bay SAC; • Ramsgate Western Undercliffe BW; • Ramsgate Sands BW; • Sandwich Bay BW; and • Stour Estuary (Kent) SFW.	All within 2 km of the proposed development.
Invasive non-native species	Yes	• Kent North (Coastal); and • Stour (Kent) (Transitional).	Potential to introduce or increase the spread of INNS.

3.10 Impact Assessment

Biology – Habitats

3.10.1 This assessment has drawn upon information and the assessments undertaken in Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Document Ref: 6.2.5). Please refer to this chapter alongside this assessment for further detail. In order to be precautionary the option for landfall with the greatest potential for impact therefore both Option 2 – Above ground and Option 1 - HDD have been considered in this assessment for saltmarsh and the intertidal respectively below.

3.10.2 A maximum of four cable trenches will be installed across the intertidal, between MLWS and the edge of the saltmarsh. Trench width will be up to 10 m wide, with burial up to 3 m below the seabed. There will be an offshore cofferdam or link floats will be used to contain the drilling mud, the maximum area of this will be 1600 m^2. The maximum temporary disturbance within the waterbody will therefore be 0.0016 km^2, which represents a total temporary disturbance of 0.04% of the intertidal soft sediment within the Stour (Kent) waterbody.

3.10.3 Up to four trenches will be installed through the saltmarsh. The trenches will be 1 m wide, with 5 m either side to be used for vehicle movement and spoil. A cofferdam will be installed for both Options 2 and 3 in the saltmarsh. This will result in a maximum working area of up to 0.0047 km^2 in the saltmarsh. This results in a total temporary disturbance of 0.4% of the available saltmarsh habitat within the Stour (Kent) waterbody (120 ha).

3.10.4 The extension of the sea defences seawards to accommodate the TJB will result in the permanent loss of part of the saltmarsh habitat in this area, if this option is selected. This option is considered the worst-case in terms of saltmarsh habitat.

3.10.5 The total maximum area of saltmarsh loss due to the sea defences works is predicted to be 1398.9 m^2. This equates to 0.13% of the saltmarsh habitat within the benthic study area (defined as the area of the Sandwich Bay Ramsar) or equates to 0.12% of the saltmarsh present within the Stour (Kent) waterbody. Given that this habitat is widespread and common throughout the area, this represents a very small footprint compared to the overall extent. While the impacts will be permanent, the impacts will be localised; therefore, the magnitude of the impact is assessed as low.

3.10.6 The saltmarsh habitat within Pegwell Bay varies in quality throughout the region (TOWF ES, 2004), with the saltmarsh habitat within the vicinity of the landfall location being considered of lower biodiversity than the habitat found further north around the hoverport (Evidence Plan meeting – 26th May 2017). Saltmarsh is a common feature at the top of the intertidal area to the west of the old hoverport, with the quality of the saltmarsh increasing to the south of the Stour, with patchier, less diverse assemblages being found to the north of the Stour.

3.10.7 A site specific extended Phase 1 intertidal survey (MESL Ltd, July, 2017 (Document Ref: 6.4.5.2)) was carried out at the proposed landfall location for the offshore export cables at Pegwell Bay in Kent. The scope was agreed under the Evidence Plan and provides adequate coverage for the purposes of EIA inclusive of the sensitive saltmarsh habitats within the upper intertidal and the designated habitats of the lower intertidal; between MHWS and MLWS. Standard Phase 1 survey methods were followed (Davies *et al*., 2001, Wyn & Brazier, 2001 and Wyn *et al*., 2000).

3.10.8 It was identified during the TOWF ES intertidal surveys that the saltmarsh to the north of the Stour was of lower quality and this is still the case due to the dominance of *Spartina* sp. rather than the more biodiverse *Salicornia* sp. which is present elsewhere in the region. This suggests that the saltmarsh to the north of the Stour estuary, at the location of the landfall, is unlikely to develop to the same quality as to the south, given that the quality of the northern saltmarsh has not increased in the 12 years between the TOWF surveys and Thanet Extension surveys.

3.10.9 As part of the mitigation measures embedded into Thanet Extension development, prior to construction, a Saltmarsh Mitigation, Reinstatement and Monitoring Plan will be produced which will detail how trenched material will be stored in order to facilitate reinstatement. A Saltmarsh Mitigation, Reinstatement and Monitoring Plan has been drafted to accompany this DCO application (Document Ref: 8.13).

3.10.10 The impacts to the saltmarsh will be localised and short-term and the Saltmarsh Mitigation, Reinstatement and Monitoring Plan will ensure that impacts are kept to an absolute minimum; therefore, the magnitude of the impact is assessed as low for saltmarsh within the intertidal.

3.10.11 Impacts to the saltmarsh in this region from the installation of cables is well known from TOWF and the recovery of the saltmarsh is known to be rapid (full recovery within two years) based on the post-construction monitoring undertaken for TOWF. Recent monitoring surveys indicate that following the TOWF installation the saltmarsh feature reverted to its pre-construction status with no significant change being found after two years. While the tolerance (resistance) of the habitat to disturbance from the installation of the cables (and presence of vehicles) will be none, the recoverability (resilience) would be classed as high based on the MarESA assessments. This results in a sensitivity assessment of medium.

3.10.12 The magnitude of the impact (taking the embedded mitigation into consideration) has been assessed as low for the area of saltmarsh which will be permanently lost as this area represents < 1% of the available habitat in an area which is recognised as saltmarsh of a lower quality due to the elevation above the wider intertidal area and the domination of *Spartina* sp. and grasses rather than the areas of *Salicornia* to the north of Pegwell Bay. Whilst this will represent a non-temporary effect on the waterbody the scale of effect is not considered significant, therefore there will not be a significant non-temporary effect on this component of the waterbody. As such there is not predicted to be a deterioration in the status of this waterbody receptor.

3.10.13 The temporary disturbance of the wider area of saltmarsh during cable installation represents a temporary disturbance of the available habitats within the waterbody. The effect is temporary with monitoring surveys in the area identifying that recovery potential is high, with recovery within five years. The effect is therefore considered to be temporary and not significant at the scale of the waterbody.

3.10.14 There will not be a significant non-temporary effect at the scale of the waterbody, and as such there is not predicted to be a deterioration in the status of this waterbody receptor.

Water Quality

Water Clarity

3.10.15 Closer to the shore, there is potential for cable installation to occur around areas of chalk producing sediment plumes. However, as part of TOWF monitoring programme, (Thanet Offshore Wind Limited (TOWL), 2009) field testing was undertaken of the cable installation plough to be used in the chalk bedrock geology that outcrops the seabed throughout much of the study area to monitor the development of dispersion of sediment plumes. The plume was over-flown once a day for a month that the plume was visible to allow temporal and spatial analysis. The monitoring concluded that the levels of suspended sediment observed as a result of the cable share plough trial appear to be relatively minor in comparison to the natural background levels of suspended sediment observed at the time of the surveys. Therefore, as a result of the short-term temporary nature of the export cable installation, the impact of installing the cables in the discrete areas of chalk bedrock or other geological formations in the vicinity of the proposed OECC is not anticipated to have a significant non-temporary impact on water clarity at the scale of the waterbody. As such there is not predicted to be a deterioration in the status of this waterbody receptor.

3.10.16 Turbid wakes (wake features additionally characterised by an elevated level of turbidity relative to water immediately outside of their local footprint) have been observed at the Thanet, London Array and Greater Gabbard OWF in the outer Thames estuary. Similar features have also been noted for other OWFs in the waters of Germany, The Netherlands and Belgium, suggesting that this is a general phenomenon associated with the placement of these structures in the sea (Forster, 2017). Turbid wakes are expected to occur within Thanet Extension. Full details of turbid wakes are presented in Volume 2, Chapter 2: Physical Processes (Document Ref: 6.2.2).

3.10.17 According to the *in situ* measurements from Forster (2017) as well as the satellite data presented in Vanhellemont and Ruddick (2014) the SSC/ SPM in the surface waters of the turbid wakes at TOWF is typically between about 10 and 30 mg/l above background levels. The relative contrast in SSC between inside and outside of the turbulent wakes is likely to vary, in response to natural variability in the naturally present magnitude and vertical distribution of SSC in both the nearbed and elsewhere in the water column.

3.10.18 Therefore, the presence of turbid wakes are not considered to be significant in terms of water clarity within or surrounding the turbid wakes. Any potential interaction with the waterbody will be of such a *de minimis* scale that there is not predicted to be a deterioration in the status of this waterbody receptor.

Nutrients, Contamination & Microbiology

3.10.19 Microbiology is considered in detail for the relevant receptors (BWs and SWs) in paragraph 3.10.26 *et seq*.

3.10.20 An assessment of subtidal sediment contamination was undertaken in Volume 2, Chapter 5, Benthic Subtidal and Intertidal Ecology and Volume 2, Chapter 3: Marine Water and Sediment Quality. Contaminant analysis was undertaken by Fugro EMU (Fugro, 2017; Volume 4, Annex 5.1) (Documents Refs: 6.2.5, 6.2.3 and 6.4.5.1). The results of the metals analysis showed that metal concentrations in sediment samples were below the marine sediment quality guidelines for most of the metals included in the analysis. The only exception was arsenic, concentrations of which was below the CSEMP (2012) ERM, but above the ERL, and between Cefas Alert Level 1 and 2 (AL1; AL2).

3.10.21 Natural sources of arsenic in the marine environment include (but are not limited to) remobilisation and erosion of arsenic-rich rocks (Research Council of Norway, 2012), which vary naturally according to local geology. Anthropogenic sources include mining and smelting (Research Council of Norway, 2012) as well as the burning of fossil fuels (ICES, 2004). Due to the high natural occurrence of this metal, it is often difficulty to precisely discern between natural and anthropogenic sources of this metal (OSPAR, 2005). However, high arsenic concentrations in the outer Thames Estuary, as well as the south-west Dogger Bank and Norfolk may be associated with a history of arsenical waste disposal in the Thames estuary (Whalley et al., 1999). The arsenic concentrations in the Fugro study (Fugro, 2017) were within the range reported for the southern North Sea: < 0.5 mg kg^{-1} to 135 mg kg^{-1} of dry weight arsenic (Whalley et al., 1999). Quantifiable, but below the standards, concentrations of cadmium and mercury at station WF47 (Volume 4, Annex 5.1), within the north-western end of the development site, may be associated with the high mud content at this station, as finer sediment offers a larger surface area to volume ratio for metals to adsorb (and conversely, to desorb) (Davies, 2004).

3.10.22 Cadmium and mercury in the marine environment are predominantly of anthropogenic origin (United Nations Environment Programme, 1990), with rivers being the dominant sources compared to direct discharge (OSPAR, 2005). Sediment hydrocarbon concentrations were below the limit of detection in samples from three out of the seven stations investigated and, where quantifiable, concentrations were below the Canadian marine sediment quality guidelines and are therefore unlikely to pose a threat to the marine environment. Polychlorinated bisphenyls and organotins levels were considerably below the limit of detection in all samples.

3.10.23 The total area that is likely to be disturbed by construction activities, and therefore the potential volume of material disturbed, resulting in the potential release of sediment bound contaminants, is small and localised in extent. In addition, the nature of the subtidal sediments is predominantly coarse, typically with low levels of fines adhering to them. Following disturbance as a result of construction activities, the majority of re-suspended sediments are expected to be deposited in the immediate vicinity of the works (see Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology, paragraphs 6.10.12 *et seq.*). The release of contaminants such as arsenic and Polycyclic Aromatic Hydrocarbons (PAHs) from the small proportion of fine sediments is likely to be rapidly dispersed with the tide and/ or currents and therefore increased bio-availability resulting in adverse eco-toxicological effects is not expected. The levels found are all comparable to the wider regional background and not considered to be of a low quality that may result in a significant effect-receptor pathway if made bioavailable.

3.10.24 Therefore, no significant effects in terms of contamination of WFD waterbodies and it is not expected to impact their chemical status. As such there is not predicted to be a deterioration in the status of this waterbody receptor.

Phytoplankton

3.10.25 The proposed activities are not anticipated to affect phytoplankton as no nutrients are anticipated to be released in significant concentrations. Furthermore, the increased SSC from sediments suspended from the seabed are anticipated to be temporary in nature and are not anticipated to affect phytoplankton communities significantly. As such there is not predicted to be a deterioration in the status of this waterbody receptor.

Bathing Waters

3.10.26 Resuspension of sediment during the construction of Thanet Extension could result in higher bacterial concentrations in the water column. Therefore, this could affect the performance of the local BWs. However, given the predicted levels of dilution and dispersion from tidal currents (Volume 2, Chapter 2: Physical Processes (Document Ref: 6.2.2) it is expected that any increases in bacteria in the water column would be temporary. Furthermore, the increased as the ultra-violet light in the water will result in a much quicker mortality than in the sediment, and would be negligible at the BWs.

3.10.27 Analysis of the BW performance during the construction of the existing TOWF has been undertaken. There was no change in BW quality/ classification at any of the three designated BWs during the period of construction (2009-10), see Figure 3.4 to Figure 3.6 (TOWF construction period highlighted in orange). Note: the lower the bars the lower the bacterial counts at the BW and so the higher the performance of the BW. Therefore, as very similar proposed activities will be occurring in very close proximity to TOWF it is concluded that no significant effects will occur in terms of BW performance as a result of Thanet Extension. As such there is not predicted to be a deterioration in the status of this waterbody receptor.

Figure 3.4: BW quality at Ramsgate Western Undercliffe BW (2004 - 2016).

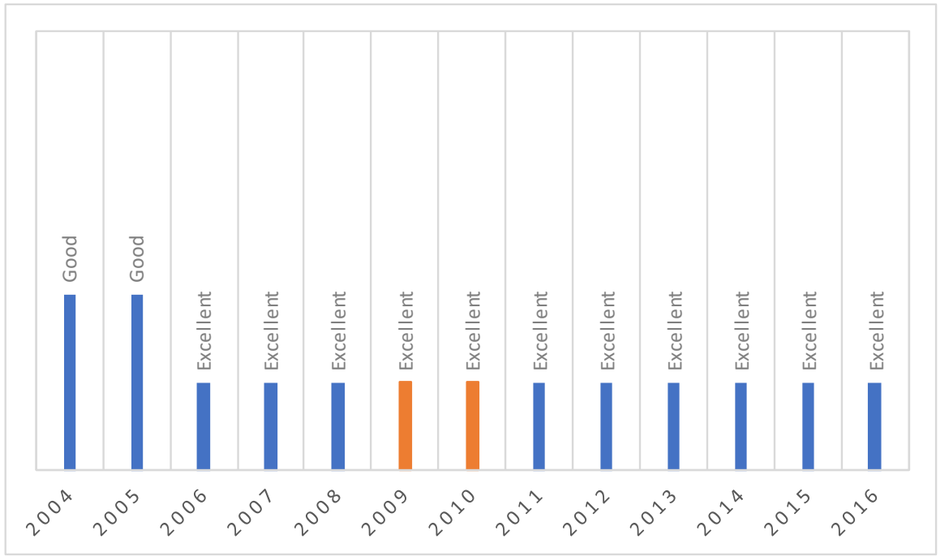


Figure 3.5: BW quality at Ramsgate Sands BW (2004 - 2016).

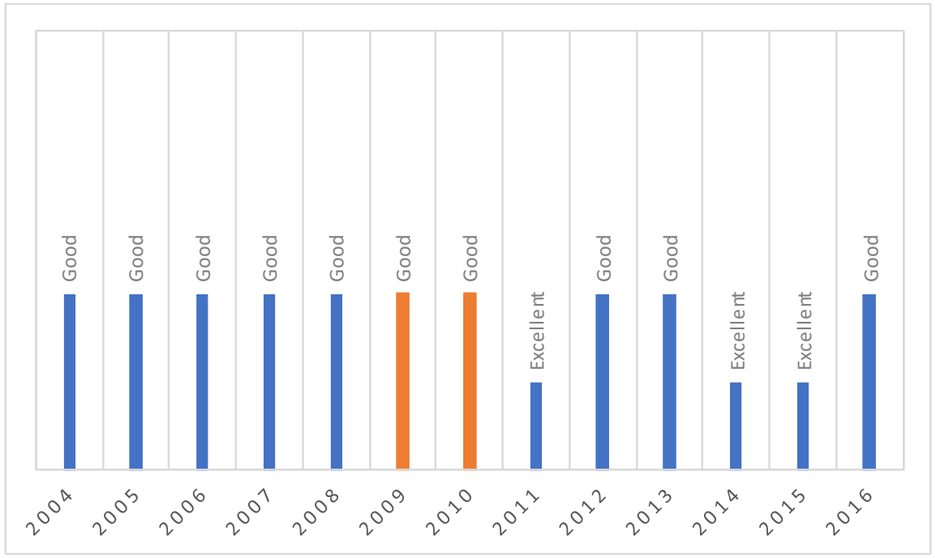
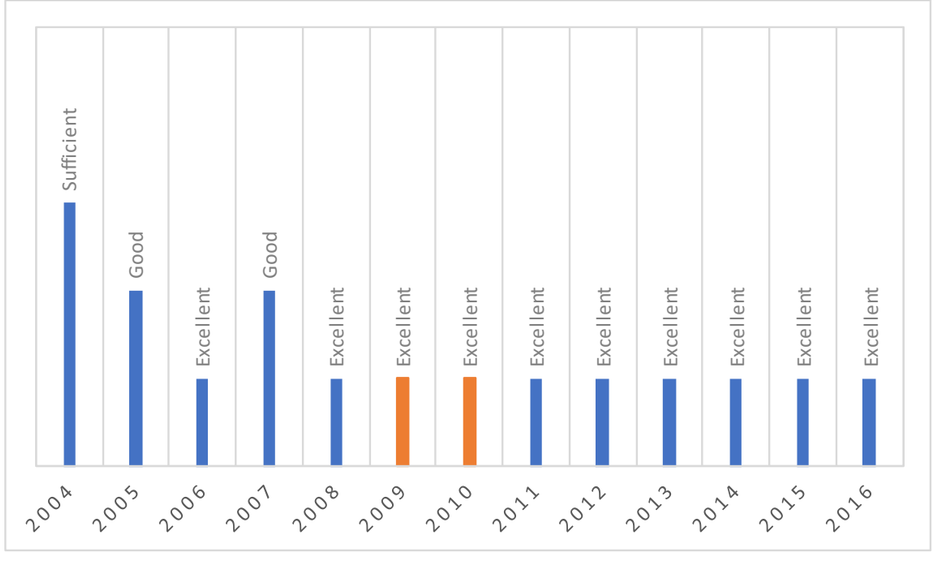


Figure 3.6: BW quality at Ramsgate Sands BW (2004 - 2016).



Shellfish Waters

3.10.28 This assessment has drawn upon information and the assessment undertaken in Volume 2, Chapter 6: Fish and Shellfish (Document Ref: 6.2.6). Please refer to this chapter alongside this assessment for further detail.

3.10.29 More sedentary species (such as shellfish) are likely to be more vulnerable to increases in SSCs than more mobile fish species, which may result in reduced growth or increased mortality, particularly when spatfall[2] occurs (ABP Research, 2007). With the exception of gravid females, edible crabs have a high tolerance to suspended sediment and are reported to be insensitive to increases in turbidity, however they are likely to avoid areas of increased SSC as they rely on visual acuity during predation (Neal and Wilson, 2008). Berried crustaceans (e.g. edible crab, European lobster and *Nephrops*) are likely to be more vulnerable to increased SSC as the eggs carried by these species require more regular aeration and as they are considered to have limited mobility, remaining sedentary while egg bearing. Increased SSCs will only affect a small area at any one time and will be temporary in nature.

3.10.30 Construction activities will re-suspend sediments. While in suspension, there is the potential for sediment bound contaminants, such as metals, hydrocarbons and organic pollutants, to be released into the water column and lead to an effect on shellfish receptors.

3.10.31 The sensitivity of shellfish receptors will vary depending on a range of factors including species and life stage. As sediment bound contaminants would be expected to be dispersed rapidly by tidal currents in the subtidal environment, the effect is predicted to be short-term and temporary in its nature. As such there is not predicted to be a non-temporary effect at the scale of the waterbody and there is not predicted to be a deterioration in the status of this waterbody receptor.

3.10.32 Similar to the BWs, the SFWs also must comply to microbiology standards. Therefore, there is the potential for increases in bacterial concentrations in the water column as a result of being released from the sediment during construction activities. Given the numbers of dilutions, the temporary nature of the activities and dispersion by tidal currents, it is not anticipated that there will be significant impacts in terms of microbiology at the Stour (Kent) SFW. As such there is not predicted to be a non-temporary effect at the scale of the waterbody and there is not predicted to be a deterioration in the status of this waterbody receptor.

Protected Areas

3.10.33 The protected areas (SACs and SPAs) have been subjected to the HRA Screening process (Document Ref: 5.2.1). Table 3.11presents the conclusions of the RIAA (Document Ref: 5.2) on those protected sites within 2 km of the project boundary. The RIAA applies the conclusions on the potential for a Likely Significant Effect (LSE), as drawn in the Screening Report, and has subsequently been updated, with respect to the conservation objectives of the screened in European sites, to determine the potential for an Adverse Effect on Integrity (AEoI).

Invasive Non-native Species

3.10.34 This assessment has drawn upon information and the assessment undertaken in Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Document Ref: 6.2.5). Please refer to this chapter alongside this assessment for further detail.

[2] The settling and attachment of young bivalves (such as oysters or mussels) to the substrate.

3.10.35 Hard substrate introduced into a predominately sedimentary environment will attract many marine organisms and colonisation of introduced habitat has been recorded at previous OWF developments and can be expected to occur at Thanet Extension. Species that typically colonise these structures include mussels, barnacles, tubeworms, sponges, hydroids and bryozoans.

3.10.36 This may result in an overall increased biodiversity; however, it represents a change from the baseline that occurs in the area. Whether this is considered a positive or negative can be subjective and both are possible. Positive effects could include an increase in abundance of commercially important invertebrate species, which would benefit commercial fisheries. Negative effects could include providing habitat that may allow the establishment of non-native species.

3.10.37 Rock outcroppings are known to occur throughout the region, therefore the introduction of hard substrate will not fundamentally change the type of available habitats available within the wider study area. No rock protection for the cables is anticipated within the intertidal area or Sandwich Bay SAC. Therefore, while impacts will be long-term, the magnitude of the impact from the introduction of hard substrate will be negligible.

3.10.38 Additionally, there is a risk that the introduction of hard substrate into a sedimentary habitat can enable the colonisation of the introduced substrate by invasive/ non-indigenous species. While there is the potential that Thanet Extension would act as a 'stepping stone' for invasive species, they are known to exist already within the wider region. This is considered to be low risk for Thanet Extension as there is exposed hard substrate occurring naturally within the wider area. Finally, the use of pleasure craft is common through the region (Volume 2, Chapter 14: Infrastructure and Other Users (Document Ref: 6.2.14)) and this provides a more likely method of transport for invasive species. Therefore, any contribution of Thanet Extension would be negligible in comparison to the impacts of other marine users.

3.10.39 Hard substrate such as the chalk outcrops are already present within the waterbodies and as such they are an existing vector for INNS. In addition, INNS have been identified in the Pegwell Bay area. Therefore, the addition of cable protection within the OECC is not considered to provide a significant risk in the spread of INNS.

3.10.40 Vessel movements will occur during all phases of the project, see Volume 2, Chapter 1: Project Description – Offshore (Document Ref: 6.2.1). These vessel movements will contribute to the risk of introduction or spread of INNS in ballast water. However, these vessel movements are also likely to be around Thanet Extension array area and from Ramsgate harbour. Designed-in measures including a biosecurity plan, a PEMMP and vessels complying with the International Maritime Organisation ballast water management guidelines will ensure that the risk of potential introduction and spread of INNS will be minimised. There is little evidence from other OWFS developments within the North Sea of non-indigenous species having any adverse effects on key species and habitats. Materials and vessels will be from within European and/ or UK waters. As a result of these measures any impacts are expected to be minor.

3.10.41 Therefore, taking into the existing hard substrate within body Kent North and Stour (Kent) waterbodies, the presence of INNS and the proposed management of INNS there is not predicted to be a deterioration in the status of the waterbody receptor.

Table 3.11: The conclusions of the RIAA on SACs and SPAs within 2 km of the project boundary

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
Thanet Coast SAC	Chalk reefs	Temporary habitat loss and disturbance	No AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
		Increased suspended sediment and associated deposition	No AEoI	No AEoI	Similar to and potentially less than those outlined in the construction phase.
		Permanent physical habitat loss and temporary habitat disturbance	N/A	No AEoI	N/A
		Change in physical processes	N/A	No AEoI	N/A
		EMF	N/A	No AEoI	N/A
Southern North Sea cSAC	Harbour porpoise	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
Thanet Coast & Sandwich Bay SPA	Non-breeding European golden plover and ruddy turnstone	Temporary habitat loss and disturbance of supporting intertidal habitats	No AEoI	No AEoI	Similar to and potentially less than those outlined in the construction phase.
		Increased suspended sediment and associated deposition affecting supporting intertidal habitats	No AEoI	No AEoI	Similar to and potentially less than those outlined in the construction phase.
		Change to physical processes affecting supporting intertidal habitats	N/A	No AEoI	N/A
		Disturbance due to possible displacement of recreational visitors	No AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.

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