

Norfolk Vanguard Offshore Wind Farm

Comparison of the Outline HHW SAC Site Integrity Plan and the Outline HHW SAC Cable Specification Installation and Monitoring Plan

Applicant: Norfolk Vanguard Limited
Document Reference: ExA; Compare; 11.D10.1

Date: February 2020

Photo: Kentish Flats Offshore Wind Farm



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1 INTRODUCTION

1.1 Project Background

1. Norfolk Vanguard Limited ('the Applicant', an affiliate company of Vattenfall Wind Power Ltd (VWPL)) is seeking a Development Consent Order (DCO) for Norfolk Vanguard ('the Project'), an offshore wind farm (OWF) located in the southern North Sea.
2. The OWF comprises two distinct areas, Norfolk Vanguard East (NV East) and Norfolk Vanguard West (NV West) ('the OWF sites'), within which the wind turbines and associated platforms and cables will be located (Figure 1.1). The offshore wind farm will be connected to the shore by offshore export cables installed within the offshore cable corridor from the OWF sites to a landfall point at Happisburgh South, Norfolk. From there onshore cables would transport power over approximately 60km to the onshore project substation and National Grid substation at Necton, Norfolk. A full project description is given in the Environmental Statement (ES), Chapter 5 Project Description.
3. Once built, Norfolk Vanguard would have an export capacity of up to 1800MW, with the offshore components comprising:
 - Wind turbines;
 - Offshore electrical platforms;
 - Accommodation platforms;
 - Met masts;
 - Lidar;
 - Array cables;
 - Inter-connector cables; and
 - Export cables.
4. This Outline ~~Site Integrity~~ HHW SAC Cable Specification, Installation and Monitoring Plan (SIPCSIMP) relates to a section of the offshore export cables, where they overlap with the Haisborough, Hammond and Winterton (HHW) Special Area of Conservation (SAC) (Figure 1.1).
5. The Norfolk Vanguard Environmental Impact Assessment (EIA) has followed a 'Rochdale' or design envelope approach, as discussed in section 5.1.1 of ES Chapter 5 Project Description. The design envelope provides flexibility allowing the project to be optimised and refined prior to construction. Therefore, realistic worst case scenarios have been adopted in the ES (document 6.1) and Information to Support Habitats Regulations Assessment (HRA) report (document 5.3), to allow a precautionary and robust impact assessment. Through various additional

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commitments made by the Applicant since the submission of the Norfolk Vanguard DCO application, the worst case scenario has been refined. A summary of the latest worst case scenario is provided in section 3, Table 3.13.1.

6. The detailed design of Norfolk Vanguard (e.g. micro-siting of the cable route and the requirement for cable protection) will be determined post-consent ~~(see section 3).~~

1.2 The Haisborough Hammond and Winterton Special Area of Conservation

7. The HHW SAC is located to the west of NV West, and the offshore cable corridor passes through the SAC. The SAC is designated for Annex I Sandbanks which are slightly covered by seawater all the time and Annex I Reefs (*Sabellaria spinulosa*).
8. The sandbank ridges consist of sinusoidal banks which have evolved over the last 5,000 years and comprise of Haisborough Sand, Haisborough Tail, Hammond Knoll, Winterton Ridge and Hearty Knoll. Older sandbanks, Hewett Ridge and Smiths Knoll, are present along the outer site boundary and have formed over the last 7,000 years. The more geologically recent sandbanks of Newarp Banks and North and Middle Cross Sands lie on the south west corner of the SAC¹.
9. The Joint Nature Conservation Committee (JNCC) HHW Site Details¹ state that *S. spinulosa* reef has been recorded at Haisborough Tail, Haisborough Gat and between Winterton Ridge and Hewett Ridge. *S. spinulosa* reefs within the HHW SAC can have an elevation of 5cm to 10cm and in areas where reef has been recorded, this can have between 30% to 100% coverage.
10. As discussed above and shown in Figure 1.1, the Norfolk Vanguard offshore cable corridor overlaps with the HHW SAC ~~and therefore there is potential for the designated features of the SAC to be impacted during the construction and maintenance of Norfolk Vanguard.~~

~~1.2.1 Conservation Objectives~~

- ~~11. Conservation objectives are set by the JNCC and Natural England to ensure that, subject to natural change, the integrity of a site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:~~
 - ~~• The extent and distribution of qualifying natural habitats and habitats of the qualifying species;~~
 - ~~• The structure and function (including typical species) of qualifying natural habitats;~~

¹ <http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030369>

- The structure and function of the habitats of the qualifying species;
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely;
- The population of qualifying species; and
- The distribution of qualifying species within the site.

12. The Conservation Objectives for the HHW SAC are as follows (JNCC and Natural England, 2013):

- “Subject to natural change maintain the sandbanks in favourable condition, in particular the sub-features:
 - Low diversity dynamic sand communities
 - Gravelly muddy sand communities”; and
- “Subject to natural change maintain or restore the reefs in favourable condition”.

13. ‘Favourable Condition’ is the term used in the UK to represent ‘Favourable Conservation Status’ (FCS) for the interest features of SACs. For an Annex I habitat, FCS occurs under the Habitats Directive when (JNCC and Natural England, 2013):

- “Its natural range and area it covers within that range are stable or increasing;
- The specific structure and functions, which are necessary for its long-term maintenance, exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable”.

14. Favourable condition of the sandbanks and reefs is assessed based on the long-term maintenance of the following (JNCC and Natural England, 2013):

- “Extent of the habitat (and elevation and patchiness for reef);
- Diversity of the habitat;
- Community structure of the habitat (population structure of individual species and their contribution to the functioning of the habitat); and
- Natural environmental quality (e.g. water quality, suspended sediment levels).”

15. Supplementary Advice² for the HHW SAC provides various qualitative targets associated with achieving the Conservation Objectives of the HHW SAC. Those of relevance to Norfolk Vanguard are outlined in Table 1.1 below.

²

<https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0030369&SiteName=hais>

16. In August 2019 Natural England published the results of the latest conservation status assessment for the site³. This assessment finds that 100% of the Annex 1 Reef and Sandbank features are in unfavourable condition and both features need to be restored to favourable condition. This is reflected in Natural England's Supplementary Advice Targets⁴ outlined in Table 1.1.

17. The latest condition of Annex 1 Reef and Sandbanks, and the associated targets will be taken in to account at the time of finalising the SIP post-consent.

Table 1.1 Supplementary Advice Targets of Relevance to Norfolk Vanguard

	Attribute	Target
Reefs	Distribution: presence and spatial distribution of biological communities	Restore the presence and spatial distribution of reef communities.
	Extent of subtidal biogenic reef	When Sabellaria reef develops within the site, its extent and persistence should not be compromised by human activities, accepting that, due to the naturally dynamic nature of the feature, its extent will fluctuate over time.
		Restore the total extent and spatial distribution and types of reef (and each of its subfeatures).
	Structure and function: presence and abundance of key structural and influential species	Maintain OR Recover OR Restore the abundance of listed species, to enable each of them to be a viable component of the habitat.
	Structure: non-native species and pathogens	Restrict the introduction and spread of non-native species and pathogens, and their impacts.
	Structure: population density	Restore the density of Sabellaria species across the feature.
	Structure: species composition of component communities	Restore the species composition of component communities.
		Restore the species composition of the Sabellaria reef community.
		Restore the environmental conditions in those locations that are known, or which become known, to be important for Sabellaria reef formation.
		Maintain the natural rate of sediment deposition.
Supporting processes: areas with conditions suitable for reef formation		Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat
		Maintain the natural water flow velocity to the subtidal Sabellaria reefs, to provide high levels of oxygen, sediment supply and food.

borough&SiteNameDisplay=Haisborough%2c+Hammond+and+Winterton+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAAArea=

³

<https://designatedsites.naturalengland.org.uk/MarineCondition/PublicSubFeature.aspx?featureGuid=c8c43fb1-2919-e611-9771-000d3a2004cf&SiteCode=UK0030369>

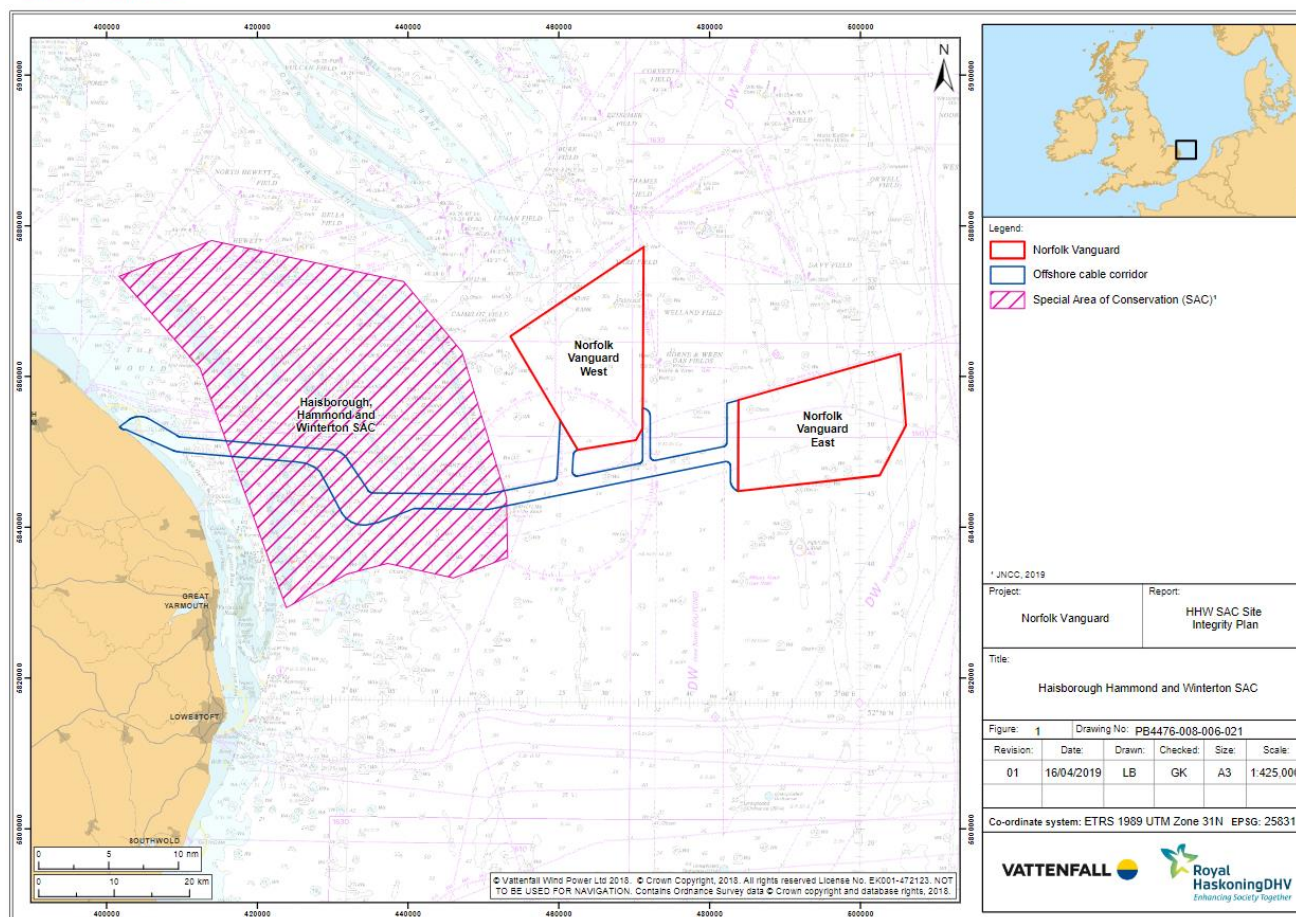
⁴

<https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0030369&SiteName=haisborough&SiteNameDisplay=Haisborough%2c+Hammond+and+Winterton+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAAArea=>

	Attribute	Target
Sandbanks	Distribution: presence and spatial distribution of biological communities	Restore the presence and spatial distribution of subtidal sandbank communities.
	Extent and distribution	Restore the total extent and spatial distribution of subtidal sandbanks to ensure no loss of integrity, while allowing for natural change and succession.
	Structure and function: presence and abundance of key structural and influential species	Maintain OR Recover OR Restore the abundance of listed species, to enable each of them to be a viable component of the habitat.
	Structure: non-native species and pathogens	Restrict the introduction and spread of non-native species and pathogens, and their impacts.
	Structure: sediment composition and distribution	Restore the distribution of sediment composition across the feature (and each of its sub-features).
	Structure: species composition of component communities	Restore the species composition of component communities.
	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing erosion or deposition through human-induced activity.
	Structure: volume	Maintain the existing (where no previous evidence exists) or best-known (where some evidence exists) volume of sediment in the sandbank, allowing for natural change.
	Supporting processes: sediment movement and hydrodynamic regime	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.

18. The species / communities listed by Natural England in the supplementary advice are:

- The infaunal and epifaunal communities found on the crests of sandbanks are relatively species poor as a result of the highly dynamic sediment environment and the associated impacts of disturbance, smothering and scour. The low diversity communities are dominated by polychaetes (primarily *Nephtys cirrosa* and *Ophelia* sp.) and the amphipods (*Bathyporeia elegans*, *Gastrosaccus* sp. and *Urothoe* spp.). Some brittlestars (*Ophiocten* sp.) and sandeel (*Ammodytes* sp.).
- Slightly higher diversity communities consist of hardy polychaetes and amphipods approximate to the biotope A5.233 (*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand).
- The areas of the site where sediment movements are reduced (flanks and troughs) support an abundance of attached bryozoans, hydroids and sea anemones. *S. spinulosa* and other tube building worms (e.g. keel worms and sand mason worms) are found, along with bivalves and crustaceans.



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Figure 1.1: Location of Norfolk Vanguard and the Haisborough Hammond and Winterton SAC

1.3 Purpose of this Document

~~19.11.~~ The purpose of this Outline Norfolk Vanguard HHW SAC ~~SIP~~CSIMP is to set out the ~~process for Norfolk Vanguard Limited to agree all works and potential mitigation measures associated with offshore cable installation (including seabed preparation works and cable protection) and maintenance within information required in the final~~ HHW SAC, ~~with the MMO in consultation with Natural England, CSIMP in order to ensure there would be no adverse effect on integrity (AEol) on the HHW SAC as a result of Norfolk Vanguard, accordance with:~~

~~20.12.~~ Condition 9(1)(m), Schedules 11 and 12 of the Norfolk Vanguard draft Deemed Marine Licences (DMLs) states:

~~“9(1) The licensed activities, or any phase part of those activities must not commence until a site integrity the following (as relevant to that part) have been submitted to and approved in writing by the MMO”~~

~~21. “9(1)(m) A cable specification, installation and monitoring plan for the installation and protection of cables within the Haisborough, Hammond and Winterton Special Area of Conservation, which accords with the principles set out in the outline Norfolk Vanguard Haisborough, Hammond and Winterton Special Area of Conservation Site Integrity Cable Specification, Installation and Monitoring Plan ~~has been such plan to be~~ submitted to the MMO ~~and the MMO~~ (in consultation with the relevant statutory nature conservation body) ~~is satisfied that the plan provides such mitigation as is necessary to avoid adversely affecting the integrity (within the meaning at least six months prior to commencement of the 2017 Regulations) of a relevant site, to the extent that sandbanks and Sabellaria spinulosa reefs are a protected feature of that site.”~~ licensed activities”~~

~~22.~~ Due to the long lead in times for the development of OWFs it is not possible to provide final detailed method statements for construction prior to consent, and as a result, the detail of any required mitigation also cannot be finalised prior to consent. Key outstanding areas of uncertainty that will be addressed post consent through the SIP include:

- ~~• The precise extent and location of Annex 1 reef feature due to the ephemeral nature of *S. spinulosa* which will be informed by pre-construction surveys which must be undertaken no earlier than 12 months prior to cable installation.~~
- ~~• The detailed installation method, cable crossings and requirement for any cable protection will be informed by pre-construction surveys which must be undertaken no earlier than 12 months prior to cable installation.~~
- ~~• Cable crossings will be determined by crossings agreements with cable and pipeline operators which will be progressed post consent.~~

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23. Whilst it is recognised that existing offshore wind farms have been permitted to route cables through SACs without the need for a SIP, lessons learned from these wind farms, as reflected in Natural England (2018) Offshore wind cabling: ten years' experience and recommendations, is that there was uncertainty although it was not realised at the consenting stage and some projects have therefore required consent variations during the construction phase as a result.
24. The Applicant has therefore taken a conservative approach in the assessment, (e.g. by assessing a contingency for cable protection) in accordance with advice from Natural England and the MMO during the Evidence Plan Process, to avoid the need for post consent variations, whilst also making a firm commitment through the SIP (as required by Condition 9(1)(m) of the Transmission DMLs) to agree all works in the HHW SAC with the MMO in consultation with Natural England. This allows a conclusion of no AEoI at the consenting stage on the basis that works cannot commence until the MMO is satisfied that there would be no AEoI.
25. This document provides a framework for further consultation by Norfolk Vanguard Limited with the MMO and Natural England, post-consent to agree the exact details of any required project related management measures. Mitigation measures are outlined in section 5.1 of this Outline SIP which would be developed in consultation with the MMO and other relevant bodies, post consent based on the final design of Norfolk Vanguard to ensure the mitigation will deliver no AEoI. The process that would be undertaken in finalising the SIP is outlined in Diagram 1.1.

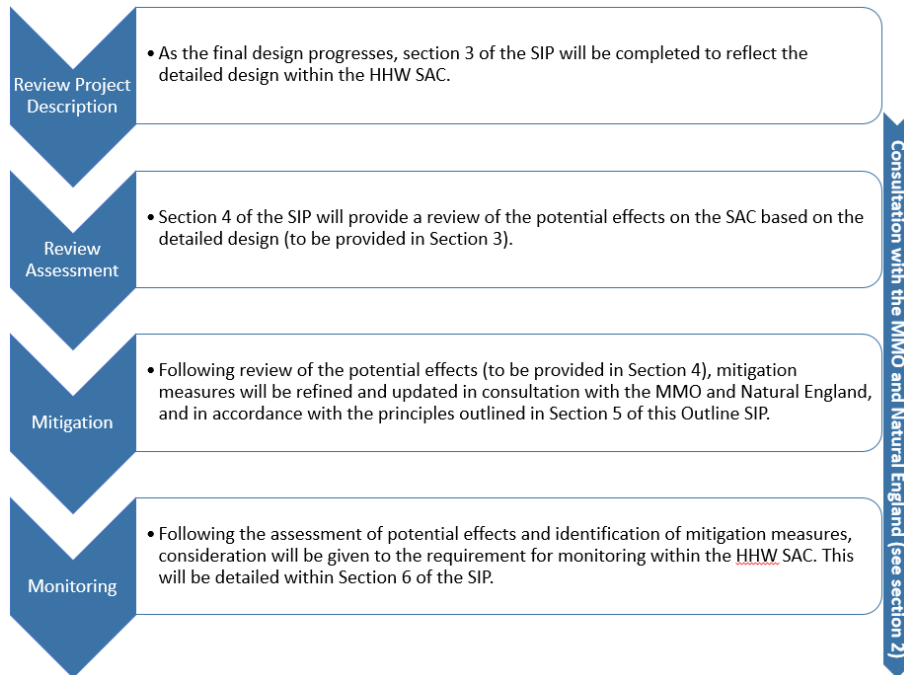


Diagram 1.1 Site Integrity Plan Process

26.13. DCO Schedules 11 and 12 Condition 9(1)(m) secure the requirement for the HHW SAC SIP within the Deemed Marine Licences (DML). The above Condition secures the requirement for the HHW SAC CSIMP within the DMLs, whilst allowing scope for refinement of the precise mitigation measures to be adopted based on pre-construction surveys as well as latest guidance and evidence, evidence and consultation with the MMO and Natural England.

27. This Outline SIP reflects the commitment of Norfolk Vanguard Limited to undertake further mitigation measures that may be necessary to avoid the potential for significant effects on the Annex 1 Reef and Sandbank features of the HHW SAC.

28.14. The DMLs set out certain timescales in advance of commencement of the licensed activities, by when the SIP must be submitted to the MMO for their approval, following revision and consultation as per the outline schedule are outlined in section 2.4.4.1 of this document. The final mitigation would be based on latest targets, the final cable installation design, guidance, pre-construction survey data and available evidence from other projects. Mitigation measures must be agreed with the MMO in consultation with Natural England.

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29.15. This document relates to Norfolk Vanguard alone, however consideration will also be given to Norfolk Vanguard's sister project, Norfolk Boreas to ensure mitigation solutions are compatible for both projects. Norfolk Boreas is an OWF located to the north of NV East which would share an offshore cable corridor with Norfolk Vanguard. ~~In accordance with this commitment, the Applicant has updated this document in line with the latest changes and additional commitments that have been made for Norfolk Boreas, submitted at Deadline 1 of their Examination.~~

2 CONSULTATION

2.1 Pre-consent

30. The draft Outline SIP was submitted to Natural England and the Marine Management Organisation (MMO) for review, during the Norfolk Vanguard Examination on 3rd April 2019.
31. The Outline SIP was then submitted to the Examining Authority at Deadline 7 on 2nd May 2019 and a final version submitted at Deadline 9 on the 6th June 2019.

2.2 Post-consent

- 32.16. There will be an ongoing requirement to engage with Natural England and the MMO throughout the detailed design stage of the project, including in the planning and review of pre-construction site investigation surveys in the HHW SAC, as well as during development of the final project design, construction plans and mitigation measures and monitoring.

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2.3 Post Examination

33. The Applicant has undertaken consultation with Natural England and the MMO in response to a Request for Information from BEIS. This has informed the additional mitigation commitments discussed in Section 5.

2.4 Project life

34. There will be an ongoing requirement to review and consult on the need for works associated with the maintenance of cables within the HHW SAC.

2.5 Schedule for Agreement

35. It is not possible at this stage to determine exact dates for agreement and refinement of the SIP as this will be determined by the final project timeline. However, key milestones are outlined in Table 2.1 to indicate the likely development of the SIP between consent and construction.

Table 2.1: Indicative milestones for refinement and agreement of the SIP

Indicative Stage	When	Action for Norfolk Vanguard	Relevant Authority / Consultee	Status
Draft Outline SIP submitted for consultation	During examination (Q1 2019)	Draft Outline SIP provided to MMO and Natural England for review	MMO and Natural England	Complete
Outline SIP submitted	During examination (Q1 2019)	Outline SIP submitted to the Examination	MMO and Natural England	Complete

Indicative Stage	When	Action for Norfolk Vanguard	Relevant Authority / Consultee	Status
Updated outline SIP submitted	During examination (Q2 2019)	Updated to reflect stakeholder feedback	MMO and Natural England	Complete
Updated outline SIP submitted	Post examination (Q1 2020)	Updated to reflect additional mitigation measures	MMO and Natural England	Complete
Consent determination and Appropriate Assessment (AA)	Q2 2020	Review Outline SIP, identify areas for revisions/updates	Internal only	To be completed
Design of Pre-construction surveys	Pre-construction	Natural England and the MMO will be consulted during the design of the pre-construction surveys to ensure they will provide the information required to develop the final SIP and associated mitigation measures	MMO and Natural England	To be completed
Front End Engineering Design (FEED)	Pre-construction	Norfolk Vanguard Limited will be refining the project design during the pre-construction period. Any updated project design will be considered in the SIP (see section 3).	Internal	To be completed
Submission and review of the draft full SIP and any associated documentation	Pre-construction, following site investigation surveys and FEED	The SIP will be updated to capture all relevant assessments and mitigation measures.	MMO and Natural England	To be completed
Iterations of the SIP, as required	Pre-construction, following site investigation surveys and FEED	The SIP will continue to be updated following review from MMO and Natural England and any further updates to the project design.	MMO, Natural England	To be completed
Final SIP sign-off	The DMLs set out certain timescales in advance of commencement of the licensed activities, by when the SIP must be submitted to the MMO for their approval	The SIP will be updated and finalised. The final SIP will be submitted to the MMO for approval at a timescale in accordance with the DMLs, prior to the commencement of works associated with cable installation, including seabed preparation works, for written approval from the MMO prior to any works commencing in the HHW SAC. This will remain a live document that may need to be updated throughout the life of the project	MMO for sign-off.	To be completed

Indicative Stage	When	Action for Norfolk Vanguard	Relevant Authority / Consultee	Status
Construction monitoring and reporting	Construction (not expected before 2024)	Monitoring/management reports will be submitted to the MMO.	MMO	To be completed

~~3~~ ~~3 CABLE INSTALLATION AND CABLE PROTECTION DESCRIPTION WITHIN THE HHW SAC~~

17. As stated in Condition 9(1)(m), Schedules 11 and 12 of the DMLs, the final HHW SAC CSIMP must be approved in writing by the MMO prior to commencing the relevant licensed activities.

3 CABLE INSTALLATION AND CABLE PROTECTION DESCRIPTION

3.1 Worst Case Scenario

~~36.18.~~ A full description of the project design envelope and worst case scenarios were provided in the Norfolk Vanguard Environmental Statement (ES) (see ES Chapter 5 Project Description, ES Chapter 8 Marine Geology, Oceanography and Physical Processes, ES Chapter 10 Benthic Ecology) and Section 7.3.2 of the Information to Support HRA report.

~~37.19.~~ During the Norfolk Vanguard Examination, the Applicant made commitments to additional mitigation in relation to works in the HHW SAC. ~~Table 3.1~~ Table 3.1 provides a summary of the worst case scenario, incorporating these additional mitigation commitments.

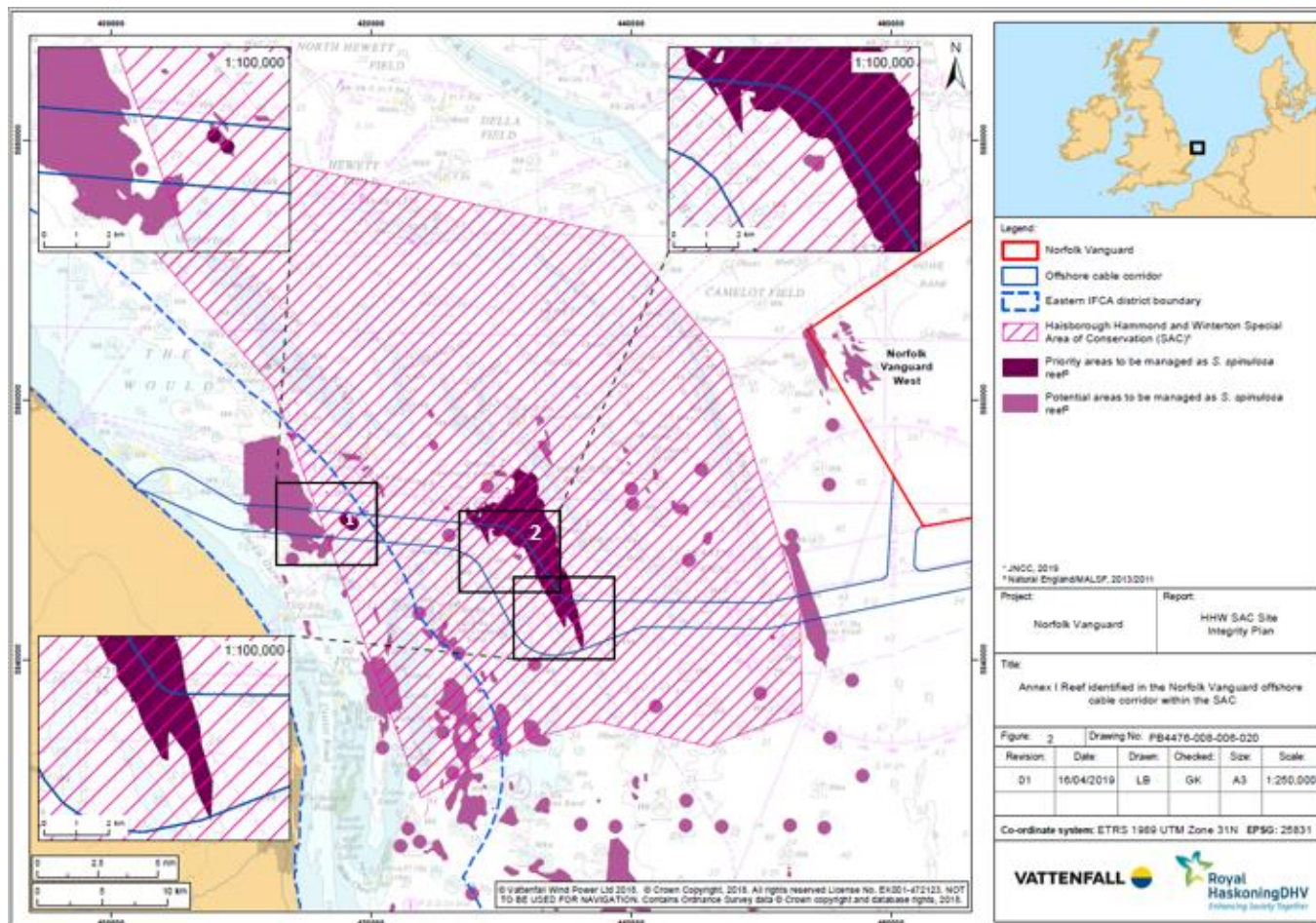
~~38.20.~~ Details of the cable specification, cable protection and installation methods within the HHW SAC will be provided once the detailed design is known.

3.1.1 Additional mitigation since submission of the DCO application

~~39.21.~~ During the DCO Examination, Norfolk Vanguard Limited made a commitment to limit the potential length of unburied cable in the HHW SAC to 5% of the cable length instead of 10%.

~~40.22.~~ Following the close of Examination, the Applicant has committed to use no surface cable protection in the priority areas to be managed as reef within the HHW SAC (shown in ~~Figure 4.1~~ Figure 3.1). This will ensure there is no significant loss of Annex 1 reef or potential reef habitat (discussed further in the HHW SAC Position Statement (document reference ExA; Pos; 11.D10.1)).

~~41.23.~~ In addition, the Applicant has committed to decommissioning of cable protection at the end of the Norfolk Vanguard project life where it is associated with unburied cables due to ground conditions (where required for crossings this will be left *in situ*). This commitment ensures that there will be no permanent habitat loss as a result of cable protection and further contributes to the ability to conclude no AEoI of the HHW SAC. This is discussed further in Appendix 2 of the Additional Mitigation document (document reference ExA; Mit; 11.D10.2.App2).



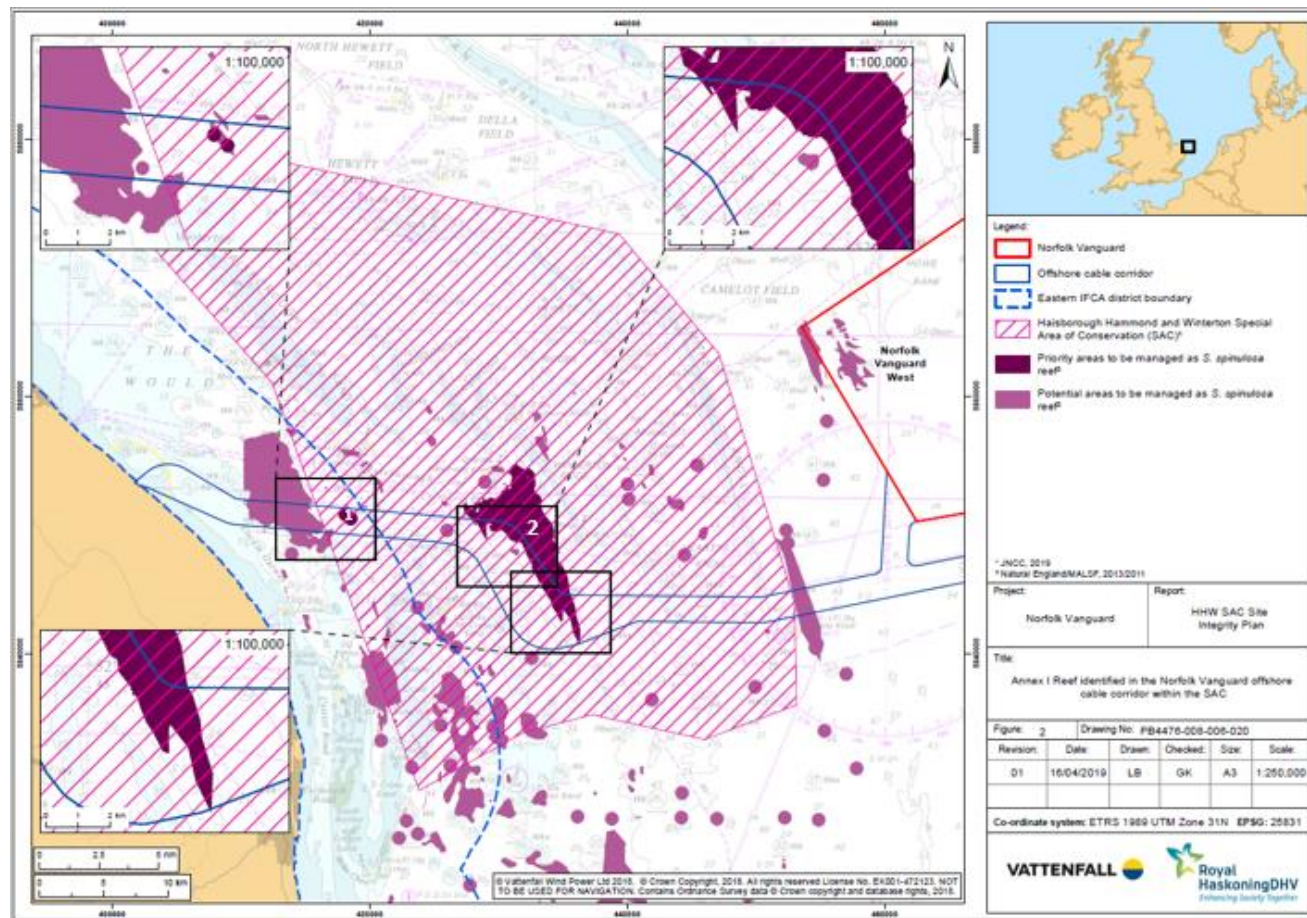


Figure 3.1 Areas to be managed as reef

~~3.2 Worst Case Scenario during Pre-Consent Stage~~

S. spinulosa Annex I reef by Natural England

Table 3.1 Worst Case Scenario in the HHW SAC

Impact	Parameter
Construction	
Temporary physical disturbance Annex 1 Sandbank	<ul style="list-style-type: none"> Boulder clearance – 0.002km² (up to 100 boulders of 5m diameter) being placed outside the cable route. Pre-sweeping area – 0.25km² based on ES Appendix 5.1 Cable Installation Study, of this up to 0.05km² could be outside the footprint of the cable installation works Cable installation – 2.4km² (based on maximum potential disturbance width of 30m for a 10m wide plough with 10m of spoil either side of the trench, along 80km of export cable trenching within the SAC) Anchor placement – 0.0003km² (based on two cable joints in the SAC, one per cable pair with a footprint of 150m² each, assuming up to 6 anchors per vessel) Other works (e.g. lifting of boulders and pre-lay grapnel run) associated with cable installation would be encompassed by the footprints outlined above. Therefore the total footprint for temporary disturbance on sandbanks is 2.45km² <p>Dredged material from the HHW SAC will be disposed of back within the SAC (see section 5.4.4 for further detail). The area affected by these disposal sites will be agreed with the MMO in consultation with Natural England. As discussed in the Sandwave Study by ABPmer (Appendix 7.1 of the Information to Support HRA report (document reference 5.3.7.1)), deposited sediment will immediately re-join the local and regional sediment transport system. The area affected will be in addition to the 2.45km² presented here.</p>
Temporary physical disturbance on Annex 1 Reef	Cable installation works as outlined above, however the location and extent of <i>S. spinulosa</i> reef and therefore the overlap of the installation works with reef feature is unknown and will be detailed in the final SHPHHW SAC CSIMP based on the pre-construction surveys.
Operation	
Temporary physical disturbance on Annex 1 Sandbank	<ul style="list-style-type: none"> An average of one repair per export cable pair every 10 years is estimated within the SAC. It is estimated that 300m sections would be removed and replaced per repair. Disturbance width of 10m = 3,000m² (0.003km²) per repair Anchor placement associated with repair works = 150m² based on 6 anchors per vessel Reburial of up to 10% of the cable length (4km per pair) every 5 years may be required should pre-sweeping <u>not</u> be undertaken. The disturbance width would be approximately 10m and therefore the total disturbance would be 80,000m² (0.08km²) every 5 years or approximately 400,000m² (0.4km²) over the indicative 30 year project life. If reburial is required, it is likely that this would be in relatively short sections (e.g. 1km) at any one time. If pre-sweeping is undertaken the requirement for cable reburial would be significantly reduced. The SHPHHW SAC CSIMP requires that the installation strategy (e.g. use of pre-sweeping) is agreed with the MMO in consultation with Natural England.
Temporary physical disturbance on Annex 1 Reef	Maintenance works as estimated above, however the location and extent of <i>S. spinulosa</i> reef and therefore the overlap of the maintenance works with

Impact	Parameter
	reef feature is unknown and will be detailed in the final SHPHHW SAC CSIMP based on the pre-construction surveys.
Persistent habitat loss on Annex 1 Sandbank	<p>Total habitat loss within the Haisborough, Hammond and Winterton SAC could be 32,000m² (0.03km², 0.002% of the 1468km² SAC area and 0.005% of the area of sandbanks within the SAC) based on the following:</p> <ul style="list-style-type: none"> • <0.001km² clump weights based on cutting two existing disused cables and placing clump weights of up to 5m² on either end of the disused cables. • Six crossings for each of the export cable pairs (12 crossings in total) within the Haisborough, Hammond and Winterton SAC with a total footprint of 12,000m² in the SAC (100m length per crossing and 10m width of protection). • A contingency of up to 2km of cable protection per cable pair, 4km in total (5% of the length) could be required in the Haisborough, Hammond and Winterton SAC in the unlikely event that unsuitable ground conditions are encountered, resulting in a footprint of 20,000m² based on 5m width of cable protection.
Permanent habitat loss of Annex 1 Reef	<p>The worst case footprint of permanent infrastructure would be as outlined above, however the location and extent of <i>S. spinulosa</i> reef and therefore the overlap of the infrastructure with reef feature is unknown and will be detailed in the final SHPHHW SAC CSIMP based on the pre-construction surveys. It is expected that there will be no loss of reef where micro-siting can be undertaken (section 4.2). <i>S. spinulosa</i> can also be expected to colonise cable protection, although Norfolk Vanguard Limited recognises that Natural England does not consider this to be Annex 1 reef.</p>
Decommissioning	
Temporary physical disturbance	Some or all of the offshore export cables may be removed. Cable protection will be removed except at cables crossings where this would be left <i>in situ</i> .

4 ASSESSMENT OF NO ADVERSE EFFECT ON INTEGRITY

42. The Information to Support HRA Report (document 5.3) provides an assessment of the potential effects based on the worst case scenario of the design envelope prior to submission of the Application.
43. In order to conclude no AEoI on the HHW SAC as a result of offshore cable installation (including seabed preparation works and cable protection) and maintenance for Norfolk Vanguard, the SIP will provide a review of the potential effects on site integrity based on the final detailed design (to be provided in Section 3). This will take into account the preferred cable route and installation methods, as well as the substrate type and up to date habitat data from the pre-construction surveys.
44. Mitigation measures would be identified following this process to ensure effects are minimised and to allow the conclusion of no AEoI (see Section 5). This will allow mitigation measures to reflect the current status of the features of the HHW SAC.
45. The SNCB Draft Conservation Objectives and Advice on Operations (JNCC & Natural England, 2009) and Formal advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended), and Regulation 18 of The Offshore Marine Conservation Regulations (Natural Habitats, &c.) Regulations 2007 (as amended) (JNCC & Natural England, 2013). identifies the following pressures that are of relevance to Norfolk Vanguard:
- Physical loss; and
 - Physical damage (i.e. disturbance).
46. The Information to Support HRA Report provides consideration of the following impacts and scenarios:
- Disturbance to Sandbanks during construction (Information to Support HRA Report section 7.4.1.1.1);
 - Disturbance to Sandbanks during maintenance (Information to Support HRA Report section 7.4.1.1.2 paragraphs 372 to 379);
 - Sandbank habitat loss from cable protection (Information to Support HRA Report section 7.4.1.1.2 paragraphs 380 to 387);
 - Disturbance to reef if micro-siting is possible (Information to Support HRA Report section 7.4.2.1.1 paragraphs 405-410);
 - Disturbance to reef if micro-siting is not possible (Information to Support HRA Report section 7.4.2.1.1 paragraphs 411-429);
 - Disturbance to Reef during maintenance (Information to Support HRA Report section 7.4.2.1.2); and

• In combination effects (Information to Support HRA Report section 7.4.2.2).

47. Norfolk Vanguard Limited concludes there would be no AEoI of the HHW SAC, however it is recognised that Natural England has identified uncertainty associated with the assessment (e.g. the extent of Reef at the time of construction and therefore the ability to microsite cables). As a result of this uncertainty, Norfolk Vanguard Limited has committed to a SIP to provide a framework to further assess the effects based on the best available information prior to construction. The wording of the Transmission DMLs (DCO Schedules 11 and 12), Condition 9(1)(m) ensures that a conclusion of no AEoI can be made at the consenting stage as construction cannot commence until the MMO is satisfied, in consultation with Natural England, that there is 'no adverse effect beyond reasonable scientific doubt' on the HHW SAC. Section 5 of this document outlines the process and commitments to delivering mitigation measures to ensure no AEoI.

48. Further to the above, Norfolk Vanguard Limited has committed to additional mitigation measures that provide more certainty that the project would have no AEoI. These mitigation measures are detailed in section 5.4.1.

49. Norfolk Vanguard Limited has undertaken further work in response to a request for more information contained in Appendix 2.5 of Natural England's Relevant Representation for the Norfolk Boreas Project (RR 099). The information, presented within Appendix 3 of this document demonstrates that any cable protection necessary in the event that cable burial is not possible is very unlikely to be placed within the areas that Natural England and the JNCC have identified as "areas to be managed as *S. spinulosa* reef".

4.1 Fisheries closure areas

50. Two fisheries closure areas have been proposed within the HHW SAC (one by DEFRA and one by Eastern Inshore Fisheries and Conservation Authority (IFCA)) which, if implemented would overlap with sections of the Norfolk Vanguard offshore cable corridor. The bye-law areas have not yet been designated and, if designated, relate specifically to restrictions on bottom towed fishing gear and therefore do not apply to Norfolk Vanguard.

51. The draft closure areas have been identified with the aim of protecting the two priority Areas to be Managed as Reef shown in Figure 4.1.

52. With regards to the large area (Area 2, shown in Figure 4.1) which underpins the DEFRA Joint Recommendation (DEFRA, 2016), this area is not extensively reef but has been identified as having potential to become reef if the recurring impact from bottom towed fishing gear is ceased in these areas. As discussed in Section 1.2.1, *S. spinulosa* reef in the HHW SAC is considered to be in unfavourable condition.

53. — Should the closure areas be implemented, they would continue to be subject to review and could be increased or decreased, where evidence supports such a change. Section 5.2 outlines the process that will be undertaken by Norfolk Vanguard Limited to minimise impacts on these priority management areas.

4.2 Revised Assessment

54. As discussed above, in order to conclude no AEoI on the HHW SAC, the final SIP will provide a review of the potential effects on site integrity based on the following:

- Final detailed design (to be provided in Section 3), including the preferred cable route and installation methods;
- Up to date habitat data from the pre-construction surveys.

55. An outline of the approach is provided in sections 4.2.1 to 4.2.3 below:

4.2.1 Interim habitat mapping

56. A survey will be completed in 2020 to map the current extent of *S. spinulosa* reef within areas of the Order limits in which it is proposed to carry out construction works within the SAC. This survey will be used to inform both the development of the SIP in consultation with the MMO and Natural England.

4.2.2 Pre-construction habitat mapping

57. Norfolk Vanguard Limited has also committed to undertaking a pre-construction survey in accordance with Condition 13 of the Transmission DMLs (Schedules 11 and 12 of the draft DCO) which will inform the final design (to be presented in Section 3), as well as informing the review of potential effects on site integrity and requirements for mitigation.

58. The survey will be undertaken within 12 months of construction commencing, in order to:

- Determine the location and extent of any *S. spinulosa* reef within areas of the Order limits in which it is proposed to carry out construction works within the SAC to inform the appropriate mitigation if found; and
- Provide a high-level biotope habitat map for the order limits within the SAC.

4.2.3 Sensitivity

59. The sensitivity of biotopes recorded during the pre-construction surveys will be determined based on the latest available information (e.g. the Marine Evidence based Sensitivity Assessment (MarESA)⁵. Where sensitivity information is unavailable, an appropriate proxy biotope or expert judgement will be agreed with the MMO in consultation with Natural England.

⁵ https://www.marlin.ac.uk/sensitivity/sensitivity_rationale

4.2.4 Potential AEoI

60. Natural England (2019) states that there are no thresholds for determining an AEoI, however in order for Natural England to advise that there is no likelihood of an AEoI, the project would need to demonstrate the following:

- “That the loss is not on the priority habitat/feature/sub feature/supporting habitat; and/or
- That the loss is temporary and reversible (within guidelines above); and/or
- That the scale of loss is so small as to be *de minimus* alone; and/or
- That the scale of loss is inconsequential including other impacts on the site/feature/sub feature”

61. A map will be produced showing the final offshore export cable route and location of cable protection, along with the pre-construction habitat and *S. spinulosa* reef mapping to identify the predicted exposure of each habitat to pressures associated with Norfolk Vanguard. The maps would be informed by the interim survey to be completed in 2020. The results would be used to determine whether any loss or disturbance is on a priority habitat/feature/sub feature/supporting habitat and therefore whether further consideration of the reversibility or scale is required.

62. Consideration of the scale of loss would be undertaken for the HHW SAC as a whole, based on the 1,467.59 km² (146,759 hectares (ha)) total site area. Consideration will also be given to the scale of loss on a feature based on the following areas quoted in the Natura 2000 Standard Data Form⁶ subject to further available information at the time of completing the SIP:

- Sandbanks 668.928km² (66,892.8ha)
- Reef 0.88km² (88.06ha)

63. It is unlikely that it will be possible to determine the scale of loss for a sub feature. This would require habitat mapping across the whole HHW SAC to determine the extent of sub features. This is beyond the scope of Norfolk Vanguard.

Mitigation associated with

⁶ <http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=UK0030369>

3.2 Pre-construction surveys

24. This section will provide detail of the relevant pre-construction surveys that will be required to inform cable installation and cable protection in accordance with the In-Principle Monitoring Plan (document 8.12), including:

- Geophysical survey within the offshore cable corridor in the HHW SAC;
- Targeted *S. spinulosa* reef surveys within the offshore cable corridor in the HHW SAC (through the interim and pre-construction surveys);
- Geotechnical assessment of the seabed within the offshore cable corridor in the HHW SAC; and
- Unexploded ordnance (UXO) survey.

25. Details of the final cable route and micro-siting within the HHW SAC will be provided in the final HHW SAC CSIMP, informed by the pre-construction surveys.

3.3 Cable Burial Risk Assessment

26. This section will summarise the cable burial risk assessment which will be undertaken for the project. Once the risk assessment has been completed this section will include the following information:

- Overview of the risk assessment;
- Overview of the site (bathymetry and seabed sediments);
- Sandwaves;
- Megaripples;
- Till outcrops;
- Steep Slopes; and
- Boulders and Debris

3.4 A Sandwave Characterisation Study

27. This section will contain a summary of the sandwave characterisation study which will be undertaken within the cable route that overlaps with HHW SAC.

3.5 Cable installation strategy

28. This section will detail the steps involved in the export cable installation process of relevance to the HHW SAC once known, including:

- Seabed preparation;
- Cable route clearance;
- Placement of cable protection; and
- Cable installation method statement.

29. The installation strategy will be informed by a burial tool capability study. A summary of the study will be provided here and the study itself provided in a technical Appendix.

3.6 Cable Protection Plan

30. As detailed in the cable burial risk assessment summary above, there is the potential for target burial depth to not be achieved along sections of the export cable route within HHW SAC. Once available, this section will provide the following information:

- Decision making process on burial and protection;
- Type of cable protection;
- Location of cable protection (see Annex 3 Likely Cable Protection Locations);
- Installation method of cable protection;
- Cable Crossings cable protection, and
- Consideration of risks to other sea users, e.g. snagging of fishing gear and vessel anchors.

4 MITIGATION

31. Norfolk Vanguard Limited is committed to minimising potential effects on the effect on features of HHW SAC.

64. The final mitigation measures in the HHW SAC is outlined in Section 5.

5 MITIGATION

~~65.32.~~ Norfolk Vanguard Limited is committed to minimising potential effects on the HHW SAC. As discussed in Section 4, the final SIP will provide a review of the potential effects on site integrity based on the final project design and pre-construction survey data for the HHW SAC. Following this process, mitigation measures CSIMP will be refined and updated on the basis of the principles outlined in the sections below and the commitments provided in Table 1.2, to ensure effects are minimised ~~and to allow the conclusion of no AEOI.~~

~~66.33.~~ For the mitigation measures identified, information will be provided in the final ~~SIP~~ HHW SAC CSIMP to detail how the measure will allow the conclusion of 'no adverse effect on integrity beyond reasonable scientific doubt' on the HHW SAC.

5.14.1 Embedded mitigation

~~67.34.~~ During the pre-~~application~~ consent stage, Norfolk Vanguard Limited made the following commitments, informed by consultation with Natural England and the MMO through the Evidence Plan Process.

5.1.14.1.1 Minimising export cabling

~~68.35.~~ Norfolk Vanguard Limited has taken the decision to use an High Voltage Direct Current (HVDC) export solution in order to reduce the number of cables and cable protection. This results in the following mitigating features:

- There will be two cable trenches instead of six for Norfolk Vanguard (and the same for Norfolk Boreas);
- The volume of sediment arising from pre-sweeping and cable installation works is reduced by 67%;
- The area of disturbance for pre-sweeping and cable installation is reduced by 67%;
- The space required for cable installation is reduced, increasing the space available within the cable corridor for micro-siting to avoid constraints such as *S. spinulosa* reef;
- The potential requirement for cable protection in the unlikely event that cables cannot be buried is reduced due to the reduction in the number of cables. In addition, Norfolk Vanguard Limited has committed to further reduction in cable protection (discussed in section 4.5.2); and
- The number of export cables required to cross existing cables and pipelines and the associated cable protection is reduced.

5.1.24.1.2 Pre-construction surveys

~~69.36.~~ An interim *S. spinulosa* survey is being planned for 2020. The scope of this survey will be agreed with the MMO and Natural England and it will encompass the full section of the offshore cable corridor that overlaps with the SAC.

~~70.37.~~ A pre-construction survey will be undertaken within 12 months of any cable installation works and the methodology for the pre-construction surveys will be agreed with the MMO in consultation with Natural England.

~~71.38.~~ The results of these surveys will be used to plan the routing of cables including micro-siting where possible (see Section 4.2).

5.24.2 Micrositing

~~72.39.~~ Norfolk Vanguard Limited is committed to micro-siting around Annex 1 reef where there is sufficient space to route the cables around reef identified during interim survey (due to commence in 2020~~-)~~ and the pre-construction surveys. The commitments made by Norfolk Vanguard Limited to date (Section 4.1), in particular the HVDC export solution to decrease the number of cable trenches from six to two, makes it highly likely that micro-siting will be possible.

~~73.40.~~ As discussed in Section 4.1.2 and Section 5, a pre-construction survey would be undertaken within 12 months of any cable installation works and the results of this survey would inform the final routing/micro-siting of cables.

~~74.41.~~ The interim survey and pre-construction survey will be used to plan the cable routes for the two Norfolk Vanguard cable trenches as well as the two Norfolk Boreas⁷ trenches. Depending on the duration between cable installation for the projects, further pre-construction surveys may be required to ensure these are undertaken within 12 months of the installation works for Norfolk Boreas. Further small scale micro-siting would be undertaken where possible within the confines of the initial cable route plan, should reef have developed since the first pre-construction survey.

~~75. Diagram 5.1 shows the process of identifying micro-siting mitigation following the interim and pre-construction surveys. This reflects Norfolk Vanguard Limited's commitment to avoiding areas of reef identified during the pre-construction surveys and to take routes which would have the least effect on the two priority Areas to be Managed as Reef (Figure 4.1).~~

~~76. As shown in Diagram 5.1, should there not be sufficient space to route cables around reef identified during the interim and pre-construction surveys the route which~~

⁷ This document relates to Norfolk Vanguard alone, however consideration will also be given to Norfolk Boreas to ensure mitigation solutions are compatible for both projects.

would result in the least temporary disturbance would be proposed. This route would then be subject to further assessment and a conclusion of no AEoI would have to be reached by the MMO in consultation with Natural England. If such a finding could not be reached, construction could not commence and the onus would be on Norfolk Vanguard Limited to consider alternative solutions. For example, this could include: minor amendments to the order limits in discrete areas where the cable route interacted with reef to provide space for micro-siting; or a variation to the Transmission DML Condition 9(1)(m) to allow a finding of AEoI should the project satisfy the HRA Assessment of Alternatives, Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures tests.

77.42. The detailed cable route, including micro-siting ~~will be determined based on the results of the interim and pre-construction surveys and,~~ must be agreed with the MMO in consultation with Natural England before any installation works, including seabed preparation can commence.

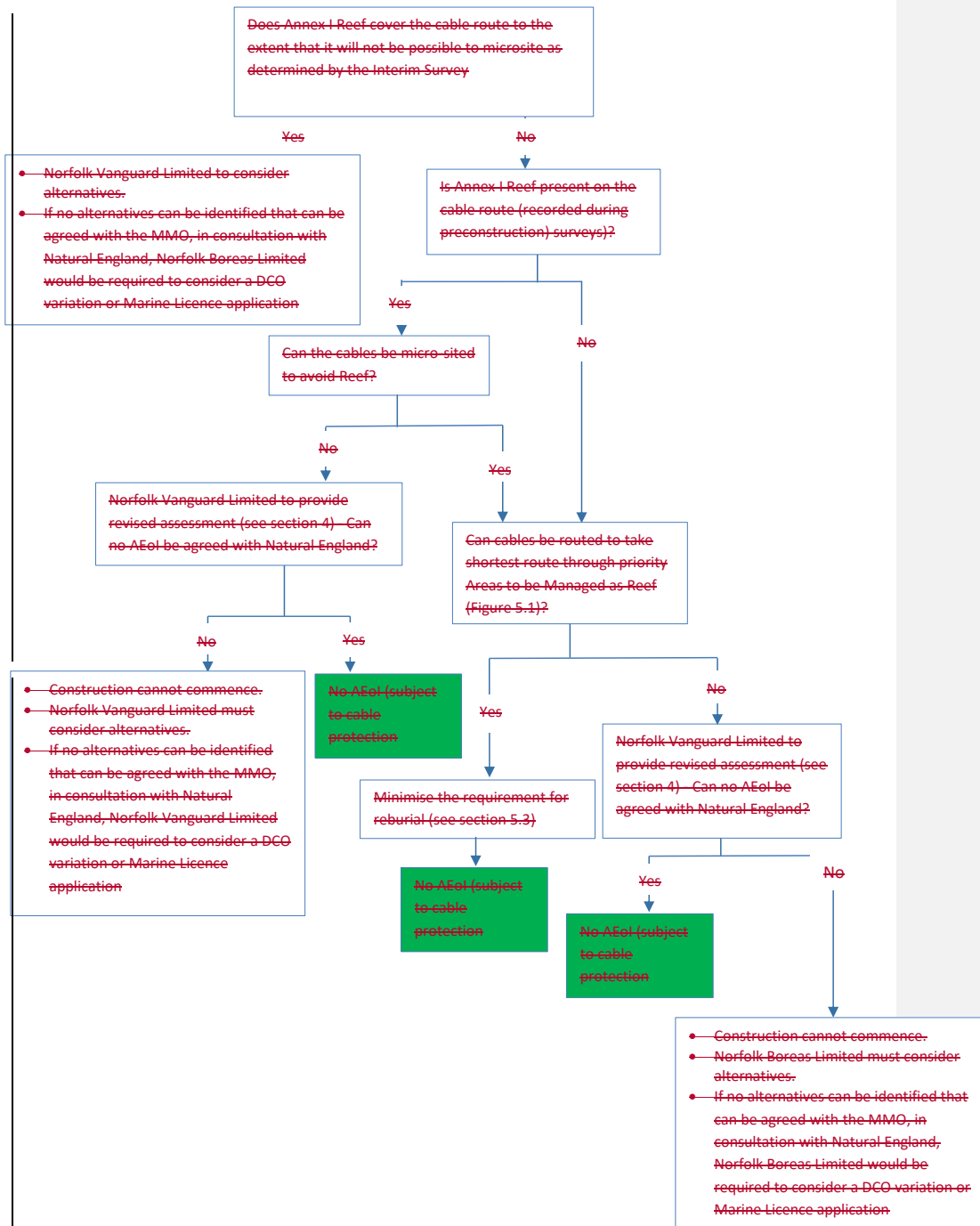


Diagram 5.1 Micrositing around Annex 1 Reef decision process

Norfolk Vanguard Offshore Wind Farm

5.2.14.2.1 Likelihood of successful micrositing

78.43. As discussed in the Information to Support HRA report (document 5.3), Norfolk Vanguard Limited commissioned a Cable Constructability Assessment by Global Marine Systems Ltd (provided in Appendix 4.2 of the ES) to determine an appropriate cable corridor width of approximately 2km to 4.7km (a combined corridor for Norfolk Vanguard and Norfolk Boreas).

79.44. The space available for micrositing within the offshore cable corridor where it overlaps with the HHW SAC is a width of approximately 1.05km along most of the route (where the corridor width is 2km), with up to 3.75km of micrositing available in the 'dog-leg' area (where the corridor width is 4.7km). This takes into account the space required for Norfolk Boreas export cables⁸. The space available for micrositing is based on the following worst case scenario:

- Up to four export cable trenches (four cables in 2 trenches for Norfolk Vanguard and four cables in two trenches for Norfolk Boreas) with spacing as shown in Plate 1-1;
- The cable corridor is typically 2km in width, with a wider section of up to 4.7km where there is a dog-leg in the corridor within the SAC;
- A total width of approximately 1.35km is required for Norfolk Vanguard and Norfolk Boreas; which includes up to four cables (laid in pairs, i.e. two trenches) for each project, a contingency of 440m (0.4km), an anchor placement zone, and a buffer for potential anchor placement and cable replacement works (GMSL, 2016 unpublished; Plate 1-1); and
- The remaining width of the offshore cable corridor within the SAC is therefore approximately 0.65km to 3.35km plus the built-in contingency of 0.4km, resulting in approximately 1.05km to 3.75km available for micrositing.

⁸ This SIP is for Norfolk Vanguard alone, however the space available for micrositing within the cable corridor must take account of Norfolk Boreas.

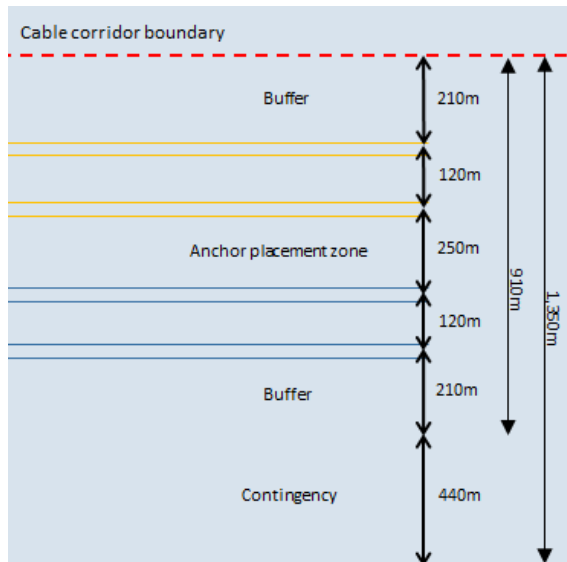


Plate 1-1 Export cables layout (two pairs of cables for Norfolk Vanguard (yellow) and two pairs of cables for Norfolk Boreas (blue)) based on 48m water depth⁹

5.34.3 Cable installation and seabed preparation

80.45. As discussed above, the commitments made by Norfolk Vanguard Limited to date (Section 4.1), in particular the HVDC export solution, greatly reduce the impact area and duration of cable installation by reducing the number of cable trenches from six to two.

81.46. Cables will be buried where the substrate allows burial to a depth of at least 1m. Should burial not be possible (e.g. in hard clay and sedimentary rocks), remedial action would be discussed with Natural England and the MMO (see Section 4.5.2). The circumstances within which cable burial would be deemed not possible and the approach if these circumstances are encountered (e.g. requirement for cable protection outside the priority areas to be managed as reef, Section 4.5.2), will be agreed with the MMO in consultation with Natural England, prior to construction.

82.47. In response to requests from Natural England during the Norfolk Vanguard Examination, the Applicant commissioned an Interim Cable Burial Study (Appendix 2) which was based on geophysical, geotechnical and environmental surveys carried

⁹ The separation between cables is determined by the potential space required to undertake a cable repair which is a factor of the water depth. Depth in the SAC is less than 48m and therefore this represents a conservative worst case scenario

out by Fugro Survey B.V. in 2016 with 100% coverage of the offshore export cable corridor, including the area within the HHW SAC. This has identified that at least 95% of the offshore export cable length within the HHW SAC is likely to be able to be buried and no cable protection will be required within the priority areas to be managed as reef.

83-48. Section 5.4.13 of ES Chapter 5 provides a description of the cable laying process, including seabed preparation and potential installation methods. This includes:

- Boulder clearance (if required)
- Pre-lay grapnel run
- An option of pre-sweeping to level sandwaves to a reference seabed level that would minimise the potential for cables becoming unburied
- Cable burial methods, e.g.:
 - Ploughing
 - Trenching or cutting
 - Jetting

84-49. There will be a minimum separation of 75m between cable pairs (as shown in Figure 11 of the Export Cable Installation Study, ES Appendix 5.1) and the maximum width of disturbance from pre-sweeping is 37m (Section 7.3.2.2.1 of the Information to Support HRA report), therefore there would be no repeated disturbance of the same footprint during construction.

85-50. If sandwave levelling is undertaken as part of the installation strategy, this would be completed at an appropriate period before the installation of each cable pair to ensure that recovery of sandwaves does not occur prior to the installation of cables. This is likely to be in the order of weeks prior to cable installation.

86-51. The aim of the installation strategy for cables in the SAC would be to bury cables below the mobile sandwaves where substrate conditions allow, to avoid or minimise the requirement for routine re-burial of cables during the operational phase. This will be considered through the design and execution of the installation process, taking account of relevant knowledge regarding seabed morphology and mobility. In order to achieve this aim, it is acknowledged that some seabed preparation activities may be required prior to cable installation. While appropriate steps should be taken to control and mitigate the additional impacts of these works (e.g. sediment disposal, see section 4.3.1), the aim of securing the long-term burial and protection of the cables is the priority.

87-52. Norfolk Vanguard Limited acknowledges that Natural England has experienced situations (notably during and after the construction of other offshore wind projects in the Greater Wash area) where the outcome of cable installation operations has

fallen short of the undertakings that were made by developers and contractors prior to construction. Norfolk Vanguard can benefit from this experience and underpin the proposed plans (i.e. detailed design and installation methodology) by establishing a comprehensive evidence base to provide confidence that execution of the burial strategy will meet the relevant burial requirements. Where applicable, this should be achieved by citing previous projects where similar design approaches, installation methods and tools have been used together with evidence that comparable, successful outcomes were achieved. Table 1.1 outlines a scope of work that Norfolk Vanguard Limited intends to carry out in order to develop detailed plans for installation of cables in the HHW SAC, and the associated evidence base to support these plans.

88-53. The methodology will be informed by the pre-construction survey data and any available evidence from other relevant projects and must be agreed with the MMO in consultation with Natural England.

Table 1.1 Process for identifying a one-off burial strategy

Brief description	Activities and aims
Learning from other projects	Norfolk Vanguard Limited will undertake a 'lessons learned' exercise focusing on other projects with challenges regarding installation of subsea cables in mobile sediments. The aim will be to identify the key areas of under-performance, the primary causes of the under-performance, and 'steps to take' to avoid similar adverse outcomes.
Identifying successes	Norfolk Vanguard Limited will undertake a review of subsea cable installation projects which have also faced challenges relating to mobile sediments, but where burial objectives were generally achieved. The aim will be to compile evidence relating to successful design approaches, methods and tools.
Designing interim survey of SAC	Norfolk Vanguard Limited will design an interim offshore survey campaign to inform the development of the <u>SIP-HHW SAC CSIMP</u> . The primary aim of the survey will be to inform understanding of the extent and character of <i>Sabellaria</i> reef within the cable corridor.
Execution of interim survey	Norfolk Vanguard Limited will procure and manage the survey activity as per the survey design (see previous row). This survey is due to commence in 2020.
Defining burial targets	Norfolk Vanguard Limited will undertake a geotechnical assessment of the seabed in the SAC, and a Cable Burial Risk Assessment (CBRA) to determine the required depth of burial for the export cables through the SAC.
Burial tool capability study	Norfolk Vanguard Limited will undertake a review of the burial tool market, informed by the initial geotechnical and CBRA work described above. The aim will be to identify tools that will be suitable for the burial requirements in the SAC, and to define the key technical requirements (relating to tool design and burial capability) to be used for procurement of the cable installation contract.
Sandwave characterisation study - cable installation strategy	Norfolk Vanguard Limited will undertake a sandwave characterisation study, focusing on the part of the cable corridor that falls within the SAC. In parallel, Norfolk Vanguard Limited will also develop a strategy for installation of cables through areas of sandwaves. This strategy will define the seabed preparation works that would be required, the required timing of these works in relation to the cable installation activity, and the relationships between the preparation works, the reference seabed level, the target burial depth and the capability of the burial tool itself. The strategy will also consider the suitability of different methods/tools for sandwave levelling, and the selection of areas in the SAC for disposal of seabed material arising from this process. The final <u>SIP-HHW SAC CSIMP</u> will contain a pre-construction sandwave levelling report as requested by Natural England within their Relevant Representation (RR-099).

5.3.14.3.1 Further mitigation regarding cable installation and seabed preparation

89.54. Following the publication of the relevant representation made by Natural England for Norfolk Boreas (RR-099), where Natural England state: “*Examples of mitigation measures undertaken by other activities in HHW SAC include reduction of footprint associated with vessel stabilisation through use of alternative work vessels*”. Norfolk Vanguard Limited has made the commitment not to use Jack-up vessels within the SAC and will use alternative work vessels in the SAC during the construction and operation of Norfolk Vanguard.

5.44.4 Sediment disposal

90.55. Norfolk Vanguard Limited has committed to the disposing of sediment arising from the HHW SAC back into the SAC to ensure no sediment is lost from the system, enabling recovery of the Sandbanks (discussed further in Section 5.4 of Appendix 7.1 of the Information to Support HRA report). Further commitment to additional mitigation designed to ensure this process occurs rapidly has also been made (see section 4.4.1).

Field Code Changed

91.56. Disposal licence HU213 relates to the Norfolk Vanguard Order Limits within the HHW SAC. Up to 500,000m³ of sediment may be dredged from the SAC over an area of 250,000m². Any sediment arising from the SAC will be deposited within the SAC based on the analysis of pre-sweeping volumes presented in ES Appendix 5.1 Cable Installation Study. The final ~~SIP~~HHW SAC CSIMP will contain a detailed a pre-construction sandwave levelling report.

92.57. The location(s) of sediment disposal must include a minimum buffer of 50m from *S. spinulosa* reef and will therefore be informed by the pre-construction surveys.

93.58. The methodology for disposal will be informed by the detailed design following the interim and pre-construction surveys. The detail of the agreed sediment disposal strategy within the SAC will be provided within the final HHW ~~SIP~~SAC CSIMP.

94.59. A primary aim of the sediment disposal strategy (i.e. locations and methodology for disposal) will be to facilitate recovery. The strategy will therefore also be informed by any available evidence regarding recovery from other relevant projects and the commitments made to expedite recovery presented in section ~~5.4.1.4.4.1~~.

95.60. The location(s) and methodology for disposal must be agreed with the MMO in consultation with Natural England before works can commence.

5.4.14.4.1 Further mitigation in relation to sediment disposal

96.61. Following the publication of the relevant representations for Norfolk Boreas made by Natural England (RR-099) and the MMO (RR-069) and additional consultation with

both organisations, Norfolk Vanguard Limited has committed to the following additional mitigation measures should sandwave levelling be permitted. ~~These measures are designed to provide further confidence that no AEoI on the HHW SAC can be concluded.~~ Norfolk Vanguard Limited will:

- Dispose of any material dredged from the seabed for sandwave levelling (also referred to as pre-sweeping) in a linear “strip” along the cable route.
- Dispose of material close to the seabed. This will be achieved through the use of fall pipe (also referred to as a down pipe) employed by the dredging vessel.
- Always attempt to bury any exposed cable within the HHW SAC prior to installing additional cable protection (placement of cable protection in new areas would be subject to a separate marine licence, see the Outline Operation and Maintenance Plan document reference 8.11 for further details).
- No use of Jack up vessels within the HHW SAC.

5.4.1.14.4.1.1 Disposal of dredged material in a linear strip close to the sea bed

97-62. It is recognised that it may not be possible to observe all the criteria proposed for sediment disposal at all locations and therefore when determining the location of disposal areas within the SAC the following criteria would be used:

- Priority 1 – material to be disposed of no closer than 50m to any *S. spinulosa* reef (see section ~~5.4.4.4~~).
- Priority 2- Dispose of material up drift of the cable route, to allow infill to occur as quickly as possible following cable installation.
- Priority 3 - Dispose of material as close as possible to cable route.

98-63. In order to ensure that material is deposited at the most appropriate locations to fulfil the criteria above Norfolk Vanguard Limited will make the commitment that, should sandwave levelling be required and permitted, material will be disposed of using a fall pipe (~~also referred to as a down pipe~~) as discussed above, employed by the dredging vessel.

5.5.4.5 Cable protection

99-64. Norfolk Vanguard Limited is committed to minimising cable protection and has already made significant reductions through embedded mitigation, in particular the commitment to use HVDC cables, requiring two cable pairs as opposed to six individual cables and therefore reducing the total number of crossings and the potential length of cable which may be unburied (Section 4.1.1).

100-65. Norfolk Vanguard Limited is committed to using only essential cable protection (i.e. where required for cable/pipeline crossings (see Section 4.5.1) and

should burial not be possible for sections of the cable length (see Section 4.5.2)), in order to minimise effects on the HHW SAC.

~~101-66.~~ Section 5.4.14 of ES Chapter 5 provides a description of the types of cable protection that may be deployed at Norfolk Vanguard, however, only essential cable protection up to the maximum values referred to in Section 4.5.3 will be used. This will be determined based on the results of the pre-construction survey and any crossings agreements. ~~Diagram 5.2 outlines the decision process when identifying a requirement for cable protection.~~ Prior to installation the need, type, sources, quantity (up to the maximum values presented below), distribution and installation method must be agreed with the MMO in consultation with Natural England. ~~As shown in Diagram 5.1, if it is not possible to reach a conclusion of no AEoI, construction cannot commence and the onus would be on Norfolk Vanguard Limited to consider alternative solutions, in consultation with Natural England and the MMO. If a solution cannot be agreed, the Applicant would need to consider a DCO variation or a Marine Licence application. For example, this could include: minor amendments to the order limits in discrete areas where the cable route interacted with reef; or a variation to the Transmission DML Condition 9(1)(m) to allow a finding of AEoI should the project satisfy the HRA Assessment of Alternatives, Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures tests.~~

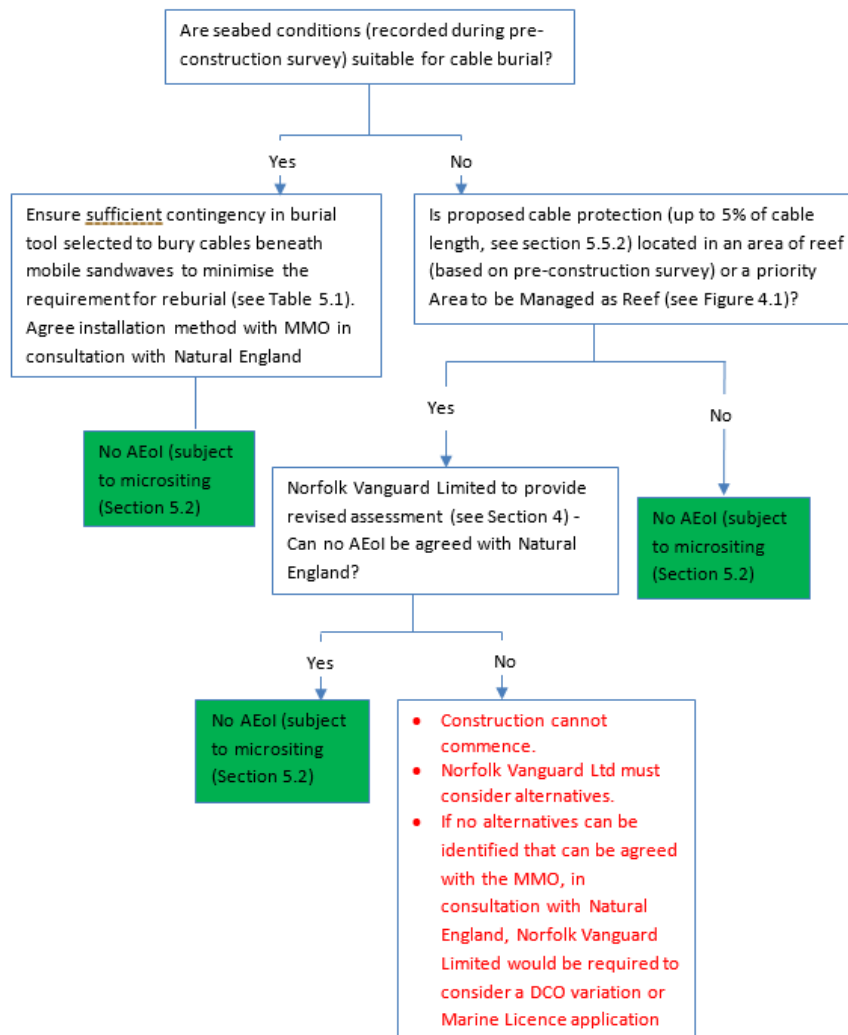


Diagram 5.2 Cable protection decision process

5.5.14.5.1 Cable and Pipeline Crossings

102-67. An estimate of five existing cables and one pipeline within the HHW SAC which each Norfolk Vanguard export cable would need to cross has been included in the calculation of the total area and volume of cable protection assessed in the ES and Information to Support HRA report and included in the parameters secured in the draft DCO. The estimated maximum width and length of cable protection for

cable crossings would be 10m and 100m, respectively. The maximum height of cable crossings is 0.9m.

~~103. In addition, there are likely to be disused cables within the HHW SAC. Subject to agreement of the owner/operator and engineering constraints, any disused cables would be cut, and a section removed to avoid the need for a crossing using cable protection. The Applicant is currently in discussion with cable owners and operators and is confident of reducing the number of cable crossings that will be required.~~

68. In addition, every effort is being made by the Applicant to reduce the number of crossings by removing disused cables where agreement can be reached with the cable owners. An Out of Service Cable Recovery Agreement has been discussed with BT Subsea who own a number of out of service assets within the HHW SAC. Appendix 4 (document reference ExA; Mit; 11.D10.2.App4) demonstrates the advanced stages of these discussions, with a formal agreement expected to be in place imminently.

104-69. Following the interim and pre-construction surveys and identification of preferred cable routes, Norfolk Vanguard Limited would identify potential crossing requirements and consult with the owner/operators of the cable or pipeline.

105-70. Consultation would be undertaken with Natural England and the MMO at the earliest opportunity to allow both parties to provide advice on the proposed location, extent, type and quantity of cable protection associated with crossings.

106-71. Should additional unregistered cables/pipelines be identified during the pre-construction surveys, Natural England and the MMO will be consulted at the earliest opportunity. If an additional crossing can be accommodated using cable protection that is within the maximum values presented in Section 4.5.3, no consent variation would be required, however the proposed location, extent, type and quantity of cable protection associated with crossing the unregistered cable/pipeline would be agreed with the MMO in consultation with Natural England, should it not be possible to remove a section of the unregistered cable/pipeline.

5.5.24.5.2 Potential Unburied Cable Due to Ground Conditions

107-72. As discussed previously, Norfolk Vanguard Limited is committed to burying cables where substrate conditions allow and therefore minimising cable protection. In addition, in response to requests from Natural England during the Norfolk Vanguard Examination, the Applicant commissioned an Interim Cable Burial Study (Appendix 2) which identified that at least 95% of the offshore export cable length within the HHW SAC is likely to be able to be buried. As a result, the length of potential cable protection required for unburied cable is 5% of the offshore export

cable length within the HHW SAC, in addition to cable protection for cable/pipeline crossings (see Sections 4.5.1 and 4.5.3). This 5% represents a significant reduction in cable protection for unburied cables from the 10% assessed in the ES and Information to Support HRA report. In addition, only essential cable protection within the 5% will be used where burial is not possible due to encountering hard substrates (e.g. hard clay and sedimentary rocks) within the top 1-2m of the seabed. As discussed in Section 4.3, the circumstances within which cable burial would be deemed not possible and the approach (e.g. number of burial attempts) if these circumstances are encountered would be agreed with the MMO in consultation with Natural England, prior to construction.

~~108-73.~~ Prior to installation, the location, extent, type and quantity of any cable protection must be agreed with the MMO in consultation with Natural England.

~~5.5.34.5.3~~ Total area and volume of cable protection in the SAC

~~109-74.~~ The total area and volume of cable protection in the SAC for unburied cables and cable/pipeline crossing will not exceed 32,000m² and 20,800m³ based on the parameters described above.

~~5.5.44.5.4~~ Further mitigation in relation to cable protection

~~5.5.4.14.5.4.1~~ No cable protection in priority areas to be managed as reef

~~110-75.~~ Due to further mitigation measures and information provided in Appendix 3, the location for such cable protection is not likely to overlap with areas to be managed as *S. spinulosa* reef. Therefore, the Applicant has made a commitment not to install any cable protection in the priority areas to be managed as reef within the HHW SAC, unless otherwise agreed with the MMO in consultation with Natural England. This commitment means ~~that~~ that, as the top priority areas to be managed as *S. spinulosa* Annex I reef are avoided, the cable protection cannot hinder the achievement of the conservation objective of maintain or restore the *S. spinulosa* Annex I reef to a favourable condition (Natural England & JNCC, 2018). Therefore, this ensures that any small scale permanent loss of habitat within the SAC would be inconsequential to the conservation objectives of Annex I reef.

~~5.5.4.24.5.4.2~~ Decommissioning of ~~Cable Protection~~ cable protection

~~111-76.~~ Following a review of the supply chain, the Applicant has made a further commitment to decommission cable protection at the end of the Norfolk Vanguard project life where it is associated with unburied cables due to ground conditions (where required for crossings this will be left *in situ*).

112-77. Further detail on the methods for decommissioning is provided in Appendix 3 of the Additional Mitigation document (document reference ExA; Mit; 11.D10.2.App3).

113-78. This commitment ensures that there will be no permanent habitat loss as a result of cable protection and further contributes to the ability to conclude no AEoI of the HHW SAC. This is discussed further in Appendix 2 of the Additional Mitigation document (document reference ExA; Mit; 11.D10.2.App2).

5.64.6 Maintenance

114-79. During the life of the project, there should be no need for scheduled repair or replacement of the subsea cables, however periodic inspection would be required and where necessary, reactive repairs and reburial would be undertaken. This is considered further below.

5.6.14.6.1 Cable repairs

115-80. While it is not possible to determine the number and location of repair works that may be required during the life of the project, an estimate of one export cable repair every 10 years on average within the SAC is included in the Information to Support HRA.

116-81. It will be critical that repairs can be instigated rapidly upon identifying a failure, therefore a protocol for undertaking repairs would be agreed with the MMO in consultation with Natural England, prior to construction. Upon identifying a requirement to undertake a repair in the HHW SAC, the repair would be instigated in accordance with agreed protocol and the MMO and Natural England would be notified.

117-82. The protocol for any subsequent repairs would then be reviewed (if necessary) and agreed with the MMO and Natural England.

118-83. It is acknowledged that *S. spinulosa* reef can be expected to recover following cable installation and therefore has potential to be affected during maintenance if a repair is required at the location of a reef. The repair protocol discussed above, would include consideration of circumstances where *S. spinulosa* reef may be present at the repair location. As discussed above the protocol would be agreed with the MMO in consultation with Natural England in advance of construction.

5.6.24.6.2 Cable reburial

119-84. As discussed in section 4.3, the aim of the installation strategy for cables in the SAC would be to bury cables below the mobile sandwaves where substrate

conditions allow, to avoid or minimise the requirement for routine re-burial of cables during the operational phase.

~~120-85.~~ The Information to Support HRA report (document 5.3) considers a worst case scenario that cables could become exposed due to moving sand waves, if sandwave levelling/pre-sweeping were not adopted during the installation phase. During the life of the project, periodic surveys would be required to ensure the cables remain buried and if they do become exposed, re-burial works would be undertaken.

~~121-86.~~ Reburial of up to 4km per cable within the SAC at approximately 5 year intervals has been estimated as a worst case scenario and assessed in the Information to Support HRA report based on a worst case scenario that no pre-sweeping is undertaken during cable installation. Should pre-sweeping be permitted the requirement for reburial would be greatly reduced, if not removed.

~~122-87.~~ It will be critical that reburial can be instigated rapidly upon identifying exposed cable, therefore the protocol for undertaking reburial would be agreed with the MMO in consultation with Natural England, prior to construction.

~~123-88.~~ Upon identifying a requirement to undertake reburial in the HHW SAC, the MMO and Natural England would be notified. The protocol for any subsequent reburial would then be discussed and agreed with the MMO and Natural England.

~~124-89.~~ In order to limit the amount of cable protection located within the SAC as far as possible, Norfolk Vanguard Limited has made the commitment to attempt to rebury any cables which become exposed within the SAC during operation prior to the installation of any cable protection. Any placement of cable protection in new areas during operation and maintenance would be subject to a separate Marine Licence.

~~125-90.~~ Should sandwave mobility be such that the cables have become unburied, it is unlikely that *S. spinulosa* reef would have formed in this location. However, as discussed above, reburial works would be agreed with the MMO in consultation with Natural England and this would include consideration of any *S. spinulosa* reef at the reburial location.

~~5.6.34.6.3~~ Cable protection

~~126-91.~~ If cable protection were to be required in new areas during maintenance, this would be subject to an additional Marine Licence.

5.74.7 Overview of Mitigation Commitments in the HHW SAC

Table 1.2: Overview of Mitigation Commitments in the HHW SAC

Pre-consent Mitigation Commitments	Status	Final Mitigation solution following detailed design	Agreed with MMO in consultation with Natural England
Use of HVDC export cable solution to reduce the no. of cable trenches from six to two	Not subject to change	N/A	✓
Pre-construction survey to be undertaken within 12 months of commencing works	Survey methodology to be agreed with MMO in consultation with Natural England	To be confirmed	To be confirmed
Seabed preparation – potential use of pre-sweeping to minimise reburial	To be confirmed based on the pre-construction survey data, any relevant available evidence from other projects and agreed with the MMO in consultation with Natural England	To be confirmed	To be confirmed
Sediment disposal - up to 500,000m ³ of sediment arising from the SAC may be deposited within the SAC	The volume (up to this maximum) will be a factor of whether/or to what extent pre-sweeping is used (see above) and this will be agreed with the MMO in consultation with Natural England. The location and method for disposal will be agreed with the MMO in consultation with Natural England as shown below.	To be confirmed	To be confirmed
Sediment disposal – location(s) to be agreed with the MMO in consultation with Natural England	To be confirmed based on the pre-construction survey data and detailed design and agreed with the MMO in consultation with Natural England.	To be confirmed	To be confirmed
Sediment disposal - method to be agreed with the MMO in consultation with Natural England	To be confirmed based on the pre-construction survey data, any relevant available evidence from other projects and agreed with the MMO in consultation with Natural England	To be confirmed	To be confirmed
Cable installation – at least 95% of the cable length in the SAC will be buried to at least 1m. Any areas of unburied cable will be discussed with Natural England and the MMO (see also Cable Protection below)	To be confirmed based on the pre-construction survey data and detailed design and agreed with the MMO in consultation with Natural England	To be confirmed	To be confirmed
Cable installation – micro-siting and cable route to be agreed with the MMO in consultation with Natural England	To be confirmed based on the pre-construction survey data and detailed design and agreed with the MMO in consultation with Natural England	To be confirmed	To be confirmed
Cable installation method to be agreed	To be confirmed based on the pre-construction survey data and	To be confirmed	To be confirmed

Pre-consent Mitigation Commitments	Status	Final Mitigation solution following detailed design	Agreed with MMO in consultation with Natural England
with the MMO in consultation with Natural England	detailed design and agreed with the MMO in consultation with Natural England		
Cable protection – up to 5% of the cable length within the SAC may require cable protection (reduction from 10%)	To be confirmed based on the pre-construction survey data and detailed design and agreed with the MMO in consultation with Natural England	To be confirmed	To be confirmed
The total area and volume of cable protection in the SAC will not exceed 32,000m ² and 20,800m ³ , respectively	Only essential cable protection up to these maximum values will be used and prior to installation the location, extent, type and quantity must be agreed with the MMO in consultation with Natural England. This will be determined based on the results of the pre-construction survey and any crossings agreements.	To be confirmed	To be confirmed
Cable repairs – approximately one cable repair every 10 years within the SAC has been assessed but any repairs would be agreed with the MMO in consultation with Natural England	The methodology for undertaking repairs would be agreed with the MMO in consultation with Natural England, prior to construction to allow a rapid response during the maintenance phase if repairs are required. Upon identifying a requirement to undertake a repairs in the HHW SAC, the MMO and Natural England would be notified. The approach for any subsequent repairs would then be discussed and agreed with the MMO and Natural England.	To be confirmed	To be confirmed
Cable reburial - approximately 10km per cable within the SAC at approximately 5 year intervals has been assessed but any reburial would be agreed with the MMO in consultation with Natural England	The methodology for undertaking reburial would be agreed with the MMO in consultation with Natural England, prior to construction to allow a rapid response during the maintenance phase if reburial is required. Upon identifying a requirement to undertake reburial in the HHW SAC, the MMO and Natural England would be notified. The approach for any subsequent reburial would then be discussed and agreed with the MMO and Natural England.	To be confirmed	To be confirmed
Additional Mitigation			
A series of additional measures relating to the sediment disposal methodology	As a result of concerns raised for Norfolk Boreas by Natural England in their Relevant Representation (RR-099) the Applicant has committed to: <ul style="list-style-type: none"> disposing of any dredged sediment close to the seabed using a fall pipe from the dredging vessel, 	Confirmed	To be confirmed

Pre-consent Mitigation Commitments	Status	Final Mitigation solution following detailed design	Agreed with MMO in consultation with Natural England
	<ul style="list-style-type: none"> disposing of sediment within a linear strip close to the cable route; and disposing of material updrift of the cable route to allow infill of any dredged areas as soon as possible following cable installation 		
Cable Reburial- If cable becomes exposed at any point during operation, reburial will be attempted before any cable protection is considered.	As a result of concerns raised for Norfolk Boreas by Natural England and the MMO in their Relevant Representations (RR-099 and RR-069). Norfolk Vanguard Limited has committed to attempting to rebury any exposed cable rather than adding cable protection. If after unsuccessful attempts to rebury the cable, cable protection is required this would only be installed following the attainment of a separate marine license. As part of this license the additional cable protection would be subject to agreement with the MMO in consultation with Natural England.	Confirmed	To be confirmed
Installation vessels – no jack up vessels will be used during construction within the HHW SAC.	The Applicant has made this commitment in response to advice provided by Natural England in their Norfolk Boreas Relevant Representation (RR099). This commitment was made as a result of comments made in both Natural England's (RR-099) and The MMO's (RR-69) Relevant Representation on Norfolk Boreas.	Confirmed	To be confirmed
Interim <i>S. spinulosa</i> reef survey to commence in 2020	Survey methodology to be agreed with MMO in consultation with Natural England	To be confirmed	To be confirmed
Cable protection – commitment not to install any cable protection in the "priority areas to be managed as <i>S. spinulosa</i> Annex I reef" identified by NE within the HHW SAC, unless otherwise agreed with the MMO in consultation with NE.	<p>The Applicant has made this commitment in response to the Department for Business, Energy and Industrial Strategy (BEIS) letter of 6 December which states:</p> <p><i>'The Applicant in consultation with the Marine Management Organisation and Natural England as necessary, is invited to provide information on the specific mitigation solutions that would address the potential effects of cable protection on the SAC features.'</i></p> <p>Therefore, further mitigation measures to address the potential effects of cable protection on the SAC features are being proposed by the Applicant. The effectiveness of the proposed mitigation on</p>	Confirmed	To be confirmed

Pre-consent Mitigation Commitments	Status	Final Mitigation solution following detailed design	Agreed with MMO in consultation with Natural England
	the HHW SAC designated features has been assessed and the outcome of the original HRA (document 5.3) remains unchanged; no AEoI of the designated features of the HHW SAC.		
Cable protection – commitment to decommission cable protection at the end of the project life where it is associated with unburied cables due to ground conditions (where required for crossings this will be left in situ).	<p>Further detail on the methods for decommissioning is provided in Appendix 3 of the Additional Mitigation document (document reference ExA; Mit; 11.D10.2.App3).</p> <p>This commitment ensures that there will be no permanent habitat loss as a result of cable protection and further contributes to the ability to conclude no AEoI of the HHW SAC. This is discussed further in Appendix 2 of the Additional Mitigation document (document reference ExA; Mit; 11.D10.2.App2).</p>	Confirmed	To be confirmed

65 MONITORING

127-92. Following the assessment of potential effects and identification of mitigation measures, consideration will be given to the requirement for monitoring within the HHW SAC.

128-93. The details of monitoring in the HHW SAC will be agreed with the MMO in consultation with Natural England prior to construction. Table 5.1 provides an overview of the likely monitoring within the HHW SAC.

94. In addition to the environmental survey and monitoring required as conditions of the DMLs within the Development Consent Order (DCO), additional studies will be undertaken for the project for engineering and design purposes. Some of these will overlap with the conditioned monitoring and wherever possible the Applicant will look to combine surveys for monitoring purposes with those already being carried out for engineering purposes. Examples of these surveys are:

- Geophysical;
- Geotechnical;
- Unexploded ordnance (UXO) survey and clearance; and
- Cable burial survey.

Table 5.1 In Principle Monitoring within the HHW SAC

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Changes in seabed topography, including scour processes	Sandbanks	Pre-construction	<ul style="list-style-type: none"> Engineering and design purposes Input in to benthic and other related ecological surveys and monitoring requirements as agreed with the MMO in consultation with SNCBs 	A single survey within the cable corridor survey areas using full sea floor coverage swath-bathymetric undertaken to IHO S44ed5 Order 1a standard and side-scan surveys of the area(s) within the Order limits in the SAC in which it is proposed to carry out construction works, including a 500m buffer area around the site of each works. (The “site of each works” being the area within the Order limits which is actually taken forwards to construction noting that it is possible that certain areas within the Order limits may not be developed.)	Scope of surveys and programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to the commencement of any survey works.
		Post-construction	<ul style="list-style-type: none"> Structural integrity / engineering (scour) Cable burial Monitoring of recovery at the location of works 	A single survey within the agreed cable corridor survey areas using full sea floor coverage swath-bathymetric surveys undertaken to IHO S44ed5 Order 1a standard and side scan sonar surveys around the footprint of the cable installation works to assess any changes in seabed topography. For this purpose the undertaker will, prior to the first such survey, submit a desk based assessment	
Effects on <i>S. spinulosa</i> reef	<i>S. spinulosa</i> reef	Post-consent	Determine the location and extent of any <i>S. spinulosa</i> reef within areas of the Order limits in the SAC in which it is proposed to carry out construction works to inform initial cable route selection.	<ul style="list-style-type: none"> A single geophysical (sidescan or Multi-Beam Echo Sounder) survey of those areas of the SAC within which it is proposed that seabed works will be carried out at a resolution sufficient to identify potential <i>S. spinulosa</i> reef; and In areas where potential <i>S. spinulosa</i> reef is identified from the review of the geophysical data, further survey e.g. drop down video will be deployed to confirm presence, extent and elevation. 	Survey methodologies shall be agreed with the MMO in consultation with Natural England.
		Pre-construction	Determine the location and extent of any <i>S. spinulosa</i> reef within areas of the Order limits in the SAC in which it is proposed to carry out construction works to inform the appropriate mitigation if found	<ul style="list-style-type: none"> A single geophysical (sidescan or Multi-Beam Echo Sounder) survey of those areas of the SAC within which it is proposed that seabed works will be carried out at a resolution sufficient to identify potential <i>S. spinulosa</i> reef; and In areas where potential <i>S. spinulosa</i> reef is identified from the review of the geophysical data, further survey e.g. drop down video will be deployed to confirm presence, extent and elevation. 	<ul style="list-style-type: none"> Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval in accordance with the timeframes set out in the DMLs Surveys may occur up to 12 months prior to the proposed construction works
		Post-construction	The requirement for post-construction monitoring will be dependent on the findings of the pre-construction surveys.	<ul style="list-style-type: none"> Where no <i>S. spinulosa</i> reef is identified by the pre-construction geophysical survey of the proposed works (and associated buffers), no further post-construction surveys will be undertaken; Where <i>S. spinulosa</i> reef is identified during the pre-construction survey and cannot be entirely avoided through micro-siting, a single post-construction survey, specifically targeting those reefs identified in the baseline survey will be undertaken as a check on their condition using the same methodology set out for pre-construction monitoring. 	<ul style="list-style-type: none"> If required, survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval in accordance with the timeframes set out in the DMLs and conducted within the first year post commissioning of the proposed wind farm. The duration over which monitoring of recovery is required would be agreed with the MMO following review of the post-construction survey data.

76 SUMMARY

~~129-95.~~ The final ~~SIP~~HHW SAC CSIMP will ~~be used to assess any effects~~ provide detail on the ~~Annex 1 Sandbank~~ cable specification, installation methods and Reef features ~~of mitigation and monitoring within~~ the HHW SAC based on the ~~findings of the~~ pre-construction ~~survey~~ survey and ~~detailed final~~ design of the project. This process will also identify any mitigation and monitoring requirements to ensure the MMO is satisfied. The CSIMP will be developed in consultation with the MMO and Natural England, that there is 'no adverse effect beyond reasonable scientific doubt' on and the HHW SAC. final CSIMP must be agreed with the MMO in consultation with Natural England.

~~130-96.~~ The following engineering work streams and offshore surveys have been identified to inform the development of the final ~~SIP~~HHW SAC CSIMP:

- Review of available information from other offshore wind and cabling projects;
- Pre-construction survey(s);
 - Geophysical survey within the offshore cable corridor in the HHW SAC;
 - Targeted *S. spinulosa* reef surveys within the offshore cable corridor in the HHW SAC (through the interim and pre-construction surveys);
 - Geotechnical assessment of the seabed within the offshore cable corridor in the HHW SAC;
- A Cable Burial Risk Assessment;
- A burial tool capability study;
- A sandwave characterisation study; and
- A cable installation strategy.

~~131-97.~~ These will be developed and undertaken in consultation with the MMO and Natural England. The results of these studies will inform the ~~review of effects on the integrity of the SAC (section 4) and the~~ identification of mitigation measures (section 54) in the final HHW SAC ~~SIP~~CSIMP.

87 REFERENCES

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