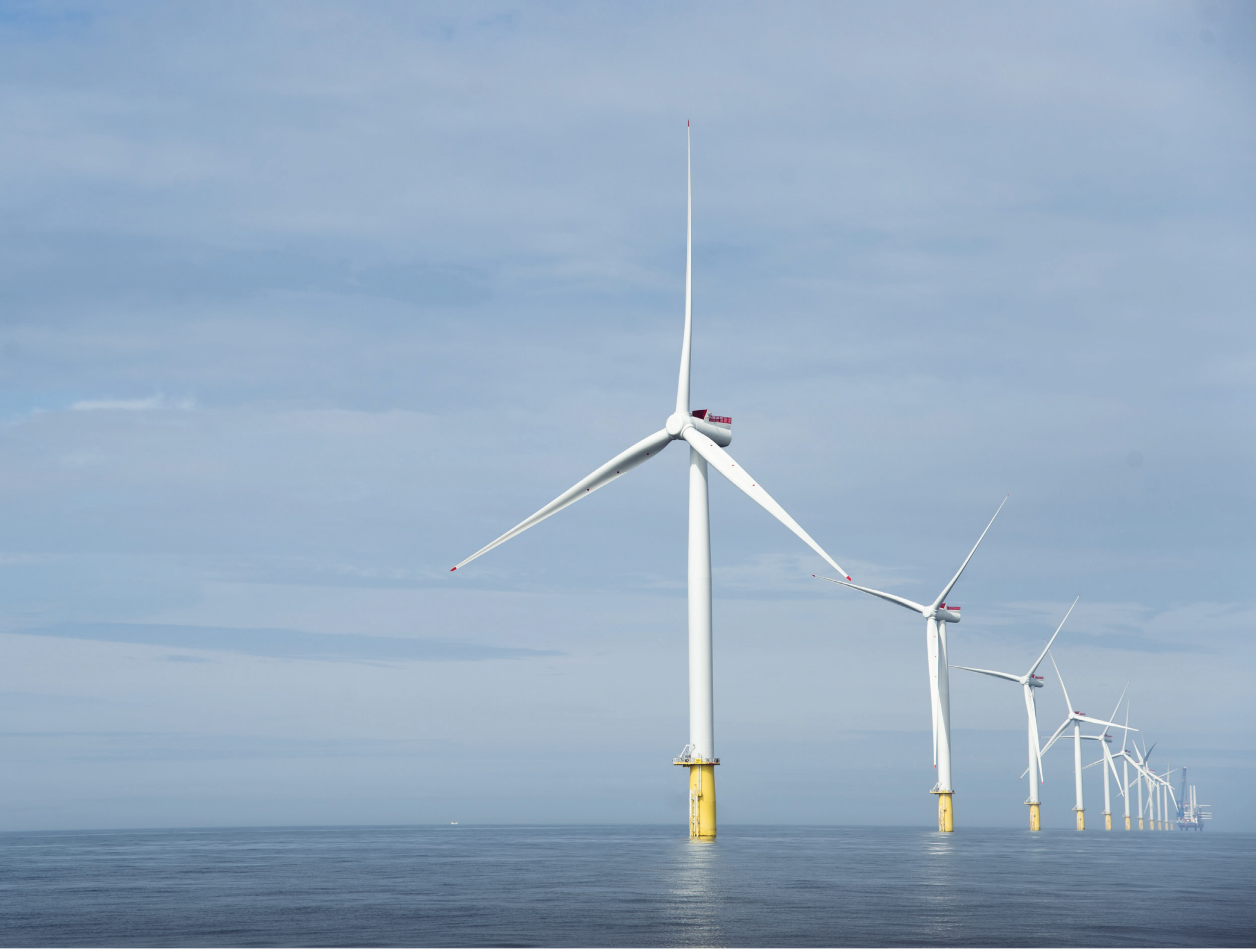

Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Environmental Statement

Volume 1

Chapter 18 - Water Resources and Flood Risk

August 2022
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Title:		
Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects Environmental Statement **Chapter 18: Water Resources and Flood Risk**		
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Glossary of Acronyms

BAP	Biodiversity Action Plan
CIA	Cumulative Impact Assessment
CIRIA	Construction Industry Research and Information Association
CMS	Construction Method Statement
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
Defra	Department for the Environment, Food and Rural Affairs
DEP	Dudgeon Extension Project
DMRB	Design Manual for Roads and Bridges
DWPA	Drinking Water Protected Area
EC	European Commission
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
GEP	Good Ecological Potential
GES	Good Ecological Status
GNDP	Greater Norwich Development Partnership
HDD	Horizontal Directional Drilling
IDB	Internal Drainage Board
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
NPS	National Policy Statements
NSIP	Nationally Significant Infrastructure Project
PPG	Pollution Prevention Guidance
RBD	River Basin District

RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SEP	Sheringham Shoal Extension Project
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
SWDP	Surface Water and Drainage Plan
WFD	Water Framework Directive

Glossary of Terms

The Applicant	Equinor New Energy Limited. As the owners of SEP and DEP, Scira Extension Limited (SEL) and Dudgeon Extension Limited (DEL) are the named undertakers that have the benefit of the DCO. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP. (See intro chapter for example).
Order Limits	The area subject to the application for development consent, including all permanent and temporary works for SEP and DEP.
The Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable corridor which would house HDD entry or exit points.
Jointing bays	Underground structures constructed at regular intervals along the onshore cable corridor to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water
Onshore cable corridor	The area between the landfall and the onshore substation sites, within which the onshore cable circuits will be installed along with other temporary works for construction.
Onshore substation sites	Parcels of land within onshore substation areas A and B, identified as the most suitable location for development of the onshore substation. Two sites have been identified for further assessment within the DCO.
Onshore Substation Zone	Parcels of land within the wider onshore substation search area identified as suitable for development of the onshore

	substation. Two substation areas (A and B) have been identified as having the greatest potential to accommodate the onshore substation.
Study area	Area where potential impacts from the project could occur, as defined for each individual EIA topic.
Sheringham Shoal Offshore Wind Farm Extension site	Sheringham Shoal Offshore Wind Farm Extension offshore wind farm boundary.
The Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.

18 WATER RESOURCES AND FLOOD RISK

18.1 Introduction

1. This chapter of the Environmental Statement (ES) describes the potential impacts of the proposed Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and Dudgeon Offshore Wind Farm Extension Project (DEP) on water resources and flood risk. The chapter provides an overview of the existing environment for the proposed onshore development area, followed by an assessment of the potential impacts and associated mitigation for the construction, operation, and decommissioning phases of SEP and DEP.
2. This assessment has been undertaken with specific reference to the relevant legislation and guidance, of which the primary sources are the National Policy Statements (NPS). Details of these and the methodology used for the Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) are presented in **Chapter 5 EIA Methodology** and **Section 18.4**.
3. This chapter follows the overall approach set out in **Chapter 5 EIA Methodology** and considers the potential impacts of SEP and DEP on the hydrology, geomorphology and quality of surface waters and the quality and quantity of groundwaters. It also considers potential changes to flood risk.
4. The assessment should be read in conjunction with the following linked chapters:
   - **Chapter 17 Ground Conditions and Contamination**; and
   - **Chapter 20 Onshore Ecology and Ornithology**.
5. Additional information to support the water resources and flood risk assessment includes:
   - **Appendix 18.1 Water Framework Directive Compliance Assessment**;
   - **Appendix 18.2 Flood Risk Assessment**; and
   - **Appendix 18.3 Geomorphological Baseline Survey Technical Report.**

18.2 Consultation

6. Consultation with regard to water resources and flood risk has been undertaken in line with the general process described in **Chapter 5 EIA Methodology** and the **Consultation Report** (document reference 5.1). The key elements to date have included scoping, the ongoing Evidence Plan Process (EPP) via the Water and Flood Risk Expert Topic Group (ETG) and the Preliminary Environmental Information Report (PEIR).
7. The feedback received throughout this process has been considered in preparing the ES. This chapter has been updated following consultation in order to produce the final assessment submitted within the Development Consent Order (DCO) application. **Table 18-1** provides a summary of the consultation responses received to date relevant to this topic, and details of how the comments have been addressed within this chapter.

8. The consultation process is described further in **Chapter 5 EIA Methodology**. Full details of the consultation process are presented in the **Consultation Report** (document reference 5.1), which has been submitted as part of the DCO application.

Table 18-1: Consultation Responses

Consultee	Date/ Document	Comment	Project Response
Scoping Responses			
Planning Inspectorate	Scoping Opinion, 2019	The Scoping Report does not justify the decision to scope out direct disturbance to surface water bodies during operation. However, the Inspectorate considers that given the operational nature of the Proposed Development there are unlikely to be any significant effects from potential direct disturbance to surface water bodies once construction is complete. The Inspectorate agrees that this matter can be scoped out of the assessment in the Environmental Statement (ES).	Impacts resulting from the temporary disturbance of surface water bodies during construction of the onshore cable corridor and access roads are presented in **Section 18.6.1.1**. The operational infrastructure will not interact with the watercourses and has been scoped out as agreed by the Planning Inspectorate.
Planning Inspectorate	Scoping Opinion, 2019	Table 3-4 proposes to scope out transboundary impacts on water resources and flood risk, although no justification is provided within the aspect chapter. Nevertheless, given the nature of the Proposed Development in this regard the Inspectorate agrees that significant transboundary effects are unlikely and therefore this matter can be scoped out of the ES.	There are no transboundary impacts with regard to water resources and flood risk as the onshore project area would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment (as agreed with the Planning Inspectorate) and are not considered further.
Planning Inspectorate	Scoping Opinion, 2019	Table 3-4 of the Scoping Report scopes in an assessment of increased sediment supply during operation, however this is not considered as a potential impact in Section 3.2.2.2. Despite this inconsistency, the Inspectorate has given consideration to the operational nature of the Proposed Development and does not consider that significant effects are likely to occur and considers this matter does not need to be assessed in the ES.	The supply of fine sediment during operation has been scoped out as agreed with the Planning Inspectorate and is not considered in the Operational Impacts section.

Consultee	Date/ Document	Comment	Project Response
Planning Inspectorate	Scoping Opinion, 2019	The Inspectorate welcomes the proposal for a Flood Risk Assessment (FRA) and a Water Framework Directive (WFD) Compliance Assessment; these assessments should form an appendix to the ES. The Applicant should make effort to discuss and agree the scope of these assessments with relevant consultation bodies including the Environment Agency (EA), the relevant internal drainage boards and the lead local flood authorities.	A WFD compliance assessment is presented in **Appendix 18.1**, and a Flood Risk Assessment is presented in **Appendix 18.2**. The scope of these assessments has been discussed with the Environment Agency, Norfolk Rivers Internal Drainage Board and lead local flood authorities through the ongoing EPP via the Water and Flood Risk ETG.
Planning Inspectorate	Scoping Opinion, 2019	The Inspectorate welcomes that changes to surface water runoff and flood risk from construction and operation of the Proposed Development will be assessed. The ES should also assess any likely significant effects resulting from potential flood events to the Proposed Development. The ES should demonstrate that consideration has been given to all potential sources of flooding.	Changes to surface water runoff and flood risk during construction and operation are assessed in **Sections 18.6.1.4** and **18.6.2.2**, respectively. A detailed FRA, which considers potential flood risks to onshore components of SEP and DEP as well as any changes to flood risk that SEP and DEP may cause is presented in **Appendix 18.2**. This FRA considers all potential sources of flooding and has utilised Product 4, Product 5 and Product 8 data packages from the Environment Agency to inform the assessment.
Planning Inspectorate	Scoping Opinion, 2019	The Applicant is advised to consider the necessary responsibilities in relation to working over or crossing of main rivers including any permits or licences that may be required (for example Flood Risk Activity Permits under the Environmental Permitting regulations). References to any water resources licensing that may be required should be outlined as part of the ES, particularly where the residual effects reported in the ES are wholly or partly reliant on the grant of such licenses.	The Applicant notes its responsibilities under the Environmental Permitting (England and Wales) Regulations 2016 and associated legislation with regards to activities in or adjacent to Main Rivers, ordinary watercourses and their floodplains. The Applicant also notes its responsibilities under these regulations with regards to water abstraction, transfer, or impoundment where it may relate to the use of temporary dams and other temporary measures during construction.

Consultee	Date/ Document	Comment	Project Response
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	The issue of drainage of haul roads and compounds should be an important aspect of the FRA.	Potential flood risk implications of drainage from haul roads and compounds is considered in of the FRA (**Appendix 18.2**).
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council requested that they are informed as early as possible about the location of Horizontal Directional Drilling (HDD) crossings and any culverting needs so that this can be part of one consent.	The Applicant notes this request and has provided a Crossing Schedule within the DCO documentation (**Appendix 4.1** of **ES Chapter 4 Project Description**) and supporting information is provided in this chapter as part of the assessment of potential impacts resulting from watercourse crossings (**Section 18.6.1.1**).
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council stated that infill material around the cable could create a pathway for water flows and impact local hydrogeology and hydrology.	Potential impacts on flow pathways are considered in **Sections 18.6.1.4** and **18.6.2.2**.
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council recommended that climate change plus 20% should be used for the FRA and Project's design.	The recommended climate change allowance has been applied in Section 20.2.6 of the FRA (**Appendix 18.2**).
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	FSR rainfall data is no longer acceptable and only FEH data will be accepted by Norfolk County Council.	FEH data has been used to inform the FRA (**Appendix 18.2**).

Consultee	Date/ Document	Comment	Project Response
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	The operation and maintenance plan will have to be shared with Norfolk County Council.	The Applicant has committed to producing an operational drainage plan for the operational development that will be secured through the DCO. See **Outline Operational Drainage Plan** (document reference 9.20)
Section 42 Responses			
Environment Agency	Section 42 Response Letter, 2021	In general, it is unfortunate that the expert topic group for this subject did not meet further beyond the initial meeting of May 2020. Norfolk river catchments are internationally important and complex as is the aquifer that feeds many of them. The study would have benefited from further input from the consultee bodies.	The engagement with the expert topic group in May 2020 discussed the refinement of the scoping boundary down to the typically 200m wide PEIR boundary. Between then and the submission of PEIR for S42 consultation the project team were undertaking assessment work on that updated boundary. The initial assessment findings were then shared with stakeholders as part of Section 42 consultation. The Applicant recognises that the chalk river catchments through which the onshore infrastructure would pass are complex, sensitive and internationally complex systems. This was acknowledged in the PEIR, in the description of the baseline environment and in the definition of the value and sensitivity of surface and groundwater receptors. Further to this the Applicant has sought to avoid direct impacts to the most sensitive watercourses by delivering these crossings using trenchless techniques.
Environment Agency	Section 42 Response Letter, 2021	The rationale applied to assign a sensitivity measure each water body is not clear. Applying a minor or low impact because an affected waterbody makes up only a small percentage of the catchment is inappropriate as this does not recognise the	The approach presented in the PEIR was agreed at the ETG meeting in May 2020, each receptor has been assigned a sensitivity based on an assessment of the observed baseline characteristics of each receptor (e.g. for surface waters, their hydrology, geomorphology, water quality and related habitats are considered). A

Consultee	Date/ Document	Comment	Project Response
		interconnectivity of the network nor local importance. An example of this can be found at Table 20-21.	precautionary approach has been adopted, whereby the receptor is assigned the highest sensitivity based on available baseline data. Additional information with regards to how the definitions set out in Table 20.7 have been applied to each receptor in Table 20.13 can be provided in Section 20.5.5. Note that this approach has previously been agreed with the Environment Agency for other wind farm developments in Norfolk and Suffolk (e.g. the Norfolk Vanguard, Norfolk Boreas, East Anglia One North and East Anglia Two projects). The magnitude of effect on each receptor has been based on measurable characteristics such as the number of watercourse crossings or the proportion of the individual river catchment (as defined by the Environment Agency in their WFD water body outlines) affected by the proposed development, in order to provide a consistent approach across impacts. The percentages set out in Tables 20.18 and 20.19 to define impact magnitude are intended to refer to the proportion of these smaller river water body catchments rather than the much larger hydrological catchments also referred to in the same table. The Applicant believes that the relatively small size of the receptors and the way in which sensitivity is assigned adequately accounts for the local importance of receptors whilst recognising the inter-connected nature of the drainage network. Although we recognise that there are sub-catchment variations in the characteristics of each watercourse, we have sought to adopt a compromise between the resolution of the assessment and ensuring that the outputs are manageable and easily relatable to all stakeholder groups. The Environment Agency's own

Consultee	Date/ Document	Comment	Project Response
			WFD river water body catchments were selected because they represent a readily available definition of catchments that have an established precedent for their definition.
Environment Agency	Section 42 Response Letter, 2021	Similarly, at Table 20-28 the percentage rationale has been applied to groundwater bodies. Whilst it is true that impacts will not have a regional effect that matches the volume of the total groundwater body, effects can be very significant to local communities and areas. Magnitude of effect should recognise this.	The approach presented in the PEIR was agreed at the ETG meeting in May 2020, each groundwater receptor has been assigned a sensitivity based on an assessment of the observed baseline characteristics (e.g. using WFD groundwater data and vulnerability mapping). A precautionary approach has been adopted, whereby the receptor is assigned the highest sensitivity based on available baseline data. The Applicant acknowledges that the groundwater receptors, as defined by WFD groundwater body outlines, each cover a large area. However, in this instance these units provide a higher resolution that freely available alternatives such as aquifer mapping (e.g., aquifer mapping indicates that the entire study area would fall within a single principal bedrock aquifer).
Environment Agency	Section 42 Response Letter, 2021	The cumulative effects of other schemes requires more detailed consideration. Whilst cables and their ducts are largely inert their presence replaces existing natural systems which, when this occurs repeatedly can fundamentally alter them.	The cumulative effects assessment presented in **Section 18.7** has been undertaken in accordance with the overall methodology used throughout the DCO ES, and the level of detail presented reflects the information available at the time of writing.
Environment Agency	Section 42 Response Letter, 2021	The proposed crossing of Spring Beck is an area of concern. The cable run appears to bisect an area of natural flood management which was finished in 2019. This area acts to hold water to help protect Weybourne from flooding downstream. The presence of the cable run will displace some of that storage capacity and may create	Spring Beck would be crossed using a trenchless technique and as such would not affect the operation of the natural flood management measures (understood to include scrapes, leaky dams and tree planting) employed between Spring Beck and Station Road. The trenchless crossings will be designed to avoid disturbing both Spring

Consultee	Date/ Document	Comment	Project Response
		other drainage routes. It is very important that this area is analysed further for any offsite increase in flood risk.	Beck and the natural flood management features on its floodplain. The impacts of construction and operation of SEP and DEP on surface and groundwater flows in the Spring Beck catchment are considered in **Section 18.6.1.4** and **Section 18.6.2.2.** The crossing of Spring Beck will not require any permanent above-ground infrastructure, and as such would not displace any surface water or increase flood risk. Subsurface cable infrastructure is not expected to significantly alter surface or subsurface flows or affect the way in which the natural flood management measures function.
Weybourne Parish Council	Section 42 Response Letter, 2021	Spring Beck is a chalk stream, an internationally rare habitat. The EA has been carrying out work to improve the watercourse, and it now features Brown Trout, Otters and Kingfishers. Equinor has stated that it will cross Spring Beck using HDD, and it is critical that it sticks to this commitment.	The Applicant acknowledges this comment and reiterates the commitment to use trenchless technique to cross Spring Beck.
Weybourne Parish Council	Section 42 Response Letter, 2021	There is concern about flooding and disruption to underground water (springs, aquifers etc), as has been the experience with previous wind farm works.	The Applicant acknowledges the comment and has provided further information in the FRA (**Appendix 18.2**).
National Farmers' Union	Section 42 Response Letter, 2021	Private Water Supplies and Irrigation Systems: The NFU will expect to see specific wording agreed to cover any temporary or permanent impacts from construction on private water supplies and irrigation	The Applicant acknowledges the requirement to agree specific wording with regards to the prevention of impacts to private water supplies and irrigation systems with individual landowners. Wording of the final CoCP will be

Consultee	Date/ Document	Comment	Project Response
		systems. Wording to be agreed and included in the Code of Construction.	agreed through specific discussions with potentially affected parties.
Norfolk County Council	Section 42 Response Letter, 2021	Flood and Drainage Issues and Comments The comments made in Norfolk County Council's response to the Environmental Impact Assessment Scoping Report in October 2019 remain valid and further detailed technical considerations are set out in Appendix 1.	The Applicant acknowledges the comment and has addressed Norfolk County Council's concerns in the FRA (**Appendix 18.2**).
Norfolk County Council	Section 42 Response Letter, 2021	During construction Impact: 20.6.1.1.5 Where temporary dams are needed for the trenched crossings and/or temporary culverts for haul roads, again as per our Scoping Opinion response any works within these ordinary watercourses will require Land Drainage Consent from NCC (as LLFA or the relevant IDB if within their district). This includes all permanent and temporary works. We would recommend the applicant discusses these with LLFA before submission to streamline the process and whether the applications need to be supported by an ecology check i.e. disturbance to hedges and aquatic habitat. However, I note that they reference some mitigation measures in this section i.e. fish passage. Overall, there are no concerns with summary tables for this section. Impact 3 and 4: 20.6.1.3.5 / 20.6.1.4.5 - A Construction Surface Water Management Plan is recommended as a mitigation measure for the substation and all significant constructions compounds. There should be a CSWMP detailing how flood risk and pollution is dealt with during	The Applicant acknowledges Norfolk County Council's concerns with regards to watercourse crossings and the flood risk from the substation and compounds. These have been discussed extensively at ETG meetings and further information has been provided in the FRA (**Appendix 18.2**). The Applicant also notes the requirement for separate Land Drainage Consent from NCC for the crossing of ordinary watercourses. These will be progressed in advance of construction.

Consultee	Date/ Document	Comment	Project Response
		the construction stages of all the infrastructure elements, especially the top three: • Max Substation Footprint (construction area) = 7.25ha. • Up to 2 main compounds of 60,000m2 each • 8 secondary compounds of 2,500m2 each • HDD compounds = 1,500m2 - 4,500m2 • Overall, there are no concerns with summary tables for this section.	
Norfolk County Council	Section 42 Response Letter, 2021	During operation: Impact 1: Supply of contaminants to surface and groundwater 20.6.2.1.5 mitigation should include reference to Phase 1 and Phase 2 Ground Investigation Reports especially if the operational drainage strategy focuses on utilising infiltration techniques to dispose of surface water. Agree that no mitigation is necessary for the onshore cable corridor but as above the temporary compounds during construction should consider surface water impacts. Overall, there no concerns with summary tables for this section.	A programme of Ground Investigation has been undertaken. Specific reference to the results of the investigation and the need for these reports to inform the drainage strategy has been included in the supporting FRA (**Appendix 18.2**).
North Norfolk District Council	Section 42 Response Letter, 2021	In respect of the impact of the project on water resources and flood risk within North Norfolk District Council jurisdiction, NNDC would defer to the expert advice of the Environment Agency in respect of the strategic overview of the management of all sources of flooding and coastal erosion, to the advice of Norfolk County Council Lead Local Flood Authority in respect of developing, maintaining and applying a strategy for local flood risk management in this area and for maintaining a register of flood risk assets.	The Applicant acknowledges this comment and confirms that further consultation with the Environment Agency and Norfolk Rivers IDB has been undertaken alongside Norfolk County Council.

Consultee	Date/ Document	Comment	Project Response
		NNDC would also defer to the advice of Norfolk Rivers Internal Drainage Board who manage assets within/along/near the route of the proposed onshore cable corridor.	
South Norfolk Council and Broadland District Council	Section 42 Response Letter, 2021	The Environmental Management Officer has looked at Noise and Vibration, Air Quality and Water and considered that there was one issue he should mention at this stage namely private water supplies. He considers it would be prudent to identify all private water supplies used for domestic and commercial purposes that could possibly be contaminated by construction and operational activities so that a risk assessment can be carried out including a description of any necessary mitigation.	The Applicant acknowledges the requirement to consider impacts to private water supplies (where residential properties have their own supplies from aquifers) and irrigation systems. Although these impacts are acknowledged in the PEIR assessment, there are no readily available data sets which define the location of all private water supplies in the onshore development area. In the absence of further information, the location of private water supplies, and the potential need for mitigation to ensure continuity of supply, will be identified through consultation with individual landowners during post-consent negotiations where applicable.
Water Management Alliance – Norfolk River Drainage Board	Section 42 Response Letter, 2021	The Board has reviewed Volume 1 Chapter 20 – Water Resources and Flood Risk of the Dudgeon and Sheringham Shoal Offshore Wind Farm Extension PIER document (Royal HaskoningDHV, April 2021) and has the following comments to make. As mentioned in the chapter, the development is partially within the Internal Drainage District (IDD) of the Norfolk Rivers Internal Drainage Board (IDB) and wholly within the watershed catchment of the aforementioned. For an overview, maps are available on the Board's webpages showing the IDD ([redacted])	The Applicant acknowledges that the proposed onshore development is located within the IDD of the Norfolk Rivers IDB. This is reflected in **Section 18.5.1**

Consultee	Date/ Document	Comment	Project Response
		as well as the wider watershed catchment ([redacted]).	
Water Management Alliance – Norfolk River Drainage Board	Section 42 Response Letter, 2021	The Board feels that it would be beneficial to include the following point which has been overlooked: Section 20.6.1.4.5 lists mitigation strategies for changes to surface water runoff from the construction phase of the proposed development. Part 144 states that additional surface water may be discharged to watercourses in consultation with the LLFA and EA. The Board would like it noted that within the Internal Drainage District, any discharges of surface water to a watercourse must be approved by the Internal Drainage Board as per our Byelaws (specifically Byelaw 3), thus consultation with ourselves will need to be included for some of these locations.	The Applicant notes the requirement for consent from Norfolk Rivers IDB for the crossing of or discharges into IDB-maintained ordinary watercourses. Following further discussion Protective Provisions for the IDB in Schedule 14 of the draft DCO (document reference 3.1) to enable this process to be wrapped up within the DCO.
Water Management Alliance – Norfolk River Drainage Board	Section 42 Response Letter, 2021	While you may not deem it relevant to the PIER document specifically, after reading it I think it only prudent to mention now that as noted in section 20.5.6 of chapter 20, climate change is already causing wetter winters leading to the expectation of higher winter flows and storm related flood events. It is likely that in the near future watercourse management may have to adapt to this by widening and deepening arterial watercourses (e.g. Board adopted watercourses) to create the additional capacity needed to contain this increase. This should be taken into account when placing the underground cable.	The Applicant notes the potential future requirement for enlarging arterial watercourses and will consider this when crossing solutions are developed for individual watercourses. Further engagement with the IDB will be undertaken post-consent to obtain their agreement for a suitable offset distance to ensure that their activities are not impinged by the presence of operational infrastructure.
Natural England	Section 42 Response Letter, 2021	Given the recent HDD drilling mud breakouts experienced on a number of other OWFs, Natural England advises that a commitment to use best available techniques and a	The Applicant acknowledges the risk of bentonite breakout during the use of trenchless crossings to cross watercourses and associated floodplain wetland systems

Consultee	Date/ Document	Comment	Project Response
		precautionary methodology be included, and that the worst-case scenario impacts of potential bentonite breakout are assessed. Given that the River Wensum SAC (and SSSI) are largely unfavourable recovering or unfavourable no change we would advise that any effects may constitute an adverse effect on integrity. We advise the Applicant to partner with Environment Agency on the River Wensum Partnership project. The Applicant needs to outline potential impacts of a drilling mud breakout either under, or in the floodplains of, the Wensum, and the potential effects on SAC and SSSI features that may be located up or downstream of the breakout. There is currently insufficient information provided in the documents provided on HDD tolerance monitoring, how quickly bentonite release can be stopped, or an assessment of a worst-case scenario bentonite breakout considering extent, timings, and environmental impacts. The Applicant needs to provide information on HDD tolerance monitoring, how quickly bentonite release can be stopped, or an assessment of a worst-case scenario bentonite breakout considering extent, timings, and environmental impacts. As with Norfolk Boreas, NE suggests that the Applicant partner with Environment Agency on the River Wensum Partnership project. In addition, the restoration of the HDD compound on the flood plain of the river Wensum should be restored in accordance with the River Wensum Restoration Strategy and the River Wensum SAC conservation objectives	and this is considered in **Section 18.6.1.2.8**. A site-specific risk assessment will be undertaken as part of the post-consent detailed design process. This will consider the potential risks of using HDD or equivalent techniques and set out the procedures required to monitor construction activities and avoid breakouts. This will be agreed with the Environment Agency prior to commencement of construction activities.
The Wildlife Trusts and	Section 42 Response Letter, 2021	River crossings (para 113)–we note the proposal to HDD under all main river crossings in order to avoid impacts on the rivers, at a depth that is predicted to avoid any impacts on the river bed and to avoid any accidental release of	The Applicant acknowledges the risk of bentonite breakout during the use of trenchless crossings to cross watercourses and associated floodplain wetland systems and this is considered in **Section 18.6.1.2.8**. A site-

Consultee	Date/ Document	Comment	Project Response
Norfolk Wildlife Trust		materials such as bentonite into the river channel. We recommend that the assessment includes an evaluation of the potential impacts of HDD on any features such as springs or other underground flows that may, if interrupted, impact on the river, for example where the proposed corridor is adjacent to the source and headwaters of the River Glaven.	specific risk assessment will be undertaken as part of the post-consent detailed design process. This will consider the potential risks of using HDD or equivalent techniques and set out the procedures required to monitor construction activities and avoid breakouts. This will be agreed with the Environment Agency prior to commencement of construction activities.
The Wildlife Trusts and Norfolk Wildlife Trust	Section 42 Response Letter, 2021	River Wensum SAC (para 167)–we note the HDD is proposed to completely avoid impacts on the SAC, but we seek clarification on any potential impacts from siting the temporary compounds nearby. The SAC is flanked by floodplain wetland CWSs which are functionally linked to the health of the SAC and so indirect impacts on the SAC are possible if there are any impacts on the adjacent CWSs.	The Applicant acknowledges that the floodplain wetlands adjacent to the River Wensum SAC are functionally linked. This is discussed in **Section 18.6.1.1** with mitigation measures discussed in **Section 18.6.1.1.5**. HDD will be used to cross the functional floodplain as far as is practicable to minimise impacts. Furthermore, construction compounds will be sited outside of the floodplain if possible.
Cley Next the Sea Parish Council	Section 42 Response Letter, 2021	Spring Beck is a chalk stream, an internationally rare habitat and it is critical that Spring Beck is crossed using HDD.	The Applicant acknowledges this comment and reiterates its previous commitment on the use of a trenchless technique to cross Spring Beck.

18.3 Scope

18.3.1 Study Area

9. As part of the Anglian River Basin Management Plan (RBMP) developed to comply with the Water Framework Directive (WFD) (discussed in **Section 18.4.1**), the Environment Agency has defined river water body catchments based on surface hydrological catchments with an area of greater than $5km^2$.

10. The study area for water resources and flood risk has been defined on the basis of these surface hydrological catchments. Catchments have been included within the study area if they are crossed by the onshore DCO order limits or are hydrologically connected downstream of the project area. Those catchments that are hydrologically connected upstream are not considered due to the lack of any mechanism for an impact to occur at distance upstream. The onshore study area is shown in **Figure 18.1**.

11. When considering the potential impacts to groundwater, the study area is limited to those groundwater bodies that lie directly beneath the project area which are shown in **Figure 18.2**.

18.3.2 Realistic Worst-case Scenario

18.3.2.1 General Approach

12. The final design of SEP and DEP will be confirmed through detailed engineering design studies that will be undertaken post-consent to enable the commencement of construction. In order to provide a precautionary but robust impact assessment at this stage of the development process, realistic worst-case scenarios have been defined in terms of the potential effects that may arise. This approach to EIA, referred to as the Rochdale Envelope, is common practice for developments of this nature, as set out in Planning Inspectorate Advice Note Nine (2018). The Rochdale Envelope for a project outlines the realistic worst-case scenario for each individual impact, so that it can be safely assumed that all lesser options will have less impact. Further details are provided in **Chapter 5 EIA Methodology**.

13. The realistic worst-case scenarios for the water resources and flood risk assessment are summarised in **Table 18-2**. These are based on the Project parameters described in **Chapter 4 Project Description**, which provides further details regarding specific activities and their durations.

14. In addition to the design parameters set out in **Table 18-2**, consideration is also given to how SEP and DEP will be built out as described in **Section 18.3.2.2** to **Section 18.3.2.4** below. This accounts for the fact that whilst SEP and DEP are the subject of one DCO application, it is possible that either one or both SEP and DEP will be developed, and if both are developed, that construction may be undertaken either concurrently or sequentially. Therefore, to ensure a thorough assessment, a worst-case scenario is set out for each potential construction scenario in **Table 18-2**.

Table 18-2: Realistic Worst-case Scenarios

Impact	SEP or DEP in Isolation	SEP and DEP Concurrently	SEP and DEP Sequentially	Notes and Rationale
Construction				
Impact 1: Direct disturbance of surface water bodies	**Onshore Cable Corridor (including haul road):** • Construction corridor: Length: 60km, Width: 45m. • Cable trench: Number: 1, Width at base: 0.85m, Width at surface: 3m, Depth: 2m. • The primary cable installation method will be trenched trenching, with cable ducts installed within the trenches and backfilled with soil. Cables would then be pulled though the pre-laid ducts at a later stage in the construction programme. • Haul road: Number :1, Length: 55km, Width: 5m (8m at passing places which are 20m long). • Temporary dam and divert for minor watercourses, ducts would be installed 2m below the channel bed. • Where the cable corridor crosses an open ditch or drain, and access for the haul road is required, an appropriately sized culvert may be installed inside the channel bed to avoid upstream impoundment. This would remain in place for the duration that the haul road is required. • Duration: Onshore cable ducting and installation (incl. reinstatement): 24 months.	**Onshore Cable Corridor (including haul road):** • Construction corridor: Length: 60km, Width: 60m. • Cable trench: Number: 2, Width at base: 0.85m, Width at surface: 3m, Depth: 2m. • The primary cable installation method will be trenched trenching, with cable ducts installed within the trenches and backfilled with soil. Cables would then be pulled though the pre-laid ducts at a later stage in the construction programme. • Haul road: Number :1, Length: 55km, Width: 5m (8m at passing places which are 20m long). • Temporary dam and divert for minor watercourses, ducts would be installed 2m below the channel bed. • Where the cable corridor crosses an open ditch or drain, and access for the haul road is required, an appropriately sized culvert may be installed inside the channel bed to avoid upstream impoundment. This would remain in place for the duration that the haul road is required. • Duration: Onshore cable ducting and installation (incl. reinstatement): 26 months.	**Onshore Cable Corridor (including haul road):** • Construction corridor: Length: 60km, Width: 60m. • Cable trench: Number: 2, Width at base: 0.85m, Width at surface: 3m, Depth: 2m. • The primary cable installation method will be trenched trenching, with cable ducts installed within the trenches and backfilled with soil. Cables would then be pulled though the pre-laid ducts at a later stage in the construction programme. • Haul road: Number :1 per project, Length: 55km, Width: 5m (8m at passing places which are 20m long). • Temporary dam and divert for minor watercourses, ducts would be installed 2m below the channel bed. • Where the cable corridor crosses an open ditch or drain, and access for the haul road is required, an appropriately sized culvert may be installed inside the channel bed to avoid upstream impoundment. This would remain in place for the duration that the haul road is required. • Duration: Onshore cable ducting and installation (incl. reinstatement): 24 months per project, therefore 48 months in total. • Maximum gap between start of construction in sequential scenario: 4 years.	Works at the landfall are not expected to cause direct disturbance to surface water bodies as HDD will be used. Likewise, no direct disturbance will occur at the onshore substation and 400kV connection. Direct disturbance of surface water bodies will only occur due to the temporary damming and diversion of ordinary watercourses and the installation of culverts for the haul road where the cable corridor crosses them. These parameters represent the worst-case scenario of the onshore cable corridor. It is considered that sequential construction of both SEP and DEP constitutes the worst-case scenario. Although the temporary dams and diversions will be removed and reinstated in between projects once the cable has been installed, the culverts for the haul road would remain in place. Therefore, these would be in situ for a greater continuous period of time than under the concurrent scenario, i.e. 2 x 24 months compared to 26 months.
Impact 2: Increased sediment supply **Impact 3:** Supply of contaminants to surface and groundwaters	**Landfall** • HDD drills: Number: up to 2, Length: 1,150m. • Transition joint bays: Number: 1, Dimensions: 26m (L) x 10m (W) x 3m (D) • HDD compound area: 75m x 75m. • Number of transition joint bays: 1. • Equipment includes a drilling rig, fuel store, water storage tanks, drilling fluid mixing tanks, • Total works area: 48,955.1m^2. • Volume (m^3) of HDD materials e.g. bentonite: assumed around 600-700m^3 per bore hole. • Approximate quantity of excavated material: Total: 3,250m^3. • Duration: Landfall HDD: 4 months.	**Landfall** • HDD drills: Number: up to 4, Length: 1,150m. • Transition joint bays: Number: up to 2, Dimensions: 2 x (26m (L) x 10m (W) x 3m (D)), or 26 x 12 x 3 if combined. • HDD compound area: 75m x 75m. • Number of transition joint bays: 2. • Equipment includes a drilling rig, fuel store, water storage tanks, drilling fluid mixing tanks, • Total works area: 48,955.1m^2.. • Volume (m^3) of HDD materials e.g. bentonite: assumed around 600-700m^3 per bore hole. • Approximate quantity of excavated material: Total: 3,450m^3. • Duration: Landfall HDD: 5 months.	**Landfall** • HDD drills: Number: up to 4, Length: 1,150m. • Transition joint bays: Number: 2, Dimensions: 2 x (26m (L) x 10m (W) x 3m (D)) adjacent to each other. • HDD compound area: 75m x 75m for each project. • Number of transition joint bays: 2. • Equipment includes a drilling rig, fuel store, water storage tanks, drilling fluid mixing tanks, • Total works area: 48,955.1m^2.. • Volume (m^3) of HDD materials e.g. bentonite: assumed around 600-700m^3 per bore hole. • Approximate quantity of excavated material: Total: 6,500m^3. • Duration: Landfall HDD: 4 months per project.	These parameters represent the maximum footprint of disturbance and activities within the DCO order limits that could lead to the potential disturbance of sediment and contamination. It is considered that concurrent construction of both projects is the worst-case scenario due to the larger construction footprint in the catchment at any one time.
	Onshore Cable Corridor	**Onshore Cable Corridor**	**Onshore Cable Corridor**	

Impact	SEP or DEP in Isolation	SEP and DEP Concurrently	SEP and DEP Sequentially	Notes and Rationale
	As for Impact 1, plus: • Access (haul) road area (m^2): 315,640m^2. • Approximate width of topsoil storage: 6m • Approximate width of subsoil storage: 3.5m. • Approximate quantity of cable trench excavated material: 180,000m^3. • Approximate quantity of haul road excavated material: 123,000m^3. • Approximate total length of trenched sections: 44,700m. • Typical jointing bay and link box frequency: every 1,000m. • Approximate number of jointing bays and link boxes: 60. • Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D) (allowing tapering of cables). • Approximate quantity of excavated material per joint bay location: 300m^3. Total quantity of joint bay excavated material: 180,000m^3. • Estimated main compound: Number: 1, area: 30,000m^2 (including area required for topsoil storage). • Secondary compounds with CBS batching: Maximum number: 2, area: 7,500m^2, operational life: 18-24 months, actively in operation for 14 months. • Secondary compounds without CBS batching: Maximum number: 6, Area: 2,500m^2, including: stoned hard-standing, topsoil bunds, welfare facilities, outside storage. In operation for approximately 12-18 months, actively in operation for approximately 6 months. • Approximate total quantity of excavated material for compounds: 21.450m^3. • Onshore HDD: Estimated HDD compound dimensions: 1,500 – 4,500m^2. Number of bores: 3 single bores per cable circuit in a flat formation. • Watercourse crossing technique: Trenchless crossings for all main rivers and IDB watercourses. Temporary dam and divert for minor watercourses and use of temporary bridges.	As for Impact 1, plus: • Access (haul) road area (m^2): 315,640m^2. • Approximate width of topsoil storage: 7m • Approximate width of subsoil storage: 7m. • Approximate quantity of cable trench excavated material: 360,000m^3. • Approximate quantity of haul road excavated material: 123,000m^3. • Approximate total length of trenched sections: 89,400m. • Typical jointing bay and link box frequency: every 1,000m. • Approximate number of jointing bays and link boxes: 120. • Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D) (allowing tapering of cables) per circuit. • Approximate quantity of excavated material per joint bay location: 300m^3. Total quantity of joint bay excavated material: 360,000m^3. • Estimated main compound: Number: 1, area: 30,000m^2 (including area required for topsoil storage). • Secondary compounds with CBS batching: Maximum number: 2, area: 7,500m^2, operational life: 18-24 months, actively in operation for 14 months. • Secondary compounds without CBS batching: Maximum number: 6, Area: 2,500m^2, including: stoned hard-standing, topsoil bunds, welfare facilities, outside storage. In operation for approximately 12-18 months, actively in operation for approximately 6 months. • Approximate total quantity of excavated material for compounds: 21.450m^3. • Onshore HDD: Estimated HDD compound dimensions: 1,500 – 4,500m^2. Number of bores: 3 single bores per cable circuit (6 in total) in a flat formation. • Watercourse crossing technique: Trenchless crossings for all main rivers and IDB watercourses. Temporary dam and divert for minor watercourses and use of temporary bridges.	As for Impact 1, plus: • Access (haul) road area (m^2): 315,640m^2 for each project. • Approximate width of topsoil storage: 6m per cable trench. • Approximate width of subsoil storage: 3.5m per cable trench. • Approximate quantity of cable trench excavated material: 360,000m^3. • Approximate quantity of haul road excavated material: 123,000m^3 per project. • Approximate total length of trenched sections: 89,400m. • Typical jointing bay and link box frequency: every 1,000m. • Approximate number of jointing bays and link boxes: 120. • Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D) (allowing tapering of cables) per circuit. • Approximate quantity of excavated material per joint bay location: 300m^3. Total quantity of joint bay excavated material: 360,000m^3. • Estimated main compound: Number: 1, area: 30,000m^2 for each project (including area required for topsoil storage). Assumed to be removed following completion of first project and reinstated for the second. • Secondary compounds with CBS batching: Maximum number: 2 per project, area: 7,500m^2, operational life: 18-24 months, actively in operation for 14 months. • Secondary compounds: Maximum number: 6 (for each project), Area: 2,500m^2, including: stoned hard-standing, topsoil bunds, welfare facilities, outside storage. In operation for approximately 12-18 months, actively in operation for approximately 6 months. • Approximate total quantity of excavated material for compounds: 42,900m^3. • Onshore HDD: Estimated HDD compound dimensions: 1,500 – 4,500m^2. Number of bores: 3 single bores per cable circuit (6 in total) in a flat formation.	

Impact	SEP or DEP in Isolation	SEP and DEP Concurrently	SEP and DEP Sequentially	Notes and Rationale
			• Watercourse crossing technique: Trenchless crossings for all main rivers and IDB watercourses. Temporary dam and divert for minor watercourses and use of temporary bridges.	
	Onshore substation and 400kV connection: • Substation area: 3.25ha operational area with 1ha construction compound. • Access road: permanent width: 6m, construction compound 2,500m². • Approximate quantity of excavated material for permanent access road: 2,000m³. • Approximate quantity of excavated material for construction compounds: 4,875m³. • Combined impermeable area: **21,350m².** • Approximate quantity of topsoil to be removed offsite: for the substation base: 11,250m³. • Depth of topsoil strip: 300mm • Substation and plinth foundations shallow foundations likely to be used in compliance with BS6031:2009 Code of Practice for Earthworks with reference to the Specification for Highway Works: Series 600. • Duration: 22 months. • 400kV connection: length of cable: 850m from Onshore Substation to Norwich Main western connection, number of trenches: 1. Number of circuits: 1. Approximate cable trench width at base: 0.85 m. Approximate depth: 2m, width of easement: 38m. Width of permanent easement: 10m.	**Onshore substation and 400kV connection**: • Substation area: 6.0ha permanent area with 1ha construction compound. • Access road: permanent width: 6m, construction compound 2,500m². • Approximate quantity of excavated material for permanent access road: 2,000m³. • Approximate quantity of excavated material for construction compounds: 4,875m³. • Combined impermeable area: **35,100m².** • Approximate quantity of topsoil to be removed offsite: for the substation base: 21,851m³. • Depth of topsoil strip: 300mm • Substation and plinth foundations shallow foundations likely to be used in compliance with BS6031:2009 Code of Practice for Earthworks with reference to the Specification for Highway Works: Series 600.. • Duration: 24 months. • 400kV connection: length of cable: 850m from Onshore Substation to Norwich Main western connection, number of trenches: 2. Number of circuits: 2. Approximate cable trench width at base per circuit: 0.85 m. Approximate depth: 2m, width of easement: 38m. Width of permanent easement: 20m.	**Onshore substation and 400kV connection**: • Substation area: 6.0ha permanent area with 1ha construction compound. • Access road: permanent width: 6m, construction compound 2,500m². • Approximate quantity of excavated material for permanent access road: 2,000m³. • Approximate quantity of excavated material for construction compounds: 8,875m³. • Combined impermeable area: **35,100m².** • Approximate quantity of topsoil to be removed offsite: for the substation base: 21,851m³. • Depth of topsoil strip: 300mm • Substation and plinth foundations shallow foundations likely to be used in compliance with BS6031:2009 Code of Practice for Earthworks with reference to the Specification for Highway Works: Series 600.. • Duration: 22 months per project, maximum 4 year gap between, maximum total 44 months. • 400kV connection: length of cable: 850m from Onshore Substation to Norwich Main western connection, number of trenches: 2. Number of circuits: 2. Approximate cable trench width at base per circuit: 0.85 m. Approximate depth: 2m, width of easement: 45m. Width of permanent easement: 20m.	
Impact 4: Changes to surface and groundwater flows and flood risk	**Landfall:** • As for Impacts 2 and 3.	**Landfall:** • As for Impacts 2 and 3.	**Landfall:** • As for Impacts 2 and 3.	These parameters represent the maximum impermeable ground and actions or structures that are likely to alter surface and groundwater flows and flood risk. It is considered that concurrent construction of both projects represents the worst-case scenario due to the larger area of land take required at any one time which may alter surface drainage patterns.
	Onshore Cable Corridor: • As for Impacts 2 and 3 • Number of cables: 1 circuit off: 3 x HVAC single core cables + 1 x Fibre Optic cable. • Cable ducts: buried to a depth of 1.2m (from the dop of the duct to the surface). • Approximate working easement: 27m. • Maximum of 10 workfronts at any one time.	**Onshore Cable Corridor**: • As for Impacts 2 and 3 • Number of cables: 2 circuits, each circuit off: 3 x HVAC single core cables + 1 x Fibre Optic cable. • Cable ducts: buried to a depth of 1.2m (from the dop of the duct to the surface). • Approximate working easement: 38m. • Maximum of 10 workfronts at any one time.	**Onshore Cable Corridor**: • As for Impacts 2 and 3 • Number of cables: 2 circuits off: 3 x HVAC single core cables + 1 x Fibre Optic cable. • Cable ducts: buried to a depth of 1.2m (from the dop of the duct to the surface). • Approximate working easement: 45m. • Maximum of 10 workfronts at any one time.	

Impact	SEP or DEP in Isolation	SEP and DEP Concurrently	SEP and DEP Sequentially	Notes and Rationale
	• Haul road: number: 1, length: 55km, width: 5m, length and width at passing places: 20 x 8m, approximately 254 passing places. • Haul road area: 351,640m^2. • Haul road indicative depth: 300mm. • Cable width at surface per circuit: 3m. Depth at surface per circuit: 2m. • Typical jointing bay and link box frequency: every 1000m, approximate number of jointing bays: 60. Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D). • Construction compound: 1 main construction compound. Area: 30,000m^2. Secondary compounds with CBS batching, number: 2, area 7,500m^2. Secondary compounds without CBS batching: number: 6, area: 2,500m^2. Surface: stoned hard standing. • HDD compounds: 1,500-4,500m^2.	• Haul road: number: 1, length: 55km, width: 5m, length and width at passing places: 20 x 8m, approximately 254 passing places. • Haul road area: 351,640m^2. • Cable width at surface per circuit: 3m. Depth at surface per circuit: 2m. • Typical jointing bay and link box frequency: every 1000m, approximate number of jointing bays: 120. Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D). • Construction compound: 1 main construction compound. Area: 30,000m^2. Secondary compounds with CBS batching, number: 2, area 7,500m^2. Secondary compounds without CBS batching: number: 6. Area: 2,500m^2. Surface: stoned hard standing • HDD compounds: 1,500-4,500m^2.	• Haul road: number: 1 for each project, length: 55km for each project, width: 5m, length and width at passing places: 20 x 8m, approximately 254 passing places. • Haul road area: 351,640m^2 for each project. This would be removed and reinstated for the second project. • Cable width at surface per circuit: 3m. Depth at surface per circuit: 2m. • Typical jointing bay and link box frequency: every 1000m, approximate number of jointing bays: 120. Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D). • Construction compound: 1 main construction compound per project. Area: 30,000m^2 . Secondary compounds with CBS batching, number: 2 per project, area 7,500m^2. Secondary compounds without CBS batching: number: 6 per project. Area: 2,500m^2. Surface: stoned hard standing. • HDD compounds: 1,500-4,500m^2.	
	Onshore substation and 400kV connection: • As Impacts 2 and 3, plus: • 1:40 fall/camber or similar to be installed with drainage gratings every 25-30m on the substation access road. • Current land use is agricultural.	**Onshore substation and 400kV connection**: • As Impacts 2 and 3, plus: • 1:40 fall/camber or similar to be installed with drainage gratings every 25-30m on the substation access road. • Current land use is agricultural.	**Onshore substation and 400kV connection**: • As Impacts 2 and 3, plus: • 1:40 fall/camber or similar to be installed with drainage gratings every 25-30m on the substation access road. • Current land use is agricultural.	
Operation				
Impact 1: Supply of contaminants to surface and groundwater	**Onshore cable corridor**: • Link boxes would require periodic access by technicians for inspection and testing during operation and maintenance. • Link box locations: approximately every 1000m, approximately 60 in total.	**Onshore cable corridor**: • Link boxes would require periodic access by technicians for inspection and testing during operation and maintenance. • Link box locations: approximately every 1000m, approximately 120 in total.	**Onshore cable corridor**: • Link boxes would require periodic access by technicians for inspection and testing during operation and maintenance. • Link box locations: approximately every 1000m, approximately 120 in total.	These parameters represent the worst-case scenario for operation and maintenance requirements. The use of vehicles for maintenance activities is the main potential source of contaminants to surface and groundwater.
	Onshore substation and 400kV connection: • Operational access: extension of existing National Grid access road. Unmanned with visits for maintenance staff and visitors approximately 1 visit per week. • Operational period: 40 years. • Hazardous materials / substances: transformer oil: filled during construction, only topped up in the event of a leak.	**Onshore substation and 400kV connection**: • Operational access: extension of existing National Grid access road. Unmanned with visits for maintenance staff and visitors approximately 1 visit per week. • Operational period: 40 years. • Hazardous materials / substances: transformer oil: filled during construction, only topped up in the event of a leak.	**Onshore substation and 400kV connection**: • Operational access: extension of existing National Grid access road. Unmanned with visits for maintenance staff and visitors approximately 1 visit per week. • Operational period: 40 years per project. • Hazardous materials / substances: transformer oil: filled during construction, only topped up in the event of a leak.	

Impact	SEP or DEP in Isolation	SEP and DEP Concurrently	SEP and DEP Sequentially	Notes and Rationale
	• Oily water sump will be present to provide secondary containment in the event of an oil spillage from transformers.	• Oily water sump will be present to provide secondary containment in the event of an oil spillage from transformers.	• Oily water sump will be present to provide secondary containment in the event of an oil spillage from transformers.	
Impact 2: Changes to surface and groundwater flows and flood risk	**Landfall:** • Number of landfall transition joint bays: 1 • Transition joint bay dimensions (L x W x D): 26m x 10m x 3m	**Landfall:** • Number of landfall transition joint bays: 2 • Transition joint bay dimensions (L x W x D): 2 x (26m x 10m x 3m) adjacent to each other.	**Landfall:** • Number of landfall transition joint bays: 2 • Transition joint bay dimensions (L x W x D): 2 x (26m x 10m x 3m) adjacent to each other.	These parameters represent the worst-case scenario for impermeable ground and potential sources of disruption to surface and groundwater flows.
	Onshore cable corridor: • Cable corridor permanent dimensions: length: 60km, minimum depth after burial: 1.2m. • Jointing bays (below ground): number: approximately 60, located: approximately every 1000m. Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D), depth of jointing bay: >1.2m. • Link box dimensions (below ground with a cover and frame at ground level for access): up to 2m x 2m x 1.5m.	**Onshore cable corridor:** • Cable corridor permanent dimensions: length: 60km, minimum depth after burial: 1.2m. • Jointing bays (below ground): number: approximately 120, located: approximately every 1000m. Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D), depth of jointing bay: >1.2m. • Link box dimensions (below ground with a cover and frame at ground level for access): up to 2m x 2m x 1.5m.	**Onshore cable corridor:** • Cable corridor permanent dimensions: length: 60km, minimum depth after burial: 1.2m. • Jointing bays (below ground): number: approximately 120, located: approximately every 1000m. Size of jointing bay: 16m (L) x 3.5m (W) x 2m (D), depth of jointing bay: >1.2m. • Link box dimensions (below ground with a cover and frame at ground level for access): up to 2m x 2m x 1.5m.	
	Onshore substation: • Permanent access road: 5,100m^2. • Total impermeable area (substation): 2.135ha • To permit surface run off a 1:40 fall/camber or similar is to be installed with drainage gratings positioned every 25 – 30m on the access road. This will form part of the detailed drainage design.	**Onshore substation**: • Permanent access road: 5,100m^2. • Total impermeable area (substation): 3.51ha • To permit surface run off a 1:40 fall/camber or similar is to be installed with drainage gratings positioned every 25 – 30m on the access road. This will form part of the detailed drainage design.	**Onshore substation**: • Permanent access road: 5,100m^2. • Total impermeable area (substation): 3.51ha • To permit surface run off a 1:40 fall/camber or similar is to be installed with drainage gratings positioned every 25 – 30m on the access road. This will form part of the detailed drainage design.	

18.3.2.2 Construction Scenarios

15. The following principles set out the framework for how SEP and DEP may be constructed:
    - SEP and DEP may be constructed at the same time, or at different times;
    - If built at the same time both projects could be constructed in four years, with offshore construction being undertaken over two years (likely years 3 and 4) of the overall construction period;
    - If built at different times, either project could be built first;
    - If built at different times, the first project would require a four year period of construction, the second project a three year period of construction including a two year offshore construction period;
    - If built at different times, the duration of the gap between the start of construction of the first project, and the start of construction of the second project may vary from two to four years;
        - If the gap between the projects is less than two years, the first project would wait for the second project in order to be constructed together;
    - Assuming maximum construction periods, and taking the above into account, the maximum construction period over which the construction of both projects could take place is seven years; and
    - The earliest construction start date is 2025 and the latest is 2028.
16. In order to determine which construction scenario presents the realistic worst-case for each receptor and impact, the assessment considers both maximum duration effects and maximum peak effects, in addition to each project being developed in isolation, drawing out any differences between each of the two projects.
17. The three construction scenarios considered by the water resources and flood risk assessment are therefore:
    - Build SEP or build DEP in isolation;
    - Build SEP and DEP concurrently – reflecting the maximum peak effects; and
    - Build one project followed by the other with a gap of up to four years (sequential) – reflecting the maximum duration of effects. This would result in a maximum gap in offshore construction of one year.
18. Any differences between the two projects, or differences that could result from the manner in which the first and the second projects are built (concurrent or sequential and the length of any gap) are identified and discussed where relevant in the impact assessment section of this chapter (**Section 18.6**). For each potential impact only the worst-case construction scenario for SEP and DEP is presented, i.e. either concurrent or sequential. The justification for what constitutes the worst-case is provided, where necessary, in **Section 18.6**.

18.3.2.3 Operation Scenarios

19. Operation scenarios are described in detail in **Chapter 4 Project Description**. The assessment considers the following three scenarios:

- Only SEP in operation;
- Only DEP in operation; and
- The two projects operating at the same time, with a gap of up to four years between each project commencing operation.

20. The operational lifetime of each project is expected to be 40 years.

18.3.2.4 Decommissioning Scenarios

21. Decommissioning scenarios are described in detail in **Chapter 4 Project Description**. Decommissioning arrangements for the onshore elements of SEP and DEP will be agreed through the submission of an onshore decommissioning plan to the relevant planning authority for approval within six months of the permanent cessation of commercial operation (unless otherwise agreed in writing by the relevant planning authority), however for the purpose of this assessment it is assumed that decommissioning of SEP and DEP could be conducted separately, or at the same time.

18.3.3 Summary of Mitigation Embedded in the Design

22. This section outlines the embedded mitigation relevant to the water resources and flood risk assessment, which has been incorporated into the design of SEP and DEP (**Table 18-3**). Where other mitigation measures are proposed, these are detailed in the impact assessment (**Section 18.6**).

Table 18-3: Embedded Mitigation Measures

Parameter	Mitigation Measures Embedded into the Design of SEP and DEP
Watercourse crossings	
Cable crossings beneath watercourses	All Main Rivers (**Figure 18.3**) will be crossed using trenchless techniques such as HDD to avoid direct interaction with these watercourses. The cable entry and exit pits will be at least 9m from the banks of the watercourse, and the cable will be at least 2m below the channel bed.
Groundwater quality and abstractions for public water supply	
Cable routing	The site selection of the cable corridor avoided interaction with Groundwater Source Protection Zone 1, and therefore minimised the potential for impact on abstractions for public water supply.

18.4 Impact Assessment Methodology

18.4.1 Policy, Legislation and Guidance

23. The following sections detail information on the key pieces of UK legislation, policy and guidance relevant to the assessment within this chapter. Further detail where relevant is provided in **Chapter 2 Policy and Legislative Context**.

18.4.1.1 National Policy Statements

24. The assessment of potential impacts upon water resources and flood risk has been made with specific reference to the relevant NPS. These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to SEP and DEP are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2011c).

25. The specific assessment requirements for water resources and flood risk, as detailed in the NPS, are summarised in **Table 18-4** together with an indication of the section of the ES chapter where each is addressed.

26. It is noted that the NPS for Energy (EN-1), the NPS for Renewable Energy Infrastructure (EN-3) and the NPS for Electricity Networks Infrastructure (EN-5) are in the process of being revised. A draft version of each NPS was published for consultation in September 2021 (Department for Business Energy and Industrial Strategy (BEIS), (2021a), BEIS, (2021b) and BEIS (2021c) respectively). A review of these draft versions has been undertaken in the context of this ES chapter.

27. Minor wording changes within the draft version which do not materially influence the compliance with NPS policy (EN-1) requirements have not been reflected in **Table 18-4**.

Table 18-4: Compliance with NPS Policy Requirements.

NPS Requirement	NPS Reference	Section Reference
EN-1 NPS for Energy (EN-1)		
'Where the development is subject to EIA [Environmental Impact Assessment] the applicant should ensure that the ES [Environmental Statement] clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the Infrastructure Planning	Section 5.3	Potential impacts on river channels, which provide physical habitats of importance for ecology, protected species and the conservation of biodiversity, are considered in **Section 18.6**.

NPS Requirement	NPS Reference	Section Reference
Commission (IPC) consider thoroughly the potential effects of a proposed project.'		
'Where a proposed development on land within or outside a Site of Special Scientific Interested (SSSI) is likely to have an adverse effect on a SSSI (either individually or in combination with other developments), development consent should not normally be granted. Where an adverse effect, after mitigation, on the site's notified special interest features is likely, an exception should only be made where the benefits (including need) of the development at this site clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs.'	Section 5.3	Potential impacts to the River Wensum SSSI are considered in **Section 18.6**.
'Applications for energy projects of 1 hectare or greater in Flood Zone 1 in England or Zone A in Wales and all proposals for energy projects located in Flood Zones 2 and 3 in England or Zones B and C in Wales should be accompanied by a flood risk assessment (FRA). An FRA will also be required where an energy project less than 1 hectare may be subject to sources of flooding other than rivers and the sea (for example surface water), or where the EA, Internal Drainage Board or other body have indicated that there may be drainage problems. This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account.'	Section 5.7	Potential impacts on flood risk are considered in **Section 18.6** and an FRA is provided in **Appendix 18.2**.
'Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent. The ES should in particular describe: the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges; existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies); existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and	Section 5.15	Potential impacts on water quality, the physical characteristics of surface watercourses and the quality and quantity of groundwater are considered in **Section 18.6**. Potential impacts on WFD compliance are considered separately in **Appendix 18.1**.

NPS Requirement	NPS Reference	Section Reference
any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions.'		
EN-5 NPS for Energy Networks Infrastructure (EN-5)		
Section 4.9 of EN-1 sets out the generic considerations that Applicants and the Secretary of State should take into account in order to ensure that electricity networks infrastructure is resilient to the effects of climate change. As climate change is likely to increase risks to the resilience of some of this infrastructure, from flooding for example, or in situations where it is located near the coast or an estuary or is underground, Applicants should in particular set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it has been designed to be resilient to: • Flooding, particularly for substations that are vital to the network; and especially in light of changes to groundwater levels resulting from climate change Section 4.8 of EN-1 advises that the resilience of the project to climate change should be assessed in the Environmental Statement (ES) accompanying an application. For example, future increased risk of flooding would be covered in any flood risk assessment (see Section 5.7 in EN-1)	Section 2.7	Flooding and the potential effects of climate change are considered in **Section 18.6** and an FRA is provided in **Appendix 18.2**.

18.4.1.2 Other

28. In addition to the NPS, there are a number of pieces of legislation, policy and guidance applicable to the assessment of water resources and flood risk. These are described in the sections below. Further detail is provided in **Chapter 2 Policy and Legislative Context**.

18.4.1.2.1 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

29. The Water Framework Directive (WFD) (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted in 2000. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 transposed the WFD into national law in the UK. The WFD Regulations remain in force following the UK's withdrawal from the European Union under the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

30. Under the Regulations, surface waters are designated as water bodies and are set objectives for achieving Good Ecological Status (GES) or Good Ecological Potential (GEP) (in the case of heavily modified water bodies). The Environment Agency is required to produce River Basin Management Plans (RBMPs) which describe the current state of the water environment within the River Basin District (RBD) and set out the objectives for protecting and improving it.

18.4.1.2.2 The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015

31. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 set out the standards and thresholds used to determine the ecological and chemical status of water bodies. These are considered in terms of biological, hydromorphological, physico-chemical and chemical status for surface water bodies, and quantitative and chemical status for groundwater bodies.

18.4.1.2.3 The Conservation of Habitats and Species Regulations 2017

32. The Dutch Nitrogen Case[1] ruled that where an internationally important site (i.e. Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar Sites) is failing to achieve the required condition due to nutrient pollution, the potential for a new development to add to the nutrient load is "necessarily limited". This has informed the way in which the Conservation of Habitats and Species Regulations 2017 (as amended) should apply to pollution related pressures and incidents.

33. Note that the further information on the Conservation of Habitats and Species Regulations 2017 is provided in ES **Chapter 20 Onshore Ecology and Ornithology.**

18.4.1.2.4 National Planning Policy Framework (2021) and Supporting Guidance

34. The National Planning Policy Framework (NPPF) sets out the UK Government planning policies for England and seeks to ensure that flood risk is considered at all stages of the planning and development process. Its policies aim to avoid inappropriate development in areas at highest risk of flooding, and to direct development away from these areas.

[1] Joined Cases C-293/17 and C-294/17 Coöperatie Mobilisation for the Environment UA and Others v College van gedeputeerde staten van Limburg and Others

35. The revised NPPF (2021) provides clarification that all strategic policies / plans should apply a sequential, risk-based approach to the location of development taking into account all sources of flood risk (e.g. fluvial, coastal, surface water, groundwater, reservoir and sewer flooding). It also provides guidance on how this is to be considered in the context of the location of site-specific development. Further guidance, on the application of the Sequential Test and Exception Test is provided in the supporting NPPF Planning Practice Guidance (PPG) (Ministry of Housing, Communities and Local Government, 2021). Both the NPPF and supporting NPPF PPG provide guidance on the application of the Sequential Test and Exception Test in terms of fluvial and tidal flood risk, based on the consideration of Flood Zones and the Vulnerability Classification relevant to a development.

36. Both the NPPF and supporting NPPF PPG provide guidance on the application of the Sequential Test and Exception Test in terms of fluvial and tidal flood risk, based on the consideration of Flood Zones and the Vulnerability Classification relevant to a development.

37. However, neither the NPPF nor the supporting NPPF PPG provides a set of criteria as to how the Sequential Test should be applied for other sources of flooding, for example surface water flooding, in terms of development vulnerability and the varying level of flood risk. It is understood that there are likely to be future updates to the NPPF PPG to provide greater clarification but at the time of writing

18.4.1.2.5 Flood and Water Management Act (2010)

38. The Flood and Water Management Act (FWMA) aims to improve the management of flood risk management and water resources by creating clear roles and responsibilities. It gave local authorities the new role of Lead Local Flood Authority (LLFA) under which they take on the responsibility of managing flood risk on a local scale from surface water, groundwater and ordinary watercourses. The Environment Agency gained a strategic overview role of all flood risk. The FWMA provides opportunities for a comprehensive, risk-based approach on land use planning and flood risk management by local authorities and other key partners.

18.4.1.2.6 Anglian River Basin District: River Basin Management Plan (2015)

39. RBMPs provide a framework for the protection and enhancement of the benefits provided by the water environment in each RBD and are produced in order to implement the WFD. As water resources and land use are closely linked, RBMPs also inform decisions on land-use planning.

40. The second RBMP for the Anglian RBD was finalised by the Department for the Environment, Food and Rural Affairs (Defra) and the Environment Agency in December 2015 and was published in 2016. It provides a baseline classification of the water environment in the Anglian RBD and highlights statutory objectives for protected areas such as waters used for drinking water, bathing, and designated sites. It lays out the actions needed to improve the water environment and achieve the objectives of the WFD.

18.4.1.2.7 Preliminary and Strategic Flood Risk Assessments

41. SEP and DEP onshore infrastructure, including the 60km onshore cable corridor and the onshore substation, falls entirely within the jurisdiction of Norfolk County Council, but passes through several local authority districts including North Norfolk District Council, Broadland District Council and South Norfolk District Council.

42. Norfolk County Council produced a Preliminary FRA in July 2011 which provides a high level overview of flooding from local sources in Norfolk. A consortium of District Councils in Norfolk worked together to produce Strategic FRAs as part of the Norfolk Strategic Framework in 2017. North Norfolk District Council and Broadland District Council worked together, and South Norfolk District Council was included in the wider Norwich area, to produce Strategic FRAs providing more detailed information and guidance on flood risk in their respective areas.

18.4.1.2.8 Local Flood Risk Management Strategy

43. The Norfolk Local Flood Risk Management Strategy was produced by Norfolk County Council in 2015 and was informed by the Preliminary FRA. It outlines the aims and objectives of the council in its role as LLFA and establishes a framework of policies to ensure a consistent and strategic approach to flood management amongst all Risk Management Authorities. The Strategy also identifies proactive measures to increase understanding of flood risk and clarifies funding and monitoring activities.

18.4.1.2.9 Local Planning Policy Documents

44. Each Local Authority has produced a planning policy document. **Table 18-5** lists the key policies of each of these which is relevant to water resources and flood risk.

Table 18-5: Relevant Local Planning Policies

Document	Policy/Guidance	Policy/Guidance Purpose
North Norfolk District Council		
North Norfolk District Council has produced a collection of planning documents to guide development in North Norfolk known as the Local Development Framework (LDF). This includes a Core Strategy and Development Management Policies document (North Norfolk District Council, 2012) alongside a Proposals Map, Site Allocations and Supplementary Documents.	Development Management Policy EN10 – 'Development and Flood Risk'	"The sequential test will be applied rigorously across North Norfolk and most new development should be located in Flood Risk Zone 1. New development in Flood Risk Zones 2 and 3a will be restricted to the following categories: • Water compatible uses; • Minor development (xii); • Changes of use (to an equal or lower risk category in the flood risk vulnerability classification) where there is no operational development (xiii); and • 'Less vulnerable' uses where the sequential test has been passed."

Document	Policy/Guidance	Policy/Guidance Purpose
	Strategic Policy	In addition, the adopted Core Strategy includes the following Strategic Policy, relevant for the project: "Renewable energy proposals will be supported and considered in the context of sustainable development and climate change, taking account of the wide environmental, social and economic benefits of renewable energy gain and their contribution to overcoming energy supply problems in parts of the District."
	Appendix B (North Norfolk Ecological Network) of North Norfolk District Council's Policy EN 9 on Biodiversity	The policy identifies the Rivers Wensum and Bure, their tributaries and their floodplains as a core area for biodiversity, where protection, enhancement and expansion of the existing resource will be a priority. Chalk river Biodiversity Action Plan (BAP) habitat in the Wensum and Bure is identified as being a particular priority in the county. The policy also sets out four objectives for river habitats: • Produce river restoration plans; • Create habitat ecotones from wet to dry habitat; • Buffer floodplains by encouraging low input agricultural systems or semi-natural habitats; and • Enhance connectivity through creating new wetland linkages and enhancing the matrix (land uses surrounding a wetland).
Joint Core Strategy (JCS) for Broadland, Norwich and South Norfolk		
The Joint Core Strategy DPD for Broadland, Norwich and South Norfolk District Councils was adopted in 2011 and amended in 2014. It was developed with Norfolk County Council as part of the Greater Norwich Development Partnership (GNDP)	Objective 1 of the Spatial Planning Objectives	This Strategy recognises flooding as a key concern, where it states: "New development will generally be guided away from areas with a high probability of flooding. Where new development in such areas is desirable for reasons of sustainability (e.g. in the city centre), flood mitigation will be required and flood protection will be maintained and enhanced."

18.4.2 Data and Information Sources

18.4.2.1 Site Specific Surveys

45. In order to provide site specific and up to date information on which to base the impact assessment, a geomorphological site walkover survey was conducted in September 2020 to characterise the physical characteristics of the major watercourses (Main Rivers and WFD water bodies) that would be crossed by the onshore cable corridor and potentially affected by the onshore substation. This included an assessment of flow conditions, channel form, floodplain characteristics and any evidence of channel modification. The survey and its results are discussed in further detail in **Appendix 18.3 Geomorphological Baseline Survey Technical Report**.

18.4.2.2 Other Available Sources

46. Other sources that have been used to inform the assessment are listed in **Table 18-6**.

Table 18-6: Other Available Data and Information Sources

Data set	Spatial coverage	Year	Notes
Environment Agency's Flood Map for Planning	Nationwide	2020	N/A
Environment Agency Product 4 data	Landfall, onshore cable corridor, onshore substation	2020	N/A
Environment Agency Product 8 data	Landfall, onshore cable corridor, onshore substation	2020	N/A
Environment Agency Catchment Data Explorer	Nationwide	2020	WFD River Basin Districts Management Catchments, Operational Catchments and WFD water bodies
IDB Classification of drains within the Norfolk Rivers Internal Drainage District	Landfall, onshore cable corridor, onshore substation	2020	N/A

18.4.3 Impact Assessment Methodology

47. **Chapter 5 EIA Methodology** provides a summary of the general impact assessment methodology applied to SEP and DEP. The following sections confirm the methodology used to assess the potential impacts on water resources and flood risk. More detailed methodologies specific to the WFD and FRA can be found in **Appendix 18.1** and **Appendix 18.2** respectively.

48. As described in **Section 18.3.2.1**, the study area has been defined on the basis of the surface hydrological catchments that could potentially interact with SEP and DEP. For the purposes of this assessment, each catchment has been defined as a single receptor, containing multiple Main Rivers and ordinary watercourses, and assigned a single sensitivity which reflects the most sensitive watercourse within that receptor. For clarity, the sensitivity of each water body is defined once, with a justification, in **Table 18-13**, and is referred to throughout the impact assessment in **Section 18.6**.

49. In addition, due to the repetition of receptors across each impact, a summary table has been produced for each impact and scenario which sets out the individual receptors and the magnitude of effect and significance both before and after mitigation for each one. These are discussed in the preceding text but are summarised in this way to avoid repetition and ensure clarity and a concise assessment.

18.4.3.1 Definitions

50. For each receptor, the assessment identifies a level of sensitivity (as defined in **Table 18-7**). This is then used in a systematic approach to understanding the impact pathways and the level of impacts on given receptors which considers both magnitude of effect (as defined in

51. **Table 18-8)** and sensitivity of receptor to determine the impact of the project on each receptor.

52. Timescales in the tables below for impact duration are defined based on the RBMP cycle. Therefore, short-term is less than one year, medium-term is one to six years (i.e. one RBMP cycle) and long-term is greater than six years (i.e. more than one RBMP cycle).

Table 18-7: Definition of Sensitivity for A Water Resources and Flood Risk Receptor

Sensitivity	Definition
High	The receptor has no or very limited capacity to tolerate changes to hydrology, geomorphology, water quality or flood risk and has little potential for substitution. Includes water resources which support human health and/or the economic activity at a regional scale, or receptors with a high vulnerability to flooding. *Water resources* • Controlled waters with an unmodified, naturally diverse hydrological regime, a naturally diverse geomorphology with no barriers to the operation of natural processes, and good water quality. • Supports habitats or species that are highly sensitive to changes in surface hydrology, geomorphology or water quality • Supports Principal Aquifer with public water supply abstractions by provision of recharge. • Site is within Inner or Outer Source Protection Zones. *Flood risk*

Sensitivity	Definition
	• Highly Vulnerable Land Use, as defined by NPPF PPG (Department for Communities and Local Governments (DCLG), 2014). • Land with more than 100 residential properties (after Design Manual for Roads and Bridges (DMRB), 2009).
Medium	Receptor has limited capacity to tolerate changes to hydrology, geomorphology, water quality or flood risk. Water resources which support human health and/or economic activity at a local scale. Receptors with a high vulnerability to flooding. *Water resources* • Controlled waters with hydrology that sustains natural variations, geomorphology that sustains natural processes, and water quality that is not contaminated to the extent that habitat quality is constrained. • Supports or contributes to habitats or species that are sensitive to changes in surface hydrology, geomorphology and/or water quality. • Supports Secondary A or Secondary B Aquifer with water supply abstractions. • Site is within a Catchment Source Protection Zone. *Flood risk* • More Vulnerable Land Use, as defined by NPPF PPG (DCLG, 2014). • Land with between 1 and 100 residential properties or more than 10 industrial premises (after DMRB, 2009).
Low	Receptor has moderate capacity to tolerate changes to hydrology, geomorphology and, water quality or flood risk. Water resources that support human health and/or economic activity at a neighbourhood (multiple property) scale. Receptors with a moderate vulnerability to flooding. *Water resources* • Controlled waters with hydrology that supports limited natural variations, geomorphology that supports limited natural processes, and water quality that may constrain some ecological communities. • Supports or contributes to habitats that are not sensitive to changes in surface hydrology, geomorphology or water quality. • Supports Secondary A or Secondary B Aquifer without abstractions. *Flood risk* • Less Vulnerable Land Use, as defined by NPPF PPG (DCLG, 2014). • Land with 10 or fewer industrial properties (after DMRB, 2009).
Negligible	Receptor is generally tolerant of changes to hydrology, geomorphology, water quality or flood risk. Water resource that supports human health and/or economic activity at a single property scale. Receptors with a low vulnerability to flooding. *Water resources* • Controlled waters with hydrology that does not support natural variations, geomorphology that does not support natural processes, and water quality that constrains ecological communities.

Sensitivity	Definition
	• Aquatic or water-dependent habitats and/or species are tolerant to changes in hydrology, geomorphology or water quality. • Non-productive strata that does not support groundwater resources. *Flood risk* • Water Compatible Land Use, as defined by NPPF PPG (DCLG, 2014). • Land with limited constraints and a low probability of flooding of residential and industrial properties (after DMRB, 2009).

Table 18-8: Definition of Magnitude for A Water Resources and Flood Risk Receptor

Magnitude	Definition
High	Permanent/irreversible, or large-scale changes, over the whole receptor affecting usability, risk, or value. Causes fundamental changes to key features of the receptor's character or distinctiveness. *Water resources* • Permanent changes to geomorphology and/or hydrology that prevent natural processes operating. • Permanent and/or wide scale effects on water quality or availability. • Permanent loss or long-term degradation of a water supply source resulting in prosecution. • Permanent or wide scale degradation of habitat quality. • Deterioration in WFD surface water body status or prevention of achieving future status objectives. • Deterioration in groundwater levels, flows or quality leading to a deterioration in WFD groundwater body status. *Flood risk* • Permanent or major change to existing flood risk. • Reduction in on-site flood risk by raising ground level in conjunction with provision of compensation storage. • Increase in off-site flood risk due to raising ground levels without provision of compensation storage. • Failure to meet either sequential or exception test (if applicable).
Medium	Partial loss or noticeable change over the majority of the receptor, and/or discernible alteration to key features of the receptor's character or distinctiveness. Moderate permanent or long-term reversible change affecting usability, value, or risk, over the medium- term or local area. *Water resources* • Medium-term effects on water quality or availability. • Medium-term degradation of a water supply source, possibly resulting in prosecution. • Habitat change over the medium-term.

Magnitude	Definition
	• Potential temporary downgrading in the status of individual WFD elements, without affecting the ability of the surface water to achieve future objectives. • Medium-term deterioration in groundwater levels, flow or quality leading to potential temporary downgrading of WFD status. *Flood risk* • Medium-term or moderate change to existing flood risk. • Possible failure of sequential or exception test (if applicable). • Reduction in off-site flood risk within the local area due to the provision of a managed drainage system.
Low	Discernible temporary change over a minority of the receptor, and/or with minimal effect on usability, risk or value. Also potential discernible alteration to key features of the receptor's character or distinctiveness. *Water resources* • Short-term or local effects on water quality or availability. • Short-term degradation of a water supply source. • Habitat change over the short-term. • No change to WFD status. *Flood risk* • Short-term temporary or minor change to existing flood risk. • Localised increase in on-site or off-site flood risk due to increase in impermeable area. • Passing of sequential and exception test.
Negligible	Temporary change, undiscernible over longer timescales, with no effect on usability, risk or value. Slight, or no, alteration to the characteristics or features of the receptor's character or distinctiveness. *Water resources* • Temporary impact on local water quality or availability. • Temporary or no degradation of a water supply source. • Very slight local changes to habitat that have no observable impact on dependent receptors. *Flood risk* • Temporary or very minor change to existing flood risk. • Highly localised increase in on-site or off-site flood risk due to increase in impermeable area.

18.4.3.2 Impact Significance

53. In basic terms, the potential significance of an impact is a function of the sensitivity of the receptor and the magnitude of the impact (see **Chapter 5 EIA Methodology** for further details). The determination of significance is guided by the use of a significance matrix, as shown in **Table 18-9**. Definitions of each level of significance are provided in **Table 18-10**.

54. Potential impacts identified within the assessment as major or moderate are regarded as significant in terms of the EIA regulations. Appropriate mitigation has been identified in respect of moderate and major impacts, where possible, in consultation with the regulatory authorities and relevant stakeholders. The aim of mitigation measures is to avoid or reduce the overall impact in order to determine a residual impact upon a given receptor which is either minor or negligible and therefore not significant.

Table 18-9: Impact Significance Matrix

		Negative impact				BeneficialImpact			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

Table 18-10: Definition of significance

Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore, no change in receptor condition.

18.4.4 Cumulative Impact Assessment Methodology

55. The cumulative impact assessment (CIA) considers other plans, projects and activities that may impact cumulatively with SEP and DEP. As part of this process, the assessment considers which of the residual impacts assessed for DEP and/or SEP on their own have the potential to contribute to a cumulative impact, the data and information available to inform the cumulative assessment and the resulting confidence in any assessment that is undertaken. **Chapter 5 EIA Methodology** provides further details of the general framework and approach to the CIA.

56. For water resources and flood risk, these activities include the potential crossing of cable routes associated with other offshore wind farms (e.g., Norfolk Boreas and Norfolk Vanguard). Activities involving large scale excavation, such as major infrastructure projects, taking place concurrently within, the same surface water catchments as SEP and DEP would also require consideration.

18.4.5 Transboundary Impact Assessment Methodology

57. For water resources and flood risk, the potential for transboundary effects was scoped out as agreed at scoping stage in the Scoping Report (Equinor, 2019) as the onshore project area is not located adjacent to any international boundaries.

18.4.6 Assumptions and Limitations

58. This assessment is based on a range of publicly available information and data sources (as laid out in **Table 18-6**) and is largely desk-based. These data sets are considered to be robust, however there is a level of uncertainty and assumptions associated with their use in this impact assessment. For example, the known characteristics of the drainage network and attributes and conditions specific to water bodies have been used as a proxy to assign value and sensitivity to the wider catchment and the ordinary watercourses within them. This is a precautionary approach that ensures value and sensitivity have not been under-assessed within the assessment.

18.5 Existing Environment

18.5.1 Surface Water

18.5.1.1 Surface Water Drainage

59. As discussed in **Section 18.3.1**, this assessment is considered in terms of the river water body catchments which are defined by the Environment Agency. Receptors are those river water bodies that are crossed, or their catchments are crossed, by the landfall, onshore cable corridor or onshore substation and those that are downstream. These are grouped within their respective operational catchments (as identified by the Environment Agency) for this assessment due to the distinctive characteristics of each catchment and the water bodies within them.

60. The onshore infrastructure associated with SEP and DEP lies within four surface water catchments (based on the operational catchments defined by the Environment Agency) as described in **Section 18.3.1**:

- The North Norfolk catchment;
- The Bure catchment;
- The Wensum catchment; and
- The Yare catchment.

61. The landfall and northern extent of the onshore cable corridor passes through the eastern section of the North Norfolk surface water operational catchment. This operational catchment encompasses three main chalk rivers, which are an internationally rare habitat, including the catchment of the River Glaven which is crossed by the onshore cable corridor.

62. The River Bure itself and the catchments of two of its tributaries within its upper reaches, Scarrow Beck and Mermaid Stream, are intersected by the onshore cable corridor. The River Bure rises at Melton Constable and flows south west through the Broads to meet the sea at Great Yarmouth. Its upper reaches are steeper and suffer from sediment runoff due to historical land management. The lower reaches include a range of wetland features including Hoveton Great Broad and Marshes, Woodbastwick Fens and Marshes, Bure Marshes and Norfolk Broads.

63. The River Wensum and two of its tributaries, the River Tud and Swannington Beck are crossed by the onshore cable corridor, along with a portion of the catchment of Blackwater Drain. The Wensum is designated along much of its length as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) due to its status as an internationally rare chalk river system, including the location of the proposed crossing. It passes through Fakenham and the Pensthorpe Nature Reserve and continues in a broadly south-easterly direction through Norwich to join the River Yare at Whitlingham. The Tud and Blackwater Drain have been identified as significant contributors of phosphate into the River Wensum, causing the SSSI to be in unfavourable condition along much of its length.

64. The River Yare and two of its tributaries, the River Tiffey and the Intwood Stream, are crossed by the onshore cable corridor. The catchments of the Intwood Stream and the River Tas (another tributary of the Yare) also contain the onshore substation area. The River Yare rises south of Dereham and flows east towards Norwich with the River Tiffey being a major tributary. It is joined by the Wensum at Whitlingham and flows into Breydon Water following which it enters the sea at Great Yarmouth. The catchment experiences pressures from agriculture and rural land management and the water industry throughout.

65. There are a number of ordinary watercourses within the river water body catchments which will be crossed by the onshore cable corridor. Ordinary watercourses are all rivers, streams, ditches and drains that are not designated Main Rivers (which are managed by the Environment Agency), instead they are the responsibility of the LLFA or, in the case of selected watercourses within an Internal Drainage District, the appropriate IDB.

66. Several of those water bodies crossed by the onshore cable corridor are maintained and managed by Norfolk Rivers IDB, as shown in **Figure 18.3**. The river water bodies and IDB drains are listed in **Table 18-11** below in their relevant operational catchments. There are also a number of smaller ordinary watercourses and unnamed agricultural drainage channels that are too numerous to be listed individually which are also crossed by the onshore cable corridor.

Table 18-11: Surface Water Receptors

Operational catchment	River water body	Relevant Norfolk Rivers IDB drains crossed by the cable corridor
North Norfolk Rivers	Spring Beck (coastal catchment)	N/A
	Glaven	N/A
Bure	Scarrow Beck	N/A
	Bure	N/A
	Mermaid Stream	N/A
Wensum	Blackwater Drain	N/A
	Swannington Beck	DRN111G0103
	Wensum upstream of Norwich	DRN111G0101 DRN112G0103
	River Tud	N/A
Yare	Yare upstream of confluence with Tiffey	N/A
	River Tiffey	N/A
	Yare (Tiffey to Wensum)	N/A
	Intwood Stream	N/A
	River Tas (Tasburgh to Yare)	N/A

18.5.1.2 Geomorphology

67. The methodology and results of the geomorphological walkover survey undertaken in September 2020 are discussed in further detail in **Appendix 18.3 Geomorphological Baseline Survey Technical Report**. The main characteristics of each watercourse within the study area are described below:

- **Spring Beck**: A modified stream diverted along an artificial course with a predominately straight uniform channel, characterised by glide flows, with limited geomorphological complexity, floodplain connectivity and in-channel aquatic vegetation. The dominant fluvial process is sediment deposition.
- **River Glaven**: A chalk river characterised by a uniform, incised channel which is straight, dominated by glide flows, with margins well vegetated, flowing through a low gradient glacial till floodplain and woodland. There is some geomorphological complexity, including an online pond and two-stage channel, although there is limited floodplain connectivity. The dominant fluvial process is sediment deposition.
- **River Bure**: A chalk river characterised by varied channel morphology and flow types, including glides, runs and pools with good floodplain connectivity. The watercourse contains several ditches in the floodplain and along with a two-stage channel consisting of high and low flow channels within a wider channel belt, provide good geomorphic complexity and habitat diversity. The dominant fluvial processes are sediment transport and deposition.
- **Swannington Beck**: A stream consisting of a primary and secondary channel, with the primary channel displaying varied morphology, such as anabranches and flow habitats including runs, riffles, glides and pools within a meandering planform that is tree lined with limited floodplain connectivity. The secondary channel is a smaller watercourse, also with limited floodplain connectivity, although similar to the primary channel has well vegetated margins. The dominant fluvial process is sediment deposition, with the beds of both channels also armoured in places.
- **River Wensum**: A chalk river consisting of a primary and secondary channel, with the primary channel characterised by a straight to sinuous planform which is wide, deep and slow flowing in places and dominated by glide flow habitat, with good marginal vegetation. There is good floodplain connection as evident by small wetlands, back waters and an overall wetted floodplain. The secondary channel is a small, straight, incised, modified watercourse, with good marginal vegetation and floodplain connectivity in places. The dominant fluvial process for both channels is sediment deposition.
- **River Tud**: A chalk river characterised by a straight to gently sinuous planform, varied flow habitats including glides, runs, pools and riffles with good marginal vegetation. There is good floodplain connectivity, with key channel and floodplain features include small benches, relic channels, drainage ditches, scrapes and wetlands, providing geomorphic complexity and habitat diversity. The dominant fluvial process is sediment deposition, although there is little silt deposition on the bed and margins, despite livestock poaching being prevalent.

- **River Yare**: Characterised by a straight to sinuous planform which is wide and deep in places and dominated by glide and pool flow types. The watercourse has good marginal vegetation, with good floodplain connection. The floodplain contains small wetland scrapes (or ponds) and backwaters. The dominant fluvial process for both channels is sediment deposition.
- **River Tiffey**: Characterised by a relatively straight planform which is deep and narrow in places and dominated by glide and pool flow types. The river has good marginal vegetation, with good floodplain connection. The floodplain contains ditches, a small lake (offline pond) and wet woodland. The dominant fluvial process for both channels is sediment deposition.
- **Intwood Stream**: Consists of two connected watercourses, a main larger western channel and a smaller eastern channel, with the western channel characterised by a straight planform of varied morphology, incised in places, with good floodplain connectivity and varied flow types. The channel has good marginal vegetation, with floodplain features including ditches and ponds. The eastern channel also has varied flow types, good marginal vegetation, although modified in places. The dominant fluvial process for both channels is sediment deposition and transport occurring at a similar degree in response to the varied nature of the flow types.

18.5.1.3 Water Quality

68. A review of the Environment Agency's Catchment Data Explorer WFD water quality data for surface water bodies gives an indication of water quality across the catchments. Most water bodies show near natural physico-chemical elements of water quality such as dissolved oxygen, temperature, pH, ammonia and phosphate. Most have suffered from physical modifications for agricultural or operational management purposes (Environment Agency, 2020) affecting hydromorphological regime and fish habitat.
69. Some water bodies show high levels of phosphate, particularly the River Tud, the River Tiffey, Intwood Stream and River Tas, which the Environment Agency attributes variously to diffuse sources of pollution from poor livestock and soil management in the agriculture and rural land management industries and also to point source pollution from wastewater treatment works by the water industry (Environment Agency, 2020).
70. The onshore cable corridor passes through a surface water Drinking Water Protected Area (DWPA) (Surface Water) towards its southern extent. DWPAs are designated under the WFD where raw water is extracted from rivers and reservoirs and therefore requires additional protection to ensure it is not polluted. Areas are identified that are at risk of deterioration, predominantly due to land use practices that cause pollution of the raw water. This data is not currently available to download but is available to view online at www.magic.gov.uk.

18.5.1.4 Flood Risk

71. The DCO order limits for SEP and DEP is primarily located on rural, agricultural land with a large number of agricultural land drains, IDB-maintained ordinary watercourses and other ordinary watercourses.

72. The NPPF PPG aims to steer development towards areas at lowest risk of flooding (Flood Zone 1) and away from medium and high flood risk areas (Flood Zones 2 and 3) (**Table 18-12**). Flood Zones are informed by the extent of modelling undertaken by the Environment Agency. All designated Main Rivers, as well as some of the larger ordinary watercourses included in the Environment Agency's modelling, are considered within the Flood Zone datasets.

Table 18-12: Summary of Flood Zone Definitions

Flood Zone	Probability of Flooding	Return Periods
1	Low	Land having a less than a 1 in 1,000 annual probability of river or sea flooding.
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
3a	High	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
3b	High – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

73. The landfall location is largely within Flood Zone 1, with a small part falling within Flood Zones 2 and 3, associated with the beach and coastal areas to the north west of Weybourne and Spring Beck which is a Main River flowing through Weybourne. Flood zones in the landfall area are therefore largely dominated by tidal influences and the risk of flooding from fluvial sources is considered low. Furthermore, the area is not at risk of flooding from sewers, reservoirs, canals or other artificial sources according to the Environment Agency's Flood Map for Planning and surface water mapping (see **Appendix 18.2 (FRA)**).

74. The onshore cable corridor mainly passes through Flood Zone 1, with some areas of Flood Zones 2 and 3 particularly associated with where it crosses Main Rivers and ordinary watercourses. The majority of the area is not at risk from tidal or coastal flooding, fluvial flooding from Main Rivers (with the exception of narrow areas at watercourse crossings), sewers, reservoirs, canals or other artificial sources. There is a low level of flood risk associated with groundwater. Details of all the flood risk zones and associated mapping is provided in **Appendix 18.2 (FRA)**.

75. The proposed onshore substation is located in Flood Zone 1 and as such is at low risk of flooding from rivers. The substation footprint is adjacent to a surface water overland flow pathway which is identified in Environment Agency Flood Map for Planning to be at primarily 'Low' risk of flooding. Some localised areas are identified as being at 'Medium' and 'High' risk of flooding.

76. Although the revised NPPF (2021) provides clarification that all strategic policies / plans should apply a sequential, risk-based approach to the location of development taking into account all sources of flood risk (i.e. including fluvial, coastal, surface water, groundwater, reservoir and sewer flooding), neither the NPPF nor the supporting NPPF PPG provides a set of criteria as to how the Sequential Test should be applied for other sources of flooding, in terms of development vulnerability and the varying level of flood risk.

77. However, for the purposes of site selection and the detailed FRA (**Appendix 18.2**), based on the indicative flood risk issues in relation to SEP and DEP, the application of a sequential approach has been considered, specifically with regard to the onshore substation site. This assessment has sought to consider the potential surface water flood risk in greater detail with the aim of sequentially locating it, wherever possible, to avoid this risk.

78. **Appendix 18.2 (FRA)** provides a detailed description of the baseline flood risk of the landfall, onshore cable corridor and onshore substation search area.

18.5.2 Groundwater

18.5.2.1 Groundwater Bodies

79. The onshore study area is underlain by two groundwater bodies as shown in **Figure 18.2**:

- North Norfolk Chalk; and
- Broadland Rivers Chalk and Crag.

80. Both aquifers are designated as Principal Aquifers by the Environment Agency meaning they usually provide a high level of water storage. The superficial deposits underlying the project area comprise areas of glacial sand and gravel, till and crag group sand and gravel (British Geological Survey, 2020). These are classified by the Environment Agency as predominantly Secondary A (permeable layers capable of supporting water supplies at a local scale) or Secondary Undifferentiated (not possible to assign either A or B categories due to often variable characteristics of rock type) with small areas of Secondary B (predominantly lower permeability with limited ability to store or yield groundwater).

81. The Environment Agency's groundwater vulnerability maps (available online at www.magic.gov.uk) indicate that the onshore project area is predominantly located within an area of medium-high groundwater vulnerability with some areas of medium vulnerability and areas of soluble rock risk. The Environment Agency defines groundwater vulnerability in terms of the risk to a groundwater body of a pollution hazard. This is dependent on hydrological, geological and soil conditions and can be intrinsic to the soil type, superficial deposits or the bedrock, or can be a factor specific to the location such as characteristics of a pollutant. The following categories apply to groundwater:

- High vulnerability: Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium vulnerability: Intermediate between high and low vulnerability.
- Low vulnerability: Areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

82. The WFD defines groundwater bodies as distinct volumes of groundwater within an aquifer, or aquifers, with a coherent flow unit including recharge and discharge areas and little flow across boundaries between distinct bodies. Groundwater bodies must be designated as drinking water protected areas based on their use for human consumption under the WFD.

83. In addition to the Principal Aquifer underlying the project area, there are also Groundwater Source Protection Zones (SPZs) (**Figure 18.4**). These zones show the risk of contamination from any activities that might cause pollution in the area, with a lesser distance causing greater risk. There are therefore three main zones, the inner zone (Zone 1), the outer zone (Zone 2) and the total catchment (Zone 3). Through the site selection process, Zones 1 and 2 have been avoided by the onshore cable corridor and substation (and operational access), although the majority of the onshore cable corridor passes through Zone 3. There is a very small area where construction access for the substation site overlaps with Zone 2, however no intrusive works will happen within this zone.

18.5.3 Abstractions

84. Data held by the Environment Agency (provided in September 2020) demonstrates that there are 172 abstractions within the DCO study area. These are comprised of:

- 28 licensed groundwater abstractions and 11 licensed surface water abstractions. These are largely associated with agricultural uses for spray irrigation, although several abstraction points are also used for general farming and domestic uses.
- 39 deregulated (i.e. smaller capacity) groundwater extractions, which are predominantly used to provide a water supply for general agriculture.

- 94 groundwater abstractions that are used to provide a private domestic water supply (i.e. through wells or boreholes).

18.5.4 Designated Sites

85. The River Wensum is designated as both a SAC and SSSI across its entire length. The SSSI was designated as an example of an enriched calcareous lowland river. In its upper reaches, the Wensum shows chalk stream characteristics which is an internationally rare habitat, recognised for protection under the UK Biodiversity Action Plan. It supports a diverse community of plant, invertebrates and other aquatic species across upper and lower reaches, including reed bed habitats and seasonally inundated flood plain. However, the SSSI is in unfavourable condition across much of its length.

86. The SAC was designated to protect the European Habitats Directive Annex I habitat: watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. It is also home to an eastern example of white-clawed crayfish *Austropotamobius pallipes* populations in England. The river is also home to Annex II species Desmoulin's whorl snail *Vertigo moulinsiana*, brook lamprey *Lampetra planeri* and bullhead *Cottus gobio* which are qualifying features of the site.

87. More detail relating to designated sites can be found in **Chapter 20 Onshore Ecology and Ornithology**.

18.5.5 Sensitivity of Receptors

88. As described in **Section 18.5.1**, there are three main surface water drainage catchments in the study area. Each of these is sub-divided into river water body catchments by the Environment Agency which contain further ordinary watercourses. Therefore, the sensitivity of each of the receptors has been set at river water body catchment level and applied to all water bodies within the catchment. Any parts of the surface drainage network that are not included in Ordnance Survey datasets are therefore considered to be part of the nearest downstream water body.

89. The sensitivity of each surface water receptor has been defined in **Table 18-13** below and is based on the geomorphological, hydrological and water quality characteristics described in **Section 18.5.1**. The sensitivity of the groundwater bodies underlying the study area have been defined on the basis of recorded water quality and the use of the water bodies and are also defined in **Table 18-13**.

Table 18-13: Sensitivity of Receptors

Receptor	Sensitivity	Justification
North Norfolk Rivers		
Spring Beck	Low	Extensively modified watercourse with resectioned banks and limited flow diversity. The hydrology supports limited natural variations and geomorphology supports limited natural processes. The watercourse

Receptor	Sensitivity	Justification
		therefore has moderate capacity to tolerate changes to hydrology and geomorphology.
Glaven	Medium	This unmodified water body is a chalk stream which is an internationally rare habitat that is (and supports species which are) sensitive to changes in surface hydrology, geomorphology and/or water quality. It sustains physico-chemical conditions, including dissolved oxygen and pH, close to its natural state. However, runoff from agricultural fields has led to contamination resulting in a reduction in macrophytes and phytobenthos but not to the extent that habitat quality is constrained. The watercourse has limited capacity to tolerate changes to hydrology, geomorphology or water quality.
Coastal catchment	Low	A few minor drains and streams within this catchment drain into the sea, although none within the landfall area. Artificial drains are controlled waters characterised by hydrology that supports limited natural variations and geomorphology that supports limited natural processes. Water quality in these drains may constrain some ecological communities. Therefore the receptor has the capacity to tolerate changes to hydrology, geomorphology and water quality.
River Bure		
Scarrow Beck	Medium	Heavily modified channel which does not support a good hydrological regime; however, water quality is generally good and is not contaminated to the extent that habitat quality is constrained. It is a tributary of (and therefore contributes to) the River Bure which supports sensitive habitats in the National Nature Reserves including Hoveton Great Broad and Marshes.
River Bure	Medium	Modified channels with evidence of natural geomorphological recovery which sustains natural processes. The hydrology of the watercourse also sustains natural variations. This watercourse supports species that are sensitive to changes in geomorphology and water quality including brown trout, brook lamprey and water voles. It also supports National Nature Reserves in lower reaches including Hoveton Great Broad and Marshes.
Mermaid Stream	Medium	Modified channel characterised by hydrology that sustains natural variations and geomorphology that sustains natural processes, and water quality that is not contaminated to the extent that habitat quality is constrained. Supports species that are sensitive to changes in surface hydrology, geomorphology and water quality including brown trout, brook lamprey and water voles.
River Wensum		
Blackwater Drain	High	Predominantly natural meandering channel with good geomorphological diversity which supports habitats or species that are highly sensitive to changes in surface hydrology, geomorphology or water quality including brown trout and potentially for water voles. This watercourse as a whole therefore has very limited capacity to tolerate

Receptor	Sensitivity	Justification
		changes to hydrology, geomorphology or water quality and has little potential for substitution.
Swannington Beck	High	Heavily modified water body with limited hydrological connectivity for fish due to barriers in place for flood and land management. Water quality is generally good and supports varied geomorphology and ecology. It supports habitats and species that are highly sensitive to changes in surface hydrology, geomorphology and water quality including water voles, bullhead and brook lamprey. Nearby drains which also fall within the Swannington Beck catchment (IDB drains DRN111G0103 and DRN111G0101) also have high ecological value; providing habitat for otters, a good population of water voles, bullhead and brook lamprey.
River Wensum	High	Gently meandering chalk river with uniform flows and extensive deposition over coarse substrates. Although heavily modified with a hydrological regime impacted by groundwater extraction, its water quality is generally near to natural conditions. The river is designated as a SAC and SSSI along its length and it and its tributaries support habitat for European eels, brown trout, bullhead, brook lamprey and water voles all of which are habitats and species which are highly sensitive to changes in hydrology, geomorphology and water quality.
River Tud	High	Although heavily modified, this watercourse is a chalk river which is an internationally rare habitat and is a tributary of the River Wensum which is designated as an SAC and SSSI. The catchment therefore supports habitats or species that are highly sensitive to changes in surface hydrology, geomorphology or water quality including brown trout and bullhead. The receptor suffers from elevated levels of phosphate due to agricultural runoff, but not to an extent that habitat quality is constrained.
River Yare		
River Yare	Medium	Largely natural channel with some geomorphological diversity. Groundwater abstraction affects flows, and although it supports habitat for fish and invertebrate species, physical modifications for land drainage have affected habitat quality
River Tiffey	Medium	Relatively straight, heavily modified, channel with good marginal vegetation communities. Water quality is not contaminated to the extent that natural habitat quality is constrained. It supports a habitat that is sensitive to changes in surface hydrology, geomorphology and water quality and therefore has limited capacity to tolerate changes.
Intwood Stream	Low	Straightened, heavily modified watercourse showing evidence of natural recovery through hydrology and geomorphology which support natural processes although affected by livestock trampling. Sewage discharges and diffuse source pollution leads to water quality that may constrain some ecological communities. This receptor has moderate capacity to tolerate change.

Receptor	Sensitivity	Justification
River Tas	Medium	Gently meandering river with hydrology that sustains natural variations, geomorphology that sustains natural processes, and water quality that is not contaminated to the extent that habitat quality is constrained (although there are low dissolved oxygen concentrations).
Groundwater		
North Norfolk Chalk	High	Both are designated as Principal Aquifers and support public water supplies. They contain a number of groundwater SPZs, and a mix of areas of medium-high to medium groundwater vulnerability.
Broadland Rivers Chalk and Crag	High	

18.5.6 Climate Change and Natural Trends

90. The review of the existing environment presented in the sections above demonstrate that the surface water bodies in the study area support large areas of high-quality natural habitats. However, many of these water bodies have experienced physical modification for land drainage and flood risk management, affecting their geomorphology. Water quality is generally good across the study area, but several watercourses are adversely affected by phosphate fertiliser runoff and sewage effluent release leading to elevated levels of phosphate and other contaminants.

91. Ongoing measures to reduce existing pressures on geomorphology and water quality as part of the implementation of the WFD and restoration of the Wensum are likely to improve its condition over time, therefore a steady improvement in the baseline condition is expected.

92. Climate change is causing wetter winters and drier summers with an increase in the likelihood of convectional rain storms. The hydrology of the surface drainage network is expected to change with higher winter flows and lower summer flows with a greater number of storm-related flood flows. This is likely to lead to changes in the hydrology of the river systems with increased geomorphological activity occurring as a result of storm events. Therefore, the drainage network is unlikely to remain stable over time and may revert to more natural river types in future.

93. Groundwater bodies face pressures from intensive land use and highly permeable soils. Ongoing initiatives are in place to reduce pressures on groundwater, including increased regulation of agricultural chemicals, in order to achieve compliance with the WFD. This would suggest that groundwater quality and quantity is likely to improve in the future, although this would occur over long timescales.

94. Details relating to climate change and natural trends in designated sites can be found in **Chapter 20 Onshore Ecology and Ornithology**.

18.6 Potential Impacts

18.6.1 Potential Impacts during Construction

18.6.1.1 Impact 1: Direct Disturbance of Surface Water Bodies

95. The proposed onshore cable infrastructure and associated temporary haul road will directly cross the following Main Rivers (**Figure 18.5**):

- The River Bure;
- The River Wensum (upstream of Norwich);
- The River Tud;
- The River Yare;
- The River Tiffey; and
- The Intwood Stream.

96. The proposed onshore cable infrastructure and associated temporary haul road will also directly cross some ordinary watercourses (including IDB-maintained drains) within the catchments listed above. Numbers and types of crossings are given in **Table 18-15**

97. Trenchless crossing techniques such as HDD have been embedded in the scheme design for Main Rivers and IDB drains (**Section 18.3.3**). The cable would be installed at least 2m below the bed of the watercourse and, although ground disturbance will occur at the entry and exit points of any trenchless crossing (which could potentially be located on the floodplain), there would be no direct disturbance to the watercourses crossed using a trenchless technique. Therefore, there is no direct mechanism for impacts to occur to the geomorphology, hydrology and physical habitats of these watercourses.

98. Trenched crossings would be carried out on ordinary watercourses which intersect with the study area, except in particular instances where trenchless crossings may be used, for example if the ordinary watercourse is adjacent to another sensitive receptor for which trenchless crossing is being used. Trenched crossings of watercourses involve installing temporary dams (composed of sand bags, straw bales and ditching clay, or another suitable technique) upstream and downstream of the crossing point. The cable trench is then excavated in the dry area of riverbed between the two dams with the river flow maintained using a temporary pump or flume.

99. This installation technique would directly disturb the bed and banks of the watercourse and would result in the direct loss of natural geomorphological features and changes to their associated physical habitat niches. It may also result in increased geomorphological instability due to enhanced scour and increased sediment supply and changes to hydrology. These are, however, temporary impacts which would only occur whilst construction work is in progress, and the bed and banks would be reinstated to their original level, position, planform and profile.

100. In addition to the cable infrastructure itself, it may also be necessary to install temporary structures to allow haul road access across watercourses where direct access is not readily available from both sides. This may comprise an appropriately sized culvert installed within the ditch with the haul road being installed over the top of the culvert. The culvert would be installed in the channel bed so as to avoid upstream impoundment and would be sized to accommodate reasonable 'worst-case' weather volumes and flows. These culverts may remain in place for the duration of the cable duct installation and subsequent cable pull. At larger crossings, temporary bridges (such as Bailey bridges) may be installed to allow continuation of the haul road as described in **Section 18.3.2**. Note that bridges will not be used to cross Main Rivers.

101. Temporary bridges are unlikely to result in significant disturbance to the bed and banks of the channel, with any impacts limited to the footprint of the bridge abutments themselves. However, the installation of temporary culverts across ordinary watercourses could potentially directly disturb the bed and banks of the watercourse and result in the direct loss of natural geomorphological features. They could also result in reduced flow and sediment conveyance, create upstream impoundment and affect the patterns of erosion and sedimentation. These impacts would be reversible once the temporary culverts have been removed and the bed and banks reinstated.

102. For the purposes of this assessment, the magnitude of effect is assumed to be directly proportional to the total number of trenched watercourse crossings within each river water body catchment and the length of time over which temporary structures could be in place, as given in **Table 18-14**. In the sequential scenario, there is potential for temporary structures to be in place for up to two periods of 24 months for the onshore cable installation works. Should there be a gap between the finish of the first project and the start of the second project there is the potential that structures may remain in watercourses for longer than the combined 48 months. For example, 10-14 trenched crossings of ordinary watercourses within a catchment for up to five years, in the absence of mitigation, would result in habitat changes which equate to a medium magnitude of effect (**Table 18-8)**. If these are in place for more than five years this becomes a high magnitude of effect.

Table 18-14: Magnitude of effect resulting from watercourse crossings

Magnitude of effect	Number of trenched crossings per catchment	
	In place <5 years	In place >5 years
No impact	0	0
Negligible	1-4	1
Low	5-9	2-4
Medium	10-14	5-9
High	≥15	≥10

103. The water body crossings over the length of the cable corridor within each catchment are listed in **Table 18-15.**

Table 18-15: Watercourse Crossings in Surface Water Catchments

Catchment	River water body catchment	Sensitivity	Trenchless crossings			Trenched crossings
			Main River	**IDB Drain**	**Ordinary Watercourse**	**Ordinary Watercourse**
North Norfolk Rivers	Spring Beck	Low	0	0	2	0
	River Glaven	Medium	0	0	0	1
	Coastal catchment	Low	0	0	0	0
River Bure	Scarrow Beck	Medium	0	0	0	0
	River Bure	Medium	1	0	5	2
	Mermaid Stream	Medium	0	0	0	0
River Wensum	Blackwater Drain	High	0	0	0	0
	Swannington Beck	High	0	1	2	0
	River Wensum	High	1	2	2	0
	River Tud	High	1	0	0	0
River Yare	River Yare	Medium	1	0	8	1
	River Tiffey	Medium	1	0	2	3

Catchment	River water body catchment	Sensitivity	Trenchless crossings			Trenched crossings
			Main River	IDB Drain	Ordinary Watercourse	Ordinary Watercourse
	Intwood Stream	Medium	1	0	4	2
	River Tas	Medium	0	0	0	0

18.6.1.1.1 Magnitude of Effect – SEP or DEP in isolation

104. Both trenched crossings of ordinary watercourses, and the installation of temporary culverts to allow the haul road to cross the watercourse would lead to short-term degradation of habitats within those watercourses during construction. This would occur due to the use of temporary dams, drying and excavation of the bed of the watercourse or the installation of temporary culverts, all of which constitute, or cause, direct disturbance of the banks and bed of the watercourse.

105. It is likely that in-channel vegetation would be removed in the localised area of trenching, and the structure of the bed and banks of the watercourse would be disturbed. This would temporarily affect the habitat quality and geomorphology and may therefore impact the health of the wider catchment due to the cumulative effect of more than one watercourse within the catchment suffering degradation. However, this effect will be very localised to the affected watercourses and, with reinstatement, would be temporary.

106. The use of trenchless crossing techniques means that there is no impact in the majority of water bodies. However, as set out in **Table 18-15** and **Table 18-14**, trenched crossings would result in a negligible effect on the River Glaven, River Bure, River Yare, River Tiffey and the Intwood Stream (**Table 18-16**).

18.6.1.1.2 Magnitude of Effect – SEP and DEP Sequentially

107. Trenched crossings of ordinary watercourses and the installation of in-channel culverts for use by the haul road along the cable corridor could potentially result in short-term degradation of habitats within those watercourses due to direct disturbance of the banks and bed as described above. This may therefore impact on the condition of the wider catchment.

108. Both the concurrent and sequential construction scenarios would require two trenches within a 60m wide construction corridor, which means that there would not be any difference with regards to the expected level of physical impact between the concurrent or sequential build scenarios in this respect. However, in the sequential scenario, temporary structures associated with the construction of a trenched crossing, such as the haul road, would be in place for a longer continuous period of time. This means that the total continuous period of disturbance would be greater in the sequential scenario, which is therefore considered to represent the worst-case.

109. The use of trenchless crossing techniques means that there is no impact in the majority of water bodies. However, as set out in **Table 18-15** and **Table 18-14**, trenched crossings would result in a negligible magnitude of effect on the River Glaven and River Yare, a low magnitude of effect on the River Bure and River Tiffey and the Intwood Stream (**Table 18-17**).

18.6.1.1.3 Impact Significance – SEP or DEP in Isolation

110. The significance of the impact on each watercourse resulting from direct disturbance due to the construction of SEP or DEP in isolation is given in **Table 18-16**. Prior to mitigation, direct disturbance to all watercourses is considered to have either no impact (where there are no trenched crossings), negligible or minor adverse (where trenched crossings are required).

18.6.1.1.4 Impact Significance – SEP and DEP Sequentially

111. The significance of the impact on each watercourse resulting from direct disturbance due to the construction of SEP and DEP sequentially is given in **Table 18-17**. Prior to mitigation, direct disturbance to all watercourses is considered to have either no impact (where there are no trenched crossings), negligible or minor adverse (where a small number of trenched crossings are required).

18.6.1.1.5 Mitigation

112. Trenchless crossings have been embedded into the scheme design for Main Rivers and IDB drains (**Outline Code of Construction Practice** (document reference 9.17)) and there is no mechanism for direct impacts to occur to the geomorphology, hydrology and physical habitat of those watercourses. Therefore, no further mitigation is proposed at those locations where trenchless crossings will be implemented.

113. Where temporary dams are required during the trenched crossing process (as described in **Section 18.6.1.1**) on ordinary watercourses, mitigation will be required and is secured in the **Outline Code of Construction Practice** (document reference 9.17):

- The amount of time that temporary dams are in place will be kept to a minimum.
- Prior to dewatering the area between the temporary dams, a fish rescue would be undertaken.
- Flumes or pumps would be adequately sized to ensure that flows downstream are maintained whilst minimising upstream impoundment.
- Scour protection would also be used to protect the river bed downstream of the dam from high energy flow at the outlets of flumes and pumps.

114. Regardless of whether trenched or trenchless crossing methods are used, the cable ducts would typically be installed two metres below the bed of the water body (dependent on local geology and geomorphological risks). This would avoid exposure during periods of higher energy flow when the bed could be mobilised, changing the geomorphological conditions. This depth takes into consideration anticipated climate-change related changes in fluvial flows and erosion that will occur over time. In addition, vegetation would not be removed from the banks unless necessary to undertake the works, in which case removal would be restricted to the smallest practicable footprint which is secured in the **Outline Code of Construction Practice** (document reference 9.17).

115. At larger crossings, temporary bridges (such as Bailey bridges) may be installed to allow continuation of the haul road. Temporary culverts would be used to cross minor watercourses.

116. In some sensitive locations where a culvert or temporary bridge would not be appropriate to maintain access over watercourses, the haul road would effectively stop and would re-start on the opposite side of the river. Access to the opposite side of the river would need to be taken from the existing road network.

117. Any culverts installed to maintain access across watercourses would be adequately sized to avoid impounding flows (including an allowance for potential increases in winter flows as a result of projected climate change). Culverts would be Installed below the active bed of the channel, so that sediment continuity and movement of fish and aquatic invertebrates can be maintained.

18.6.1.1.6 Residual Impacts – SEP or DEP in Isolation

118. Following the implementation of the mitigation measures, the impacts to the ordinary watercourses in which trenched crossings are proposed will be reduced. The resulting magnitude of effect and impact significance to river water body catchments due to the construction of SEP or DEP in isolation are given in **Table 18-16** below.

119. The mitigation measures outlined in **Section 18.6.1.1.5** will not reduce the number of watercourses that would need to be crossed by the proposed cable corridor. These measures will reduce the magnitude of impact from low to negligible or negligible to no impact, thereby reducing the significance of the impact to **no impact** for all catchments.

18.6.1.1.7 Residual Impacts – SEP and DEP Sequentially

120. The mitigation measures outlined in **Section 18.6.1.1.5** will not reduce the number of watercourses that would need to be crossed by the proposed cable corridor and associated infrastructure such as the haul road. These measures will reduce the magnitude of impact from low to negligible or negligible to no impact, thereby reducing the significance of the impact to **no impact** for the majority of catchments, with the exception of the Intwood Stream, which would be **negligible** and the River Tiffey, which would be **minor adverse**.

18.6.1.1.8 Summary – SEP or DEP in Isolation

Table 18-16: Impacts Resulting from Direct Disturbance of Water Bodies During the Construction of SEP or DEP In Isolation

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Coastal catchment	Low	No trenched watercourse crossings are required in these catchments; therefore no impacts are anticipated from direct disturbance.	No impact	**No impact**	No impact	**No impact**
	Spring Beck	Low		No impact	**No impact**	No impact	**No impact**
	River Glaven	Medium	One trenched crossing is required in the River Glaven catchment. This will lead to a negligible magnitude of impact across the catchment.	Negligible	**Minor adverse**	No impact	**No impact**
River Bure	Scarrow Beck	Medium	No trenched crossings of ordinary watercourses are due to take place in the catchment of Scarrow Beck, therefore no impact is anticipated in this catchment.	No impact	**No impact**	No impact	**No impact**
	River Bure	Medium	The trenched crossings of two ordinary watercourses in the catchment of the River Bure will lead to a negligible magnitude of effect across the catchment.	Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium	No trenched crossings of ordinary watercourses are due to take place the catchment of the Mermaid Stream,	No impact	**No impact**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			therefore no impact is anticipated in this catchment.				
River Wensum	Blackwater Drain	High	There are no crossings of watercourses within the Blackwater Drain catchment, therefore no impact is anticipated.	No impact	**No impact**	No impact	**No impact**
	Swannington Beck	High	There are no trenched crossings of watercourses within the Swannington Beck catchment, therefore no impact is anticipated	No impact	**No impact**	No impact	**No impact**
	River Wensum	High	There are no trenched crossings of watercourses in the catchment of the River Wensum, therefore no impact is anticipated.	No impact	**No impact**	No impact	**No impact**
	River Tud	High	No trenched or trenchless crossings of ordinary watercourses are required in the catchment of the River Tud, therefore no impact is anticipated in this catchment.	No impact	**No impact**	No impact	**No impact**
River Yare	River Yare	Medium	One trenched crossings is required in the catchment of the River Yare. This will lead to a negligible magnitude of impact across the catchment.	Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tiffey	Medium	Three trenched crossings are required on the River Tiffey, which will lead to a negligible magnitude of impact.	Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	Two trenched crossings are required in the Intwood Stream catchment, therefore a negligible magnitude of impact is anticipated.	Negligible	**Negligible**	No impact	**No impact**
	River Tas	Medium	No trenched or trenchless crossings are required in the River Tas catchment. Therefore no impact is anticipated in this catchment.	No impact	**No impact**	No impact	**No impact**

18.6.1.1.9 Summary – SEP and DEP Sequentially

Table 18-17: Impacts Resulting from Direct Disturbance of Water Bodies During the Construction of SEP and DEP

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Coastal catchment	Low	No trenched watercourse crossings are required in these catchments; therefore, no impacts are anticipated from direct disturbance.	No impact	**No impact**	No impact	**No impact**
	Spring Beck	Low		No impact	**No impact**	No impact	**No impact**
	River Glaven	Medium	One trenched crossing is required in this catchment, leading to a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
River Bure	Scarrow Beck	Medium	No trenched crossings of ordinary watercourses are due to take place in either Scarrow Beck, therefore no impact is anticipated in this catchment.	No impact	**No impact**	No impact	**No impact**
	River Bure	Medium	The two ordinary watercourse crossings in the catchment of the River Bure will be reinstated to their former condition. Therefore, the overall magnitude of effect across the catchment is considered to be negligible.	Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Mermaid Stream	Medium	No trenched crossings of ordinary watercourses are due to take place the catchment of the Mermaid Stream, therefore no impact is anticipated in this catchment.	No impact	**No impact**	No impact	**No impact**
River Wensum	Blackwater Drain	High	There are no crossings of watercourses within the Blackwater Drain catchment, therefore no impact is anticipated.	No impact	**No impact**	No impact	**No impact**
	Swannington Beck	High	There are no trenched crossings of watercourses within the Swannington Beck catchment, therefore no impact is anticipated	No impact	**No impact**	No impact	**No impact**
	River Wensum	High	There are no trenched crossings of watercourses within the River Wensum catchment, therefore no impact is anticipated	No impact	**No impact**	No impact	**No impact**
	River Tud	High	No trenched crossings of ordinary watercourses are required in the catchment of the River Tud, therefore no impact is anticipated.	No impact	**No impact**	No impact	**No impact**
River Yare	River Yare	Medium	One trenched crossing is required on the River Yare, which will lead to a	Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			negligible magnitude of impact across the catchment.				
	River Tiffey	Medium	Three trenched crossings are required on the River Tiffey, which will lead to a low magnitude of impact.	Low	**Minor adverse**	Negligible	**Minor adverse**
	Intwood Stream	Low	Two trenched cossings are required in the Intwood Stream catchment, leading to a low magnitude of effect.	Low	**Minor adverse**	Negligible	**Negligible**
	River Tas	Medium	No trenched or trenchless crossings are required in the River Tas catchment, therefore no impact is anticipated.	No impact	**No impact**	No impact	**No impact**

18.6.1.2 Impact 2: Increased Sediment Supply

121. The construction of the landfall, onshore cable corridor and onshore substation will involve earthworks, excavation, the tracking of large construction machinery and potentially some piling. This will create areas of bare ground by removing vegetation cover and topsoil and will increase the potential for the erosion of soil particulates. This could result in an increase in the supply of fine sediment (e.g. clays, silts and fine sands) to surface water bodies through surface runoff and the erosion of exposed soils.

122. Increased sediment supply can affect the geomorphology of water bodies by increasing the turbidity of the water column and, where energy is sufficiently low, encouraging increased deposition of fine sediment on the bed of the channel. Further sediment loads could therefore smother existing bed habitats, reduce light penetration and reduce dissolved oxygen concentration, adversely affecting the biota of the water body including macrophytes, aquatic invertebrates and fish. This has the overall effect of reducing the quality of in-channel habitats.

123. The magnitude of the potential impact on each river water body is proportional to the area of each catchment that would be disturbed during construction. The worst-case scenario for the area of disturbance in each catchment under each construction scenario is given in **Table 18-2**. These areas have been used to calculate the area of disturbance in each catchment and the percentage of the total catchment that this represents under each construction scenario. The results of the calculations of the area of disturbed ground in each water body receptor are shown in **Table 18-18**.

Table 18-18: Estimated Maximum Area of Disturbed Ground in Each Water Receptor

Catchment	River water body catchment	Estimated total area of disturbed ground during construction			
		SEP or DEP in Isolation		SEP & DEP	
		km^2	% of total catchment	km^2	% of total catchment
North Norfolk Rivers	River Glaven	0.19	0.25	0.25	0.33
	Spring Beck	0.33	0.92	0.41	1.14
	Coastal catchment	0.06	0.08	0.06	0.08
River Bure	Scarrow Beck	0.14	0.21	0.18	0.28
	River Bure	0.44	0.44	0.58	0.99
	Mermaid Stream	0.03	0.16	0.04	0.20

Catchment	River water body catchment	Estimated total area of disturbed ground during construction			
		SEP or DEP in Isolation		SEP & DEP	
		km^2	% of total catchment	km^2	% of total catchment
River Wensum	Blackwater Drain	0.16	0.24	0.21	0.32
	Swannington Beck	0.35	1.21	0.46	1.60
	River Wensum	0.32	0.17	0.41	0.22
	River Tud	0.14	0.20	0.18	0.60
River Yare	River Yare	0.24	0.31	0.32	0.40
	River Tiffey	0.20	0.73	0.27	0.97
	Intwood Stream	0.32	1.10	0.42	1.45
	River Tas	0.09	0.15	0.11	0.19

124. In addition to the potential sources of sediment considered above, temporary bridges may be employed to maintain haul road access across water bodies. These would also provide a mechanism by which sediment could be produced close to the water bodies which they cross.

125. The worst-case across all construction scenarios is that a theoretical maximum of 4.13km^2 of land could be exposed during construction of both SEP and DEP under the concurrent scenario. For the purposes of this assessment, the magnitude of effect is assumed to be directly proportional to the area of exposed land in each water body catchment as shown in **Table 18-19**. Although this provides a high-level proxy for the magnitude of effect, this is also dependent on the proximity of the exposed ground to the main water body. If the magnitude of effect differs from that given in **Table 18-19** it is stated and explained in **Table 18-20** and **Table 18-21**.

Table 18-19: Magnitude of Effect Resulting from Exposed Land in a Water Body Catchment

Magnitude of effect	Area of exposed ground per catchment during construction
Negligible	<1%
Low	1.00 - 5.99%
Medium	6.00 – 10.00%

Magnitude of effect	Area of exposed ground per catchment during construction
High	>10%

18.6.1.2.1 Magnitude of Effect - SEP or DEP in Isolation

126. If either SEP or DEP is built in isolation, the overall area of exposed land would be approximately 3.28km^2. The magnitude of effect associated with the exposed area in each river catchment is discussed in **Table 18-20**. Construction work in all catchments is likely to result in effects of negligible magnitude (an exposed area of <1% of the catchment) in most catchments, with the exception of Swannington Beck (low magnitude area of 1.21%) and Intwood Stream (low magnitude with an area of 1.10%).

18.6.1.2.2 Magnitude of Effect – SEP and DEP Concurrently

127. If both SEP and DEP are built the overall area of exposed land would be approximately 4.13 km^2. It is considered that the concurrent construction scenario would have a greater potential for impact than sequential. A greater area of land would be exposed at any one time, under the concurrent scenario, than under the sequential scenario. The magnitude of effect associated with the exposed area in each river catchment are discussed in **Table 18-21**. Construction work in all catchments is likely to result in effects of negligible magnitude (an exposed area of <1% of the catchment) in most catchments, with the exception of Spring Beck, Swannington Beck and Intwood Stream, which would have a low magnitude of effect.

18.6.1.2.3 Impact Significance – SEP or DEP in Isolation

128. Prior to mitigation, impacts are considered to be of minor adverse or negligible significance in all surface water bodies except for Swannington Beck, where its high sensitivity would combine with a low magnitude of effect to create an impact of moderate adverse significance. The significance of the impact on each water body resulting from increased sediment supply due to the construction of SEP or DEP in isolation is given in **Table 18-20**.

18.6.1.2.4 Impact Significance – SEP and DEP Concurrently

129. Prior to mitigation, impacts are considered to be of minor adverse or negligible significance in all surface water bodies except for Swannington Beck, where its high sensitivity would combine with a low magnitude of effect to create an impact of moderate adverse significance. The significance of the impact on each water body resulting from increased sediment supply due to the construction of SEP and DEP concurrently is given in **Table 18-21**.

18.6.1.2.5 Mitigation

130. In order to manage the supply of sediment into water bodies in each catchment, sediment management measures would be implemented. These are secured in the **Outline Code of Construction Practice** (document reference 9.17) and include:

- Limiting extent of open excavations along the onshore cable corridor to short sections at any one time (work fronts). Topsoil would be stripped from the entire width of the onshore cable corridor for the length of the work front, then stored and capped to minimise erosion from wind and rain.
- Temporary works areas (e.g. construction compounds and trenchless crossing areas) within the onshore development area may comprise hardstanding of permeable material, such as gravel aggregate or alternatively matting/timber or similar, underlain by geotextile or another suitable material to a minimum of 50% of the exposed area. This would minimise the area of open ground.
- Construction activities will adhere to industry good practice measures as detailed in the Environment Agency's Pollution Prevention Guidance (PPG) notes (including PPG1, PPG5, PPG8 and PPG21) (although these have been revoked, they provide a useful guide for best practice measures) and Construction Industry Research and Information Association (CIRIA)'s 'Control of water pollution from construction sites: Guidance for consultants and contractors (C532)' (2001). Specific measures within the CMS will include:
- Minimising of subsoil exposure and retention of strips of undisturbed vegetation on the edge of the working area where possible;
- On-site retention of sediment to be maximised by routing all drainage through the site drainage system;
- Including measures to intercept sediment runoff at source in the drainage system using suitable filters to remove sediment from water discharged to the surface drainage network;
- Cleaning of the wheels of vehicles leaving site to prevent the accumulation of soil and sediment on road surfaces. Traffic movements would be restricted to minimise surface disturbance; and
- Routing the cable to avoid water resources and flood risk receptors where possible.
- In locations where large areas of exposed ground lie adjacent to watercourses, buffer strips of vegetation will be retained where possible to prevent runoff.

18.6.1.2.6 Residual Impacts - SEP or DEP in Isolation

131. The mitigation measures outlined in **Section 18.6.1.3.7** would reduce the quantity of sediment that would enter surface watercourses. These measures would therefore considerably reduce the supply of sediment from the proposed works such that there would be very limited potential for changes to the geomorphology or water quality of surface water receptors to occur. These measures would reduce the magnitude of effect from negligible to no impact for the majority of receptors. The greater magnitude of pre-mitigation impact in Swannington Beck and Intwood Stream would be reduced to negligible, representing a residual impact of **negligible** significance. Also refer to **Table 18-20** for details.

18.6.1.2.7 Residual Impacts – SEP and DEP Concurrently

132. The mitigation measures outlined in **Section 18.6.1.2.5** would reduce the quantity of sediment that would enter surface watercourses. These measures would therefore considerably reduce the supply of sediment from the proposed works such that there would be very limited potential for changes to the geomorphology or water quality of surface water receptors to occur. These measures would reduce the magnitude of effect from negligible to no impact for the majority of receptors. The greater magnitude of pre-mitigation impact in Spring Beck, Swannington Beck and Intwood Stream would be reduced to negligible, representing a residual impact of **negligible** significance. Also refer to **Table 18-21** for details.

18.6.1.2.8 Summary – SEP or DEP in Isolation

Table 18-20: Impacts Associated with an Increased Sediment Supply Resulting from the Construction of SEP or DEP

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	Approximately 0.25% of the River Glaven catchment, 0.92% of Spring Beck and 0.08% of the coastal catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Spring Beck	Low		Negligible	**Negligible**	No impact	**No impact**
	Coastal catchment	Low		Negligible	**Negligible**	No impact	**No impact**
River Bure	River Bure	Medium	Approximately 0.44% of the River Bure catchment 0.21% of Scarrow Beck and 0.16% of the Mermaid Stream would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Scarrow Beck	Medium		Negligible	**Minor adverse**	No impact	No impact
	Mermaid Stream	Medium		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	Approximately 0.17% of the River Wensum catchment, 0.20% of the River Tud catchment	Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Wensum	High	and 0.24% of the Blackwater Drain catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High		Negligible	**Minor adverse**	No impact	**No impact**
	Swannington Beck	High	The construction of the cable corridor will bisect the Swannington Beck catchment, affecting a maximum 1.21% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away from the DCO order limits. The impact prior to mitigation is likely to be low magnitude.	Low	**Moderate adverse**	Negligible	**Minor adverse**
River Yare	River Yare	Medium	Approximately 0.31% of the River Yare catchment, 0.73% of the River Tiffey catchment and 0.15% of the River Tas catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each	Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tas	Medium	catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	Onshore construction activities would affect a maximum 1.10% of the Intwood Stream catchment. The impact prior to mitigation is likely to be low magnitude.	Low	**Minor adverse**	Negligible	**Negligible**

18.6.1.2.9 Summary – SEP and DEP Concurrently

Table 18-21: Impacts Associated with an Increased Sediment Supply Resulting from the Construction of SEP and DEP Concurrently

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	Approximately 0.33% of the River Glaven catchment and 0.08% of the coastal catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Coastal catchment	Low		Negligible	**Negligible**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Spring Beck	Low	Approximately 1.14% of the Spring Beck catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. This is considered to have a low magnitude of effect.	Low	**Minor adverse**	Negligible	**Negligible**
River Bure	River Bure	Medium	Approximately 0.99% of the River Bure catchment, 0.28% of Scarrow Beck and 0.20% of the Mermaid Stream would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Scarrow Beck	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	Approximately 0.22% of the River Wensum catchment, 0.60% of the River Tud catchment and 0.32% of the Blackwater Drain catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Wensum	High		Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Swannington Beck	High	The construction of the cable corridor will bisect the Swannington Beck catchment, affecting a maximum 1.60% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away from the DCO order limits. The impact prior to mitigation is likely to be low magnitude.	Low	**Moderate adverse**	Negligible	**Minor adverse**
River Yare	River Yare	Medium	Approximately 0.40% of the River Yare catchment, 0.97% of the River Tiffey catchment and 0.19% of the River Tas catchment would be affected by the construction of the onshore cable corridor, which could increase sediment supply to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	River Tas	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	Onshore construction activities would affect a maximum of 1.45% of the Intwood Stream catchment. The impact prior to mitigation is likely to be low magnitude.	Low	**Minor adverse**	Negligible	**Negligible**

18.6.1.3 Impact 3: Supply of Contaminants to Surface and Groundwaters

133. During construction, there is potential for the accidental release of lubricants, fuels and oils from construction machinery. This can occur as a result of spillages, leakage from vehicle storage areas and direct release from construction machinery working directly in or adjacent to water bodies. Bentonite, which is an inert clay-based material used at the drillhead during trenchless crossing techniques, can breakout during use and cause smothering of habitats, although it is not a pollutant. There is also potential for accidental leakages of foul water from welfare facilities, and construction materials including concrete. These can enter surface waters and connected groundwaters through run-off, especially following rainfall.

134. A significant leakage or spillage has the potential to cause adverse impacts to water quality if contaminants enter the surface drainage network and can adversely affect the ecology of the water bodies, in particular fish and invertebrate species (see **Chapter 20 Onshore Ecology and Ornithology**), if pollutant concentrations are sufficiently high.

135. Construction activities including excavations for cable trenching, could result in the remobilisation of contaminants that are already present in the soil. This could include in situ contaminated land and nutrients such as nitrogen and phosphorus from nitrogen-rich arable soils. Nutrients could also be supplied through discharges of foul water from temporary welfare facilities and construction compounds. The supply of nutrients to surface waters could result in adverse effects on water quality (including, in extreme cases, eutrophication) and aquatic plant, invertebrate and fish communities supported by surface waters. This could be a particular issue in designated habitats supported by the River Wensum and the Norfolk Broads (**Section 18.5.1.1**).

136. Construction activities such as excavation, piling and underground trenchless crossing techniques which disturb the ground can also introduce contaminants (including nutrients) into underlying groundwater bodies, particularly shallow aquifers. Therefore, these activities could adversely affect the quality of the underlying groundwater body (including the Principal Aquifers and any secondary aquifers) and any licensed or unlicensed abstractions associated with it.

137. The magnitude of the potential impact upon a surface water catchment or body of groundwater is proportional to the area of each catchment that would be affected during construction (i.e. the total footprint of construction activities within the DCO order limits). These areas, and associated magnitudes, are shown in **Table 18-18**.

18.6.1.3.1 Magnitude of Effect - SEP or DEP in Isolation

138. The area of each catchment that is affected during construction of SEP and DEP in isolation is given in **Table 18-18**. This is taken into consideration when considering the magnitude of effect in each water body, as discussed in **Table 18-22**. Construction work in all catchments is likely to result in effects of negligible magnitude (an exposed area of <1% of the catchment) in most catchments, with the exception of Swannington Beck (low magnitude area of 1.21%) and Intwood Stream (low magnitude with an area of 1.10%).

18.6.1.3.2 Magnitude of Effect – SEP and DEP Concurrently

139. The construction of SEP and DEP concurrently is likely to lead to a marginally greater magnitude of effect than a sequential construction scenario due to the greater amount of construction machinery present in the catchment at one time. The magnitude of effect associated with the exposed area in each river catchment are discussed in **Table 18-23**. Construction work in all catchments is likely to result in effects of negligible magnitude (an exposed area of <1% of the catchment) in most catchments, with the exception of Spring Beck, Swannington Beck and Intwood Stream, which would have a low magnitude of effect.

18.6.1.3.3 Impact Significance - SEP or DEP in Isolation

18.6.1.3.4 Prior to mitigation, impacts are considered to be of minor adverse or negligible significance in all surface water bodies except for Swannington Beck, where its high sensitivity would combine with a low magnitude of effect to create an impact of moderate adverse significance. The significance of the impact on each water body resulting from the potential supply of contaminants during the construction of SEP or DEP in isolation is given in **Table 18-22**.

18.6.1.3.5 Impact Significance – SEP and DEP Concurrently

18.6.1.3.6 Prior to mitigation, impacts are considered to be of minor adverse or negligible significance in all surface water bodies except for Swannington Beck, where its high sensitivity would combine with a low magnitude of effect to create an impact of moderate adverse significance. The significance of the impact on each water body resulting from the potential supply of contaminants during the construction of SEP and DEP concurrently is given in **Table 18-23**.

18.6.1.3.7 Mitigation

140. Construction will adopt specific measures relevant to the prevention of contaminant supply to water bodies. These are secured in the **Outline Code of Construction Practice** (document reference 9.17) and will prevent immediate discharge of contaminated water and sediment from the onshore cable corridor into the surface drainage network and include:

- Situating concrete and cement mixing and washing areas at least 10m away from the nearest water body. These areas will incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment would take place in a contained area and the water collected for disposal off-site.
- Storing all fuels, oils, lubricants and other chemicals in impermeable bunds with at least 110% of the stored capacity, with any damaged containers being removed from site. Refuelling would take place in a dedicated impermeable area, using a bunded bowser, located at least 10m away from the nearest water body.

- Ensuring that spill kits are available on site at all times as well as sandbags and stop logs for deployment on the outlets from the site drainage system in case of emergency spillages.
- Foul drainage (e.g. from construction welfare facilities) will be collected through mains connection to an existing mains sewer (if such a connection is available) or collected in a septic tank located within the DCO order limits and transported off site for disposal at a licensed facility with appropriate treatment capacity within its existing permit.
- During construction, the onshore cable installation will be designed with drainage channels to intercept drainage within the working width. Additional drainage channels will be installed to intercept water from the cable trench. This will be discharged at a controlled rate into local ditches or drains via temporary interceptor drains. Depending upon the precise location, water from the channels will be infiltrated or discharged into the existing drainage network.
- Construction drainage will be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. If water enters the trenches during installation from surface runoff of groundwater seepage, this will be pumped via settling tanks, sediment basins, sediment filtration socks or mobile treatment facilities to remove sediment, before being discharged into local ditches or drains via temporary interceptor drains. Existing land drains will be reinstated following construction.

141. In addition, buffer strips of vegetation will be retained adjacent to water bodies where possible, to intercept any contaminated runoff (as secured in the **Outline Code of Construction Practice** (document reference 9.17)). To protect groundwater bodies, excavation will be shallow, limited to approximately 1.6m below the surface, except where it passes below road and rail infrastructure or water bodies where it may be deeper.

18.6.1.3.8 Residual Impacts - SEP or DEP in Isolation

142. The mitigation measures outlined in **Section 18.6.1.3.7** would reduce the likelihood and quantity of contaminants entering surface and groundwater bodies. These measures would reduce the magnitude of effect from negligible to no impact for the majority of receptors. The greater magnitude of pre-mitigation impact in Swannington Beck and Intwood Stream would be reduced to negligible, representing a residual impact of **negligible** significance. Refer to **Table 18-22** for details.

18.6.1.3.9 Residual Impacts – SEP and DEP Concurrently

The mitigation measures outlined in **Section 18.6.1.3.7** would reduce the likelihood and quantity of contaminants entering surface and groundwater bodies. These measures would reduce the magnitude of effect from negligible to no impact for the majority of receptors. The greater magnitude of pre-mitigation impact in Spring Beck, Swannington Beck and Intwood Stream would be reduced to negligible, representing a residual impact of **negligible** significance. Further information is provided in **Table 18-23**.

18.6.1.3.10 Summary - SEP or DEP in Isolation

Table 18-22: Impact of Supply of Contaminants Associated with the Construction of SEP or DEP in Isolation

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	HDD would take place at the landfall with the drilling rig, drilling fluid and fuels and oils associated with construction machinery. In addition, a temporary works compound would be required with fuel storage. The presence of these activities increases the likelihood of a contamination event occurring in the areas affected by onshore construction activities (approximately 0.25% of the River Glaven catchment, 0.92% of Spring Beck and 0.08% of the coastal catchment). Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Spring Beck	Low		Negligible	**Negligible**	No impact	**No impact**
	Coastal catchment	Low		Negligible	**Negligible**	No impact	**No impact**
River Bure	River Bure	Medium	Approximately 0.44% of the River Bure catchment 0.21% of Scarrow Beck and 0.16% of the Mermaid Stream would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Scarrow Beck	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
River Wensum	Blackwater Drain	High	Approximately 0.17% of the River Wensum catchment, 0.20% of the River Tud catchment and 0.24% of the Blackwater Drain catchment would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Wensum	High		Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High		Negligible	**Minor adverse**	No impact	**No impact**
	Swannington Beck	High	The construction of the cable corridor will bisect the Swannington Beck catchment, affecting a maximum 1.21% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away from the DCO order limits. The impact prior to mitigation is likely to be low magnitude.	Low	**Moderate adverse**	Negligible	**Minor adverse**
River Yare	River Yare	Medium	Approximately 0.31% of the River Yare catchment, 0.73% of the River Tiffey catchment and 0.15% of the River Tas catchment would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	River Tas	Medium		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Intwood Stream	Low	Onshore construction activities would affect a maximum 1.10% of the Intwood Stream catchment. The impact of the potential supply of contaminants prior to mitigation is likely to be low magnitude.	Low	**Minor adverse**	Negligible	**Negligible**
Groundwater Bodies	North Norfolk Chalk	High	An area of approximately 0.36 km^2 may be affected by construction activities. This accounts for approximately 0.06% of the total groundwater body. Any adverse impacts would be spatially limited, representing an effect of negligible magnitude.	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	An area of approximately 2.38 km^2 may be affected by construction activities. This accounts for approximately 0.08% of the total groundwater body. Any adverse impacts would be spatially limited, representing an effect of negligible magnitude.	Negligible	**Minor adverse**	No impact	**No impact**

18.6.1.3.11 Summary - SEP and DEP Concurrently

Table 18-23: Impact of Supply of Contaminants Associated with the Construction of SEP and DEP Concurrently

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	Approximately 0.33% of the River Glaven catchment and 0.08% of the coastal catchment would be affected by the construction of the onshore cable infrastructure, which could increase the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Coastal catchment	Low		Negligible	**Negligible**	No impact	**No impact**
	Spring Beck	Low	Approximately 1.14% of the Spring Beck catchment would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. This is considered to have a low magnitude of effect.	Low	**Minor adverse**	Negligible	**Negligible**
River Bure	River Bure	Medium		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Scarrow Beck	Medium	Approximately 0.99% of the River Bure catchment, 0.28% of Scarrow Beck and 0.20% of the Mermaid Stream would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	Approximately 0.22% of the River Wensum catchment, 0.60% of the River Tud catchment and 0.32% of the Blackwater Drain catchment would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Wensum	High		Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Swannington Beck	High	The construction of the cable corridor will bisect the Swannington Beck catchment, affecting a maximum 1.60% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away from the DCO order limits. The impact prior to mitigation is likely to be low magnitude.	Low	**Moderate adverse**	Negligible	**Minor adverse**
River Yare	River Yare	Medium	Approximately 0.40% of the River Yare catchment, 0.97% of the River Tiffey catchment and 0.19% of the River Tas catchment would be affected by the construction of the onshore cable corridor, which could result in the supply of contaminants to the surface drainage network. Because this area comprises a small proportion of each catchment, this is considered to have a negligible magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	River Tas	Medium		Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	Onshore construction activities would affect a maximum of 1.45% of the Intwood Stream catchment.	Low	**Minor adverse**	Negligible	**Negligible**

Catchment	Water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			The impact prior to mitigation is likely to be low magnitude.				
Groundwater Bodies	North Norfolk Chalk	High	An area of approximately 0.36 km^2 could be affected by construction activities. This accounts for approximately 0.06% of the total groundwater body. However, any effects are likely to be spatially limited and of negligible magnitude.	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	An area of approximately 2.38 km^2 could be affected by construction activities. This accounts for approximately 0.08% of the total groundwater body. However, any effects are likely to be spatially limited and of negligible magnitude.	Negligible	**Minor adverse**	No impact	**No impact**

18.6.1.4 Impact 4: Changes to Surface and Groundwater Flows and Flood Risk

143. Initial site preparation activities and construction works would alter surface drainage patterns and surface flows by changing the distribution of surface drainage across the landfall, onshore cable corridor and onshore substation area. Infiltration would be reduced, and surface runoff increased, by a reduction in the proportion of impermeable surfaces in a drainage catchment caused by the compaction of soil by construction vehicles and the development of surface infrastructure. This is directly related to the area of construction and can alter site runoff characteristics; the greater the area of construction the greater the potential impact on surface and groundwater flows.

144. Temporary changes to surface flows as a result of trenched crossings of ordinary watercourses may also occur, particularly if the capacity of any pumps or flumes are exceeded. Any changes in surface flows can alter and/or increase flood risk in the proposed onshore development area, particularly in third party land and property in Flood Zones 2 or 3.

145. Subsurface flow patterns can be altered as a result of changes to infiltration rates, surface flows and the installation of impermeable subsurface infrastructure.

146. Therefore, the construction of the onshore infrastructure associated with SEP and DEP has the potential to generate increased surface water flows resulting in increased discharge within watercourses and associated bed and bank scour, as well as in-wash of increased volumes of fine sediment related to the additional surface runoff. This could adversely affect hydrology and geomorphology of the surface drainage network.

147. Note that the potential flood risk implications of the proposed development are described in more detail in the separate Flood Risk Assessment (**Appendix 18.2**).

18.6.1.4.1 Magnitude of Effect - SEP or DEP in Isolation

148. The magnitude of effect associated with these potential changes to surface water runoff and flood risk are proportional to the area of land that would be affected during construction. The magnitude of effects as a result of the construction of SEP or DEP in isolation are discussed in detail in **Table 18-24**. and range from negligible to medium related to the number of watercourse crossings and the area of land affected.

18.6.1.4.2 Magnitude of Effect – SEP and DEP Concurrently

149. It is considered that the magnitude of effect resulting from the construction of SEP and DEP concurrently is greater than if it were constructed sequentially. This is due to the larger area of land take required at any one time, which has the potential to alter surface drainage patterns.

150. The magnitude of effect associated with these potential changes to surface water runoff and flood risk are proportional to the area of land that could be affected during construction. The magnitude of effects as a result of the construction of SEP and DEP concurrently are discussed in **Table 18-25** and range from negligible to medium related to the number of watercourse crossings and the area of land affected.

18.6.1.4.3 Impact Significance - SEP or DEP in Isolation

151. The impact significance of changes to surface water and flood risk resulting from the construction of SEP or DEP is given in **Table 18-24**. Prior to mitigation this ranges from negligible to moderate adverse due to the high sensitivity of some catchments particularly the River Wensum and the River Tud.

18.6.1.4.4 Impact Significance – SEP and DEP Concurrently

152. The impact significance of changes to surface water and flood risk resulting from the construction of SEP and DEP concurrently is given in **Table 18-25**. Prior to mitigation this ranges from negligible to moderate adverse due to the high sensitivity of some catchments particularly the River Wensum and the River Tud.

18.6.1.4.5 Mitigation

153. Changes in surface water runoff resulting from the increase in impermeable area from the construction of the onshore cable corridor and particularly the onshore substation would be attenuated and discharged at a controlled rate, in consultation with the LLFA and the Environment Agency, and potentially Anglian Water if a connection to their drainage infrastructure is required during construction of the onshore substation. This controlled runoff rate would be equivalent to the greenfield runoff rate. A Construction Surface Water and Drainage Plan will be developed as part of the Code of Construction Practice in agreement with the relevant regulators.

154. During construction, the onshore cable installation would be designed with drainage channels to intercept drainage within the working width. Additional drainage channels would be installed to intercept water from the cable trench. This would be discharged at a controlled rate into local ditches or drains via temporary interceptor drains. Depending upon the precise location, water from the channels would be infiltrated or discharged into the existing drainage network.

155. Construction drainage would be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. If water enters the trenches during installation from surface runoff of groundwater seepage, this would be pumped via settling tanks, sediment basins, sediment filtration socks or mobile treatment facilities to remove sediment, before being discharged into local ditches or drains via temporary interceptor drains. Existing land drains would be reinstated following construction.

156. Along the cable corridor, temporary culverts will be adequately sized to avoid impounding flows (including allowing for increased winter flows as a result of climate change).

157. Further details on mitigation measures for flood risk are included in **Appendix 18.2 FRA**.

18.6.1.4.6 Residual Impacts - SEP or DEP in Isolation

158. Following the implementation of mitigation measures, the magnitude of effects relating to changes in surface water drainage and flood risk would be reduced. The resulting magnitude of effect and impact significance to river and groundwater bodies due to the construction of SEP or DEP in isolation, are given in **Table 18-24**.

159. The mitigation measures set out in **Section 18.6.1.4.5** would not reduce the area of impermeable ground that would be created during construction. However, the measures would ensure that runoff rates remain the same as the greenfield rate through the use of appropriate construction drainage measures. Consequently, any potential change in flood risk would be reduced and the change would not be permanent. This would limit the magnitude of effect to **negligible**, representing an impact of **minor adverse** or **negligible** significance.

18.6.1.4.7 Residual Impacts – SEP and DEP Concurrently

160. Following the implementation of mitigation measures, the magnitude of effects relating to changes in surface water drainage and flood risk would be reduced. The resulting magnitude of effect and impact significance to river and groundwater bodies due to the construction of SEP and DEP concurrently, are given in **Table 18-25**.

161. The mitigation measures set out in **Section 18.6.1.4.5** would not reduce the area of impermeable ground that will be created during construction. However, the measures will ensure that runoff rates will remain the same as the greenfield rate through the use of appropriate construction drainage measures. Consequently, there will be a reduction in the level of alteration to the flood risk and the change will not be permanent. The magnitude of effect will therefore be limited to **negligible**, representing an impact of **minor adverse** or **negligible** significance.

18.6.1.4.8 Summary – SEP or DEP in Isolation

Table 18-24: Impact of Changes to Surface Water Drainage and Flood Risk as a Result of Construction of SEP or DEP in Isolation

Catchment	**River water body catchment**	**Sensitivity**	**% catchment affected by construction**	**Assessment**	**Magnitude**	Impact significance prior to mitigation	**Magnitude following mitigation**	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	0.25	Only a small proportion of each catchment would be directly affected by construction activities for the landfall and/or onshore cable corridor. None of the catchments have trenched crossings except for the River Glaven, which has one and the River Bure has two. Across entire catchments, these activities would not lead to a significant change in surface water drainage or flood risk and the low number of trenched crossings mean that there is limited potential for flood water flow to be affected by the capacity of pumps or flumes at trenched crossings. In addition, mitigation measures would be in place, which would minimise the impact of any changes to surface water flows.	Negligible	**Minor adverse**	No impact	**No impact**
	Spring Beck	Low	0.92		Negligible	**Negligible**	No impact	**No impact**
	Coastal catchment	Low	0.08		Negligible	**Negligible**	No impact	**No impact**
River Bure	Scarrow Beck	Medium	0.21		Negligible	**Minor adverse**	No impact	**No impact**
	River Bure	Medium	0.44		Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium	0.16		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	0.24		Negligible	**Minor adverse**	No impact	**No impact**
	Swanningtonn Beck	High	1.21		Low	**Moderate adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	% catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Wensum	High	0.17	Swannington Beck has a higher proportion of the catchment affected and is therefore expected to experience a low magnitude of effect.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High	0.20		Negligible	**Minor adverse**	No impact	**No impact**
River Yare	River Yare	Medium	0.31	The River Yare would have one trenched crossing, the River Tiffey would have three and the Intwood Stream would have two. Across entire catchments, this low number of trenched crossings would not lead to a significant change in surface water drainage or flood risk and therefore there is limited potential for flood water flow to be affected by the capacity of pumps or flumes at trenched crossings. In addition, mitigation measures would be in place, which would minimise the impact of any changes to surface water flows.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium	0.73		Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	1.10		Low	**Minor adverse**	Negligible	**Negligible**
	River Tas	Medium	0.15		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	% catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	0.06	A very low proportion of the total area of the groundwater body catchments may be affected by the construction of the landfall, onshore cable corridor and onshore substation. This is likely to have a minimal impact on subsurface flows and the potential to cause flood risk.	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	0.08		Negligible	**Minor adverse**	No impact	**No impact**

18.6.1.4.9 Summary – SEP and DEP Concurrently

Table 18-25: Impact of Changes to Surface Water Drainage and Flood Risk as a Result of Construction of SEP and DEP Concurrently

Catchment	River water body catchment	Sensitivity	% catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	0.33	Only a small proportion of each catchment would be directly affected by construction activities for the	Negligible	**Minor adverse**	No impact	**No impact**
	Spring Beck	Low	1.14		Low	**Minor adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	% catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Coastal catchment	Low	0.08	landfall and/or onshore cable corridor. None of the catchments have trenched crossings, except for the River Glaven, which would have one, and the River Bure, which would have two. Across entire catchments, this low number of trenched crossings would not lead to a significant change in surface water drainage or flood risk and therefore there is no potential for flood water flow to be affected by the capacity of pumps or flumes at trenched crossings. In addition, mitigation measures would be in place, which would minimise the impact of any changes to surface water flows. Swannington Beck has a higher proportion of the catchment affected and is therefore expected to experience a low magnitude of effect.	Negligible	**Negligible**	No impact	**No impact**
River Bure	Scarrow Beck	Medium	0.28		Negligible	**Minor adverse**	No impact	**No impact**
	River Bure	Medium	0.59		Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium	0.20		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	0.22		Negligible	**Minor adverse**	No impact	**No impact**
	Swanningto n Beck	High	1.60		Low	**Moderate adverse**	Negligible	**Minor adverse**
	Wensum	High	0.22		Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High	0.26		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	% catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
River Yare	River Yare	Medium	0.40	The River Yare would have one trenched crossing, the River Tiffey would have three, and the Intwood Stream two. The River Tas would have none. Across entire catchments, this low number of trenched crossings would not lead to a significant change in surface water drainage or flood risk and therefore there is no potential for flood water flow to be affected by the capacity of pumps or flumes at trenched crossings. In addition, mitigation measures would be in place, which would minimise the impact of any changes to surface water flows.	Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium	0.97		Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	1.45		Low	**Minor adverse**	Negligible	**Negligible**
	River Tas	Medium	0.19		Negligible	**Minor adverse**	No impact	**No impact**
Groundwater Bodies	North Norfolk Chalk	High	0.08	A very low proportion of the total area of the groundwater body catchments will be affected by the construction of the landfall, onshore cable corridor and onshore substation. This is likely to have a minimal impact on	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	0.10		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	% catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				subsurface flows and the potential to cause flood risk.				

18.6.2 Potential Impacts during Operation

18.6.2.1 Impact 1: Supply of Contaminants to Surface and Groundwater

162. Operational activities at the landfall, along the onshore cable corridor and at the onshore substation would include planned and unplanned maintenance. This could lead to a supply of fine sediment, fuels, oils and lubricants from the road network and other impermeable surfaces, which could affect water quality and geomorphology of water bodies in the surface water drainage network. This in turn could consequently impact upon aquatic ecology.

163. Contaminants may leak into surface waters during operation from the transformers or through surface runoff or accidental spillage or leakage of fuel oils or lubricants from vehicles during operational activities, which could impact upon surface water quality and that of connected groundwaters (including aquifers which support potable water supplies, particularly in SPZ1). This could have subsequent impacts upon aquatic ecology and the use of water resources for licensed and unlicensed abstractions.

164. In addition, welfare facilities at the onshore substation could increase the supply of nutrients such as nitrogen and phosphorus to the drainage system through increased loadings to the sewage treatment network and associated treated effluent discharges. The supply of additional nutrients to surface waters could result in adverse effects on water quality (including, in extreme cases, eutrophication) and aquatic plant, invertebrate and fish communities supported by surface waters. This could be a particularly significant issue in designated habitats supported in the River Wensum and the Norfolk Broads (**Section 18.5.1.1**).

18.6.2.1.1 Magnitude of Effect - SEP or DEP in Isolation

165. The area of installed infrastructure (above ground or buried) can be used as a proxy to indicate the extent of required maintenance activities in each catchment (**Table 18-26**). This is based on the area of the installed onshore cable, onshore substation and permanent access roads within each catchment.

Table 18-26: Maximum Area of Permanent Development in Each Water Body Catchment for SEP or DEP in Isolation

Catchment	Water body catchment	Estimated total area of permanent development	
		m^2	%
North Norfolk Rivers	Glaven	222	0.0003
	Spring Beck	200	0.0060
	Coastal catchment	N/A	N/A
River Bure	Scarrow Beck	164	0.0003
	River Bure	526	0.0005

Catchment	Water body catchment	Estimated total area of permanent development	
		m^2	%
	Mermaid Stream	39	0.0002
River Wensum	Blackwater Drain	185	0.0003
	Swannington Beck	424	0.0015
	Wensum	350	0.0002
	River Tud	165	0.0002
River Yare	River Yare	286	0.0007
	River Tiffey	246	0.0009
	Intwood Stream	377	0.0013
	River Tas	32,587	0.0543
Groundwater	North Norfolk Chalk	398	0.0001
	Broadland Rivers Chalk and Crag	35,368	0.0011

166. Magnitudes of effect in each receptor resulting from operational activities at the landfall and along the cable corridor are **negligible** prior to mitigation due to the relatively infrequent and highly localised nature of likely operation and maintenance activities, which in turn are unlikely to generate large volumes or contaminants that could have a discernible alteration to the water quality of receptors. In the event of a cable failure the affected stretch of cable (500-1,000m section) would be pulled out of the duct and replaced. To do this the joint bays, which are below ground at either end of that stretch of cable, would be exposed to get access to those bays, and then backfilled after the works are complete. This activity would be highly localised and may not be required during the operational life of the cable infrastructure.

167. The Intwood Stream and River Tas are exceptions where the magnitude is likely to be **low** as the catchments contain the onshore substation and therefore the potential for oil leakage from the transformers. This will also require more frequent maintenance and foul water drainage, and also represents a larger area of impermeable above-ground infrastructure with the potential to cause an increase in surface water runoff. This can translate to a greater potential for contaminants to be released into the surface water system.

18.6.2.1.2 Magnitude of Effect – SEP and DEP Concurrently

168. The area of installed infrastructure (above ground or buried) can be used as a proxy to indicate the extent of required maintenance activities in each catchment (**Table 18-27**). This is based on the area of the installed onshore cable, onshore substation and permanent access roads within each catchment.

Table 18-27: Maximum Area of Permanent Development in Each Water Body Catchment for SEP and DEP Together

Catchment	Water body catchment	Estimated total area permanent development	
		m^2	%
North Norfolk Rivers	Glaven	443	0.0006
	Spring Beck	400	0.0120
	Coastal catchment	N/A	N/A
River Bure	Scarrow Beck	327	0.0005
	River Bure	1,053	0.0011
	Mermaid Stream	77	0.0004
River Wensum	Blackwater Drain	369	0.0006
	Swannington Beck	848	0.0029
	Wensum	701	0.0004
	River Tud	330	0.0005
River Yare	River Yare	573	0.0014
	River Tiffey	486	0.0018
	Intwood Stream	753	0.0026
	River Tas	62,673	0.1044
Groundwater	North Norfolk Chalk	795	0.0001
	Broadland Rivers Chalk and Crag	68,237	0.0022

169. Magnitudes of effect in each receptor, prior to mitigation, are **negligible** due to the relatively infrequent nature of likely operation and maintenance activities, which in turn are unlikely to generate large volumes or contaminants that could have a discernible alteration to the water quality of receptors (see **Section 18.6.2.1.1** for further details).

170. The Intwood Stream and River Tas are exceptions where the magnitude is likely to be **low** as the catchments contain the onshore substation. There is potential for oil to leak from the transformers at the onshore substation, which will also require more frequent maintenance and foul water drainage. It represents a larger area of impermeable above-ground infrastructure with the potential to cause an increase in surface water runoff. This can translate to a greater potential for contaminants to be released into the surface water system.

18.6.2.1.3 Impact Significance - SEP or DEP in isolation

171. Prior to mitigation, the impact significance of potential supply of contaminants into water bodies resulting from the operation of SEP or DEP is negligible or minor adverse across all receptors. This is discussed in **Table 18-28**.

18.6.2.1.4 Impact Significance – SEP and DEP Concurrently

172. Prior to mitigation, the impact significance of potential supply of contaminants into water bodies resulting from the operation of SEP and DEP is negligible or minor adverse across all receptors. This is discussed in **Table 18-29**.

18.6.2.1.5 Mitigation

173. Operational drainage at the onshore substation would be developed according to the principles of the sustainable drainage system (SuDS) discharge hierarchy and is secured through the **Outline Operational Drainage Plan** (Document reference 9.20). Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable: i) into the ground (infiltration); ii) to a surface water body; iii) to a surface water sewer, highway drain or another drainage system; or iv) to a combined sewer. This will include attenuation and hydrocarbon interceptors to prevent the supply of contaminants (including oils and fine sediment). Further discussion of the drainage approach is set in the **Onshore Substation Drainage Study** (document reference 6.3.18.2.1).

174. Foul waters from welfare facilities will either be discharged through a mains connection to an existing mains sewer (if such a connection is available) or collected in a septic tank located within the DCO order limits and transported off site for disposal at a licensed facility with appropriate treatment capacity within its existing permit. The operational use of the site is likely to be limited to a maximum of 2 workers visiting the site per week, and as such additional nutrient loadings are likely to be very low.

175. All fuels, oils, lubricants and other chemicals used at the onshore substation would be stored in an impermeable bund with at least 110% of the stored capacity. Damaged containers will be removed from site and all refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils will be used where possible.

176. Spill kits would be available on site at all times. Sand bags or stop logs will also be available for deployment on the outlets from the site drainage system in case of emergency.

177. Given the sporadic nature of maintenance activities along the cable corridor and the predicted lack of impact, no permanent mitigation is proposed beyond that suggested for the substation site. Any excavations would employ best-practice measures to manage runoff and the supply of sediment and contaminants from construction sites, (**Sections 18.6.1.2.5** and **18.6.1.3.7**).

18.6.2.1.6 Residual Impacts - all Scenarios

178. Following the implementation of mitigation measures at the onshore substation, the residual impacts to the River Tas and Intwood Stream would be of **minor adverse** significance for both SEP or DEP or SEP and DEP. These measures would prevent a significant quantity of contaminants from entering the surface water system and connected groundwater bodies, and causing a measurable change in the water quality of surface and groundwater receptors. This would therefore also prevent alterations to the characteristics of these water bodies. The residual impacts to groundwater bodies would be of **minor adverse** significance due to their high sensitivity to change. Residual impacts are shown in **Table 18-28** and **Table 18-29**.

18.6.2.1.7 Summary – SEP or DEP in Isolation

Table 18-28: Impacts Associated with the Supply of Contaminants Due to the Operation of SEP or DEP in Isolation

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	222	The permanent infrastructure associated with the onshore cable corridor would have a limited spatial extent within each catchment. Infrequent maintenance activities would be necessary during the operational life of SEP or DEP. However, the mechanism for contaminants to enter the surface water drainage system as a result of the operation of the project is limited. Nutrient loadings to the River Wensum and connected Broads SACs from treated foul water effluent are also likely to be minimal.	Negligible	**Minor adverse**	No impact	**No impact**
	Spring Beck	Low	200		Negligible	**Negligible**	No impact	**No impact**
	Coastal catchment	Low	N/A		Negligible	**Negligible**	No impact	**No impact**
River Bure	Scarrow Beck	Medium	164		Negligible	**Minor adverse**	No impact	**No impact**
	River Bure	Medium	526		Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium	39		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	185		Negligible	**Minor adverse**	No impact	**No impact**
	Swannington Beck	High	424		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	350		Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High	165		Negligible	**Minor adverse**	No impact	**No impact**
River Yare	River Yare	Medium	286		Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium	243		Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Medium	377	Both the Intwood Stream and the River Tas contain elements of the proposed onshore substation. This forms a small proportion of the overall catchment for each, and although some routine maintenance would be required throughout the operational life of the project, however, mitigation measures will be in place to control any potential accidental release of oils from the transformer, foul drainage and surface water drainage.	Low	**Minor adverse**	Negligible	**Minor adverse**
	River Tas	Medium	32,587		Low	**Minor adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	398	Less than 0.005% of the overall area of each groundwater body will be impacted by the onshore project area. Infrequent planned and unplanned maintenance activities would be necessary during the operational life of the project. Mitigation measures will control potential for accidental release of foul drainage and surface water drainage from the substation.	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	35,368		Negligible	**Minor adverse**	No impact	**No impact**

18.6.2.1.8 Summary – SEP and DEP

Table 18-29: Impacts Associated with the Supply of Contaminants Due to the Operation of SEP and DEP Together

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	443	The permanent infrastructure associated with the onshore cable corridor will have a limited spatial extent within each catchment. There is no expected requirement to undertake routine maintenance, although some planned and unplanned activities may be necessary during the operational life of SEP and DEP. Therefore, the mechanism for contaminants to enter the surface water drainage system as a result of the operation of the project is limited. Nutrient loadings to the River Wensum and connected Broads SACs from treated foul water effluent are also likely to be minimal. Whilst maintenance activities for SEP and DEP would be more than either project in isolation the scale is such that the magnitude remains no greater than SEP or DEP in isolation.	Negligible	**Minor adverse**	No impact	**No impact**
	Spring Beck	Low	400		Negligible	**Negligible**	No impact	**No impact**
	Coastal catchment	Low	N/A		Negligible	**Negligible**	No impact	**No impact**
River Bure	Scarrow Beck	Medium	327		Negligible	**Minor adverse**	No impact	**No impact**
	River Bure	Medium	1,053		Negligible	**Minor adverse**	No impact	**No impact**
	Mermaid Stream	Medium	77		Negligible	**Minor adverse**	No impact	**No impact**
River Wensum	Blackwater Drain	High	369		Negligible	**Minor adverse**	No impact	**No impact**
	Swanninton Beck	High	848		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	701		Negligible	**Minor adverse**	No impact	**No impact**
	River Tud	High	330		Negligible	**Minor adverse**	No impact	**No impact**
River Yare	River Yare	Medium	573		Negligible	**Minor adverse**	No impact	**No impact**
	River Tiffey	Medium	486		Negligible	**Minor adverse**	No impact	**No impact**
	Intwood Stream	Low	753	Both the Intwood Stream and the River Tas contain elements of the proposed onshore substation. This forms a small proportion of the overall catchment for each, and although some routine maintenance is likely to be required, mitigation measures will be in place to control any potential accidental release of oils from the transformers, foul drainage or surface water drainage.	Low	**Minor adverse**	Negligible	**Minor adverse**
	River Tas	Medium	62,673		Low	**Minor adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Ground water Bodies	North Norfolk Chalk	High	795	Less than 0.0025% of the overall area of each groundwater body would be impacted by the onshore project area. Inert solid plastic insulated cables will be used in place of oil insulated cables, removing the potential for fluid leakage into groundwater. There is no requirement to undertake routine maintenance along the cable corridor (although some planned and unplanned activities may be necessary during the operational life of the project). Mitigation measures will control potential for accidental release of foul drainage and surface water drainage from the substation.	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	68,237		Negligible	**Minor adverse**	No impact	**No impact**

18.6.2.2 Impact 2: Changes to Surface and Groundwater Flows and Flood Risk

179. The permanent above ground infrastructure, including the onshore substation and any new permanent access tracks, would result in permanent changes to land use. Although permeable surface treatments will be used where possible, permanent features will include surface panels of link boxes along the onshore cable corridor, and the onshore substation, with associated infrastructure such as access roads. This change in land use from greenfield agricultural land would result in an increase in impermeable land area.

180. The presence of the buried cable ducting and subsurface joint bays along the onshore cable corridor may impact upon subsurface flow corridors as it will introduce an impermeable barrier which may change subsurface flow patterns; forcing water to move upwards towards the surface, or downwards away from the surface. Buried cable ducting may also impact upon the level of recharge and distribution of groundwater within the aquifers underlying the proposed onshore project area (including shallow aquifers and deeper Principal Aquifers). However, the relatively shallow depth of the cable infrastructure means that any impacts are likely to be highly localised and confined to shallow near-surface groundwater bodies.

181. An increase in the impermeable area in a catchment would result in a reduced rate of infiltration and therefore a potential increase in surface runoff. Changes in surface water runoff and subsurface flows could be sufficient to impact upon the hydrology of the surface water system, by increasing surface water volumes, and may result in permanent changes to geomorphology by increasing rates of bed and bank erosion, encouraging geomorphological adjustment. Geomorphological changes may also impact upon in-channel habitat conditions for aquatic organisms. Impacts on geomorphology and in-channel habitats are likely to be particularly marked if drainage from a large area is discharged at a discrete location within the existing surface drainage network.

182. Furthermore, the ground disturbance during installation of the cable trench is likely to change the transmissivity of the ground which overlays the cable infrastructure after reinstatement and may therefore become a preferential corridor for subsurface water flow.

183. Changes to the proportion of groundwater contained in surface waters could potentially alter water chemistry and impact upon the quality of water-dependent habitats.

184. The Environment Agency's Long-Term Flood Risk Information map identified that the field within which the onshore substation would be located includes an overland flow path ranging from a low to high risk of surface water flooding. The land in this area falls from west to east towards the railway line, which subsequently appears to form a barrier to the overland flow path crossing the fields. This results in the mapping showing a potential area of ponding adjacent to the railway line. Refer to **Appendix 18.2 FRA** for further details. The Applicant has committed to a substation footprint that avoids this area of surface water flood risk.

18.6.2.2.1 Magnitude of Effect - SEP or DEP in Isolation

185. The scale of potential impact upon a sub-catchment is proportional to the area of permanent infrastructure in each catchment during operation. This has been estimated based on the area of the onshore cable corridor, onshore substation and permanent access road within each catchment (**Table 18-26**).

186. The magnitude of effect in each receptor is discussed in **Table 18-30**, but has been assessed as being low in the Intwood Stream, River Tas and groundwater bodies due to the presence of permanent onshore substation infrastructure in the Intwood Stream and River Tas catchments which could alter surface flow patterns. The magnitude of effect in all other receptors is anticipated to be negligible due to the very small proportion of the catchment containing operational above or below ground infrastructure and therefore a lack of mechanism for impact during operation.

18.6.2.2.2 Magnitude of Effect – SEP and DEP

187. The scale of potential impact upon a sub-catchment is proportional to the area of permanent infrastructure in each catchment during operation. This has been estimated based on the area of the onshore cable corridor, onshore substation and permanent access road within each catchment (**Table 18-27**) and is a greater area for SEP and DEP concurrently than in isolation.

188. The magnitude of effect in each receptor is discussed in **Table 18-31,** but is anticipated to be low in the Intwood Stream, River Tas and groundwater bodies due to the presence of permanent onshore substation infrastructure in the Intwood Stream and River Tas catchments which could alter surface flow patterns. The magnitude of effect in all other receptors is anticipated to be negligible due to the very small proportion of the catchment containing operational infrastructure above or below ground and therefore a lack of mechanism for impact during operation through maintenance activities.

18.6.2.2.3 Impact Significance - SEP or DEP in Isolation

189. The impact significance for each receptor as a result of the operation of SEP or DEP in isolation is given in **Table 18-30**, and is assessed as negligible or minor adverse for all receptors.

18.6.2.2.4 Impact Significance – SEP and DEP

190. The impact significance for each receptor as a result of the operation of SEP and DEP is given in **Table 18-31**, and is assessed as negligible or minor adverse for all receptors.

18.6.2.2.5 Mitigation

191. Surface water drainage at the onshore substation would be designed to meet the requirements of the NPPF and NPS EN-5, with runoff limited, where feasible, through the use of infiltration techniques which can be accommodated within the DCO Order limits. The drainage would be developed according to the principles of the SuDS discharge hierarchy. Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable: i) into the ground (infiltration); ii) to a surface water body; iii) to a surface water sewer, highway drain or another drainage system; or iv) to a combined sewer. This will include attenuation and hydrocarbon interceptors to prevent the supply of contaminants (including oils and fine sediment). Further discussion of the drainage approach is set in the **Onshore Substation Drainage Study** (document reference 6.3.18.2.1). No mitigation is proposed specifically along the onshore cable corridor.

18.6.2.2.6 Residual Impacts - SEP or DEP in Isolation

192. Following the implementation of mitigation measures, the potential for increased surface water runoff and flood risk during the operational phase of either SEP or DEP would be reduced to an effect of negligible magnitude across those receptors associated with the onshore substation – the River Tas, the Intwood Stream and the groundwater bodies. For the remaining surface water bodies which are associated with onshore cable corridor no mitigation measures are proposed and the effects here will remain of negligible magnitude. Therefore, across all receptors, the residual impact is assessed to be **minor adverse** where they have high or medium sensitivity, and **negligible** where they have low sensitivity. The residual impacts are given in **Table 18-30**.

18.6.2.2.7 Residual Impacts – SEP and DEP Concurrently

193. Following the implementation of mitigation measures, the potential for increased surface water runoff and flood risk during the operational phase of SEP and DEP would be reduced to an effect of negligible or low magnitude across those receptors associated with the onshore substation – the River Tas, the Intwood Stream and the groundwater bodies. For the remaining surface water bodies which are associated with onshore cable corridor no mitigation measures are proposed and the effects here will remain of negligible magnitude. Therefore, across all receptors, the residual impact is assessed to be **minor adverse** where they have high or medium sensitivity, and **negligible** where they have low sensitivity. The residual impacts are given in **Table 18-31**.

18.6.2.2.8 Summary – SEP or DEP in Isolation

Table 18-30: Impacts to Surface and Groundwater Flows and Flood Risk Associated with the Operation of SEP or DEP in Isolation

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	222	As a result of the limited spatial extent of permanent impermeable development along the cable corridor, the effect is considered to be of negligible magnitude in the North Norfolk Rivers, River Bure and River Wensum catchments as well as the two catchments in the River Yare that contain only the onshore cable corridor. No operational mitigation measures are proposed for the cable corridor and associated infrastructure therefore the magnitude of effect will remain negligible.	Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Spring Beck	Low	200		Negligible	**Negligible**	Negligible	**Negligible**
	Coastal catchment	Low	N/A		Negligible	**Negligible**	Negligible	**Negligible**
River Bure	Scarrow Beck	Medium	164		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Bure	Medium	526		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Mermaid Stream	Medium	39		Negligible	**Minor adverse**	Negligible	**Minor adverse**
River Wensum	Blackwater Drain	High	185		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Swannington Beck	High	424		Negligible	**Minor adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	350		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Tud	High	165		Negligible	**Minor adverse**	Negligible	**Minor adverse**
River Yare	River Yare	Medium	286		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Tiffey	Medium	243		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Intwood Stream	Low	377	A small proportion of each catchment could potentially be impacted by changes to surface water runoff, groundwater flows and flood risk resulting from the permanent presence of the onshore substation. However, mitigation measures implemented to ensure that runoff rates remain at their greenfield rates would reduce the magnitude to negligible.	Low	**Minor adverse**	Negligible	**Negligible**
	River Tas	Medium	32,587		Low	**Minor adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	398	It is expected that subsurface (groundwater) flows would pass above or below the ducting along the cable corridor and would not change significantly. As a result, although there will be some minor changes in the distribution of flows, there is unlikely to be a significant perturbation / change in overall flow directions and quantities. Furthermore, the size and shallow depth of the impermeable subsurface barrier created by the cable ducting and foundations for the onshore substation in comparison to the size of the groundwater bodies which underlie the onshore project area is very small. The impermeable area comprises 0.0001% and 0.0011% of the overall area of the North Norfolk Chalk and Broadland Rivers Chalk groundwater bodies respectively. This would result in an effect upon infiltration rates, groundwater	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers Chalk and Crag	High	35,368		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				flows, sub-surface flow corridors and alterations in the distribution of groundwater of negligible magnitude.				

18.6.2.2.9 *Summary – SEP and DEP*

Table 18-31: Impacts to Surface Water Runoff and Flood Risk Associated with the Operation of SEP and DEP Concurrently

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	443	As a result of the limited spatial extent of permanent impermeable development along the cable corridor, the effect is considered to be of negligible magnitude in the North Norfolk Rivers, River Bure and River Wensum catchments as well as the two catchments in the River Yare that	Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Spring Beck	Low	400		Negligible	**Negligible**	Negligible	**Negligible**
	Coastal catchment	Low	N/A		Negligible	**Negligible**	Negligible	**Negligible**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
River Bure	Scarrow Beck	Medium	327	contain only the onshore cable corridor.	Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Bure	Medium	1,053		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Mermaid Stream	Medium	77		Negligible	**Minor adverse**	Negligible	**Minor adverse**
River Wensum	Blackwater Drain	High	369		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	Swanningt on Beck	High	848		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Wensum	High	701		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Tud	High	330		Negligible	**Minor adverse**	Negligible	**Minor adverse**
River Yare	River Yare	Medium	573		Negligible	**Minor adverse**	Negligible	**Minor adverse**
	River Tiffey	Medium	486		Negligible	**Minor adverse**	Negligible	**Minor adverse**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Intwood Stream	Low	753	Whilst the installed infrastructure would cover a larger area this still represents a small proportion of each catchment that could potentially be impacted by changes to surface water runoff, groundwater flows and flood risk resulting from the permanent presence of the onshore substation. However, mitigation measures implemented to ensure that runoff rates remain at their greenfield rates will reduce the magnitude from low to negligible.	Low	**Minor adverse**	Negligible	**Negligible**
	River Tas	Medium	62,673		Low	**Minor adverse**	Negligible	**Minor adverse**
Groundwater Bodies	North Norfolk Chalk	High	795	It is expected that subsurface (groundwater) flows would pass above or below the ducting along the cable corridor and would not change significantly. As a result, although there will be some minor changes in the distribution of flows, there is unlikely to be a significant perturbation / change in overall flow directions and quantities. Furthermore, the size and shallow depth of the impermeable subsurface barrier created by the cable ducting and	Negligible	**Minor adverse**	No impact	**No impact**
	Broadland Rivers	High	68,237		Negligible	**Minor adverse**	No impact	**No impact**

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Chalk and Crag			foundations for the onshore substation in comparison to the size of the groundwater bodies which underlie the onshore project area is small. The impermeable area comprises 0.0001% and 0.0022% of the overall area of the North Norfolk Chalk and Broadland Rivers Chalk groundwater bodies respectively. This would result in an effect upon infiltration rates, groundwater flows, sub-surface flow corridors and alterations in the distribution of groundwater of negligible magnitude.				

18.6.3 Potential Impacts during Decommissioning

194. No decision has yet been made regarding the final decommissioning policies for either SEP or DEP as it is recognised that industry best practice, rules and legislation change over time. The detail and scope of decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator with decommissioning plan provided.

195. However, it is considered likely that the proposed onshore substation would be removed and will be reused or recycled and that the onshore cables would also be removed and recycled, with the transition bays and cable ducts (where used) left *in situ*. For the purposes of a worst-case scenario, it is considered that impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.

18.7 Cumulative Impacts

18.7.1 Identification of Potential Cumulative Impacts

196. The first step in the cumulative assessment is the identification of which residual impacts assessed for SEP and/or DEP on their own have the potential for a cumulative impact with other plans, projects and activities (described as 'impact screening'). This information is set out in **Table 18-32** below, together with a consideration of the confidence in the data that is available to inform a detailed assessment and the associated rationale. Only potential impacts assessed in **Section 18.6** as negligible or above are included in the CIA (i.e. those assessed as 'no impact' are not taken forward as there is no potential for them to contribute to a cumulative impact).

197. **Table 18-32** concludes that in relation to water resources and flood risk, all impacts identified in **Section 18.6** have the potential to act cumulatively with other projects.

Table 18-32: Potential Cumulative Impacts (impact screening)

Impact	Potential for Cumulative Impact	Rationale
Construction Impacts		
Direct disturbance of surface water bodies	Yes	Impacts to surface water bodies could act cumulatively with other projects if these cause direct disturbance to the same water bodies, particularly if there is a temporal or spatial overlap. The likelihood of a temporal overlap may increase with the sequential scenario where construction will take place over a longer period of time.
Increased sediment supply	Yes	Other projects being constructed within 1km of the onshore construction area associated with SEP and DEP may also cause an increase in sediment supply to the surface water drainage system which could act cumulatively. SEP and DEP being constructed concurrently may have a greater cumulative effect due to the greater area of exposed land during construction which has the potential to cause more sediment runoff.

Impact	Potential for Cumulative Impact	Rationale
Supply of contaminants	Yes	Other projects being constructed within 1km of the onshore construction area of SEP and DEP may act cumulatively to reduce surface and groundwater quality in the event that they cause a supply of contaminants to be released into the surface water drainage system. There is greater potential for cumulative effects under the sequential scenario as more works are required over a greater timescale to complete each project and reinstate the works area in between, therefore there is more time for a contamination event to occur.
Changes to surface water runoff and flood risk	Yes	Any project involving construction within 1km of the onshore project infrastructure could also cause changes in surface flow patterns, compaction and an increase in impermeable area. This could act cumulatively to cause further changes to surface water runoff and flood risk.
Operational Impacts		
Supply of contaminants	Yes	All new developments are likely to have operational or maintenance requirements which may require regular access by machinery, therefore increasing the likelihood of contaminants being released and acting cumulatively. However, operational activities associated with SEP and DEP are largely confined to the onshore substation site and as such could only result in cumulative impacts in the catchments which contain the substation (the River Tas and the Intwood Stream).
Changes to surface water runoff and flood risk	Yes	As a result of the limited spatial extent of permanent impermeable development along the cable corridor, the effect is considered to be limited and highly localised and therefore unlikely to act cumulatively with other projects. However, the greater area of impermeable ground at the substation could result in cumulative impacts with other projects in the same catchments (the River Tas and the Intwood Stream).

18.7.2 Other Plans, Projects and Activities

198. The second step in the cumulative assessment is the identification of the other plans, projects and activities that may result in cumulative impacts for inclusion in the CIA (described as 'project screening'). This information is set out in **Table 18-33** below, together with a consideration of the relevant details of each, including current status (e.g. under construction), planned construction period, closest distance to SEP and DEP, and rationale for including or excluding from the assessment.

199. The project screening has been informed by the development of a CIA Project List which forms an exhaustive list of plans, projects and activities in a very large study area relevant to SEP and DEP. The list has been appraised, based on the confidence in being able to undertake an assessment from the information and data available, enabling individual plans, projects and activities to be screened in or out.

200. Those projects that are located more than 20km away are not included in **Table 18-33** (unless an exception is stated) as there is no mechanism for impacts to act cumulatively on water resources and flood risk over that distance as no works will be taking place in the same catchments. In addition, the following types of applications which are included on the CIA Project List, have been screened out and are not included in **Table 18-33**:

- Tree works as there is no mechanism for cumulative impact;
- Those that have been completed and are more than 500m away as there would be no physical overlap of construction impacts, and at that distance there are unlikely to be any cumulative operational effects on surface or groundwater flows or supply of contaminants.
- Small scale residential extensions and change of use applications that have no mechanism for cumulative construction impacts and are likely to have been completed by the time construction of SEP and/or DEP commences have also been screened out.

Table 18-33: Summary of Projects Considered for the CIA in Relation to Water Resources and Flood Risk (Project Screening)

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Included in the CIA (Y/N)	Rationale
Hornsea Project Three Offshore Wind Farm	DCO consented	2021-2025 (single phase) 2021-2031 (two phase)	0km, direct intersection of the two cable corridors	Y	There is potential that this project could be constructed in two phases meaning that the entire construction period could be either ten years or six years. Therefore, there could be temporal overlap of construction with SEP and DEP which could lead to cumulative impacts in direct disturbance of water bodies, contaminant and sediment release and changes to surface water drainage. The onshore infrastructure for this project follows a very similar route to that of SEP and DEP, therefore potential impacts would affect the same catchments.
Norfolk Vanguard Offshore Wind Farm	DCO consented	2022-2027	0km – onshore cable corridor crosses the SEP and DEP onshore cable corridor.	Y	The onshore cable route for both the Norfolk Vanguard and Norfolk Boreas offshore wind farms will also pass through the catchments of the Mermaid Stream, River Bure, Blackwater Drain and the River Wensum. There may be concurrent construction, therefore some cumulative effects may occur in direct disturbance of water bodies, supply of sediment and contaminants.
Norfolk Boreas Offshore Wind Farm	DCO consented	2023-2028	0km – onshore cable corridor crosses the SEP and DEP onshore cable corridor	Y	
A47 North Tuddenham to Easton	Examination	January-March 2022/2023-2024-2025	0km – SEP and DEP cable corridor crosses the A47 directly where	Y	There is a possibility that there will be temporal overlap in the construction of these two projects. Cumulative impacts

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Included in the CIA (Y/N)	Rationale
			improvement works are taking place.		could occur within the River Tud catchment.
Improvement of the Thickthorn A11/A47 junction	Pre-examination	January – March 2023 until 2024-2025. Duration likely to be 26 months	2.5km	Y	There is potential for a temporal overlap in construction for this project. If construction does overlap, concurrent construction in the Intwood Stream catchments could cause cumulative effects in supply of sediment and contaminants, and also in flood risk.
Land west of Norwich Road, Swainsthorpe	Pending consideration	Unknown	0km – direct overlap to southern edge of substation location	Y	The construction period for this project is unknown, therefore there is potential for a temporal overlap with the construction of SEP and DEP. If construction does overlap, concurrent construction in the River Tas catchment could cause cumulative impacts in supply of sediment, contaminants and also flood risk. The potential for cumulative impacts on flood risk and contaminant release may also occur during operation.
Construction of up to 650 dwellings, primary school, sixth form college and associated infrastructure on land to the north east of Wymondham	EIA Scoping Opinion submitted and concluded to be required	Unknown	Approximately 0.75km	Y	The construction period for this project is unknown, therefore there is potential for concurrent construction to occur. If construction does overlap, concurrent construction in the River Tiffey catchment could cause cumulative impacts in direct disturbance to watercourses, supply of sediment,

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Included in the CIA (Y/N)	Rationale
					contaminants and also flood risk. The potential for cumulative impacts on flood risk may also occur during operation.
Norwich Western Link road comprising the dualling of the A1067 Fakenham Road from the junction with A1270 Broadland Northway to a new junction with the A47 near Honingham and associated works.	EIA Scoping Opinion submitted	2023-2025	0km – this scheme directly intersects the DCO order limits just east of Weston Green	Y	There is unlikely to be a temporal or spatial overlap in construction due to the completion date of 2025 for this project and the start date of SEP and DEP construction in 2025. However, there is potential for cumulative effects to occur in the changes to surface and groundwater flows and flood risk during construction (if a temporal overlap did occur) and operation.
New access road to Honingham Food Enterprise Park from the enhanced Honingham Junction of the improved A47.	Registered	Unknown	276m	Y	The proposed access road development is confirmed in a FRA to be entirely within Flood Zone 1 and therefore at low risk of flooding. The scheme includes provision for SuDS such as filter strips, infiltration trenches and filter trains which will help to mitigate operational impacts on contaminants and runoff, and therefore cumulative impacts. However, it is unclear whether there will be a temporal overlap in construction. If concurrent construction does occur, there is potential for cumulative

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Included in the CIA (Y/N)	Rationale
					impacts in sediment run-off and supply of contaminants.
Erection of 890 dwellings on land north and south of the Dereham Road, Easton. Includes the creation of a village heart with primary school, a new village hall, a retail store and areas of public open space; the relocation and increased capacity of the allotments; and associated infrastructure including public open space and highway works	Approved with conditions	Phased construction over 10 years between 2021 and 2031	1.4	Y	This housing development may lead to an increase in sediment or contaminant supply within the River Tud catchment during construction for which there may be temporal overlap with SEP and DEP. It may also lead to changes in surface water runoff during both construction and operation and could lead to contaminants entering surface and groundwaters during operation.

18.7.3 Assessment of Cumulative Impacts

201. Having established the residual impacts from DEP and/or SEP with the potential for a cumulative impact, along with the other relevant plans, projects and activities, the following sections provide an assessment of the level of impact that may arise. This assessment uses the worst-case scenario for each impact as stated in the Impact Significance sections in **Section 18.6**.

18.7.3.1 Cumulative Impact 1: Construction Phase – Direct Disturbance of Watercourses

202. The following projects may also lead to direct disturbance of watercourses potentially affected by SEP and DEP:

- Hornsea Project Three;
- Norfolk Vanguard and Norfolk Boreas; and
- The construction of 650 dwellings northeast of Wymondham.

203. Hornsea Project Three follows a similar landfall, cable corridor and onshore substation location and has the potential to cause direct disturbance to Ordinary Watercourses within the North Norfolk, River Bure, River Wensum and River Yare operational catchments. Norfolk Vanguard and Norfolk Boreas both also cross Ordinary Watercourses in the catchments of the River Bure and River Wensum, and Blackwater Drain.

204. Hornsea Project Three has committed to trenchless crossings of all Main Rivers and IDB maintained Ordinary Watercourses but may carry out trenched crossings in smaller and less sensitive Ordinary Watercourses. This means that although any cumulative impacts are likely to be limited, there is potential for cumulative impacts to occur. Although the number of trenched crossings and the residual impact for each receptor is not given in the submitted Environmental Statement, the overall residual impact following mitigation is anticipated to be minor adverse as a result of the construction of Hornsea Project Three (Ørsted, 2018).

205. Mitigation measures proposed for Hornsea Project Three include the installation of pre-installed culvert (flume) pipes in the watercourse under the construction accesses and haul road. The pipe would be of suitable size to accommodate the water volumes and flows, or temporary bridging may be installed. The access and haul roads would be removed at the end of the construction programme and measures would be implemented to ensure that watercourses, including their banks, are reinstated to their previous condition where possible. These measures will minimise the potential for cumulative impacts when combined with similar commitments by SEP and DEP (**Section 18.6.1.1.5**).

206. There is potential that due to delays in the granting of a DCO, Norfolk Vanguard will not complete cable installation as planned by 2024. Therefore, with SEP and DEP construction programmed to start in 2025, there is potential that temporal overlap could occur and therefore cumulative impacts through direct disturbance of water bodies. Norfolk Vanguard would be installing cable ducts for Norfolk Boreas and a temporary haul road with associated watercourse crossings using temporary culverts would still be required for the cable pulling phase of Norfolk Boreas. Cable pulling is anticipated to occur during 2026 and 2027 (although this may also be delayed) when construction works would be underway for SEP and DEP.

207. Catchments where watercourse crossings may occur concurrently for both Norfolk Boreas and SEP and DEP are shown in **Table 18-34**. The data in this table was obtained from the Environmental Statement for Norfolk Boreas (Vattenfall, 2019)

Table 18-34: Trenched or Culverted Crossings in Catchments Affected by Both Norfolk Boreas Offshore Wind Farm and SEP and DEP

Receptor	Sensitivity	Number of crossings: Norfolk Boreas	Number of crossings: SEP and DEP	Total	Residual impact Norfolk Boreas	Residual Impact SEP and DEP
River Bure	Medium	5	2	7	Minor adverse	Minor adverse
Mermaid Stream	Medium	0	0	0	No impact	Minor adverse
Blackwater Drain	High	1	0	1	Minor adverse	Minor adverse
River Wensum	High	0	2	2	No impact	Minor adverse

208. In the Mermaid Stream and River Wensum, no greater effect would occur cumulatively than for DEP and/or SEP. However, in both the River Bure and the Blackwater Drain catchments, there is potential that Norfolk Vanguard or Norfolk Boreas combined with SEP and DEP could act cumulatively to cause a greater level of direct disturbance to surface watercourses than each alone.

209. **Table 18-14** defines that between four and nine trenched crossings in a catchment equates to a low magnitude of effect, therefore the cumulative effect of both Norfolk Boreas and SEP and DEP in the catchment of the River Bure would not increase the magnitude of effect defined in the SEP and DEP assessment. Overall cumulative impacts remain no greater than for SEP and DEP, i.e. no greater than minor adverse significance.

210. The proposed construction of up to 650 dwellings on the north east edge of Wymondham will lead to the direct disturbance of at least two drains in the River Tiffey catchment. When considered cumulatively with SEP and DEP, this will lead to a worst-case scenario of six watercourses undergoing direct disturbance due to construction. As shown in **Table 18-14**, this is considered to constitute a low magnitude of effect, therefore no overall increase in the magnitude of effect will occur. Together with the implementation of mitigation measures, it is considered unlikely that cumulative impacts would occur.

18.7.3.2 Cumulative Impact 2: Construction Phase – Increased Supply of Sediment

211. The following projects identified in **Table 18-33** may also contribute an increased supply of sediment to surface water receptors potentially affected by SEP and DEP:

- Hornsea Project Three – has potential to cause impacts in the same catchments as SEP and DEP;
- A47/A11 junction at Thickthorn – Intwood Stream;
- Norfolk Boreas – River Bure, River Wensum and Blackwater Drain;
- A47 North Tuddenham to Easton – River Tud;
- New access road at the Food Enterprise Park, Honingham – River Tud;
- Norwich Western Link Road – River Wensum and River Tud;
- Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham; and
- Construction of 890 dwellings north and south of the Dereham Road, Easton – River Tud and River Yare.

212. Construction works for these projects could increase the potential for erosion and entrainment of soil particulates, resulting in an increase in the supply of fine sediment to surface water bodies through surface runoff. The potential cumulative impacts in each receptor are discussed in **Table 18-35**.

Table 18-35: Potential for Cumulative Impact Due to An Increased Supply of Sediment

Receptor	Cumulative project residual impact	SEP and DEP residual Impact	Cumulative Impact
Hornsea Project Three			
River Glaven	Minor adverse	Minor adverse	The ES for Hornsea Project Three does not consider the residual impact on each receptor individually and considers that the potential impact of HDD and trenched crossing methods as a whole across all receptors. The residual impact as such is considered to be minor adverse across all affected catchments. Detailed mitigation measures are given in the Outline Code of Construction Practice (Ørsted, 2018) which will prevent the release of sediment into the surface water drainage system that drains into each watercourse. These measures are similar to those proposed by SEP and DEP (Section 18.6.1.2.5), and include: • Active management of surface drainage; • Retention of bankside vegetation to act as a buffer for sediment and silt; • Reducing disturbance close to watercourses to the minimum required for works; • Excavated materials to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into watercourses; and • Ongoing consultation with the Environment Agency and Natural England. • Although the potential for cumulative impacts exists due to potential temporal overlap of construction, and work in the same catchments; mitigation measures implemented by both projects would act to prevent cumulative impacts that are greater than SEP and DEP alone.
Spring Beck	Minor adverse	Negligible	
Coastal catchment	Minor adverse	Negligible	
Scarrow Beck	Minor adverse	Minor adverse	
River Bure	Minor adverse	Minor adverse	
Mermaid Stream	Minor adverse	Minor adverse	
Blackwater Drain	Minor adverse	Minor adverse	
Swannington Beck	Minor adverse	Moderate adverse	
River Wensum	Minor adverse	Moderate adverse	
River Tud	Minor adverse	Minor adverse	
River Yare	Minor adverse	Minor adverse	
River Tiffey	Minor adverse	Minor adverse	
Intwood Stream	Minor adverse	Minor adverse	
River Tas	Minor adverse	Minor adverse	

Receptor	Cumulative project residual impact	SEP and DEP residual Impact	Cumulative Impact
A47/A11 junction at Thickthorn			
Intwood Stream	No impact	Minor adverse	The proposed scheme involves construction work in the catchment of the Intwood Stream and the realignment of the Cantley Stream, which is a tributary of the Intwood Stream, (Highways England, 2021a). This could lead to the release of sediment into the Cantley Stream with potential effects on the hydrological and geomorphological regime of the Intwood Stream downstream. However, the scheme is located over 2km to the north of SEP and DEP DCO. Furthermore, the two schemes are located in different sub-catchments with SEP and DEP located in the main Intwood Stream catchment, and the A47/A11 scheme being located in the sub-catchment of the Cantley Stream approximately 1.6km upstream of the Intwood Stream. The spatial distribution of the two projects means that any sediment released by either project is likely to undergo attenuation in the sub-catchments of the receptor and would not act cumulatively to increase the magnitude of impact.
Norfolk Boreas Offshore Wind Farm / Norfolk Vanguard Offshore Wind Farm			
River Bure	Minor adverse	Negligible	Both Norfolk Vanguard and Norfolk Boreas are consented and Norfolk Vanguard will install the cable ducts for Norfolk Boreas, i.e. there will be a single cable duct installation exercise to cover both projects. Both Norfolk Boreas/Vanguard and SEP/DEP have committed to use HDD to cross Main Rivers and IDB drains with the cable infrastructure and use temporary crossing methods such as Bailey bridges or temporary culverts to provide access during construction. However, both will use temporary culverts to cross Ordinary Watercourses which may lead to the release of sediment into these watercourses. However, the Ess for Norfolk Boreas and Norfolk Vanguard state that less than 0.03% of each catchment would be disturbed ground during the construction of the cable corridor. This is likely to be similar to the area of disturbed ground for SEP and DEP as all four catchments will contain only the cable corridor, haul road and potentially some
Mermaid Stream	Minor adverse	Negligible	
Blackwater Drain	Minor adverse	Minor adverse	
River Wensum	Minor adverse	Minor adverse	

Receptor	Cumulative project residual impact	SEP and DEP residual Impact	Cumulative Impact
			construction compounds. An area of approximately 1%, of disturbed ground in each catchment is unlikely to produce significant quantities of sediment.
A47 North Tuddenham to Easton			
River Tud	Slight adverse	Minor adverse	The construction works associated with this project include a bridge structure over the River Tud which may involve temporary construction works in the river channel, near Hockering, with the potential to mobilise sediment, although this does not directly overlap with the proposed cable corridor of SEP and DEP. Mitigation measures would be implemented in accordance with relevant DMRB Standards to ensure that there are no adverse impacts on the watercourse, and monitoring of the baseline conditions would also be undertaken (Highways England, 2021b).
Colmans Food Enterprise Park Access Road from new A47 Junction			
River Tud	N/A as no EIA carried out	Minor adverse	As yet, there is no detailed assessment associated with this project. However, it is possible that there may be temporal overlap in construction and the two projects are in close proximity. There is a potential for increase in sediment associated with both projects. However, the cumulative area of both projects is likely to be a very small proportion of the overall River Tud catchment. In addition, mitigation measures to prevent sediment egress into surface water will be in place for SEP and DEP during construction, therefore it is considered unlikely that a cumulative impact will occur.
Norwich Western Link Road			
River Wensum	Negligible	Minor adverse	The Norwich Western Link Road crosses the flood plain of the River Wensum via a bridge, which would not require disturbance of the River Wensum itself. However, the construction of the access track would require the crossing of land drains within the area. Depending on the nature of the crossings, this may lead to a cumulative increase of sediment mobilisation with SEP and DEP within the Wensum catchment. It is,

Receptor	Cumulative project residual impact	SEP and DEP residual Impact	Cumulative Impact
			however, expected the negligible impact associated with this project, would not present a sufficient increase in sediment to create a significant cumulative impact.
River Tud	Minor adverse	Minor adverse	The Norwich Western Link Road will require the trenched crossing and culverting of a tributary of the River Tud which may lead to an increase in sediment deposition or scour and would potentially change flow dynamics and sediment transport within the River Tud (Norfolk County Council, 2021). This project is not expected to directly overlap with SEP and DEP within the catchment of the River Tud and mitigation measures introduced by SEP and DEP will help to prevent cumulative impacts in the catchment.
Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham			
River Tiffey	Only at EIA Scoping stage, therefore no definitive residual impact yet.	Minor adverse	Construction works associated with this large scale housing development may lead to the release of sediment into the drainage network. There is potential for temporal overlap in construction as no construction date has been confirmed, and the site is located only 750m away from the DCO order limits. A commitment is made in the Scoping Report to develop an appropriate runoff management plan for implementation during the construction phase which would enable prevention of impacts to water quality. In addition, only up to 5.4% of the catchment will be exposed at any one time if concurrent construction were to occur. This equates to a low magnitude of effect. With the mitigation measures outlined for this housing development, it is unlikely that cumulative impacts will occur.
Erection of 890 dwellings north and south of the Dereham Road, Easton			
River Tud	Negligible	Minor adverse	Construction works associated with this large-scale housing development may lead to the release of sediment into the drainage network. There is potential for temporal overlap in construction as no construction date has been confirmed, although this project is taking place in phases over 10 years. It is located approximately 1.2km from the DCO Order limits and does not directly disturb any watercourses. The associated environmental statement (Easton Landowner Consortium, 2014) contains extensive
River Yare	Negligible	Minor adverse	

Receptor	Cumulative project residual impact	SEP and DEP residual Impact	Cumulative Impact
			mitigation measures aimed at reducing impacts to surface water environment and complying with construction good practice measures. The impact is negligible and is not considered likely to lead to cumulative impacts with SEP and DEP.

18.7.3.3 Cumulative Impact 3: Construction Phase – Supply of Contaminants

213. SEP and DEP (and associated catchments) identified in **Section 18.7.3.2** also have the potential to result in the accidental release of contaminants such as oils, fuels and lubricants into surface water bodies during construction. The residual impacts resulting from the construction of SEP and DEP concurrently are predicted to be either negligible or minor adverse significance across all catchments.

214. The following projects identified in **Table 18-33** may also contribute an increased supply of contaminants to surface water receptors potentially affected by SEP and DEP:

- Hornsea Project Three – has potential to cause impacts in the same catchments as SEP and DEP;
- A47/A11 junction at Thickthorn – Intwood Stream;
- Norfolk Boreas – River Bure, River Wensum and Blackwater Drain;
- A47 North Tuddenham to Easton – River Tud;
- New access road at the Food Enterprise Park, Honingham – River Tud;
- Norwich Western Link Road;
- Erection of 650 dwellings at Wymondham; and
- Construction of 890 dwellings north and south of the Dereham Road, Easton – River Tud and River Yare.

215. The construction works associated with each of the projects listed above could increase the potential for contaminants to be released into surface waters through accidental spillage or release of fuels, oils, lubricants, foul waters and construction materials. The potential for cumulative impacts in each receptor is discussed in **Table 18-36**.

Table 18-36: Potential Cumulative Impacts in each Receptor Associated with a Potential Increased Supply of Contaminants

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
Hornsea Project Three			
River Glaven	Minor adverse	Minor adverse	The ES for Hornsea Project Three does not consider the residual impact on each receptor individually and considers that the potential impact of degradation of water quality due to the release of contaminants is minor adverse across all affected catchments. Detailed mitigation measures are given in the Outline Code of Construction Practice (Ørsted, 2018) which will prevent adverse impacts on each water body, which are similar to those proposed by SEP and DEP. These include: Active management of drainage from the construction site; Retention of bankside vegetation; Bunding of areas a risk of spillage including vehicle maintenance and storage areas; Bunded areas to have impermeable bases; Construction materials to be handled and stored in a way that minimises risks posed to the aquatic environment; Where possible, less toxic alternative materials to be used; and Maintaining plant and machinery in good condition to minimise the risk of leaks. Although there may be a temporal overlap in construction, and in some cases an overlap in receptors affected, the mitigation measures committed to would prevent the potential for cumulative effects, and the residual impacts resulting from each project alone would not be increased.
Coastal catchment	Minor adverse	Minor adverse	
River Bure	Minor adverse	Minor adverse	
Blackwater Drain	Minor adverse	Minor adverse	
Swannington Beck	Minor adverse	Minor adverse	
River Wensum	Minor adverse	Minor adverse	
River Tud	Minor adverse	Minor adverse	
River Yare	Minor adverse	Minor adverse	
Intwood Stream	Minor adverse	Minor adverse	
River Tas	Minor adverse	Minor adverse	
North Norfolk Chalk	Minor adverse	Minor adverse	
Broadland Rivers Chalk and Crag	Minor adverse	Minor adverse	
A47/A11 junction at Thickthorn			

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
Intwood Stream	Neutral	Minor adverse	The proposed scheme involves construction work in the catchment of the Intwood Stream and realignment of its tributary, the Cantley Stream, and also in-channel works in the Thickthorn Stream, which is a tributary of the River Yare, to widen culverts and also a possible realignment (Highways England, 2021a). This could lead to the release of contaminants into the Thickthorn Stream with potential effects on the water quality of the River Yare downstream. However, the scheme is located over 2km to the north of SEP and DEP DCO order limits. Furthermore, the two schemes are located in different sub-catchments with SEP and DEP located in the main Intwood Stream catchment, and the A47/A11 scheme being located in the sub-catchment of the Cantley Stream approximately 1.6km upstream of the Intwood Stream. The spatial distribution of the two projects means that any sediment released by either project is likely to undergo attenuation in the sub-catchments of the receptor and will not act cumulatively to increase the magnitude of effect. In addition, best practice construction measures will be implemented in the construction of the A47/A11 junction through the Construction Environment Management Plan (CEMP) which will be developed in accordance with CIRIA Guidelines (CIRIA C543, 2002; CIRIA C648, 2006; and CIRIA C741, 2015) (Highways England, 2021a).
River Yare	Neutral	Minor adverse	
Norfolk Boreas Offshore Wind Farm			
River Bure	Minor adverse	Negligible	The construction processes associated with both Norfolk Boreas and SEP and DEP have the potential to lead to the accidental release of lubricants, fuels and oils from construction machinery. However, the ES for Norfolk Boreas states that less than 0.03% of each catchment will be disturbed ground during the construction of the cable corridor. The cable corridors of each project cross in one location in the Blackwater Drain catchment where there maybe a greater risk of contaminants entering the surface water receptors. However, mitigation measures to ensure that the release of contaminants is controlled are included in both projects, based on recognised
Mermaid Stream	Minor adverse	Negligible	
River Wensum	Minor adverse	Minor adverse	
Blackwater Drain	Minor adverse	Minor adverse	

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
North Norfolk Chalk Groundwater Body	Minor adverse	Minor adverse	construction industry best practice. These will ensure that cumulatively, the impacts on these receptors will be no worse than SEP and DEP alone.
A47 North Tuddenham to Easton			
River Tud	Slight adverse	Minor adverse	The construction works associated with this project include a bridge structure over the River Tud which may involve temporary construction works in the river channel, near Hockering, with the potential to cause contaminant release into the surface water drainage system, particularly the River Tud. Mitigation measures would be implemented in accordance with relevant DMRB Standards and in accordance with CIRIA Guidelines (CIRIA C532, 2002; CIRIA C648, 2006; and CIRIA C741, 2015a), to ensure that there is no deterioration in WFD status and monitoring of the baseline conditions would also be undertaken (Highways England, 2021b). Therefore, no cumulative impacts are anticipated.
New access road at the Food Enterprise Park, Honingham			
River Tud	N/A as no EIA carried out	Minor adverse	There are no trenched crossings associated with SEP and DEP within the River Tud catchment, and the onshore cable corridor only covers approximately 0.26% over the overall catchment. Mitigation measures would be in place to ensure that contaminants associated with construction do not enter the surface water environment. Although no detailed assessment is as yet available for this project, when considered with the minor adverse impact associated with SEP and DEP there is unlikely to be a cumulative impact.
Norwich Western Link Road			

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
River Wensum	Negligible	Minor adverse	This project will require construction within the floodplain of the River Wensum and the River Tud and therefore presents the potential for cumulative impacts of contaminant release during construction if there is a temporal overlap. Both this project and SEP and DEP have committed to mitigation measures within either a Construction Environmental Management Plan (Norwich Western Link Road) or Outline Code of Construction Practice (for SEP and DEP) which will reduce the risk of contamination to the water environment. Therefore, it is considered that cumulative impacts are unlikely. There is potential that the project will be constructed and operational by the time SEP and DEP is undergoing construction. There is potential for cumulative impacts with the operational discharge to the River Tud during construction of SEP and DEP. It is likely that the Norwich Western Link Road runoff, once operational, will be discharged to nearby watercourses. Surface water runoff is likely to contain high levels of sediment and hydrocarbons that can pollute surface water and groundwater features. A robust treatment system will therefore be required including measures to manage accidental spillages. If the Norwich Western Link Road is operational by the time that SEP and DEP is constructed (and therefore there is no temporal overlap in construction), these mitigation measures will prevent any cumulative impact with the construction of SEP and DEP.
River Tud	Minor adverse	Minor adverse	
Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham			
River Tiffey	Only at EIA Scoping stage, therefore no definitive residual impact yet.	Minor adverse	This project is due to be constructed on what is currently arable agricultural land and therefore unlikely to be contaminated. Risk of contamination to watercourses and groundwater comes only from leakage and accidental spillage of construction fuels and lubricants as well as runoff from construction containing sediment. A commitment has been made to mitigating any potential contamination through the use of an appropriate SuDS and runoff management plan during construction. The potential for contamination during construction as a result of SEP and DEP is considered to be low with best practice mitigation measures in place. Therefore, it is considered that no cumulative impacts are likely that would be of greater magnitude than SEP and DEP.

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
Erection of 890 dwellings north and south of the Dereham Road, Easton			
River Tud	Negligible	Minor adverse	Construction works associated with this large-scale housing development may lead to the release of contaminants into the drainage network during construction. There is potential for temporal overlap in construction as no construction date has been confirmed, although this project is taking place in phases over 10 years. It is located approximately 1.2km from the DCO order limits and does not directly disturb any watercourses. The associated environmental statement (Easton Landowner Consortium, 2014) contains extensive mitigation measures aimed at reducing impacts to surface water environment and complying with construction good practice measures. The impact is negligible and is not considered likely to lead to cumulative impacts with SEP and DEP.
River Yare	Negligible	Minor adverse	

18.7.3.4 Cumulative Impact 4: Construction Phase – Changes to Surface and Groundwater Flows and Flood Risk

216. All the projects identified in **Table 18-33** have the potential to result in an increase in impermeable ground within the catchments identified in **Section 18.7.3.2** and to cause an alteration in surface water drainage patterns and subsurface flow characteristics. During the construction stage, impacts could occur as a result of site preparation, construction activities and the development of surface infrastructure for the various projects. The potential cumulative impacts in each receptor are discussed in **Table 18-37**.

Table 18-37: Potential for Cumulative Impacts in each Receptor Associated with an Increase in Surface and Groundwater Flows and Flood Risk

<table>
<tr><th>Receptor</th><th>Cumulative project residual impact</th><th>SEP and DEP residual impact</th><th>Cumulative Impact</th></tr>
<tr><td colspan="4">Hornsea Project Three</td></tr>
<tr><td>River Glaven</td><td>Minor adverse</td><td>N/A</td><td rowspan="11">The ES for Hornsea Project Three does not consider the residual impact on each receptor individually and considers that the potential impact of changes to field drainage and drainage infrastructure across all affected catchments would be minor adverse. Detailed mitigation measures are given in the Outline Code of Construction Practice (Ørsted, 2018) which will ensure that flow rates are unaffected either directly or indirectly and prevent an increase in the potential flood risk which are similar to those proposed by SEP and DEP. These include:
The onshore compounds, construction access and haul roads will comprise permeable surfaces;
Temporary culvert crossings will be installed with appropriately sized flume pipes, equal to or greater than the diameter of the flume upstream;
Drainage would be installed either side of the Hornsea Three onshore cable corridor to ensure existing land drainage flow is maintained and is not altered and channelled by the cable corridor; and
Any existing field drainage intercepted during construction works will be reinstated following installation of the cable corridor.
Although there may be a temporal overlap in construction, and in some cases an overlap in receptors affected, the mitigation measures will prevent the potential for cumulative impacts in surface and groundwater flows and flood risk.</td></tr>
<tr><td>Coastal catchment</td><td>Minor adverse</td><td>N/A</td></tr>
<tr><td>River Bure</td><td>Minor adverse</td><td>N/A</td></tr>
<tr><td>Blackwater Drain</td><td>Minor adverse</td><td>N/A</td></tr>
<tr><td>Swannington Beck</td><td>Minor adverse</td><td>Minor adverse</td></tr>
<tr><td>River Wensum</td><td>Minor adverse</td><td>Minor adverse</td></tr>
<tr><td>River Tud</td><td>Minor adverse</td><td>N/A</td></tr>
<tr><td>River Yare</td><td>Minor adverse</td><td>Minor adverse</td></tr>
<tr><td>Intwood Stream</td><td>Minor adverse</td><td>Minor adverse</td></tr>
<tr><td>River Tas</td><td>Minor adverse</td><td>Minor adverse</td></tr>
<tr><td>North Norfolk Chalk</td><td>Minor adverse</td><td>N/A</td></tr>
</table>

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
Broadland Rivers Chalk and Crag	Minor adverse	N/A	
A47/A11 junction at Thickthorn			
Intwood Stream	Neutral	Minor adverse	This scheme is located over 2km from the cable corridor of SEP and DEP. Its purpose is to improve the Thickthorn Junction of the A47/A11 by creating an interchange link road between the A11 and the A47 to provide bi-directional free flowing interchange links. It is building on existing infrastructure and would therefore not be introducing impermeable ground to a catchment where it does not already exist (Highways England, 2021a) identifies pilings and foundations as having the potential to act as groundwater dams. However, it is considered that these are localised effects, and the distance between the two schemes and the shallow nature of the cable corridor for SEP and DEP means this is not likely to act cumulatively. In addition, both projects would implement mitigation measures (**Section 18.6.1.4.5**) which for the A47/A11 junction include monitoring of groundwater flows and the development and implementation of a drainage strategy, to be incorporated into the Construction Environmental Management Scheme, including the use of SuDS. Compensatory storage would also be provided where construction could lead to the loss of floodplain storage (Highways England, 2021a). These measures would prevent cumulative impacts from occurring where mitigation measures are implemented for both projects.
Norfolk Boreas Offshore Wind Farm / Norfolk Vanguard Offshore Wind Farm			
River Bure	Minor adverse: 0.01% of catchment affected and five temporary crossings	Minor adverse: 0.59% of catchment affected	Within the catchments in which both projects would construct infrastructure, particularly where the cable corridors cross in the Blackwater Drain catchment, there is potential for an increase in impermeable ground, reduced infiltration and changes to surface water flows to act cumulatively to alter surface and groundwater flows and increase flood risk. However, both projects will lead to a

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
Mermaid Stream	Minor adverse: 0.01% of catchment affected and no temporary crossings	Minor adverse: 0.20% of catchment affected	very small increase in the proportion of each catchment with impermeable ground which would remain of negligible impact when combined. In addition, both projects would implement mitigation measures (**Section 18.6.1.4.5**) including the implementation of construction drainage, including SuDS measures, which would maintain the greenfield runoff rate at the onshore substation, and ensuring that temporary culverts used in trenched crossings are adequately sized to avoid impounding flows (Vattenfall, 2019). These measures will ensure that there will be no cumulative impact greater than that of SEP and DEP alone.
River Wensum	Minor adverse: 0.01% of catchment affected and four temporary crossings	Minor adverse: 0.22% of catchment affected	
Blackwater Drain	Minor adverse: 0.03% of catchment affected and one temporary crossing.	Minor adverse: 0.22% of catchment affected	
A47 North Tuddenham to Easton			
River Tud	Slight adverse	Minor adverse	Although the potential for cumulative impacts to surface and groundwater flows exist due to the overlap of construction works in the River Tud catchment, both projects would implement mitigation measures (**Section 18.6.1.4.5**) These would include a temporary surface water drainage strategy which would be developed to ensure that there would be no increase in run-off and flood risk during the construction phase. SuDS would be implemented where appropriate (Highways England, 2021b). These measures would prevent the two projects from acting cumulatively to increase flood risk.

Receptor	Cumulative project residual impact	SEP and DEP residual impact	Cumulative Impact
New access road at the Food Enterprise Park, Honingham			
River Tud	N/A as no EIA carried out	Minor adverse	There is potential for both temporal and geographical overlap in construction, however SEP and DEP is unlikely to significantly alter surface or groundwater flows during construction due to the small surface area affected and the shallow nature of excavations. Therefore, it is considered that no cumulative impacts would occur in relation to surface and groundwater flows.
Norwich Western Link Road			
River Wensum	Minor adverse	Minor adverse	The northern sections of the Norwich Western Link Road will pass through Flood Zones 2 and 3 associated with the River Wensum. It would also require significant below-ground infrastructure due to the construction of the bridge foundations. Although there is potential for cumulative impacts, both projects will adhere to either a CEMP (Norwich Western Link Road), or an Outline Code of Construction Practice (SEP and DEP) and mitigation measures (**Section 18.6.1.4.5**) which would reduce the likelihood of any changes to surface or groundwater flows during construction or during operation. In addition, SEP and DEP would not lead to any trenched crossings in the Wensum catchment during construction and construction related changes to surface or groundwater flows will be managed through a Construction Surface Water and Drainage Plan, to be secured through the Code of Construction Practice.
River Tud	Minor adverse	Minor adverse	In the River Tud catchment, SEP and DEP construction related changes to surface water flows would be managed through the construction drainage plan included in the mitigation measures (**Section 18.6.1.4.5**). This project commits to developing a CEMP which would minimise construction-related impacts including to flood risk to ensure no increased risk of flooding would occur. Therefore, no cumulative impact to surface and groundwater flows during construction is expected.
Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham			

<table>
<tr><th>Receptor</th><th>Cumulative project residual impact</th><th>SEP and DEP residual impact</th><th>Cumulative Impact</th></tr>
<tr><td>River Tiffey</td><td>Only at EIA Scoping stage, therefore no definitive residual impact yet.</td><td>Minor adverse</td><td>If there is temporal overlap in construction between the two projects, up to 5.4% of the catchment will be exposed at one time which may have the potential to alter the surface flows and increase flood risk during construction. However, Environment Agency flood maps suggest that both the SEP and DEP DCO order limits within the River Tiffey catchment and the dwellings at Wymondham are at very low risk of surface water flooding from extreme rainfall. Risk from surface water flooding is also considered low and the use of SuDS and appropriate surface water runoff management and flow control measures will be included during construction to mitigate changes in runoff prior to discharge from the site. Therefore, no cumulative impacts are anticipated.</td></tr>
<tr><td colspan="4">Erection of 890 dwellings north and south of the Dereham Road, Easton</td></tr>
<tr><td>River Tud</td><td>Negligible</td><td>Minor adverse</td><td rowspan="2">Construction works associated with this large-scale housing development may lead to the release of sediment into the drainage network. There is potential for temporal overlap in construction as no construction date has been confirmed, although this project is taking place in phases over 10 years. It is located approximately 1.2km from the DCO order limits and does not directly disturb any watercourses. The associated environmental statement (Easton Landowner Consortium, 2014) contains extensive mitigation measures aimed at reducing impacts to surface and ground water flows and complying with construction good practice measures including SUDS. The impact is anticipated to be negligible and is not considered likely to lead to cumulative impacts with SEP and DEP.</td></tr>
<tr><td>River Yare</td><td>Negligible</td><td>Minor adverse</td></tr>
</table>

18.7.3.5 Cumulative Impact 1: Operation Phase – Supply of Contaminants

217. The following projects may also contribute an increased supply contaminants to surface water receptors potentially affected by SEP and DEP during operation:

- Hornsea Project Three – has potential to cause impacts in the same catchments as SEP and DEP;
- A47/A11 junction at Thickthorn – Intwood Stream;

218. No impacts to those receptors associated with the cable corridor due to a supply of contaminants during operation are anticipated as a result of the operation of SEP and DEP, therefore only those projects which may cause an increase in the supply of contaminants in the catchment of the Intwood Stream and River Tas which overlap with the substation area are considered for operational cumulative impacts.

219. Hornsea Project 3 considers that operational processes would have a minor adverse impact in the catchments of the River Tas and Intwood Stream which contain the substation for both Hornsea Project 3 and SEP and DEP, whereas SEP and DEP residual impacts would be negligible. Operational practices involve management plans including spill procedures, clean up and remediation of contaminated water runoff and water quality monitoring (if required) in order to mitigate against any decrease in water quality status (Ørsted, 2018).

220. The A47/A11 junction at Thickthorn is located in the catchment of the Intwood Stream. The scheme may lead to an increase in traffic volume and therefore an increased likelihood of spillages and contamination occurring. However, the implementation of SuDS incorporating suitable pollution prevention measures in both projects will help to prevent cumulative effects from occurring (Highways England, 2021a).

221. The Scoping Report for the proposed construction of 650 dwellings at Wymondham includes a commitment to install SuDS to mitigate against operational runoff of contaminated water and improve water quality prior to discharge from site. With these measures in place there are not considered to be any increase the supply of contaminants during operation within the catchment of the River Tiffey.

222. Norfolk Boreas Offshore Wind Farm, the A47 North Tuddenham to Easton works and erection of 650 dwellings at Wymondham are not considered to act cumulatively with SEP and DEP to increase the supply of contaminants during operation.

18.7.3.6 Cumulative Impact 2: Operation Phase – Changes to Surface Water Runoff and Flood Risk

223. It is considered that operational changes to surface and groundwater flows along the cable corridor due to permanent infrastructure would be so small, and so localised, that they will not act cumulatively with the projects that overlap, namely Hornsea Three, Norfolk Vanguard and Boreas and the three highways projects.

224. Cumulative impacts may occur in the catchments affected by the substation, the River Tas and the Intwood Stream. The projects that overlap within these catchments are Hornsea Three and the A47/A11 Junction at Thickthorn.

225. The proposed onshore substation for Hornsea Three is situated in the catchments of the River Tas and the Intwood Stream, along with the onshore substation for SEP and DEP. Hornsea Three is predicted to have a negligible impact on flood risk as the substation area is located in Flood Zone 1, and a commitment is made to mitigation measures that will ensure that there is no change from the baseline hydrological environment (Ørsted, 2018). SEP and DEP has also committed to ensuring greenfield runoff rates are maintained, therefore no overall increase in flood risk will occur.

226. The Environmental Statement for A47/A11 Junction at Thickthorn (Highways England, 2021a) states that operational impacts include an increase in impermeable area which could result in an increase in peak flow rates and volumes. However, appropriate mitigation by attenuation will be implemented to ensure that there is no increase in surface water run-off peak flow rate, including SuDS. Compensatory flood storage will also be included to mitigate the loss of floodplain storage. SEP and DEP will also aim to ensure that greenfield runoff rates from the onshore substation area remain unchanged through mitigation measures (**Section 18.6.2.2.5**), therefore cumulative impacts are unlikely to occur. In addition, the spatial separation between the two projects within the Intwood Stream catchment indicates that localised changes to groundwater flow and small changes to flood risk or surface water flows would not act cumulatively across the catchment.

18.8 Inter-relationships

227. Water receptors (including surface waters and groundwater) are intrinsically linked to:

- Ground conditions, which influence the quality of groundwater, how it moves through subsurface strata, and how it interacts with surface waters.
- Ecology, which is to some extent controlled by the availability of habitat niches, and therefore the hydrology, geomorphology and chemical quality of surface waters and the distribution and quality of groundwater.

228. A summary of the potential inter-relationships between water resources, ground conditions and terrestrial ecology is provided in **Table 18-38**.

Table 18-38: Surface Water and Flood Risk Inter-Relationships

Impact / receptor	Related chapter	Where addressed in this chapter	Rationale
Construction			
Impact 1: Direct disturbance of surface water bodies **Impact 2**: Increased sediment supply **Impact 3**: Supply of contaminants **Impact 4**: Changes to surface water runoff and flood risk	**Chapter 17 Ground Conditions and Contamination**	**Sections 18.6.1.2.5** and **18.6.1.4**	Potential changes to ground conditions (including chemical quality and physical properties such as transmissivity) during construction could affect the quality and quantity of groundwater and hydrologically-connected surface water receptors (particularly chalk rivers)
Impact 1: Direct disturbance of surface water bodies	**Chapter 20 Onshore Ecology**	**Sections 18.6.1.1**, **18.6.1.2**, **18.6.1.2.5** and **18.6.1.4**	Potential changes to the hydrology, geomorphology and water quality of the River Wensum SAC and SSSI during construction could impact upon water-dependent biological communities (including the designated interest features)
Operation			
Impact 1: Supply of contaminants	**Chapter 17 Ground Conditions and Contamination**	**Sections 18.6.2.1** and **18.6.2.2**	Impacts on the quality and quantity of groundwater Potential changes to ground conditions (including chemical quality and transmissivity) during operation could affect the quality and quantity of groundwater and hydrologically-connected surface water receptors (particularly chalk rivers)
Impact 2: Changes to surface water runoff and flood risk	**Chapter 20 Onshore Ecology**	**Sections 18.6.2.1** and **18.6.2.2**	Impacts on water-dependent habitats and designated sites Potential changes to the hydrology, geomorphology and water quality of the River Wensum SAC and SSSI could impact upon

Impact / receptor	Related chapter	Where addressed in this chapter	Rationale
			water-dependent biological communities (including the designated interest features)
Decommissioning			
Impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.			

18.9 Interactions

229. The impacts identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between impacts are presented in **Table 18-39**. This provides a screening tool for which impacts have the potential to interact. **Table 18-40** provides an assessment for each receptor (or receptor group) as related to these impacts. This assessment uses the worst-case scenario for each impact as stated in the Impact Significance sections in **Section 18.6**.

230. Within **Table 18-40** the impacts are assessed relative to each development phase (Phase assessment, i.e. construction, operation or decommissioning) to see if (for example) multiple construction impacts affecting the same receptor could increase the level of impact upon that receptor. Following this, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across all development phases.

231. The significance of each individual impact is determined by the sensitivity of the receptor and the magnitude of effect; the sensitivity is constant whereas the magnitude may differ. Therefore, when considering the potential for impacts to be additive it is the magnitude of effect which is important – the magnitudes of the different effects are combined upon the same sensitivity receptor.

Table 18-39: Interaction between Impacts - Screening

Potential Interaction between Impacts				
Construction				
	Impact 1: Direct disturbance of surface water bodies	**Impact 2**: Increased sediment supply	**Impact 3**: Supply of contaminants	**Impact 4**: Changes to surface water runoff and flood risk
Impact 1: Direct disturbance of surface water bodies	-	Yes	Yes	Yes

Potential Interaction between Impacts				
Impact 2: Increased sediment supply	Yes	-	Yes	Yes
Impact 3: Supply of contaminants	Yes	Yes	-	No
Impact 4: Changes to surface water runoff and flood risk	Yes	Yes	No	-
Operation				
	Impact 1: Supply of contaminants		Impact 2: Changes to surface water runoff and flood risk	
Impact 1: Supply of contaminants	-		No	
Impact 2: Changes to surface water runoff and flood risk	No		-	

Table 18-40: Interaction between Impacts – Phase and Lifetime Assessment

Receptor	Highest significance level				
	Construction	Operation	Decommissioning	Phase assessment	Lifetime assessment
Surface watercourses	Moderate adverse	Minor adverse	Moderate adverse	**No greater than individually assessed impact** The proposed mitigation will minimise the potential for the direct disturbance of watercourses, the direct (from in-channel works) and indirect (from activities in the vicinity of the channel) supply of fine sediment and contaminants, and changes to surface hydrology and flow patterns during the construction phase. There would be no direct disturbance during operation, and further measures would be in place to prevent the supply of contaminants or changes to flow patterns during operation. It is therefore considered that there would be no pathway for interaction to exacerbate the potential impacts associated with these activities during or between any of the project phases.	**No greater than individually assessed impact** The greatest magnitude of effect would occur during the construction of trenched watercourse crossings. Once this disturbance impact has ceased all further impact during construction and operation will be small scale, highly localised and episodic. It is therefore considered that over the project lifetime these impacts would not combine to increase the significance level of any impacts identified in this assessment.
Groundwater	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact** The proposed mitigation will minimise the potential for the introduction of contaminants to groundwater during	**No greater than individually assessed impact** The greatest magnitude of effect will occur as a result of subsurface excavations during the construction

	Highest significance level				
				construction. The inert nature of the cables will prevent contamination during operation. Furthermore, the small scale and relative shallowness of the permanent infrastructure means that impacts on groundwater flows during operation are minimal. It is therefore considered that there would therefore be no pathway for interaction to exacerbate the potential impacts associated with these activities during or between any of the project phases.	phase. Once this disturbance impact has ceased, any further impact would be small scale, highly localised and episodic. It is therefore considered that over the project lifetime these impacts would not combine to increase the significance level of any impacts identified in this assessment.

18.10 Assessment Summary

232. This chapter has provided a characterisation of the existing environment for surface water and flood risk based on both existing data (e.g. national flood risk and WFD classification datasets) and site-specific survey data (e.g. a geomorphological walkover survey).

233. The assessment has established that surface and groundwater receptors could be affected as a result of direct disturbance, the supply of fine sediment and contaminants, and changes to flow patterns during the construction and decommissioning phases. The residual impacts on all receptors during these phases would be negligible or minor adverse.

234. The assessment has also established that surface and groundwater receptors could be affected by the supply of contaminants and changes to flow patterns during the operational phase. However, given the passive or sporadic nature of operational activities, the resulting residual impacts will be negligible or minor adverse.

235. A summary of the results of this assessment is provided in (**Table 18-41**). This summarises the worst-case scenario for all receptors and impacts, as determined in **Section 18.6**. In all cases this relates to SEP and DEP whether this is the concurrent or sequential scenario.

Table 18-41: Summary of Potential Impacts on Water Resources and Flood Risk (SEP and DEP (worst-case))

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
Construction						
Impact 1: direct disturbance of surface water bodies	Surface water bodies (various)	Low - High	No impact - Medium	**No impact – Moderate adverse**	• HDD techniques used to cross all Main Rivers • HDD used to cross floodplain meadow channels within 200m of channel (where applicable) • If temporary dams are used, the amount of time that they are in place would be minimised; • Prior to dewatering between temporary dams, a fish rescue would take place; • Flumes or pumps would be adequately sized to ensure flows downstream are maintained; • Scour protection would be used downstream of flumes or pumps to protect river bed downstream. • Cable ducts would be installed two metres below the bed of water body to avoid exposure during high flows; and • Vegetation will not be removed from banks unless necessary to undertake works.	**No impact - Minor adverse**
Impact 2: Increased sediment supply	Surface water bodies (various)	Low - High	Negligible - Low	**Negligible - Moderate adverse**	• Limiting work along the onshore cable corridor to short sections at any one time; • Strip topsoil from the entire width of the onshore cable corridor for each section then store and cap to minimise erosion from wind and rain; • Re-distribute topsoil over the work front area once trenching complete and back-filled; • Temporary works areas would comprise permeable hard-standing material; • A CMS would be developed adhering to construction industry good practice measures including minimising subsoil exposure, on-site retention of sediment, intercepting sediment runoff at source in the drainage system using suitable filters and cleaning wheels of construction vehicles leaving the site.	**No impact - Minor adverse**
Impact 3: Supply of contaminants	Surface and ground water bodies (various)	Low - High	Low - Negligible	**Negligible – Moderate adverse**	• Specific measures will be included in the CMS including: • Concrete and cement mixing and washing areas would be situated at least 10m away from water bodies; • All washing out of equipment would be carried out in contained areas and water would be collected for disposal off-site; • Fuels, oils, lubricants and other chemicals would all be stored in impermeable bunds with at least 110% of the stored capacity; • Any damaged containers would be removed from site; • All refuelling would take place in a dedicated impermeable area using a bunded bowser, located at least 10m from water bodies; • Spill kits, sand bags and stop logs would be available on site at all times; • Foul drainage would be collected through mains connection to an existing mains sewer or collected in a septic tank within the boundary of the development for disposal at a licensed facility.	**No impact – Minor adverse**

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
					• Buffer strips to be retained adjacent to water bodies where possible to intercept contaminated runoff.	
Impact 4: Changes to surface water runoff and flood risk	Surface and ground water bodies (various)	Low - High	Negligible - Low	**Negligible - Minor adverse**	• Changes in surface water runoff from the increase in impermeable area would be attenuated and discharged at a controlled rate equivalent to the greenfield runoff rate, in consultation with the LLFA and Environment Agency; • Drainage channels would be created during construction to intercept water from the cable trench to control the release of surface waters from onshore development activities; • A SWDP would be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land; and • If water enters the trenches during installation from surface runoff or groundwater seepage, this will be pumped via settling tanks, sediment basins or mobile treatment facilities before being discharged into local ditches or drains.	**No impact – Minor adverse**
Operation						
Impact 1: Supply of Contaminants	Surface and ground water bodies (various)	Low - High	Negligible - Low	**Negligible - Minor adverse**	• A drainage strategy will be developed according to the principles of SuDS discharge hierarchy, this will include hydrocarbon interceptors to prevent the supply of contaminants (including oils and fine sediment); • At the onshore substation, all fuels, oils, lubricants and other chemicals will be stored in an impermeable bund with at least 110% capacity; • Damaged containers will be removed from site; • Refuelling will take place in a dedicated impermeable area, using a bunded bowser, located at least 10m from all water bodies; and • Spill kits, sand bags and stop logs will be available on site at all times in case of an emergency.	**No impact – Minor adverse**
Impact 2: Changes to surface water runoff and flood risk	Surface and ground water bodies (various)	Low - High	Negligible - Low	**Negligible – Minor adverse**	• Post construction surface water drainage requirements will be presented in the final SWDP and will meet the requirements of the National Planning Policy Framework (NPPF) and National Policy Statement (NPS) EN-5; • Runoff will be limited, where feasible, through the use of infiltration techniques which can be accommodated within the DCO order limits; • The drainage strategy will be developed according to the principles of the SuDS discharge hierarchy; • Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable: i) into the ground (infiltration); ii) to a surface water body; iii) to a surface water sewer, highway drain or another drainage system; or iv) to a combined sewer.	**No impact – Minor adverse**
Decommissioning						
No decision has yet been made regarding the final decommissioning policies for either SEP or DEP as it is recognised that industry best practice, rules and legislation change over time. The detail and scope of decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator with decommissioning plan provided.						

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
However, it is considered likely that the proposed onshore substation would be removed and will be reused or recycled and that the onshore cables would also be removed and recycled, with the transition bays and cable ducts (where used) left in situ. For the purposes of a worst-case scenario, it is considered that impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.						

References

Broadland District Council and North Norfolk District Council (2017) Strategic Flood Risk Assessment [online] Available at: [redacted] Accessed 01/10/2020
Construction Industry Research and Information Association (CIRIA)'s (2001) Control of water pollution from construction sites: Guidance for consultants and contractors (C532)
Department of Energy and Climate Change (2011a) Overarching NPS for Energy (EN-1) [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf . Accessed 30/09/2020.
Department of Energy and Climate Change (2011b) NPS for Renewable Energy Infrastructure (EN-3) [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf . Accessed 30/09/2020.
Department of Energy and Climate Change (2011c) NPS for Electricity Networks Infrastructure (EN-5) [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47858/1942-national-policy-statement-electricity-networks.pdf. Accessed 30/09/2020.
Easton Landowner Consortium Joint Venture LLP (2014) Easton Village Growth Location Environmental Statement [online] Available at: [redacted] . Accessed 10/08/222
Environment Agency (2004) Pollution Prevention Guidelines: Safe storage and disposal of used oils: PPG8. [online] Available: https://webarchive.nationalarchives.gov.uk/20140328095348/http://cdn.environment-agency.gov.uk/pmho0304bhxb-e-e.pdf. Accessed 12/10/2020
Environment Agency (2007) Pollution Prevention Guidelines: Works and Maintenance in or Near Water: PPG5. [online] Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485199/pmho1107bnkg-e-e.pdf. Accessed 12/10/2020
Environment Agency (2009) Pollution Prevention Guidelines: Incident Response Planning: PPG21. [online] Available:

https://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx. Accessed 12/10/2020
Environment Agency (2013) Pollution Prevention Guidelines: PPG1 Understanding Your Environmental Responsibilities – Good Environmental Practices [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485211/LIT_1404.pdf. Accessed 12/10/2020
Environment Agency (2015). Anglian river basin district River basin management plan [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718327/Anglian_RBD_Part_1_river_basin_management_plan.pdf. Accessed 01/10/2020
Environment Agency Flood Map for Planning [online] Available at: https://flood-map-for-planning.service.gov.uk/ Accessed
European Commission (EC) (2000). The Water Framework Directive (WFD) (Council Directive 2000/60/EC).
EPS (2018) Phase I & II Geo-Environmental Assessment Station Road Swannington. [online] Available at: https://secure.broadland.gov.uk/MVM.DMS/Planning%20Application/735000/735340/20181400%20Phase%20I%20and%20II%20GeoEnvironmental%20Assessment.pdf. Accessed 08/11/2020
Flood and Water Management Act (2010) C29. [online] Available at: https://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf. Accessed 01/10/2020
Greater Norwich Development Partnership (2014) Joint Core Strategy for Broadland, Norwich and South Norfolk. [online] Available at: https://www.south-norfolk.gov.uk/sites/default/files/JCS_Adopted_Version_Jan_2014.pdf. Accessed 02/10/220
Highways England (2021a) A47/A11 Thickthorn Junction EIA Environmental Statement. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47-a11-thickthorn-junction/?ipcsection=docs&stage=app&filter1=Environmental+Statement (Accessed 08/06/2022)
Highways England (2021b) A47 North Tuddenham to Easton Environmental Statement – Chapter 13 – Road Drainage and the Water Environment. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010038/TR010038-000143-

6.1%20Chapter%2013%20Road%20Drainage%20and%20Water%20Environment.pdf. Accessed 10/08/2022

Ørsted (2018) Hornsea Project Three Environmental Statement – Hydrology and Flood Risk. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000544-HOW03_6.3.2_Volume%203%20-%20Ch%202%20-%20Hydrology%20and%20Flood%20Risk.pdf. Accessed 09/11/2020

Ørsted (2018) Hornsea Project Three Outline Code of Construction Practice. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000649-HOW03_8.5_Outline%20Code%20of%20Construction%20Practice.pdf. Accessed 09/11/2020

Ministry of Housing, Communities and Local Government, 2019. National Planning Policy Framework [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf. Accessed 01/10/2020

Ministry of Housing, Communities and Local Government, 2014. Guidance – Flood risk and coastal change [online] Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change. Accessed 01/10/2020.

Natural England (undated) Designated Sites View. River Wensum SSSI Citation.

Norfolk County Council (2011) Preliminary Flood Risk Assessment Report [online] Available at: https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management-policies/local-flood-risk-management-strategy. Accessed 01/10/2020.

Norfolk County Council (2015) Norfolk Local Flood Risk Management Strategy [online] Available at: https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management-policies/local-flood-risk-management-strategy. Accessed 02/10/2020.

Norfolk County Council (2021) Norwich Western Link Road Environmental Impact Report [online] Available at: https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/norwich/norwich-western-link/timeline. Accessed 08/06/2022

North Norfolk District Council (2012) North Norfolk Local Development Framework Core Strategy Incorporating Development Control Policies. [online] Available at: https://www.north-norfolk.gov.uk/media/1370/3-_core_strategy_-incorporating_development_control_policies-_adopted_2008_-updated_2012.pdf#page=2. Accessed 02/10/2020

Norwich City Council, South Norfolk District Council (2017) Greater Norwich Area Strategic Flood Risk Assessment. [online] Available at: [redacted] Accessed 01/10/2020.
PINS (2018). Planning Inspectorate Advice Note Nine: Rochdale Envelope.
Standards for Highways (2020) Design Manual for Roads and Bridges. [online] Available at: [redacted] Accessed 02/10/2020.
The Water Framework Directive (Standards and Classification) Directions (England and Wales (2015).
Vattenfall (2019) Environmental Statement Volume 1 Chapter 20, Water Resources and Flood Risk. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000406-6.1.20%20Environmental%20Statement%20Chapter%2020%20Water%20Resources%20and%20Flood%20Risk.pdf. Accessed 09/11/2020
Water Environment (Water Framework Directive) (England and Wales) Regulations (2017).