



# Hornsea Project Four: Additional Application Information

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## **Volume F2.6: Outline Onshore Infrastructure Drainage Strategy**

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## Glossary

Term	Definition
Attenuation feature	Area within which SuDS measures are to be adopted to facilitate attenuation and/ or storage of surface water drainage. Measures can be, but are not limited to, the use of filter drains, swales, attenuation and flow control structures.
Code of Construction Practice (CoCP)	A document detailing the overarching principles of construction, contractor protocols, construction-related environmental management measures, pollution prevention measures, the selection of appropriate construction techniques and monitoring processes.
Commitment	<p>A term used interchangeably with mitigation and enhancement measures. The purpose of Commitments is to reduce and/or eliminate Likely Significant Effects (LSEs), in EIA terms.</p> <p>Primary (Design) or Tertiary (Inherent) are both embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, Preliminary Environmental Information Report (PEIR) or ES).</p> <p>Secondary commitments are incorporated to reduce LSE to environmentally acceptable levels following initial assessment i.e. so that residual effects are acceptable.</p>
Connection Works	Defined as Work No. 6 to 10 of the DCO (and any related further associated development in connection with those works. These works numbers relate to the construction of the onshore export cable corridor, the onshore substation and associated temporary and permanent access tracks and temporary logistics compounds.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Energy balancing infrastructure (EBI)	The onshore substation includes energy balancing Infrastructure. These provide valuable services to the electrical grid, such as storing energy to meet periods of peak demand and improving overall reliability.
Export cable corridor (ECC)	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Project Four array area to the Creyke Beck National Grid substation, within which the export cables will be located.
Local Authority	<p>The Local Authority is a body empowered by law to exercise various statutory functions for a particular area of the United Kingdom. This includes County Councils, District Councils and the Broads Authority, as set out in Section 43 of the Planning Act 2008.</p> <p>East Riding of Yorkshire Council (ERYC) is the Local Authority for the entirety of the onshore project footprint.</p>
National Grid Electricity	The grid connection location for Hornsea Four at Creyke Beck.

Term	Definition
Transmission (NGET) substation	
Onshore substation (OnSS)	Comprises a compound containing the electrical components for transforming the power supplied from Hornsea Project Four to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid. If a HVDC system is used the OnSS will also house equipment to convert the power from HVDC to HVAC.
Order Limits	The limits within which Hornsea Project Four (the 'authorised project') may be carried out.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).
Planning Inspectorate (PINS)	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
Relevant Planning Authority	<p>The Relevant Planning Authority is the Local Authority (ERYC for the entirety of onshore elements of Hornsea Four) in respect of an area within which a project is situated, as set out in Section 173 of the Planning Act 2008. The Relevant Planning Authority is the body empowered by law to exercise statutory town planning functions for a particular area of the United Kingdom.</p> <p>Relevant Planning Authorities may have responsibility for discharging requirements and some functions pursuant to the Development Consent Order, once made.</p>
Sustainable Drainage Systems	Sustainable Drainage Systems (SuDs) include a selection of water management practices that aim to mimic modern drainage systems with natural processes as closely as possible.
Trenchless Techniques	<p>Also referred to as trenchless crossing techniques or trenchless methods. These techniques include Horizontal Directional Drilling (HDD), thrust boring, auger boring, and pipe ramming, which allow ducts to be installed under an obstruction without breaking open the ground and digging a trench.</p>

## Acronyms

Acronym	Definition
BRE	Building Research Establishment
CIRIA	Construction Industry Research and Information Association
DCO	Development Consent Order
ECC	Export Cable Corridor
EBI	Energy Balancing Infrastructure
ERY	East Riding of Yorkshire
ERYC	East Riding Of Yorkshire Council
FRA	Flood Risk Assessment
FWEP	Flood Warning Evacuation Plan
HDD	Horizontal Directional Drilling
IDB	Internal Drainage Board (Beverley and North Holderness)
LLFA	Lead Local Flood Authority (ERYC)
NGET	National Grid Electricity Transmission
OnSS	Onshore substation
PEIR	Preliminary Environmental Information Report
PPG	Pollution Prevention Guidelines
PPP	Pollution Prevention Plan
SuDS	Sustainable Drainage Systems

## Units

Unit	Definition
km	kilometre
kV	kilovolt
l/s	litres per second
m	metre
mm	millimetre

## 1 Introduction

### 1.1 Project Background

1.1.1.1 Orsted Hornsea Project Four Limited (the 'Applicant') is proposing to develop Hornsea Project Four offshore wind farm (hereafter 'Hornsea Four'). Hornsea Four will be located approximately 69 km offshore the East Riding of Yorkshire in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone. Hornsea Four will include both offshore and onshore infrastructure including offshore generating stations (wind turbines), export cables to landfall, and on to an onshore substation (OnSS) with energy balancing infrastructure (EBI) and connection to the electricity transmission network.

1.1.1.2 This outline Onshore Infrastructure Drainage Strategy (hereafter the 'outline Drainage Strategy') relates to the onshore construction ([Section 2](#)) and operation ([Section 3](#)), and decommissioning ([Section 4](#)) of Hornsea Four landward of Mean High-Water Springs.

1.1.1.3 Details of the activities and infrastructure associated with Hornsea Four are fully set out in [Volume A1, Chapter 4: Project Description](#). In summary, the onshore elements of Hornsea Four will comprise of:

- **Landfall** – including transition joint bays connecting the offshore export cable corridor (ECC) and onshore ECC, one temporary landfall compound and temporary access tracks;
- **Onshore ECC** - including the onshore export cables, eight temporary logistics compounds, joint bays and link boxes, and temporary access tracks;
- **OnSS and EBI** – including the temporary working area, temporary and permanent access tracks, the permanent working area (inclusive of the OnSS, EBI and associated landscaping and attenuation feature); and
- **400 kV National Grid Electricity Transmission (NGET) connection area** – the area within which a 400 kV section of the onshore ECC will connect to the existing NGET substation at Creyke Beck.

1.1.1.4 This outline Drainage Strategy also further details the mitigation and management measures provided in [Volume A6, Annex 2.2: Onshore Infrastructure Flood Risk Assessment](#), [Volume A6, Annex 2.3: Water Framework Directive](#), and [Volume A3, Chapter 2: Hydrology and Flood Risk](#). All watercourses which have been identified to date and proposed to be crossed by Hornsea Four are shown in [Volume A4, Annex 4.2: Onshore Crossing Schedule](#).

### 1.2 Structure

1.2.1.1 This outline Drainage Strategy adheres to the following structure:

- [Section 2](#) – Pre-construction and construction drainage;
- [Section 3](#) – Operational drainage; and
- [Section 4](#) – Decommissioning drainage.

### 1.3 Purpose of the outline Drainage Strategy

- 1.3.1.1 Developments such as Hornsea Four can potentially affect drainage and run-off characteristics, for example where there may be permanent above ground infrastructure. As such the objective of this outline Drainage Strategy is to ensure that the ground and surface water characteristics within all onshore elements of Hornsea Four are maintained, and where possible enhanced.
- 1.3.1.2 This outline Drainage Strategy provides the high-level principles to be used during the construction, operation and decommissioning of all onshore elements of Hornsea Four (as defined in [Paragraph 1.1.1.2](#)), including reference to relevant guidelines and codes of practice relating to site drainage.
- 1.3.1.3 This outline drainage strategy will form the basis for the detailed Drainage Schemes (see [Figure 1](#)), which will be prepared and submitted for approval to the lead local flood authority (LLFA), by the Principal Contractor prior to the commencement of construction and/or operation of Hornsea Four, in consultation with the relevant sewerage and drainage authorities and the Environment Agency. This document is secured via Requirement 13 'Surface and foul water drainage' and Requirement 15 'Surface water' (relating to the OnSS only, see [Section 2.2](#), [Section 3.2](#), [Section 3.2.3](#), [Section 3.2.4](#) and [Section 4](#)) of the draft Development Consent Order (DCO) ([Volume C1, Chapter 1: Draft DCO including Draft DML](#)) which states:

**13. –(1)** No stage of the connection works shall be commenced until written details of the surface and (if any) foul water drainage system (including means of pollution control) (which must accord with the outline onshore infrastructure drainage strategy) for the construction of that stage of the connection works have, after consultation with the relevant sewerage and drainage authorities and the Environment Agency, been submitted to and approved in writing by the lead local flood authority.

**(2)** No stage of the connection works shall commence operation until written details of the surface and (if any) foul water drainage system (including means of pollution control) for that stage of the connection works have, after consultation with the relevant sewerage and drainage authorities and the Environment Agency, been submitted to and approved in writing by the lead local flood authority.

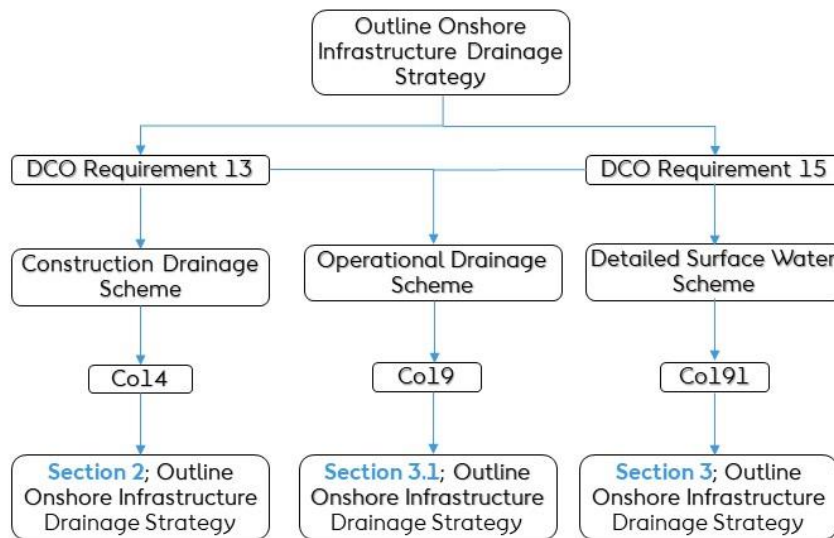
**(3)** The surface and foul water drainage system must be constructed and maintained in accordance with the approved details.

**15. - (1)** No stage of the connection works in Work No. 7 shall commence until, in respect of that installation, a detailed surface water scheme has been prepared in consultation with the relevant sewerage and drainage authorities and Environment Agency and submitted to and approved in writing by the lead local flood authority.

**(2)** The detailed surface water schemes must accord with the outline onshore infrastructure drainage strategy and –  
a) be based on sustainable drainage principles;

- b) an assessment of the hydrological and hydrogeological context of the connection works in Work No. 7; and
- c) include detailed designs of a surface water drainage scheme.

**(3)** Construction of the connection works in Work No. 7 must be carried out in accordance with the approved scheme.



**Figure 1: Discharge of the Onshore Infrastructure Drainage Strategy.**

1.3.1.4 Hornsea Four will adopt a staged approach to the approval of DCO requirements enabling requirements to be approved in part or in whole, prior to the commencement of the relevant stage of works according to whether a staged approach is to be taken to construction of the works in question. This approach will be governed by the inclusion of Requirement 27 within the draft DCO which requires a written scheme setting out the stages of construction to be approved prior to the commencement of the authorised development. The Construction Staging Scheme must be approved by the relevant Planning Authority in respect of the onshore connection works and by the MMO in relation to authorised works seaward of MHWS.

1.3.1.5 The Construction Staging Scheme will detail the stages of construction and the timing of approval of relevant DCO requirements with respect to the relevant construction stages identified within the scheme.

(1) The authorised development may not be commenced until a written scheme setting out the stages of construction of the authorised development has been submitted to and approved by the relevant planning authority, in relation to the connection works, or the MMO, in relation to works seaward of MHWS.

(2) The stages of construction referred to in sub-paragraph (1) shall not permit the authorised development to be constructed in more than one overall phase.



(3) The scheme must be implemented as approved.

1.3.1.6 Hornsea Four has developed a range of commitments to eliminate or reduce the impacts and effects as far as possible, and where practicable enhance the local environment. All commitments identified for Hornsea Four to date are detailed within the Commitments Register (see [Volume A4, Annex 5.2: Commitments Register](#)) and are summarised within the relevant topic specific chapters of the ES. The Commitments Register includes the following commitments secured via the outline Drainage Strategy ([Table 1](#)):

**Table 1: Hornsea Four commitments relevant to this outline Drainage Strategy.**

Commitment ID	Type	Hornsea Four Commitment	How the measure will be secured
Co14	Tertiary	A Construction Drainage Scheme will be developed for the temporary onshore construction works in accordance with the Outline Onshore Infrastructure Drainage Strategy. The Construction Drainage Scheme will ensure that existing land drainage is maintained during construction and will identify specific drainage measures for each area of land based on information identified and recorded by a Land Drainage Consultant prior to construction. The Construction Drainage Scheme will be developed in consultation with landowners, the Lead Local Flood Authority (ERYC), the Environment Agency and relevant Internal Drainage Board.	DCO Requirement 13 (Surface and foul water drainage)
Co19	Tertiary	An Onshore Infrastructure Drainage Strategy will be developed for the permanent onshore operational development in accordance with the Outline Onshore Infrastructure Drainage Strategy. The Onshore Infrastructure Drainage Strategy will include measures to ensure that existing land drainage is reinstated and/or maintained. This will include measures to limit discharge rates and attenuate flows to maintain greenfield run-off rates at the Onshore Substation. The Onshore Infrastructure Drainage Strategy will be developed in line with the latest relevant drainage guidance notes in consultation with the Environment Agency, Lead Local Flood Authority and relevant Internal Drainage Board as appropriate.	DCO Requirement 13 (Surface and foul water drainage) and DCO Requirement 15 (Surface water)
Co191	Secondary	The drainage design at the onshore substation will include Sustainable Drainage System (SuDS) measures including filter drains, swales, attenuation and flow control structures for the operational drainage of the Onshore Substation. Surface water will be discharged from the site at a controlled rate which will be determined during the detailed design stage. Appropriate consideration will be given to maintaining the existing floodplain	DCO Requirement 15 (Surface Water)

Commitment ID	Type	Hornsea Four Commitment	How the measure will be secured
		capacity and / or flow conveyance during extreme rainfall events. These principles are provided in the Outline Onshore Infrastructure Drainage Strategy with which the Onshore Infrastructure Drainage Strategy will be developed.	

## 2 Pre-construction and construction drainage

### 2.1 Landfall and onshore ECC

- 2.1.1.1 Hornsea Four has committed to using trenchless technology such as Horizontal Directional Drilling (HDD) to cross all Environment Agency Main Rivers and IDB maintained drains (Co1) in order to avoid and/or limit effects associated with crossing these major watercourses. Further details on specific crossings can be found in [Volume A4, Annex 4.2: Onshore Crossing Schedule](#). The HDD entry and exit pits will be located a minimum of 20 m from Environment Agency Main Rivers, and 9 m away from IDB maintained drains and Ordinary Watercourses (Co18). The onshore ECC will be installed at least 1.2 m beneath the hard bed of any watercourse being crossed by HDD in order to avoid and minimise any associated flood risk (Co18). The optimal clearance depth will be agreed with relevant authorities (e.g. Environment Agency and IDB), where appropriate, prior to construction (Co18).
- 2.1.1.2 Prior to construction a Construction Drainage Scheme will be developed to facilitate the temporary construction works (Co14). Hornsea Four has coordinated detailed drainage surveys to establish the existing land drainage baseline environment, prior to submitting an application for development consent. A suitably qualified drainage expert with experience of working in the local area has been enlisted to carry out the baseline surveys, and to consult with landowners and occupiers (Co14) in order to understand the drainage environment of Hornsea Four. This is to ensure that local, site-specific and landowner knowledge is effectively captured.
- 2.1.1.3 The baseline surveys undertaken to date identify additional information, for example on Ordinary Watercourses and land drains (including agricultural ditches), to be intercepted by the onshore ECC (and OnSS, see [Section 2.2](#)). These baseline surveys will form the basis of the Construction Drainage Scheme which will allow drainage to be maintained during construction. They will also inform any further post-construction (i.e. operational, [Section 3.1](#)) detailed drainage designs which may be required. Any post-construction (operational) drainage identified will also be developed in consultation with landowners, occupiers, the Environment Agency, LLFA and IDB, as appropriate. As such, care will be taken to ensure that land drainage is not compromised for the duration of the construction of Hornsea Four. For details on the operational drainage refer to [Section 3.1](#).
- 2.1.1.4 Where the onshore ECC crosses land drains and minor ditches during cable installation, existing field drainage may be severed. In these locations, it will be necessary to ensure

that flow is maintained and that there is no increase in flood risk as a result of the temporary works. The methodology to be used for any temporary construction at crossing points over existing ditches and watercourses shall be agreed with the Environment Agency, LLFA and / or Internal Drainage Board, and in consultation with landowners, where necessary.

- 2.1.1.5 Where land drainage may be intercepted the pre-construction drainage will be installed at the edge(s) of the export cable corridor to match the existing field drainage. This temporary drainage will intercept existing field drains and ditches in order to ensure that the integrity of the existing land drainage are maintained during construction. This is to ensure there is no increase in flood risk to on and off-site receptors during and after construction, and to ensure existing flow is not channelled by the onshore ECC. All temporary drainage will pass through a silt interceptor before being discharged back into any watercourses at a controlled rate equivalent to the greenfield run-off rate. Temporary attenuation / storage will be provided, where necessary. This drainage will also assist in reducing the potential for wet areas to form during construction, thereby reducing the impact on soil structure and fertility. Drainage systems, however, will not be installed into areas where they are not already present.

## 2.2 OnSS

- 2.2.1.1 A construction drainage system will be implemented at the beginning of the construction phase. Any baseline land drainage surveys relevant to the site and undertaken to date will be used to inform this construction drainage design (Co14). This will cover the drainage requirements for both the temporary and permanent working areas for the OnSS (and the onshore ECC, see [Section 2.1](#)). It will ensure that any land drainage is maintained and that any drainage rates will be restricted to greenfield run-off rates (Co19). Where practicable, opportunities will be taken to reduce the run-off rate. This will be used alongside the most up to date pollution prevention guidance available at the time (Co4).

## 2.3 Flood Warning and Evacuation Plan

- 2.3.1.1 A flood warning and evacuation plan (FWEP) is a list of steps to be taken in case of a flood. However, it can also include steps such as taking out the relevant insurance or using recommended flood mitigation products.
- 2.3.1.2 Specific FWEPs should be produced for the construction phase of the landfall, onshore ECC and OnSS, specifically related to construction works at watercourse crossing locations where personnel or materials may be located, albeit temporarily, within Flood Zones 2 and 3.

- 2.3.1.3 All personnel using the access tracks should be made aware of those access tracks which are located within Flood Zones 2 and 3, including the temporary and permanent access track to the OnSS. Any flood warnings issued for those areas should result in the relevant access tracks being cleared of all project personnel and, where possible, all project plant / materials.
- 2.3.1.4 A site-specific FWEP should include practical steps for protecting the project, be easy to communicate, and consider delegated responsibility or whether personnel are likely to require additional support during a flood event.
- 2.3.1.5 The Environment Agency has produced guidance for 'Preparing Businesses for Flooding' (Environment Agency 2015). It provides check lists and supporting guidance for preparing for a flood event. Whilst the project is not of the same scale as those considered within these documents, it is anticipated that the project will require a comprehensive Flood Warning and Evacuation Plan including elements of this guidance which should form the foundation of any flood plan considerations. The following aspects need to be considered:
- A list of important contacts, including Floodline, utilities companies and insurance providers;
  - A description or map showing locations of service shut-off points;
  - Basic strategies for protecting property, including moving assets to safety (where possible), turning off / isolating services and moving to safety;
  - Safe access and egress routes;
  - Where available, incorporation of Environment Agency flood alerts (e.g. 'How to plan ahead for flooding'(Environment Agency 2020); and
  - Where flood alerts and warnings are not available and issued, independent checks e.g. weather and tides should be considered.
- 2.3.1.6 During construction, contractors and management should sign up to receive Environment Agency flood alerts and engage with the LLFA so they are aware of any forecast related to heavy rainfall events. A flood alert may be issued when 'flooding is possible' and when 'flooding is expected.' In cases where flood alerts and warnings may not be in place prior to the onset of flooding, an independent method for reviewing weather and tides will be considered, with an understanding that some working areas may be at risk from failure of defences (e.g. a breach). Contractors and management can then consider how this information will affect planned works, and a flood warning can then be issued when and where necessary to allow work to stop. In particular in areas in close proximity to key watercourses. The site would be cleared of all personnel in these instances.

## **3** Operational drainage

### **3.1** Landfall and onshore ECC

- 3.1.1.1 The baseline land drainage surveys conducted prior to construction will identify all construction and operational drainage requirements for the landfall and onshore ECC (Co14). Any field drainage ditches and drainage outfalls intercepted during the

construction and installation of the onshore ECC will either be reinstated following the completion of the construction the landfall and onshore ECC (Co157) or diverted into a secondary channel. Should any diversions interact with any Environment Agency Main Rivers or IDB maintained Ordinary Watercourses, this will be conducted only with prior agreement from the Environment Agency and the relevant IDB, respectively. Where necessary post construction drains may also be installed, these will typically sit on either side of the onshore ECC. The operational drainage will be developed (in accordance with this outline Drainage Strategy), which will ensure that existing land drainage is reinstated and maintained such that pre-development greenfield run-off rates are maintained throughout the operation of Hornsea Four (Co19).

## 3.2 OnSS

### 3.2.1 Sustainable Drainage systems

3.2.1.1 The use of SuDS in sustainable water management is promoted through the National Planning Policy Framework (Ministry of Housing, Communities and Local Government 2019) and associated planning policy guidance (Ministry of Housing, Communities and Local Government 2018). Additional best practice guidance is provided in The SuDS Manual (CIRIA C753) (Woods Ballard et al 2015). These documents identify a hierarchy of techniques:

- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing);
- **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting);
- **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site); and
- **Regional Control** – management of runoff from several sites, typically in a detention pond or wetland.

3.2.1.2 Surface water drainage requirements will be provided in full in the detailed Surface Water Scheme (secured via DCO Requirement 15, see [Figure 1](#)) and will be designed to meet the requirements of the NPPF, NPS EN-1, NPS EN-5, and the SuDs Manual (CIRIA C753) (Woods Ballard et al 2015). Runoff will be limited where feasible, through the use of infiltration techniques which can be accommodated within the area of the development.

3.2.1.3 The implementation of SuDS as opposed to conventional drainage systems, can provide multiple benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;

- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources.
- Reducing potable water demand through rainwater harvesting;
- Improving amenity through the provision of public open spaces and wildlife habitat; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

### 3.2.2 SuDs at the OnSS

3.2.2.1 The final impermeable areas of the OnSS are not yet defined, and as such the baseline pre-construction land drainage surveys (Co14) will be used to develop a detailed Surface Water Scheme for the OnSS post-consent, once the design of the OnSS has been finalised. The detailed Surface Water Scheme will be developed according to the principles of the SuDS discharge hierarchy (see [Section 3.2.1](#) for further details) and this outline Drainage Strategy. Generally, the aim will be to discharge surface water runoff in the following order of priority as reasonably practicable ('1' being the highest priority of the hierarchy listed below):

1. Into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer, highway drain or another drainage system; and
4. To a combined sewer.

3.2.2.2 When considering surface water flood risk, the LLFA (the ERYC) guidance requires drainage design to accommodate a 30% increase, by either increasing peak rainfall in hydraulic calculations or by increasing on-site storage, as set out in the SuDS Combined Planning Note and Standing Advice (ERYC 2016) (Co14 and Co19).

3.2.2.3 The design of the detailed Surface Water Scheme will be based on a series of infiltration/soakaway tests which will be carried out on site and on completion of the necessary hydraulic calculations to identify the required attenuation volumes. The tests will be undertaken prior to construction and in accordance with the Building Research Establishment (BRE) Digest 365 Guidelines. The detailed Surface Water Scheme will ensure that the current run-off rates at the OnSS are maintained at a rate to be agreed with the Environment Agency and LLFA and are monitored to ensure that any discharge will be restricted to the greenfield run-off rate.

3.2.2.4 The permanent OnSS area will include an attenuation feature (Co191), delineated by Work Number 7(e) in [Volume D1, Annex 4.2: Works Plan – Onshore](#). The exact position and design will be confirmed post-consent, and during the detailed design stages for the OnSS (detailed design is secured via Requirement 7 of [Volume C1, Annex 1: Draft DCO including Draft DML](#)). Any attenuation feature for the OnSS will be appropriately sized to store the existing volume of flood water during a flood event, as well as any water arising from the proposed OnSS development. By incorporating sufficient storage volume for both the OnSS and the existing flood risk in this location, within any drainage design, there will be no

displacement of flood water as a result of any surface water body (see [Paragraph 3.2.1](#)) used to facilitate attenuation at the OnSS.

- 3.2.2.5 The permanent access track for the OnSS intersects with an area of Flood Zone 3 where it passes over an existing watercourse (see [Volume A6, Annex 2.2: Onshore Infrastructure Flood Risk Assessment](#) for further details). As such Hornsea Four has committed to appropriately design the permanent crossing to maintain existing ground elevations to ensure continued floodplain capacity and/or flow conveyance, where reasonably practicable (Co185). Equally, where the proposed OnSS permanent access track may be required to pass over an existing watercourse, the crossing will be designed to maintain floodplain capacity and/or flow conveyance, where practicable (Co184).

### 3.2.3 Runoff Rates

#### Runoff Rate Calculations

- 3.2.3.1 An assessment of the current greenfield and proposed runoff rates has not yet been undertaken. However, the surface water attenuation requirements for the OnSS will be determined in-line with The SuDS Manual (CIRIA C753) (Woods Ballard et al 2015), which indicates that the flow rate discharged from the OnSS must not exceed that prior to construction for the:

- 1 in 1-year event;
- $\bar{Q}$ ;
- 1 in 30-year event; and
- 1 in 100-year event.

- 3.2.3.2 The controlled runoff rate will be equivalent to the greenfield runoff rate. The resultant storage / attenuation volume provided will be sufficient to ensure that during the 1 in 100-year event there will be no increase in runoff from the site. This will include an allowance for the advised 30% increase to allow for future climate change (ERYC 2016).

#### Attenuation requirements

- 3.2.3.3 The attenuation feature / tank(s) will be required to ensure that the peak runoff rate to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event will not exceed the peak greenfield runoff rate for the same event. Sufficient storage will be provided to attenuate surface water and discharge at a controlled rate during surface water events. The full specification for the volume and location of the attenuation storage will be set out post consent within the detailed Surface Water Scheme and discharged via Requirement 15 of [Volume C1, Annex 1: Draft DCO including Draft DML](#). This detailed Surface Water Scheme will be in accordance with this outline Drainage Strategy.

- 3.2.3.4 Drainage systems installed for the OnSS. will include a suitably sized attenuation feature and/or tank(s). The specific location within which the attenuation feature can be

constructed is delineated by Work Number 7(e) in [Volume D1, Annex 4.2: Works Plan – Onshore](#). However, the exact position will be confirmed during detailed design, post-consent.

- 3.2.3.5 The controlled runoff rate will be restricted to the greenfield runoff rate. The resultant storage / attenuation volume provided will be sufficient to ensure that during the 1 in 100-year event plus an allowance for climate change there will be no increase in runoff from the site. This will include an allowance for the advised 30% increase to allow for future climate change.

### **3.2.4 Drainage Systems**

- 3.2.4.1 Underground attenuation tank(s) are also proposed. Surface water from impermeable areas where oil may have been used, such as roofs and open oil-filled compounds will be controlled in the drainage/attenuation system and will be passed through an oil separator.
- 3.2.4.2 Oil dumps will provide storage and will be designed based upon the bund areas and would discharge via a bund water control pump into an oil separator at a rate of 1.2 l/s. A class 1 full-retention oil separator will be specified with a capacity to accept flows from the bund areas using manufacturer's proprietary data tables. This clean water would then be discharged along with the surface water drainage into the attenuation feature / tank(s). Waste water from toilets etc. will either be connected to the public utility sewerage system or be connected to an on-site septic tanks) (i.e. not connected to the public utility system).
- 3.2.4.3 Surface water from permeable areas including roads and hard standings will run-off into minimum 350 mm deep soakaways running around the perimeter of the respective areas. These will be sized based on the surface area in question. The soakaways will not run into the attenuation feature / tank(s) but will (following the completion of ground investigations including geotechnical surveys) go straight to ground.

## **4 Decommissioning drainage**

- 4.1.1.1 During decommissioning, the preferred option at landfall (including the intertidal area) and the onshore ECC is to leave the cables in situ in the ground with the cable ends cut, sealed and securely buried as a precautionary measure. At the OnSS all electrical infrastructure will be removed, the foundations will be broken up and the site will be reinstated to its original condition or for an alternative use. Hornsea Four has also committed to producing an Onshore Decommissioning Plan (Co127) which will include all details relating to decommissioning drainage, including consideration of flood risk. It will adhere to the latest relevant available guidance and will be agreed with the appropriate stakeholders.
- 4.1.1.2 Further details in relation to decommissioning can be found in [Volume A1, Chapter 4: Project Description](#).



## 5 References

East Riding of Yorkshire Council (2016). Sustainable Drainage Systems (SuDS) & Surface Water Drainage Requirements For New Development. Design and Maintenance. Combined Planning Note and Standing Advice. [Online] Available from <https://www.eastriding.gov.uk/EasySiteWeb/GatewayLink.aspx?allid=604683> (Accessed 20/05/2019)

Environment Agency (2020) How to plan ahead for flooding [Online] Available from: [https://flood-warning-information.service.gov.uk/plan-ahead-for-flooding?utm\\_source=warning&utm\\_medium=gov.uk&utm\\_campaign=prepare&utm\\_content=national-view](https://flood-warning-information.service.gov.uk/plan-ahead-for-flooding?utm_source=warning&utm_medium=gov.uk&utm_campaign=prepare&utm_content=national-view). (Accessed 16/06/2020)

Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework. London: The Stationery Office, February 2019.

Ministry of Housing, Communities and Local Government (2018) National Planning Practice Guidance – Flood Risk and Coastal Change. London: The Stationery Office, September 2018.

Woods Ballard, B, Wilson, S, Udale-Clarke, H, Illman, S, Scott, T, Ashley, R and Kellagher, R (2015) The SuDS Manual. CIRIA C753. London: CIRIA, 2015.