



Rampion Offshore Wind Farm



ES Section 23 – Surface Water, Hydrology & Flood Risk

RSK Environmental Ltd

Document 6.1.23

December 2012

APFP Regulation 5(2)(a)

Revision A

E.ON Climate & Renewables UK Rampion Offshore Wind Limited

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23 SURFACE WATER HYDROLOGY AND FLOOD RISK

23.1 Introduction

- 23.1.1 This section of the Environmental Statement (ES) considers the water resources and drainage conditions in relation to the proposed onshore cable route and onshore substation for the Rampion Offshore Wind Farm (the Project), and assesses factors such as flood risk, drainage design and water resource management which will affect the proposed development in terms of its sustainability, safety and integrity. This in turn will have direct and indirect impacts on the environment.
- 23.1.2 A desk-based study of the hydrology and hydrogeology has been undertaken, which includes watercourses, areas prone to flooding, aquifers, water abstraction and discharge points.

23.2 Legislation and Policy Context

Key Legislation

- 23.2.1 **The Water Resources Act 1991 and The Water Act 2003:** The Water Resources Act 1991 (the 1991 Act) sets out the relevant statutory regulatory controls that provide protection water bodies and water resources. The 1991 Act was modernised by the introduction of the Water Act 2003 (the 2003 Act). The 2003 Act governs the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision. The 2003 Act has changed six key areas of the 1991 Act and of relevance to the proposed elements of the Project is the need to obtain a licence for any dewatering for engineering works, which was previously exempt.
- 23.2.2 **Flood and Water Management Act 2010:** This legislation was formally ratified in April 2010 with the aim to implement the findings of the 2007 Pitt Review and co-ordinate control of drainage and flood issues. There are a number of increased responsibilities within the act that affect adoption of Sustainable Drainage Systems (SuDS) features and the role of the Environment Agency to expand on the mapping data they provide. The implementation of SuDS features has many beneficial impacts on the treatment of surface water during remediation works.

23.2.3 The Water Framework Directive (WFD) 2000: The WFD which came into force in 2000; is the most substantial piece of EU water legislation to date. All new activities in the water environment will need to consider the Directive. The WFD was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The WFD requires that environmental objectives be set for all surface and ground waters in England and Wales to enable them to achieve Good Status (or Good Ecological Potential for Heavily Modified and Artificial Water Bodies) by a defined date. These environmental objectives are listed below:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- Aim to achieve at least good status for all water bodies by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve good status by 2021 or 2027;
- Meet the requirements of Water Framework Directive Protected Areas;
- Promote sustainable use of water as a natural resource;
- Conserve habitats and species that depend directly on water;
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment; progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to mitigating the effects of floods and droughts.

Other relevant legislation that has been taken into account includes the following:

- Contaminated Land (England) Regulations 2006, SI 1380;
- Environmental Protection Act 1990;
- Environment Act 1995;
- Groundwater Regulations 1998;
- Environmental Permitting Regulations 2010 (as amended);
- Site Waste Management Plans Regulations 2008, SI 314;
- Environmental Protection (Duty of Care) Regulations 1991, SI 2839 (as amended);
- Wildlife and Countryside Act 1981 (as amended); and

- Environmental Damage (Prevention and Remediation) Regulations 2009, SI 153.

National Policy Context

- 23.2.4 National Policy Statements (NPS) provide the primary basis on which the Secretary of State is required to make its decisions. The specific assessment requirements for geology, hydrogeology, land quality and flood risk, as detailed within the NPSs, are set out below.
- 23.2.5 NPS EN-5 (Electricity Network Infrastructure) and EN-3 (Renewable Energy) do not specifically consider geology, hydrogeology, land quality or flood risk impacts. However, EN-1 (Overarching NPS for Energy) does include generic requirements.
- 23.2.6 Paragraph 5.3.3 states that: *“Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance....”*
- 23.2.7 Paragraph 5.14.6 states that: *“The applicant should set out the arrangements that are proposed for managing any waste produced and prepare a Site Waste Management Plan. The arrangements described and Management Plan should include information on the proposed waste recovery and disposal system for all waste generated by the development, and an assessment of the impact of the waste arising from development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation. The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that this is the best overall environmental outcome.”*
- 23.2.8 Paragraph 5.15.2 states that: *“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.”*
- 23.2.9 Paragraph 5.15.3 states that: *“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.*
- *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."*

23.2.10 Paragraph 5.7.4 states that: *"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 should be accompanied by a flood risk assessment (FRA)." Paragraph 5.7.6 also states that: "Further guidance can be found in the Practice Guide which accompanies Planning Policy Statement 25 (PPS25)".*

National Planning Policy Framework

23.2.11 The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF) and its accompanying guidance document.

23.2.12 The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. The key definitions (DCLG, 2012) are:

- "Areas at risk of flooding" means land within flood zones 2 and 3 or land within flood zone 1 that has critical drainage problems and has been notified to the local planning authority by the Environment Agency; and
- "Flood risk" means risk from all sources of flooding, including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

Pollution Prevention Guidance

23.2.13 The Environment Agency (EA) has published a number of Pollution Prevention Guidelines (PPGs) many of which apply to the proposed onshore works. These are:

- PPG 1: General guide to the prevention of water pollution;
- PPG 2: Above ground oil storage tanks;
- PPG 3: Use and design of oil separators in surface water drainage systems;
- PPG 4: Treatment and disposal of sewage where no mains drainage is available;

- PPG 5: Works in, near or liable to affect watercourses;
- PPG 6: Working at construction and demolition sites;
- PPG 8: Safe storage and disposal of used oils;
- PPG13: Vehicle washing and cleaning;
- PPG 18: Managing fire water and major spillages;
- PPG 20: Dewatering of underground ducts and chambers;
- PPG 21: Pollution incident response planning;
- PPG 26: Drums and intermediate bulk containers;
- Pollution Prevention: Major cable routes;
- CIRIA guidelines: Control of Water Pollution from Linear Construction Projects;
- CIRIA and Environment Agency joint guidelines: Masonry Bunds for Oil Storage Tanks; and
- CIRIA and Environment Agency joint guidelines: Concrete Bunds for Oil Storage Tanks.

23.3 Assessment Methodology

Establishment of Baseline Environment

23.3.1 Information on surface water and flood risk within an area of search comprising a 2km wide corridor around the proposed onshore works, including the onshore cable route and the substation, was collected from the following sources:

- British Geological Survey (BGS) 1:50,000 scale geological mapping provided in digital format (where available);
- Information from the Environment Agency and local authorities on abstractions and discharges to watercourses;
- Hydrogeological maps;
- Groundwater vulnerability maps;
- Soil survey maps;
- Environment Agency water quality and discharge records;

- Local Authority private water supply records; and
- Relevant publications including the Strategic Flood Risk Assessment (SFRA), Catchment Management Plan (CMP), South West River Basin Management Plan (RBMP) and Shoreline Management Plan 2 (SMP2).

23.3.2 In addition, site visits to specific locations along the cable route and substation site were undertaken by an RSK hydrologist in June and October 2011, and discussions were held with the Environment Agency (Solent and South Downs Area).

Scoping

23.3.3 As part of the scoping phase of the Environmental Impact Assessment (EIA), a Scoping Report (E.ON/RSK, September 2010) was prepared to set out the proposed approach to EIA in respect of the proposed development, including the identification of assessment methodologies for each of the EIA topic areas to be assessed. The Scoping Report was submitted to the Infrastructure Planning Commission (IPC) in September 2010. A Scoping Opinion (IPC, October 2010) was received from the IPC in October 2010 incorporating comments from a wide range of consultees. A copy of the Scoping Report and Scoping Opinion including consultee comments are included in Appendix 5.1 and 5.2.

23.3.4 The information and advice received during the scoping process with regard to hydrology and flood risk is summarised in Table 23.1.

Table 23.1: Relevant Scoping Responses

Date	Consultee	Summary of issues	Where addressed
11/10/2010 and 12/10/2010	Adur District Council	Adur District Council's Strategic Flood Risk Assessment should be used for Adur District, not Environment Agency info.	Flood Risk Assessment. Paragraphs 23.3.1
08/10/2010	Environment Agency	We would expect the following to be included in the assessment methodology: The Shoreham to Lancing Sea Defences fall under the jurisdiction of the Environment Agency. Under the Water Resources Act 1991 the integrity of these defences must be ensured. All watercourses along the proposed route must be identified, including ditches and drains. Several of these watercourses have status under the Water Framework Directive (WFD). It will be necessary to demonstrate how this development will contribute to the delivery of WFD actions on impacted water bodies. A number of main rivers will be crossed, including the tidal Adur. The method of	Flood Risk Assessment, Paragraphs 23.4, 23.5.4-23.5.5

Date	Consultee	Summary of issues	Where addressed
		crossing these must be appropriate to the type and size of watercourse. All crossings must be below bed level. The impacts on flood storage and flow routes from excavation and storage of material in the flood plain in accordance with the principles of Planning Policy Statement 25 - "Development and Flood Risk (PPS25). The construction impacts across the beach areas may have an impact on water quality through pollution, specifically affecting bathing water quality for which there are statutory water quality standards. This risk should be considered within the EIA. Where any works are proposed near or crossing a watercourse, this may require prior flood defence consent from the Environment Agency.	

- 23.3.5 The scope of the assessment was modified accordingly to take account of the above consultee responses and the opinions of the IPC, the findings of which were reported in draft form in the Draft ES.

Formal Pre-application Consultation

- 23.3.6 As detailed in Section 5 (EIA Methodology), an extensive programme of engagement has been undertaken with regard to the Project, details of which are provided in the Consultation Report (which accompanies the Development Consent Order (DCO) application) Document 5.1. This included publication of the Draft ES as part of the Section 42 and Section 48 consultation in June 2012.
- 23.3.7 Following a review of consultee feedback on the Draft ES, and discussions with consultees including the Environment Agency the following modification has been made to the Project and overall assessment scope:

- Change to the cable routing in the vicinity of Teville Stream to account for the Environment Agency's proposal for realignment of this watercourse.

Hydrology Assessment

- 23.3.8 This has been undertaken through a desktop study based on information provided above, site visits and liaison with relevant consultees. The assessment includes consideration of potential impacts that could cause deterioration in the status of a water body or could hinder the water body from meeting its WFD objectives.

- 23.3.9 For the purpose of the WFD assessment the EA RBMP has been used. The aim of this process is to determine whether the proposed onshore works could have an impact upon the water quality criteria for the water bodies located within the area of search (see section 24 Ecology, paragraph 24.3.6).

Flood Risk Assessment

- 23.3.10 RSK was commissioned to undertake a FRA of the proposed onshore cable route and substation site (see Appendix 23.1 and 23.2).
- 23.3.11 Although revoked and replaced with the NPPF, the FRA has been prepared in accordance with *PPS25: Development and Flood Risk* and the *Interim Code of Practice for Sustainable Drainage Systems* (DEFRA, 2004).
- 23.3.12 The publication of the NPPF has revoked PPS25 amongst others as of 27 March 2012. The Technical Guidance to the National Planning Policy Framework (DCLG, 2012) includes flood risk guidance and retains key elements of PPS25 including the Sequential and Exception Tests, climate change allowances and development classifications. The information contained in this new technical guidance along with the NPPF when combined with guidance contained in the Communities and Local Government's Planning Policy Statement 25: Development and Flood Risk Practice Guide (DCLG, 2010) and the British Standard 'BS 8533:2011 Assessing and managing flood risk in development. Code of practice' has formed the basis of the FRA.
- 23.3.13 The FRA has considered the effects of the proposed onshore cable route on the identified potential flood areas in the immediate locality. The FRA for the proposed substation site has been undertaken to:
- Determine the extent of new flooding provision and the influence on the site;
 - Review the surface water drainage based upon the proposed layouts, and to determine the extent of infrastructure required; and
 - Assess the impact on the onshore works from global warming and anticipated increases in rainfall over the lifetime of the development.

Identification and Assessment of Impacts and Mitigation Measures

- 23.3.14 Potential impacts have been identified from data gathered during the desk study. This data has been assessed with the knowledge and experience of the impacts from similar construction projects, leading to the development of appropriate mitigation measures.

23.3.15 An assessment has been made of the significance of impact taking into account the importance/sensitivity of the receptor, the magnitude of impact, the duration/persistence of impact and the likelihood of the impact. Examples of criteria that have been used to make judgements on the importance/sensitivity of the receptor(s) and the magnitude of change are presented in Table 23.2 and Table 23.3 respectively.

Table 23.2: Receptor Sensitivity

Receptor Sensitivity	Example of Receptor
High	Low-lying land, groundwater, and local drainage network Protected areas (e.g. SSSI, Ramsar sites, SPAs, SACs) highly sensitive to disturbance Principal aquifers Flood zone 3b and flood zone 3a - high probability Groundwater inner protection zone (SPZ1) Human receptor – public and visitors Very good and good water quality with pristine or near pristine water quality corresponding to classes A and B of the Environment Agency water quality classification Major change in the species diversity of flora and fauna due to the significant change in the water quality Highly and more vulnerable developments, including landfill and sites used for waste management facilities for hazardous waste Areas of known/confirmed contaminated land/groundwater
Medium	Areas with intermediate groundwater vulnerability Biological and chemical water quality within rivers and streams Surface water (flow patterns) Secondary (A, B and undifferentiated) aquifers Flood zone 2 - medium probability Groundwater outer protection zone (SPZ2) and total catchment (SPZ3) Human receptor – workforce and operators with prior knowledge of site conditions Fairly good and fair water quality with a measurable degradation in its water quality as a result of anthropogenic factors corresponding to classes C and D of the Environment Agency water quality classification Water quality has only limited effects upon the species diversity of flora and fauna in the watercourse Biological and chemical water quality within rivers and streams. Less vulnerable developments, including industrial properties and waste treatment (except landfill and hazardous waste facilities) Surface water drainage networks (flow patterns and capacity)
Low	Areas with low groundwater vulnerability. Non-aquifers Flood zone 1 - low probability Areas with low groundwater vulnerability Poor and bad quality resulting from anthropogenic factors, corresponding to classes E and F of the Environment Agency water quality classification Water quality does not affect the diversity of species of flora and fauna

Receptor Sensitivity	Example of Receptor
	Water compatible development, including water transmission infrastructure and pumping stations, sewage transmission infrastructure and pumping stations, and sand and gravel workings. Local drainage network (including existing private site drainage, soakaways, etc.).

Table 23.3: Magnitude of Impact

Magnitude	Definitions
Large	The proposals could result in a significant change in terms of flooding, surface water drainage, hydrology or hydrogeology, which may result in hardship.
Medium	The proposals could result in moderate changes to flooding, surface water drainage, hydrology or hydrogeology, which cause inconvenience, which will recover over a medium period of time (5–10 years).
Small	A slight change where the proposals could occasionally cause a minor flooding, surface water drainage, hydrology or hydrogeology change in the short term. (1–5 years).
Negligible	No effect detectable
Beneficial	Change is likely to beneficially impact on flooding, surface water drainage, hydrology or hydrogeology.

Significance of Residual Effects

23.3.16 The categories used when classifying overall significance are indicated in Table 23.4.

Table 23.4: Significance of Residual Effects

	Sensitivity/Importance		
Magnitude	High	Medium	Low
Large	Major	Major/Moderate	Moderate
Medium	Major/Moderate	Moderate	Minor
Small	Moderate	Minor	Minor
Negligible	Minor	Negligible	Negligible

23.3.17 An assessment has been made of the significance of residual effects, i.e. those remaining after mitigation.

Uncertainty and Technical Difficulties Encountered

23.3.18 There are no significant areas of uncertainty with regard to the assessment of hydrological environmental impacts and mitigation measures. However, further geotechnical assessment will be undertaken at the detailed design stage for construction and engineering purposes.

23.4 Baseline Conditions

Hydrology – Cable Route

- 23.4.1 The watercourses within the area of search include the main River Adur and its tributaries, which drain the Low Weald area through the South Downs, flowing out to sea at Shoreham, and the Teville Stream (designated as a main river) which drains the coastal area to the west of the River Adur.
- 23.4.2 The River Adur and its tributaries are situated in the High Weald, Low Weald and South Downs natural conservation areas (as defined by Natural England). The catchment is largely rural with a few urban centres such as Horsham and the urbanised coastal strip of Brighton and Hove, Shoreham and Worthing. The entire catchment of the River Adur is in excess of 600km² and extends from the south coast at Littlehampton in the west, Brighton and Hove in the east, northwards to Horsham and Haywards Heath. The upper and western branch of the Adur catchment spans most of Horsham and is underlain by the Weald Clay. As a result, the watercourses respond rapidly to rainfall causing the water to run-off the impermeable surface. There is, however, little history of flooding in this sub-catchment of the Adur and consequently there is a low risk to people and property in this area. This differs from the lower, more permeable chalk areas, which respond more slowly and can be a source of groundwater flooding from the chalk aquifers. Flooding can occur from a number of sources such as rivers overtopping their defences (fluvial flooding), urban surface water run-off and inadequate local drainage, run-off from fields and groundwater flooding as well as a mixture of tidal and fluvial flooding.
- 23.4.3 The River Adur to the south of Upper Beeding includes part of the Adur Estuary Site of Special Scientific Interest (SSSI) and consists of relatively flat low-lying ground in a valley between the South Downs. The defences along this stretch of river will not generally overtop unless the fluvial flooding is influenced by the tidal conditions.
- 23.4.4 The Teville Stream rises at allotments in Tarring, before flowing alongside Tarring Road and Teville Road for much of its length. Passing through Homefield Park and the playing fields of Davison High School, the stream continues into fields near East Worthing railway station, it meets with Broadwater Brook (also known as Sompting Brook) before turning abruptly southwards to Brooklands Lake, from where it flows into the English Channel. The Teville Stream forms a shallow valley, so land to the south of the stream rises, reaching a high point along the line of the A259 before falling again to the south, towards the sea where a flood storage lake is situated.
- 23.4.5 The Environment Agency also administers the internal drainage boards (IDB) to the south of the Horsham DC boundary along the River Arun and the River Adur.

Water Framework Directive

- 23.4.6 The South East River Basin Management Plan and the Environment Agency's web-based 'Flood Map' were used to determine which water bodies could be potentially affected by the proposed onshore works. The names, ID numbers, designation, status classification and objectives for all relevant water bodies were obtained from Annex B of the RBMP.
- 23.4.7 The water bodies listed in Table 23.5 have been identified within the study area (data extracted from the South East RBMP).

Table 23.5: WFD Water Bodies and Current Condition

Water Body	Current Status	Status Objective
Herrings Stream	Poor	Good by 2027
Woodsmill Stream	Moderate	Good by 2027
Hammer Stream	Moderate	Good by 2027
River Arun	Moderate	Good by 2027
Teville Stream	Bad	Good by 2027
Egerton Park Stream	Moderate	Good by 2027
Langley Sewer	Moderate	Good by 2027

- 23.4.8 As indicated in Table 23.5, under the WFD the Teville Stream has been designated as 'bad' ecological status and has numerous urban pressures. The WFD sets out structured mitigation measures to achieve good ecological potential. The Environment Agency is currently undertaking a project (Teville Stream Restoration) that investigates engineering options for improving Teville Stream.

Hydrology – Substation Site

- 23.4.9 The within a study area of 500m surrounding the proposed substation site contains a number of surface water features including approximately 23 surface water lagoons, possibly associated with water retention for irrigation purposes.
- 23.4.10 Within the site a small drainage ditch runs parallel to an existing north south hedge line. This ditch takes run off from the surrounding fields (see Target Note 278/271 in Appendix 24.11- referenced as a dry ditch).

Geology

- 23.4.11 A description of the geology along the proposed cable route is presented in Sections 22.4.7–22.4.19 and is summarised here. The solid geology beneath the first 2km from the landfall of the route comprises silty clay of the Woolwich and Reading Beds; this section of the route is also the most developed with commercial, industrial and public open space found alongside. These rocks typically have a lower infiltration rate, greater surface flow and intermediate sensitivity.
- 23.4.12 The underlying Chalk geology, which is found throughout much of West Sussex, underlies the majority of the proposed route (from 1.4km to 15.0km). These are overlain by generally shallow and well-drained chalk or lime dominated top soils that are often very shallow and can sustain little vegetation. Rain can easily infiltrate this geology through large fissures into the underlying chalk aquifers, which then emerges along a scarp-slope spring line further downstream towards the lower reaches of the River Adur.
- 23.4.13 The lower reaches of the River Adur catchment is underlain mainly by Chalk. Groundwater from the Chalk is likely to discharge into the river as base-flow at a relatively constant rate throughout the year. However, when groundwater levels rise groundwater flooding can occur, particularly in the broad chalk valleys. The upper reaches of the River Adur are underlain by silty mudstone of the Weald Clay, which retards infiltration and is further characterised by standing surface water features and higher rates of surface flow at times of heavy rainfall. Consequently, river flow rates in these geological settings can be influenced by precipitation and can be characterised by a greater range of flow conditions.

Flood Risk – Cable Route

- 23.4.14 The EA has available on their website flood zone maps for much of England and Wales. The latest EA flood zone map (Figure 23.1) indicates that the proposed cable route for the Project will cross all flood zone types.
- 23.4.15 Flooding from rivers occurs when water levels rise higher than bank levels, causing floodwater to spill across adjacent land (flood plain). The main reasons that water levels can rise in rivers are:
- Intense or prolonged rainfall causing run-off rates and flow to increase in rivers, exceeding the capacity the channel. This can be exacerbated by wet antecedent conditions and where there are significant contributions of groundwater;
 - Constrictions in the river channel causing flood water to backup;
 - Blockage of structures or the river channel causing flood water to backup; and

- High water levels and/or locked flood (tide) gates preventing discharge at the outlet of the river.

23.4.16 The proposed cable route will inevitably cross a number of watercourses and associated flood plains. As a result, the route will be located in all flood zone types over its course (Figure 23.1).

23.4.17 Flooding from the sea occurs when water levels in the sea rise above ground levels of coastal land. This can occur:

- During normal high tides, where land floods on a regular basis;
- When there are extreme atmospheric effects such as storm surges and tsunamis; and
- When wind action causes water levels of the sea to rise.

23.4.18 Flooding from the sea is a natural and regular occurrence in estuarine environments and coastal marshlands. All low-lying ground along the coastline of West Sussex is at risk. Where development has encroached on the coastal flood plain, flood defences have been constructed to prevent flooding from the sea.

23.4.19 The onset of flooding from the sea can be extremely rapid. Deep, fast-flowing floodwater can be extremely hazardous. The severity of flooding will depend on tide levels, wind and wave conditions and topography. The Environment Agency has provided tide levels for a range of return periods as presented in Table 23.6.

23.4.20 The coastline of West Sussex is heavily populated and sea defences mostly protect the area of low-lying land, which is at risk of flooding. However, these defences can be overtopped or can breach, which can cause extensive flooding of the land with significant flood depths and high velocities. Flooding from sea is hazardous to life, property and the environment. Significant rebuild is required after severe flood events. Flooding from sea can also last a long time in areas where gravity drainage to the sea is hindered by flood defences.

Table 23.6: Peak Tide Levels for a Range of Annual Return Periods

Annual Exceedance Probability (%)	Shoreham (m AOD*)	Brighton (m AOD*)
10	3.94	4.10
2	4.14	4.30
1	4.22	4.40
0.5	4.30	4.50

* AOD: Above Ordnance Datum

- 23.4.21 Flooding from land occurs when intense, often short duration rainfall is unable to soak into the ground or enter drainage systems. It is made worse when soils are saturated so that they cannot accept any more water. The excess water then ponds in low points, overflows or concentrates in minor drainage lines that are usually dry. This type of flooding is usually short-lived and associated with heavy downpours of rain. Often there is limited warning before this type of localised flooding occurs. Surface water run-off can cause localised flooding in natural valleys as normally dry areas become inundated and in natural low spots where water may collect.
- 23.4.22 Drainage basins or catchments vary in size and shape, which has a direct effect on the amount of surface run-off. The amount of run-off is also a function of geology, slope, climate, rainfall, saturation, soil type and vegetation. Geological considerations include rock and soil types and characteristics, as well as degree of weathering. Porous material (sand, gravel, and soluble rock) absorbs water more readily than fine-grained, dense clay or unfractured rock and has a lower run-off potential. Poorly drained material has a higher run-off potential and is more likely to cause flooding.
- 23.4.23 Flooding from sewers occurs when rainfall exceeds the capacity of networks or when there is an infrastructure failure.
- 23.4.24 Groundwater flooding is caused by the natural emergence at the ground surface of water originating from underlying permeable sediments or rocks (aquifers). The groundwater may emerge as one or more point discharges (springs) or as diffuse discharge/seepage over an extended area. Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than for hours or days.
- 23.4.25 Groundwater flooding does not generally pose a significant risk to life owing to the slow rate at which the water level rises; however, it can cause significant damage to property, especially in urban areas.
- 23.4.26 The EA has recently published flood risk mapping as a result of potential failure of reservoirs. This map shows that the Project site is not in an area at risk of flooding from this source. There are no other known structures in the vicinity of the Project site that could pose a flood risk to the cable route or the substation.

Flood Defences

- 23.4.27 A number of flood defences are present within the area of search (2km around the route). The main river flood defences in West Sussex typically consist of:
- Raised barriers such as walls or embankments;
 - Online storage areas, which act to reduce flood peaks by attenuating flood waters prior to discharge back into the river network;

- Diversion of flows from high risk areas, or increasing channel capacity to carry greater flow through high risk areas (e.g. widening, deepening and straightening of channels); and/or
- Other structures that modify the natural flow of rivers, including weirs, sluices, culverts and bridge crossings, and bank protection works.

23.4.28 The main raised defence structures in West Sussex are earth embankments that run along the Adur and Arun rivers. The embankments run along the middle and lower reaches and protect against river and sea flooding. On the Adur there are secondary defences known as counterbanks, which are at right angles to the river. The purpose of this is to restrict flooding to a smaller, more confined area if the raised flood embankments are overtopped. There are also several small earth embankments around Selsey.

23.4.29 The Environment Agency and local planning authorities carry out annual inspections of flood defence assets and update National Flood and Coastal Defence Database (NFCDD). The data from these inspections is used to inform the owner of their duty to maintain assets to an appropriate level.

23.4.30 The management of the river and coastal defences and assets within West Sussex is divided between several different parties. The Environment Agency is responsible for the majority of the tidal and river defences and has a supervisory duty over all flood defences given under the Environment Act 1995.

23.4.31 The coastal frontage between Sea Lane, Ferring and Western Road, Lancing is managed by Worthing Borough Council under its permissive powers as the Coast Protection Authority given by the Coast Protection Act 1949. This excludes the coastline between Ferring, Sea Lane and the Borough Boundary (approx. 250m) for which the Council is only the landowner.

23.4.32 The proposed cable route crosses the following flood defences:

- Coastal sea defences (groynes) at the landfall; and
- Earth embankments that run along the River Adur.

Flood Risk – Substation Site

23.4.33 The Environment Agency has produced flood zone maps for much of England and Wales. The latest flood zone map shows the flood risk to the substation site is low, being located within flood zone 1.

23.4.34 Given the rural nature of the substation location, it is unlikely that there are any adopted sewer infrastructure serving the site; therefore, any new sewerage infrastructure will be installed in line with current best practice. Flooding at the site from this source is considered low.

- 23.4.35 Groundwater flooding is caused by the natural emergence at the ground surface of water originating from underlying permeable sediments or rocks (aquifers). The groundwater may emerge as one or more point discharges (springs) or as diffuse discharge/seepage over an extended area. Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than for hours or days. Groundwater flooding does not generally pose a significant risk to life owing to the slow rate at which the water level rises; however, it can cause significant damage to property, especially in urban areas. The soils around the Project's substation site are generally impermeable and therefore largely unresponsive to groundwater levels because of low infiltration. Owing to the type of development proposed, it is not thought that groundwater flooding will impact on the operations at the site.
- 23.4.36 If intense rain is unable to soak into the ground or be carried through man-made drainage systems, for a variety of reasons, it can run-off over the surface causing localised floods before reaching a river or other watercourse. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration. Flooding from this source is considered low and will be considered within the layout of the site by ensuring sensitive equipment is not located within a low spot on the site; this should ensure the development is not at increased risk. Flooding of the site from this source is considered low.
- 23.4.37 A number of small ponded areas have been identified from the Ordnance Survey (OS) mapping, and following a walkover of the site and surrounding area it has been confirmed that all these water bodies are retained below the surrounding ground levels and are not retained by embankment. Therefore flooding from these water bodies is considered low. There are no other potential sources of flood risk known to the site.
- 23.4.38 The substation will be designed with reference to the potential impacts of climate change. This will include incorporating the increase in rainfall over the lifetime of the Project when designing the surface-water management system.

23.5 Assessment of Impacts

Rochdale Envelope Principles

- 23.5.1 In line with the use of the "Rochdale Envelope" (see Section 5 – EIA Methodology), the assessment in this section has been based on a development scenario, which is considered to be the worst case in terms of impacts to surface water hydrology and flood risk. Rochdale Envelope principles relating to impacts on surface water hydrology and flood risk relate primarily to the area of temporary and permanent land take.

23.5.2 Installation of the cable will require a working width no wider than 30m (except at the locations where Horizontal Directional Drilling (HDD) is proposed), comprising 15m for the cable easement and 15m for additional areas for storage of excavated material and access along the cable trench. The cable easement will not necessarily be central to the working width. Therefore, the Development Boundary generally encompasses a working width of 40m along the cable route. A 40m working width been taken to represent the worst case scenario for the cable route assessment undertaken below.

23.5.3 The substation site covers an area of approximately 23.3 hectares. Approximately 7.01 hectares will be required for the permanent footprint of the substation, with the remainder required for site establishment, the temporary construction road, lay down areas and landscaping. For the assessment undertaken below, permanent land take of 7.01 hectares has been adopted as the worst case scenario.

Construction – Cable Route

Hydrology

23.5.4 The watercourses along the onshore cable route mainly comprise field drains and ditches. These will be diverted and reinstated on completion of the cable installation works.

23.5.5 Apart from the River Adur crossing identified for HDD, the default crossing method of watercourses will be trenching, but mini-HDD may also be employed in certain cases. Open-cut trenching through watercourses could potentially result in hydrological changes, including possible disturbance and modification to flows, and potential impacts to water users. The banks and beds of watercourses are also potentially at risk of physical damage.

23.5.6 The onshore cable route generally passes through agricultural land and, therefore, a potential impact on surface waters may arise from silt discharged from the working width during sudden rainfall events mobilising silt and materials. Suspended solids produced during construction can potentially produce adverse effects on aquatic ecology. In particular, suspended solids may have an effect on:

- The survival of fish eggs in gravel beds or spawning grounds as a result of deoxygenation caused by silt deposition;
- The survival of plants and algae by smothering;
- The survival of young fish and aquatic invertebrates such as dragonflies through gill damage from sediment particles;
- The success of angling owing to increased turbidity; and
- Amenity value through impaired visual appearance.

23.5.7 Other potential impacts to surface waters include:

- Risk of accidental spillages from oil and fuel storage facilities as well as construction materials; and
- Risk of adverse impacts to surface water quality as a result of the mobilisation of existing contaminants.

23.5.8 There is potential for the cable trenches to act as drainage channels for surface water run-off or lead to the drainage of the near surface water table water. Where trenches are constructed on slopes the flow of water could potentially lead to the erosion of soils, which could enter watercourses. These potential effects would be particularly noticeable during wet weather periods.

23.5.9 The EA will be consulted during the detailed design phase to determine the most appropriate method for each crossing and the appropriate method statements will be prepared. A number of factors will affect the choice of crossing method, including depth of water, available space, duration of works, bed conditions, accessibility and potential ingress of water. Working widths are to be reduced to 20m at specific watercourse crossings (as listed in Section 2b Project Description (Onshore), Table 2b.1) where potential risk to stream ecology has been identified.

23.5.10 Potential impacts to surface waters as a result of HDD of watercourse crossings include risk of adverse impacts to surface water quality arising from the break-out of drilling muds.

23.5.11 HDD will also be used to cross the railway in the vicinity of the Teville Stream. The HDD drill pit will be located to the east of the proposed realignment for the Teville Stream thereby avoiding any impact on the realigned channel.

Water Quality

23.5.12 During onshore construction, the greatest risk will be when works in progress expose areas of bare ground or soils. Sudden rainfall events can mobilise silt and materials held within the site and, if not controlled, these will be conveyed to the surrounding area. To a lesser degree, there is a potential risk of accidental spillages.

Geology

23.5.13 Potential impacts common to all cable route construction works are outlined below:

- Risk of pollution to groundwater from fuel and chemical spills;
- Risk of pollution to groundwater from the mobilisation of existing contaminants;

- The cable trench creating a preferential pathway for the migration of groundwater and any contaminants contained within the groundwater;
- Dewatering activities for earthworks, excavations and HDD, which may impact surface watercourse flows fed by groundwater, and cause the drawing in of mobile contaminants from off-route sources; and
- Disruption of buried field drainage systems.

Flood Defences

23.5.14 The cable route will be constructed beneath the coastal sea defences using an HDD technique, as described in Section 2b (Project Description (Onshore)). Similarly, the River Adur flood defences will also be crossed using HDD. As a result, no potential impacts are expected on the coastal defences.

Climate Change

23.5.15 The cable route will be designed with reference to the potential impacts of climate change. This will include designing the cable route to take account of potential shoreline re-alignment and future coastal inundation plans, and ensuring that water stops are inserted in the trench to prevent the cable route acting as a conduit for groundwater.

Construction – Substation Site

23.5.16 Construction impacts are considered to occur as a consequence of the actual development (preliminary earthworks and construction operations) itself, and are all considered as being potentially adverse in nature. The following potentially significant impacts are typically associated with construction works and are considered relevant to the proposed onshore substation development:

- Site drainage;
- Surface water outfalls;
- Siltation;
- Storage and handling of materials / oils / chemicals;
- Delivery / storage of construction materials;
- Concrete mixing; and
- Cross-contamination of geological strata due to piling.

23.5.17 During construction, the greatest risk will be when construction works are being undertaken prior to completion of the proposed drainage system at the onshore substation site. Sudden rainfall events can mobilise silts and materials held within the site.

23.5.18 To a lesser degree the potential risk of accidental spillages from oil and fuel storage facilities as well as construction materials would be present on site. Cement, if leached into drainage ditches, water bodies or watercourses, would potentially have detrimental effects by drawing oxygen from the water altering the pH of the water. If these effects occur prior to the construction of the drainage network then direct discharge to the watercourse, drainage ditch, water bodies or groundwater may be a consequence.

Hydrology

23.5.19 Potential longer term impacts of the Project are considered to occur both as a consequence of changes to the onshore substation site's character and also future use of the development.

23.5.20 The following impacts are likely to be associated with the substation development:

- Run-off from roads, parking areas and other exposed processing areas potentially containing elevated levels of hydrocarbons (oils) and heavy metals;
- Increase in surface run-off from site leading to overloading of local drainage infrastructure during intense rainstorms;
- Development of the site should not affect the surrounding surface water features owing to the lack of hydraulic connectivity;
- Ditch diversions or culverting may be required to allow development of the substation; and
- The development will not affect the existing flooding regime, subject to suitable provision of drainage infrastructure on the site.

Water Quality

23.5.21 During onshore construction, the greatest risk will be when works in progress expose areas of bare ground or soils. Sudden rainfall events can mobilise silt and materials held within the site and, if not controlled, these will be conveyed to the surrounding area. To a lesser degree, there is a potential risk of accidental spillages of construction materials. Cement, if leached into surface-water features, could have detrimental effects by drawing oxygen from the water and altering the pH of the water. However, much of the works will be carried out below the level of the surrounding ground, thus any surface water run-off will be retained on site and will drain to the existing sewer network.

Operation – Cable Route

- 23.5.22 There are no planned maintenance activities that will impact on water resources during the operation of the onshore cable. Once constructed the cable route will not impede existing flood flow routes or impact on the volumetric attenuation of functional flood plains.

Operation – Substation Site

- 23.5.23 It is intended that surface water run-off from the proposed development once constructed will be discharged to groundwater through infiltration techniques or off-site at a controlled rate designed to closely mimic the existing situation.
- 23.5.24 Both the latest Sustainable Urban Drainage systems (SUDs) guidance and the Environment Agency recommend that SUDs, in whole or part, should be considered for all new development sites. It is therefore proposed to incorporate SUDs into the development and this can be a combination of both physical structures and techniques used to control surface water run-off as close to its origin as possible.
- 23.5.25 A wide variety of sustainable drainage options are available that can be applied in different ways to help manage both surface and groundwater in a sustainable manner. Specific solutions need to be developed for each site individually, the choice of which will depend on factors such as the nature of the site, the type of pollutants present and the hydrology of the area – the substation site is not located within a groundwater source protection zone.
- 23.5.26 The effectiveness of infiltration-based SUDs depends on the ‘infiltration potential’ of the soil, protection of such systems from siltation and avoidance of compaction of the ground during construction. There are currently no points of discharge off the substation site and it is assumed that any rainfall on the site either infiltrates into the soils or ponds on the surface. The proposed development will increase the impermeable area on the site and therefore reduce the potential area for infiltration; as a result the surface water run-off from the site is expected to increase unless mitigation measures are incorporated into the development. The site currently comprises 100% soft landscaping, so it is assumed that, where possible, the site will be covered by a suitable aggregate to allow for vehicle movements while allowing for infiltration to occur.
- 23.5.27 The effectiveness of infiltration devices can diminish with the silting up of the receiving substrata. This will need to be considered within the structures to provide attenuation for additional volume (approximately 20%), should this be the case. Silt traps and catch pits will be provided on-site to reduce the potential of siltation of the storage structure; these will be subject to a suitable maintenance programme.

Decommissioning – Cable Route

- 23.5.28 At decommissioning it is anticipated that the onshore cables will be left buried in situ, unless lifted to be replaced by new cables to be run along the same route as part of future developments or wind farm repowering. Details of the decommissioning of the cable route will be investigated in detail at the end of its service life. It is likely that ducting will remain in place; however, the cables may be pulled out of the ducts via the jointing bays. If the cables are removed, residual impacts on water resources and drainage would be of smaller scale than impacts described in this section for construction as works would only occur at specific locations.

Decommissioning – Cable Route

- 23.5.29 The onshore substation may continue to be used as a substation site after the original offshore wind farm has been decommissioned. It is quite possible that the substation will be upgraded for use by future offshore renewable developments. The decommissioning methodology cannot be finalised until immediately prior to decommissioning; the substation will be decommissioned inline with relevant policy at that time.

23.6 Mitigation Measures

Construction – Cable Route

Hydrology and Water Framework Directive

- 23.6.1 The majority of the minor watercourses along the cable route comprise field drains and ditches, and are likely to be diverted and reinstated on completion of the cable installation.
- 23.6.2 Mitigation measures to minimise physical damage to watercourses and prevent pollution, flooding and erosion during construction are described below:
- Watercourses will be temporarily flumed (by the installation of pipes) and ramped over where necessary to allow uninterrupted flow of water within the watercourse and a continuous running track for vehicles. Crossings will be timed, where possible, to coincide with periods of low flow;
 - Method statements for the crossing and reinstatement of the watercourses along the cable route and for flume pipe installation will be agreed with the Environment Agency before the start of construction;
 - A vegetated strip will be left adjacent to the watercourse, where possible, during construction;
 - Banks will be reinstated following construction. Soft revetment materials will be used wherever possible to stabilise banks, where necessary;
 - The cable will be buried at sufficient depth, to prevent scour and to allow a natural substrate to develop;
 - Bank-side vegetation will be reinstated subject to restrictions on the replanting of large tree species in close proximity to the cable route;
 - Fuels, lubricants, solvents, etc. will be stored in appropriately bunded areas and a range of other pollution prevention measures taken;
 - All soils will be stored away from watercourses and any potentially contaminated soil will be stored on an impermeable surface and covered to reduce leachate generation and potential migration to surface waters;
 - Limited sections of the trench line will be excavated at any one time; and
 - Any dewatering will have appropriate treatment and disposal.

- 23.6.3 Unless otherwise agreed in writing there is no intention to abstract water from or discharge water into watercourses or water bodies adjacent to the working areas including groundwater. All existing ditches and field drains in close proximity to the working areas will be maintained and kept free from potential obstruction.
- 23.6.4 Any existing drains affected as part of the construction works will be restored following the duct laying and backfilling operations. This will be in accordance with landowner agreements. Furthermore, in areas of steep slopes or where there is a risk of flood risk areas becoming linked appropriate measures will be employed to prevent the flow of water along the trench – for example baffles being installed in trenches at regular intervals to disperse water evenly across the slope.
- 23.6.5 As required by the Water Resources Act 1991, river crossings will require appraisal from Environment Agency under flood defence consent process. The following activities on a main river (River Adur, Teville Stream and Cutlers Brook) require Environment Agency consent under Section 109 of the Water Resources Act 1991:
- The erection of any structure in, over or under a watercourse which is part of a main river;
 - The alteration or repair of any structure in, over or under a main river if the work is likely to affect the flow of water in the main river or impede any drainage work; and
 - The erection or alteration of any structure designed to contain or divert floodwaters of any part of the main river.

Groundwater

- 23.6.6 To mitigate potential impacts to groundwater resources the following measures will be implemented:
- Fuels, lubricants, solvents etc. will be stored in appropriately bunded areas and a range of other pollution prevention measures taken;
 - Water stops will be installed to prevent the cable route trench altering groundwater flows;
 - If the cable route encounters areas of contamination, and the trench has the potential to act as a conduit, water stops (e.g. clay plugs) will be placed in the trench when backfilling to prevent the formation of a preferential flow path;

- Temporary cut-off drains will be installed parallel to the trench-line, before the start of construction, to intercept soil and groundwater before it reaches the trench. These field drains will discharge to local drainage ditches through silt traps, as appropriate, to minimise sediment release; and
- Following cable installation, existing drains will be reinstated any pre-existing field drainage systems to pre-construction condition.

23.6.7 Unless otherwise agreed in writing there is no intention to abstract water from or discharge water into watercourses or water bodies adjacent to the working areas including groundwater. In the event that dewatering is required, the Environment Agency will be consulted and any necessary abstraction licence and environmental permit for discharge obtained. Prior to discharge it will be necessary to ensure that the water meets appropriate quality criteria. Discharge of water pumped out from excavations will, wherever possible, be to land after filtration to remove sediment and will be controlled under a 'permit to pump' that will define pump location, discharge point and filtration measures in advance and in accordance with best practice. This requirement will be incorporated into a Construction Environmental Management Plan (CEMP).

Flood Risk

23.6.8 In the vicinity of designated flood zone 3 (1-in-100-year flood extent, see Figure 23.1) the following measures to reduce the potential impact of the works in the event of a flood will be implemented:

- Where possible, stockpiles of excavated materials will be placed outside the flood plain, to avoid impeding any flood flows;
- If, because of constraints on available working areas, stockpiles must be sited within the flood plain, they will be set back from the edges of the watercourse to reduce the risk of silt run-off from the stockpiles to the watercourse;
- Gaps will be provided at intervals in the stockpiles to act as water pathways to ensure that floodwater movement is not hindered and flooding exacerbated;
- Any surplus excavated materials will be disposed of off-site as early as possible, to minimise the size of stockpiles and the consequent risk of obstructing water flows;
- No fuel or other hazardous substances will be stored within the flood plain and, where possible, mobile plant will be parked out of the flood plain at night or when not in use; and

- The flood plain area will be reinstated as early as possible during the summer growing season to ensure that vegetation can become established over the reinstated area before flooding is likely to occur to minimise the risk of unprotected topsoil being lost by scour during flooding.

23.6.9 The requirement for any further measures to reduce the potential impact of the works in the event of a flood will be discussed with the Environment Agency and implemented as agreed. Pollution Prevention and Emergency Response Plans will be developed to control construction works and will include a requirement to monitor weather forecasts and flood warnings. This requirement will be incorporated into a CEMP.

Flood Defences

23.6.10 At the landfall the cable route will be constructed beneath the coastal flood defences and River Adur flood defences using an HDD technique.

23.6.11 The defences will be maintained during construction with the detailed methodology. Crossings will be discussed and agreed with the Environment Agency, and the necessary consents obtained. Where the cable route has been completed in close proximity to flood defences a structural assessment will be carried out to ensure the defences remain operational with no detrimental impact.

Construction – Substation Site

On-site Hydrology

23.6.12 Many of the short-term impacts arising from the construction at the onshore substation site can be mitigated effectively by the utilisation of good construction techniques and the implementation of a CEMP. Where feasible, suitable construction techniques will be adopted to ensure that no migration pathways are created that could jeopardise groundwater quality. Where deeper foundations may be required, appropriate piling techniques will be used to minimise the associated risk.

23.6.13 A drainage ditch and farm track running parallel to the north to south tree line will also require diverting to allow for the development of the substation. This ditch is a field drain taking little more than localised run-off from the surrounding land and therefore falls under riparian ownership. Any works will ensure that any conveyance route (from other ditches) is maintained and that flows are not reduced from that at present.

23.6.14 Mitigation will include the use of appropriate measures as outlined in the Environment Agency PPGs to prevent spillage of potentially polluting substances, including the following guidance.

23.6.15 Guidance for storing and handling materials and products:

- PPG2: Above ground oil storage tanks;
- PPG 6: Working at construction and demolition sites;
- PPG 7: Refuelling facilities; and
- PPG 26: Drums and intermediate bulk containers.

23.6.16 Guidance for site drainage, dealing with sewage and trade effluents:

- PPG 3: Use and design of oil separators in surface water drainage systems;
- PPG 4: Disposal of sewage where no mains drainage is available; and
- PPG 13: Vehicle washing and cleaning.

23.6.17 Guidance on general good environmental practice:

- PPG 1: General guide to the prevention of pollution;
- PPG 5: Works in, near or liable to affect watercourses; and
- PPG 21: Incident response planning.

23.6.18 In applying the abovementioned PPG, the CEMP will incorporate the following:

- Appropriate storage and handling measures for all hydrocarbon fuels and lubricating oils, including the use of bunded storage areas or the use of double-skinned storage tanks;
- All wastes must be stored in designated areas that are isolated from surface water features and bunded to contain any spillages. Rubbish compactors should be covered to prevent the build-up of contaminated rainwater and drained to the foul sewer to prevent polluting liquid entering the surface water drains;
- The use of drip trays for static plant and designated refuelling areas for mobile plant. The implementation of appropriate spillage contingency measures to mitigate the impact of such spillages on the surface water network; and
- Appropriate personnel awareness training of the potential environmental implications of all construction work on-site.

Flood Risk and Drainage

23.6.19 To reduce the impact of uncontrolled run-off from the site during construction the following measures to reduce the potential impact of the works in the event of an extreme rainfall event will be implemented:

- Where possible, stockpiles of excavated materials will be placed away from the drainage system to minimise the potential for silt that may be mobilised entering the drainage network;
- Gaps will be provided at intervals in the stockpiles to act as water pathways to ensure that floodwater movement is not hindered and surface water flooding is not exacerbated;
- Any surplus excavated materials will be disposed of off-site as early as possible to minimise the size of stockpiles and the consequent risk of obstructing water flows; and
- No fuel or other hazardous substances will be stored within close proximity to the drainage network and where possible mobile plant will be parked within designated compounds at night or when not in use.

Operation

23.6.20 No mitigation measures are required during cable operation.

23.6.21 The surface water drainage scheme for the onshore substation site will be designed to meet the requirements of the NPPF by limiting the post-development off-site run-off to the equivalent predevelopment rate for the site while providing sufficient on-site attenuation for rainfall events up to the 1-in-100 year rainfall event, including a suitable allowance for climate change over the lifetime of the Project.

23.6.22 The reduction in groundwater recharge due to an increase in impermeably surfaced area will have a small impact. Subject to further investigations there is potential for clean surface water run-off to discharge to groundwater through infiltration, thus limiting the impact.

23.6.23 The proposed surface-water drainage network will require a programme of maintenance to ensure that siltation does not reduce the efficiency of the network. It has been assumed that the on-site drainage will be privately owned and operated; therefore, this will need to be carried out by the site owner/operator.

Decommissioning

23.6.24 During decommissioning of the cable the ducts will remain in position and therefore mitigation would relate to those areas where the cable will be pulled from the ducts. Mitigation measures at these specific location are likely to be similar to that during construction.

23.6.25 During decommissioning of the substation, similar mitigation measures to those described for the construction phase are likely to be required to prevent contamination, such as from silt laden run-off arising from vehicle movements on site. Any new legislation or guidelines published prior to decommissioning will be adhered to and incorporated into mitigation design prior to any decommissioning taking place.

23.7 Residual Effects

- 23.7.1 The proposed development has a number of mitigation measures that will reduce its impact on the water environment. The residual effects, i.e. those likely to remain following adoption of mitigation measures, are summarised in Table 23.7 below.
- 23.7.2 The greatest impact is to the surrounding area. However, the proposals include the control and attenuation of rainfall run-off from the onshore substation site during most storm events. These proposals can also add increased ecological variety and the opportunity to enhance the wildlife habitat around the substation site.
- 23.7.3 Impacts resulting from spillages of oils and operational compounds would be minimised by appropriate site management procedures.
- 23.7.4 The cable route crosses area of known floodplain, therefore placing plant and the workforce at potential risk. Works within the flood plain should be avoided where possible, however where this is unavoidable a flood plan should be established to inform the workforce what actions should take place should a flood event occur, this plan should also consider a safe egress route away from the source of flooding.

23.8 Cumulative Impacts

- 23.8.1 Although a final option for the Teville Stream Restoration scheme has not been commissioned, the Environment Agency has indicated that construction of the final Teville Stream Restoration option is to commence within the 2012/2013 financial year. Should this occur, the proposed Project cable route will follow the completion of the restoration scheme, paying due attention to the new route of the stream and implementing mitigation. Should the Teville Stream project be delayed, the timing of the construction works could coincide with the construction of the cable route. Should this be the situation it could be advantageous to carry out ground works in conjunction with each other to avoid additional groundworks and diversion of the watercourse.
- 23.8.2 Once in situ and the working areas have been restored, the cable route will have no residual impact on the Teville Stream.
- 23.8.3 The following planned developments are noted in the vicinity of the proposed substation:
- Modifications to the existing National Grid Bolney substation (associated with Rampion connection).
 - Modifications to the existing National Grid Bolney substation (not associated with Rampion).

- 23.8.4 Recent discussions between National Grid and E.ON have indicated that the works associated with the Rampion connection would fall outside NGET's permitted development rights and therefore planning consent would be required. E.ON intends to apply for planning permission from Mid Sussex District Council for these works.
- 23.8.5 It is understood that National Grid will undertake the works not associated with Rampion as Permitted Development with pre-application consultation with the LPA expected in 2013.
- 23.8.6 The National Grid Bolney substation modifications will be located in close vicinity to the works required as part of the Rampion Project. The Bolney modifications will be located on land immediately adjacent to the existing National Grid operational land at Bolney.
- 23.8.7 Should the timing of the Bolney construction works coincide with the construction of the Rampion substation precautions should be taken to ensure surface water run-off from both development sites do not impact on the surrounding hydrology. Any drainage solution should ensure silt and other pollutants do not enter the existing watercourses.

23.9 References

Department for Communities and Local Government (DCLG), 2010 "Planning Policy Statement – Development and Flood Risk" PPS 25, Mar 2010.

Department for Communities and Local Government (DCLG), 2012 "Technical Guidance to the National Planning Policy Framework", Mar 2012.

DEFRA, 2004 "Interim Code of Practice for Sustainable Drainage Systems" National SUDS Working Group, July 2004.

Department for Communities and Local Government (DCLG), 2012 *National Planning Policy Framework* Available from:

<http://www.communities.gov.uk/documents/planningandbuilding/pdf/2116950.pdf>

Table 23.7: Summary of Impacts, Mitigation Measures and Significance of Effects

Aspect	Impact	Proposed Mitigation Measures	Sensitivity	Magnitude	Residual Effect
Construction Phase					
Surface Water Hydrology	Disruption of soil drainage leading to potential soil saturation and/or field flooding.	Land drainage systems will be maintained during construction and reinstated on completion	Medium	Medium	Moderate
Surface Water Hydrology	Risk of pollution from spills during construction	Fuels, lubricants, solvents, etc. will be stored in appropriately bunded areas and should not be stored near watercourses if possible	Medium	Medium	Moderate
Surface Water Hydrology	Physical damage to watercourses	Watercourses will be temporarily flumed to allow the passage of plant and machinery A vegetated strip will be left adjacent to the watercourse, where possible, during construction Banks will be reinstated following construction. Soft revetment materials will be used wherever possible to stabilise banks, where necessary The cable will be buried at sufficient depth, to prevent scour and to allow a natural substrate to develop Bank-side vegetation will be reinstated subject to restrictions on the replanting of large tree species in close proximity to the cable route Method statements for the watercourse crossings will be agreed with the Environment Agency before construction begins	Medium	Medium	Moderate
Surface Water Hydrology	Risk of pollution to surface watercourses from silt run-off or discharges of water pumped from excavations	Discharges to watercourses and sediment run-off will be controlled, to prevent pollution. In addition, where practicable, vegetated strips will be retained adjacent to watercourses to impede surface water run-off and to catch sediment	Medium	Medium	Moderate

Aspect	Impact	Proposed Mitigation Measures	Sensitivity	Magnitude	Residual Effect
Surface Water Hydrology	Risk of pollution to surface water from fuel and chemical spills and leachate from contaminated soils	Fuels, lubricants, solvents etc. will be stored in appropriately bunded areas All soils will be stored away from watercourses and any potentially contaminated soil will be stored on an impermeable surface and covered to reduce leachate generation and potential migration to surface waters	Medium	Medium	Moderate
Surface Water Hydrology	The stockpiling of excavated materials could hinder water flows and exacerbate flooding in flood risk areas	Gaps will be provided at intervals within soil stockpiles to act as drainage pathways Stockpiles will be set back at least 10m from watercourses Surplus materials will be disposed promptly off-site	Low	Small	Minor
Surface Water Hydrology	The cable route trench could act as a preferential pathway for groundwater flow, potentially resulting in down-slope flooding	Water stops will be placed in the trench to ensure that groundwater flows are not significantly altered by the presence of the cable	Low	Small	Minor
Groundwater	Potential for the cable route to create a migration pathway for contaminated groundwater	If the cable route encounters areas of different chemical composition, and the trench has the potential to act as a conduit, water stops (e.g. clay plugs) will be placed in the trench when backfilling to prevent the formation of a preferential flow path	Medium	Small	Minor
Groundwater	Pollution from fuels and lubricants	Fuels, lubricants solvents, etc., will be stored in appropriately bunded areas	Medium	Medium	Moderate
Groundwater	Disruption of buried field drainage systems	Land drainage systems will be maintained during construction and reinstated on completion	Medium	Small	Minor

Aspect	Impact	Proposed Mitigation Measures	Sensitivity	Magnitude	Residual Effect
Groundwater	Dewatering activities for earthworks which may impact surface watercourse flows fed by groundwater	Discharge of water pumped out from excavations will, wherever possible, be to land after filtration to remove sediment and will be controlled under a 'permit to pump' that will define pump location, discharge point and filtration measures in advance and in accordance with best practice	Medium	Small	Minor
Springs, Abstractions and Discharges	For springs and abstractions, see Groundwater and Surface Water, above Physical damage or disruption of existing discharges	Flume all minor watercourses to ensure that flows to downstream abstraction points are not affected	Low	Small	Minor
Operational Phase – Substation Site					
Surface Water Run-off	Increase in surface water run-off from new hard standing areas	On-site attenuation restricting any run-off to a rate agreed with the relevant bodies.	Low	Small	Minor
Flood Risk	Flooding of infrastructure	Flood risk is low, consideration should be given to the surface water run-off and overland flow routeing	Low	Small	Minor