AQUIND Limited

AQUIND INTERCONNECTOR

Environmental Statement – Volume 3 – Appendix 20.4 Flood Risk Assessment

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

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WSP

WSP House

70 Chancery Lane

London

WC2A 1AF

+44 20 7314 5000

www.wsp.com

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APPENDIX 20.4 FLOOD RISK ASSESSMENT

1.1. INTRODUCTION

1.1.1. APPOINTMENT, BRIEF AND PROJECT OVERVIEW

1.1.1.1. This Flood Risk Assessment ('FRA') has been prepared on behalf of AQUIND Limited (the 'Applicant') to support an application (the 'Application') for a Development Consent Order ('DCO'). AQUIND Interconnector (the 'Project') is a proposed electricity Interconnector between France and the UK (see Plate 1).

1.1.1.2. The Application for the DCO is made in respect of the UK elements of AQUIND Interconnector (referred to as the 'Proposed Development').

1.1.1.3. The Proposed Development is described in detail in Chapter 3 (Description of the Proposed Development) of the Environmental Statement ('ES') Volume 1 (document reference 6.1.3).

1.1.1.4. This FRA forms Appendix 20.4 of the ES Volume 3 (document reference 6.3.20.4) and is referred to as 'the report' hereafter.

1.1.1.5. The Project comprises a new marine and onshore High Voltage Direct Current ('HVDC') power cable transmission link between Normandy in France and Eastney in Hampshire, converter stations in both England and France and infrastructure necessary to facilitate the import and export of electricity between both countries.

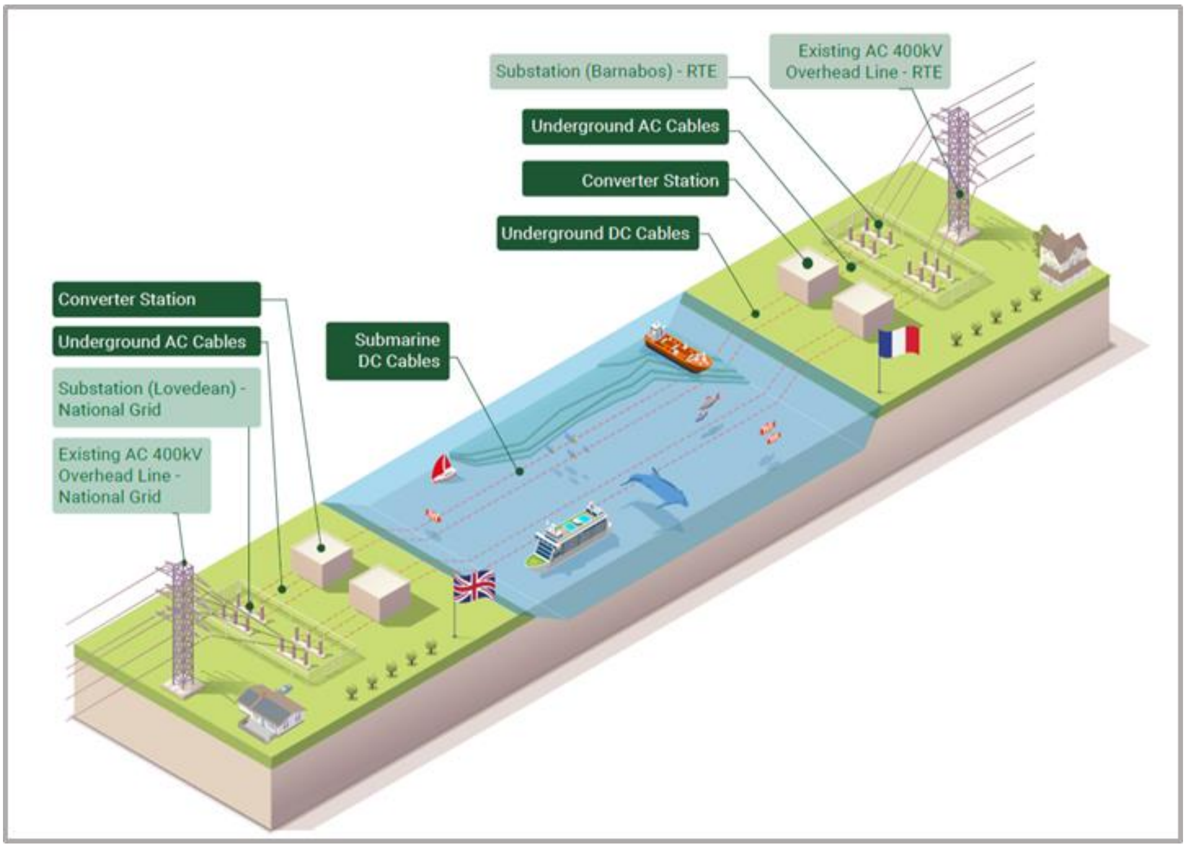


Plate 1 – High Level Schematic of Project

1.1.1.6. The Project comprise three parts: onshore elements in the UK; marine elements between the British and French coastlines; and onshore elements in France.

1.1.1.7. This report only considers the UK Onshore Order Limits ('Order Limits') and in broad terms comprises of the following elements:

- The Onshore Cable consisting of two HVDC Circuits;
- A Converter Station and associated electrical and telecommunications infrastructure;
- High Voltage Alternating Current ('HVAC') Cables, and associated infrastructure connecting the Converter Station to the Great Britain electrical transmission network, the National Grid, at Lovedean Substation and;
- Fibre Optic Cable ('FOC') together with each of the HVDC and HVAC Circuits and associated infrastructure.

1.1.1.8. Refences to the Order Limits in this report, is only in relation to the Order Limits as applicable to the Onshore Components as illustrated in Figure 3.9 of the ES Volume 2 (document reference 6.2.3.9).

1.1.1.9. Plate 2 illustrates the UK aspect of the Interconnector with further detail provided in Section 3 of this report.

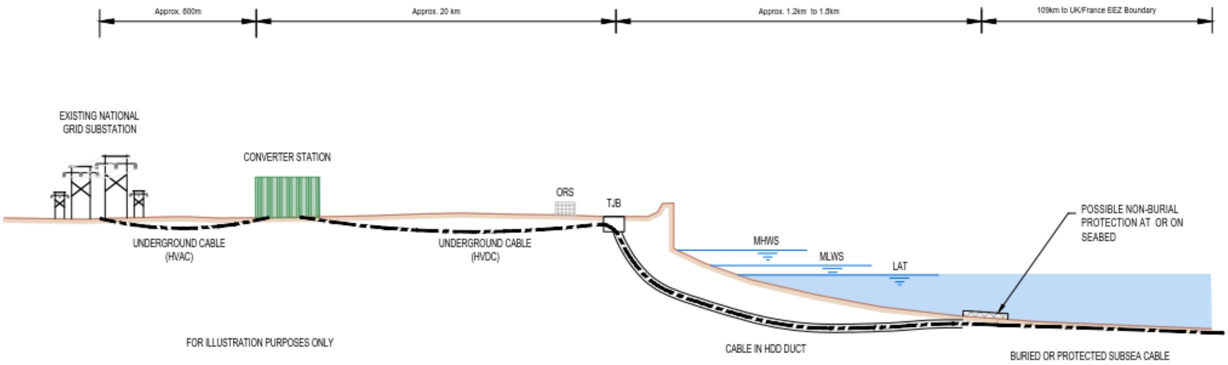


Plate 2 - AQUIND Interconnector Arrangement - UK Side

1.1.1.10. This report is intended for the sole benefit of the parties named above and shall not be capable of reassignment, WSP shall not be liable for any use of the report for any reasons other than that for which the report was originally prepared and provided.

1.1.1.11. Although this report was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances please note that WSP cannot take responsibility for errors in the information provided by third parties.

1.1.1.12. Reference to other documents that form part of the DCO are made within this report including:

- Chapter's from Environmental Statement Volume 1 (document reference 6.1);
- Figures from Environmental Statement Volume 2 (document reference 6.2); and
- Appendices from Environmental Statement Volume 3 (document reference 6.3).

1.1.2. OBJECTIVE OF STUDY

1.1.2.1. This report investigates flood risk in the vicinity of the Proposed Development and establishes mitigation measures required to ensure the sustainability and safety of the Proposed Development over its lifetime and includes:

- a description of the Proposed Development;
- an assessment of the flood risk from all sources of flooding within the Order Limits with an allowance for climate change;
- estimated flood levels where appropriate;
- details of any proposed flood resistance and resilience measures where appropriate; and
- supporting design information or reference to the wider Environmental Statement where appropriate.

1.1.2.2. This report has been informed by gov.uk, Environment Agency, Local Planning Authority and Lead Local Flood Authority information and guidance where appropriate and has been prepared in line with the requirements set out within the

National Policy Statement for Energy ('EN-1') (2011) and the National Planning Policy Framework ('NPPF') (2019); where:

- EN-1 sets out the Government's policy for delivery of major energy infrastructure. Parts 4 and 5 of EN-1 detail the general principles that will be used in the assessment of applications and sets out how generic physical impacts (i.e. those impacts most likely to arise from the development of any type of energy infrastructure) and means of mitigation will be considered. Parts 5.7 considered relevant to the flood risk environment.
- NPPF aims to protect the environment and promote sustainable growth, with an overarching presumption in favour of sustainable development that should be the basis of every plan and every decision. Paragraphs 155, 158, 163 and 165 are considered relevant to the flood risk environment.

1.1.3. STUDY METHODOLOGY

1.1.3.1. Baseline conditions have been established through a desk-based review, complimented by a site walkover and consultation with relevant consultees as detailed hereafter.

Desk Study

1.1.3.2. The desk study assessment to inform the baseline data, as detailed within Chapter 20 (Surface Water Resources and Flood Risk) of the ES Volume 1 (document reference 6.1.20), included a review of:

- Ordnance Survey mapping;
- British Geological Survey data;
- Defra.gov.uk online MAGiC Map database;
- Gov.uk / Environment Agency online 'Flood map for planning' database;
- Gov.uk / Environment Agency online 'Long term flood risk information' database;
- Environment Agency Catchment Data Explorer database;
- Local Planning Authority and Lead Local Flood Authority documentation including as appropriate:
  - Local Plans/ Core Strategies;
  - Strategic Flood Risk Assessment;
  - Surface Water Management Plans;
  - Preliminary Flood Risk Assessments;
  - Local Flood Risk Management Strategies; and
  - Groundwater Management Plans.

Consultee Engagement and Meetings

1.1.3.3. In addition to the above summarised data sets, the desk study has been informed by data sets obtained through consultation; including:

- Environment Agency surface waters and flood risk data sets;
- East Solent Costal Partnership coastal flood defence datasets;
- Lead Local Flood Authority (also acting as Local Planning Authority) surface waters and flood risk datasets from:
  - Portsmouth City Council;
  - Hampshire County Council;
- Additional Local Planning Authority information/ flood risk datasets from:
  - Havant Borough Council;
  - Winchester City Council;
  - East Hampshire Borough Council;

1.1.3.4. Key engagement that has informed an understanding of the baseline environment includes various email correspondence and meetings with the above names statutory and non-statutory consultees; namely, the 'Flood Risk Workshop' held by the Applicant on 23 July 2019 with the Environment Agency, Portsmouth City Council Lead Local Flood Authority & Hampshire County Council Lead Local Flood Authority. Details of the consultee engagement is provided in the Appendix 20.1 (Consultation Responses) of the ES Volume 3 (document reference 6.3.20.1).

Site Visits

1.1.3.5. To verify and further compliment the information gathered through the desk top study and engagement with consultees many site visits were undertaken to verify assumptions and baseline collected.

1.1.3.6. A high-level walkover of the Converter Station Area was undertaken in February 2018, to confirm the understanding of flood risk profile and surface water features at the Converter Station Area.

1.1.3.7. A detailed site wide walkover was subsequently undertaken in July 2019 of all identified surface water and flood risk features within or directly adjacent to the Order Limits; including:

- Main Rivers and Ordinary Watercourses identified, based on the desk top review (Ordnance Survey data, Environment Agency / Lead Local Flood Authority data);
- Areas identified to be at high risk of extreme event surface water flooding based on gov.uk mapping;
- Coastal flood defences;

- Overview of topography;
- Overview of Converter Station Area; and
- Overview of Landfall.

1.1.3.8. A summary of the watercourses and site observations is presented in Appendix 20.3 (Watercourses Summary) of the ES Volume 3 (document reference 6.3.20.3).

1.1.4. SUMMARY OF POLICY RELEVANT TO ASSESSMENT

National Policy Statement for Energy 2011

1.1.4.1. The EN-sets out the Government's policy for delivery of major energy infrastructure.

1.1.4.2. Parts 4 and 5 of EN-1 detail the general principles that will be used in the assessment of applications and sets out how generic physical impacts (i.e. those impacts most likely to arise from the development of any type of energy infrastructure) and means of mitigation will be considered.

1.1.4.3. Parts 5.7 (Flood Risk) states:

- "Paragraph 5.7.4: states "Applications for energy projects of 1 hectare or greater in Flood Zone 1 in England […] and all proposals for energy projects located in Flood Zones 2 and 3 in England […] should be accompanied by a flood risk assessment;"
- Paragraph 5.7.5: details the minimum requirements for the assessments; namely:
  - "*be proportionate to the risk and appropriate to the scale, nature and location of the project;*
  - *consider the risk of flooding arising from the project in addition to the risk of flooding to the project;*
  - *take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;*
  - *be undertaken by competent people, as early as possible in the process of preparing the proposal;*
  - *consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;*
  - *consider the vulnerability of those using the site, including arrangements for safe access;*
  - *consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the decisions being made;*

- *consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;*
- *include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been considered and demonstrate that this is acceptable for this particular project;*
- *consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;*
- *consider if there is a need to be safe and remain operational during a worst-case flood event over the development's lifetime; and*
- *be supported by appropriate data and information, including historical information on previous events*."

National Planning Policy Framework 2018

1.1.4.4. The NPPF was first published on 27 March 2012 and updated on 24 July 2018 and 19 February 2019 with the aim of protecting the environment and to promote sustainable growth. There is an overarching presumption in favour of sustainable development that should be the basis of every plan and every decision.

1.1.4.5. The following paragraphs/ policies are considered relevant to this assessment:

- Paragraph 155: Requires that "Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.";
- Paragraph 158: Explains that "the aim of the Sequential Test is to steer development to areas with the lowest probability of flooding";
- Paragraph 163: Explains that "When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere […];
- Paragraph 165: Recommends that "major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
  - *take account of advice from the lead local flood authority;*
  - *have appropriate proposed minimum operational standards;*
  - *have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
  - *where possible, provide multifunctional benefits*".

2. EXISTING SITE AND BASELINE DATA

2.1. SITE LOCATION

2.1.1.1. The Order Limits consists of a maximum parameter envelope for the Proposed Development which is illustrated in Figure 3.2 of the ES Volume 2 (document reference 6.2.3.2).

2.1.1.2. The Order Limits extend from Lovedean, Waterlooville in the North down to Eastney, Portsmouth in the South.

2.1.1.3. The Onshore Cable Corridor passes through the rural environment between more urbanised environments within and adjacent to many local settlements, including:

- Anmore;
- Waterlooville;
- Purbrook;
- Drayton;
- Farlington;
- Portsea Island (East side); and
- Eastney.

2.2. SITE CONTEXT AND DESCRIPTION

2.2.1.1. The Order Limits consist of rural and urbanised environments as visible within Figure 3.2.

2.2.1.2. Based on the Environment Agency Flood Map for Planning, reproduced in Figure 20.4 of the ES Volume 2 (document reference 6.2.20.4), the Order Limits are in a range of Flood Zone 1, 2 and 3.

2.2.1.3. Key features relevant to the flood risk environment are further described hereafter with the sequential acceptability discussed in Section 3 of this report.

2.3. SITE TOPOGRAPHY

2.3.1.1. A summary of the topography within each section of the Order Limits is provided within Table 1 which is based on Opensource gov.uk LiDAR data which has been reproduced on Figure 20.2 of the ES Volume 2 (document reference 6.2.20.2).

2.3.1.2. A high-level review of the LiDAR's accuracy was undertaken as part of the detailed site visit and has been used to inform identification of potential overland flow routes in the following surface water flood risk section.

2.3.1.3. Key terrain features within the Order Limits include:

- Hills: areas of high ground, from hilltop ground slopes down in all directions;

- Ridges: a line of high ground with height variations along its crest;
- Valleys: reasonably level ground bordered on the sides by higher ground (contours often U shaped);
- Draws: like a valley, except that it normally is less developed (contours often V shaped); and
- Spurs: a usually short, continuously sloping line of higher ground, normally jutting out from the side of a ridge.

Table 1– Summary of Site Topography (based on Figure 20.2)

Section	Overview	Typical Approximate Elevations
1	Section 1 is the most northern section of the Order Limits and located 400 m south of a ridge/ spur of the South Downs. Two minor draws fall towards the south and converge at the southern end of section.	North approximately 100 m above Ordnance Datum Newlyn ('AODN') dropping to 60 m AODN at the south, 40 m elevation drop over 1 km (1 in 25 = 4%).
2	The draw develops into valley and continues dropping south throughout section.	North approximately 60 m AODN dropping to approximately 40 m AODN at the south, 20 m elevation drop over 1.2 km (1 in 60 = 1.6%).
3	Below the South Downs a more defined valley forms from north to south with many draws heading towards the valley.	North approximately 41 m AODN dropping to 37 m AODN at the south, 4 m elevation drop over 0.75 km (1 in 187.5 = 0.5%).
4	From north to south the Order Limits passes across a small ridge (1) at 42 m AODN, followed by two shallow valleys at 37 m and 36 m AODN respectively, the route then passes over a hill (2) at 61 m AODN followed by a valley at 38 m AODN. The study area then follows a spur up a hill/ ridge (3) of Port Downs at a high of approximately 90 m AODN.	1) Ridge (1 in 40 = 2.5%) 2) Hill (1 in 60 = 1.6%) 3) Hill/ ridge (1 in 200 = 5%)
5	The Order Limits then follows the hill down towards the coast.	North approximately 90 m AODN dropping to 4 m AODN at the south, 86 m drop over 2 km (1 in 23.3 = 4.3%)

Section	Overview	Typical Approximate Elevations
6	Section 6 of the Order Limits is typically low lying with minor level variations.	Levels range between 1 m and 9 m AODN
7	Section 7 of the Order Limits is typically low lying with minor level variations.	Levels range between 0 m and 10 m AODN
8	Section 8 of the Order Limits is typically low lying with minor level variations.	Levels range between 0 m and 6 m AODN
9	Section 9 of the Order Limits is typically low lying with minor level variations.	Levels range between 2 m and 6 m AODN
10	Section 10 of the Order Limits is typically low lying with minor level variations.	Levels range between 3 m and 5 m AODN

2.4. GEOLOGY

2.4.1.1. A detailed description of the geology is available in Chapter 18 (Ground Conditions) and Chapter 19 (Groundwater) of the ES Volume 1 (document reference 6.1.18 and 6.1.19) with a summary based on a review of British Geological Survey ('BGS') mapping and other available data sources as described hereafter.

2.4.2. SECTION 1 – LOVEDEAN (CONVERTER STATION AREA)

2.4.2.1. Superficial Geology:

- Head Deposits around the Converter Station and Access Road comprising mostly clay, silt, sand and gravel.

2.4.2.2. Bedrock Geology:

- Tarrant Chalk Member comprising soft white chalk with relatively widely spaced but large flint seams.

2.4.2.1. Groundwater Level

- Groundwater was not encountered at the Converter Station Area (Section 1) during the Phase 1 Ground Investigation ('GI'). Portsmouth Water suggest that groundwater is anticipated to be located at depth within the Principal Chalk aquifer at approximately 45.0 meters below ground level ('mBGL') and 60.0 mBGL at this location.
- The Environment Agency provided groundwater level monitoring data for Crossways observation borehole which is located close to the Converter Station Location. Manual dips are only recorded for this site for groundwater levels within the Principal Chalk aquifer. A maximum groundwater level of 38.58 mBGL (44.42

mAODN) and minimum groundwater level of 30.12 mBGL (52.88 mAODN) was recorded. These records confirm that groundwater levels for the Principal Chalk aquifer at this location (Section 1) are at depth.

2.4.3. SECTION 2 TO SECTION 9 – (ONSHORE CABLE CORRIDOR)

2.4.3.1. Superficial Geology:

- Head Deposits composed mostly of clay, silt, sand and gravel;
- River Terrace Deposits (undifferentiated) consisting of sand, silt and clay; and
- Raised Marine Deposits comprising sand and gravel.

2.4.3.2. Bedrock Geology:

- Tarrant Chalk Member which is composed of soft white chalk with relatively widely spaced but large flint seams (Section 2 of the Order Limits);
- Lambeth Group comprising clay, silt and sand (Section 3 of the Order Limits);
- London Clay and Wittering Formations both comprising clay, silt and sand (Section 4 of the Order Limits);
- Portsdown Chalk Formation and Whitecliff Sand Member comprising white chalk with marl seams and flint bands (Section 4 of the Order Limits);
- Spetisbury Chalk Member which is composed of firm white chalk with regular large flint seams (Section 4 and Section 5 of the Order Limits);
- Tarrant Chalk Member (Section 4 and Section 5 of the Order Limits);
- Newhaven Chalk Formation comprising soft to medium hard chalk with marl and flint bands (Section 5 of the Order Limits);
- White Chalk Subgroup comprising chalk with flints (Section 5 to Section 7 of the Order Limits), which is composed of the following units:
    - Portsdown Chalk Member;
    - Spetisbury Chalk Member;
    - Tarrant Chalk Member;
    - Newhaven Chalk Formation;
    - Seaford Chalk Formation; and
    - Lewes Nodular Chalk Formation.
- Lambeth Group, London Clay Formation and Bognor Sand Member, the latter is composed of partially cemented fine to medium grained sands (Section 8 of the Order Limits); and
- London Clay Formation (Portsmouth Sand Member) and Wittering Formation (Section 9 of the Order Limits).

2.4.3.3. Groundwater Level

- The Phase 2 GI focused on confirming ground conditions along the Onshore Cable Corridor and was undertaken between July 2018 and November 2018.
- Groundwater observations from the Phase 2 GI along the Onshore Cable Corridor (Section 2 to Section 9 of the Order Limits) found water levels to be variable along the entire corridor. Shallow groundwater levels were recorded at 0.47mAODN (0.28 mBGL) within the White Chalk Subgroup in boreholes developed in Section 7. The deepest groundwater level was recorded at 1.61mAODN (2.48 mBGL) within superficial Tidal Flat Deposits in boreholes developed in Section 9.
- Continuous groundwater level monitoring commenced on the 27th – 28th November 2018 and continued to May 2019. Groundwater level data predominantly reflects groundwater levels for winter within the superficial deposits along Section 6 to Section 9 of the Onshore Cable Corridor. A maximum winter groundwater level of 0.72mAODN was recorded in BH15A (Section 6 of the Order Limits) and a minimum groundwater level of 2.59mAODN recorded in BH33 D (Section 9 of the Order Limits).
- Section 6 and Section 7 of the Order Limits fall within the Broom Channel Estuary, which is tidal influenced. Groundwater levels recorded in BH36, BH18, BH19, BH16 and BH15A are strongly influenced by the tidal (see Technical Appendix 19.1) and suggests that the superficial deposits are in hydraulic continuity with the channel and the tide influences local groundwater levels.
- The Environment Agency provided groundwater level monitoring data for two (2 no.) observation boreholes (Denmead Nurseries and Portsdown) within Section 2 and Section 4 of the Order Limits respectively. Manual dips are only provided for these sites and are discontinuous i.e. records are broken over the time series record.
- A minimum groundwater level for Denmead Nurseries (Section 2 of the Order Limits) of 1.03 mBGL (44.9mAODN) and a maximum groundwater level of 16.2 mBGL (29.8mAODN) is recorded.
- A minimum groundwater level for Portsdown (Section 4 of the Order Limits) identifies a seasonal response in groundwater levels for the Principal Chalk aquifer (refer to Technical Appendix 19.1). A minimum groundwater level of 49.5 mBGL (49.5 mAODN) and maximum groundwater level of 89.72 mBGL (9.28 mAODN) is recorded.
- Portsmouth City Council provided continuous groundwater monitoring data for four (4 no.) observation boreholes located within Section 6 to Section 9 of the Order Limits. The groundwater level data reflects groundwater levels for summer and winter months between 2015 and 2018 within the superficial deposits predominantly.

- A maximum summer groundwater level of 0.50 mBGL (-0.29m AODN) and minimum winter groundwater level of 0.17 mBGL (0.04 mAODN) was recorded in Section 6 of the Order Limits.
- A maximum groundwater level of 1.04 mBGL and minimum groundwater level of 2.92 mBGL is recorded for Section 9 of the Order Limits.

2.4.4. SECTION 10 – EASTNEY (LANDFALL)

2.4.4.1. Superficial geology:

- River Terrace Deposits and Tidal Flat Deposits comprising clay, silt, sand and gravel; and
- Storm Beach Deposits comprising gravel and rarely sand.

2.4.4.2. Bedrock geology:

- The Wittering Formation is composed of clay, silt and sand and underlies the superficial deposits in Section 10 of the Order Limits.

2.4.4.3. Groundwater Level

- Portsmouth City Council provided continuous groundwater monitoring data for an observation borehole located in Section 10 of the Order Limits. A maximum groundwater level of 1.8 mBGL and minimum groundwater level of 2.92 mBGL is recorded.
- Due to the proximity to the coast in Section 10 of the Order Limits, local groundwater levels are expected to be influenced by the tide where the superficial deposits are in hydraulic continuity with the channel.

2.5. WATERCOURSES AND WATERBODIES

2.5.1.1. Based on the Environment Agency's Catchment Data Explorer, which builds upon the data in the river basin management plan, the Order Limits is located within:

- **River Basin District**: South East;
- **Management Catchments**: East Hampshire and South East Transitional and Coastal; and
- **Operational Catchments**: East Hampshire Rivers, Hampshire East Transitional and Coastal and Solent.

2.5.1.2. Within the South-East river basin catchment, the Order Limits are located within a number of different water bodies with a number of water framework directive ('WFD') designated watercourses identified.

2.5.1.3. Other Main Rivers and Ordinary Watercourses are not specifically designated; however, are direct tributaries to WFD designated watercourses and contribute to the same WFD water body catchment.

2.5.1.4. Based on OS and EA mapping and the detailed site visit undertaken on July 2019 a summary of watercourses, including Main Rivers, Ordinary Watercourses and other surface water features (e.g. ponds and lakes) is summarised within Table 2, illustrated in Figure 20.3 and detailed in Appendix 20.3 (Watercourses Summary) including site specific recordings and photos from the site visit.

2.5.1.5. Consultation with Hampshire County Council Lead Local Flood Authority, Portsmouth City Council Lead Local Flood Authority and the Environment Agency did not identify any other additional watercourses.

2.5.1.6. Other minor ditches and dry watercourses, also defined as Ordinary Watercourses, have not been individually identified at this stage; however, it is anticipated that several additional Ordinary Watercourse crossings may be required within the Cable Corridor. Identification of any other Ordinary Watercourse crossings will be further investigated post-application as part of the detailed design undertaken by the Appointed Contractor once the specific Cable Route is confirmed within the Onshore Cable Corridor.

2.5.1.7. Furthermore, the water bodies are discussed within Chapter 20 (Surface Water Resources and Flood Risk) and illustrated within Figure 20.8 of the ES Volume 2 (document reference 6.2.20.8).

Table 2– Summary of Watercourse Designations and Figure 20.3 Reference

Section	Watercourse	Designation	Figure 20.3 Watercourse Reference
1 & 2	No watercourses	n/a	n/a
3	Kings Pond	Pond	WC.01
	Soake Farm – North	Main River	WC.01
	Soake Farm – East	Main River	WC.02
4	Unnamed Watercourse	Ordinary Watercourse	WC.03
	Old Park Farm	Main River	WC.04
	Unnamed Watercourse	Ordinary Watercourse	WC.05
	Unnamed Watercourse	Ordinary Watercourse	WC.06
	No Watercourse	n/a	n/a
	Unnamed Watercourse	Ordinary Watercourse	WC.07
	Unnamed Watercourse	Ordinary Watercourse	WC.08
	North Purbrook Heath (North)	Main River	WC.09
	North Purbrook Heath (South)	Main River	WC.10

Section	Watercourse	Designation	Figure 20.3 Watercourse Reference
5 & 6	No Watercourses	n/a	n/a
7	Farlington Marshes Gutter	Ordinary Watercourse	WC.11
	Farlington Marshes Gutter	Main River	WC.12
	Ports Creek / Broom Channel	Main River/ Coastal Environment	WC.13
8	Great Salterns Drain	Main River	WC.14
	Milton Common Ponds	Pond's	n/a
9 & 10	Langstone Harbour	Main River/ Coastal Environment	n/a

2.6. FLOOD DEFENCES

2.6.1. INLAND WATERCOURSE FLOOD DEFENCES

2.6.1.1. A summary of all known flood defences for the inland Main Rivers is presented in Table 3 and is based on the Environment Agency Product 4 data and gov.uk spatial data 'spatial flood defences (including standardised attributes)'.

2.6.1.2. Coastal flood defences are discussed in the following sub-section.

Table 3 – Summary of known Fluvial Flood Defences within/ adjacent to the Site (see Figure 20.4)

Watercourse	Defence Type
Soake Farm (North)	High Ground/ Embankment
Soake Farm (East)	High Ground/ Embankment
Old Park Farm	High Ground/ Embankment
River Wallington (South)	High Ground/ Embankment
North Purbrook Heath (North)	Culvert
North Purbrook Heath (South)	High Ground
Farlington Marshes Gutter	High Ground
Great Salterns Drain	High Ground

2.6.2. INTERTIDAL AND COASTAL FLOOD DEFENCES

Farlington Marshes and Mainland

Havant Bypass

2.6.2.1. The flood defences fronting the Havant Bypass flyover comprise of a concrete revetment with sheet piled toe which is maintained by Highways England.

2.6.2.2. Based on LiDAR data the defences and high ground thereafter creates a minimum crest level of 3.8 m AODN, it is expected that there are many surface water outfalls within this location.

Farlington Marshes

2.6.2.3. The flood defences around Farlington Marshes comprise of a concrete revetment with a crest level of 3.1 m AODN, based on LiDAR data. The flood defence is maintained by the Environment Agency/ Portsmouth City Council, and an outfall from Farlington Marshes Drain discharges through the flood defences into Langstone Harbour, it is understood that the outfall is a gravity discharge based on correspondence with the Environment Agency and Portsmouth City Council.

Portsea Island

2.6.2.4. There are a number of coastal / tidal flood defences around the perimeter of Portsea Island.

2.6.2.5. Based on correspondence with the Environment Agency and East Solent Coastal Partnership it is understood that a programme of improvement works to the coastal / tidal flood defences within Portsea Island is being undertaken.

North Portsea

2.6.2.6. Within north Portsea the new flood defence schemes are designed to provide a standard of protection up to the 1 in 500-year (plus allowance for climate change to 2100). A number of these schemes have already been completed.

2.6.2.7. Based on East Solent Coastal Partnership data the status of these schemes is summarised below and illustrated in Plate 3.

- Phase 1: new defences constructed in 2015-2016 to manage the flood and erosion risk to properties of Anchorage Park. The new defences comprise raised earth embankments with a rock revetment front face.
- Phase 2: new defences constructed in 2016 comprise of 750m of rock revetment to manage the erosion risk to the historic landfill area of Milton Common and two set back earth embankments to manage flood risk to the residents of Portsmouth.
- Phase 3: new defences currently being constructed which comprise of vertical sea walls to protect the area from flood risk. Landscaping works will also be developed to enhance the natural amenity of the surrounding area.
- Phase 4: new defences currently going through detailed design and due to be constructed in the next few years. It should be noted that extensive consultation

between the Applicant and East Solent Coastal Partnership has been undertaken to understand opportunities and constraints between these two schemes.

- Phase 5: new defences currently going through detailed design and likely to be brought forward in 2023.

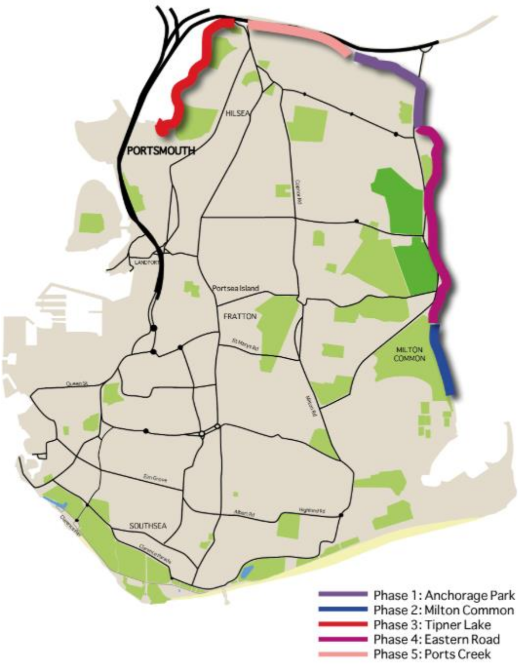


Plate 3– North Portsea Island Flood Defence Schemes: East Solent Coastal Partnership Extract (http://www.escp.org.uk, 2019)

Eastney Beach/ Fort Cumberland/ Marina/ Lock Lake

2.6.2.8. Based on correspondence with East Solent Coastal Partnership it is understood that most of the existing costal flood defences from Eastney Beach around to Milton Common are owned by Portsmouth City Council, however there are also other privately-owned flood defences.

2.6.2.9. It is understood that there are currently no proposed capital investment schemes to enhance the existing flood defences in this location and the mix of flood defences typically comprise:

- Milton Common to Thatched House Pub Car Park east end: Sea wall / brick structure, Portsmouth City Council maintained;
- Thatched House Pub Car Park east end to Pub west boundary: Sea Wall, Privately Owned;
- Thatched House Pub west boundary to most westerly point of Lock Lake: Made ground (reclaimed landfill) with sporadic gabion baskets to provide erosion protection;
- Most westerly point of Lock Lake to north end of Southsea Marina: Rip-rap armour, Portsmouth City Council maintained;

- Southsea Marina: Sheet piled marina wall with rock armour frontage Portsmouth City Council maintained;
- Langstone Harbour Entrance: Beach, Portsmouth City Council maintained;
- Pier to Caravan park (Fraser Battery): mix of concrete revetment and seawall, Private ownership; and
- Caravan Park and Eastney Beach: Beach, Portsmouth City Council maintained.

Southsea/ Seafront

2.6.2.10. The Southsea sea front flood defence scheme is being brought forward under a separate flood defence scheme to the North Portsea flood defence schemes and ends on Eastney Beach approximately 1.5 km west of the Order Limits.

2.6.2.11. As this section of the coastline is not within proximity to the Order Limits it is not discussed further.

2.7. WATER SUPPLY AND WASTEWATER DRAINAGE NETWORKS

2.7.1.1. Throughout the Oder Limits there are many water supply and wastewater drainage networks anticipated to be crossed by the Proposed Development.

2.7.1.2. Within the Order Limits; Portsmouth Water supply the clean water supply, Southern Water supply the public wastewater/ sewage, and Hampshire County Council/ Portsmouth City Council manage the highway drainage in their role as highways authorities in each respective authority area.

2.7.1.3. Adjacent to the Converter Station Area the closest public sewers are located within Lovedean Lane approximately 1 km east of Onshore Cable Corridor Section 1 of the Order Limits.

2.7.1.4. No site-specific water supply and wastewater drainage network details have been obtained for the purposes of this assessment, however a high-level overview of the water supply and wastewater drainage networks across the Oder Limits is provided in Chapter 20 (Surface Water Resources and Flood Risk).

2.8. RESERVOIRS

2.8.1.1. The majority of the Order Limits is located outside of the maximum extent of reservoir flooding based on the gov.uk “Long term flood risk information” flood risk from reservoirs, as illustrated Figure 20.6 of the ES Volume 2 (document reference 6.2.20.6).

2.8.1.2. There are two areas within the Order Limits at risk of flooding from reservoirs as summarised below with their approximate distance to the Order Limits detailed:

- Risk associated to Purbrook Regulating Reservoir (0.7 km from Section 4):
  - **Grid reference**: SU6791508112;
  - **Owner**: Southern Water Services Ltd;

- Lead Local Flood Authority: Hampshire;
- **Risk designation**: High Risk; and
- **Comments**: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

- Risk Associated to Farlington No 9 (0.1 km from Section 5):
  - **Grid reference**: SU6813606107;
  - **Owner**: Portsmouth Water Ltd;
  - **Lead Local Flood Authority**: Portsmouth;
  - **Risk designation**: To be determined; and
  - **Comments**: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority.

2.8.1.3. Elsewhere within the Order Limits, other artificial water bodies include:

- Kings Pond – small pond embedded into the ground; and
- Milton Common (Frog Pond, Duck Lake, Swan Lake) - small ponds/ lakes embedded into the ground.

3. PROPOSED DEVELOPMENT

3.1. DEVELOPMENT PROPOSALS

3.1.1.1. The Proposed Development includes a new marine and onshore HVDC power cable transmission link between Normandy in France and Eastney, Hampshire, converter stations in both England and France, and fibre optic data transmission cables (see Plate 1).

3.1.1.2. The Proposed Development comprise the following elements:

- Converter Station Area
  - Converter Station
  - Telecommunications Buildings
  - Associated Ancillary Infrastructure
- Onshore Cable Corridor
  - HVDC Cables
  - FOC Equipment
  - Joint Bays
  - Link Boxes
  - Link Pillars
- Landfall
  - Optical Regeneration Station(s) ('ORS')

3.1.1.3. For further detail of the Proposed Development refer to Chapter 3 (Description of the Proposed Development).

3.2. VULNERABILITY CLASSIFICATION

3.2.1.1. The Proposed Development, utility infrastructure, is considered as **essential infrastructure** based on the flood risk vulnerability classification.

3.3. SEQUENTIAL TEST

3.3.1.1. Based on the NPPF 'Flood risk vulnerability and flood zone compatibility' matrix, essential infrastructure is appropriate within Flood Zone 1 and Flood Zone 2, and the exception test is required for Flood Zone 3.

3.3.1.2. A Sequential Test aims to steer new development to areas with the lowest probability of flooding if there are reasonably available sites appropriate to the proposed development in areas with a lower probability of flooding.

3.3.1.3. With regards to the ORS, this is required to be located within 1 km of Landfall with the Applicant having considered the following alternative locations available to site the ORS (within a compound up to 450 sqm) within 1 km of the Landfall. Discounted alternatives include:

- the open space immediately east of the car park also sits within Flood Zone 2, and is designated as a SINC. The land further east within Flood Zone 1 is in immediate proximity to, and includes part of the scheduled ancient monument of Fort Cumberland. The loss of an area of protected open land, also available for public use, and likely negative impact on the setting of the SAM was considered to result in an overall negative environmental effect;
- Southsea Marina, Eastney Cruising Association and the Eastney - Hayling terminal further east along Fort Cumberland Road and Ferry Road were found to have no suitable open space to meet the land area requirements;
- Fraser Range, whilst having available land, is subject to a pending planning application for residential development, as a major development site providing up to 134 dwellings and associated works, was not considered available, and had the potential to impact on the setting of Fort Cumberland SAM;
- the open areas of amenity space north of the Landfall, in the locality of the Lumsden Road residential estate were not considered suitable, with a mix of Flood Zones 1 and 2. Where Flood Zone 1, the siting of the ORS is considered to have a negative impact on residential amenity (noise) due to the proximity of dwellings and general residential amenity in terms of the loss of open space;
- other alternatives comprised areas of open land to the west and northwest of the Landfall (Bransbury Park, the Royal Marines playing fields north of Driftwood Gardens, land around Eastney Swimming Pool, and Kingsley Road open space) but were considered to have a negative environmental impact in terms of the permanent loss of publicly accessible open space and recreation facilities.

3.3.1.4. The car park, providing an area of existing compacted ground for car parking, with no formal open space use, directly adjacent to the proposed Landfall and HVDC cables and transition joint bays (which cannot be built above) was considered to provide the most appropriate location in terms of the least environmental impact. The location was not considered to have any impact on open space, residential amenity, or the setting of the SAM given the distance over 200 m, with opportunities for landscape screening to be provided to reduce the visual impact of the above ground elements.

3.3.1.5. Based on the NPPF 'Flood risk vulnerability and flood zone compatibility' matrix, the ORS is deemed appropriate in Flood Zone 2 as no other suitable alternative locations were identified in locations with a reduced risk of flooding within Flood Zone 1.

3.4. EXCEPTION TEST (NPPF & EN-1)

3.4.1.1. The proposed Converter Station and the majority of the Order Limits are proposed within Flood Zone 1. Part of the Onshore Cable Corridor passes through Flood Zone 2 and Flood Zone 3.

3.4.1.2. Where the Order Limits pass through Flood Zone 3 the exception test is passed; where in accordance with the exception test from NPPF 2019 and EN-1:

- (NPPF 2019 & EN-1) *the development would provide wider sustainability benefits to the community that outweigh the flood risk* – Government has identified a need for Interconnectors as a key element of the UK electricity network. In doing so, an Interconnector is considered to form essential infrastructure, providing significant benefits to the UK as a whole and thus the local community which outweighs the flood risk; and
- (EN-1) *the project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs* – The main infrastructure elements are located in either Flood Zone 1 (Converter Station) or Flood Zone 2 (ORS) with the Onshore Cable Corridor in a range of Flood Zone 1, 2 and 3 where it would not be feasible to avoid Flood Zone 3 in its entirety due to the layout of the River Basin Catchment and associated watercourses;
- (NPPF 2019 & EN-1) *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall* – The risk of flooding is considered for the component elements of the Proposed Development with appropriate mitigation to ensure the development will be safe over its lifetime with regards to the current understanding of flood risk profile and future climate change predictions, as detailed within this Section 7 of this report.

4. CLIMATE CHANGE

4.1. BACKGROUND INFORMATION

4.1.1.1. Due to climate change, more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall could be expected. Sea levels are also expected to continue to rise.

4.1.1.2. Environment Agency guidance "Flood risk assessments: climate change allowances" issued on the 19th February 2016 (and subsequent minor updates) provides up to date information on expected changes in rainfall, river flows and sea level rise because of climate change.

4.1.1.3. For peak rainfall the Environment Agency Guidance provides an upper end and central allowance depending on epoch; the guidance recommends assessing both the central and upper end allowances to understand the range of possible impacts. These allowances are detailed in Table 2 of the Environment Agency climate change guidance.

4.1.1.4. Sea level rise allowances reflect the previous guidance and vary on a regional basis as detailed in Table 3 of the Environment Agency climate change guidance.

4.1.1.5. Furthermore, UK Climate Projections 2018 ('UKCP18'), published on 26th November 2018 stated that

"the allowances in 'Flood risk assessments: climate change allowances' (published February 2016) are still the best national representation of how climate change is likely to affect flood risk for:

- peak river flow
- peak rainfall intensity

The climate change allowances for sea level rise in 'Flood risk assessments: climate change allowances' will be updated and published as early as possible in 2019. Until then, it is reasonable to continue to use the sea level rise allowances in 'Flood risk assessments: climate change allowances' (published in 2016) for planning decision making, because the allowances that have been used to date represent the high end of the range of sea level rise projected by UKCP18.

However, in exceptional cases where developments are very sensitive to flood risk and have a lifetime of at least 100 years, [we] the Environment Agency recommend [you] developers to assess the impact of both the current allowance in 'Flood risk assessments: climate change allowances' and the 95th percentile of UKCP18 'RCP 8.5' scenario (high emissions scenario) standard method sea level rise projections of UKCP18, and plan according to this assessed risk. You will need to calculate sea level rise allowances beyond 2100 by extrapolating the

UKCP18 dataset. The Environment Agency will check your extrapolation methodology and provide advice."

4.1.1.6. Based on 'Adapting to Climate Change, UK Climate Predictions, June 2009', because of climate change winters in the southern UK up to 2080 are predicted to be on average generally wetter by approximately 30%. Conversely, summers will be drier and warmer. The significance of this is that there will likely be more marked seasonal variation with respect to groundwater levels with greater groundwater level variations between average summer and average winter levels. Notably, this is predicted to result in increased groundwater levels during winter.

4.1.1.7. As groundwater near the coast is likely to be tidally influenced i.e. in hydraulic continuity with the sea, the effect of sea level rise will lead to groundwater level rise. The combined climate change effects of sea level rise, increased storm surge and extreme rainfall may also lead to greater interaction between surface water and groundwater water bodies in the future.

4.2. DEVELOPMENT LIFESPAN

4.2.1.1. The Proposed Development will be designed, manufactured and installed for a minimum service life of 40 years, however the operation life may exceed this duration.

4.3. IMPACT OF CLIMATE CHANGE ON THE DEVELOPMENT

4.3.1.1. Due to the nature of the Proposed Development there are only limited elements of infrastructure above ground during operation that have the potential to be impacted by, or impact upon flood risk, when considering the effects of climate change.

4.3.1.2. The elements that have the potential to be impacted by climate change are summarised below and are further considered as part of the 'definition of flood hazard' (Section 6 of this report) and 'proposed mitigation' (Section 7 of this report).

4.3.2. ACTIVITIES DURING CONSTRUCTION

4.3.2.1. As the Proposed Development construction is proposed to be brought forward within the next few years, as agreed through consultation with the Environment Agency, no allowance for climate change is considered for the current day scenarios/ construction stager of the Proposed Development.

4.3.3. OPERATION

Converter Station

4.3.3.1. Located in Flood Zone 1 with no watercourses in the near vicinity of the Converter Station there is no requirement to consider the impact of climate change in relation to peak river flows or sea level rise.

4.3.3.2. Peak rainfall allowances as a result of climate change are considered, and as set out in Table 2 of the Environment Agency's "Flood risk assessments: climate change allowances" the below climate change allowances are considered:

- Upper End – 40% increase in peak rainfall by 2100; and
- Central – 20% increase in peak rainfall by 2100.

Onshore Cable Corridor

4.3.3.3. During operation, the Onshore Cable Corridor and associated equipment will be in a mix of Flood Zone 1, 2 and 3, however the majority of equipment will be buried and have a negligible impact upon, or have a negligible impact from, the flood risk environment associated to peak rainfall, peak river flows and sea level rise.

4.3.3.4. Therefore, the impacts of climate change are not predicted to have any impact on the Onshore Cable Corridor during operation and are not considered further.

Optical Regeneration Station(s)

4.3.3.5. The ORS's are in the tidal/ coastal Flood Zone 2 and would result in an increase in impermeable land where the surface water will need to be managed. The impact of climate change from sea level rise and increase in peak rainfall are therefore considered. Impacts associated to increase in peak river flows are not applicable.

4.3.3.6. As set out in Table 2 of the Environment Agency's "Flood risk assessments: climate change allowances" the below climate change allowance should be considered:

- Upper End – 40% increase in peak rainfall by 2100; and
- Central – 20% increase in peak rainfall by 2100.

4.3.3.7. As agreed with the Environment Agency through consultation, the Upper End and H++ scenarios for sea level risk have been considered as defined in Table 3 of the Environment Agency's "Flood risk assessments: climate change allowances" and Table 5 of the "Advice for Flood and Coastal Erosion Risk Management Authorities". These allowances predicted for the south east are summarised in Table 4.

Table 4 – Extract of Environment Agency Predicted Annual Rates of Sea Level Rise

Sea Level Rise in Millimetres (mm) per Year				
	2018 - 2025	2026 - 2055	2056 - 2085	2086 - 2115
Upper End	4	8.5	12	15
	2018 - 2025	2026 - 2050	2051 - 2080	2081 - 2120
H++ Scenario	6	12.5	24	33

5. DEFINITION OF FLOOD HAZARD

5.1. OVERVIEW

5.1.1.1. This section of the report provides detail of the identified sources and mechanisms of flooding associated within the Order Limits and associated to the Proposed Development.

5.1.1.2. This assessment considers flood risk profile, sources and mechanisms of flooding during:

- the current day scenario with no allowance for climate change in association to construction of the Proposed Development; and
- the future scenario with an allowance for climate change, where appropriate, in association to the elements of the Proposed Development that are expected to either impact or be impacted by the future flood risk environment. These discrete elements of the proposed development include:
  - Converter Station Area;
  - Link Pillar(s); and
  - ORS.

5.2. FLOOD HAZARD RISK RATING

5.2.1.1. Based on the information available the flood risk probability from the various sources of flooding has been classified in association to; Table 5 to Table 9.

Table 5 - Fluvial and Tidal Flooding

Flood Source	Flood Risk/ Probability Rating	Description
Fluvial/ Tidal	Negligible	Located within Flood Zone 1, away from any fluvial/tidal floodplain; **or** located in an area of very low risk according to the Environment Agency's Risk of Flooding from Rivers and Sea/ gov.uk 'Long term flood risk information' Map **and** the site is located a significant distance and/or elevation away from the nearest fluvial/tidal feature; **or** another source of data suggests this is the appropriate rating.
	Low	Located within Flood Zone 1 but located close to a fluvial/tidal floodplain; **or** located in Flood Zone 2; **or** located in an area of low/ very low risk according to the Environment Agency's Risk of Flooding from Rivers and Sea/ gov.uk 'Long term flood risk

Flood Source	Flood Risk/ Probability Rating	Description
		information' Map; **or** located within Flood Zone 2 or 3 but is defended to a 1 in 100 (1%) year flood level and the defences are publicly maintained to a 'good' standard; **or** another source of data suggests this is the appropriate rating.
	Medium	Located within Flood Zone 3 **and** located in an area of medium risk according to the Environment Agency's Risk of Flooding from Rivers and Sea/ gov.uk 'Long term flood risk information' Map; **or** another source of data suggests this is the appropriate rating.
	High	Located within Flood Zone 3 **and** located in an area of high risk according to the Environment Agency's Risk of Flooding from Rivers and Sea/ gov.uk 'Long term flood risk information' Map; **or** another source of data suggests this is the appropriate rating.

Table 6- Surface Water Flooding

Flood Source	Flood Risk/ Probability Rating	Description
Surface Water	Very Low	Located in an area of very low risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from Surface Water Map.
	Low	Located in an area of low risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from Surface Water Map; **or** located in an area of medium risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from Surface Water Map but the depths are below 300mm **or** do not affect the operation/ function of the site; **or** another source of data suggests this is the appropriate rating
	Low to Medium	Located in an area of low risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from Surface Water Map but it appears the risk is underestimated; **or** located in an area of medium risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from

Flood Source	Flood Risk/ Probability Rating	Description
		Surface Water Map but it appears the risk is overestimated; **or** another source of data suggests this is the appropriate rating.
	Medium	Located in an area of medium risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from Surface Water Map; **or** by inspection identified preferential flow paths onto or across the development, although level suggest flooding avoids development; **or** another source of data suggests this is the appropriate rating.
	Medium to High	Located in an area of medium risk according to the Gov.uk' 'Long term flood risk information' Risk of Flooding from Surface Water Map but it appears the risk is underestimated; **or** located in an area of high risk according to the Gov.uk 'Long term flood risk information' Risk of Flooding from Surface Water Map but it appears the risk is overestimated; **or** by inspection identified preferential flow paths onto or across the development, with levels suggesting flooding doesn't avoid development; **or** another source of data suggests this is the appropriate rating.
	High	Located in an area of high risk according to the Gov.uk's 'Long term flood risk information' Risk of Flooding from Surface Water Map; **or** by inspection identified preferential flow paths onto or across the development affecting the development; **or** another source of data suggests this is the appropriate rating.

Table 7 - Groundwater

Flood Source	Flood Risk/ Probability Rating	Description
Ground-water	Low	No recorded groundwater flooding problems and the available data indicates that there is a low risk of groundwater flooding (e.g. the EA Groundwater Susceptibility Map and/or local groundwater monitoring data show a Negligible risk of groundwater flooding).

Flood Source	Flood Risk/ Probability Rating	Description
	Low to Medium	The available data (e.g. EA Groundwater Susceptibility Map and/or local groundwater monitoring data) indicates that the site is in low susceptibility zone or borehole logs indicate that groundwater is a significant depth below ground level or there is a layer of impermeable material
	Medium	The available data (e.g. EA Groundwater Susceptibility Map and/or local groundwater monitoring data) indicates that the site is in moderate to moderately high susceptibility zone and borehole logs (where available) indicate that there may be potential for groundwater to be close to the surface
	Medium to High	The available data (e.g. EA Groundwater Susceptibility Map and/or local groundwater monitoring data) indicates that the site is in the high susceptibility zone and borehole logs (where available) indicate that the groundwater levels are close to the surface
	High	Recorded instances of groundwater flooding.

Table 8 – Sewer and Drainage

Flood Source	Flood Risk/ Probability Rating	Description
Sewer and Drainage	Negligible	The site has no sewers or drainage networks.
	Low	The sewers are well maintained and unlikely to have capacity issues; **or** another source of data suggests this is the appropriate rating; **or** another source of data suggests this is the appropriate rating.
	Medium	The sewers are poorly maintained and/or may have capacity issues; **or** another source of data suggests this is the appropriate rating; **or** another source of data suggests this is the appropriate rating.
	High	The sewers are poorly maintained and/or likely to have capacity issues; **or** another source of data suggests this is

		the appropriate rating; **or** another source of data suggests this is the appropriate rating.

Table 9 - Reservoirs

Flood Source	Flood Risk/ Probability Rating	Description
Reservoirs	Negligible	No non-natural or artificial sources identified within 1km.
	Low	Non-natural or artificial sources embedded at or below ground level with no dam; **or** large reservoirs that hold over 25,000 cubic meters of water which are regulated under the Reservoirs Act 1975, as amended by the Flood and Water Management Act 2010, and enforced by the Environment Agency in England; **or** another source of data suggests this is the appropriate rating.
	Medium	Non-natural or artificial sources embedded at or below ground level with dam elevated above Site in reasonable condition; **or** large reservoirs that hold over 25,000 cubic meters identified to be at medium risk; **or** another source of data suggests this is the appropriate rating.
	High	Non-natural or artificial sources embedded at or below ground level with dam elevated above Site in poor condition; **or** large reservoirs that hold over 25,000 cubic meters identified to be at high risk.

5.2.2. SUMMARY OF DATA SOURCES

5.2.2.1. The sources and mechanisms of flooding associated to the Order Limits have been informed by a desk top study, consultation/ engagement with consultees and site visits.

5.2.2.2. Alongside a review of relevant local planning authority documents summarised noted in section 1.3.2 an understanding of the flood risk profile environment is primarily based on the following data sets:

- **Tidal Flooding** - gov.uk “Flood Map for Planning”; and Environment Agency and ESCP consultation.
- **Fluvial Flooding** - gov.uk “Flood Map for Planning”; and Environment Agency and Hampshire County Council Lead Local Flood Authority consultation.

- **Surface Water Flooding** - gov.uk "Long term flood risk information" flood risk from surface water mapping; LiDAR data detailed site visit observations; and Lead Local Flood Authority consultation.
- **Reservoir Flooding** - gov.uk "Long term flood risk information" flood risk from reservoir mapping: flood extent;
- **Groundwater Flooding** - Hampshire Ground Water Management Plan: Figure 7 Areas susceptible to groundwater flooding; Lead Local Flood Authority consultation; and Chapter 19 Groundwater Resources and the Environment Agency Groundwater Flood Susceptibility Map.
- **Sewer Flooding** - Lead Local Flood Authority consultation.

5.2.2.3. A summary of key areas at risk of flooding is provided within Figure 20.1 based on the assessment made hereafter. Further figures associated to the flood risk profile include:

- **LiDAR** – Figure 20.2;
- **Watercourses** – Figure 20.3;
- **Flood Zones Map** – Figure 20.4;
- **Flood Risk from Surface Water** – Figure 20.5 of the ES Volume 2 (document reference 6.2.20.5);
- **Flood Risk from Reservoirs** – Figure 20.6; and
- **History of Flooding** – Figure 20.7 of the ES Volume 2 (document reference 6.2.20.7).

5.2.3. TIDAL AND FLUVIAL FLOODING HAZARDS

5.2.3.1. Based on the Flood Map for Planning (Figure 20.4), the Order Limits is within a range of Flood Zone 1, 2, and 3. The flood zones are defined as:

- **Flood Zone 1** is land assessed as having a less than 0.1% annual probability of flooding from the sea or rivers in any given year in the absence of flood defences;
- **Flood Zone 2** is land assessed as having between a 0.5% and 0.1% annual probability of flooding from the sea (between 1 in 200 and 1 in 1,000-year return period) or between 1% and 0.1% annual probability of flooding from rivers (between 1 in 100 and 1 in 1,000-year return period event or greater) in any given year in the absence of flood defences; and
- **Flood Zone 3** is land assessed as having a 0.5% or greater annual probability of flooding from sea flooding (1 in 200 return period events or greater) or 1% or greater annual probability of flooding from river flooding (1 in 100 return period events or greater) in any given year in the absence of flood defences.

5.2.3.2. Flood zone designation ignores the presence of any flood defences and only considers flooding from fluvial and tidal sources. Local knowledge obtained through consultation with stakeholders and relevant flood risk documents have been used alongside the Gov.uk 'Risk of Flooding from Rivers and Sea' Map.

5.2.3.3. This mapping takes into account the presence of flood defences that may be in an area. It should be noted that flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail which is taken into consideration within this assessment. The different risk categories within the mapping includes:

- **Very low** – an area that has an annual chance of flooding of less than 0.1% (1 in 1000-year return period);
- **Low** – an area that has an annual chance of flooding of between 0.1% and 1% (1 in 1000 to 1 in 100-year return period);
- **Medium** – an area that has an annual chance of flooding of between 1% and 3.3% (1 in 100 to 1 in 30-year return period); and
- **High** – an area that has an annual chance of flooding of greater than 3.3% (1 in 30-year return period).

5.2.3.4. With reference to the tidal and fluvial environment, Section 5 to 10 of the Order Limits are at risk of tidal flooding due to the coastal environment; and, Section 3 and 4 of the Order Limits is at risk of fluvial flooding.

Tidal

General Coastal Environment – Extreme Sea Levels

5.2.3.5. The tidal flood risk within Section 5 to Section 10 of the Order Limits is associated to low lying land adjacent to Langstone Harbour and Eastney Beach which are part of the tidal environment.

5.2.3.6. Based on the Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels (2018) the predicted still sea water level for the 0.5% annual exceedance event is presented in Table 10.

Table 10 - Summary of Environment Agency Predicted Extreme Sea Level and Future Scenario Estimates

		Baseline Extreme Tide Level (2017)	Assumed Start of Operation		40 Years from 2025		60 Years from 2025		80 Years from 2025	
			2025		2065		2085		2105	
			Upper End	H++	Upper End	H++	Upper End	H++	Upper End	H++
1 in 200 Year Return Period/ 0.5% AEP	'C1'	3.07	3.10	3.12	3.48	3.79	3.77	4.36	4.74	5.70
	'T'	**3.17**	**3.20**	**3.22**	**3.58**	**3.89**	**3.87**	**4.46**	**4.84**	**5.80**
	'C2'	3.31	3.34	3.36	3.72	4.03	4.01	4.60	4.98	5.94

5.2.3.7. The tidal Flood Zone 2 and 3 extents is qualitatively comparable to the ground elevation within the area (Figure 20.2) and current day predicted extreme tidal flood levels (Table 10).

5.2.3.8. It should however be noted that this does not take into consideration the presence of any flood defences or high ground adjacent to the flood defences.

5.2.3.9. Flood defences are located around Portsea Island to protect Portsmouth from both tidal flooding and coastal erosion, which in places comprise revetment bunds that are higher than the land behind the defence.

5.2.3.10. Based on consultation with East Solent Coastal Partnership the design standard of protection ranges throughout Portsea Island. Where new capital investment flood defence schemes have been completed, these flood defences offer a higher standard of protection up to a 1 in 500 year return period tidal event extreme sea level.

5.2.3.11. Areas located within Flood Zones 2 and 3 in the coastal environment are considered to have a medium and high probability of tidal flooding but this does not take into consideration the presence of any flood defences or high ground adjacent to the flood defences. If the presence of flood defences is considered, the Portsea Island Coastal Study (2011) illustrates that the actual current day risk of tidal flooding is significantly reduced and the present-day flood risk is limited to the northern perimeter of Portsea Island.

5.2.3.12. Furthermore, the implementation of the flood defence scheme at Anchorage Park, Milton Common and at the Great Salterns Lake Outfall has further increased the standard of protection up to a 1 in 500 year return period tidal event extreme sea level.

5.2.3.13. Where new flood defence schemes have not been implemented, based on LiDAR data, the crest of the existing flood defences are circa 3.1 m AODN which is 70mm below to the current day predicted 1 in 200-year return period tidal event extreme sea level which is qualitatively consistent to the Portsea Island Coastal Study (2011).

5.2.3.14. A history of overtopping related flash flooding has been recorded by Portsmouth City Council along Eastern Road (see Figure 20.7) and any extreme events of greater magnitude, or flooding from potential wave overtopping remains a risk to the coastal environment of the Order Limits.

Farlington Marshes Playing Fields– Tidal Surcharging

5.2.3.15. The flood map for planning does not take into consideration the presence of flood defences or high ground. In the instance of Farlington Marshes, high ground is present from the Havant Bypass flyover and associated flood defences.

5.2.3.16. As illustrated within Plate 4, the Havant Bypass flyover is not located within the Flood Zone 2 or 3 extent, due to the elevation above the coastal environment. Based on the adjacent high ground there is no direct flood pathway from Langstone Harbour over Havant Bypass flyover. The flyover creates a natural bunding up to a minimum elevation of 4 m AODN which is significantly higher than the predicted current day 1 in 200 year return period tidal event extreme sea level. However, secondary pathways could exist if surface water outfalls flap valves (or similar pathway non-return devices) are not in place or operational.

5.2.3.17. A residual risk of wave overtopping the Farlington Marshes coastal flood defences would cause surcharging of the Farlington Marshes Gutter which links via gravity up to Farlington Playing Fields.

5.2.3.18. Overall, based on the information available the actual probability of tidal flooding in Farlington Marshes Playing Fields is expected to be low, based on the high ground created from the Havant Bypass flyover, with a residual risk of medium associated to the risk of surcharging back through Farlington Marshes Gutter or surcharging through any surface water outfalls that could create a pathway between Langstone Harbour and north of the Havant Bypass flyover.

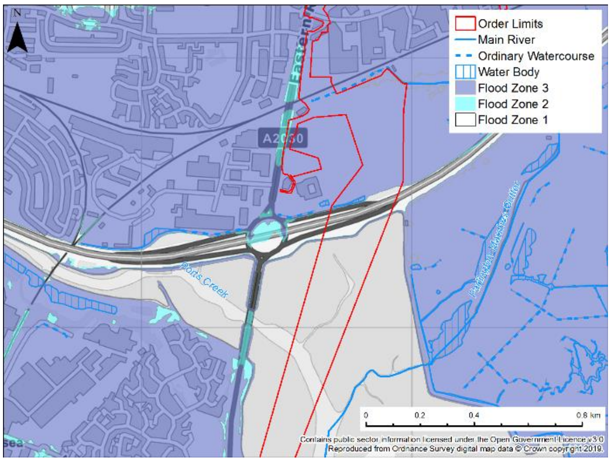


Plate 4– Flood Map Extract of Farlington Marshes

Portsea Island (Eastern Road, Milton Common, Eastney) – Overtopping

5.2.3.19. Due to the residual risk of a breach in the historic flood defences coming to the end of their serviceable life and history of overtopping flooding in the area the probability of tidal flooding is medium where the new coastal flood defence schemes have not been completed.

Great Salterns Drain

5.2.3.20. A risk of surface water flooding is present within Great Salterns Drain as large parts of Portsea Island drain through the golf courses to Great Salterns Lake before discharging via an Environment Agency maintained pump system that outfalls to Langstone Harbour which was upgraded in early 2011.

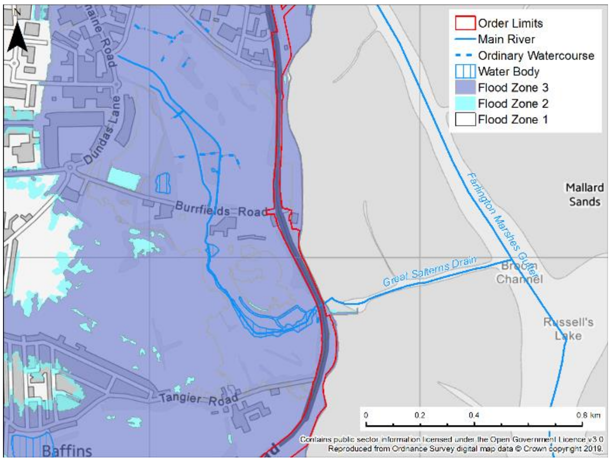


Plate 5 - Flood Map Extract of Great Salterns Drain

5.2.3.21. The lake has recently had its capacity increased (early 2011), and reed beds realigned to improve flow. Due to the low-lying nature of the land, during extensive heavy rainfall events localised flooding occurs, particularly when tide levels rise above the outfall level preventing it to freely discharge, known as tide locking.

5.2.3.22. Based on the information available the risk of flooding within the Order Limits adjacent to the Great Salterns Drain is considered to be medium, however the high ground of the carriageway within the Order Limits is likely to reduce the actual risk.

Landfall, Eastney – Future Scenario

5.2.3.23. The predicted current day and future flood levels at the landfall are summarised in Table 10. These findings are based on the baseline predicted extreme sea levels and applying the climate change estimates.

5.2.3.24. The proposed location of the ORS has a ground elevation of circa. 3.4 m AODN. Based on the information available the current day probability of flooding from the sea is considered to be low however the future probability of flooding from the sea is medium when considering the impacts of climate change and sea level rise.

Tidal flood hazard summary

5.2.3.25. In areas north of Ports Down the probability of tidal flooding is considered to be negligible due to the ground elevation being significantly higher than the sea in the current day and future scenario.

5.2.3.26. The probability of tidal flooding during the current day scenario is considered to range from low to medium along Eastney Road and the Onshore Cable Corridor (Section 7 – 10 of the Order Limits), when taking into consideration the presence of the existing flood defences, high ground and history of overtopping.

5.2.3.27. Based on the information available the probability of tidal flooding during the future scenario at the ORS is considered to be medium based on current ground levels and predicted future tidal flood event water levels and potential inundation pathways to the ORS.

Fluvial

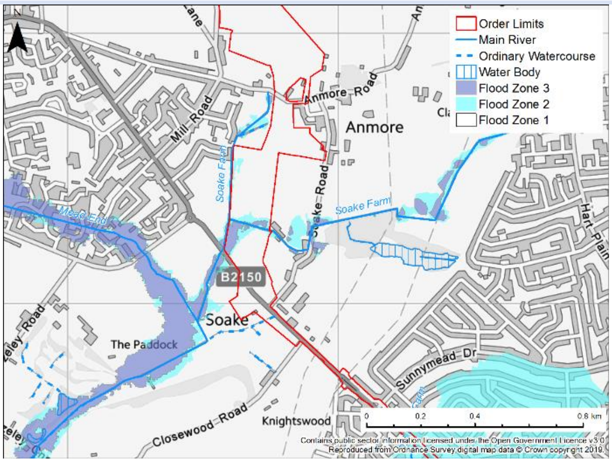
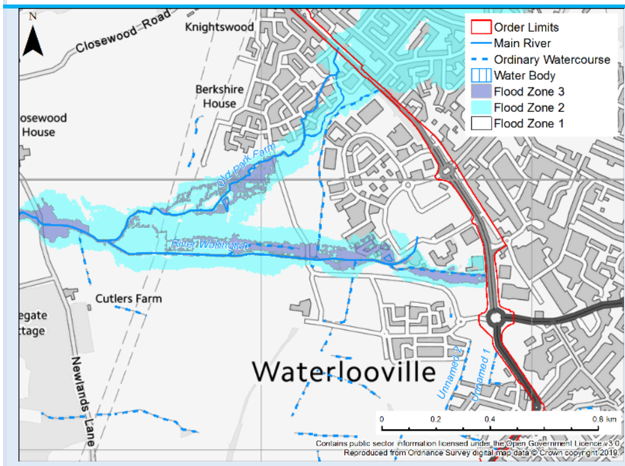
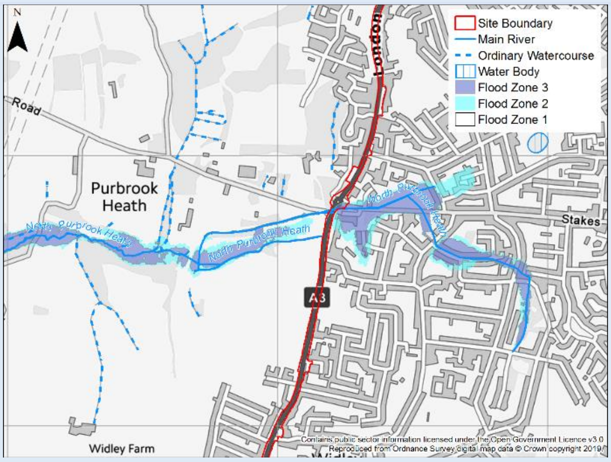
5.2.3.28. North of the Ports Downs' most of the Order Limits is located within Flood Zone 1 as the majority of the Order Limits is located at higher elevations than the associated inland watercourses and their associated catchments.

5.2.3.29. Within the Order Limits there are five locations where a fluvial flood risk remains, including:

- Soake Farm North (locally Flood Zone 2 and 3 within Site);
- Soake Farm East (locally Flood Zone 2 and 3 within Site);
- Old Park Farm (locally Flood Zone 2 within Site);
- River Wallington (locally Flood Zone 2 and 3 within Site); and
- North Purbrook Heath (North) (locally Flood Zone 2 and 3 within Site).

5.2.3.30. Areas of the Order Limits within Flood Zone 2 and 3 (undefended) (see Figure 20.4) are considered to have a medium to high probability of flooding respectively against the criteria in Table 5, when looking at their Flood Zone alone. These specific locations are detailed in Table 11 with consideration of 'Long term flood risk information' Map and any other information, where available.

Table 11– Summary of Fluvial Flood Risk Areas

 **Plate 6– Fluvial Flood Risk from Soake Farm North & Soake Farm East (Section 2 of Order Limits)**	The Soake Farm North and Soake Farm East have river banks and high ground and are located towards the top of their catchments and as such the associated flood plain and areas that fall within Flood Zone 2 and 3 are small. In the direct vicinity of the watercourses the risk of flooding is medium and high respectively, however areas thereafter are at low risk of flooding.
 **Plate 7– Fluvial Flood Risk from Old Park Farm & River Wallington (Section 4 of Order Limits)**	The flood extent associated to Old Park Farm extends north through the Order Limit where the Order Limits are located within Flood Zone 2. The risk of flooding in this area is considered to be typically low and medium where Old Park Farm passes under Hambledon Road. The flood extent associated with the River Wallington floodplain is shown to start west of the carriageway and the risk of flooding within the Order Limits where land is within Flood Zone 1 is assessed to be low.
 **Plate 8 – Fluvial Flood Risk from North Purbrook Heath (Section 4 of Order Limits)**	The North Purbrook Heath passes under the A3 in a twin box culvert. The only residual risk of flooding within the Order Limit in relation to this watercourse is from surcharging from culvert manholes. and the risk of flooding within the Order Limits (London Road) is low.

Fluvial Flood Hazard Summary

5.2.3.31. Based on the information available, all areas relevant to the Onshore Cable Corridor away from Main River watercourses, including the Converter Station, are considered to have a negligible probability of fluvial flooding due to the ground elevation being significantly higher than watercourses and due to the land being located within Flood Zone 1.

5.2.3.32. Based on the information available, the probability of flooding in the immediate vicinity of the Main River watercourses where land is located within Flood Zone 2 and 3 is typically reduced to low and medium due to the presence of flood defences/ hydraulic structures such as a twin box culvert within North Purbrook Heath.

5.2.3.33. The future scenarios for fluvial flood risk is not considered once the Proposed Development is operational, as the infrastructure will be buried in the ground and not exposed to the fluvial flood risk environment.

5.2.4. SURFACE WATER FLOODING HAZARDS

Overview

5.2.4.1. Alongside the detailed site visit, mapping data sets and information on flooding history from the Lead Local Flood Authorities has been used to identify the 'hot spot' locations at risk of flooding which have a medium to high risk of surface water flooding.

5.2.4.2. Surface water flood risk based on the gov.uk 'Long term flood risk information' mapping is illustrated in Figure 20.5.

5.2.4.3. The gov.uk 'Long term flood risk information' flood risk from surface water mapping represents flood risk on a scale of very low, low, medium and high; defined as:

- **Very Low risk** - means that each year this area has a chance of flooding of less than 0.1% (1 in 1000-year return period);
- **Low risk** - means that each year this area has a chance of flooding of between 0.1% and 1% (1 in 1000 to 1 in 100-year return period);
- **Medium risk** - means that each year this area has a chance of flooding of between 1% and 3.3% (1 in 100 to 1 in 30-year return period); and
- **High risk** - means that each year this area has a chance of flooding of greater than 3.3% (1 in 30-year return period).

5.2.4.4. Within the context of the Order Limits surface water flood risk is considered in two main parts:

- Flow Path – where predicted extreme event surface water overland flow path located within or passes through the Order Limits; and
- Localised Ponding – where predicted extreme event surface water ponding is expected.

5.2.4.5. It should be noted that the modelling used to predict surface water flooding overland flow routes and ponding, as presented within the Gov.uk 'Long term flood risk information' mapping, does not accurately take into consideration the operation of public drainage networks, highway drainage and other drainage features which can lead to the predicted flood extent being overestimated in some instances. The detailed site visit has been used alongside the available mapping data sets and history of flooding from the Lead Local Flood Authorities to identify the 'hot spot' locations at risk of flooding.

5.2.4.6. Within the Order Limits many locations pass through or are located within predicted extreme event overland flow routes, identified on the Gov.uk 'Long term flood risk information' mapping. These identified locations are consistent with the topographic data and site observations and typically include the following features:

- Overland flow paths where valleys are noted within the natural landscape, which are expected to convey surface water through the low spot of the valley;
- Overland flow paths identified within roads, where the impermeable surface of roads identify a risk of overland flow in extreme scenarios, however it is anticipated that generally the overland flow would be managed, at least partially, by the highway drainage network;
- Overland flow routes shown to be located along watercourses; and
- Localised low spots in the local terrain where ponding is anticipated to occur in extreme scenarios.

Localised Surface Water Flood Risk Areas

5.2.4.7. Within the Order Limits many locations are identified to have a risk of localised surface water flooding during extreme events based on the gov.uk long term flood risk mapping.

5.2.4.8. Table 12 summarises the key areas where a risk of surface water flooding is expected within the Order Limits. These findings are based on the detailed site visit, LiDAR data and consultation with the Lead Local Flood Authorities. For full details of the areas at risk refer to Figure 20.5 & 20.8 (Surface Water Flooding and History of Flooding).

Table 12 – Summary of Key Areas at Risk of Surface Water Flooding

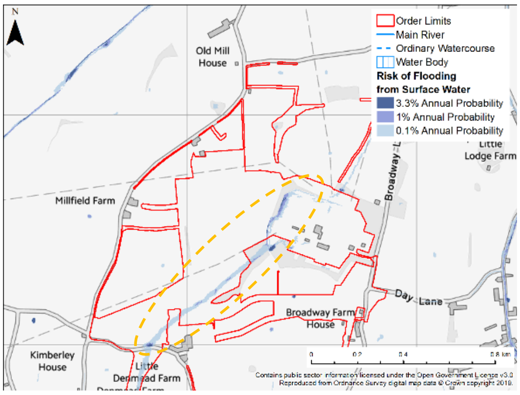
<table>
<tr>
<td>


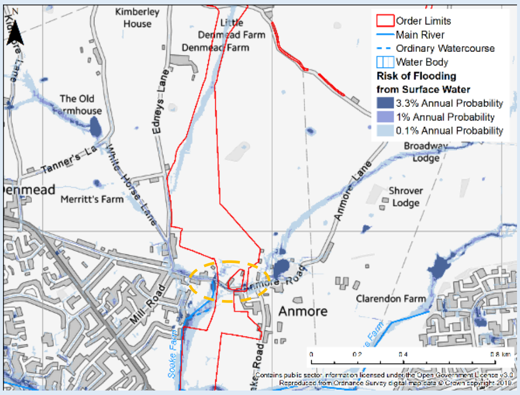
Plate 9 – Surface Water Flood Risk: (Section 1 of Order Limits)
</td>
<td>Winterbourne/dry watercourse within the natural local terrain which is likely to be present during winter months when the ground is saturated. Low risk of flooding.</td>
</tr>
<tr>
<td>


Plate 10 – Surface Water Flood Risk: (Section 1/ 2 of Order Limits)
</td>
<td>A history of flooding has been recorded from overland flow passing down White Horse Lane down towards Anmore Road.

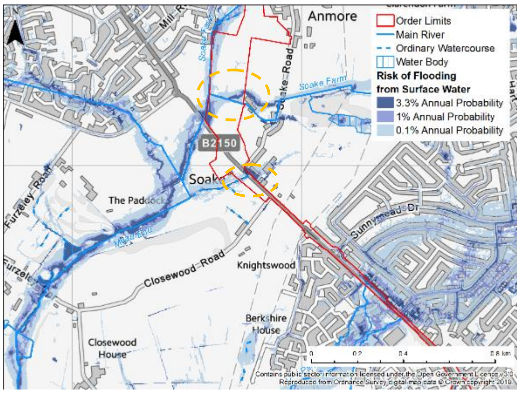
Anmore Road is a low spot in the local road network which can act as a conduit for surface water to convey (medium to high risk).</td>
</tr>
<tr>
<td>


Plate 11 – Surface Water Flood Risk: (Section 3 of Order Limits)
</td>
<td>Surface water flooding is like the extent of the Soake Farm watercourses. Any flood risk in this area will be more dominant from the fluvial influences and surface water flood risk is expected to be typically low to medium.

The junction of Soake Road is at increased risk of surface water flooding as it is a low spot in the local road network and therefore can act as a conduit for surface water to convey (medium to high risk).</td>
</tr>
</table>

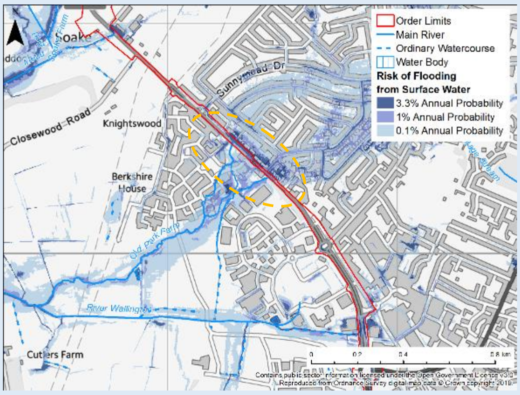


Plate 12 – – Surface Water Flood Risk: (Section 4 of Order Limits)

This area of Hambleden Road is at increased risk of surface water flooding as the road creates a low spot in the local road network. Furthermore, the urbanised area north of Hambleden Road falls towards the road. Both can act as a conduit for surface water to convey (medium to high risk).

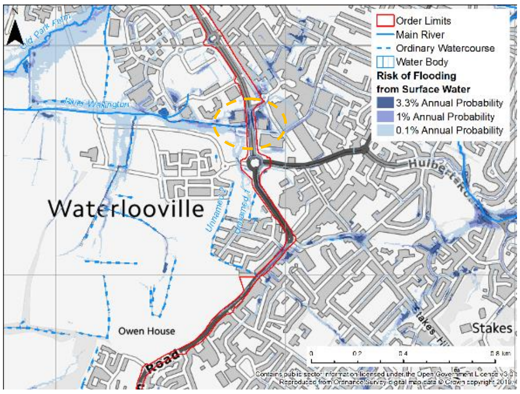


Plate 13 – – Surface Water Flood Risk: (Section 4 of Order Limits)

This area of Hambleden Road is at increased risk of surface water flooding as the road creates a low spot in the local road network which can act as a conduit for surface water to convey and pond (medium to high risk).

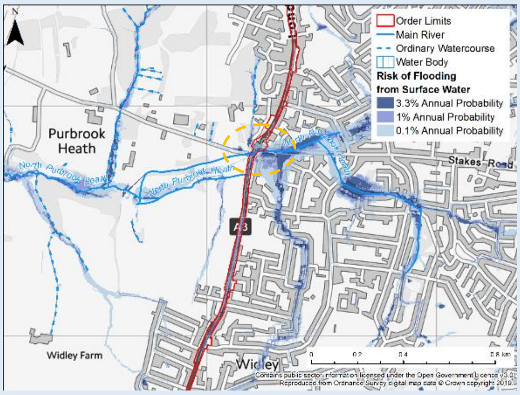


Plate 14 – Surface Water Flood Risk: (Section 4 of Order Limits)

Surface water flood risk is shown to a similar extent of the Flood Zone 2 extent. It is expected that the risk of surface water modelled is linked to the low spot within the natural terrain where the urbanised area and road networks can act as a conduit for surface water to convey and pond (medium to high risk).

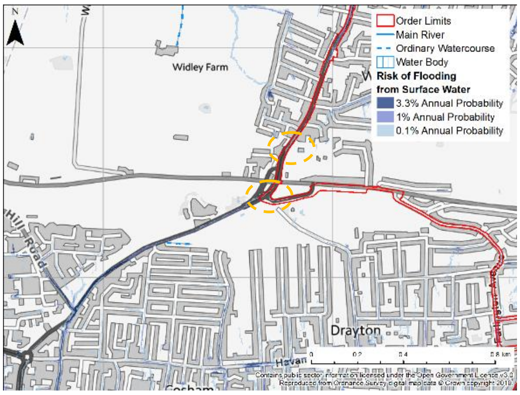


Plate 15 – Surface Water Flood Risk: (Section 4 of Order Limits)

The junction down onto London Road is an example of where there is a limited risk of flooding illustrated, due to the general fall of the carriageway and highway drainage, however, isolated areas of increased risk are expected due to localised low spots in the carriageway which can act as a conduit for surface water to convey (low risk).

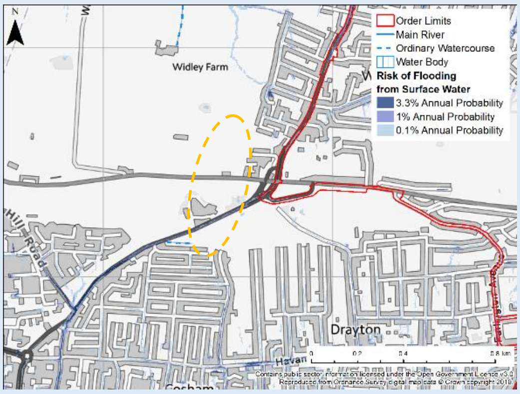


Plate 16 – Surface Water Flood Risk: (Section 1 of Order Limits)

Portsmouth City Council have a history of flooding recorded in this area which is likely to be associated to surface water overland flow in the local urbanised area. It is understood that improvement works (culvert cleaning) have been undertaken to help reduce the risk of flooding (medium risk).

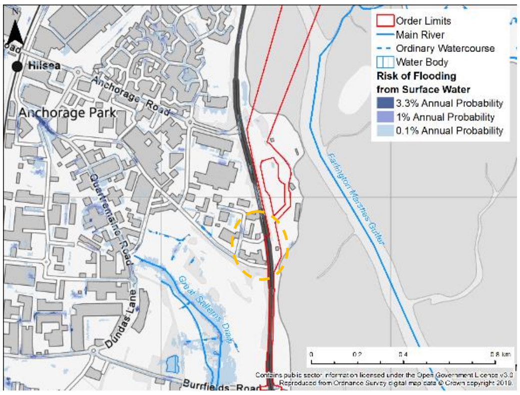


Plate 17 – Surface Water Flood Risk: (Section 1 of Order Limits)

History of flooding recorded in the area, which is likely to be associated to localised low spot within the local urbanised/ flash flooding from extreme peak rainfall and exceedance of the drainage networks capacity (medium risk).

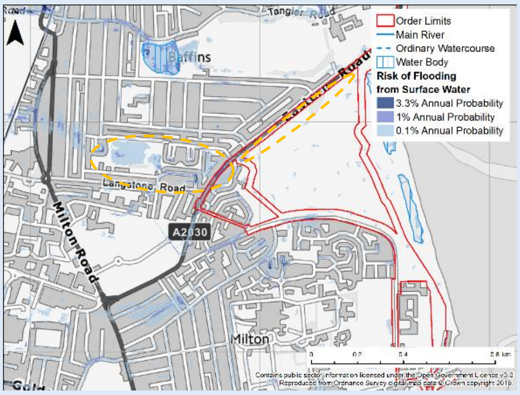


Plate 18 – Surface Water Flood Risk: (Section 1 of Order Limits)

History of flooding recorded in the area linked to extreme peak rainfall events and groundwater flow from Milton Common towards Tamworth Park where surface ponding occurs (medium risk).

Surface water ponding to south side of carriageway associated to low spot within the local urbanised/ flash flooding from extreme peak rainfall and exceedance of the drainage networks capacity (medium risk).

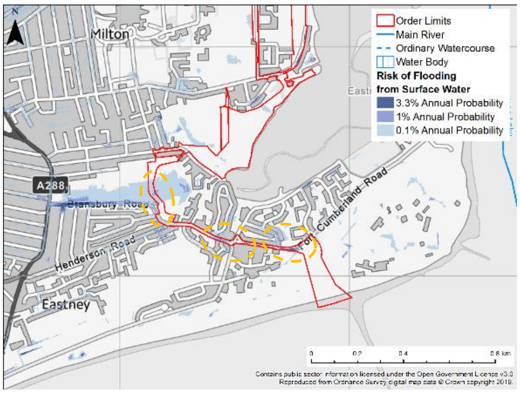


Plate 19 – Surface Water Flood Risk: (Section 1 of Order Limits)

Isolated low spots within the natural urbanised landscape where overland flow is likely to convey to low spots (typically low to medium risk, isolated areas of high risk).

Summary

5.2.4.9. At the Converter Station and ORS, the risk of surface water flooding is typically very low. However, at the Converter Station the risk locally increases to low where the winterbourne/dry watercourse passes through the Order Limits.

5.2.4.10. Thereafter throughout the Onshore Cable Corridor, risk of surface water flooding is typically very low, however it increases to low, medium and high in identified 'hot spot' locations where extreme event overland flow paths are anticipated or where there has been a history of flooding recorded.

5.2.4.11. These areas detailed in Table 12 at increased risk of surface water flood risk include:

- Section 1 of Order Limits - Winterbourne/dry watercourse (low);
- Section 2 of Order Limits – Anmore Road (medium to high);
- Section 3 of Order Limits – Soake Farm Watercourses (low/ medium);
- Section 3 of Order Limits – Hambledon Road/ Soake Road Junction (medium/ high);
- Section 4 of Order Limits – Hambledon Road, north of Waterlooville (medium/ high);

- Section 4 of Order Limits – Hambledon Road, north of Wellington Retail Park (medium/ high);
- Section 4 of Order Limits – London Road/ Ladybridge Road Junction (medium/ high);
- Section 4 of Order Limits – London Road/ Portsdown Hill Road Junction (low);
- Section 6 of Order Limits – Eastern Road (medium);
- Section 7 of Order Limits – Eastern Road/ Anchorage Road Junction (medium);
- Section 7 of Order Limits – Milton Common/ Tamworth Park (medium); and
- Section 9/10 of Order Limits – Bransbury Road/ Henderson Road/ Fort Cumberland Road (low to high).

Reservoir Flooding Hazard

Large Reservoirs

5.2.4.12. The majority of the Order Limits is located outside of the maximum extent of reservoir flooding based on the gov.uk "Long term flood risk information" flood risk from reservoirs, as illustrated on Figure 20.6.

5.2.4.13. The areas located outside the maximum extent of reservoir flooding are considered to have a negligible risk of reservoir flooding.

5.2.4.14. There are two areas within the Order Limits at risk of flooding from reservoirs as summarised below with the approximate distance to the Site Boundary detailed:

- Risk associated to Purbrook Regulating Reservoir (0.7 km from Section 4); and
- Risk Associated to Farlington No 9 (0.1 km from Section 5).

5.2.4.15. The risk designation for Purbrook Regulating Reservoir is high and Farlington No 9 is yet to be determined. However, it should be noted that flooding from reservoirs is extremely unlikely and there has been no loss of life in the UK from reservoir flooding since 1925.

5.2.4.16. It is therefore considered that the probability of flooding from reservoirs is low due to the areas being located within the maximum reservoir flood extent and rarity of an event occurring. The remainder of the Order Limits are considered to have a negligible risk of reservoir flooding.

Ponds

5.2.4.17. Within the Order Limits there are a number of small ponds. No specific information is available on the function and or operation of these features however an assessment on the risk of flooding has been based on the elevation of the features in relation to the surrounding landscape observed during the detailed site visit.

5.2.4.18. A summary of the assessed risk of flooding from these ponds is presented summarised below:

- Kings Pond – small pond below ground and flood risk would be associated to surface water flooding (see surface water flood risk) and is assessed as having a low risk of flooding in relation to the Proposed Development.
- Milton Common (Frog Pond, Duck Lake, Swan Lake) - small ponds/ lakes below ground and flood risk would be associated to surface water flooding (see surface water flood risk) and is assessed as having a low risk of flooding in relation to the Proposed Development.

5.2.5. GROUNDWATER FLOODING HAZARDS

5.2.5.1. The BGS defines groundwater flooding as the emergence of groundwater at the ground surface away from perennial river valleys or the rising of groundwater into man-made ground under conditions where the 'normal' range of groundwater levels and groundwater flow is exceeded. Groundwater flooding can be defined as superficial deposit or clearwater flooding.

5.2.5.2. Superficial deposit flooding is often associated with shallow unconsolidated sedimentary aquifers which overly non-aquifers (i.e. impermeable strata). These are often susceptible to flooding as the storage capacity is often limited. Direct groundwater recharge from rainfall can be relatively high and the sediments may be very permeable, creating a good hydraulic connection with adjacent river networks.

5.2.5.3. Clearwater flooding can be caused by the water table in an unconfined aquifer rising above the land surface in response to extreme rainfall and is most likely to occur in the Principal Chalk aquifers.

5.2.5.4. The Environment Agency Groundwater Flood Susceptibility Map identifies that Section 2 of the Order Limits is susceptible to superficial deposit flooding approximately 700 m south of the Converter Station Area (Section 1). A minimum groundwater level of 1.03 mBGL (44.9mAODN) has been recorded at Denmead Nurseries (Section Ref 2.4.3.3).

5.2.5.5. The Environment Agency Groundwater Flood Susceptibility Map identifies Section 3 and Section 4 (up to Widley) of the Order Limits are susceptible to superficial deposit flooding. From Widley to the lower most part of Section 4 (B2177) the Onshore Cable Corridor is susceptible to both superficial deposit and clearwater flooding.

5.2.5.6. Section 5 and Section 6 of the Order Limits has been identified as being susceptible to clearwater flooding. The Principal Chalk aquifer is unconfined in parts of Section 5 and Section 6 of the Order Limits. Continuous groundwater level monitoring data identifies a maximum groundwater level of 0.72 mAODN recorded at BH15A (Section 6).

5.2.5.7. Section 7 to Section 9 of the Order Limits are identified as being susceptible to both superficial deposit and clearwater flooding. The superficial geology for these sections is composed of low permeability River Terrace and Raised Marine Deposits which overlie the Principal Chalk aquifer. Local groundwater levels will be tidal influenced where superficial deposits are in hydraulic continuity with the Broom Estuary (Section Ref 2.4.3.3).

5.2.5.8. Section 10 of the Order Limits is also susceptible to both superficial deposit and clearwater flooding. A maximum groundwater level of 1.8mBGL and minimum groundwater level of 2.92 mBGL has been recorded (Section Ref 2.4.3.6). The superficial geology at this location is composed of a combination of River Terrace, Tidal Flat and Storm Beach deposits. These overlie the Wittering Formation which is predominantly composed of clay. Local groundwater levels will be tidal influenced for the same reason specified above.

5.2.5.9. Note that the required groundwater dewatering quantities for trench construction will be determined at detailed design. The designer must ensure the discharge quantities are accurate or conservative to ensure no flood risk should be increased due to surplus groundwater encountered during construction.

Groundwater Flood Risk Summary

5.2.5.10. The Onshore Cable Corridor (Section 2 to Section 10) is susceptible to groundwater flood risk – although the likelihood is generally low. Groundwater level data (available from ground investigation and data available from the Environment Agency and Portsmouth City Council) identified that groundwater levels along the Onshore Cable Corridor are variable within the superficial and bedrock geologies.

5.2.5.11. Isolated locations along the Onshore Cable Corridor may pose a medium to high risk including:

- Section 2 (Denmead/Kings Pond) due to spring upwelling/issue
- Section 6 where records of groundwater have been recorded within 0.2 mbgl (winter) and 0.5 mbgl (summer)
- Section 7 to 10 due to interconnection of groundwater to the coastal environment and potential extreme tidal levels.

5.2.5.12. Groundwater flood risks are exacerbated if construction is planned over winter as groundwater levels are expected to be at shallower depths.

5.2.6. SEWER FLOODING HAZARDS

5.2.6.1. Sewer flooding occurs when the below ground sewer network cannot cope with the volume of water that is entering it and flood water emerges (surcharges) from the below ground system. Where a sewer serves more than two properties it is classified as a public sewer and all public sewers are owned and maintained by the water and sewerage company.

5.2.6.2. The majority of sewer flooding is the result of temporary problems such as capacity overload, blockage, siltation, collapses, groundwater inundation and equipment or operational failure.

5.2.6.3. Surface water sewer flooding often occurs at the same time as other types of flooding (particularly surface water flooding). Surface water flooding can also contribute to sewer flooding in areas where combined sewers are present (surface water and foul water in the same sewer) or where misconnections have taken place to a foul sewer (surface water wrongly drains into the foul sewer).

5.2.6.4. It is often hard to differentiate if flooding has been directly caused by sewer, surface water or groundwater. For the purposes of this assessment, the risk of sewer flooding has qualitatively been elevated in urban areas where there is an urban area at risk flooding or where consultation with the Lead Local Flood Authority has identified any specific issues.

5.2.6.5. In the context of the Proposed Development the risk of surface water sewer and combined sewer flooding is considered in connection to areas identified at risk of surface water flooding.

5.2.7. OVERALL FLOODING HAZARD SUMMARY

5.2.7.1. Table 13 provides a summary of the probability of flood risk for the assessed sources of flood risk based on the FRA. The typical risk expected during construction and operation is presented for the key components of the Proposed Development (Converter Station Area, Cables, Joint Bay & Link Pillar/ Box, and Optical Regeneration Building).

5.2.7.2. Isolated locations within the Order Limits that recognise a locally higher probability and risk of flooding, are considered as a 'Hot-spot' flood risk areas for this assessment. Where 'Hot-spot' flood risk areas exist, these are presented in brackets within Table 13 and illustrated within Figure 20.1, for example '(High[x]), further detail of the specific location with a 'high' risk of flooding is presented within Table 13 footnotes and illustrated within Figure 20.1.

Table 13 - Summary of Risk of Flooding During Construction and Operation

Source of Flooding	Probability and Risk of Flooding			
	Convertor Station	**Power Cable**	**Link Pillars**	**Landfall Building**
Tidal	C – N/A O – N/A (N/A)	C –Low O – N/A (Medium[1])	C –Low O –Low (Medium[1])	C – Low O – Medium[2] (N/A)
Fluvial	C –Low O –Low (N/A)	C –Low O – N/A (High[3])	C –Low O –Low (High[3])	C – N/A O – N/A (N/A)
Surface Water	C – Very Low O – Very Low	C – Very Low O – N/A	C – Very Low O – Very Low	C – Very Low O – Very Low

	(Low[4])	(High[5])	(High[5])	(N/A)
Groundwater	C –Low O –Low (N/A)	C –Low O – N/A (High[6])	C –Low O –Low (High[6])	C –Low O –Low (N/A)
Sewer	Refer to surface water.			
Other/ Reservoir	C – N/A O – N/A (N/A)	C –Low O – N/A (Low[7])	C –Low O – N/A (Low[7])	C – N/A O – N/A (N/A)

Footnotes:
C = Construction Stage, **O** = Operational Stage, **(text[no.])** = Isolated hot spot flood risk area as detailed within the footnotes and illustrated in Figure 20.1
Severity classifications based on Table 5, Table 6, Table 7, Table 8, Table 9.

1. **Tidal flood risk** within Section 7 to 10 of Order Limits – tidal flood risk during construction associated to the risk of extreme event tidal/ wave overtopping or tidal exceedance of historic flood defences where new flood defence schemes have not been completed (medium)
2. **Tidal flood risk** Section 10 of Order Limits – tidal flood risk during operation risk to the ORS (medium)
3. **Fluvial flood risk** during construction for cable route and potential during operation if Link Pillars are located in these specific areas:
   a. Section 2 of Order Limits – Soake Farm North & Soake Farm East (Medium to High)
   b. Section 4 of Order Limits - Old Park Farm (Medium)
   c. Section 4 of Order Limits - River Wallington (Low)
   d. Section 4 of Order Limits - North Purbrook Heath (Low)
4. **Surface Water flood risk** within Section 1 of Order Limits – during construction and operation – Surface Water flood risk from extreme event winterbourne/ dry watercourse (low)
5. **Surface Water flood risk** during construction for cable route and potential during operation if Link Pillars are located in these specific areas
   a. Section 2 of Order Limits – Anmore Road (medium to high);
   b. Section 3 of Order Limits – Soake Farm Watercourses (low/ medium);
   c. Section 3 of Order Limits – Hambledon Road/ Soake Road Junction (medium/ high);
   d. Section 4 of Order Limits – Hambledon Road, north of Waterlooville (medium/ high);
   e. Section 4 of Order Limits – Hambledon Road, north of Wellington Retail Park (medium/ high);
   f. Section 4 of Order Limits – London Road/ Ladybridge Road Junction (medium/ high);
   g. Section 4 of Order Limits – London Road/ Portsdown Hill Road Junction (low);
   h. Section 6 of Order Limits – Eastern Road (medium);

i. Section 7 of Order Limits – Eastern Road/ Anchorage Road Junction (medium);
j. Section 7 of Order Limits – Milton Common/ Tamworth Park (medium); and
k. Section 9/10 of Order Limits – Bransbury Road/ Henderson Road/ Fort Cumberland Road (low to high).

6. **Groundwater flood risk** during construction which is exacerbated in winter as groundwater levels are expected to be at shallower depths:
   a. Section 2 to Section 10 is susceptible to groundwater flood risk during construction below ground level – (low)
   b. Section 2 – Kings Pond (medium to high)
   c. Section 6 – shallow groundwater recorded (medium to high)
   d. Section 7 to 10 – coastal Environment due to groundwater linkage to sea levels (medium to high)
7. **Reservoir flood risk** during construction for cable route and potential during operation if Link Pillars are located in these specific areas:
   a. Section 4 – maximum flood extent from Purbrook Regulating Reservoir
   b. Section 5 and 6 – maximum flood extent from Farlington No 9

6. FLOOD RISK MITIGATION

6.1. CONSTRUCTION

6.1.1.1. During construction the Proposed Development could have the potential to increase the risk of flooding off site. Overarching principles to appropriately manage this temporary risk of flooding are discussed in Chapter 20 (Surface Water Resources and Flood Risk) and the Onshore Outline Construction Environmental Management Plan ('CEMP') (document reference 6.9) and principally include:

- Flood Warning and Planning;
- Temporary de-watering (including pollution prevention);
- Temporary bunding; and
- Over pumping (including pollution prevention).

6.1.1.2. Open trench excavation works are typically limited in distances of 30 m to 50 m per day and will typically be backfilled during the same day. Excavation works in some discrete locations, as discussed within Chapter 20 (Surface Water Resources and Flood Risk) are expected to encounter surface water ingress. The specific methodologies for managing surface water will be subject to detailed design by the Appointed Contractor post-application and any dewatering works would need to ensure that:

- relevant Environmental Permitting consent or exemptions (including consent to discharge to the receiving watercourse or sewer) are obtained prior to works;
- there is no increase to the flood risk; and
- appropriate pollution prevention measures are in place.

6.1.1.3. Construction works in Flood Zone 2 or 3 or within proximity to flood defences should be undertaken subject to consent or exemptions of Environmental Permitting with the Environment Agency through a Flood Risk Activities Permit and others as required, where specific works methodologies will be developed by the Appointed Contractor during the detailed design to ensure there is no increase in tidal or fluvial flood risk.

6.1.1.4. Construction works within or adjacent to Ordinary Watercourses should be undertaken subject to consent or exemptions of an Ordinary Watercourse Consent prior to works as permitted through the relevant Lead Local Flood Authority (Hampshire County Council and Portsmouth City Council) to ensure there is no increase in flood risk associated to these Ordinary Watercourses.

6.1.1.5. Groundwater encountered during open trench construction or surface water ingress into trenches will require appropriate management. The method of discharge [of any surface water or groundwater] has yet to be determined. The surface water or groundwater collected will either be discharged to surface water, sewer, disposed off-site or a combination of these three methods. If the water is to be discharged to sewer or a surface water body, then a discharge consent(s) may be required.

6.1.1.6. The permitting process will be completed by the Appointed Contractor, after detailed design, once a dewatering and discharge management methodology has been agreed upon. The Appointed Contractor will be responsible for acquiring the relevant consents and permits and for adhering to the conditions of said consents and permits.

6.1.1.7. The quantities of any required surface water or groundwater dewatering for trench construction will be determined at detailed design. The designer should ensure that the discharge quantities are accurate or conservative to ensure flood risk is not increased due to a potential surplus of qualities encountered during construction.

6.1.1.8. Discussions with East Solent Coastal Partnership, as detailed in Appendix 20.1 (Consultation Responses), have been on-going to discuss the practicability of the: construction programme, scheme alignment, and interactions between the Proposed Development and flood defences schemes.

6.1.1.9. These discussions have informed the Proposed Development, and where the Proposed Development is in close proximity to the coastal flood defences; detailed design will demonstrate that the e proposed works would not compromise the existing and current proposed coastal flood defences subject to relevant environmental permitting/ consenting.

6.2. OPERATION

6.2.1. CONVERTER STATION

6.2.1.1. Based on the definition of flood hazard (Section 6 of this report) the only significant flood risk hazard at the Converter Station is surface water flooding.

6.2.1.2. All others sources are considered to be low or negligible and therefore no mitigation is proposed for the operation of the Converter Station other than for the management of surface water.

Proposed Flood Risk Mitigation Measures

6.2.1.3. Due to the creation of impermeable land within the Converter Station, surface water flood risk could be increased if appropriate mitigation measures are not put in place.

6.2.1.4. A surface water management strategy as summarised hereafter is proposed to manage surface water up to and including the 1 in 100-year return period pluvial event with an allowance for climate change as further detailed within Appendix 3.6 (Surface Water Drainage and Aquifer Contamination Mitigation) of the ES Volume 3 (document reference 6.3.3.6).

6.2.1.5. In addition, the Converter Station external building thresholds/ entrances are expected to have a threshold of 150 mm or 300 mm above the existing ground level, subject to detailed design, to provide resilience against any potential extreme rainfall events exceeding the design standard or localised reduction in capacity of the drainage system associated to local blockages or failure.

Surface Water Management

6.2.1.6. As part of the application an outline drainage strategy has been developed to ensure surface water is appropriately managed on-site and that there is no increase in flood risk off-site because of the Proposed Development.

6.2.1.7. The key principles of the drainage strategy, as detailed in Appendix 3.6 (Surface Water Drainage and Aquifer Contamination Mitigation) in relation to the flood risk environment, are summarised below:

- Surface water generated within the Converter Station on hard landscaped areas will be managed for pluvial events up to and including the 1 in 100-year return period with a 40% allowance for climate change.
- Appropriate levels of treatment surface water will convey water to attenuation ponds prior to discharge through a soakaway to ground. Key areas contributing include:
  - Building Roof Areas: surface water drainage will convey from roof areas via roof gutters into network of underground drainage pipework located beneath the site.
  - Associated Roads: roads will be laid with a cross fall with surface water run-off drainage discharging to a filter drain collector drain, surrounded by clean graded stone wrapped in a geo-membrane (SuDS).
  - Converter Station Oily Water system: a separate system is proposed for the management of oily water which has been designed in accordance with Environment Agency documentation and other published documents such as 'NGTS 2.10.01 Oil Containment' to manage potential pollutants occurring within this water.

Overland Flow Route

6.2.1.8. The proposed access road ties into the existing terrain to ensure that the extreme event overland flow route passing adjacent to the Convertor Station is not affected. All other proposed infrastructure is proposed to remain outside of this extreme event overland flow route/ winterbourne watercourse.

6.2.2. CABLE, JOINT BAYS AND LINK BOXES (OPERATION)

6.2.2.1. The power cable is lined and not at risk of flooding from any sources, therefore no additional mitigation is proposed throughout the power cable, subject to detailed design.

6.2.2.2. Joint bays and Link Boxes will be protected from water ingress and below ground with a sealed man hole at ground level.

6.2.3. LINK PILLARS & JOINT BAYS (OPERATION)

6.2.3.1. If required as part of the Proposed Development, Link Pillars should be proposed outside of areas at risk of flooding; however, where this is not feasible further consideration as part of the detailed design will be undertaken to identify if any further site-specific resilience measures should be implemented.

6.2.3.2. The housing of the Link Pillars is proposed to be IP68 rated; where in accordance with IEC 60529, the '8', in IP68 refers to the highest standard of protection against water ingress on a scale of 1 to 8. The degree of protection for '8' should protect against the effects of continuous immersion in water subject to manufacturer specifications.

6.2.4. ORS (OPERATION)

6.2.4.1. The ORS is in Flood Zone 2 with the potential future risk from tidal flooding and it will generate some limited surface water runoff due to the proposed impermeable footprint. The proposed mitigations are discussed hereafter.

Tidal Flood Resilience

6.2.4.2. Flood resilience to the ORS is proposed to be provided through a raised external threshold with additional secondary resilience, where feasible, by raising the equipment inside the building off the floor level (if internal raising can be accommodated within the spatial constraints of the buildings).

6.2.4.3. The exact level of internal and external raising will be determined during detailed design based on the level of resilience deemed to be appropriate for the Proposed Development.

External Raised Threshold

6.2.4.4. Where feasible the finished floor level and external threshold of the ORS would be kept above the predicted 1 in 200yr tidal flood event flood level during the future 2065 scenario (40 year serviceable life), which includes an allowance for sea level rise.

Internal Raising

6.2.4.5. If feasible, the provision of an internal raised threshold would act as an additional freeboard from the external finished floor level to the bottom of the vulnerable equipment inside the building. This would provide further resilience against uncertainties of the predicted flood levels and resilience against a potentially longer serviceable life.

Future Resilience

6.2.4.6. At this planning stage, it is proposed to design the ORS resilience for the 40-year serviceable life and assess scenarios for 60-years of operation and beyond.

6.2.4.7. Flood resilience measures for future scenarios beyond the 40-year serviceable life have not been integrated into the proposed design flood resilience measures as it could result in a disproportionate level of resilience being designed and will be reassessed during detailed design.

6.2.4.8. Consideration will be made to determine if it is feasible to integrate a flood resistant building into the design, or if it would be more appropriate to increase the flood resilience measures (for example, through a further raised external or internal threshold).

6.2.4.9. If operation remains on-going beyond 2065 with flood resilience measures only embedded for a 40 year serviceable life, any additional flood resilience would subsequently be re-assessed in the future and any additional flood resilience or resistance measures would be retrofitted as deemed appropriate.

Possible Design Option

6.2.4.10. A possible option for flood resilience is presented hereafter, assuming an existing ground level of 3.4 m AODN. It should be noted that this design option is presented to demonstrate the feasibility of incorporating appropriate resilience, however the exact design levels will be confirmed during detailed design.

- External raised threshold of 500 mm (3.9 m AODN)
- Internal raised threshold to bottom of equipment of 300 mm (4.2 m AODN)

6.2.4.11. Based on the predicted tidal flood still sea water level for the 0.5% annual exceedance event (1 in 200 year return period) as presented in Table 10 the external and internal flood depths for the 0.5% annual exceedance event for the 'T' Confidence Level is presented in Table 14.

Table 14 - Summary of predicted 1 in 200 year Flood Levels for possible ORS Design Option

	40 Years from 2025		60 Years from 2025		80 Years from 2025	
	2065		2085		2105	
	Upper End	H++	Upper End	H++	Upper End	H++
Depth above external threshold (3.9m AODN)	**Dry**	**Dry**	**Dry**	0.56m	0.94m	1.90m
Depth above bottom of equipment (4.2m AODN)	**Dry**	**Dry**	**Dry**	0.26m	0.64m	1.60m

6.2.4.12. The proposed raising demonstrates the building would remain dry during the 2065 extreme flood event scenario and 2085 scenario assuming the upper end sea level rise allowances.

6.2.4.13. Based on the future scenario predictions (2085 and 2105 scenario), the building would be expected to flood, with a flood depth more than 1 m during the 2105 scenario assuming the H++ sea level rise allowances.

6.2.4.14. However, if operation remains on-going beyond 2085, additional flood resilience would subsequently be re-assessed later and any additional flood resilience or resistance would be retrofitted as deemed appropriate.

Surface Water Management

6.2.4.15. Surface water generated from the impermeable ORS footprints would be managed in a sustainable manner, where feasible, for events up to and including the 1 in 100-year return period pluvial event with a 40% allowance of climate change.

6.2.4.16. In the first instance, and in accordance with the drainage hierarchy it is proposed to manage surface water through a filter strip, or similar, sustainable drainage feature prior to infiltration into the ground.

6.2.4.17. A potential outline option to manage surface water is presented hereafter. It should be noted that this design option is presented to demonstrate the feasibility of managing surface water from the ORS (assumed combined roof area of 80m²), however the exact design of surface water management will be confirmed during detailed design subject to approval from Portsmouth City Council Lead Local Flood Authority.

Preferential Discharge Option - Infiltration

6.2.4.18. Based on the ground investigation data including groundwater monitoring of BH25 (borehole located within the lower side of the landfall car park) groundwater levels remained 2 m bgl (monitoring between November 2018 and May 2019). Furthermore, BH25 recorded strata composed of ‘medium dense fine to coarse sand and gravel’.

6.2.4.19. Based on The SuDS Manual (C753), Table 25.1, which provides a useful first indicator of the magnitude of the infiltration capacity, sandy gravel is expected to have a typical infiltration coefficient of between $3x10^{-4}$ to $3x10^{-2}$ m/s.

6.2.4.20. Conservatively assuming an infiltration coefficient of $3x10^{-4}$ m/s and an outline MircoDrainage calculation using FEH Rainfall 2013 Point Data for a 1 in 100-year return period pluvial event with a 40% allowance for climate change a filter strip of 0.5m wide by 15m long by 1m deep (infiltrating from the base only, allowing a 1m separation to expected groundwater levels) would provide sufficient capacity to manage surface water generated from the ORS (see Annex 1).

6.2.4.21. It is proposed to undertake infiltration testing in accordance with the Building Research Establishment publication for soakaway design and testing (‘BRE Digest 365’) post application as part of the detailed design of the Proposed Development to determine if ground conditions are suitable for the utilisation of a soakaway (infiltration rates and groundwater levels) and to determine if the above assumed parameters are realistic.

6.2.4.22. During detailed design the proposed surface water management design will be further developed/ refined based on local site constraints and subject to approval from Portsmouth City Council Lead Local Flood Authority.

Secondary Discharge Option – Discharge to Sewer

6.2.4.23. If infiltration testing proves infiltration not to be feasible, it would be proposed to discharge the surface water generated across the ORS to a local public surface water drainage system at a discharge rate to be agreed with the Lead Local Flood Authority and Southern Water post application during the detailed design.

6.2.4.24. Based on an outline Micro Drainage calculation using FEH Rainfall 2013 Point Data for a 1 in 100-year return period pluvial event with a 40% allowance for climate change a tank of 0.3 m deep x 8 m^2 (2.4m^3 volume) with a 25-mm orifice plate flow control device would provide sufficient capacity to manage surface water generated from the two proposed ORS with a maximum discharge rate of 0.8l/s (see Annex 1).

6.2.4.25. The tank could be provided through many sustainable drainage features, for example: permeable paving, linear lined swale, blue/ green roof or a tank structure.

6.2.4.26. If infiltration is identified not to be feasible the above proposed outline option to manage surface water through a surface water attenuation structure prior to controlled discharge to a public sewer, including storage structure and discharge rate, will be further developed/ refined in consideration of local constraints and subject to approval from Portsmouth City Council Lead Local Flood Authority and Southern Water.

7. OFFSITE IMPACTS

7.1. CONSTRUCTION ACTIVITIES

7.1.1.1. Specific measures to manage the temporary risk of flooding as a consequence of the proposed construction activities will be developed alongside the relevant Environmental Permits to ensure that the risk of flooding off-site is not increased during construction.

7.1.1.2. Further detail on this can be found in Chapter 19 (Groundwater) and 20 (Ground Conditions) and in the Onshore Outline CEMP.

7.1.1.3. As discussed above, the groundwater encountered during trench construction will require management. The potential consents and permits required to manage this water will be completed by the Appointed Contractor.

7.1.1.4. The method of discharge has yet to be determined however, the groundwater collected will either be discharged to surface water, sewer, disposed off-site or a combination of these three (3 no.) methods.

7.1.1.5. The designer will need to ensure that discharge quantities determined at detailed design are accurate or conservative to ensure that the flood risk is not increased due to surplus groundwater encountered during construction.

7.2. OPERATION

7.2.1. CONVERTER STATION

7.2.1.1. The proposed surface water drainage strategy at the Converter Station has been designed to manage surface water run-off generated up to and including the 1 in 100-year return period pluvial event with an allowance for climate change.

7.2.1.2. Based on the implementation of this proposed strategy there will be no increase to surface water flood risk off-site up to this design standard. Furthermore, it is proposed to maintain existing winterbourne/ dry watercourse to continue to convey the extreme event overland flow, subject to detailed design.

7.2.1.3. Any construction works or permanent alterations affecting the surface water overland flow path (also known as a winterbourne/ dry watercourse) would need to be agreed with the Lead Local Flood Authority through an Ordinary Watercourse Consent or exception.

7.2.2. CABLE, JOINT BAYS AND LINK BOXES

7.2.2.1. During operation the Cable, Joint Bays and Link Boxes are considered to have a negligible impact on the flood risk profile as the infrastructure is typically buried and backfilled within native soils.

7.2.3. LINK PILLARS

7.2.3.1. If required as part of the Proposed Development Link Pillars will be proposed outside of areas at risk of flooding, where this is not feasible further consideration as part of the detailed design will be undertaken to identify if any further site-specific design measures should be implemented to avoid any off-site impacts.

7.2.3.2. Based on the limited size of the proposed Link Pillars above ground a negligible impact on fluvial flood plain storage is expected if these are in the fluvial flood plain, however this should be assessed if required in consultation with the Environment Agency during detailed design.

7.2.4. OPTICAL REGENERATION BUILDING

7.2.4.1. The proposed drainage strategy at the Converter Station shall be designed to manage surface water run-off generated up to and including the 1 in 100-year return period pluvial event with an allowance for climate change. Based on the implementation of this proposed strategy there will be no increase to surface water flooding off-site up to this design standard.

7.2.4.2. As the landfall building is located within the tidal environment, dispersion of water due to the footprint of the building during a potential extreme tidal event will be negligible and will not increase the off-site risk of flooding associated to a tidal flood event.

8. RESIDUAL RISKS/ EXCEEDANCE EVENTS

8.1. CONSTRUCTION ACTIVITIES

8.1.1.1. Construction activities in areas at risk of flooding (e.g. overland flow path, tidal or fluvial flood plain) will be at risk of flooding if an extreme event that exceeds the systems design standard, design capacity or if a failure/ breach of the system/ defences occurred.

8.1.1.2. The Appointed Contractor (designer) must ensure that suitable emergency procedures (eg a construction flood warning and evacuation plan) are in place to manage these risks, which may be subject to approval from Environmental Permits with the Environment Agency and Lead Local Flood Authorities.

8.1.1.3. The Appointed Contractor (designer) will need to ensure that groundwater discharge quantities determined at detailed design for trench construction are accurate or conservative to ensure no flood risk be increased due to surplus groundwater encountered during construction.

8.1.1.4. Further details can be found in Chapter 20 (Surface Water Resources and Flood Risk) and the Onshore Outline CEMP.

8.2. OPERATION

8.2.1. CONVERTER STATION

8.2.1.1. At the Converter Station there is a residual risk of a surface water rainfall event occurring with a greater magnitude than the proposed design. It should be noted that this is highly unlikely, however if such an extreme event occurred there would be a residual risk of surface water flooding effecting the Converter Station Area.

8.2.1.2. External building thresholds/ entrances are proposed to have a raised threshold of 150 mm or 300 mm above the existing ground level to provide resilience against any potential exceedance rainfall events or localised reduction in capacity of the drainage system associated to blockages or failure.

8.2.2. LINK PILLARS, LINK BOXES & JOINT BAYS

8.2.2.1. The housing of the Link Pillars and Joint Bays is proposed to be IP68 rated where in accordance with IEC 60529 the ‘8’ in IP68 refers to the highest standard of protection against water on a scale of 1 to 8 for the protection against water. The degree of protection for ‘8’ should protected against the effects of continuous immersion in water.

8.2.2.2. This protection against water ingress provides resilience against exceedance events that has the potential to cause flooding in the area where the Link Pillars and Joint Bays are proposed.

8.2.2.3. Therefore, unless there is a failure to the housing water proofing there is a negligible residual risk.

8.2.3. OPTICAL REGENERATION STATION(S)

8.2.3.1. At the ORS there is a residual risk of a surface water rainfall event occurring with a greater magnitude than the proposed design. It should be noted that this is unlikely, however if such an extreme event occurred there would be a residual risk of surface water flooding effecting the ORS.

8.2.3.2. The ORS is proposed to have a raised threshold into the building entrance, and equipment inside the building is further raised above the ground level. This will provide resilience pluvial rainfall event of 1 in 100-year return period with 40% allowance for climate change.

8.2.3.3. It is expected that the ORS floor level will be designed to the 1 in 200-year return period tidal event with allowance for sea level rise.

8.2.3.4. Events of a greater magnitude are extremely unlikely, however if they were to occur they would cause flooding. Furthermore, if the ORS is in operation further into the the future that surpasses the designs allowance for sea level rise, there would be an increased risk against tidal flooding.

8.2.3.5. Further, consideration for the level of resilience against risk and sea level rise against the likely operational life of the ORS will be considered during detailed design.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1.1.1. This Flood Risk Assessment confirms that the Proposed Development meets the requirements of the National Policy Statement for Energy (EN-1) and National Planning Policy Framework (NPPF 2019) in relation to flood risk when taking into consideration the proposed mitigation measures incorporated into the design parameters for the Proposed Development.

9.1.1.2. Flood risk areas should be brought to the attention of the designer and Appointed Contractor for consideration for the proposed detailed design and construction works to ensure there is no increase in flood risk off-site and risks on-site are appropriately managed.

9.1.1.3. Where activities are being undertaken in areas at risk of flooding the Applicant and their appointed designer and Appointed Contractor will need to obtain relevant Environmental Permits from the relevant regulatory bodies, these permits are likely to include:

- Flood Risk Activities Permit;
- Ordinary Watercourse Consent;
- Temporary de-watering; and
- Other relevant approvals from highways authority or statutory undertaker who maintains any watercourse/ sewer assets.

9.1.1.4. The proposed design measures or suitable equivalents should be taken forward into the implementation of the Proposed Development to limit the potential risk of flooding during operation and to ensure there is no increase in flood risk up to the proposed design standard.

9.1.1.5. This assessment has also been used to inform Chapter 20 (Surface Water Resources and Flood Risk) and the Onshore Outline CEMP.

Annex 1 – ORS Infiltration Calculation

WSP Group Ltd		Page 1
. . .	Aquind Interconnector ORS Building Infiltration	Micro Drainage
Date 29/10/2019 File Infiltration 1 in 100 4...	Designed by JW Checked by LC	
XP Solutions	Source Control 2018.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 18 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	3.196	0.796	1.1	1.8	O K
30 min Summer	3.278	0.878	1.1	2.0	O K
60 min Summer	3.257	0.857	1.1	1.9	O K
120 min Summer	3.025	0.625	1.1	1.4	O K
180 min Summer	2.820	0.420	1.1	0.9	O K
240 min Summer	2.659	0.259	1.1	0.6	O K
360 min Summer	2.474	0.074	1.1	0.2	O K
480 min Summer	2.444	0.044	1.0	0.1	O K
600 min Summer	2.437	0.037	0.8	0.1	O K
720 min Summer	2.432	0.032	0.7	0.1	O K
960 min Summer	2.425	0.025	0.6	0.1	O K
1440 min Summer	2.418	0.018	0.4	0.0	O K
2160 min Summer	2.413	0.013	0.3	0.0	O K
2880 min Summer	2.410	0.010	0.2	0.0	O K
4320 min Summer	2.408	0.008	0.2	0.0	O K
5760 min Summer	2.406	0.006	0.1	0.0	O K
7200 min Summer	2.406	0.006	0.1	0.0	O K
8640 min Summer	2.405	0.005	0.1	0.0	O K
10080 min Summer	2.405	0.005	0.1	0.0	O K
15 min Winter	3.198	0.798	1.1	1.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	135.672	0.0	15
30 min Summer	90.518	0.0	24
60 min Summer	57.579	0.0	42
120 min Summer	33.970	0.0	74
180 min Summer	24.854	0.0	106
240 min Summer	19.840	0.0	134
360 min Summer	14.331	0.0	188
480 min Summer	11.338	0.0	244
600 min Summer	9.439	0.0	302
720 min Summer	8.118	0.0	364
960 min Summer	6.388	0.0	482
1440 min Summer	4.561	0.0	714
2160 min Summer	3.278	0.0	1084
2880 min Summer	2.609	0.0	1464
4320 min Summer	1.919	0.0	2156
5760 min Summer	1.562	0.0	2840
7200 min Summer	1.346	0.0	3576
8640 min Summer	1.199	0.0	4288
10080 min Summer	1.093	0.0	4960
15 min Winter	135.672	0.0	15

WSP Group Ltd		Page 2
. . .	Aquind Interconnector ORS Building Infiltration	Micro Drainage
Date 29/10/2019 File Infiltration 1 in 100 4...	Designed by JW Checked by LC	
XP Solutions	Source Control 2018.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	3.269	0.869	1.1	2.0	O K
60 min Winter	3.193	0.793	1.1	1.8	O K
120 min Winter	2.840	0.440	1.1	1.0	O K
180 min Winter	2.572	0.172	1.1	0.4	O K
240 min Winter	2.449	0.049	1.1	0.1	O K
360 min Winter	2.436	0.036	0.8	0.1	O K
480 min Winter	2.428	0.028	0.6	0.1	O K
600 min Winter	2.424	0.024	0.5	0.1	O K
720 min Winter	2.420	0.020	0.5	0.0	O K
960 min Winter	2.416	0.016	0.4	0.0	O K
1440 min Winter	2.412	0.012	0.3	0.0	O K
2160 min Winter	2.408	0.008	0.2	0.0	O K
2880 min Winter	2.407	0.007	0.2	0.0	O K
4320 min Winter	2.405	0.005	0.1	0.0	O K
5760 min Winter	2.404	0.004	0.1	0.0	O K
7200 min Winter	2.404	0.004	0.1	0.0	O K
8640 min Winter	2.403	0.003	0.1	0.0	O K
10080 min Winter	2.403	0.003	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	90.518	0.0	25
60 min Winter	57.579	0.0	44
120 min Winter	33.970	0.0	78
180 min Winter	24.854	0.0	106
240 min Winter	19.840	0.0	124
360 min Winter	14.331	0.0	186
480 min Winter	11.338	0.0	246
600 min Winter	9.439	0.0	306
720 min Winter	8.118	0.0	368
960 min Winter	6.388	0.0	486
1440 min Winter	4.561	0.0	724
2160 min Winter	3.278	0.0	1088
2880 min Winter	2.609	0.0	1484
4320 min Winter	1.919	0.0	2176
5760 min Winter	1.562	0.0	2728
7200 min Winter	1.346	0.0	3576
8640 min Winter	1.199	0.0	4552
10080 min Winter	1.093	0.0	5304

WSP Group Ltd		Page 3
. . .	Aquind Interconnector ORS Building Infiltration	Micro Drainage
Date 29/10/2019 File Infiltration 1 in 100 4...	Designed by JW Checked by LC	
XP Solutions	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 467822 99147	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.008

Time From:	(mins) To:	Area (ha)
0	4	0.008

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

WSP Group Ltd		Page 4
. . .	Aquind Interconnector ORS Building Infiltration	Micro Drainage
Date 29/10/2019 File Infiltration 1 in 100 4...	Designed by JW Checked by LC	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 3.400

Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	1.08000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	15.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	2.400	Cap Infiltration Depth (m)	0.000

Annex 2 – ORS Tank Calculation

WSP Group Ltd		Page 1
. . .	Aquind Interconnector ORS Building Tank	Micro Drainage
Date 29/10/2019 File Tank 1 in 100 40cc.SRCX	Designed by JW Checked by LC	
XP Solutions	Source Control 2018.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	3.288	0.288	0.7	2.3	O K
30 min Summer	3.347	0.347	0.8	2.8	O K
60 min Summer	3.379	0.379	0.8	3.0	Flood Risk
120 min Summer	3.360	0.360	0.8	2.9	Flood Risk
180 min Summer	3.331	0.331	0.7	2.6	O K
240 min Summer	3.302	0.302	0.7	2.4	O K
360 min Summer	3.252	0.252	0.6	2.0	O K
480 min Summer	3.214	0.214	0.6	1.7	O K
600 min Summer	3.184	0.184	0.5	1.5	O K
720 min Summer	3.160	0.160	0.5	1.3	O K
960 min Summer	3.124	0.124	0.4	1.0	O K
1440 min Summer	3.084	0.084	0.3	0.7	O K
2160 min Summer	3.055	0.055	0.3	0.4	O K
2880 min Summer	3.042	0.042	0.2	0.3	O K
4320 min Summer	3.032	0.032	0.2	0.3	O K
5760 min Summer	3.028	0.028	0.1	0.2	O K
7200 min Summer	3.025	0.025	0.1	0.2	O K
8640 min Summer	3.023	0.023	0.1	0.2	O K
10080 min Summer	3.022	0.022	0.1	0.2	O K
15 min Winter	3.288	0.288	0.7	2.3	O K
30 min Winter	3.348	0.348	0.8	2.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	135.672	0.0	2.7	17
30 min Summer	90.518	0.0	3.6	29
60 min Summer	57.579	0.0	4.6	46
120 min Summer	33.970	0.0	5.4	80
180 min Summer	24.854	0.0	6.0	114
240 min Summer	19.840	0.0	6.3	146
360 min Summer	14.331	0.0	6.9	210
480 min Summer	11.338	0.0	7.3	272
600 min Summer	9.439	0.0	7.5	332
720 min Summer	8.118	0.0	7.8	392
960 min Summer	6.388	0.0	8.2	512
1440 min Summer	4.561	0.0	8.8	750
2160 min Summer	3.278	0.0	9.4	1104
2880 min Summer	2.609	0.0	10.0	1468
4320 min Summer	1.919	0.0	11.0	2200
5760 min Summer	1.562	0.0	12.0	2936
7200 min Summer	1.346	0.0	12.9	3608
8640 min Summer	1.199	0.0	13.8	4400
10080 min Summer	1.093	0.0	14.7	5112
15 min Winter	135.672	0.0	2.7	16
30 min Winter	90.518	0.0	3.6	29

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	3.376	0.376	0.8	3.0	Flood Risk
120 min Winter	3.343	0.343	0.8	2.7	O K
180 min Winter	3.303	0.303	0.7	2.4	O K
240 min Winter	3.266	0.266	0.7	2.1	O K
360 min Winter	3.206	0.206	0.6	1.6	O K
480 min Winter	3.163	0.163	0.5	1.3	O K
600 min Winter	3.132	0.132	0.5	1.1	O K
720 min Winter	3.109	0.109	0.4	0.9	O K
960 min Winter	3.079	0.079	0.3	0.6	O K
1440 min Winter	3.049	0.049	0.3	0.4	O K
2160 min Winter	3.034	0.034	0.2	0.3	O K
2880 min Winter	3.029	0.029	0.1	0.2	O K
4320 min Winter	3.024	0.024	0.1	0.2	O K
5760 min Winter	3.021	0.021	0.1	0.2	O K
7200 min Winter	3.019	0.019	0.1	0.2	O K
8640 min Winter	3.018	0.018	0.1	0.1	O K
10080 min Winter	3.017	0.017	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.579	0.0	4.6	48
120 min Winter	33.970	0.0	5.4	84
180 min Winter	24.854	0.0	6.0	120
240 min Winter	19.840	0.0	6.3	154
360 min Winter	14.331	0.0	6.9	218
480 min Winter	11.338	0.0	7.3	282
600 min Winter	9.439	0.0	7.5	342
720 min Winter	8.118	0.0	7.8	400
960 min Winter	6.388	0.0	8.2	520
1440 min Winter	4.561	0.0	8.8	752
2160 min Winter	3.278	0.0	9.4	1100
2880 min Winter	2.609	0.0	10.0	1472
4320 min Winter	1.919	0.0	11.0	2200
5760 min Winter	1.562	0.0	12.0	2968
7200 min Winter	1.346	0.0	12.9	3568
8640 min Winter	1.199	0.0	13.8	4312
10080 min Winter	1.093	0.0	14.7	4984

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 467822 99147	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.008

Time (mins) From:	To:	Area (ha)
0	4	0.008

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 3.400

Tank or Pond Structure

Invert Level (m) 3.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8.0	0.300	8.0

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 3.000