AQUIND Limited

AQUIND INTERCONNECTOR

Environmental Statement – Volume 3 – Appendix 20.2 Onshore Water Framework Directive Assessment

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

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

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

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EXECUTIVE SUMMARY

A Water Framework Directive ('WFD') Assessment is required to assess the potential impacts of a proposed underground cable route between landfall at Eastney Beach and the Lovedean Substation, Hampshire; hereafter referred to as the 'Proposed Development'.

An assessment of the impact of any works / modifications to water bodies is required in England under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 2017 Regulations). This law was brought into force under the European Union's Water Framework Directive (WFD) (2000/60/EC).

The Proposed Development has the potential to impact upon the Potwell Trib (GB107042016400) and Langstone Harbour (GB580705130000) surface water bodies. The present status of the Potwell Trib is Moderate and it is designated as a Heavily Modified Water Body. The present status of the Langstone Harbour is Moderate and it is designated as a Heavily Modified Water Body. These water bodies lie within the Environment Agency's South East River Basin District River Basin Management Plan. The adjacent and downstream surface water bodies, the Upper Wallington (GB107042016350), Hermitage Stream (GB107042016370) and Wallington below Southwick (GB107042016360), are screened out of this study.

The groundwater bodies within the study area are East Hants Chalk (GB40701G502700), Hants East Lambeth Group (GB40702G500800), Hants South Lambeth Group (GB40702G503700) and Hants South East Bracklesham Group (GB40702G503000). These water bodies also lie within the Environment Agency's South East River Basin District.

Construction impacts have been considered due to the potential for detrimental impacts on the WFD quality elements. During operation, the design of the Proposed Development would neutralise any potential impacts on the WFD status of the water body.

There are no proposed structures, discharges, diversions or realignments associated with the operation of the Proposed Development that would impact on the WFD surface water bodies. There are no anticipated impacts at the water body scale for groundwater.

APPENDIX 20.2 ONSHORE WATER FRAMEWORK DIRECTIVE ASSESSMENT

1.1. INTRODUCTION

1.1.1. BACKGROUND

1.1.1.1. This Onshore Water Framework Directive ('WFD') Assessment (Surface Water and Groundwater) (from here on referred to as the 'WFD Assessment') has been prepared on behalf of AQUIND Limited in order to support an Application to install and operate the AQUIND Interconnector between the UK and France Exclusive Economic Zone.

1.1.1.2. This report is a requirement under the WFD legislation and forms an Appendix to the Environmental Statement ('ES') which accompanies the Application for a Development Consent Order ('DCO') submitted to the Secretary of State for Business, Energy and Industrial Strategy ('BEIS') and should be read in conjunction with Chapter 19 (Groundwater) of the ES Volume 1 (document reference 6.1.19) and Chapter 20 (Surface Water Resources and Flood Risk) of the ES Volume 1 (document reference 6.1.20).

1.1.1.3. This WFD assessment is in relation to the Proposed Development and its possible effects on the surface water and groundwater environment within the Order Limits; (see Plate 1.1 to 1.3). Marine water bodies have been assessed separately and are presented in Appendix 7.1 (Marine WFD Assessment) of the ES Volume 3 (document reference 6.3.7.1).

1.1.1.4. A consultation meeting with the Environment Agency was held on 23 July 2019 where the proposed scope and preliminary analysis for WFD compliance were presented. The EA was in agreement with the methodological approach and the preliminary findings that were presented.

1.1.1.5. Consultation was also undertaken on 15 October 2019 with the Langstone Harbour Master regarding historic bathymetry for Broom Channel.

1.1.1.6. The WFD Assessment assesses surface and groundwaters the onshore components of the Proposed Development which comprise the Converter Station Area, Onshore Cable Corridor (which runs from Lovedean Substation, west of Horndean in Hampshire) and Landfall at Eastney, Portsmouth. Plate 1.1 shows in the Order Limits within which the Onshore Components of the Proposed Development would be located. Plate 1.2 and 1.3 show the WFD water bodies potentially impacted by the Proposed Development within the South East River Basin Management Plan (‘RBMP’).

1.1.1.7. The Order Limits have been split into 10 sections for ease of reference. Section 1 is a site adjacent to the existing Lovedean Sub-station, west of Horndean, Sections 2 to 9 are the Onshore Cable Corridor as it travels from the converter station south to Portsmouth, and Section 10 is at Eastney Beach where the Onshore Cable joins the Marine Cable. Further details can be found in Chapter 3 (Description of the Proposed Development) of the ES Volume 1 (document reference 6.1.3) which has informed this assessment.

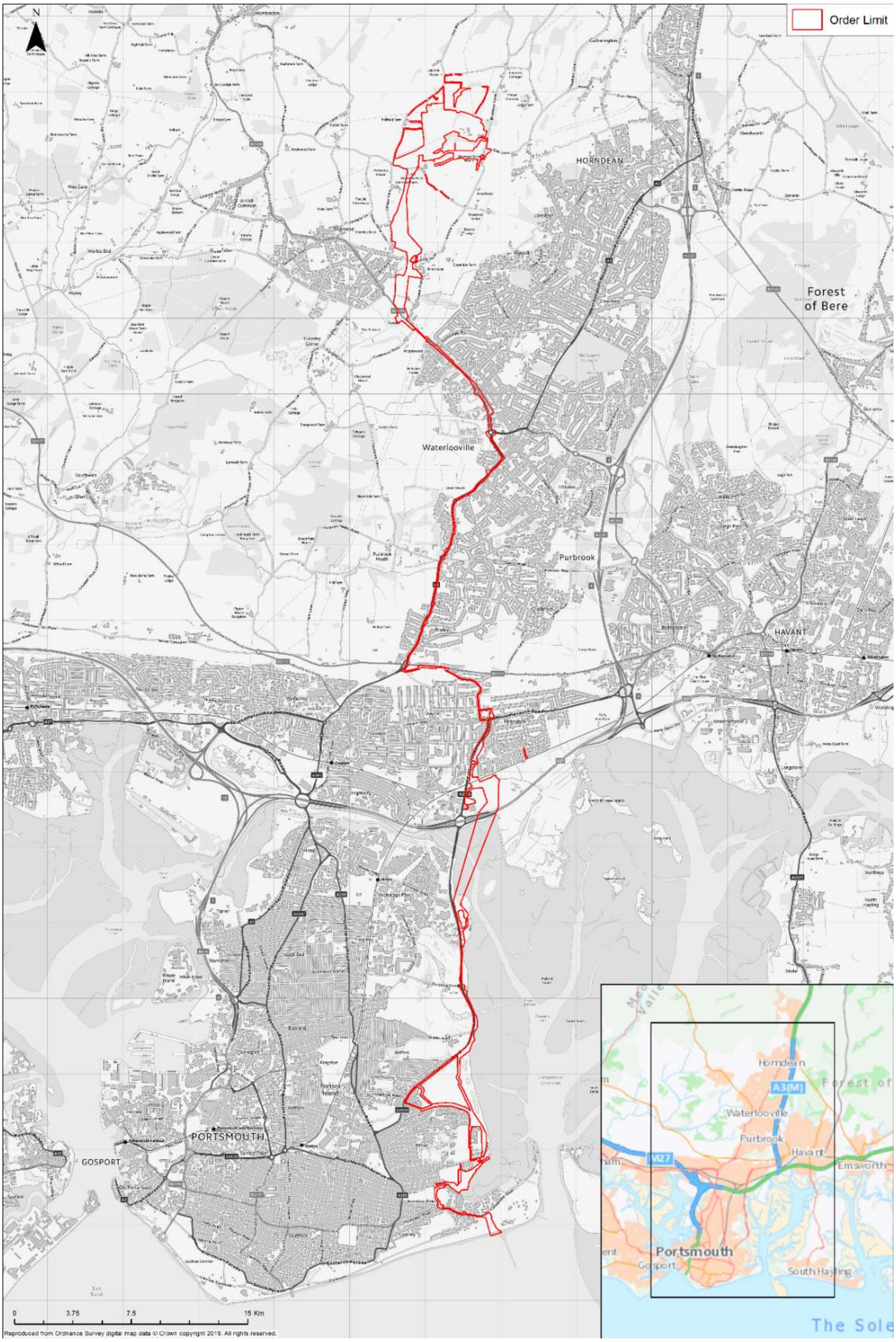

Plate 1.1 - Order Limits of the Onshore Components of the Proposed Development

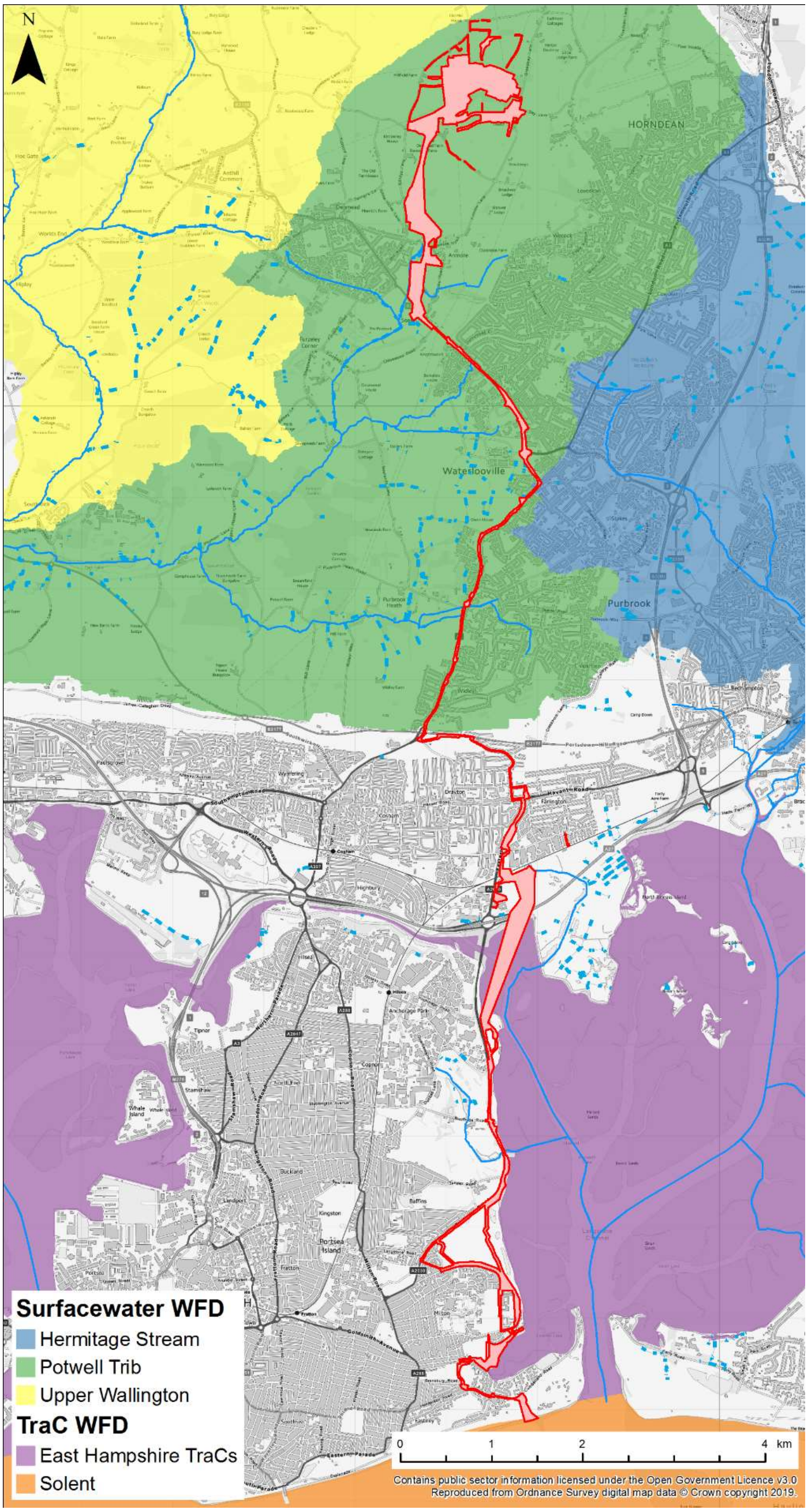

Plate 1.2 - WFD surface water bodies potentially impacted by the Proposed Development (for context, Transitional and Coastal water bodies (TraCs) are shown)

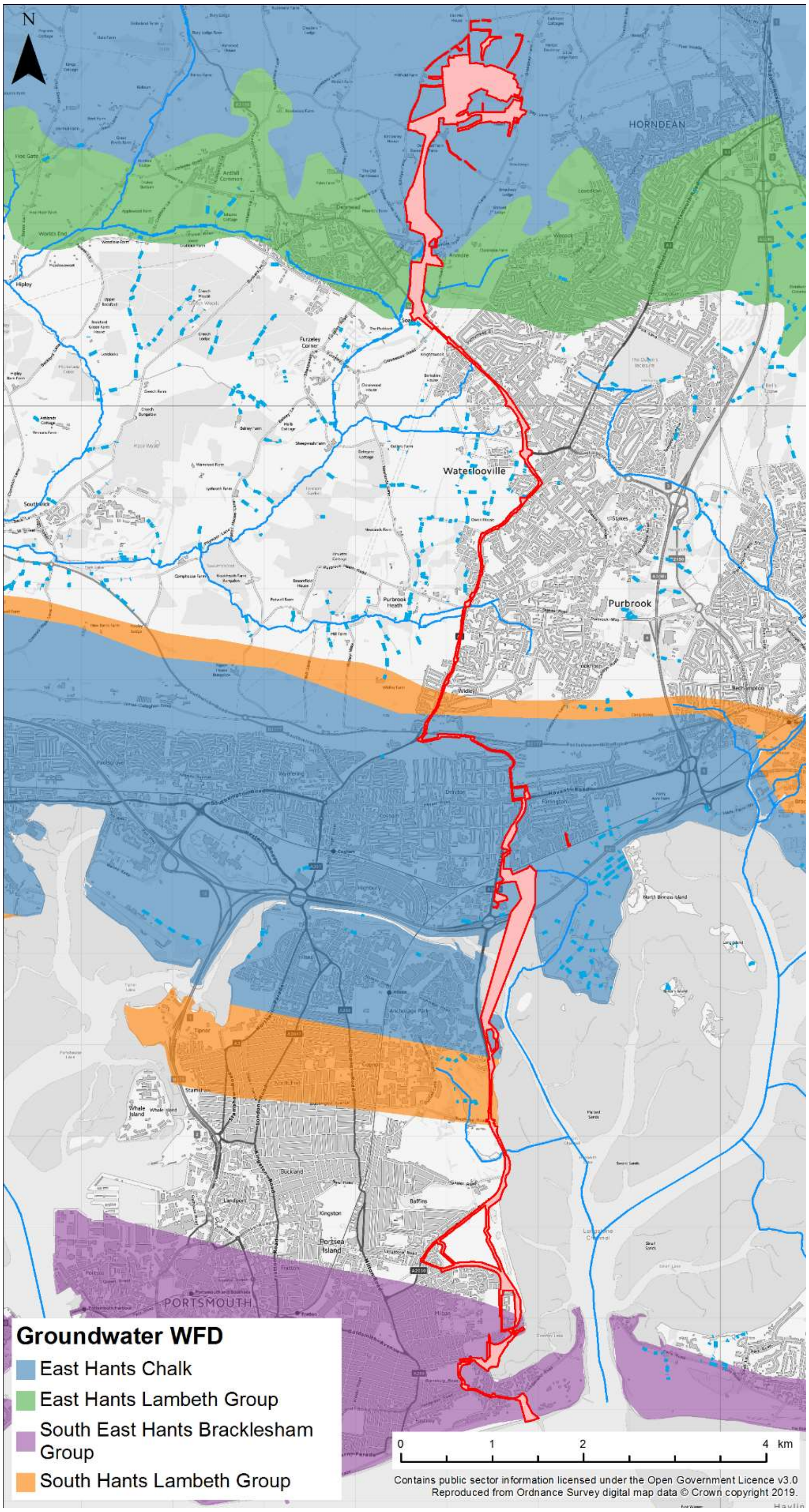

Plate 1.3 - WFD groundwater water bodies potentially impacted by the Proposed Development

1.2. WATER FRAMEWORK DIRECTIVE

1.2.1.1. The EU Water Framework Directive (Directive 2000/60/EC) came into force in 2000. The goal of the WFD is to protect and enhance all inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters to one nautical mile ('nmi') and groundwater in order to reach or maintain 'good' status. The WFD is transposed into law in England and Wales under The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (SI 2017/407).

1.2.1.2. To facilitate this, the UK has established river basin districts, each of which has been subdivided into management catchments, operational catchments and water bodies. For each district, a RBMP was produced to establish the ecological and chemical status of each water body and to set objectives for each to achieve good status by 2015, under Article 4(1) of the WFD. Where this goal was not achieved, new objectives have been set with a deadline extension to 2021 or 2027. In all cases, there should be no deterioration in status. Implementation of the WFD is under the control of the Environment Agency.

1.2.1.3. The purpose of a WFD assessment is to determine the potential impact an activity may have on any immediate or linked water bodies, and whether or not it complies with relevant RBMPs.

1.2.1.4. The introduction of a new modification, change in activity or change to structure on a water body needs to be considered in relation to whether it could cause deterioration in the Ecological Status or Potential of any water body. New modifications or changes to activities or structures may also result in any proposed mitigation measures or actions to achieve GES/GEP being ineffective. This could result in the water body failing to meet GES/GEP. Where a development is considered to cause deterioration, or where it may contribute to the failure of the water body to meet GES/GEP, then an Article 4.7 assessment would be required, which makes provision for deterioration of status provided that certain conditions are met, and thus WFD compliant.

1.3. PURPOSE OF THE WFD ASSESSMENT

1.3.1.1. The purpose of this WFD Assessment is to:

- Evaluate the potential impacts of construction and operation of the Proposed Development on the WFD groundwater and surface water bodies within the study area.
- Determine the potential impact an activity may have on any immediate or linked water bodies, and whether or not it complies with relevant RBMPs.

1.4. STRUCTURE OF THE REPORT

1.4.1.1. The WFD Assessment is structured as follows:

- Section 2: Methodology – a description of the WFD methodological approach applied;
- Section 3: WFD Assessment – Surface Water;
- Section 4: WFD Assessment – Groundwater; and
- Section 5: Conclusion.

2. METHODOLOGY

2.1. GUIDANCE

2.1.1.1. The assessment methodology used here is based on guidance provided by the UK Technical Advisory Group ('UKTAG') UK Environmental Standards and Conditions (2008), UKTAG Rivers Assessment Methods – Benthic Invertebrate Fauna Guidance (Water Framework Directive UK Technical Advisory Group, 2014), and Planning Inspectorate ('PINS') Advice Note 18: The Water Framework Directive (PINS, 2017). The PINS Advice Note 18 (2017) outlines a three-stage process to WFD assessment.

2.1.2. STAGE 1 SCREENING

2.1.2.1. Screening is required to identify projects / activities which have the potential to result in deterioration of a water body or fail to comply with the objectives of that water body. Screening also serves to identify which project activities (e.g. proposed construction methods) are required to be taken through to scoping, and which activities do not have the potential to result in the deterioration of the water body.

2.1.3. STAGE 2 SCOPING

2.1.3.1. Scoping is required in order to identify risks to receptors from the Proposed Development's activities, based on the relevant water bodies and their WFD quality elements (including information on status, objectives, and the parameters for each water body). Specifically, potential risks to hydromorphology, biology (habitats and fish), physico-chemical, and water quality should be assessed. WFD protected areas and invasive non-native species ('INNS') are also considered. The scoping stage will assess if elements identified during screening will have a significant non-temporary effect on the status of WFD quality elements. Where potential impacts are identified during the scoping stage, the assessment will be taken forward to Stage 3: Impact Assessment. Stage 3 will be eliminated if no impacts are anticipated.

2.1.4. STAGE 3 IMPACT ASSESSMENT

2.1.4.1. Where assessment has been considered necessary at scoping stage, an impact assessment is carried out for each receptor identified as being at risk as a result of proposed activities in terms of potential deterioration or non-compliance with its specific objectives as set out in the RBMP. Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided, the project would need to be assessed in the context of Article 4(7) of the WFD.

2.1.4.2. The sequence of the WFD impact assessment is summarised below:

- **Step 1:** Identify potential generic construction and operational impacts of the Proposed Development on hydromorphological quality elements (see Section 4.2);
- **Step 2:** Site specific assessment of the Proposed Development against biological, physico-chemical and hydromorphological quality elements (see Section 4.3 of this report);
- **Step 3:** Review actions to deliver WFD objectives (see Section 4.4 of this report);
- **Step 4:** Assessment of Proposed Development against WFD status objectives (see Section 4.5 of this report); and
- **Step 5:** Assessment of the Proposed Development against other EU legislation (see Section 4.6 of this report).

2.1.4.3. Whilst the assessment of potential construction impacts is not required as part of a WFD assessment, these impacts may have detrimental impacts on the WFD quality elements and construction periods may sometimes be of long duration (i.e. several years). Thus, construction impacts are considered, along with mitigation to reduce or eliminate potential impacts on the water body and WFD quality elements.

2.2. CONSULTATION

2.2.1.1. A consultation meeting with the Environment Agency was held on 23 July 2019 where the proposed scope and preliminary analysis for WFD compliance were presented. The presentation included a walk-through of each water course encountered by the Proposed Development from the Converter Station to Eastney Beach.

2.2.1.2. Consultation was also undertaken on 15 October 2019 with the Langstone Harbour Master regarding historic bathymetry for Broom Channel.

2.3. STUDY AREA

2.3.1.1. For the purposes of the surface water WFD assessment, a study area has been defined and dictated by the fluvial water bodies potentially impacted by the Proposed Development. This includes a 1 km corridor around the Onshore Cable Corridor, which is approximately 20 km in length. Cumulative impacts from the Proposed Development and other developments are assessed within the 1 km buffer zone.

2.3.1.2. The route involves crossing seven main watercourses and three ordinary watercourses, however, no culverting or direct disruptions to the watercourses are proposed. The watercourses are shown in Plates 2.1 to 2.5. Where possible the route follows carriageways and works would be carried out above, or below, existing culverts. In areas where the Onshore Cable Route is not along a carriageway, Trenchless techniques or Horizontal Directional Drilling ('HDD') would be used to cross under watercourses. Full details on the proposed Onshore Cable Route can be found in Chapter 3 (Description of the Proposed Development).

2.3.1.3. The Proposed Development could potentially impact five WFD surface water bodies:

- Upper Wallington (GB107042016350);
- Potwell Trib (GB107042016400);
- Hermitage Stream (GB107042016370);
- Wallington below Southwick (GB107042016360); and
- Langstone Harbour (GB580705130000).

2.3.1.4. The four WFD groundwater water bodies which could be potentially impacted by the Proposed Development are:

- East Hants Chalk (GB40701G502700);
- Hants East Lambeth Group (GB40702G500800);
- Hants South Lambeth Group (GB40702G503700); and
- Hants South East Bracklesham Group (GB40702G503000).

2.3.1.5. These water bodies lie within the EA's South East River Basin District (Environment Agency, 2016a).

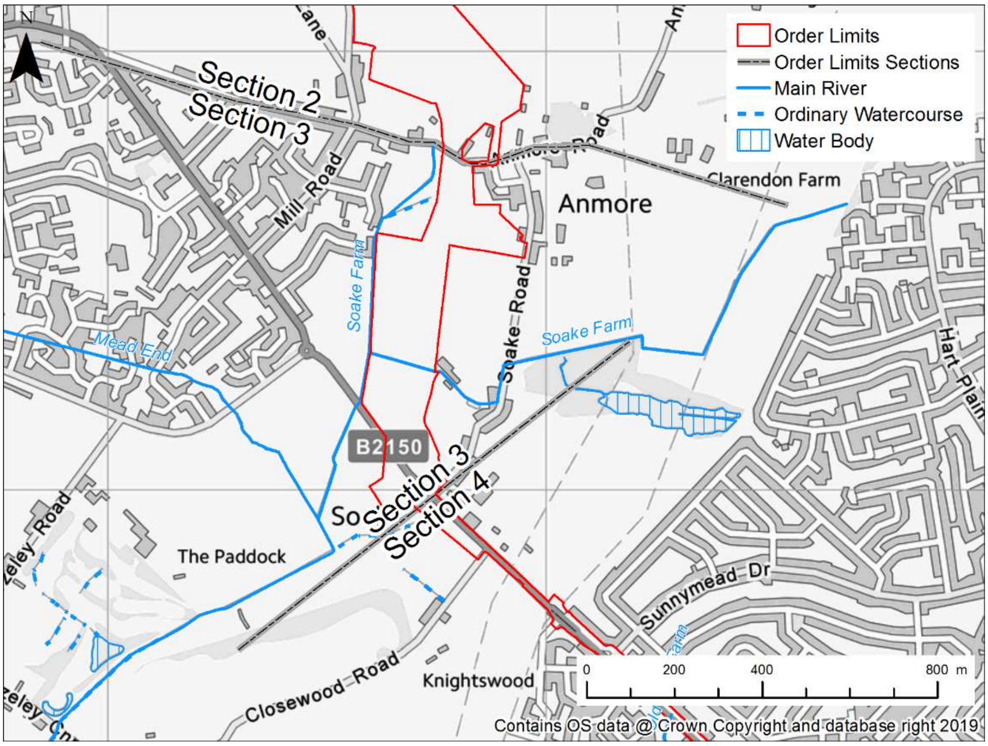

Plate 2.1 - Watercourses within or adjacent to Section 3 of the Proposed Development

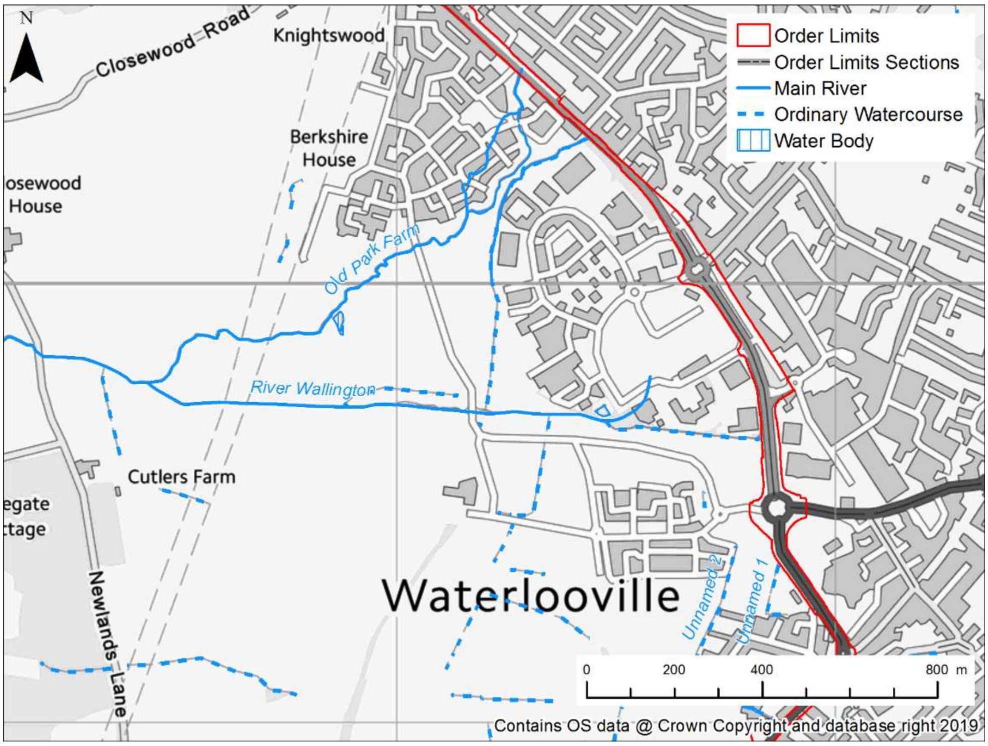

Plate 2.2 - Watercourses within or adjacent to Section 4, north, of the Proposed Development

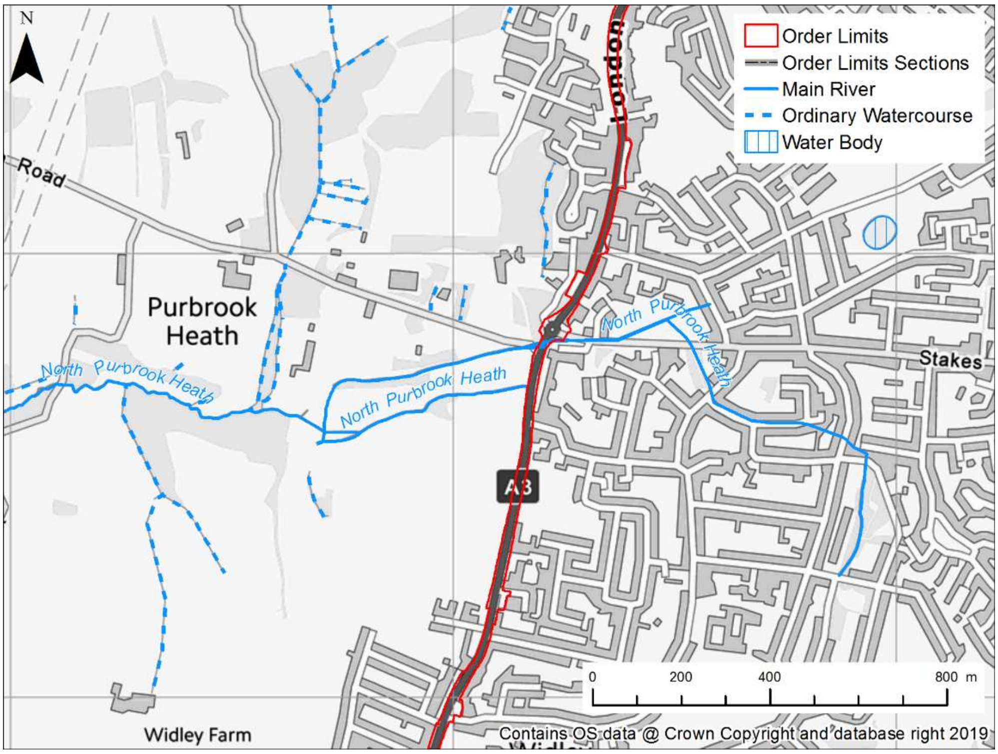

Plate 2.3 - Watercourses within or adjacent to Section 4, south, of the Proposed Development

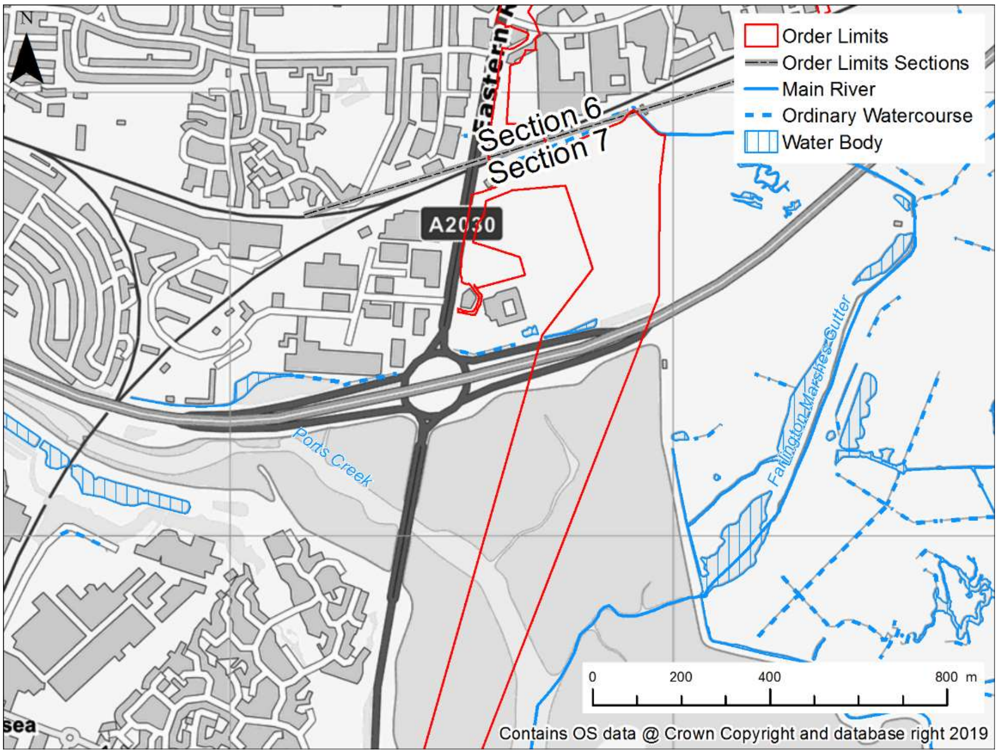

Plate 2.4 - Watercourses within or adjacent to Section 7 of the Proposed Development

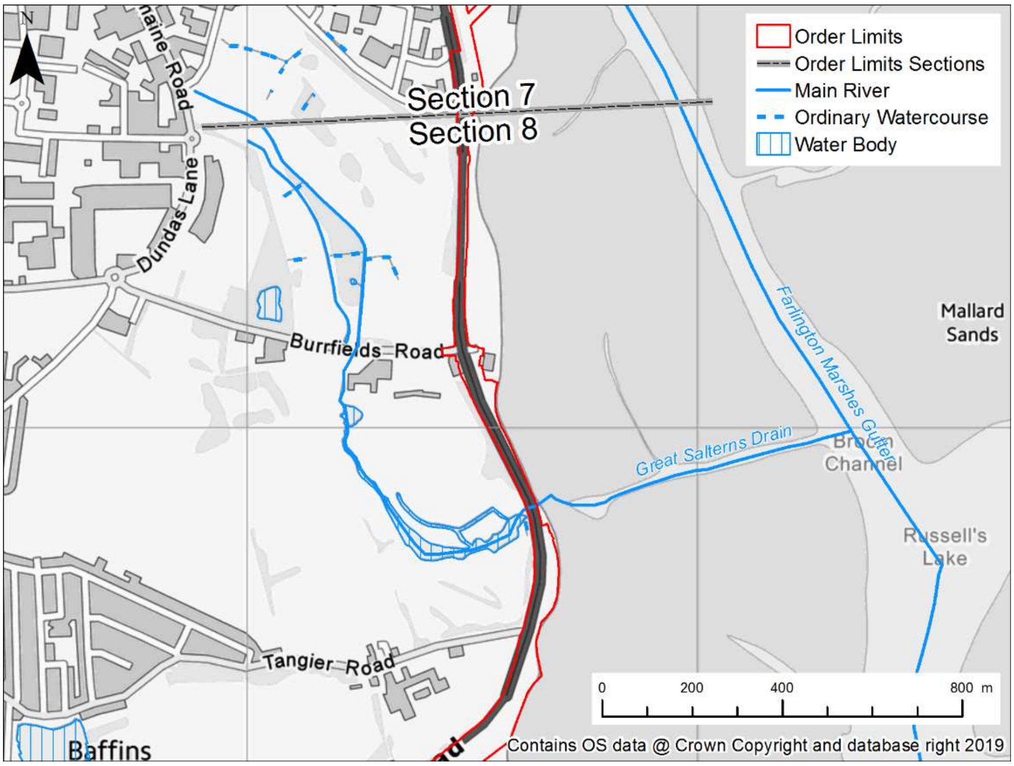

Plate 2.5 - Watercourses within or adjacent to Section 8 of the Proposed Development

2.4. DATA COLLECTION

2.4.1. DESK STUDY

2.4.1.1. A desk-based study was carried out to inform the WFD assessment, reviewing the existing information of the Proposed Development and study area to develop a baseline for the catchments, watercourses and surrounding areas. The following data sources were used for the desk study:

- Contemporary Ordnance Survey ('OS') maps (accessed 11 June 2019);
- Geology and soil maps (accessed 11 June 2019);
- Current aerial photography (accessed 11 June 2019);
- EA ecology data (accessed 11 June 2019);
- Historic maps (accessed 11 June 2019);
- Designated areas data (DEFRA, 2019) (accessed 11 June 2019);
- Hydrological information (Centre for Ecology & Hydrology, 2019) (accessed 11 June 2019);
- WFD status and objectives from the 2015 South East River Basin District River Basin Management Plan (Environment Agency, 2016a) (Environment Agency, 2016b) for cycle 2 data (accessed 11 June 2019);
- EA Catchment Data Explorer for Cycle 2 water body status and objectives (accessed 11 June 2019);
- British Geological Society ('BGS') Geology of Britain viewer (accessed 11 June 2019);
- British Geological Survey GeoIndex Online Database (accessed 11 June 2019);
- Department for Environment, Food and Rural Affairs ('DEFRA') MAGIC Map portal (accessed 11 June 2019);
- WSP Preliminary Ground Investigation data (Geotechnics Ltd, 2019):
  - Initial Ground Investigation Findings, Milton Common, October 2018;
  - UK Converter Station Ground Investigation – Geotechnical Interpretative Design Development Report dated May 2019;
  - UK Route, HDD and Landfall Ground Investigation - Geotechnical Interpretative Design Development Report dated May 2019;
- EA groundwater level monitoring (1967 to 2018) dataset;
- Portsmouth City Council groundwater level monitoring (2015 to 2018) dataset;

- WSP groundwater level monitoring (November 2018 to May 2019) dataset:
  - UK Route, HDD and Landfall Ground Investigation - Geotechnical Interpretative Design Development Report dated May 2019;
- Channel Coast Observatory LiDAR (accessed 15 October 2019);
- Channel Coast Observatory bathymetry (accessed 15 October 2019); and
- Langstone Harbour Authority bathymetry (accessed 15 October 2019).

2.4.2. FIELD SURVEY

Hydromorphology Walkover Survey

2.4.2.1. A walkover survey was undertaken on 9 July 2019 to determine the baseline conditions of the watercourses and WFD water bodies potentially impacted by the Proposed Development and to evaluate potential impacts of both the construction (including enabling works) and operational impacts. The walkover survey provided an understanding of the existing local fluvial processes and boundary conditions of the channels. A photographic record of the general character of the watercourses was collected, including photographs of the channel bed and banks, existing modification and erosional and depositional features. Field notes were recorded on the biological, physico-chemical and hydromorphological quality elements.

Aquatic Ecology Walkover Assessment

2.4.2.2. An aquatic ecology walkover survey was carried out on land south of Anmore Road, to the east of Denmead, approximate central grid reference SU 66606 11477, in May 2019. The purpose was:

- To provide baseline ecological information about the water bodies within the Site with reference to the potential for them to support legally protected and / or notable species and to inform recommendations of further survey;
- To provide recommendations to enable compliance with relevant nature conservation legislation, planning policy; and
- If necessary, to identify the need for avoidance, mitigation, compensation or enhancement measures.

2.4.2.3. A walkover was carried out on all water bodies, which were described and mapped from a visual inspection. Notes were made in relation to approximate width and depth, dominant in-channel and bank vegetation as well as any other notable characteristics of the water body or channel structure.

2.4.2.4. The area was divided into discrete sections based on observed characteristics during the walkover assessment. These are detailed in Plate 2.6 labelled Areas 1 to 6.

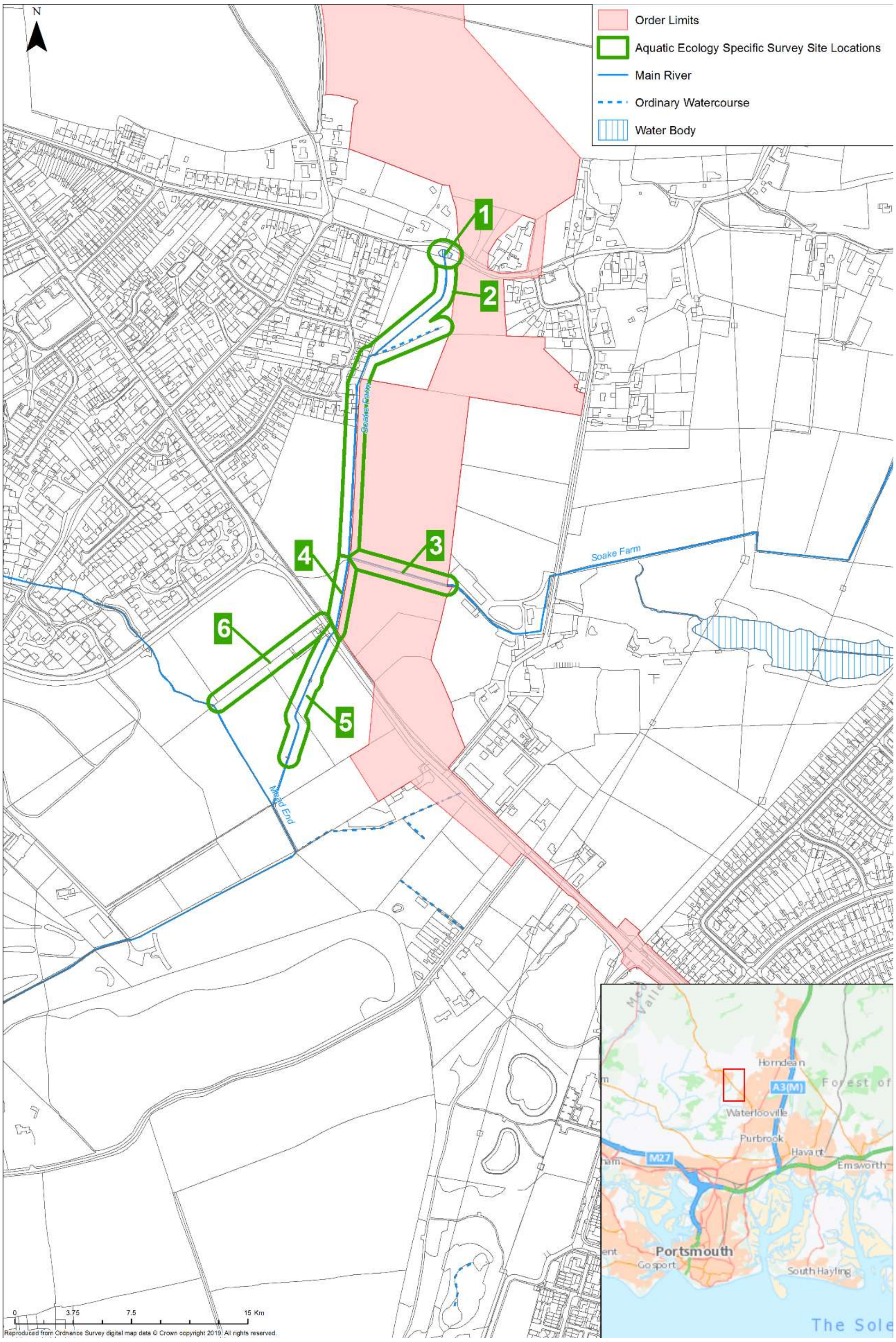

Plate 2.6 - Aquatic ecology specific survey site locations

2.4.2.5. Macroinvertebrate and fish surveys were carried out on 5 July 2019 on areas 3, 5 and 6 (Plate 2.6) of watercourses previously identified in the aquatic ecology walkover assessment.

2.4.2.6. The purpose was:

- To provide baseline ecological information with reference to whether legally protected and/or notable aquatic macroinvertebrate species or habitat were present or likely to be present, in the area surveyed (Plate 2.6);
- To provide baseline ecological information with reference to whether legally protected and/or notable fish species or habitats were present, or likely to be present, in the area surveyed (Plate 2.6);
- To provide recommendations to enable compliance with relevant legislation and planning policy; and
- If necessary, to identify the need for avoidance, mitigation, compensation or enhancement measures and / or further ecological surveys.

Macroinvertebrates

2.4.2.7. Macroinvertebrate sampling followed WFD UKTAG Rivers Assessment Methods – Benthic Invertebrate Fauna Guidance (Water Framework Directive UK Technical Advisory Group, 2014), which conforms to BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for macroinvertebrates in fresh waters (British Standards Institution , 2012).

2.4.2.8. Three sampling locations were selected; one in each of areas 3, 5 and 6.

2.4.2.9. One surveyor carried out the sampling using a standard Freshwater Biological Association ('FBA') design sampling net with a rectangular frame, 20 to 25 cm long and 19 to 22 cm tall, a minimum of 30 cm deep and with a 1 mm mesh.

2.4.2.10. At each site all meso-habitats (medium sized habitats) were surveyed and macroinvertebrates were collected using sampling, sweeping and hand searching for three minutes.

2.4.2.11. All samples were preserved in 70% Industrial Denatured Alcohol ('IDA') for transportation to the laboratory.

2.4.2.12. Following identification in the laboratory to mixed taxonomic level (TL5) a series of pressure-specific indices were produced. These were:

- Whalley, Hawkes, Paisley and Trigg ('WHPT');
- Community Conservation Index ('CCI');
- Lotic-Invertebrate Index for Flow Evaluation ('LIFE'); and
- Proportion of Sediment-Sensitive Invertebrates ('PSI').

Fish

2.4.2.13. Fish communities of areas 3, 5 and 6 were surveyed by electric fishing, using a battery powered backpack system (e-Fish).

2.4.2.14. Electric fishing is the term applied to a process that establishes an electric field in the water in order to capture fish. When exposed to the field, most fish become oriented toward the anode and as the density of the electric field increases they swim toward it. In close proximity to the anode, they are immobilised.

2.4.2.15. Electric fishing followed a standard electric fishing method and technique following guidelines developed by the Environment Agency (Beaumont, 2002) and which conformed to British Standard BS EN 14011:2003 Water Quality – Sampling of Fish with Electricity (British Standards Institution , 2003).

2.4.2.16. Electric fishing was carried out by a two-person fishing team who surveyed the watercourse in short sections, where it was possible to enter the watercourse by wading. Immobilised fish were captured using a hand net and placed into a container of fresh water to recover.

2.4.2.17. Sampled fish were transferred to an aerated container from which they were identified to species level, weighed and measured from the tip of their snout to the end of the middle caudal fin rays (fork length); before being returned safely to the watercourse from which they were captured.

Environmental Measurement and Observations

2.4.2.18. Measurements of conductivity, water temperature, dissolved oxygen and pH were obtained at each macroinvertebrate and fish sampling location using a calibrated YSI ProDSS handheld multiparameter meter. The turbidity and flow of the watercourse were also noted at the time of sampling.

2.4.2.19. At each survey location, a standardised field sheet was completed to include details of channel and bank physical habitat (material of banks and substrates, flow types, physical processed, bank structure), riparian land use and potential sources of anthropogenic stress.

2.5. WATER BODY CLASSIFICATIONS

2.5.1.1. England and Wales are divided into eight RBMPs which include estuarine and coastal catchments (Defra & Environment Agency, 2019). These are broken down into management and operational catchments, which are in turn classified into discrete water bodies. There are two WFD classifications for water bodies: ecological and chemical. For a water body to obtain overall ‘good’ status, it has to have ‘good’ status in both categories.

2.5.1.2. Where the cost to achieve 'good' status would be disproportionate, the deadline for achieving the objective can be extended or a less stringent target can be set. Such objective setting decisions are part of the river basin management planning process. Status information for each water body is provided by the Environment Agency via the Catchment Data Explorer (Environment Agency, 2019).

2.5.1.3. Ecological status is recorded on the scale of 'high', 'good', 'moderate', 'poor' or 'bad'. 'High' denotes largely undisturbed conditions and the other classes represent increasing deviation from this natural condition. The ecological status classification for the water body is determined from the worst scoring quality element. This means that the condition of a single quality element can cause a water body to fail to reach its WFD classification objectives.

2.5.1.4. Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the European Commission ('EC') Environmental Quality Standards Directive ('EQSD') (2008/105/EC) (Environment Agency, 2016c). These chemicals include priority substances, priority hazardous substances, and eight other pollutants carried over from the substance-specific directives (widely known as the Dangerous Substance Daughter Directives). Chemical status is recorded as 'good' or 'fail'. The chemical status classification for the water body is determined by the worst scoring chemical.

2.5.2. WFD SURFACE WATER QUALITY ELEMENTS

2.5.2.1. WFD quality elements assessed for surface waters are summarised below:

Hydromorphology Quality Elements

2.5.2.2. Hydromorphology is a physical characteristic which supports biological elements. Where the hydromorphology of a surface water body has been significantly altered for anthropogenic purposes (e.g. navigation), it can be designated as an Artificial or Heavily Modified Water Body ('A/HMWB'). An alternative environmental objective, good ecological potential ('GEP') applies in these cases.

2.5.2.3. WFD Hydromorphology quality elements for surface water are:

- Quantity and dynamics of water flow;
- Connection to groundwater;
- River continuity;
- River width and depth variation;
- Structure and substrate of the river bed; and
- Structure of the riparian zone.

Biological Quality Elements

2.5.2.4. WFD biological quality elements for surface water are:

- Composition and Abundance of Aquatic Flora;
- Composition and Abundance of Benthic Invertebrate Fauna; and
- Composition, Abundance and Age Structure of Fish Fauna.

Physico-chemical Quality Elements

2.5.2.5. WFD physico-chemical quality elements for surface water are:

- Thermal conditions;
- Oxygenation conditions;
- Salinity;
- Acidification status; and
- Nutrient Conditions.

2.5.3. WFD GROUNDWATER QUALITY ELEMENTS

2.5.3.1. For groundwater, the water bodies are assessed against the following:

- Quantitative status:
  - Saline Intrusion;
  - Water Balance;
  - Groundwater Dependant Terrestrial Ecosystems;
  - Dependent Surface water body status;
- Chemical status:
  - Drinking Water Protected Area;
  - General Chemical Test;
  - Groundwater Dependant Terrestrial Ecosystems;
  - Dependent Surface water body status;
  - Trend assessment; and
  - Protected Areas.

2.5.4. WFD PROTECTED AREAS

2.5.4.1. WFD protected areas encompass sites protected under Natura 2000 (i.e. Special Areas of Conservation ('SACs') and Special Protection Areas ('SPAs'), bathing waters, shellfish waters and nutrient sensitive areas ('NSAs'). Ramsar sites should also be considered in line with advice from Natural England's designated sites database (Natural England, 2019). Only the NSA's are considered in this assessment as the other protected areas are covered in Appendix 7.1 (Marine WFD Assessment).

Nutrient Sensitive Areas

2.5.4.2. Nutrient sensitive areas comprise nitrate vulnerable zones ('NVZs') and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as NSAs under the Urban Waste Water Treatment Directive (91/271/EEC). Nutrient sensitive areas are managed via measures applied to terrestrial sources (e.g. sewage treatment and agricultural practices), and therefore are not considered further within this WFD assessment.

2.5.5. INVASIVE NON-NATIVE SPECIES

2.5.5.1. The introduction and spread of INNS can occur directly through the release of individuals of INNS species into the environment via activities, e.g. through vegetation management and removal and construction activities. Therefore, consideration is given to INNS within the WFD assessment process.

2.5.6. MEASURES TO ACHIEVE THE ENVIRONMENTAL OBJECTIVES

2.5.6.1. For each river basin district, a programme of measures has been drawn up to enable the achievement of objectives of the RBMP. These include:

- Current measures;
- Measures to enable improvements by 2021; and
- Additional measures identified to achieve objectives beyond 2021.

2.5.6.2. These are integrated with measures for protected areas via site specific action plans. Current measures include:

- Physical Modifications (e.g. navigation, flood risk management, fishing, and other recreational activities);
- Managing pollution from waste water;
- Managing pollution from towns, cities and transport;
- Changes to natural flow and levels of water;
- Managing INNS; and
- Manage pollution from rural areas.

2.5.6.3. These are managed through the application of relevant legislation, policy and guidance by regulators and operators, as well as future planning, joint planning and coordination between regulators and operators. Additional measures include improved flood resilience, climate change adaptation, increased biodiversity and social cohesion.

2.6. LIMITATIONS AND ASSUMPTIONS

2.6.1.1. Due to land access constraints, watercourses were only surveyed within the vicinity of the Proposed Development. As a result, contemporary channel characteristics upstream and downstream of the Proposed Development were not observed. Site visits took place in summer 2019 when overgrown vegetation, typical for the time of year, limited visual inspection of some watercourses and potential features; however, low flows improved the likelihood of identifying in-channel features.

2.6.1.2. Overgrown vegetation also limited fish surveys carried out to the south of Anmore Road to ‘spot sampling’ in the sections which were open and accessible. The results therefore can only be presented as a qualitative, minimum estimate of the fish community.

2.6.1.3. The metrics calculated by the River Invertebrate Classification Tool (‘RICT’) are not appropriate for artificial water bodies, non-flowing or ephemeral water bodies (such as ditches), or sites located within 2.5 km of their source. Therefore, this was excluded from the biological indices for this site.

2.6.1.4. Environmental data was requested from the EA for designated water bodies and non-designated tributaries in the vicinity of the Proposed Development. With the exception of designated water bodies very little biological or chemical data was returned. In the absence of appropriately detailed data, professional judgement has been made to provide an evaluation.

3. WFD ASSESSMENT – SURFACE WATER

3.1. STAGE 1 SCREENING

3.1.1.1. The WFD screening assessment considers the aspects of the Proposed Development which have the potential to impact upon the surface water WFD water bodies. The screening assessment for activities is discussed below. Along the Order Limits, the Onshore Cable Corridor crosses or runs adjacent to 13 surface watercourses within the Potwell Trib or tributaries to Langstone Harbour. Although the Onshore Cable Corridor crosses these watercourses, no works are proposed within the watercourses.

3.1.2. ROUTE PREPARATION AND CLEARANCE

3.1.2.1. Based upon a review of Chapter 3 (Description of the Proposed Development), it is considered that the route preparation activities can be screened out of the WFD assessment. This is due to the cable route following predominantly existing carriageways along the cable route from landfall at Eastney and the Converter Station Area, at Lovedean Substation, west of Horndean.

3.1.2.2. The route preparation and clearance activities in relation to Langstone Harbour are assessed within Appendix 7.1 (Marine WFD Assessment).

3.1.2.3. Route preparation and clearance activities could result in the creation of dust and require vegetation clearance. This could result in fine sediment delivery to watercourses, which could impact upon the water environment. Should fine sediment reach the water environment, the potential impacts could be for:

- Increased turbidity due to fine sediment input;
- Smothering of channel substrate and increased fine sediment supply; and
- Smothering of benthic invertebrates, reduction in light penetration from increased turbidity, clog fish gills and spawning habitats.

3.1.2.4. The risks of these impacts are considered low due to the proposed cable route, where the watercourses would not be directly impacted during route preparation. Due to the absence of surface water flow paths which could carry fine sediment to the watercourses, this risk is lowered further.

3.1.2.5. Noise and vibration as a result of route preparation activities could impact upon resident and migratory aquatic species. This could result in behavioural changes, avoidance or localised mortalities. With standard best practice, including avoiding undertaking activities during the migratory and spawning season, these risks would be negligible and are screened out of further assessment. Best practice guidance is provided within the Onshore Outline Construction Environmental Management Plan (‘CEMP’) (document reference 6.9).

3.1.2.6. Where INNS occur, caution should be exercised to prevent their spread. Adherence to best practice for the control of INNS would be followed, as provided within the Onshore Outline CEMP.

3.1.2.7. These risks would be managed using standard best practice guidance, including avoiding works in close proximity to watercourses as far as practicable, limiting the extent of any riparian vegetation, and general fine sediment management. The best practice guidance is provided within the Onshore Outline CEMP. With the Onshore Outline CEMP in place, these activities would be appropriately managed and therefore they have been screened out of further assessment.

3.1.3. CONSTRUCTION (CABLE INSTALLATION & CABLE PROTECTION)

3.1.3.1. The Proposed Development has been designed so that where possible the Onshore Cable Route follows the carriageway. This means that trenching of the carriageway would cross watercourses where they have already been culverted. Where watercourse culverts are encountered, the preference is for the cable to pass over them, but if necessary, it may pass under them.

3.1.3.2. Where culverting is not in the carriageway and watercourses are to be crossed, i.e. at Soake Farm East and Farlington Marshes Gutter Ordinary River, the Onshore Cable would pass under the watercourse. At Soake Farm this would be via HDD and at Farlington Marshes Gutter Ordinary River this would be via Trenchless techniques. Further details on these methods can be found in Chapter 3 (Description of the Proposed Development). As a result of this, there are no works proposed within any of the watercourses within or adjacent to the Order Limits.

3.1.3.3. HDD activities would be undertaken at both the marine HDD entry/exit landfall point at Eastney and to the north-west of Langstone Harbour (A2030 Bridge) where the cables cross underneath Langstone Harbour between Portsea Island and the mainland. Drilling would take place entirely under Langstone Harbour.

3.1.3.4. For the landfall HDD, transition jointing bays would be constructed above Mean High Water Spring (MHWS), and ducts would be installed under the intertidal zone. Excavations required prior to HDD works at the entry/exit landfall at Eastney are considered as part of the route preparation works described above. HDD activities require the use of a drill fluid to lubricate the drilling process and cool the drill head. Fluid pressures would be monitored throughout activities to reduce the risk for breakout of the drilling fluid, however, should this occur, there is potential for the release of drill fluids into the marine environment. It is proposed that a bentonite based drilled drilling fluid which is Cefas approved will be used, made up of water (>90%), bentonite (~7%), Xanthan gum (<0.5%).

3.1.3.5. Xanthan gum (a natural starch) is listed on the Offshore Chemical Notification Scheme ('OCNS') list as Group E, showing least hazard potential, and bentonite is listed as Group P, showing least hazard potential under Harmonised Mandatory Control Scheme (Cefas, 2019b). According to its Material Safety Data Sheet ('MSDS'), bentonite is a persistent but non-toxic natural material which is used as a lubricant.

3.1.3.6. Any potential effect from the release of drilling fluid into the marine environment is minimised by reducing the pressure of the fluid within the drill and via transfusing the drill fluid with xanthan gum which reduces the concentration of bentonite within the drill fluid. Bentonite is also broken down by seawater and it 'flocculates' and dissipates quickly. Bentonite and xanthan gum contained within the drilling fluid are in low concentration, are non-toxic and will be non-persistent in the marine environment, therefore do not pose a threat to water quality. The potential release of drill fluid during HDD works is therefore screened out of further assessment.

3.1.3.7. During cable installation, noise and vibration could cause a disturbance for aquatic species, as described in the section above. By implementing standard best practice provided within the Onshore Outline CEMP, these risks would be managed effectively and are therefore screened out of further assessment.

3.1.3.8. Pollutants arising from construction activities, such as fuel, oils and cement and chemicals could have a significant impact upon the water environment. Following pollution prevention guidance, provided within the Onshore Outline CEMP, would mitigate these risks. Therefore, this is screened out of further assessment.

3.1.4. CABLE OPERATION AND MAINTENANCE

3.1.4.1. The Proposed Development has been designed so that routine maintenance to the cables is not required during their operational lifetime. Therefore, operation and maintenance is screened out of further assessment.

3.1.4.2. The indicative worst-case failure rate for marine cables (including internal and external failures) is one repair every 10 to 12 years per cable, adding up to an estimated 4 repairs per cable over the 40-year lifespan. Typically, repair works would require exposure of the cable at the point where the fault is identified, cutting the cable where damaged, recovery to the surface, repair and re-deployment and re-burial to the seabed as an omega joint using methods similar to those employed during installation. This is likely to include a requirement for placement cable protection e.g. rock placement.

3.1.4.3. The potential impact of operation and repair/maintenance (‘O&M’) activities is considered to be significantly reduced in comparison to route preparation and installation activities for the entire cable. While it is noted that some additional cable protection may be required post construction, a contingency amount has been added to account for this within the Construction Stage assessments. Therefore, O&M activities have been screened out of the further assessment.

3.1.5. DECOMMISSIONING

3.1.5.1. The potential effects of decommissioning are considered in the worst case (i.e. cable removal), to be equivalent to the effects associated with construction. They may potentially be less than those associated with construction depending on the decommissioning activities undertaken, for instance where the cable is left in situ. Decommissioning activities have therefore been screened out of further assessment. A sperate consent would be sought for decommissioning, should the proposed activities be licensable, and a WFD assessment would be undertaken at the time to support the application.

3.1.6. POLLUTION EVENTS AND WASTE MANAGEMENT

3.1.6.1. Pollution events could potentially occur at any stage of the project; however, such events would be managed through standard best practice plans, which deal with spillages, silt management, noise and vibration and are covered within the Onshore Outline CEMP. Pollution events have therefore been screened out of further assessment.

3.1.6.2. All chemicals and waste, including organic waste, will be managed in line with standard best practice waste management plans, with release into the water environment. Release of nutrients or chemicals has therefore been screened out of further assessment.

3.1.6.3. The screening assessment for activities is summarised in Table 3.1. Further information on construction mitigation relevant to the WFD is provided in Annex A.

Table 3.1 – WFD surface water screening for activities

Activity	Screening outcome	Justification
Route preparation and clearance		
Cutting open trenches resulting in dust and requirement for vegetation clearance	OUT	Whilst route preparation and clearance activities could result in the creation of dust and require vegetation clearance, potential releases of fine sediment would be controlled via standard best practice guidance, as provided in Annex A and within the Onshore Outline CEMP.
Noise and vibration	OUT	Noise and vibration may cause disturbance to and behavioural changes in fish species. These potential impacts would be mitigated through standard best practice, as provided in Annex A and within the Onshore Outline CEMP and, therefore, screened out of further assessment.
Construction (Cable installation and cable protection)		
HDD (marine exit/entry point at Eastney landfall)	IN	Release of drilling fluids is screened out of assessment due to non-toxic and non-persistent nature. Assessment of potential disturbance and scour risk over duration of the Proposed Development is screened in for further assessment.
HDD (Langstone Harbour - A2030 Bridge)	IN	Release of drilling fluids is screened out of assessment due to non-toxic and non-persistent nature. Assessment of potential disturbance and scour risk over duration of the Proposed Development is screened in for further assessment.
Noise and vibration	OUT	Noise and vibration may cause disturbance to and behavioural changes in fish species. These potential impacts would be mitigated through standard best practice, as provided in Annex A and within the Onshore Outline CEMP and, therefore, screened out of further assessment. There is no vibration impact from HDD methods.
Fuels, oils, cement and chemicals	OUT	With standard best practice methods, as provided in Annex A and within the Onshore Outline CEMP, these

		risks to the water environment would be managed and are, therefore, screened out of further assessment.
O&M activities	OUT	The potential impacts of O&M activities are considered to be significantly reduced in comparison to construction activities, as cable de-burial/re-burial is likely to occur only at the point of a cable failure.
Decommissioning	OUT	Decommissioning impacts are considered in the worst case, to be equivalent to or lesser than those for construction.
Pollution events and waste	OUT	Pollution events and waste would be managed via standard best practice plans and methods, as provided in Annex A and within the Onshore Outline CEMP, and via relevant regional/national pollution prevention and control mechanisms.

3.1.7. SCREENING OF SURFACE WATER WFD WATER BODIES

3.1.7.1. The Onshore Cable Corridor passes through, or is adjacent to, the following surface water WFD water bodies of relevance to this WFD assessment are:

- Upper Wallington (GB107042016350);
- Potwell Trib (GB107042016400);
- Hermitage Stream (GB107042016370); and
- Langstone Harbour (GB580705130000).

3.1.7.2. The WFD water bodies downstream of those listed above are Wallington below Southwick (GB107042016360), Portsmouth Harbour (GB580705140000) and Solent (GB650705150000). The Wallington below Southwick catchment starts approximately 10 km west of the Section 4 of the Onshore Cable Corridor. This feeds into Portsmouth Harbour (GB580705140000) after flowing for approximately 7 km from Southwick to Fareham. No impacts on either WFD water body are anticipated from the Proposed Development. This is due to the distance from any construction activities, and no operation activities would impact the watercourses due to the cable being beneath ground with no new structures being proposed for watercourse crossings. Both Wallington below Southwick and Portsmouth Harbour have therefore been screened out and are not considered further in this assessment. The Solent is considered further in Appendix 7.1 (Marine WFD Assessment).

3.1.7.3. The summary of the screening assessment for potential impacts upon the surface water WFD water bodies is provided in Table 3.2.

Table 3.2 – WFD surface water screening for surface water WFD water bodies

WFD Water body	Activity	Screening outcome	Justification
Potwell Trib (GB107042016400)	HDD.	IN	Onshore Cable Corridor crosses multiple watercourses within this water body. Whilst HDD or trenching above or beneath existing watercourse crossing structures is proposed, this water body is screened in for further assessment due to the potential for impacts due to the close proximity of construction activities to the watercourses.
Langstone Harbour (GB580705130000)	HDD.	IN	HDD is the proposed method to cross beneath this water body, thus impacts are anticipated to be minimal. However, due to the potential sensitivity of this water body, and due to the proximity of Farlington Marshes, this water body is screened in for further assessment. The Langstone Harbour water body is considered further in Appendix 7.1 (Marine WFD Assessment).
Upper Wallington (GB107042016350)	No direct activities.	OUT	This water body lies adjacent to the Potwell Trib but is not hydrologically connected to it. It is outside of the Order Limits, thus, is screened out.
Hermitage Stream (GB107042016370)	Cable trenching along existing carriageways but not crossing any watercourses.	OUT	Although the Order Limits crosses into the Hermitage Stream water body, there are no watercourses within close proximity to the Order Limits, thus, this water body is screened out.
Wallington below Southwick (GB107042016360)	No direct activities.	OUT	This water body starts approximately 10 km west of the Section 4 of the Onshore Cable Corridor and is, thus, considered to be of sufficient distance from the Proposed Development to be

			impacted, and is therefore screened out.
Portsmouth Harbour (GB580705140000)	No direct activities.	OUT	No direct impact due to the distance from any construction activities. The Portsmouth Harbour water body is considered in Appendix 7.1 (Marine WFD Assessment).
Solent (GB650705150000)	Covered in the Marine WFD Assessment.	OUT	The Solent water body is considered further in Appendix 7.1 (Marine WFD Assessment).

3.2. WFD SURFACE WATER STATUS

3.2.1.1. The current status of the water bodies screened in for further assessment is provided in Table 3.3. Further information on the contemporary catchment characteristics and site specific WFD data are presented in the next section, scoping stage.

Table 3.3 - WFD Status of the Potwell Trib and Langstone Harbour (Source EA, 2016)

Water Body ID	**GB107042016400**	**GB580705130000**
Water Body Name	**Potwell Trib**	**Langstone Harbour**
Water Body Type	River	Transitional
Water Body area*	42.2 km^2	18.9 km^2
Hydromorphological Designation	HMWB	HMWB
Reason for Designation	Physical modification including barriers (ecological discontinuity)	Unknown – under investigation
Status Objective (overall)	Good by 2027	Good by 2027
Overall Ecological Status / Potential	Moderate	Moderate
Current Overall Status / Potential	Moderate	Moderate

Water Body ID	GB107042016400	GB580705130000
Justification for not Achieving Good Status by 2015	Disproportionate burdens Cause of adverse impact unknown	Disproportionate burdens
Protected Area Designation*	Nitrates Directive (NVZ12SW011840; NVZ12SW015270)	Habitats and Species Directive (Solent Maritime; Solent & Isle of Wight Lagoons) Shellfish Water Directive (Portsmouth Harbour; Langstone Harbour; Chichester Harbour (Emsworth Channel) Nitrates Directive (NVZ12SW011840) Urban Waste Water Treatment Directive (Portsmouth Harbour; Langstone Harbour) Conservation of Wild Birds Directive (Chichester and Langstone Harbours)
Overall Biological Quality Element Status Objective	Poor	Good
Fish	Poor	No Data
Invertebrates	Good	Good
Macrophytes (River) **Macroalgae (Transitional)**	Moderate	Good
Overall Physico-Chemical Quality Element Status Objective	Good	Good
Specific pollutants	High	No Data (2016)

Water Body ID	GB107042016400	GB580705130000
		High (2014)
Priority substances	Good	Does not require assessment
Priority hazardous substances	Good	Good
Dissolved inorganic Nitrogen	No Data	Good
Overall Chemical Quality Element Status Objective	Good	Good
Acid Neutralising Capacity	No Data	No Data
Ammonia (Phys-Chem)	High	No Data
Dissolved Oxygen	High	High
pH	High	No Data
Phosphate	Good	No Data
Temperature	High	No Data
Hydromorphology Supporting Elements Status Objective	Not Assessed	Supports Good
Hydrological regime	No Data	Supports Good
Morphology	No Data	No Data
Current	Moderate or Less	Tidal
Note: see Appendix 7.1 (Marine WFD Assessment) for the protected areas within Langstone Harbour. For the Potwell trib, there are no notable flow pathways for pollution to reach watercourses to impact upon nutrient concentrations.		

3.3. STAGE 2: SCOPING – SURFACE WATER

3.3.1.1. An evaluation of the watercourses within the study area was made in terms of their biological, physico-chemical and hydromorphological characteristics following the walkover surveys and data analysis. As agreed with the Environment Agency, the summary of findings is presented below to inform the scoping phase of the assessment, which demonstrates that there would be no impacts upon the surface water WFD water bodies.

3.3.2. POTWELL TRIB BASELINE CHARACTERISTICS

3.3.2.1. The Potwell Trib is approximately 10.9 km in length, draining a predominantly agricultural area of 42.2 km^2. The water body has its source south east of Denmead with its wider catchment area reaching into the south west of the South Downs National Park. The water body flows south west and then westwards for approximately 10 km, passing through Southwick Park Lake, before flowing into the Wallington River to join the Wallington below Southwick WFD water body (GB107042016360). The Wallington River then flows into Portsmouth Harbour WFD transitional water (GB580705140000). The channel is relatively sinuous with straightened areas in places. A number of small streams and drainage channels discharge into the water body. Nearby infrastructure and communities include Waterlooville and the A3 to the west, Purbrook and Southwick to the south and Denmead to the north.

3.3.2.2. Tributaries of the Potwell Trib that may be impacted by the Proposed Development are: Kings Pond and Soake Farm North, Soake Farm East, Unnamed Tributary of Soake Farm, Old Park Stream, Unnamed Tributary of Old Park Farm, River Wallington, Unnamed Ordinary Watercourse1, Unnamed Ordinary Watercourse 2, North Purbrook Heath North and North Purbrook Heath South. Watercourses are shown in Plates 2.1 to 2.5 (see Section 2).

Catchment Geology and Soils

Review of BGS mapping indicates that superficial deposits in the Potwell Trib comprise the following:

- Head Deposits composed mostly of clay, silt, sand and gravel;
- Bedrock geology throughout the Onshore Cable Corridor of the Proposed Development includes the following:
  - Tarrant Chalk Member which is composed of soft white chalk with relatively widely spaced but large flint seams;
  - Lambeth Group comprising clay, silt and sand;
  - London Clay and Wittering Formations both comprising clay, silt and sand;

- Portsdown Chalk Formation and Whitecliff Sand Member comprising white chalk with marl seams and flint bands;
- Spetisbury Chalk Member which is composed of firm white chalk with regular large flint seams; and
- Tarrant Chalk Member.

3.3.2.3. Soils in the south of the Potwell Trib water body are moderately fertile with impeded drainage and are mainly slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (DEFRA, 2019). Also present in smaller areas to the south west of the catchment are slightly acid loamy and clayey soils with slightly impeded drainage and moderate to high fertility. To the north of the catchment, where soils a more freely draining with lime-rich fertility, shallow lime-rich soils over chalk or limestone are interspersed with freely draining lime-rich loamy soils and freely draining slightly acid loamy soils (Soilscapes, 2019).

Catchment Hydrology

3.3.2.4. Potwell Trib is not a gauged catchment and so there are no records of stream levels or flow rates. Therefore, flow rates for these watercourses have been estimated using Low Flows 2000 software (published by (Wallingford HydroSolutions, 2016)) as recommended by the DMRB (Volume 11, Section 3, Part 10, Paragraph 5.20). The results from Low Flows 2000 indicate that at:

- Soake Farm upstream of BNG 466500 111000
  - Q95 flow for the catchment is 0.026 m3/s
  - Q5 value is 0.157 m3/s
- Old Park Farm upstream of BNG 465900 109700
  - Q95 flow for the catchment is 0.069 m3/s
  - Q5 value is 0.508 m3/s
- Purbrook Heath upstream of BNG 465750 107600
  - Q95 flow for the catchment is 0.0047 m3/s
  - Q5 value is 0.246 m3/s

3.3.2.5. The northern extent of the Potwell Trib water body is founded across the Lambeth Group, not the Chalk, and therefore only small proportions of baseflow to the Potwell Trib are anticipated to be groundwater fed. The standard annual average rainfall (SAAR 1961-1990) for the catchment is 819 mm (NRFA, 2019).

3.3.2.6. EA flood risk mapping indicates that the Proposed Development crosses areas within flood zone 2 indicating that it has a risk of flooding each year of between 1% and 0.1% and within flood zone 3 indicating that it has a risk of flooding each year greater than 1%. A separate Flood Risk Assessment has been undertaken for the Proposed Development in Appendix 20.1 (Flood Risk Assessment) of the ES Volume 3 (document reference 6.3.20.1).

Historical Channel Change

3.3.2.7. Very little modification has taken place to the watercourses within Potwell Trib water body since the 1870's, by which time they had already been straightened in locations. Small modifications to straighten the northern tributary of Soake Farm are noticeable in the 1960's. Further south, Old Park Farm and North Purbrook Heath remain relatively unchanged since early mapping in the 1870's (Old-Maps.co.uk, 2019).

3.3.3. POTWELL TRIB CONTEMPORARY CHANNEL CHARACTERISTICS

Overview of Results: Land South of Anmore Road

3.3.3.1. Initial site assessment determined that the northern section of the site, i.e. areas 1 and 2 (Plate 2.6), which includes Kings pond, were dry at the time of conducting the walkover assessment. Observations suggested that this may not represent the character these sections would exhibit at other times of year and, in fact, it is likely that Kings pond and the lower reaches of Section 2 of the Onshore Cable Corridor could be inundated for extended periods of the year. As areas 1 and 2 were dry at the time of surveying, they were not considered to support any legally protected species, and as such were not recommended for further assessment.

3.3.3.2. Water was recorded in areas 3, 4, 5 and 6 of the Proposed Development (Plate 2.6) at the time of the walkover assessment. Again, these water bodies showed characteristic signs such as built infrastructure and in-channel gravel deposition, suggesting that they do, at times, carry significantly more water than was seen during the walkover assessment. However, even exhibiting lower flows than normal, it was considered that these water bodies do have the potential to support legally protected species such as European eel. As a result, recommendations were made to conduct further surveys to establish the presence or likely absence of legally protected species in these water bodies, including fish, eels and aquatic macroinvertebrates.

3.3.3.3. Results from these surveys are summarised in section descriptions below.

Kings Pond and Soake Farm North

3.3.3.4. Kings Pond is an online pond north of Soake Farm main river within Section 3 of the Onshore Cable Corridor (Plate 3.1 A). When visited in July 2019 the pond was dry but is understood to be ephemeral in nature. Soake Farm North is a main river consisting of depression with vegetated banks.

3.3.3.5. The pond was bordered by a mix of loosely scattered trees, including ash (‘*Fraxinus excelsior’)*, willow (‘*Salix* sp’). and birch (‘*Betula pendula’)* of varying ages. The bank vegetation was predominantly a mix of ruderal herbs, dominated by nettle (‘*Urtica dioica’)*, common thistle (‘*Cirsium vulgare’)*, rosebay willowherb (‘*Chamaenerion angustifolium’)*, cow parsley (‘*Anthriscus sylvestris’)* and cleavers (‘*Galium aparine’)*.

3.3.3.6. Some emergent vegetation was still present, particularly in the margins and wetter areas of ground within the dry pond bed. Notable species were sedge *Carex* sp., reedmace (‘*Typha latifolia’)* and yellow iris (‘*Iris pseudacorus’)*, present as single plants or dotted around in small groups.

3.3.3.7. To the south of the pond, the surface water channel took the form of a ground depression (Plate 3.1 B). The in-channel vegetation was characteristic of terrestrial vegetation, and that of the adjacent land assemblages. Much of it was very overgrown with bramble (‘*Rubus fruticosus’)* and there was a short section of culvert beneath this dense vegetation stand.

3.3.3.8. Further down this section, above the confluence with area 3 (Plate 2.6), the channel was uniform and straight. It had primarily dry gravel substrate, with very few damp areas, save for that near a culverted field boundary crossing, where a clump of iris was observed.

3.3.3.9. Dominant bank and in-channel species in this section were Hawthorn (‘*Crataegus monogyna’)*, blackthorn (‘*Prunus spinosa’)*, willow, wild dog rose *(‘Rosa canina’)*, scattered mature oak (‘*Quercus* sp.’), Grasses, nettle (‘*Urtica dioica’)*, bramble.

3.3.3.10. This pond and watercourse would not be crossed but is adjacent to the trenching and the HDD lay down area.

Plate 3.1 - A - Kings Pond looking south (466745, 111775); B. Soake Farm North looking south (466755, 111770)

3.3.3.11. Soake Farm East is a main river within Section 3 of the Onshore Cable Corridor (area 3, Plate 2.6). It is a straight, trapezoid ditch, approximately 0.6 m wide and 0.15 m deep, with a mix of silt and gravel substrate and had no perceptible flow during the site visit in July 2019 (Plate 3.2). Both the left and right banks had simple vegetation including bramble, nettle, wild dog rose, blackthorn, hawthorn and grasses. In-channel vegetation included rush (‘*juncus* sp.’) iris, sedge, water parsnip (‘*Sium latifolium’)* and water plantain (‘*Alisma plantago*-aquaticae’). The land surrounding the watercourse is improved grassland and farmyards / sheds along the right bank. Upstream of this watercourse is an online pond adjacent to the farm house that was stagnant during the July 2019 visit. This watercourse would be crossed via HDD.

Plate 3.2 - Soake Farm East looking west (466800, 111240)

Soake Farm South

3.3.3.12. Soake Farm South is an ordinary river consisting of overgrown, over shaded (Plate 3.3 A) trapezoid ditch at the border of Sections 3 and 4 of the Onshore Cable Corridor (area 4, Plate 2.6). Due to the dense vegetation, much of this section was inaccessible to view the in-channel features during the site visit (Plate 3.4). Predominant substrate appeared to be gravel and silt with a channel width of approximately 1 m and a depth of 0.15 m.

3.3.3.13. The section is situated below the confluence of areas 2 and 3, and although visually it appears to be a continuation from north to south of area 3 (Plate 2.6), at the time of the assessment, the fluvial source derived entirely from area 3 (Plate 2.6).

3.3.3.14. At the confluence between areas 3 and 4 (Plate 2.6) was an exposed gravel point bar with extensive undercutting of the right bank, indicating that this channel can experience much higher flows than were visible on the day of the assessment, potentially carrying water from both areas 2 and 3 (Plate 2.6).

3.3.3.15. At the southern extent, the channel passed through a double culvert under the B2150, which was constructed so that the inline opening was set lower than the off-channel opening, the presumption being to improve conveyance under the road in high flow conditions (Plate 3.3 B).

3.3.3.16. Dominant vegetation in this section was hawthorn, blackthorn, willow (‘Salix sp.’), common holly (‘Ilex aquifolium’), wild dog rose and scattered mature oak. In channel vegetation was limited to water parsnip.

Plate 3.3 - A. Soake Farm South over shaded channel looking north (466581, 111237); B. Soake Farm South looking south to double culvert under the B2150 (466574, 111203)

Plate 3.4 - Soake Farm South looking north (466581, 111231)

Land South of Hambledon Road (B2150)

3.3.3.17. This section, leading south from Hambledon Road, averaged approximately 0.5 m wide and 0.1 m deep although some discrete sections had depths reaching up to 0.5 m. The channel was particularly overgrown with bramble at the top end, making the channel inaccessible in this area. Other vegetation in this section included bramble, nettle, gorse, cow parsley, wild dog rose, rosebay willowherb, cleavers, oak saplings and grasses. It was more accessible further south, as amenity vegetation management practises were undertaken on this site leaving only a narrow, vegetated buffer to the watercourse (Plate 3.5 A).

3.3.3.18. This section, leading south from Hambledon Road, averaged approximately 0.5 m wide and 0.1 m deep although some discrete sections had depths reaching up to 0.5 m. The channel was particularly overgrown with bramble at the top end, making the channel inaccessible in this area. Other vegetation in this section included bramble, nettle, gorse, cow parsley, wild dog rose, rosebay willowherb, cleavers, oak saplings and grasses. It was more accessible further south, as amenity vegetation management practises were undertaken on this site leaving only a narrow, vegetated buffer to the watercourse (Plate 3.5 A).

3.3.3.19. The wider land area was well used by dog walkers and there was evidence of this on the banks of the channel, with significant poaching in some areas, resulting in bare banks and high turbidity in the channel.

3.3.3.20. There was a clear and obvious flow in this section as the watercourse, below Hambledon Road, generally began to widen and take on more riverine, rather than ditch-like, characteristics (Plate 3.5 B).

Plate 3.5 - A. Land South of Hambledon Road (B2150); narrow vegetation buffer (466522, 111098) B. Land South of Hambledon Road (B2150) indicative channel form, (466535, 111127)

3.3.3.21. To the west of this land parcel and of the main watercourse there was an additional ditch, approximately 0.5 m wide and 0.1 m deep, which contained standing water for approximately half of its length with the southern half being dry at the time of survey (area 6, Plate 2.6). This section showed signs of similar poaching and land management pressures at several points along its course until connecting with the main channel at its southern extremity (Plate 3.6 A and B).

3.3.3.22. To the west of this land parcel and of the main watercourse there was an additional ditch, approximately 0.5 m wide and 0.1 m deep, which contained standing water for approximately half of its length with the southern half being dry at the time of survey (area 6, Plate 2.6). This section showed signs of similar poaching and land management pressures at several points along its course until connecting with the main channel at its southern extremity (Plate 3.6 A and B).

3.3.3.23. Dominant vegetation included nettles, cleavers, blackthorn and grasses with a row of mature oaks along its course (Plate 3.7).

Plate 3.6 - A. Land South of Hambledon Road (B2150) western boundary ditch, dog poaching (466469, 111150); B. Land South of Hambledon Road (B2150) western boundary ditch, northern section standing water (466520, 111190)

Plate 3.7 - Land South of Hambledon Road (B2150) western boundary ditch, line of mature oaks and narrow vegetated buffer (466492, 111169)

Old Park Stream

3.3.3.24. Old Park Stream is a main river within Section 4 of the Onshore Cable Corridor. The watercourse is a trapezoid ditch with a choked channel (Plate 3.8). It has a re-sectioned bank with an over deepened channel and a silty bed. During the visit in July 2019 there was no perceptible flow in Old Park Stream. The watercourse is culverted upstream from Hambledon Road after which point it passes through a small park in a suburban area. Approximately 200 m downstream of Hambledon Road Old Park Stream has been landscaped with riparian planting to create a wildflower meadow. No aquatic surveys have been carried out in this watercourse. This water course would be crossed via trenching above the culverts under B2150/Hambledon Road.

Plate 3.8 - Old Park Stream looking north (467275, 110460)

Unnamed Tributary of River Wallington

3.3.3.25. This watercourse is an ordinary river within Section 4 of the Onshore Cable Corridor and is mapped as an unnamed tributary of the River Wallington. The Unnamed Tributary is culverted under Hambledon Road and then flows along a trapezoid ditch until it reaches the landscaped area to the south (Plate 3.9 A). However, approximately 100 m downstream of Hambledon Road the Unnamed Tributary appears to merge with Old Park Stream. This area has been landscaped with riparian planting to create a wildflower meadow making access difficult to confirm channel alignment (Plate 3.9 B). No aquatic surveys have been carried out in this watercourse. This water course would be crossed via trenching above the culverts under B2150 / Hambledon Road.

Plate 3.9 - A. Unnamed Tri Tributary of River Wallington looking south (467430, 110330); B. recent riparian planting south of Hambledon Road along Old Park Stream / Unnamed Tributary (467290, 110290)

River Wallington

3.3.3.26. The River Wallington is culverted upstream of, and under Hambledon Road within Section 4 of the Onshore Cable Corridor. It then passes through a screened structure to the west and carries on as a trapezoid ditch (Plate 3.10). The watercourse was bordered by established tree vegetation on both banks downstream of Hambledon Road. Bed composition was not able to be determined due to the large screen and no access. No aquatic surveys have been carried out in this watercourse. This water course would be crossed via trenching above the culverts under B2150 / Hambledon Road.

Plate 3.10 - River Wallington looking west from Hambledon Road (467830, 109650)

Unnamed Ordinary Watercourse 1

3.3.3.27. The unnamed Ordinary Watercourse is an overgrown small depression southwest of Maurepas Way within Section 4 of the Onshore Cable Corridor. No water was present during the site visit in July 2019 (Plate 3.11 A). Recent landscaping for a relatively new development has added an additional ditch which feeds into the start of the ordinary watercourse (Plate 3.11 B). This ditch has re-sectioned banks and was also a dry, choked channel in July 2019. Sustainable Drainage Systems ('SuDS') and highway drainage were also present in the area. No aquatic surveys have been carried out in this watercourse. This watercourse would not be crossed but lies adjacent to trenching works that would occur along Maurepas Way.

Plate 3.11 - A. Unnamed Watercourse 1 looking south (467870, 109360); B. Looking southeast along Maurepas Way to the additional ditch (right) and SuDS pond (left) (467840, 109840)

Unnamed Ordinary Watercourse 2

3.3.3.28. This Ordinary Watercourse is no longer present and is within Section 4 of the Onshore Cable Corridor. This has been piped and backfilled (Plate 3.12 A). A waterway gully grate was observed approximately 20 m west of the A3 / London Road (Plate 3.12 B). This water course would be crossed via trenching above the culverts under the A3/London Road.

Plate 3.12 - A. Unnamed Watercourse 2 looking east towards A3 / London Road (467850, 109015); B. Gully grate approximately 20m west of the A3 / London Road (467870, 109010)

North Purbrook Heath (north)

3.3.3.29. North Purbrook Heath (north) is a main river within Section 4 of the Onshore Cable Corridor. It is culverted under the A3 / London Road and is a concrete lined channel to the west after it passes through the screened culverts (Plates 3.13 A and B). Both banks are brick lined with a reinforced toe and re-sectioned top bank. A small amount of silt was built up but the watercourse maintained a smooth flow. The left bank had simple vegetation while the right bank had more complex vegetation. Upstream of the watercourse is suburban land with improved grassland adjacent to the left bank downstream of the A3 / London Road. No aquatic surveys have been carried out in this watercourse. This water course would be crossed via trenching above the culverts under the A3 / London Road.

Plate 3.13 - A. North Purbrook Heath looking upstream (east) towards A3 / London Road (467150, 107790); B. Screened culverts where North Purbrook Heath exists culvert under A3/London Road (467180, 107780)

North Purbrook Heath (south)

3.3.3.30. North Purbrook Heath (south) is also a main river and is culverted under the A3 / London Road within Section 4 of the Onshore Cable Corridor. Access was not possible during the July 2019 site visit and visibility of the watercourse was poor due to complex vegetation downstream of the A3 / London Road (Plate 3.14). The watercourse is assumed to be a trapezoid ditch. Surrounding land use south of the road is improved grassland with areas of complex vegetation. No aquatic surveys have been carried out in this watercourse. This water course would be crossed via trenching above the culverts under the A3 / London Road.

Plate 3.14 - Looking south along A3/London Road with hedge and overgrown vegetation blocking access to the couth branch of North Purbrook Heath (467175, 107730)

3.3.4. LANGSTONE HARBOUR BASELINE CHARACTERISTICS

3.3.4.1. Langstone Harbour is a shallow tidal basin and is classified as a transitional water body. WFD water bodies upstream of the harbour are the Hermitage Stream (GB107042016370), Lavant (Hants) (GB107042016420) and Langstone Oysterbeds (GB510070073000), while downstream is the Solent coastal waters (GB650705150000). A small number of watercourses also feed directly into the Harbour such as Farlington Marshes Gutter and Great Salterns Drain. Langstone Channel (up to Bedhampton) and Broom Channel are dredged for navigational purposes.

3.3.4.2. An assessment of the stability of the sea bed through Langstone Harbour is required to inform the HDD of the cable through this region. The cable route is proposed to pass through the north west of Langstone Harbour, under Broom Channel, within Section 7 of the development. This intertidal region can be classified as a mud flat with small creeks and channels leading into Broom Channel. To the south of the site boundary is Kendall's Wharf while the site is bounded by the A27 to the north.

3.3.4.3. A site boundary, indicating the region where the cable passes under the intertidal area of Langstone Harbour, is recreated from the Section 7 boundary shown in Plate 3.15.

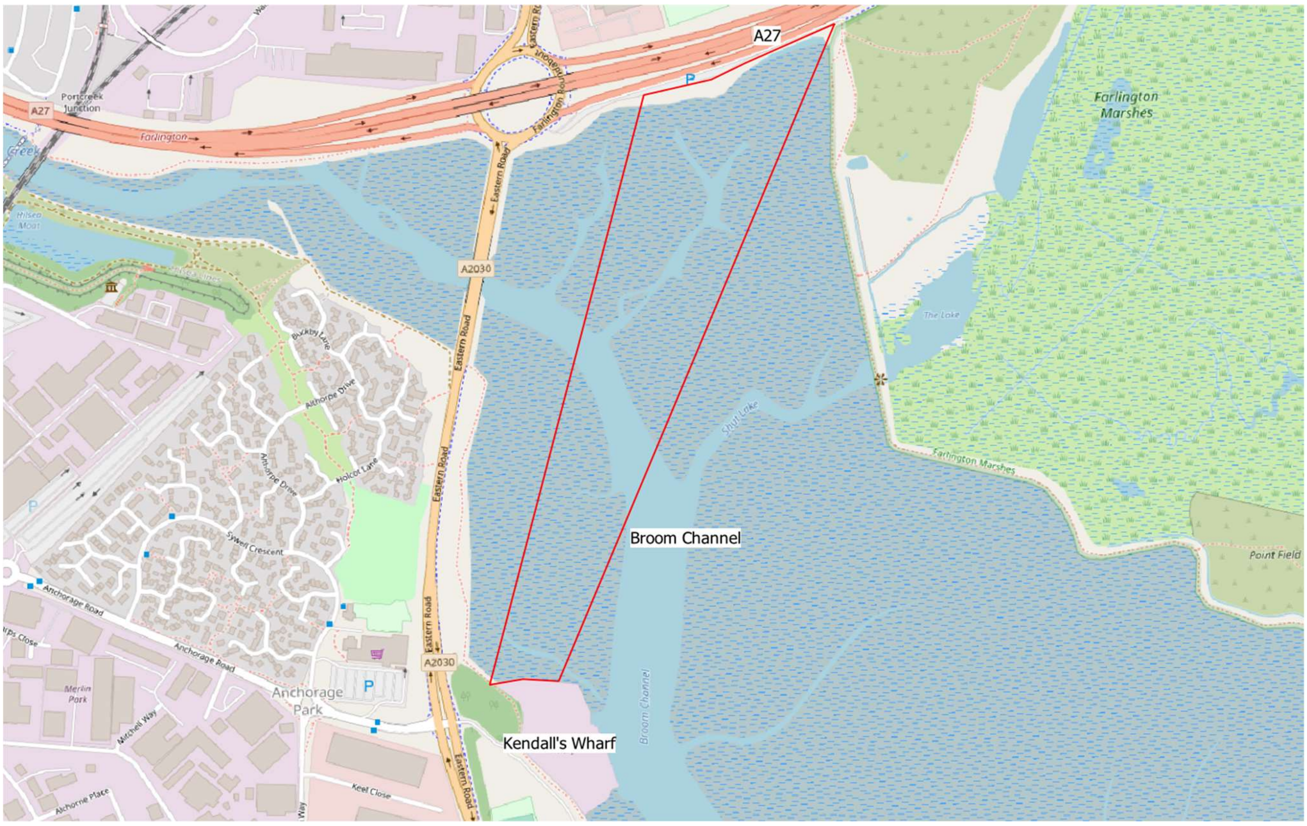

Plate 3.15 - Order Limits (red line) for the cable route passing under the intertidal mudflats of Langstone Harbour. Broom Channel, Kendall's Wharf and the A27 are also labelled

3.3.4.4. Langstone Harbour is defined as a tidal inlet and can be characterised by extensive tidal lagoons and barrier beaches. Waves are prevented from penetrating the harbour due to the confined harbour entrance caused by sand and gravel spit growth. The harbour is reported to be ebb dominated, resulting in the harbour acting as a sediment sink for fine sediments and resulting in the formation of mudflats and saltmarshes in the upper harbour reaches, providing further protection from wave action (Halcrow, 2009).

3.3.4.5. The harbour contains a range of sediments from sand to fine silts and mud, where the intertidal areas predominantly consist of fine cohesive sediments with some vegetation and algae growth (Halcrow, 2009). The vegetation and algal growth will have a stabilising effect on the mudflats, therefore further reducing the potential for erosion and increasing the likelihood of sediment deposition.

3.3.4.6. Maintenance dredging is reported to occur in the approach channel to Kendall's Wharf however no dredging is reported to take place north of this, within the Section 7 site boundary. No information on the frequency of maintenance dredging was available to the author at the time of writing this report.

3.3.4.7. The assessment of seabed stability will utilise freely publicly available information on bed levels through time. Comparisons of these bed levels will show historic bed level changes, which will inform the potential for future bed level changes within this area.

Catchment Geology and Soils

3.3.4.8. Review of BGS mapping indicates that superficial deposits in the Potwell Trib comprise the following:

- 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.

3.3.4.9. Bedrock geology along the Onshore Cable Corridor of the Proposed Development includes the following:

- White Chalk Subgroup comprising chalk with flints (Section 5 to Section 7 of the Onshore Cable Corridor), 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 Onshore Cable Corridor);
* London Clay Formation (Portsmouth Sand Member) and Wittering Formation (Section 9 of the Onshore Cable Corridor); and
* The Wittering Formation is composed of clay, silt and sand and underlies the superficial deposits (Section 10 of the Onshore Cable Corridor).

Catchment Hydrology

3.3.4.10. The closest standard port tide gauge to Langstone Harbour is Portsmouth. No correction factor is reported within the Admiralty tide tables for Langstone Harbour. Table 3.4 shows the astronomic tide levels for the Portsmouth tide gauge (NTSLF, 2019).

Table 3.4 – Astronomic tide levels for Portsmouth

Tidal Parameter	Level (mCD)	Level (mOD)
Highest Astronomical Tide HAT	5.13	2.40
Lowest Astronomical Tide LAT	0.14	-2.59
Mean High Water Spring MHWS	4.72	1.99
Mean High Water Neap MHWN	3.87	1.14
Mean Low Water Neap MLWN	1.90	-0.83
Mean Low Water Neap MLWS	0.73	-2.00
Highest for 2019	5.07	2.34
Lowest for 2019	0.20	-2.53
Highest for 2020	5.11	2.38
Lowest for 2020	0.17	-2.56
Mean spring range	3.99	3.99
Mean neap range	1.97	1.97

3.3.4.11. Actual tidal water levels will vary from the predicted values presented in Table 3.4 due to meteorological conditions, such as wind and barometric pressure.

3.3.4.12. The volume of freshwater flowing into Langstone Harbour is small coming from Hermitage Stream and the Lavant. The standard annual average rainfall (SAAR 1961-1990) for the catchment is 819 mm (NRFA, 2019).

3.3.4.13. EA flood risk mapping indicates that the Proposed Development crosses areas adjacent to the Harbour within flood zone 2 indicating that it has a risk of flooding each year of between 1% and 0.1% and within flood zone 3 indicating that it has a risk of flooding each year greater than 1%. A separate Flood Risk Assessment has been undertaken for the Proposed Development in Appendix 20.1 (Flood Risk Assessment).

Intertidal Sea Bed Levels

3.3.4.14. Sea bed levels for the intertidal region around the site within Langstone Harbour were obtained from two sources: Lidar and multibeam bathymetry.

3.3.4.15. LiDAR data were obtained from the Channel Coastal Observatory (Channel Coastal Observatory, 2019) for January 2005, March 2007, December 2007 and September 2013. LiDAR is a surveying method that measures distance to a target by illuminating the target with laser light and measuring the reflected light with a sensor. Data is collected using an airborne remote sensing technique which cannot penetrate the water surface.

3.3.4.16. Figure 3.16 shows the December 2012 LiDAR data as an example of the available coverage. The water surface within Broom Channel can also be clearly seen in this figure. These data were flown at times of low water; therefore, the intertidal mud flats are included however, the full depth of Broom Channel is not available due to the presence of water within the channel at the time of survey. These data are supplied with a vertical reference of metres Ordnance Datum (mOD).

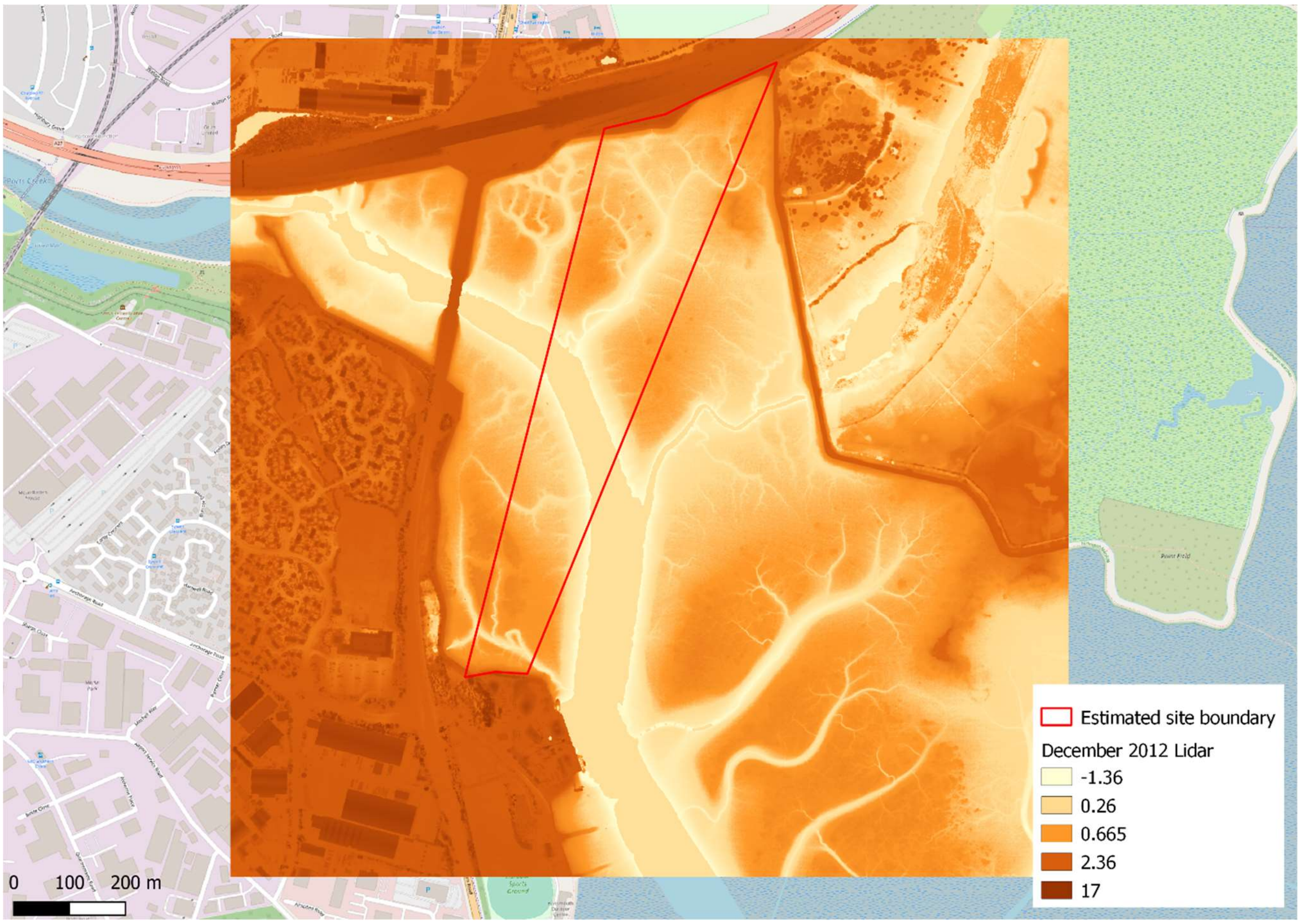

Plate 3.16 - Coverage of the December 2012 Lidar dataset in relation to the sea bed stability assessment region (red line)

3.3.4.17. Multibeam bathymetry were obtained from the Admiralty Maritime Data Solutions web portal (Admiralty Maritime Data Solutions, 2019) for July 2002 (2002 2006-360174 Langstone Harbour Broom Channel) and February 2005 (2005 2006-362051 Langstone Harbour) to inform bed levels within Broom Channel. These bathymetry data contain public sector information, licensed under the Open Government License v3.0, from Langstone Harbour Authority and the Channel Coast Observatory.

3.3.4.18. The February 2005 bathymetry data covers a portion of Broom Channel within the site boundary, however it has better coverage of Broom Channel south of the site towards Kendall's Wharf. The July 2002 bathymetry data does not cover Broom Channel within the site boundary, however it has reasonable coverage of Broom Channel at Kendall's Wharf. The spatial coverage of these bathymetry survey data is shown in Plate 3.17 and Plate 3.18. These bathymetry data were interpolated over their respective spatial coverage so that profiles could be extracted for further analysis. These data were supplied with a vertical refence of metres Chart Datum (mOD) and were converted to mOD using the conversion factor of -2.73 m.

Plate 3.17 - Coverage of the 2002 2006-360174 Langstone Harbour Broom Channel bathymetry dataset in relation to the sea bed stability assessment region (red line)

Plate 3.18 - Coverage of the 2005 2006-362051 Langstone Harbour bathymetry dataset in relation to the sea bed stability assessment region (red line)

3.3.4.19. Profiles were defined to extract data from the Lidar and bathymetry datasets, which are then used for historic comparisons. Four profiles were defined for the Lidar data, traversing Broom Channel, extending 200m from the channel centre. These will show the stability of the channel and the mudflats on the channel banks. Four profile lines were also defined for the bathymetry data; however, these are located to the south of the site boundary in the closest location that the available bathymetry data sets coincide. The length of these profile lines is limited by the availability of the bathymetry data. Plate 3.19 shows the location and extent of these profile lines.

3.3.4.20. The bed elevation data from Lidar profiles 1-4 will indicate the stability of Broom Channel and the historic erosion of the surrounding mudflats. While bathymetry profiles 5-8 are outside of the site boundary they have been chosen to give an indicative view of potential erosion of the sea bed within Broom Channel. This assumes that the hydrodynamic forces responsible for erosion of sediment within Broom Channel at the site are similar to those downstream at Kendall's Wharf. While these may not be identical in magnitude it is considered that this will provide an informed understanding of the erosion potential of bed levels within Broom Channel. It should be noted that Broom Channel at Kendall's Wharf is subject to maintenance dredging, therefore it is likely to observe changes in the bed level between dredge operations. Consideration of the magnitude of bed level change at Kendall's Wharf is therefore a conservative case of channel erosion within the site boundary.

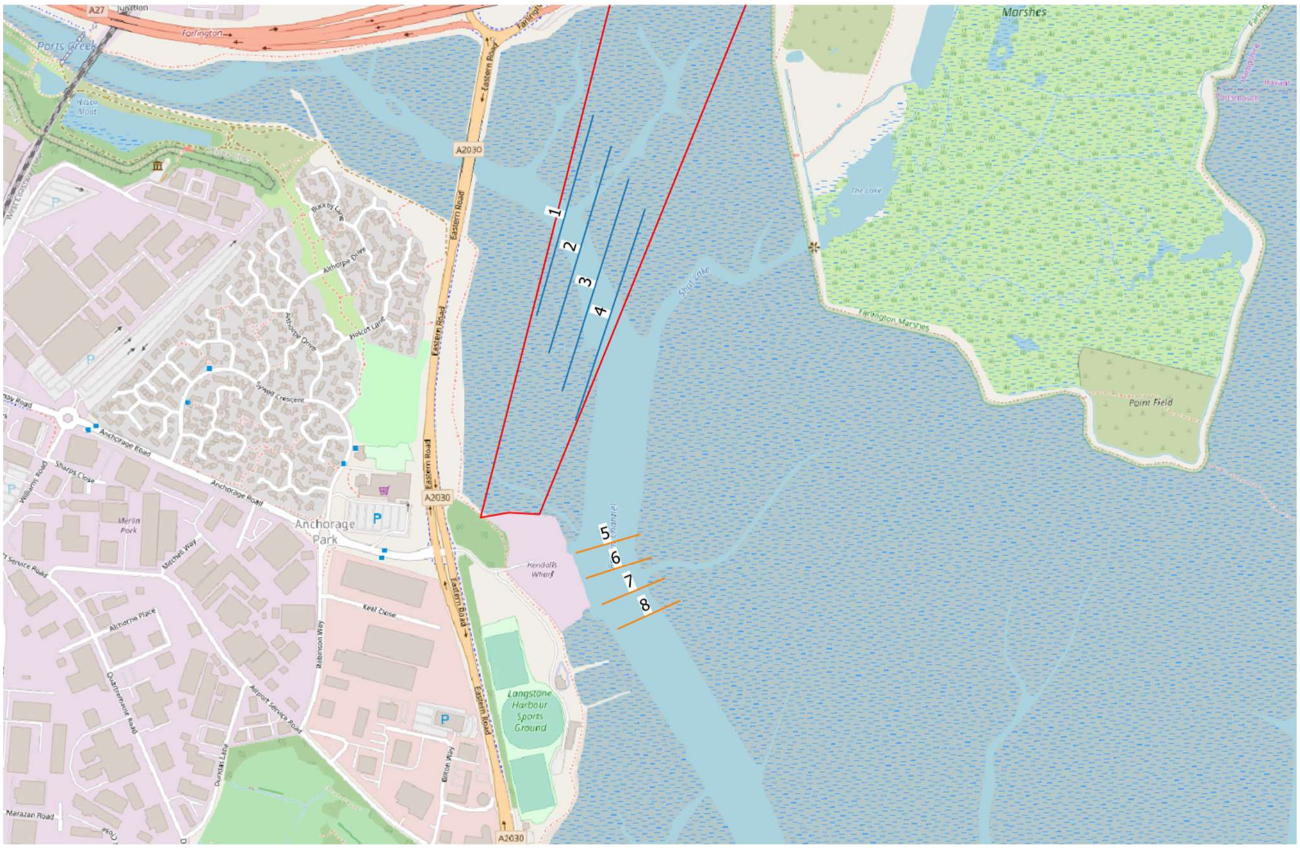

Plate 3.19 - Location of Lidar profile lines (blue) and bathymetry profile lines (orange). The sea bed stability assessment region is also shown for reference (red line)

Historical Channel Change

3.3.4.21. The area around Langstone Harbour has undergone significant modification since historical records in 1870, however, the channel of Langstone Harbour has only had minor alterations to its flow path. Considerable alterations to the banks of the harbour have also occurred, including erosion protection in the form of reinforced banks. The largest changes to the area are the end of the Farlington Race Course between 1910 and 1932, in the area of the current playing fields, the construction of the Eastern Road / A27 roundabout in the 1960's and the addition of pumping stations on Farlington Marshes Gutter in the 1990's and on Great Salterns Drain in 2014.

3.3.4.22. Plate 3.20 – Plate 3.23 shows the historic LiDAR data between January 2005 – September 2013 for Lidar profiles 1-4. Lidar data has been removed from within Broom Channel to eliminate any water surface effects. The banks of Broom Channel and the surrounding mudflats can be seen to be stable through time, with minimal change in bed levels observed within the Lidar profile data.

3.3.4.23. LiDAR profile 2 (Plate 3.21) shows that there has been some potential lowering of bed levels within the small creeks extending to the north from Broom Channel, with a maximum change in bed level of 0.58m. However, it should be noted that there is uncertainty associated with this change in bed levels, as the presence of water in the small creek at the time of the LiDAR survey will artificially raise the bed level so that a comparison against LiDAR data without the water present will result in an apparent change in bed levels. While the water surface has been removed from Broom Channel, due to the small size of these connecting creeks it has not been possible to identify and remove a water surface.

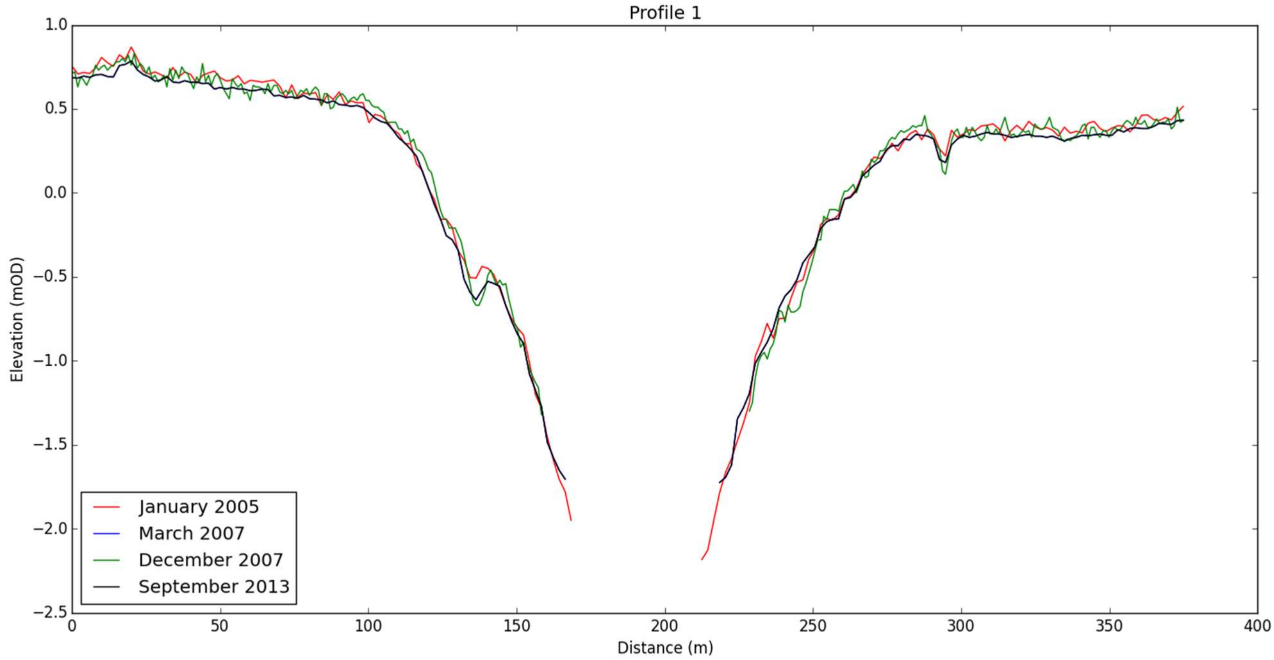

Plate 3.20 - LiDAR elevation data between January 2005 and September 2013 for profile 1

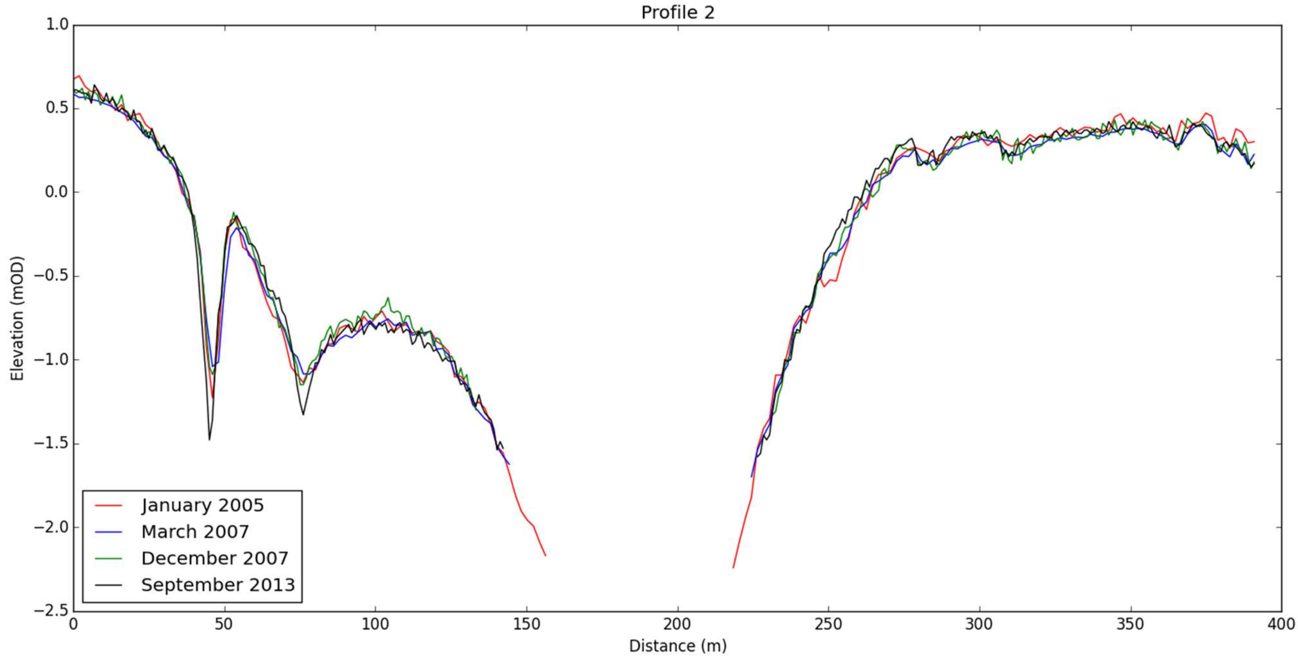

Plate 3.21 - Lidar elevation data between January 2005 and September 2013 for profile 2

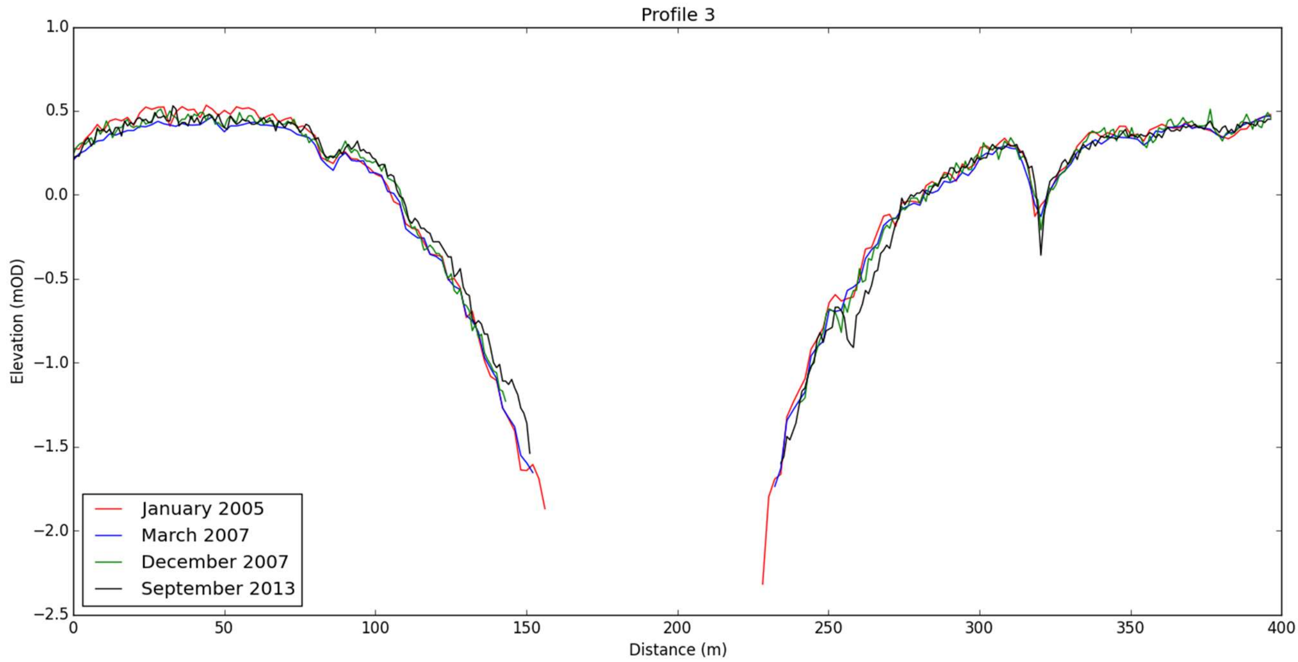

Plate 3.22 - Lidar elevation data between January 2005 and September 2013 for profile 3

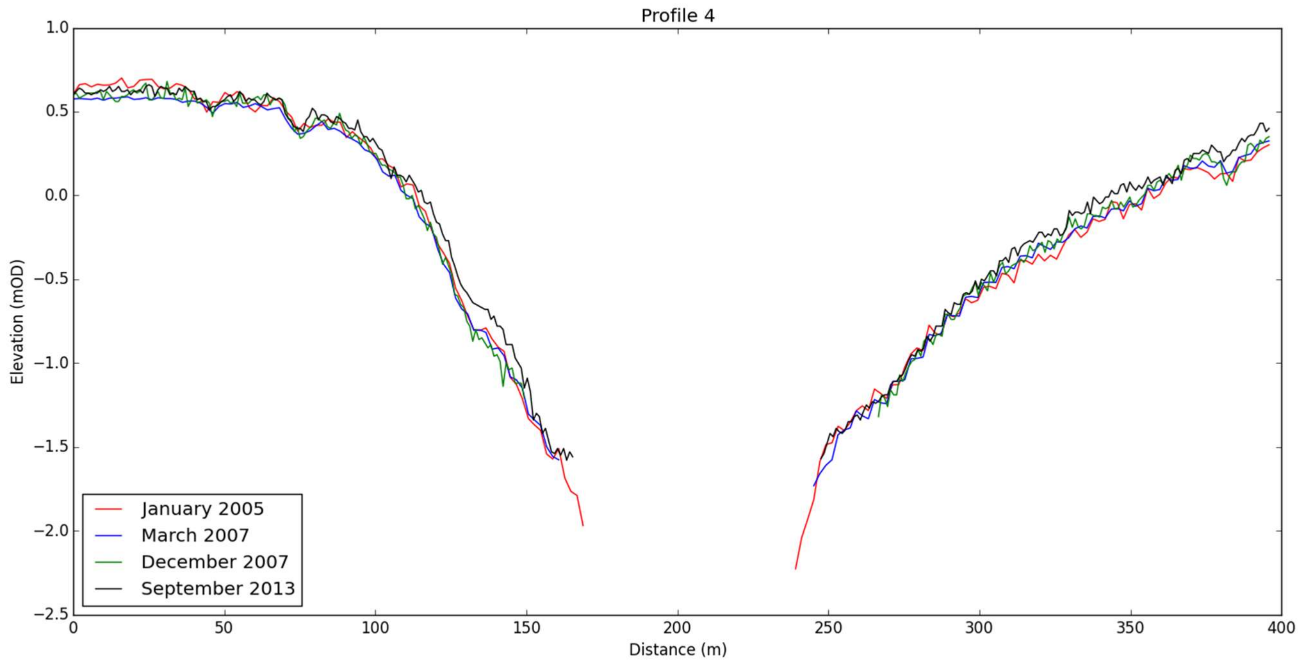

Plate 3.23 - Lidar elevation data between January 2005 and September 2013 for profile 4

3.3.4.24. The maximum difference in bed level between LiDAR survey data was calculated along each profile to show the maximum erosion potential between January 2005 and September 2013. These are presented in Table 3.5 along with the minimum bed elevation experienced along each profile in mOD. Table 3.5 shows that the bed level change ranges between 0.21 - 0.58 m for Lidar profiles 1-4.

Table 3.5 – Maximum bed level change and minimum bed elevation for LiDAR profiles 1-4

	Profile 1	Profile 2	Profile 3	Profile 4
Maximum bed level change (m)	0.21	0.58	0.37	0.34
Minimum bed elevation (mOD)	-2.18	-2.24	-2.32	-2.19

3.3.4.25. Plate 3.24 – Plate 3.27 shows bed elevations for bathymetry profiles 5-8 between July 2002 and February 2005. Kendall's Wharf is located to the left of the plots while a large extensive mudflat is located to the right of the plot. This shows that there is greater variability observed in Broom Channel at this location when compared with the LiDAR profiles within the study site. However, it should be noted that while there is increased variability in the bed levels for bathymetry profiles 5-8, the change in the minimum bed level for each profile is relatively small. The narrow temporal window between available bathymetry survey data (2 years 8 months) creates uncertainty in the observed change in bed level. A comparison of a greater number of bathymetry survey data covering a wider time frame would reduce this uncertainty.

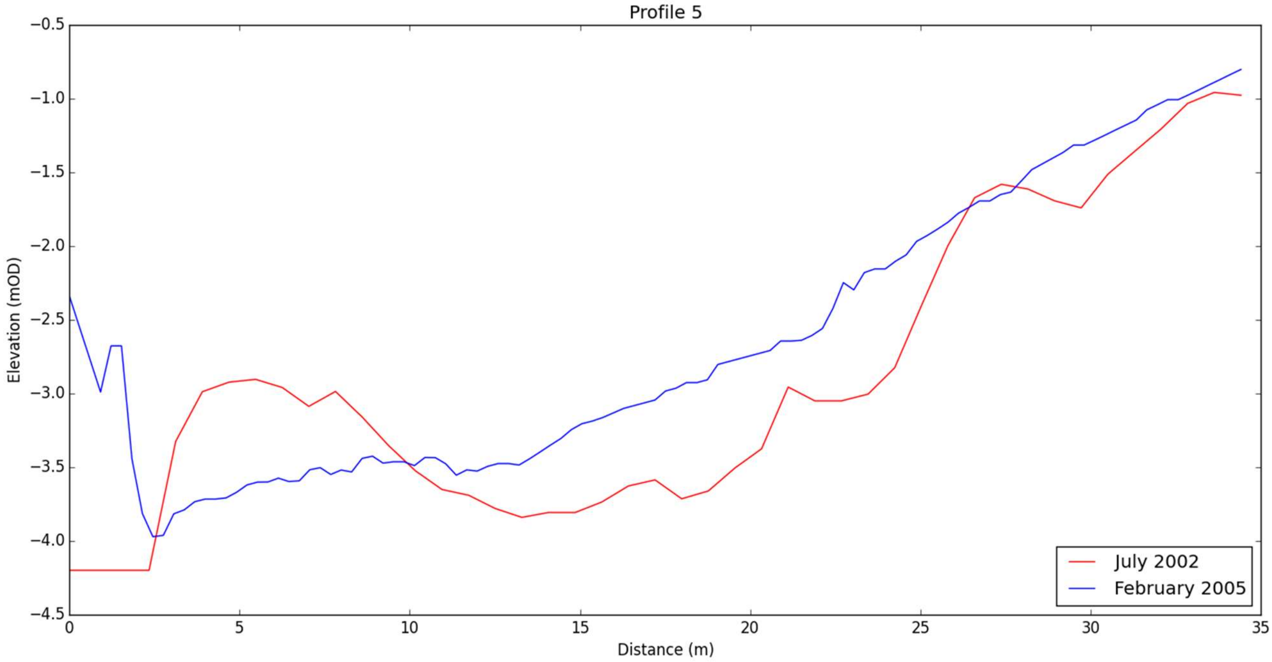

Plate 3.24 - Bathymetry data between July 2002 and February 2005 for profile 5

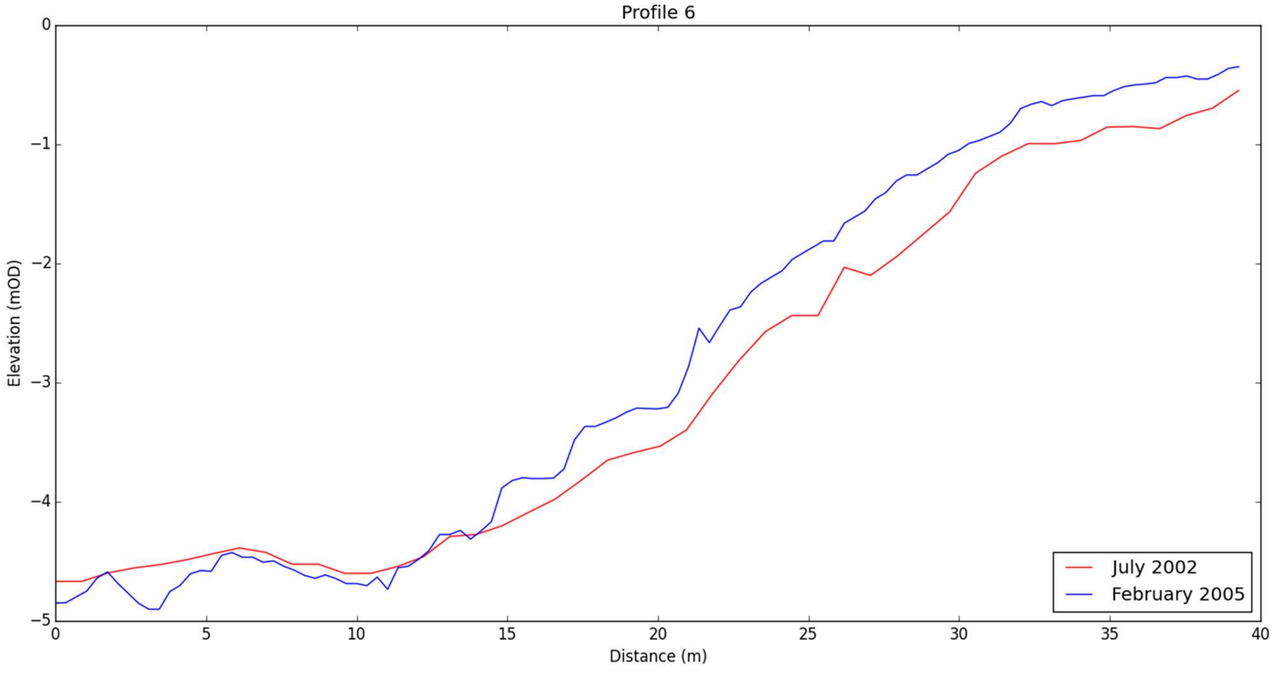

Plate 3.25 - Bathymetry data between July 2002 and February 2005 for profile 6

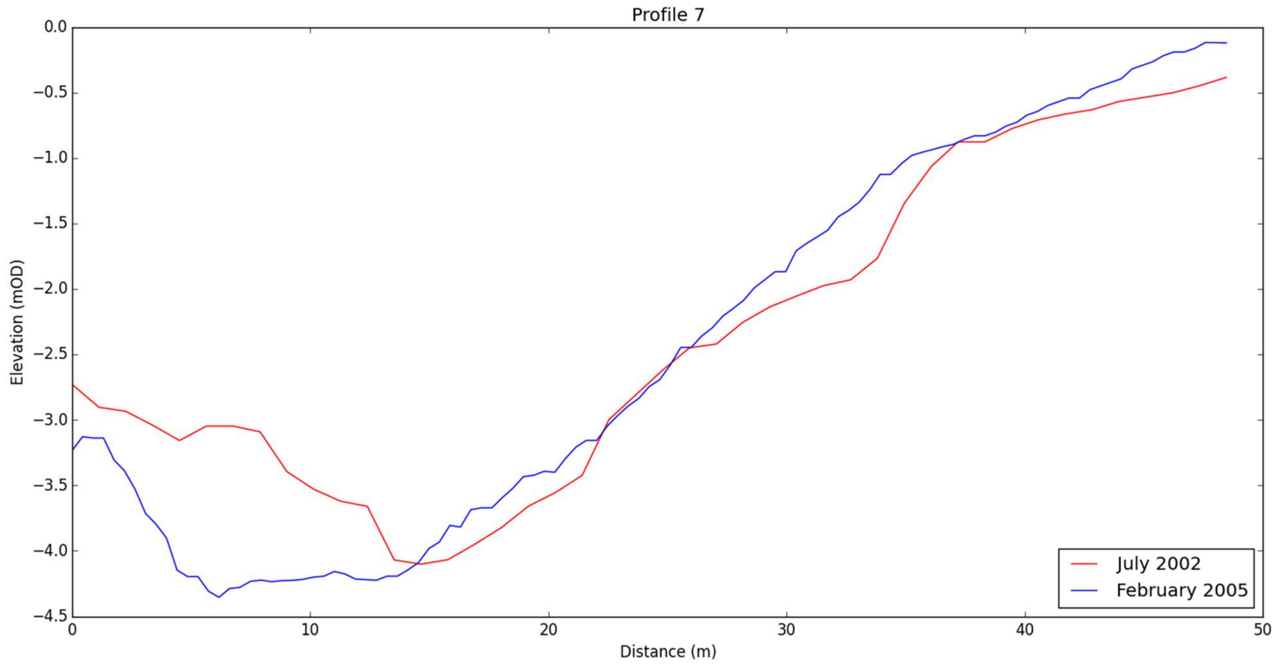

Plate 3.26 - Bathymetry data between July 2002 and February 2005 for profile 7

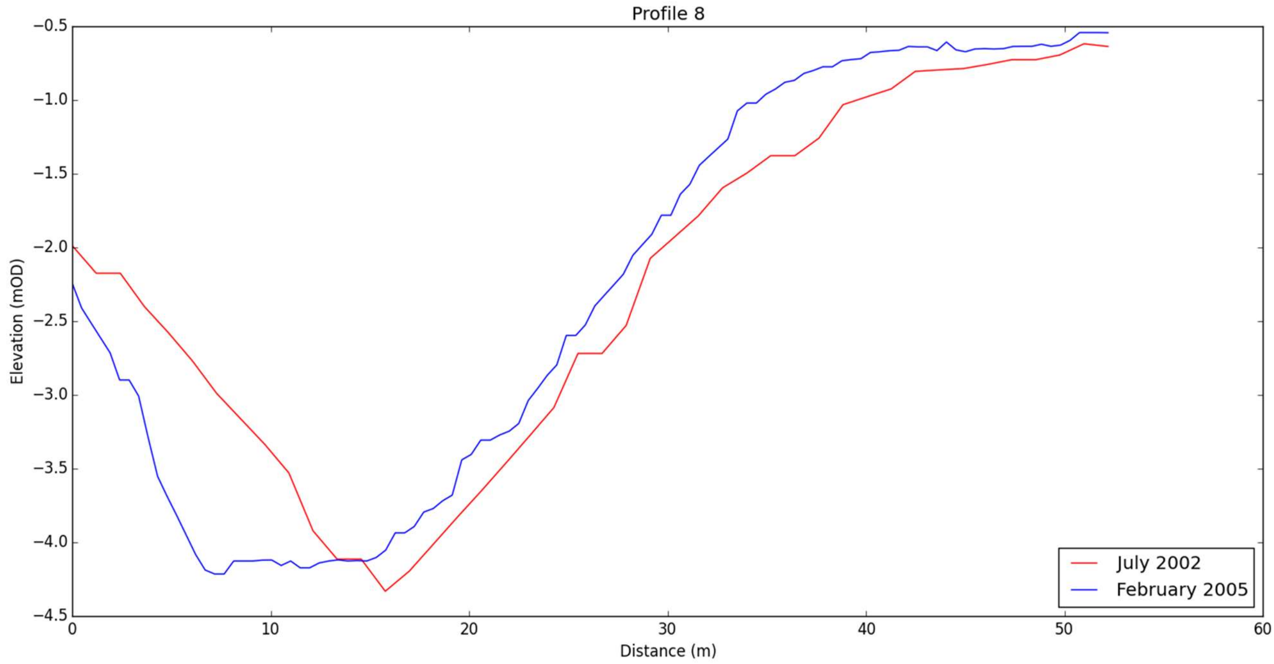

Plate 3.27 - Bathymetry data between July 2002 and February 2005 for profile 8

3.3.4.26. Plate 3.24 – Plate 3.27 shows that the greatest change in bed levels for bathymetry profiles 5-8 occurs at approximately the 5m chainage point for profiles 5,7 and 8. This change in bed level appears to be associated with a horizontal translation of the bed slope. The maximum change in bed level for each of the bathymetry profiles is calculated as well as the change in the minimum bed level along each profile (Table 3.6).

Table 3.6 – Maximum bed level change and minimum bed elevation for bathymetry profiles 5-8

	Profile 5	Profile 6	Profile 7	Profile 8
Maximum bed level change (m)	1.87	0.71	1.31	1.30
Change in minimum bed elevation (m)	0.16	0.2	0.27	0.08

3.3.4.27. Table 3.6 shows that maximum changes in bed levels along bathymetry profiles 5-8 ranges between 0.71 – 1.87m, however the change in minimum bed level ranges between 0.08m – 0.27m. This indicates that while bed level change along the bathymetry profiles 5-8 is large (almost 2 m) there is limited change in the minimum bed elevation for each profile. This could be the result of maintenance dredging which is known to occur for the approaches to Kendall's Wharf (Halcrow, 2009) and also suggests that the hydrodynamic processes within Broom Channel do not result in a deepening of the channel.

3.3.5. LANGSTONE HARBOUR CONTEMPORARY CHANNEL CHARACTERISTICS

Farlington Marshes Gutter

3.3.5.1. Farlington Marshes Gutter is an ordinary river feeding into main river within and adjacent to Section 7 of the Onshore Cable Corridor. No water was observed in the upstream extent of the ordinary river, but stagnant water was present at confluence with the main stem (Plate 3.28 A). The main river is an overgrown trapezoid ditch. Scrub is present on the banks and no perceptible flow was observed (Plate 3.28 B). The ordinary watercourse would be crossed via Trenchless techniques while the main stem will not be crossed but lies adjacent to trenching works.

Plate 3.28 - A. Confluence of ordinary and main branches of Farlington Marshes Gutter with stagnant water present (467910, 104970); B. Looking south east downstream the main branch of Farlington Marshes Gutter (467915,104960)

Ports Creek/Langstone Harbour

3.3.5.2. Langstone Harbour is a transitional water body within Section 7 of the Onshore Cable Corridor. Ports Creek is the north western upstream extent of Langstone Harbour where it passes under the A2030. The water body is heavily influenced by tides. Ports creek has undergone extensive re-sectioning with rip rap present on both banks (Plates 3.29 A and B). The left bank also has a reinforced toe with brick lining the left bank. At the time of visiting, the tide was on its way out thus exposing mudflats. Ports Creek feeds into Langstone Harbour, which would be crossed via HDD.

Plate 3.29 - A. Ports Creek looking west (466980, 104090); B. Ports Creek looking east towards A2030 and main body of Langstone Harbour (466980, 104090)

Great Salterns Drain

3.3.5.3. Concrete lined channel followed by onstream ponds within Section 8 of the Onshore Cable Corridor. The onstream ponds border the edge of Eastern Road where a pumping station is present to pump water from Great Salterns Drain into Langstone Harbour. The online ponds have an abundance of reeds present (Plate 3.30 A). No outfall was observed within immediate vicinity, so it is assumed the outfall extends further into the harbour (Plate 3.30 B). This water course would be crossed via trenching above the culverts under the A2030/Eastern Road.

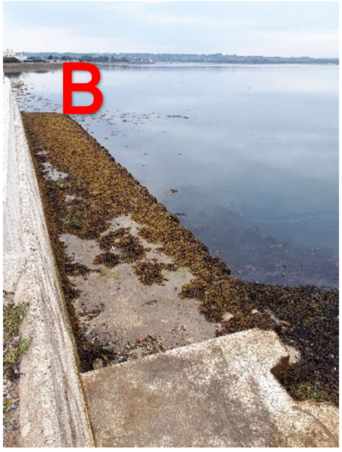

Plate 3.30 - A Looking west across A2030 / Eastern Road towards the onstream ponds of Great Salterns Drain (467650, 101790); B. looking north along the tidal defence adjacent to A2030 / Eastern Road downstream of Great Salterns Drain (467670, 101790)

3.3.6. SCOPING ASSESSMENT SUMMARY

3.3.6.1. This section summarises the findings of the scoping stage of the WFD assessment, whereby the potential risks to each of the key receptor groups are considered. The detailed scoping assessment is presented in Table 3.7.

3.3.6.2. There are no potential risks to onshore watercourses as there are no proposed works within watercourses and all watercourses are to be crossed either via HDD or through trenching the carriageway above existing culverts.

3.3.6.3. In Langstone Harbour, analysis of LiDAR data has shown that there is minimal change in the Broom Channel location and bed elevation for the surrounding mudflats within Section 7 site boundary of the cable route. Bed elevation change in this region ranges between 0.21 – 0.58m for January 2005 to September 2013. Bed elevation data were not available within Broom Channel from the available LiDAR data due to the presence of a water surface.

3.3.6.4. Further analysis of publicly available bathymetry data, available south of the Section 7 site boundary, shows that there is greater variability in bed levels within Broom Channel, ranging between 0.71 - 1.87m. However, there is limited change in the minimum bed level within these data, which ranges between 0.08 – 0.27m. Therefore, it is concluded that the local hydrodynamic forces do not have the potential to significantly deepen Broom Channel.

3.3.6.5. The proposed HDD has been specified to a depth of between 10-15m below existing bed levels when crossing the intertidal region of Langstone Harbour. Therefore, the change in bed levels shown in the assessment of sea bed stability should not pose a risk to the Onshore Cable Route.

3.3.6.6. Table 3.8 summarises the surface water WFD compliance assessment of the Proposed Development against WFD Status. Following assessment of the Proposed Development, there are no operational or construction impacts on WFD water body quality elements or water body status. This demonstrates that for surface water, no detailed WFD impact assessment is required, and therefore Stage 3 of the WFD assessment methodology is not required.

Table 3.7 – WFD scoping assessment summary for the surface water quality elements for the screened in water bodies

WFD Quality Element	Potential Risk to Receptor?	Note the risk / issues for the impact assessment
Biological Quality Elements		
Composition and Abundance of Aquatic Flora	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development, therefore, there would be no anticipated impact upon the aquatic flora.
Composition and Abundance of Benthic Invertebrate Fauna	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development, therefore, there would be no anticipated impact upon the benthic invertebrate fauna.
Composition, Abundance and Age Structure of Fish Fauna	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development, therefore, there would be no anticipated impact upon fish.
Physico-chemical Quality Elements		

Thermal conditions	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development, therefore, there would be no alteration to thermal conditions.
Oxygenation conditions	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development. Dust arising from the construction activities may settle within the watercourses, which may have localised impacts on oxygenation. This would be reduced through implementation of best practices for the control of pollution, as detailed in Annex A and within the Onshore Outline CEMP.
Salinity	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development. There are no anticipated salinity issues and any risk of pollution would be controlled following best practice, as detailed in Annex A and within the Onshore Outline CEMP.
Acidification status	No	The proposed activities would not directly impact the watercourses crossed by the Proposed Development. There are no anticipated acidification issues and any risk of pollution would be controlled following best practice, as detailed in Annex A and within the Onshore Outline CEMP.
Nutrient conditions	No	There are no direct surface water pathways to any watercourses as a result of the proposed construction activities. Therefore, the risk of any potential alteration to nutrient conditions is considered negligible or none and is scoped out of further assessment.
Hydromorphology Quality Elements		
Quantity and dynamics of water flow	No	The proposed watercourse crossings would not impact upon the hydromorphology quality elements due to the construction methods

Connection to groundwater	No	having no direct impact upon the watercourses. Therefore, these are scoped out of detailed assessment.
River continuity	No	
River width and depth variation	No	
Structure and substrate of the river bed	No	
Structure of the riparian zone	No	

Table 3.8 – Surface water WFD compliance assessment of the Proposed Development against WFD Status

Water body ID	**GB107042016400**	**GB580705130000**
Water body name	Potwell Trib	Langstone Harbour
Deterioration in the status / potential of the water body	No deterioration is anticipated as a result of operation of the Proposed Development.	No deterioration is anticipated as a result of operation of the Proposed Development.
Ability of the water body to achieve Good Ecological Potential / Status	The water body is currently achieving Moderate Ecological Status. The Proposed Development is unlikely to affect the ability of the water body to achieve GES.	The water body is currently achieving Moderate Ecological Status. The Proposed Development is unlikely to affect the ability of the water body to achieve GES.
Impact on the WFD objectives of other water bodies within the same River Basin District ('RBD')	No impacts are expected on other water bodies within the RBD, including downstream WFD water bodies Wallington below Southwick (GB107042016360), Portsmouth Harbour (GB580705140000) and Solent (GB650705150000).	No impacts are expected on other water bodies within the RBD, including downstream WFD water body Solent (GB650705150000).
Ability to contribute to the	No impacts on WFD status, or impacts upon the status of the WFD quality elements, are anticipated as a result of the	No impacts on WFD status, or impacts upon the status of the WFD quality elements, are anticipated as a result of the

Water body ID	GB107042016400	GB580705130000
delivery of the WFD objectives	Proposed Development, as demonstrated in the screening and scoping assessment. The Proposed Development would, therefore, not prevent the delivery of WFD objectives.	Proposed Development, as demonstrated in the screening and scoping assessment. The Proposed Development would, therefore, not prevent the delivery of WFD objectives.

3.3.6.7. At the consultation meeting with the EA, dated 23 July 2019, the EA identified that the Proposed Development should consider making a contribution towards:

- Nesting seabird habitats at Farlington Marshes;
- Fish passage improvements at Southwick Park Lake; and
- Control of invasive non-native species (e.g. Hermitage Stream Invasive Species Plant Project).

3.3.6.8. Given the absence of impacts identified by the WFD assessment, these WFD measures are not considered necessary to mitigate any adverse effects, and therefore have not been included in connection with the Proposed Development. The control of invasive non-native species is included within the Onshore Outline CEMP and would be followed as part of best practice guidance.

3.3.7. ASSESSMENT AGAINST RELEVANT EU LEGISLATION

3.3.7.1. Although both the Potwell Trib and Langstone Harbour are in Nitrate Sensitive Areas, the Nitrates Directive, the assessment concludes that the Proposed Development would not impact upon nitrates due to the natural of the watercourse crossings and the absence of surface water flow paths for channelling pollutants into the watercourses. The adoption of best practice for pollution prevention would also mitigate any risks for nitrates in run-off.

3.3.7.2. The Freshwater Fish Directive was originally adopted in 1978 and was consolidated in 2006, then repealed in 2013. Therefore, no separate assessment is required for fish. The Proposed Development not further impede fish passage.

3.3.7.3. The assessment of other protected areas is covered in Appendix 7.1 (Marine WFD Assessment).

4. WFD ASSESSMENT – GROUNDWATER

4.1. STAGE 1 SCREENING

4.1.1.1. The groundwater bodies within the study area are East Hants Chalk (GB40701G502700), Hants East Lambeth Group (GB40702G500800), Hants South Lambeth Group (GB40702G503700) and Hants South East Bracklesham Group (GB40702G503000). The WFD groundwater water bodies can be seen in Plate 1.3.

4.1.1.2. The 'East Hants Chalk' Groundwater water body (water body ID GB40701G502700) is present in Section 1 and 2. This water body has been assessed and assigned a 'Poor' status for both quantitative and chemical classifications based on the 2016 dataset. The main pressures that are resulting in a less than good status are from agricultural and rural land management and the water industry (groundwater abstraction). The groundwater water body is linked to protected areas under the Nitrates and Drinking Water Directives and the Safeguard Zone Directive for the Bedhampton and Havant spring complex.

4.1.1.3. The 'East Hants Lambeth Group' Groundwater water body (water body ID GB40702G500800) Is located in Sections 2 and 3. It is classified as holding a 'Poor' quantitative status and 'Good' chemical status classifications based on the 2016 dataset. The main pressures are classified 'no sector responsible', which applies where the pressure (and reason for status) is not related to the activities of a particular sector. The groundwater water body is linked to protected areas under the EU Nitrates Directive (1991) and Drinking Water Directives (98/83/EC).

4.1.1.4. Sections 4 (Portsdown Hill Road) to Section 7 are located in the 'East Hants Chalk' Groundwater water body (water body ID GB40701G502700), classified as holding a 'Poor' status for both quantitative and chemical classifications based on the 2016 dataset. The main pressures are either from agricultural and rural land management and the water industry (groundwater abstraction). The groundwater water body is linked to protected areas under the Nitrates and Drinking Water Directives and the Safeguard Zone Directive for the Bedhampton and Havant spring complex.

4.1.1.5. Section 4 (at Widley), Section 8 and the southernmost part of Section 7 (Airport Service Road) lie within the 'South Hants Lambeth Group' Groundwater water body (water body ID GB40702G503700), classified as holding both 'Good' quantitative and chemical status classifications based on the 2016 dataset. The groundwater water body is linked to protected areas under the Nitrates and Drinking Water Directives.

4.1.1.6. Section 9 and 10 lies within the 'South East Hants Bracklesham Group' Groundwater water body (water body ID GB40702G503000), classified as having 'Good' qualitative and 'Poor' chemical status classifications based on the 2016 dataset. The main pressures are from landfill leaching. The groundwater water body is linked to protected areas under the Drinking Water Directive.

4.2. WFD GROUNDWATER STATUS

4.2.1.1. The WFD groundwater water bodies potentially impacted by the Proposed Development are listed below and summarised in Tables 4.1 to 4.4 (see Plate 1.3 in Section 1 of this report for a map of the groundwater water bodies):

- East Hants Chalk;
- Hants East Lambeth Group;
- Hants South Lambeth Group; and
- Hants South East Bracklesham Group.

Table 4.1 - East Hants Chalk water body

Water Body ID	**GB40701G502700**	Water Body Name	**East Hants Chalk**
Water Body Type	Groundwater	Water Body surface area	N/A
Description	The north half of the Proposed Development crosses the East Hants Chalk in Sections 1 and 2 which includes the Chalk and Head Deposits aquifer. The Chalk and Head deposits are classified as Principal and Secondary Undifferentiated aquifers by the EA. The south half of the Proposed Development crosses the East Hants Chalk in Sections 4 and 7 which includes the Chalk, Head Deposits, River Terrace Deposits, and Raised Marine Deposits aquifers. The Chalk is classified as Principal aquifer by the EA. The River Terrace Deposits are classified as Secondary A aquifers by the EA. The Raised Marine Deposits and Head Deposits are classified as a Secondary Undifferentiated aquifer by the EA. Further details of the geological and hydrogeological properties of these ground materials can be found in Chapter 19 (Groundwater).		
Overall Status	Poor	Status Objective	Poor by 2027 -
Overall Quantitative Status	Poor	Status Objective	Poor by 2027
Overall Chemical Status	Poor	Status Objective	Good by 2027
Protected Area Designation	This water body is protected under the Nitrates Directive, Drinking Water Protected Area (protected area code UKGB40701G502700, GWSGZ0138, GWSGZ0145, NVZ12GW011430, NVZ12GW010560 & NVZ12GW010580) and Safeguard Zone (Bedhampton & Havant Springs & Maindell)		

Water Body ID	GB40701G502700	Water Body Name	East Hants Chalk
Reasons for not achieving Good status	Groundwater abstraction (confirmed & probable) and poor nutrient management (probable)		
Water body measures	None identified		
Supporting Elements			
<u>Quantitative Status Elements</u>			
Saline Intrusion	Good	Objective	Good by 2027
Water Balance	Poor	Objective	Poor by 2027
Groundwater Dependent Terrestrial Ecosystems (GWDTE) test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Poor	Objective	Good by 2027
<u>Chemical Status Elements</u>			

Water Body ID	GB40701G502700	Water Body Name	East Hants Chalk
Drinking Water Protected Area	Poor	Objective	Good by 2027
General Chemical Test	Poor	Objective	Good by 2027
GWDTE test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Good	Objective	Good by 2027
Saline Intrusion	Good	Objective	Good by 2027
Trend Assessment	Upward trend		

Table 4.2 - Hants East Lambeth Group water body

Water Body ID	GB40702G500800	Water Body Name	Hants East Lambeth Group
Water Body Type	Groundwater	Water Body surface area	N/A
Description	The Proposed Development crosses the Hants East Lambeth Group Section which includes for the Lambeth Group and Head Deposits aquifers. The Lambeth Group and Head deposits are classified as Secondary A and Secondary Undifferentiated aquifers by the EA. Further details of the geological and hydrogeological properties of these ground materials can be found in Chapter 19 (Groundwater).		
Overall Status	Poor	Status Objective	Good by 2027
Overall Quantitative Status	Poor	Status Objective	Good by 2027
Overall Chemical Status	Good	Status Objective	Good by 2027
Protected Area Designation	This water body is protected under the Nitrates Directive & Drinking Water Protected Area (protected area code NVZ12GW010560, NVZ12GW011430 & UKGB40702G500800).		
Reasons for not achieving Good status	N/A		
Water body measures	None identified		
Supporting Elements			

Water Body ID	GB40702G500800	Water Body Name	Hants East Lambeth Group
Quantitative Status Elements			
Saline Intrusion	Good	Objective	Good by 2027
Water Balance	Good	Objective	Good by 2027
Groundwater Dependent Terrestrial Ecosystems (GWDTE) test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Poor	Objective	Good by 2027
Chemical Status Elements			
Drinking Water Protected Area	Poor	Objective	Good by 2027
General Chemical Test	Poor	Objective	Good by 2027
GWDTE test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Good	Objective	Good by 2027
Saline Intrusion	Good	Objective	Good by 2027
Trend Assessment	No trend		

Table 4.3 - Hants South Lambeth Group water body

Water Body ID	GB40702G503700	Water Body Name	Hants South Lambeth Group
Water Body Type	Groundwater	Water Body surface area	N/A
Description	The Proposed Development crosses the Hants South Lambeth Group to the south of Section 4 which includes for the Lambeth Group and Head Deposits aquifers. The Lambeth Group and Head deposits are classified as Secondary A and Secondary Undifferentiated aquifers by the EA. Further details of the geological and hydrogeological properties of these ground materials can be found in Chapter 19 (Groundwater).		
Overall Status	Good	Status Objective	Good by 2027 -
Overall Quantitative Status	Good	Status Objective	Good by 2027
Overall Chemical Status	Good	Status Objective	Good by 2027
Protected Area Designation	This water body is protected under the Nitrates Directive & Drinking Water Protected Area (protected area code UKGB40702G503700, & NVZ12GW010580).		
Reasons for not achieving Good status	N/A		
Water body measures	None identified		
Supporting Elements			

Water Body ID	GB40702G503700	Water Body Name	Hants South Lambeth Group
Quantitative Status Elements			
Saline Intrusion	Good	Objective	Good by 2027
Water Balance	Good	Objective	Good by 2027
Groundwater Dependent Terrestrial Ecosystems (GWDTE) test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Good	Objective	Good by 2027
Chemical Status Elements			
Drinking Water Protected Area	Good	Objective	Good by 2027
General Chemical Test	Good	Objective	Good by 2027
GWDTE test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Good	Objective	Good by 2027
Saline Intrusion	Good	Objective	Good by 2027
Trend Assessment	No trend		

Table 4.4 - Hants Southeast Bracklesham Chalk water body

Water Body ID	GB40702G503000	Water Body Name	Hants Southeast Bracklesham Group
Water Body Type	Groundwater	Water Body surface area	N/A
Description	The Proposed Development crosses the Hants Southeast Bracklesham Group in Section 9 and Section 10 which includes for the Portsmouth Sand Member and Whitecliff Sand Member, Wittering Formation, River Terrace Deposits, Tidal Flat Deposits, and Storm Beach Deposits aquifers. The Portsmouth Sand Member and Whitecliff Sand Member, Wittering Formation and River Terrace Deposits are classified as Secondary A aquifers by the EA. The Tidal Flat Deposits, and Storm Beach Deposits aquifers are classified as Secondary Undifferentiated aquifers by the EA. Further details of the geological and hydrogeological properties of these ground materials can be found in Chapter 19 (Groundwater).		
Overall Status	Poor	Status Objective	Good by 2027 - Disproportionate burdens / Disproportionately expensive
Overall Quantitative Status	Good	Status Objective	Good by 2027
Overall Chemical Status	Poor	Status Objective	Good by 2027 - Disproportionate burdens / Disproportionately expensive

Water Body ID	GB40702G503000	Water Body Name	Hants Southeast Bracklesham Group
Protected Area Designation	This water body is protected under the Drinking Water Protected Area (protected area code UKGB40702G503000).		
Reasons for not achieving Good status	2015 (poor) – landfill leaching probable		
Water body measures	None identified		
Supporting Elements			
Quantitative Status Elements			
Saline Intrusion	Good	Objective	Good by 2027
Water Balance	Good	Objective	Good by 2027
Groundwater Dependent Terrestrial Ecosystems (GWDTE) test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Good	Objective	Good by 2027
Chemical Status Elements			

Water Body ID	GB40702G503000	Water Body Name	Hants Southeast Bracklesham Group
Drinking Water Protected Area	Good	Objective	Good by 2027
General Chemical Test	Good	Objective	Good by 2027
GWDTE test	Good	Objective	Good by 2027
Dependent Surface Water Body Status	Poor	Objective	Good by 2027 - Disproportionate burdens / Disproportionately expensive
Saline Intrusion	Good	Objective	Good by 2027
Trend Assessment	No trend		

4.3. STAGE 2: SCOPING – GROUNDWATER

4.3.1. POTENTIAL IMPACTS AND MITIGATION

Converter Station Impacts

4.3.1.1. The construction of the proposed Converter Station would create hard standing where greenfield currently exist, reducing the permeable area footprint through the temporary siting of contractor's compounds and storage areas which may increase the amount of local surface water runoff. Two surface karst features are located within the boundary of the proposed Converter Station; one in an area of cutting and the second in an area of embankment. Karst conduits can transmit groundwater rapidly meaning that any pollution incident at the Convertor Station location could be far reaching.

Trenched Onshore Cable Corridor Impacts

4.3.1.2. The Onshore Cable Corridor will be constructed in part via trench. This will require excavating approximately 1.1 m - 1.3 m below the ground surface. The construction process will require mechanical excavation of ground materials. The cable will be installed in a 400 mm deep cement bound sand at the bottom of the trench, the excavation will then be back filled with native ground materials/soil backfill. There is potential for groundwater interceptions and groundwater management/dewatering will be required.

4.3.1.3. The trench construction process will require mechanical excavation of ground materials. This process will loosen sediment which will collect in the bottom of the trench. When the trench is open and rainfall occurs, water will collect in the base of the trench any loose sediment will become entrained in the water, which will percolate through the unsaturated zone to the aquifer. Therefore, there is potential for groundwater turbidity contamination when open trenching. This issue is more prevalent in the wet season, when more frequent rainfall is expected.

4.3.1.4. Contamination could arise from the spillage of fuels from machinery, lubricants, hydraulic fluids and cement from construction plant. As the open trenches provide a direct pathway to groundwater, pollution incidents to groundwater should be considered.

4.3.1.5. Groundwater is thought to provide flow to Denmead Meadows and Kings Pond (located in Section 2 and Section 3) and are considered to be Groundwater Dependent Terrestrial Ecosystems ('GWDTE'). Kings Pond is designated a Site Important for Nature Conservation ('SINC'). Dewatering in these areas could cause degradation to these habitats.

4.3.1.6. WSP have undertaken two site visits; one (no.1) in the winter (December 2018) and another in the summer (July 2019). During the summer site visit Kings Pond was observed to be dry and during the winter site visit it was observed to contain water. The groundwater relationship to these ecological habitats is therefore believed to be gaining in the winter and losing in the summer. It is therefore recommended that the trenching works be completed in the summer months to ensure no groundwater flow is diverted from these habitats.

4.3.1.7. Once the cables are installed no maintenance is proposed and therefore no quantity operational impacts would arise i.e. through operational dewatering and these impacts are scoped out herein. The ground materials used are either inert or reinstalled in-situ ground materials and therefore no groundwater quality issues would arise through the Operational Stage, therefore groundwater quality operational impacts are scoped out herein.

HDD Onshore Cable Corridor impacts

4.3.1.8. HDD is a guided borehole drilling technique used to guide drill bits to a desired non-linearly placed destination, often used for the installation of cable and pipeline services. The drilling process includes a drill pit penetrating the ground with drilling fluid circulating around the drill bit to provide lubrication.

Embedded Mitigation Measures

4.3.1.9. Embedded mitigation measures include those measures that have already been incorporated into the Proposed Development design to avoid or reduce any likely significant effects (these measures are included in the assessment).

Converter Station Construction Embedded Mitigation Measures

4.3.1.10. The construction design includes for grouting of the surface karst at the Converter Station site prior to any earthwork movements, removing the primary pathway to underlying Chalk aquifer. The mitigation measures to complete this are outlined in Appendix 3.6 Aquifer Contamination Mitigation Strategy. This applies to Section 1.

Trenching Embedded Mitigation Measures

4.3.1.11. The cables that will be installed in excavated trenched ducts will typically be installed in lengths of 50 m open of trench, with up to 200 m of trench backfilled to the level of the asphalt courses, that would then be reinstated at the end of each week. Any groundwater or rainwater that collects in a trench will be pumped into locations agreed with the landowners, local authorities, EA or drain operators. The water management permitting licenses and agreements will be completed by the appointed contractor, with the quantities of groundwater management determined at the detailed design stage. This applies to all sections.

4.3.1.12. Groundwater encountered during trench construction will require management. The potential consents and permits required to manage this water will be completed by the contractor. The method of discharge has yet to be determined. The groundwater collected will either be discharged to surface water, sewer, disposed of off-site or a combination of these three methods. This applies to all sections.

4.3.1.13. If the water is to be discharged to sewer or a surface waterbody then a discharge consent(s) may be required. The permitting process will be completed by the contractor, after detailed design, once a dewatering and discharge management methodology has been agreed upon. This applies to all sections.

4.3.1.14. Should groundwater dewatering be substantial an abstraction licence and discharge consent will be required from the EA. At present the requirement for a groundwater abstraction for trench installation is unknown, the quantities of groundwater removal will be determined at detailed design stage. The contractor will be responsible for acquiring the relevant consents and adhering to the conditions of said consents. All groundwater abstraction licensing and discharge permits will not be disapplied but obtained during the detailed design phase, as agreed upon with the EA during the consultation meeting held on 23 July 2019. This applies to all sections.

4.3.1.15. Trenching in Section 2 and Section 3, in the vicinity of the Kings Pond and Denmead Meadows, will be completed between August and November to avoid the highest groundwater levels expected mid-winter. The trenches will be installed at end of the summer to ensure groundwater is at its lowest elevation. If the trenches were to be installed during the peak winter months, groundwater dewatering would likely be required, and this could potentially impact upon Kings Pond which is considered to have a proportion of groundwater dependency. This applies to Sections 2 and 3.

4.3.1.16. Please 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. This applies to all sections.

HDD Groundwater Level and Flow Embedded Mitigation Measures

4.3.1.17. To ensure drilling fluids do not break out into the groundwater environment or groundwater seep into the bore, a mud engineer will be present at all times during the HDD drilling process to monitor drilling fluid viscosity, density, annual pressure, solids contents, filter cake quality and total mud volume and thereby ensuring the filter cake remains intact and that drilling fluid is not lost to the ground and that groundwater does not seep into the bore annulus.

4.3.1.18. Drilling fluid losses to groundwater can occur in high permeability ground materials. Where these conditions are to be encountered the drilling contractors will need to monitor the fluid pressures and observe for pressure drops. When a significant pressure drop occurs, losses maybe occurring. To stop drilling fluid loss a number of actions can be taken to seal the area of loss, for example increasing the drilling fluid viscosity or introducing a cement grout. Real time downhole annular pressure monitoring should be completed to allow for these observations. No HDD works are proposed in Karstic Chalk to the north of the Proposed Development.

4.3.1.19. If any fluid loss occurs works will halt immediately to allow drilling fluid reconfiguration.

4.3.1.20. HDD5A (near Kings Pond) will be installed within the Lambeth Group geology to avoid the Chalk. This will therefore ensure the HDD alignment avoids the Chalk karst features. Karst features can be present in ground materials overlying the Chalk and if any voided overburden is encountered, drilling fluid control measures will be implemented to prevent drilling fluid losses. The contractor will ensure that when drilling HDD5A there will be at least a 5m standoff between the proposed HDD alignment and the Chalk at all times.

4.3.1.21. The launch and receptor pits for the HDD4 micro tunnel will include perimeter sheet piled walls toed into the Chalk to reduce groundwater ingress from the superficial River Terrace Deposits. Groundwater seepage at the base of the pits could occur and this will be sump pumped during operation. The potential consents and permits required to manage this water will be completed by the contractor. The method of discharge has yet to be determined. The 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 waterbody then a discharge consent(s) may be required. The permitting process will be completed by the contractor, after detailed design, once a dewatering and discharge management methodology has been agreed upon. The contractor will be responsible for acquiring the relevant consents and adhering to the conditions of said consents. Any contaminated water would require off-site disposal.

4.3.1.22. Please note that the required groundwater dewatering quantities for HDD4 pits 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.

HDD Groundwater Quality Mitigation Measures

4.3.1.23. All drilling equipment will be checked and cleaned before use. This will prevent cross contamination. A review of the drilling fluid and inert polymers will also be completed before ground is broken. All drilling fluids, including polymers, will be Cefas rated.

4.3.1.24. Drilling through alternative geologies can transfer existing contamination from one source to another. Drilling can also generate fines which can increase sediment in the water column, creating turbidity contamination. The Filter Cake (see Paragraph 4.3.1.8) will prevent the mobilisation of contaminants from one groundwater body to another, as the cake 'self-seals' as the drilling progresses. Therefore, no cross contamination is anticipated. Following the embedded mitigation measures the drilling fines and fluids will be contained in the drilling cake, preventing contamination from spreading between sources and drilling fines entering the local groundwater receptors.

4.3.1.25. Please note that HDD6 penetrates the Milton Common landfill. Landfill and associated leachates will be 'locked in place' by the drilling mud, as outlined in paragraph 19.6.7.4 and therefore no leachate disturbance is anticipated.

4.3.1.26. To ensure surface breakout is not lost to the environment a flexible hose pump will be contained at the exit compound site so breakout fluid can be retained on site. A sufficiently sized Intermediate Bulk Container or similar will be stored on site to store such a breakout.

Additional Mitigation Measures

4.3.1.27. Additional mitigation measures, as provided in Environmental Statement Chapter 19 (Groundwater), are presented below.

4.3.1.28. It is assumed that standard mitigation measures, including a variety of good environmental site practices, will be undertaken at the Proposed Development during the site preparation, earthworks and Construction Stage to minimise the risk of site runoff transmitting contaminants and sediment into surface waterbodies via the surface water drainage system.

4.3.1.29. A variety of good environmental site practices will be implemented to avoid or minimise impacts at the source. Such measures include, but are not limited to, the following:

- Working areas shall be clearly defined to ensure the disturbance of soils is minimised, where possible;
- Haul routes and accesses shall be clearly defined to minimise the risk of accidents. Construction vehicles will be regularly inspected and maintained to reduce the risk of hydrocarbon contamination associated with leaks and spillage and will only be active when required;
- The cleaning of vehicle wheels prior to leaving site;
- Dust suppression (i.e. damping down);

- Installation of systems such as silt traps and swales designed to trap silty water including adequate maintenance and monitoring of these to ensure effectiveness, particularly after adverse weather conditions;
- Designated areas for the storage of hazardous materials, fuels and chemicals. All designated areas will be appropriately bunded to at least 110% capacity and all filler points/valves will be located within the extent of bund or appropriate drip trays provided;
- On-site availability of oil spill clean-up equipment including absorbent material and inflatable booms for use in the event of an oil spill or leak;
- Use of drip trays under mobile plant;
- Provision of environmental awareness training for site workers; and
- Use of inert, uncontaminated material during construction.

4.3.1.30. The risk of pollution to surface and groundwater can be significantly reduced by the adoption of good working practices and strict adherence to guidance provided by the EA on Gov.uk. The current guidance on gov.uk explains how to:

- Report an environmental incident;
- Get permission to discharge to surface water and groundwater;
- Manage business and commercial waste;
- Store oil and any oil storage regulations;
- Discharge sewage with no mains drainage; and
- Work on or near water and manage water on land

4.3.1.31. Guidance is also available in the following CIRIA publications;

- C532 - Control of Water Pollution from Construction Sites;
- C698 - Site handbook for the construction of SUDs; and
- C648 - Control of Water Pollution from Linear Construction Projects.

4.3.1.32. Best practice recommendations for the prevention of contamination will be outlined in more detail in a Construction Environment Management Plan ('CEMP') and agreed with relevant statutory consultees prior to commencement of construction works. This will include measures to comply with relevant legislation and guidance (including the Environment Agency's Guidance online) and best practice measures in line with the Considerate Contractors Scheme and 'Site handbook for the construction of SUDS' (CIRIA C698). It will include an erosion prevention and sediment control plan to reduce the quantity of sediment entrained in runoff.

4.3.1.33. It is recommended that surface runoff from the various construction areas within the site is managed by the use of temporary bunding and settlement ponds to protect the receiving water environment. Settlement ponds are beneficial in that they allow for isolation and on-site treatment of sediment laden or chemically contaminated surface water runoff prior to discharge, following agreement with the appropriate authority, or use of other appropriate means of disposal.

4.3.1.34. Movement of materials around the site will be managed under an appropriate Materials Management Plan ('MMP').

4.3.1.35. The above list of additional mitigation measures reduces the risk of pollution spillages to the trenches. Groundwater dewatering would likely be required to the south of the Proposed Development (Section 5 to Section 10 of the Onshore Cable Corridor) where superficial deposit aquifers have near surface elevations which would be intercepted by the proposed trenches. Groundwater dewatering may be required between Section 1 and Section 4 of the Onshore Cable Corridor. Sump pump dewatering may be required where groundwater seepages occurs, these dewatering quantities are predicted to be of negligible quantity and therefore no impact to the groundwater waterbodies (see Section 4.1) qualitative status is predicted. The water management permitting licenses and agreements will be completed by the appointed contractor, with the quantities of groundwater management determined at the detailed design stage. This applies to all sections.

4.3.2. SCOPING ASSESSMENT

4.3.2.1. Please note this assessment includes for the embedded mitigation measures and additional mitigation measures as listed above in Section 4.3.1.

Table 4.5 - East Hants Chalk Assessment

Water body Name & ID	East Hants Chalk (Groundwater Water body ID GB40701G502700)	
Proposed Development design element:	**Trenched Onshore Corridor**	**Converter Station**
Quantitative Status (current status: Poor; Objective: Poor by 2027)		
Saline intrusion **Current Status: Good** **Objective: Good**	Groundwater dewatering in trenches in Section 1 and Section 2 will not increase risk to saline intrusion. Groundwater dewatering in Section 4 to Section 7 could increase risk of saline intrusion pathway. The areas of concern (Section 4 to Section 7) are presently assumed to be experiencing saline water interaction. Care should be given to southern section of exposed East Hants Chalk to ensure no clean groundwater waterbodies are impacted by dewatering. Dewatering would be completed temporarily and locally to ensure no significant impacts arise. The Proposed Development is not expected to cause any significant changes that would increase saline intrusion at the water body scale.	No impact expected.

Water body Name & ID	East Hants Chalk (Groundwater Water body ID GB40701G502700)	
Water balance **Current Status: Poor** **Objective: Poor**	Some potential for localised loss of groundwater due to sump pump dewatering but this would be of insufficient value to affect regional groundwater flows and availability.	No impact expected.
GWDTE tests **Current Status: Good** **Objective: Good by 2027**	Some potential for localised effects on GWDTE's however, mitigation measures include summer construction to avoid dewatering requirements. No impact expected.	No impact expected.
Dependent surface water body status **Current Status: Poor** **Objective: Good**	No impact expected.	No impact expected.
Chemical Status (current status: Poor; Objective: Good by 2027)		
Drinking Water Protected Area **Current Status: Poor** **Objective: Good by 2027**	No impact expected.	Potential for contaminants to enter groundwater via infiltration attenuation ponds however, proposed additional mitigation measures (as listed in 4.3.1) will ensure this does not occur. No impact expected.

Water body Name & ID	East Hants Chalk (Groundwater Water body ID GB40701G502700)	
		The study area does lies within an SPZ.
General Chemical Test **Current Status: Poor** **Objective: Good**	No impact expected.	Some potential for contaminants to enter groundwater via surface karsts features during construction and via infiltration ponds during operation, however, karsts would be grouted prior to construction and infiltration includes appropriate mitigation measures to ensure no contamination occurs. Please see section 4.3.1 for further information. No impact expected.
GWDTE test **Current Status: Good** **Objective: Good**	Some potential for localised effects on GWDTE's (Denmead Meadow and Kings Pond), however, mitigation include for construction when groundwater management would not be required for construction. Construction Stage activities advised to be completed during the winter season. No impact expected.	No impact expected.

Water body Name & ID	East Hants Chalk (Groundwater Water body ID GB40701G502700)	
Dependent Surface Water body Status **Current Status: Good** **Objective: Good**	No impact expected.	No impact expected.
Saline intrusion **Current Status: Good** **Objective: Good**	Some potential for increased saline intrusion pathway due to trench dewatering in the south, however, effects would likely be temporary and localised. The Proposed Development is not expected to cause any significant changes that would increase saline intrusion at water body scale.	No impact expected.
Trend assessment **Upward trend**	No impact expected.	
Protected Areas **Nitrate Directive, Drinking Water Protected Area**	No impact expected.	Following mitigation, no impact expected.
Mitigation measures	No impacts expected. No specific mitigation measures are identified for groundwater water body.	

Water body Name & ID	East Hants Chalk (Groundwater Water body ID GB40701G502700)
Compliant with WFD objectives?	Yes – while there may be some localised effects these are not sufficient to affect the status of any of the quality elements of the East Hants Chalk groundwater water body. Similarly, they would not affect the ability to meet the objectives for the water body set out in the RBMP.

Table 4.6 - Hants South Lambeth Group Assessment

Water body Name & ID	Hants South Lambeth Group (Groundwater Water body ID GB40702G503700)
Proposed Development design element:	Trenched Alignment Construction
Saline intrusion **Current Status: Good** **Objective: Good**	No impact expected.
Water balance **Current Status: Good** **Objective: Good**	Some potential for localised loss of groundwater due to sump pump dewatering but this would be of insufficient value to affect regional groundwater flows and availability.
GWDTE tests **Current Status: Good** **Objective: Good by 2027**	No impact expected.
Dependent surface water body status **Current Status: Good** **Objective: Good**	No impact expected.

Water body Name & ID	Hants South Lambeth Group (Groundwater Water body ID GB40702G503700)
Drinking Water Protected Area **Current Status: Good** **Objective: Good**	No impact expected.
General Chemical Test **Current Status: Good** **Objective: Good**	No impact expected.
GWDTE test **Current Status: Good** **Objective: Good**	No impact expected.
Dependent Surface Water body Status **Current Status: Good** **Objective: Good**	No impact expected.
Saline intrusion **Current Status: Good** **Objective: Good**	No impact expected.
Trend assessment	No impact expected.

Water body Name & ID	Hants South Lambeth Group (Groundwater Water body ID GB40702G503700)
No trend	
Protected Areas **Nitrate Directive, Drinking Water Protected Area**	No impact expected.
Mitigation measures	No impacts expected. No specific mitigation measures are identified for groundwater water body.
Compliant with WFD objectives?	Yes – while there may be some localised effects these are not sufficient to affect the status of any of the quality elements of the East Hants Chalk groundwater water body. Similarly, they would not affect the ability to meet the objectives for the water body set out in the RBMP.

Table 4.7 - Hants Southeast Bracklesham Group Assessment

Water body Name & ID	Hants South Lambeth Group (Groundwater Water body ID GB40702G503700)
Proposed Development design element:	Trenched Alignment Construction
Saline intrusion **Current Status: Good** **Objective: Good**	Groundwater dewatering could increase risk of saline intrusion pathway; however, the areas of concern are likely to already be impacted. Care should be given to near the coastal areas to ensure no clean groundwater aquifers are impacted by dewatering activities. Dewatering would be completed temporarily and locally to ensure no significant impacts arise. The Proposed Development is not expected to cause any significant changes that would increase saline intrusion at the water body scale.
Water balance **Current Status: Good** **Objective: Good**	Some potential for localised loss of groundwater due to sump pump dewatering but this would be of insufficient value to affect regional groundwater flows and availability.
GWDTE tests **Current Status: Good** **Objective: Good by 2027**	No impact expected.

Water body Name & ID	Hants South Lambeth Group (Groundwater Water body ID GB40702G503700)
Dependent surface water body status **Current Status: Poor** **Objective: Good by 2027**	No impact expected.
Drinking Water Protected Area **Current Status: Good** **Objective: Good**	No impact expected.
General Chemical Test **Current Status: Good** **Objective: Good**	No impact expected.
GWDTE test **Current Status: Good** **Objective: Good**	No impact expected.
Dependent Surface Water body Status **Current Status: Good** **Objective: Good**	No impact expected.

Water body Name & ID	**Hants South Lambeth Group (Groundwater Water body ID GB40702G503700)**
Saline intrusion **Current Status: Good** **Objective: Good**	No impact expected.
Trend assessment **No trend**	No impact expected.
Protected Areas **Nitrate Directive, Drinking Water Protected Area**	No impact expected.
Mitigation measures	No impacts expected. No specific mitigation measures are identified for groundwater water body.
Compliant with WFD objectives?	Yes – while there may be some localised effects these are not sufficient to affect the status of any of the quality elements of the East Hants Chalk groundwater water body. Similarly, they would not affect the ability to meet the objectives for the water body set out in the RBMP.

4.3.3. ASSESSMENT AGAINST RELEVANT EU LEGISLATION

4.3.3.1. The Proposed Development is partially located in a Drinking Water Groundwater Safeguard Zones ('SgZ's), Water Framework Directive, the assessment concludes that the Proposed Development would not impact upon the Drinking Water Groundwater Safeguard Zones due to the proposed embedded and additional mitigation measures.

4.3.3.2. The Proposed Development is also located in Nitrate Sensitive Areas, the Nitrates Directive, the assessment concludes that the Proposed Development would not impact upon nitrates due to the proposed embedded and additional mitigation measures.

5. CONCLUSION

5.1. OVERVIEW

5.1.1.1. The Proposed Development consists of the Converter Station Area and the Onshore Cable Corridor that runs from the Landfall at Eastney, Portsmouth, north to a Site adjacent to the existing Lovedean Substation west of Horndean, Hampshire. The Proposed Development has the potential to impact upon the following water bodies:

- Surface water
  - Potwell Trib (GB107042016400);
  - Langstone Harbour (GB580705130000);
- Groundwater
  - East Hants Chalk (GB40701G502700);
  - Hants East Lambeth Group (GB40702G500800);
  - Hants South Lambeth Group (GB40702G503700); and
  - Hants South East Bracklesham Group (GB40702G503000).

5.2. SURFACE WATER

5.2.1.1. The surface water bodies (Potwell Trib and Langstone Harbour water bodies) are designated as highly modified water bodies.

5.2.1.2. There are no proposed structures, discharges, diversions, realignments or on-going maintenance that would impact on surrounding WFD surface water bodies of the South East River Basin District RBMP during the Operational Stage.

5.2.1.3. Potential impacts from construction on WFD quality elements include modifications to fine sediment from construction works. Overall these impacts are considered to pose minimal threat to the integrity of the WFD quality elements at a water body scale with only localised impacts anticipated. The general low quality of the watercourses could aid in buffering the effects of localised impacts from works during construction so that there would be no deterioration in status / potential on the WFD designated water bodies. These impacts would be effectively mitigated through following best practice, as provided in the Onshore Outline CEMP.

5.2.1.4. Physico-chemical and hydromorphological quality elements could potentially be affected during the Construction Stage. Pumping of trenches and HDD pits could result in increased flow to surrounding watercourses if it is not managed correctly. This could then affect the hydrological discharges and dilution, whilst the works could also release contaminants or sediment into the watercourse. It is anticipated that these impacts would be mitigated for through the discharge consent process and by following best practices during the detailed design and construction, as provided within the Onshore Outline CEMP.

5.3. GROUNDWATER

5.3.1.1. Following the listed embedded mitigation measures (see Section 4.3.1) and additional mitigation measures (see Section 4.3.1) the risk to WFD groundwater water bodies is nullified. Care should be given around the spread of saline intrusions, however, the coastal aquifers which are in hydraulic connectivity to the tide will already be contaminated. Care to contain spread of saline waters should be given and trenching where dewatering is required should be completed as quickly as is practicable to negate the requirement of extended dewatering requirements.

5.4. SUMMARY

5.4.1.1. Overall, this assessment has indicated that if embedded mitigation measures (see Section 4.3.1) and additional mitigation measures (see Section 4.3.1 and Annex A), are implemented during the detailed design, the impact of the scheme on the WFD water bodies would be assessed as compliant with WFD. The Proposed Development would also comply with all other relevant EU legislation.

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Annex A – Construction Mitigation

ANNEX A

1.1. CONSTRUCTION MITIGATION

1.1.1.1. The objectives of the mitigation measures outlined in this section are to avoid/prevent, reduce or offset construction impacts upon Water Framework Directive ('WFD') water bodies.

1.1.1.2. Potential Environmental Risks include:

- Fuel oil spillage resulting in contamination of water course;
- Contamination of watercourse with cement material;
- Contamination of watercourse with chemicals; or
- Contamination of watercourse with sediments.

1.1.1.3. The release of potentially toxic compounds such as fuel, oils and chemicals could have a significant impact in the vicinity and downstream of the construction site. Measures need to be in place to prevent the accidental release of pollutants into the watercourse.

1.1.1.4. To prevent fine sediment entering the watercourses, construction activities should occur away from the watercourses where possible. Should vegetation clearance be required, the extent should be limited to the areas necessary. This would reduce the amount of sediment released during clearance and the potential release of sediment from bare ground following clearance.

1.1.2. PREVENTION AND MITIGATION MEASURES

1.1.2.1. Proposed mitigation measures include:

- All operatives should be made aware of the need to protect the watercourse from contamination, including Environment Agency ('EA') guidance and legal obligations.
- To prevent fine sediment entering the watercourses, construction activities should occur away from the watercourses where possible.
- When construction activities, including stock piling (not permitted within fluvial flood zone 2 or 3 unless otherwise agreed with the EA) and plant and vehicle washing, occur in close proximity to a watercourse they should be separated from the watercourse with barriers (e.g. sediment fences) to prevent surface runoff from these sites entering the watercourse.

- Geotextile-material silt fences should be installed to filter suspended solids from runoff.
- The extent of vegetation clearance should be limited to the areas necessary to reduce the amount of sediment released during clearance and the potential release of sediment from bare ground following clearance.
- The works should be carried out in accordance with established best practice and environmental permitting requirements.
- Pollution spill kits should be kept on site. In the event of an incident these would be used.
- Any soils contaminated would be removed immediately to a suitable landfill site.
- Waste facilities should be provided on site for debris away from areas at risk of flooding.
- Cleaning of tools and shuttering will be carried out in water not draining directly to the watercourse.
- In any event of expected heavy rain pouring concrete and other activities which increase the risk of contaminating runoff should not be undertaken.
- Activities near watercourses should be avoided during fish migratory and spawning seasons (typically October to May).
- The control on invasive non-native species should be managed through best practice guidance and by implementing the Wildlife Law: Control of Invasive Non-native Species HC1039 (Law Com No. 342).