

CHAPTER 11: HYDROLOGY

11.1 INTRODUCTION

11.1.1 This chapter of the ES has been produced by PFA Consulting Ltd to assess the Proposed Development in relation to the effects it would have upon Hydrology.

11.1.2 This chapter contains an assessment of the likely significant effects that the Proposed Development would have on the water environment and, where necessary, identifies mitigation measures in accordance with relevant legislation, planning policies, guidance, and statutory requirements in respect of flood risk, surface water drainage and surface water quality. This assessment is supported by:

- A detailed Flood Risk Assessment (FRA) and Drainage Strategy for the Wider OPA produced by PFA Consulting Ltd contained in Appendix 11.1 in Volume 2 of this ES;
- A detailed FRA and Drainage Strategy for OPA Phase 1 produced by Odyssey contained in Appendix 11.2 in Volume 2 of this ES;
- A detailed Nitrate Neutrality Study produced by Hilson Moran contained in Appendix 11.3 in Volume 2 of this ES;
- A Nitrate Neutrality Study – First Residential Parcel produced by Hilson Moran contained in Appendix 11.4 in Volume 2 of this ES; and
- A Water Quality Outline Monitoring and Management Plan produced by Johns Associates contained in Appendix 11.5 of Volume 2 of the ES.

11.2 ASSESSMENT CRITERIA & METHODOLOGY

11.2.1 This section of the chapter references previous assessments undertaken in relation to the Wider OPA Site; the Screening Opinion issued by Eastleigh Borough Council; the legislation, policy, published standards, guidance and best practice relevant to the assessment; and the method by which the baseline has been established.

Previous Assessment

11.2.2 A 'Water Environment' ES Chapter was produced for West Horton Heath in December 2014 and an addendum to that Chapter was produced in October 2016 for North West Horton Heath. These assessments concluded that all construction effects could be successfully

mitigated and that, after mitigation, the residual effects of the operation phase would range from Moderate Adverse to Moderate Beneficial.

11.2.3 This ES Chapter is produced independently of the previous studies.

Scoping Opinion

11.2.4 An EIA Scoping Opinion was issued by Eastleigh Borough Council on 12 August 2020. Comments relevant to this chapter are summarised below:

- The assessment of flood risk should demonstrate how flood risk will be managed now and over the lifetime of the proposed development, ensuring that the latest climate change guidance is taken into account, that a sequential approach to the site layout should be taken and that the assessment is in line with national planning policy and guidance.
- The surface water drainage strategy should include information on water management across the site before, during, post-construction and for the longer term operation once development is completed and the site occupied/in use. The water management strategy should maintain existing sub catchments and ensure adequate space is provided in the masterplan for robust and effective Sustainable Drainage (SuDS) systems within connected blue-green infrastructure, in order to ensure that sensitive wetlands and receiving waters are protected.
- The term 'water management strategy' should be used in the ES and subsequent application documents rather than 'surface water drainage strategy' to ensure all hydrological sources and receptors (especially hydro-ecology) are covered for the lifetime of the site.
- The assessment must feed into and link to the biodiversity section, and both should include the nearby designated-site wetland habitats and water dependent ecological features in the list of receptors.
- Appropriate and effective ongoing monitoring (before, during, post construction and over the operational lifetime of the site) of hydrological impacts on sensitive receptors, and of the effectiveness of SuDS in reducing flood risk and protecting water quality of the sensitive receiving waters, must be incorporated in any water management (sustainable drainage) strategy and the ES should include further information in this respect.

11.2.5 These comments have been addressed in the production of the FRA which contains a water management (sustainable drainage) strategy and in the assessment below. Furthermore, the scheme has been developed iteratively to ensure effects on sensitive ecological (biodiversity) and hydrological receptors have been appropriately mitigated and that the site layout incorporates coherent blue-green infrastructure. Design mitigation and additional mitigation measures (including monitoring) are discussed in the sections below.

Legislative Context

11.2.6 This section summarises those pieces of legislation that are directly relevant to surface water drainage, surface water quality and flood risk which have been acknowledged in the preparation of this ES chapter. Please note that this is not exhaustive and focuses on the key pieces of legislation. The sustainable use and management of water resources is the key driver behind all legislation detailed below.

International and European Legislation

Water Framework Directive (2000/60/EC)

11.2.7 The Water Framework Directive (WFD) aims for a more integrated approach to water management. It sets the target for all waters, both surface and groundwater, to achieve 'Good' status by 2027. Good status refers to ecological and chemical status for surface waters and both chemical and quantitative status for groundwaters.

National Legislation

Flood and Water Management Act 2010

11.2.8 The Act was established to provide better, more comprehensive management of flood risk. The Act creates Lead Local Flood Authorities (LLFA) at the Unitary Authority and County Council level. The LLFA is responsible for managing the risk of all 'local floods'. In this instance the LLFA is Hampshire County Council.

Water Resources Act 1991

11.2.9 The Act sets out the regulatory controls and restrictions that provide protection to the water environment through controls on abstraction, impounding and discharges as well as identifying water quality and drought provisions.

11.2.10 It ensures that any works that potentially impact a 'Main River' need to be consented by the Environment Agency.

Land Drainage Act 1991

11.2.11 The Act places the responsibility for the maintenance of ordinary watercourses on the riparian landowners.

11.2.12 The amended Act ensures that any channel works cannot be undertaken without prior authorisation from the LLFA or (where relevant) the Internal Drainage Board.

Salmon and Freshwater Fisheries Act 1975

11.2.13 The Act makes it an offence for polluting activity that can cause the waters to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish and contains other provisions to protect migration routes.

Planning Policy and Guidance

11.2.14 This section summarises the national and local policies and guidance relevant to surface water drainage and flood risk.

National Planning Policy

11.2.15 Paragraphs 155 – 165 in the National Planning Policy Framework (NPPF) set out the national planning policy in relation to planning and flood risk and is supported by the 'Flood Risk and Coastal Change Planning Practice Guidance'.

11.2.16 Both the NPPF and its Guidance highlight the need to avoid inappropriate development in areas at risk of flooding and the need to make development safe from flooding without increasing flood risk elsewhere.

11.2.17 The Planning Practice Guidance references the Government's 'Non-statutory Technical standards for sustainable drainage systems'¹ which relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. It contains standards for peak flow and volume control and management of flood risk within the development.

¹ Department for Environment, Food and Rural Affairs (March 2015) 'Non-statutory technical standards for sustainable drainage systems'

Local Planning Policy

Current Planning Policy

11.2.18 The Eastleigh Borough Council Local Plan review (2001 – 2011) contains saved policies relevant to this assessment:

- Policy 41.ES – Development affecting water courses.
- Policy 42.ES – Development in a catchment of a water course.
- Policy 43.ES – Areas at risk of flooding.
- Policy 45.ES – Sustainable Drainage.

Emerging Planning Policy

11.2.19 The Eastleigh Borough Local Plan 2016 – 2036 was submitted in October 2018 for public examination. The following policies in the submitted Local Plan are relevant to this assessment:

- Policy DM3 – Adaptation to climate change.
- Policy DM5 – Managing flood risk.
- Policy DM6 – Sustainable surface water management and watercourse management.
- Policy DM10 – Water and Waste Water.
- Policy DM11 – Nature conservation.

Guidance / Best Practice

Strategic Flood Risk Assessment (SFRA)

11.2.20 The Strategic Flood Risk Assessment² (SFRA) was produced for the Partnership for Urban South Hampshire (PUSH) in December 2007. The SFRA provides an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. The SFRA also includes guidance specific to

² Atkins (2007) Partnership for Urban South Hampshire Strategic Flood Risk Assessment Final Report

Eastleigh Borough. This includes a qualitative assessment of the likely effects of new development and guidance on the preparation of site specific Flood Risk Assessments, including the use of Sustainable Drainage Systems (SuDS).

11.2.21 A SFRA 2016 Update³ was produced to inform emerging Local Plans and other policy documents within the PUSH area. This included taking account of updates to national planning policy and guidance since the publication of the 2007 SFRA.

The SuDS Manual

11.2.22 The SuDS Manual⁴ provides best practice information on the design, construction, operation and maintenance of Sustainable Drainage Systems (SuDS). It promotes the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system.

Hampshire County Council Guidance

11.2.23 Hampshire County Council is in the process of publishing a series of Technical Guidance (TG) Notes. TG8-1 to TG8-6 will outline the standards for drainage but have yet to be published.

11.2.24 Hampshire County Council in its role as the LLFA has also published an information leaflet for developers covering the principles and application of SuDS. The information provides guidance on sources of further information and how to obtain pre-application advice. In January 2020 Hampshire County Council published a Surface Water Checklist for developers.

Baseline Data Collection

11.2.25 The following sources of information have been reviewed, to establish the baseline and future conditions:

- Site Parameter Plans;
- Ordnance Survey 1:25,000 scale Maps;
- Topographical Survey;
- Environment Agency website and online mapping;

³ Eastern Solent Coastal Partnership (2016) Partnership for Urban South Hampshire Strategic Flood Risk Assessment (SFRA) Update - 2016

⁴ CIRIA (2015) 'The SuDS Manual' CIRIA C753

- Environment Agency Modelled Flood Levels;
- Ground Investigation Report⁵, including soakage testing;
- Soil Site Report⁶;
- Cranfield Soil and AgriFood Institute (CSAI) Soilscales dataset;
- British Geological Survey[®] (2020) NERC online mapping;
- Southern Water Asset Mapping;
- Partnership for Urban Hampshire Strategic Flood Risk Assessment (SFRA), 2007;
- Partnership for Urban Hampshire SFRA 2016 Update, 2016; and
- A site walkover was undertaken in July 2018 to inform the FRA and Drainage Strategy for the Wider OPA and in February 2020 to inform the Nitrate Neutrality Study;

Assessment Methodology

11.2.26 A general assessment methodology is presented in Chapter 5. How this methodology is applied to the Hydrology subject area is set out in the section below.

Flood Risk Assessment and Drainage Strategy

11.2.27 The assessment draws upon a more detailed Flood Risk Assessment (FRA) for the Wider OPA contained in Appendix 11.1 in Volume 2 of this ES.

11.2.28 The Wider OPA FRA assesses the flood risk to and from the Site from all sources including:

- Fluvial (flooding from watercourses);
- Pluvial (direct rainfall and surface water flooding);
- Groundwater;

⁵ Hydrock (2019) Horton Heath, Hampshire Ground Investigation Report. Document reference: HHD-HYD-XX-XX-RP-GE-0002

⁶ National Soil Resources Institute (2018) Soils Site Report for location 448946E, 116881N, 2km x 2km, National Soil Resources Institute, Cranfield University.

- Overwhelmed Sewers and Drainage Systems; and
- Artificial Sources.

11.2.29 The Wider OPA FRA demonstrates how flood risk will be managed now and over the Proposed Development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.

11.2.30 A Water Management Strategy (including the application of SuDS) for the Wider OPA is contained within the Wider OPA FRA along with information on the future operation and maintenance of the proposed on-site drainage systems.

11.2.31 The FRA and Drainage Strategy for OPA Phase 1 contained in Appendix 11.2 in Volume 2 of this ES provides the necessary details for the SuDS in OPA Phase 1 to deliver the concepts set out in the Wider OPA FRA and Drainage Strategy.

Receptor Sensitivity

11.2.32 Generic receptor sensitivity has been classified in Chapter 5 on a scale ranging from 'Negligible' to 'Very High'.

11.2.33 In terms of hydrology, flood risk and surface water quality the receptor sensitivity will be assessed as shown in Table 11.1 below. These categories are derived from legislative controls, designated status, number of individual receptors, characteristics (such as rarity or condition of the receptor) and the ability of the receptor to tolerate and adjust to change.

Table 11.1: Receptor Sensitivity

Sensitivity	Description
Very High	- Local Residents (persons and property) - National or Internationally Designated Areas e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site, or National Nature Reserve. - Nationally or Internationally protected species. - Functional Floodplain or flood storage area (Flood Zone 3b).
High	- Watercourse, waterbody or wetland with 'High' quality. - Areas with a 'High' probability of flooding (Flood Zone 3a).
Medium	- Non statutory sites of regional or local importance e.g. Local Nature Reserve (LNR) or Site of Importance for Nature Conservation (SINC). - Areas with a 'Medium' probability of flooding (Flood Zone 2). - Watercourse, waterbody or wetland with 'Good' quality.
Low	- Watercourse, waterbody or wetland with 'Moderate' quality. - Areas benefiting (protected) from flood defences.
Very Low	- Areas with a 'Low' probability of flooding (Flood Zone 1). - Unclassified Ordinary Watercourses.
Negligible	Watercourse, waterbody or wetland with 'Poor' or 'Bad' quality or a Heavily Modified Waterbody (including drainage ditches).

Magnitude of Change

11.2.34 The criteria to assess the magnitude of the effects are set out in Table 11.2 and are derived from the spatial scale, permanence and severity of the effects.

Table 11.2: Magnitude of Change

Sensitivity	Description
Very High	Long term, permanent and severe changes to the hydrology (flood risk, flow characteristics of watercourses, and habitat quality) or water quality. • Increase/decrease in whole catchment risk of flooding. • Large loss/addition of floodplain storage. • Severe permanent deterioration/improvement of water quality, habitat quality or flow characteristics of a watercourse at a regional scale.
High	Long term, permanent or severe changes to the hydrology (flow characteristics of watercourses, and habitat quality) or surface water quality or flood risk. • Increase/decrease in sub-catchment risk of flooding. • Loss/addition of floodplain storage. • Significant permanent deterioration/improvement of water quality, habitat quality or flow characteristics of a watercourse at a local to regional scale.
Medium	Material short to medium term local changes to hydrology or surface water quality or flood risk. • Increase/decrease in flood risk affecting the Site and its immediate vicinity. • Minor loss/addition of floodplain storage. • Moderate changes to the habitat quality or flow characteristics of a watercourse. • Severe temporary reduction or moderate local scale improvement in the quality of surface water resources.
Low	Measurable but immaterial changes to hydrology or surface water quality or flood risk. • Increase/decrease in flood risk to the Site. • Minor changes to habitat quality or flow characteristics of a watercourse. • Minor local scale reduction (reversible with time) or improvement in the quality of surface water.
Very Low	Measurable, immaterial and temporary changes to hydrology or surface water quality or flood risk. • Temporary minor increase/decrease in flood risk to the Site. • Temporary and minor changes to habitat quality or flow characteristics of a watercourse. • Minor, temporary and local scale reduction (reversible with time) or improvement in the quality of surface water.
Negligible	No appreciable effect on hydrology or surface water quality or flood risk.

Effect Significance

11.2.35 The significance of effects is determined by combining the predicted magnitude of change with the assigned sensitivity of the receptor and can be classified as 'Substantial', 'Major', 'Moderate', 'Minor', 'Neutral' and described as 'Adverse' or 'Beneficial' in accordance with Table 5.2 in Chapter 5 of this ES.

11.2.36 All effects classified 'Moderate' or above require additional assessment regarding their significance in EIA terms. 'Minor' and 'Neutral' effects are considered to not be significant in EIA terms.

11.2.37 Effects can also be described as direct, indirect, reversible, irreversible, cumulative, temporary, and permanent.

Geographical Scope

11.2.38 The geographical scope of this assessment will focus on the Wider OPA Site (including the OPA Phase 1 Site), watercourses flowing within and along the boundary of the Wider OPA Site and OPA Phase 1 Site, watercourses that may affect the Wider OPA Site and OPA Phase 1 Site (i.e. an off-site watercourse with an associated floodplain or overland flow path that affects the Wider OPA Site or OPA Phase 1 Site) and watercourses downstream of the Wider OPA Site and OPA Phase 1 Site in the context of the interlinked wider hydrological system associated with the River Itchen catchment draining into Southampton Water and the Solent.

Temporal Scope

11.2.39 The temporal scope will cover the construction and occupation phases of the OPA Phase 1 and the Wider OPA. This will include an assessment of the baseline environment, assessment of the construction phase during the timeframe envisaged for construction, and an assessment of the occupation phase both in the medium and longer term, taking the potential effects of climate change into account.

Assumptions & Limitations

11.2.40 The assessment of the significance of the effects of the Proposed Development on the water environment is based upon the assumption that the baseline data is appropriate and that any mitigation measures proposed will be delivered during the detailed design of the scheme and maintained throughout their lifetime to ensure their effectiveness.

11.3 CONSULTATION

11.3.1 The FRA and Water Management Strategy has been produced in consultation with the Lead Local Flood Authority (LLFA), the Environment Agency and Southern Water.

11.3.2 A pre application meeting with Hampshire County Council in its role as the LLFA was completed in January 2020. There was broad agreement of the surface water drainage strategy consisting of Strategic SuDS features and upstream Source Control. It was agreed that the Strategic SuDS features would incorporate a series of treatment processes, i.e. sediment forebays, micropools, low flow channels, wetland planting areas and swales for outfalls where possible with flow rates for the 1 in 100 year + 40% rainfall event being restricted to Q_{BAR}/Q_{MED} of the natural catchment as closely as possible. The upstream Source

Control and green infrastructure measures are covered by text within the FRA to inform later detailed designs. The submission would be supported by Micro Drainage Source Control modelling outputs for the Strategic SuDS features.

11.3.3 As part of the Environmental Statement Scoping exercise, the emerging Water Management / SuDS Strategy was presented to the Environment Agency and to Eastleigh Borough Council at an online meeting in March 2020.

11.3.4 The Environment Agency was consulted via email in May 2020 and the flood risk data was provided by the Environment Agency in June 2020. This included modelled flood levels for the on-site watercourses and details of flood defences and historic flood events. An additional enquiry was raised with the Environment Agency relating to flood levels downstream of the Quobleigh Pond and in the vicinity of Moon River. This additional information was provided by the Environment Agency in July 2020.

11.3.5 High level strategic meetings were held with Southern Water in July and August 2018 and topics covered included greywater reuse on the site and on-site wastewater treatment. These processes have subsequently been discounted and an adoptable on-site sewer network with a pumped connection to the public foul sewerage network is now proposed to manage waste water from the proposed development on the Site. Discussions regarding the point of connection to the public sewer network are ongoing with Southern Water. The delivery of a S98 sewer requisition is separate to the planning process.

11.4 BASELINE ENVIRONMENT

11.4.1 This section describes the Site in the context of the hydrological (surface water) environment; and sets the baseline conditions which the potential effects of the Proposed Development can be assessed against.

OPA Phase 1

Hydrological Context

Watercourses

11.4.2 A number of drainage features and watercourses are present within the OPA Phase 1 Site. An ordinary watercourse bisects the northern area of the OPA Phase 1 Site and flows from

southeast (adjacent to Burnetts Lane) to west (running north of Chalcroft Farm, and south of the Solar Farm and eventually into an unnamed 'Main River' to the north west of the OPA Phase 1 Site). The OPA Phase 1 Site falls within the wider catchment of the River Itchen. No other water bodies are identified in the OPA Phase 1 Site.

Catchment Hydrological Characteristics

11.4.3 The Soils Site Report classifies the soils by their HOST (Hydrology of Soil Type) Class. The western area of the OPA Phase 1 Site falls into HOST Class 25 which is defined as “*Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity*”. The Cranfield Soil and AgriFood Institute (CSAI) Soilscales dataset map indicates that soils in the area are classified as ‘impeded drainage’ which refers to tight, compact deep subsoil that impedes downward water movement which after heavy rainfall the subsoil becomes waterlogged, particularly during the winter. HOST Class 25 soils have a Standard Percentage Runoff (SPR) of 49.6%.

11.4.4 The eastern area of the OPA Phase 1 Site falls into HOST Class 3, which is defined as “*Free draining permeable soils on soft sandstone substrates with relatively high permeability and high storage capacity*”. The Cranfield Soil and AgriFood Institute (CSAI) Soilscales dataset map indicates that soils in the area are classified as ‘freely draining’ which refers to soils which absorb rainfall readily and allow it to drain through to underlying layers. HOST Class 3 soils have a SPR of 14.5%.

11.4.5 The OPA Phase 1 Site therefore has variable underlying soils and has a variable response to rainfall.

Surface Water Drainage

11.4.6 The OPA Phase 1 Site currently comprises largely undeveloped greenfield land. In its undeveloped state the surface water runoff from the OPA Phase 1 Site drains into the on-site watercourses by overland and subsurface flow. The existing access track which connects to Chalcroft Farm drains into the adjacent drainage ditches and the ordinary watercourse described above by overland flow.

11.4.7 No public surface water sewers are identified on the OPA Phase 1 Site.

Historic Pollution Incidences

11.4.8 The Environment Agency maintains a register of pollution incidents. Inspection of the data reproduced in the Ground Investigation Report shows that there are no historic pollution incidences on the OPA Phase 1 Site.



Discharge Consents / Permits

11.4.9 No active Environmental Permits (formerly known as Discharge Consents) are identified on the OPA Phase 1 Site.

Abstraction Licence

11.4.10 No active Abstraction Licences are identified on the OPA Phase 1 Site.

Flood Risk

11.4.11 A detailed FRA for the OPA Phase 1 Site has been produced to support this assessment and is contained in Appendix 11.2 in Volume 2 of this ES and is summarised below.

Flood Source: Watercourses and Surface Water

11.4.12 The OPA Phase 1 Site is predominately at Very Low risk of flooding from watercourses (located entirely in Flood Zone 1) and from surface water runoff or localised accumulations of surface water as a consequence of an intense rainfall event.

11.4.13 Areas of elevated surface water flood risk (Low, Medium and High) are associated with the low lying areas adjacent to the existing access track, hedgerow and ditches which bisects the OPA Phase 1 Site and around the on-site watercourses.

Flood Source: Groundwater

11.4.14 The OPA Phase 1 Site is predominately underlain by Wittering Formation (Sand, Silt and Clay) bedrock with a small area of Earnley Sand Formation (Sand, Silt and Clay) in the southeast corner of the Site. Alluvium (Clay, Silt, Sand and Gravel) superficial deposits are associated with the areas underlying on-site watercourses.

11.4.15 The underlying Bedrock and Superficial deposits are classified as a Secondary A aquifers which are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

11.4.16 It is considered that groundwater could be shallow on the site and shallowest in proximity to the on-site watercourses. If groundwater were to emerge it would follow a similar route to surface water flooding discussed in the section above and collect at low lying areas of the OPA Phase 1 Site adjacent to watercourses.

11.4.17 The majority of the OPA Phase 1 Site is at Low risk of flooding from groundwater with areas of elevated risk associated with the low lying areas in proximity to on-site watercourses.

Flood Source: Overwhelmed Sewers

11.4.18 No public sewers are identified on the OPA Phase 1 Site. There are no known instances of flooding from overwhelmed sewers affecting the OPA Phase 1 Site. The risk of flooding from overwhelmed sewers is therefore assessed as Low.

Flood Source: Artificial

11.4.19 The GOV.UK Flood risk from reservoirs map indicates the OPA Phase 1 Site is unaffected by flooding from any reservoirs and no significant waterbodies are identified which are considered to pose a risk. The risk of artificial flood hazards affecting the OPA Phase 1 Site is considered to be Very Low.

Historic Flood Risk

11.4.20 No historic flood risks have been identified on the OPA Phase 1 Site.

Environmental and Surface Water Quality

On-site Watercourses, Waterbodies and Wetland Areas

11.4.21 No watercourses, waterbodies or wetland areas within the OPA Phase 1 Site are designated for its nature conservation value or assessed by the Environment Agency against WFD quality targets.

Off-site Watercourses, Waterbodies and Wetland Areas

11.4.22 The OPA Phase 1 Site is located within the catchment of the River Itchen. The River Itchen corridor is designated as a Special Area of Conservation (SAC) and as a Site of Special Scientific Interest (SSSI). The boundary of the designated site is approximately 2.1km downstream of the OPA Phase 1 Site.

11.4.23 The unnamed Main River to the northwest runs through Field West of Treeline Break SINC and Treeline Break SINC.

11.4.24 There are a number of other designated sites downstream of the OPA Phase 1 Site which depend on the water environment. These are summarised in Table 11.4 below.

Table 11.4: Environmental Designations

Environmental Designation	Area(s) affected
Ramsar Sites	Downstream reaches of the River Itchen and Southampton Water
Local Nature Reserves (LNR)	Areas adjacent to River Itchen and Southampton Water downstream of the Site.
Sites of Special Scientific Interest (SSSIs)	Following River Itchen corridor and adjacent to Southampton Water.
Special Areas of Conservation (SACs)	Following River Itchen corridor and adjacent to Southampton Water (Solent Maritime SAC).
Special Protection Areas (SPAs)	River Itchen through Southampton and areas adjacent to Southampton Water
Nitrate Vulnerable Zones 2017 – Eutrophic Water	The Wider OPA Site and the wider River Itchen catchment.

11.4.25 The designated sites downstream of the OPA Phase 1 Site are sensitive to land use change across their catchment with specific sensitivities to fine sediment and nutrient enrichment (with a particular focus on Nitrogen levels).

Foul Water

11.4.26 The OPA Phase 1 Site is undeveloped and not served by any public sewers. The OPA Phase 1 Site lies in the catchment of the Chickenhall Wastewater Treatment Works (WwTW) which is located 2.6km to the north west of the OPA Phase 1 Site and discharges to the River Itchen.

The Wider OPA

Hydrological Context

Watercourses

11.4.27 A number of drainage features and watercourses are present within the Wider OPA Site. The watercourses within the Wider OPA Site are tributaries of the River Itchen which is located approximately 1.5km to the west of the Wider OPA Site's boundary.

11.4.28 The watercourse on the western boundary of the Wider OPA Site is classified as a 'Main River' and flows from south to north under Allington Lane and into the River Itchen to the south of Chickenhall Lane Wastewater Treatment Works (WwTW). All other on-site watercourses discharge into this unnamed 'Main River'.

11.4.29 An ordinary watercourse is present on the Wider OPA Site's southern boundary to the north of Chalcroft Business Park and drains from southeast to north. A second ordinary watercourse bisects the southern area of the Wider OPA Site and flows from southeast (adjacent to Burnetts Lane) to west (running north of Chalcroft Farm, and south of the Solar Farm). A third ordinary watercourse bisects the central area of the Wider OPA Site and flows from east (in the vicinity of Horton Heath) to west (to the north of the Solar Farm). A number of smaller ditches drain into the on-site watercourses and are adjacent to existing highways which cross the Wider OPA Site located within hedgerows.

11.4.30 A second 'Main River' bisects the north western area of the Wider OPA Site and flows from north east to west to the north of Firtree Farm. This watercourse is known locally as the Fair Oak Stream.

11.4.31 A number of ponds are also present on the Wider OPA Site and in its immediate vicinity. A pond is present within the Chalcroft Farm site and another is present adjacent to the Fair Oak Stream in an area of woodland to the north of Firtree Farm. Quobleigh Pond is located to the north of the Wider OPA Site on the Fair Oak Stream and an unnamed pond is present to the west of the site to the west of the unnamed 'Main River' and south of Allington Lane. These waterbodies are supplemented by a number of ephemeral pools associated with the small watercourses on the Wider OPA Site.

11.4.32 The natural catchments of the on-site watercourses are defined by the Wider OPA Site's topography.

Catchment Hydrological Characteristics

11.4.33 The Soils Site Report classifies the soils by their HOST (Hydrology of Soil Type) Class. The majority of the Wider OPA Site falls into HOST Class 25 which is defined as "*Slowly permeable, seasonally waterlogged soils over impermeable clay substrates with no storage capacity*" which is classified as 'impeded drainage' with a Standard Percentage Runoff (SPR) of 49.6%⁷.

11.4.34 A small area in the south-east of the Wider OPA Site falls into HOST Class 3, which is defined as "*Free draining permeable soils on soft sandstone substrates with relatively high permeability and high storage capacity*" which is classified as 'freely draining' with a SPR of 14.5%.

⁷ Institute of Hydrology (1995) Report No. 126 Hydrology of soil types: a hydrologically-based classification of the soils of the United Kingdom.



11.4.35 The majority of the Wider OPA Site is therefore in an area with a high standard percentage runoff and would respond rapidly to rainfall.

Surface Water Drainage

11.4.36 The Wider OPA Site currently comprises largely undeveloped greenfield land. In its undeveloped state the surface water runoff from the Wider OPA Site drains into the on-site watercourses by overland and subsurface flow.

11.4.37 It is likely that the small amount of existing development on the Wider OPA Site drains into on-site watercourses through direct piped connections or via overland flow.

11.4.38 No public surface water sewers are identified on the Wider OPA Site.

Historic Pollution Incidences

11.4.39 Inspection of the Environment Agency register of pollution incidents reproduced in the Ground Investigation Report shows that there are no historic pollution incidences on the site. However, there are records on the Wider OPA Site's southern boundary likely associated with activities on the Chalcroft Business Park. These included a 'Minor (Category 3)' incident in 2002 associated with Oils and Fuel and a 'Significant (Category 2)' incident in 2002 associated with Diesel. Other pollution incidences recorded are remote from the Site and are unlikely to have affected the water environment on the Wider OPA Site.

Discharge Consents / Permits

11.4.40 The Environment Agency maintains a public register of Environmental Permits (formerly known as Discharge Consents).

11.4.41 Two Environment Permits are present on the Chalcroft Business Park associated with the discharge of treated sewage effluent. One active Environmental Permit is located on the eastern boundary of the Wider OPA Site related to the Burnetts Lane sewage pumping station operated by Southern Water which has an outfall into the ordinary watercourse which runs to the north of the Solar Farm.

Abstraction Licence

11.4.42 The Environment Agency maintains a register of Abstraction Licences. Inspection of the data reproduced in the Ground Investigation Report shows that there are no active Abstraction Licences on the Wider OPA Site. The nearest surface water abstraction is located 0.25km to the west of the site associated with the unnamed 'Main River' for use as Spray Irrigation by Allington Manor Farm. Other abstraction licences are present downstream of the Wider OPA Site.

Flood Risk

11.4.43 A detailed FRA for the Wider OPA has been produced to support this assessment and is contained in Appendix 11.1 in Volume 2 of this ES.

11.4.44 The FRA assesses the flood hazards on the Wider OPA Site from all sources - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. The FRA is summarised below.

Flood Source: Watercourses and Surface Water

11.4.45 The Wider OPA Site is predominately at Very Low risk of flooding from watercourses and from surface water runoff or localised accumulations of surface water as a consequence of an intense rainfall event.

11.4.46 Areas of elevated watercourse and surface water flood risk (Low, Medium and High) are associated with the routes and low lying areas around the on-site watercourses.

11.4.47 Areas of Flood Zones 2 and 3 are present along the unnamed Main River which forms the Wider OPA Site's western boundary and Fair Oak Stream which bisects the northern area. The remainder of the Wider OPA Site is defined as Flood Zone 1.

11.4.48 Areas of High, Medium and Low surface water flood risk are restricted to the naturally defined channels of the on-site watercourses and a small number of isolated low lying areas within the Wider OPA Site, including the western extent of Fir Tree Lane. The remainder of the Wider OPA Site is at Very Low risk of surface water flooding.

Flood Source: Groundwater

11.4.49 Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks such as sands, gravels, limestone and chalk. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.

11.4.50 The Wider OPA Site is predominately underlain by Wittering Formation (Sand, Silt and Clay) bedrock with a small area of Earnley Sand Formation (Sand, Silt and Clay) in the southeast corner of the Wider OPA Site. Alluvium (Clay, Silt, Sand and Gravel) superficial deposits are associated with the areas underlying on-site watercourses.

11.4.51 The underlying Bedrock and Superficial deposits are classified as a Secondary A aquifers which are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

11.4.52 With respect to Groundwater the Ground Investigation Report states “Groundwater is anticipated to be shallow within Alluvium and River Deposits in the vicinity of the streams within the site. Groundwater within the Wittering Formation is anticipated to be a similar elevation to the streams or forming a hydraulic gradient to the groundwater levels in the superficial deposits”. As part of the investigatory work which supported the Ground Investigation Report, 10 Boreholes were drilled across the Wider OPA Site and groundwater levels recorded during post-fieldwork monitoring in the winter months. Groundwater levels varied between 0.9m below ground level (m bgl) and 3.04m bgl. It is considered that groundwater could be shallow on the site and shallowest in proximity to the on-site watercourses.

11.4.53 If groundwater were to emerge it would follow a similar route to surface water flooding discussed in the section above and collect at low lying areas of the Wider OPA Site adjacent to watercourses.

11.4.54 The majority of the Wider OPA Site is at Low risk of flooding from groundwater with areas of elevated risk associated with the low lying areas in proximity to on-site watercourses.

Flood Source: Overwhelmed Sewers

11.4.55 No public sewers are identified on the Wider OPA Site. There are no known instances of flooding from overwhelmed sewers affecting the Wider OPA Site. The risk of flooding from overwhelmed sewers is therefore assessed as Low.

Flood Source: Artificial

11.4.56 The GOV.UK Flood risk from reservoirs map indicates the Wider OPA Site is unaffected by flooding from any reservoirs.

11.4.57 No significant waterbodies are identified upstream of the Wider OPA Site which are considered to pose a risk to the Wider OPA Site.

11.4.58 The risk of artificial flood hazards affecting the Wider OPA Site is considered to be Very Low.

Historic Flood Risk

11.4.59 The Wider OPA Site and the vicinity have been subject to historic flood events. This includes Allington Lane and Fir Tree Lane which both suffer from frequent silting and damage to the existing ditches and regular routine maintenance is required.

11.4.60 The Moon River development at the confluence of the unnamed Main River and the Fair Oak Stream has also suffered historic flooding.

Environmental and Surface Water Quality

On-site Watercourses, Waterbodies and Wetland Areas

11.4.61 Only one on-site watercourse, waterbody or wetland area is designated for its nature conservation value. The Fair Oak Stream which bisects the northern area of the site falls within a Site of Importance for Nature Conservation (SINC) (Quobleigh Pond and Woods SINC, Fair Oak School Meadow SINC, Wyvern Technical College Meadow SINC and Ponds and Meadow adjacent to Wyvern Technical College SINC). A SINC is a Local Wildlife Site. However, the Fair Oak Stream (and on-site ordinary watercourses) are not assessed by the Environment Agency against Water Framework Directive (WFD) water quality targets.

11.4.62 The unnamed Main River on the Wider OPA Site's western boundary is assessed by the Environment Agency against WFD quality targets. The area where the data is applicable is across the length of the Lower Itchen and its tributaries from Winchester in the north to Swaythling in the south. The overall status in 2019 was assessed as Moderate. The latest monitoring data is summarised in Table 11.3 below.

Table 11.3: River Quality (based on Environment Agency data)⁸

Classification Item	2019
Overall Water Body	Moderate
Ecological	Good
• Biological quality elements	Good
○ Macrophytes and Phytobenthos Combined	Good
○ Fish	High
○ Invertebrates	High
• Hydromorphological Supporting Elements	Supports Good
○ Hydrological Regime	Does Not Support Good
• Physico-chemical quality elements	High
○ Acid Neutralising Capacity	High
○ Ammonia (Phys-Chem)	High
○ Biochemical Oxygen Demand (BOD)	High
○ Dissolved oxygen	High
○ pH	High
○ Phosphate	High
○ Temperature	High
• Specific pollutants	High
Chemical	Fail
• Priority substances	Good
• Other Pollutants	Good
• Priority hazardous substances	Fail
○ Polybrominated diphenyl ethers (PBDE)	Fail
○ Benzo(g-h-i)perylene	Fail
○ Mercury and Its Compounds	Fail
○ Other Priority hazardous substances	Good

11.4.63 The reasons for not achieving 'Good' status and the reasons for deterioration in the River Itchen are listed as 'Physical modification' and 'Suspect data' affecting the Hydrological Regime Element.

11.4.64 The unnamed Main River on the Wider OPA Site's western boundary runs through Field West of Treeline Break SINC and Treeline Break SINC.

⁸ Environment Agency (2020) Catchment Data Explorer

Off-site Watercourses, Waterbodies and Wetland Areas

11.4.65 The Wider OPA Site is located within the catchment of the River Itchen. The River Itchen corridor is designated as a SAC and as a SSSI. The boundary of the designated site is approximately 0.9km downstream of the Wider OPA Site.

11.4.66 The River Itchen SAC covers 304 Ha of river from New and Old Alresford at the head of the catchment to the tidal reaches in Swaythling (Southampton). The designated features include *'Rivers with floating vegetation often dominated by water-crowfoot'* (*Ranunculon* and *Batrachion* vegetation) and populations of Southern Damselfly, Freshwater Crayfish, Brook Lamprey, Atlantic Salmon, Bullhead, and Otter. The habitat notification (Code H3260) comprises the watercourse channel, its banks and part of the riparian zone in addition to parts of the floodplain.

11.4.67 Regarding the baseline quality of the River Itchen SAC and the pressures it faces the Natural England document⁹ states *'The Itchen faces numerous pressures from water abstraction and flow diversions, discharges, agricultural runoff, channel modifications, fisheries management and human impacts associated with the urbanisation alongside much of the river's valley.'*

11.4.68 Natural England's document¹⁰ recognises that the *'Rivers with floating vegetation often dominated by water-crowfoot'* qualifying habitat *'has been adversely affected by nutrient enrichment, mainly from sewage inputs and agriculture, and where agriculture has caused serious siltation. It is also vulnerable to artificial reductions in river flows and to unsympathetic channel engineering works.'*

11.4.69 The River Itchen SSSI covers approximately 42km length of river from New and Old Alresford at the head of the catchment to the tidal reaches in Swaythling (Southampton). This SSSI is notified for classic chalk stream and river, fen meadow, flood pasture and swamp habitats, particularly formations of in-channel vegetation dominated by Water Crowfoot, riparian vegetation communities (including wet woodlands) and side channels, runnels and ditches associated with the main river and former water meadows. This SSSI is also notified for significant populations of the nationally-rare Southern Damselfly and assemblages of nationally-rare and scarce freshwater and riparian invertebrates, including the White-clawed

⁹ Natural England (2014) Site Improvement Plan – River Itchen

¹⁰ Natural England (2019) European Site Conservation Objectives: Supplementary advice on conserving and restoring site features River Itchen Special Area of Conservation (SAC) Site Code: UK0012599

Crayfish. This SSSI is notified for Otter, Water Vole, freshwater fishes including Bullhead, Brook Lamprey and Atlantic Salmon, and the assemblage of breeding birds.

11.4.70 Chalk rivers are predominately groundwater fed ecosystems which typically have high water quality, relatively constant temperatures and high dissolved oxygen levels. The river and its surrounding waterways maintain high groundwater levels creating a diverse fen, swamp and meadow habitat in the low lying floodplain adjacent to the river.

11.4.71 Pressures facing the lowland reaches of the River Itchen include nutrient enrichment which can cause a shift in plant communities away from traditional chalk stream species. The River Itchen is a recreation game fishery with fishing for Atlantic Salmon occurring along its lower reaches. Atlantic salmon stock levels are identified as under pressure due to poor in-gravel egg survival caused by high levels of silt input to the river. The River Itchen SSSI Notification document states *'The majority of extra silt originates from cultivated land and point sources such as fish farms, sewage treatment works and cress farm discharges. In recent years substantial effort has been made to restore the river channel for Atlantic salmon by gravel reinstatement, cleaning and channel modifications.'*

11.4.72 The length of the River Itchen designated as an SSSI downstream of the Wider OPA Site is approximately 5km. The SSSI is divided into different management units. The management units downstream of the Site which are directly reliant on the quality of the water environment are Unit 100 'Main Habitat - Fen, Marsh and Swamp – Lowland' and Unit 108 'Main Habitat – Rivers and Steams'. Unit 100 condition is assessed as 'Unfavourable – Recovering' in 2013 and Unit 108 condition is assessed as 'Unfavourable - No change' in 2015.

11.4.73 Areas of the Solent foreshore are classified as the Solent Maritime SAC which is designated for its estuarine and Atlantic salt meadows habitat and Smooth Cord-grass vegetation. The Solent is being affected by high levels of Nitrogen and Phosphorus causing eutrophication and algal blooms resulting in changes to dissolved oxygen concentrations and smoothing of habitat ultimately causing the degradation of the designated sites. The sources of the nutrient input come from agricultural activity and treated wastewater discharges in the upstream watercourse catchments.

11.4.74 Natural England's document¹¹ states *'For the Solent Maritime SAC the condition assessments completed considered the SAC features across the site as a whole and found the condition of these features - estuary, mudflat & sandflats, sandbanks – to be unfavourable. The*

¹¹ Natural England (2020) Advice On Achieving Nutrient Neutrality For New Development In The Solent Region' (version 5 – June 2020)

unfavourable assessment is based on a number of attributes failing, including the nutrient water quality attribute. Other attributes were also found to be failing, such as, for seagrasses, their extent, distribution, rhizome structure and reproduction as well as biomass, and for the intertidal mud and sand features their infaunal quality. These failures are considered to be in part due to impacts from elevated nutrients.'

11.4.75 Natural England recognise that *'There is evidence that inputs of both phosphorus and nitrogen influence eutrophication of the water environment. However, the principal nutrient that tends to drive eutrophication in the marine environment is nitrogen and this is supported by modelling and evidence.'*

11.4.76 There are a number of other designated sites downstream of the Wider OPA Site which depend on the water environment. These are summarised in Table 11.4 above.

11.4.77 To summarise, the designated sites downstream of the Wider OPA Site are sensitive to land use change across their catchment with specific sensitivities to fine sediment and nutrient enrichment (with a particular focus on Nitrogen levels).

Foul Water

11.4.78 The Wider OPA Site is not served by any public sewers. It is assumed that all foul sewage generated by pre-existing dwellings and farmsteads is currently treated on-site by septic tanks and drainage fields, discharging leachate ultimately to local watercourses or groundwaters.

11.4.79 The Site lies in the catchment of the Chickenhall Wastewater Treatment Works (WwTW) which is located 1.7km to the west of the Site and discharges to the River Itchen.

11.4.80 In relation to the capacity of public foul water network and treatment capacity the Partnership for Urban South Hampshire (PUSH) Integrated Water Management Study¹² was published in 2018 to support Eastleigh Borough Council's 'Eastleigh Local Plan'. It states *'The growth areas in the Eastleigh Borough Council area are predicted to drain to either the Chickenhall Eastleigh, Peel Common or Portswood WwTW. The water quality assessments indicated that there are no significant constraints to prevent future housing growth related to Chickenhall Eastleigh or Portswood WWTWs, although they will require upgrades to their sewer networks. Although overall no significant impact or deterioration is predicted due to future housing growth, the Peel Common WwTW may require improvements by 2025 to increase capacity in*

¹² Amec Foster Wheeler (2018) Partnership for Urban South Hampshire – Integrated Water Management Study

the WwTW, which will be subject to review in 2022. Sewer capacity upgrades are also likely to be required at this WwTW. The catchment has nitrate problems and catchment level nitrate measures are required now.'

11.4.81 The Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016-2036¹³ states in relation to Peel Common *'The possible need for an improved N discharge limit will also be reviewed in 2022.'*

11.4.82 The Wider OPA Site lies within a catchment which drains to Southern Water's WwTW. Southern Water have a statutory duty to provide sewerage conveyance and treatment infrastructure for new development and to provide additional capacity as and when required. It is Southern Water's responsibility to comply with its Environmental Permits at WwTW and their wider environmental obligations.

Future Baseline

11.4.83 For the purposes of this assessment, it is considered that the future baseline is the same as the existing baseline with respect to watercourses and surface water drainage.

11.4.84 In respect to flood hazards climate change will increase peak rainfall intensities and peak river flows. The effect of climate change on flood hazards is considered as part of the FRA. The predominant flooding mechanism across the site would remain watercourses and drainage ditches overtopping causing inundation of low lying areas adjacent to watercourse flows and shallow overland flows where topography concentrates surface water runoff when the effects of climate change are taken into account.

11.4.85 The future baseline for the surface water quality of on-site and off-site watercourses is difficult to predict due to the complexities surrounding the sources and pathways of pollution and catchment land use as a driver for water quality change. Implementation of the WFD seeks to prevent deterioration of the surface water status.

11.4.86 Natural England advocate new larger developments (in excess of 200-300 houses) within the watercourse catchments draining to the Solent achieve 'Nutrient Neutrality'. Through application of the Natural England methodology the new development does not add to existing nutrient burdens and that *'demonstrating nutrient neutrality is, in our view, able to provide sufficient and reasonable certainty that the development does not adversely affect the*

¹³ Urban Edge Environmental Consulting Ltd (2019) The Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016-2036 HRA Report for the Submission Plan

integrity, by means of impacts from nutrients, on the relevant internationally designated sites.’¹⁴.

11.4.87 As such for the purposes of this assessment it is considered that the future baseline is the same as the existing baseline with respect to surface water quality and that the condition of designated sites will not deteriorate.

Summary of Receptors

11.4.88 A summary of the sensitivity of the receptors identified as part of the baseline conditions relevant to the assessment of the effect of the Proposed Development on the water environment (hydrology, flood risk and surface water quality) is set out below:

- Local Residents (persons and property) downstream of the Site – Very High
- Protected aquatic habitat and species in River Itchen SSSI and SAC – Very High
- Protected marine habitat and species in Solent Maritime SAC – Very High
- Floodplain associated with the unnamed Main River on western boundary - Very High to Medium
- Floodplain associated with Fair Oak Stream on bisecting northern areas of the site - Very High to Medium
- Protected aquatic habitat and species in adjacent SINC (Quobleigh Pond and Woods SINC, Fair Oak School Meadow SINC, Wyvern Technical College Meadow SINC and Ponds and Meadow adjacent to Wyvern Technical College SINC) – Medium
- Surface water and environmental quality of the unnamed Main River on western boundary - Medium
- Drainage function of on-site ordinary watercourses / drainage ditches – Very Low to Negligible
- Surface water quality of on-site ordinary watercourses / drainage ditches – Very Low to Negligible

¹⁴ Natural England (2020) Advice On Achieving Nutrient Neutrality For New Development In The Solent Region – Version 5

11.5 INHERENT DESIGN MITIGATION

11.5.1 The inherent design of OPA Phase 1 and the Wider OPA and construction management measures secured with a CEMP mitigate a range of effects associated with the delivery of the scheme. The mitigation measures are set out below design out the main effects of the both the OPA Phase 1 and Wider OPA. Where inherent design mitigation is specific to OPA Phase 1, this is highlighted below.

OPA Phase 1

Construction Mitigation

11.5.2 Management measures at the construction phase will be delivered through a Construction Environmental Management Plan (CEMP) to control runoff and pollution related risks associated with the construction processes taking place on the OPA Phase 1 Site.

11.5.3 It is the Principal Contractor's responsibility to coordinate the construction of the scheme and implement the CEMP which must adhere to the principles set out below.

Flood Risk in Construction

11.5.4 Strategic SuDS features will be constructed in the first phase of construction and flow controls should be installed upon completion of the SuDS feature and outfall arrangements.

11.5.5 Sewers will be installed in phases during construction to ensure that runoff can be intercepted by the surface water drainage scheme and any temporary construction drainage (piped or temporary ditches) will be routed through the SuDS features to minimise uncontrolled overland flows.

11.5.6 Works within or around watercourses associated with watercourse crossing should as far as practicable only occur during periods of dry weather or when water levels are low.

11.5.7 Any topsoil stockpiles should not be located close to retained trees, ditches, watercourses, SuDS features, flood risk areas and existing and future excavations. If topsoil is planned to be stockpiled for more than six months the surface of the stockpiles should be seeded with a grass/clover mix to minimise soil erosion.

Pollution Prevention

11.5.8 Proper supervision of construction activities at all stages of the project using appropriately experienced and qualified staff and supervisors with defined environmental responsibilities

and strict adherence to Health and Safety Regulations, Codes of Practice, and consent Conditions as stipulated by the Environment Agency.

11.5.9 Contractors will employ best construction site management practice, good housekeeping and adopt pollution prevention principles and measures set out in CIRIA C532 and CIRIA C692.

11.5.10 Waste storage (with segregated waste streams) and concrete washout areas will be designated to minimise the risk of pollution in areas prone to contamination.

11.5.11 Additional precautions will be taken in any areas where there is increased risk of hydrocarbon/chemical spillage and hazardous substance stores. Any relevant fuels, lubricants or chemicals will be stored in accordance with the pollution prevention principles with an impermeable base and suitable bunding to prevent discharge in the event of spillage and leakage, and the design and location will be in accordance with the Environment Agency's requirements. Drip trays will be utilised under mobile plant.

11.5.12 Effective contingency plans will be put in place to manage the risk associated with accidents and/or unforeseen circumstances. For example, contamination response procedures (including training on the use and location of spill kits) will be disseminated to the construction personnel. A suitable stock of oil booms, absorbent materials, drain covers and geotextile fencing will be kept on-site. An emergency response plan could be developed based on the Stop-Contain-Notify principal in consultation with the Environment Agency. The plan would include the need for staff training in emergency procedures and the provision of appropriate emergency response equipment.

11.5.13 The site will be adequately secured with hoarding and security staff to counteract vandalism, theft and breakage thereby minimising the risk of a pollution incident occurring by this means.

11.5.14 The on-site watercourses will be inspected regularly to check for any unforeseen discharges from the development site (changes in colour, transparency, oil sheen or foam build up, or increased siltation). If any deterioration in the quality of the on-site watercourses is identified this should be reported to the construction site manager and construction site management techniques reviewed and adjusted accordingly.

11.5.15 Site welfare facilities will be provided for construction staff and foul waste tankered from the site prior to the construction of a foul water drainage network and connection into the public sewer network.

11.5.16 The contractor will provide additional street cleaning facilities as necessary to keep supporting highways clear of mud and prevent sediment contaminating surface runoff. Wheel cleaning

facilities, appropriate stockpiling of topsoil, suitable timing of earthwork and earthmoving operations, and dust suppression measures will be used to prevent migration of sediment and other potentially polluting substances.

Silt Management

11.5.17 Dewatering of excavations may be required during construction of the scheme. Any water pumped out of excavations should be discharged via a SuDS feature (detention basin) with flow control in place. This ensures that runoff from the construction site is managed and discharged from the surface water drainage scheme at a controlled rate to minimise effect on downstream receptors. If water is heavily laden with silt, it should be pumped via a settlement tank or lagoon or other silt management techniques (e.g. Silt Busters / Silt Bags) prior to discharge to the SuDS system (detention basin). This is to ensure silt mobilised as a result of construction activities is captured at source to minimise discharge to on-site watercourses.

11.5.18 Silt fences should be erected along the boundary of watercourses to minimise silt laden runoff entering the on-site watercourses and the use of sedimats (or similar approved product) may be necessary.

11.5.19 Where active construction will not take place for more than 60 working days areas should be stabilised by temporary seeding and/or mulching or by other suitable means.

Delivery of Construction Mitigation

11.5.20 Details of environmental monitoring protocols and method statements incorporating the above measures will be outlined in a CEMP which can be subject to a planning condition.

Flood Risk Design Mitigation

11.5.21 The FRA contained in Appendix 11.2 sets out flood mitigation measures for OPA Phase 1 Site.

Sequential Approach to Site Layout

11.5.22 OPA Phase 1 Site is located entirely within Flood Zone 1 and the layout has been devised to provide at least a 10m buffer from on-site watercourses to built development (except for outfalls from SuDS systems, ecological improvements and watercourse crossings).

Watercourse Crossings

11.5.23 Culverting of ordinary watercourses is required to facilitate site access into future development parcels and will require Land Drainage Consent from Hampshire County Council. Through the

detailed design of watercourse crossings and the application process for Land Drainage Consent disruption to the watercourse's flow, morphology and habitat will be minimised.

Surface Water Flood Risk

11.5.24 Localised areas of surface water flood risk are present on the site as a result of topography concentrating runoff into an overland flow route or runoff accumulating in localised low spots. Where these areas are within development parcels the surface water flood risk is a result of rainfall falling on the development area. As such the provision of a surface water drainage system (as described below) will intercept and manage this rainfall and remove the flood risk as a constraint from development area.

Surface Water Runoff Mitigation

11.5.25 The OPA Phase 1 FRA contains a water management strategy involving the implementation of SuDS to manage the disposal of surface water runoff from the Proposed Development.

11.5.26 Surface water runoff from the Proposed Development will be intercepted by on-site drainage systems designed to contain the runoff from storms up to the 1 in 100 year return period, including an appropriate allowance for climate change.

11.5.27 The water management strategy comprises two elements. Strategic SuDS are embedded in the green infrastructure across the site and Source Control will be delivered within the development parcels.

11.5.28 Due to the ground conditions, the use of infiltration SuDS measures has been discounted. This is set out in the attached FRA and the drainage hierarchy has been followed.

Strategic SuDS

11.5.29 Strategic SuDS features are proposed within the green infrastructure on the site. The Strategic SuDS Features will comprise detention basins (incorporating low flow channels, micro pools, wetland areas and sediment forebays) to detain and treat the runoff.

11.5.30 Runoff will be temporarily stored within the Strategic SuDS Features before being discharged at greenfield runoff rates into on-site watercourses to mimic the natural drainage sub catchments on the site.

11.5.31 The Strategic SuDS create wetland habitat on the Site and contribute to the treatment of surface water runoff by encouraging settlement of particles, biodegradation and photolytic breakdown of pollutants and biological uptake of nutrients.

Source Control SuDS

11.5.32 Upstream Source Control in the form of areas of pervious pavement on private drives and shared parking and swales to collect runoff from localised areas creates a SuDS Management Train across the OPA Phase 1 Site. These measures ensure surface water runoff is managed as close to its source as possible.

Surface Water Quality Mitigation

SuDS and Water Quality

11.5.33 The enhanced risk of pollution as a result of the Proposed Development can be mitigated by an adequately designed surface water drainage system. All road areas and other areas that drain to gullies should pass through deep trapped gullies. All larger parking areas (>800m² and/or >50 parking spaces) should drain via pervious paving or pass through a separator before discharging into the downstream drainage system.

11.5.34 Sedimentation, deposition and filtration, UV action, and biological uptake by the vegetation within the Strategic SuDS and upstream Source Control features will contribute to the pollution removal capability of the surface water drainage system.

Landscape Management

11.5.35 Effects on surface water quality from the application of fertiliser, pesticides or herbicides in the landscaped areas will be mitigated by adopted good management practice such as the provision of untreated buffer strips, and not applying chemicals before periods of heavy rain. These measures will be set out in an appropriate Landscape Management Plan which will be secured by an appropriate condition.

Foul Water Drainage Strategy

11.5.36 Impacts from foul water drainage will be dealt with through connection of the site to the downstream Southern Water public foul water sewerage system. Due to site's topography, foul water flows arising from the Proposed Development will be collected in foul sewers and directed to an on-site foul water pumping station. The pumping station will pump the foul sewage to the public sewer network via a rising main. The preferred point of connection is to the public sewerage system to the south east of the development which drains to the Peel Common Wastewater Treatment Works (WwTW) which is operated by Southern Water and discharges into the Solent. The Environmental Permit for Peel Common WwTW includes provision for Total Nitrates.

Nutrient Neutrality

11.5.37 A detailed Nitrate Neutrality Study has been produced by Hilson Moran and is attached as Appendix 11.3 in Volume 2 of this ES. A Nitrate Neutrality Study – First Residential Parcel has been produced by Hilson Moran which focuses on OPA Phase 1 and is attached as Appendix 11.4 in Volume 2 of this ES.

11.5.38 Although OPA Phase 1 does not achieve nitrate neutrality in isolation, it will contribute to the betterment attained by the Wider OPA as a whole which is discussed in more detail in the sections below. The management of nutrient loadings from OPA Phase 1 is achieved through the cessation of agriculture, connection of foul flows to Peel Common WwTW, and treating nutrients in development runoff by means of a network of SUDS feature OPA Phase 1.

The Wider OPA

Construction Mitigation

11.5.39 The same measures as set out in the OPA Phase 1 section above must be adhered to and implemented by the Principal Contractor as part of the CEMP for the Wider OPA. Additional construction management measures are set out below which are specific for the Wider OPA.

Flood Risk in Construction

11.5.40 The surface water drainage scheme is designed to be delivered in a phased manner to ensure sufficient attenuation volume is available throughout the construction of the Proposed Development. Any SuDS features will be constructed at the commencement of the phase it serves and flow controls should be installed upon completion of the SuDS feature and outfall arrangements.

11.5.41 Construction activities close to the on-site watercourses should whenever practicable be a minimum of 10m away from watercourses/ditches. Exceptions to this are where watercourse crossings are required for site access roads (including the Link Road).

11.5.42 The Principal Contractor will sign up to the Environment Agency's flood warnings for flooding from Main Rivers. Plans will be put in place to ensure any construction activities in flood risk areas will cease when a flood warning or alert is issued by the Environment Agency.

11.5.43 All construction compounds and material and plant storage areas should be located outside areas susceptible to flooding.

Pollution Prevention

11.5.44 Contractors will employ best construction site management practice, good housekeeping and adopt pollution prevention principles and measures set out in CIRIA C532 and CIRIA C692 as per OPA Phase 1.

Silt Management

11.5.45 Silt Management measures as per OPA Phase 1 should be implemented for the construction period of the Wider OPA.

Delivery of Construction Mitigation

11.5.46 Details of environmental monitoring protocols and method statements incorporating the above measures will be outlined in a CEMP which can be subject to a planning condition.

11.5.47 Works on or near a Main River (including temporary works) may require an Environmental Permit for flood risk activities from the Environment Agency. Any relevant works must comply with the permit conditions

Flood Risk Design Mitigation

11.5.48 The FRA contained in Appendix 11.1 sets out flood mitigation measures for the Wider OPA site.

Sequential Approach to Site Layout

11.5.49 With respect to the risk of flooding from watercourses, the site layout has taken a sequential risk based approach to direct development to the areas at the lowest risk of flooding. Built development (residential, school and mixed use area) are restricted to areas of Flood Zone 1. Only the Link Road, which connects Allington Lane to the north with Burnetts Lane to the south, crosses areas of Flood Zones 2 and 3 associated with the Main Rivers on the site.

11.5.50 The layout has been devised to provide at least a 10m buffer from on-site watercourses to built development (except for outfalls from SuDS systems, ecological improvements and watercourse crossings). The 10m buffer allows for easy maintenance of the watercourses and minimises disturbance to the habitat in the watercourse corridors.

Minimum Finished Floor Levels

11.5.51 Minimum ground floor levels for all built development on the site would be set at least 600mm above the 1 in 100 year annual probability flood level in any year (including an allowance for climate change) or at least 300mm above existing ground level (whichever is higher). In addition, all residential development would be set at least 10m away from a Main River. These

measures ensure the proposed dwellings will be appropriately safe and the residual flood risk is appropriately managed.

Watercourse Crossings

11.5.52 Any works crossing a Main River will be designed to ensure flood risk does not increase downstream. Any works, including embankments, which encroach on the 1 in 100 year, including an allowance for climate change, flood outline will be subject to level-for-level floodplain compensation and volume-for-volume compensation. These works are subject to detailed design and can be secured with an appropriate condition to avoid displacing flood waters. Opportunities for flood risk betterment should be explored during the detailed design of flood compensation schemes.

11.5.53 Crossings of the Main Rivers will be set with a soffit level above the 1 in 100 year flood level, including an allowance for climate change. It is recommended that Main River crossings are designed to be single span structures (bridge or pre cast structures with natural bed and no artificial invert) where possible. Due to the small size of the ditches it may also be appropriate to consider closed culverts at the detailed design stage for any ditch crossings. Culverts should be designed with natural beds and sufficient freeboard to accommodate design flood events.

11.5.54 Culverting or crossing of a Main River will require an Environmental Permit for flood risk activities from the Environment Agency. Culverting of ordinary watercourses to facilitate site access will require Land Drainage Consent from Hampshire County Council. Through the application process for Land Drainage Consent or Environmental Permit, and a properly designed outfall and culvert, disruption to the watercourse's flow, morphology and habitat will be minimised.

Surface Water Flood Risk

11.5.55 As per OPA Phase 1 the provision of a surface water drainage system (as described below) will intercept and manage this rainfall and removes surface water flood risk as a constraint from development area.

Surface Water Runoff Mitigation

11.5.56 The Wider OPA FRA contains a comprehensive water management strategy for the site involving the implementation of SuDS to manage the disposal of surface water runoff from the Proposed Development.

11.5.57 Surface water runoff from the Proposed Development will be intercepted by on-site drainage systems designed to contain the runoff from storms up to the 1 in 100 year return period, including an appropriate allowance for climate change. The aims of this will be to ensure that the Proposed Development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the Proposed Development would not increase flood risk elsewhere, and would reduce flood risk overall. Pollution control measures are incorporated to mitigate any impacts on the downstream environment.

11.5.58 The water management strategy comprises two elements. Strategic SuDS are embedded in the green infrastructure across the site and Source Control will be delivered within the development parcels.

11.5.59 Due to ground conditions the use of infiltration SuDS measures has been discounted. This is set out in the attached FRA and the drainage hierarchy has been followed.

Strategic SuDS

11.5.60 Strategic SuDS features are proposed within the green infrastructure on the site. The Strategic SuDS Features will comprise a combination of swales, detention basins (incorporating low flow channels, micro pools, wetland areas and sediment forebays) to detain and treat the runoff.

11.5.61 Runoff will be temporarily stored within the Strategic SuDS Features before being discharged at greenfield runoff rates (Q_{BAR} / Q_{MED}) into on-site watercourses. Discharging runoff at greenfield values reduces peak runoff rates from the Site during extreme storm events and contributes to reducing flood risk downstream while maintaining baseflows to the receiving watercourses.

11.5.62 The Strategic SuDS features have been placed to ensure that the outfalls mimic the natural drainage sub catchments on the site. Through breaking the site into sub catchments, the Strategic SuDS can be delivered in a phased manner as development phases move forward.

11.5.63 The detailed design of the Strategic SuDS features will be delivered as part of future reserved matter applications for the site. The design of these features can be secured by way of a planning condition.

11.5.64 The Strategic SuDS features will be designed to incorporate specific design features to maximise their ability to enhance quality of runoff, deliver biodiversity net gain and their general amenity value. These design features include:

- The Strategic SuDS will be 'online' and receive runoff during all storm events.

- Low flow channels will be incorporated into the SuDS features to create wetter areas of habitat and encourage drier areas across other parts of the basin creating a diverse mosaic of habitats within the feature. Low flow channels will be locally widened to create wetland areas in the base.
- Micro pools will create areas of standing water at the outlet of the Strategic SuDS to prevent the resuspension of fine sediment.
- Sediment forebays will be provided at the inlet to promote sedimentation and allow fine sediments (which also contains nutrients) to collect in an area for periodic removal.
- Planting throughout the Strategic SuDS features will enhance the rate of evapotranspiration, provide interception and increase rates sedimentation. Biological uptake of nutrients from vegetation growth will also contribute to the surface water quality enhancement of the Strategic SuDS features.

11.5.65 Outfall routes connecting Strategic SuDS to the on-site watercourses (downstream of the flow control) should utilise swales where possible. This measure increases the entrapment of sediments within the grass and minimises the risk of erosion around the outfall.

11.5.66 Pollution treatment through the SuDS Management Train is primarily by gravitational settling of particulate pollutants. Other mechanisms of pollution removal include filtration through the vegetation on the detention basin base together with biodegradation and photolytic breakdown of any hydrocarbons during the drying processes between runoff events. Nutrients will also be absorbed through biological activity of the plants within the detention basin.

11.5.67 The strategic SuDS are located outside of flood risk areas associated with watercourses so as not to increase flood risk elsewhere.

11.5.68 The Strategic SuDS create wetland habitat on the Site.

Source Control SuDS

11.5.69 Upstream Source Control will be provided in the development parcels to create a SuDS Management Train across the development site and ensure surface water runoff is managed as close to its source as possible.

11.5.70 The design of these features require detailed information on layouts and site levels. As such these measures will be delivered as part of future reserved matters applications.

- 11.5.71 Source Control features include areas of pervious pavement on private drives and shared parking, use of bioretention areas / rain gardens to collect runoff from localised areas, use of swales to convey runoff above ground. The use of green roofs and rainwater harvesting / reuse systems for public / commercial buildings should be considered where appropriate. Water butts shall be provided in residual gardens for rainwater reuse (e.g. domestic irrigation).
- 11.5.72 The use of multiple SuDS features across the development site gives the SuDS Management train resilience as it does not rely on one or two features to deliver its aims of enhancing water quality, biodiversity, amenity value and flood risk.

Surface Water Drainage

- 11.5.73 The Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016-2036¹⁵ advocates three forms of naturalised filtration to ensure surface water quality is treated before discharge in the absence of infiltration drainage. Through the use of upstream Source Control, Strategic SuDS and an outfall swale it is considered that this design criterion is achieved.
- 11.5.74 The on-site drainage systems will be designed in accordance with the relevant national standards and guidance including the SuDS Manual (C753), Building Regulations Part H, BS EN 752:2017, Design and Construction Guidance for foul and surface water sewers, together with Environment Agency documents such as Rainfall Runoff Management for Developments and DEFRA's Non-Statutory Technical Standards for Sustainable Drainage Systems.
- 11.5.75 Events in excess of the design standard of the drainage system (also known as exceedance events) will be managed to minimise the residual risk and these measures are outlined in the FRA. The detailed design of the Proposed Development will set site levels such that exceedance flow routes are directed towards Strategic SuDS features and on-site watercourses and away from existing and proposed properties.
- 11.5.76 The water management strategy contained in the FRA includes an outline management and maintenance strategy to reduce the risk of blockages or system failures. The maintenance strategy will include details of sediment removal frequencies from Strategic SuDS features.
- 11.5.77 The requirement for Strategic SuDS features to be lined with clay, butyl or geomembrane liner to minimise the ingress of groundwater will be assessed at the detailed design stage.

Surface Water Quality Mitigation

¹⁵ Urban Edge Environmental Consulting Ltd (2019) The Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016-2036 HRA Report for the Submission Plan

SuDS and Water Quality

11.5.78 The enhanced risk of pollution as a result of the Proposed Development can be mitigated by an adequately designed surface water drainage system. Pollution control measures incorporated into the surface water drainage design include the use of deep trapped gullies and separator systems (if required for larger parking areas). All road areas and other areas that drain to gullies should pass through deep trapped gullies. All larger parking areas (>800m² and/or >50 parking spaces) should drain via pervious paving or pass through a separator, which meets the requirements of BS EN 858 'Separator systems for light liquids (e.g. oil and petrol)', before discharging into the downstream drainage system. No "high risk" elements of development (i.e. petrol filling stations, lorry parking areas or industrial yard areas) are proposed which would require greater pollution control measures.

11.5.79 Sedimentation, deposition and filtration, UV action, and biological uptake by the vegetation within the Strategic SuDS and upstream Source Control features will contribute to the pollution removal capability of the surface water drainage system.

11.5.80 The proposed SuDS features will intercept and contribute to the reduction of urban diffuse phosphate and nitrite loads which could drain into the River Itchen. For example, the SuDS features will intercept silt and runoff from the Site which could be enriched with nutrients as a result of detergent use from washing of cars, or the application of fertilisers by homeowners or in areas of public open space.

11.5.81 The Wider OPA FRA contains an assessment of surface water quality using the simple index approach as advocated by the CIRIA SuDS Manual 2015. This shows total pollution mitigation index (for each contaminant type) equals or exceeds the pollution hazard index (for each contaminant type) and that SuDS components deliver adequate surface water quality treatment.

Landscape Management

11.5.82 Effects on surface water quality from the application of fertiliser, pesticides or herbicides in the landscaped areas will be mitigated by adopted good management practice and secured by an appropriate condition for a Landscape Management Plan.

Foul Water Drainage Strategy

11.5.83 Impacts from foul water drainage will be dealt with through connection of the site to the downstream Southern Water public foul water sewer system. Due to site topography foul water flows arising from the Proposed Development will be collected in foul sewers and directed to on-site foul water pumping stations. The pumping stations will pump the foul

sewage to the public sewer network via a rising main. The preferred point of connection is to the public sewerage system to the south east of the development which drains to the Peel Common Wastewater Treatment Works (WwTW) which is operated by Southern Water and discharges into the Solent.

11.5.84 The Peel Common WwTW is subject to an Environmental Permit which controls the quality of its discharge to the receiving watercourse / waterbody. The Environmental Permit for Peel Common WwTW includes provision for Total Nitrates.

11.5.85 Southern Water has a statutory duty to provide sewerage conveyance and treatment infrastructure for new development and to provide additional capacity as and when required. It is Southern Water's responsibility to comply with its Environmental Permits at WwTW and their wider environmental obligations.

11.5.86 The details of the connection to the Peel Common WwTW will be agreed with Southern Water as part of a detailed S106 / S98 application. Any off-site works delivered by Southern Water will be designed to current standards and would mitigate the effect of additional foul water flows on sewer flood risk.

11.5.87 Through discharging treated foul water effluent into a different watercourse catchment (and into the Solent) the effect of the development on nutrient levels in the River Itchen is mitigated. Southern Water has an obligation to treat and mitigate the nutrient loadings from the development before it is discharged into the Solent.

Nutrient Neutrality

11.5.88 In the PUSH region Natural England advises development should calculate a nutrient budget and achieve nutrient neutrality. The achievement of nutrient neutrality is a means of ensuring that development does not add to existing nutrient burdens in the designated sites. The Proposed Development will be Nitrate Neutral. A detailed Nitrate Neutrality Study has been produced by Hilson Moran and is attached as Appendix 11.3 in Volume 2 of this ES.

11.5.89 The focus of this study has been Nitrogen inputs as this is the primary driver of Eutrophication in the Solent. The existing Nitrogen load from the site's agricultural and existing residential development on the Site has been calculated and on-site and off-site mitigation measures identified.

11.5.90 Mitigation measures built into the scheme include the cessation of agricultural practices that generate high nutrient loads and conversion to built development and inclusion of wetland areas of the site as part of the Strategic SuDS features.

11.5.91 Through the cessation of agricultural activities on the Wider OPA Site, connection to Peel Common WwTW and removal of nitrogen from runoff using SuDS Management Train the Wider OPA Site would result in a net decrease in Nitrogen discharged to the local environment of c.1,839.6 kg TN/yr and total mass of Nitrogen discharged to sensitive European Designated Sites (both the River Itchen and Solent) would be reduced.

11.5.92 Excess organic and inorganic Phosphate can contribute to eutrophication of receiving waters and it generally more of a problem for freshwaters rather than marine or estuarine habitats where nitrate is typically the limiting nutrient. The main source of Phosphate from new developments will be from foul sewerage. The Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016-2036¹⁶ states that in both academic modelling work and scientific observation that *'country actions to reduce agricultural diffuse eutrophication are having much more success at reducing P than in reducing N. This suggests a focus of action on reducing N source losses from farming to address nitrogen enrichment in the Solent sites will coincidentally deliver a high degree of agricultural diffuse P reduction on the River Itchen SAC.'* It also identifies that at the bottom of the River Itchen agricultural diffuse and the Wastewater treatment works are the dominant sources of Phosphate. By connecting foul water discharges to Peel Common WwTW, achieving Nitrate Neutrality and deploying a water management strategy incorporating SUDS the need for detailed analysis of Phosphate is not required as part of this assessment as it is covered by measures to mitigate Nitrates.

11.6 POTENTIAL ENVIRONMENTAL IMPACTS & EFFECTS

11.6.1 This section provides a summary of the predicted likely effects arising as a result of the construction and operation of the Proposed Development but taking into account the design mitigation measures set out above.

OPA Phase 1

Construction Impacts and Effects

Surface Water Drainage and Flood Risk

11.6.2 The construction of the Proposed Development has the potential to locally affect flood hazards on the OPA Phase 1 Site. During the construction phase there will be the potential for on-going disruption to the OPA Phase 1 Site's drainage regime prior to the completion of the surface water drainage system. There is a potential risk of ponding on the OPA Phase 1 Site

¹⁶ Urban Edge Environmental Consulting Ltd (2019) The Habitats Regulations Assessment for the Eastleigh Borough Local Plan 2016-2036 HRA Report for the Submission Plan

as a result of the runoff from the increased impermeable area draining from the OPA Phase 1 Site; the disruption of existing overland surface water and flood flow routes; and potential soil compaction as a result of construction activities. It is anticipated that overland flow routes will be unaffected and will continue to flow towards the low points on the OPA Phase 1 Site and the on-site watercourses.

- 11.6.3 During the construction phase, earth will be exposed on the OPA Phase 1 Site and construction materials will be stored on the OPA Phase 1 Site. There is potential for silt to be washed off into the watercourses after periods of rainfall. Siltation of on-site watercourses could reduce channel capacity and increase blockage risk. There is also the potential for construction materials to be washed into the on-site watercourses which could reduce channel capacity and increase blockage risk.
- 11.6.4 Excavation will be required to construct below ground services, foundations and SuDS features. The excavations across the OPA Phase 1 Site have the potential to intercept shallow groundwater. To facilitate construction, excavations may have to be dewatered and water pumped onto a designated area of the Site or into an on-site watercourse. Dewatering of excavations has the potential to temporarily increase the base flow of the on-site watercourses.
- 11.6.5 Potential effects of a changed surface and ground water hydrological regime, such as changed quantities and flow direction, may result in impacts on existing wetland areas which may receive less or more water as a result of the development if not mitigated.
- 11.6.6 Through the implementation of construction management measures set out in a CEMP and phased delivery of the Strategic SuDS the magnitude of change on flood risk and surface water drainage on the OPA Phase 1 Site and downstream is Very Low to Negligible. The overall effect significance taking into account design mitigation and the CEMP is **Neutral** to **Moderate Adverse** and effects would be temporary for the duration of the construction period.

Surface Water and Environmental Quality

- 11.6.7 There are a number of substances which could adversely affect surface water quality on the OPA Phase 1 Site and in the downstream environment as a result of construction activities. Potentially polluting construction activities include excavation and groundworks; vehicle operation; machine and plant washing; erosion from temporary vehicle routes and exposed earth; incorrect storage of substances; and accidental spillages. Vandalism of plant and material storage could also be a pollution risk if substances are discharged or if leakage occurs as a result of damage. Polluting substances could include:

- Fine sediment (e.g. silts and clays);
- Cementitious materials;
- Oil, fuels and chemicals, including lubricants, coolants and hydraulic fluids; and
- Other general wastes including wood, plastics, sewerage and construction aggregate.

11.6.8 These substances may contaminate the underlying groundwater or downstream watercourses via surface runoff, especially after periods of rainfall.

11.6.9 Construction activities may encounter shallow groundwater within the underlying superficial deposits. The excavations will need to be dewatered to a nearby watercourse to facilitate construction works. These waters are likely to contain suspended sediments which can cause siltation, increase turbidity and affect dissolved oxygen levels and habitat quality in the downstream watercourses.

11.6.10 Release of sediments and silt to surface waters from stock piled material and excavations can reduce channel capacity and cause the deterioration of water and habitat quality. Siltation of the river bed can smother and infill coarse gravels, which can affect fish spawning success and the establishment of submerged plants, as well as having an impact on the invertebrates living in and on the riverbed. This could occur along the entire works area as well as at construction compounds;

11.6.11 The significance of the contaminate effects is dependent on the pollution event, the nature of the pollutant, and antecedent conditions. The implementation of measures set out in the CEMP will reduce the effect of a pollution event occurring.

11.6.12 The impact magnitude of the effect of potentially polluting construction activities on the OPA Phase 1 Site taking account the measures in the CEMP is assessed as Low to Negligible. The principles set out above to be incorporated into a CEMP reduce the risk of a pollution event occurring. However, the risk of a pollution event can never be eliminated. The effect significance is therefore assessed as **Neutral to Moderate Adverse** and effects would be temporary for the duration of the construction period.

Occupation Impacts and Effects

Surface Water Drainage and Flood Risk

11.6.13 At the occupation stage the key effects on flood hazards and surface water drainage will be as follows:

- Increased surface water runoff due to the creation of hard standing and buildings on-site leading to a potential increase in the rate and volume of surface water runoff discharged to the receiving watercourse and disruption to the natural drainage regime;
- Reduced infiltration to underlying strata due to the increase in hard standing on-site; and
- Effects on local topography creating or disrupting overland flows paths increasing on-site and off-site flood risk.

11.6.14 The implementation of the water management strategy as described above will mitigate these key effects to ensure the risk of flooding on-site and off-site does not increase.

11.6.15 The provision of a water management strategy, involving the implementation of SuDS with a controlled discharge at greenfield Q_{BAR} / Q_{MED} values reduces peak runoff rates from the OPA Phase 1 Site during extreme storm events will reduce the impact magnitude of the effects identified above to Negligible to Low Beneficial.

11.6.16 The effect significance of the operation of OPA Phase 1 on flood risk on-site and off-site is assessed as **Neutral** to **Moderate Beneficial**. The benefits to off-site flood risk will be permanent.

Surface Water and Environmental Quality

11.6.17 Following the completion of OPA Phase 1 there is potential for polluting substances from the ongoing use to have a detrimental effect on the surface water quality of the surface water runoff and consequently the receiving water bodies. These substances include:

- Hydrocarbons from increased vehicular movement, leakages and cleaning of vehicles;
- Heavy metals, primarily Zinc, Iron, Lead, Cadmium and Copper originating from fuel combustion emissions and wear down of brakes and tyres;
- Sediment introduced to the Site from vehicle movement;
- Sediment mobilised by activities by residents (e.g. washing cars, gardening);
- Spillages and leakages associated with on-site facilities (employment / commercial);
- De-icer and gritting material during periods of cold weather;
- Fertiliser and herbicides from management of landscape areas; and

- Foul sewage generated by occupants.

11.6.18 The delivery of Strategic SuDS features creates wetland habitat on the OPA Phase 1 Site.

11.6.19 The phased cessation of agriculture and conversion permanent stable surfaces as the scheme develops changes the nutrient budget of the OPA Phase 1 Site. The OPA Phase 1 Site is currently in agricultural use (arable and pastoral) which typically is a diffuse source of nutrients as a result of fertiliser application, soil losses and any animal wastes entering watercourses or groundwaters. These diffuse sources could contribute to the phosphate and nitrite loadings in the downstream designated sites. Nutrient enrichment of receiving waters can shift algal and plant communities having a knock on and detrimental effect across on BOD and populations causing wider ecosystem to change. The cessation of agricultural activities on the OPA Phase 1 Site will have a positive effect on offsetting the proposed development's nutrient load. Nitrite loading from the discharge from the Peel Common WwTW is controlled by the efficiency of the wastewater treatment process which is managed by Southern Water. The treated effluent discharge from the WwTW is controlled by the requirements of an Environmental Permit which is regulated by the Environment Agency. This is assessed in more detail in the Nitrate Neutrality Study.

11.6.20 The provision of a water management strategy, involving the implementation of Strategic and Source Control SuDS to intercept contaminated runoff and provide a degree of pollution treatment, will reduce the impact magnitude of the effect identified above to between Very Low to Negligible. The effect significance of the operation of the OPA Phase 1 on downstream surface water quality is assessed as **Moderate Adverse to Neutral**. This effect is considered permanent. The risk of a pollution event can never be eliminated but due to the low risk nature of the proposed land use the risk of pollution is Low.

11.6.21 The cessation of agricultural activities, connection of foul water to a Peel Common WwTW and application of a SuDS Management Train to on-site surface water management reduces the effect of the OPA Phase 1 on nutrient loadings to Very Low. The effect significance of the operation of OPA Phase 1 on downstream nutrient loadings and in the designated sites is assessed as **Moderate**. This effect is considered temporary and the significance of the effect would reduce to **Neutral to Moderate Beneficial** when permanent 'Nitrate Neutrality' and net reduction is achieved as part of the Wider OPA.

The Wider OPA

Construction Impacts and Effects

Surface Water Drainage and Flood Risk

11.6.22 The effect of the construction of the Wider OPA is the same as the construction of OPA Phase 1 and would affect the same receptors. These effects are set out above. Due to the greater scale of the Wider OPA the duration of the construction period is longer and therefore potential for effects to occur is over a longer period.

11.6.23 Through the implementation of construction management measures set out in a CEMP and phased delivery of the Strategic SuDS the magnitude of change on flood risk and surface water drainage on the Wider OPA and downstream is Very Low to Negligible. The overall effect significance taking into account design mitigation and the CEMP is **Neutral to Moderate Adverse** and effects would be temporary for the duration of the construction period.

Surface Water and Environmental Quality

11.6.24 The effect of the construction of the Wider OPA is the same as the construction of OPA Phase 1 and would affect the same receptors. These effects are set out above. Due to the greater scale of the Wider OPA the duration of the construction period is longer and therefore potential for effects to occur is over a longer period.

11.6.25 The impact magnitude of the effect of potentially polluting construction activities taking account the measures in the CEMP on the Wider OPA Site and downstream is assessed as Low to Negligible. The principles set out above to be incorporated into a CEMP reduce the risk of a pollution event occurring. However, the risk of a pollution event can never be eliminated. The effect significance is therefore assessed as **Neutral to Moderate Adverse** and effects would be temporary for the duration of the construction period.

Occupation Impacts and Effects

Surface Water Drainage and Flood Risk

11.6.26 The provision of a water management strategy, involving the implementation of SuDS with a controlled discharge at greenfield Q_{BAR} / Q_{MED} values reduces peak runoff rates from the Wider OPA Site. The positive magnitude of the effects increases to between Negligible to Medium Beneficial due to the greater volume of attenuation storage and flow control delivered on the Wider OPA Site.

11.6.27 The effect significance of the operation of the Wider OPA on flood risk on-site and off-site is assessed as **Neutral to Major Beneficial**. The benefits to off-site flood risk will be permanent.

Surface Water and Environmental Quality

11.6.28 The effect of the operation of the Wider OPA on environmental and surface water quality and nutrient loadings is the same as the operation of OPA Phase 1 and affect the same receptors.

These effects are set out above. Due to the greater scale of the Wider OPA the magnitude for the effect is greater.

11.6.29 The provision of a water management strategy, involving the implementation of Strategic and Source Control SuDS to intercept contaminated runoff and provide a degree of pollution treatment will reduce the impact magnitude of the effect identified above to between Very Low to Negligible. The effect significance of the operation of the Wider OPA on downstream surface water quality is assessed as **Moderate Adverse to Neutral**. This effect is considered permanent. The risk of a pollution event can never be eliminated but due to the low risk nature of the proposed land use the risk of pollution is Low.

11.6.30 The cessation of agricultural activities, connection of foul water to a Peel Common WwTW and application of a SuDS Management Train to on-site surface water management reduces the effect of the Wider OPA on nutrient loadings to between Negligible and Medium Beneficial. The effect significance of the operation of the Proposed Development on downstream nutrient loadings and in the designated sites is assessed as **Neutral to Major Beneficial**. This effect is considered permanent.

11.7 ADDITIONAL MITIGATION, COMPENSATION & ENHANCEMENT MEASURES

11.7.1 It is considered that the majority of the effects of the Proposed Development on the water environment would be mitigated to an acceptable level based on design mitigation measures set out within the Flood Risk Assessment (including water management drainage strategy) and that the potential for construction related effects can be appropriately dealt with via a CEMP. Details of mitigation measures to deliver a nutrient neutral development are set out in the Nitrate Neutrality Study.

11.7.2 Due to the sensitivity of the downstream designated sites to deterioration in surface water quality, primarily from fine sediment and excess nutrients, additional mitigation measures are proposed to ensure confidence and give certainty that the mitigation measures are achieving the desired outcomes, and that the effects are reduced to an acceptable level.

OPA Phase 1

Construction Measures

Surface Water Quality Monitoring

11.7.3 Surface water quality monitoring of the on-site watercourses is necessary pre development (to establish a baseline) and during construction and operation of the development to assess and

confirm the effectiveness of the proposed mitigation measures at capturing fine sediment and reducing nutrient levels.

- 11.7.4 A Water Quality Outline Monitoring and Management Plan produced by Johns Associates is contained in Appendix 11.5 of Volume 2 of the ES. This plan will be implemented during the construction of OPA Phase 1 and through to the completion of the Wider OPA.
- 11.7.5 A monitoring programme will be established whereby regular sampling of the watercourses (at 10 locations), and at discharge points from the Strategic SuDS features (an additional 17 locations) is undertaken to ensure that there is no adverse impact on the quality of any surface water discharging into on-site watercourses. The water quality monitoring regime will be agreed with Eastleigh Borough Council, the Environment Agency and Natural England.
- 11.7.6 The monitoring regime will consist of weekly monitoring at all sample locations using a hand held multiparameter water quality meter to measure dissolved oxygen, oxidation reduction potential, temperature, pH, electrical conductivity, turbidity, total dissolved solids, ammonium nitrogen, nitrate nitrogen, chloride, atmospheric pressure, and flow.
- 11.7.7 Spring and autumn Macroinvertebrate surveys are proposed at the watercourse sampling locations to identify the composition of the Macroinvertebrate community to enable the calculation of different quality indices for biodiversity, overall water quality, flow conditions, acidification, siltation, morphology, salinity and the community conservation importance.
- 11.7.8 In addition, suspended solids will be sampled using an automatic sampler and sent for laboratory analysis, and water samples will be obtained from watercourse sampling locations for laboratory analysis to quantify total nitrogen levels.
- 11.7.9 The intensity and duration of the monitoring will vary depending on the phase of the development. The monitoring regime is set out in the Water Quality Outline Monitoring and Management Plan.
- 11.7.10 The organisation responsible for maintaining the POS and Strategic SuDS will produce an annual maintenance report summarising the maintenance activities completed by the maintenance contractor and the results of the surface water quality monitoring. The ongoing maintenance and monitoring regime will be agreed with Eastleigh Borough Council, the Environment Agency and Natural England.
- 11.7.11 If, or when, the SuDS scheme has been fully adopted by the Southern Water which has a statutory responsibility for the maintenance and monitoring of adopted drainage systems the scheme may need to be revised.

11.7.12 There is an opportunity for adaptive management to ensure that, if an issue is identified, targeted adaptive mitigation measures can be put in place. Adaptive mitigation measures include:

- Enhanced management including increased sediment / vegetation removal frequencies;
- Enhanced planting of Strategic SuDS features to increase sediment entrapment or nutrient uptake;
- Retrofit Source Control in problem areas;
- Retrofit hydrodynamic vortex separators in problem areas; and
- Education / enforcement if pollution is as a result of unconsented activities on the Site.

11.7.13 The CEMP will include monitoring of on-site watercourses to establish sediment loadings being discharged downstream. A management plan will be put in place to ensure that silt management techniques are working effectively and include alternative working methods.

11.7.14 The water quality monitoring, management plan and CEMP can be secured by way of a planning condition.

11.7.15 The delivery of OPA Phase 1 will test the effectiveness of construction management mitigation measures and through implementation of the monitor-manage feedback loop these measures can be refined for future phases of the Wider OPA.

Occupation Measures

11.7.16 The delivery of OPA Phase 1 will test the effectiveness of the design mitigation measures and through implementation of monitor-manage feedback loop these can be taken forward into future phases of the Wider OPA.

The Wider OPA

Construction Measures

Surface Water Quality Monitoring

11.7.17 The monitoring and management plan is a means of assessing and confirming the effectiveness of mitigation measures to downstream surface water quality and is necessary to be taken forward throughout the delivery of the Wider OPA due to the sensitivity of downstream designated sites.

11.7.18 The monitoring and management measures described above would be applied as part of the Wider OPA as set out in the Water Quality Outline Monitoring and Management Plan produced by Johns Associates contained in Appendix 11.5 of Volume 2 of the ES.

Occupation Measures

11.7.19 An ongoing water quality monitoring and management plan is proposed to monitor the effectiveness of the SuDS system at removing fine sediment and nutrients from surface water runoff as the Wider OPA is delivered. Through implementation of the monitor-manage feedback loop, management measures can be refined to mitigate the effect of the Wider OPA.

11.8 RESIDUAL ENVIRONMENTAL IMPACTS & EFFECTS

11.8.1 This section assesses the residual environmental effects after taking into account the proposed design mitigation and additional mitigation outlined above.

OPA Phase 1

Construction Effects

Surface Water Drainage and Flood Risk

11.8.2 Taking into account the measures outlined above which will be incorporated into a CEMP and supported by monitoring and adaptive management the impact magnitude of the effect of the construction of OPA Phase 1 on surface water drainage regime and the resultant flood risk implications in the receiving water bodies is assessed as is Very Low to Negligible. The effect significance is therefore assessed as **Neutral to Moderate Adverse**. The effects of the disruption to the surface water drainage regime are considered to be temporary, and reversible with time as OPA Phase 1 is built out and permanent mitigation measures are fully implemented. It is concluded the effects of construction activities on flood risk and drainage are mitigated to an acceptable level and the effects are not deemed significant.

Surface Water and Environmental Quality

11.8.3 Taking into account the measures outlined above which will be incorporated into a CEMP and supported by monitoring and adaptive management the impact magnitude of the effect of the construction of OPA Phase 1 on downstream surface water quality is assessed as Low to Negligible. The measures set in the CEMP and enhanced monitoring reduce the risk of pollution occurring to a low as possible. However, the risk of a pollution event can never be eliminated. The effect significance is therefore assessed as **Neutral to Moderate Adverse**. It is concluded the temporary effects of construction activities on downstream surface water quality are mitigated to an acceptable level and the effects are not deemed significant.

Occupation Effects

Surface Water Drainage and Flood Risk

11.8.4 The provision of a water management strategy, involving the implementation of SuDS incorporating attenuation and flow controls and Source Control measures will reduce the impact magnitude of OPA Phase 1 on flood risk and drainage to between Negligible to Low Beneficial. The effect significance of the operation of OPA Phase 1 on flood risk on-site and off-site is assessed as **Neutral to Moderate Beneficial**. The benefits to off-site flood risk will be permanent.

Surface Water and Environmental Quality

11.8.5 The provision of a water management strategy, involving the implementation of Strategic and Source Control SuDS to intercept contaminated runoff and provide a degree of pollution treatment supported by monitoring and targeted adaptive management will reduce the impact magnitude of the effect of OPA Phase 1 on downstream surface water quality to between Very Low to Negligible. The risk of a pollution event can never be eliminated but due to the low risk nature of the proposed land use the risk of pollution is Low. The effect significance of the operation of OPA Phase 1 on downstream surface water quality is assessed as **Moderate Adverse to Neutral**. It is concluded the permanent effects of the operation of the development on downstream surface water quality are mitigated to an acceptable level and the effects are not deemed significant.

11.8.6 The cessation of agricultural activities, connection of foul water to a Peel Common WwTW and application of a SuDS Management Train to on-site surface water management reduces the effect of the OPA Phase 1 on nutrient loadings to Very Low. The effect significance of the operation of OPA Phase 1 on downstream nutrient loadings and in the designated sites is assessed as **Moderate**. This effect is considered temporary and the significance of the effect would reduce to **Neutral to Moderate Beneficial** when permanent 'Nitrate Neutrality' and net reduction is achieved as part of the Wider OPA.

The Wider OPA

Construction Effects

Surface Water Drainage and Flood Risk

11.8.7 Taking into account the measures outlined above which will be incorporated into a CEMP and supported by monitoring and adaptive management the impact magnitude of the effect of the construction of the Wider OPA on surface water drainage regime and the resultant flood risk

implications in the receiving water bodies is assessed as is Very Low to Negligible. The effect significance is therefore assessed as **Neutral to Moderate Adverse**. The effects of the disruption to the surface water drainage regime are considered to be temporary, and reversible with time as Wider OPA is built out and permanent mitigation measures are fully implemented. It is concluded the effects of construction activities on flood risk and drainage are mitigated to an acceptable level and the effects are not deemed significant.

Surface Water and Environmental Quality

11.8.8 Taking into account the measures outlined above which will be incorporated into a CEMP and supported by monitoring and adaptive management the impact magnitude of the effect of the construction of the Wider OPA on downstream surface water quality is assessed as Low to Negligible. The measures set in the CEMP and enhanced monitoring reduce the risk of pollution occurring to a low as possible. However, the risk of a pollution event can never be eliminated. The effect significance is therefore assessed as **Neutral to Moderate Adverse**. It is concluded the temporary effects of construction activities on downstream surface water quality are mitigated to an acceptable level and the effects are not deemed significant.

Occupation Effects

Surface Water Drainage and Flood Risk

11.8.9 The provision of a water management strategy, involving the implementation of SuDS incorporating attenuation and flow controls and Source Control measures will reduce the impact magnitude of Wider OPA on flood risk and drainage to between Negligible to Medium Beneficial. The effect significance of the operation of Wider OPA on flood risk on-site and off-site is assessed as **Neutral to Major Beneficial**. The benefits to off-site flood risk will be permanent.

Surface Water and Environmental Quality

11.8.10 The provision of a water management strategy, involving the implementation of Strategic and Source Control SuDS to intercept contaminated runoff and provide a degree of pollution treatment supported by monitoring and targeted adaptive management will reduce the impact magnitude of the effect of Wider OPA on downstream surface water quality to between Very Low to Negligible. The risk of a pollution event can never be eliminated but due to the low risk nature of the proposed land use the risk of pollution is Low. The effect significance of the operation of Wider OPA on downstream surface water quality is assessed as **Moderate Adverse to Neutral**. It is concluded the permanent effects of the operation of the development on downstream surface water quality are mitigated to an acceptable level and the effects are not deemed significant.

11.8.11 The cessation of agricultural activities, connection of foul water to a Peel Common WwTW and application of a SuDS Management Train to on-site surface water management reduces the effect of the Wider OPA on nutrient loadings to between Negligible and Medium Beneficial. The effect significance of the operation of the Proposed Development on downstream nutrient loadings and in the designated sites is assessed as **Neutral to Major Beneficial**. This effect is considered permanent.

11.9 CUMULATIVE EFFECTS

11.9.1 Cumulative and in-combination effects can result from a combination of impacts, which on their own may not be significant but when combined with others, could generate significant effects.

11.9.2 In-combination effects arise where effects from one environmental element bring about changes in another environmental element. With respect to surface water drainage and flooding a change in the hydrology and downstream surface water quality as a result of the Proposed Development can effect aquatic habitats and therefore have wider ecological implications.

11.9.3 It is necessary to assess the effects of the development taking into account the potential cumulative and in-combination effects as a result of other developments in the vicinity of the Site. Due to the nature of the potential effect of development on hydrology and flood risk it is considered that a cumulative or in-combination effect can only occur if the other development sites (and therefore their effects) are within the same surface water drainage catchment or wider river catchment of the Site. The effects of development on surface water drainage and flood risk are limited to within the same surface water or river catchment and cross catchment effects are rare.

11.9.4 On this basis it is possible to scope out development sites situated outside of the natural drainage catchment of the Site and the development sites which fall outside of the River Itchen catchments. Sites not assessed further include:

- Land off Botley Road, West End, Southampton
- Land at Hedge End North, Winchester Road, Botley, Southampton (Land north west of Boorley Green)
- Land to North and East of Boorley Green, Winchester Road, Botley, Southampton SO32 2UA

- Land west of Woodhouse Lane
- Land South of Maddoxford Lane, Boorley Green, Botley, Southampton, SO32 2DB,
- Land to the south of Maddoxford Lane and west of Westfield, Boorley Green, Botley, SO32 2DB
- Land to the North and East of Winchester Street, Botley
- Land at Woodhouse Lane and to the North and East of Botley Village, Eastleigh
- Land off St Johns Road, South of Foord Road, Hedge End, Southampton SO30 4DG
- Serenity, Heath House Lane, Hedge End, Southampton, SO30 0LE
- Land west of Waylands Place and north of Peewit Hill Close, Hedge End, SO31 1DJ
- Land at Park Farm/North Stoneham Park Stoneham Lane, Eastleigh, SO50 9HS
- Land south of Chestnut Avenue north Stoneham Park, Chestnut Avenue, Stoneham Lane, Eastleigh
- Land South of Bursledon Road, Bursledon, Southampton

11.9.5 Sites which require further assessment include:

- One Horton Heath Utilities Enabling Works – Underground cabling
- Allington Lane, Burnetts Lane and Bubb Lane access
- Chalcroft Business Park, Burnetts Lane, West End
- Pembers Hill Farm, Mortimers Lane, Fair Oak, Eastleigh SO50 7EA
- Southampton International Airport, Mitchell Way, Eastleigh,
- The Mount Hospital, Church Road, Bishopstoke
- Eastleigh Police Station, 18-24 Leigh Road, Eastleigh, SO50 9DG

11.9.6 It is considered the effect of other developments and mitigation measures will not change the sensitivity, importance or value of receptors. The cumulative assessment will therefore focus on the effects of the other developments on affecting the magnitude or severity of the effect.

The effects of the Proposed Development identified in the section above are considered to occur regardless of the presence of the other development sites.

Design of Cumulative Assessment Sites

11.9.7 The basis of the assessment for cumulative and in-combination effects is that the other developments will deliver mitigation measures to address their effects on hydrology and flood risk. Government Planning Policy ensures that the significance of the residual effects of new development on surface water drainage and flood risk is minimised following the construction of suitably designed surface water drainage systems, application of SuDS and pollution prevention principles. Thus, the cumulative effects of several developments in an area should have 'Neutral' effect on surface water drainage and flood risk, provided government planning policy, industry best practice and Environment Agency Guidance are complied with.

11.9.8 In order to assess the cumulative and in-combination effects of the other developments their drainage strategies for the above developments are summarised in Table 11.5 below.

Table 11.5: Summary of Other Sites Drainage and Flood Risk Management Strategy

Development Site	Summary of Drainage and Flood Risk Management Strategy
One Horton Heath Utilities Enabling Works – Underground cabling	Works are related to the diversion of electricity cables and water mains which cross the Site. Works are underground which will have negligible flood risk implications. No drainage proposed.
Allington Lane, Burnetts Lane and Bubb Lane access	The Site access was consented under application references O/14/75735 and O/16/79354. The site access from Bubb Lane and Burnetts Lane. The road is drained via deep trapped gullies, detention basins and attenuation tanks with runoff restricted to greenfield runoff rates (Q_{MED}) up to and including the 100 year critical storm. The Bubb Lane drainage system connects into an existing highway drainage system. The Burnetts Lane drainage system drains onto watercourses on-site in the vicinity of Phase 1. No significant flood risk constraints are identified in this access work. The Allington Lane site access is drained via deep trapped gullies and a detention basin with runoff restricted to greenfield runoff rates (Q_{MED}) up to and including the 100 year critical storm. The drainage system drains into an existing ditch adjacent to Allington lane. No significant flood risk constraints are identified in this access work. No foul water drainage is proposed as part of the site access work. No significant flood risks constraints were identified.
Chalcroft Business Park, Burnetts Lane, West End	Chalcroft Business Park is located on the site's southern boundary. The redevelopment proposals drain via a combination of infiltration drainage (where ground conditions allow) and attenuation drainage. Infiltration drainage is in the form of porous pavement. Attenuation drainage utilises the sub base of the porous pavement for storage with a discharge to the watercourse which forms the boundary with the Site or a below ground

	attenuation tank which connects into the existing drainage network. Both situations discharge at greenfield runoff rates (Q_{BAR}). It is proposed that the foul water will discharge to the public sewer system proposed as part of the Proposed Development. As an interim solution an on-site package treatment plant is proposed to manage the domestic drainage and an effluent storage tank to receive trade effluent. No significant flood risks constraints were identified on the redevelopment area. To mitigate surface water flooding it is proposed to lower hardstanding yards and open spaces 0.5m lower than nearby buildings.
Pembers Hill Farm, Mortimers Lane, Fair Oak, Eastleigh SO50 7EA	Surface water drainage consists of a series of SuDS attenuation basins and attenuation tanks which discharge at greenfield rates (Q_{BAR}) into an on-site watercourse which falls within the Fair Oak Stream catchment. The SuDS attenuation basins are enhanced with bio-retention areas and sediment forebays designed to provide the required level of treatment. A vortex separator is provided prior to discharging to an existing drainage ditch. Foul water discharges into the public sewer network on Mortimers Lane. No significant flood risks constraints were identified.
Southampton International Airport, Mitchell Way, Eastleigh,	Surface water drainage is via geocellular storage combined with an infiltration drainage field and permeable paving. A bypass interceptor and penstock valve are contained in the below ground drainage system consistent with the wider airport drainage system. No foul water drainage is proposed as part of the runway or car park extension. No significant flood risks constraints were identified.
The Mount Hospital, Church Road, Bishopstoke	Surface water will be disposed of by means of infiltration utilising porous pavement and areas of geocellular storage. Existing drainage system will be utilised with discharge to the River Itchen albeit serving a smaller area. Rainwater harvesting systems will be designed for toilet flushing and irrigation based on 5% development roof area. It is proposed that the foul water will discharge to the public sewer system which is within the Chickenhall WwTW catchment. This appears to be via an indirect connection to an existing private sewer on the site. No significant flood risks constraints were identified.
Eastleigh Police Station, 18-24 Leigh Road, Eastleigh, SO50 9DG	Surface water will be disposed of by means of infiltration and would utilise permeable paving and shallow geocellular soakaways. It is proposed that the foul water will discharge to the public sewer system within Leigh Road. No significant flood risks constraints were identified.

Cumulative Effects from Construction

11.9.9 It is assumed that during the construction phase for other development sites best practice construction site management with adequate contingency planning, and following the

principles of pollution prevention which will be formalised and incorporated into a CEMP. The CEMP will be implemented and adhered to during the construction of these schemes. These measures will reduce the risk of a pollution event occurring and reduce the disruption of surface water drainage regime and the resultant flood risk implications in the receiving water bodies.

11.9.10 The cumulative effect significance of construction activities on flood risk, drainage and surface water quality is therefore assessed as **Neutral to Moderate Adverse**. The risk of an accidental pollution incident can never be completely removed and would be temporary and reversible in time.

Cumulative Effects from Operation

11.9.11 The cumulative impact of operation of the development and nearby development sites on flood risk, drainage and surface water quality receptors is assessed in Table 11.6 below.

Table 11.6: Cumulative impact of operation of the development and other development sites

Development Site	Summary of Cumulative Operation Effects
One Horton Heath Utilities Enabling Works – Underground cabling	Once operational the utilities infrastructure will have a negligible effect on the water environment with very limited opportunity for flood risk and drainage effects to interact between the two schemes. The cumulative effect is therefore Neutral .
Allington Lane, Burnetts Lane and Bubb Lane access	Surface Water Drainage - The proposed water management strategy is consistent with the attenuation based drainage strategy for the site accesses. Taking into account the attenuation storage and flow control on both schemes the significance of the cumulative effect is assessed at Neutral to Major Beneficial. Foul Water Drainage – No foul water drainage proposed therefore Neutral cumulative effect. Flood Risk – No flood hazards are considered to interact and cumulative effect is Neutral
Chalcroft Business Park, Burnetts Lane, West End	Surface Water Drainage - The proposed water management strategy is consistent with the attenuation based drainage strategy for the redevelopment of the Chalcroft Business Park. Taking into account the attenuation storage and flow control on both schemes the significance of the cumulative effect is assessed at Neutral to Major Beneficial. Foul Water Drainage – The reliance on a private package treatment plant will result in a Very Low magnitude of change on nutrient loadings to the downstream watercourse. The proposed Development relies on a connection into the public sewer network in the adjacent catchment. Consequentially the cumulative effect is Neutral. Flood Risk – No flood hazards are considered to interact and cumulative effect is Neutral
Pembers Hill Farm, Mortimers Lane, Fair Oak, Eastleigh SO50 7EA	The Pembers Hill Farm site is located upstream of the Proposed Development. Surface Water Drainage - Taking into account the attenuation storage and flow control on both schemes the significance of the cumulative effect is assessed at Neutral to

	Major Beneficial. Foul Water Drainage - Foul sewerage from the Pembers Hill Farm development likely drains to the Chickenhall WwTW and could increase nutrient load on the receiving River Itchen. The proposed Development relies on a connection into the public sewer network in the adjacent catchment. Consequentially the cumulative effect is Neutral. Flood Risk – Site is remote from the Proposed Development and no flood hazards are considered to interact and cumulative effect is Neutral.
Southampton International Airport, Mitchell Way, Eastleigh,	Surface Water Drainage – Southampton Airport scheme drains via infiltration devices and is remote form the Proposed Development and therefore cumulative effect is Neutral. Foul Water Drainage - No foul water drainage proposed therefore Neutral cumulative effect. Flood Risk – Site is remote from the Proposed Development and Flood no flood hazards are considered to interact and cumulative effect is Neutral.
The Mount Hospital, Church Road, Bishopstoke	Surface Water Drainage – The Mount Hospital scheme drains predominately via infiltration drainage and maintains an existing positive outflow to the River Itchen at greenfield rates and is remote from the site. The cumulative effect is Neutral. Foul Water Drainage - Foul sewerage from the Mount Hospital development drains to the Chickenhall WwTW and could increase nutrient load on the receiving River Itchen. The proposed Development relies on a connection into the public sewer network in the adjacent catchment. Consequentially the cumulative effect is Neutral. Flood Risk – Site is remote from the Proposed Development and Flood no flood hazards are considered to interact and cumulative effect is Neutral.
Eastleigh Police Station, 18-24 Leigh Road, Eastleigh, SO50 9DG	Surface Water Drainage – The Eastleigh Police Station redevelopment drains via infiltration devices and is remote form the Proposed Development and therefore cumulative effect is Neutral. Foul Water Drainage - Foul sewerage from the Eastleigh Police Station redevelopment drains to the Chickenhall WwTW and could increase nutrient load on the receiving River Itchen. The proposed Development relies on a connection into the public sewer network in the adjacent catchment. Consequentially the cumulative effect is Neutral. Flood Risk – Site is remote from the Proposed Development and Flood no flood hazards are considered to interact and cumulative effect is Neutral.

11.9.12 The proposed mitigation measures set out in the section above relating to the Proposed Development will complement the other developments' mitigation measures, minimising the cumulative effects of various schemes across the wider watercourse catchment.

11.9.13 With mitigation measures in place (as set out in the section above) the overall significance of the cumulative and in-combination effect of other development and the proposed development

on surface water drainage, flood risk and environmental quality of on-site watercourses should be **Neutral**.

11.10 IMPACT OF CLIMATE CHANGE

11.10.1 The mitigation measures set out in this assessment and supporting FRA have considered the effects of climate change and the residual environmental effects set out above are considered to be representative of the residual environmental effect of the Proposed Development on the water environment taking into account climate change.

Effect of Climate Change on Flood Risk

11.10.2 The allowances for climate change on peak river flow and peak rainfall intensities are in accordance with the Environment Agency's guidance entitled 'Flood risk assessments: climate change allowances'.

11.10.3 The Flood Risk Assessment includes an assessment of climate change on flood hazards on the Site. The proposed built development is designed to be located in Very Low areas of flood risk from watercourses taking into account the effects of climate change.

11.10.4 The water management system has been designed to take into account the effects of climate change on peak rainfall intensities.

11.10.5 The flood risk and drainage mitigation measures set out in this report and supporting FRA take into account the effects of climate change and are designed to continue to function throughout the lifetime of the development.

Effect of Climate Change on Water Quality

11.10.6 The effect of climate change on designated sites downstream is likely to be complex and manifest in multiple ways generally increasing pressures across the whole catchment. It is likely to reduce the designated sites resilience to change and will likely could become increasing sensitive over time. For example, increasing water temperatures will result in reduction in dissolved oxygen levels which can have detrimental effects throughout the aquatic ecosystem.

11.10.7 For the purposes of this assessment the designated sites are already classified as Very High sensitivity. The effects of climate change are very unlikely to have a beneficial effect on downstream designated sites.

11.10.8 To ensure the quality of designated sites downstream of the Site do not deteriorate additional mitigation is proposed in the section above. The mitigation measures proposed are considered to be resilient to the effects of climate change and are designed to continue to function throughout the lifetime of the development.

11.11 ASSESSMENT SUMMARY

11.11.1 Table 11.7 below summarises the impacts and effects, mitigation and residual effects of the Proposed Development on flood risk, surface water drainage and surface water quality.

11.11.2 Table 11.8 below summarises the proposed additional mitigation and how it is to controlled, implemented and verified.



Table 11.7: Hydrology Assessment Summary

Environmental Effect	Sensitivity of Receptor	Nature of Impact	Impact Magnitude	Significance	Additional Mitigation	Residual Impact Magnitude	Residual Significance of Effect
OPA PHASE 1							
CONSTRUCTION EFFECTS							
<u>Flood risk to downstream persons and property</u> A CEMP containing site management measures and through the phasing of the delivery of the surface water drainage and flood mitigation measures will minimise effect on site drainage.	Very High	Temporary	Negligible to Very Low Adverse	Neutral to Moderate Adverse	-	Negligible to Very Low Adverse	Neutral to Moderate Adverse
<u>Surface Water Quality</u> Adoption of best practice construction site management with adequate contingency planning, following the principles of pollution prevention will be formalised and incorporated into a CEMP to reduce the risk of a pollution event occurring from potentially polluting construction activities.	Medium to Very High	Temporary	Negligible to Low Adverse	Neutral to Moderate Adverse	Surface water quality monitoring and management plan	Negligible to Low Adverse	Neutral to Moderate Adverse
OPERATION EFFECTS							
<u>Flood risk to downstream persons</u>	Very High	Permanent	Negligible to Low Beneficial	Neutral to Moderate	-	Negligible to Low Beneficial	Neutral to Moderate

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<u>and property</u> Provision of a surface water drainage system based on SuDS principles to attenuate and release runoff at controlled rate and sequentially designed site layout				Beneficial			Beneficial
<u>Surface Water Quality</u> Surface water drainage system based on SuDS principles to intercept and provide pollution treatment	Medium to Very High	Permanent	Negligible to Low Adverse	Neutral to Moderate Adverse	Surface water quality monitoring and management plan	Negligible to Very Low Adverse	Neutral to Moderate Adverse
<u>Nutrients</u> Connection to public sewer draining to Peel Common WwTW and delivering on-site and off-site nutrient mitigation.	Very High	Temporary	Very Low	Moderate Adverse	Deliver 'Nutrient Neutrality' and net reduction as part of Wider OPA	Negligible to Medium Beneficial	Neutral to Major Beneficial
WIDER OPA							
CONSTRUCTION EFFECTS							
<u>Flood risk to downstream persons and property</u> A CEMP containing site management measures and through the phasing of the delivery of the surface water drainage and flood mitigation measures will minimise effect on site drainage.	Very High	Temporary	Negligible to Very Low Adverse	Neutral to Moderate Adverse	-	Negligible to Very Low Adverse	Neutral to Moderate Adverse

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<u>Surface Water Quality</u> Adoption of best practice construction site management with adequate contingency planning, following the principles of pollution prevention will be formalised and incorporated into a CEMP to reduce the risk of a pollution event occurring from potentially polluting construction activities.	Medium to Very High	Temporary	Negligible to Low Adverse	Neutral to Moderate Adverse	Surface water quality monitoring and management plan	Negligible to Low Adverse	Neutral to Moderate Adverse
OPERATION EFFECTS							
<u>Flood risk to downstream persons and property</u> Provision of a surface water drainage system based on SuDS principles to attenuate and release runoff at controlled rate and sequentially designed site layout	Very High	Permanent	Negligible to Medium Beneficial	Neutral to Major Beneficial	-	Negligible to Medium Beneficial	Neutral to Major Beneficial
<u>Surface Water Quality</u> Surface water drainage system based on SuDS principles to intercept and provide pollution treatment	Medium to Very High	Permanent	Negligible to Low Adverse	Neutral to Moderate Adverse	Surface water quality monitoring and management plan	Negligible to Very Low Adverse	Neutral to Moderate Adverse
<u>Nutrients</u> Connection to public sewer draining to Peel Common WwTW and	Very High	Permanent	Negligible to Medium Beneficial	Neutral to Major Beneficial	-	Negligible to Medium Beneficial	Neutral to Major Beneficial

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delivering on-site and off-site nutrient mitigation.							
Cumulative Effects							
Effect	Description			Mitigation		Significance	
Flood risk to downstream persons and property	Effect of multiple schemes on runoff rates and resultant flood risk.			All schemes incorporate appropriate mitigation measures consisting of attenuation SuDS and flow control or infiltration drainage.		Neutral	
Surface Water Quality	Effect of multiple schemes on downstream surface water and environmental quality primarily from fine sediment and nutrients.			Implementing a CEMP and delivering nitrite neutral development and discharging foul water to Peel Common WwTW.		Neutral	
Impact of Climate Change							
Effect	Description			Mitigation		Significance	
Increase peak river flow and peak rainfall intensities	The design of flood risk and drainage mitigation measures take into account the effects of climate change and are designed to continue to function throughout the lifetime of the development.			Sequential site layout design + SuDS		Negligible	
Surface water quality in designated sites	The effect of climate change on water quality and overall resilience of an aquatic ecosystem is complex is very likely to become increasing sensitive over time. The mitigation measures proposed are considered to be resilient to the effects of climate change and are designed to continue to function throughout the lifetime of the development.			SuDS + surface water quality monitoring and management		Negligible	



Table 11.8: Mitigation Implementation

Mitigation Measure	Implementing Agent(s)	Legal Instrument	Compliance Target	Implementation Timescale
OPA Phase 1				
CEMP	Principal Contractor	Planning Condition	Compliance with WFD assessment criteria	Construction Phase
SuDS	Developer/Principal Contractor	Planning Condition	Surface water quality monitoring and management feedback loop	Lifetime of development / Phased delivery
Appropriately designed watercourse crossings	Developer/Principal Contractor	Planning Condition / Land Drainage Consent	Compliance with Land Drainage Consent	Construction Phase
Surface water quality monitoring	Developer/Principal Contractor	Planning Condition	Compliance with WFD assessment criteria	Construction Phase through to Operation
Connection to Peel Common WwTW	Developer	Planning Condition / S106 / S98	Compliance with Planning Condition on Foul Water Drainage Strategy	Lifetime of development / Phased delivery
Wider OPA				
CEMP	Principal Contractor	Planning Condition	Compliance with WFD assessment criteria	Construction Phase
SuDS	Developer/Principal Contractor	Planning Condition	Surface water quality monitoring and management feedback loop	Lifetime of development / Phased delivery
Appropriately designed watercourse crossings	Developer/Principal Contractor	Planning Condition / Environmental Permit /Land Drainage Consent	Compliance with Environmental Permit /Land Drainage Consent	Construction Phase
Surface water quality monitoring	Developer/Principal Contractor	Planning Condition	Compliance with WFD assessment criteria	Construction Phase through to Operation
Connection to Peel Common WwTW	Developer	Planning Condition / S106 / S98	Compliance with Planning Condition on Foul Water Drainage Strategy	Lifetime of development / Phased delivery