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OP5 APPENDIX 15.2 - **WATER CYCLE STUDY**

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Technical Glossary

- **Abstraction Licensing Strategies (ALS)** - The production of a strategy by the Environment Agency (EA) to assess and improve the amount of water that is available on a catchment scale. Formerly referred to as Catchment Abstraction Management Strategies (CAMS), the latest ALS can be found at: https://www.gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process/
- **Affinity Water (AW) –** A potable water supply company, supplying water to consumers within the south east region of the UK.
- **Albion Water Limited (AWL)** – A small water company with potable and wastewater supply and treatment capabilities within the south east region of the UK.
- **Asset Management Period (AMP)** - A period of five years in which water companies implement planned upgrades and improvements to their asset base. For example, AMP5 is 2010-2015 and AMP6 is 2015-2020.
- **Biochemical Oxygen Demand (BOD)** – A measure of the oxygen demand that results from bacteria breaking down organic carbon compounds in water. High levels of BOD can use up oxygen in a watercourse, to the detriment of the ecology.
- **Combined Sewer Overflow (CSO)** – A point on the sewerage network where untreated wastewater is discharged during storm events to relieve pressure on the network and prevent sewer flooding. Sewerage systems that are not influenced by storm water should not require a CSO.
- **Deployable Output** – The amount of water that can be abstracted from a source (or bulk supply) as constrained by the environment, license, pumping plant and well/aquifer properties, raw water mains, transfer, treatment and water quality.
- **Discharge Consent** – A consent issued and reviewed by the EA which permits an organisation or individual to discharge sewage effluent or trade effluent into surface water, groundwater or the sea. Volume and quality levels are set to protect water quality, the environment and human health.
- **Dry Weather Flow (DWF)** – An estimation of the flow of wastewater to a Water Recycling Centre during a period of dry weather. This is based on the 20th percentile of daily flow through the works over a rolling three year period.
- **Dry Year Critical Period (DYCP)** – The period of time during which the customer experiences the greatest risk of loss of potable water supply, during a year of rainfall below the long-term average (characterised with high summer temperatures and high demand).
- **Environment Agency (EA)** – A non-departmental government body with responsibilities relating to the protection and enhancement of the environment in England. Acts as a stakeholder for the environmental impacts of any proposed development.
- **Eutrophication** – Higher than natural levels of nutrients in a watercourse, which may lead to the excessive build-up of plant life (especially algae). Excessive algal blooms remove valuable oxygen from the watercourse, block filters at water recycling centres, affect the taste and smell of water, and can be toxic to other wildlife.
- **Folkestone and Hythe District Council (F&HDC)** – The Local Planning Authority responsible for the review and decision process for the outline planning application for developments within this area.
- **General Quality Assessment (GQA)** – The current assessment method used by the EA to describe the chemical and biological quality of watercourses, along with nutrient levels and aesthetic quality.
- **Habitats Directive** - Promotes biodiversity by requiring measures to be taken to maintain or restore natural habitats and wild species to a favourable conservation status, introducing robust protection for those habitats and species of European importance.
- **Lead Local Flood Authority (LLFA)** – A unitary or county council responsible for the development of a coordinated management of flooding across their region as well as providing guidance to major planning applications from a surface water management and flood risk perspective. Kent County Council is the LLFA for Otterpool Park.

- **Local Plan** – A document outlining the spatial planning strategy for each local authority. The Local Plan will contain a number of statutory documents setting out the long-term planning and land use policies for a given area.
- **Local Nature Reserve (LNR)** – Are areas with wildlife or geological features that are of special interest locally. Details of LNR can be found at http://www.natureonthemap.org.uk/.
- **National Nature Reserve (NNR)** – Are areas of national importance, protected because they are amongst the best examples of a particular habitat in the country. Details of NNR can be found at http://www.natureonthemap.org.uk/.
- **National Planning Policy Framework (NPPF)** - The National Planning Policy Framework, updated in 2021, sets out the government's planning policies for England and how these are expected to be applied. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.
- **Natura 2000 Sites** - Natura 2000 is a network of core breeding and resting sites for rare and threatened species and some rare natural habitat types which are protected in their own right. It stretches across all 28 EU countries, both on land and at sea. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats, listed under both the Birds Directive and the Habitats Directive. More information is available at: http://ec.europa.eu/environment/nature/natura2000/index_en.htm.
- Nutrient Neutrality – An approach that involves the key nutrients (nitrogen and/or phosphorus) arising from all surface water runoff and wastewater generated by the proposed development is less than or equal to the nutrients generated by the existing land uses and wastewater discharges in the same hydrological catchment.
- **New Appointment and Variation (NAV)** - Are limited companies which provide a water and/or sewerage service to customers in an area which was previously provided by the incumbent monopoly provider. A new appointment is made when a limited company is appointed by Ofwat to provide water and/or sewerage services for a specific geographic area.
- **Optant –** In terms of water supply the term optant is used to describe customer driven water reducing measures. A customer can choose to use these measures under recommendation from the water supplier.
- **Per Capita Consumption (PCC)** – The volume of water used by one person over a day, expressed in units of litres per person per day (l/p/d).
- **Population Equivalent** – A method of measuring the loading on a Water Recycling Centre and is based on a notional population comprising; resident population, a percentage of the transient population, cessed liquor input expressed in population, and trade effluent expressed in the population.
- **Potable Water** – Water that is fit for drinking, being free of harmful chemicals and pathogens. Raw water can be potable in some instances, although it usually requires treatment of some kind to bring it up to this level.
- **Raw Water** - Water taken from the environment, which is subsequently treated or purified to produce potable water.
- **River Basin Management Plans (RBMP)** – Documents being produced for consultation by each of the EA regions to catalogue the water quality of all watercourses and set out actions to ensure they achieve the ecological targets stipulated in the WFD.
- **River Ecosystem (RE) Targets** – Are the targets used to assess quality against the below mentioned RQO.
- **River Quality Objective (RQO)** - Targets for all rivers in England and Wales that specify the water quality needed in rivers if we are to be able to rely on them for water supplies, recreation and conservation.
- **Site of Special Scientific Interest (SSSI)** - An area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure). A map showing all SSSI sites can be found at: http://www.natureonthemap.org.uk/.
- **Southern Water (SW)** – A large-scale water company responsible for supplying potable water and treating wastewater within the south and south-east region of the UK.

- **Source Protection Zones (SPZ)** - Zones designated around public drinking water abstractions and sensitive receptors which detail risk to the groundwater zone they protect.
- **Special Area for Conservation (SAC)** - A site designated under the European Community Habitats Directive, 1991, to protect internationally important natural habitats and species. A map showing all SAC sites can be found at http://www.natureonthemap.org.uk/.
- **Special Protection Area (SPA)** - Sites classified under the European Community Directive on Wild Birds to protect internationally important bird species. A map showing all SPA sites can be found at: http://www.natureonthemap.org.uk/.
- **Strategic Flood Risk Assessment (SFRA)** – A document required by the National Planning Guidance published in March 2014 that informs the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations.
- **Strategic Housing Market Assessment (SHMA)** - A study of local housing markets to assess needs and demand for different types of housing in the District.
- **Surface Water Management Plans (SWMP)** – Assist in the assessment of flood risk to ensure that increased levels of development, and climate change, do not have an adverse impact on flooding from surface water sources within the catchment. SWMP were introduced following the severe flooding in 2007, as means for Local Authorities to take the lead in reducing flood risk.
- **Sustainable Drainage Systems (SuDS)** – A combination of physical structures and management techniques designed to drain, attenuate, and in some cases treat, runoff from urban (and in some cases rural) areas.
- **Target Headroom** - The threshold of minimum acceptable headroom, which would trigger the need for water management options to increase water available for use or decrease demand.
- **Urban Wastewater Treatment Directive (UWWTD) 1991** – A European Union directive (91/271/EEC) which sets treatment levels on the basis of sizes of wastewater discharges and the sensitivity of waters receiving the discharges. Under the Directive, the UK is required to review environmental waters at four-yearly intervals to determine whether they are sensitive to the effects of wastewater discharges.
- **Water Available for Use (WAFU)** – The amount of water remaining after allowable outages and planning allowances are deducted from the deployable output in a WRZ.
- **Water Cycle Study (WCS)** – a document that is produced as part of the pre-planning documents that allow the Local Planning Authority to make an informed decision and recommendations regarding water supply and wastewater treatment as a result of proposed development. A WCS provides an indication of the most up to date requirements for the water cycle management and infrastructure impacts.
- **Water Framework Directive (WFD) (2000)** - A European Union directive (2000/60/EC) which commits member states to make all water bodies of good qualitative and quantitative status by 2015. The WFD could have significant implications on water quality and abstraction. Important dates for the WFD are:

  2015

  - Meet environmental objectives;
  - First management cycle ends;
  - Second river basin management plan and first flood risk management plan.

  2021

  - Second management cycle ends.

  2027

  - Third management cycle ends, final deadline for meeting objectives.
- **Water Neutrality** – The concept of offsetting demand from new developments by making existing homes and buildings more water efficient.
- **Water Resource Zone (WRZ)** – Are areas based on the existing potable water supply network and represent the largest area in which water resources can be shared.

- **Wastewater** - Is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture.
- **Wastewater Treatment Works (WwTW)** – Facility which treats waste water through a combination of physical, biological and chemical processes.
- **Water Resource Management Plan (WRMP)** - The Water Resource Management Plans are studies undertaken by every water company in England to determine the availability of water resources for the next 25 years. WRMPs can be found on most water company websites.
- **Water Sensitive Urban Design (WSUD)** - A land planning and engineering design approach which integrates the urban water cycle, including storm water, groundwater and wastewater management and water supply, into the urban design to minimise environmental degradation and improve aesthetic and recreational appeal.

Executive Summary

Otterpool Park LLP, as the applicant, are proposing a garden settlement called Otterpool Park (the proposed Development) that is located to the west of Folkestone in Kent.

Arcadis has prepared this updated Water Cycle Study (WCS) Report on behalf of Otterpool Park LLP as well as a separate Flood Risk Assessment (FRA) and a site-wide Surface Water Drainage Strategy (SWDS) Report[1], as part of the amended outline planning application for the proposed Development. The amended application for planning permission relates to an existing outline planning application that was submitted to F&HDC as the local planning authority ('LPA') in 2019 (the '2019 planning application'), under planning reference Y19/0275/FH.

The amended outline planning application is part of a three-tier approach to the planning process and seeks permission for a new garden settlement accommodating up to 8,500 homes (Use Classes C2 and C3) and Use Class E, F, B2, C1, Sui Generis development with related infrastructure, highway works, green and blue infrastructure, with access, appearance, landscaping, layout and scale matters to be reserved. The - Application Site, which has a total area of approximately 589 ha, is located within the wider Otterpool Framework Masterplan Area, which ultimately aims to deliver up to 10,000 new homes across a total area of 756 ha.

In order for the development to be policy compliant a site-specific WCS, that meets with the requirements of the policies from the F&HDC Core Strategy Review (2022), is required. This report presents the findings of the updated WCS, promoting an integrated approach to sustainable water management. This should be read in conjunction with the updated FRA and SWDS Report[1] that has also been prepared by Arcadis to support this amended planning application.

Water Resources and Supply Infrastructure

Otterpool Park is situated to the west of Folkestone, which is known to have limited surface water or groundwater resources and is considered a water-stressed area. The Environment Agency (EA) currently class the surface water and groundwater resources within the District as over-licensed or over-abstracted, meaning that there is no additional water available for supply. This highlights the importance of further developing policies to encourage the conservation of water in new and existing dwellings, and commercial properties.

Based on the currently known forecasts, Affinity Water (AW) has confirmed there is water infrastructure supply capacity for the early phase(s) of Otterpool Park, of approximately 1,500 additional residential units over-and-above the remaining quantum of growth modelled for in the latest forecasting completed for their Water Resource Management Plan 19[2] (WRMP19), which will cover the period from 2020 to 2080.

WRMP19 forecasts a population growth of approximately 13% by 2025, 32% by 2045 and 64% by 2080, equivalent to over 100,000 more people living in the Water Resource Zone 7 (WRZ7) that Otterpool Park is also located. This growth in demand results in the small surplus of 1.3 Ml/day under average conditions in 2020 moving to a small deficit of 0.1 Ml/day under average conditions in 2045 to a larger deficit of 4.3 Ml/day under average conditions in 2080. WRMP19 confirms that there are no planned sustainability reductions in WRZ7 at average or peak conditions. It also shows that no noticeable long-term climate change impact is expected on supply in WRZ7.

AW has some headroom at present in terms of both water resources and distribution network for the initial 1,500 homes, but an offsite infrastructure upgrade will be required to accommodate the full development. The required reinforcement can be planned and implemented ahead of the remaining development through the normal water industry's five-yearly business planning process. The routing to the proposed point of water supply connection for Otterpool will be from the northeast.

Additional water efficiency measures encouraging Water Sensitive Urban Design (WSUD) principles will be put in place to a restricted and limited maximum desirable target amount of extra drinkable water consumed by each new household to 110 litres of water per person, per day. Opportunity to further reduce the extra drinkable water consumption will be maximised, where possible, with targeted and site-based integrated water

[1] 10029956-AUK-XX-XX-RP-CW-0010-P3-FRA & SWDS, Arcadis March 2022 (ES Appendix 15.1)

[2] Water Resource Management Plan 19, Affinity Water April 2020

reuse solutions for other non-drinkable water uses. This will reduce the extra water demand across the site as a whole.

Wastewater Treatment and Sewage

Wastewater in the District is currently collected and treated by Southern Water (SW). There are two potential offsite treatment options for the proposed Development to discharge. This would be either to the nearby Sellindge Wastewater Treatment Works (WwTW) approximately 1 km to the west or West Hythe WwTW in the adjoining catchment, approximately 7 km to the southeast. SW has completed a feasibility study to identify what additional wastewater infrastructure upgrades would be required to serve the proposed Development at their preferred Sellindge WwTW. This feasibility study confirmed that a new rising main and major upgrade to the existing works will be required in a phased manner. SW has not identified any fundamental reasons why development should not go ahead as the required new infrastructure can be delivered through the water industry's five-yearly business planning process to match with the proposed development trajectory and phasing plans at Otterpool Park. The current Asset Management Plan (AMP7), which covers the period 2020 to 2025 has already made the necessary provisions to undertake the required detailed investigations and initial infrastructure upgrades to accommodate Otterpool Park. As part of this, a Risk and Value exercise is currently underway by SW.

However, Sellindge WwTW and other WwTWs that are discharging into the River Stour and surroundings are subject to a separate detailed investigation in connection with their potential negative impacts on the Stodmarsh European designated sites under the Environment Agency's (EA's) Water Industry National Environment Programme (WINEP) that will report in 2022. This WINEP investigation has been initiated to investigate potential links between the River Stour and the Stodmarsh lakes systems, then propose appropriate, possible and cost-effective solutions to resolve any identified impacts. Until this WINEP study is complete, including any mitigation solutions are fully implemented (i.e., if deemed required) all new development in the impacted Stour catchment must achieve nutrient neutrality as per the latest Natural England's (NEs) guidance for Stodmarsh sites.

Therefore, it is currently proposed that the initial development phases will be served by a dedicated onsite WwTW with suitable additional onsite nutrient neutrality mitigation. This will include a minimum of 25 ha of constructed wetlands and a minimum of 35 ha of woodland planting to offset surplus Nitrogen and Phosphorous, due to the wastewater and surface water discharges from the proposed Development. This approach has been agreed with the NE and the EA in principle so that Otterpool Park will ensure nutrient neutrality, as per the required precautionary principle to protect the integrity of the downstream Stodmarsh lakes sites.

The onsite WwTW will be located within the red line boundary towards the northwest corner (at Development Parcel HT.5) and two options have been identified for the final treated effluent discharge outfall location, one upstream location on the River East Stour near to the onsite WwTW and a second further downstream location on the same watercourse near to the Sellindge WwTW. The latest discussions with Severn Trent Connect (STC), which has been identified as the New Appointment and Variation (NAV) company for Otterpool Park, indicate that providing onsite works to achieve both the nutrient neutrality and the EA's proposed discharge permits are viable. The modular onsite WwTW will be constructed and commissioned in three main phases to match with the proposed development trajectory. This phased approach will also ensure the flexibility to connect the later development phases of the Otterpool Framework Masterplan Area to Sellindge WwTW, if deemed required.

A new appointment is made where a limited company is appointed by Ofwat to provide water and/or sewerage services. A NAV, therefore, involves one company replacing another as the appointee for a specific geographic area. In line with the current EA legislation and policies, new discharges should first consider connecting to existing infrastructure, where reasonable although as stated above this is currently not viable due to the ongoing WINEP study and the limited capacity currently available within the existing network and Sellindge WwTW that require major upgrades following detailed design, which is currently on hold till the outcome of WINEP study is available.

Water Quality

The results of the indicative water quality discharge permit analysis indicate that the proposed development will not lead to a Deterioration of WFD status or unduly compromise the achievement of Water Framework Directive (WFD) Good Status in the receiving watercourses. The WFD assessment[3] has been undertaken, which confirmed that the proposed wetlands and other surface water and flood mitigation measures indeed helps to improve water quality, ecology and biodiversity benefits of the proposed Development.

However, tightened water quality parameters will be required as the existing WwTW flow consents are exceeded and new discharge permits are issued by the EA. The increased flows as a result of the proposed development trajectory do not present any major constraints in relation to wastewater treatment or water quality subject to the timely implementation of new infrastructure. Therefore, engagement with the EA and Water and Sewerage Companies should continue throughout the planning and construction process to facilitate timely site-specific assessments and phased infrastructure implementation.

Flood Risk and Surface Water Management

An updated site-specific assessment has been completed considering the flood risk to the proposed development from all sources, including fluvial, surface water, groundwater, sewer and tidal. This has been completed following guidelines set out by the latest National Planning Policy Framework[4] (NPPF) and the associated Flood Risk & Coastal Change planning practice guidance[5] (PPG), including the Strategic Flood Risk Assessments[6] (SFRA) completed for F&HDC.

All proposed main built development areas will be located outside the high and medium risk flooding areas with suitable detailed hydraulic modelling (including climate change mapping), satisfying the NPPF sequential test/approach requirements. An exception test has also been performed for the three new bridge crossings over the River East Stour. The proposed design has been discussed with the EA, and it will ensure that the development is safe over the recommended 100-year minimum design life, while addressing ecology needs, climate change risk and helping to reduce offsite flood risk through additional floodplain enhancements and an integrated water management strategy.

Otterpool Park will aim to be an exemplary site with provision of extensive Sustainable Drainage Systems (SuDS) and multi-functional green space, promoting WSUD principles. They will ensure that flooding and surface water drainage needs are fully accounted for and mitigated, while reducing extra potable water demand and maximising overall environmental benefits through an integrated approach to Green Infrastructure, Biodiversity and Water Management.

A high-level assessment indicates that extra WwTW discharges will not appreciably increase flood risk when compared to the current baseline situation. The increased flow from each WwTW location is classified overall as having a low flood risk on the receiving River East Stour, when considered in conjunction with the surplus long-term attenuation storage and reduced peak flow discharge from the proposed extensive SuDS, nutrient mitigation wetlands and floodplain enhancement measures. The development proposals can indeed reduce downstream flood risk.

The FRA&SWDS Report[1] details how all flood risk and surface water management needs are managed, as part of an integrated water management strategy. The proposed strategy will include an interconnected network of well-designed and managed onsite swales, basins, ponds and wetlands with dedicated outfalls within the site boundary to meet the agreed integrated approach and limiting parameters with the EA and Lead Local Flood Authority (LLFA) in order to collect, treat, infiltrate, transport and store water, while encouraging water reuse where practical. This system of drainage will manage and reduce flood risk by limiting development runoff below the current greenfield rates during extreme events and will maximise available water resource from rainfall during the normal events.

[3] 10029956-AUK-XX-XX-RP-CW-0034-P2- WFD Screening Report, Arcadis, October 2021

[4] National Planning Policy Framework, Ministry of Housing, Communities & Local Government July 2021

[5] Flood risk and coastal change Planning Practice Guidance, Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, March 2014

[6] Level 2 Strategic Flood Risk Assessment, Herrington Consulting/ F&HDC (Shepway) July 2015

1 Introduction

Otterpool Park LLP, as applicant for an amended outline planning application, intends to develop approximately 589 hectares (ha) of land in the vicinity of Otterpool Park (hereafter referred to as the site) within the administrative area of Folkestone & Hythe District Council (F&HDC) in Kent, to develop a new garden settlement known as Otterpool Park. The new garden settlement (the 'proposed Development') is proposed as part of the UK Government's nationwide initiative to deliver new housing stock across the country, including the Locally-Led Garden Cities, Towns and Villages programme that was first announced by the Department for Communities and Local Government (DCLG) in 2016[7].

This document relates to the amended application for planning permission that was originally submitted to F&HDC as the local planning authority ('LPA') in 2019 (the '2019 planning application'), under planning reference Y19/0275/FH, and which was the subject of environmental impact assessment (EIA). It was proposed to amend the 2019 planning application to enable a revised and more flexible approach to the planning implementation process, while incorporating some general updates to the proposed Development. The revised three-tier approach to the planning process and the key changes to the proposed Development is described in Section 1.5.

This report presents the findings of the updated WCS, to guide Otterpool Park LLP and F&HDC to make informed decisions with suitable recommendations regarding the proposed Development. Extensive consultation has been undertaken with Southern Water (SW), Affinity Water (AW), Severn Trent Connect (STC), Albion Water (AWL), Natural England (NE) and the Environment Agency (EA) as well as other relevant parties such as Kent County Council (KCC) in order to provide an indication of the most up to date requirements for the sustainable water cycle management planning and associated infrastructure impacts.

This updated WCS assessment has used the following key data sources as detailed in Section 2:

F&HDC- Development policies and site mapping;

SW - Asset datasets and feasibility studies for sewers / pumping stations / Wastewater Treatment Works (WwTW);

STC and **AWL** - Information on the provision of a new onsite WwTW and water reuse proposals;

AW - Water Resource Management Plan 2019 and new water infrastructure requirements;

NE – Nutrient neutrality mitigation advice;

EA - River Basin Management Plan, water body quality, Catchment Abstraction Licencing Strategies, flood risk data, and environmental permits.

Other key information that has been drawn on is also referenced in the subsequent sections, as required.

1.1 The Role of this Document

This updated WCS report first examines the existing water environment, water and wastewater infrastructure, and provides an assessment of the water and wastewater infrastructure constraints and opportunities associated with the Otterpool Park, with reference to associated documentation. This document then provides an assessment of potential holistic and strategic options for implementing and managing the identified integrated water management mitigation solutions to enable the effective and sustainable delivery of the Otterpool Park as a leading exemplar project, while ensuring that the required water and wastewater infrastructure is fully considered within the early stages of planning and design. It also provides further recommendations for the next stages of the proposed Development.

This document will inform the Blue-Green Infrastructure Proposals, Sustainability Statement and Design and Access Statement (ES Appendix 4.16), to develop an overarching framework for how water can be fully integrated and managed across the development while delivering wider sustainability objectives of the

[7] Locally-Led Garden Villages, Towns and Cities, Department for Communities and Local Government March 2016 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733047/Locally-led_garden_villages__towns_and_cities_archived.pdf)

Otterpool Park, including sense of place, biodiversity net gain, education and awareness, and water sensitive behaviour to maximise potential benefits within the development and downstream communities.

A key ambition of the Otterpool Park is environmental responsibility and stewardship. As a development of significance, the development has considered sustainability in all its forms, including the human impact on the planet resulting in climate change, loss of critical ecosystem services, carbon footprint, potable water consumption and waste generation. Developments such as at Otterpool Park can contribute to sustainability targets by creating new places that demonstrate major reductions in carbon and significantly reduce their water footprint. The development proposes ambitious water use targets, and integrated and sustainable drainage principles to mitigate the potential impact of the development on the natural water cycle and catchment processes.

The preferred strategies for the provision of; potable water to the development, collection and treatment of wastewater, and water reuse options have been appraised in conjunction with third-party infrastructure providers, AW and SW.

The confirmation of a long-term sustainable, commercially viable and technically feasible strategy requires detailed technical discussions. However notable progress has been made to develop integrated water management solutions addressing water supply, flood risk and environmental issues, which are reported here.

Arcadis has also prepared an updated site-specific Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS)[1] document for the development, in parallel with this updated WCS. For this reason and to avoid repetition, this WCS mainly includes flooding and surface water considerations where a potential link exists with water supply, and wastewater collection and treatment. Therefore, a reference to the above document should be made for the full detail on flood risk and surface water management, along with the relevant chapters in the Environmental Statement.

1.2 The Water Cycle

The natural water cycle as illustrated in Figure 1 below is the process by which water is transported throughout a region. The process commences with some form of precipitation, be it rain, snow, sleet or hail. This is then intercepted by the ground and either travels overland through the process of surface runoff to rivers or lakes, or percolates through the surface and into underground water aquifers.

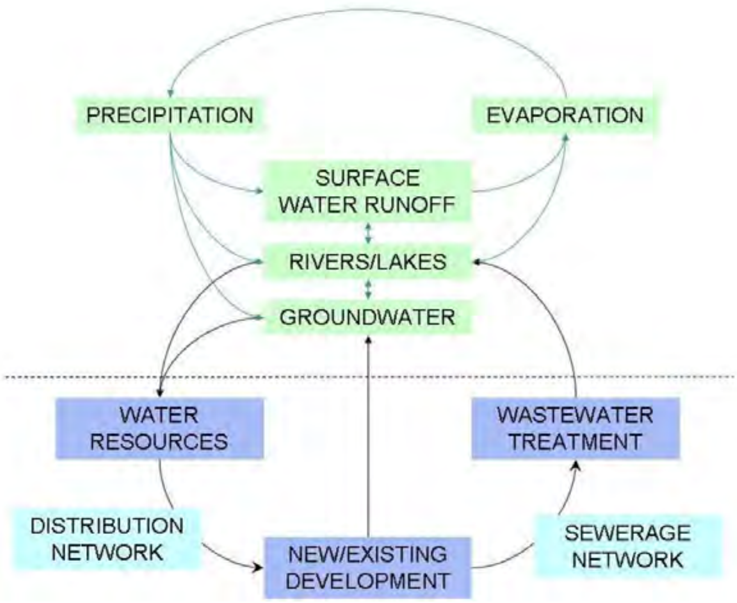

Figure 1: The Wider Water Cycle.

The presence of vegetation can also intercept this precipitation through the natural processes that plants carry out, such as transpiration and evapotranspiration. The water will eventually travel through the catchment and will be evaporated back into the atmosphere along the way or will enter the sea where a large amount will be evaporated from the surface. This evaporated water vapour then forms into clouds and falls as precipitation again to complete the cycle.

Urbanisation and new development such as Otterpool Park, create a number of interactions with the natural water cycle. Abstraction of water, from both surface water and groundwater sources for use by the local population, interacts with the water cycle by reducing the amount of water that is naturally held within the aquifers. Following treatment at a Water Treatment Plant this water, now potable, is transported via trunk mains and distribution pipes to the dwellings in the area. The potable water is then used by the population within the dwellings for a number of different purposes, which creates large volumes of wastewater.

The use of paved and other surfaces in this development also reduces the amount of water that is able to percolate through the underlying soil to the groundwater aquifers. This increases the rate of surface water runoff, which leads to flooding and increased peak discharges in rivers if not appropriately managed. Therefore, within the development permeable hard surfaces and drainage techniques that encourage infiltration should be used where possible to keep rainwater in the ground and slow down the transit to the watercourses and reduce the risk of flooding. Flood risk management and surface water management will be in the form of SuDS to maintain the natural water cycle as far as possible.

The wastewater from the developments is transported via the sewerage network to a WwTW, where the water is screened, treated, and then discharged back into the rivers or groundwater. Discharges from WwTW require consent from the EA. This consent will set out the maximum volume of treated wastewater that can be discharged, and the quality standards that this discharge must meet. Typically, the consent will set limits on the concentrations of the following physiochemical determinands: Ammoniacal Nitrogen (Amm. N), Biochemical Oxygen Demand (BOD) and suspended solids in the discharge. In addition, the consent can stipulate a Phosphorous (SRP) concentration, along with limits on the concentrations of other chemicals (such as Iron) used in the Phosphorous stripping process.

The key elements of the water cycle relevant to the Otterpool Park is described within the following chapters:

Water Environment Evidence Base Review – **Chapter 2**

Water Resources and Supply – **Chapter 3**

Water Treatment and Sewerage – **Chapter** 4

Integrated Water Management Strategy – **Chapter 5**

Chapter 1 below also summarises the site characteristics, planning strategy and development proposals.

1.3 Study Location and Characteristics

The proposed Development is located on approximately 589 ha of land directly south-west of Junction 11 of the M20 motorway, and south of the Channel Tunnel Rail Link (CTRL) in the administrative area of F&HDC in Kent (see Figure 2). The site is centred around National Grid Reference TR112 365 in the general area of Otterpool Manor buildings. Much of the site is greenfield in nature and is predominantly occupied by agricultural uses and associated farm holdings, as well as some residential and light commercial uses. A range of historic land uses associated with both rural and commercial/industrial activities have been present on the site.

The site is located within an area that has been formed from the geological development of the Kent North Downs. The site topography generally slopes from the south toward the north-west where the River East Stour traverses the site from east to west, with variable undulating landforms present across the central parts. Site levels range from 57m above ordnance datum (AOD) in the north-west to 107m AOD in the south.

The site is linked off-site to the north-west and south-east via the A20 Ashford Road that traverses through the central part of the site. The site is bounded by a section of Harringe Lane and farmland to the west and Harringe Brooks Woods and more farmland to the south-west. The southern boundary wraps around Lympne industrial estate, Aldington Road and Lympne. The northern site boundary runs largely parallel with, and adjacent to, the CTRL line and borders the settlement of Sellindge.

The site area excludes the parcels of land at Otterpool Manor, Upper Otterpool and south of Westenhanger. The south-eastern and eastern boundary is bordered by the settlements of Lympne and Newingreen and further north the eastern boundary runs parallel with the A20 before terminating at the intersection of the A20 (Ashford Rd) with the CTRL line.

The site is characterised by the River East Stour that flows from east to west across the northern part of the site and to which three tributaries (Harringe Brook, North Lympne Drain and Racecourse Drain) and associated drainage channels are connected. The majority of these existing watercourses flow from east and south to the north and west. The River East Stour leaves the red line boundary at the north-west corner of the site and flows west towards Ashford, where it joins the Great Stour. The site has some associated flood risk associated with the River East Stour and its tributaries, as discussed in Section 5.1.

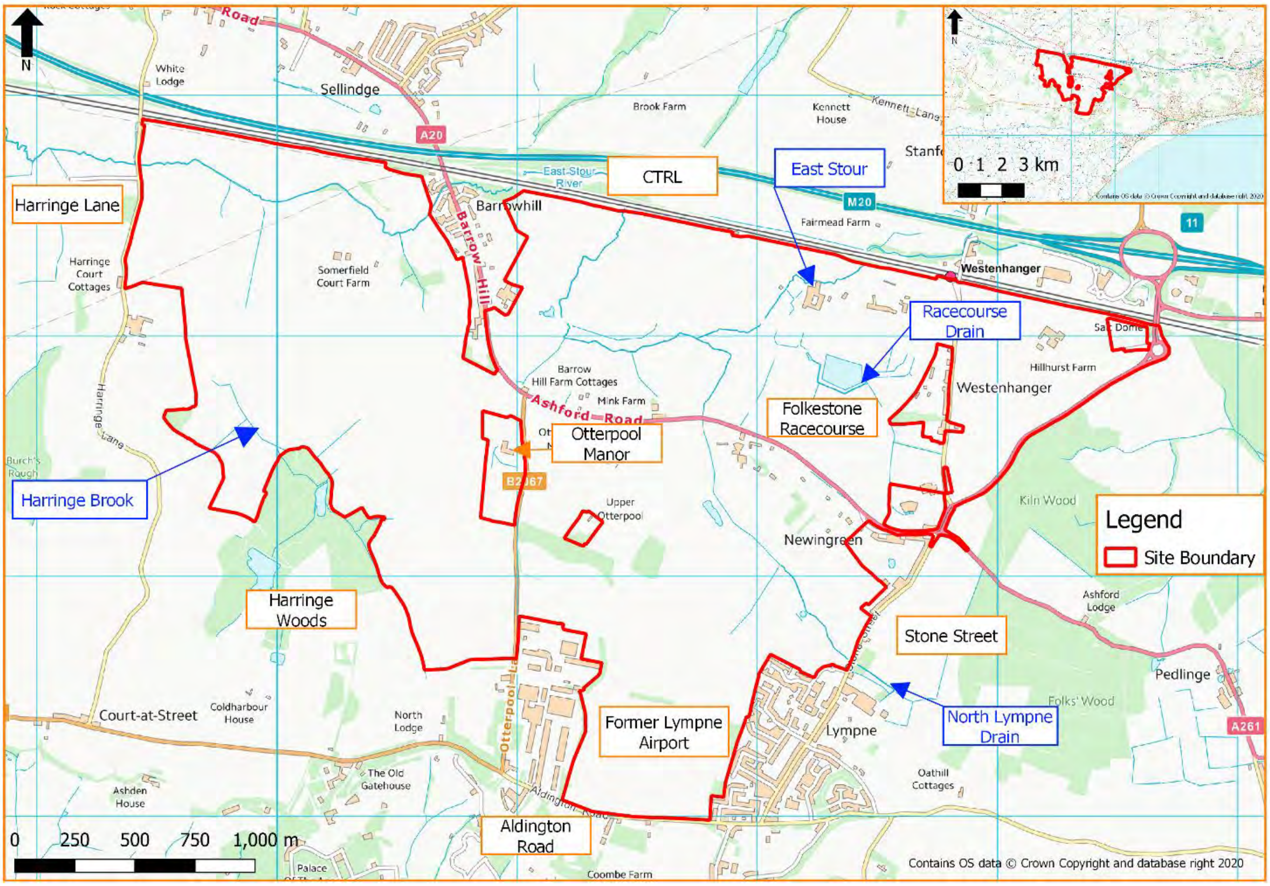

Figure 2: Location Plan
(The planning Application Site boundary is outlined in red.)

Currently, there are no existing settlements on site. Scattered residences are present along Ashford Road and the A20. Larger settlements are present just outside the Application Site boundary in Barrow Hill to the north and Lympne to the south east. Review of the UK Centre for Ecology and Hydrology (CEH) Land Cover Map (LCM) 2007[8] dataset shows that existing land cover comprises arable land, both improved and rough grassland, woodland and pockets of urbanised areas.

A large proportion of the site area is occupied by farmsteads and associated agricultural land for a mixture of arable and livestock breeding purposes. There are farmsteads located at Somerfield Court Farm (west of

8 UK Land Cover Map LCM2007. 2011. Centre for Ecology and Hydrology.

Barrow Hill), Barrow Hill Farm (east of Barrow Hill), Hillhurst Farm (east of Westenhanger) and several smaller practices located adjacent to the A20 in the area of Newingreen. The historical Lympne Airport site is now partially used as Lympne Business Park. Folkestone racecourse is present in the north east, however, is no longer functioning.

Land within the site that lies to the north of the A20 is mainly occupied by a mixture of agricultural land, the River East Stour watercourses and a man-made lake in the centre of the former Folkestone Racecourse. Hillhurst Farm lies in the north-eastern corner of the site, while a number of disused racecourse pavilion buildings are present directly east of Westenhanger Castle. Barrow Hill Farm lies 50 m east of the northern stretch of the A20 that runs through Barrow Hill, close to the intersection of the A20 and Otterpool Lane is a café and small lorry parking area, beyond further north of which lies Barrow Hill Farm.

To the south of the A20, the land east of Otterpool Lane is predominantly occupied by farm land and a number of small holdings along the A20 itself. To the north of A20, a section of the River East Stour traverses the site from south to north, and disused quarry workings south of the A20 form a designated a geological Site of Special Scientific Interest.

Land to the west of Otterpool Lane and the northern stretch of the A20 is occupied mainly by agricultural land and the River East Stour. Other features in the area include Park Wood and Somerfield Court Farm located west of Barrow Hill, and Springfield Wood located adjacent to the western site boundary.

The superficial and bedrock outcrop geology at the site is shown in Figure 3.

The hydrogeology aquifer classification data from the British Geological Survey (BGS)[9] shows that the site lies upon a section of the Lower Greensand Group, which is a highly productive aquifer with significant intergranular flow. This formation generally consists of sandstone and conveys water of a soft nature with good infiltration rates. A small proportion of the site to the west is located upon a section of the Wealden Group, which consists mainly of sandstones and limestones with very small yields for low-quality water.

An initial analysis of the limited available British Geological Survey (BGS) borehole scans[10] for the site area did not highlight the presence of shallow groundwater levels, but further site-specific ground investigation is required to confirm this.

The EA has defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. After a review of the EA SPZ[11] data, it can be concluded that no SPZs are located within the site boundary. The closest SPZ in proximity to the site is 2.2 km to the east. This indicates that, should infiltration-based methods of surface water drainage be applied, the impacts on existing potable water abstractions would be limited.

The Otterpool Park is within Water Resource Zone (WRZ) 7 for which potable water provision is currently managed by AW. The WRZ7 is supplied via a number of groundwater abstractions from the underlying chalk aquifer and the import of treated water from neighbouring water companies, namely South East Water and Southern Water. More information regarding potable water supply is included in Section 3.

The company responsible for collecting and treating wastewater within the study area and surrounds is Southern Water. More information is included in Section 4.

Sources of flood risk within the District were identified in the Folkestone and Hythe District SFRA[6]. Key messages from this report, and other relevant flood risk policies, are highlighted and built upon in Section 5.0.

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[9] https://www.bgs.ac.uk/datasets/hydrogeology-625k/, aquifer classification, British Geological Survey 2021

[10] Borehole Scans. British Geological Survey, 2016 (available at https://www.bgs.ac.uk/information-hub/borehole-records/)

[11] Source Protection Zone mapping. Environment Agency. Available at https://magic.defra.gov.uk/MagicMap.aspx

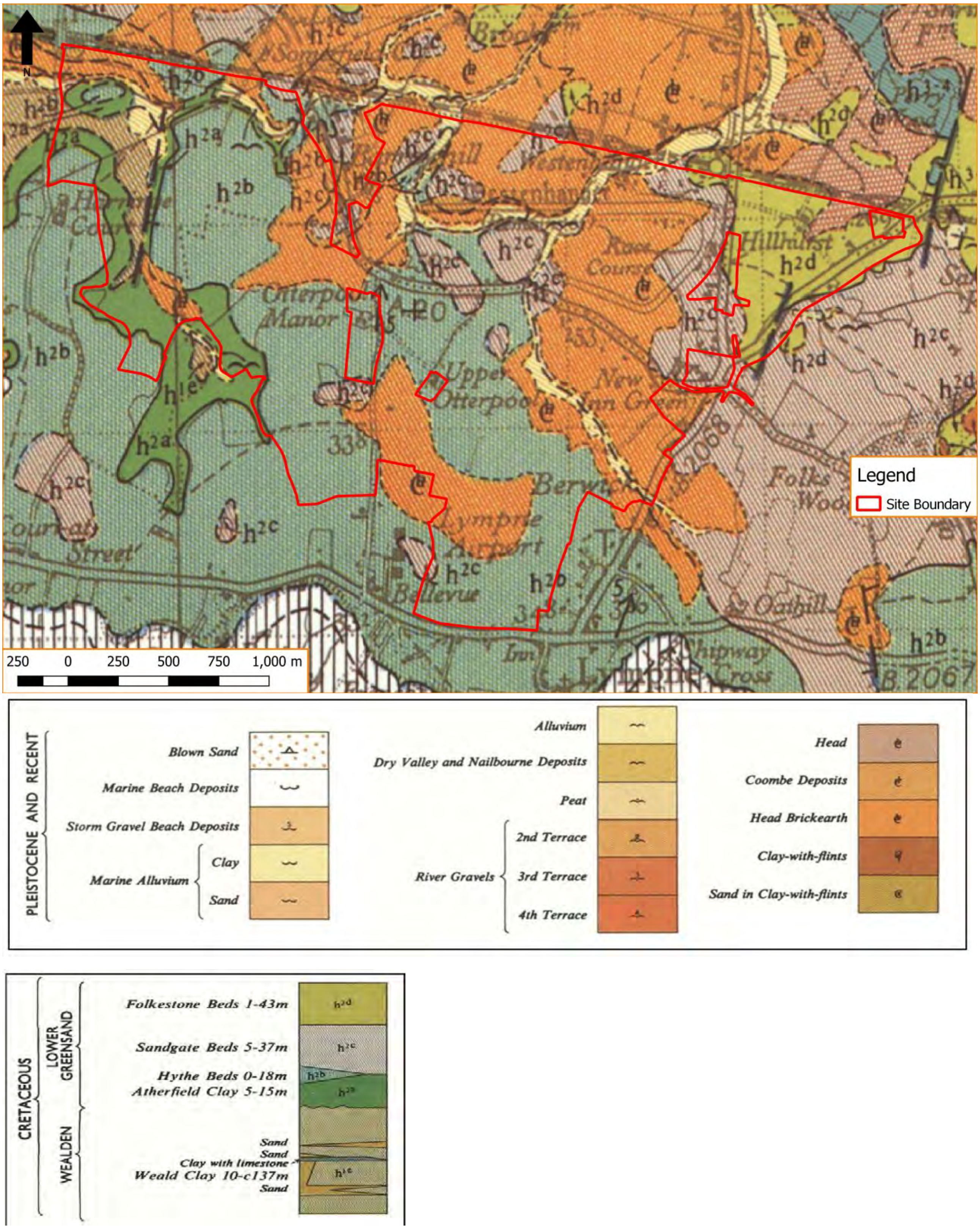


Figure 3: Superficial and bedrock geology (Source: BGS).
(The planning Application Site boundary is outlined in red.)

1.4 Revised Planning Approach

Following consultation on the Environment Statement submitted as part of the 2019 planning application (the '2019 ES'), a 'three-tier' approach is proposed for the amended planning application. The conditions that would be attached to the Tier 1 outline planning permission, if granted, would require two further consents stages to control the design and delivery of the proposed Development from outline to the reserved matters stage. It is anticipated that there will be development quantum threshold 'triggers' that will inform the need to provide certain key infrastructure in advance of other development land parcels or zones coming forward. These triggers will be established by the LPA and key infrastructure providers in order to demonstrate how the proposed Development can be constructed without the need for fixed development phasing at the outline application stage.

The 'three tier' system includes the following key stages, as illustrated in

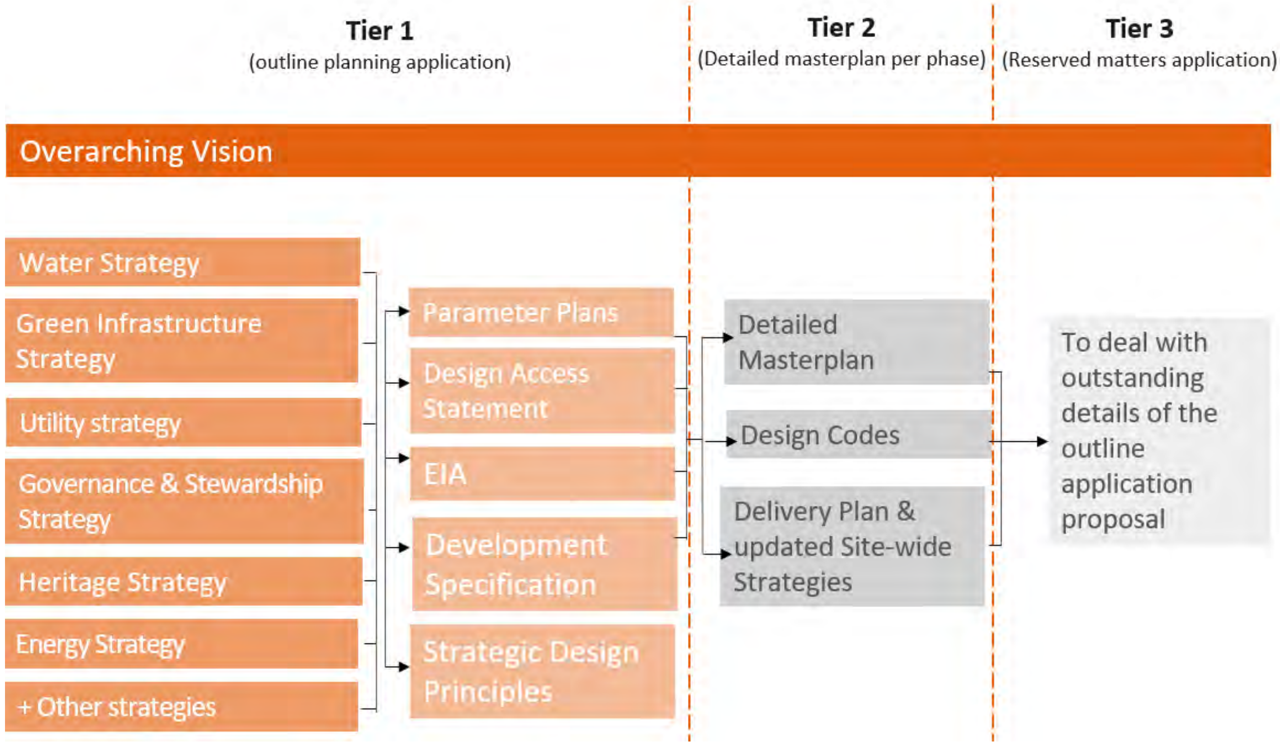


Figure 4:

- **Tier 1: Outline planning application** – agreement of overall land uses, parameter plans and a series of site wide strategies.
- **Tier 2: Detailed masterplan and design code for each phase** – each phase of development will need to be supported by a detailed masterplan that will accord with the Tier 1 material.
- **Tier 3: Reserved Matters application** – each development plot will need to be the subject of a reserved matters application, the detail of which will need to include detailed design for the relevant plot and will need to be in accordance with the information approved as part of Tier 1 and Tier 2.

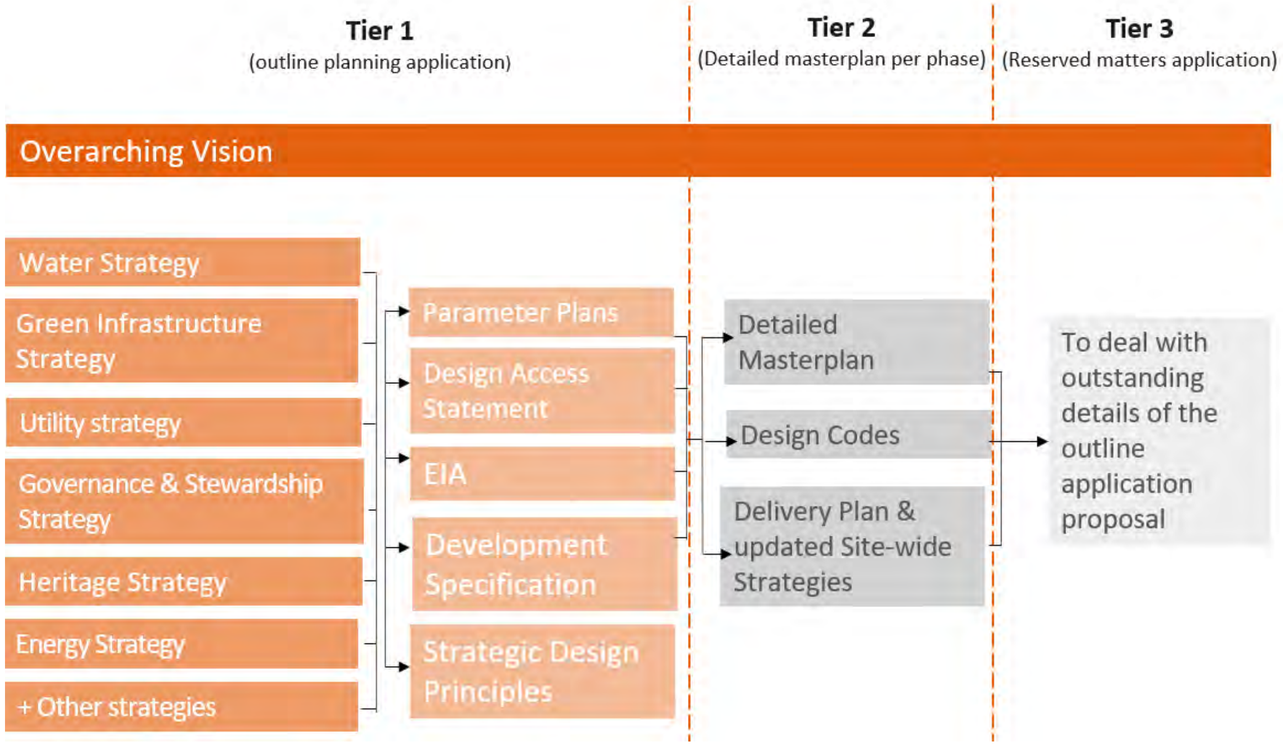


Figure 4: Tiered planning approach.

1.5 Development Proposals

The proposed main development area considered in the Tier 1 outline planning application is located on approximately 589 ha of land within the redline site boundary shown in Figure 1. It is located within the wider Otterpool Framework Masterplan Area, which ultimately aims to deliver up to 10,000 new homes across a total area of 756 ha. Details of the proposed Development are given in the Development Specification (ES Appendix 4.1) and Strategic Design Principles (ES Appendix 4.3) submitted as part of the amended outline planning application documentation, along with the Parameter Plans (ES Appendix 4.2) for approval and other supporting plans. The key changes to the previous development scheme include:

- The inclusion of Westenhanger Castle within the redline planning Application Site boundary; and
- The inclusion of additional land in the north-west of the Site for wastewater treatment.

The planning application seeks permission for a new garden settlement accommodating up to 8,500 homes (Use Classes C2 and C3) and Use Class E, F, B2, C1, Sui Generis development, including use of retained buildings as identified, with related infrastructure, highway works, green and blue infrastructure, with access, appearance, landscaping, layout and scale matters to be reserved. A summary of the maximum floorspace areas for approval for each land use is shown in Table 1.

Table 1: Total Proposed Residential Units and Floorspace by Use

Land Use	Including	Maximum No. of Proposed Units
Residential	Residential units and Extra Care accommodation	8,500

Land Use	Including	Proposed Gross External Area (GEA) Floorspace (m^2)

Education and Community Facilities	Schools, nurseries, crèches , reserve school floorspace and/or SEN, health centres, place of worship, community centres.	Up to 67,000
Hotel	Hotel	Up to 8,000
Leisure	Sports pavilion and indoor sports hall	Up to 8,500
Mixed retail and related uses	Shops, professional services, restaurants, cafes, drinking establishments, hot food takeaways, offices, businesses	Up to 29,000
Employment	Commercial business space in hubs, commercial business park, light industrial business park.	Up to 87,500
Total		**Up to 200,000**

In line with the concept of the proposed Development as a ‘new garden settlement’, a high proportion of the development will either be retained open land or comprise new formal and informal open space provision. Parameter Plan OPM(P)4002_YY (ES Appendix 4.2), confirms the location of open space across the site. This open space will include public realm and space for leisure, sport and play as well as other forms of open space, such as up to 5 ha of burial ground. The parameter plan secures 260.5 ha of open space (44% of the Application Site). Furthermore, as an indicative guideline, it is anticipated that within Development Areas (other than private gardens) approximately 10-15% of the land will be provided as open space. This will result in approximately 50% of the total Application Site being open space. The open space will provide a range of green infrastructure, for example, formal play areas, habitats, space for food production and outdoor sports.

A network of proposed primary roads will provide access through Otterpool Park, connecting both sides of the A20 and serving the station, town centre, schools, local centres and employment as well as giving access to the residential areas. These routes will provide for bus movements and have walking and cycling connections alongside. The proposed development areas and primary roads are indicated in the Development Areas and Movement Corridors Parameter Plan (OPM(P)4001_YY, ES Appendix 4.2). There will also be other access roads delivered across the Site but the detail of these will not be submitted until Tier 2 and Tier 3 stages.

The development proposals are detailed in the Parameter Plans (ES Appendix 4.2), Development Specification (ES Appendix 4.1) and Strategic Design Principles (ES Appendix 4.3), along with the supporting illustrative masterplan (ES Appendix 4.5) submitted with the amended planning application. As part of this, three new road bridge crossings over the River East Stour are proposed to connect the proposed Development through the Riverside Park.

The proposed SuDS strategy makes use of the existing River East Stour and drainage tributaries as part of a ‘blue-green corridor’. The SuDS strategy will take account of the capacity of existing watercourses and include proposals to designate land for landscaped flood alleviation purposes (i.e., in the form of ‘blue-green corridors’), while enhancing the role and amenity of existing watercourses and landscape through the site. Opportunities will be taken to maintain important hedgerows and trees on the site, as well as providing new planting and enhance the local biodiversity.

Otterpool Park is set on a path towards net zero carbon. The proposed Development will align with, and surpass, regional and national energy and carbon policy requirements, and exceed interim Future Homes Standard targets. It will integrate smart solutions and exploit new technologies and commercial arrangements in the design of sustainable and cost-effective homes across the proposed Development’s lifecycle. The landscape-led masterplan is key to achieving environmental and social sustainability as well as designing a low carbon development that is accessible to people with different needs and on different incomes. The proposed Development aims for a quality sustainable community with a sense of vitality, a distinctive local character, and a close connection with its natural environment. The Sustainability Statement[12] sets out the foundations of the integrated vision that links energy, water, transport, infrastructure, resources, waste, biodiversity, and place-making with the local aspects of community, culture, and economy.

1.6 Development Trajectory

The development trajectory to be included in the Tier 1 Outline Planning Application includes a total of 8,500 residential units completed by 2042. Outside the Application Site boundary, the total Otterpool Park proposes to include an extra 1,500 homes, bringing the overall total to 10,000 homes by 2044. Therefore, to ensure the total impact of the Otterpool Park Framework Masterplan is included the WCS calculations assess the total 10,000 units to 2044.

A breakdown of the indicative development trajectory (based on the Illustrative Accommodation Schedule, ES Appendix 4.4) and phasing for the residential properties assumed in this assessment is summarised in overleaf and a detailed breakdown, including non-residential areas, is contained in Appendix A.

To assess the impact of the proposed Development on the water infrastructure, an estimate of the predicted population and dwellings amounts, and hence occupancy rate, is required. Therefore, as per the masterplan assumptions, an average occupancy rate of 2.4 has been adopted as a constant occupancy rate for calculations in the WCS. This occupancy rate will ensure a conservative estimate of the impacts on the water infrastructure and wider water environment.

[12] Otterpool Park Sustainability Statement, Arcadis March 2022

Table 2: Otterpool Park Indicative Development Trajectory[13]

Year	Annual Residential Dwellings Built (No.)	Cumulative Dwellings Total (No.)	Within Tier 1 Application Site? (Yes/No)
2024	121	121	Yes
2025	264	385	Yes
2026	331	716	Yes
2027	350	1,066	Yes
2028	423	1,489	Yes
2029	423	1,912	Yes
2030	528	2,440	Yes
2031	528	2,968	Yes
2032	557	3,525	Yes
2033	498	4,023	Yes
2034	502	4,525	Yes
2035	534	5,059	Yes
2036	534	5,593	Yes
2037	504	6,097	Yes
2038	504	6,601	Yes
2039	661	7,262	Yes
2040	535	7,797	Yes
2041	582	8,379	Yes
2042	121	8,500	Yes
2042	435	8,935	No – part of wider masterplan
2043	531	9,466	No – part of wider masterplan
2044	534	10,000	No – part of wider masterplan

[13] Otterpool Park Illustrative Accommodation Schedule (ES Appendix 4.4)

1.7 Key Stakeholders

Stakeholder engagement is key to informing and providing an evidence base for the WCS in terms of the water resource, wastewater treatment capacity and water environmental capacity constraints. The following Stakeholders have been engaged throughout the WCS preparation process:

EA – Flood Risk, Water Resources and Water Environment;

SW – Sewerage and Wastewater;

STC and AWL - Sewerage and Wastewater;

AW – Water Resources and Supply;

KCC – Water Resources and Surface Water;

NE – Landscape and Water Environment;

F&HDC - Development policies and proposals; and

Ashford Water Group and Ashford Borough Council – Cross boarder issues.

Consultations have been undertaken through meetings and teleconferences, and representation provided to F&HDC. A summary of the consultation meetings that have taken place is given in Appendix B**.**

2 Water Environment Evidence Base Review

2.1 Policy Context

The following sections introduce the national policies relating to mitigating the impacts on the water environment from new development.

2.1.1 National

2.1.1.1 National Planning Policy Framework

The National Planning Policy Framework[4] (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced to contribute to the achievement of sustainable development. The NPPF also relies on the fact that specific details of the requirements previously obtained from national planning policy will be set out in local plans. These plans will be founded on a locally developed evidence base, including relevant technical studies, such as this Water Cycle Study. By emphasising the importance of local plans, local communities will feel empowered to decide the look and feel of the local area.

Local authorities should ensure that planning documents consider these policies, and they can use some of the policies contained within NPPF to make decisions on individual planning applications. The key themes in the NPPF that are most relevant to this WCS are:

- Delivering Sustainable Development and Climate Change;
- Housing;
- Biodiversity and Geological Conservation;
- Planning and Pollution Control; and
- Development and Flood Risk.

Relevant topics that consistently occur within the above mentioned NPPF are:

- Conservation / biodiversity;
- Sustainable use of resources;
- Mitigation of flood risk and the use of SuDS;
- Suitable infrastructure capacity; and
- Protection of groundwater and freshwater.

The proposed development has a mixed flood risk vulnerability classification, ranging from 'Water Compatible' (areas of open space and recreational/sports facilities), to 'Less Vulnerable' (commercial and employment space) to 'More Vulnerable' (residential use, schools and health facilities) as per the NPPF Annex 3. Flood Risk and Coastal Change Planning Practice Guidance[5] also states that the lifetime of a residential development is at least 100 years in terms of flood risk and coastal change.

2.1.1.2 Flood and Water Management Act 2010

The Flood and Water Management Act 2010[14] sets out a number of changes to the way that new development and water infrastructure will interact, including the proposed future mechanism for utilising SuDS where practical. SuDS assist in reducing the runoff rates (and potentially volumes) of surface water arising from new developments and therefore reducing the impacts on the existing water cycle. This is important in ensuring that existing flood risks do not increase as a consequence of new developments and can provide the ability to

[14] Flood and Water Management Act, HM Government, April 2010

reduce (or even eliminate) the need to use existing sewerage systems to convey surface water. This reduces unnecessary expenditure in the upgrading of existing sewers and WwTWs and reduces the probability of untreated discharges of wastewater during flood events and can delay the requirement to consent increased flows from WwTW.

2.1.2 Local

2.1.2.1 Core Strategy and Local Plan Review

The development plan for F&HDC comprises the Places and Polices Local Plan (2020) and the Core Strategy Review (CSR) 2022. The documents contain key policies relating to the water environment, whereby development should contribute to sustainable water resource management which maintains or improves the quality and quantity of water bodies.

The CSR 2022 identifies and defines proposed strategic site allocations to meet national policy for housing provision up to 2037. The requirement to commence a CSR was prompted by the findings of the 2017 Strategic Housing Market Assessment[15] (SHMA) carried out jointly with Dover District Council.

Water of sufficient quality and quantity and in the right place is a growing issue, which needs to be addressed in planning for development. The impact and causes of climate change also need to be considered in the Council's plan-making process. A key purpose of this study is to review and integrate the approach to water supply, waste water treatment, flood risk issues and biodiversity.

F&HDC has adopted an optional building regulations water efficiency target of 110 litres/per person /day within its CSR. An extract of the proposed amended draft policy SS8 'New Garden Settlement – Sustainability and Healthy New Town Principles', drawn from the CSR 2022, is repeated below and will effectively guide the key water management requirements for Otterpool Park.

b. All new build housing shall be built to water efficiency standards that exceed the current building regulations so as to achieve a maximum use of 110 litres per person per day of potable water (including external water use). The development shall be informed by a Water Cycle Strategy which includes detail of:

- i. Water efficiency, and demand management measures to be implemented to minimise water use and maximise the recycling and reuse of water resources (i.e. through the use of 'grey' water) across the settlement, utilising integrated water management solutions;
- ii.The need to maintain the integrity of water quality, how it will be protected and improved, and how the development complies with the Water Framework Directive;
- iii. Surface water management measures to avoid increasing, and where possible to reduce, flood risk through the use of Sustainable Drainage Systems (SuDS); and
- iv. Water services infrastructure requirements and their delivery having regard to Policy CSD5, and as agreed with the relevant statutory providers, and the Environment Agency's guidance on Water Cycle Studies;

c. All proposed development will have to satisfy the requirements of policy CSD5 (d). in order to avoid any significant impact on the water quality of the Stodmarsh European designated sites.

d. For non-residential development, development shall achieve BREEAM 'excellent' standard including addressing maximum water efficiencies under the mandatory water credits;

2.1.2.2 Stodmarsh Nutrient Neutrality Guidance

There is currently uncertainty as to whether existing and new growth without appropriate further mitigation measures could deteriorate the integrity of the Stodmarsh Lakes European designated sites due to

[15] F&HDC (Shepway) Strategic Housing Land Availability Assessment 2015/16, F&HDC (Shepway) 2016

eutrophication from extra nitrogen and phosphorus inputs. This uncertainty is one reason that the wastewater treatment works discharging into the River Stour and surroundings are currently subject to an investigation of their impacts and connection with Stodmarsh designated sites under the EA Water Industry National Environment Programme (WINEP) that will report in 2022. This WINEP investigation has been initiated to investigate potential links between the Stour and the Stodmarsh lakes systems, then propose appropriate, possible and cost-effective solutions to any identified impacts.

Until this work is complete, the uncertainty of new growth's impacts on designated sites remains, therefore there is potential for future housing developments (if unmitigated) within the Stodmarsh catchment to exacerbate the existing impacts thereby creating a risk to their potential future conservation status. To address this risk, NE has published Stodmarsh Nutrient Neutrality Guidance[16] (November 2020) for the impacted Local Planning Authorities (LPAs), which sets out a practical and precautionary methodology for calculating how nutrient neutrality can be achieved. Therefore, this guidance has also been applied to Otterpool Park to ensure that there is no adverse impact to the integrity of Stodmarsh lakes deriving from the proposed Development. Section 4 provides further discussion on nutrient budget analysis and nutrient neutrality mitigation proposals at the proposed Development.

This methodology is based on best available scientific knowledge, and will be subject to revision as further evidence is obtained. It details a precautionary approach in line with existing legislation and case-law when addressing uncertainty and calculating nutrient budgets. This is to remove the uncertainty and subsequent risk, until any solutions are implemented the current adverse effects on Stodmarsh, is for new development to achieve nutrient neutrality. Assessing and mitigating nutrients is a means of ensuring that development does not add to existing nutrient burdens and this provides certainty that the whole of the scheme is deliverable in line with the requirements of the Conservation of Habitats and Species Regulations 2017[17] (as amended) (the 'Habitats Regulations') and in light of relevant case law.

2.2 Previous Water Cycle Studies

The Kent Water for Sustainable Growth study[18] (2017), which refers to Affinity Water's WRMP14[19], concluded that to achieve water neutrality, demand after all planned houses in the LPA are built and occupied would need to be less than the currently used 16.14 Ml/d. This study concluded that it would require unrealistic measures to achieve this.

A WCS was initially produced for F&HDC in May 2011, an update to this document was published in 2019. F&HDC's WCS Update[20] (2019) examines the issues relating to water within the context of the District and the physical characteristics of its hydrology. One of the primary reasons for updating the WCS was to investigate the potential impact of new growth proposed under the adopted Places and Policies Local Plan and the CSR with corresponding plan periods up to 2031 and 2037 respectively.

The WCS Update[20] (2019) estimates the existing water demand (residential only) within the F&HDC LPA area as 16.14 Ml/d and the additional demand from projected residential growth is estimated to be 3.85 Ml/d. In line with the findings of the Kent Water for Sustainable Growth study, two more realistic water demand management scenarios were tested in the WCS Update (2019) and these are listed below:

- Mandatory requirements scenario plus retrofit – All new homes would be built to deliver a water use of 125 litres per person per day (Building Regulation Part G Mandatory); and, 5% of existing homes in the district would be retrofitted with low flush cisterns, as well as aerated taps and shower heads;

[16] Stodmarsh Nutrient Neutrality Guidance, Landscape and Water Environment November 2020
[17] Conservation of Habitats and Species Regulations 2017, HM Government November 2017
[18] Kent Water for Sustainable Growth Study, KCC/AECOM May 2017
[19] Affinity Water WRMP14, Affinity Water June 2014
[20] F&HDC Water Cycle Study Update, F&HDC, January 2019

- Optional requirements scenario plus retrofit – All new homes would be built to deliver a water use of 110 litres per person per day (Building Regulation Part G Mandatory[21]); and, 5% of existing homes in the district would be retrofitted with low flush cisterns, as well as aerated taps and shower heads.

The water neutrality analysis demonstrated that the optional requirement scenario would make some contribution to reducing the post-development demand (in 2031) within AW's current planned supply and demand balance. The mandatory scenario would potentially deliver a post-development demand reduction of 0.25Ml/d (6% reduction in additional demand) while the optional requirement would deliver a potential reduction of 0.66 Ml/d (17% reduction in additional demand). This highlights the importance of alternative strategic water resource options and demand management measures to be developed.

2.3 Water Resource Management Plan (WRMP)

The South East has experienced low rainfall in recent years, including dry winters. The 2013 EA classification confirms that both water supply areas that overlay F&HDC are ranked as being under serious water stress, meaning the South East regions do not have sufficient water for the whole of the 25-year planning period and therefore do not meet the customers demand for water. Expected climate change trends for the south-east are for drier summers, wetter winters, and more extreme events which also present possible issues in terms of water resources for AW. The District, with its important wetland habitats, is particularly susceptible to such changes and as such strenuous efforts are required to reduce the risk of water stress, especially in the European wetland sites.

AW is currently the supplier of potable water to F&HDC, along with South East Water, however, AW is the sole supplier of Potable Water to the area associated with the Otterpool Park, and the entirety of the study area is located within the WRZ7, which is also known as the Southeast region. WRZ7 abstracts 90% of the water supply from chalk and greensand groundwater boreholes with a minor component from the Denge gravels.

The AW Supply Zone is divided into eight WRZs which are broadly independent areas in which customers are supplied by a strategic pipe network from a number of local water sources. The WRZs also allow water to be transferred between zones to enable operational flexibility and are created as a strategic framework to facilitate assessment of the supply and demand. However, the Otterpool Park sits within AW's WRZ7, which is not directly connected to other AW WRZs, but small amounts of water are imported from the neighbouring South East Water and SW networks as discussed below.

The previous WRMP14, published by AW in 2015 concluded that there was not enough water to meet demand in all of the operating areas, and therefore options appraisal had been undertaken to consider ways to resolve the deficits. Feasible options to balance supply and demand included schemes to reduce leakage and implementing other water efficiency measures. These were consistent with Government aspirations to reduce per capita water consumption. AW identified possible schemes to provide additional water resources from groundwater, surface water and transfers from neighbouring water companies and third parties within, and in close proximity to, their boundaries. AW balanced supply and demand with a combination of options that had been identified through modelling and then validated through customer consultation. In general, across the aquifers, the 2005/06 water levels were more extreme although at a few sources the 2011/12 levels were lower and the Deployable Outputs values were modified at these sources. Within WRZ7, adjustments had been made in terms of source performance and for environmental reasons, which had resulted in some sustainability reductions, requiring additional measures within those areas to ensure the demand is met.

AW has since published the final WRMP[22] (WRMP19) in April 2020, which describes how the supply-demand balance from AMP7 (2020-25) onwards will be maintained till 2080. Arcadis and F&HDC have been closely engaging with AW since 2017 to ensure that the Otterpool Park is fully accommodated within WRMP19 proposals. The following latest information is provided by the WRMP19.

Table 3 below details the deployable output for WRZ7. Deployable output (DO) is the term used to define how much water can be abstracted reliably from a source during a dry year and delivered into the supply. It is measured in megalitres per day (Ml/d) and it is evaluated as an average DO over the whole year (known as

[21] Building Regulation Part G - Sanitation, hot water safety and water efficiency, HM Government 2015
[22] Water Resources Management Plan (2020 – 2080), Affinity Water April 2020

average DO or ADO) and during critical periods (typically a seven-day period) when demands are at their highest (known as peak DO or PDO).

Table 3: Deployable Output in Water Resource Zone 7

1 in 200 annual chance Average Deployable Output (Ml/d)	1 in 500 annual chance Average Deployable Output (Ml/d)	1 in 200 annual chance Peak Deployable Output (Ml/d)	1 in 500 annual chance Peak Deployable Output (Ml/)d
46	46	55	51

WRZ7 currently benefits from the following two existing bulk transfer agreements shown in Table 4. The volumes stated are the available capacity under the applicable agreement or arrangement, rather than utilisations which can vary depending on needs.

Table 4: Existing bulk transfer capacities in WRZ7

Providing Company	Receiving Company	Maximum Capacity At Average (Ml/d)	Maximum Capacity At Peak (Ml/d)
South East Water	Affinity Water WRZ7	2.0	2.0
Southern Water	Affinity Water WRZ7	0.0714	4.0

WRMP19 provides the baseline supply-demand balances at Dry Year Annual Average (DYAA) and Dry Year Critical Period (DYCP) for the Southeast region (WRZ7) as shown in Table 5. WRMP19 forecasts a population growth of approximately 13% by 2025, 32% by 2045 and 64% by 2080, equivalent to over 100,000 more people living in WRZ7. This growth in demand results in the small surplus of 1.3 Ml/d under average conditions in 2020 moving to a small deficit of 0.1 Ml/day under average conditions in 2045 to a larger deficit of 4.3 Ml/day under average conditions in 2080. WRMP confirms that there are no planned sustainability reductions in WRZ7 at average or peak conditions. It also shows that no noticeable long-term climate change impact is expected on supply in WRZ7.

Table 5: Estimated Baseline Supply Demand Balance in WRZ7 for DYAA and DYCP

DYAA or DYCP	2020/21 (Ml/d)	2045/46 (Ml/d)	2080/81 (Ml/d)
DYAA	1.3	-0.09	-4.28
DYCP	-0.65	-3.75	-11.18

The key objectives of the WRMP19 are outlined below, however, some of these may not be fully applicable to WRZ7 (e.g. water metering as this is already extensively implemented in WRZ7):

- Continue to work collaboratively with other water companies in our regions, in order to share water resources and promote regional coordination. For example, reducing the import of water from Anglian Water allowing Anglian Water to utilise more of this resource;
- Reduce leakage from water pipes where the savings justify the expenditure and to meet customer expectations;
- Continue to promote water efficiency to support customers to reduce demand;

- Facilitate economic growth by planning for housing and population needs; and
- Extend customer water metering and promote smart metering innovation, where it is cost beneficial.

WRMP19 confirms that the majority of the deficit in WRZ7 can be managed through the demand management measures, plus extension of AW's bulk supply arrangements with South East Water and SW shown in Table 4 before. Some licence changes and infrastructure schemes are still required (e.g. removing constraints around AW's Dover source and strengthening the network around Broome), primarily to address needs during periods of peak demand. A summary of the proposed supply side schemes are timings is provided in Table 6 below.

Table 6: Summary of proposed WRMP19 supply side developments in WRZ7

Scheme Name	Date Required	Deployable Peak Output (Ml/d)
Lye Oak Variation	2021	0.14
Tappington South Licence Variation	2044	0.7
Broom Network Improvement	2066	2.27
Dover Constraint Removal	2022	1.32
Barham Import increase (of 2 Ml/d) to 4 Ml/d	2057	2
Deal Continuation After 2020	2020	0.0714
Barham Continuation (After 2019/20)	2020	2

The final supply/demand tables in WRMP19 show that WRZ7 will have sufficient water till 2080 for both average conditions (DYAA) and peak conditions (DYCP).

Due to the scale of the Otterpool Park, the proposed housing allocation of 8,500 dwellings by 2042 (covered in this amended Planning Application) and a total of 10,000 dwellings by 2044 (including potential future development in wider masterplan area) are being included and assessed by AW in the updated WRMP19. The impact on water resources and infrastructure as a result of new development within the District does not solely depend upon the number of new dwellings constructed. Demographic changes, i.e. changes in population and occupancy rates, will influence the impact of each new dwelling. Behavioural changes such as changes in per capita consumption (PCC), in both new and existing dwellings, will also affect the impact that the development has on the water infrastructure.

Section 3 provides further discussion on water resources and supply considerations and impacts from Otterpool development, based on the WRMP19 findings and latest engagement being undertaken with AW.

2.4 Abstraction Licensing Strategies (ALS)

The EA monitors existing abstractions so as to understand the water balance within catchments and what water may be available for future use. The EA prepares Abstraction Licensing Strategies (ALS) to make sure there is enough water for people and the environment.

ALS assess the amount of water available in each river catchment and review all abstraction licenses to determine whether or not they are having an unsustainable impact on the environment. The ALS help to identify where water may be available for future use but also where water resource demands may be impacting the water balance and no further water is available for abstraction. There is one main strategy which covers the study area and the details are contained in Table 7.

Table 7: Abstraction Licensing Strategies Summary

ALS catchment	WRMU reference	Resource Availability Status
Stour	River East Stour and tributaries, Upper River Stour	Surface Water- water available for licensing during high flows. No water available for licensing during low flow. Groundwater- water available for licensing during high flows. No water available for licensing during low flow. Overall consumptive abstraction availability is at least 30% of the time

The ALS indicate that overall no further consumptive licences will be granted for the existing groundwater or surface water sources. There is no further water for abstraction as overall further abstraction would result in an unsustainable impact on the environment. Water companies may be able to 'buy' (known as licence trading) the entitlement to abstract water from an existing licence holder. In terms of groundwater, the Stour Catchment is important as it contains the principal aquifers that supply the wider District with water.

In summary, with no further licences being granted within the majority of F&HDC water efficiency measures relating to the existing supply will need to be implemented to safeguard water supplies into the future. Further sustainability reductions may be required in the future to support the aspirations of the Water Framework Directive[23] (WFD) (2000). Development of additional resources, or increased efficiency through demand management, will be required to maintain the supply required for new developments. Additional potable water demand for the Otterpool Park will be met by AW from the surplus water available elsewhere in WRZ7, in conjunction with the development of additional sources in the long-term, as discussed in Section 3.

2.5 River Basin Management Plan (RBMP)

River Basin Management Plans (RBMP) have been developed by the various regional offices of the EA and were published in 2009 and updated in 2015. The current RBMP is being updated and the final plan is due to be published in 2022. The RBMPs set out a strategy, including a Programme of Measures, for each catchment to comply with the requirements of the WFD. The WFD applies one of five statuses to a waterbody; Bad, Poor, Moderate, Good and High, with Bad status showing severe change from natural conditions as a result of human activity and High meaning that the water body is reaching near natural conditions. An assessment of the current status of the rivers has been made, showing the rivers and lakes that currently fall below the 'good' status required to meet the WFD targets. The documents then set out those rivers that should be at 'good' status by 2027. As with the ALS designations, Otterpool Park falls within the Stour catchment. Further information on the WFD, the current status, and future targets is included in Table 8.

Table 8: River Basin Management Plan Status Summary

Catchment	Sub Catchment	RBMP Cycle 2 2016			
		Overall Status	Ecological Status	Chemical Status	Objectives
South East	River East Stour	Moderate	Moderate	Good	Good by 2027

The major impact of the Otterpool Park on the water environment will be the variations in water quality and quantity discharged to receiving watercourses from the development itself (surface water runoff) and the

23 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, HM Government, April 2017

WwTW that serves the development. Water discharged from the development will require careful management to ensure that the development does not have a detrimental impact on the water environment.

2.6 Surface Water Management Plan (SWMP)

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by Lead Local Flood Authority (LLFA) in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments.

The eastern portion of the proposed development is covered by the Folkestone and Hythe SWMP[24] and the site falls within the DA01 Drainage Area. There were no specific actions or issues identified in the SWMP for the Otterpool Park. A generic priority action was to ensure new developments incorporate SuDS in accordance with the NPPF and to increase awareness of the benefits of SuDS and water recycling. This priority action is relevant to the Otterpool Park.

2.7 Catchment Flood Management Plan (CFMP)

Catchment Flood Management Plans (CFMP) are high-level policy documents covering large river basin catchments prepared by the EA. They aim to set policies for sustainable flood risk management for the whole catchment covering the next 50 to 100 years.

The Otterpool Park falls within the Stour CFMP. CFMPs split their catchments into sub-areas with similar flood risk management types and assign one of six policies to each sub-area. Table 9 summarises the policy statements relating to the Upper Stour sub-catchment, which the proposed development falls within.

Table 9: Catchment Flood Management Plan Summary which covers Otterpool Park

CFMP	Sub Area	Policy
River Stour	Upper Stour	Policy 6- Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

Action and objectives are then identified for each sub-area based on the policy assigned. These actions have been summarised in Table 10. Despite the different policies, all areas have been identified as rural areas of low to moderate risk and therefore there are some common themes in the proposed actions, most notably the need to maintain flood defences and improving floodplain connectivity.

Table 10: Catchment Flood Management Plan Policy Summary applicable to Otterpool Park

CFMP	Policy	Actions
River Stour	Policy 3	Develop a System Asset Management Plan (SAMP) to ensure existing defences are in good condition and able to accommodate increased flooding due to climate change. Carry out Upper Stour Strategic Review, a wider study from Upper Stour to Wye, exploring options for flood risk management including looking for opportunities for increasing floodplain connectivity, storage and attenuation.

[24] Folkestone and Hythe SWMP, JBA 2012

These wider policies are applicable to the Otterpool Park, and it is important that it seeks to manage surface water run-off to provide overall flood risk reduction or benefits.

2.8 Strategic Flood Risk Assessment (SFRA)

A Level 2 SFRA[6] for F&HDC was completed in 2015. The SFRA identified that a large proportion of the district is low-lying, with tidal inundation presenting the source of the most significant flood risk. Approximately 55% of the district's total area lies within Flood Zone 3a, an area considered to be at high risk from flooding. However, most of the residential areas and the fertile (yet low-lying) arable farmland that covers much of the district are generally well protected from flooding by tidal defences. These are either formal hard engineered structures or are formed by natural shingle barrier beaches that are actively managed to reduce the risk of breaching.

Many of the settlements across the district have experienced flooding in the past, including (but not limited to), Hythe, Folkestone, Newington and Etchinghill. Sources of past flooding have been predominantly from main coastal flooding, ordinary watercourses and surface water.

However, no historical flooding was listed for the Otterpool Park. The Stage 2 SFRA concluded that the Folkestone and Hythe District is generally located within a low-risk area in terms of groundwater flooding and has not specifically identified any risk within the area impacted by the proposed Development.

3 Water Resources and Supply

This section further discusses the relevant water resources and supply issues and recommendations for the proposed development area, by building on the initial discussion given in Section 2.

On a strategic level to meet the demand of the new developments within the F&HDC District, water will need to be continued to be brought into the catchment by AW. This is already the case, with water moved around the network to ensure demand is met resiliently. Strategic network reinforcements will be required to facilitate this increased demand. On a more granular level, local network reinforcements will be required to supply the development, and where necessary new mains will need to be laid to provide connections. Behavioural changes such as changes in per capita consumption (PCC), in both new and existing dwellings, will also affect the impact that development has on the water infrastructure.

A summary of PCC figures used in this updated WCS assessment are provided in Table 11 below.

Table 11: Otterpool per capita consumption Demand Scenarios

Scenario	PCC for New Dwellings	PCC for Commercial Buildings
D1	110 l/p/d – As defined by Building Regulations optional requirements and F&HDC CSR Policy SS8	PCC rate for commercial buildings is estimated in accordance with British Water Code of Practice: Flows and Loads – 4 (Latest Edition, 2013).
D2	125 l/p/d – As defined by Building Regulations minimum requirements.	PCC rate for commercial buildings is estimated in accordance with British Water Code of Practice: Flows and Loads – 4 (Latest Edition, 2013).

3.1 Water Demand Impacts

In order to assess the assumed development trajectory's (see and Appendix A) impact on extra water demand the following equation was used:

Total Water Demand = Existing Water Demand + New Water Demand

Where,

Water Demand = Population Equivalent * Per capita Consumption (PCC)

The key assumptions applied include:

- Water distribution leakage values have been discounted from the baseline demand calculation;
- Occupancy has been assumed to remain at a flat rate of 2.4 for new dwellings across the assessment period;
- PCC rate for residential homes for each demand scenario is taken as per Table 11; and
- PCC ate for commercial buildings is taken from British Water Code of Practice: Flows and Loads – 4 (Latest Edition, 2013), but only a selected commercial land use types and % of areas are added to the domestic water consumption demand to avoid double counting. This is because the majority of the new jobs will be fulfilled by the local residents of the Otterpool Park itself. Therefore, other uses such as Hotel (Class C1) and other non-residential uses (e.g., Classes E, F, B2 and Sui Generis) have been included in addition to the domestic water demand.

- The cumulative demand projection graphs for Otterpool Park are shown in Figure 5 below.

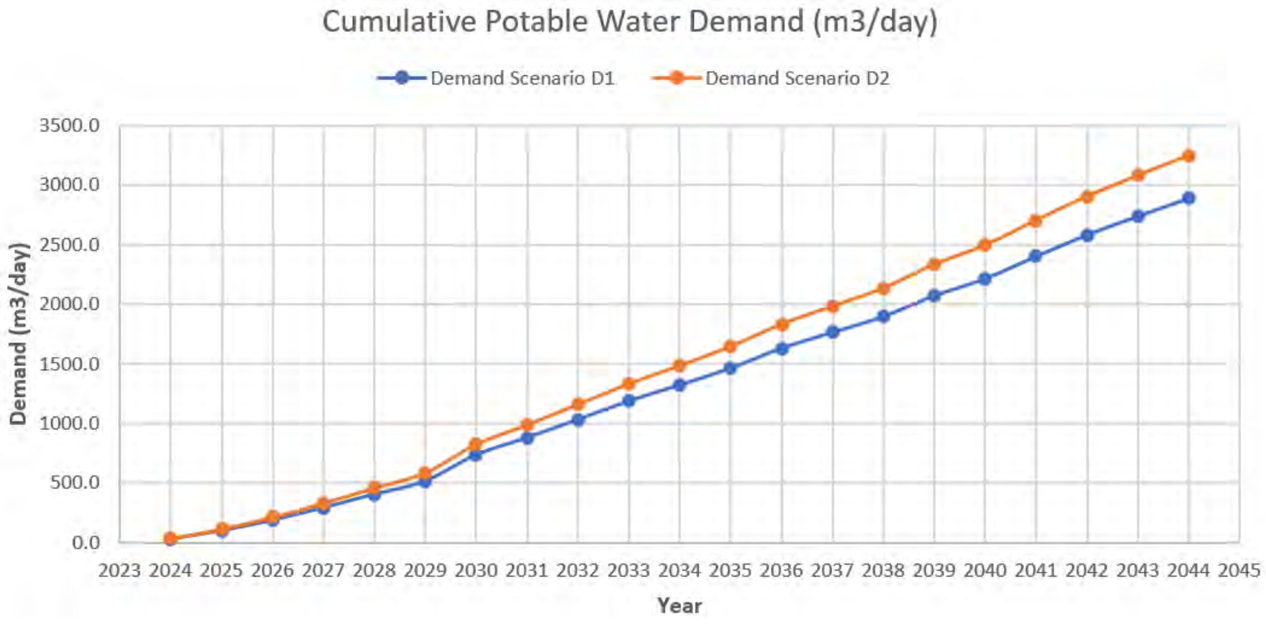


Figure 5: Otterpool Park Demand Projections 2024 – 2044

The projections show that there is a variation between scenarios with a final difference of 360 m^3/day between the two scenarios at the full completion of the Otterpool Masterplan Framework development in 2044. Table 12 provides an overview of the total extra potable water consumption within the development for each scenario shown in Figure 5 above.

Table 12: Otterpool Park Extra Cumulative Potable Water Demand Summary (by 2044)

Scenario	Domestic Demand (m^3/day)	Commercial Demand (m^3/day)	Total demand (m^3/day)
D1 (110 l/d/p)	2,640	248	2,888
D2 (125 l/d/p)	3,000	248	3,248

Phase 1 development is expected to be fully completed by 2030, which includes approximately 1,975 homes and associated commercial development. The total potable water demand by 2030 is estimated as 738 m^3/day and 826 m^3/day for scenario D1 and D2 respectively.

AW published WRMP19 (2020 – 2080) in 2020 and this is based on an estimated PCC of 124 l/p/d at the zonal level for new properties. AW also adopted this PCC figure to assess the necessary infrastructure needed to transfer water from source to the point of use at Otterpool Park. However, AW has used a per property figure of 450 l/property/day, which includes a Factor of Safety to allow for a certain level of daily and seasonal peak usage.

AW has carried out significant work to ensure that a sustainable and resilient water supply is available for this area. AW has adopted the latest plan-based forecasts (including the entire Otterpool Framework Masterplan Area) in its technical assessment for the Dour community (Water Resource Zone 7) up to 2080 for the WRMP19, where the proposed Development is located. Based on these, Water Resource Zone 7 is not currently predicted to enter a supply deficit until 2044/45 under the Dry Year Annual Average (DYAA) conditions. The final supply/demand tables in WRMP19 also show that WRZ7 will have sufficient water till 2080 for both average conditions (DYAA) and peak conditions (DYCP). The proposed WRMP19 supply side development schemes shown in Table 6 for WRZ7, have been already informed by a strategic environmental assessment and technical studies.

Therefore, AW has sufficient water resources to supply the whole Otterpool Framework Masterplan Area involving 10,000 homes. Based on the currently known development forecast AW has confirmed there is water supply infrastructure capacity for the early phase(s) of Otterpool Park, of approximately 1,500 additional residential units (i.e. until 2028) over-and-above the remaining quantum of growth modelled for in the latest WRMP19 forecasting. However, an offsite infrastructure upgrade will be required to accommodate the remaining Otterpool Park. This will include the construction of approximately a 11 km long, 560 mm diameter, new dedicated distribution main from Paddlesworth Reservoir to Otterpool Park, which involves the crossing of M20 and CTRL that may involve construction methods such as micro tunnelling, to minimise construction impacts. AW has confirmed that the required reinforcement can be planned and implemented ahead of the remaining development through the normal water industry's five-yearly business planning process.

The final route alignment and construction details will be determined by AW in the current AMP7 cycle (2020-25), as informed by future Environmental Impact Assessment and technical appraisals, minimising the potential environmental and construction impacts. As indicated in the Utility Strategy[25], the proposed offsite water main is likely to follow the route of existing main from the Paddleworth Reservoir and the routing to the point of water supply connection for Otterpool Park will be from the east.

AW has also confirmed that further work has been completed since 2017 to sustain the planned developments and improve resilience the existing customers, including the strategic plans for the future network reinforcements that will be required to service future development in the area.

AW currently has two large reservoirs, serving this part of the operational area that will also serve the Otterpool Park. These reservoirs are supplied by multiple, treated water sources and linked through a recently completed strategic transfer pumping station. Resilience is achieved by having flexibility to supply these treated water storage reservoirs and the transfer capability. Therefore, the proposed Development will be served from these reservoirs depending on the operational regime adopted. There are currently no plans for further strategic storage for the region, although AW will continue to examine future resilience needs in this operational area (e.g. upgrade to Paddlesworth supply reservoir).

The F&HDC WCS[20] recognises that there is also an opportunity for Otterpool Park to take an innovative approach to water supply and wastewater treatment through the endorsement of a site-wide integrated water system and smart technologies, to endorse the principles of water re-use and water recharge within the site boundary. F&HDC Core Strategy Review Policy SS8 (2022) endorses the need for an integrated water management approach to be applied and that domestic PCC should be limited to a maximum of 110 l/p/d.

AW strongly encourage policies which require all new developments to meet the highest water efficiency standards. The South East of England is a heavily water-stressed area, so this is well justified. Further discussion on how the Otterpool Park is planning to achieve this is given in the following sections.

3.2 Water Efficient Technologies

To achieve the required PCC target of 110 l/d/p under F&HDC Core Strategy Policy SS8 (2022), every residential property should include the following water efficiency measures as a minimum as per Building Regulations Part G2 optional standard requirement:

- 4.0/ 2.6 l for dual flush toilets;
- 8 l/minute for showers;
- 170 l for bath;
- 5 l/minute for basin taps
- 6 l/minute for sink taps
- 1.25 l/place setting for dishwasher; and

[25] Utility Strategy, Arcadis March 2022 (ES Appendix 4.8)

- 8.17 l/kilogram for dishwasher.

In addition, a 210 l standard water butt for each property is recommended.

For all non-residential properties (i.e. where applicable), in order to reduce whole building potable water usage development and therefore achieve the maximum water efficiencies under the mandatory water credits/ BREEAM 'Excellent' standard, the following fixtures and fittings should be provided:

- 4.0/2.6 l for dual flush toilets;
- Dry urinal systems;
- Kitchen and bathroom taps limited to 5 l/minute and 3 l/minute respectively; and
- 3.5 l/minute showers.

(However, where appropriate higher flow devices might be required for non-residential properties. Should be provided where this is appropriate.)

Other water efficiency technologies that have also been considered at Otterpool Park to exceed the required 110 l/p/d CSR SS8 policy target (with 2021 Main Modifications), as part of the proposed integrated water management solutions include:

- Rainwater harvesting at property level or community level for non-potable usage – the limited rainfall in Kent and longer drier periods along with cost constraints of providing large storage facilities to accommodate such practical considerations will limit the effectiveness and financial viability of delivering such measures across Otterpool Park. However, targeted intervention can be further explored where appropriate (e.g. schools, public buildings and high density development plots);
- Rainwater harvesting from strategic SuDS facilities for non-potable usage – the limited rainfall available in south Kent and additional space/storage and dual plumbing requirements plus extra financial costs will be a significant constraint again. Therefore, targeted intervention can be further explored (e.g. where larger existing and proposed water bodies are located);
- Monitor water usage, quality, and climate change impacts at all stages of the design-life of the proposed Development through smart metering. This should be combined with other smart home and office systems to give wider utility control and customer behaviours – e.g., educational and behavioural initiatives, network sensing to reduce network losses and improve efficiency, micro-controlled irrigation and smart irrigation systems); and
- Reclaimed wastewater recycling or 'grey water' recycling to provide some of the non-potable water demand – this option has been previously considered, but has been discounted now (i.e., in particular for the initial development phases) due to the higher financial, technical and operational risks when compared to the available other cost-effective rainwater harvesting methods above.

Local groundwater abstraction from new boreholes at a large scale would not be permitted as the local principal aquifer is over abstracted and its WFD quantitative status is classified as poor.

Local rainwater harvesting has many benefits including:

- Allowing valuable water resources to remain in the environment;
- Offsetting potable water use;
- Reducing net energy use by eliminating the need for additional treatment and associated transportation costs of potable water; and

- Reducing peak potable water demand.

Further discussion on the potential integrated water management solutions is given in Section 5. However, centralised rainwater or reclaimed wastewater harvesting will require a dual plumbing system in each household and a strategic distribution network from the recycled facility to each property. Therefore, this will increase initial capital cost for the development. Therefore, this solution is to be assessed further in terms of Life-Cycle cost and practicality within the detailed WCS for each phase of the Otterpool Park.

3.3 Sustainable Drainage Systems Infiltration for Water Supply Benefits

As mentioned before, the development is situated in a location which is known to have limited groundwater resources and is considered a water-stressed area. As part of the SuDS concept strategy and design development, consideration has been given within the masterplan as to how SuDS could be implemented with the aim to recharge the limited groundwater supplies, which will serve a dual benefit as this will also reduce the flood risk and the amount of surface water above ground.

This can be achieved through the implementation of SuDS strategies, which allow the water to infiltrate into the soil subject to the presence of suitable permeable ground coverage and depth. It is intended to promote the natural infiltration of water into the ground via swales, rain gardens, infiltration basins and wetlands. They can also encourage the base flows in the receiving watercourses to help to address the existing low flow issues during drier summer periods. However, this approach requires the surface water to be sufficiently treated before it is discharged and stored within the aquifer, this again can be achieved naturally through a ‘treatment train’ with a series of inter-linked SuDS. This treatment train allows runoff to be treated at the source, by allowing heavy metals and other pollutants to settle and separate from the runoff before discharging into the main watercourse.

Using a natural method such as infiltration basins and bio retention features is consistent with the garden settlement theme of the development and forms part of the surface water management strategy masterplan. Soakaways, permeable paving, swales, detention and infiltration basins as well as ponds and wetlands are located at multiple areas of the proposed development.

This is to contribute to the strategic objectives and desired effect of the SuDS design which is to ensure green space and properly landscaped SuDS are allocated to permeate the development providing aesthetic, biodiversity and education benefits to residents and surrounding communities, while providing the most efficient multifunctional form of SuDS. Water sensitive and attractive blue-green infrastructure proposals have been proposed across the Otterpool Park working closely with the landscape architects, master planner and ecologists to ensure water is a key defining feature in the landscape and place making process to maximise flood risk and non-flood risk benefits to the communities.

The infiltration-based SuDS measures require permeable and unsaturated zones to convey the water into the underlying soils and to the aquifer, and have sufficient capacity for lateral flow to prevent excessive groundwater mounding. Parts of the site is covered by freely draining soils which create good permeable conditions for the first stages of the infiltration. The underlying bedrock of the site consists of the Hythe Formation, which due to its limestone content presents as an efficient aquifer. The Hythe Formation is a suitable aquifer as it exhibits both fracture flow in cemented sandstones and intergranular flow through poorly consolidated sands. This could prove to have a capacity for further groundwater storage and would provide a porous storage area. However, the Hythe Formation presents difficulties with construction and infiltration as this formation is prone to solution features.

As mentioned in Section 3.2 above, there is further potential to harvest rainwater from the larger existing waterbodies and proposed water features/ SuDS at targeted locations, making an extra contribution to meet the non-potable water demand and therefore helping the development achieve its sustainability and water neutrality aspirations at Otterpool Park. Section 5.0 provides further discussion on this.

3.4 Summary

AW has sufficient water resources to supply the whole Otterpool Framework Masterplan Area involving 10,000 homes, but the key issue is to bring this water from their Dover and Folkestone supply zones to Otterpool Park. AW has adopted plan-based forecasts in their technical assessment for the Dour community (Water Resource Zone 7) up to 2080 for its Water Resource Management Plan 2019. Based on these, Water Resource Zone 7 is not currently predicted to enter a supply deficit until 2080 and the proposed WRMP19 supply side development schemes have been already informed by a strategic environmental assessment and technical studies.

The point of connection will be at various locations along the existing A20, with spine mains emanating off the points of connection to create ring mains within the respective development phases. In order to reduce the number of offsite mains needed for the Otterpool Development, AW will need to reconfigure the network to suit.

The full length of the 11 km water main will not to be in place until 1501st occupation and as such, AW has confirmed the following infrastructure phasing strategy to serve the full 8,500-unit development:

1. The first 1,500 properties can be provided by the existing system. This is because by utilising the spare capacity, a dedicated water main would not need to be in place until 2028 (i.e., assuming an onsite construction start date in 2023 and first occupation in 2024) with a build rate of 300-450 units per annum;

2. The next Phase of work will involve a new pipe (11 km long, 560 mm diameter) up to and beyond the HS1 crossing and the M20 (although the actual crossings could come later) to release capacity from Paddlesworth Reservoir for a significant number of properties, currently estimated at 6,000; and

3. The final phases of the works will be to complete the local network reinforcement around the crossings and tie in with one of AW higher strategic pressure mains, including carrying-out local reconfiguration of the network to release capacity for up to 10,000 properties (i.e., from Paddlesworth Reservoir or multiple storage assets in the WRZ7) and ensure a sustainable and resilient supply is available for Otterpool Park and wider area.

Significant design work and network modelling is required before Affinity Water is able to estimate the potential cost, delivery timeframes and construction details of the full network upgrade scheme, but the costs will very likely be recovered as a contribution associated to each new connection as opposed to a single high-value contribution by the developer. The first phase can be implemented by 2024. The indicative implementation programme for the second phase (i.e., from the start of planning through to construction completion) is 4-5 years to allow for the two crossings of strategic infrastructure by AW, including the associated environmental assessment and technical appraisals. Therefore, this upgrade can be planned in AMP7 cycle (2020 – 25),the second phase can be implemented prior to 2028 within the next AMP8 cycle (2025-30) and the final phase can be implemented in AMP9 cycle (2030-35).

Ofwat has revised the way that Infrastructure Contributions are calculated for all new connections and subsequently invested by the water undertakers. The new water main is classified as a ‘site-specific off-site main’ and according to AW charging rules, a 10% offset contribution is required from the Developer.

As Otterpool Park is located in a water-stressed area, further water efficiency measures will be put in place to manage the amount of extra drinkable water consumed by each new household to 110 litres of water per person, per day as per the modified CSR Policy SS8 (with 2021 Main Modifications). This PCC target can be achieved using the water efficient fittings described in Section 3.2 alone. However, it is recommended further assessment is undertaken as part of the development planning process to cover the detailed requirements of delivering and monitoring such measures, including whether rainwater harvesting can be implemented at targeted locations to exceed the current PCC target of 110 l/p/d, where this is practical and viable.

Water management at the Otterpool Park can also help to deliver other objectives for the development including a sense of place, green infrastructure, biodiversity, education and awareness, and water sensitive behaviour. Early consideration of water management provides the opportunity to integrate the water environment into the local context and character of the area, enriching both the natural and built environment.

By fully integrating the management of water and by considering all space as potentially multifunctional, water management systems can be used to enhance development viability through the delivery of the design criteria.

This can result in a number of benefits:

- Additional supply of water resources, to improve water security;
- Higher value amenity, recreation and education facilities within public open space;
- Improved habitats and biodiversity;
- Improved climate resilience;
- Reduced pressure on water infrastructure and reduced surface water flooding;
- A mechanism for enhancing and defining the quality, character and visual aesthetics of both the built environment and green/ open space;
- A surface water management system that can be easily maintained and cost-effectively maintained; and
- Flood risk reduction or betterment within Otterpool Park and downstream.

Therefore, water sensitive and attractive blue-green infrastructure proposals that promote a low-carbon and highly sustainable development is a key theme in the Otterpool Park to create place making and maximise flood risk and non-flood risk benefits of the proposed development. Surface Water Management Strategy, Green Infrastructure Strategy (ES Appendix 4.11), Strategic Design Principles (ES Appendix 4.3) and Design and Access Statement (ES Appendix 4.16) fully explore

4 Wastewater Treatment and Sewerage

4.1 Existing Situation

Wastewater treatment and conveyance within the Otterpool Park and the wider District is managed by SW, a simplified overview map of wastewater collection and treatment assets in this area is provided in Figure 6 below.

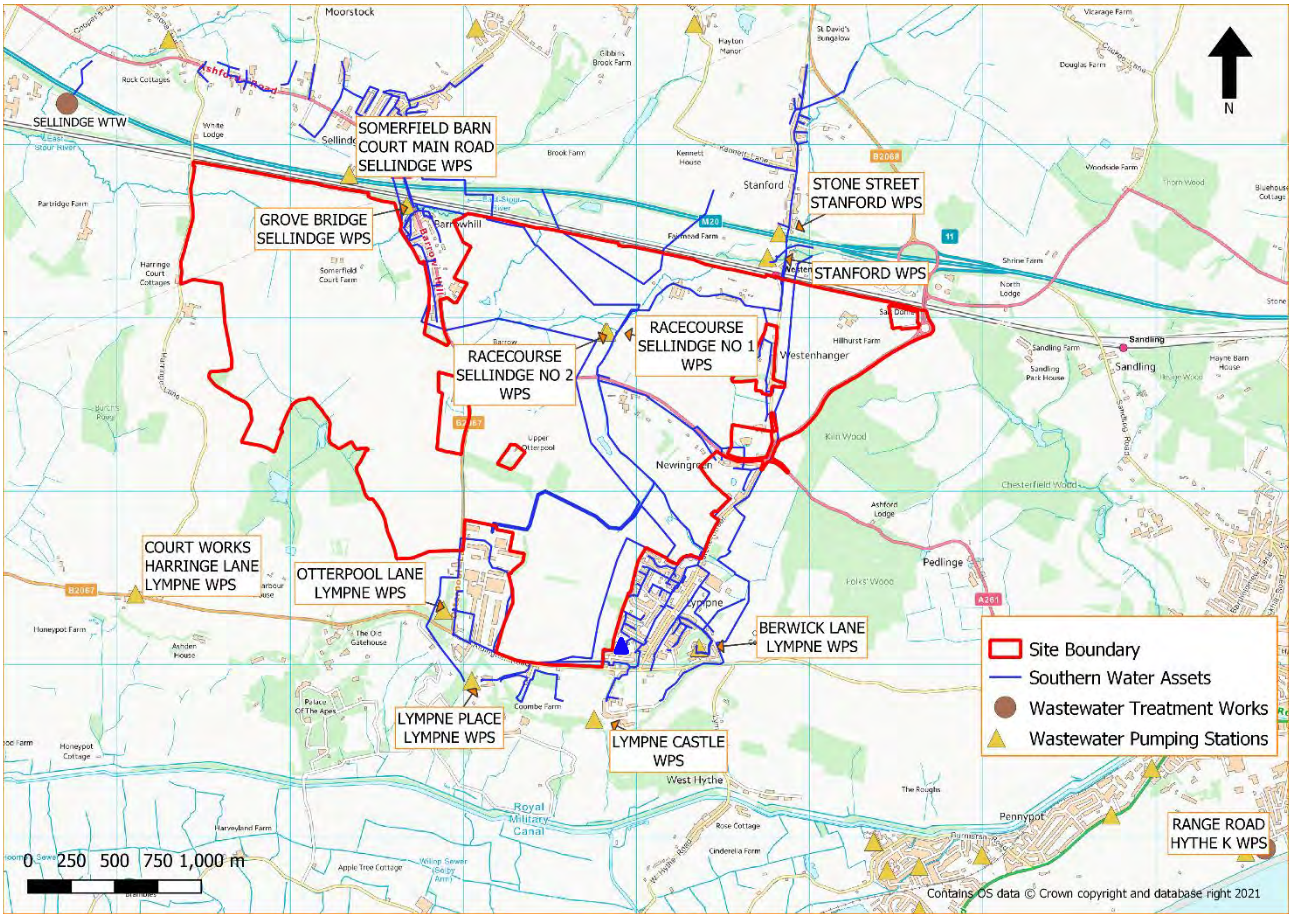


Figure 6: Wastewater collection and treatment assets.
(The planning Application Site boundary is outlined in red.)

There are existing operational SW wastewater assets on the site that serve the wider catchment. Arcadis has explored the potential to use this existing infrastructure to serve the initial phases of the development, but currently insufficient extra capacity is available for this. Significant lengths of the existing rising mains and gravity network will also need to be diverted to facilitate development build-out, as much of this existing infrastructure currently sterilises developable land, which can be seen on Figure 6 above.

The nearest WwTW is located at Sellindge, north of HS1 railway line to the north-west of the Otterpool Park. A Pumping Station (PS) is currently located on the existing racecourse within SW owned land, within the redline boundary extent, which takes flows from the existing wider catchment. The existing Racecourse Pumping Station (PS) is connected to the Sellindge WwTW by a series of rising mains and gravity sewers, which extend north to the northern boundary of the site and cross under the HS1 railway and M20 before heading west along A20, into Sellindge WwTW.

SW has advised that Sellindge WwTW has headroom for approximately 1,000 new household units before a significant upgrade will be required to accommodate the additional flows from the proposed Development, but the required upgrades are still possible within the boundary of land owned by SW at the location of the works. SW has also advised that significant offsite reinforcement will be required to connect the development to the existing network. A feasibility study[26] was completed in 2019, which assessed the current Racecourse and Grove Bridge PSs, rising mains and the receiving gravity network as well as the upgrade requirements at Sellindge WwTW to accommodate Otterpool Park. This feasibility study concluded that no capacity for additional flow from the Otterpool Park is currently available at Racecourse PS and there are no planned upgrades or maintenance works to this PS in the short term. SW has also confirmed that there is capacity for only 163 new homes at their Grove Bridge Sellindge PS for the initial phases at Otterpool Park.

Discussion on the potential sewerage and WwTW options are discussed below. Therefore, in order to confirm the impact of the proposed Development, the following aspects have been assessed as part of this WCS:

- Impact of development trajectory on volumetric discharge in terms of Dry Weather Flow (DWF) in relation to existing WwTW discharge consents;
- Identification of WwTWs which require upgrading or where upgrades are not feasible or preferable, identification of potential for new WwTWs;
- Identification of key wastewater and environmental constraints;
- Commentary on the sewerage network constraints; and
- Recommendations for mitigation solutions and future detailed studies.

4.2 Otterpool Flow Loading Projections

As mentioned before, the proposed development consists of 8,500 dwelling units up to the year 2042 (within the Application Site), with an additional 1,500 units from 2042 to 2044 (within wider masterplan area), taking the total to 10,000 units.

A recognised methodology has been applied to calculate the wastewater generated from the development as follows:

$$\textit{Total DWF} = \textit{Existing DWF} + \textit{New DWF}$$

Where

$$\textit{DWF} = \textit{PG (population equivalent} \times \textit{PCC)} + \textit{I (infiltration)} + \textit{E (trade flow)}$$

The maximum PCC rate stated in the recently amended Policy SS8 for new dwellings is now 110 l/p/d, which is below the maximum requirement for Building Regulations (125 l/p/d).

The baseline DWF has been calculated using the measured DWF provided by SW for the existing Sellindge WwTW whereas the increased DWF from the proposed Development in this WCS is calculated using the following criteria:

- PCC rate for residential dwellings is taken as 110 l/p/d to estimate the “Lower Bound DWF” for the EA discharge permit analysis purpose;
- PCC rate for residential dwellings is taken as 130 l/p/d to estimate the “Upper Bound DWF” for preliminary WwTW treatment capacity design and worst case for the EA discharge permit analysis purpose;
- PCC rate for commercial buildings is estimated in accordance with British Water Code of Practice: Flows and Loads – 4 (Latest Edition, 2013). However, only a small % commercial land use types and areas is added to the domestic DWF loading to avoid double counting. This is because the majority of the new jobs will be fulfilled by the future occupants of the Otterpool Park itself;
- An average household occupancy rate of 2.4 is assumed as per the Otterpool masterplan;
- An infiltration rate allowance is assumed as 10%, reflecting new construction status of the sewers in line with SW general developer services modelling guidance; and
- No additional trade flow is added as trade flow permits are not expected at the proposed Development.

[26] Otterpool – Growth Study, Southern Water June 2019

However, WwTWs typically discharge up to three times their DWF (referred to as Flow to Full Treatment – FFT) at peak. An increase in FFT, due to growth in the catchment, may increase the flood risk to properties and environmental sites on the watercourse downstream of the discharge point.

Total FFT = Existing FFT + New FFT

Where

FFT = 3 x PG (population equivalent × PCC) +I (infiltration) + E (trade flow)

Table 13 shows Lower Bound and Upper Bound DWF and FFT estimates for Otterpool Park Tier 1 OPA and Framework Masterplan.

Table 13: Extra DWF Loading Projections From Proposed Development

Flow Loading Type	Otterpool Park Tier 1 OPA		Otterpool Park Framework Masterplan	
	Lower Bound DWF (m^3/day) – with domestic PCC rate of 110 l/p/d	Upper Bound DWF (m^3/day) – with domestic PCC rate of 130 l/p/d	Lower Bound DWF (m^3/day) – with domestic PCC rate of 110 l/p/d	Upper Bound DWF (m^3/day) – with domestic PCC rate of 130 l/p/d
Domestic	2,244	2,652	2,640	3,120
Commercial	248	248	248	248
Domestic + Commercial	2,492	2,900	2,888	3,368
Infiltration (@ 10%)	249.2	290.0	288.8	336.8
Total DWF	**2,741.4**	**3,190.2**	**3,177.0**	**3705.0**
Total FFT	**7,725.6**	**8,990.4**	**8,953.2**	**10,441.2**

However, an extra 350 new dwellings are also proposed at Sellindge Phase 2 Sites (CSD9A and CSD9B) as part of F&HDC CSR, which will generate following extra DWF and FFT values (inclusive of 10% infiltration allowance) if they are included within the WwTW and nutrient mitigation options discussed below:

- Lower Bound DWF – 101.6 m^3/day;
- Upper Bound DWF – 120.1 m^3/day;
- Lower Bound FFT – 286.4 m^3/day; and
- Upper Bound FFT – 338.5 m^3/day.

4.3 Preliminary Wastewater Treatment Options

Three options have been considered for the treatment of the wastewater generated by the Otterpool Park development. There are two potential options to discharge offsite, one option is to utilise Sellindge WwTW, located 1 km to the north west, and a second option is to connect, via the Range Road PS, to West Hythe WwTW, located approximately 7 km to the south-east. An onsite WwTW is also considered as discussed below.

4.3.1 Option 1 – Southern Water Sellindge Wastewater Treatment Works

Under this option, all the wastewater from Otterpool Park would be disposed of to the Sellindge WwTW operated by Southern Water. Southern Water have confirmed that it is possible to upgrade the Sellindge WwTW to accommodate flows from the development and that the capital cost for undertaking these upgrade works will be normally met by Southern Water.

4.3.2 Option 2 – Onsite Wastewater Treatment Works

Wastewater generated by the Otterpool Park development can also be treated on site. This will be facilitated through the engagement of a New Appointment Variation (NAV).

NAV are limited companies which provide a water and / or sewerage service to customers in an area which was previously provided by the incumbent monopoly provider. A new appointment is made when a limited company is appointed by Ofwat to provide water and/or sewerage services for a specific geographic area.

4.3.3 Option 3 – Southern Water West Hythe Wastewater Treatment Works

There is another existing WwTW; West Hythe, approximately 7 km from the boundary of the Otterpool Park development. West Hythe WwTW will need to be upgraded and this cost can be met by Southern Water subject to further benefit-cost assessment. However, these upgrades are complex and costly compared to the upgrade works that will be required at Sellindge WwTW.

4.4 Preliminary Wastewater Treatment Options Assessment

Extensive discussions with SW engineers and planners based on their knowledge of current capacity and performance at these existing WWTWs have been undertaken to assess the potential impact from the proposed development. The outcome of these consultations with SW and other NAV providers, that is informed by feasibility studies, are discussed below.

4.4.1 Option 1 – Southern Water Sellindge Wastewater Treatment Works

An initial connection to the WwTW can be made via Grove Bridge Pump Station if required but this has capacity for only 163 new units. Southern Water have confirmed that there is treatment capacity at Sellindge WwTW for approximately 1,000 new units. However, there is insufficient capacity within the existing pipe network between Grove Bridge Pump Station and Sellindge WwTW beyond 163 new homes even if the pump station was upgraded. Therefore, under this WwTW option, the proposed Point of Connection will be directly to Sellindge WwTW via a new rising main from the northwest boundary of the development to the WwTW crossing underneath HS1 Railway. The new rising main is likely to consist of a 200mm diameter temporary rising main for the first phase of the proposed Development, which will cater for up to 2,100 new homes (to ensure self-cleansing velocity of 0.75 m/s etc) and then increasing to 450mm diameter permanent rising main to accommodate the entire 10,000 homes Otterpool Framework Masterplan Area.

The proposed Development will require diversions of the existing FW drainage network across the site especially in south eastern and central parts of the site. As highlighted above in Section 4.1, the existing flows from Lympne and Stamford currently drain to the existing Racecourse Pump Station and Grove Bridge Pump Station. Therefore, Option 1 will provide the opportunity to introduce improvements to the existing network and by incorporating this existing network into the proposed Otterpool Park network. This makes the new pipework immediately adoptable by SW as it will be carrying flows from the existing customers. This solution may also attract cost sharing opportunities with SW due to the mutual benefits to all parties.

SW have provided preliminary proposals and feedback comments for the phased approach to this option. It is noted that a total delivery period of approximately 4 years is estimated to provide the new rising mains to Sellindge WwTW plus the Phase 1 upgrade to the treatment plant, which will accommodate 8,500 dwellings. Phase 2 upgrade to the WwTW will accommodate the full 10,000 dwellings.

Following the completion of the Otterpool Park growth feasibility study in 2019, SW started a Risk and Value Exercise in 2020 to confirm and develop the preferred WwTW to accommodate Otterpool Park. However as highlighted in Section 2.1.2.2, Sellindge WwTW is also one of the SW assets that is also being investigated under a separate WINEP detailed study, which is due to be completed in 2022. This is to address NE's concerns in relation to potential linkage of existing WwTW discharges with nutrient enrichment at Stodmarsh Lakes European Designated Sites, as further described in Section 4.8. Therefore, until the WINEP study and associated recommendations are fully implemented there is considerable risk that the proposed Development is unable to connect to Sellindge WwTW, delaying the current programme.

4.4.2 Option 2 – On-site Wastewater Treatment Works

It is proposed that an on-site WwTW will be located in the northwest corner of the site with treated discharge into the adjacent watercourse (River East Stour). Albion Water and STC have been approached as a potential NAV provider to provide preliminary proposals for this option. As highlighted in Section 4.10, STC has now been formally appointed by Otterpool Park LLP to progress the Otterpool WwTW feasibility studies, enhanced outline design and EA discharge permit application.

As per Option 1 above, NE's concerns on the Stodmarsh Lakes nutrient enrichment, including the need to achieve nutrient neutrality is applicable to Option 2 because onsite WwTW will be located within the same EA's River Upper Stour operational catchment. Sections 4.8 to 4.10 provide further details on nutrient neutrality assessment and mitigation requirements, confirming the preferred option for Otterpool Park.

4.4.3 Option 3 – Southern Water West Hythe Wastewater Treatment Works

West Hythe WwTW will need to be upgraded, but these are inherently complex and costly compared to the upgrade works that will be required at Sellindge WwTW.

As part of SW's preliminary appraisal for the required treatment upgrade, the additional full development flow was considered by increasing the existing FFT by 120 l/s, utilising the existing works with additional treatment processes. The upgrade requirements would be for new inlet screening and grit removal; additional Activated Sludge Processing lane with upgrades to the Return Activated Sludge pumps and intermediate pumps; 2 No. new Final Settlement Tanks; 1 No. new sludge holding tank; upgrade of effluent return pumps and upgrade of power facilities. This notional solution however excluded an assessment of the outfall condition and its ability to accept the additional flows, which remains as a significant risk to this option.

The main difficulties associated with accommodating proposed Development at West Hythe WwTW include:

- Treatment works is served by a single pumping station (Range Road), which accommodates the preliminary treatment for the catchment prior to flow transfer to the treatment works, and limited expansion capacity is available at the pumping station site;
- A 7km long rising main is required for the transfer of flow to Range Road pumping station, including the significant potential for undertaking an Environmental Impact Assessment (EIA) for the pipeline;
- Limited land availability within the existing WwTW site boundary;
- Significant uprating of pumping capability and rising main to the WwTW is required if Otterpool Park flows are transferred to Range Road;
- Flows from treatment works are pumped back to Range Road prior to pumping down long sea outfall, the increase in flow will require new transfer pumps and rising main between West Hythe WwTW and Range Road Pumping Station;
- As there is no storage at West Hythe WwTW the incoming flow and outgoing flows are finely balanced, introducing additional flows directly to West Hythe also make the management of flows more complex; and
- Increased flows may require new/additional long sea outfall and a tightened discharge permit.

These complexities are in addition to the issues associated with transferring flows from Otterpool Park over a distance of 7 km to a different water catchment/coast from the current East Sour catchment that Otterpool Park is located. This is not desirable due the scarcity of water in south-east England and exacerbate low flow issues in the River Stour.

Therefore, the West Hythe WwTW option has been discounted from further appraisal and only Sellindge WwTW will be taken forward along with onsite WwTW option discussed in Section 4.5 below.

4.5 Shortlisted Wastewater Disposal Options Assessment

4.5.1 Shortlisted WwTW Options Comparison

As highlighted in Section 4.4, only Options 1 and 2 have been taken forward for further review due to the complexities and costs associated with Option 3. Table 14 below compares the two shortlisted WwTW options.

Table 14: High level appraisal of shortlisted WwTW options

WwTW	Pros	Cons
Option 1 – Southern Water Sellindge WwTW	Make use of an existing WwTW facility with all upgrades paid for by Southern Water so less up-front costs for the developer	Less control over the timeframe for delivery
	Potential for early adoption of the network and reduced costs/land take for existing sewer diversions if existing flows are incorporated in the Otterpool Park new network	Possible issues with crossing HS1
	Retains option of disposal of wastewater for Otterpool Park future development phases	• Need to achieve precautionary nutrient neutrality requirement (nitrates and phosphates) to protect Stodmarsh • The required nutrient neutrality measures are likely to be more extensive, costly and complex to deliver when compared with Option 2 • Significant risk to Otterpool Phase 1 programme due to the ongoing WINEP study
	Benefit to outlying communities	Offsite rising mains and pumping costs
	Favours the EA's discharge permitting regime	Possible lack of space on Sellindge WwTW to accommodate the additional process units required to meet the NE's nutrient neutrality requirement and OWFAT also may not allow funding for the level of growth and treatment required that could limit the amount of development that SW are prepared to do in the longer term, limiting the actual development growth.

WwTW	Pros	Cons
Option 2 – Onsite WwTW	Greater control over deliverability	Land required for the treatment facility and significant up-front costs impacting overall development viability
	Greater engagement with the local community, potential for ecosystem service and natural capital benefits as a result of land ownership/ stewardship/ management	No benefits for existing communities
	Reduced foul water pumping	Need to achieve nutrient neutrality (nitrates and phosphates) as per Option 1
	Avoiding construction of offsite sewers and crossing under HS1	Higher capital costs
	Potential for local employment	Lead in time for delivery and commissioning
	Potential to use residual nutrients in local irrigation schemes (bio-resources and certain foods)	Less favours the EA's discharge permitting regime
	Prices no higher than regional incumbent	Additional sludge tanker movements on the road to and from the new WwTW
	Ability to provide a more advance and greener treatment technology plus onsite wetlands/ woodland planting to help achieving NE's nutrient neutrality requirement to protect Stodmarsh Lakes	
	Ability to provide an integrated water management solution for Otterpool and wider community, including possible water reuse	

4.5.2 Sellindge WwTW Option

Sellindge WwTW discharges to the River East Stour and the catchment is primarily underlain by impermeable Weald Clay. Rainfall flows quickly into the watercourse producing high flows in the wetter, winter months and very little flow during dry summers. Average annual flood, at 650 mm/year, makes it one of the driest areas in the country. For extra discharges to the River East Stour, the relatively large DWF volume compared with the river's natural flow will result in tight discharge permit limits (see Section 4.6).

Arcadis latest wastewater DWF calculations associated with Sellindge WwTW Option are outlined in Table 15. This shows that the Lower Bound and Upper Bound DWF impacts for the Otterpool Park Tier 1 OPA and Framework Masterplan, including 350 new homes at Sellindge Phase 2 Sites.

Table 15 indicates that Otterpool Park and Sellindge Phase 2 Sites will result in the existing EA discharge permit being significantly exceeded at Sellindge WwTW for all scenarios. SW has confirmed Sellindge WwTW could be upgraded (within the currently owned land limit) to fully cater for the Otterpool development, while meeting the suggested indicative discharge permit provided by the EA (Section 4.6). As mentioned above, SW has also confirmed there is currently capacity for approximately 1000 new homes at the WwTW.

Table 15: Dry Weather Flow Impacts at Sellindge WwTW (including 350 homes at Sellindge Phase 2 Sites)

New Development Coverage	Existing DWF Consent (m^3/day)	Measured Baseline DWF (m^3/day)	Total Increase in Dwellings (2024-2044)	DWF Increase – Lower Bound (m^3/day) (PCC:110 l/p/d)	DWF Increase - Upper Bound (m^3/day) (PCC:130 l/p/d)	Total DWF - Lower Bound (m^3/day) (PCC:110 l/p/d)	Total DWF – Upper Bound (m^3/day) (PCC:130 l/p/d)
Otterpool Park Tier 1 OPA + Sellindge Phase 2	1,594	773	8,850	2,843	3310.3	3,616	4,083.3
Otterpool Park FMP + Sellindge Phase 2	1,594	773	10,350	3,278.6	3,825.1	4051.6	4,598.1

As explained before, a 200mm diameter temporary rising main and a new 450mm diameter rising main will be required as the available Point of Connection is directly to Sellindge WwTW, including a new crossing under the HS1 railway. The concurrent laying of both pipes is preferential from cost-viability purpose, but the temporary rising main will be required to connect the first property.

SW has started the Stage 1 Risk and Value exercise in 2020, to develop its preferred WwTW solution to serve Otterpool Park, by building on the recommendations of the 2019 feasibility study. However, making significant progress on the detailed design of the preferred rising mains route and Phase 1 treatment capacity upgrade has been partly hampered by the ongoing WINEP study risk, which is planned to be concluded in 2022.

If the WINEP study concludes that the discharge of nitrates and phosphates from Sellindge and other WwTWs negatively impacts Stodmarsh, then significant quality upgrades and offsite mitigation may be required across the impacted catchment. Given the five yearly cycle AMP funding periods, it could be unlikely that any such major improvements would be sufficiently completed before 2030 (i.e., as the worst case) although theoretically construction works can start anytime from 1st April 2025, assuming that further technical studies will be undertaken by SW in the current AMP7 period (2020-25). This is a major risk and will have a significant impact on the Otterpool Park delivery programme, leading to the consideration of alternative solutions discussed below.

Section 4.9 discusses likely indirect measures required to meet nutrient neutrality if proposed Development is to be connected to Sellindge WwTW ahead of WINEP study completion.

4.5.3 On-Site Disposal Providing New Onsite WwTW

Using the same approach as per Sellindge WwTW, the latest wastewater DWF calculations associated with onsite WwTW Option are outlined in Table 16 below. As a worst-case scenario for DWF loading, it was assumed that Sellindge Phase 2 Sites will also be connected to Otterpool onsite WwTW, as per the consultations held with F&HDC and NE.

Table 16: Dry Weather Flow Impacts at Onsite WwTW (including 350 homes at Sellindge Phase 2 Sites)

New Development Coverage	Total Increase in Dwellings (2024-2044)	Total DWF – Lower Bound (m^3/day) (PCC:110 l/p/d)	Total DWF – Upper Bound (m^3/day) (PCC:130 l/p/d)
Otterpool Park Tier 1 OPA + Sellindge Phase 2	8,850	2,843	3310.3
Otterpool Park FMP + Sellindge Phase 2	10,350	3,278.6	3,825.1

4.6 Wastewater Treatment Discharge Permitting Needs

The major impact of the development on the water environment will be the variations in water quality and quantity discharged to receiving watercourses from the WwTW that serve Otterpool Park. Where discharges from WwTW will exceed the existing DWF consent, it is likely that the chemical constraints included within these consents will be tightened by the EA, to ensure that the water quality of the receiving watercourses does not deteriorate due to the increased discharges.

When assessing possible consent changes to the existing permits or issuing permits for new WwTWs the EA will take account of any sensitive sites and species downstream of the discharge, as well as the current dilution available from the river flow, and the possible benefits of increased flows.

The majority of receiving watercourses already exhibit high levels of phosphate, which cause them to be classed as not achieving good ecological status (or GES) under the WFD. This is a key concern throughout the majority of the East of England and will require ongoing cooperation between water companies, the EA and other parties such as Defra to overcome this issue. The development may not be permitted if it will lead to a deterioration in water status or will prevent Good Status from being achieved in line with DEFRA/EA recommendations.

WwTWs treat the sewage by a variety of methods to a standard that allows the water to be discharged to a watercourse without harm to the environment. The EA provides the regulatory framework in terms of rate of discharge and acceptable water quality that sewerage undertakers must achieve to allow the effluent to be discharged.

For WwTWs which receive effluent from combined sewerage systems, the EA regulate flow volume discharged by limiting the DWF of the discharge to a maximum value. This is important because the impact of a discharge on the receiving water is directly linked to the volume discharged. The effluent quality limits are determined on the basis of the consented DWF. In general, as the DWF increases, the quality limits become tighter.

Discharge volumes from the WwTW are calculated by the operator and a new permit issued by the EA which states a maximum DWF and corresponding limits for various parameters, principally BOD, ammonia, phosphate and suspended solids. Also, depending on the process chosen, the EA can impose other parameters (e.g. Iron or Aluminium if added to remove phosphate). It should be noted that the permit limits required for the new discharge may be beyond the limit of conventional treatment technology and thus could constrain development within a WwTW catchment.

4.6.1 Indicative Discharge Permit Modelling

The estimated DWF values were provided to the EA and mass balance Monte Carlo simulations had been undertaken by the EA in 2018 to understand the future indicative consent standards that would need to be applied to a new discharge or increased existing flow consents, and the change in downstream concentrations of physio chemical elements following a discharge. The EA 2018 modelling used the following projected DWF scenarios shown in Table 17.

Table 17: Dry Weather Flow Estimated Used in 2018 EA Discharge Permitting Modelling

New Development Coverage	Lower Bound DWF (m^3/day)	Upper Bound DWF (m^3/day)
Sellindge WwTW	3,877	4,508
Onsite WwTW	2,841	3,472

Table 15 and Table 16 show that the latest DWF estimates for each WwTW option are still within the EA's previously modelled DWF range in Table 17 if only Otterpool Park Tier 1 OPA and Sellindge Phase 2 Sites are to be connected.

However, the previously modelled DWF Upper Bound value will be exceeded at both WwTW options when the extra 1,500 dwellings within the remaining Framework Masterplan are also connected (i.e. by 90.1 m^3/day at Sellindge WwTW and 353.1 m^3/day at onsite WwTW respectively). Therefore, the indicative quality discharge permit values should be verified with the EA and updated accordingly through the normal permitting process.

For the purposes of comparing the implications of future consent requirements, the following physio-chemical standards have been assumed to represent current and future best practice. However, these should not be considered definitive, and will be subject to individual site conditions, existing processes employed, and strategic investment decisions undertaken by SW or the appointed NAV based on current and future Ofwat/ EA priorities.

The Red Amber Green (RAG) colour convention in Table 18 is used throughout the following sections to identify where the modelled water quality values fit into the above categories. The figures quoted are in milligrams per litre (mg/l) and the determinants are Biochemical Oxygen Demand (BOD), Ammonia (Amm.N) and Soluble Reactive Phosphorus (SRP).

Table 18: Current and future effluent quality standards assumed to be economically achievable using conventional treatment technology

Notes	BOD mg/l **(95%ile)**	Amm. N mg/l **(95%ile)**	SRP mg/l **(Annual Average)**
Limits typically considered as reliably economically achievable using conventional technologies.	8	3	1
Limits that may be currently achieved by enhanced operation of conventional and emerging processes. Although not as reliable as the above, it is assumed that consents such as these will become more common over the study period if water quality constraints are to be met.	5	0.5	0.25
Limits more stringent than the above, where it is assumed unlikely a water company or process supplier would be able to guarantee such performance in the foreseeable future at a large scale without resorting to energy-intensive processes normally reserved for potable water treatment. *	<5	<0.5	<0.25

** If such standards were required in the short term, it is likely the water company and the EA would have to agree to set lower targets for the waterbody under the provision of the WFD, allowing the failure to meet good status for reasons of technical feasibility or disproportionate cost. This would be reviewed every six years under the WFD.*

The EA normally takes the applied-for DWF, described above, limit at face value, although details of the calculation form part of the consent application. However, it is in the operator's own interests to apply for the correct limit, as a too-low limit may lead to consent non-compliance and a too-high limit can result in tighter quality standards than would otherwise be the case.

The River East Stour River is classified as Moderate under the WFD. One of the reasons that the water body is not achieving Good status is high phosphate levels. Phosphate levels are believed to be elevated due to a number of factors including agriculture, urban run-off and treated wastewater. The water body is also not achieving Good status due to Macrophytes and Phytobenthos.

River flows in the upper catchment of the River East Stour can be very low, making it generally unsuitable as a receiving watercourse for treated effluent. Any treated effluent would need to be to a very tight standard to ensure no deterioration of the water body.

Table 19 below details the potential water quality implications of the EA discharge permits if the new development is connected to existing Sellindge WwTW or served by a new onsite WwTW, based on the previous EA preliminary modelling in 2018. The EA has recently confirmed that these discharge permit values are still applicable unless the previous DWF estimates are changed.

Table 19: Indicative Discharge Permit Modelling Results Summary (based on EA's 2018 preliminary modelling)

WwTW	BOD mg/l		Ammonia mg/l		Phosphorus mg/l	
	Lower Bound DWF	Upper Bound DWF	Lower Bound DWF	Upper Bound DWF	Lower Bound DWF	Upper Bound DWF
Sellindge WwTW	8/45	8/45	2/12	2/12	0.3	0.3
Onsite WwTW – Upstream Outfall Location @ NGR 609426 137712 (at Harringe Lane Bridge)	5/20	*	0.5/12	*	0.1	*
Onsite WwTW – Downstream Outfall Location @ NGR 608558 138047 (at confluence with East Stour and Horton Priory Dyke)	8/45	7/44	2/12	2/12	0.3	0.3

** Not calculated due to very stringent limits calculated for DWF*

For discharges to the River East Stour, the relatively large DWF volume compared with the river's natural flow will result in tighter permit limits than the existing limits, both to achieve no deterioration in current WFD status and also plans to achieve good status in the East Stour. To meet river nutrient standards, phosphorus removal from the discharge will be required. In summary, both WwTW options discharging to the River East Stour will need to meet very stringent discharge conditions, including phosphate reduction measures.

For Sellindge WwTW overall, the increased DWF results in more stringent requirements for all determinants, however, this is still largely within the limits of conventional and emerging treatment technology. SW has confirmed Sellindge WwTW could be upgraded (within the current land limit) to fully cater for the Otterpool development, while meeting the suggested indicative discharge permits provided by the EA. It should be noted that even under the Upper Bound scenario, the indicative permit values are still within the limits of conventional and emerging technology for this conservative DWF estimate.

STC, has confirmed that it can achieve the discharge permit values for the onsite WwTW with both final outfall locations. Whereas, AWL can only commit to the downstream final location due to the perceived risks associated with meeting very strict indicative permit limit for Phosphorus of 0.1 mg/l associated with the upstream outfall location. Due to the larger existing baseflow available in the River East Stour to dilute the effluent discharge, the downstream outfall location has a less stringent permit limit for Phosphorus of 0.3 mg/l.

All flows in excess of 2,841 m^3/day (i.e., the maximum DFW that can be discharged at the upstream outfall location) will require discharging to the downstream outfall location using an offsite outfall sewer. Based on the latest DWF estimates presented before, this excess DFW can be between 437.6 m^3/day (Lower Bound) and 984.1 m^3/day (Upper Bound) in order to fully accommodate the entire Otterpool Framework Masterplan Area and Sellindge Phase 2 Sites. The indicative permit limits that the EA have previously provided did not account for simultaneously having discharges at more than one outfall location, i.e. both "at Harringe Lane Bridge" and at "confluence with East Stour and Horton Priory Dyke". For the indicative permit limits, the calculations were based on having only one of those discharges.

Therefore, STC should make a new request to the EA for providing indicative permit limits through the normal permitting channels, prior to reaching the currently agreed DWF limit of 2,841 m^3/day at the upstream outfall at Harringe Lane Bridge. This staged approach also gives STC the opportunity to monitor actual DWFs (from flow meters) and PCC rates (from the customer meter readings), while taking into account any positive impacts on the baseline water quality (from sampling) and base flows (from flow gauging) due to the proposed SuDS, wetlands, woodlands etc. in the impacted East Stour reach between the wastewater outfalls locations.

The additional discharge permit must be then obtained from the EA to ensure that this extra DWF can be discharged at the downstream outfall location at the confluence with River East Stour and Horton Priory Dyke (NGR 608558 138047). However, STC is able to meet the same quality parameters that is applicable to the upstream discharge point (i.e. BOD = 5 mg/l, Ammonia = 0.5 mg/l and Phosphorous = 0.1 mg/l) using the proposed NUTREM® treatment technology, which is considerably tighter than the indicative permit values previously provided by the EA for the second downstream outfall location, as a single discharge point.

It should also be noted that NAV as a statutory undertaker, could lay a discharge pipe to the offsite outfall location under its statutory powers under the Water Resources Act, prior to the trigger point for this offsite discharge outfall has been reached.

This analysis confirms that the WFD requirements can be sufficiently met to accommodate the proposed Development (including Sellindge Phase 2 Sites) with both Sellindge and Onsite WwTW options. However, it is also recommended that as the development phases are progressed DWF is closely monitored, and a revised EA discharge permit is applied to account for the final development phases in OFMA. This will allow for a better understanding of:

- The actual water consumption rates in Otterpool Park and the treated flow amounts at the receiving WwTW, fully reflecting the effectiveness of the implemented water efficiency and reuse options proposed in Section 3.2 and 5.3; and
- Expected general water quality improvements in the River East Stour due to increased baseflows and the proposed onsite SuDS and nutrient mitigation wetlands.

4.7 Flood Risk from WwTW Discharges

Increased discharge volumes from WwTWs to watercourses have the potential to increase fluvial flood risk and a multi-criterion scoring system has been applied to assess the risk. The assessment uses a multi-criteria approach to assess the increase in peak flow, the sensitivity of the watercourse to changes in flood levels, and the potential impact of flooding in order to determine a combined flood risk index. The following three elements of the system are principal:

Quantification of the increase in peak river flows, resulting from the predicted increase in treated effluent discharges;

Evaluation of the likely sensitivity of flood levels to increases in flood flows; and

Evaluation of the impact of increases in flood levels.

For each principal element listed above, the impact at each discharge site has been classified as high, medium or low; and the multi-criteria analysis applied to combine these elements.

4.7.1 Methodology

The analysis has been conducted using the 1 in 2 annual chance flood event, also known as the 50% AEP (Annual Exceedance Probability) event. This has a probability of occurrence in any one year of 50%. It is also referred to as QMED. According to the following methodology, this flood severity was selected because:

- Increases in WwTW discharge would contribute a relatively greater proportion of flood flows than if a more extreme flood event had been used, and hence results are likely to be conservative;
- The 1 in 2 annual chance flood event is, very crudely, considered to approximate bank full conditions. Any increase in the 1 in 2 annual chance would, therefore, be expected to result in out of bank flooding; and
- The 1 in 2 annual chance flood event is the smallest event which can practically be estimated using standard techniques.

The increase in the 1 in 2 annual chance flood event peak flow in the receiving watercourse has been calculated in line with best practise techniques as stated in the Flood Estimation Handbook (FEH). The increase in discharge from the WwTW used in these calculations are discussed below.

DWF received at the WwTWs will increase following the connection of new dwellings to the sewerage network. While some of this increase may be stored on the WwTW site during peak flows, an increase to the volumetric flow rate of the discharge is likely. However as mentioned in Section 4.2, WwTWs typically (in particular within combined sewer catchments) discharge up to three times their DWF (referred to as FFT) at peak. An increase in FFT, due to growth in the catchment, may increase the flood risk to properties and environmental sites on the watercourse downstream of the discharge point.

Multi-criteria analysis (as described above) has been utilised to provide a risk score for each of the three impacted WwTW effluent discharge points. Flood Risk scores were assigned to each discharge by determining the contribution that the increased FFT (due to the proposed growth from 10,000 homes to 2044) makes to the flow levels in the watercourse during a 1 in 2 annual chance flood event. This was then weighted to account for the sensitivity of the watercourse to flow increases, and the local impacts of any flooding.

4.7.2 Results

It must be highlighted that the above methodology compares the total 2044 FFT from the WwTWs (flows from both existing dwellings and proposed entire Otterpool Park Framework Masterplan and 350 dwellings at Sellindge Phase 2 Sites) against the 1 in 2 annual flood events for the watercourses, hence providing a risk score for the total predicted flows by 2044.

The estimated FFT values are presented in Table 20 below, which confirms that the total increase in FFT from the cumulative development is:

- Lower Bound – 9,239.7 m^3/day or 106.9 l/s
- Upper Bound – 10,779.7 m^3/day or 124.8 l/s

Table 20: FFT values due to the planned development

Development Details	Estimated FFT (m^3/day)	
	Lower Bound – with domestic PCC rate of 110 l/p/d	**Upper Bound – with domestic PCC rate of 130 l/p/d**
Otterpool Park Framework Masterplan	8,953.2	10,441.2
Sellindge Phase 2 Sites	286.4	338.5
Total FFT (m^3/day)	**9,239.6**	**10,779.7**

If FTFT from the existing properties is considered to be an integral part of the current river flows, it can be shown that the actual increase in peak flood flows by rivers by 2044, which is solely attributable to proposed growth, makes up a considerably smaller proportion.

In accordance with EA's latest guidelines on climate[27], an additional 45% was added to the 1 in 2 annual chance flood event flows. The new FTFT values have been projected to 2044 at each WwTW location; therefore, considering river flow values, including a +45% allowance for climate change.

Due to the relatively low base flows in the River East Stour, the proposed increases in WwTW discharges do noticeably change the flow risk score when compared against the current situation as shown in Table 21 overleaf. The risk value for all three WwTW options has been assessed as having a "Low" or "Medium" impact.

27 https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

There are limited receptors (i.e. villages and towns) located in the immediate downstream reaches, resulting in a low impact. However, Aldington Flood Storage Reservoir (FSR) is located slightly downstream of the Otterpool Park towards Ashford, this more sensitive receptor has been fully considered during the development of the surface water and flood risk management strategy to ensure no increase in downstream flooding.

For example, the proposed surface water discharge rates for 1 in 100 annual chance flood (1% AEP) are lower than the existing greenfield rates (see Section 5.0) in several drainage zones and significant additional long-term attenuation storage has been provided in the proposed SuDS and other large wetland features. This means no overall increase in peak flow rates on the River East Stour when compared to the potential maximum extra DWF discharge of 3,825.1 m^3/day (44 l/s), resulting from the Otterpool Framework Masterplan Area and Sellindge Phase 2 Sites. This represents a very minor proportion of the flood flows in the River East Stour (i.e., 2% of QMED and 0.3% of 1 in 100 annual chance flood for the 11 hr catchment duration) and therefore considered to have a negligible impact on the downstream flood risk. Even with maximum FFT flow of 9,239.6m^3/day (107 l/s) from the Otterpool Framework Masterplan Area and Sellindge Phase 2 Sites, this represents only 0.8% of in 100 annual chance flood for the 11hr catchment duration. The proposed reedbeds wetlands for delivering nutrient neutrality will also inherently act as stormwater attenuation.

Section 5.0 provides discussion on the predicted overall reductions in modelled flows and volumes (based on Infoworks ICM modelling undertaken), which can be further improved as part of the recommended integrated water management strategy, with rainwater reuse etc. Therefore, it is proposed that some rainwater harvesting will be implemented in targeted areas, which will further reduce downstream flood risk impacts on the Aldington FSR. This means there is a net flood risk reduction benefit in downstream Ashford due to the Otterpool Park.

Table 21: Summary of flood risk multi-criteria analysis results.

WwTW Discharge	Impact of FTFT (Lower Bound) from Development (2024- 2044) on river flows			Impact of FTFT (Upper Bound) from Development (2024- 2044) on river flows		
	Increase in 1 in 2 annual chance river flow	Flood Flow Risk Value	Risk Assessment	Increase in 1 in 2 annual chance river flow	Flood Flow Risk Value	Risk Assessment
Sellindge WwTW	1.71	3	Medium	1.71	3	Medium
Onsite WwTW – Upstream Outfall Location @ NGR 609426 137712 (at Harrindge Lane Bridge)	1.92	3	Medium	1.92	4	Medium
Onsite WwTW – Downstream Outfall Location @ NGR 608558 138047 (at confluence with East Stour and Horton Priory Dyke)	3.65	2	Low	3.65	3	Medium

Flood Flow Risk Value:

- Flow increase between 0 and 1%: 1 (Low)

- Flow increase between 1 and 3%: 2 (Low)
- Flow increase between 3 and 10%: 3 (Medium)
- Flow increase between 10 and 20%: 4 (Medium)
- Flow increase greater than 20%: 5 (High)

The River East Stour catchment can have very low summer flows and the EA has identified the increased flows from WwTWs can have beneficial impacts in relation to the hydrology of watercourse (provided that stringent discharge parameters are met). In addition, as the Otterpool SuDS strategy reduces peak flows for the extreme events (e.g. 1 in 30, 1 in 100 annual chance) to the River East Stour, by limiting discharge rates to the equivalent greenfield runoff rates or lower (2 l/s/ha) as stated above, so that any increased flow from the WwTW discharge will be classified as negligible in comparison. Therefore, the increased flow from each WwTW site is classified overall as having a low – medium flood risk, which not compromising the current Standard of Protection in the downstream river reaches.

However, it has for some time been acknowledged that climate change will impact flood risk in the future. This is a risk defined as “the frequency and intensity of future rainfall events may increase due to climate change, leading to higher run-off rates into surrounding rivers, altering the hydraulic response of the river to the rainfall event”. It is now academically accepted that climate change has had such an effect on UK flooding. It follows therefore that the flow rates associated with the 1 in 2 annual chance flood events (as described in the analysis above) have been predicted to occur more frequently in the future. While the significance of the WwTW discharges, and downstream impacts and sensitivity are likely to remain the same for any given river flow; the frequency of flooding is likely therefore to increase. F&HDC should, therefore, continue to ensure that flood resilience and mitigation remain key in the decision-making process of their Planning and Development Control Functions in line with the latest government and local guidance and policy on flood risk management, including implementation of the recommendations of this WCS and associated FRA&SWDS prepared by Arcadis.

4.8 Nutrient Budget Analysis

4.8.1 Background

Excessive nutrient levels (nitrogen and phosphorous) can negatively impact on the Stodmarsh Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. The site is also designated as a Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR). Information has recently emerged related to existing water quality impacts (eutrophication) on the designated sites, caused by high nutrient levels including nitrogen and in particular phosphorus. NE believes that the latter originates mainly from the permitted wastewater discharges into the River Stour and a detailed Water Industry National Environment Programme (WINEP) investigation is currently underway by Southern Water, which will report its findings in 2022. Existing Sellindge WwTW that Otterpool Park could potentially use is also included in this WINEP investigation.

NE advised FHDC in May 2020 that the water quality issues should be assessed through an updated Habitats Regulation Assessment (HRA) as part of the CSR, which is currently been submitted for Examination. This should include all proposed site allocations (including the Otterpool Park), which may be served by the existing or new WwTW within the River Stour Catchment that can impact Stodmarsh. This should include calculation of the nutrient budget for all affected CSR site allocations with respect to nitrogen and phosphorous, with all mitigation options outlined, along with the fundamental precautionary principle that each scheme must achieve nutrient neutrality in order to provide certainty of avoiding adverse effect on integrity of the designated sites.

A roundtable meeting was organised by F&HDC in June 2020 to discuss the methodology and scope for their Appropriate Assessment Update and Nutrient Neutrality Assessment for the CSR and the Tier 1 Otterpool Park OPA. At this meeting, NE also advised that if Otterpool Park can demonstrate (i.e. as a standalone site) that it can achieve Nutrient Neutrality (as set out in their published guidance in relation to Stodmarsh), then it would fully satisfy their current concerns on any adverse impacts to Stodmarsh from the proposed Development.

As stated in NE advice to planning authorities, proposed developments that would result in a net increase in population served by a wastewater system should be nutrient neutral to remove uncertainty as to whether they might contribute to the unfavourable water quality at Stodmarsh, and thus facilitate their compliance with the Conservation of Habitats and Species Regulations (CHSR) (2017). In practice, this means that the key nutrients (nitrogen and/or phosphorus) from all surface water runoff and wastewater generated by the proposed development must be less than or equal to the nutrients generated by the existing land uses and wastewater discharges. Any development being approved for development through the planning process that is not nutrient neutral could be deemed to contravene the CHSR and the approving planning authority be at risk of judicial review because of an objection by NE.

Further consultation took place with F&HDC and NE to scope the methodology and the extent of study area for the Otterpool Park Nutrient Neutrality assessment. The following proposed site allocations from F&HDC's Regulation 19 Submission Version of the CSR that are planned to discharge to the River Stour Upper Catchment have been then included in the nutrient budget calculations presented in this WCS:

- The proposed Development and the remainder of Ottterpool Park Framework Masterplan Area; and
- Two proposed broad site allocations in Sellindge (CSD9A and CSD9B).

Otterpool Park nutrient budget assessment follows:

- NE's published final guidance on Nutrient Neutrality for new development in the Stour Valley Catchment in relation to the Stodmarsh Designated Sites for Local Planning Authorities[16] (November 2020);
- Consultation advice provided to Arcadis within NE's letter dated 06th October 2020, as part of NE's Discretionary Advice Service;
- Consultation advice provided to FHDC for their CSR Site Allocations within NE's letter dated 15th October 2020, as part of NE's Discretionary Advice Service;
- Consultation advice provided to Arcadis within NE's letter dated 02nd December 2020, as part of NE's Discretionary Advice Service;
- Statement of Common Ground between NE and F&HDC dated 03rd December 2020 (see Appendix C); and
- Consultation advice provided to Arcadis within NE's letter dated 01st June 2021, as part of NE's Discretionary Advice Service.

4.8.2 Development Details and Assessment Parameters

As stated in Section 1.5, the Otterpool Park Framework Masterplan for the proposed garden settlement includes up to 10,000 new residential homes and associated non-residential uses/infrastructure, 71 ha of existing community and 54.9 ha of retained farmland, covering a total area of 756.1 ha. Otterpool Park Garden Settlement is jointly promoted by F&HDC and Otterpool Park LLP. Section 1.5 also provided further details of the proposed Development as part of this Tier 1 OPA.

In summary, the nutrient budget calculations for the Otterpool Park Framework Masterplan are based on:

- 8,704 Class C3 residential units;
- 1,296 Class C2 extra care residential units ; and
- 117 rooms Class C1 hotel.

Similarly, Sellindge CSD9A and CSD9B CSR site allocations include 188 new houses within a total site area of 9.06 ha and 162 new houses within a total site area of 18.91 ha respectively. These two sites are currently being promoted by Quinn Estates and other developers. The total of 350 homes at two Sellindge Sites were taken as Class C3 residential units.

The two PCC scenarios shown in are used in the nutrient budget assessment discussed in the remaining sections. Both PCC scenarios provide a robust assessment as the rates used for Class C1 and C2 are higher than the recommended minimum 110 l/p/d by NE.

Table 22 Assumed PCC Scenarios in Nutrient Budget Assessment

Residential Land use	PCC Scenario 1 – See Note 1 (l/p/d)	PCC Scenario 2 – See Note 2 (l/p/d)
Class C3	110	110
Class C2	350	262.5
Class C1	300	225

Notes

1 Scenario 1 PCC rate for Class C3 is based on 110 l/p/d as per NE published guidance and CSR Policy SS9. However, for Class C2 and Class C1 are as per the recommended higher PCC rates in British Water Flows and Loads – 4 Code of Practice (revised in 2013)

2 Scenario 2 PCC rate for Class C3 is based on 110 l/p/d as per NE published guidance and CSR Policy SS9. However, for Class C2 and Class C1 are as per the recommended PCC rates in British Water Flows and Loads – 4 Code of Practice (revised in 2013) are reduced by 25% to reflect the additional water efficiency measures proposed at Otterpool Park. This is because a similar % reduction can be seen for PCC in relation to the standard Class C3 dwellings when compared with the British Water recommended PCC rates.

4.8.3 Baseline Nutrient Loading

The existing land use within the area impacted by Otterpool Park Framework Masterplan boundary is predominately agricultural use or greenfield in nature although it includes 71 ha of existing community and 54.9 ha of retained farmland. Appendix D includes a figure showing the existing land type categories in the main development area. This information is also summarised in Table 23 below, along with their assumed nutrient loss rates. This information is derived based on the NE's published guidance stated above, along with the ecological habitat surveys that had been undertaken by Arcadis throughout the project duration since 2016 and recent consultations undertaken with F&HDC, NE, Arcadis project team and local land agents.

Table 23 Existing Land Types and Nutrient Loss Rates Within Otterpool Park Framework Masterplan

Existing Land Type	Area (ha)	Average Total Nitrogen (TN) Loss Rate - Kg/ha/year	Average Total Phosphorus (TP) Loss Rate - Kg/ha/year
Cereals	324.9	27.3	0.36
Lowland Grazing Livestock	119.1	12.2	0.24
Racetrack – See Note 2	13.5	13.3	0.5
Hay Cut	18.9	5	0.14

Existing Land Type	Area (ha)	Average Total Nitrogen (TN) Loss Rate - Kg/ha/year	Average Total Phosphorus (TP) Loss Rate - Kg/ha/year
Other Grassland or greenfield	101.1	5	0.14
Mixed – Urban	11.5	14.3	0.83
Mixed – Greenfield	4.5	5	0.14
Remaining Urban Area in Framework Masterplan	19.9	14.3	0.83
Total Area	**613.4**		

Notes

1 The remaining 142.7 ha in the Otterpool Park Framework Masterplan boundary is excluded from the nutrient neutrality assessment as the existing land use in this area is unchanged by the proposed development. This excluded area includes 71 ha of existing community, 54.9 ha of retained farmland and 16.8 ha of retained buildings, waterbodies, woodland, hedgerows and other ecological features.

2 Average TN and TP loss values of Urban Land and Lowland Grazing Livestock Farmland categories (i.e. assuming a 50:50 split) have been taken for the Racetrack as discussed with NE to reflect its former use.

Similarly, existing land use information for CSD9A and CSD9B is summarised in Table 24 below, along with their assumed nutrient loss rates as per NE's published guidance.

Table 24 Existing Land Types and Nutrient Loss Rates Within CSD9A and CSD9B

Existing Land Type	Area (ha)	Average Total Nitrogen (TN) Loss Rate - Kg/ha/year	Average Total Phosphorus (TP) Loss Rate - Kg/ha/year
CSD9B/Cereals	17.16	27.3	0.36
CSD9B/ Urban	0.7	14.3	0.83
CSD9B/Other grassland or greenfield	1.05	5	0.14
CSD9A/ Urban	0.08	14.3	0.83
CSD9A/Other grassland or greenfield	8.98	5	0.14
Total Area	**27.97**		

4.8.4 Post Development Nutrient Loading

4.8.4.1 Onsite WwTW Option

Nutrient budget estimates have been undertaken for the currently preferred Onsite WwTW solution in accordance with STC proposal as it provide a higher level of nutrient removal compared to the alternative AWL proposal. The assessment is completed using an average household occupancy rate of 2.4 for the two PCC scenarios in Table 20.

Depending on the chosen final discharge outfall location for the proposed Otterpool Park Onsite WwTW and corresponding DWF volume, the EA has confirmed the indicative discharge permit values shown in Table 19 (see Section 4.6). STC has confirmed that they are able to meet any of these EA discharge permit values while limiting Total Nitrogen (TN) discharge to 7.2 mg/l for the purpose of achieving NE's nutrient neutrality requirement. Therefore, as agreed with NE, a Total Nitrogen limit of 7.2 mg/l and a Total Phosphorus (TP) limit of 0.1 mg/l have been used.

The excel calculation files used for performing the nutrient budget assessment for onsite WwTW (see Appendix D), include the following information along with the key assumptions and parameters used in the calculations:

- Worksheet 1 – Key Input Data;
- Worksheet 2 – Nutrient Budget Calculations for Onsite STC WwTW option, with PCC Scenario 1;
- Worksheet 3 – Nutrient Budget Calculations for Onsite STC WwTW option, PCC Scenario 2;
- Worksheet 4 – Wetland Mitigation Requirement Summary for PCC Scenario 1 and Scenario 2;
- Worksheet 5 – Existing Land Type Information Used in the Assessment;
- Worksheet 6 – Existing Mixed Land Type Information Used in the Assessment;
- Worksheet 7 – Proposed Land Use Type Information Used in the Assessment; and
- Worksheet 8 – Proposed Wetland Details and Preliminary Hydraulic Loading Assessment.

The nutrient budget assessment follows the following principal four-staged approach described in NE's published nutrient neutrality guidance[16]:

- **Stage 1** - Calculate the developments' total nutrients loading that would be discharged (via wastewater treatment works) into the Stour catchment;
- **Stage 2** - Calculate existing (pre-development) nutrients loading from the current land use of the development site;
- **Stage 3** - Calculate nutrients loading for the future land uses proposed for the development site; and
- **Stage 4** - Calculate change in total nutrients loading as a result of the proposed development

Table 25 below summarises the estimated total net nutrient budget requirement for Onsite WwTW, which includes a 20% precautionary buffer under Stage 4, as per the Natural England's guidance.

Table 25 Nutrient Budget Assessment Summary for Onsite WwTW Option

Development Coverage	PCC Rate – Scenario 1		PCC Rate – Scenario 2	
	TN (Kg/year)	TP (Kg/year)	TN (Kg/year)	TP (Kg/year)
Otterpool Park Framework Masterplan Only	3,526 *(2,845)**	285 *(234)**	2,703 *(2,023)**	273 *(223)**
Otterpool Park Framework Masterplan plus Sellindge Sites CSD9A and CSD9B	3,526 *(2,845)**	299 *(248)**	2,704 *(2,023)**	287 *(237)**

**The sensitivity check values for the reduced TN and TP values are shown in italics/brackets. This is after reducing the urban area by 61 ha due to the additional open space areas (including SuDS) provided in the illustrative masterplan (ES Appendix 4.5) outside the designated open space, but currently excluded in the Tier 1 OPA parameter plans (ES Appendix 4.2). Suitable Alternative Natural Green Space (SANG) area is also increased by the same 61 ha accordingly.*

4.8.4.2 Sellindge WwTW Option

Nutrient budget estimates have also been undertaken for the alternative Sellindge WwTW solution (see Appendix E) in accordance with the same methodology discussed in Section 4.8.4.1. Therefore, TP discharge permit value of 0.3 mg/l is used for Sellindge WwTW, whereas a TN limit of 25 mg/l was assumed (as per NE published guidance and consultations held with Southern Water) in the absence of a defined discharge permit value for TN.

Table 26 below summarises the estimated nutrient budget requirement for Sellindge, which includes a 20% precautionary buffer under Stage 4, as per the Natural England's guidance.

Table 26 Nutrient Budget Assessment Summary for Sellindge WwTW Option

Development Coverage	PCC Rate – Scenario 1		PCC Rate – Scenario 2	
	TN (Kg/year)	TP (Kg/year)	TN (Kg/year)	TP (Kg/year)
Otterpool Park Framework Masterplan Only	27,780 *(27,100*)*	557 *(507)**	24,925 *(24,425)**	523 *(473)**
Otterpool Park Framework Masterplan plus Sellindge Sites CSD9A and CSD9B	28,429 *(27,749*)*	578 *(528)**	25,574 *(24,893*)*	544 *(494)**

**The sensitivity check values for the reduced TN and TP values are shown in italics/brackets. This is after reducing the urban area by 61 ha due to the additional open space areas (including SuDS) provided in the illustrative masterplan (ES Appendix 4.5) outside the designated open space, but currently excluded in the Tier 1 OPA parameter plans (ES Appendix 4.2). SANG area is also increased by the same 61 ha accordingly.*

4.9 Nutrient Mitigation Options

For undertaking the preliminary hydraulic loading calculations and design for the proposed wetlands and associated nutrient mitigation measures the following key guidance documents have been used:

- EA's Guidance Manual for Constructed Wetlands[28], has been used for undertaking the initial hydraulic loading calculations and design preparation for the proposed wetlands;
- NE's published final guidance on Nutrient Neutrality for new development in the Stour Valley Catchment in relation to the Stodmarsh Designated Sites for Local Planning Authorities[16];
- CIRA SuDS Manual C753[29].

As per the NE's guidance and consultations undertaken during this WCS, the following well-accepted median values have been assumed for the TN and TP removal rates for the constructed wetlands, at this Tier 1 Outline stage:

- TN removal rate – 93 $g/m^2/yr$ for both wastewater and stormwater discharges;
- TP removal rate – 1.2 $g/m^2/yr$ for both wastewater and stormwater discharges.

However, at the detailed design stage it must be demonstrated that these values will be achievable on site. Therefore, bespoke wetland specific calculations using estimations of hydraulic and nutrient loading are required at the Tier 3 reserved matters stage, which can demonstrate that the efficacy proposed can be achieved at Otterpool Park.

4.9.1 Onsite WwTW Option

Table 27 below shows that 20 – 25 ha of new wetlands may be required to offset the overall nutrient loading surplus shown in

[28] Guidance Manual for Constructed Wetlands, R&D Technical Report P2-159/TR2, Environment Agency 2003
[29] SuDS Manual C753, CIRA 2015

Table 25 for the onsite WwTW to serve both the Otterpool Park FMP and Sellindge Phase 2 Sites. Potential locations to provide approximately 29 ha of new wetlands have been identified within the proposed Development (see Table 28). Therefore, achieving nutrient neutrality with STC onsite WwTW option is technically feasible with both PCC Scenario rates.

Table 27 Wetland Area Requirements for Onsite WwTW

WwTW Option	PCC Rate – Scenario 1		PCC Rate – Scenario 2	
	Wetland for Area TN (ha)	Wetland for Area TP (ha)	Wetland for Area TN (ha)	Wetland for Area TP (ha)
Otterpool Park Framework Masterplan Only	3.8 (3.1)*	23.7 (19.5)*	2.9 (2.2)*	22.8 (18.6)*
Otterpool Park Framework Masterplan plus Sellindge Sites CSD9A and CSD9B	3.8 (3.1)*	**24.9** (20.7)*	2.9 (2.2)*	23.9 **(19.7)***
		Upper Bound		Lower Bound

**The sensitivity check values for the reduced TN and TP values are shown in italics/brackets. This is after reducing the urban area by 61 ha due to the additional open space areas (including SuDS) provided in the illustrative masterplan (ES Appendix 4.5) outside the designated open space, but currently excluded in the Tier 1 OPA parameter plans (ES Appendix 4.2). SANG area is also increased by the same 61 ha accordingly.*

Figure 7 below and Table 28 below and Appendix F summarise the key information related to the proposed wetlands. In line with Natural England's guidance, stormwater wetland sizes will be optimised where possible to maximise their nutrient removal efficiency by interlinking smaller storm wetlands with SuDS features and existing smaller local watercourses, to collectively provide a larger wetland area while maintaining sufficient base flow.

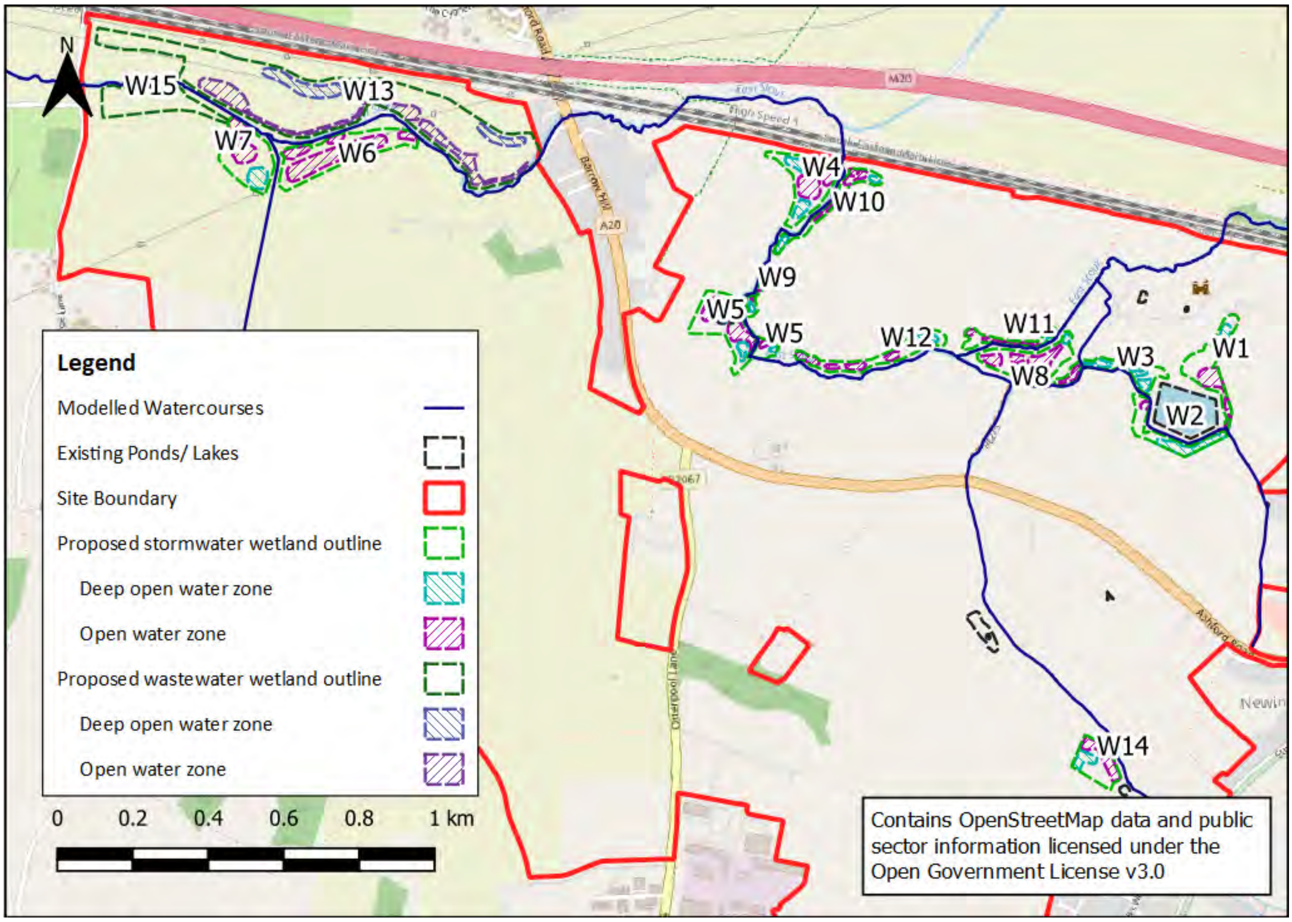


Figure 7: Overview plan of proposed wetlands

HRT's of 5-30 days and Hydraulic Loading Rates (HLRs) of <0.1m/day have been recommended (Wu et al,, 2015). Shallow water depths (<0.5m) are also recommended to increase the contact time between effluent and wetland sediment, whilst also keeping water oxygenated through good contact with the atmosphere (Wu et al,, 2015).

Preliminary hydraulic loading calculations (see Appendix D) have been initially undertaken in line with EA's Guidance Manual for Constructed Wetlands, R&D Technical Report P2-159/ TR2 to provide treatment storage for the 15 mm first flush runoff from the contributing stormwater catchments. The estimated treatment depth is shown in Table 28, which demonstrates that the preliminary proposals are technically feasible and able to provide sufficient level of treatment volume to accommodate the proposed development. The estimated preliminary Hydraulic Retention Time (HRT) for the Wastewater Treatment Wetlands (W13 and W15) indicates that this may vary between 1 day to 8 days, depending on the effective wetland treatment depth provided between 50mm and 250mm. Therefore, an effective treatment depth of 250mm is recommended for Wetlands W13 and W15 to provide a HRT of greater than 5 days to provide effective treatment for sediment and nutrient removal from the wastewater discharges from the Onsite WwTW. The hydraulic calculations in Appendix D also show that HLR is less than the recommended 0.1m/day maximum value. As highlighted in Table 28 and Section 4.10, wastewater wetland W15 is only needed to provide the tertiary treatment for the extra wastewater discharge from the remaining 1500 homes in OFMA.

Table 28 Proposed Wetland Details Summary

Wetland Location Ref.	Indicative Wetland Area (ha)	Treatment Depth (m)	Average Wetland Depth (m)	Comments
W1	1.46	0.35	0.65	Treats OPA Site storm discharge. W1, W2, W3 & W8 are interlinked (Total area: 4.9ha).
W2	0.92	0.38	0.68	Treats OPA Site storm discharge. W1, W2, W3 & W8 are interlinked (Total area: 4.9ha).
W3	0.94	0.04	0.34	Treats s OPA Site storm discharge. W1, W2, W3 & W8 are interlinked (Total area: 4.9ha).
W4	1.70	0.07	0.37	Treats OPA Site storm discharge, W4 and W5 are interlinked (Total area: 3.81ha).
W5	2.11	0.16	0.46	Treats OPA Site storm discharge. W4 and W5 are interlinked (Total area: 3.81ha).
W6	2.63	0.27	0.87	Treats OPA Site storm discharge.
W7	1.87	0.05	0.35	Treats OPA Site storm discharge but can also provide tertiary treatment for the extra wastewater discharge from the remaining 1500 homes in OFMA.. W7 and W15 are interlinked (Total area: 3.71 ha).
W8	1.61	0.45	0.75	Treats OPA Site storm discharge. W1, W2, W3 & W8 are interlinked (Total area: 4.9ha).
W9	0.27	0.13	0.73	Treats OPA Site storm discharge. W9, W10, W11 and W12 are interlinked (Total area: 2.83 ha).
W10	0.78	0.21	0.81	Treats OPA Site storm discharge. W9, W10, W11 and W12 are interlinked (Total area: 2.83 ha).
W11	0.52	0.04	0.64	Treats OPA Site storm discharge. W9, W10, W11 and W12 are interlinked (Total area: 2.83 ha).
W12	1.26	0.04	0.34	Treats OPA Site storm discharge. W9, W10, W11 and W12 are interlinked (Total area: 2.83 ha).
W13	9.75	0.25	0.50	Provides tertiary treatment for the wastewater discharge from the OPA site. The total footprint of the wetland is 13.01ha but only 75% is taken as effective area (9.75ha) due to earth works required for cascade wetland features.
W14	1.11	0.08	0.38	Treats storm discharge.
W15	1.84	0.25	0.50	Not required for the Tier 1 OPA – but provides tertiary treatment for the extra wastewater discharge from the remaining 1500 homes in

Wetland Location Ref.	Indicative Wetland Area (ha)	Treatment Depth (m)	Average Wetland Depth (m)	Comments
				OFMA. W7 and W15 are interlinked (Total area: 3.71 ha).
Total Area	**28.77**			

The proposed offline storm wetlands are distributed across the Otterpool Park Site and strategically located in the downstream section of the contributing catchment, prior to discharging to the receiving watercourses. In addition, upstream of these proposed wetlands there will be a series of linked SuDS features that will work together to provide further source control and water quality treatment, prior to discharging to the wetlands.

The illustrative masterplan (ES Appendix 4.5) for the revised Otterpool Park OPA alone, includes over 60 ha of such open surface SuDS features, which will help to maintain the required permanent baseflow within the proposed wetlands, ensuring the efficacy of their nutrient removal. The water permanently stored in proposed wetlands and SuDS will form a part of a rainwater recycling strategy for non-potable usage within Otterpool Park to reduce potable water consumption. Therefore, this also enables the ability to circulate stored stormwater within the proposed linked SuDS and wetlands system to maintain sufficient baseflow for treatment efficacy, during periods of dry weather as required.

The treated effluent from the onsite WwTW will then be routed through the proposed Wetland W13, prior to discharging to the East Stour. The total footprint of this large wetland area is approximately 13.0 ha but only 75% of this is taken as effective treatment area (i.e., 9.75 ha) in Table 28 above to account for the earthworks required for constructing small cascade wetland features on 1 in 20 sloping existing ground. Wetland W13 is sufficient to treat the wastewater flows from the entire OPA site. However, additional wetland areas (W15 and W7) will be required in future to accommodate wastewater and stormwater discharges from the remaining 1,500 homes from the OFMA. Section 4.10 provides further detail on this.

The long-term adoption and management of the onsite WwTW, including the associated sewer infrastructure and wastewater wetlands system will be provided by STC. Similarly, STC has confirmed that they can adopt the proposed stormwater wetlands and strategic SuDS system at Otterpool Park. Therefore, this is the currently preferred approach for the long-term maintenance of storm water wetlands and SUDS but alternatively, a 'Company Limited by Guarantee' or 'Community Interest Company' can also take this responsibility if required, as explained in Section 5.4. The full details of adoption and maintenance arrangements and requirements for the proposed wetlands and SuDS will be confirmed ahead of discharging any relevant planning conditions.

4.9.2 Sellindge WwTW Option

Table 29 below summarises the indicative total area of the new wetlands required to offset the overall nutrient loading surplus shown in Table 26 for Sellindge WwTW. This shows that approximately 41 – 49 ha of additional wetlands will be required to achieve nutrient neutrality if this WwTW option is to be considered (i.e. to serve both the Otterpool Park FMP and Sellindge Phase 2 Sites).

Table 29 Wetland Area Requirements for Sellindge WwTW

WwTW Option	PCC Rate – Scenario 1		PCC Rate – Scenario 2	
	Wetland for Area TN (ha)	Wetland for Area TP (ha)	Wetland for Area TN (ha)	Wetland for Area TP (ha)
Otterpool Park Framework Masterplan Only	29.9 *(29.1)*	46.4 *(42.2)*	26.8 *(26.1)*	43.6 *(39.4)*
Otterpool Park Framework Masterplan plus Sellindge Sites CSD9A and CSD9B	30.6 *(29.8)*	**48.2** *(44.0)*	27.5 (26.8)	45.3 ***(41.1)****
		Upper Bound		Lower Bound

** This is after reducing the urban area by 61 ha due to the additional open space areas (including SuDS) provided in the illustrative masterplan (ES Appendix 4.5) outside the designated open space, but currently excluded in the Tier 1 OPA parameter plans (ES Appendix 4.2). SANG area is also increased by the same 61 ha accordingly.*

4.10 Preferred Wastewater and Nutrient Mitigation Option

Table 14 provided a high-level appraisal of the two shortlisted WwTW options, which was then followed by further discussion in Section 4.5. Due to the scale of the proposed Development, the existing Sellindge WwTW will require a major treatment upgrade and there is zero capacity in the existing sewer network to send the extra flows from Otterpool Park without new offsite rising mains crossing HS1.

Section 4.6 and Section 4.7 showed that both options can satisfy the EA's discharge permitting quality parameters and will have negligible downstream flood risk impacts.

Section 4.8 and Section 4.9 then confirmed that to address the precautionary nutrient neutrality requirement to project Stodmarsh approximately 41 – 48 ha of new wetlands be required with Sellindge WwTW option, but the proposed Development has insufficient space to provide them without offsite mitigation. Whereas onsite WwTW option can achieve nutrient neutrality as well as increased biodiversity with a minimum of 25 ha of onsite wetlands and a minimum of 35 ha of onsite new woodland planting (which includes 8 ha of wet woodland), in accordance with the preliminary assessment presented in the earlier sections above. Therefore, onsite WwTW option is preferred and taken forward for further assessment, as described below.

The most recent feedback received to the draft wetland design from NE in their letter of 01st June 2021 also stated that further clarification is required on the nutrient neutrality calculations to demonstrate how Otterpool Park will be nutrient neutral for phosphorus. In particular, NE advised that if the interceptor values are being used then they will need to intercept the nutrients they are actually offsetting. Therefore, separating the nutrient budget values for land use and wastewater, and updating calculations for the wetlands that intercept these is essential to fully demonstrate neutrality.

To address this additional requirement, Table 30 below gives the updated nutrient budgets separately for land use and WwTW discharges with the Onsite WwTW option, using the worst-case PCC rate Scenario 1. This assessment is conservative as it currently ignores the reduced nutrient loading from circa 61 ha of the additional open space areas (including associated SuDS) that are provided in the illustrative masterplan (ES Appendix 4.5) within the development parcels, outside the designated open space (i.e., such areas are also treated as urban areas for the purpose of nutrient budget assessment).

Table 30 Refined Nutrient Budgets and Wetland Area Requirements for Onsite WwTW

WwTW Option	Land Use Discharge Only		WwTW Discharge Only	
	Nutrient Budget (kg/yr)	Wetland Area (ha)	Nutrient Budget (kg/yr)	Wetland Area (ha)
Otterpool Park OPA only	-6,341 – for TN **140 – for TP**	-6.8 - TN **11.7 - TP**	7,623 – for TN **106 – for TP**	8.2 - TN **8.8 - TP**
Otterpool Park Framework Masterplan Only	-6,285 – for TN **149 – for TP**	-6.8 - TN **12.4 - TP**	9,811 – for TN **136 – for TP**	10.5 - TN **11.4 - TP**
Otterpool Park Framework Masterplan plus Sellindge Sites CSD9A and CSD9B	-6,547 – for TN **159 – for TP**	-7.0 - TN **13.2 - TP**	10,073 – for TN **140 – for TP**	10.8 - TN **11.7 - TP**

The above shows that TP is the critical nutrient loading that will require mitigation for both land use and WwTW discharges, while there is a general betterment in TN loading already due to the change in land use after the development. It also shows that the total wetland area requirement of 24.9 ha to ensure the full nutrient neutrality the OFMA and Sellindge Sites CSD9A and CSD9B, should include 11.7 ha of wastewater wetland area and 13.2 ha of stormwater wetland area.

Following gives a further breakdown of the minimum estimated wetland area requirement to sufficiently remove the surplus TP loading from just the **treated WwTW effluent discharge**:

- **Tier 1 OPA Development Only:** 8.8 ha of wetland to remove a TP load of 106 kg/year
- **Entire OFMA Development:** 11.4 ha of wetland to remove a TP load of 136 kg/year
- **Entire OFMA Development plus CSD9A and CSD9B:** 11.7 ha of wetland to remove a TP load of 140 kg/year

Similarly, following values are the minimum estimated wetland area requirement to sufficiently remove the surplus TP loading from just the **land use discharge**:

- **Tier 1 OPA Development Only:** 11.9 ha of wetland to remove a TP load of 142 kg/year
- **Entire OFMA Development:** 12.4 ha of wetland to remove a TP load of 149 kg/year
- **Entire OFMA Development plus CSD9A and CSD9B:** 13.2 ha of wetland to remove a TP load of 159 kg/year

The proposed wastewater wetland W13 has an effective treatment area of 9.75 ha, which is sufficient to accommodate the Tier 1 OPA Development. The wastewater wetland W15 is 1.84 ha in size, which can easily provide the remaining 1.65 ha of wetland requirement to give a total effective wetland area of 11.4 ha (i.e., when the additional 1,500 homes from the OFMA come online later). Wetland W7 has a total area of 1.87 ha, which can be used to treat the additional wastewater discharges (i.e., to provide the extra 0.3 ha of wetland) from Sellindge CSD9A and CSD9B if necessary, assuming that these sites will be actually connected to Otterpool Park. Therefore, wetlands W13, W15 and W7 can provide a total effective wetland area of 13.46 ha, exceeding the minimum total wetland area requirement of 11.7 ha to completely remove the estimated total

TP loading of 140 kg/year from the entire extra WwTW discharge from the OFMA Development plus Sellindge CSD9A and CSD9B sites.

Similarly, to remove the land use surplus TP loading of 159 kg/year from the entire OFMA Development plus CSD9A and CSD9B Sellindge Sites will require 13.2 ha of wetland. The remaining proposed total wetland area (i.e., excluding W13, W15 and W7) is 15.3 ha, which is greater than the requirement of 13.2 ha. As highlighted in Section 4.9, the stormwater wetland requirement can be potentially reduced by another 4.2 ha, if the remaining 61 ha of additional SuDS and public open space in the urban development parcel areas are also considered in the detailed assessment. This is because, in accordance with NE's published guidance, SuDS and public open space will have lower nutrient leaching rates than the values currently been used for the urban areas.

Therefore, an onsite WwTW, operated by STC as the NAV, is chosen as the current preferred WwTW and nutrient mitigation option for the proposed Development. This is mainly because the ease of deliverability and the overall benefits it can provide are significantly higher than the new infrastructure and timescale needed to deliver Sellindge WwTW upgrade and rising mains, along with the delivery constraints and risks associated with the ongoing WINEP study impacts.

A letter is attached in Appendix G, which confirms that STC has now been formally appointed by Otterpool Park LLP to progress the Otterpool WwTW feasibility studies, enhanced outline design and EA discharge permit application. It also provides the following indicative timeline for completing these tasks:

- The six-month programme of water quality sampling and flow monitoring exercise will be completed by March 2022 with the final report due in April 2022, which will support the EA permit application submission by end of May 2022.
- The enhanced outline design of the WwTW will be available in March 2022.
- The permit is expected in May 2023 and the Ofwat application will then follow.

However, Sellindge WwTW could still be a viable and potentially attractive alternative option for the later phases of Otterpool Park, subject to a favourable outcome of the current WINEP study and any recommended extra water quality mitigation measures can be easily delivered, prior to the commencement of later phases of Otterpool Park. The onsite WwTW and the associated new sewers and pumping stations will be constructed in a modular fashion to match with the development phasing as described below, which will still allow for such later inclusion of Sellindge WwTW option, if deemed beneficial.

The onsite WwTW solution will be located in the north western portion of Otterpool Park (at Development Area HT.5) away from residential homes, near to the River East Stour. Approximately 160 m long x 60 m wide site compound (9,600 m^2 footprint) will be required for the buildings and treatment infrastructure. A maximum building height of 6.5 m is expected. However, this will increase to 7.5 m from the existing ground, including the handrailing on top of the reactors. STC will continue to optimise the configuration of the WwTW plant, but this will not have an impact on footprint or maximum building heights.

To accommodate the proposed delivery trajectory shown in Appendix A across the total 20-year duration of the Otterpool Park Framework Masterplan, four separate treatment streams will be built, in four distinct phases. A preliminary layout of the proposed WwTW plant and illustrative images showing the side views and elevations are included in Appendix J. The initial phase of the WwTW will be sized much smaller than the remaining phases to enable early commissioning of the plant from the first house of occupation.

The current STC onsite WwTW is based on the relatively new NUTREM® treatment technology. It is an activated sludge treatment process, which has been developed to include the integration of advanced process control and configuration with the same basic principles founded by Arden & Lockett over 100 years ago. The process is the result of an evolution of our tried and tested Pure Sequencing Batch Reactor (SBR) technology, updated to meet the emerging needs of our environment.

Appendix H provides an overview of the NUTREM® Process, which will typically involve the following key components:

- Main Inlet;
- Balance Tank/Fermenter;
- Booster System;
- Reactors;
- Sludge Thickening;
- Aerated Sludge Storage Tank;
- Final Effluent Discharge;
- Attenuation Tank;
- Final Effluent Disinfection and Polishing;
- Control Kiosk and Panel; and
- Alarm System and Remote Monitoring.

The NUTREM® process is a unique, compact and efficient Biological Nutrient Removal process. It offers a reliable and robust solution to nutrient removal, using purely biological treatment, but requiring a much smaller footprint and consuming less energy than more traditional Biological Nutrient Removal systems.

According to the product information available from Plantwork Systems (https://www.plantworksystems.com/nutrem/) the key advantages of the NUTREM® process over alternative solutions are:

- industry-leading level of TP removal (below 0.25 mg/l)
- industry-leading level of TN removal (below 5 mg/l)
- ability to meet 0.1mg/l TP with the addition of tertiary filters
- no dosing requirements
- effective in all seasons (i.e. including weak sewage strengths)
- lower capital expenditure
- lower operating costs
- smaller footprint, with resulting cost saving
- modular and scalable, allowing cost to be spread
- high quality effluent capable of re-use without tertiary treatment
- virtually odour free process; and
- no corrosive by-products.

The proposed plant will have covered a balance tank/fermenter in each treatment stream, which will significantly reduce any residual odour impacts. The detailed designs we would also include extra mitigation as appropriate – for example, a covered inlet works, covers on screenings skips and mandatory washdown of sludge tanker coupling point (with return drain).

The following water quality limits shown in Table 31 have been used for preliminary design of the treatment process, which meets the EA's indicative permit standards for the Onsite WwTW – Upstream Outfall Location @ NGR 609426 137712 (at Harringe Lane Bridge).

Table 31 Indicative Discharge permit limits used for the preliminary design

Water Quality Parameter	Units	Limit	Compliance
BOD_5	mg/l	5	95%ile
TSS	mg/l	10	95%ile
NH_4-N	mg/l	0.5	95%ile
TP	mg/l	0.1	Average Annual
TN	mg/l	7	Average Annual

As discussed in Section 4.6, an additional discharge permit with similar quality parameter values to those in Table 31, will be required from the EA to ensure that the excess DWF volume beyond 2,841 m^3/day (i.e. up 984.1 m^3/day) from the full Framework Masterplan can also be discharged at the downstream outfall location at the confluence with River East Stour and Horton Priory Dyke (NGR 608558 138047). STC is able lay the offsite outfall using its statutory powers under the Water Resources Act if required, prior to the trigger point for this offsite discharge outfall has been reached.

Consideration will need to be given to either providing temporary treatment or tankering of flows up to the point minimum DWF conditions are met to operate the plant (i.e., unless a relatively smaller initial treatment plant is constructed, which will also treat a small number of nearby residential homes in Barrow Hill or Sellindge, to maintain sufficient amount of initial flow to operate the plant from the day 1 of commissioning). Permanent or temporary diversion of some flows from the adjoining Sellindge WwTW catchment or temporary treatment would offer the most cost-effective and sustainable solution. Such temporary treatment options may include:

- Hire temporary treatment plant to provide treatment for the first portion of the flows required.
- Programme construction of the NUTREM® plant to facilitate the use of the aerated sludge storage tank to be operated as an SBR reactor for provision of temporary treatment. The relevant strategic Sewerage Pumping Station (SPS) is used as a temporary Balance Tank.

For any of the above options to be utilised, it would be necessary to obtain a temporary discharge permit from the EA, but this is likely to have less stringent quality parameters (i.e. reflecting the relatively small DWF volume to be discharged).

In addition, 0 provides the proposed nutrient neutrality mitigation strategy to protect Stodmarsh, which will provide further tertiary treatment to the final effluent using a large wetland, before discharging to the River East Stour.

Initial wetland designs shown in Table 28 have been further developed using a DTM model (based on LiDAR) as shown in Figure 8 to Figure 10. These wetlands were tested with ICM hydraulic modelling software to determine hydraulic loading, treatment volume/time, water depths and outflows for several design events as well as Time Series Rainfall (TSR) using the available local rainfall data, which covers the period from 1992 to 2019. This has confirmed that the proposed initial designs are satisfactory and will provide a robust foundation for subsequent detailed design of the wetlands, as part of the reserved matters.

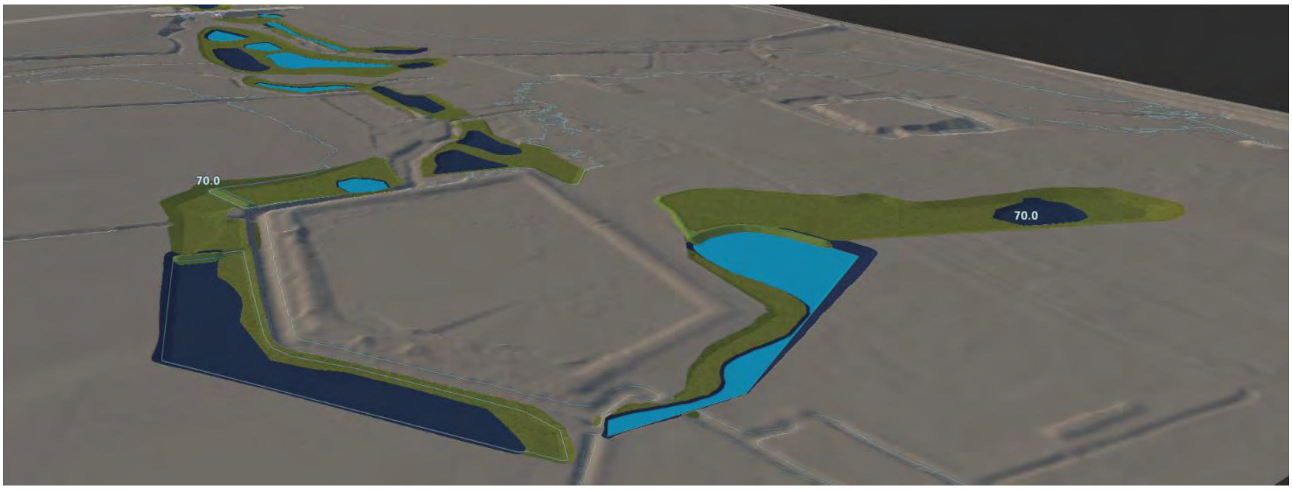


Figure 8 Proposed wetland features near to the existing Racecourse Lake/ Caste Park area

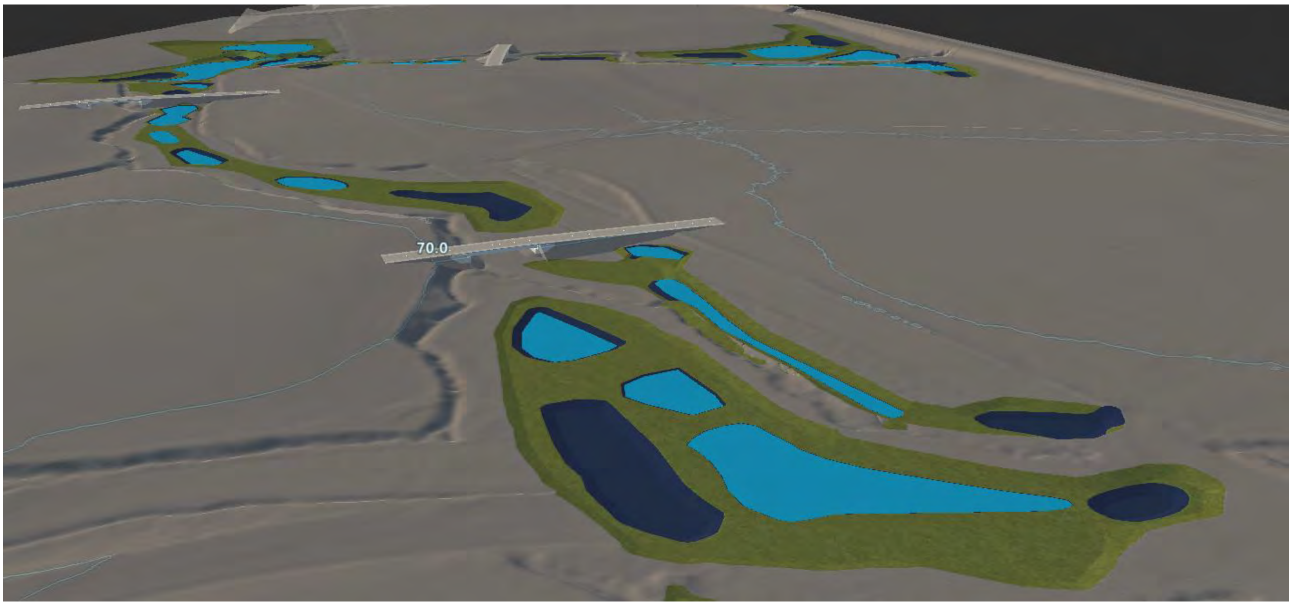


Figure 9 Proposed wetland features at Riverside Park area

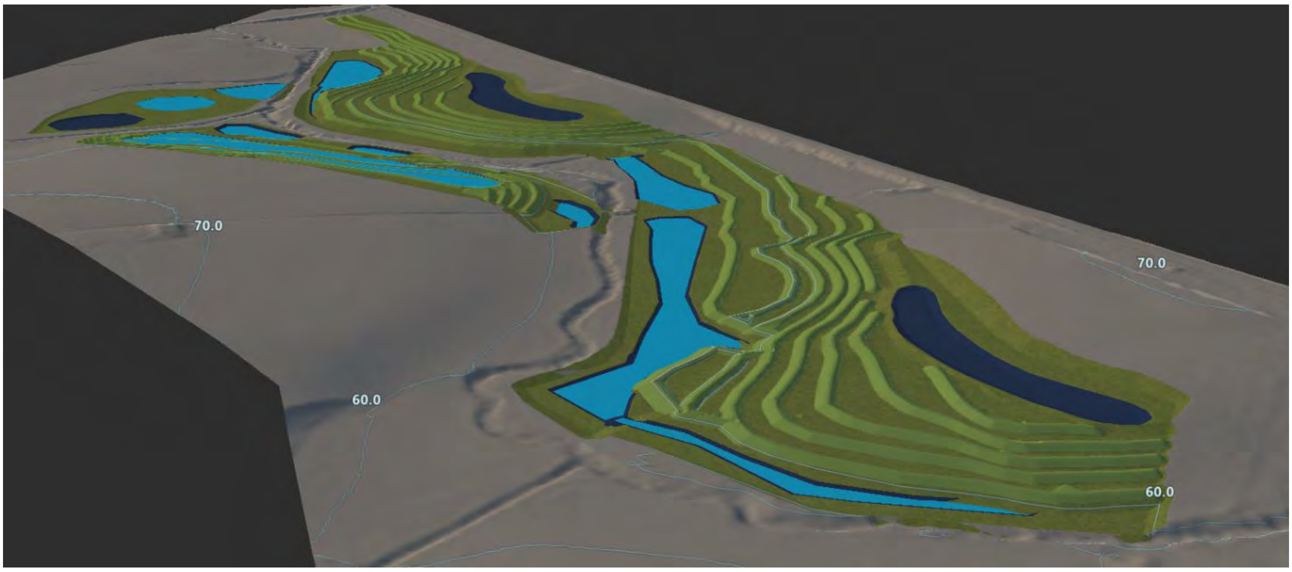


Figure 10 Proposed wetland features at Barrow Hill Park area

Section 5.0 provides further details of these wetlands in terms of wider benefits (e.g. flood risk, water quality, water resource) with further analysis of ICM model results for 1 in 30 and 1 in 100 annual chance flood events.

The location of proposed onsite WwTW and its connecting sewerage and outfall infrastructure requirements (including supporting calculations) are shown in Appendix I. This includes:

- The onsite WwTW;
- The two main pumping stations (PS1 and PS2) and the connecting rising mains and gravity sewer network;
- A potential outfall connection from Sellindge Phase 2 sites to the onsite WwTW (i.e. subject to further discussions with the relevant developers and F&HDC; and
- The preferred outfall route from the tertiary treatment wetland to Harringe Lane Bridge and the additional outfall to the downstream location.

The current flows from the wider catchment will continue to be pumped from the existing Racecourse PS to Sellindge WwTW, with necessary separate advance sewer diversions being in place in areas where new development is proposed at Otterpool Park.

4.11 Summary

A key impact of the development on the water environment will be the variations in water quality and quantity discharged to receiving watercourses from Otterpool Park itself (surface water runoff) and the WwTW that serves the development. Therefore, water discharged from Otterpool Park will require careful management to ensure that the development does not have a detrimental impact on the water environment.

The results of the qualitative water quality analysis indicate that the proposed Development will not lead to a deterioration of WFD status or will compromise the achievement of WFD ‘Good’ status in the receiving watercourses, although tightened water quality parameters will be required for the new discharge permits to accommodate the proposed Development.

The WCS provides the impacts of the proposed development trajectory on the existing wastewater assets. There is no capacity in the existing sewer network to accommodate the proposed Development and therefore new rising mains (via HS1) directly to a substantially upgraded Sellindge WwTW will be required unless a new onsite WwTW is provided at Otterpool Park. While the new rising mains and Sellindge WwTW can be upgraded this option is currently less favourable for achieving NE's nutrient neutrality requirement to protect Stodmarsh, with significant risk to Otterpool Park delivery programme.

WCS assessment confirms that onsite WwTW option is technically viable, and it is the current preferred solution for Otterpool Park. STC should make the EA discharge permit application for the onsite WwTW in spring/summer 2022 and Ofwat application as the NAV in spring/summer 2023.

This chapter also confirms that Otterpool Park Framework Masterplan even with the two CSR site allocations, CSD9A and CSD9B), can achieve Nutrient Neutrality using the Onsite WwTW solution with the associated wetlands and woodlands. The current minimum wetland area estimate of 25 ha is a precautionary estimate as advised by NE. For example, the urban area currently included in the nutrient budget assessment can be reduced by 61 ha if necessary, to account for extra public open space (including SuDS) within the urban parcels, as per the illustrative masterplan (ES Appendix 4.5). In accordance with NE's published guidance, SuDS will have lower nutrient leaching rates (i.e., similar to SANG) than the urban areas currently used, which means that the stormwater wetland requirement can be potentially reduced by another 4.2 ha, if this additional SuDS and public open space in development areas are considered in the detailed assessment.

This demonstrates that Otterpool Park, CSD9A and CSD9B site allocations in FHDC Core Strategy Review 2022) can achieve nutrient neutrality, protecting the integrity of the downstream Stodmarsh designated sites and thereby can meet the required tests under the HRA. A project HRA has also been prepared as part of this Tier 1 planning application (ES Appendix 7.19) to supplement F&HDC Core Strategy Review HRA Addendum: Nutrient Neutrality (December 2020) to confirm this. However, bespoke calculations and maintenance plans will be required at Tier 2 and Tier 3 stages to show the nutrient removal values of the proposed wetlands can be achieved on site, in order to clearly demonstrate how nutrient neutrality will be achieved and managed at Otterpool Park over its design life.

Section 5 below provides further discussion on the preferred wastewater and sewerage strategy, as part of the proposed integrated water management strategy.

5 Integrated Water Management Strategy

5.1 Flood Risk Management

Figure 11 illustrates the key features of the existing site drainage system along with the ground levels defined by lidar. The surface water runoff from the existing site drains into the River East Stour through several small drainage tributaries, with the River East Stour finally leaving the site via a culvert under Harringe Lane on the north-west boundary. The North Lympne Drain and the Harringe Brook act as natural drains from the south-east and west areas of the site, respectively.

A network of drainage ditches is present within the grounds of the former Folkestone Racecourse, which collects the surrounding surface water, directing flows around the existing Racecourse Lake at its southern boundary, before continuing west towards the North Lympne Drain and the River East Stour. The North Lympne Drain meets the River East Stour downstream of the Racecourse Ditch system.

In addition to the named watercourses, several culverts are present within, and adjacent to, the development area along the River East Stour through the CTRL, Folkestone Racecourse track and along Barrow Hill. Similarly, several other culverts are present on the smaller site drainage tributaries at the existing access crossings.

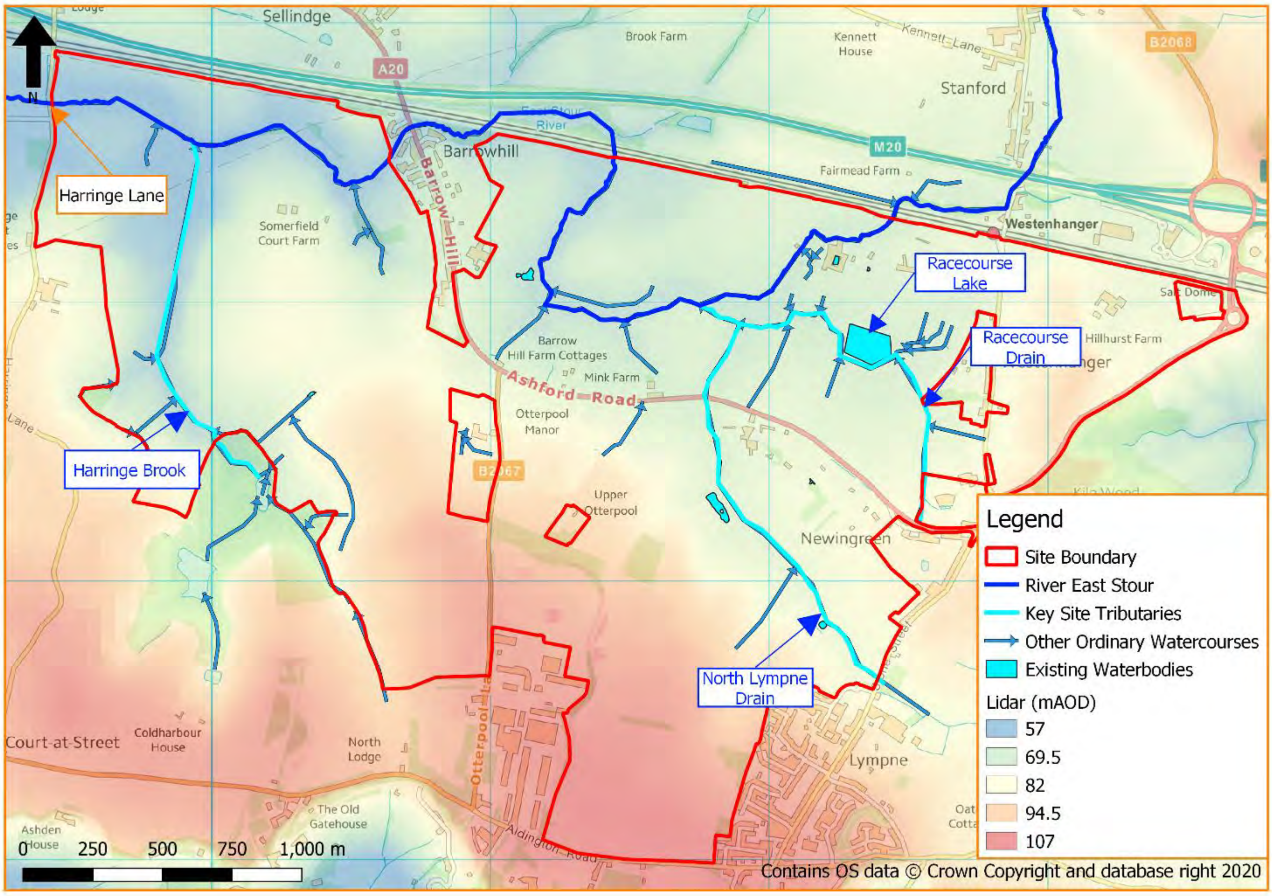


Figure 11: Existing site drainage system.
(The planning Application Site boundary is outlined in red.)

Flood risk from all sources has been assessed in a separate FRA report with the following main conclusions:

- **Fluvial**: the majority of the site currently lies in EA Flood Zone 1, with flooding chance of less than 1 in 1000 annual chance flood event . Through the northern half of the site, there are extents of Flood Zones 2 and 3 associated with the River East Stour main river. No built development is proposed within these zones. Appropriate mitigation is required as proposed for the key bridge crossings over the River East Stour and associated tributaries.

- **Surface Water**: limited areas of the site are at a potential risk of flooding from surface water, these areas follow the alignments of the North Lympne Watercourse, the Harringe Brook and the River East Stour and the associated contributors to these watercourses. Through a considered surface water strategy both on and off-site surface water, flood risk would be sustainably managed, and the risk mitigated.
- **Groundwater**: Most of the site lies upon a section of the Lower Greensand Group which is a highly productive aquifer and significant intergranular flow, therefore the site is located within a generally low-risk area. The development proposals are unlikely to include any significant subterranean elements except for the proposed shallow SuDS features and nutrient mitigation wetlands.
- **Artificial and Sewer**: The development proposals will discharge directly into existing watercourses. No significant flood risk is associated with the artificial sources including reservoirs.

The FRA and SWDS has been submitted as Appendix 15.1 to the Otterpool Park Environmental Statement. Therefore, a reference to this document should be made for the full detail on flood risk and surface water management, along with the relevant chapters in the Environmental Statement.

FRA & SWDS Report details the site-specific river modelling and groundwater modelling undertaken to assess the baseline situation and the development impacts, accounting for the latest climate change allowance. As per the NPPF, the sequential test and sequential approach have been applied to locate the built parts of the proposed Development into the lowest flood risk areas. The exception test has been applied to the key bridges over the River East Stour (see Figure 12 below). The modelling of the proposed key river crossings, existing culvert removals, floodplain enhancement measures, wetlands and SuDS has evidenced that the proposed Development will be safe from flood risk over the design of 100 years and it will not increase offsite flood risk. The integrated flood risk and water management strategy will reduce peak river levels in the downstream river reaches.

Figure 12 to Figure 14 below illustrates an example of the development of proposals for the River Park.

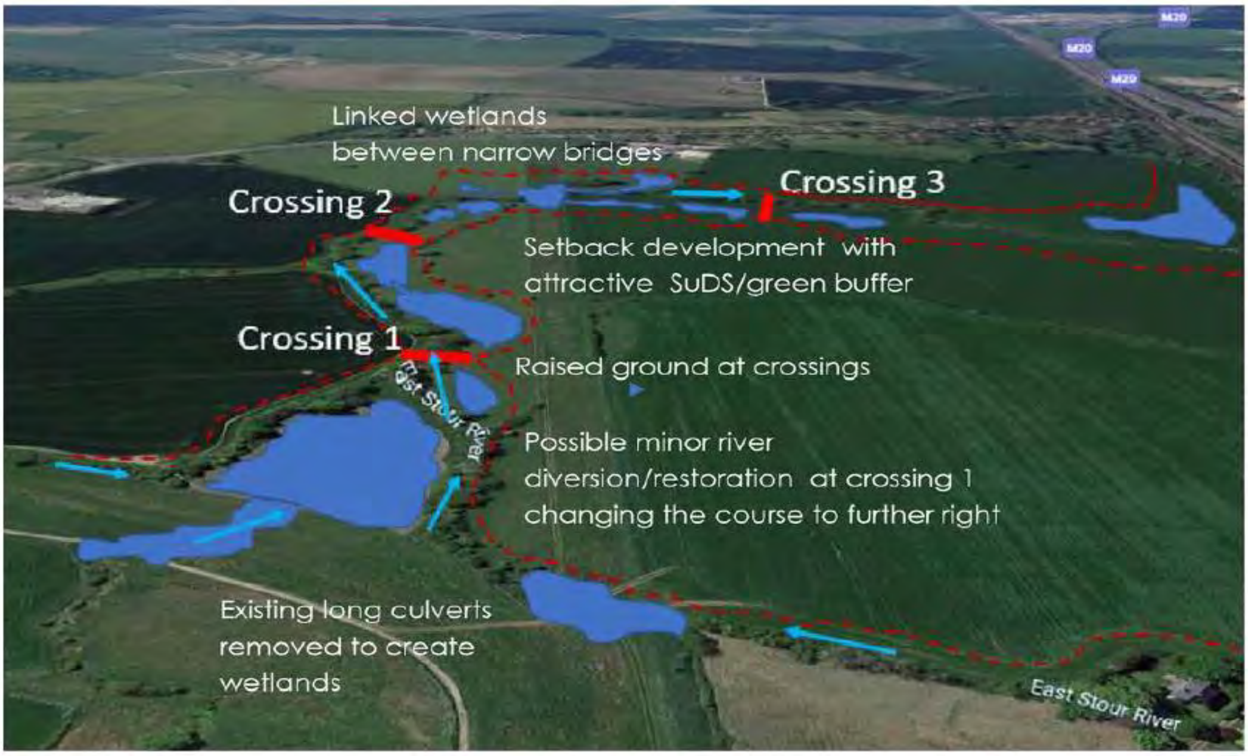


Figure 12 Preliminary proposals for the River East Stour Corridor – integrated bridge crossings and wetlands in landscaped linear river park

Figure 13 Latest proposals for the River East Stour Corridor – bridge crossing 1 and integrated wetlands in landscaped linear river park

Figure 14 Latest proposals for the River East Stour Corridor –bridge crossing 2, bridge crossing 3 and wetlands in landscaped linear river park

5.2 Surface Water Management

5.2.1 SuDS Concept and Principles

SuDS are methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques. The development could have a significant impact on flood risk downstream if SuDS principles and strict controls on runoff are not enforced. Opportunity should be taken by F&HDC and developers to incorporate techniques such as these at the development, in order to comply with the Building Regulations, NPPF and local policies implemented by both F&HDC and KCC.

In line with SuDS principles, the destination for surface water runoff that is not collected for reuse should be prioritised in the following order:

a) Infiltration;
b) Discharge to surface waters;
c) Discharge to surface water sewer, highway drain or another drainage system; then
d) Discharge to a combined sewer

Arcadis Phase 1 and Phase 2 ground investigation (including other available ground information data) show that some parts of the site are suitable for shallow infiltration-based SuDS, and there are no defined Source Protection Zones by the EA within the site. If further localised tests suggest that there is suitable permeability, developers and F&HDC in consultation with the LLFA and EA should maximise shallow infiltration-based SuDS techniques, and develop suitable designs that take account of any nearby Source Protection Zones and those principal and secondary aquifers within the site, that may be vulnerable and ensure that the risk of pollution is adequately controlled.

A concept SWDS has been developed for the Otterpool Park to show how the impact of the development will be reduced through SuDS techniques, with surface water run-off rates attenuated according to Kent County Council's SuDS Guidance local design standards as well as CIRIA SuDS Manual[30].

The Otterpool Park will aim to be an exemplar site with provision of SuDS and multi-functional green space promoting WSUD principles, to ensure that flooding is accounted for and mitigated wherever possible, while reducing extra potable water demand and maximising overall environmental benefits. The water management strategy will include an interconnected network of well-designed and managed onsite swales, basins, ponds and wetlands with dedicated outfalls within site boundary in agreement with the EA and LLFA to collect, treat, infiltrate, transport and store water.

This system of drainage will manage and reduce flood risk by limiting development runoff below the current greenfield rates during extreme events and will maximise available water resource from rainfall during the normal events. The drainage strategy will also ensure green space and properly landscaped SuDS are allocated to permeate the development, providing aesthetic and biodiversity benefits to residents while providing the most efficient multifunctional form of SuDS.

Innovation really occurs in the development of a holistic approach to a SuDS train (a network of different SuDS) from the outline design. Where possible, the sites natural hydrology would be used to inform design decisions and guide the character of the public realm. SuDS and blue-green infrastructure have been integrated into the wider masterplan strategy, providing multi-functions and benefits.

FRA&SWDS[1] illustrates a range of SuDS components (including green roofs/walls, rain gardens, soakaways etc.) which should be used, including their expected benefits and potential application. For example, the construction of green roofs could result in a reduction of runoff occurring from roof surfaces, through

[30] Kent County Council Guidance available at https://www.kent.gov.uk/__data/assets/pdf_file/0007/23578/Masterplanning-for-SuDS.pdf and Ciria Manual at https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

absorption, and evaporation by the rooftop vegetation. The reduction in impervious surface could also provide benefits in reducing the speed of runoff and providing water quality benefits through filtration and bio-retention. Green roofs also have the potential to provide a range of wider benefits, including provision of habitat for biodiversity, improved air quality, recreational and amenity benefits and amelioration of the urban heat effect. Living walls and green facades may also be suitable for installation and provide similar functions and benefits as green roofs.

By considering SuDS early in this way, as in this integrated water management strategy, they can provide a more meaningful contribution to controlling runoff rates, improving water quality and increasingly provide a source of water reuse in the most cost-effective way.

Preliminary drainage zones are illustrated in

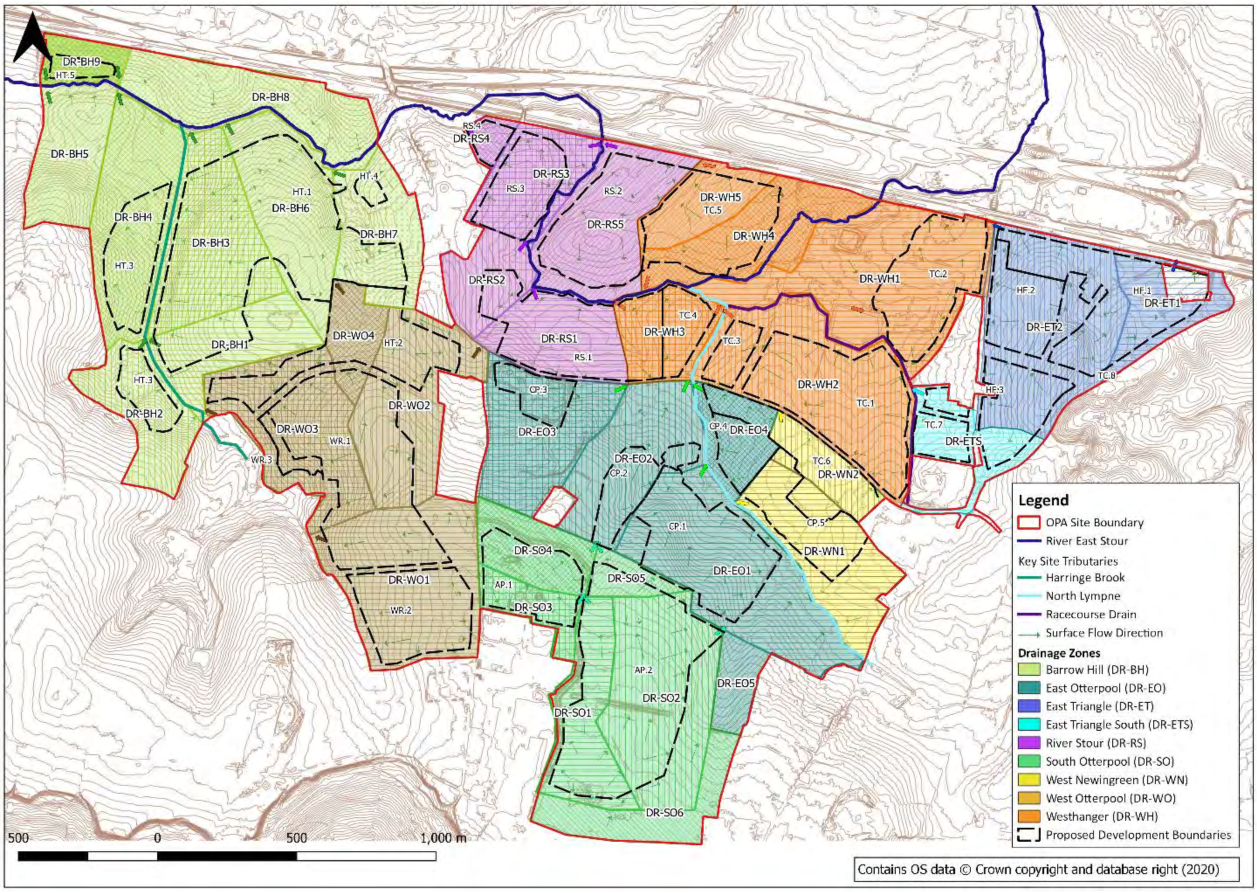


Figure 15 and identification of these zones reflects the existing site topography and proposed features (e.g. key access and drainage corridors) across the development areas. Each drainage zone is further divided into drainage sub-zones for the purposes of developing the SWDS (see also Appendix J). These drainage zones along with their corresponding discharge rates (both existing and proposed) and indicative outfall locations, that have been agreed with the LLFA are presented in 0.

This information provides the basis for the concept site-wide surface water drainage strategy at this Tier 1 Outline Planning Application Stage. Further refinements to this will be required as more detailed development layouts and design information become available at Tier 2 and Tier 3 planning stages.

It is also essential to ensure the integration of water is not lost in other, less-permeable, parts of the masterplan. Therefore, it will be important to secure these source control SuDS measures as appropriate through planning conditions and the Section106 as well as through the next stage of the detailed WCS for each phase.

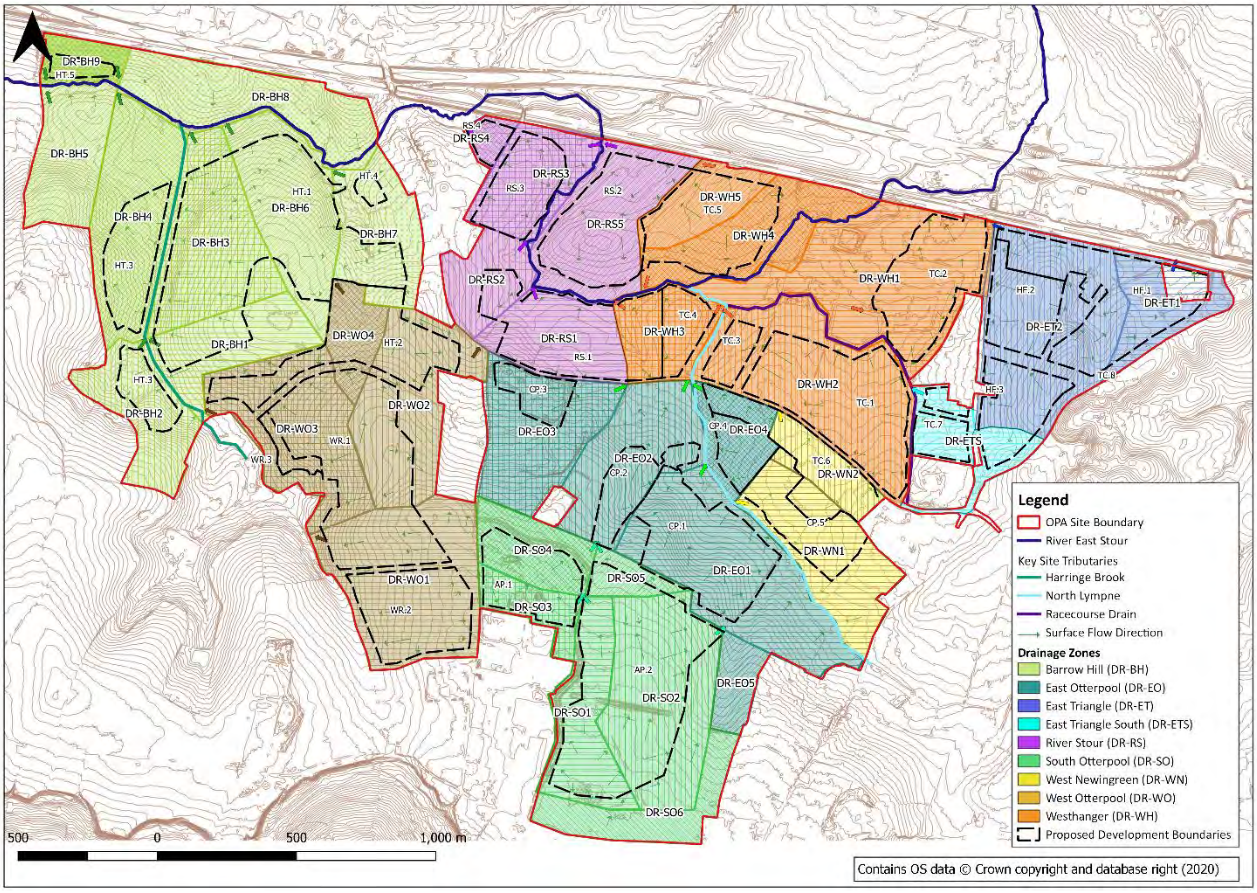


Figure 15: Preliminary drainage zones

The following key design considerations have been applied in developing the conceptual surface water drainage strategy, which will need further attention as the detailed surface water drainage strategy is developed:

- The proposed strategy has evidenced what attenuation storage is required to ensure the Application Site does not exceed Greenfield discharge rates for up to 1 in 100 annual chance flood events including 40% allowance for climate change. The development masterplan currently has provided sufficient space to accommodate the required SuDS storage ahead of each respective phase and this should be monitored and safeguarded;
- At some drainage zones it may be possible to provide extra storage to accommodate a much tighter allowable post-development discharge rate of 2 l/s/ha (which is approximately equivalent to twice as 1 in 1 annual chance flood event greenfield runoff rate) for all annual flood events, without applying a staged discharge approach to deliver downstream flood risk benefits but it is important that 50% drain-down times are not excessively long and prohibitive for dealing with follow-on smaller storm events;
- In other drainage zones, post-development runoff rate will be limited to the corresponding greenfield runoff rates or a tighter rate of 2 l/s/ha (i.e. subject to ground infiltration capacity and available SuDS space), using a staged outfall arrangement system;
- Strategic long-term SuDS storage can be designed in order to provide multi-functional benefits;
- Although there is sufficient space within the Application Site for strategic long-term attenuation storage provision, infiltration is the primary choice for surface water discharges where ground conditions are favourable with permeable soils. Therefore, infiltration potential should be established as part of the detailed design with further site investigation and the surface water drainage should be modified, to maximise use of this method of surface water management;
- Following confirmation of the detailed surface water drainage strategy a maintenance, operation and adoption schedule should be drawn up in consultation with key stakeholders including: the LLFA, Highways Authority, EA, NE and SW;
- Site-specific exceedance event flow routes should be established as part of the detailed drainage strategy, this should also confirm that the built development does not experience any flooding during events up to a 1 in 30 annual chance flood event, while no property flooding will occur for 1 in 100 annual chance flood event (inclusive of 40% climate change and 10% urban creep allowances); and
- Mitigation measures may be required within the detailed drainage design to ensure land use legacy issues do not negatively impact the water environment.

5.2.2 Blue-Green Infrastructure Integration

The proposed conceptual surface water drainage strategy, which shows the existing watercourses, watersheds and ponds and the proposed conveyance routes, storage ponds, infiltration areas and detention areas can be seen in Appendix J.

This shows that the majority of the SuDS components has been incorporated within the allocated space for SuDS within the Green Infrastructure space that is designed throughout the development to provide areas for increased biodiversity, education and awareness, and water sensitive behaviour. This includes the green corridors between housing parcels that will provide areas for surface water conveyance, treatment, infiltration and long-term attenuation storage.

Green infrastructure, ecology and water management strategies have been aligned to support well integrated proposals that will help enhance ecosystem performance, increase natural drainage capacity, maximise natural capital benefits while minimising flood risk. The combined strategies aim to support the following overarching key green infrastructure principles.

Figure 16: Green Infrastructure Principles[31]

[31] Otterpool Park Green Infrastructure Strategy, Arcadis March 2022 (ES Appendix 4.11)

Figure 17 shows how the green and blue infrastructure proposals have been produced for the proposed Development, by building on the above principles.

Figure 17: Green and Blue Infrastructure Proposals[31]

5.2.3 SuDS Storage and Treatment Train

In areas outside of the allocated green infrastructure, other SuDS components will be incorporated to manage surface water on a more local level, such as within housing parcels and business parks. This will include swales, soakaways and permeable paving, which will provide localised surface water management at the property level. These components may not be accounted for within the wider storage requirement calculation, however, may provide a localised safety factor for surface water management.

Additional, or allocated storage will also be incorporated into the surface water management plan at the plot levels within development parcels as required to intercept and treat the pollutants that occur due to the 5 mm 'first flush' following a storm event after a dry spell. This will reduce the risk of river pollution from urbanisation. Therefore, it is expected that approximately 10% storage volume will be generally provided at source near to the development parcels, including soakaways, permeable paving, rain gardens and swales where appropriate. Wetlands, ponds and canals will also be situated at some selected locations to provide areas for surface water attenuation and to reduce the flow rates within the development while enhancing ecology, amenity, water resources, water quality and place making.

To reduce the downstream flood volumes on the River East Stour and amount of surface water that is to be stored above ground onsite, and to refill the groundwater supplies, infiltration areas will be included within the surface water management strategy where the ground is permeable. Examples include within the southern portion and the strip of land from Otterpool Lane and Barrow Hill towards the River East Stour whereby the soils and Hythe Beds present the best conditions for sufficient infiltration. Detention Areas will be designed in areas that require a buffer from flood sensitive zones, this includes up to a 25 m buffer either side of the River

East Stour, throughout the length of the development and in areas where a permanent watercourse is located near to housing parcels, such as the west border of the development area.

Preliminary attenuation storage requirements have been calculated for 1 in 100 and 1 in 30 annual chance flood events using the equivalent greenfield discharge rates as well as with a much tighter allowable discharge rate of 2 l/s/ha (i.e. where ground infiltration capacity is more favourable), which is approximately double the 1 in 1 annual chance flood event greenfield rate. As well as ensuring the sufficient space storage it is essential that these SuDS features do not have excessively long 50% drain-down time to accommodate successive rainfall events, avoiding onsite residual flood while reducing downstream flood risk. During a flood event of up to a 1 in 100 annual chance event (inclusive of climate change), no specific actions are required to provide additional protection to the development as sufficient protection will be incorporated within the drainage strategy.

Table 32 and Appendix J summarise the long-term SuDS storage and space requirements (both at Drainage Zone and Drainage Sub-Zone Levels) along with 50% drain-down times, which will require further appraisal during the detailed design. This table shows that the proposed Development currently has an overall surplus of approximately 17.7ha of SuDS strategic space within the allocated strategic green infrastructure space, assuming the average SuDS storage depth is 1.0m.

However, drainage sub-zones WH2, WH5, WN1, WN2, ET1, ET2, ETS, SO4, WO2, WO4, BH2, BH5 and RS1) will have a small shortfall in SuDS provision (between 0.05ha and 0.8ha or 350m^3 and 5,600m^3) unless the depth of the features is slightly increased. Two alternative strategies exist to mitigate for this shortfall:

- Provision of excess storage in hydraulically connected drainage sub-zones downstream. These downstream drainage sub-zones are required to be constructed ahead of the respective drainage sub-zones for which a shortfall in SuDS storage is predicted.
- Provision of additional attenuation storage at development parcels and roadside swales which are currently excluded in the high-level assessment presented in this report.

The agreed phasing plan with the LLFA will ensure that the full storage requirement is met ahead of any upstream development runoff is discharged.

At some Development Zones (i.e. West Hanger, East Triangle, East Triangle South, West Newingreen and River Stour) where good infiltration rates are not available 50% SuDS drain-down time exceeds the normally recommended 24 hours maximum limit. However, a significant surplus of SuDS volume storage is already provided in other drainage zones to offset this longer drain-down times and managing the potential flood risks from any consecutive flood events.

Further long-term attenuation storage (e.g., between 10,000 and 15,000m^3) could also be made available for at the existing Racecourse Lake during such follow-on flood events, as this extra storage is currently excluded in Table 32 and Appendix J. However, this would require temporary pumping into the existing lake from the proposed drainage system because of the existing level differences between the existing base of the lake and Racecourse Drain, and the lake is also fully enclosed by an earth bund. The FRA&SWDS[1] provides further details on the existing lake and its former pumping facilities, including potential suggestions on how temporary pumping and active flow management can be used to provide additional long-term flood storage and water reuse as part of the development proposals.

The different SuDS components that have been explained above have been designed so that they provide a sufficient treatment train, which does not decrease local water quality. As well as a surface water management strategy that mimics natural drainage and utilises local topography and ground conditions it provides a functional drainage strategy that does not increase the local flood risk.

There is sufficient green space, incorporating extensive SuDS and integrated water management solutions to manage onsite and offsite flood risk following the proposed development, which can be implemented in a phased manner as part of the strategic infrastructure, in advance of the main development construction. Opportunities have been exploited to ensure multiple benefits are delivered in terms of integrated sustainable drainage, green infrastructure, amenity, biodiversity and WFD status.

As described in Section 4.10, further tertiary treatment will be provided within proposed extra storm wetlands that are specifically designed to achieve nutrient neutrality to protect downstream Stodmarsh Lakes European

Sites to satisfy Natural England's requirements. These storm wetlands are generally located towards the final section of the SuDS train (i.e. prior to discharging to the existing watercourses) to specifically intercept and treat the pollutants that occur due to the 10 to 15 mm 'first flush' following a storm event after a dry spell. This will avoid the risk of river pollution and harmful nutrients (e.g. Phosphorus and Nitrogen) impacting the Stodmarsh Lakes due to the proposed Development.

Table 32 Long-term SuDS Storage and Space Requirement at Drainage Zone Level

Drainage Zone	Average Attenuation Storage Requirement, including 40% climate change allowance (m^3)		SuDS Space Requirement with 1.0m Average Depth (ha)		Available Strategic SuDS Space in Application Site (ha)	SuDS Area Surplus/ Shortfall for attenuating 1 in 100 annual chance event (ha)
	1 in 100 annual chance	1 in 30 annual chance	1 in 100 annual chance	1 in 30 annual chance		
Westenhanger	70,835	53,333	9.21	6.93	12.11	2.90
East Otterpool	33,277	23,512	4.33	3.06	7.30	2.97
West Newingreen	20,445	15,407	2.66	2.00	1.49	-1.17
East Triangle	36,548	27,486	4.75	3.57	4.32	-0.43
East Triangle South	7,348	5,526	0.96	0.72	0.89	-0.07
South Otterpool	35,454	25,447	4.61	3.31	7.13	2.53
West Otterpool	63,151	43,659	8.21	5.68	11.16	2.95
Barrow Hill	42,804	30,542	5.56	3.97	9.56	4.00
River Stour	47,318	35,627	6.15	4.63	10.19	4.04
Total	**357,177**	**260,536**	**46.43**	**33.87**	**64.15**	**17.72**

5.2.4 Downstream Flood Impacts

Figure 18 and Figure 20 below show the total flow hydrographs, extracted from the ICM model, on the River East Stour at Harringe Lane bridge for the baseline and proposed design scenarios for a 1 in 100 + 40% climate change annual chance event for 8.0 hour and 12.5 hour storm durations. These hydrographs, indicate a total peak flow reduction of 4.01m^3/s (36%) and 7.07m^3/s (33%) respectively when compared with the corresponding baseline event. There is also a slight reduction in total flood volumes 42,676m^3 (3%) and 43,946m^3 (2%) for the same 8.0 hr and 12.5 hr storm event over the seven-day period shown in these graphs after the reduced flood peak. The slight decrease in total volume is mainly due to the extra SuDS infiltration and attenuation storage provided with a tighter allowable discharge rate of 2l/s/ha (i.e. compared to 3l/s/ha greenfield rate). The additional flood attenuation storage provided by the proposed wetlands also helps to reduce the peak flood flows.

A sensitivity test was undertaken modelling the wetlands with an initial water level 300mm above the ground level of the wetlands. The effects of this test were to cause a negligible increase of the peak design flows, at the downstream end of the model (by 0.21m^3/s and 0.11m^3/s for the 8.0 hour and 12.5 hour storm durations respectively), keeping them well below the baseline values. The reduction in flood volume slightly eroded, however the percentage reduction from the baseline did not change for both storm durations.

It should also be noted that this is currently a conservative assessment due to the following key reasons:

- A Factor of Safety between 10 to 33 has also been currently applied to the infiltration rates where infiltration-based SuDS are considered generally feasible. Therefore, if higher infiltration rates than these modelled values are proven by further detailed site investigation then the predicted post development flood volume discharge to River East Stour will reduce to account for increased infiltration discharge losses to the ground;
- The delayed time response through the extensive sequentially linked upstream SuDS systems (SuDS features at plot, roadside and strategic level) has been discounted in this preliminary modelling exercise because the ICM model did not explicitly represent these discrete features at a level sufficient to enable an accurate assessment of travel time and individual attenuation effects. The MicroDrainage quick storage estimate methodology applied to derive the total SuDS storage requirement for each post development drainage sub-zone has been input as a lumped storage node in the ICM model along with standard urban drainage modelling methods and a simplistic staged outfall arrangement, limiting the total outflow from the storage node to the required 1 in 30 and 1 in 100 annual chance allowable discharge rate;
- It has been assumed that all permanent waterbodies within each wetland are completely full, prior to the commencement of the storm event; and
- Infiltration discharge losses from the remaining plot level SuDS and roadside swales are currently not modelled in the ICM model.

Therefore, it is expected that the predicted volume decrease may further improve when further detailed modelling is undertaken during Tier 2 and Tier 3 application stages, using the updated site layouts, drainage designs and infiltration rates (with reduced Factor of Safety).

Note that the ICM modelling currently excludes the additional 38l/s of extra effluent discharges to the River East Stour from the proposed onsite WwTW (due to the proposed Development included in the current Tier 1 Outline Planning Application), which can add another 22,982m^3 of Dry Weather Flow volume to the total post development flood volume. However, even with this extra Dry Weather Flow, the total post development flood volume is still less than the baseline flood volume (because this DWF increase is still < 42,676m^3 and 43,946m^3 volume reductions discussed before). Furthermore, 38l/s Dry Weather Flow constitutes a very minor proportion of the flood flows in the River East Stour (i.e., 2% of QMED and 0.3% of the 11hr catchment duration 1 in 100 annual chance flood event) and therefore considered to have a negligible impact on the downstream flood risk.

Figure 18 and Figure 20 below also provide the breakdown of:

- Total stormwater inflows to wetlands from the proposed SuDS;
- Total stormwater outflows from the proposed wetlands directly to the watercourses; and
- Total stormwater outflows from the proposed SuDS directly to the watercourses

Figure 19 and Figure 21 then show the proportional distribution of total runoff volume discharged to the watercourses from the SuDS and wetlands in Otterpool Park and other non-Otterpool Park discharges, for the 1 in 100 annual chance event plus 40% climate change, 8 hr and 12.5 hr storm durations. They also show the breakdown of total stormwater flows to the watercourses directly from the wetlands and the proposed SuDS.

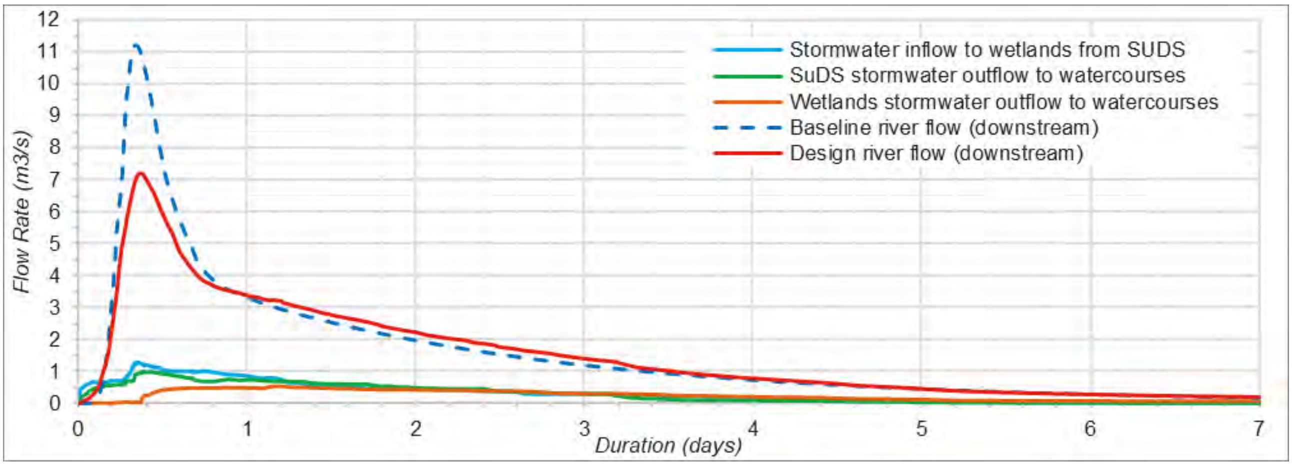


Figure 18: Flow hydrographs for 1 in 100 + 40% Climate Change annual probability 8 hr storm duration event

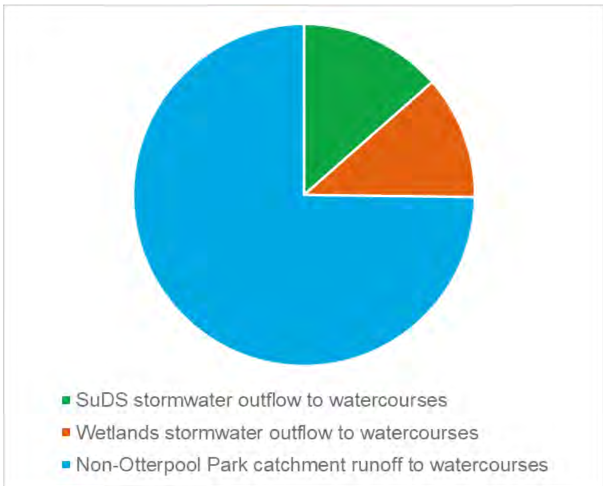


Figure 19: Proportional distribution of runoff volume discharges to watercourses for 1 in 100 + 40% Climate Change annual probability 8 hr storm duration

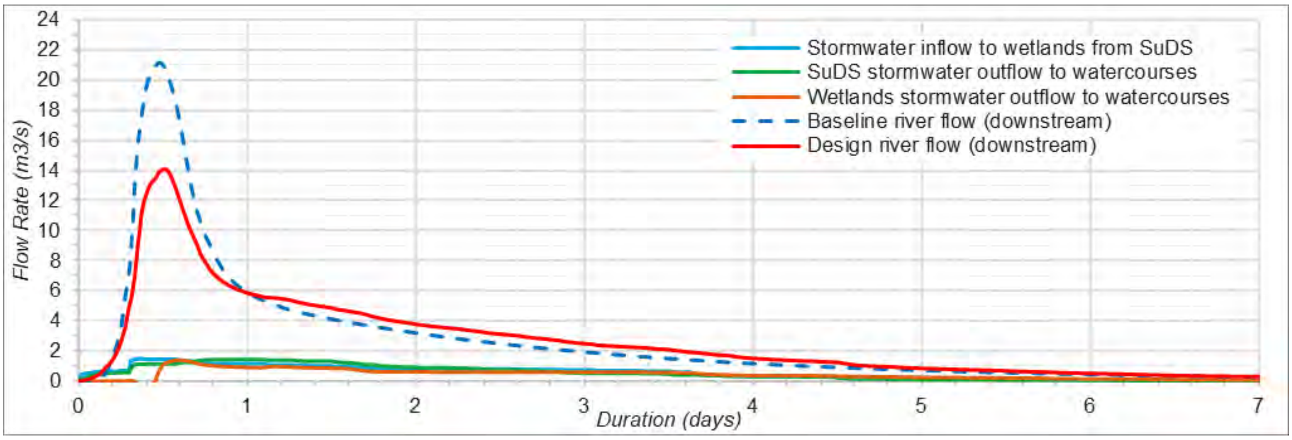


Figure 20: Flow hydrographs for 1 in 100 + 40% Climate Change annual probability 12.5 hr storm duration event

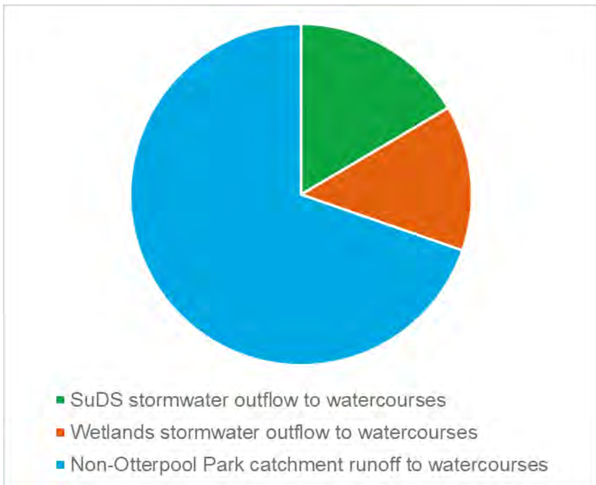


Figure 21: Proportional distribution of runoff volume discharges to watercourses for 1 in 100 + 40% Climate Change annual probability 12.5 hr storm duration

As mentioned before, a temporary pumping from the proposed drainage system to the Racecourse Lake or would be another potential option to increase the long-term attenuation storage provision. Furthermore, a key component of the proposed integrated water management strategy is to minimise any residual increased overall flood volume impacts on the downstream Aldington FSR due to the proposed Development during successive rainfall events in unusually wet periods.

Therefore, further hydraulic modelling during Tier 2 and Tier 3 Planning Application Stages, incorporating extra DWF from the onsite WwTW as well updated site layouts, drainage designs and infiltration rates (with reduced Factor of Safety) is recommended to refine the current integrated water management strategy.

5.3 Water Reuse

5.3.1 Rainwater Harvesting

Utilising some (and at times of peak demand, most) of the collected surface waters for non-potable uses within the Otterpool Park development, should result in an overall reduction of surface water discharge to the local water environment during large flood events. This should form an important point for consideration for catchment flood management planning, and may warrant further review and appropriate design development.

The proposed interlinked ponds-wetlands system and the existing Racecourse Lake that are located in the north-eastern and central parts of the proposed Development, which comprise less permeable ground where more high dense housing and town-centre related uses are also located, provide an ideal opportunity to implement a centralised rainwater harvesting solution, as part of the proposed integrated water management strategy.

Currently, the average daily per capita consumption of potable water within the Affinity Water supply region is 129 litres. However, around half of this water isn't used for drinking or personal washing purposes, despite being of a drinking water standard. The southeast of England is classified as a water-stressed region with a long- term water supply-demand imbalance. As mentioned in Section 2, Affinity Water is forecasting a deficit of 3.8 mega litres per day within their Water Resource Zone 7 (i.e. home to Otterpool Park) by 2045/47, which is expected to reach 11.2 mega litres per day by the end of their planning horizon of 2080.

The potential onsite treatment options for rainwater harvesting vary depending on two main factors:

- Sources of water – if highway drainage is to contribute to the system, oil interceptors and reedbed filtration may be required; and
- Desired quality of water – if water is to be used for spray irrigation (i.e., where aerosols are likely) then disinfection may be needed. Disinfection is achieved by using one, or a combination of the following systems; ultraviolet radiation, ozone dosing, or chlorine dosing. All three forms of disinfection system are common within the water sector and are available in small package plant kiosks. Ultraviolet

radiation needs power only, while the others add chemicals to the water which some irrigation systems may prohibit using them as they add chemicals to the ground.

In Otterpool Park there are no plans for extensive spray irrigation and therefore the wetland treatment with the proposed reedbeds, is likely to be sufficient.

The existing racecourse lake can provide a maximum storage of approximately 37,570 m^3 to the existing spillway level of 71.27 mAOD or 22,944 m^3 with the proposed lowered spillway level of 70.40 mAOD (see FRA&SWDS for further detail on the lake capacity). Therefore, this together with the nearby proposed wetlands/ponds in Castle Park and Riverside Park can provide further permanent water storage of up to 76,263 m^3 or 61,637 m^3. It has been assumed that 30% of available storage may be lost due to evapotranspiration in dry periods and therefore the remaining storage could be potentially available for reuse purpose. This gives a total effective storage volume of 53,384 m^3 for reuse purpose or 43,145 m^3. However, further modelling is required during Tier 2 and Tier 3 stages to confirm this, while accounting for the evapotranspiration and ensuring sufficient baseflows in the downstream wetlands to maintain their amenity, ecology and water treatment functions during dry periods.

Therefore, a centralised non-potable rainwater harvesting system present an opportunity to further reduce the current minimum potable water supply requirement of 110 l/p/d as follows:

- **Option 1**: 18.5 l/p/d (for toilet flushing and garden watering)
- **Option 2**: 35.7 l/p/d (for toilet flushing, garden watering and washing machine)

Development Area	Dwellings (No)	Peak Water Reuse Demand (m^3)			
		1 day	30 days	60 days	90 days
Town Centre & Castle	1,975	132	3,946	7,892	11,838
Hillhurst Farm	547	36	1,093	2,186	3,279
River Stour	1,495	100	2,987	5,974	8,961
Total	**4,017**	**268**	**8,026**	**16,052**	**24,078**

Table 33 and Table 34 below show the potential domestic peak demand for the above two water reuse options for some targeted development zones that are within reasonable proximity to the available water storage features in Castle Park and Riverside Park area. An additional Factor of Safety of 1.5 has also been applied to account for the potential peak and seasonal variations.

Table 33 Water Reuse Supply Demand Requirement for Option 1 (includes FoS of 1.5)

Development Area	Dwellings (No)	Peak Water Reuse Demand (m^3)			
		1 day	30 days	60 days	90 days
Town Centre & Castle	1,975	132	3,946	7,892	11,838
Hillhurst Farm	547	36	1,093	2,186	3,279
River Stour	1,495	100	2,987	5,974	8,961
Total	**4,017**	**268**	**8,026**	**16,052**	**24,078**

Table 34 Water Reuse Supply Demand Requirement for Option 2 (includes FoS of 1.5)

Development Area	Dwellings (No)	Peak Water Reuse Demand (m^3)			
		1 day	30 days	60 days	90 days
Town Centre & Castle Park	1,975	254	7615	15230	22844
Hillhurst Farm	547	70	2109	4218	6327
River Stour	1,495	192	5764	11528	17292
Total	**4,017**	**516**	**15,488**	**30,976**	**46,464**

This indicates that the above Development Areas can be potentially supplied between 60 and 90 days in dry periods with both options before the potable water back up system is required. This is because a total effective storage volume of up to 43,145m^3 is potentially available for reuse purpose within the Racecourse Lake and nearby proposed wetlands/ponds in Castle Park and Riverside Park based on the current development proposals. Therefore, it is recommended that subject to further detailed analysis, design and financial viability of providing the dual pipe system and pumping facilities, a centralised rainwater reuse system (i.e., in conjunction with a potable water back up system) for the above targeted development zones is implemented. This will enhance the climate resilience on existing water resources as well minimise the predicted increase in total flood volumes (see Section 5.2) that will enter the River East Stour during infrequent flood events.

As discussed in the FRA&SWDS Report[1], there is already an abstraction licence issued to F&HDC within the Site to abstract water from a location (NGR 611730, 137000), near to the proposed wetlands W12, W11 and W8. This licence has been operational since 1966 for the purpose of spray irrigation storage at the former racecourse and the licence was transferred to F&HDC in 2020. It has a daily maximum licenced quantity of 909.2m^3 and maximum annual licenced quantity of 36,368m^3.

The information supplied by the EA shows that the maximum abstracted volume was 32,760m^3 in 2003-2004 and no water has been abstracted since 2013. Local knowledge also suggests that the former pump was decommissioned in 2014 and it was previously used to abstract water from a local well/borehole and pump into the Racecourse Lake, ahead of the spring/summer race season, using the metal rising main (220mm outside diameter) shown in Figure 22.

Therefore, this abstraction licence and rising main can be potentially used with a new pumping facility located at wetland W8 or W12, to store water at the Racecourse Lake and reuse within Otterpool Park. However, further abstraction licenses will be required from the EA to abstract the stored water from the proposed wetlands and SuDS features to ensure sufficient water is available for reuse purpose throughout the year. The extra ground infiltration from the proposed SuDS in higher parts of the proposed Development may generally enhance the baseflows in the local watercourses and proposed wetlands in the lower parts of the Site, supporting more abstraction from the current location and potential future locations. Similarly, the proposed onsite WwTW will introduce up to 44 l/s of DWF to the River East Stour, enhancing baseflows in general. Table 7 in Section 2.4 shows a summary of the Stour Abstraction Licensing Strategy, indicating water is available for licensing from surface water and groundwater sources during high flows, but no water is available to abstract during low flows and overall consumptive abstraction availability is at least 30% of the time.

In addition, for those dwellings with relatively large roof areas that are more remote from the opportunities for centralised water storage, rainwater harvesting for garden watering and toilet flushing is recommended directly from roof areas, in conjunction with an underground storage tank and a small solar pump. This would avoid any constraints on water abstraction and intercept much cleaner water, and therefore this also offers an alternative sustainable approach that can be more widely used across the development, if abstracting water from the proposed SuDS and wetlands network proves not to be feasible with the EA. It should be noted that abstractions of less than 20m^3 per day are currently licence-exempt. The EA have also indicated that an abstraction licence may not be required to pump out water from offline SuDs storage facilities, but further discussion will be required to fully confirm this.

Figure 22 Disused existing metal rising main (220mm outside diameter) at the western edge of the racecourse lake

5.3.2 Effluent Reuse

Centralised wastewater effluent reuse from the onsite WwTW has not currently been pursued for the early development phases of Otterpool Park. However, it is still a potential opportunity for the later phases of the development west of A20 and Otterpool Lane because the treated wastewater and stormwater from the proposed large wetlands (W13, W15, W7 and W6) can be reused for the non-potable consumption within the development. Therefore, this opportunity can be further explored, as part of Tier 2 and Tier 3 investigations for these development phases subject to technical, financial, sustainability and social considerations.

Further technical standards and regulatory guidance on wastewater reuse options should be readily available in the UK by then to support and implement this option. A significant advantage of such wastewater effluent reuse as a water supply option is that it is largely climate independent, so is more reliable and therefore requires much reduced storage volumes. It's also possible to combine it with reuse of rainwater harvesting to maximise flood risk reduction benefits. This then even provides a potential and commercially attractive bulk water supply opportunity for the wider water consumption outside Otterpool Park in the long-term.

5.3.3 Preferred Approach

Otterpool Park is located in a water-stressed area, which require effective water efficiency and water reuse measures, as per the modified CSR Policy SS8 (with 2021 Main Modifications). Section 3.2 previously outlined the general water efficiency measures that should also be considered, in conjunction with the potential additional rainwater and wastewater reuse options discussed above. This includes water efficient fittings and appliances, water labelling, monitoring water usage, quality, and climate change impacts at all stages of the design-life of the proposed Development through smart metering. This should be combined with other smart home and office systems to give wider utility control and customer behaviours – e.g., educational and behavioural initiatives, network sensing to reduce network losses and improve efficiency, micro-controlled irrigation and smart irrigation systems. The final strategy should be devised in Tier 2 and 3 stages, by choosing a mixture of the above measures as each key development phase come forward so that the Policy SS8 requirements as well as the wider sustainability and community stewardship aspirations of Otterpool Park can be met.

5.4 Implementation and Maintenance

The integrated water management solutions (e.g. SuDS, nutrient mitigation wetlands, floodplain enhancement, rainwater harvesting) will be designed and implemented ahead of each development phase, as well as working as a wider blue-green infrastructure network across the phases once the development has been completed. This creates a localised and self-sufficient water management strategy for each phase, as well as an interconnected larger network.

Further information on the detailed design, implementation, operation and maintenance of the proposed blue-green infrastructure for each phase will be provided as part of the Tier 2 and Tier 3 stages. A Maintenance Plan will be prepared, which should follow the recommended maintenance requirements for each of the SuDS components set out in CIRIA SuDS Manual. Opportunities to combine landscaping maintenance with SuDS maintenance should be identified to reduce the lifetime costs of the drainage system. The full details of adoption and maintenance arrangements and requirements for the proposed wetlands and SuDS will be confirmed ahead of discharging any relevant planning conditions. Section 106 money should be allocated to ensure that suitable funds for maintenance activities of the proposed SuDS, wetlands and blue-green infrastructure would be available for the lifetime of the development.

The surface water management strategy and its construction sequence will also ensure that any potential construction impacts, such as dealing with runoff from bare, compacted or muddy surfaces including haul roads associated with off-site infrastructure works are accounted for and therefore present a limited flood risk to the construction site.

The proposed Governance and Stewardship Strategy[32] sets out the potential options for long-term ownership and maintenance of SuDS and recommends a 'Company Limited by Guarantee' or 'Community Interest Company' as the preferred Governance Body to ensure that those assets within the Governance Body are 'locked' and safeguarded for use in perpetuity, so any transfer of land ownership should require that specific terms and conditions are met. A Company Limited by Guarantee would be the most flexible option and would not preclude the body being converted to a Community Interest Company at a later date if that were ultimately to be a preference. Assets of a Company Limited by Guarantee could be transferred to other third-party bodies in the longer term, which could include charitable or other bodies as appropriate to the operation and management of assets. For those items which are identified as being the responsibility of the Governance Body (e.g., strategic parks and open space), long-term stewardship and governance will be undertaken by a new body established for this purpose.

In order to maintain the proposed SuDS and stormwater wetland features (including associated engineering structures), they will need to be adopted by a body that can maintain the different components so that they continue to function as designed. It is currently envisaged that they will be adopted by a combination of a Governance Body and STC as the New Appointment Variation company, which will also operate the onsite Wastewater Treatment Facility. However, it should be noted that Southern Water, which is the incumbent sewerage provider, can also adopt SuDS in accordance with the Design Construction Guidance published in 2020. Kent County Council may also retain adoption of certain SuDS features within the adopted highways subject to further detailed discussion.

The onsite WwTW (including the associated wastewater tertiary treatment wetlands system) will be operated and maintained by STC in perpetuity under the legal and regulatory provisions of the Water Industry Act, while ensuring water quality standards and nutrient mitigation to satisfy Water Framework Directive and Habitat Directive requirements. All proposed centralised rainwater and wastewater recycling measures will also be adopted and maintained by STC.

[32] Governance and Stewardship Strategy (ES Appendix 4.13)

Habitat creation and ecology mitigation, including addressing any potential conflicts between accessibility, safety, ecology and water management should be carefully considered and resolved, as part of the design development process of the nutrient mitigation wetlands and stormwater SuDS. For example, Wastewater Wetland W13 and the surrounding area is within the mitigation area designated for water voles and reptiles (including a presence of a public footpath), which needs consideration in preparing the design and maintenance plans.

Plants have an important role in wetland systems, which can directly affect the wastewater quality by improving various removal processes and consumption of phosphorous, nitrogen, and other elements33. Various studies have concluded that plants along the wetland system can lead to higher percentage of nitrogen and phosphorus being removed. One study concluded 15-80% and 24-80%34 reduction for nitrogen and phosphorus whereas another concluded 14.29%-51.89% and 10.76%-34.17%35 respectively; there is a close relationship between nutrient content and increase in phytomass; the rapid increase in phytomass during the third and fourth months corresponded with high nutrient levels.

Since plants store significant amounts of nutrient and trace elements during their growth, periodic harvesting of the above-ground plant parts is a recommended practice to remove significant amounts of nutrients (mainly during the first 5 months of growth) from the wastewater flowing into the wetlands. Wetland plant species with high phytomass productivity and a well-developed root system and ability to withstand flooding are most productive in nutrient removal. Plant harvesting in wetlands generally has a positive effect on nutrient removal such as TN, TP, COD, and BOD.

Therefore, this method could be recommended as best wetland management practice to improve and maintain nutrient removal in constructed wetlands. Maintenance should also look to achieve ~20% open water, which is recommended as optimal pollutant removal (Almuktar et al. 2018). However, it should be noted that one study on the River Ingol wetland36, where no maintenance has taken place five years after the construction, is still performing well with high levels of nutrient removal.

Potential community education and involvement exercises in promoting the biodiversity within Otterpool Park can be linked with the proposed SuDS, wetlands and blue-green infrastructure across the Site. Further discussions will be required with the design teams, LPA and STC during Tier 2 and Tier 3 stages, in respect of the detailed design of the onsite WwTW to explore how utilities infrastructure and buildings could be attractively integrated into the landscape, and what role the proposed Otterpool Park community stewardship vehicle will play in managing this area.

An example of this could be a commitment to use green roofs and green walls on key utility buildings. The early delivery of the onsite WwTW (including associated foul water pumping station in the town centre) is a good example of where a benchmark of great design could be set from the outset and adopt a design-led approach to all utility buildings and structures, to minimise the impact on the quality of the public realm. Therefore, SuDS and blue-green infrastructure have been integrated into the wider masterplan strategy, providing multi-functions and benefits

[33] Vymazal, J. (2007) Removal of nutrients in various types of constructed wetlands. Science of the Total Environment, 380, 48–65

[34] Greenaway, M. and Woolley, A., 2001. Changes in plant biomass and nutrient removal over 3 years in a constructed wetland in Cairns, Australia. Water Science and Technology, 44(11-12), pp.303-310. https://iwaponline.com/wst/article-abstract/44/11-12/303/7971/Changes-in-plant-biomass-and-nutrient-removal-over

[35] Wu, H., Zhang, J., Li, C., Fan, J. and Zou, Y., 2013. Mass balance study on phosphorus removal in constructed wetland microcosms treating polluted river water. *CLEAN–Soil, Air, Water*, *41*(9), pp.844-850. https://onlinelibrary.wiley.com/doi/pdf/10.1002/clen.201200408?casa_token=5uNWbphEaCEAAAAA:aXq7j7oblsZESaihpAEfRD4G4EmxYoib8COihJzawswb54OjN3mJ9_iIJ3bxq_88GHc-wFWRzw8eA00m

[36] Cooper, R.J., Hawkins, E., Locke, J., Thomas, T. and Tosney, J., 2020. Assessing the environmental and economic efficacy of two integrated constructed wetlands at mitigating eutrophication risk from sewage effluent. *Water and Environment Journal*, *34*(4), pp.669-678. https://onlinelibrary.wiley.com/doi/epdf/10.1111/wej.12605

5.5 Summary

The proposed integrated approach to managing flood risk and surface water at Otterpool Park will ensure that the development passes the Sequential Test and Sequential Approach, as per the NPPF so that the developed areas are located in the lowest areas of flood risk and flood risk is safely managed over the lifetime of the proposed Development. As explained in this WCS report and within the Otterpool Park FRA and SWDS (Arcadis, 2021[1]), opportunities have been maximised to ensure multiple benefits are delivered through an integrated sustainable drainage, blue-green infrastructure and water management strategy.

Integrated water management at the Otterpool Park can also help to deliver other objectives for the development including a sense of place, green infrastructure, biodiversity, education and awareness, and water sensitive behaviour. Early consideration of water management provides the opportunity to integrate the water environment into the local context and character of the area, enriching both the natural and built environment.

Sufficient green space has been allocated within the Otterpool Park to incorporate an extensive SuDS and integrated water management solutions to manage onsite and offsite flood risk following the proposed Development. This can be implemented in a phased manner as part of the strategic infrastructure, in advance of the main development construction. The proposed Development will reduce peak flood levels in the River East Stour while that the predicted increase in overall flood volume is acceptable, during infrequent catchment-wide storms.

A high-level assessment in Section 4.7, together with integrated water management strategy presented in Section 5.1 to 5.4 confirm that WwTW and surface water discharges will not increase flow risk (either flood levels or volumes) when compared against the current baseline situation, and the development proposals can indeed reduce downstream flood risk.

As highlighted in Section 1.5, the proposed Development aims for a quality sustainable community with a sense of vitality, a distinctive local character, and a close connection with its natural environment. The Sustainability Statement[12] sets out the foundations of the integrated vision that links energy, water, transport, infrastructure, resources, waste, biodiversity, and place-making with the local aspects of community, culture, and economy.

Therefore, the development proposals show how water strategies and other site-wide strategies (e.g., green infrastructure, energy, utilities) play a key role in delivering 20% Biodiversity Net Gain, improving climate resilience and place making, and promoting sustainable and low carbon design approaches across Otterpool Park. This includes delivering a net flood risk reduction, limiting extra potable water consumption below 110 l/p/d, and ensuring nutrient neutrality and use of green walls and roofs where feasible as well as promoting smart technologies, including exploring potential opportunity to utilise waste sewer heat or from the on-site WwTW to futureproof Otterpool Park.

6 Conclusions

The key conclusions of the updated WCS assessment are presented here. This updated WCS Report should be treated as a 'living document' with the conclusions and analysis being subject to change following further detailed investigation and consultation. It is considered that developing and implementing integrated water management solutions based on the WCS conclusions and recommendations, ensuring a reliable and sustainable long-term supply of water resources while addressing the local flood risk, water quality and wastewater provision capacity constraints is key to meeting the ambitious development aspirations of the proposed Otterpool Park. The updated WCS, and related FRA and drainage strategy provide suitable building blocks for developing integrated water management solutions with the Otterpool Park development.

This updated WCS has highlighted the key infrastructure required to serve the Otterpool Park, including SuDS, integrated blue-green infrastructure, and holistic water supply and wastewater provision aspects. While infrastructure issues would be unlikely to significantly limit the proposed Otterpool Park, large-scale upgrades and new infrastructure will be required. The identified key infrastructure phasing limitations will be addressed through the proposed Infrastructure Delivery Programme.

The need to meet nutrient neutrality strengthens the case for the preferred onsite WwTW solution as well as brings significant placemaking, flood reduction, biodiversity and sustainability benefits, which will add to value creation across Otterpool Park.

Indicative guidance from the water companies suggests the following planning and construction timeframes for wastewater infrastructure provision as a normal starting point, if the new infrastructure was to be funded from their normal 5-yearly business planning cycles:

- Network improvements – up to three years;
- Significant new network, and upgraded processes capability at WwTW – up to five years; and
- Construction of a new WwTW or major upgrade to existing WwTW – up to ten years.

STC, as a potential NAV provider, has indicated a faster delivery timescale (less than 4 years) for a new onsite WwTW provision from the placement of order because this can be funded and delivered outside the normal Ofwat's 5-yearly regulatory business planning cycles.

Any localised network upgrades can be commenced by water companies once planning permission for the development has been approved, and the developer requisition is received. Therefore, development phasing and planned development trajectories should clearly allow for sufficient lead-in time involved in investigating, planning and constructing the required key infrastructure needs. Close consultation with the water and sewerage companies will be required (i.e., both prior to and after planning permission being granted) to ensure smooth planning, investigation and construction.

Table 35: Overall Conclusions

Section	Concluding Comments
Water Resources and Supply	Based on the currently known forecasts AW has confirmed there is supply capacity for the early phase(s) of Otterpool Park, of approximately 1,500 additional units over-and-above the quantum of existing growth modelled for in the latest WRMP19 forecasting. AW has some headroom at present in terms of both water resources and distribution network for the initial 1,500 homes, but significant offsite infrastructure upgrade will be required to accommodate the full development. The required reinforcement can be planned and implemented ahead of the remaining development through the normal water industry's five yearly business planning process. The routing to the point of water supply connection for Otterpool will be from the northeast. Additional water efficiency and reuse measures encouraging WSUD principles will be put in place to restrict the maximum amount of extra drinkable water consumed by each new household to 110 litres (or less) of extra potable water consumption per person, per day.

Section	Concluding Comments
Water and Sewerage	Overall, the capacity constraints associated with the existing WwTWs and sewerage network to accommodate increased flows from the proposed Development can be addressed, with future investment and careful planning. However, Sellindge and other existing wastewater treatment works discharging into the River Stour and surroundings are also currently being investigated by the EA and NE to understand their potential negative impacts on the downstream Stodmarsh lakes European designated sites, the report due in 2022. This will investigate potential links between the River Stour and the Stodmarsh lakes systems and then propose solutions to resolve any identified impacts. Until the report is complete and any subsequent mitigation is in place, all new development in the impacted Stour catchment must achieve nutrient neutrality under Natural England's published guidance. Therefore, Otterpool Park will be served by a dedicated onsite WwTW that will be operated by STC, including a significant amount of additional constructed wetlands (25ha) and woodland planting (35ha) to offset the estimated surplus Nitrogen and Phosphorous budget from wastewater and surface water discharges from the proposed Development, as detailed in this WCS report. The onsite WwTW will be located towards the northwest corner of the Application Site boundary (at Development Parcel HT.5), and it will be constructed and commissioned in three phases to match with the proposed development trajectory. However, there is still some flexibility to connect the later phases of the proposed Development and Otterpool Framework Masterplan Area to Sellindge WwTW that is currently operated by SW, if this alternative approach is deemed to be more beneficial than expanding the onsite WwTW. These proposals have also been discussed with NE, EA and LPA to obtain their agreement in principle.
Water Quality	The major impact of the Otterpool Park on the water environment will be the variations in water quality and quantity discharged to receiving watercourses from surface water runoff and the treated effluent discharge from the associated WwTW. The results of the qualitative water quality analysis indicate that the proposed Development will not lead to a Deterioration of WFD status or will compromise the achievement of WFD Good status. Tightened water quality parameters will be required, and STC and SW have confirmed the indicative discharge consent parameters previously advised by the EA are technically and economically achievable within the current limits of wastewater treatment technology. However, these indicative quality discharge permit values should be verified with the EA and updated accordingly to reflect the latest DWF figures, water quality monitoring data and proposed outfall arrangements through the normal permitting process. The surface runoff from the development will be routed through several SuDS treatment stages (including first 5mm first flush treatment and construction stage silt management measures) prior to discharging to the receiving watercourses, which will ensure no deterioration of water quality. Furthermore, the proposed constructed wetlands and woodland planting will aim to improve the downstream water quality and ensure that the water quality in Stodmarsh lakes is not compromised due to the proposed Development.
Flood Risk Management	A site-specific assessment which considered the flood risk to the proposed development from all sources has been completed. All proposed main built development areas will be located outside the high and medium risk flooding areas. An exception test was also performed as per the NPPF for the three new bridge crossings over the River East Stour and the proposed design will ensure the development is safe over the recommended 100-year minimum design life, whilst addressing climate change risk and helping to reduce offsite flood risk through additional floodplain enhancements and an integrated water management strategy. The updated WCS confirms that surface runoff and WwTW discharges will not increase downstream flood risk (i.e., in terms of both flood flows and volumes) when compared against the current baseline situation. The proposed Development (with mitigation measures) can indeed reduce downstream peak river flows for the design event in excess of 30% when compared to the baseline situation.

7 Recommendations

Water Resources and Supply

To meet the sustainability and healthy town aspirations of the Policy SS8 (with 2021 Main Modifications) rainwater harvesting and reclaimed effluent re-use is an important consideration. Therefore, targeted rainwater harvesting is encouraged as part of the integrated water management strategy (e.g., by utilising the long-term storage available at the proposed SuDS and wetland features and Racecourse Lake, together with plot level water reuse for the buildings with large roofs if necessary).

Reclaimed effluent re-use from the onsite WwTW could still be a possibility within the later phases of the proposed Development, subject to satisfactory future commercial and technical viability study outcomes.

Engagement with AW should also continue to ensure the timely implementation of 11 km long new rising main to serve the Ottterpool Park from their Paddlesworth storage reservoir, prior to constructing 1,500 homes in Phase 1development.

Wastewater and Sewerage

The viable and preferred options to serve the development with the new onsite WwTW or by connecting to the existing Sellindge WwTW should be further developed in consultation with STC (as the preferred NAV provider), SW, EA and NE, by building on the work done by this WCS.

The initial development phases should be served by the dedicated onsite WwTW, including the proposed additional constructed wetlands and woodland planting to offset surplus Nitrogen and Phosphorous from wastewater and surface water discharges from the proposed Development, in consultation with NE, EA and LPA.

The onsite WwTW should be constructed and commissioned in three phases (at Development Parcel HT.5) to match with the proposed development trajectory, while still maintaining some flexibility to connect the later phases of the proposed Development and Otterpool Framework Masterplan Area phases to the alternative Sellindge WwTW if deemed more advantageous.

Water Quality

The detailed WCS should confirm the detailed proposals for the nutrient mitigation measures along with any further downstream water quality requirements associated with the preferred onsite WwTW option, incorporating the formal discharge permit requirements for the initial temporary stage and final permanent treatment for the full development.

The EA has started planning for the third cycle of RBMPs (2021-27) and therefore should be able to present a clearer view of any further requirements to move watercourses towards Good Ecological Potential, and hence what constraints this may pose to the proposed growth.

Flood Risk and Surface Water Management

Flood risk and surface water management has been primarily covered by the proposed SuDS strategy and other fluvial mitigation measures presented in the updated Site-Specific FRA and SWDS. The scope of any further modelling and the detail design development of the proposed mitigation measures should be defined in consultation with the EA and LLFA.

This work can be undertaken as part of the proposed Detailed WCS, incorporating any further surface water and river modelling that is required to fully demonstrate and maximise downstream flood risk benefits from Otterpool Park.

Detailed Water Cycle

It is recommended that there would be a suitable planning condition stating that the Tier 2 and Tier 3 design for each key development phase should be in accordance with this WCS document.

By building on the work done as part of this updated WCS, a detailed WCS should be prepared to confirm the delivery programme for the key water and wastewater infrastructure for each key development phase (or combined phases) and inform Tier 2 and Tier 3 planning applications, which should:

- collate any ongoing/future assessments undertaken by the EA and the water companies with regards to the indicative onsite and offsite wastewater discharge consenting requirements included in this updated WCS;
- coordinate the design development for the preferred onsite WwTW (for the initial development phases) and alternative existing Sellindge WwTW (for the latter development phases) to deliver the proposed Development;
- confirm (by jointly working with STC and Southern Water) the scale, detail and phasing of the other required WwTW, sewerage and water supply infrastructure upgrades to accommodate the final development up to 10,000 dwellings, while protecting the water environment and giving specific attention for the sewerage upgrade requirements associated with the early development phases;
- provide bespoke calculations to show that the nutrient removal values of the proposed wetlands can be achieved on site, in order to clearly demonstrate how nutrient neutrality will be achieved at Otterpool Park;
- identify how any infrastructure constraints can be overcome, the further action required to achieve this, and which of the stakeholders will be responsible for these actions;
- assess the applicability of the 'smart' technology opportunities to enable scalable, robust and long-term sustainable water management within the development. The WCS should also link to the emerging energy strategy (ES Appendix 4.9);
- develop a detailed surface water management strategy (in conjunction with any updated hydraulic modelling of the River East Stour, Racecourse Drain and Racecourse Lake), to effectively manage onsite flood risk while maximising downstream benefits from a range of potential integrated and attractive SuDS, WSUD and other Natural Flood Management measures at Otterpool Park;
- provide additional details of maintenance requirements associated with the proposed SuDS and nutrient mitigation wetlands, including how this will be legally secured;
- work with key stakeholders to determine the extent and most sustainable delivery options (including adoption and maintenance) for the proposed integrated water management solutions; and
- inform the WCS stakeholders of the indicative costs of the required water infrastructure and provide advice on financial contributions required from the developer to fund strategic infrastructure improvements.

APPENDIX A

Development Buildout Trajectory

Summary Indicative Development Phasing 18-10-21							Non resi		Phase ref		TC.1-3	TC.1-3	TC.1-3	TC.1-3	TC.1-3	TC.1-3	TC.1-3	TC.6	CP.5	TC.7-8	TC.5	TC.1-3	TC.1-3	WR.1	HT.2	HT.2	WR.1	WR.1	HF.1-3	HF.1-3	RS.1-4	TC.5	HF.1-3	CP.1-2	CP.3	CP.5	RS.1-4	HF.1-3	AP.1	CP.1-2	AP.1	HT.1-5	HT.1-5	HT.1-5	HT.1-5	RS.1-4	HF.1-3	HF.1-3	HF.1-3	HF.1-3	HF.1-3	HF.1-3		
							Housing		Phase ref		TC.1-3	TC.1-3	TC.1-3	TC.4	TC.1-3	TC.5	TC.1-3	TC.6	CP.4	TC.7-8	TC.5	TC.5	TC.1-3	HT.2	WR.1	HT.2	WR.3	WR.2	WR.2	HF.1-3	RS.1-4	RS.1-4	HF.1-3	CP.1-2	CP.3	CP.1-2	RS.1-4	HF.1-3	AP.1	CP.1-2	AP.1	HT.1-5	HT.1-5	HT.1-5	RS.1-4	RS.1-4	RS.1-4	AP.2	AP.2	FMP	FMP	FMP		
									TARGET		121	264		331		350		423			423			528	528			557			498			502			534			534		504	504		661	535		582	121	435	531	534		
																																											6601				8379		8500	8935		10000	Masterplan	
									SCHEDULE		121	264		331		350		423			423			528	528			557			498			502			534			534		504	504		661	535		582		556	531	534		10000
Indicative Year						*TARGET*	*SCHEDUL*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*		*2027*		*2028*		*2029*			*2030*			*2031*	*2032*			*2033*			*2034*			*2035*			*2036*			*2037*		*2038*	*2039*		*2040*	*2041*		*2042*		*2043*	*2044*	*2045*	*check*
																																																Application	Framework Masterplan				
Residential C3 Units		Application				7,855	7,855	0	0		121	264	281	50		154	142	281	207	166	50	178	92	258	528	67	32	326	161	174	163	168	168	166	131	225	178	205	93	236	226	278	504	412	249	218	202	380	121	218	314	317		
Cumulative C3 units		Application									121	385		716			716	1293			1716			2244	2772			3197			3695			4197			4731	4936				5769	6273	6685		7152	7354			8073	8387	8704		
Residential C2 Units		Application				645	645								196											132																				317				217	217	217		
Cumulative residential units		Application				8500	8,500	0	0		121	385		716			1066	1489			1912			2440	2968			3197			4023			4525			5059	5264				6097	6601	7013		7797	7999			8935	9466	10000		
Resdiential C3 Units		Framework Masterplan				8704																																																
Residential C2 Units		Framework Masterplan				1296																																																
Cumulative residential units		Framework Masterplan				10000					121	385		716			1066	1489			1912			2440	2968			3525			4023			4525			5059	5593				6097	6601	7262		7797	8379		8500	8935	9466	10000		
			NIA m2	GEA m2	GIA ft2	GIA m2	GIA m2																																															
Hotel	C1 c120 bed		5,600.0	7,700.0	75,348	**7000**	**7,000**																7000															-																
Retail Space																																																						
	A1		12,600.0	17,325.0	169,533	**15750**	**15,750**						1500			1500							7500		750	1500													2250				-						750					
	A2/A3		8,400.0	11,550.0	113,022	**10500**	**10,500**						1500			1500							3000		750	750												750	1500				-						750					
Commercial Space																																																						
	B1		40,368.0	55,506.0	543,151	**50460**	**50,460**																			-			9375									6250									6250	6250	6250	6250	6250	3585		
	B1 hub		11,129.6	15,303.2	149,749	**13912**	**13,912**									3756							3756		1500	1500								400					3000															
	B2 (GIA)		6,612.0	9,091.5	88,964	**8265**	**8,265**																						1111									1111									1111	1111	1111	1111	1111	488		
Schools																																																						
	Application 7 Primary schools		16,604.0	22,830.5	223,407	**20755**	**20,755**				3235								2290								3235					3235							3235			3235				2290								
	IsApplication 2 Secondary Schools		16,080.0	22,110.0	216,356	**20100**	**20,100**												10050																											10050					Framework Masterplan			
	Framework Masterplan 1 Primary school		1,832.0	2,519.0	24,650	**2290**	**2,290**																																													2290		
Sport																																																			1 primary school			
	D2 Indoor sports facility		4,200.0	5,775.0	56,511	**5250**	**5,250**																1000		1000											750						500				2000								
	Sports pavilion		1,200.0	1,650.0	16,146	**1500**	**1,500**									500																		500								500												
	1 main site and two																																																					
Health	'surgeries'		4,480.0	6,160.0	60,278	**5600**	**5,600**									600							4400																							600								
Community																																																	Application					
	Application 12 Nurserys		3,360.0	4,620.0	45,209	**4200**	**4,200**				350								700						350			350				350		350					350			350				700			350	Framework Masterplan				
	Framework Masterplan 1 Nursery		280.0	385.0	3,767	**350**	**350**																																												350		
	Community Centre(s)		5,040.0	6,930.0	67,813	**6300**	**6,300**				600											600			600			500				600		900			600		400			1000				500					1 Nurserys			
							hectares																																															
Green Infrastructure	GI Habitat					169.53	**169.53**				5.72		4	2.34	3	2.37		0.81	2.78	2.934				2.73	2.08		2.42	2.67	1.17	0.8	2.25	1.99	0.72	3.65	24.2	3.8	1.5	3.84	5.69	4		26.6	20.666	20.67		1.5		12.6		4	1	1.06		
	GI sports playing fields					11.53	**11.53**				0		1.62			1.23		0	0.74	0					0.74		0	0.74	0		0	0		1.88	0		0.49		0			4.09		0		0		0		1.8				
	GI general amenity					38.92	**38.92**				3.4		1.86	1		1.07		1.35	0	0				1.56	1.61	1.56	0.15	2.34		2.63	1.66	1.9		0.8	0.2	0.8	1.9	0.81	1.53	0.6		1.91	1.91	1.91		1.72		2.74		1.8	1.8	1.8	1.8	
	GI playspace					6.00	**6.00**				0.56		0.23	0.31				0.2	0.15	0					0.36	0.35	0.02	0.35		0.39	0.37				0.1	0.28	0.4		0.23	0.17		0.35	0.35	0.16		0.31		0.36		0.5		0.58		
	GI Strategic parks					15.71	**15.71**						6.48			0.52		0.34	0	0					0.52	0.5	0.04	0.58		0.66					0	0.48			0.38	0.27			1.16	0.27		1.41		2.1				1.02		
	GI allotments orchards					9.75	**9.75**				0.43					0.21		0	1.6	0					0.9		0	0		0.26				2.7	0				0.15				2					1.5				0.41		
	GI cemeteries					3.00	**3.00**											0	0	0							0	0							0				0				3					0						
	GI mixed use suds					7.20	**7.20**						0.46		0.4		0.4	0	1.04	0		0.34			0.3	0.22	0	0.04	0.35		0.17	0.17	0.3		0	0.09	0.15	0.28	0.46			0.35				0.18	0.3	0.3	0.3	0.3	0.3	0.29		
	GI housing Suds					40.76	**40.76**				1.45	1.18	1	0.7666	0.41	0.7466		1.21	0.79	0.64	0.747			1.39	1.5	1.5	0.22	3.08	0.44	0.9	1.02	1.25	0.91		0.6	1.37	1.5	0.9	1.81	1		2.47	2.533	2.533		1.5		3.39		1.25	1.25	1.25	1.29	
	GI secondary school playing fields					9.78	**9.78**											0	6	0							0	0							0				0							3.78		0						
	GI primary school playing fields					8.14	**8.14**				1.3							0	0.82	0						1.3	0	0				1.3			0				1.3			1.3				0.82		0				1.3		
						320.318	**320.32**																																															
Infrastructure	Roads					20.33	**20.33**				2.94			0.831			1.14	0.224	0.44	3.887					1.2			1.048	1.606			0.5		0.779	0		1.348		1.41			0.76	0.763	0.763				0.69		1	1	1		
	Parking					0.83	**0.83**				0.33																		0.5																									
	Utilities					0.00	**0.45**				0.15						0.15																										0.15											
	WW¬T					0.00	**0.85**									0.85																																						
Infrastructure	Total					**21.1562**	**22.458**																																															

Notes

Home sale assumptions based on a mix of tenure types and multiple sales outlets being opened up on site (includes extra care units). units built one year before assumption on schedule for sale

Hotel is assumed early as existing market for tourist and business travel given excellent transport connections (M20 A20)

Retail is assumed other than coffee/corner shop to require some development to have taken place before enquires grow in town centre are and station. A20 frontage helpful.

Commercial space assume requires a level of on site development to have happened before enquiries to build will commence

Schools follow broad housing numbers and likely impact on school age numbers

Sports Hall only required when reasonably through development as secondary school opened earlier with facilities

Health envisages at least one main facility and perhaps 3 supporting. The major facility may grow over time with modular approach

Nurseries will follow housing numbers

Community centres will also integrate with school and health offer but additional allowance for space allowed for as shown (may also integrate with community art plans in existing outbuilding in racecourse)

APPENDIX B

Stakeholder Consultation Summary

Date	Description	Details
21/06/2017	Consultation meeting with KCC	Discussed Surface Water Strategy with LLFA
14/09/2017	Pre-Planning Application Meeting – representations from SW, AW, EA, KCC, NE & F&HDC	Workshop on Blue and Green Infrastructure Strategies
08/12/2017	Consultation meeting with AW, including representation from F&HDC and KCC	Consultation on water resources and supply issues
13/12/2017	Pre-Planning Application Meeting – F&HDC & KCC	Presentations from Py Terra and AWL regarding potential innovative water solutions
15/03/2018	Pre-Planning Application Meeting – representations from F&HDC and KCC	Discussion on WCS scope clarification and progress update
23/04/2018	Place Panel Workshop - incl. representations from EA, KCC & F&HDC	Workshop on Blue and Green Infrastructure
10/05/2018	Consultation Meeting AWL	Consultation on onsite WwTW
16/05/2018	Consultation meeting with SW, including representation from F&HDC	Consultation on offsite WwTW options
17/05/2018	Pre-Planning Application Meeting – representations from F&HDC and KCC	Consultation and progress update on infrastructure and utility strategies (including potable water & wastewater)
18/06/2018	Consultation meeting with SW, including representation from F&HDC	Consultation on offsite WwTW options
19 & 20 /06/2018	Community Engagement Events	Several wider community engagement events on Otterpool Park proposals
26/06/2018	Site Visit to Albion Water WwTW plant at Oaklands Hamlet Development near Chigwell	Site visit and presentation from AWL regarding onsite WwTW plant example at this residential development
09/08/2018	Pre-Planning Application Meeting – representations from KCC and F&HDC	Discussion with KCC (water resources team and LLFA) regarding draft WCS &

Date	Description	Details
		FRA Report findings and key feedback comments
15/08/2018	Consultation meeting with SW, including representation from F&HDC	Consultation on offsite WwTW and sewerage options
20/08/2018	Consultation meeting with KCC, EA and F&HDC	Discussion with KCC (water resources team and LLFA) and EA to finalise FRA & SW drainage strategy
21/08/2018	Consultation meeting with SW	Consultation with SW design lead to update and discuss Otterpool onsite sewerage options
18/10/2018	Consultation with Ashford Water Group	Presentation and discussion on Otterpool Park water management strategy and mitigation of cross border issues
10/01/2019	Consultation meeting with SW	Consultation with SW design team to discuss the initial findings of SW's Otterpool Growth Impact Study regarding existing network and WwTW constraints and solutions.
29/05/2020	Flood Risk and Water Management Workshop	Workshop with F&HDC and KCC (LLFA) to discuss and agree the scope for updates to the WCS and FRA&SWDS for Tier 1 Planning Application
27/02/2020	Water Strategy Scoping Workshop	Workshop with FHDC and KCC to discuss and agree the scope for updating WCS and FRA&SWDS for the new Tier 1 Planning Application
29/05/2020	Flood Risk and Water Management - Technical Workshop 1	Workshop with F&HDC, EA and KCC (LLFA/ Water resources) to update progress and discuss discharge permitting, flood risk modelling and key elements of the WCS and FRA&SWDS updates for Tier 1 Planning Application.
29/06/2020	Nutrient Neutrality Roundtable meeting	Roundtable meeting with NE and F&HDC (including their HRA consultants) to discuss Nutrient Neutrality assessment needs to overcome NE's Stodmarsh Lake concerns

Date	Description	Details
14/10/2020	Flood Risk and Water Management Workshop – Technical Workshop 2	Workshop with F&HDC, EA, NE and KCC (LLFA/ water resources) to discuss baseline hydraulic modelling, nutrient neutrality mitigation strategy, River East Stour bridge crossings design approach and integrated water management.
31/03/2021	Cross boundary nutrient neutrality mitigation opportunity discussion	Meeting with ABC to discuss if Otterpool Park can help offering nutrient neutrality mitigation credits to deliver development sites in Ashford.

Note – Several monthly liaison meetings with the water companies (Southern Water, Affinity Water, Albion Water and STC) have also been held in 2020 -2021 period, which are not listed in the above table.

APPENDIX C

Statement of Common Ground Between NE and F&HDC

Statement of Common Ground

Folkestone & Hythe District Council and Natural England

1. Overview

1.1 This Statement of Common Ground (SCG) has been prepared by Folkestone & Hythe District Council (FHDC) together with Natural England (NE). It reflects the agreed position between the parties.

1.2 The purpose of this SCG is to document the cross-boundary matters being addressed and progress in cooperating to address them. It is the means by which the signatory authorities can demonstrate that their plans are based on effective and ongoing cooperation and that they have sought to produce strategies that as far as possible are based on agreements with other authorities.

1.3 Under section 33A of the Planning and Compulsory Purchase Act 2004 (amended by section 110 of the Localism Act 2011) and in accordance with the National Planning Policy Framework (NPPF) 2019 it is a requirement under the Duty to Cooperate for local planning authorities, county councils and other named bodies to engage constructively, actively and on an ongoing basis in the preparation of development plan documents and other local development documents. This is a test that local authorities need to satisfy at the Local Plan examination stage and is an additional requirement to the test of soundness.

1.4 The Duty to Cooperate applies to strategic planning issues of cross boundary significance. Local authorities all have common strategic issues and, as set out in the National Planning Practice Guidance (NPPG):

> *"local planning authorities should make every effort to secure the necessary cooperation on strategic cross boundary matters before they submit their plans for examination."*

1.5 The statutory requirements of the Duty to Cooperate are not a choice but a legal obligation. Whilst the obligation is not a duty to agree, cooperation should produce effective and deliverable policies on strategic cross boundary matters in accordance with the government policy in the NPPF, and practice guidance in the NPPG.

1.6 FHDC went out to a very limited public consultation on a revision to the Regulation 19 Core Strategy in November/December 2019 to bring it 'in check' with the Government's published figures on housing requirement.

1.7 NE responded to the Regulation 19 Core Strategy Review – submission version dated 11th March 2019, and the response is set out in Appendix A. In summary, within NE's response it is contended that:

> *"... the CSR can be further improved particularly with regard to the garden settlement (Otterpool Park) policies (SS6-9), especially in relation to the Kent Downs Area of Outstanding Natural Beauty (AONB), as well as general policy for green infrastructure (GI) and biodiversity net gain in policy CSD4."*

1.8 This SCG deals solely with the issue of nutrient neutrality. Notwithstanding this, FHDC wishes to work with NE through the examination process to address NE's concerns, while also meeting wider national policy requirements.

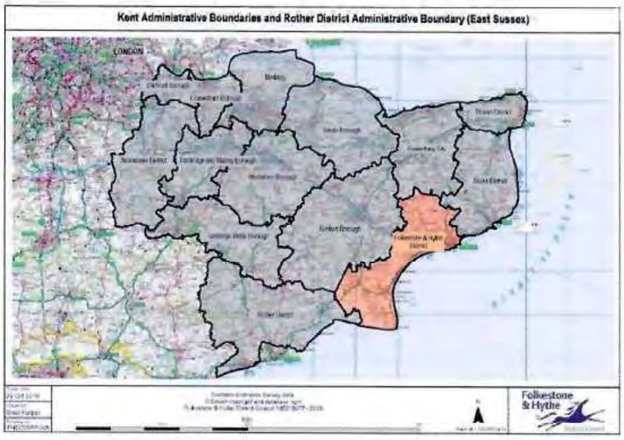
2.0 Strategic matters

2.1 The NPPF defines the topics considered to be strategic matters (para 20). Those strategic matters relevant to FHDC and the NE are explored under suitably-titled headings, and can be summarised as follows:

- Housing
- Nutrient Neutrality and the impact on Habitats Sites[1] (Stodmarsh)

2.2. The geographical relationship of FHDC in the context of Kent (upper tier authority) and neighbouring East Sussex is represented in Figure 2.1.

Figure 2.1. Geographical relationship between FHDC and Kent and East Sussex



[1] Sites covered by Conservation of Habitats and Species Regulations 2017 (as amended) are referred to as 'habitats sites' in the National Planning Policy Framework and Government guidance on HRA.

Housing

2.3 Government policy places much emphasis on housing delivery as a means for ensuring economic growth and addressing the current national shortage of housing. The NPPF is very clear that:

> *"strategic policy-making authorities should establish a housing requirement figure for their whole area, which shows the extent to which their identified housing need (and any needs that cannot be met within neighbouring areas) can be met over the plan period."*

2.4 The Government's new national formula calculated from household formation and housing affordability figures is published regularly by Office for National Statistics, and the most recently published figure for Folkestone & Hythe district currently stands at 738 new homes a year. FHDC's Regulation 19 Plan outlines a housing requirement for 13,284 new homes over plan period (to 2036/37). Meeting this target over the plan period will be provided for by development in Core Strategy Review, Places and Policies Local Plan, existing planning permissions and small sites. Accordingly FHDC is not seeking any assistance from neighbouring authorities to meet its identified housing need.

Table 2.1: Core Strategy Review 2019/20-2036/37– elements of housing supply

Source of housing supply	Number of homes
Current planning permissions and sites under construction (with adjustment for lapsed permissions)	4,274
Places and Policies Local Plan and 2013 Core Strategy sites without planning permission	1,703
Windfall allowance (95 homes a year over 15 years)	1,425
New garden settlement (Core Strategy Review policies SS6-SS9)	5,925
Expansion of Sellindge (Core Strategy Review policy CSD9) (part of allocation without permission)	188
Total Core Strategy Review plan period	**13,515**

2.5 Bringing together the different sources of housing supply outlined above creates the anticipated supply of housing over the Core Strategy Review plan period. This is outlined in Table 2.1. This gives an anticipated housing supply of 13,515 homes over the Core Strategy plan period, exceeding the national minimum requirement of 13,284 homes by around 230 homes and, as a result, the district's housing need requirement can be met in full.

Nutrient neutrality and implications on the Stodmarsh designated site

2.6 As set out Annex 1 of NE's detailed advice dated 15th October 2020:

> *"The Stodmarsh Nutrient Neutral methodology (NNM) we have proposed is one way for competent authorities to satisfy themselves that an adverse effect upon integrity of nutrient impacts of proposals can be avoided with sufficient certainty to meet the HRA tests. An appropriate assessment should be produced for the local plan, or as an additional section in the existing local plan appropriate assessment. Natural England is a statutory consultee with regards to appropriate assessments under the Conservation of Habitats and Species Regulations (2017) as amended. We advise the appropriate assessment should include information on any likely significant effects the planned development could have and how to mitigate those to avoid an adverse effect upon the integrity of any relevant European sites. It is likely the information contained within the above documents (subject to the additional information and changes recommended in this letter) will form an important part of any appropriate assessment/ amendment to the existing local plan appropriate assessment."*

2.7 NE have advised in respect to the nutrient calculation that the following information is included within the updated Appropriate Assessment:

- *All the information, values and assumptions made in the nutrient calculations.*
- *Information and evidence to support assumptions used, especially where these deviate from Natural England's methodological advice (e.g. the Council's evidence on occupancy rates and their long term stability).*
- *Evidence to support any mitigation planned, including source evidence or link if a website or copies of documents are not readily or freely available.*
- *Evidence of types of mitigation (wetlands, proposals) including proposed locations to ensure the areas of mitigation are draining relevant areas of mitigation land/ WwTW so will function effectively.*
- *Any additional hydraulic loading or nutrient loading calculations undertaken for wetlands or bespoke mitigation.*
- *Clarification of how long term management of any mitigation land in particular wetland and other types of SUDS will be secured.*
- *Maps, locations, or identification of how any mitigation that is not within the developer's ownership will be secured. In particular, information on mitigation proposals for the allocations other than Otterpool.*
- *Any information on winter maintenance programmes or other information material to water quality assessment that may impact the efficacy of proposed nutrient removal systems.*

Chronology of progress made with Natural England in respect of Nutrient Neutrality

2.8 The below chronology charts progress that has been made by the promoters of the Otterpool Park Garden Settlement, FHDC and NE regarding concerns raised by NE in relation to the excessive nutrient levels (nitrogen and phosphorous) which are impacting on the Stodmarsh Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site and the impact of the Core Strategy Review and in particular the proposed New Garden Settlement.

- Regulation 19 response was issued by NE to the District Council dated 11th March 2019, and a copy is provided in Appendix A. The Regulation 19 response raised no issue in relation to the matter of nutrient neutrality regarding Stodmarsh designated sites
- The Submission Version of the Core Strategy Review was formally submitted to the Planning Inspectorate on 10th March 2020 for its Examination in Public
- Letter dated 21st May 2020 from Natural England to the District Council titled 'Conservation of Habitats and Species Regulations 2017 as amended - Folkestone & Hythe DC Core Strategy Review Examination and Otterpool Park – nutrient neutrality re Stodmarsh designated sites. A copy of this correspondence is provided in Appendix B
- The District Council formally engaged NE under its Discretionary Advice Service (Charged Advice) dated 18 June 2020.
- The District Council sought technical support from water quality consultants and appointed Urban Edge Environmental Consulting on 9th July 2020. A Technical Note was issued by Urban Edge Environmental Consulting (dated August 2020) that was shared with NE for their review/comment. A copy of the Technical Note is provided in Appendix C. This was supplemented by an updated Nutrient Budget spreadsheet dated 21st September 2020
- NE re-issued advice for development proposals with the potential to increase nutrient impacts to nationally and internationally important wildlife sites within the Stour Valley catchment to all Local Planning Authorities to which the advice refers by letter dated 10th July 2020. A copy of the letter is enclosed in Appendix D. This advice clarified the wastewater treatment works to which the advice applied.
- Advice on Nutrient Neutrality for New Development in the Stour Catchment in Relation to Stodmarsh Designated Sites - For Local Planning Authorities (dated July 2020) and updated again in November 2020. This replaced guidance issued in December 2019. A copy of the November advice is provided in Appendix E

- Officers of the District Council first shared technical reporting with Natural England (by email) on 9th September 2020. There was follow-up correspondence from F&HDC to seek feedback from NE
- Technical information was circulated separately by consultants Arcadis, working on behalf of the promoters of Otterpool Park, to NE on 1st October 2020 (referenced as 'Otterpool updated memo') to summarise the work undertaken on behalf of the promoter side to achieve Nutrient Neutrality at Otterpool Park. A copy of the Technical Memo is enclosed in Appendix F
- A workshop session was hosted by Arcadis on 14th October 2020, and one agenda item was the issue of Nutrient Neutrality. Both NE and officers of F&HDC were in attendance
- NE issued a formal response on 15th October 2020 in accordance with the scope of the Discretionary Advice Service dated 18th June 2020 to provide advice to F&HDC concerning housing proposals and allocations for their local plan specifically with respect to issues around nutrient neutrality. A copy of the letter is enclosed in Appendix G
- A teleconference call with NE was held on Tuesday 20th October 2020 to talk through the advice issued on 15th October 2020
- [redacted] of NE joined a teleconference hosted by [redacted] (on behalf of the District Council) with attendance by officers of the District Council on 28th October 2020, following discussions with officers on the 26th and 27th October
- NE have provided further written advice to the District Council dated 29th October 2020 (Appendix H refers) to advise that *"Folkestone and Hythe District Council have reported significant progress to Natural England following our advice, reporting the aim to ensure safeguards are set out through policy Amendments which will be tabled at the examination."*
- Arcadis issued an updated Technical Note and associated Technical Appendices to NE on 4th November 2020. A copy of the updated Technical Note is enclosed as Appendix I.
- F&HDC issued a revised version of policy CSD5 to NE for their review/comment on 5th November 2020. A copy of the revised policy is enclosed as Appendix J. F&HDC instructed its Sustainability Appraisal consultants to undertake a new Habitats Regulations Assessment based on advice received from NE
- NE responded to the draft revision to policy CSD5 on 19th November 2020. A copy of the correspondence is provided as Appendix K.
- On 2nd December 2020 NE provided a response to the updated Technical Note issued by Arcadis on 4th November. A copy of the response is enclosed as Appendix L.

2.9 Within the response from NE dated 2nd December 2020 it is advised that the calculations and mitigation proposals supporting documents provided above are likely to meet the HRA tests for water quality at the plan level.

3. Actions going forward

Key issue	Agreed action
Nutrient neutrality and implications on the Stodmarsh designated site	FHDC and NE to continue to liaise and work together on this matter going forward, including planning applications

4 Governance arrangements

4.1 The NPPG outlines that the SCG should include governance arrangements for the cooperation process, along with a statement of how it will be maintained and kept up-to-date.

4.2 Officers of FHDC have met virtually with representatives of the NE to discuss cross boundary strategic matters under the Duty to Cooperate. The narrative and outcome of these discussions is demonstrated in this SCG.

4.3 It is intended that the SCG will be updated going forward, particularly as FHDC progresses its Core Strategy Review. The SCG will then be kept under ongoing review and will be updated at key stages in FHDC plan making process and/or when new key strategic issues arise which require amendments to this SCG. If there are any changes of the content of the SCG these matters can be discussed at future Duty to Co-operate meetings.

4.4 It is confirmed by both signatory parties that agreement has been reached on all cross boundary issues referenced within this SCG, specifically nutrient neutrality and implications on the Stodmarsh designated site. Importantly, NE are satisfied with the policy wording following a revision to policy CSD5 (as set out in Appendix K).

4.5 Evidently, discussion of strategic matters under the Duty to Cooperate is an officer-led exercise. The process for reaching agreement and sign-off of SCG includes signatories from both FHDC and NE, as declared under section 5 of this SCG.

5 Signatories/declaration

Signed on behalf of Folkestone & Hythe District Council (Officer)	**Signed on behalf of Natural England**

Position: Strategy & Policy Senior Specialist [redacted]	**Position: Area Manager Sussex and Kent** [redacted]
Date: 03/12/2020	**Date: 03/12/2020**

Appendices

- Appendix_A_Natural_England_CSR_Reg_19_Representation
- Appendix_B_Folkestone_and_Hythe_DC_Natural_England_advice_nutrient_neutrality_Stodmarsh_May_2020_final
- Appendix_C_F&H_Nutrient_Budget_Technical_Note_200824_DRAFT
- Appendix_D_Natural_England's_advice letter_to_Authorities_within_the_Stour_Valley_Catchment
- Appendix_E_Stodmarsh_Nutrient_Neutral_Methodology_November_2020
- Appendix_F_Otterpool_Nutrient_Mitigation_Analysis_Update_Memo_P1
- Appendix_G_201012_UDS_Folkestone_and_Hythe_Nutrients_NE_response_to_queries_FINAL_151020
- Appendix_H_Natural_England_ letter_291020
- Appendix_I_Otterpool_Nutrient_Mitigation_Analysis_Update_Memo_November_P2
- Appendix_J_2020_11_01_Policy_CSD5_Proposed_Modifications
- Appendix_K_Folkstone_Proposed_amended_wording_for_Policy_CSD5_f_NE_191120
- Appendix_L_Otterpool_updated_technical_note_and_NN_calculation_NE_response

APPENDIX D

Nutrient Neutrality Assessment – For Onsite WwTW

The relevant excel calculations printouts associated with Nutrient Neutrality Assessment are given for the Onsite WwTW proposal for the following scenarios:

1. ***Combined Nutrient WwTW and Land Use Loading***
2. ***WwTW Nutrient Loading Only***
3. ***Land Use Nutrient Loading Only***

For the Scenario 1, *calculations (including preliminary hydraulic loading calculations for the proposed mitigation wetland areas) are provided for:*

- *Otterpool Framework Masterplan Area (OFMA)*
- *OFMA and Sellindge Phase 2 Sites Combined*

Sensitivity testing are also given to account for the 61ha of additional open space areas in urban development parcels (i.e., those additional Public Open Space currently not shown in Tier 1 Parameter Plans to facilitate more flexibility in masterplanning in Tier 2 and Tier 3 stages)

For the Scenario 2 and 3, *further calculations are provided for:*

- *Otterpool Tier 1 Application*
- *Otterpool Framework Masterplan Area (OFMA)*
- *OFMA and Sellindge Phase 2 Sites Combined*

Common datasheets (e.g. existing land use type measurement information – worksheets 5 & 6, wetland hydraulic loading calculations – worksheet 8) are generally not repeated unless some information is different.

Onsite WwTW

Scenario 1 - Combined Land Use and WwTW Discharges Loading

1A - Otterpool NN (V1.8) - Onsite WwTW – OFMA.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Otterpool Park Garden Town - Masterplan Framework Only
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	756.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area	350.5	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of designated Suitable Alternative Natural Space (SANG)/open space	183.60	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14
	0.00		

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	**Figures**	**Units/ Data source**	**Further information**
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3456696	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	22399390.08	mg/TN/day	
TP discharged after WwTW treatment	311102.64	mg/TP/day	
Annual wastewater total nitrogen load	**8175.78**	kg/TN/yr	
Annual wastewater total phosphorous load	**113.55**	kg/TP/yr	

Stage 2	**Figures**	**Units/ Data source**	**Further information**
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	**Figures**	**units/ Data source**	**Further information**
New urban area	350.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5012.15	kgN/yr	
Phosphorous load from future urban area	290.92	kgP/yr	
New SANG/open space	183.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	918	kgN/yr	
Phosphorous Load from SANG/open space	25.70	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6335.45**	kgN/yr	
Combined phosphorous load from future land uses	**320.06**	kgP/yr	

Disclaimer:

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	**TP (kgP/yr)**
Stage 1 - WwTW load	8175.8	113.6
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	6335.5	320.1

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	**TP (kgP/yr)**
Step 1 (Stage 1)	8175.8	113.6
Step 2 (Stage 3 - Stage 2)	-5237.7	123.8
Step 3 (Step 1 + Step 2)	2938.0	237.4
Step 4 (= Step 3, i.e. N/P budget without buffer)	2938.0	237.4
Step 5 (Step 4*20%)	587.6	47.5
Step 6 (Step 4 + Step 5)	**3525.7**	**284.8**
Nitrogen/Phosphorous Budget with 20% buffer	**3525.7**	**284.8**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3166986	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	20522069.28	mg/TN/day	
TP discharged after WwTW treatment	285028.74	mg/TP/day	
Annual wastewater total nitrogen load	**7490.56**	kg/TN/yr	
Annual wastewater total phosphorous load	**104.04**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	350.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5012.15	kgN/yr	
Phosphorous load from future urban area	290.92	kgP/yr	
New SANG/open space	183.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	918	kgN/yr	
Phosphorous Load from SANG/open space	25.70	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6335.45**	kgN/yr	
Combined phosphorous load from future land uses	**320.06**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	7490.6	104.0
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	6335.5	320.1

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	7490.6	104.0
Step 2 (Stage 3 - Stage 2)	-5237.7	123.8
Step 3 (Step 1 + Step 2)	2252.8	227.8
Step 4 (= Step 3, i.e. N/P budget without buffer)	2252.8	227.8
Step 5 (Step 4*20%)	450.6	45.6
Step 6 (Step 4 + Step 5)	**2703.4**	**273.4**
Nitrogen/Phosphorous Budget with 20% buffer	**2703.4**	**273.4**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	3526	285	2703	273

Nutrient Mitigation - Wetland Area Requirement Summary

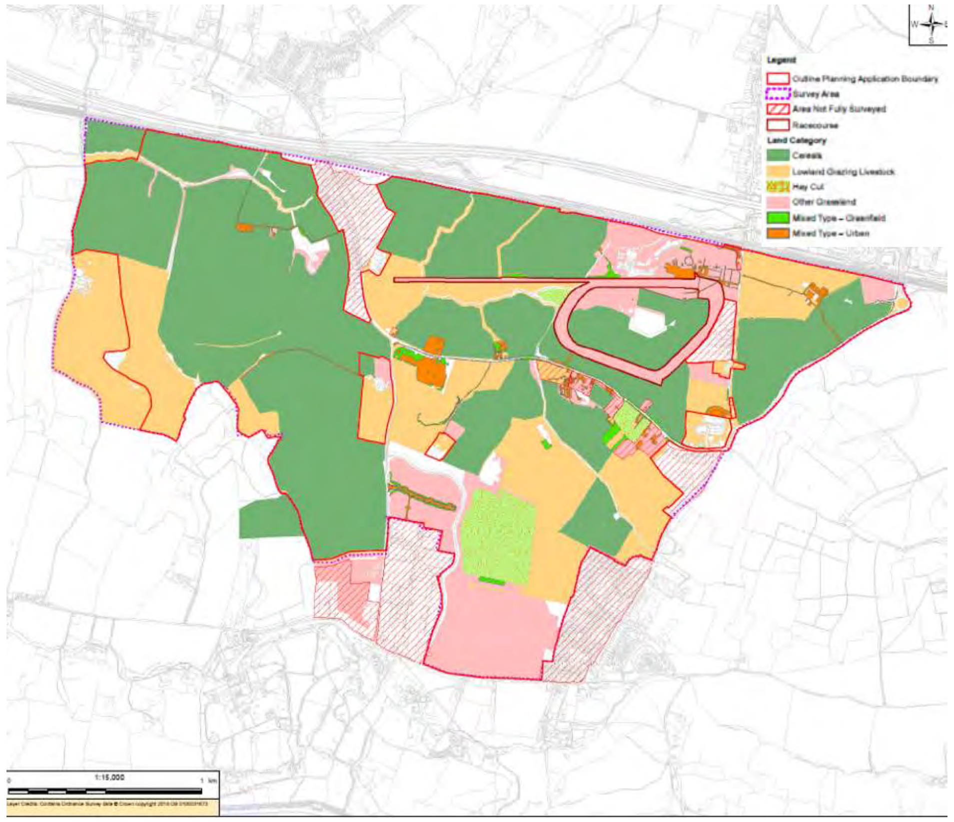
WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	3.8	23.7	2.9	22.8

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

5. Existing Land Type Data



Existing Land Type Area Statement within Outline Planning Application Boundary		
Land Category	**Area in Mt**	**Area in Ha**
Cereals	3189561.4	319.0
Lowland Grazing Livestock	1191257.8	119.1
Racetrack	135944.9	13.6
Hay Cut	188948.6	18.9
Other Grassland	682491.8	68.2
Mixed Type - Urban	114712.8	11.5
Mixed Type - Greenfield	45277.5	4.5
	5548194.8	**554.8**

Racetrack area deducted from "Other Grassland" area

Existing Land Type Area Statement Outside Outline Planning Application Boundary But Within Framework Masterplan Where Existing Land Use Will Be Changed		
Land Category	**Area in Mt**	**Area in Ha**
Cereals	59053.0	5.9
Other Grassland	328090.0	32.8
Urban	199241.0	19.9
	586384.0	**58.6**

	Area in Ha
Retained farmland in Framework Masterplan Area	54.9
Existing Community in Framework Masterplan Area	71.0
Other existing retained land within Otterpool OPA (e.g. vegetation/buildings/ waterbodies/ecological features)	16.8
	142.7

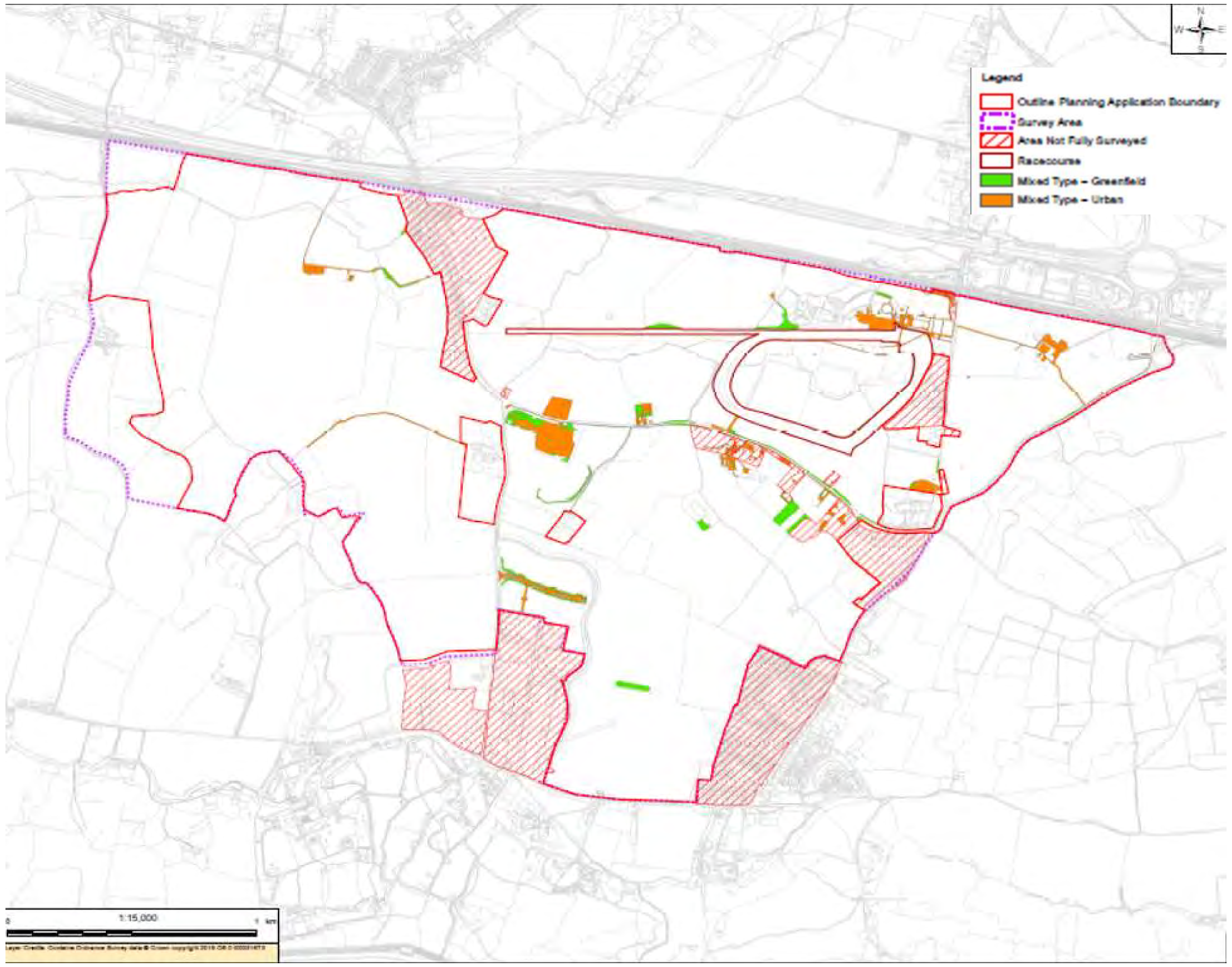
	Area in Ha
Framework Masterplan Boundary	**756.1**

Existing Land Type Area Statement For CSD9A & CSD9B

Land Type	Area in Ha
CSD9B (Cereals)	17.16
CSD9B (Urban)	0.7
CSD9B (Other Grassland/greenfield)	1.05
CSD9A (Urban)	0.08
CSD9A (Other Grassland/greenfield)	8.98
	27.97

Note: Existing landuse data for CSD9A and CSD9B is currently taken from FHDC Stodmarsh Nutrient Budget (dated 21/09/2020) without GIS measurement although Arcadis undertaken a quick sense check by comparing with Google Areal images to validate this info.

6. Existing Mixed Land Type



Sr No	Mixed Land Bifurcation	Area In mt	Area In mt	Reclassify
1	Bare ground	23746.05	114712.81	Mixed Type - Urban
2	Building	14063.76		
3	Hardstanding	76903.00		
4	Broad-leaved semi-natural woodland	2368.32	45277.52	Mixed Type - Greenfield
5	Dense/continuous scrub	10226.22		
6	ESP	5400.94		
7	Introduced shrub	4640.75		
8	Parkland Scattered Trees	610.57		
9	Plantation woodland	7195.03		
10	Riparian	335.52		
11	Standing water	2286.54		
12	Tall ruderal	12213.65		
Total		159990.33	159990.33	

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	**350.5**
Total Landscape open space in Framework Masterplan	**275.2**
Exisiting community in framework masterplan area	**71**
Retained farmland in framework masterplan area	**49.4**
Existing Road	**10**
Total OP Framework Area	**756.10**

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A					
Sellindge CSD9B					
CSD9A & 9B TOTAL	**0**	**0.00**	**0**		**0**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

<u>PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN</u>

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*71.0*	
Retained farmland in framework masterplan area	*49.4*	
Existing Roads	*10.0*	
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**183.6**	
Total Urban Area in Framework Masterplan	**350.5**	
Total OP Framework Area Check	**756.1**	

***Note that leachate loads from woodland is calculated separately instead of SANG leachate rates.**

8. Wetland Hydraulic Loading

Wetland Details Summary

Wetland_ID (See Note 1)	Wetland Area (m2)	Wetland Area (ha)	Wetland Depth (m)	Treatment depth (m)	Comments
W1	14609	1.46	0.72	0.35	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W2	9161	0.92	0.73	0.38	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W3	9365	0.94	0.45	0.04	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W4	17028	1.70	0.37	0.07	Receives storm discharge
W5	21077	2.11	0.46	0.16	Receives storm discharge
W6	26315	2.63	0.87	0.27	Receives storm discharge
W7	18736	1.87	0.54	0.24	Receives storm discharge
W8	16076	1.61	0.79	0.45	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W9	2692	0.27	0.73	0.13	Receives storm discharge. W9 & W10 are interlinked (Total area 1.1ha)
W10	7784	0.78	0.81	0.21	Receives storm discharge. W9 & W10 are interlinked (Total area 1.1 ha)
W11	5243	0.52	0.65	0.04	Receives storm discharge. W11 & W12 are interlinked (Total area 1.8 ha).
W12	12623	1.26	0.34	0.04	Receives storm discharge. W11 & W12 are interlinked (Total area 1.8 ha).
W14	11103	1.11	0.38	0.08	Receives storm discharge
W13	130129	13.01	0.50	0.25	Receives wastewater discharge. The total footprint of the wetland is 13.0ha but only 75% is taken as effective area (9.75ha) due to earth works required for cascade wetland features.
	301942	**30.19**			

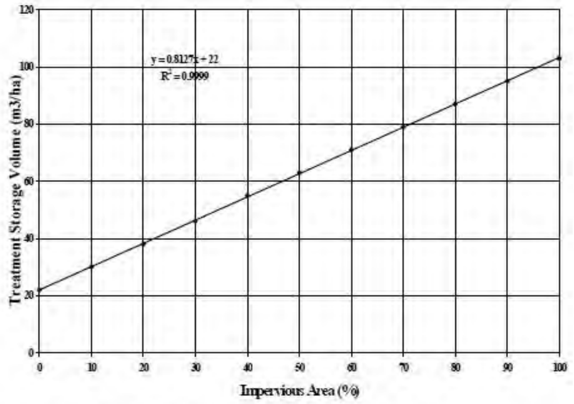


Figure 2.2 Wetland Treatment Storage Volumes

Guidance Manual for Constructed Wetlands

R&D Technical Report P2-159/TR2

J. B. Ellis, R.B.E. Shutes and D.M. Revitt

Preliminary Hydraulic Loading Calcs For Storm Wetlands

			First Flush Treatment Storage Check - using 15mm depth (Based on EA R&D Technical Report P2-159/TR2)			Alternative Treatment Storage Check - (Based on EA R&D Technical Report P2-159/TR2)			
Storm Wetland	**Contributing Drainage Zones (See Notes 2 and 3)**	**Contributing Storm Drainage Zone Area (ha)**	**Estimated Storm Catchment Impermeability (%)**	**Paved First Flush Volume (m3)**	**Average Treatment Depth (m)**	**WWAR (%)**	**Treatment Storage Rq (m3/ha) - Ref Figure 2.2**	**Treatment Storage Rq (m3)**	**Average Wetland Depth (m)**
W1	WH1 (75%), ET1, ET2	66.76	51%	5113	0.35	2%	64	4273	0.29
W2	WH2 (80%), ETS	33.69	68%	3448	0.38	3%	76	2561	0.28
W3	WH1 (25%)	8.20	30%	363	0.04	11%	45	369	0.04
W4	RS2, RS3 & RH4	23.04	34%	1178	0.07	7%	49	1129	0.07
W5	RS1, WH3, E03 & WO2	62.45	37%	3473	0.16	3%	52	3247	0.15
W6	WO1, WO3,BH1, BH3, BH6, BH7, WO4	121.94	39%	7185	0.27	2%	53	6463	0.25
W7	BH2, BH4, BH5 & Phase 9	101.25	29%	4404	0.24	2%	44	4455	0.24
W8	WH2 (20%), WN1, WN2, EO4, SO6(30%), EO1 (70%), EO2, SO1, SO2 (70%), SO3, SO4, S05	131.97	36%	7185	0.45	1%	51	6730	0.42
W9	RS5 (25%)	4.87	49%	357	0.13	6%	61	297	0.11
W10	WH5, RS5 (75%)	23.02	47%	1616	0.21	3%	60	1381	0.18
W11	WH4 (30%)	4.74	29%	206	0.04	11%	44	208	0.04
W12	WH4 (70%)	11.05	29%	480	0.04	11%	44	486	0.04
W14	EO5, EO1 (30%), SO2 (30%)	21.57	27%	874	0.08	5%	43	928	0.08
				35882				**32527**	

Preliminary Hydraulic Loading Calcs For Wastewater Wetland (W13)

	Effective Wetland Area (m2) - See Note 4	Effective Wetland Depth (m)	Max Dry Weather Flow, DWF (m3/day)	Hydraulic Retention Time, HRT (days) - See note 5	Hydraulic Loading Rate, HRT (m/day) - See Note 5
OPTION 1 - Assuming 50mm effective treatment depth	97597	0.05	3456.70	1.4	0.04
OPTION 2 - Assuming 150mm effective treatment depth	97597	0.15	3456.70	4.2	0.04
OPTION 3 - Assuming 250mm effective treatment depth	97597	0.25	3456.70	7.1	0.04

The hydraulic residence time (HRT) was calculated as follows:

$$\text{HRT (days)} = \frac{\text{Wetland volume (m}^3\text{)}}{\text{Outflow rate (m}^3\text{/day)}}$$

The hydraulic loading rate (HLR) was calculated as follows:

$$\text{HLR (m/day)} = \frac{\text{Inflow rate (m}^3\text{/day)}}{\text{Wetland surface area (m}^2\text{)}}$$

Hydraulic residence times and loading rates

Wetland nutrient removal efficiency is widely considered to be dependent upon both the HLR and the HRT (Dong *et al.*, 2011). A high effluent loading rate coupled with a short residence time will typically overload the ICW, giving insufficient contact time for physical, chemical and biological removal of pollutants. For this reason, HRTs of 5-30 days and HLRs of < 0.1 m/day have been recommended (Wu *et al.*, 2015). Shallow water depths (<50 cm) are also recommended to increase the contact time between effluent and wetland sediment, whilst also keeping water oxygenated through good contact with the atmosphere (Wu *et al.*, 2015).

https://onlinelibrary.wiley.com/doi/epdf/10.1111/wej.12605

Notes

1. Proposed Wetland locations are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0041-P3 (Proposed Nutrient Mitigation Strategy) in Appendix F.
2. Proposed Surface Water Drainage Zones are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0007-P7 (Surface Water Drainage Zones and Runoff Rates) in Appendix J.
3. Proposed Surface Water Drainage Strategy is shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0014-P4 (Surface Water Drainage Strategy Overview) in Appendix J.
4. Total wetland area for W13 is 13.01ha but assumed 75% for effective wetland area and remaining 25% for creating bunds for cascade features (i.e. @ 1 in 20 existing ground slope).
5. The above shows that HRT of > 5 days and HLR of < 0.1 m/day can be achieved with the proposed WwTW wetland W13 (Option 3 - 250mm effective treatment depth) and therefore meets the recommended wetland design guidance.

Onsite WwTW

Scenario 1- Combined Land Use and WwTW Discharges Loading

1B - Otterpool NN (V1.8) - Onsite WwTW - OFMA & Sellindge.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Masterplan Framework (**incl CSD9A & CSD9B)**
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	784.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
New Urban Area	369.0	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of designated Suitable Alternative Natural Space (SANG)/open space	193.10	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)
CSD9B (Cereals)	17.16	27.3	0.36
CSD9B (Urban)	0.7	14.3	0.83
CSD9B (Other Grassland/greenfield)	1.05	5	0.14
CSD9A (Urban)	0.08	14.3	0.83
CSD9A (Other Grassland/greenfield)	8.98	5	0.14
	27.97		

2. Otterpool FM+CSD9A&B@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value. Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3549096	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value. Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	22998142.08	mg/TN/day	
TP discharged after WwTW treatment	319418.64	mg/TP/day	
Annual wastewater total nitrogen load	**8394.32**	kg/TN/yr	
Annual wastewater total phosphorous load	**116.59**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	369.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5276.27	kgN/yr	
Phosphorous load from future urban area	306.25	kgP/yr	
New SANG/open space	193.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	965.5	kgN/yr	
Phosphorous Load from SANG/open space	27.03	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6647.07**	kgN/yr	
Combined phosphorous load from future land uses	**336.72**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate		Estimated Nutrient loss	
		Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate		Estimated Nutrient loss	
		Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	8394.3	116.6
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6647.1	336.7

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	8394.3	116.6
Step 2 (Stage 3 - Stage 2)	-5455.9	132.2
Step 3 (Step 1 + Step 2)	2938.4	248.8
Step 4 (= Step 3, i.e. N/P budget without buffer)	2938.4	248.8
Step 5 (Step 4*20%)	587.7	49.8
Step 6 (Step 4 + Step 5)	**3526.1**	**298.6**

	TN (kgN/yr)	TP (kgP/yr)
Nitrogen/Phosphorous Budget with 20% buffer	**3526.1**	**298.6**

3. Otterpool FM+CSD9A&B@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value. Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3259386	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value. Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	21120821.28	mg/TN/day	
TP discharged after WwTW treatment	293344.74	mg/TP/day	
Annual wastewater total nitrogen load	**7709.10**	kg/TN/yr	
Annual wastewater total phosphorous load	**107.07**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	369.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5276.27	kgN/yr	
Phosphorous load from future urban area	306.25	kgP/yr	
New SANG/open space	193.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	965.5	kgN/yr	
Phosphorous Load from SANG/open space	27.03	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6647.07**	kgN/yr	
Combined phosphorous load from future land uses	**336.72**	kgP/yr	

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This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	7709.1	107.1
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6647.1	336.7

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	7709.1	107.1
Step 2 (Stage 3 - Stage 2)	-5455.9	132.2
Step 3 (Step 1 + Step 2)	2253.2	239.3
Step 4 (= Step 3, i.e. N/P budget without buffer)	2253.2	239.3
Step 5 (Step 4*20%)	450.6	47.9
Step 6 (Step 4 + Step 5)	**2703.9**	**287.2**
Nitrogen/Phosphorous Budget with 20% buffer	**2703.9**	**287.2**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	3526	299	2704	287

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	3.8	24.9	2.9	23.9

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	**350.5**
Total Landscape open space in Framework Masterplan	**275.2**
Exisiting community in framework masterplan area	**71**
Retained farmland in framework masterplan area	**49.4**
Existing Road	**10**
Total OP Framework Area	**756.10**

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A	7.56	1.50	9.06	83%	188
Sellindge CSD9B	10.91	8.00	18.91	58%	162
CSD9A & 9B TOTAL	**18.47**	**9.50**	**27.97**		**350**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*71.0*	
Retained farmland in framework masterplan area	*49.4*	
Existing Roads	*10.0*	
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**183.6**	
Total Urban Area in Framework Masterplan	**350.5**	
Total OP Framework Area Check	**756.1**	

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

8. Wetland Hydraulic Loading

Wetland Details Summary

Wetland_ID (See Note 1)	Wetland Area (m2)	Wetland Area (ha)	Wetland Depth (m)	Treatment depth (m)	Comments
W1	14609	1.46	0.72	0.35	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W2	9161	0.92	0.73	0.38	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W3	9365	0.94	0.45	0.04	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W4	17028	1.70	0.37	0.07	Receives storm discharge
W5	21077	2.11	0.46	0.16	Receives storm discharge
W6	26315	2.63	0.87	0.27	Receives storm discharge
W7	18736	1.87	0.54	0.24	Receives storm discharge
W8	16076	1.61	0.79	0.45	Receives storm discharge. W1, W2, W3 & W8 are interlinked (Total area 4.9ha).
W9	2692	0.27	0.73	0.13	Receives storm discharge. W9 & W10 are interlinked (Total area 1.1ha)
W10	7784	0.78	0.81	0.21	Receives storm discharge. W9 & W10 are interlinked (Total area 1.1 ha)
W11	5243	0.52	0.65	0.04	Receives storm discharge. W11 & W12 are interlinked (Total area 1.8 ha).
W12	12623	1.26	0.34	0.04	Receives storm discharge. W11 & W12 are interlinked (Total area 1.8 ha).
W14	11103	1.11	0.38	0.08	Receives storm discharge
W13	130129	13.01	0.50	0.25	Receives wastewater discharge. The total footprint of the wetland is 13.0ha but only 75% is taken as effective area (9.75ha) due to earth works required for cascade wetland features.
	301942	**30.19**			

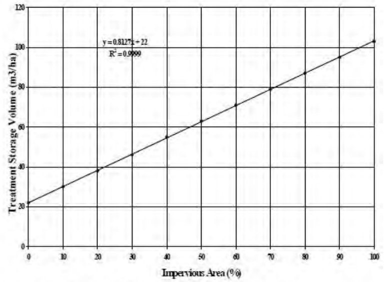

Figure 2.2 Wetland Treatment Storage Volumes

Guidance Manual for Constructed Wetlands

R&D Technical Report P2-159/TR2

J. B. Ellis, R.B.E. Shutes and D.M. Revitt

Preliminary Hydraulic Loading Calcs For Storm Wetlands

			First Flush Treatment Storage Check - using 15mm depth (Based on EA R&D Technical Report P2-159/TR2)			Alternative Treatment Storage Check - (Based on EA R&D Technical Report P2-159/TR2)			
Storm Wetland	**Contributing Drainage Zones (See Notes 2 and 3)**	**Contributing Storm Drainage Zone Area (ha)**	**Estimated Storm Catchment Impermeability (%)**	**Paved First Flush Volume (m3)**	**Average Treatment Depth (m)**	**WWAR (%)**	**Treatment Storage Rq (m3/ha) - Ref Figure 2.2**	**Treatment Storage Rq (m3)**	**Average Wetland Depth (m)**
W1	WH1 (75%), ET1, ET2	66.76	51%	5113	0.35	2%	64	4273	0.29
W2	WH2 (80%), ETS	33.69	68%	3448	0.38	3%	76	2561	0.28
W3	WH1 (25%)	8.20	30%	363	0.04	11%	45	369	0.04
W4	RS2, RS3 & RH4	23.04	34%	1178	0.07	7%	49	1129	0.07
W5	RS1, WH3, E03 & WO2	62.45	37%	3473	0.16	3%	52	3247	0.15
W6	WO1, WO3,BH1, BH3, BH6, BH7, WO4	121.94	39%	7185	0.27	2%	53	6463	0.25
W7	BH2, BH4, BH5 & Phase 9	101.25	29%	4404	0.24	2%	44	4455	0.24
W8	WH2 (20%), WN1, WN2, EO4, SO6(30%), EO1 (70%), EO2, SO1, SO2 (70%), SO3, SO4, S05	131.97	36%	7185	0.45	1%	51	6730	0.42
W9	RS5 (25%)	4.87	49%	357	0.13	6%	61	297	0.11
W10	WH5, RS5 (75%)	23.02	47%	1616	0.21	3%	60	1381	0.18
W11	WH4 (30%)	4.74	29%	206	0.04	11%	44	208	0.04
W12	WH4 (70%)	11.05	29%	480	0.04	11%	44	486	0.04
W14	EO5, EO1 (30%), SO2 (30%)	21.57	27%	874	0.08	5%	43	928	0.08
				35882				**32527**	

Preliminary Hydraulic Loading Calcs For Wastewater Wetland (W13)

	Effective Wetland Area (m2) - See Note 4	Effective Wetland Depth (m)	Max Dry Weather Flow, DWF (m3/day)	Hydraulic Retention Time, HRT (days) - See note 5	Hydraulic Loading Rate, HRT (m/day) - See Note 5
OPTION 1 - Assuming 50mm effective treatment depth	97597	0.05	3549.10	1.4	0.04
OPTION 2 - Assuming 150mm effective treatment depth	97597	0.15	3549.10	4.1	0.04
OPTION 3 - Assuming 250mm effective treatment depth	97597	0.25	3549.10	6.9	0.04

The hydraulic residence time (HRT) was calculated as follows:

$$HRT\,(days) = \frac{\text{Wetland volume } (m^3)}{\text{Outflow rate } (m^3/day)}$$

The hydraulic loading rate (HLR) was calculated as follows:

$$HLR\,(m/day) = \frac{\text{Inflow rate } (m^3/day)}{\text{Wetland surface area } (m^2)}$$

Hydraulic residence times and loading rates

Wetland nutrient removal efficiency is widely considered to be dependent upon both the HLR and the HRT (Dong *et al.*, 2011). A high effluent loading rate coupled with a short residence time will typically overload the ICW, giving insufficient contact time for physical, chemical and biological removal of pollutants. For this reason, HRTs of 5-30 days and HLRs of < 0.1 m/day have been recommended (Wu *et al.*, 2015). Shallow water depths (<50 cm) are also recommended to increase the contact time between effluent and wetland sediment, whilst also keeping water oxygenated through good contact with the atmosphere (Wu *et al.*, 2015).

https://onlinelibrary.wiley.com/doi/epdf/10.1111/wej.12605

Notes

1. Proposed Wetland locations are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0041-P3 (Proposed Nutrient Mitigation Strategy) in Appendix F.
2. Proposed Surface Water Drainage Zones are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0007-P7 (Surface Water Drainage Zones and Runoff Rates) in Appendix J.
3. Proposed Surface Water Drainage Strategy is shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0014-P4 (Surface Water Drainage Strategy Overview) in Appendix J.
4. Total wetland area for W13 is 13.01ha but assumed 75% for effective wetland area and remaining 25% for creating bunds for cascade features (i.e. @ 1 in 20 existing ground slope).
5. The above shows that HRT of > 5 days and HLR of < 0.1 m/day can be achieved with the proposed WwTW wetland W13 (Option 3 - 250mm effective treatment depth) and therefore meets the recommended wetland design guidance.

Onsite WwTW

Scenario 1 - Combined Land Use and WwTW Discharges Loading

1C - Otterpool NN (V1.8) - Onsite WwTW-OFMA – Sensitivity.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC	
Development name	Otterpool Park Garden Town - Masterplan Framework Only	
Development location (grid reference)	TR112 365	https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	8704	
Number of residential dwellings (Class C2)	1296	
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	756.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area	289.5	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of designated Suitable Alternative Natural Space (SANG)/open space	244.60	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

		Average Nutrient Loss Rate		
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14
	0.00		

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	**Figures**	**Units/ Data source**	**Further information**
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3456696	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	22399390.08	mg/TN/day	
TP discharged after WwTW treatment	311102.64	mg/TP/day	
Annual wastewater total nitrogen load	**8175.78**	kg/TN/yr	
Annual wastewater total phosphorous load	**113.55**	kg/TP/yr	

Stage 2	**Figures**	**Units/ Data source**	**Further information**
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	**Figures**	**units/ Data source**	**Further information**
New urban area	289.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4139.85	kgN/yr	
Phosphorous load from future urban area	240.29	kgP/yr	
New SANG/open space	244.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1223	kgN/yr	
Phosphorous Load from SANG/open space	34.24	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
*** Note that Sellindge Sites are not applicapable for this calcula**	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**5768.15**	kgN/yr	
Combined phosphorous load from future land uses	**277.97**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	8175.8	113.6
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	5768.2	278.0

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	8175.8	113.6
Step 2 (Stage 3 - Stage 2)	-5805.0	81.7
Step 3 (Step 1 + Step 2)	2370.7	195.3
Step 4 (= Step 3, i.e. N/P budget without buffer)	2370.7	195.3
Step 5 (Step 4*20%)	474.1	39.1
Step 6 (Step 4 + Step 5)	**2844.9**	**234.3**
Nitrogen/Phosphorous Budget with 20% buffer	**2844.9**	**234.3**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3166986	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	20522069.28	mg/TN/day	
TP discharged after WwTW treatment	285028.74	mg/TP/day	
Annual wastewater total nitrogen load	**7490.56**	kg/TN/yr	
Annual wastewater total phosphorous load	**104.04**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	289.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4139.85	kgN/yr	
Phosphorous load from future urban area	240.29	kgP/yr	
New SANG/open space	244.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1223	kgN/yr	
Phosphorous Load from SANG/open space	34.24	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
*** Note that Sellindge Sites are not applicapable for this calcula**	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**5768.15**	kgN/yr	
Combined phosphorous load from future land uses	**277.97**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	7490.6	104.0
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	5768.2	278.0

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	7490.6	104.0
Step 2 (Stage 3 - Stage 2)	-5805.0	81.7
Step 3 (Step 1 + Step 2)	1685.5	185.7
Step 4 (= Step 3, i.e. N/P budget without buffer)	1685.5	185.7
Step 5 (Step 4*20%)	337.1	37.1
Step 6 (Step 4 + Step 5)	**2022.6**	**222.9**

Nitrogen/Phosphorous Budget with 20% buffer	**2022.6**	**222.9**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	2845	234	2023	223

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	3.1	19.5	2.2	18.6

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	350.5
Total Landscape open space in Framework Masterplan	275.2
Exisiting community in framework masterplan area	71
Retained farmland in framework masterplan area	49.4
Existing Road	10
Total OP Framework Area	756.10

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A					
Sellindge CSD9B					
CSD9A & 9B TOTAL	0	0.00	0		0

* Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN			
	Ha	Ha	
Excluded Retained Existing Land			
Existing community in framework masterplan area	*71.0*		
Retained farmland in framework masterplan area	*49.4*		
Existing Roads	*10.0*		
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*	
Excluded Mitigation Land From SANG			
Wetlands	*30*	*65*	
*Woodland **	*35*		
Community Farm/Allotment Land in current OPA boundary	**9.8**		
Remaining Total SANG in Framework Masterplan*	**244.6**		**Increased SANG area by 61 to account for other SuDS & Openspace in development parcels - For Sensitivity Testing**
Total Urban Area in Framework Masterplan	**289.5**		**Reduced urban area by 61 to account for other SuDS & Openspace in development parcels - For Sensitivity Testing**
Total OP Framework Area Check	**756.1**		

*note leachate loads from woodland is calculated separately instead of SANG leachate rates.

Onsite WwTW

Scenario 1 - Combined Land Use and WwTW Discharges Loading

1D - Otterpool NN (V1.8) - Onsite WWTW- OFMA & Sellindge – Sensitivity.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Masterplan Framework (**incl CSD9A & CSD9B**)
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	784.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
New Urban Area	308.0	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of designated Suitable Alternative Natural Space (SANG)/open space	254.10	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

		Average Nutrient Loss Rate		
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**
CSD9B (Cereals)	17.16	27.3	0.36
CSD9B (Urban)	0.7	14.3	0.83
CSD9B (Other Grassland/greenfield)	1.05	5	0.14
CSD9A (Urban)	0.08	14.3	0.83
CSD9A (Other Grassland/greenfield)	8.98	5	0.14
	27.97		

2. Otterpool FM+CSD9A&B@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3549096	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	22998142.08	mg/TN/day	
TP discharged after WwTW treatment	319418.64	mg/TP/day	
Annual wastewater total nitrogen load	**8394.32**	kg/TN/yr	
Annual wastewater total phosphorous load	**116.59**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	308.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4403.97	kgN/yr	
Phosphorous load from future urban area	255.62	kgP/yr	
New SANG/open space	254.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1270.5	kgN/yr	
Phosphorous Load from SANG/open space	35.57	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6079.77**	kgN/yr	
Combined phosphorous load from future land uses	**294.63**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	8394.3	116.6
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6079.8	294.6

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	8394.3	116.6
Step 2 (Stage 3 - Stage 2)	-6023.2	90.1
Step 3 (Step 1 + Step 2)	2371.1	206.7
Step 4 (= Step 3, i.e. N/P budget without buffer)	2371.1	206.7
Step 5 (Step 4*20%)	474.2	41.3
Step 6 (Step 4 + Step 5)	**2845.4**	**248.1**
Nitrogen/Phosphorous Budget with 20% buffer	**2845.4**	**248.1**

3. Otterpool FM+CSD9A&B@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3259386	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	21120821.28	mg/TN/day	
TP discharged after WwTW treatment	293344.74	mg/TP/day	
Annual wastewater total nitrogen load	**7709.10**	kg/TN/yr	
Annual wastewater total phosphorous load	**107.07**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	308.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4403.97	kgN/yr	
Phosphorous load from future urban area	255.62	kgP/yr	
New SANG/open space	254.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1270.5	kgN/yr	
Phosphorous Load from SANG/open space	35.57	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6079.77**	kgN/yr	
Combined phosphorous load from future land uses	**294.63**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	7709.1	107.1
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6079.8	294.6

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	7709.1	107.1
Step 2 (Stage 3 - Stage 2)	-6023.2	90.1
Step 3 (Step 1 + Step 2)	1685.9	197.2
Step 4 (= Step 3, i.e. N/P budget without buffer)	1685.9	197.2
Step 5 (Step 4*20%)	337.2	39.4
Step 6 (Step 4 + Step 5)	**2023.1**	**236.7**
Nitrogen/Phosphorous Budget with 20% buffer	**2023.1**	**236.7**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	2845	248	2023	237

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	3.1	20.7	2.2	19.7

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	**350.5**
Total Landscape open space in Framework Masterplan	**275.2**
Exisiting community in framework masterplan area	**71**
Retained farmland in framework masterplan area	**49.4**
Existing Road	**10**
Total OP Framework Area	**756.10**

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A	7.56	1.50	9.06	83%	188
Sellindge CSD9B	10.91	8.00	18.91	58%	162
CSD9A & 9B TOTAL	**18.47**	**9.50**	**27.97**		**350**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha	
Excluded Retained Existing Land			
Existing community in framework masterplan area	*71.0*		
Retained farmland in framework masterplan area	*49.4*		
Existing Roads	*10.0*		
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*	
Excluded Mitigation Land From SANG			
Wetlands	*30*	*65*	
*Woodland **	*35*		
Community Farm/Allotment Land in current OPA boundary	**9.8**		
Remaining Total SANG in Framework Masterplan*	**244.6**		**Increased SANG area by 61 to account for other SuDS & Openspace in development parcels - For Sensitivity Testing**
Total Urban Area in Framework Masterplan	**289.5**		**Reduced urban area by 61 to account for other SuDS & Openspace in development parcels - For Sensitivity Testing**
Total OP Framework Area Check	**756.1**		

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

Onsite WwTW

Scenario 2 - WwTW Discharges Only Loading

2A - Otterpool NN (V1.8) - Onsite WwTW - Tier 1 OPA DWF.xlsx

1. Input Data

Indicative Nutrient budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Otterpool Park Garden Town - Tier 1 OPA Only
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	7855 Tier 1 OPA Dwellings Only
Number of residential dwellings (Class C2)	645 Tier 1 OPA Dwellings Only
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site		hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area		hectares		
Area of designated Suitable Alternative Natural Space (SANG)/open space		hectares		
Area of Community Farm/Allotments		hectares		
Current land use nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate Phosphorous (kg P/ha/yr)	
Cereals		27.3	0.36	
Lowland Grazing Livestock		12.2	0.24	
Racetrack		13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut		5	0.14	
Other Grassland/Greenfield		5	0.14	
Mixed area - Urban		14.3	0.83	
Mixed area - Greenfield		5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B		14.3	0.83	

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14

*** Note all land use data is excluded because only extra DWF nutrient budget from Tier 1 OPA is considered in this assessment**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Otterpool Park Garden Town - Tier 1 OPA Only	
Number of residential dwellings (Class C3)	7855	Tier 1 OPA Dwellings Only
Number of residential dwellings (Class C2)	645	Tier 1 OPA Dwellings Only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	18852	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	1548	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	2685720	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	17403465.6	mg/TN/day	
TP discharged after WwTW treatment	241714.80	mg/TP/day	
Annual wastewater total nitrogen load	**6352.26**	kg/TN/yr	
Annual wastewater total phosphorous load	**88.23**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use			
Total area of existing 'agricultural' and other land			
Nitrate loss from current site land use			
Phosphate loss from current site land use			
Total nitrate loss from current land use			
Total Phosphate loss from current land use			

Stage 3	Figures	units/ Data source	Further information
New urban area			
Urban area nitrogen load			
Urban area phosphate load			
Nitrogen load from future urban area			
Phosphorous load from future urban area			
New SANG/open space			
SANG/open space nitrogen load			
SANG/open space phosphorous load			
Nitrogen Load from SANG/open space			
Phosphorous Load from SANG/open space			
New Community Farm/Allotments area			
New Community Farm/Allotments nitrogen load			
New Community Farm/Allotments phosphorous load			
Nitrogen Load from Community Farm/Allotments			
Phosphorous Load from New Community Farm/Allotments			
New Woodland			
New Woodland Area nitrogen load			
New Woodland Area phosphorous load			
Nitrogen Load from New Woodland			
Phosphorous Load from New Woodland			
Combined nitrogen load from future land uses			
Combined phosphorous load from future land uses			

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals					
Lowland Grazing Livestock					
Racetrack					
Hay Cut					
Other Grassland/Greenfield					
Mixed area - Urban					
Mixed area - Greenfield					
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B					

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)					
CSD9B (Urban)					
CSD9B (Other Grassland/greenfield)					
CSD9A (Urban)					
CSD9A (Other Grassland/greenfield)					

*** Note all land use data is excluded because only extra DWF nutrient budget from Tier 1 OPA is considered in this assessment**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load	6352.3	88.2	
Stage 2 - existing agriculture landuse load			Land Use Fully Excluded
Stage 3 - proposed development landuse load			Land Use Fully Excluded

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)	
Step 1 (Stage 1)	6352.3	88.2	
Step 2 (Stage 3 - Stage 2)	0.0	0.0	
Step 3 (Step 1 + Step 2)	6352.3	88.2	
Step 4 (= Step 3, i.e. N/P budget without buffer)	6352.3	88.2	
Step 5 (Step 4*20%)	1270.5	17.6	
Step 6 (Step 4 + Step 5)	**7622.7**	**105.9**	
Nitrogen/Phosphorous Budget with 20% buffer	**7622.7**	**105.9**	**Only extra DWF Nutrient Budget Included**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Park Garden Town - Tier 1 OPA Only	
Number of residential dwellings (Class C3)	7855	Tier 1 OPA Dwellings Only
Number of residential dwellings (Class C2)	645	Tier 1 OPA Dwellings Only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	18852	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	1548	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	2532720	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	16412025.6	mg/TN/day	
TP discharged after WwTW treatment	227944.80	mg/TP/day	
Annual wastewater total nitrogen load	**5990.39**	kg/TN/yr	
Annual wastewater total phosphorous load	**83.20**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use			
Total area of existing 'agricultural' and other land			
Nitrate loss from current site land use			
Phosphate loss from current site land use			
Total nitrate loss from current land use			
Total Phosphate loss from current land use			

Stage 3	Figures	units/ Data source	Further information
New urban area			
Urban area nitrogen load			
Urban area phosphate load			
Nitrogen load from future urban area			
Phosphorous load from future urban area			
New SANG/open space			
SANG/open space nitrogen load			
SANG/open space phosphorous load			
Nitrogen Load from SANG/open space			
Phosphorous Load from SANG/open space			
New Community Farm/Allotments area			
New Community Farm/Allotments nitrogen load			
New Community Farm/Allotments phosphorous load			
Nitrogen Load from Community Farm/Allotments			
Phosphorous Load from New Community Farm/Allotments			
New Woodland			
New Woodland Area nitrogen load			
New Woodland Area phosphorous load			
Nitrogen Load from New Woodland			
Phosphorous Load from New Woodland			
Combined nitrogen load from future land uses			
Combined phosphorous load from future land uses			

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals					
Lowland Grazing Livestock					
Racetrack					
Hay Cut					
Other Grassland/Greenfield					
Mixed area - Urban					
Mixed area - Greenfield					
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B					

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)					
CSD9B (Urban)					
CSD9B (Other Grassland/greenfield)					
CSD9A (Urban)					
CSD9A (Other Grassland/greenfield)					

*** Note all land use data is excluded because only extra DWF nutrient budget from Tier 1 OPA is considered in this assessment**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load	5990.4	83.2	
Stage 2 - existing agriculture landuse load			Land Use Fully Excluded
Stage 3 - proposed development landuse load			Land Use Fully Excluded

Stage 4 - Net Change in Nitrogen and Phosphorous Budget	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	5990.4	83.2
Step 2 (Stage 3 - Stage 2)	0.0	0.0
Step 3 (Step 1 + Step 2)	5990.4	83.2
Step 4 (= Step 3, i.e. N/P budget without buffer)	5990.4	83.2
Step 5 (Step 4*20%)	1198.1	16.6
Step 6 (Step 4 + Step 5)	**7188.5**	**99.8**

Nitrogen/Phosphorous Budget with 20% buffer	**7188.5**	**99.8**	**Only extra DWF Nutrient Budget Impacts Included**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1) TN (Kg/yr)	PCC (Scenario 1) TP (Kg/yr)	PCC (Scenario 2) TN (Kg/yr)	PCC (Scenario 2) TP (Kg/yr)
Severn Trent Connect - onsite WwTW	7623	106	7188	100

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1) TN Wetland Area (ha)	PCC (Scenario 1) TP Wetland Area (ha)	PCC (Scenario 2) TN Wetland Area (ha)	PCC (Scenario 2) TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	8.2	8.8	7.7	8.3

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

8. Wetland Hydraulic Loading

Wetland Details Summary

Wetland_ID (See Note 1)	Wetland Area (m2)	Wetland Area (ha)	Wetland Depth (m)	Treatment depth (m)	Comments
W13	130129	13.01	0.50	0.25	Receives wastewater discharge. The total footprint of the wetland is 13.0ha but only 75% is taken as effective area (9.75ha) due to earth works required for cascade wetland features.
	130129	**13.01**			

Preliminary Hydraulic Loading Calcs For Wastewater Wetland (W13)

	Effective Wetland Area (m2) - See Note 4	Effective Wetland Depth (m)	Max Dry Weather Flow, DWF (m3/day)	Hydraulic Retention Time, HRT (days) - See note 5	Hydraulic Loading Rate, HRT (m/day) - See Note 5
OPTION 1 - Assuming 50mm effective treatment depth	97597	0.05	2685.72	1.8	0.03
OPTION 2 - Assuming 150mm effective treatment depth	97597	0.15	2685.72	5.5	0.03
OPTION 3 - Assuming 250mm effective treatment depth	97597	0.25	2685.72	9.1	0.03

The hydraulic residence time (HRT) was calculated as follows:

$$HRT\,(days) = \frac{Wetland\ volume\ (m^3)}{Outflow\ rate\ (m^3/day)}$$

The hydraulic loading rate (HLR) was calculated as follows:

$$HLR\,(m/day) = \frac{Inflow\ rate\ (m^3/day)}{Wetland\ surface\ area\ (m^2)}$$

Hydraulic residence times and loading rates

Wetland nutrient removal efficiency is widely considered to be dependent upon both the HLR and the HRT (Dong *et al.*, 2011). A high effluent loading rate coupled with a short residence time will typically overload the ICW, giving insufficient contact time for physical, chemical and biological removal of pollutants. For this reason, HRTs of 5-30 days and HLRs of < 0.1 m/day have been recommended (Wu *et al.*, 2015). Shallow water depths (<50 cm) are also recommended to increase the contact time between effluent and wetland sediment, whilst also keeping water oxygenated through good contact with the atmosphere (Wu *et al.*, 2015).

https://onlinelibrary.wiley.com/doi/epdf/10.1111/wej.12605

Notes

1. Proposed Wetland locations are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0041-P3 (Proposed Nutrient Mitigation Strategy) in Appendix F.
2. Proposed Surface Water Drainage Zones are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0007-P7 (Surface Water Drainage Zones and Runoff Rates) in Appendix J.
3. Proposed Surface Water Drainage Strategy is shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0014-P4 (Surface Water Drainage Strategy Overview) in Appendix J.
4. Total wetland area for W13 is 13.01ha but assumed 75% for effective wetland area and remaining 25% for creating bunds for cascade features (i.e. @ 1 in 20 existing ground slope).
5. The above shows that HRT of > 5 days and HLR of < 0.1 m/day can be achieved with the proposed WwTW wetland W13 (Option 3 - 250mm effective treatment depth) and therefore meets the recommended wetland design guidance.

Onsite WwTW

Scenario 2 - WwTW Discharges Only Loading

2B - Otterpool NN (V1.8) - Onsite WwTW - OFMA DWF.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC	
Development name	Otterpool Park Garden Town - Masterplan Framework Only	
Development location (grid reference)	TR112 365	https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	8704	OFMA Dwellings only
Number of residential dwellings (Class C2)	1296	OFMA Dwellings only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Known)	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site		hectares		
New Urban Area		hectares		
Area of designated Suitable Alternative Natural Space (SANG)/open space		hectares		
Area of Community Farm/Allotments		hectares		
Current land use nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	
Cereals		27.3	0.36	
Lowland Grazing Livestock		12.2	0.24	
Racetrack		13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut		5	0.14	
Other Grassland/Greenfield		5	0.14	
Mixed area - Urban		14.3	0.83	
Mixed area - Greenfield		5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B		14.3	0.83	

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14

*** Note all land use data is excluded because only extra DWF nutrient budget from OFMA is considered in this assessment**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Otterpool Park Garden Town - Masterplan Framework Only	
Number of residential dwellings (Class C3)	8704	OFMA Dwellings only
Number of residential dwellings (Class C2)	1296	OFMA Dwellings only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3456696	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	22399390.08	mg/TN/day	
TP discharged after WwTW treatment	311102.64	mg/TP/day	
Annual wastewater total nitrogen load	**8175.78**	kg/TN/yr	
Annual wastewater total phosphorous load	**113.55**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use			
Total area of existing 'agricultural' and other land			
Nitrate loss from current site land use			
Phosphate loss from current site land use			
Total nitrate loss from current land use			
Total Phosphate loss from current land use			

Stage 3	Figures	units/ Data source	Further information
New urban area			
Urban area nitrogen load			
Urban area phosphate load			
Nitrogen load from future urban area			
Phosphorous load from future urban area			
New SANG/open space			
SANG/open space nitrogen load			
SANG/open space phosphorous load			
Nitrogen Load from SANG/open space			
Phosphorous Load from SANG/open space			
New Community Farm/Allotments area			
New Community Farm/Allotments nitrogen load			
New Community Farm/Allotments phosphorous load			
Nitrogen Load from Community Farm/Allotments			
Phosphorous Load from New Community Farm/Allotments			
New Woodland			
New Woodland Area nitrogen load			
New Woodland Area phosphorous load			
Nitrogen Load from New Woodland			
Phosphorous Load from New Woodland			
Combined nitrogen load from future land uses			
Combined phosphorous load from future land uses			

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals					
Lowland Grazing Livestock					
Racetrack					
Hay Cut					
Other Grassland/Greenfield					
Mixed area - Urban					
Mixed area - Greenfield					
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B					

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)					
CSD9B (Urban)					
CSD9B (Other Grassland/greenfield)					
CSD9A (Urban)					
CSD9A (Other Grassland/greenfield)					

*** Note all land use data is excluded because only extra DWF nutrient budget from OFMA is considered in this assessment**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load	8175.8	113.6	
Stage 2 - existing agriculture landuse load			Land Use Fully Excluded
Stage 3 - proposed development landuse load			Land Use Fully Excluded

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)	
Step 1 (Stage 1)	8175.8	113.6	
Step 2 (Stage 3 - Stage 2)	0.0	0.0	
Step 3 (Step 1 + Step 2)	8175.8	113.6	
Step 4 (= Step 3, i.e. N/P budget without buffer)	8175.8	113.6	
Step 5 (Step 4*20%)	1635.2	22.7	
Step 6 (Step 4 + Step 5)	**9810.9**	**136.3**	
Nitrogen/Phosphorous Budget with 20% buffer	**9810.9**	**136.3**	**Only extra DWF Nutrient Budget Included**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Town - Masterplan Framework Only	
Number of residential dwellings (Class C3)	8704	OFMA Dwellings only
Number of residential dwellings (Class C2)	1296	OFMA Dwellings only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3166986	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	20522069.28	mg/TN/day	
TP discharged after WwTW treatment	285028.74	mg/TP/day	
Annual wastewater total nitrogen load	**7490.56**	kg/TN/yr	
Annual wastewater total phosphorous load	**104.04**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use			
Total area of existing 'agricultural' and other land			
Nitrate loss from current site land use			
Phosphate loss from current site land use			
Total nitrate loss from current land use			
Total Phosphate loss from current land use			

Stage 3	Figures	units/ Data source	Further information
New urban area			
Urban area nitrogen load			
Urban area phosphate load			
Nitrogen load from future urban area			
Phosphorous load from future urban area			
New SANG/open space			
SANG/open space nitrogen load			
SANG/open space phosphorous load			
Nitrogen Load from SANG/open space			
Phosphorous Load from SANG/open space			
New Community Farm/Allotments area			
New Community Farm/Allotments nitrogen load			
New Community Farm/Allotments phosphorous load			
Nitrogen Load from Community Farm/Allotments			
Phosphorous Load from New Community Farm/Allotments			
New Woodland			
New Woodland Area nitrogen load			
New Woodland Area phosphorous load			
Nitrogen Load from New Woodland			
Phosphorous Load from New Woodland			
Combined nitrogen load from future land uses			
Combined phosphorous load from future land uses			

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate		Estimated Nutrient loss	
		Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals					
Lowland Grazing Livestock					
Racetrack					
Hay Cut					
Other Grassland/Greenfield					
Mixed area - Urban					
Mixed area - Greenfield					
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B					

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate		Estimated Nutrient loss	
		Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)					
CSD9B (Urban)					
CSD9B (Other Grassland/greenfield)					
CSD9A (Urban)					
CSD9A (Other Grassland/greenfield)					

*** Note all land use data is excluded because only extra DWF nutrient budget from OFMA is considered in this assessment**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load	7490.6	104.0	
Stage 2 - existing agriculture landuse load			Land Use Fully Excluded
Stage 3 - proposed development landuse load			Land Use Fully Excluded

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)	
Step 1 (Stage 1)	7490.6	104.0	
Step 2 (Stage 3 - Stage 2)	0.0	0.0	
Step 3 (Step 1 + Step 2)	7490.6	104.0	
Step 4 (= Step 3, i.e. N/P budget without buffer)	7490.6	104.0	
Step 5 (Step 4*20%)	1498.1	20.8	
Step 6 (Step 4 + Step 5)	**8988.7**	**124.8**	
Nitrogen/Phosphorous Budget with 20% buffer	**8988.7**	**124.8**	**Only extra DWF Nutrient Budget Included**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	9811	136	8989	125

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	10.5	11.4	9.7	10.4

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

8. Wetland Hydraulic Loading

Wetland Details Summary

Wetland_ID (See Note 1)	Wetland Area (m2)	Wetland Area (ha)	Wetland Depth (m)	Treatment depth (m)	Comments
W13	130129	13.01	0.50	0.25	Receives wastewater discharge. The total footprint of the wetland is 13.0ha but only 75% is taken as effective area (9.75ha) due to earth works required for cascade wetland features.
W15	18400	1.84	0.50	0.25	Provides tertiary treatment for the extra wastewater discharge from the remaining 1500 homes in OFMA. W7 and W15 are interlinked (Total area: 3.71 ha).
	148529	**13.01**			

Preliminary Hydraulic Loading Calcs For Wastewater Wetland (W13)

	Effective Wetland Area (m2) - See Note 4	Effective Wetland Depth (m)	Max Dry Weather Flow, DWF (m3/day)	Hydraulic Retention Time, HRT (days) - See note 5	Hydraulic Loading Rate, HRT (m/day) - See Note 5
OPTION 1 - Assuming 50mm effective treatment depth	115997	0.05	3456.70	1.7	0.03
OPTION 2 - Assuming 150mm effective treatment depth	115997	0.15	3456.70	5.0	0.03
OPTION 3 - Assuming 250mm effective treatment depth	115997	0.25	3456.70	8.4	0.03

The hydraulic residence time (HRT) was calculated as follows:

$$HRT\ (days) = \frac{Wetland\ volume\ (m^3)}{Outflow\ rate\ (m^3/day)}$$

The hydraulic loading rate (HLR) was calculated as follows:

$$HLR\ (m/day) = \frac{Inflow\ rate\ (m^3/day)}{Wetland\ surface\ area\ (m^2)}$$

Hydraulic residence times and loading rates

Wetland nutrient removal efficiency is widely considered to be dependent upon both the HLR and the HRT (Dong *et al.*, 2011). A high effluent loading rate coupled with a short residence time will typically overload the ICW, giving insufficient contact time for physical, chemical and biological removal of pollutants. For this reason, HRTs of 5-30 days and HLRs of < 0.1 m/day have been recommended (Wu *et al.*, 2015). Shallow water depths (<50 cm) are also recommended to increase the contact time between effluent and wetland sediment, whilst also keeping water oxygenated through good contact with the atmosphere (Wu *et al.*, 2015).

https://onlinelibrary.wiley.com/doi/epdf/10.1111/wej.12605

Notes

1. Proposed Wetland locations are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0041-P3 (Proposed Nutrient Mitigation Strategy) in Appendix F.
2. Proposed Surface Water Drainage Zones are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0007-P7 (Surface Water Drainage Zones and Runoff Rates) in Appendix J.
3. Proposed Surface Water Drainage Strategy is shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0014-P4 (Surface Water Drainage Strategy Overview) in Appendix J.
4. Total wetland area for W13 is 13.01ha but assumed 75% for effective wetland area and remaining 25% for creating bunds for cascade features (i.e. @ 1 in 20 existing ground slope).
5. The above shows that HRT of > 5 days and HLR of < 0.1 m/day can be achieved with the proposed WwTW wetland W13 (Option 3 - 250mm effective treatment depth) and therefore meets the recommended wetland design guidance.

Onsite WwTW

Scenario 2 - WwTW Discharges Only Loading

2C - Otterpool NN (V1.8) - Onsite WwTW - OFMA & Sellindge DWF.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC	
Development name	Masterplan Framework (**incl CSD9A & CSD9B**)	
Development location (grid reference)	TR112 365	https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	9054	OFMA + CSD9A & 9B Dwellings only
Number of residential dwellings (Class C2)	1296	OFMA + CSD9A & 9B Dwellings only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site		hectares		
New Urban Area		hectares		
Area of designated Suitable Alternative Natural Space (SANG)/open space		hectares		
Area of Community Farm/Allotments		hectares		
Current land use				
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate Phosphorous (kg P/ha/yr)	
Cereals		27.3	0.36	
Lowland Grazing Livestock		12.2	0.24	
Racetrack		13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut		5	0.14	
Other Grassland/Greenfield		5	0.14	
Mixed area - Urban		14.3	0.83	
Mixed area - Greenfield		5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B		14.3	0.83	

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14

*** Note all land use data is excluded because only extra DWF nutrient budget from OFMA + CSD9A & 9B is considered in this assessment**

2. Otterpool FM+CSD9A&B@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Otterpool Park Garden Town - Masterplan Framework (incl CSD9A & CSD9B)	
Number of residential dwellings (Class C3)	9054	OFMA + CSD9A & 9B Dwellings only
Number of residential dwellings (Class C2)	1296	OFMA + CSD9A & 9B Dwellings only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3549096	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	22998142.08	mg/TN/day	
TP discharged after WwTW treatment	319418.64	mg/TP/day	
Annual wastewater total nitrogen load	**8394.32**	kg/TN/yr	
Annual wastewater total phosphorous load	**116.59**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use			
Total area of existing 'agricultural' and other land			
Nitrate loss from current site land use			
Phosphate loss from current site land use			
Total nitrate loss from current land use			
Total Phosphate loss from current land use			

Stage 3	Figures	units/ data source	Further information
New urban area			
Urban area nitrogen load			
Urban area phosphate load			
Nitrogen load from future urban area			
Phosphorous load from future urban area			
New SANG/open space			
SANG/open space nitrogen load			
SANG/open space phosphorous load			
Nitrogen Load from SANG/open space			
Phosphorous Load from SANG/open space			
New Community Farm/Allotments area			
New Community Farm/Allotments nitrogen load			
New Community Farm/Allotments phosphorous load			
Nitrogen Load from Community Farm/Allotments			
Phosphorous Load from New Community Farm/Allotments			
New Woodland			
New Woodland Area nitrogen load			
New Woodland Area phosphorous load			
Nitrogen Load from New Woodland			
Phosphorous Load from New Woodland			
Combined nitrogen load from future land uses			
Combined phosphorous load from future land uses			

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals					
Lowland Grazing Livestock					
Racetrack					
Hay Cut					
Other Grassland/Greenfield					
Mixed area - Urban					
Mixed area - Greenfield					
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B					

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)					
CSD9B (Urban)					
CSD9B (Other Grassland/greenfield)					
CSD9A (Urban)					
CSD9A (Other Grassland/greenfield)					

* Note all land use data is excluded because only extra DWF nutrient budget from OFMA + CSD9A & 9B is considered in this assessment

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load	8394.3	116.6	
Stage 2 - existing agriculture landuse load			Land Use Fully Excluded
Stage 3 - proposed development landuse load			Land Use Fully Excluded

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	8394.3	116.6
Step 2 (Stage 3 - Stage 2)	0.0	0.0
Step 3 (Step 1 + Step 2)	8394.3	116.6
Step 4 (= Step 3, i.e. N/P budget without buffer)	8394.3	116.6
Step 5 (Step 4*20%)	1678.9	23.3
Step 6 (Step 4 + Step 5)	**10073.2**	**139.9**

Nitrogen/Phosphorous Budget with 20% buffer	**10073.2**	**139.9**	**Only extra DWF Nutrient Budget Included**

3. Otterpool FM+CSD9A&B@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Framework (incl CSD9A & CSD9B)	
Number of residential dwellings (Class C3)	9054	OFMA + CSD9A & 9B Dwellings only
Number of residential dwellings (Class C2)	1296	OFMA + CSD9A & 9B Dwellings only
Hotel Bedrooms (Class C1)	117	
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Onsite WwTW**	NAV	N/A - This calculation is alternative for onsite WwTW option.
and permitted TN concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Permitted Total Phosphate concentration	N/A		N/A - This calculation is alternative for onsite WwTW option.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	7.2	mg/l Severn Trent Connect	ST Connect's UCAS certified TN value
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.1	mg/l Severn Trent Connect	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3259386	litres/day	
Receiving WwTW environmental permit for TN	7.2	mg/l TN	ST Connect's UCAS certified TN value
Receiving WwTW environmental permit for TP	0.1	mg/l TP	ST Connect's committed TP value, Onsite WwTW permit u/s outfall option.
90% of the proposed consent TN limit	6.48	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.09	mg/l TP	
TN discharged after WwTW treatment	21120821.28	mg/TN/day	
TP discharged after WwTW treatment	293344.74	mg/TP/day	
Annual wastewater total nitrogen load	**7709.10**	kg/TN/yr	
Annual wastewater total phosphorous load	**107.07**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use			
Total area of existing 'agricultural' and other land			
Nitrate loss from current site land use			
Phosphate loss from current site land use			
Total nitrate loss from current land use			
Total Phosphate loss from current land use			

Stage 3	Figures	units/ Data source	Further information
New urban area			
Urban area nitrogen load			
Urban area phosphate load			
Nitrogen load from future urban area			
Phosphorous load from future urban area			
New SANG/open space			
SANG/open space nitrogen load			
SANG/open space phosphorous load			
Nitrogen Load from SANG/open space			
Phosphorous Load from SANG/open space			
New Community Farm/Allotments area			
New Community Farm/Allotments nitrogen load			
New Community Farm/Allotments phosphorous load			
Nitrogen Load from Community Farm/Allotments			
Phosphorous Load from New Community Farm/Allotments			
New Woodland			
New Woodland Area nitrogen load			
New Woodland Area phosphorous load			
Nitrogen Load from New Woodland			
Phosphorous Load from New Woodland			
Combined nitrogen load from future land uses			
Combined phosphorous load from future land uses			

Disclaimer:

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals					
Lowland Grazing Livestock					
Racetrack					
Hay Cut					
Other Grassland/Greenfield					
Mixed area - Urban					
Mixed area - Greenfield					
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B					

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)					
CSD9B (Urban)					
CSD9B (Other Grassland/greenfield)					
CSD9A (Urban)					
CSD9A (Other Grassland/greenfield)					

* Note all land use data is excluded because only extra DWF nutrient budget from OFMA + CSD9A & 9B is considered in this assessment

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load	7709.1	107.1	Land Use Fully Excluded
Stage 2 - existing agriculture landuse load			Land Use Fully Excluded
Stage 3 - proposed development landuse load			

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	7709.1	107.1
Step 2 (Stage 3 - Stage 2)	0.0	0.0
Step 3 (Step 1 + Step 2)	7709.1	107.1
Step 4 (= Step 3, i.e. N/P budget without buffer)	7709.1	107.1
Step 5 (Step 4*20%)	1541.8	21.4
Step 6 (Step 4 + Step 5)	**9250.9**	**128.5**

Only extra DWF Nutrient Budget Included

	TN (kgN/yr)	TP (kgP/yr)
Nitrogen/Phosphorous Budget with 20% buffer	**9250.9**	**128.5**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1) TN (Kg/yr)	PCC (Scenario 1) TP (Kg/yr)	PCC (Scenario 2) TN (Kg/yr)	PCC (Scenario 2) TP (Kg/yr)
Severn Trent Connect - onsite WwTW	10073	140	9251	128

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1) TN Wetland Area (ha)	PCC (Scenario 1) TP Wetland Area (ha)	PCC (Scenario 2) TN Wetland Area (ha)	PCC (Scenario 2) TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	10.8	11.7	9.9	10.7

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

8. Wetland Hydraulic Loading

Wetland Details Summary

Wetland_ID (See Note 1)	Wetland Area (m2)	Wetland Area (ha)	Wetland Depth (m)	Treatment depth (m)	Comments
W13	130129	13.01	0.50	0.25	Receives wastewater discharge. The total footprint of the wetland is 13.0ha but only 75% is taken as effective area (9.75ha) due to earth works required for cascade wetland features.
W15	18400	1.84	0.50	0.25	Provides tertiary treatment for the extra wastewater discharge from the remaining 1500 homes in OFMA. W7 and W15 are interlinked (Total area: 3.71 ha).
	148529	**13.01**			

Preliminary Hydraulic Loading Calcs For Wastewater Wetland (W13)

	Effective Wetland Area (m2) - See Note 4	Effective Wetland Depth (m)	Max Dry Weather Flow, DWF (m3/day)	Hydraulic Retention Time, HRT (days) - See note 5	Hydraulic Loading Rate, HRT (m/day) - See Note 5
OPTION 1 - Assuming 50mm effective treatment depth	115997	0.05	3549.10	1.6	0.03
OPTION 2 - Assuming 150mm effective treatment depth	115997	0.15	3549.10	4.9	0.03
OPTION 3 - Assuming 250mm effective treatment depth	115997	0.25	3549.10	8.2	0.03

The hydraulic residence time (HRT) was calculated as follows:

$$HRT\ (days) = \frac{Wetland\ volume\ (m^3)}{Outflow\ rate\ (m^3/day)}$$

The hydraulic loading rate (HLR) was calculated as follows:

$$HLR\ (m/day) = \frac{Inflow\ rate\ (m^3/day)}{Wetland\ surface\ area\ (m^2)}$$

Hydraulic residence times and loading rates

Wetland nutrient removal efficiency is widely considered to be dependent upon both the HLR and the HRT (Dong *et al.*, 2011). A high effluent loading rate coupled with a short residence time will typically overload the ICW, giving insufficient contact time for physical, chemical and biological removal of pollutants. For this reason, HRTs of 5-30 days and HLRs of < 0.1 m/day have been recommended (Wu *et al.*, 2015). Shallow water depths (<50 cm) are also recommended to increase the contact time between effluent and wetland sediment, whilst also keeping water oxygenated through good contact with the atmosphere (Wu *et al.*, 2015).

https://onlinelibrary.wiley.com/doi/epdf/10.1111/wej.12605

Notes

1. Proposed Wetland locations are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0041-P3 (Proposed Nutrient Mitigation Strategy) in Appendix F.
2. Proposed Surface Water Drainage Zones are shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0007-P7 (Surface Water Drainage Zones and Runoff Rates) in Appendix J.
3. Proposed Surface Water Drainage Strategy is shown on Drawing No. 10029956-AUK-XX-XX-DR--CW-0014-P4 (Surface Water Drainage Strategy Overview) in Appendix J.
4. Total wetland area for W13 is 13.01ha but assumed 75% for effective wetland area and remaining 25% for creating bunds for cascade features (i.e. @ 1 in 20 existing ground slope).
5. The above shows that HRT of > 5 days and HLR of < 0.1 m/day can be achieved with the proposed WwTW wetland W13 (Option 3 - 250mm effective treatment depth) and therefore meets the recommended wetland design guidance.

Onsite WwTW

Scenario 3 - Land Use Discharges Only Loading

3A - Otterpool NN (V1.8) - Onsite WwTW - Tier 1 OPA Land Use.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC	
Development name	Otterpool Park Garden Town - Tier 1 OPA Only	
Development location (grid reference)	TR112 365	https://gridreferencefinder.com/
Number of residential dwellings (Class C3)		Dwellings DWF Excluded
Number of residential dwellings (Class C2)		Dwellings DWF Excluded
Hotel Bedrooms (Class C1)		Dwellings DWF Excluded
Local Planning Authority	Folkstone and Hythe DC	

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	589.0	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area	317.9	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of designated Suitable Alternative Natural Space (SANG)/open space	179.49	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool OPA)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.6	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	69.7	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
	562.2			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Other excluded existing retained land within Otterpool OPA (e.g. vegetation/buildings/ waterbodies/ecological features/roads)	26.8

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14
	0.00		

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only Tier 1 OPA Land use is included).**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Otterpool Park Garden Town - Tier 1 OPA Only	
Number of residential dwellings (Class C3)		Dwellings DWF Excluded
Number of residential dwellings (Class C2)		Dwellings DWF Excluded
Hotel Bedrooms (Class C1)		Dwellings DWF Excluded
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate			
Step 2 confirm water use (litres per person)			
Step 3 confirm Waste water Treatment Works (WwTW) and permitted TN concentration			
Permitted Total Phosphate concentration			
Proposed permitted Total Nitrogen concentration to accommodate Otterpool			
Proposed permitted Total Phosphate concentration to accommodate Otterpool			
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)			
Additional population (Residential Class C2)			
Additional population (Hotel Class C1)			
Wastewater volume generated by development			
Receiving WwTW environmental permit for TN			
Receiving WwTW environmental permit for TP			
90% of the proposed consent TN limit			
90% of the proposed consent TP limit			
TN discharged after WwTW treatment			
TP discharged after WwTW treatment			
Annual wastewater total nitrogen load			
Annual wastewater total phosphorous load			

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	562.2	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11132.94**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**175.40**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	317.9	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4546.11	kgN/yr	
Phosphorous load from future urban area	263.87	kgP/yr	
New SANG/open space	179.5	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	897.45	kgN/yr	
Phosphorous Load from SANG/open space	25.13	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**5848.86**	kgN/yr	
Combined phosphorous load from future land uses	**292.44**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool OPA)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.6	13.25	0.535	180.20	7.28
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	69.7	5	0.14	348.50	9.76
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
0	0	0	0	0.00	0.00
	562.2			**11132.94**	**175.40**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OPA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load			WWTW DWF Excluded
Stage 2 - existing agriculture landuse load	11132.9	175.4	
Stage 3 - proposed development landuse load	5848.9	292.4	

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	0.0	0.0
Step 2 (Stage 3 - Stage 2)	-5284.1	117.0
Step 3 (Step 1 + Step 2)	-5284.1	117.0
Step 4 (= Step 3, i.e. N/P budget without buffer)	-5284.1	117.0
Step 5 (Step 4*20%)	-1056.8	23.4
Step 6 (Step 4 + Step 5)	**-6340.9**	**140.4**

	TN (kgN/yr)	TP (kgP/yr)	
Nitrogen/Phosphorous Budget with 20% buffer	**-6340.9**	**140.4**	**Only Land Use Nutrient Budget Included**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	ark Garden Town - Tier 1 OPA Only	
Number of residential dwellings (Class C3)		Dwellings DWF Excluded
Number of residential dwellings (Class C2)		Dwellings DWF Excluded
Hotel Bedrooms (Class C1)		Dwellings DWF Excluded
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate			
Step 2 confirm water use (litres per person)			
Step 3 confirm Waste water Treatment Works (WwTW) and permitted TN concentration			
Permitted Total Phosphate concentration			
Proposed permitted Total Nitrogen concentration to accommodate Otterpool			
Proposed permitted Total Phosphate concentration to accommodate Otterpool			
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)			
Additional population (Residential Class C2)			
Additional population (Hotel Class C1)			
Wastewater volume generated by development			
Receiving WwTW environmental permit for TN			
Receiving WwTW environmental permit for TP			
90% of the proposed consent TN limit			
90% of the proposed consent TP limit			
TN discharged after WwTW treatment			
TP discharged after WwTW treatment			
Annual wastewater total nitrogen load			
Annual wastewater total phosphorous load			

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	562.2	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11132.94**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**175.40**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	317.9	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4546.11	kgN/yr	
Phosphorous load from future urban area	263.87	kgP/yr	
New SANG/open space	179.5	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	897.45	kgN/yr	
Phosphorous Load from SANG/open space	25.13	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**5848.86**	kgN/yr	
Combined phosphorous load from future land uses	**292.44**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool OPA)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.6	13.25	0.535	180.20	7.28
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	69.7	5	0.14	348.50	9.76
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
0	0	0	0	0.00	0.00
	562.2			**11132.94**	**175.40**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OPA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load			WWTW DWF Excluded
Stage 2 - existing agriculture landuse load	11132.9	175.4	
Stage 3 - proposed development landuse load	5848.9	292.4	

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)	
Step 1 (Stage 1)	0.0	0.0	
Step 2 (Stage 3 - Stage 2)	-5284.1	117.0	
Step 3 (Step 1 + Step 2)	-5284.1	117.0	
Step 4 (= Step 3, i.e. N/P budget without buffer)	-5284.1	117.0	
Step 5 (Step 4*20%)	-1056.8	23.4	
Step 6 (Step 4 + Step 5)	**-6340.9**	**140.4**	
Nitrogen/Phosphorous Budget with 20% buffer	**-6340.9**	**140.4**	**Only Land Use Nutrient Budget Included**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	-6341	140	-6341	140

Nutrient Mitigation - Wetland Area Requirement Summary

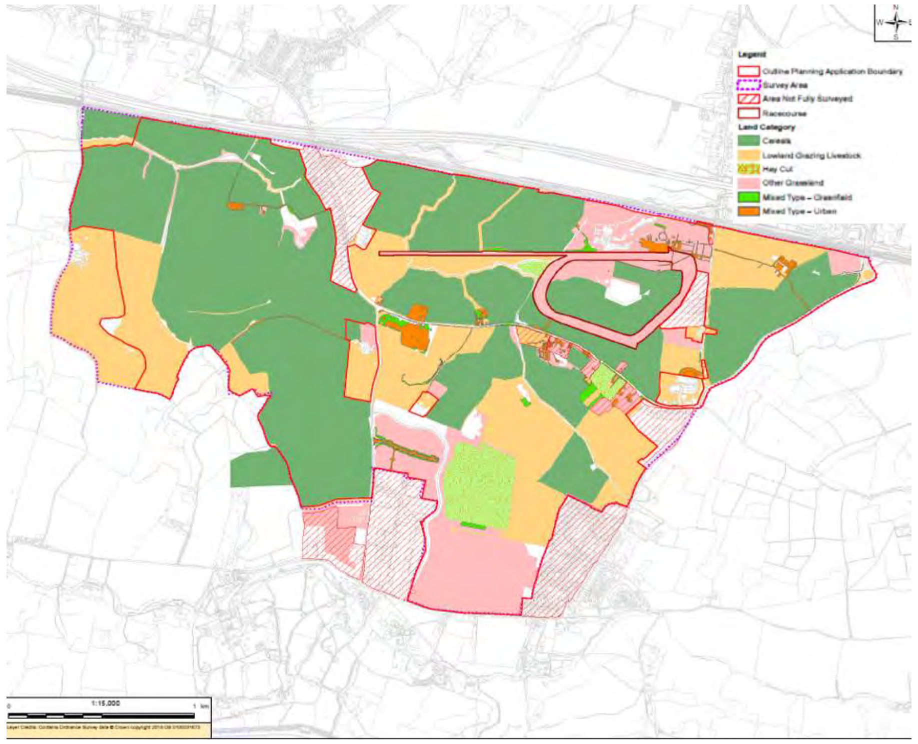
WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	-6.8	11.7	-6.8	11.7

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

5. Existing Land Type Data



Existing Land Type Area Statement within Outline Planning Application Boundary

Land Category	Area in Mt	Area in Ha	
Cereals	3189561.4	319.0	
Lowland Grazing Livestock	1191257.8	119.1	
Racetrack	135944.9	13.6	
Hay Cut	188948.6	18.9	
Other Grassland	682491.8	68.2	Racetrack area deducted from "Other Grassland" area
Mixed Type - Urban	114712.8	11.5	
Mixed Type - Greenfield	45277.5	4.5	
	5548194.8	**554.8**	

Extra Existing Land Type Area Statement in recently extended OPA boundary @ NW Corner

Land Category	Area in Mt	Area in Ha
Cereals	59053.0	5.9
Other Grassland		1.5
	59053.0	**7.4**

	Area in Ha
Other existing retained land within Otterpool OPA (e.g. roads)	10.0
Other existing retained land within Otterpool OPA (e.g. vegetation/buildings/ waterbodies/ecological features)	16.8
	26.8

	Area in Ha
Outline Planning Application Boundary	**589.0**

Existing Land Type Area Statement For CSD9A & CSD9B

Land Type	Area in Ha
CSD9B (Cereals)	17.16
CSD9B (Urban)	0.7
CSD9B (Other Grassland/greenfield)	1.05
CSD9A (Urban)	0.08
CSD9A (Other Grassland/greenfield)	8.98
	27.97

Note: Existing landuse data for CSD9A and CSD9B is currently taken from FHDC Stodmarsh Nutrient Budget (dated 21/09/2020) without GIS measurement although Arcadis undertaken a quick sense check by comparing with Google Areal images to validate this info.

7. Proposed Land Use

	Area (ha)
Total Urban in OPA	317.9
Total Landscape open space in OPA	271.09
Exisiting community in framework masterplan area	
Retained farmland in framework masterplan area	
Existing Road	
Total OP Framework Area	589.00

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A					
Sellindge CSD9B					
CSD9A & 9B TOTAL	0	0.00	0		0

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OPA is included).**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL OPA

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*0.0*	
Retained farmland in framework masterplan area	*0.0*	
Existing Roads		
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*16.8*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**179.49**	
Total Urban Area in Framework Masterplan	**317.9**	
Total OP Framework Area Check	**589.0**	

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

Onsite WwTW

Scenario 3 - Land Use Discharges Only Loading

3B - Otterpool NN (V1.8) - Onsite WwTW - OFMA Land Use.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC	
Development name	Otterpool Park Garden Town - Masterplan Framework Only	
Development location (grid reference)	TR112 365	https://gridreferencefinder.com/
Number of residential dwellings (Class C3)		Dwellings DWF Excluded
Number of residential dwellings (Class C2)		Dwellings DWF Excluded
Hotel Bedrooms (Class C1)		Dwellings DWF Excluded
Local Planning Authority	Folkstone and Hythe DC	

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	756.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area	350.5	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of designated Suitable Alternative Natural Space (SANG)/open space	183.60	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14
	0.00		

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA Land use is included).**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC	
Development	Otterpool Park Garden Town - Masterplan Framework Only	
Number of residential dwellings (Class C3)		Dwellings DWF Excluded
Number of residential dwellings (Class C2)		Dwellings DWF Excluded
Hotel Bedrooms (Class C1)		Dwellings DWF Excluded
Local Planning Authority	Folkstone and Hythe DC	

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate			
Step 2 confirm water use (litres per person)			
Step 3 confirm Waste water Treatment Works (WwTW) and permitted TN concentration			
Permitted Total Phosphate concentration			
Proposed permitted Total Nitrogen concentration to accommodate Otterpool			
Proposed permitted Total Phosphate concentration to accommodate Otterpool			
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)			
Additional population (Residential Class C2)			
Additional population (Hotel Class C1)			
Wastewater volume generated by development			
Receiving WwTW environmental permit for TN			
Receiving WwTW environmental permit for TP			
90% of the proposed consent TN limit			
90% of the proposed consent TP limit			
TN discharged after WwTW treatment			
TP discharged after WwTW treatment			
Annual wastewater total nitrogen load			
Annual wastewater total phosphorous load			

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	350.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5012.15	kgN/yr	
Phosphorous load from future urban area	290.92	kgP/yr	
New SANG/open space	183.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	918	kgN/yr	
Phosphorous Load from SANG/open space	25.70	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6335.45**	kgN/yr	
Combined phosphorous load from future land uses	**320.06**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load			WWTW DWF Excluded
Stage 2 - existing agriculture landuse load	11573.2	196.3	
Stage 3 - proposed development landuse load	6335.5	320.1	

Stage 4 - Net Change in Nitrogen and Phosphorous Budget	TN (kgN/yr)	TP (kgP/yr)	
Step 1 (Stage 1)	0.0	0.0	
Step 2 (Stage 3 - Stage 2)	-5237.7	123.8	
Step 3 (Step 1 + Step 2)	-5237.7	123.8	
Step 4 (= Step 3, i.e. N/P budget without buffer)	-5237.7	123.8	
Step 5 (Step 4*20%)	-1047.5	24.8	
Step 6 (Step 4 + Step 5)	**-6285.3**	**148.6**	
Nitrogen/Phosphorous Budget with 20% buffer	**-6285.3**	**148.6**	**Only Land Use Nutrient Budget Included**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	0
Number of residential dwellings (Class C2)	0
Hotel Bedrooms (Class C1)	0
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate			
Step 2 confirm water use (litres per person)			
Step 3 confirm Waste water Treatment Works (WwTW) and permitted TN concentration			
Permitted Total Phosphate concentration			
Proposed permitted Total Nitrogen concentration to accommodate Otterpool			
Proposed permitted Total Phosphate concentration to accommodate Otterpool			
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)			
Additional population (Residential Class C2)			
Additional population (Hotel Class C1)			
Wastewater volume generated by development			
Receiving WwTW environmental permit for TN			
Receiving WwTW environmental permit for TP			
90% of the proposed consent TN limit			
90% of the proposed consent TP limit			
TN discharged after WwTW treatment			
TP discharged after WwTW treatment			
Annual wastewater total nitrogen load			
Annual wastewater total phosphorous load			

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	350.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5012.15	kgN/yr	
Phosphorous load from future urban area	290.92	kgP/yr	
New SANG/open space	183.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	918	kgN/yr	
Phosphorous Load from SANG/open space	25.70	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6335.45**	kgN/yr	
Combined phosphorous load from future land uses	**320.06**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)	
Stage 1 - WwTW load			WWTW DWF Excluded
Stage 2 - existing agriculture landuse load	11573.2	196.3	
Stage 3 - proposed development landuse load	6335.5	320.1	

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)	
Step 1 (Stage 1)	0.0	0.0	
Step 2 (Stage 3 - Stage 2)	-5237.7	123.8	
Step 3 (Step 1 + Step 2)	-5237.7	123.8	
Step 4 (= Step 3, i.e. N/P budget without buffer)	-5237.7	123.8	
Step 5 (Step 4*20%)	-1047.5	24.8	
Step 6 (Step 4 + Step 5)	**-6285.3**	**148.6**	
Nitrogen/Phosphorous Budget with 20% buffer	**-6285.3**	**148.6**	**Only Land Use Nutrient Budget Included**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1) TN (Kg/yr)	PCC (Scenario 1) TP (Kg/yr)	PCC (Scenario 2) TN (Kg/yr)	PCC (Scenario 2) TP (Kg/yr)
Severn Trent Connect - onsite WwTW	-6285	149	-6285	149

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1) TN Wetland Area (ha)	PCC (Scenario 1) TP Wetland Area (ha)	PCC (Scenario 2) TN Wetland Area (ha)	PCC (Scenario 2) TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	-6.8	12.4	-6.8	12.4

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	**350.5**
Total Landscape open space in Framework Masterplan	**275.2**
Exisiting community in framework masterplan area	**71**
Retained farmland in framework masterplan area	**49.4**
Existing Road	**10**
Total OP Framework Area	**756.10**

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A					
Sellindge CSD9B					
CSD9A & 9B TOTAL	**0**	**0.00**	**0**		**0**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*71.0*	
Retained farmland in framework masterplan area	*49.4*	
Existing Roads	*10.0*	
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**183.6**	
Total Urban Area in Framework Masterplan	**350.5**	
Total OP Framework Area Check	**756.1**	

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

Onsite WwTW

Scenario 3 - Land Use Discharges Only Loading

3C - Otterpool NN (V1.8) - Onsite WwTW - OFMA & Sellindge Land Use.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Masterplan Framework (**incl CSD9A & CSD9B**)
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	Not Used in this Calcs as onsite WwTW is used instead
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Known	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	784.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
New Urban Area	369.0	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of designated Suitable Alternative Natural Space (SANG)/open space	193.10	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

		Average Nutrient Loss Rate		
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**
CSD9B (Cereals)	17.16	27.3	0.36
CSD9B (Urban)	0.7	14.3	0.83
CSD9B (Other Grassland/greenfield)	1.05	5	0.14
CSD9A (Urban)	0.08	14.3	0.83
CSD9A (Other Grassland/greenfield)	8.98	5	0.14
	27.97		

2. Otterpool FM+CSD9A&B@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate			
Step 2 confirm water use (litres per person)			
Step 3 confirm Waste water Treatment Works (WwTW) and permitted TN concentration			
Permitted Total Phosphate concentration			
Proposed permitted Total Nitrogen concentration to accommodate Otterpool			
Proposed permitted Total Phosphate concentration to accommodate Otterpool			
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)			
Additional population (Residential Class C2)			
Additional population (Hotel Class C1)			
Wastewater volume generated by development			
Receiving WwTW environmental permit for TN			
Receiving WwTW environmental permit for TP			
90% of the proposed consent TN limit			
90% of the proposed consent TP limit			
TN discharged after WwTW treatment			
TP discharged after WwTW treatment			
Annual wastewater total nitrogen load			
Annual wastewater total phosphorous load			

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	369.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5276.27	kgN/yr	
Phosphorous load from future urban area	306.25	kgP/yr	
New SANG/open space	193.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	965.5	kgN/yr	
Phosphorous Load from SANG/open space	27.03	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6647.07**	kgN/yr	
Combined phosphorous load from future land uses	**336.72**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load		
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6647.1	336.7

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	0.0	0.0
Step 2 (Stage 3 - Stage 2)	-5455.9	132.2
Step 3 (Step 1 + Step 2)	-5455.9	132.2
Step 4 (= Step 3, i.e. N/P budget without buffer)	-5455.9	132.2
Step 5 (Step 4*20%)	-1091.2	26.4
Step 6 (Step 4 + Step 5)	**-6547.1**	**158.7**
Nitrogen/Phosphorous Budget with 20% buffer	**-6547.1**	**158.7**

3. Otterpool FM+CSD9A&B@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate			
Step 2 confirm water use (litres per person)			
Step 3 confirm Waste water Treatment Works (WwTW) and permitted TN concentration			
Permitted Total Phosphate concentration			
Proposed permitted Total Nitrogen concentration to accommodate Otterpool			
Proposed permitted Total Phosphate concentration to accommodate Otterpool			
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)			
Additional population (Residential Class C2)			
Additional population (Hotel Class C1)			
Wastewater volume generated by development			
Receiving WwTW environmental permit for TN			
Receiving WwTW environmental permit for TP			
90% of the proposed consent TN limit			
90% of the proposed consent TP limit			
TN discharged after WwTW treatment			
TP discharged after WwTW treatment			
Annual wastewater total nitrogen load			
Annual wastewater total phosphorous load			

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	369.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5276.27	kgN/yr	
Phosphorous load from future urban area	306.25	kgP/yr	
New SANG/open space	193.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	965.5	kgN/yr	
Phosphorous Load from SANG/open space	27.03	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6647.07**	kgN/yr	
Combined phosphorous load from future land uses	**336.72**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	**Nitrate - nitrogen (kg N/yr)**	**Phosphorous (kg P/yr)**
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	**Nitrate - nitrogen (kg N/yr)**	**Phosphorous (kg P/yr)**
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load		
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6647.1	336.7

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	0.0	0.0
Step 2 (Stage 3 - Stage 2)	-5455.9	132.2
Step 3 (Step 1 + Step 2)	-5455.9	132.2
Step 4 (= Step 3, i.e. N/P budget without buffer)	-5455.9	132.2
Step 5 (Step 4*20%)	-1091.2	26.4
Step 6 (Step 4 + Step 5)	**-6547.1**	**158.7**

Nitrogen/Phosphorous Budget with 20% buffer	**-6547.1**	**158.7**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Severn Trent Connect - onsite WwTW	-6547	159	-6547	159

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Severn Trent Connect - onsite WwTW	-7.0	13.2	-7.0	13.2

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	**350.5**
Total Landscape open space in Framework Masterplan	**275.2**
Exisiting community in framework masterplan area	**71**
Retained farmland in framework masterplan area	**49.4**
Existing Road	**10**
Total OP Framework Area	**756.10**

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A	7.56	1.50	9.06	83%	188
Sellindge CSD9B	10.91	8.00	18.91	58%	162
CSD9A & 9B TOTAL	**18.47**	**9.50**	**27.97**		**350**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*71.0*	
Retained farmland in framework masterplan area	*49.4*	
Existing Roads	*10.0*	
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**183.6**	
Total Urban Area in Framework Masterplan	**350.5**	
Total OP Framework Area Check	**756.1**	

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

APPENDIX E

Nutrient Neutrality Assessment – For Sellindge WwTW

Excel calculations printouts associated with Nutrient Neutrality Assessment (i.e., for the combined land use and WwTW Discharges Loading) are given for the Sellindge WwTW proposal for:

- *Otterpool Framework Masterplan Area (OFMA)*
- *OFMA and Sellindge Phase 2 Sites Combined*

Sensitivity testing are also given to account for the 61ha of additional open space areas in urban development parcels (i.e., those additional Public Open Space currently not shown in Tier 1 Parameter Plans to facilitate more flexibility in masterplanning in Tier 2 and Tier 3 stages)

Common datasheets (e.g. existing land use type measurement information – worksheets 5 & 6, wetland hydraulic loading calculations – worksheet 8) are generally not repeated unless some information is different.

Sellindge WwTW

Combined Land Use and WwTW Discharges Loading

Otterpool Nitrogen Budget - V1.8 - Sellindge WwTW - Otterpool FMP & Sellindge.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Masterplan Framework (**incl CSD9A & CSD9B**)
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total Phosphorous value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Known	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	
Total area of site	784.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
New Urban Area	369.0	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of designated Suitable Alternative Natural Space (SANG)/open space	193.10	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)
CSD9B (Cereals)	17.16	27.3	0.36
CSD9B (Urban)	0.7	14.3	0.83
CSD9B (Other Grassland/greenfield)	1.05	5	0.14
CSD9A (Urban)	0.08	14.3	0.83
CSD9A (Other Grassland/greenfield)	8.98	5	0.14
	27.97		

2. Otterpool FM+CSD9A&B@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3549096	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	79854660	mg/TN/day	
TP discharged after WwTW treatment	958255.92	mg/TP/day	
Annual wastewater total nitrogen load	**29146.95**	kg/TN/yr	
Annual wastewater total phosphorous load	**349.76**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	369.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5276.27	kgN/yr	
Phosphorous load from future urban area	306.25	kgP/yr	
New SANG/open space	193.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	965.5	kgN/yr	
Phosphorous Load from SANG/open space	27.03	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6647.07**	kgN/yr	
Combined phosphorous load from future land uses	**336.72**	kgP/yr	

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	29147.0	349.8
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6647.1	336.7

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	29147.0	349.8
Step 2 (Stage 3 - Stage 2)	-5455.9	132.2
Step 3 (Step 1 + Step 2)	23691.1	482.0
Step 4 (= Step 3, i.e. N/P budget without buffer)	23691.1	482.0
Step 5 (Step 4*20%)	4738.2	96.4
Step 6 (Step 4 + Step 5)	**28429.3**	**578.4**

	TN (kgN/yr)	TP (kgP/yr)
Nitrogen/Phosphorous Budget with 20% buffer	**28429.3**	**578.4**

3. Otterpool FM+CSD9A&B@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A		N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1		Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3259386	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	73336185	mg/TN/day	
TP discharged after WwTW treatment	880034.22	mg/TP/day	
Annual wastewater total nitrogen load	**26767.71**	kg/TN/yr	
Annual wastewater total phosphorous load	**321.21**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	369.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5276.27	kgN/yr	
Phosphorous load from future urban area	306.25	kgP/yr	
New SANG/open space	193.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	965.5	kgN/yr	
Phosphorous Load from SANG/open space	27.03	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6647.07**	kgN/yr	
Combined phosphorous load from future land uses	**336.72**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	26767.7	321.2
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6647.1	336.7

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	26767.7	321.2
Step 2 (Stage 3 - Stage 2)	-5455.9	132.2
Step 3 (Step 1 + Step 2)	21311.8	453.4
Step 4 (= Step 3, i.e. N/P budget without buffer)	21311.8	453.4
Step 5 (Step 4*20%)	4262.4	90.7
Step 6 (Step 4 + Step 5)	**25574.2**	**544.1**

Nitrogen/Phosphorous Budget with 20% buffer	**25574.2**	**544.1**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Southern Water - Sellindge WwTW	28429	578	25574	544

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Southern Water - Sellindge WwTW	30.6	48.2	27.5	45.3

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	**350.5**
Total Landscape open space in Framework Masterplan	**275.2**
Exisiting community in framework masterplan area	**71**
Retained farmland in framework masterplan area	**49.4**
Existing Road	**10**
Total OP Framework Area	**756.10**

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A	7.56	1.50	9.06	83%	188
Sellindge CSD9B	10.91	8.00	18.91	58%	162
CSD9A & 9B TOTAL	**18.47**	**9.50**	**27.97**		**350**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*71.0*	
Retained farmland in framework masterplan area	*49.4*	
Existing Roads	*10.0*	
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**183.6**	
Total Urban Area in Framework Masterplan	**350.5**	
Total OP Framework Area Check	**756.1**	

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

Sellindge WwTW

Combined Land Use and WwTW Discharges Loading

Otterpool Nitrogen Budget - V1.8 - Sellindge WwTW - Otterpool FMP & Sellindge - Sensitivity Test.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Masterplan Framework (**incl CSD9A & CSD9B**)
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Known)	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	Not Used in this Calcs as onsite WwTW is used instead
Total area of site	784.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
New Urban Area	308.0	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of designated Suitable Alternative Natural Space (SANG)/open space	254.10	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP plus CSD9A & CSD9B
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)
CSD9B (Cereals)	17.16	27.3	0.36
CSD9B (Urban)	0.7	14.3	0.83
CSD9B (Other Grassland/greenfield)	1.05	5	0.14
CSD9A (Urban)	0.08	14.3	0.83
CSD9A (Other Grassland/greenfield)	8.98	5	0.14
	27.97		

2. Otterpool FM+CSD9A&B@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3549096	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	79854660	mg/TN/day	
TP discharged after WwTW treatment	958255.92	mg/TP/day	
Annual wastewater total nitrogen load	**29146.95**	kg/TN/yr	
Annual wastewater total phosphorous load	**349.76**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	308.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4403.97	kgN/yr	
Phosphorous load from future urban area	255.62	kgP/yr	
New SANG/open space	254.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1270.5	kgN/yr	
Phosphorous Load from SANG/open space	35.57	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6079.77**	kgN/yr	
Combined phosphorous load from future land uses	**294.63**	kgP/yr	

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	29147.0	349.8
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6079.8	294.6

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	29147.0	349.8
Step 2 (Stage 3 - Stage 2)	-6023.2	90.1
Step 3 (Step 1 + Step 2)	23123.8	439.9
Step 4 (= Step 3, i.e. N/P budget without buffer)	23123.8	439.9
Step 5 (Step 4*20%)	4624.8	88.0
Step 6 (Step 4 + Step 5)	**27748.5**	**527.9**
Nitrogen/Phosphorous Budget with 20% buffer	**27748.5**	**527.9**

3. Otterpool FM+CSD9A&B@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Framework (incl CSD9A & CSD9B)
Number of residential dwellings (Class C3)	9054
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	21729.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3259386	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	73336185	mg/TN/day	
TP discharged after WwTW treatment	880034.22	mg/TP/day	
Annual wastewater total nitrogen load	**26767.71**	kg/TN/yr	
Annual wastewater total phosphorous load	**321.21**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	641.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**12102.96**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**204.49**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	308.0	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4403.97	kgN/yr	
Phosphorous load from future urban area	255.62	kgP/yr	
New SANG/open space	254.1	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1270.5	kgN/yr	
Phosphorous Load from SANG/open space	35.57	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6079.77**	kgN/yr	
Combined phosphorous load from future land uses	**294.63**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	17.16	27.3	0.36	468.47	6.18
CSD9B (Urban)	0.7	14.3	0.83	10.01	0.58
CSD9B (Other Grassland/greenfield)	1.05	5	0.14	5.25	0.15
CSD9A (Urban)	0.08	14.3	0.83	1.14	0.07
CSD9A (Other Grassland/greenfield)	8.98	5	0.14	44.90	1.26
	28.0			**529.77**	**8.23**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	26767.7	321.2
Stage 2 - existing agriculture landuse load	12103.0	204.5
Stage 3 - proposed development landuse load	6079.8	294.6

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	26767.7	321.2
Step 2 (Stage 3 - Stage 2)	-6023.2	90.1
Step 3 (Step 1 + Step 2)	20744.5	411.4
Step 4 (= Step 3, i.e. N/P budget without buffer)	20744.5	411.4
Step 5 (Step 4*20%)	4148.9	82.3
Step 6 (Step 4 + Step 5)	**24893.4**	**493.6**
Nitrogen/Phosphorous Budget with 20% buffer	**24893.4**	**493.6**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1) TN (Kg/yr)	PCC (Scenario 1) TP (Kg/yr)	PCC (Scenario 2) TN (Kg/yr)	PCC (Scenario 2) TP (Kg/yr)
Southern Water - Sellindge WwTW	27749	528	24893	494

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1) TN Wetland Area (ha)	PCC (Scenario 1) TP Wetland Area (ha)	PCC (Scenario 2) TN Wetland Area (ha)	PCC (Scenario 2) TP Wetland Area (ha)
Southern Water - Sellindge WwTW	29.8	44.0	26.8	41.1

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	350.5
Total Landscape open space in Framework Masterplan	275.2
Exisiting community in framework masterplan area	71
Retained farmland in framework masterplan area	49.4
Existing Road	10
Total OP Framework Area	756.10

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A	7.56	1.50	9.06	83%	188
Sellindge CSD9B	10.91	8.00	18.91	58%	162
CSD9A & 9B TOTAL	**18.47**	**9.50**	**27.97**		**350**

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha	
Excluded Retained Existing Land			
Existing community in framework masterplan area	*71.0*		
Retained farmland in framework masterplan area	*49.4*		
Existing Roads	*10.0*		
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*	
Excluded Mitigation Land From SANG			
Wetlands	*30*	*65*	
*Woodland **	*35*		
Community Farm/Allotment Land in current OPA boundary	**9.8**		
Remaining Total SANG in Framework Masterplan*	**244.6**		**Increased SANG area by 61 to account for other SuDS & openspace in development parcels**
Total Urban Area in Framework Masterplan	**289.5**		**Reduced urban area by 61 to account for other SuDS & openspace in development parcels**
Total OP Framework Area Check	**756.1**		

***note leachate loads from woodland is calculated separately instead of SANG leachate rates.**

Sellindge WwTW

Combined Land Use and WwTW Discharges Loading

Otterpool Nitrogen Budget - V1.8 - Sellindge WwTW - Otterpool FMP.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Otterpool Park Garden Town - Masterplan Framework Only
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	
Total area of site	756.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area	350.5	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of designated Suitable Alternative Natural Space (SANG)/open space	183.60	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14
	0.00		

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA Land use is included).**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3456696	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	77775660	mg/TN/day	
TP discharged after WwTW treatment	933307.92	mg/TP/day	
Annual wastewater total nitrogen load	**28388.12**	kg/TN/yr	
Annual wastewater total phosphorous load	**340.66**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	350.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5012.15	kgN/yr	
Phosphorous load from future urban area	290.92	kgP/yr	
New SANG/open space	183.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	918	kgN/yr	
Phosphorous Load from SANG/open space	25.70	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6335.45**	kgN/yr	
Combined phosphorous load from future land uses	**320.06**	kgP/yr	

Disclaimer:

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	28388.1	340.7
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	6335.5	320.1

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	28388.1	340.7
Step 2 (Stage 3 - Stage 2)	-5237.7	123.8
Step 3 (Step 1 + Step 2)	23150.4	464.5
Step 4 (= Step 3, i.e. N/P budget without buffer)	23150.4	464.5
Step 5 (Step 4*20%)	4630.1	92.9
Step 6 (Step 4 + Step 5)	**27780.5**	**557.3**

Nitrogen/Phosphorous Budget with 20% buffer	**27780.5**	**557.3**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3166986	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	71257185	mg/TN/day	
TP discharged after WwTW treatment	855086.22	mg/TP/day	
Annual wastewater total nitrogen load	**26008.87**	kg/TN/yr	
Annual wastewater total phosphorous load	**312.11**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	Sellindge CSD9A & CSD9B Sites included separately based on available data .
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	350.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	5012.15	kgN/yr	
Phosphorous load from future urban area	290.92	kgP/yr	
New SANG/open space	183.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	918	kgN/yr	
Phosphorous Load from SANG/open space	25.70	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**6335.45**	kgN/yr	
Combined phosphorous load from future land uses	**320.06**	kgP/yr	

Disclaimer:

This nutrient budget is provided in good faith, populated using the best available science and expert option and adhering to the precautionary principle. Arcadis accept no responsibility from loss or damage however incurred as a direct or indirect result of acting upon this nitrogen budget and the figures contained herein.

Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	Hectares	Nitrate - Nitrogen (kg N/ha/yr)	Phosphorous (kg P/ha/yr)	Nitrate - nitrogen (kg N/yr)	Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	26008.9	312.1
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	6335.5	320.1

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	26008.9	312.1
Step 2 (Stage 3 - Stage 2)	-5237.7	123.8
Step 3 (Step 1 + Step 2)	20771.1	435.9
Step 4 (= Step 3, i.e. N/P budget without buffer)	20771.1	435.9
Step 5 (Step 4*20%)	4154.2	87.2
Step 6 (Step 4 + Step 5)	**24925.4**	**523.1**

Nitrogen/Phosphorous Budget with 20% buffer	**24925.4**	**523.1**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Southern Water - Sellindge WwTW	27780	557	24925	523

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Southern Water - Sellindge WwTW	29.9	46.4	26.8	43.6

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	350.5
Total Landscape open space in Framework Masterplan	275.2
Exisiting community in framework masterplan area	71
Retained farmland in framework masterplan area	49.4
Existing Road	10
Total OP Framework Area	756.10

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
Sellindge CSD9A					
Sellindge CSD9B					
CSD9A & 9B TOTAL	0	0.00	0		0

* Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha
Excluded Retained Existing Land		
Existing community in framework masterplan area	*71.0*	
Retained farmland in framework masterplan area	*49.4*	
Existing Roads	*10.0*	
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*
Excluded Mitigation Land From SANG		
Wetlands	*30*	*65*
*Woodland **	*35*	
Community Farm/Allotment Land in current OPA boundary	**9.8**	
Remaining Total SANG in Framework Masterplan*	**183.6**	
Total Urban Area in Framework Masterplan	**350.5**	
Total OP Framework Area Check	**756.1**	

*note leachate loads from woodland is calculated separately instead of SANG leachate rates.

Sellindge WwTW

Combined Land Use and WwTW Discharges Loading

Otterpool Nitrogen Budget - V1.8 - Sellindge WwTW -Otterpool FMP - Sensitivity Test.xlsx

1. Input Data

Indicative nitrogen budget for new development - Scoping data

Client name	Folkstone and Hythe DC
Development name	Otterpool Park Garden Town - Masterplan Framework Only
Development location (grid reference)	TR112 365 https://gridreferencefinder.com/
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

	Figures	Units	Data source	Guidance
Sewage treatment works that development drains to (if known)	Sellindge sewage works		Southern Water	
Total Nitrogen existing consent for this treatment works, if any, (if Known)	N/A	mg/l		
Total Phosphorous existing consent for this treatment works, if any, (if Known)	N/A	mg/l	Southern Water - annual mean currently consented Total **Phosphorous** value is 1 mg/l	
Total Nitrogen proposed consent for this treatment works, if any, (if Known)	N/A	mg/l	Not available at present from the Environment Agency	
Total Phosphorous proposed consent for this treatment works, if any, (if Know	0.3	mg/l	Environment Agency - this is indicative annual mean Total Phosphorous value for the proposed consent to accommodate Otterpool	
Total area of site	756.1	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
New Urban Area	289.5	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of designated Suitable Alternative Natural Space (SANG)/open space	244.60	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Area of Community Farm/Allotments	9.8	hectares	See Proposed Land Use Tab	Otterpool Park FMP Only
Current land use	A mixture of arable land, improved grassland & species poor semi-improved grassland (see the breakdown in Table 1 below		Based on the habitat survey info presented in the previous OP Outline Planning Application in 2019, consultations with FHDC & Land Agents etc. See Existing Land Type Tab	
nitrate loss from current site land use	**See Table 1 below**	kgN/ha/yr		

Table 1A - Existing Land Types and Nutrient Loss Rates (Otterpool Framework Masterplan)

		Average Nutrient Loss Rate		
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	
Cereals	324.9	27.3	0.36	
Lowland Grazing Livestock	119.1	12.2	0.24	
Racetrack	13.5	13.3	0.5	Average of urban & lowland grazing livestock loss rates used.
Hay Cut	18.9	5	0.14	
Other Grassland/Greenfield	101.1	5	0.14	
Mixed area - Urban	11.5	14.3	0.83	
Mixed area - Greenfield	4.5	5	0.14	
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	
	613.4			

See 'Existing Land Type Overview' tab for further detail .

	Hectares
Remaining existing area within Otterpool Framework boundary excluded from the NN Assessment (i.e. 71 ha existing community, 54.9 ha retained farmland & 16.8 ha retained buildings/waterbodies/woodland/ hedgerows/ other ecological features)	142.7

Table 1B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**
CSD9B (Cereals)		27.3	0.36
CSD9B (Urban)		14.3	0.83
CSD9B (Other Grassland/greenfield)		5	0.14
CSD9A (Urban)		14.3	0.83
CSD9A (Other Grassland/greenfield)		5	0.14
	0.00		

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA Land use is included).**

2. Otterpool FM@110(S1)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Otterpool Park Garden Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	**Figures**	**Units/ Data source**	**Further information**
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	350	l/p/d British Water recommendation - for residential Class C2	No allowance included for Otterpool water efficiency measures
	300	l/p/d British Water recommendation - for Hotel Class C1	No allowance include for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3456696	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	77775660	mg/TN/day	
TP discharged after WwTW treatment	933307.92	mg/TP/day	
Annual wastewater total nitrogen load	**28388.12**	kg/TN/yr	
Annual wastewater total phosphorous load	**340.66**	kg/TP/yr	

Stage 2	**Figures**	**Units/ Data source**	**Further information**
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	**Figures**	**units/ Data source**	**Further information**
New urban area	289.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4139.85	kgN/yr	
Phosphorous load from future urban area	240.29	kgP/yr	
New SANG/open space	244.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1223	kgN/yr	
Phosphorous Load from SANG/open space	34.24	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**5768.15**	kgN/yr	
Combined phosphorous load from future land uses	**277.97**	kgP/yr	

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	**Nitrate - nitrogen (kg N/yr)**	**Phosphorous (kg P/yr)**
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

		Average Nutrient Loss Rate		Estimated Nutrient loss	
Land Type	**Hectares**	**Nitrate - Nitrogen (kg N/ha/yr)**	**Phosphorous (kg P/ha/yr)**	**Nitrate - nitrogen (kg N/yr)**	**Phosphorous (kg P/yr)**
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	**TP (kgP/yr)**
Stage 1 - WwTW load	28388.1	340.7
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	5768.2	278.0

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	**TP (kgP/yr)**
Step 1 (Stage 1)	28388.1	340.7
Step 2 (Stage 3 - Stage 2)	-5805.0	81.7
Step 3 (Step 1 + Step 2)	22583.1	422.4
Step 4 (= Step 3, i.e. N/P budget without buffer)	22583.1	422.4
Step 5 (Step 4*20%)	4516.6	84.5
Step 6 (Step 4 + Step 5)	**27099.7**	**506.8**

Nitrogen/Phosphorous Budget with 20% buffer	**27099.7**	**506.8**

3. Otterpool FM@110(S2)

New development nitrogen budget

Client	Folkstone and Hythe DC
Development	Town - Masterplan Framework Only
Number of residential dwellings (Class C3)	8704
Number of residential dwellings (Class C2)	1296
Hotel Bedrooms (Class C1)	117
Local Planning Authority	Folkstone and Hythe DC

Stage 1	Figures	Units/ Data source	Further information
Step 1 calculate additional population			
Occupancy rate	2.4	Natural England recommendation	
Step 2 confirm water use (litres per person)	110	l/p/d Natural England recommendation - for resinential Class C1	
	262.5	l/p/d British Water recommendation - for residential Class C2 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
	225	l/p/d British Water recommendation - for Hotel Class C1 (adjusted to 75%)	75% of the BW value assumed to account for Otterpool water efficiency measures
Step 3 confirm Waste water Treatment Works (WwTW)	**Sellindge WwTW**	Southern Water	
and permitted TN concentration	N/A	mg/l Southern Water	N/A, Subject to review in 2022.
Permitted Total Phosphate concentration	1	mg/l Southern Water	Current Sellndge Permit TP.
Proposed permitted Total Nitrogen concentration to accommodate Otterpool	25	mg/l Southern Water/NE	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Proposed permitted Total Phosphate concentration to accommodate Otterpool	0.3	mg/l Environment Agency	Proposed TP at Sellindge permit.
Step 4 calculate Total Nitrogen (TN) in kg per annum that would exit the WwTW after treatment			
Additional population (Residential Class C3)	20889.6	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Residential Class C2)	3110.4	Persons	Assumed 2.4 Occupancy Rate/per dwelling
Additional population (Hotel Class C1)	234	Persons	Assumed 2.0 Occupancy Rate/per room
Wastewater volume generated by development	3166986	litres/day	
Receiving WwTW environmental permit for TN	25	mg/l TN	N/A, Subject to review in 2022. The currently proposed design at Sellindge expect to achieve TN value of 25 mg/l as per SW advice received. However, a use of MBR could potentially further lower this TN figure if required.
Receiving WwTW environmental permit for TP	0.3	mg/l TP	Used proposed EA TP permit level for Sellindge WwTW upgrade.
90% of the proposed consent TN limit	22.5	mg/l TN	Applied 90% correction as a precautionary basis.
90% of the proposed consent TP limit	0.27	mg/l TP	
TN discharged after WwTW treatment	71257185	mg/TN/day	
TP discharged after WwTW treatment	855086.22	mg/TP/day	
Annual wastewater total nitrogen load	**26008.87**	kg/TN/yr	
Annual wastewater total phosphorous load	**312.11**	kg/TP/yr	

Stage 2	Figures	Units/ Data source	Further information
Current land use	A mixture of arable land (i.e. Cereals/Lowland Grazing Livestock), Hay Cut, Mixed and Other Grassland (see the breakdown in Table 2 below and 'Land Type Overview' Tab) - this largely based on the habitat survey info presented in the previous OP Outline Planning Application in 2019.	Ecology Survey report reference/remote imagery	
Total area of existing 'agricultural' and other land	613.4	hectares	See Table 2A/2B & Input Data Tab
Nitrate loss from current site land use	See Table 2A/2B	kgN/ha/yr	
Phosphate loss from current site land use	See Table 2A/2B	knP/ha/yr	
Total nitrate loss from current land use	**11573.19**	kgN/yr	See Table 2A/2B
Total Phosphate loss from current land use	**196.26**	kgP/yr	See Table 2A/2B

Stage 3	Figures	units/ Data source	Further information
New urban area	289.5	hectares/site layout	See Proposed Land Use Tab
Urban area nitrogen load	14.3	kgN/ha/yr	
Urban area phosphate load	0.83	kgP/ha/yr	
Nitrogen load from future urban area	4139.85	kgN/yr	
Phosphorous load from future urban area	240.29	kgP/yr	
New SANG/open space	244.6	ha	Excluded proposed mitigation areas (i.e. Wetland & Woodland areas). See Input Data Tab and Proposed Land Use Tab for details.
SANG/open space nitrogen load	5	kgN/ha/yr	
SANG/open space phosphorous load	0.14	kgP/ha/yr	
Nitrogen Load from SANG/open space	1223	kgN/yr	
Phosphorous Load from SANG/open space	34.24	kgP/yr	
New Community Farm/Allotments area	9.8	ha	See Input Data Tab and Proposed Land Use Tab for details.
New Community Farm/Allotments nitrogen load	23.5	kgN/ha/yr	
New Community Farm/Allotments phosphorous load	0.28	kgP/ha/yr	
Nitrogen Load from Community Farm/Allotments	230.30	kgN/yr	
Phosphorous Load from New Community Farm/Allotments	2.74	kgP/yr	
New Woodland	35	ha	See Proposed Land Use Tab
New Woodland Area nitrogen load	5	kgN/ha/yr	
New Woodland Area phosphorous load	0.02	kgP/ha/yr	
Nitrogen Load from New Woodland	175	kgN/yr	
Phosphorous Load from New Woodland	0.70	kgP/yr	
Combined nitrogen load from future land uses	**5768.15**	kgN/yr	
Combined phosphorous load from future land uses	**277.97**	kgP/yr	

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Table 2A - Existing Land Types and Nutrient Loss Rates (Otterpool Masterplan Framework)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
Cereals	324.9	27.3	0.36	8869.77	116.96
Lowland Grazing Livestock	119.1	12.2	0.24	1453.02	28.58
Racetrack	13.5	13.25	0.535	178.88	7.22
Hay Cut	18.9	5	0.14	94.50	2.65
Other Grassland/Greenfield	101.1	5	0.14	505.50	14.15
Mixed area - Urban	11.5	14.3	0.83	164.45	9.55
Mixed area - Greenfield	4.5	5	0.14	22.50	0.63
Remaining Urban Area in Framework Masterplan, CSD9A & CSD9B	19.9	14.3	0.83	284.57	16.52
	613.4			**11573.19**	**196.26**

Table 2B - Existing Land Types and Nutrient Loss Rates (CSD9A & CSD9B)

Land Type	Hectares	Average Nutrient Loss Rate: Nitrate - Nitrogen (kg N/ha/yr)	Average Nutrient Loss Rate: Phosphorous (kg P/ha/yr)	Estimated Nutrient loss: Nitrate - nitrogen (kg N/yr)	Estimated Nutrient loss: Phosphorous (kg P/yr)
CSD9B (Cereals)	0	27.3	0.36	0.00	0.00
CSD9B (Urban)	0	14.3	0.83	0.00	0.00
CSD9B (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
CSD9A (Urban)	0	14.3	0.83	0.00	0.00
CSD9A (Other Grassland/greenfield)	0	5	0.14	0.00	0.00
	0.0			**0.00**	**0.00**

*** Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).**

Stage 1 to Stage 3 Nutrient Loading Calcs Summary

	TN (kgN/yr)	TP (kgP/yr)
Stage 1 - WwTW load	26008.9	312.1
Stage 2 - existing agriculture landuse load	11573.2	196.3
Stage 3 - proposed development landuse load	5768.2	278.0

Stage 4 - Net Change in Nitrogen and Phosphorous Budget

	TN (kgN/yr)	TP (kgP/yr)
Step 1 (Stage 1)	26008.9	312.1
Step 2 (Stage 3 - Stage 2)	-5805.0	81.7
Step 3 (Step 1 + Step 2)	20203.8	393.8
Step 4 (= Step 3, i.e. N/P budget without buffer)	20203.8	393.8
Step 5 (Step 4*20%)	4040.8	78.8
Step 6 (Step 4 + Step 5)	**24244.6**	**472.6**
Nitrogen/Phosphorous Budget with 20% buffer	**24244.6**	**472.6**

4. Nutrient Mitig Rquir Summary

Nutrient Budget Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN (Kg/yr)	TP (Kg/yr)	TN (Kg/yr)	TP (Kg/yr)
Southern Water - Sellindge WwTW	27100	507	24245	473

Nutrient Mitigation - Wetland Area Requirement Summary

WwTW Option	PCC (Scenario 1)		PCC (Scenario 2)	
	TN Wetland Area (ha)	TP Wetland Area (ha)	TN Wetland Area (ha)	TP Wetland Area (ha)
Southern Water - Sellindge WwTW	29.1	42.2	26.1	39.4

Assumed Wetland TN removal rate	*93*	*g/m2/yr*	930	kg/ha/yr
Assumed Wetland TP removal rate	*1.2*	*g/m2/yr*	12	kg/ha/yr

PCC Scenario 1
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 350 l/p/d
Hotel (Class C1) = 300 l/p/d

PCC Scenario 2
Residential (Class C3) = 110 l/p/d
Residential (Class C2) = 262.5 l/p/d
Hotel (Class C1) = 225 l/p/d

7. Proposed Land Use

	Area (ha)
Total Urban in Framework Masterplan	350.5
Total Landscape open space in Framework Masterplan	275.2
Exisiting community in framework masterplan area	71
Retained farmland in framework masterplan area	49.4
Existing Road	10
Total OP Framework Area	756.10

	New Urban Area (ha)	New Open Space (ha)	Total Site Area (ha)	Impermeabilty (%)	Houses (No)
CSD9A & 9B TOTAL	0	0.00	0		0

* Note that Sellindge Sites are not applicapable for this calculation sheet purpose (i.e. only OFMA is included).

PROPOSED LAND USE AREA SUMMARY FOR NUTRIENT LOADING CALCS - OTTERPOOL FRAMEWORK MASTERPLAN

	Ha	Ha	
Excluded Retained Existing Land			
Existing community in framework masterplan area	*71.0*		
Retained farmland in framework masterplan area	*49.4*		
Existing Roads	*10.0*		
Existing vegetation/buildings/ waterbodies/ ecological features within the current OPA boundary	*16.8*	*147.2*	
Excluded Mitigation Land From SANG			
Wetlands	*30*	*65*	
*Woodland **	*35*		
Community Farm/Allotment Land in current OPA boundary	**9.8**		
Remaining Total SANG in Framework Masterplan*	**244.6**		**Increased SANG area by 61 to account for other SuDS and openspace in development parcels**
Total Urban Area in Framework Masterplan	**289.5**		**Reduced urban area by 61 to account for other SuDS & openspace in development parcels**
Total OP Framework Area Check	**756.1**		

*note leachate loads from woodland is calculated separately instead of SANG leachate rates.