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Havant Borough Council

Review of the Warblington Farm Mitigation Option for Nutrient Neutral Development in the Havant Borough

Report for Havant Borough Council

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1 Introduction

1.1 Background and Purpose of the Report

New housing growth in the Solent area is affected by the change in case law as a result in the Dutch Case[1]. This is due to concerns that likely significant effects (through the Habitats Regulations Assessment (HRA) process) will occur to the internationally designated sites[2] from increased or continued nutrient loading, arising from the additional wastewater generated by the new development.

Work is ongoing to establish the source-pathway-receptors, and likelihood of an adverse effect, due to housing development within the jurisdiction of Havant Borough Council (HBC) and the southern parishes of East Hampshire District Council (EHDC) which either drain to Budds Farm Wastewater Treatment Works (WwTW) in Langstone Harbour or to Thornham WwTW in Chichester Harbour. Both harbours are part of the Solent Maritime Special Area of Conservation (SAC), and the Chichester and Langstone Harbours Special Protection Area (SPA) and Ramsar site. The harbours also connect to the wider Solent coastal system with connectivity to Portsmouth Harbour SPA and Ramsar, and which is designated as part of the Solent and Dorset Coast SPA, and areas are part of the Solent and Southampton Water SPA and Ramsar.

Should adverse effects from new housing development projects be identified through the Appropriate Assessment stage of the HRA process (i.e. Stage 2), then mitigation to ensure no adverse effect on the integrity of the European site(s) in question will be required before planning permission can be granted. Havant BC has identified Warblington Farm as a potentially suitable mitigation option to be used by developers for offsetting increases in nitrogen loading from new housing development, by taking this area of land out of intensive agricultural use; an existing source of nitrogen to the system. Consideration is being given as to whether sufficient 'credits' are available to mitigate for new housing in the Havant Borough and southern parishes of East Hampshire.

This report therefore aims to summarise the pathways for impact from the new housing development and establish using information provided by Havant BC, whether Warblington Farm would provide effective and reliable mitigation for new development in Emsworth, and the wider Havant Borough and southern parishes of East Hampshire.

1.2 The Study Area

The study area comprises Chichester Harbour where Thornham WwTW discharges, which serves the area of Emsworth and Langstone Harbour which serves the remainder of Havant Borough and the southern parishes of East Hampshire which discharge to Budds Farm WwTW. Offshore areas within the Solent are considered due to offsite functional habitat usage, the long-sea outfall from Budds Farm WwTW and the cumulative impact of nutrient loading in the wider coastal system.

1.3 Report Structure

This report is divided into the following sections:

- Section 2: The HRA Process
- Section 3: The Water Environment in Chichester Harbour
- Section 4: The Water Environment in Langstone Harbour
- Section 5: Potential Effects to be Mitigated
- Section 6: Review of the Warblington Farm Mitigation Proposal

[1] Full reference is Cooperatie Mobilisation for the Environment UA and College van gedeputeerde staten van Noord-Brabant (Case C-293/17 and C294/17) available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:62017CA0293

[2] Special Areas of Conservation, Special Protection Areas and Ramsar sites, collectively referred to as European sites.

- Section 7: Conclusions and next steps.

Information on Budds Farm WwTW and Langstone Harbour is provided from the *Review of the Need for Nutrient Neutral Development in the Budds Farm Wastewater Treatment Works catchment June 2020,* as necessary (see report for full details and background).

2 The Habitats Regulations Assessment Process

All new developments within Havant BC and the southern parishes of East Hampshire will be required to complete a HRA Stage 1 Screening and Stage 2 Appropriate Assessment under the Conservation of Habitats and Species Regulations 2017 (amended) given the risk of increases in nutrient loading affecting the European designated sites of the Solent.

The Stage 1 Screening assessment is a relatively short exercise used to determine whether there is a 'possibility' or 'risk' of a significant effect, in the absence of any mitigation, that requires further consideration (with mitigation) through the Stage 2 Appropriate Assessment. The conservation objectives of the site, conservation status and site condition are used to inform this decision. High level conservation objectives are available for each designated site, along with Supplementary Advice to the Conservation Objectives (SACO) which provide details of attributes and targets that when met, ensure the habitat or species across the suite of European sites are in favourable condition. At a site level, the condition assessments for the underlying Site of Special Scientific Interest (SSSI) can be used to determine whether the habitats are in favourable condition.

Sections 3 of this report details the baseline water quality conditions of Chichester Harbour using relevant information from the Environment Agency's Nitrate Vulnerable Zone classification document and summarises how the Thornham WwTW operates and identifies potential pathways for impact that could lead to a Likely Significant Effect (LSE). Section 4 provides the same information for Budds Farm WwTW and the eutrophic harbours in the wider Solent which receive nitrogen inputs from Budds Farm WwTW via the Eastney LSO and dispersion through the East Solent.

The Stage 2 Appropriate Assessment's scope should be constrained to the potentially significant effects on the qualifying features likely to be affected. To determine this, the sources and pathways for increases in nutrients in the two harbours have been identified in Sections 3 and 4. Section 5 identifies the receptors of the impact, detailing the qualifying features likely to be sensitive to changes in nutrient levels, and whether these are present in Chichester Harbour and in proximity to the pathways for impact, and Section 6 the same for the Solent harbours.

When determining whether there will be an adverse effect to site integrity, guidance available on the HRA process states that

"….In order to avoid an adverse effect on integrity, the conservation status of a habitat must, if favourable, be preserved and, if unfavourable, must not be further harmed or rendered more difficult to restore to a favourable status."[3]

The duration of the effects must be considered (short, medium and long-term) as well as the reversibility.

Section 5 therefore also considers the condition of the designated sites to determine whether the increase or continued loading of nutrients into the Solent system would constitute an adverse effect on site integrity.

[3] Tylesdsley, D., and Chapman, C, (2013) The Habitats Regulations Assessment Handbook, (December 2019) edition UK: DTA Publications Limited.

3 The Water Environment in Chichester Harbour

3.1 Baseline Water Quality

3.1.1 Nitrogen Loading

The following section provides a brief overview of water quality in Chichester Harbour into which Thornham WwTW discharges, with a focus on concentrations of nitrogenous compounds. The data used for this baseline taken from a master's dissertation that utilised historic Environment Agency (EA) datasets,[4] the EA Open Data water quality dataset[5], data collected for Nitrate Vulnerable Zone designations[6] and WFD investigations[7].

Chichester Harbour has nutrient issues related to the spatial locations of freshwater inputs and balance between these inputs and nutrient inputs derived from coastal sources. The harbour comprised two separate waterbodies during WFD Cycle 1, with a small transitional waterbody area and large coastal waterbody area, and had these areas combined to be treated as one waterbody in WFD Cycle 2. The harbour is hypernutrified and nitrogen limited and thus nitrogen is the key nutrient of concern for the promotion of inhibition of macroalgal growth. The harbour has also shown consistent failures of WFD standards for dissolved inorganic nitrogen (DIN) and macroalgae, being classed as Moderate since the first classifications in 2009. The nitrogen limitation seen means failure of the WFD DIN standard is likely linked to the high macroalgal growth that causes failure of the WFD macroalgae standard. This macroalgal growth is in turn sufficient to cause ecological impacts. There is a strong spatial component to the macroalgal growth problems in Chichester Harbour, with problem growth of macroalgae seen primarily in the intertidal zone. This issue is most pronounced in the transitional waterbody areas, where a combination of diffuse riverine and sewage treatment works (STW) sources of DIN tend to result in these small areas of the harbour having higher average DIN concentrations and greater macroalgal biomass. However, these freshwater inputs of DIN still comprise a minority of the DIN loading to the combined waterbodies.

For Chichester Harbour, <20% of nitrogen loading is derived from freshwater (riverine, STW or urban diffuse) sources and only 3% of nitrogen inputs come from Thornham WwTW (**Table 3.1**). The vast majority of nitrogen loading is from the offshore marine environment and within this marine load, only 8% is derived from other rivers/indirect STW inputs (**Table 3.1**). On review of the different information available which assigns a proportion of the nitrogen load to each STW, the Environment Agency dataset provided to Havant BC and NVZ datasheets would suggest no significant contribution from Budds Farm WwTW to Chichester Harbour. However, a review of the EA's Telemac modelling (summary only) shows that Budds Farm WwTW contributes approximately 1% of the nitrogen source at the harbour entrance. The CPM modelling then looks at the relative contribution of the nitrogen sources to algal growth. Within Chichester Harbour (total) 83% of nitrogen comes from offshore marine sources therefore the percentage of nitrogen in Chichester Harbour from Budds Farm WwTW contributing to algal growth is less than 1%.

As a consequence of the low proportion of nitrogen loading from STWs to the harbour, cost-benefit analysis for measures to tackle WFD failures for DIN and macroalgae has suggested that the significant costs of moving STW outfalls offshore would be matched by an appropriate reduction in nutrient loading from freshwater sources. Instead, catchment measures to tackle diffuse pollution and the eventual

[4] Glover, G. 2018. Comparative analysis of nitrate levels as an indicator of water quality, in relation to the spatial variation of sources between Langstone, Portsmouth and Chichester harbour

[5] See: https://environment.data.gov.uk/water-quality/view/landing

[6] Environment Agency. 2016. Datasheet: Nitrate vulnerable zone (NVZ) designation 2017 – Eutrophic Waters (Estuaries and Coastal Waters)

[7] Udal, I., Rees-Jones, S., Robinson, K. 2014. Chichester Harbour Water Framework Directive DIN and Ecological Impact Investigations. Environment Agency.

decrease in nitrogen loading from groundwater once groundwater nitrogen peak have been suggested as key to tackling the nutrient loading problems seen in Chichester and Portsmouth Harbours.

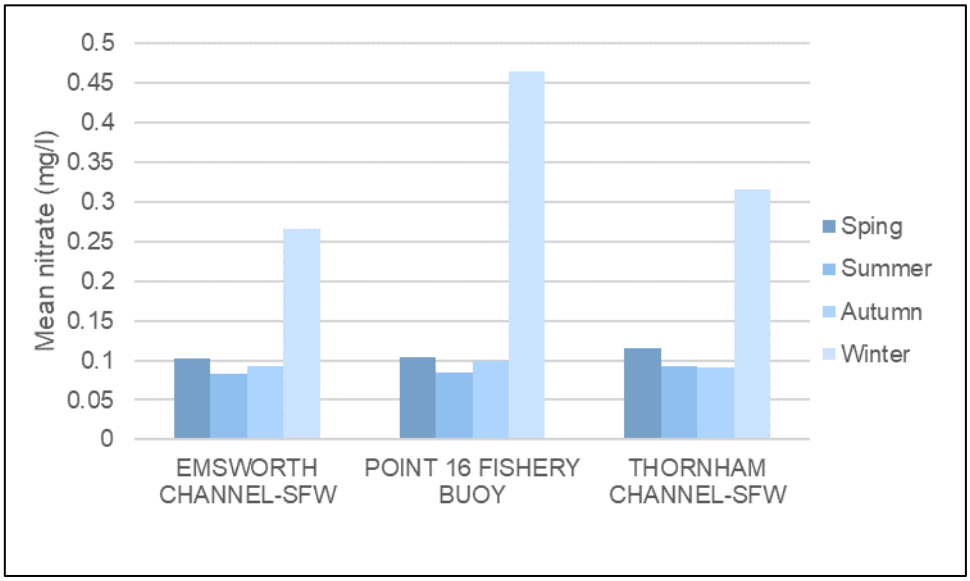
Table 3.1: Source apportionment of nitrogen loads to Chichester Harbour[8]

Nitrogen source	Chichester Harbour
Freshwater	**17%**
Riverine	11%
STW (direct)	6%
Urban diffuse	0%
Marine	**83%**
Coastal background	54%
Indirect riverine	21%
Other rivers/indirect STW	8%

3.1.2 Spatial and Temporal Patterns in Nitrogen Concentrations in Chichester Harbour

Figure 3.11 represents seasonal change in average nitrate concentrations at three sampling locations in Chichester Harbour. The Western arm of the harbour drains from Emsworth Channel-SFW, Thornham Channel-SFW is at the confluence of all remaining channels to the East of the harbour and Point 16 Fishery Buoy is situated at the mouth of the harbour, representing nitrate concentrations that combine water from the harbour's Western and Eastern arms as well as the largest contribution of the coastal background due to tidal exchange. These sites thus provide an overview of nitrate concentrations for the harbour's main sources of nitrate. At all sites, nitrate concentrations are considerably higher in the winter months, with Point 16 Fishery Buoy showing the greatest winter nitrate concentration that is more than four times higher than in other seasons. Minimum nitrate concentrations occur in summer or autumn, with all sites having average nitrate concentrations <0.1 mg/l in these seasons.

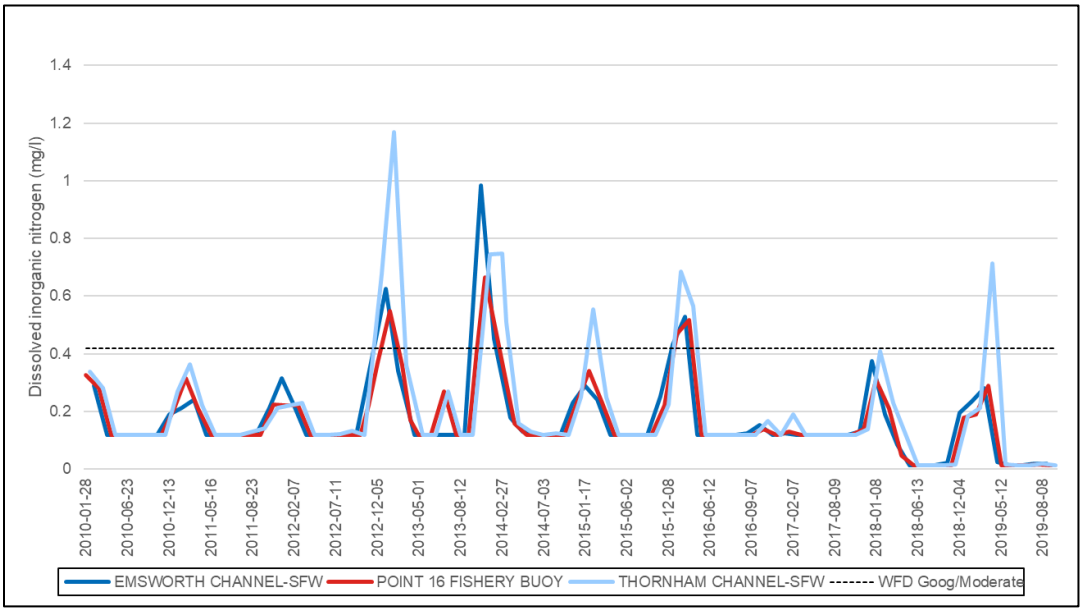
Figure 3.1: Seasonal variation in nitrate concentrations at selected locations in Chichester Harbour (see text above for reasoning behind site choices).



[8] Note the STW (direct) refers to discharge of treated effluent directly into a harbour, as opposed to via an LSO, e.g. Budds Farm STW. Taken from the Environment Agency's WFD DIN and Ecological Impact Investigation reports (2014).

Figure 3.22 shows that seasonality in total dissolved inorganic nitrogen (DIN) matches that of nitrate, with winter spikes observed at the Emsworth Channel, Thornham Channel and Point 16 Fishery Buoy sites. Since 2010, five exceedances of the WFD good-moderate boundary for DIN were observed, with all of these exceedances occurring in winter. For three of these exceedances, all sites measured DIN concentrations > the 0.42 mg/l threshold, whereas on two occasions only Thornham Channel exceeded this threshold in winter. The highest DIN concentrations in a given year were also usually observed at Thornham Channel. In 2018 the limit of detection (LOD) for DIN changed from 0.12 mg/l to 0.014 mg/l which more accurately displays summer results.

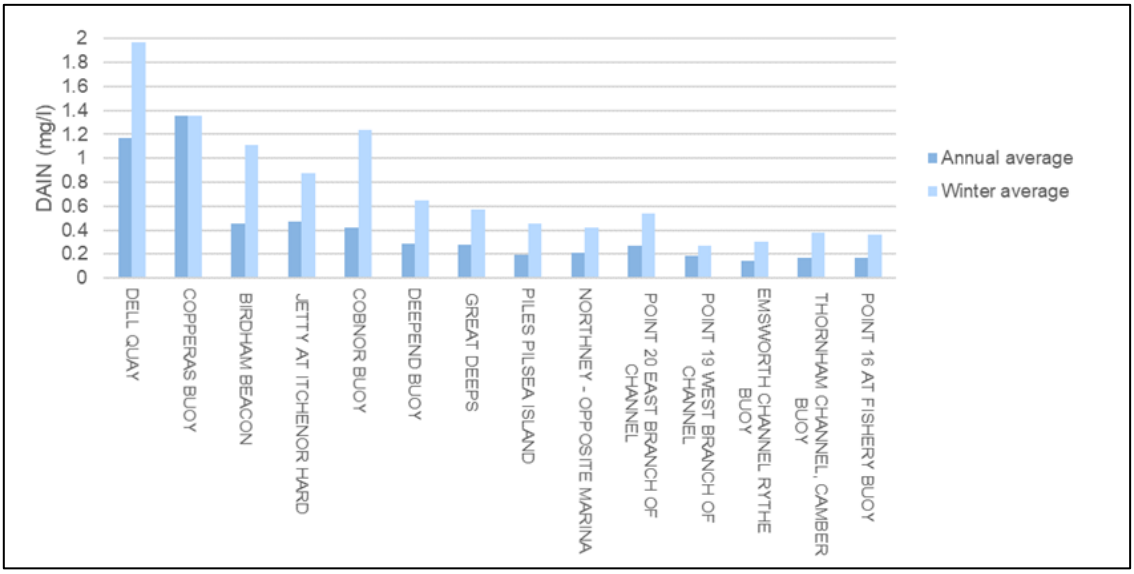
Figure 3.2: Seasonal variation in total dissolved inorganic nitrogen concentrations at EA Open WIMS sampling points in Chichester Harbour. The dashed line shows the WFD good–moderate status boundary for transitional waterbodies.



Annual and winter dissolved available inorganic nitrogen (DAIN) concentrations have a distinct spatial patterning, shown in **Figure 3.3**. The highest concentrations are seen in harbour's eastern-most arm that drains the River Lavant, with a strong gradient of decreasing concentrations in a seaward direction along this arm. In general sites that closer to land show higher concentrations than sites towards the centre of the harbour and the harbour mouth. Amongst the sites closer to land, there is also a broad east to west gradient in decreasing DAIN concentrations. This spatial pattern is a result of a salinity gradient whereby nutrient enriched inland surface waters become increasingly diluted as the reach the saline harbour mouth.[9] The DAIN concentrations at Great Deep the outfall for Thornham WwTW are around the middle of sites. There is evidence that DAIN levels have fallen from Thornham, Chichester and Bosham STW discharges following the 2008 improvements to nitrogen stripping though DAIN from freshwater sources into the harbour has not changed since the 1990's.

[9] Environment Agency. 2016. Datasheet: Nitrate vulnerable zone (NVZ) designation 2017 – Eutrophic Waters (Estuaries and Coastal Waters)

Figure 3.3: Annual and Winter dissolved available inorganic nitrogen at sites across Chichester Harbour



In terms of macroalgae, Chichester Harbour received a Moderate classification under the WFD system. There has been some recent improvement in macroalgal cover although further monitoring is needed to determine whether this improvent is part of long term trend or from interanual variability. The harbour sees substantial summer algal blooms of up to 15.5%-44% cover of interdidal area. In some locations macroalgae survive throughout winter months and exceedances of 600 g/m^2 occuring which suggests that Chichester Harbour has a problem of eutrophication.

In summary, the biological evidence clearly indicates that macroalgae is still a problem in Chichester Harbour based on the combination of percentage cover, biomass, the presence of entrained algae and because macroalgae persists through the winter.

3.2 How Thornham Wastewater Treatment Works (WwTW) Operates

Thornham WwTW is located to the north of Thorney Island in the middle of Chichester Harbour and discharges into the harbour via the Little Deep, with no Long Sea Outfall (LSO). Thornham WwTW serves the area of Emsworth within Havant Borough Council's jurisdiction and the areas of Southbourne and Hambrook / Nutbourne in Chichester District Council's jurisdiction.

There are five intermittent discharges into the Chichester and Langstone Harbour system, all of which are CSOs[10]. Discharging directly into Chichester Harbour around Thorney Island are the Kings Road CSO and Fishery Lane CSO, however there is insufficient information publicly available about Thornham WwTW to confirm if these are connected to this system. Following the Environment Agency's Review of Consent process, the discharge permit was reduced to 10 mg/l of nitrate[11]. The water quality assessment completed by Amec Foster Wheeler on behalf of Chichester District Council concluded that Thornham WwTW was reaching its volumetric capacity and would therefore need to be upgraded and an increase in the Dry Weather Flow (DWF) permit sought to support future housing growth (both Havant and Chichester area). Frequent storm tank overflows were recorded between 2016 and 2017, and the sewer network has limited capacity with a moderate risk of sewer capacity constraints identified for Thornham[11].

[10] Environment Agency Review of Consents Appropriate Assessment Chichester and Langstone Harbour SPA. Part B1 Water Quality Functional Assessment.

[11] Chichester District Council (August 2018) Chichester District Council Water Quality Assessment. Prepared by Amec Foster Wheeler. Accessed at http://www.chichester.gov.uk/CHttpHandler.ashx?id=30900.

4 The Water Environment in Langstone Harbour

4.1 Baseline Water Quality

4.1.1 Nitrogen Loading

The following section provides a brief overview of water quality in Langstone Harbour, with a focus on concentrations of nitrogenous compounds. The data used for this baseline was taken from a master's dissertation research that utilised historic EA datasets,[12] the EA Open Data water quality dataset[13] and data collected for Nitrate Vulnerable Zone designations[14] and WFD investigations[15].

Source apportionment data for Langstone Harbour shows a considerably larger proportion of nitrogen inputs to this harbour are derived from freshwater sources, though since the Budds Farm STW discharge was relocated to the Eastney LSO, freshwater inputs of DIN to Langstone Harbour from STWs are ostensibly 0% (**Table 4.1**). However, a closer analysis of nitrogen concentrations and macroalgal cover in the area around consented outfalls for Budds Farm that operate when the Eastney LSO cannot cope with discharge rates due to storm events suggests some STW contribution to nitrogen loading in Langstone Harbour (see below). Assuming there is some contribution from sporadic discharges from Budds Farm directly to Langstone Harbour, they are not sufficient cause failure of WFD standards for DIN and macroalgae, which were both classified as Good status in 2015, though it is noted that DIN has fluctuated between Good and Moderate status between 2009-2015. Of the freshwater nitrogen load to Langstone Harbour, the majority is derived from diffuse pollution of river flows from agriculture, with a significant groundwater contribution also noted. It has been suggested that water quality and associated eutrophication and macroalgal problems in Langstone Harbour are slowly recovering after the relocation of the main Budds Farm discharge to the Eastney LSO and in response to catchment measures to reduce diffuse pollution, though more long-term monitoring is required to confirm this. As with Chichester Harbour, the majority of nitrogen loading to Langstone Harbour is from marine sources, with the coastal background again predominant and indirect STW inputs causing a minority of the marine load (**Table 4.1**). The Telemac modelling (detailed via EA correspondence) shows that Budds Farm WwTW (via the long sea outfall) contributes 0.78% of the total sources from the Solent, at Langstone Harbour entrance; Thornham WwTW is not identified as a source. The Langstone Harbour CPM model shows that 64% of the nitrogen into Langstone Harbour comes from outside the harbour, through the entrance/mouth. Therefore, the percentage of nitrogen from Budds Farm LSO contributing to algal growth within Langstone Harbour is 0.50%.

Table 4.1: Source apportionment of nitrogen loads to Langstone Harbour[16]

Nitrogen source	Langstone Harbour
Freshwater	**36%**
Riverine	28%
STW	0%
Urban diffuse	8%
Marine	**64%**
Coastal background	40%
Indirect riverine	19%
Indirect STW	5%

[12] Glover, G. 2018. Comparative analysis of nitrate levels as an indicator of water quality, in relation to the spatial variation of sources between Langstone, Portsmouth and Chichester harbour

[13] See: https://environment.data.gov.uk/water-quality/view/landing

[14] Environment Agency. 2016. Datasheet: Nitrate vulnerable zone (NVZ) designation 2017 – Eutrophic Waters (Estuaries and Coastal Waters)

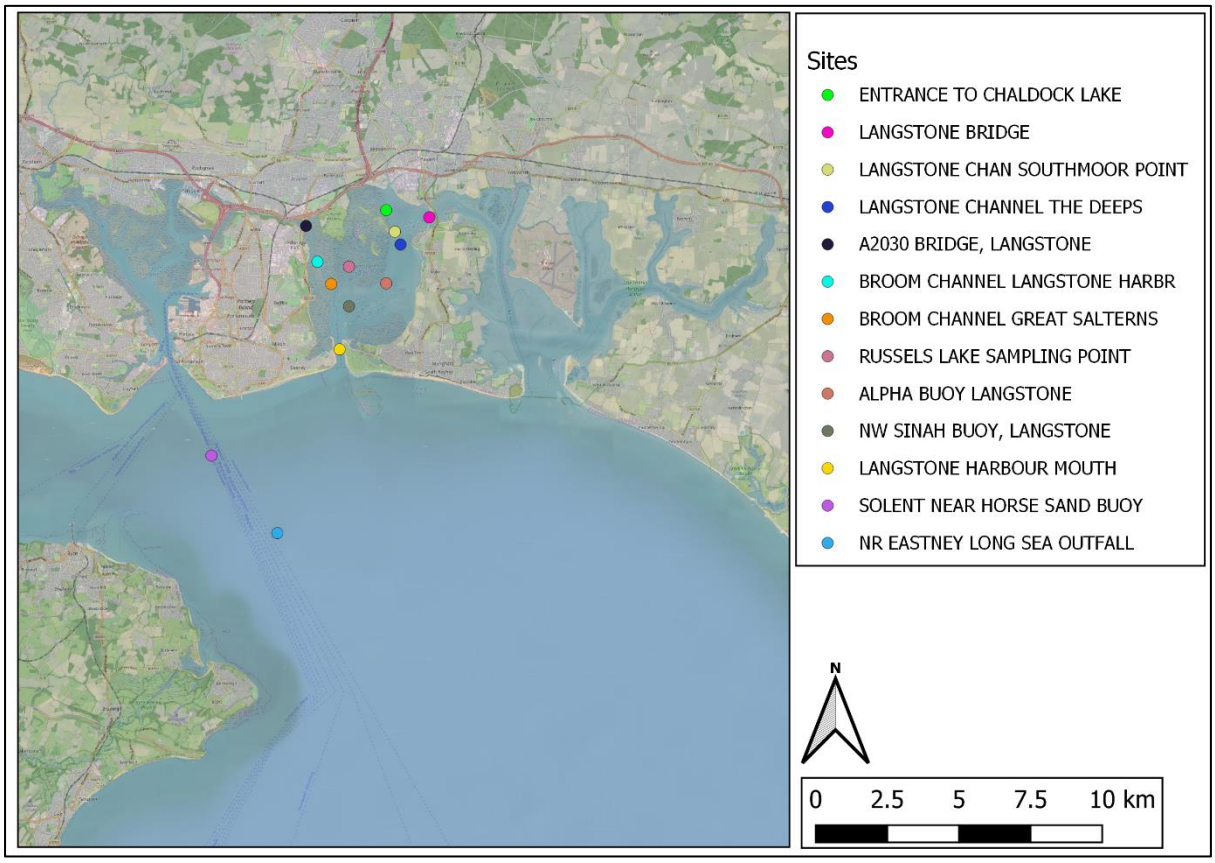
[15] Rees-Jones, S., Robinson, K., Udal, I. 2014. Langstone Harbour Water Framework Directive DIN and Ecological Impact Investigations. Environment Agency.

[16] Note the STW (direct) refers to discharge of treated effluent directly into a harbour, as opposed to via an LSO, e.g. Budds Farm STW. Taken from the Environment Agency's WFD DIN and Ecological Impact Investigations report (2015).

4.1.2 Spatial and Temporal Patterns in Nitrogen Concentrations in Langstone Harbour

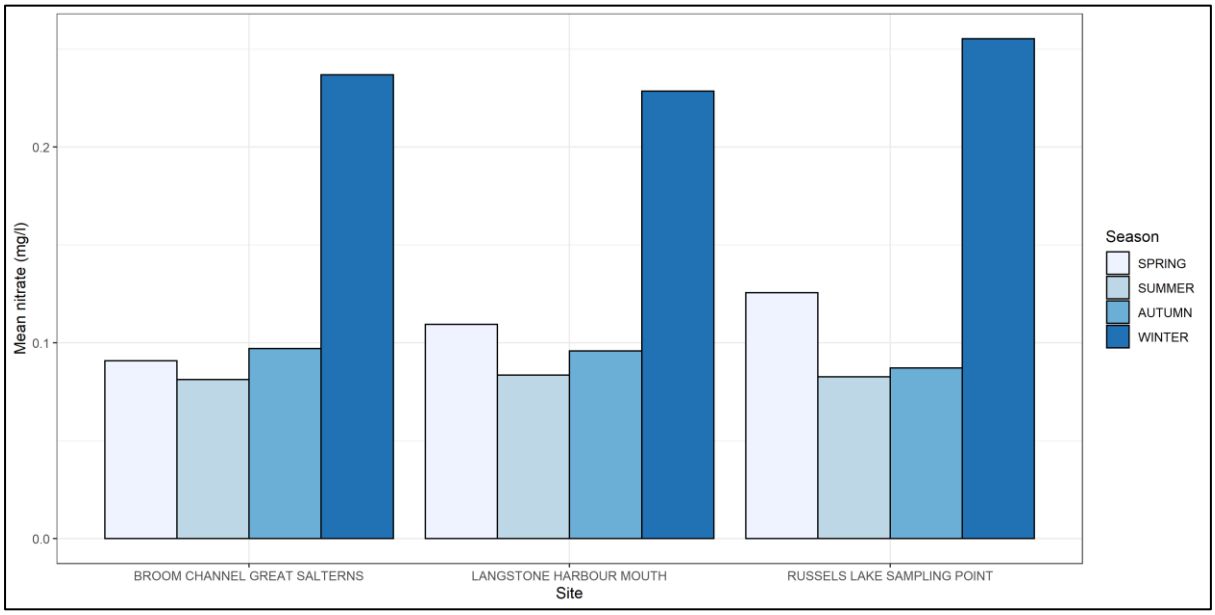
The following analysis shows temporal fluctuations in nitrogen concentrations at sampling locations around Langstone Harbour, with the locations of sampling points shown in **Figure 4.1**.

Figure 4.1: Environment Agency sampling locations in Langstone Harbour and the Solent



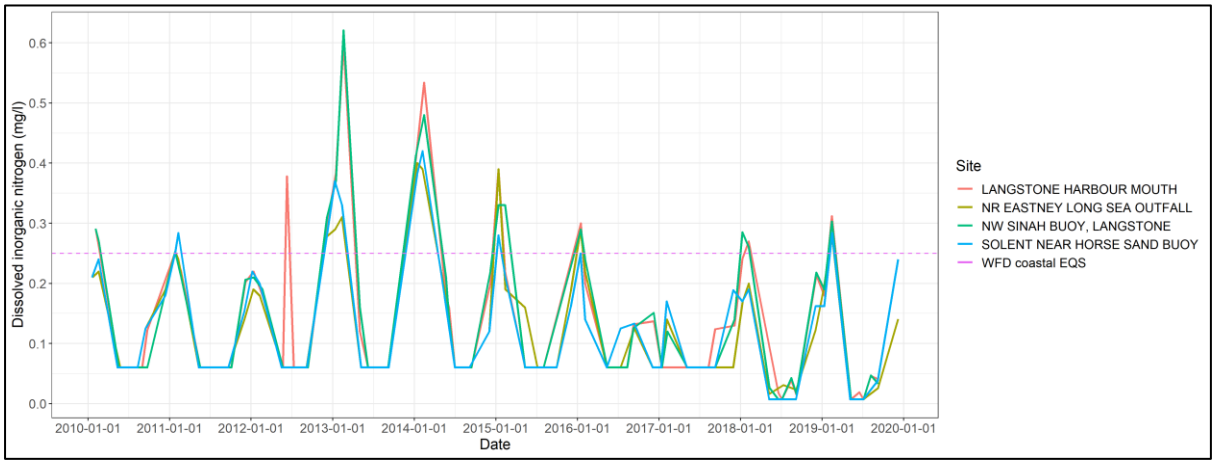
Error! Reference source not found. shows average seasonal nitrate concentrations for sites in L angstone Harbour representing a site towards the middle of the harbour (Russel's Lake), a site closer to the western edge of the harbour (Broom Channel) and a site at the harbour mouth (Langstone Harbour Mouth). All sites show considerably higher winter average nitrate concentrations, which feed into the greater average spring nitrate concentrations seen at Langstone Harbour Mouth and Russell's Lake. A closer analysis[4] of seasonal variation in nitrate concentrations at 11 sites distributed across Langstone Harbour showed that nitrate concentrations peak at all sites in winter.

Figure 4.2: Seasonal average nitrate concentrations at sites in selected sites in Langstone Harbour



Seasonal patterns in nitrate concentrations (Error! Reference source not found.) are also seen in t emporal variations in total DIN, with winter peaks observed at four sites for which data are available in the EA Open WIMS dataset (Error! Reference source not found.). It is worth noting that DIN c onentrations at the “Nr Eastney Long Sea Outfall” site are generally lower than those observed at sites within or at the mouth of Langstone Harbour. DIN concentrations at the “Nr Eastney Long Sea Outfall” are also very similar to those observed at the “Solent Near Horse Sand Buoy” site that is located 3.8 km away, suggesting that the coastal background DIN concentrations in the Solent are the main driver of fluctuations in nitrogen levels in the Solent. All sites shown in Error! Reference source not found. h ave average salinities of 34 ppt and thus are assessed against the WFD Coastal DIN standard. Over the past 10 years, sites within the harbour (“NW Sinah Buoy, Langstone”) and at the harbour mouth (“Langstone Harbour Mouth”) have breached the WFD Good – Moderate status boundary eight times, with the sites in the Solent breaching the Good – Moderate status boundary seven times. Breaches tend to occur concurrently at all sites during the winter months, likely due to increased seasonal rainfall.

Figure 4.3: Seasonal variation in total dissolved nitrogen concentrations at EA Open WIMS sampling points in Langstone Harbour. All sites have average salinities of 34 ppt and thus the dashed line shows the WFD good – moderate status boundary for coastal waterbodies



Assessment of dissolved available inorganic nitrogen (DAIN) for the purposes of NVZ designation[6] provides further evidence from sites across Langstone Harbour that ntirogen levels in the harbour peak in winter (Error! Reference source not found.). Within the harbour, there is distinct spatial variation in t he location of sites that show DAIN conentrations that exceed the WFD good – moderate status boundary for transitional waterbodies (0.42 mg/l DIN). The only sites exceeding this threshold are found in a cluster towards the north-east of Langstone Harbour and in close proximity to the Budds Farm outfall. Salinity for these sites is not available but as they are found at the landward end of the harbour, it is assumed that they would be classed as transitional waterbodies. Any available water quality monitoring data at the CSOs by Southern Water should be obtained for further analysis as part of the wider PfSH Water Quality Group study.

4.2 How Budds Farm Wastewater Treatment Works (WwTW) Operates

The following section provides a brief overview of information made available on Budds Farm WwWT by Southern Water. The information used was taken from Southern Water's Management of Wastewater in Portsmouth and Havant case study, the article on the improvements at the works taken from the Wastewater and Sewerage report (article by Andrew Collett), a presentation on bathing water quality given by Southern Water to Havant BC in November 2018, and correspondence between Southern Water and Havant BC relating to the nutrient neutrality issue (December 2019 and March 2020).

Budds Farm WwTW serves a catchment of nearly 410,000 homes across Portsmouth, Hayling Island, Cosham, Paulsgrove, Waterlooville, Horndean and Hambledon.[17] In storm conditions it can treat up to 200 Ml/d of waste water. Flows to Budds Farm from Portsmouth are pumped under Langstone Harbour from Eastney Pumping Station. Following treatment, treated wastewater from all developments in the Budds Farm catchment is pumped back via Eastney Pumping Stations and discharged at Eastney long sea outfall (LSO), 5.7 km offshore in the Solent (**Figure** 4.4**4.4**).

Effluent at Budds Farm is treated using the Bardenpho processes for biological nutrient removal, which was incorporated into the wastewater treatment process in 2007[17]. Previously, treatment used an activated sludge process (ASP), with 8 lanes flowing through an anoxic and aerated zone before effluent entered the final sedimentation tanks. The ASP was modified and expanded to increase total nitrogen removal, with an additional ASP tank added and the Bardenpho method chosen for further nitrogen stripping. Modification of the ASP tanks was needed to incorporate the Bardenpho method, with these additional processes aiming to achieve 9.7mg/l total nitrogen in the final effluent.

The Bardenpho process is a process of biological nutrient removal where wastewater is mixed with sludge and introduced to aerobic conditions for phosphorus uptake. It then goes though denitrification in an anoxic zone before being aerated, simultaneously causing phosphorus uptake, carbonaceous oxidation and nitrification. The process is cycled through the aerobic zone to the anoxic zone to increase rates of denitrification until it enters a final anoxic zone to complete denitrification. Denitrification occurs in low oxygen conditions were bacteria reduce nitrate instead of oxygen to create energy, using nitrate or nitrite as an alternative electron acceptor to respire carbon. Finally, effluent briefly enters another aerobic tank to inhibit anaerobic conditions in the sedimentation tank. The sedimentation process produces waste sludge and final effluent with reduced nutrient concentrations that, under normal conditions, is discharged from the Eastney LSO.

[17] Southern Water. No date. Management of Wastewater in Portsmouth and Havant.

Figure 4.4: Location of Southern Water outfalls in Langstone Harbour[17]

As a fallback option to discharge from the Eastney LSO, Southern Water also have a consented discharge point to Langstone Harbour at Budds Farm (**Figure 4.4**). This outfall is activated if Eastney Pumping Station is unable to cope with the volume of treated wastewater coming from Budds Farm. Other discharges to Langstone Harbour can occur due to Portsmouth's combined sewer system that mixes stormwater with foul water. When wastewater flows to Budds Farm exceed its 200 ML/d capacity, stormwater is stored in tanks at Fort Cumberland and Budds Farm with 40 ML and 7 ML capacity, respectively. If storage capacity is exceeded, a mix of untreated stormwater and foul water is discharged directly to Langstone Harbour and the Solent through combined sewer overflows (CSOs). Southern Water estimate that CSO discharges are generally between 99.90-99.98% surface water

runoff and 0.1-0.02% raw sewage[18]. Southern Water have a total of 12 permitted discharges into Langstone Harbour either directly (via either treatment works, pumping stations or storm tanks) or into other watercourses which lead to the harbour (CSOs). The storm discharges may only be used when the defined rate of flow in the sewer is exceeded due to rainfall and/or snowmelt. Six of the 12 are screened to 6mm (the locations of the CSOs is shown in **Figure 5.2**).

[18] Bathing water presentation to Havant Borough Council November 2018 states 0.1%, Southern Water Management of Wastewater in Portsmouth and Havant technical note states 0.02%.

5 Potential Effects to be Mitigated

5.1 European Designations

The Thornham WwTW discharges directly, including Combined Sewer Overflows (CSOs), into the following European designated sites, as shown in **Figure 5.1**:

- Solent Maritime Special Area of Conservation (SAC)
- Chichester and Langstone Harbour Special Protection Area (SPA) and Ramsar

Dispersion of the discharge and circulation in the wider coastal system could give rise to an impact on the following designated sites:

- Solent and Dorset Coast SPA

It is unclear how much water circulates from Chichester Harbour to the East Solent and Southampton Water, and therefore whether the Solent and Southampton Water SPA and Ramsar site could be affected by discharges from Thornham WwTW. The source apportionment information for the closest Nitrate Vulnerable Zone in Southampton Water, Hamble Estuary, does not attribute nitrogen sources from other wastewater treatment works further afield than Southampton Water. Nitrogen concentrations from WwTW discharges into the Solent have reduced since nutrient removal was installed from December 2008. However, the Environment Agency Review of Consents (RoC) process concluded there could be an in-combination effect on the Solent and Southampton Water SPA and Ramsar site from Thornham WwTW discharges. Ryde coastal area on the Isle of Wight forms part of this designation, and therefore the waters around Spithead and further east could provide offshore feeding sites for the qualifying bird species. As such, this designated site will also need to be considered.

Although there is a minor theoretical pathway for an indirect impact to the Farlington Marshes coastal lagoon, part of the Solent and Isle of Wight Lagoons SAC, the contribution of effluent from Thornham WwTW that could enter the lagoon from Langstone Harbour via the sluice is considered imperceptible. The source apportionment work completed by the Environment Agency for the Nitrate Vulnerable Zone classification does not identify Thornham WwTW as a nitrogen source to Langstone Harbour (whereas for other NVZs offshore WwTWs have been identified). It is therefore concluded that the Thornham WwTW discharges will not undermine the conservation objectives of the Solent and Isle of Wight SAC.

Budds Farm WwTW discharges directly to Langstone Harbour via CSOs and to the East Solent via the Eastney Long Sea Outfall, as shown in **Figure 5.2**. Source apportionment work completed by the Environment Agency has identified nitrogen input from Budds Farm WwTW at the entrances of Portsmouth, Langstone and Chichester Harbours. The following European designated sites need to be considered[19]:

- Solent Maritime SAC
- Solent and Isle of Wight Lagoons SAC
- Chichester and Langstone Harbour SPA and Ramsar
- Portsmouth Harbour SPA and Ramsar
- Solent and Southampton Water SPA and Ramsar
- Solent and Dorset Coast SPA

5.2 Qualifying Features Sensitive to Changes in Nutrient Levels

The following qualifying features are considered to be at risk from an effect, with full details provided in Tables 1 to 5 in Appendix A:

[19] See *Review of the Need for Nutrient Neutral Development in the Budds Farm Wastewater Treatment Works catchment June 2020* for full details and water quality information for Portsmouth Harbour.

- Solent Maritime SAC
    - 1130 Estuaries (sub-features subtidal mixed sediments (A5.4), subtidal seagrass beds (A5.53), intertidal sand and muddy sand (A2.2), intertidal mud (A2.3), intertidal mixed sediment (A2.4), intertidal seagrass beds (A2.61), Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (H1330), *Salicornia* and other annuals colonising mud and sand (H1310) and Spartina swards (*Spartinion maritimae*)(H1320))
    - 1320 Spartina swards (*Spartinion maritimae*)
    - 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
    - 1110 Sandbanks which are slightly covered by sea water all the time
    - 1140 Mudflats and sandflats not covered by seawater at low tide
    - 1310 Salicornia and other annuals colonizing mud and sand
- Chichester and Langstone Harbour SPA and Ramsar:
    - All bird species – direct impacts from location of CSOs into Chichester Harbour (Thornham WwTW) and Langstone Harbour (Budds Farm WwTW) predominantly on feeding areas. Sensitivity of bird species will be determined by response of prey items to eutrophication.
    - Ramsar habitats – Langstone Harbour predominantly, impacts to Chichester Harbour would be dependent on amount of flow from Langstone Harbour.
- Portsmouth Harbour SPA and Ramsar:
    - Impacts to bird species and Ramsar habitats would be dependent on amount of flow from Langstone Harbour and via East Solent.
- Solent and Dorset Coast SPA
    - Offsite functional habitat use of Portsmouth, Langstone and Chichester Harbour by the tern species for which the site is designated.
    - Impacts as a result of in-combination effects from the continued nutrient loading from multiple sources into the East Solent,
- Solent and Southampton Water SPA and Ramsar:
    - Impacts to bird species and Ramsar habitat as a result of in-combination effects from the continued nutrient loading from multiple sources into the Eastern Solent.

Direct impacts from Thornham WwTW's discharge to Little Deep, then Great Deep, and from the CSOs will be confined predominantly to Chichester Harbour, with in-combination effects in the wider Solent. The sluice from Great Deep discharges to the east into the harbour, the western channel is separated from the harbour by sea defences. The Environment Agency RoC suggests that the most sensitive feature within Chichester Harbour would be the intertidal mudflats and sandflats directly adjacent to the discharge location. These are designated under the Solent Maritime SAC and are supporting habitats for the qualifying bird features of the Chichester and Langstone Harbours SPA. Great Deep itself is identified in priority habitat mapping as being mudflats. Saltmarsh was identified as being of low sensitivity/vulnerability to changes in nutrient loading, that would be subject to a diluted effect of the discharge for a shorter period than the mudflats during high water. However, where direct discharges occur into the habitat, more significant effects can occur. The habitats found within Chichester Harbour, to the east of the Great Deep mouth include mudflats and sandflats, saltmarsh, mixed sediments and shallow coastal waters. Intertidal seagrass beds are found within the wider estuary system at Cobnor Rithe to the east and Gutner Point to the west.

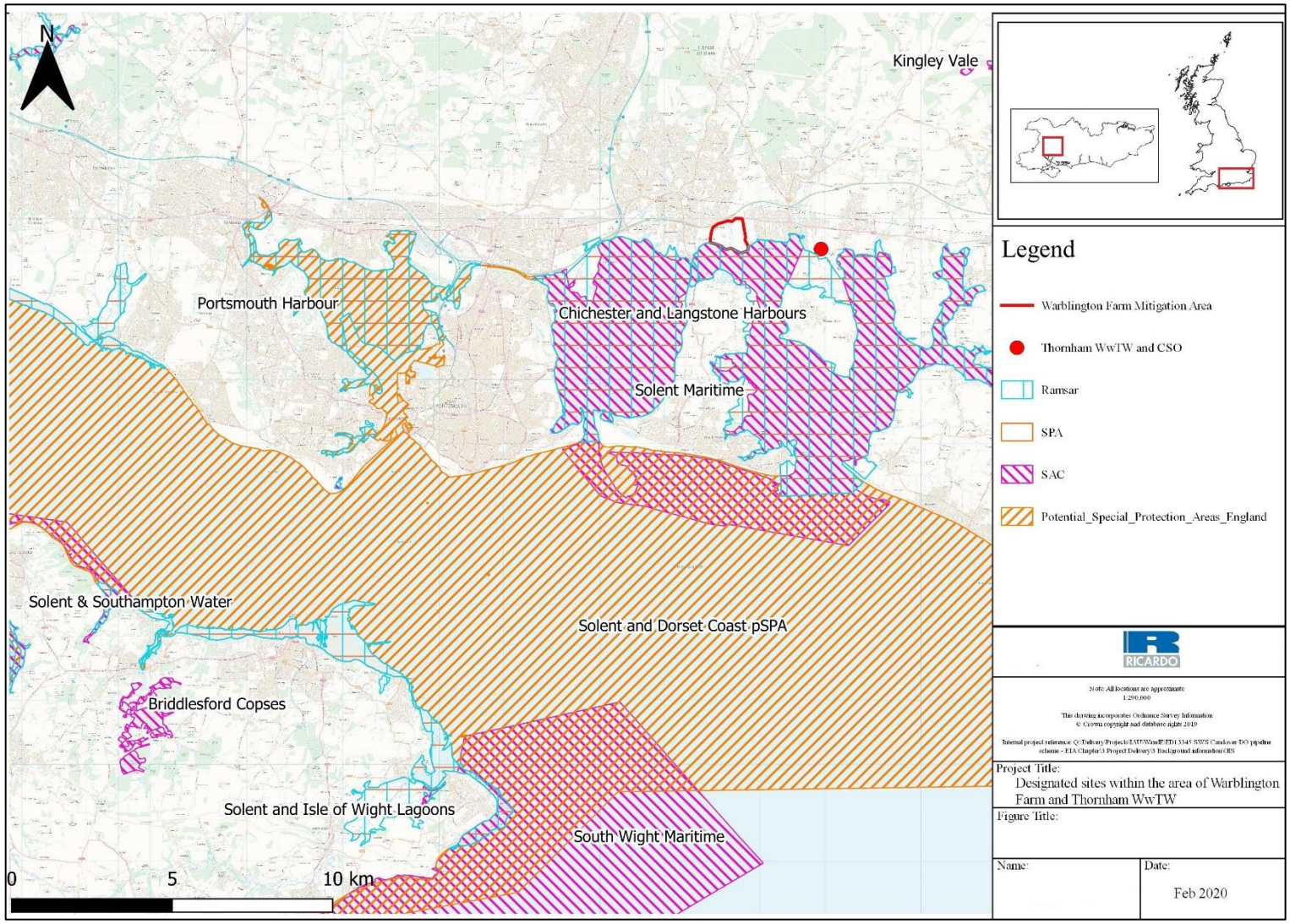
Indirect impacts from Budds Farm WwTW discharge to the East Solent via Eastney LSO could affect areas of offshore habitat, for example the Solent Maritime SAC sandbanks which priority habitat mapping shows extend off the coastline between Eastney and West Wittering, comprising areas of subtidal sand and subtidal mixed sediment. Mudflats and sandflats designated as part of the Solent

and Southampton Water SPA and Ramsar are located offshore of Ryde on the north east coast of the Isle of Wight. The wider dispersion of the wastewater also needs to be considered and the impact to the offshore feeding grounds within the East Solent utilised by the qualifying bird species of the various SPAs.

Seabed habitat mapping using the Defra MAGIC website[20] and the EMODnet Seabed Habitats website[21] has been used to identify where the qualifying features occur within the zone of influence and are therefore more likely to be susceptible to impacts. Literature review, including that contained on The Marine Life Information Network[22], has been used to determine the likely sensitivity of the habitats and species to changes in nutrient levels.

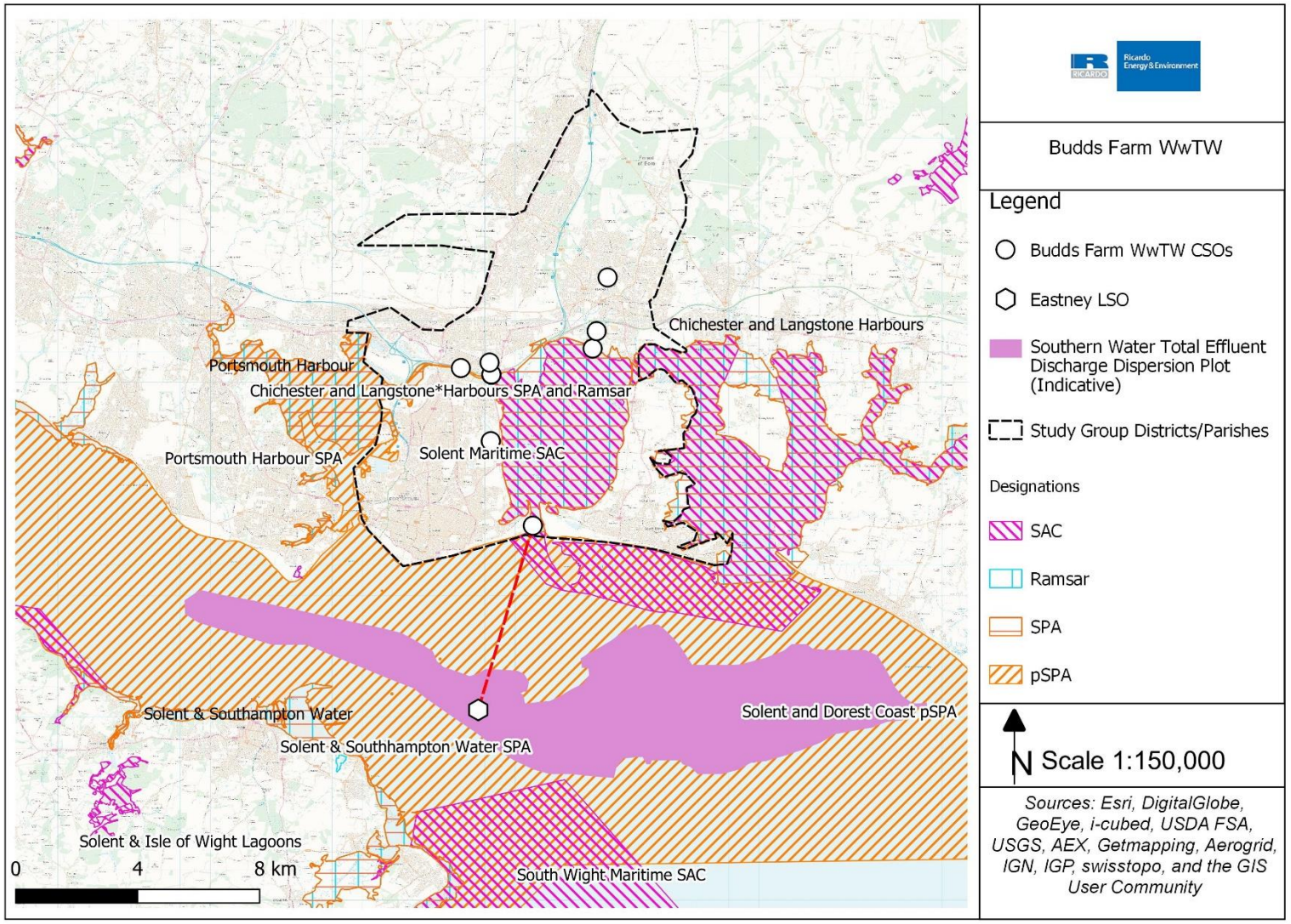
[20] Accessed at https://magic.defra.gov.uk/MagicMap.aspx
[21] Accessed at https://www.emodnet-seabedhabitats.eu/
[22] Accessed at https://www.marlin.ac.uk/

Figure 5.1: Thornham WwTW, Warblington Farm and European Designated Sites[23]



[23] Solent and Dorset Coast SPA was fully classified in January 2020. The GIS shapefiles available from www.gov.uk have not been updated yet.

Figure 5.2: Budds Farm WwTW Catchment (estimated) and European Designated Sites[24]



[24] The Solent and Dorset Coast SPA was fully classified in January 2020, however the available GIS shapefiles from www.gov.uk have not been updated yet.

5.3 Potential Adverse Effects

5.3.1 Thornham WwTW

5.3.1.1 Source and Pathway for Impacts

As Thornham WwTW is at, or nearing capacity, any increase in housing development within its catchment area could result in an exceedance of the Dry Weather Flow permit, with continued and potentially increased nitrogen loading directly into Chichester Harbour[25]. There is also a risk of an impact from the CSOs. The increases in surface water runoff and wastewater generated by new development has the potential to cause the capacity of the sewerage system to be exceeded more quickly and, with climate change, at a greater occurrence therefore potentially increasing the use of the CSOs. Use of the CSOs would result in greater volumes of wastewater being discharged into Chichester Harbour which has only received primary treatment, leading to an increase in organic matter available for accelerated macroalgal growth and decreases in dissolved oxygen.

5.3.1.2 Receptors

Chichester Harbour is part of the Solent Maritime SAC and Chichester and Langstone Harbours SPA and Ramsar, and is predominantly in unfavourable-no change condition (81.18%), with the latest SSSI assessments for the units either side of Great Deep stating;

"*The water environment of the unit is assessed as unfavourable for the interest features on the weight of evidence on elevated levels of inorganic nitrogen and biological indication of eutrophication shown by the abundance of macroalgae. There is poor evidence of a reducing nutrient status adequate to substantially prevent the growth of dense macroalgae mats. A very large part of the nitrogen load input is carried by tidal flow from the Solent and relatively little by minor rivers into the arms of the harbour but where these inputs may have more significance in encouraging the growth of macroalgae*."
Point source pollution from sewerage treatment works is listed as an action to address through improvement to works and better storm overflow management[26].

Each of the qualifying features listed for all the designations being considered[27] has a similar feature target in the Supplementary Advice to Conservation Objectives for water quality/nutrients;

"*Restore water quality to mean winter dissolved inorganic nitrogen levels at which biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features*".

Therefore, to avoid adverse effects to site integrity, the following targets should be met, using the WFD opportunistic macroalgae and phytoplankton quality assessment tools to monitor:

- Opportunistic macroalgae levels should be restored so there is no adverse effect to the feature through limited algal cover (< 15 %) and low biomass (< 500 g m^2) of macroalgal blooms in the available intertidal habitat. The area of available intertidal habitat affected by opportunistic macroalgae should be less than 15 %.
- There should also be limited (< 5 %) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth).

[25] Chichester District Council (August 2018) Chichester District Council Water Quality Assessment. Prepared by Amec Foster Wheeler. Accessed at http://www.chichester.gov.uk/CHttpHandler.ashx?id=30900.
[26] Chichester Harbour SSSI Unit Assessment Prinsted Channel (017) and Wicker Point Mud (012) Assessed September 2018. Accessed at https://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1016991
[27] Note that Chichester and Langstone Harbours Ramsar does not have Supplementary Advice to Conservation Objectives, but the habitats and species are generally covered by the SAC and SPA designations.

- Phytoplankton levels should be restored to above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions.

The risk of an impact from new development comes from the increase in DWF from the direct discharge to the harbour and potential increased use in the CSOs, leading to greater volumes of wastewater receiving only primary treatment being discharged and potentially resulting in increases in algal cover.

New developments on brownfield sites are required under NPPF guidance and in accordance with flood risk considerations to reduce runoff rates to greenfield rates, whilst greenfield development must not exceed greenfield runoff rates. Assuming these planning considerations and conditions are upheld, new developments will have either a neutral or net beneficial impact on surface water drainage rates to combined sewers. This will in turn have either a neutral or positive impact on the probability of CSO discharges and the flux of nitrogen from this pathway. It is noted that greenfield runoff rates for developments should be secured through suitable drainage strategies at the planning stage to allow consideration in the Stage 2 Appropriate Assessment. Consented drainage strategies that cause net increases in runoff from development sites could, however, have a negative impact on the runoff rates to a combined sewer system, with negative impacts on CSO discharge frequencies and nitrogen fluxes, thus requiring further mitigation.

The increase in housing development within the Thornham WwTW catchment will need to ensure nitrogen neutrality to avoid the conservation objectives of the site being undermined. The ability for Warblington Farm to mitigate for this is discussed in Section 6.5.

5.3.2 Budds Farm WwTW

5.3.2.1 Source and Pathways for Impacts

Combined Sewer Overflows

Budds Farm WwTW also CSOs which directly discharge into Langstone Harbour; the outfall at Budds Farm WwTW, the Court Lane group CSO in the north west of the harbour, and Fort Cumberland at the mouth. Dispersion plumes for *Ecoli*, generated for bathing water quality assessments, are available for the Budds Farm WwTW and Court Lane group CSOs[28]. Discharge from Budds Farm CSO is concentrated in Broad Lake, north of Long Binness Island and Long Island, and extends east to approximately Langstone Bridge. Discharge from Court Lane group CSOs discharges into Broom Channel, west of Farlington Marshes.

Discharges from the CSOs therefore provide a point source of nitrogen input to Langstone Harbour, with an estimate of 0.02-0.1% raw sewage. The risk of using the CSOs increases over time due to climate change, with an increased number and severity of storm events. If the additional housing development within the Budds Farm WwTW catchment increases surface water runoff into the system, the risk of using the CSOs increases further, leading to a potential flux of nitrogen into Langstone Harbour from this pathway.

As discussed for Thornham WwTW, compliance with greenfield rates will be required to ensure no adverse effects from the potential increase in use of CSOs as a result of new housing development.

Eastney Long Sea Outfall

The majority of nutrient discharge from the Budds Farm WwTW is via the Eastney LSO (approximately 5.7km offshore). Although nitrogen limits are set for the Eastney LSO discharge (9.7mg/Tn/l), a c18% increase in the discharge rate is likely with the proposed housing growth in the catchment.

[28] Southern Water presentation to Havant Borough Council, November 2018.

As part of work to designate areas as NVZs, the Environment Agency assessed the percentage contributions of nitrogen to Portsmouth Harbour, Langstone Harbour and Chichester Harbour using a range of modelling techniques (CPM, SAGIS and Telemac), as discussed in Sections 3 and 4. To summarise, the Eastney LSO is shown to contribute a small percentage ≤1% of nitrogen to each harbour (measured at the entrance), although in-combination, the nitrogen contribution of offshore STWs to the three harbours equates to 6% for Langstone, 5-6% for Portsmouth and 4-5% for Chichester. However, for all harbours, the contribution of nitrogen from indirect STWs are the least significant nitrogen input[29,30,31]; with diffuse agricultural sources and coastal background being bigger contributors.

The Solent waterbody is not currently classified as eutrophic by the Environment Agency, and therefore a similar source apportionment study has not been completed, favourable condition information is also not available as there are no offshore SSSIs. Given the circulation and mixing within this waterbody, effects are considered less likely, however further consideration of eutrophication issues within the East Solent waterbody and achievement of favourable condition should be made when supplementary advice is available for the Solent and Dorset Coast SPA.

With the predicted housing growth, the nitrogen contribution from Budds Farm WwTW to the three harbour systems remains ≤1%[32]. Despite such a small contribution of nitrogen alone, there is a spatial overlap of similar discernible effects from other STWs discharging directly or indirectly to the Solent. The significance of the nitrogen inputs from STWs also increases when the coastal background, which cannot easily be attributed to sectors, is removed as a source, and predicted long-term trends are considered. Currently, the biggest nitrogen contributor is diffuse pollution from agriculture. However, long-term trends are likely to shift the significance of the sources as agricultural practices improve, but continued housing development maintains or increases the nitrogen load from this source. The future baseline during the lifetime of the housing developments (80-125 years) is therefore likely to be different to that currently monitored.

It is therefore concluded that there is an additive in-combination effect from the proposed new housing development, and other STW nitrogen sources within the Solent. A low-level impact but with a potential long-term effect (retention time in system, although exact duration currently unknown), could arise from continued and increased nitrogen loading of the wastewater treatment system, which on discharge, adds to the existing background concentrations of nitrogen in the wider Solent system. The continued excess of nitrogen in the system and nutrient enrichment may therefore lead to the stimulation of phytoplankton blooms, predominantly in shallow coastal waters, which may reduce light availability to sea grass beds and during decomposition cause de-oxygenation of the water column adversely impacting populations of small fish. Increased growth of *Enteromorpha/Ulva* spp can form dense mats which smother benthic invertebrates on the intertidal sediments and lower pioneer saltmarsh species. Mats can be dislodged and washed further onto the saltmarsh habitats during high tides causing die back. The exact levels of impacts and attribution to continued housing growth is difficult to quantify, and therefore mitigation is required until the uncertainty can be removed through further scientific evidence.

5.3.2.2 Receptors

Given the connectivity and water exchange from the East Solent waterbody, into which the Eastney LSO discharges, and the harbour systems, the following designated sites could be impacted; Solent

[29] Udal, I., Rees-Jones, S., Robinson, K. 2014. Chichester Harbour Water Framework Directive DIN and Ecological Impact Investigations. Environment Agency.

[30] Rees-Jones, S., Robinson, K., Udal, I. 2014. Langstone Harbour Water Framework Directive DIN and Ecological Impact Investigations. Environment Agency.

[31] Udal, I., Rees-Jones, S., Robinson, K., Schroeder, S. 2014. Portsmouth Harbour & Wallington Water Framework Directive DIN and Ecological Impact Investigations. Environment Agency.

[32] Partnership for South Hampshire (2018) Integrated Water Management Study: Appendix B Review of Pressures and Mitigation Measures. Prepared by Amec Foster Wheeler. Accessed at https://www.push.gov.uk/wp-content/uploads/2018/07/IWMS-Appendix-1.pdf, Appendix B available from Havant Borough Council.

Maritime SAC, Portsmouth Harbour SPA and Ramsar and Chichester Harbour SPA and Ramsar, Solent and Southampton Water SPA and Ramsar, and the Solent and Dorset Coast SPA.

6 Review of the Warblington Farm Mitigation Proposal

6.1 Overview of Mitigation Requirements in HRA Process

As detailed in Section 5, the potential for adverse effects from continued or increased nitrogen loading on a number of designated sites from development in the Havant Borough and southern parishes of East Hampshire DC, which drain to Thornham WwTW and Budds Farm WwTW, has been identified. Therefore, to ensure planning permission can be granted, applications for new housing development must include mitigation that is sufficient to avoid an adverse effect on site integrity. The potential impacts from an increased use in CSOs can be mitigated by achieving greenfield runoff rates and attenuating wastewater flows at the new developments. Mitigation for the increased loading of nitrogen to the wastewater system which is released directly to Chichester Harbour via Thornham WwTW, and indirectly to a larger spatial extent by Budds Farm WwTW Eastney LSO requires further consideration.

To satisfy the integrity test, mitigation measures need to be effective, timely, reliable, guaranteed to be delivered and in perpetuity where necessary. Mitigation measures must seek to avoid or reduce the harm where it occurs, and for each adverse effect identified for each qualifying feature. For example, the same reduction measure may not be suitable for two different qualifying features, and the same effect may be caused by two different pathways, each which would require mitigation.

Considering this last point, three pathways have been identified from Thornham WwTW and Budds Farm WwTW by which increases in nutrient levels may arise as a result of new housing development:

- Increased use of the CSOs.
- Increase in the DWF release from the Thornham WwTW with potential for a reduction in the efficiency in the nitrogen stripping process.
- In-combination increased contribution of nitrogen to the wider Solent coastal waterbody, the greatest spatial extent arising from Budds Farm WwTW.

In response to the issue of nutrient neutrality in the Solent, Natural England has released advice on the contextual factors surrounding the issue, as well as nitrogen budget calculations to assess the amount of mitigation that may be required by new development.[33]

Havant BC own the freehold of the majority of Warblington Farm and therefore, subject to leaseholder agreement, has the opportunity to take it out of intensive agricultural use, thereby offering the potential to offset the additional nitrogen produced by new housing development. The mitigation is proposed to offset new housing in Havant Borough and southern parishes of East Hampshire District Council.

It should be noted that offsetting measures are the last stages of the mitigation hierarchy. It will need to be demonstrated as part of the HRA process that there are no suitable avoidance or reduction measures available for use on-site, or that residual adverse effects remain after reduction measures that need further mitigation.

Havant BC has provided REE with the following information to determine whether Warblington Farm offers the opportunity to mitigate for adverse effects on site integrity, and this is reviewed in Sections 6.2 to 6.4:

- Map of farm and areas in Havant BC's ownership.
- Land agent information on the existing uses of the land.

[33] Natural England. 2020. Advice on achieving nutrient neutrality for new development in the Solent region v3.

- Nutrient budget for the whole of Havant BCs proposed new housing development and the options for mitigation.

6.2 Existing Land Use

The area of land available at Warblington Farm, owned by Havant BC, is shown in **Figure 6.1**[34]. The land is located to the south east of Havant, and directly adjoins Chichester Harbour. Any direct runoff is thought to be minimised by the presence of the sea wall that extends along the front, with only two ditches/outfalls into the harbour visible on Google Earth imagery; one on the western boundary and one from Warblington Meadow SSSI within the middle of the site. No land use changes are proposed for the area of land designated as Warblington Meadow SSSI (fen meadow and saltmarsh communities). The farm has been historically used as a dairy farm with some arable crop production, however herd numbers have recently reduced from 100 cows to about 45 dairy cows and 45 followers[35] following a review of Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 and storage capacity on the farm.

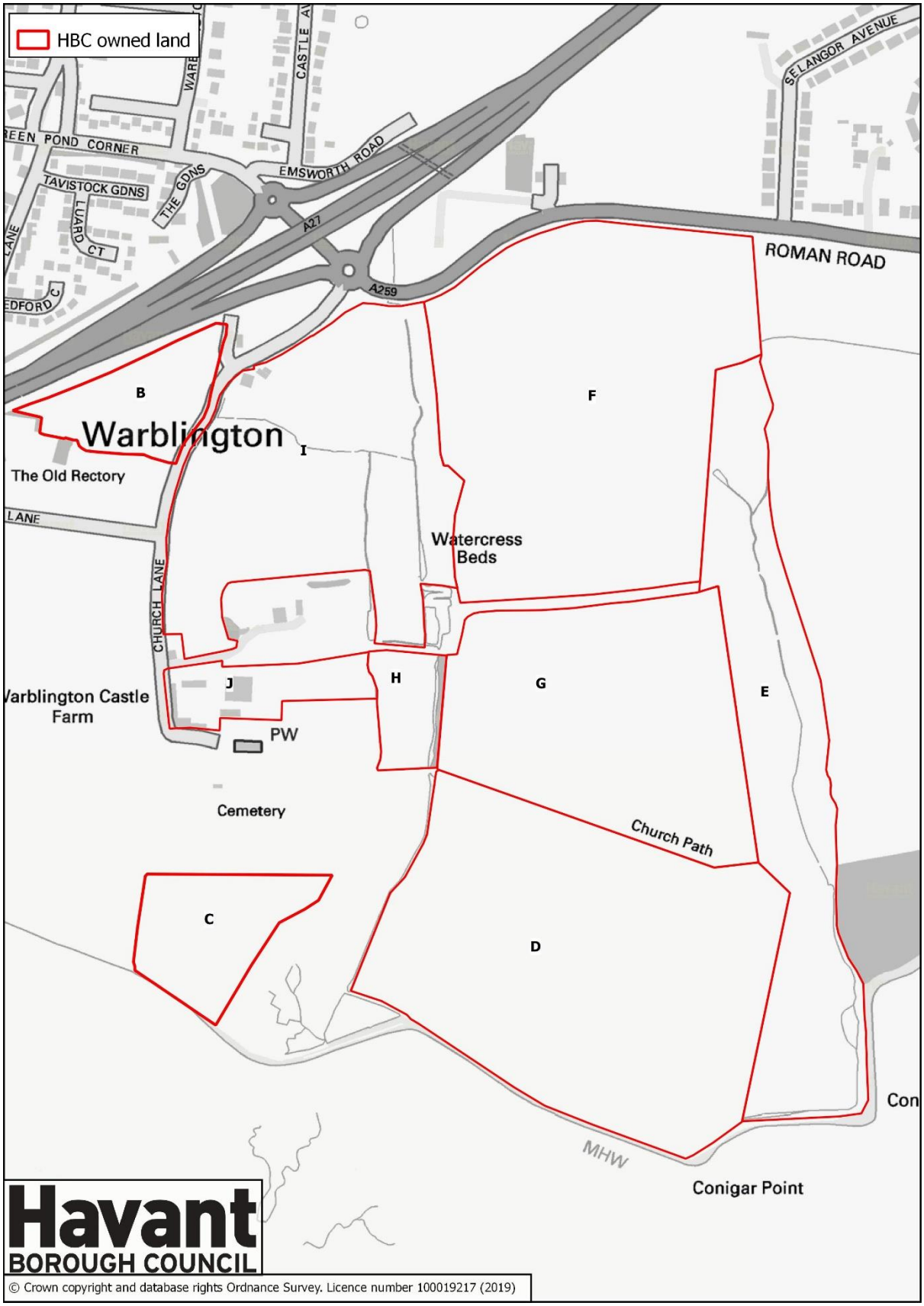
Figure 6.1 shows the current agricultural use of the land, which has been used when determining the available credits using Natural England's nitrogen budget calculator. **Table 6.1** provides an overview of the use and approximate area.

Table 6.1 Warblington Farm Agricultural Land Use

Area (identified on Fig 6.1)	Land use	Area (hectares)[36]
B	Permanent pasture	2
C	Permanent pasture	2.3
D	Permanent pasture with 50% being ley	12.9
E	Rough permanent pasture; including about 5 acres to the south occasionally flooded, some by saltwater (an area considered suitable for managed retreat)	6.1
F	Land in arable rotation	13[37]
G	Land in arable rotation	8.3
H	Permanent pasture	0.9
I	Permanent pasture	9.2
J[38]	Farmyard and curtilage	6.8 (including cemetery)
K[38]	Wetland HLS, rough grazing	3.7
	TOTAL (B-K)	**65.2ha**

[34] Area A is permanent pasture with 11 acres ley included, totalling 16.7ha. This is not currently available to Havant Borough Council (as of June 2020).
[35] Young stock in a dairy herd intended as replacements in the production herd.
[36] Estimated from MAGIC.gov.uk.
[37] As these land parcels are in rotation, the inputs to the nitrogen budget calculator need to be precautionary. See Section 5.3 for further details.
[38] Will not be part of the mitigation plan.

Figure 6.1 Land Use Types on Warblington Farm



6.3 Application of the Nutrient Budget Calculator

Stage 1 – Total Nitrogen Derived from New Development: 534 residential dwellings are proposed which drain to Thornham WwTW, which are presumed to be in the Emsworth area, but this is not clear. A total of 7,983 residential dwellings are proposed which drain to Budds Farm WwTW. The calculator has used the assumed occupancy rate of 2.4 people per house, as detailed in Natural England's guidance, the acceptability of which was discussed with Natural England at a meeting on 4 March 2020.

Stage 2 – Existing Nitrogen from Current Land Use Offset and Stage 3 – Proposed Development Land Uses: This stage calculates the amount of nitrogen currently being exported from the land use in the area of the proposed development (Stage 2) and the nitrogen loads that will be exported from the post-development land uses. Assuming the pre-development land use is agriculture, Stage 2 calculates the amount of nitrate-nitrogen (NO3-N) that is currently being exported from the proposed development using modelled values from Farmscoper assessments of farms in the Solent catchment area. The annual NO3-N export per hectare of farmland varies for different farm types, from 13 kg/ NO3-N/yr for lowland grazing to 70.7 kg/ NO3-N/yr for poultry farming, with an average for all farming in the Solent catchment area of 26.9 kg/ NO3-N/yr.

In the nutrient budget calculations to inform the potential for Warblington Farm to provide mitigation for the proposed developments draining to Budds Farm and Thornham WwTWs, each development is named with an associated total area that will be converted to urban and open space land use. The sum of these areas is then used to calculate the annual NO3-N export from the current pre-development land use, indicating the proposed areas for development in the nutrient budget are currently all under agricultural land use. The average NO3-N loss (26.9 kg/NO3-N/yr) is then used calculate the annual NO3-N lost from the pre-development land. This average NO3-N loss is relatively low compared to other farm types, with only lowland grazing and general cropping having lower estimated annual NO3-N loss. Thus, if the farm types for proposed development areas are known, it may be possible to increase the nitrogen offset provided by conversion from agricultural land. Furthermore, using the average NO3-N loss for all farm types may result in an overestimate of the NO3-N export from the pre-development land use and not be considered to be suitably precautionary/providing evidence beyond "reasonable scientific doubt" that the nutrient budget will provide an accurate representation of the mitigation required. Where possible, it is highly recommended to use the NO3-N export estimates for specific farm types, rather than using the average.

Stage 4 – Net Change in Total Nitrogen Load: The final stage of the nutrient budget calculates the net change in nitrogen export from the new developments based on the nitrogen load from sewage, the offset from nitrogen loading lost by conversion of agricultural land to urban/open space land use and nitrogen export from the post-development land use. Natural England recommend the addition of a 20% precautionary buffer to net change in total nitrogen loading from new development, however their guidance indicates that competent authorities can apply site-specific precautionary buffers if appropriate.

6.4 Suitability of Mitigation to Conclude No Adverse Effect

Mitigation measures should be designed to address the specific effect. Therefore, for housing development draining to both Thornham WwTW and Budds Farm WwTW, the effect to be mitigated is the addition of nutrients, specifically nitrogen, into an environment which is already experiencing water quality issues that are hindering the achievement of favourable conservation status. Three pathways for impact have been identified; an increase in the use of the CSOs, an increase in loading from the WwTW (although Budds Farm has existing capacity for treatment), and an additive in-combination effect in Chichester Harbour, Langstone Harbour and Portsmouth Harbour via the East Solent.

Measures to reduce inputs to the system via an increase in use of CSOs will be undertaken by managing surface runoff and flows from the housing sites by increased sewer capacity and use of SUDs. Where this is insufficient to address the nutrient load arising from the housing development and achieve nutrient neutrality, 'credits' will be secured against the Warblington Farm mitigation. By taking the farm out of intensive agricultural use, the reduction in nitrogen input from the farm will cancel out the increase in nitrogen input from the housing developments.

Warblington Farm is situated north east of Langstone Bridge, around Conigar Point and directly north of the Emsworth Harbour area of Chichester Harbour. There is a small watercourse which extends through the farm and discharges into Sweare Deep. Although Thornham WwTW discharges further to the east, via Great Deep into Thorney Channel, the overall contribution of Thornham WwTW to the nitrogen load in Chichester Harbour (measured at the mouth) is 3%. Therefore, the direct proximity of the Warblington Farm to, and drainage of its catchment into Chichester Harbour, makes it suitable for mitigating housing development draining to Thornham WwTW.

The pathway for impact from Budds Farm WwTW is less direct, with wastewater being discharged via the Eastney LSO into the East Solent. However, there is a known net flow of water between Chichester Harbour and Langstone Harbour at high water, with the harbours considered to represent one hydrographic unit, and exchange occurs with the East Solent, with water entering the harbours at flood tide. Modelling completed for the East Solent Shoreline Management Plan in 1997 showed that westward ebb flows were stronger than eastward flood flows[39]. It is considered that there is sufficient exchange of water between Chichester Harbour, Langstone Harbour and the East Solent such that Warblington Farm mitigation will also be applicable to cancelling the in-combination effects of continued nutrient loading to the East Solent via the Eastney LSO.

Natural England's revised advice (v3 March 2020) confirms the suitability of Warblington Farm as mitigation for both on-site land use change (Thornham WwTW) and off-site land use change (Budds Farm WwTW) stating:
"5.34: For the WwTWs that drains to each harbour (Portsmouth Harbour, Langstone Harbour and Chichester Harbour), priority locations for mitigation are the same river catchment as the WwTW outfall" – as discussed above Warblington Farm drains to and is within the Chichester Harbour catchment.

"5.40: For development that drains to Budds Farm WwTW, mitigation is appropriate in the following catchments – River Meon, Portsmouth Harbour, Langstone Harbour, Chichester Harbour, Wootton Creek, Medina Estuary (and the estuaries in between)" – as discussed above, because there is sufficient exchange of water between the harbour systems via the East Solent, and channel linking Chichester and Langstone Harbours, Warblington Farm is suitable mitigation for housing development within the Budds Farm WwTW catchment.

Havant BC have completed nitrogen budget calculations to determine the amount of nitrogen offsetting Warblington Farm will provide; 1872kg/TN/yr. Discussions were held with Natural England on 4 March 2020 to discuss and agree the approach to occupancy rates, coverage of the 20% precautionary buffer, and compatibility with the Intertidal Habitat Compensation at Northney and Conigar and Warblington (IN1J) policy as identified on the Emsworth policy map for the Local Plan affecting part of land parcel E[40]. The use of Warblington Farm as mitigation was also discussed, with agreement on the spatial area it could be applied to.

[39] HR Wallingford (June 1997) East Solent Shoreline Management Plan. Volume 1 The Open Coast. Accessed at http://www.environmentdata.org/archive/ealit:1890/OBJ/20002515.pdf

[40] Natural England provided further advice at the meeting on 4 March 2020, which is also covered in the updated advice note. Occupancy rates: the Office for National Statistics latest information was used in deriving the 2.4 value, and Natural England note that this figure is stable (over the last 10 years) and is, in their view, an appropriate figure as a proxy for in perpetuity trend; 20% precautionary buffer: the buffer has been used to account for unknowns or uncertainties that cannot be easily rectified e.g. pipeline misconnections, and the different forms of nitrogen as highlighted above. The buffer also includes the potential for indirect

As part of Havant BC's Local Plan, an HRA will be completed demonstrating the number of housing developments that can be offset using the Warblington Farm mitigation, with an updated nitrogen budget. Additional areas may be required to fully offset the housing development proposed within Havant Borough and southern parishes of East Hampshire, and where necessary this mitigation will be identified in the HRA.

atmospheric deposition; compatibility with managed retreat: it was agreed that part of the area to saltmarsh and wetlands could potentially be beneficial but noting further work would need to be undertaken by Havant BC when the SMP comes forward to ensure any managed realignment project demonstrated no additional resultant nutrient loading to the system.

7 Conclusions and Next Steps

New housing development provides a source of nitrogen, through increases in wastewater production and surface water runoff. Proposed housing within the Emsworth area will drain to Thornham WwTW which is already at capacity, and therefore additional wastewater into the system will likely exceed its permitted Dry Weather Flow permit and potentially reduce the efficiency of the existing nitrogen stripping treatment process which limits outputs to 10mg/l. Proposed housing elsewhere within Havant BC will drain to Budds Farm WwTW, which can be accommodated within the permitted Dry Weather Flow permit until approximately 2036. However, the discharge of wastewater from Budds Farm WwTW via Eastney LSO has a large spatial overlap with other sewage work discharges and therefore in combination could hinder the restoration of water quality across a number of sites within the Solent European Marine Site. Increased use of CSOs within the catchments of both Thornham WwTW and Budds Farm WwTW from exceeding the capacity of the sewerage system with additional runoff generation, provides another pathway for impact, directly into Chichester Harbour and Langstone Harbour.

Key points: *There is insufficient headroom available at Thornham WwTW to treat the increase in wastewater volume arising from the new housing development in its catchment and meet the existing Dry Weather Flow permit. Increases in surface water runoff from new housing development could increase the use of the CSOs to avoid flooding which discharge directly into Chichester Harbour. There is a continued in-combination effect with other sources of nitrogen input to the coastal system.*

Chichester Harbour is predominantly in unfavourable-no change condition. The above impacts will potentially cause a further deterioration in condition, or make it more difficult to meet favourable condition status. Thus, the impacts will undermine the conservation objectives for the Solent Maritime SAC and Chichester and Langstone Harbours SPA and Ramsar directly, and in-combination undermine the conservation objectives of the Solent and Southampton Water SPA and Ramsar. As such, site integrity will not be maintained.

Wastewater from Budds Farm WwTW disperses within the East Solent, and although new housing development can be accommodated within the existing Dry Weather Flow permit, it will result in an increase in rate of c.18% against the baseline. Although this increase does not result in a change in nitrogen loading from the Budds Farm WwTW source across the Solent European Marine Site (≤1%), in-combination with continued outputs from other sewage treatment works the contribution is higher (4-6%), and could therefore undermine the achievement of the water quality conservation objective target or cause further deterioration at the following sites; Solent Maritime SAC, Chichester and Langstone Harbours SPA and Ramsar, Solent and Southampton Water SPA and Ramsar, and Solent and Dorset Coast SPA.

Nitrogen offsetting as a mitigation measure should be used once the preceding stages of the mitigation hierarchy have been exhausted. Avoidance and reduction measures onsite, through water efficiency, Sustainable Drainage Systems (SUDS), individual wastewater treatment plants, need to be used first. Warblington Farm drains to Chichester Harbour which given the exchange of water with the East Solent, can be used to mitigate new housing development draining to both Thornham WwTW and Budds Farm WwTW, as confirmed in Natural England's revised advice. Taking Warblington Farm out of intensive agricultural use will provide 1,872kg/TN/yr against which nitrogen loads from new housing developments can be offset. A field sampling programme may show that these mitigation options have a greater rate of total nitrogen export than the values provided by Natural England's nitrogen budget calculator (via Farmscoper modelling).

Key points:
Although the pathways for impact are slightly different between Thornham WwTW and Budds Farm WwTW, the consideration of Langstone and Chichester Harbours and the East Solent as a hydrological unit that has a level of exchange, predominantly at high tide, such that the Warblington Farm mitigation is applicable to cancelling the direct and in-combination effects of continued nutrient loading from new housing development in Havant BC and the southern parishes of East Hampshire.

Appendix A – Designated Sites Tables

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To support any assessment of the potential impacts to a European designated site, the following information needs to be reviewed:

- Qualifying features
- Conservation objectives
- Favourable conservation status
- Condition of features
- Site condition

A.1 Qualifying Features

The designated sites cover a range of features and over a large area, and therefore not all the qualifying features will be present in the zone of influence of the Thornham WwTW outfall or be sensitive to changes in nutrient levels. The qualifying features of the sites are associated with the complex estuarine and marine environment, influenced by a "double tidal" regime with long periods of tidal stand at high water and low tide. Habitats within the estuaries include extensive areas of mudflats and sandflats, intertidal areas supporting eelgrass *Zostera* spp., saltmarshes, pioneer cordgrass communities and drift line vegetation. The habitats support nursery grounds for fish and important assemblages of nesting, roosting and feeding birds. Salinities are variable with lower salinities in the upper estuaries and fully marine conditions found in Chichester and Langstone Harbours. Full details of the qualifying features for each site can be found in Tables 1 to 5 of this Appendix.

A.2 Conservation Objectives

The Habitats Regulations require that the Appropriate Assessment is of "*the implications for the site in view of that site's conservation objectives.*" The development of conservation objectives is required by the Habitats Directive. In accordance with the Directive, the objectives aim to achieve the 'favourable conservation status' of the habitat and species features for which a European site is designated, see Figure A below.

Conservation objectives for SPAs and SACs have been developed by Natural England and provide a description of what is considered to be the favourable conservation status (see Figure A) of the feature within the whole site area.

Figure A ***Favourable conservation status as defined in Articles 1(e) and 1(i) of the Habitats Directive***

"*The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:*
• Its natural range and areas it covers within that range are stable or increasing;
• The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future and;
• The conservation status of its typical species is favourable.

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:
• Population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
• The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future and;
• There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis."

Although there aren't any formal conservation objectives for Ramsar sites, the features are often overlapping with those covered by SACs and SPAs and the objectives are relatively generic. Therefore, those same objectives can be applied.

A.3 Favourable Conservation Status and Site Condition

There are several pieces of information that can be used to understand the existing condition of the features across their UK range, the condition of the habitats at the site level, and the threats and pressures affecting the feature.

A.3.1 Feature Level

The fourth UK Habitats Directive Report was published in 2019[1], and considered the Conservation Status of all terrestrial and marine habitats listed under Annex I of the Directive, and all terrestrial and marine species listed under Annexes II, IV and V of the Directive that were present within the UK during the reporting period (2013 to 2018). Each habitat was assessed in terms of the following parameters; range, area, structure and function whilst each species was assessed for range, population, habitat for the species and future prospects.

A similar process is undertaken for the SPAs, with the 11th Article 12 report published in October 2019[2]. The report contains information on; population size and trend (short and long term); breeding distribution and trend (short and long term); species action plans; and information on pressures, threats, conservation measures and population size inside the SPA network.

A.3.2 Site Level

At a site level, the condition of the underlying Sites of Special Scientific Interest (SSSI) can be used to provide an indication as to whether the site itself is achieving favourable condition. Supporting the

[1] JNCC (2019) Fourth Article 17 UK Habitats Directive Report (2019): The UK Approach to assessing Conservation Status for the 2019 Article 17 reporting under the EU Habitats Directive 2019. Accessed at https://hub.jncc.gov.uk/assets/6420776d-2a25-4575-8b6f-1922a6a13806
[2] JNCC (2019) Article 12 Birds Directive Report 2019. Accessed at https://jncc.gov.uk/our-work/article-12-report-2019/

SSSIs are Favourable Condition Tables. These FCTs provide a number of measures and targets of condition for the SSSI, against which Natural England determine whether the features are in favourable condition. The conservation objectives and definitions of favourable condition for features of the SSSI can be used to inform the Appropriate Assessment under the Habitats Regulations where the features are the same.

Site Improvement Plans (SIPs) have also been produced for each European designated site, encompassing both SACs and SPAs. Ramsar sites are not specifically covered, however features often overlap with the SAC and SPA designations. The SIPs were developed in England as part of the Improvement Programme for England's Natura 2000 sites (IPENS). The SIPs provide a high-level overview of the issues (both current and predicted) affecting the condition of the Natura 2000 features on the site(s) and outlines the priority measures required to improve the condition of the features. The plans do not cover issues where remedial actions are already in place or the ongoing management activities which are required for maintenance of the status.

A summary of the above information, where available, has been collated for each of the designated sites within the zone of influence from Thornham WwTW, and is presented in Tables 1 to 4.

Table 1 Solent Maritime SAC: Qualifying Features, condition and vulnerability to changes in nutrients

Designated site name:	**Solent Maritime**	
Designation type: (SAC, SPA, Ramsar):	SAC	
Qualifying features (those in bold considered to be within the zone of influence and sensitive to changes in nutrient levels):	Feature	Vulnerability to changes in nutrients:
	1130 Estuaries	Chichester Harbour is a bar-built estuary with nearly fully marine conditions supporting the estuarine habitats and species[3]. The Solent Maritime SAC estuaries comprise the following sub-features: subtidal coarse sediment (A5.1), subtidal sand (A5.2), **subtidal mixed sediments (A5.4)**, **subtidal seagrass beds (A5.53)**, intertidal coarse sediment (A2.1), **intertidal sand and muddy sand (A2.2), intertidal mud (A2.3), intertidal mixed sediment (A2.4)**, **intertidal seagrass beds (A2.61)**, **Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (H1330), *Salicornia* and other annuals colonising mud and sand (H1310) and Spartina swards (*Spartinion maritimae*)(H1320)**[4]. A number of these sub-features are considered separately below, consideration in this section is therefore given to the vulnerability of subtidal coarse sediment, subtidal mixed sediments, subtidal seagrass beds and intertidal coarse sediment. Subtidal coarse sediment Representative subtidal coarse sediment biotopes in the Solent include A5.13 Infralittoral coarse sediment, A5.14 Circalittoral coarse sediment and A5.141 *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles. There is no quantified baseline extent for subtidal coarse sediment in the Solent Maritime SAC available from the time of site designation. The current extent of subtidal coarse sediment within the site is 59.32 hectares and is found primarily along the open coast of the north-west Isle of Wight and in tide swept channels such as the estuary mouths of Langstone and Chichester Harbours[5]. There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities. Sensitivity to nutrient enrichment is considered to be low, with the WFD high ecological status providing sufficient protection. Some studies show tolerance of enhanced nutrient levels and a slight increase in nutrient levels potentially being beneficial for barnacles and other suspension feeders by promoting growth of phytoplankton and therefore increasing food supplies[6]. **Subtidal mixed sediments** Representative subtidal mixed sediment biotopes in the Solent include A5.421 *Aphelochaeta* species and *Polydora* species in variable salinity infralittoral mixed sediment and A5.422 *Crepidula fornicata* and *Mediomastus fragilis* in variable salinity infralittoral mixed sediment. There is no quantified baseline extent for subtidal mixed sediment in the Solent Maritime SAC available from the time of site designation. The current extent of subtidal mixed sediment within the site is 2,619.08 hectares. Mixed sediments are widespread in the subtidal channels of the harbours and estuaries of the Solent Maritime SAC. There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities. The A5.421 biotope occurs in muddy mixed sediment, in reduced and variable/low salinities that are experienced due to its locations in estuaries and marine inlets. Nutrient enrichment may reduce the abundance of *Aphelochaeta marioni* while *Polydora* is probably resistant. However, the biotope is considered not sensitive assuming compliance with good status as defined by the WFD[7]. The A5.422 biotope occurs in the lower estuary where the hydrodynamic regime allows a suitable environment to develop. Nutrient enrichment can lead to significant shifts in community composition in sedimentary habitats. However, as with A5.421 the biotope is considered not sensitive assuming compliance with good status as defined by the WFD[8]. **Eelgrass** The estuary supports extensive eel grass beds (*Zostera* spp.) which an important food source for the overwintering dark-bellied brent goose[9]. In 1987, the estimated area of *Zostera* in Chichester and Langstone Harbours alone was 560 hectares (Tubbs, 1999)[4]. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. *Zoestra* spp. have a high intolerance to nutrient enrichment with high nitrate concentrations leading to a decline of *Zoestra marina*. The adverse effects of increases in nitrate has been shown to be exacerbated by the level of salinity, with estuarine habitats being more intolerant than marine habitats. Intertidal coarse sediment A study conducted in 2005 found A2.111 barren littoral shingle to be one of the dominant biotopes of the Solent Maritime SAC, occurring extensively within Langstone Harbour. There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities[4]. The bioptope is characterised by a lack of species due to high sediment mobility, therefore it is not considered to be sensitive to nutrient enrichment[10].
	1320 Spartina swards (Spartinion maritimae)	Pioneer saltmarsh have an intermediate tolerance to increases in nutrient with a low sensitivity, however long term increases in nutrient levels could result in a decline in species diversity. Poor evidence base to support this conclusion.

[3] English Nature (2001) Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation Solent and Southampton Water Special Protection Area & Ramsar Site Chichester and Langstone Harbours Special Protection Area & Ramsar Site Portsmouth Harbour Special Protection Area & Ramsar Site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 18th October 2001

[4] https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0030059&SiteName=solent&SiteNameDisplay=Solent+Maritime+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=0

[5] https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0030059&SiteName=solent&SiteNameDisplay=Solent+Maritime+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=0

[6] Tillin, H.M., Tyler-Walters, H. & Garrard, S. L. 2016. [Spirobranchus triqueter] with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/177

[7] De-Bastos, E. & Tyler-Walters, H., 2016. [Aphelochaeta] spp. and [Polydora] spp. in variable salinity infralittoral mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/114

[8] Readman, J.A.J. & Rayment, W.J. 2016. [Crepidula fornicata] and [Mediomastus fragilis] in variable salinity infralittoral mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/52

[9] English Nature (2001) Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation Solent and Southampton Water Special Protection Area & Ramsar Site Chichester and Langstone Harbours Special Protection Area & Ramsar Site Portsmouth Harbour Special Protection Area & Ramsar Site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 18th October 2001

[10] Tillin, H.M., Budd, G. & Tyler-Walters, H. 2019. Barren littoral shingle. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/143

	1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Generally tolerant with low sensitivity, but algal mats washed onto vegetation could smother, higher nutrient enrichment could be favoured by particular species leading to a reduction in diversity and higher enrichment could reduce oxygen levels in the sediment. Poor evidence base to support this conclusion[11].
	1110 Sandbanks which are slightly covered by sea water all the time	This habitat consists of soft sediment types that are permanently covered by shallow sea water, typically at depths of less than 20 metres below chart datum[12]. Subtidal sand can be found in the mouth of Chichester Harbour with subtidal muddy sand found in the central part[13]. Changes in nutrient status may indirectly affect this biotope where these result in changes in diatom production and inputs of macroalgal debris. Primary production is low and the biotope is species poor, with characterising species may be present at low abundances (depending on wave exposure). The biotope is considered not sensitive assuming compliance with good status as defined by the WFD[14].
	1140 Mudflats and sandflats not covered by seawater at low tide	Sub-features found within Langstone Harbour are intertidal mud communities, intertidal muddy sand communities and intertidal sand communities. Long-term nutrient enrichment may alter the biotope if high biomass of algal mats persists. If the benchmark for compliance is set at the WFD criteria for good status, based on nitrogen concentration, then changes to the habitat are considered unlikely as the benchmark is relatively protective and is set at a level to avoid blooms of green algae on the sediment[15].
	1150 Coastal lagoons	The coastal lagoon feature for the Solent Maritime SAC has been recorded at Newtown Quay, Borrow Dyke in Yarmouth Harbour and Stuart's Pond at the base of Hurst Spit. These are sufficiently distant from the zone of influence such as not to be impacted from the increased housing development.
	1210 Annual vegetation of drift lines	AVDL is found on the shingle islands in the harbour. However, the habitat type occurs on deposits of shingle lying at or above mean high-water spring tides. It is therefore considered unlikely that the habitat would be adversely affected by changes in nutrient levels in the waterbody.
	1220 Perennial vegetation of stony banks	This habitat typically occurs where shingle (cobbles and pebbles) and gravel form elevated ridges or banks above the highest astronomical tide mark and are therefore unlikely to be adversely affected by changes in nutrient levels in the water.
	1310 Salicornia and other annuals colonizing mud and sand	The vegetation of this habitat type is dominated by areas of glasswort (*Salicornia*) or annual sea-blite (*Suaeda maritima*) and generally comprises a very small number of species[13]. As with Spartina, the pioneer saltmarsh communities have an intermediate tolerance to increases in nutrient with a low sensitivity, however long term increases in nutrient levels could result in a decline in species diversity. There is a poor evidence base to support this conclusion.
	2120 "Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")"	This habitat typically occurs above the highest astronomical tide mark and excludes the lower, embryonic dunes where occasional exposure to saltwater flooding constrains the growth of marram grass[16]. The habitat is therefore unlikely to be adversely affected by changes in nutrient levels in the water.
	1016 Desmoulin`s whorl snail *Vertigo moulinsiana*	Upon review of the Regulation 33 information for the European Marine Site, it is understood that the Desmoulin's whorl snail (*Vertigo moulinsiana*) population has only been recorded in one location; historically present in the freshwater fen, swamp and brackish reedbeds at the top of Fishbourne Channel in Chichester Harbour. This is to the very east of Chichester Harbour, approximately 13km from Budds Farm WwTW. Therefore, LSEs from increased housing development in the Budds Farm WwTW catchment are considered unlikely.
Current conservation status (Article 17):	Estuaries: bad and deteriorating (range: favourable, area: favourable, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures and threats: fish and Shellfish Aquaculture; professional fishing; fixed location fishing; leisure fishing; bait digging; taking / removal of fauna, general; taking / removal of flora, general; hunting, fishing or collecting activities not referred to above; sand and gravel extraction; urbanised areas, human habitation; industrial or commercial areas; discharges; port areas; energy transport; pipe lines; shipping; nautical sports; motorised vehicles; pollution; water pollution; trampling, overuse; landfill, land reclamation and drying out, general; polderisation; reclamation of land from sea, estuary or marsh; infilling of ditches, dykes, ponds, pools, marshes or pits; removal of sediments (mud...); canalisation; flooding; modification of hydrographic functioning, general; modification of marine currents; management of water levels; dumping, depositing of dredged deposits; dykes, embankments, artificial beaches, general; sea defence or coast protection works; erosion; drying out / accumulation of organic material; eutrophication; acidification; invasion by a species; interspecific faunal relations; interspecific floral relations; genetic pollution. Spartina swards (*Spartinion maritimae*): bad and deteriorating (range: bad and deteriorating, area: bad and deteriorating, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures and threats: discharges; water pollution; air pollution; soil pollution; military manoeuvres; reclamation of land from sea, estuary or marsh; drainage; flooding; modification of marine currents; sea defence or coast protection works; erosion; submersion; invasion by a species; competition; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*): bad and deteriorating (range: favourable, area: inadequate and deteriorating, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures and threats: grazing; abandonment of pastoral systems; discharges; water pollution; soil pollution; military manoeuvres; reclamation of land from sea, estuary or marsh; drainage; flooding; modification of marine currents; sea defence or coast protection works; erosion; submersion; invasion by a species; competition.	

[11] Tyler-Walters, H., 2004. [Puccinellia maritima] salt-marsh community. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/350

[12] English Nature (2001) Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation Solent and Southampton Water Special Protection Area & Ramsar Site Chichester and Langstone Harbours Special Protection Area & Ramsar Site Portsmouth Harbour Special Protection Area & Ramsar Site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 18th October 2001

[13] English Nature (2001) Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation Solent and Southampton Water Special Protection Area & Ramsar Site Chichester and Langstone Harbours Special Protection Area & Ramsar Site Portsmouth Harbour Special Protection Area & Ramsar Site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 18th October 2001

[14] Ashley, M., 2016. Sublittoral sand in variable salinity (estuaries). In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/1014

[15] Ashley, M. & Budd, G.C., 2020. [Hediste diversicolor] and oligochaetes in littoral mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/habitat/detail/268

[16] 2120 Shifting dunes along the shoreline with Ammophila arenaria ('white dunes'): Description and ecological characteristics. Accessed at: https://sac.jncc.gov.uk/habitat/H2120/

	Sandbanks which are slightly covered by sea water all the time: bad and deteriorating (range: favourable, area: favourable, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures and threats: fish and shellfish aquaculture; professional fishing; trawling; drift-net fishing; leisure fishing; sand and gravel extraction; exploration and extraction of oil or gas; urbanised areas, human habitation; industrial or commercial areas; discharges; port areas; energy transport; pipe lines; shipping; pollution; water pollution; Modification of hydrographic functioning, general; modification of marine currents; dumping, depositing of dredged deposits; sea defence or coast protection works; erosion; eutrophication; invasion by a species; interspecific faunal relations; other forms or mixed forms of interspecific faunal competition; introduction of disease; genetic pollution; Mudflats and sandflats not covered by seawater at low tide: bad and deteriorating (range: favourable, area: favourable, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures and threats: fish and shellfish aquaculture; professional fishing; fixed location fishing; leisure fishing; bait digging; urbanised areas, human habitation; industrial or commercial areas; discharges; port areas; sport and leisure structures; nautical sports; motorised vehicles; pollution; water pollution; trampling, overuse; dykes, embankments, artificial beaches, general; erosion; eutrophication; invasion by a species; interspecific faunal relations; interspecific floral relations; genetic pollution. Coastal lagoons**:** inadequate (range: favourable, area: favourable, structure and function: favourable, future prospects: inadequate). Main pressures and threats: pollution to surface waters, change in biotic conditions, other human intrusions and disturbances, human induced changes in hydraulic conditions, changes in abiotic and biotic conditions. Annual vegetation of drift lines: bad and deteriorating (range: unknown, area: inadequate and deteriorating, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures: abandonment of pastoral systems; removal of beach materials; walking, horse-riding and non-motorised vehicles; motorised vehicles; air pollution; modification of marine currents; sea defence or coast protection works; erosion; other natural processes. Main threats: removal of beach materials; walking, horse-riding and nonmotorised vehicles; motorised vehicles; air pollution; erosion; biocenotic evolution; other natural processes. Perennial vegetation of stony banks: bad but improving (range: favourable, area: inadequate and deteriorating, structure and function: bad but improving, future prospects: bad but improving). Main pressures: abandonment of pastoral systems; removal of beach materials; walking, horse-riding and non-motorised vehicles; motorised vehicles; air pollution; modification of marine currents; sea defence or coast protection works; erosion; other natural processes. Main threats – same as main pressures. Salicornia and other annuals colonizing mud and sand: bad and deteriorating (range: favourable, area: inadequate and deteriorating, structure and function: bad and deteriorating, future prospects: bad and deteriorating). Main pressures and threats: discharges; water pollution; air pollution; soil pollution; military manoeuvres; reclamation of land from sea, estuary or marsh; drainage; flooding; modification of marine currents; sea defence or coast protection works; erosion; submersion; invasion by a species; competition. "Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")": bad (range: favourable, area: inadequate, structure and function: bad, future prospects: inadequate). Main pressures: removal of beach materials; urbanised areas, human habitation; industrial or commercial areas; disposal of household waste; disposal of industrial waste; walking, horse-riding and non-motorised vehicles; motorised vehicles; air pollution; sea defence or coast protection works; erosion. Main threats – same as pressures but also includes submersion. Desmoulin`s whorl snail (*Vertigo moulinsiana*): Bad **–** range; favourable, population; bad, habitat for the species; inadequate, future prospects; bad. Main threats and pressures: human induced changes in hydraulic conditions, abiotic (slow) natural processes, grazing, pollution to groundwater (point sources and diffuse sources) and fertilisation.
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • The populations of qualifying species, and, • The distribution of qualifying species within the site.
SSSI Condition assessment:	• Langstone Harbour SSSI: 8.39% favourable, 91.05% unfavourable recovering, 0.56% unfavourable-no change. • Chichester Harbour SSSI: 15.26% favourable, 3.56% unfavourable recovering, 81.18% unfavourable no change. • Portsmouth Harbour SSSI: 2.58% favourable, 25.70% unfavourable-recovering, 71.21% unfavourable-no change, 0.15% unfavourable-declining, 0.35% destroyed.
Site Improvement Plan (only actions that could be impacted by new housing development included):	1. Public Access/ Disturbance - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail,) Shoveler, Red-breasted Merganser, Ringed Plover,Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Annual vegetation of driftlines, Coastal shingle vegetation outside the reach of waves, Waterbird assemblage - Reduce disturbance through access management, awareness raising and wardening 4. Water Pollution - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Intertidal mudflats and sandflats, Glasswort and other annuals colonising mud and sand, Cord-grass swards, Atlantic salt meadows, Waterbird assemblage- Implement actions in the Diffuse Water Pollution Plan, and investigate further pollution. 13. Air Pollution: impact of Pressure Not yet determined atmospheric nitrogen deposition - dark-bellied brent goose, wigeon, pintail, Black-tailed Godwit, Curlew, Common greenshank, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Coastal lagoons, Glasswort and other annuals colonising mud and sand, Atlantic salt meadows, Shifting dunes with marram

Table 2 Chichester and Langstone Harbours SPA and Ramsar: Qualifying Features, condition and vulnerability to changes in nutrients

Designated site name:	**Chichester and Langstone Harbours**	
Designation type: (SAC, SPA, Ramsar):	SPA and Ramsar	
Qualifying features:	Feature	Vulnerability to changes in nutrients
	Article 4.1 **During the breeding season;** Little Tern *Sterna albifrons*, 100 pairs representing up to 4.2% of the breeding population in Great Britain (5 year mean, 1992-1996) Sandwich Tern *Sterna sandvicensis*, 158 pairs representing up to 1.1% of the breeding population in Great Britain (1998) **Article 4.2** **Over winter;** Bar-tailed Godwit *Limosa lapponica*, 1,692 individuals representing up to 3.2% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6) Dark-bellied Brent Goose *Branta bernicla bernicla*, 17,119 individuals representing up to 5.7% of the wintering Western Siberia/Western Europe population (5 year peak mean 1991/2 - 1995/6) Dunlin *Calidris alpina alpina*, 44,294 individuals representing up to 3.2% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6) Grey Plover *Pluvialis squatarola*, 3,825 individuals representing up to 2.5% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6) Redshank *Tringa totanus*, 1,788 individuals representing up to 1.2% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6) Ringed Plover *Charadrius hiaticula*, 846 individuals representing up to 1.7% of the wintering Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6) Over winter, the area regularly supports 93,142 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Wigeon *Anas penelope*, Bar-tailed Godwit *Limosa lapponica*, Dark-bellied Brent Goose *Branta bernicla bernicla*, Ringed Plover *Charadrius hiaticula*, Grey Plover *Pluvialis squatarola*, Dunlin *Calidris alpina alpina*, Black-tailed Godwit *Limosa limosa islandica*, Redshank *Tringa totanus*, Little Grebe *Tachybaptus ruficollis*, Little Egret *Egretta garzetta*, Shelduck *Tadorna tadorna*, Curlew *Numenius arquata*, Teal *Anas crecca*, Pintail *Anas acuta*, Shoveler *Anas clypeata*, Red-breasted Merganser *Mergus serrator*, Oystercatcher *Haematopus ostralegus*, Lapwing *Vanellus vanellus*, Knot *Calidris canutus*, Sanderling *Calidris alba*, Cormorant *Phalacrocorax carbo*, Whimbrel *Numenius phaeopus*.	The vulnerability of the bird species to changes in nutrients will depend on the impact to their preferred prey. Nesting and roosting opportunities are considered unlikely to be adversely affected. Bird species that feed on eelgrass (dark-bellied brent goose) and mudflat and sandflat habitats are likely to be highly sensitive to the impacts of eutrophication. Those species that feed on prey in the main water column are considered to be less sensitive, as this prey are mobile and less likely to be smothered. Reductions in dissolved oxygen could result in temporary changes in species availability. Information below is taken from Natural England's designated views site[17] on the feeding and habitat preferences of the species in Chichester and Langstone Harbours, other information sources are referenced where used: Little tern: forage alone in shallow water often within 1km of their breeding colony for small fish, crustaceans, and insects. Little terns take food from near the surface of the water by plunge diving, often following hovering, or by 'contact dipping', where only the bill enters the water and the bird remains in flight throughout (Natural England, 2012). They forage throughout the harbours, in the harbour mouths and into the Solent (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm) and (Hughes, 2017 Pers Comm). Common tern: Common terns forage alone or in small flocks for small fish and crustaceans, terrestrial insects and occasionally squid. They take food from near the surface of the water by plunge diving to a depth of 1-2m, often following hovering. Prey might also be gathered by 'contact dipping': where only the bill enters the water and the bird remains in flight throughout (Natural England, 2012). They forage throughout the harbours, in the harbour mouths and into the Solent (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm) and (Hughes, 2017 Pers Comm). Sandwich tern: prey species are more varied than that of the other terns, including sandeels, herring and sprats, as well as crustaceans and small squid. Sandwich terns forage alone or in small flocks taking prey from near the surface of the water by plunge-diving to a depth of 2m (Natural England, 2012). Foraging behaviour is seen throughout the harbours with a stronger tendency to feed at the harbour mouths. Bar-tailed godwit: feed throughout both harbours on intertidal sediments but show a preference for sandier substrates. Polychaete worms can make up around 95% of their winter diet (Smith, 1975). In Chichester Harbour, their main foraging areas are at Pilsey Sands and north of Black Point (Frost et al., 2017) and (Rowsell, 2017 Pers Comm). Dark-bellied brent goose: The main food sources for dark-bellied Brent goose in the harbours are the green algae (Ulva species) and seagrass beds growing on the intertidal sediments (Rowcliffe and Mitchell, 1996). Green algae is found throughout the harbours, whilst seagrass beds are located in more limited areas such as Sinah Lake and Mallard Sands in Langstone Harbour and the Hayling Island coast, West Thorney, West Chidham, East Head and the Horsepond in Chichester Harbour (Thomas et al., 2016) and (Rowsell, 2017 Pers Comm). Curlew: Curlew feed on marine worms, shellfish and shrimps found in the intertidal sediments within the sheltered harbours (Royal Society for the Protection of Birds (RSPB), 2017). They forage throughout both harbours, in low densities and can be seen south of Farlington Marshes and south of Bedhampton Wharf in Langstone Harbour (Frost et al., 2017), (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm) and (Hughes, 2017 Pers Comm). Dunlin: At low tide, dunlin spread out, feeding in groups on the intertidal sediments throughout the harbours, particularly south of Thorney Island and in the Emsworth Channel. They select snails, worms and shrimps from within and on top of the mudflats (Royal Society for the Protection of Birds (RSPB), 2017). Grey plover: Grey plover feed on cockles, lugworm, ragworms and small crustaceans but will also take surface prey such as sea slugs on the intertidal sediments (British Trust for Ornithology (BTO), 2017), (Royal Society for the Protection of Birds (RSPB), 2017) and (Durell and Kelly, 1990). Grey plover feed in low densities throughout both harbours Pintail: Pintail feed at the surface of the water by dabbling (submerging the head) for vegetation (The Wildlife Trusts, 2017). They feed throughout the harbours but particularly favour the Nutbourne Bay area and north of the Thorney Channel in Chichester Harbour (Rowsell, 2017 Pers Comm) and (Frost et al., 2017).

[17] https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9011011&SiteName=CHichester&SiteNameDisplay=Chichester%20and%20Langstone%20Harbours%20SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=18&HasCA=1

		Red-breasted merganser: Red-breasted merganser feed and roost on the water in both harbours. They dive and swim to forage on fish and aquatic invertebrates in the water column (The Wildlife Trusts, 2017). In Chichester Harbour, they favour deep-water areas such as Thorney Deeps, south of Pilsey Island, and north Hayling / Sweare Deep. In Langstone Harbour, they favour the deeper waters to the east of Farlington Marshes and towards Langstone Bridge (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm) and (Hughes, 2017 Pers Comm) Redshank: Redshank feed on invertebrates, both inland and in estuaries. Prey includes earthworms and crane fly larvae as well as crustaceans, molluscs and marine worms (British Trust for Ornithology (BTO), 2017). In Chichester and Langstone Harbours, they feed throughout and are seen regularly at Texaco Bay and the Kench (Rowsell, 2017 Pers Comm). Ringed plover: Ringed plover feed on invertebrates found on sand and shingle shores, mudflats, saltmarshes, short grassland and flooded fields (Joint Nature Conservation Committee (JNCC), Unk), throughout the harbours in low densities. Important areas for such habitat are Pilsey Sands, East Head, north of Black Point, Hayling Beach and Sword Sands (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm), and (Hughes, 2017 Pers Comm). Sanderling: Sanderlings feed in small groups at the edge of the tide, chasing the waves as they go out to collect crustaceans, worms, fish and jellyfish (The Wildlife Trusts, 2017). They feed in the site in area including: Pilsey Sands; East Head; north of Black Point; Hayling Beach; Sword Sands and Eaststoke Beach (Rowsell, 2017 Pers Comm) and (MacCallum and Smith, 2017 Pers Comm). Shelduck: Shelduck feed on marine snails, invertebrates and small shellfish found within intertidal sediments (Royal Society for the Protection of Birds (RSPB), 2017) and (Royal Society for the Protection of Birds (RSPB), 2017) .They forage throughout the site but particularly prefer the Fishbourne, Thorney and Bosham Channels as well as the Warblington Coast in Chichester Harbour (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm) and (Hughes, 2017 Pers Comm) Shoveler: Shoveler feed by sweeping their wide, long bills through the water to filter out invertebrates and plant matter (The Wildlife Trusts, 2017). They feed throughout the harbours but are regularly seen on mudflats to the south of Southmoor in Langstone Harbour and in low numbers in Nutbourne Bay and adjacent to Tournerbury Farm in Chichester Harbour (Rowsell, 2017 Pers Comm) and (MacCallum and Smith, 2017 Pers Comm). Teal: Teal feed on small invertebrates and seeds (Royal Society for the Protection of Birds (RSPB), 2017). In Chichester Harbour, they forage in the Thorney Channel, at Snowhill Creek and at Mill Rythe / Yacht Haven. They favour Farlington Marshes in Langstone Harbour (Rowsell, 2017 Pers Comm), (MacCallum and Smith, 2017 Pers Comm) and (Hughes, 2017 Pers Comm). Turnstone: Turnstone forage on intertidal sediment and rocky substrates. The prey on a wide variety of foods including crustaceans, barnacles and bivalves often found by turning over stones and seaweed (Sussex Inshore Fisheries Conservation Authority (IFCA), 2017). However, they will also feed upon bird eggs, corpses and even chips (The Wildlife Trusts, 2017). In Chichester and Langstone Harbours, they feed in low densities throughout (Rowsell, 2017 Pers Comm) and (MacCallum and Smith, 2017 Pers Comm). Wigeon: Wigeon feed on grazing marsh, seagrass (Zostera species) and other aquatic plants and roots, often at night (Royal Society for the Protection of Birds (RSPB), 2017) and (Rowsell, 2017 Pers Comm). Their favoured areas in the harbours include the Emsworth and Thorney Channels, the northern tips of the Bosham and Chichester Channels, Eames Farm, Thorney Deeps, Tournerbury Farm, School Rithe and Farlington Marshes (Rowsell, 2017 Pers Comm) and (MacCallum and Smith, 2017 Pers Comm).
	Ramsar criterion 1 Two large estuarine basins linked by the channel which divides Hayling Island from the main Hampshire coastline. The site includes intertidal mudflats, saltmarsh, sand and shingle spits and sand dunes. Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 76480 waterfowl (5 year peak mean 1998/99-2002/2003). Assemblages of international importance: Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: Ringed plover, Europe/Northwest Africa 853 individuals, representing an average of 1.1% of the population (5 year peak mean 1998/9-2002/3) Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe 906 individuals, representing an average of 2.5% of the population (5 year peak mean 1998/9-2002/3)	Covered above (Ramsar criteria 5 and 6) or as part of the Solent Maritime SAC designation (Ramsar criterion 1).

	Common redshank, *Tringa totanus totanus*, 2577 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3) Species with peak counts in winter: Dark-bellied brent goose, 12987 individuals, representing an average of 6% of the population (5 year peak mean 1998/9-2002/3) Common shelduck, NW Europe 1468 individuals, representing an average of 1.8% of the GB population (5 year peak mean 1998/9-2002/3) Grey plover, E Atlantic/W Africa -wintering 3043 individuals, representing an average of 1.2% of the population (5 year peak mean 1998/9-2002/3) Dunlin W Siberia/W Europe 33436 individuals, representing an average of 2.5% of the population (5 year peak mean 1998/9-2002/3) Species/populations identified after designation for possible future consideration under criterion 6. Species regularly supported during the breeding season: Little tern, *Sterna albifrons albifrons*, W Europe 130 apparently occupied nests, representing an average of 1.1% of the breeding population (Seabird 2000 Census)	
Current conservation status (Article 12)[18]:	• Bar-tailed Godwit: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Black-tailed Godwit: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Dark-bellied Brent Goose*:* Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Insufficient • Dunlin (breeding): Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Insufficient • Grey Plover: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Little Egret: Population numbers: Insufficient, Range coverage: Insufficient, Ecological sufficiency: Insufficient • Little Tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Redshank (non-breeding): Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Ringed Plover (breeding): Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Ringed Plover (non-breeding): Population numbers: Insufficient, Range coverage: Insufficient, Ecological sufficiency: Sufficient • Sandwich Tern (breeding): Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Sandwich Tern (non-breeding): Population numbers: Insufficient, Range coverage: Insufficient, Ecological sufficiency: Insufficient	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.	
SSSI Condition assessment:	• Langstone Harbour SSSI: 8.39% favourable, 91.05% unfavourable recovering, 0.56% unfavourable-no change. • Chichester Harbour SSSI: 15.26% favourable, 3.56% unfavourable recovering, 81.18% unfavourable no change.	
Site Improvement Plan (only actions that could be impacted by new housing development included):	1 Public Access/ Disturbance - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail,) Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Annual vegetation of driftlines, Coastal shingle vegetation outside the reach of waves, Waterbird assemblage - Reduce disturbance through access management, awareness raising and wardening 4.Water Pollution - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Intertidal mudflats and sandflats, Glasswort and other annuals colonising mud and sand, Cord-grass swards, Atlantic salt meadows, Waterbird assemblage- Implement actions in the Diffuse Water Pollution Plan, and investigate further pollution. 13. Air Pollution: impact of Pressure Not yet determined atmospheric nitrogen deposition - dark-bellied brent goose, wigeon, pintail, Black-tailed Godwit, Curlew, Common greenshank, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Coastal lagoons, Glasswort and other annuals colonising mud and sand, Atlantic salt meadows, Shifting dunes with marram	

[18] Ramsar condition is not currently reported on. The features are normally covered by the SAC and SPA which are reported on, and as part of European Marine Sites.

Table 3 Solent and Dorset Coast SPA: Qualifying Features, condition and vulnerability to changes in nutrients

Designated site name:	**Solent and Dorset Coast**	
Designation type: (SAC, SPA, Ramsar):	SPA (marine)	
Qualifying features:	Feature	Vulnerability to changes in nutrients
	Sandwich tern *Sterna sandvicensis* (Breeding) 441 pairs (882 breeding adults) (2008 - 2014), 4.01% of GB breeding population Common tern *Sterna hirundo* (Breeding) 492 pairs (984 breeding adults) (2009 - 2014), 4.77% of GB breeding population Little tern *Sternula albifrons* (Breeding) 63 pairs (126 breeding adults) (2009 - 2014) 3.31%	Sandwich tern and common tern foraging areas are predominantly confined to the Langstone and Chichester Harbours (of relevance to the new development in Havant BC), with some foraging offshore between the mainland and the Isle of Wight. Little tern foraging areas were confined to the Langstone and Chichester Harbours, rather than further offshore[19]. Nesting of all three species occurs on extensive shingle ridges and islands within Langstone Harbour. At the North East side of the harbour abandoned oyster beds off of Hayling Island provide an artificial lagoon which provides foraging and nesting habitat for the terns. Within Chichester Harbour, little tern nest on the shingle banks near to the harbour entrance. Common, little, and Sandwich terns feed in shallow coastal waters mainly on small fish (e.g. sandeel, sprats etc.) and crustacea (shrimps, prawns, and crabs etc.), as well as worms and molluscs in shallow waters overlying sediment[20]. Increases in nutrients in important feeding areas could therefore change the diversity and abundance of prey, and as such, the tern species are considered sensitive to changes in nutrients, although to a lesser extent than those bird species feeding directly on the mudflats and sandbanks.
Current conservation status (Article 12):	• Sandwich tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Common tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Little tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.	
SSSI Condition assessment:	• Langstone Harbour SSSI: 8.39% favourable, 91.05% unfavourable recovering, 0.56% unfavourable-no change. • Chichester Harbour SSSI: 15.26% favourable, 3.56% unfavourable recovering, 81.18% unfavourable no change. • Portsmouth Harbour SSSI: 2.58% favourable, 25.70% unfavourable-recovering, 71.21% unfavourable-no change, 0.15% unfavourable-declining, 0.35% destroyed.	
Site Improvement Plan (only actions that could be impacted by new housing development included):	Not available yet, only recently designated in January 2020, assume similar actions to those covered in the Solent SIP.	

[19] Natural England (January 2016) Departmental brief Solent and Dorset Coast potential Special Protection Area (pSPA). Accessed at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/560622/solent-dorset-departmental-brief.pdf
[20] English Nature (2001) Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation Solent and Southampton Water Special Protection Area & Ramsar Site Chichester and Langstone Harbours Special Protection Area & Ramsar Site Portsmouth Harbour Special Protection Area & Ramsar Site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

Table 4 Portsmouth Harbour SPA and Ramsar: Qualifying Features, condition and vulnerability to changes in nutrients

Designated site name:	**Portsmouth Harbour**	
Designation type: (SAC, SPA, Ramsar):	SPA and Ramsar	
Qualifying features (those in bold considered most sensitive to changes in nutrient levels):	Feature	Vulnerability to changes in nutrients
	Article 4.2 Over winter: **Dark-bellied Brent Goose *Branta bernicla bernicla*,** 2,847 individuals representing at least 0.9% of the wintering Western Siberia/Western Europe population (5-year peak mean 1991/2 - 1995/6)	Dark-bellied Brent geese roost on the water in Portsmouth Harbour at night. During the day they generally do not roost. Instead at high tide they feed on grassland and wheat fields near to the harbour and at low tide they feed on the harbour seagrass beds and green algae, particularly in the north and west at Paulsgrove Lake, Portchester and Forton Lake. As eelgrass beds are a major food source, and this habitat is susceptible to impacts from changes in nutrient input (see Ramsar criterion 3 below), dark-bellied brent goose are also considered to be sensitive[21].
	Red-breasted merganser *Mergus serrator* 100 individuals, 1% of GB population	In Portsmouth Harbour SPA, Red-breasted merganser feed throughout the channels in the harbour, favouring Paulsgrove Lake and utilise the shallow coastal waters within the site, feeding primarily on fish and aquatic invertebrates[21,22]. Given their feeding preferences, it is considered that the species is less sensitive to changes in nutrient levels.
	Black-tailed godwit *Limosa limosa* 70 individuals, over 1% of GB population	The main roost sites for black-tailed godwit are Pewit Island, the saltmarsh shore below RNAD Gosport, Bedenham and Farlington Marshes in Langstone Harbour. In wet weather, black-tailed godwits also move between Portsmouth Harbour and Titchfield Haven in the Meon Valley along the coast to the west. As well as feeding at low tide on the intertidal sediment in the north western part of the harbour, black-tailed godwit also feed during wet winters on the wet grassland at RNAD Gosport, Bedenham[21]. Black-tailed godwits feed on intertidal sediments, with ragworm and bivalve molluscs being important prey items. Mudflats and sandflats are susceptible to changes in nutrient levels (see Solent Maritime SAC for details), and therefore black-tailed godwit are considered to be sensitive.
	Dunlin *Calidris alpina* 8,010, over 1% of GB population	The main roost sites for dunlin are on pontoons near Wicor Shore, on saltmarsh below RNAD Gosport, Bedenham and on the island by Priddy's Hard. Some birds also fly back to Langstone Harbour to roost. At low tide, dunlin feed on the intertidal mudflats in the north west of the harbour around Cams Bay and Wicor Lake and in the west of the harbour at Forton Lake[21]. Mudflats and sandflats are susceptible to changes in nutrient levels (see Solent Maritime SAC for details), and therefore dunlin is considered to be sensitive.
	Ramsar criterion 3 The intertidal mudflat areas possess extensive beds of **eelgrass** *Zostera angustifolia* and *Zostera noltei* which support the grazing dark-bellied brent geese populations. The mud-snail *Hydrobia ulvae* is found at extremely high densities, which helps to support the wading bird interest of the site. Common cord-grass *Spartina anglica* dominates large areas of the saltmarsh and there are also extensive areas of green algae *Enteromorpha* spp. and sea lettuce *Ulva lactuca*. More locally the **saltmarsh** is dominated by sea purslane *Halimione portulacoides* which gradates to more varied communities at the higher shore levels. The site also includes a number of saline lagoons hosting nationally important species.	There are approximately 77 ha of seagrass beds in Portsmouth Harbour, which are found mainly in the north-west of the harbour. These beds include both *Zostera marina* (found on the low shore) and *Zostera noltii* (on the upper to mid shore). Excessive nutrients and / or high turbidity can lead to a reduction in dissolved oxygen, especially in warmer months. *Zoestra* spp. have a high intolerance to nutrient enrichment with high nitrate concentrations leading to a decline of *Zoestra marina*. The adverse effects of increases in nitrate has been shown to be exacerbated by the level of salinity, with estuarine habitats being more intolerant than marine habitats. Den Hartog (1994) reported the growth of a dense blanket of *Ulva radiata* in Langstone Harbour in 1991 that resulted in the loss of 10ha of *Zostera marina* and *Zostera noltii*; by summer 1992 the *Zostera* sp. were absent, however this may have been exacerbated by grazing by Brent geese[23]. Although Langstone Harbour and Portsmouth Harbour are linked, the habitats in Portsmouth Harbour would only be adversely effect if there was a significant input of water from Langstone Harbour into Portsmouth Harbour to allow the transfer of nutrients. Two brackish lagoons are located adjoining Haslar Lake in the south-west of the harbour. Both, Little Anglesey Lake and Cockle Pond, support populations of both the starlet sea anemone *Nematostella vectensis* and the lagoon sand shrimp *Gammarus insensibilis*[24]. The lagoons are located at sufficient distance from Langstone Harbour, at the head of Haslar Marina, to be impacted by detectable increases in nutrients from the proposed housing development in the Budds Farm WwTW catchment.
	Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species with peak counts in winter: Dark-bellied brent goose, *Branta bernicla bernicla*, 2105 individuals, representing an average of 2.1% of the GB population (5 year peak mean 1998/9-2002/3)	As above for the SPA.
Current conservation status (Article 12):	• Black-tailed Godwit: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Dark-bellied Brent Goose*:* Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Insufficient • Red-breasted merganser: • Dunlin: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Insufficient	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features	

[21] Portsmouth Harbour SPA Last updated: 14th September 2018 Supplementary advice. Accessed at: https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9011051&SiteName=Portsmouth+Harbour&SiteNameDisplay=Portsmouth+Harbour+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=4%2c4

[22] English Nature (2001) Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation Solent and Southampton Water Special Protection Area & Ramsar Site Chichester and Langstone Harbours Special Protection Area & Ramsar Site Portsmouth Harbour Special Protection Area & Ramsar Site English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

[23] Tyler-Walters, H., 2008. Zostera (Zostera) marina Common eelgrass. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-01-2020]. Available from: https://www.marlin.ac.uk/species/detail/1282

[24] Portsmouth Harbour SSSI citation (1993). Accessed at https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1003174.pdf

	• The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.
SSSI Condition assessment:	Portsmouth Harbour SSSI: 2.58% favourable, 25.70% unfavourable-recovering, 71.21% unfavourable-no change, 0.15% unfavourable-declining, 0.35% destroyed.
Site Improvement Plan (only actions that could be impacted by new housing development included):	1 Public Access/ Disturbance - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail,) Shoveler, Red-breasted Merganser, Ringed Plover,Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Annual vegetation of driftlines, Coastal shingle vegetation outside the reach of waves, Waterbird assemblage - Reduce disturbance through access management, awareness raising and wardening 4.Water Pollution - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Intertidal mudflats and sandflats, Glasswort and other annuals colonising mud and sand, Cord-grass swards, Atlantic salt meadows, Waterbird assemblage- Implement actions in the Diffuse Water Pollution Plan, and investigate further pollution. 13. Air Pollution: impact of Pressure Not yet determined atmospheric nitrogen deposition - dark-bellied brent goose, wigeon, pintail, Black-tailed Godwit, Curlew, Common greenshank, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Coastal lagoons, Glasswort and other annuals colonising mud and sand, Atlantic salt meadows, Shifting dunes with marram

Table 5 Solent and Southampton Water SPA and Ramsar: Qualifying features, condition and vulnerability to changes in nutrients

Designated site name:	**Solent and Southampton Water**	
Designation type: (SPA, Ramsar):	SPA and Ramsar site	
Qualifying features:	Feature:	Vulnerability to changes in nutrients:
	Article 4.1: During the breeding season; common tern *Sterna hirundo*, 267 pairs representing at least 2.2% of the breeding population in Great Britain; little tern *Sterna albifrons*, 49 pairs representing at least 2.0% of the breeding population in Great Britain; Mediterranean gull *Larus melanocephalus*, 2 pairs representing at least 20.0% of the breeding population in Great Britain; roseate tern *Sterna dougallii*, 2 pairs representing at least 3.3% of the breeding population in Great Britain; sandwich tern *Sterna sandvicensis*, 231 pairs representing at least 1.7% of the breeding population in Great Britain. Article 4.2: Over winter; Black-tailed godwit *Limosa limosa islandica*, 1,125 individuals representing at least 1.6% of the wintering Iceland - breeding population; dark-bellied brent goose *Branta bernicla bernicla*, 7,506 individuals representing at least 2.5% of the wintering Western Siberia/Western Europe population; ringed plover *Charadrius hiaticula*, 552 individuals representing at least 1.1% of the wintering Europe/Northern Africa - wintering population; teal *Anas crecca*, 4,400 individuals representing at least 1.1% of the wintering Northwestern Europe population. Assemblage qualification: A wetland of international importance. Over winter, the area regularly supports 53,948 individual waterfowl including: gadwall *Anas strepera*, teal *Anas crecca*, ringed plover *Charadrius hiaticula*, black-tailed godwit *Limosa limosa islandica*, little grebe *Tachybaptus ruficollis*, great crested grebe *Podiceps cristatus*, Cormorant *Phalacrocorax carbo*, dark-bellied brent goose *Branta bernicla bernicla*, wigeon *Anas penelope*, redshank *Tringa totanus*, Pintail *Anas acuta*, shoveler *Anas clypeata*, red-breasted merganser *Mergus serrator*, grey plover *Pluvialis squatarola*, lapwing*Vanellus vanellus*, dunlin *Calidris alpina alpina*, curlew *Numenius arquata*, shelduck *Tadorna tadorna*.	The vulnerability of the bird species to changes in nutrients will depend on the impact to their preferred prey. Nesting and roosting opportunities are considered unlikely to be adversely affected. Bird species that feed on eelgrass (e.g. dark-bellied brent goose) and mudflat and sandflat habitats are likely to be highly sensitive to the impacts of eutrophication. Those species that feed on prey in the main water column are considered to be less sensitive, as these prey are mobile and less likely to be smothered. Reductions in dissolved oxygen could result in temporary changes in species availability. Tidal circulation patterns viewed in ABPmer's South Coast and Solent model suggest that water is retained within the Eastern Solent, rather than significantly entering Southampton Water. The offshore area that could be affected is around Ryde, Isle of Wight. A review of Natural England's designated views site suggests that Ryde is not a key feeding ground for the qualifying species.
	Ramsar criterion 1: The site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs. Ramsar criterion 2: Important assemblage of rare plants and invertebrates. At least 33 BRDB invertebrates and at least eight BRDB plants are represented on site. Ramsar criterion 5: Assemblages of international importance: Species with peak counts in winter: 51343 waterfowl. Ramsar criterion 6: Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: ringed plover, *Charadrius hiaticula*, Europe/Northwest Africa 397 individuals, representing an average of 1.2% of the GB population. Species with peak counts in winter: dark-bellied brent goose, *Branta bernicla bernicla*, 6456 individuals, representing an average of 3% of the population, Eurasian teal, *Anas crecca*, NW Europe 5514 individuals, representing an average of 1.3% of the population, black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe 1240 individuals, representing an average of 3.5% of the population.	Covered above (Ramsar criterion 5 and 6) or as part of the Solent Maritime SAC designation (Ramsar criterion 1 and 2).
Current conservation status (Article 12):	• Mediterranean gull: Population: Insufficient, Range coverage: Insufficient, especially in northern parts of the range. Ecological sufficiency: Sufficient • Sandwich tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Common tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Little tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Roseate tern: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Dark bellied brent geese: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: insufficient • Teal: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Ringed plover: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient • Black-tailed godwit: Population numbers: Sufficient, Range coverage: Sufficient, Ecological sufficiency: Sufficient	
Conservation objectives (SPA):	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying feature • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features • The distribution of the qualifying features within the site. Supplementary Advice to the conservation objectives is not currently available, however Regulation 33 advice is available[25].	
SSSI condition assessment:	Lower Test Valley SSSI: 100% favourable Medina Estuary SSSI: 100% favourable	

[25] Solent European Marine Site comprising: Solent Maritime candidate Special Area of Conservation, Solent and Southampton Water Special Protection Area & Ramsar Site, Chichester and Langstone Harbours Special Protection Area & Ramsar Site, Portsmouth Harbour Special Protection Area & Ramsar Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994. Accessed at http://publications.naturalengland.org.uk/publication/3194402.

	Newtown Harbour SSSI: 89.34% favourable, 10.31% unfavourable recovering, 0.35% unfavourable declining. Diffuse pollution affecting littoral sediment is being addressed through the Isle of Wight Catchment Sensitive Farming Project, whilst the unit in unfavourable-declining condition consists of neutral grassland which has been improved and overgrazed. Yar Estuary SSSI: 83.15% favourable, 16.85% unfavourable recovering. Key issues for unfavourable recovering condition include dominance of ragwort, public disturbance issues, overgrazing by rabbits and coastal squeeze.
Site Improvement Plan (only actions that could be impacted by new housing development included):	1 Public Access/ Disturbance - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail,) Shoveler, Red-breasted Merganser, Ringed Plover,Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Annual vegetation of driftlines, Coastal shingle vegetation outside the reach ofwaves, Waterbird assemblage - Reduce disturbance through access management, awareness raising and wardening 4.Water Pollution - Little Egret, Dark-bellied Brent Goose, Common shelduck, Wigeon, Eurasian teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Common redshank, Turnstone, Mediterranean Gull, Sandwich Tern, Roseate Tern, Common Tern, Little Tern, Estuaries, Intertidal mudflats and sandflats, Glasswort and other annuals colonising mud and sand, Cord-grass swards, Atlantic salt meadows, Waterbird assemblage- Implement actions in the Diffuse Water Pollution Plan, and investigate further pollution. 13. Air Pollution: impact of Pressure Not yet determined atmospheric nitrogen deposition - dark-bellied brent goose, wigeon, pintail, Black-tailed Godwit, Curlew, Common greenshank, SandwichTern, Roseate Tern, Common Tern, Little Tern, Estuaries, Coastal lagoons, Glasswort and other annuals colonising mud and sand, Atlantic salt meadows, Shifting dunes with marram