GROVE HOUSE

SELLINDGE

NUTRIENT NEUTRALITY ASSESSMENT AND MITIGATION STRATEGY

GLADMAN DEVELOPMENTS LTD

DOCUMENT REFERENCE:

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WATER | ENVIRONMENT

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Authorisation and Version Control

Water Environment was commissioned by Gladman Developments Ltd to investigate and mitigate against the concerns raised by Natural England regarding the nutrient neutrality of the proposed development at Grove House in Sellindge, and the potential adverse effects on downstream Habitats Sites.

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C01	22/11/2023	Final Issue	MW	CMG	GL
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EXECUTIVE SUMMARY

In 2018, the European Court of Justice refined the definition of plans and projects and ruled that mitigation needs to be in place to ensure that there will be no likely significant effect on the conservation status of designated sites. Additional nutrient loading to designated sites already in an unfavourable conservation status is necessarily limited unless mitigation is in place. This ruling has come to be known as 'The Dutch Case'.

In the Stour River catchment in East Kent, developments could adversely affect the designated site known as Stodmarsh. Several of the nature reserve lakes are in a state of eutrophication (an unfavourable conservation status) and therefore the ruling of the Dutch Case applies. All developments in the catchment must demonstrate 'nutrient neutrality' in order to ensure no adverse effect on the integrity of the designated site, meaning that the nutrients generated by the development must be less than or equal to the nutrients generated by the existing land use.

The application site is located on the western edge of Sellindge and west of Bulls Lane. The site is bounded by the M20 to the south and the A20 to the north.

The total application area is approximately 2.95 hectares of proposed residential development of up to 52 dwellings, with associated amenities, greenspace, access roads and parking. The land is currently used for grazing animals. There is a single dwelling that is shown to be within the site boundary, however, it is excluded from the application.

An adverse effect on Stodmarsh cannot be ruled out from the development, in the absence of any mitigation. It was found that Sustainable Drainage systems, a Water Recycling Centre and the use of nutrient credits would be sufficient to completely mitigate the nutrient budget of the site.

ABBREVIATIONS

Acronym	Definition
AA	Appropriate Assessment
ABC	Ashford Borough Council
DFP	Development Framework Plan
EMC	Event Mean Concentrations
FCA	Favourable Condition Targets
HRA	Habitats Regulations Assessment
NE	Natural England
NEGM	Natural England Generic Methodology
NENBC	Natural England Nutrient Budget Calculator
ONS	Office for National Statistics
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TN	Total Nitrogen
TP	Total Phosphorus
WRC	Water Recycling Centre
WwTW	Wastewater Treatment Works
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

1 INTRODUCTION

1.1 The application site is located on the western edge of Sellindge and west of Bulls Lane. The site is bounded by the M20 to the south and the A20 to the north.

1.2 The total application area is approximately 2.95 ha of residential development. The proposal is for the construction of up to 52 dwellings, with associated amenities, access roads, parking and greenspace.

1.3 The land is currently used for grazing animals. There is a single dwelling that is shown to be within the site boundary, however, it is excluded from the application.

1.4 As the site lies within the catchment of a European and internationally designated site – Stodmarsh – a Habitats Regulations Assessment (HRA) is required.

Background

1.5 A HRA refers to the several distinct stages of assessment which must be undertaken in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended) to determine if a plan or project may affect the protected features of a habitats site (any site which would be included within the definition at Regulation 8 of the Conservation of Habitats and Species Regulations 2017) before deciding whether to undertake, permit or authorise it.

1.6 A significant effect should be considered likely if it cannot be excluded on the basis of objective information and it might undermine a site's conservation objectives. A risk or a possibility of such an effect is enough to warrant the need for an Appropriate Assessment (AA) to be carried out by the competent authority. 'Appropriate' is not a technical term. It indicates that an assessment needs to be proportionate and sufficient to support the task of the competent authority in determining whether the plan or project will adversely affect the integrity of the habitats site. An AA must contain complete, precise, and definitive findings and conclusions to ensure that there is no reasonable scientific doubt as to the effects of the proposed plan or project.[1]

1.7 In 2018, the European Court of Justice refined the definition of plans and projects in the so-called 'Dutch case' ruling that mitigation needs to be certain at the time of assessment to ensure that there will be no adverse effect on the conservation status of European designated sites which already exceed compliance limits[2].

1.8 Nutrient neutrality is a means of ensuring that a plan or project does not add to existing nutrient burdens. Where nutrient neutrality is properly applied and the existing land does not undermine the conservation objectives, Natural England (NE) considers that an adverse effect on integrity alone and in combination can be ruled out[3].

1.9 In the Stour Valley River catchment in East Kent, developments could adversely affect Stodmarsh, which is designated a Site of Special Scientific Interest (SSSI), a Special Protection Area (SPA), a Special Area of Conservation (SAC) and a Ramsar site. Several of the nature reserve lakes at Stodmarsh are in a state of eutrophication (an unfavourable conservation status) and therefore the ruling of the Dutch Case applies.

1.10 The practical implication of the Dutch Case across England is the necessity to mitigate increases in nutrient loading from new development including nutrients contained in surface water runoff

[1] Guidance on the use of Habitats Regulations Assessment – https://www.gov.uk/guidance/appropriate-assessment – accessed 11/2023
[2] Joined Cases C-293/17 and C-294/17 of the European Court of Justice
[3] Wood, A., Wake, H., and McKendrick-Smith, K. (2022) 'Nutrient Neutrality Principles' Natural England Technical Information Note, TIN186

and an increase in wastewater flows to any of the Wastewater Treatment Works (WwTW) in the relevant catchment.

Scope of Study

1.11 The main objectives of this study are to:

- Provide an overview of NE's position with respect to water quality within the Habitats Sites;
- Present calculations, based on the absence of any mitigation measures, to outline the potential increase in nutrient loading as a result of the proposed development; and
- Outline the mitigation strategy proposed to manage surface and wastewater from the proposed development and present supporting calculations in order to ensure that, from first occupation of the dwellings, the proposed development is nutrient neutral.

2 WATER QUALITY IN STODMARSH

Stodmarsh Designated Sites[4]

2.1 The Stodmarsh SSSI is designated by NE for the following features of interest:

- Wetland habitats including extensive reedbeds, swamp and fen communities;
- Open water habitats including lakes, ditches, and lagoons;
- Diverse breeding and non-breeding bird communities. Two rare British birds – Cetti's warbler and bearded tit – breed here in nationally significant numbers;
- Varied invertebrate fauna, including multiple scarce moth species;
- An assemblage of vascular plants.

2.2 The Stodmarsh SPA is designated for the following features and supported species:

- Bittern (Non-Breeding);
- Gadwall (Breeding and Non-Breeding);
- Hen Harrier (Non-Breeding);
- Shoveler (Non-Breeding);
- Breeding bird assemblage;
- Waterbird assemblage;

2.3 The Stodmarsh Ramsar Site is designated, under criteria 2 of the Ramsar Convention, for:

- Wetland invertebrate assemblage;
- Wetland plant assemblage;
- Assemblage of rare wetland birds;
- Bearded tit populations (Breeding and Wintering);
- Bittern (Wintering);
- Gadwall (Breeding and Wintering);
- Hen Harrier (Wintering);
- Shoveler (Wintering);

2.4 The Stodmarsh SAC is designated for the following qualifying species:

- Desmoulin's whorl snail;

2.5 The focus of this letter is on the evidence of degrading water quality in the Stodmarsh SSSI, SPA, Ramsar and SAC, henceforth referred to as the 'Habitats Sites'.

[4] Designatedsites.naturalengland.org.uk (Accessed 11/2023)

Nutrients of Significance

2.6 It has been found that the nutrients of the highest significance in terms of water quality in the Habitats Sites are Total Nitrogen (TN) and Total Phosphorus (TP).

2.7 TN includes organic and inorganic forms of nitrogen, both of which are available for plant growth and can contribute to algal blooming. TN is the sum of inorganic forms of nitrogen – nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-N) and ammoniacal nitrogen (NH_3-N and NH_4-N) – and organically bonded nitrogen.

2.8 TP includes all phosphorus components – phosphate phosphorus (PO_4-P), dissolved organic phosphorus and particulate phosphorus in algal and bacterial cells – and also includes mineral particles such as clay.

Water Quality

2.9 The condition of the Habitats Sites which support the designated features is in part dependent on the water quality within them. The occurrence of excessive nutrients in the Habitats Sites can impact the competitive interactions between high plant species, and between higher plant species and algae, which can result in dominance in attached forms of algae, and a loss of characteristic plant species.

2.10 Changes in plant growth and community composition can have implications for the wider food web and the species present. Increased nutrients and the occurrence of eutrophication can also affect the dissolved oxygen levels in the waterbody, which can also impact the biota within the Habitats Sites.

2.11 Algal Bloom and fish kill events have been observed in one of the Habitats Sites Lakes (SSSI Unit 010). Assessments by NE have described the condition of this lake as 'unfavourable' and indicated high nutrient levels. TP has been measured at 1000 µg/l where the target for SSSI lakes is 49 µg/l. Eutrophication, which arises as a result of increased water nutrient levels, can lead to a reduction of fish and macrophyte populations. This in turn impacts food availability for SPA/Ramsar birds and the qualifying invertebrate community. The reason for this adverse condition is quoted as 'Freshwater pollution – Water Pollution – Discharge'.

2.12 The lake within SSSI Unit 007 has also been described as 'unfavourable' and has been found to fail in reaching nationally agreed water quality targets, including an excess of nitrogen and phosphorus. The reason for this adverse condition is quoted as 'Freshwater pollution – Water Pollution – Agriculture/Runoff'.

2.13 Lakes within Units 001, 002 and 005 are described as in 'Favourable' or 'Unfavourable – recovering' condition and thus are not of concern for this assessment.

2.14 Concentrations of TN and TP have been recorded within the lakes in SSSI Units 007 and 010 above the NE SSSI Favourable Condition Targets (FCTs) of 49 µg/l TP and 1.5 mg/l TN. It is important to understand the mechanism by which these nutrients enter the Habitats Sites. Some of the major sources of TN and TP have been identified as the following[5]:

- WwTWs which outfall into the Stour upstream of the Habitats Sites;
- Runoff from urban and agricultural land;
- Flood waters from the River Great Stour (during both high flow and tidal events); and
- Recycling of Nutrients within lake 007 itself.

[5]APEM, Stodmarsh SSSI, SPA and NNR Lake Hydrology Project Phase 1, April 2016

2.15 In the case of TP, it has been estimated that the dominant source of phosphate in the River Stour is WwTWs, accounting for 50% – 80% of concentrations in the river adjacent to the Habitats Sites[6].

Strategic Approach

2.16 Where sites are already in unfavourable condition due to elevated nutrient levels, NE considers that competent authorities will need to carefully justify how further inputs from new plans and projects, either alone or in combination, will not adversely affect the integrity of the site given the conservation objectives.[7]

2.17 To address the uncertainty and the subsequent risk to the Habitats Sites, the mitigation strategy outlined in this report will ensure that the proposed development does not add to existing nutrient burdens and provides certainty that the whole of the scheme is deliverable in line with the requirements of the Conservation of Habitats and Species Regulations 2017[8] and in light of relevant case law[9].

2.18 The latest NE guidance has been followed to ensure that the proposed development will be nutrient neutral (i.e. will not increase the flux of nutrients to the designated site).

2.19 In this report the following staged approach has been implemented: in Part 1, it was calculated, in the absence of any mitigation measures, the potential increase in nutrient loading from the proposed development. In Part 2, a mitigation strategy was proposed and supporting calculations have been presented which provide sufficient and reasonable certainty that the development will not contribute to an increase in nutrient loading.

2.20 The nutrient neutrality calculations in this report were based on key inputs and assumptions based on the best available scientific evidence and research. To accommodate for the necessary level of uncertainty in these key assumptions, a buffer has been used when calculating levels of nutrients. This buffer ensures that a precautionary approach is followed throughout.

[6]ATKINS, Stodmarsh Lake Hydrology Study, May 2016
[7] Natural England (16 March 2022) Letter to LPA Chief Executives and heads of planning 'Advice for development proposals with the potential to affect water quality resulting in adverse nutrient impacts on habitats sites.'
[8] Conservation of Habitats and Species Regulations (England and Wales) Regulations 2017
[9] Including Wildlife and Countryside Act 1981, Countryside and Rights of Way Act 2000 and Rural Communities Act 2006

3 SITE DESCRIPTION

Location

3.1 The application site is located on the western edge of Sellindge and west of Bulls Lane. The site is bounded by the M20 to the south and the A20 to the north.

3.2 The site is 10 km southeast of Ashford. The total application area is approximately 2.95 ha, and excludes the area hatched in grey, that is shown to be within the site boundary in Figure 1.

3.3 The site boundary and location in respect to the Stour Valley catchment is shown in Figure 1 below. The site is located in the Upper Stour Operational Catchment.

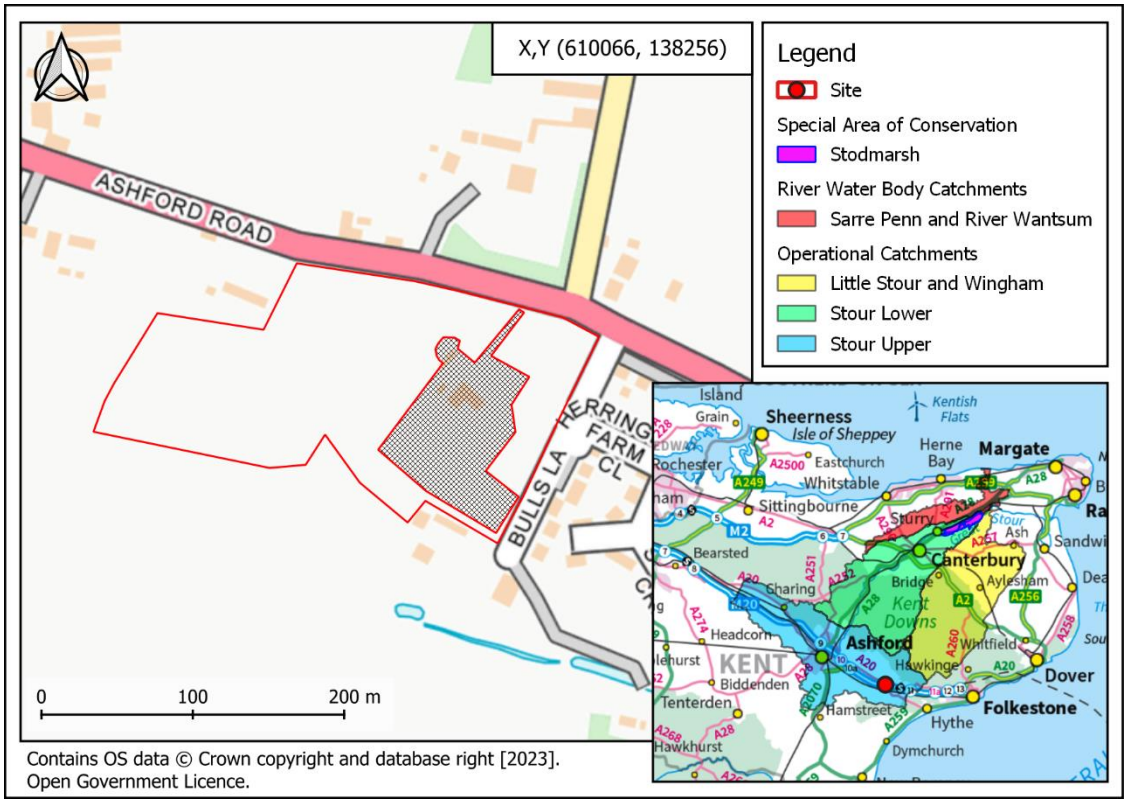

Figure 1: Site Location Relative to the Habitats Site Catchment

Proposed Development

3.4 The proposal is for the construction of residential development with up to 52 dwellings, with associated amenities, greenspace, access roads and parking.

3.5 The Development Framework Plan (DFP) for the proposed scheme is attached in Appendix A.

4 PART 1: CALCULATING THE NUTRIENT BUDGET

Natural England Methodology

4.1 The latest version of the Natural England Generic Methodology (NEGM) for determining whether a site achieves nutrient neutrality was issued in March 2022[10]. This guidance lays out the process of calculating the nutrient budget and provides worked examples.

Stage 1 – Total Wastewater Load

4.2 Stage 1 of the calculation is to calculate the nutrient load from the additional wastewater that will be generated by the development. This stage specifically only includes new overnight stays in the development, as it is assumed that any additional wastewater generated by diurnal use would be accounted for elsewhere.

4.3 This is done by multiplying the total amount of wastewater by the expected concentration of treated effluent from the WwTW serving the development. The WwTW can be determined through an enquiry from the wastewater service provider in the development location.

4.4 The NEGM recommends using water use as a proxy for total wastewater amount, excluding any garden use. NE's advice is to use the Building Regulations to determine the average water use per person, and then to add 10 litres/person/day (l/p/d) to the value to account for uncertainty in any future changes to fittings.

4.5 The increase in the number of people from a development can be determined using census data from the Office for National Statistics (ONS). This gives the average occupancy of a dwelling type, and NE recommends the use of the national average occupancy rate to determine the expected population.

Stage 2 and Stage 3 – Existing and Future Surface Water Loads

4.6 Stage 2 of the calculation is to consider the existing land use on the site, and Stage 3 is to consider the future land-use onsite. Using the ADAS Farmscoper tool, loading factors can be determined for all different agriculture uses within the catchment. These loading factors are further separated by the underlying soil drainage conditions and average rainfall and are measured in kg/ha/year.

4.7 The NEGM does not elaborate on how greenspace and woodland loading rates were derived, however, in previous NE Guidance[11], detail was provided on how TN loading factors for non-agricultural and non-urban land uses were calculated. Three main sources of TN were identified: atmospheric deposition, pet waste and TN fixation. It was estimated, based on several studies, that the catchment would retain 90% of all TN. This was studied in both the Solent catchment and the Stodmarsh catchment, and it was found that the numbers did not vary significantly. It is expected that this would be the case throughout England.

4.8 For woodland and heathland, the pet waste was discounted, and a total loading factor of 3 kgN/ha/year was therefore calculated. In the latest guidance, greenspace, open space, and woodland have all been given the same loading factor of 3 kgN/ha/year.

4.9 For TP, evidence suggested that non-agricultural, non-urban land uses do not leach TP. It was therefore conservatively assumed that woodland, greenspace, and similar land uses would leach TP at the limit of detection which, in some studies, was 0.02 kgP/ha/year.

[10] Ricardo and Natural England (February 2022) Nutrient Neutrality Generic Methodology NECR459, Natural England
[11] Natural England (2020), 'Advice on Nutrient Neutrality for New Development in the Stour Catchment in Relation to Stodmarsh Designated Sites'

4.10 In the NEGM, urban loading factors were modelled using assumed[12] 'event mean concentrations' (EMC) of nutrients for rainfall events. The average runoff for a site can be calculated using the Modified Rational Method and multiplying the runoff by the EMC will give the nutrient load. This has been standardised for a 1 ha site so that a loading factor can be obtained in the same units of measurement as for agriculture and greenspace.

4.11 Using these loading factors, and the area of various land uses on the site, the existing and future nutrient load from diffuse sources can be calculated.

Stage 4 – Final Unmitigated Nutrient Budget

4.12 Stage 4 of the calculation is the final stage. At this point, the totals from Stage 1 and Stage 3 are added together, and the total from Stage 2 is subtracted. If there is a surplus (i.e., the proposed total is higher than the existing total), a buffer (factor of safety) of 20% is added to the total, and this is then referred to as 'the nutrient budget'. If the nutrient budget comes out as less than or equal to zero, then the development has achieved nutrient neutrality.

4.13 The calculations have been presented in Water Environment's bespoke calculator, as it is more readable and can incorporate mitigation scenarios. All the calculations set out in this section can be seen in full in Appendix B of this report.

Additional Wastewater

4.14 The primary source of nutrients from residential development is usually domestic wastewater. Typically, wastewater is conveyed from the development to the public sewerage and onto the WwTW for treatment before discharge to surface waters.

4.15 In the case of the proposed development, wastewater would usually be conveyed to Sellindge WwTW which has a TP licence limit of 0.5 mgP/l and no limit for TN, and for the purposes of establishing a nutrient baseline, this has been assumed to be the case. Therefore, in line with the NEGM, the effluent concentrations have been taken as 0.45 mgP/l and 27 mgN/l.

4.16 In line with the NEGM, the national average occupancy of 2.4 has been used for houses. The proposed development is for the construction of up to 52 dwellings, which gives an average total future occupancy of 124.8 people.

4.17 The development will use a water use of 110 l/p/d, along with the advice in the NEGM to add an extra 10 l/p/d to the value to account for uncertainty in any future changes to fittings, therefore putting the total water use for the development at 120 l/p/d.

4.18 Using the information above, for 52 dwellings a wastewater nutrient load of 147.69 kgN/year and 2.46 kgP/year has been calculated for the proposed development scheme.

Land-Use Change

4.19 The site is within the Upper Stour Operational Catchment and lies within the River Great Stour nitrate vulnerable zone[13]. The greenfield runoff estimation tool on the HR Wallingford Website[14], gives a standard annual average rainfall (SAAR) for this site of 760 mm/year, and Cranfield University's Soilscapes tool[15] gives a soil drainage type of 'Naturally Wet'.

[12] The latest NE methodology quotes 'Mitchell, G., 2005. Mapping hazard from urban non-point pollution: A screening model to support sustainable urban drainage planning. Journal of Environmental Management, 74(1), pp. 1-9' in the definition of the so-called 'event mean concentrations'. However, the paper does not disclose how the event mean concentrations listed were calculated.
[13] https://mapapps2.bgs.ac.uk/ukso/home.html?layers=NVZEng [accessed 11/2023]
[14] Available at: uksuds.com
[15] Available at: http://www.landis.org.uk/soilscapes/# [Accessed on 11/2023]

4.20 The land is currently used for grazing animals. There is a single dwelling that is shown to be within the site boundary, however, it is excluded from the application. Under the NEGM, the land use is classified as 'Lowland' with an area of 2.95 ha and an existing surface water nutrient load of 32.95 kgN/year and 0.55 kgP/year. Historic satellite imagery dating back to 2014 and a handwritten letter of support from the land manager have been attached in Appendix C to support this land use.

4.21 After redevelopment, the land uses on site will be designated as follows:

- Residential Urban: 1.32 ha with a nutrient load of 19.07 kgN/year and 2.05 kgP/year;
- Open Urban: 0.04 ha with a nutrient load of 0.34 kgN/year and 0.03 kgP/year; and
- Greenspace: 1.59 ha with a nutrient load of 4.77 kgN/year and 0.03 kgP/year.

The future surface water nutrient load will therefore be 24.18 kgN/year and 2.11 kgP/year.

4.22 A plan has been attached to Appendix A showing how the land use categorisation of the site was done. It should be noted that the residential urban area of 1.32 ha used in the calculations differs from the developable area in the DFP of 1.30 ha. This is due to the inclusion of the access road as part of the residential urban area.

The Nutrient Budget

4.23 The existing nutrient load from the site is 32.95 kgN/year and 0.55 kgP/year, and the future nutrient load from the proposed development is 171.87 kgN/year and 4.57 kgP/year. Therefore, the future nutrient loading for the proposed development, due to increased wastewater load and land-use change, exceeds the existing nutrient load by 138.92 kgN/year and 4.03 kgP/year.

4.24 Including the recommended 20% buffer, these calculations set the 'nutrient budget' for the proposed development as 166.71 kgN/year and 4.83 kgP/year.

4.25 The following section outlines the proposed mitigation strategy for the reduction of this additional nutrient loading to zero, i.e. to establish nutrient neutrality.

5 PART 2: MITIGATION STRATEGY

5.1 As the development will result in an increase in nutrient load, mitigation will be required to achieve nutrient neutrality. The mitigation strategy presented in this section has been designed to reduce the nutrient budget to zero.

5.2 All calculations for the proposed mitigation strategy are included in full in Appendix B of this report.

Reduction in Load through Sustainable Drainage Systems

5.3 CIRIA's guidance for using SuDS to reduce TP load in surface water (C808) provides reduction rates for various types of SuDS.

5.4 Through the use of a bioretention area or a tree-pit (80% reduction of particulate phosphorus), combined with a bed/cage of adsorption media (90% reduction of dissolved phosphorus), a TP reduction of 84.5% can be achieved

5.5 CIRIA has released new guidance on TN removal rates (C815). The guidance suggests that a TN removal rate of 30% can be achieved using a SuDS treatment train, which will be confirmed at the detailed design stage of the application.

5.6 Using the removal rates of 30% for TN and 84.5% for TP, the future surface water nutrient load would be reduced from 24.18 kgN/year and 2.11 kgP/year to 18.36 kgN/year and 0.35 kgP/year.

5.7 The SuDS elements of the strategy will be maintained according to the appropriate maintenance schedule as listed in the CIRIA SuDS Manual C753 to ensure that they will operate as expected in perpetuity.

5.8 In a previous technical note issued by Water Environment[16], it was concluded that water infiltrated to the ground would in this location be hydrogeologically disconnected from the Habitats Sites due to the presence of the Gault Formation between the Site and the Habitats Sites. Upon consideration, this was agreed by NE.

5.9 Therefore, infiltration should be considered and, if possible, implemented at the detailed design stage of the application. This would mean that the future surface water nutrient load can be set at zero, and the overall nutrient budget will be significantly reduced.

Reduction in Load through a Water Recycling Centre

5.10 The proposed development, namely 'Grove House', will connect to the neighbouring Water Recycling Centre (WRC) that is being proposed as part of the mitigation solution of another application 'Potten Farm[17]' which borders 'Grove House'. The nutrient neutrality assessment and mitigation strategy for Potten Farm has been included in Appendix C.

5.11 STC have prepared a letter of support for the proposed wastewater treatment strategy which will confirm:

- STC are an Ofwat-regulated water company appointed by the Secretary of State to provide wastewater and surface water management services in England and Wales.

[16] Water Environment Ltd (March 2022) – Nutrient Neutrality Addendum Ref: 20086-NUT-TN-01-C01
[17] Water Environment Ltd (November 2023) – Nutrient Neutrality Assessment and Mitigation Strategy Ref: 20128-NUT-RP-01-C01

- After an assessment of all relevant site constraints and consideration of the scale of the development, STC will confirm that a WRC can be delivered and adopted on this site.
- The treatment strategy that will comprise of an STC designed and built onsite WRC; which shall be adopted, maintained, and operated in the long-term by STC in their capacity as the local statutory wastewater undertaker.
- STC will operate the WRC to comply with an Environment Agency (EA) site-specific permit. (Including any other parameters set by the EA in consultation with NE).
- A detailed design of the WRC will be completed, and the STC system will be based on an advanced form of activated sludge treatment which doesn't require chemical dosing for effective treatment.
- STC will apply to the EA for the required permit having commenced the necessary studies (including a water quality and quantity study).

5.12 In line with the NEGM, for sewage to a WRC operated by a water company with a licence limit, the effluent concentration will be taken as 90% of the licence limit.

5.13 A licence will be sought to discharge at a limit of 7.5 mgN/l and 0.25 mgP/l.

5.14 Using these license limits the wastewater nutrient load is reduced from 147.69 kgN/year and 2.46 kgN/year to 36.92 kgN/year and 1.23 kgP/year.

Reduction in Load through the Acquisition of Excess Nutrient Credits

5.15 After a reduction in total nutrient load due to the use of an onsite WRC and SuDS, the remaining nutrient budget stands at 26.80 kgN/year and 1.24 kgP/year.

5.16 The neighbouring Gladman site of 'Potten Farm', has proven to be more than nutrient neutral, with a total amount of excess nutrient credits of 43.40 kgN/year and 1.32 kgP/year.

5.17 Therefore, the proposed development at Grove House will use the excess nutrient credits generated at Potten farm to offset the remaining budget of 26.80 kgN/year and 1.24 kgP/year.

5.18 The development is therefore able to achieve nutrient neutrality.

The Mitigated Nutrient Budget

5.19 In Part 1 of this report the nutrient budget for the proposed development was calculated as 166.71 kgN/year and 4.83 kgP/year.

5.20 Through the mitigation strategy detailed above, the site has achieved nutrient neutrality, and generated a nutrient surplus of 16.60 kgN/year and 0.08 kgP/year.

6 CONCLUSIONS

6.1 Following the procedure outlined in the NEGM it has been demonstrated, through the implementation of the proposed mitigation strategy, that the proposed development will be nutrient neutral with respect to the Habitats Site.

6.2 The nutrient budget can be mitigated through the onsite treatment of wastewater to a high standard and by reducing the future surface water load through the use of SuDS.

6.3 The remaining budget has been offset by acquiring credits from the neighbouring Gladman site of 'Potten Farm'. This ensures that the development can achieve nutrient neutrality.

6.4 As demonstrated, there are multiple opportunities for the development to achieve nutrient neutrality. It is expected that a suitably worded condition can be applied that will restrict occupation of any phase of development, subject to the approval of a strategy to mitigate nutrient impacts for that phase. This approach will allow for flexibility in mitigation solutions and ensure that the development remains nutrient neutral through all phases of construction.

6.5 The SuDS elements of the strategy will be maintained according to the appropriate maintenance schedule as listed in the CIRIA SuDS Manual C753.

6.6 The onsite wastewater treatment will be performed through a system operated by an Ofwat-licensed water company. They will be responsible for its maintenance.

6.7 The mitigation strategy proposed for this development follows a similar suit to the applications of Kingsnorth Green and the Otterpool Park Project, with particular emphasis an onsite WwTW. These applications have received approval from NE and permits to discharge from the Environment Agency. Therefore, there are recent precedents of residential development being accepted as a solution for nutrient neutrality.

APPENDIX A: SITE PLAN AND INDICATIVE MIX

CSA Landscapes Ltd: Development Framework Plan No: CSA/4509/122 Rev E

Land Use Classification Plan

Proposed vehicular access point

SUSTAINABLE DRAINAGE SYSTEMS (SuDS)
Proposed location for drainage feature at the lower part of the Site to manage the flow of surface water during periods of heavy and persistent rainfall.

Relocated bus stop along Ashford Road.

LANDSCAPE FEATURES
Existing mature tree belts and hedgerows are to be retained and will inform the layout to ensure that the new homes sit within a strong landscape framework.

CHILDREN'S PLAY
Proposed children's play area located within area of open space.

INTEGRATION
Potential vehicular and pedestrian links are proposed to the other parts of Phase 2 (Policy CSD9) to ensure that Site A is brought forward in a holistic manner.

Development under construction

ASHFORD ROAD
B
Potten Farm Shop
Duke's Head Public House
Sellindge Primary School
Sellindge Village Hall
Sellindge Surgery
M20

0 20 40 60 80 100 metres

- Site Boundary: **2.95ha**
- Proposed residential development: **1.30ha (up to 52 dwellings)**
- Proposed/potential vehicular access points
- Proposed tree-lined primary street
- Proposed secondary streets
- Proposed pedestrian links
- Proposed recreational routes
- Existing public rights of way
- Potential vehicular links to other parts of Phase 2 allocation
- Proposed public open space
- Existing vegetation
- Ancient veteran tree buffer zone
- Proposed tree, thicket and woodland planting
- Proposed wildflower planting
- Proposed location for children's play area (LAP)
- Proposed locations for seating areas
- Proposed location for drainage features (SuDS)
- Proposed pump station

CONTEXT

- Existing water features
- Existing bus routes and bus stops
- Listed Buildings
- Policy CSD9 land outside the scope of the applicant's control

Rev	Date	By	Description
E	31.05.24	RC	DRAINAGE BASIN UPDATED
D	20.03.24	RC	MINOR TEXT AMENDMENTS

CSA environmental
Dixies Barns, High Street,
Ashwell, Hertfordshire SG7 5NT
t 01462 743647
e ashwell@csaenvironmental.co.uk
w csaenvironmental.co.uk

Project	Land south of Ashford Road, Sellindge
Title	Development Framework Plan
Client	Gladman Developments Ltd

Scale	1:2000 @ A2	Drawn	RC
Date	June 2023	Checked	RR
Drawing No.	CSA/4509/122	Rev	E


Legend:
Application Boundary (2.95ha)
Greenspace Land-use (1.59ha)
Open Urban Land-use (0.04ha)
Residential Urban Land-use (1.32ha)
ASHFORD ROAD
Duke's Head (PH)
Duke's Head Public House
Guinea Hall
Path
Apsley Cottages
Wellington Cottage
Potten Cottage
Hale Cottage
Hale House
Shelter
A 20
Fieldhead
The Chase
MS
CP
Grove House
Pond
Woodlands
Ponds
Rothergate
CG
Path (um)
Rotherwood Cottage
Rotherwood Farm
M 20
INTEGRATION
BULLS LANE
THE AVENUE

APPENDIX B: CALCULATIONS

Water Environment Limited: Nutrient Neutrality Calculations Ref 23064-NUT-CA-01 C03:

- Sheet 1: Unmitigated
- Sheet 2: Mitigated

Nutrient Neutrality Calculations
Unmitigated

Reference	*Revision*	*Sheet*
23064-NUT-CA-01	**C03**	**1**

Client	Gladman Developments Ltd
Project	Grove House
Author	Megan Ward
Checker	Christopher Garrard
Date	19/07/2024

WATER | ENVIRONMENT
Water Environment Limited ● 6 Coppergate Mews ● Brighton Road ● Surbiton ● London ● KT6 5NE
Tel: 020 8545 9720 ● Email: admin@waterenvironment.co.uk

Standard Average Annual Rainfall (mm)	760	Soil Type	Naturally Wet
Nitrate Vulnerable Zone	TRUE	Catchment	Upper Stour

Stage 1 - Total Nutrient Load from Development Wastewater

Measurement		Value	Unit	Reference
New Dwellings		52	number	Number of Houses taken from Development Framework Plan Dwg No: CSA/4509/122 Revision E.
Average Occupancy		2.4	persons/dwelling	
Future Population		124.8	persons	
Water Use		120	litres/person/day	
Wastewater Discharging to:	Sellindge WwTW	Post-2025	epoch	
		TN	TP	
Licence Limits (mg/l)		27.00	0.50	
Deductible Acceptable Loading (mg/l)				
Effluent Concentrations (mg/l)		27.00	0.45	
Future Wastewater Nutrient Load		**147.69** kgN/year	**2.46** kgP/year	

Stage 2 - Calculation of Existing Nutrient Load from Surface Water

Existing Land Use	Existing Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Lowland	2.95	32.95	0.55	
Existing Surface Water Nutrient Loads		**32.95** kgN/year	**0.55** kgP/year	

Stage 3 - Calculation of Future Nutrient Load from Surface Water

Future Land Use	Proposed Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Urban Land Uses				
Residential Urban	1.32	19.07	2.05	Developable Area taken from Development Framework Plan Dwg No: CSA/4509/122 Revision E.
Open Urban	0.04	0.34	0.03	
Reduction factor due to SuDS				
Urban Nutrient Load		19.41	2.08	
Non-Urban Land Uses				
Greenspace	1.59	4.77	0.03	
Non-Urban Nutrient Load		4.77	0.03	
Future Surface Water Nutrient Loads		**24.18** kgN/year	**2.11** kgP/year	

Stage 4 - Calculation of Nutrient Budget

Measurement	TN	TP	Explanation
Future Nutrient Load	171.87	4.57	The nutrient budget is equal to the future nutrient load minus the existing nutrient load
Existing Nutrient Load	32.95	0.55	
Nutrient Budget	138.92	4.03	
Nutrient Budget with 20% Buffer	**166.71** kgN/year	**4.83** kgP/year	

Nutrient Neutrality Calculations Mitigated

Reference	*Revision*	*Sheet*
23064-NUT-CA-01	**C03**	**2**

Client	Gladman Developments Ltd
Project	Grove House
Author	Megan Ward
Checker	Christopher Garrard
Date	19/07/2024

WATER | ENVIRONMENT
Water Environment Limited ● 6 Coppergate Mews ● Brighton Road ● Surbiton ● London ● KT6 5NE
Tel: 020 8545 9720 ● Email: admin@waterenvironment.co.uk

Standard Average Annual Rainfall (mm)	760	Soil Type	Naturally Wet
Nitrate Vulnerable Zone	TRUE	Catchment	Upper Stour

Stage 1 - Total Nutrient Load from Development Wastewater

Measurement		Value	Unit	Reference
New Dwellings		52	number	Number of Houses taken from Development Framework Plan Dwg No: CSA/4509/122 Revision E.
Average Occupancy		2.4	persons/dwelling	
Future Population		124.8	persons	
Water Use		120	litres/person/day	
Wastewater Discharging to:	Onsite WwTW		epoch	
		TN	TP	
Licence Limits (mg/l)		7.50	0.25	
Effluent Concentrations (mg/l)		6.75	0.23	
Future Wastewater Nutrient Load		**36.92** kgN/year	**1.23** kgP/year	

Stage 2 - Calculation of Existing Nutrient Load from Surface Water

Existing Land Use	Existing Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Lowland	2.95	32.95	0.55	
Existing Surface Water Nutrient Loads		**32.95** kgN/year	**0.55** kgP/year	

Stage 3 - Calculation of Future Nutrient Load from Surface Water

Future Land Use	Proposed Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Urban Land Uses				
Residential Urban	1.32	19.07	2.05	Developable Area taken from Development Framework Plan Dwg No: CSA/4509/122 Revision E.
Open Urban	0.04	0.34	0.03	
Reduction factor due to SuDS		30%	85%	
Urban Nutrient Load		13.59	0.32	
Non-Urban Land Uses				
Greenspace	1.59	4.77	0.03	
Non-Urban Nutrient Load		4.77	0.03	
Future Surface Water Nutrient Loads		**18.36** kgN/year	**0.35** kgP/year	

Stage 4 - Calculation of Nutrient Budget

Measurement	TN	TP	Explanation
Future Nutrient Load	55.28	1.59	The nutrient budget is equal to the future nutrient load minus the existing nutrient load
Existing Nutrient Load	32.95	0.55	
Nutrient Budget	22.33	1.04	
Nutrient Budget with 20% Buffer	**26.80** kgN/year	**1.24** kgP/year	

Offsetting against Nutrient Credit from Neighbouring Site

Nutrient Surplus from Potten Farm	**-43.40** kgN/year	**-1.32** kgP/year	Water Environment Nutrient Neutrality Calculations Ref: 20128-NUT-CA-01 C03
Mitigated Nutrient Budget	**-16.60** kgN/year	**-0.08** kgP/year	

APPENDIX C: SUPPORTING DOCUMENTATION

- Historic Satellite Imagery dating back to 2014
- Handwritten letter of support from land manager
- Water Environment Limited: Nutrient Neutrality Assessment and Mitigation Strategy, Potten Farm Ref: 20128-NUT-RP-01 P04

2014


7/2014
2 old school cottages
Microwave Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Harringe Ln
Moorstock Rd
Bells Ln
Woodlands Rescue
Potten Cl
M20
image © 2024 Maxar Technologies
Google Earth
Imagery Date: 7/4/2014 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2017


4/2017
2 old school cottages
Microwave Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Harringe Ln
Moorstock Rd
Bells Ln
Woodlands Rescue
Potten Cl
M20
Google Earth
Imagery Date: 4/9/2017 51°06'23.61" N 0°59'22.51" E elev 67 m eye alt 803 m

2018


9/2018
2 old school cottages
Harringe Ln
Motorway Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Woodlands Rescue
Potten Cl
Bulls Ln
M20
Image © 2024 CNES / Airbus
Google Earth
Imagery Date: 9/1/2018 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2019


5/2019
2 old school cottages
Harringe Ln
Motorway Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Woodlands Rescue
Potten Cl
Bulls Ln
M20
Google Earth
Imagery Date: 5/16/2019 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2020


5/2020
2 old school cottages
Microwave Service Company
Potten Farm Shop
Dukes Head
AGM Fencing
Woodlands Rescue
M20
Image © 2024 CNES / Airbus
Google Earth
Imagery Date: 5/7/2020 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2021


3/2021
2 old school cottages
Microwave Service Company
Potten Farm Shop
Dukes Head
AGM Fencing
Woodlands Rescue
M20
Image © 2024 CNES / Airbus
Google Earth
Imagery Date: 3/9/2021 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

SYMNEL COTTAGE
ALDINGTON
ASHFORD
KENT TN25 7DU
01233 720391

15th July 2024

To whom it may concern

I was born in 1950 and lived at Grove House, Sellindge from 1950 to 1974 since when I have continued to live in the area and to manage the fields next to Grove House.

To my personal knowledge Mr George Fuller and then his son John Fuller trading as G. W. Fuller & Son have grazed the Grove House fields with sheep continuously from prior to 1958 to the present day, and continue to do so.

RICHARD HARRY RIX

POTTEN FARM

SELLINDGE

NUTRIENT NEUTRALITY ASSESSMENT AND MITIGATION STRATEGY

GLADMAN DEVELOPMENTS LTD

DOCUMENT REFERENCE:

20128-NUT-RP-01 | C03

WATER | ENVIRONMENT

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Authorisation and Version Control

This Nutrient Neutrality Assessment was commissioned by Gladman Developments Ltd to investigate and mitigate against the concerns raised by Natural England regarding the nutrient neutrality of the proposed development at Sellindge and the potential adverse effects on downstream designated sites.

Author:	**Megan Ward** BSc Environmental Science	
Checker:	**Christopher Garrard** BSc Eng (Civil)	
Approver:	**Guy Laister** Director	 *for and on behalf of Water Environment Limited*

Document Version History

Rev	Date	Comments	Auth	Chck	Appr
C01	22/11/2023	Final Issue	MW	CMG	GL
C02	16/04/2024	New STC Letter	MW	CMG	GL
C03	19/07/2024	Revised to address AECOM comments	CMG	MW	GL

CONTENTS

List of Figures

EXECUTIVE SUMMARY

In 2018, the European Court of Justice refined the definition of plans and projects and ruled that mitigation needs to be in place to ensure that there will be no significant adverse impacts on the conservation status of designated sites. Additional nutrient loading to designated sites already in an unfavourable conservation status is effectively therefore not permissible unless mitigation is in place. This ruling has come to be known as 'The Dutch Case'.

In the Stour River catchment in East Kent, developments could adversely impact the designated site known as Stodmarsh. Several of the nature reserve lakes of which the Stodmarsh is composed are in a state of eutrophication (an unfavourable conservation status) and therefore the ruling of the Dutch Case applies. All developments in the catchment have to demonstrate 'nutrient neutrality' in order to ensure no adverse effect on the integrity of the designated site, meaning that the nutrients generated by the development must be less than or equal to the nutrients generated by the existing land use.

The application site is located on the western edge of Sellindge. The site is bounded by the M20 to the south and the A20 to the north.

The total application area is approximately 6.99 hectares of proposed residential development of up to 105 dwellings, with associated amenities, greenspace, access roads and parking. The land is currently used to grow arable crops.

An adverse effect on Stodmarsh cannot be ruled out from the development, in the absence of any mitigation. It was found that Sustainable Drainage systems and a Water Recycling Centre would be sufficient to completely mitigate the nutrient budget of the site.

ABBREVIATIONS

Acronym	Definition
AA	Appropriate Assessment
EA	Environment Agency
EMC	Event Mean Concentration
FCT	Favourable Conditions Target
HRA	Habitats Regulations Assessment
NE	Natural England
NEGM	Natural England Generic Methodology
ONS	Office for National Statistic
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TN	Total Nitrogen
TP	Total Phosphorus
WRC	Water Recycling Centre
WwTW	Wastewater Treatment Works

1 INTRODUCTION

1.1 The application site is located on the western edge of Sellindge. The site is bounded by the M20 to the south and the A20 to the north.

1.2 The total application area is approximately 6.99 ha of residential development. The proposal is for the construction of up to 105 dwellings, with associated amenities, access roads, parking and greenspace. The land is currently used to grow arable crops.

1.3 As the site lies within the catchment of a European and internationally designated site – Stodmarsh – a Habitats Regulations Assessment (HRA) is required.

Background

1.4 A HRA refers to the several distinct stages of assessment which must be undertaken in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended) to determine if a plan or project may affect the protected features of a habitats site (any site which would be included within the definition at Regulation 8 of the Conservation of Habitats and Species Regulations 2017) before deciding whether to undertake, permit or authorise it.

1.5 A significant effect should be considered likely if it cannot be excluded on the basis of objective information and it might undermine a site's conservation objectives. A risk or a possibility of such an effect is enough to warrant the need for an Appropriate Assessment (AA) to be carried out by the competent authority. 'Appropriate' is not a technical term. It indicates that an assessment needs to be proportionate and sufficient to support the task of the competent authority in determining whether the plan or project will adversely affect the integrity of the habitats site. An AA must contain complete, precise, and definitive findings and conclusions to ensure that there is no reasonable scientific doubt as to the effects of the proposed plan or project.[1]

1.6 In 2018, the European Court of Justice refined the definition of plans and projects in the so-called 'Dutch case' ruling that mitigation needs to be certain at the time of assessment to ensure that there will be no adverse effect on the conservation status of European designated sites which already exceed compliance limits[2].

1.7 Nutrient neutrality is a means of ensuring that a plan or project does not add to existing nutrient burdens. Where nutrient neutrality is properly applied and the existing land does not undermine the conservation objectives, Natural England (NE) considers that an adverse effect on integrity alone and in combination can be ruled out[3].

1.8 In the Stour Valley River catchment in East Kent, developments could adversely affect Stodmarsh, which is designated a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar site. Several of the nature reserve lakes at Stodmarsh are in a state of eutrophication (an unfavourable conservation status) and therefore the ruling of the Dutch Case applies.

1.9 The practical implication of the Dutch Case across England is the necessity to mitigate increases in nutrient loading from new development including nutrients contained in surface water runoff and an increase in wastewater flows to any of the Wastewater Treatment Works (WwTW) in the relevant catchment.

[1] Guidance on the use of Habitats Regulations Assessment – https://www.gov.uk/guidance/appropriate-assessment – accessed 11/2023
[2] Joined Cases C-293/17 and C-294/17 of the European Court of Justice
[3] Wood, A., Wake, H., and McKendrick-Smith, K. (2022) 'Nutrient Neutrality Principles' Natural England Technical Information Note, TIN186

Scope of Study

1.10 The main objectives of this study are to:

- Provide an overview of NE's position with respect to water quality within the Habitats Sites;
- Present calculations, based on the absence of any mitigation measures, to outline the potential increase in nutrient loading as a result of the proposed development; and
- Outline the mitigation strategy proposed to manage surface and wastewater from the proposed development and present supporting calculations to ensure that, from the first occupation of the dwellings, the proposed development is nutrient neutral.

2 WATER QUALITY IN STODMARSH

Stodmarsh Designated Sites[4]

2.1 The Stodmarsh SSSI is designated by NE for the following features of interest:

- Wetland habitats including extensive reedbeds, swamp and fen communities;
- Open water habitats including lakes, ditches, and lagoons;
- Diverse breeding and non-breeding bird communities. Two rare British birds – Cetti's warbler and bearded tit – breed here in nationally significant numbers;
- Varied invertebrate fauna, including multiple scarce moth species;
- An assemblage of vascular plants.

2.2 The Stodmarsh SPA is designated for the following features and supported species:

- Bittern (Non-Breeding);
- Gadwall (Breeding and Non-Breeding);
- Hen Harrier (Non-Breeding);
- Shoveler (Non-Breeding);
- Breeding bird assemblage;
- Waterbird assemblage.

2.3 The Stodmarsh Ramsar Site is designated, under criteria 2 of the Ramsar Convention, for:

- Wetland invertebrate assemblage;
- Wetland plant assemblage;
- Assemblage of rare wetland birds;
- Bearded tit populations (Breeding and Wintering);
- Bittern (Wintering);
- Gadwall (Breeding and Wintering);
- Hen Harrier (Wintering);
- Shoveler (Wintering).

2.4 The Stodmarsh SAC is designated for the following qualifying species:

- Desmoulin's whorl snail.

2.5 The focus of this letter is on the evidence of degrading water quality in the Stodmarsh SSSI, SPA, Ramsar and SAC, henceforth referred to as the 'Habitats Sites'.

[4] Designatedsites.naturalengland.org.uk (Accessed 11/2023)

Nutrients of Significance

2.6 It has been found that the nutrients of the highest significance in terms of water quality in the Habitats Sites are Total Nitrogen (TN) and Total Phosphorus (TP).

2.7 TN includes organic and inorganic forms of nitrogen, both of which are available for plant growth and can contribute to algal blooming. TN is the sum of inorganic forms of nitrogen – nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-N) and ammoniacal nitrogen (NH_3-N and NH_4-N) – and organically bonded nitrogen.

2.8 TP includes all phosphorus components – phosphate phosphorus (PO_4-P), dissolved organic phosphorus and particulate phosphorus in algal and bacterial cells – and also includes mineral particles such as clay.

Water Quality

2.9 The condition of the Habitats Sites which support the designated features is in part dependent on the water quality within them. The occurrence of excessive nutrients in the Habitats Sites can impact the competitive interactions between high plant species, and between higher plant species and algae, which can result in dominance in attached forms of algae, and a loss of characteristic plant species.

2.10 Changes in plant growth and community composition can have implications for the wider food web and the species present. Increased nutrients and the occurrence of eutrophication can also affect the dissolved oxygen levels in the waterbody, which can also impact the biota within the Habitats Sites.

2.11 Algal Bloom and fish kill events have been observed in one of the Habitats Sites Lakes (SSSI Unit 010). Assessments by NE have described the condition of this lake as 'unfavourable' and indicated high nutrient levels. TP has been measured at 1000 µg/l where the target for SSSI lakes is 49 µg/l. Eutrophication, which arises as a result of increased water nutrient levels, can lead to a reduction of fish and macrophyte populations. This in turn impacts food availability for SPA/Ramsar birds and the qualifying invertebrate community. The reason for this adverse condition is quoted as 'Freshwater pollution – Water Pollution – Discharge'.

2.12 The lake within SSSI Unit 007 has also been described as 'unfavourable' and has been found to fail in reaching nationally agreed water quality targets, including an excess of nitrogen and phosphorus. The reason for this adverse condition is quoted as 'Freshwater pollution – Water Pollution – Agriculture/Runoff'.

2.13 Lakes within Units 001, 002 and 005 are described as in 'Favourable' or 'Unfavourable – recovering' condition and thus are not of concern for this assessment.

2.14 Concentrations of TN and TP have been recorded within the lakes in SSSI Units 007 and 010 above the NE SSSI Favourable Condition Targets (FCTs) of 49 µg/l TP and 1.5 mg/l TN. It is important to understand the mechanism by which these nutrients enter the Habitats Sites. Some of the major sources of TN and TP have been identified as the following[5][6]:

- WwTWs which outfall into the Stour upstream of the Habitats Sites;
- Runoff from urban and agricultural land;
- Flood waters from the River Great Stour (during both high flow and tidal events); and

[5]APEM, Stodmarsh SSSI, SPA and NNR Lake Hydrology Project Phase 1, April 2016
[6]ATKINS, Stodmarsh Lake Hydrology Study, May 2016

- Recycling of Nutrients within lake 007 itself.

2.15 In the case of TP, it has been estimated[6], that the dominant source of phosphate in the River Stour is WwTWs, accounting for 50% – 80% of concentrations in the river adjacent to the Habitats Sites.

Strategic Approach

2.16 Where sites are already in unfavourable condition due to elevated nutrient levels, NE considers that competent authorities will need to carefully justify how further inputs from new plans and projects, either alone or in combination, will not adversely affect the integrity of the site given the conservation objectives.[7]

2.17 To address the uncertainty and the subsequent risk to the Habitats Sites, the mitigation strategy outlined in this report will ensure that the proposed development does not add to existing nutrient burdens and provides certainty that the whole of the scheme is deliverable in line with the requirements of the Conservation of Habitats and Species Regulations 2017[8] and in light of relevant case law[9].

2.18 The latest NE guidance has been followed to ensure that the proposed development will be nutrient neutral (i.e. will not increase the flux of nutrients to the designated site).

2.19 In this report the following staged approach has been implemented: in Part 1, it was calculated, in the absence of any mitigation measures, the potential increase in nutrient loading from the proposed development. In Part 2, a mitigation strategy was proposed and supporting calculations have been presented which provide sufficient and reasonable certainty that the development will not contribute to an increase in nutrient loading.

2.20 The nutrient neutrality calculations in this report were based on key inputs and assumptions based on the best available scientific evidence and research. To accommodate for the necessary level of uncertainty in these key assumptions, a buffer has been used when calculating levels of nutrients. This buffer ensures that a precautionary approach is followed throughout.

[7] Natural England (16 March 2022) Letter to LPA Chief Executives and heads of planning 'Advice for development proposals with the potential to affect water quality resulting in adverse nutrient impacts on habitats sites.'
[8] Conservation of Habitats and Species Regulations (England and Wales) Regulations 2017
[9] Including Wildlife and Countryside Act 1981, Countryside and Rights of Way Act 2000 and Rural Communities Act 2006

3 SITE LOCATION

Location

3.1 The application site is located on the western edge of Sellindge. The site is bounded by the M20 to the south and the A20 to the north.

3.2 The site is 10 km southeast of Ashford. The total application area is approximately 6.99 ha.

3.3 The site boundary and location in respect to the Stour Management Catchment is shown in Figure 1. The site is located in the Upper Stour Operational Catchment.

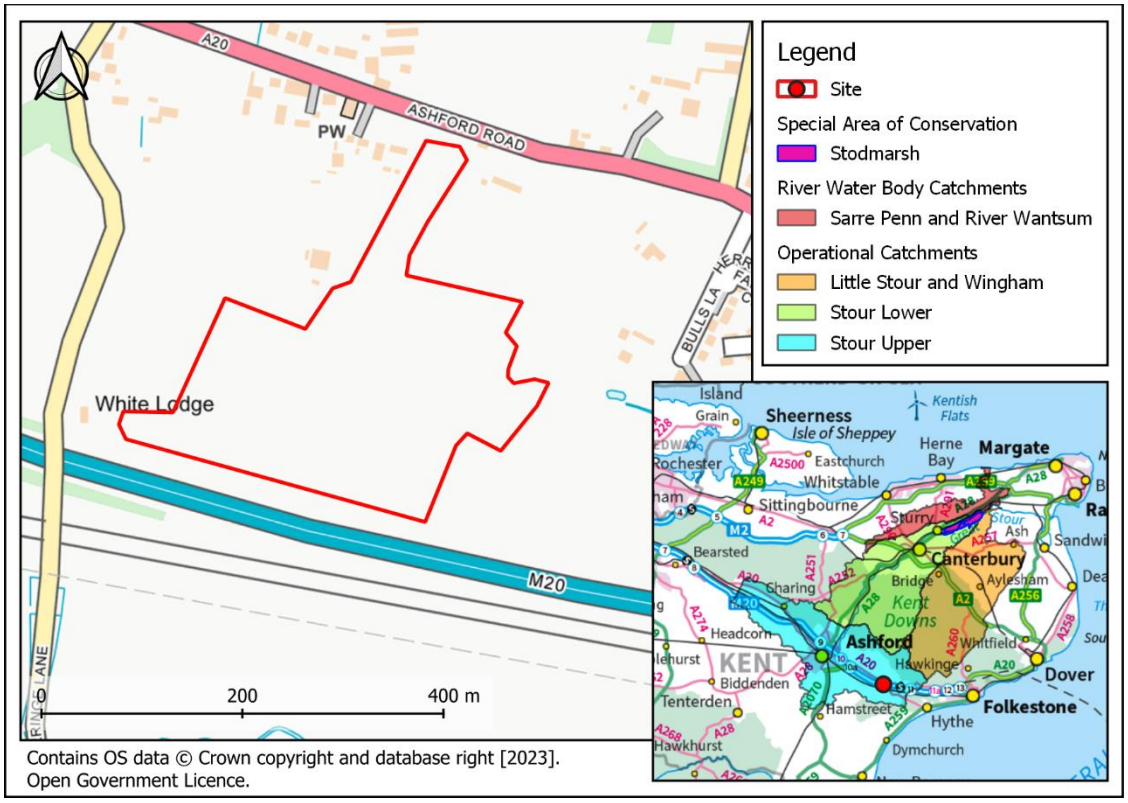


Figure 1: Site Location Relative to the Habitats Site Catchment

Proposed Development

3.4 The proposal is for the construction of residential development with up to 105 dwellings, with associated amenities, greenspace, access roads and parking.

3.5 The Development Framework Plan (DFP) for the proposed scheme is attached in Appendix A.

4 PART 1: CALCULATING THE NUTRIENT BUDGET

Natural England Methodology

4.1 The latest version of the Natural England Generic Methodology (NEGM) for determining whether a site achieves nutrient neutrality was issued in March 2022[10]. This guidance lays out the process of calculating the nutrient budget and provides worked examples.

Stage 1 – Total Wastewater Load

4.2 Stage 1 of the calculation is to calculate the nutrient load from the additional wastewater that will be generated by the development. This stage specifically only includes new overnight stays in the development, as it is assumed that any additional wastewater generated by diurnal use would be accounted for elsewhere.

4.3 This is done by multiplying the total amount of wastewater by the expected concentration of treated effluent from the WwTW serving the development. The WwTW can be determined through an enquiry from the wastewater service provider in the development location.

4.4 The NEGM recommends using water use as a proxy for total wastewater amount, excluding any garden use. NE's advice is to use the Building Regulations to determine the average water use per person, and then to add 10 litres/person/day (l/p/d) to the value to account for uncertainty in any future changes to fittings.

4.5 The increase in the number of people from a development can be determined using census data from the Office for National Statistics (ONS). This gives the average occupancy of a dwelling type, and NE recommends the use of the national average occupancy rate to determine the expected population.

Stage 2 and Stage 3 – Existing and Future Surface Water Loads

4.6 Stage 2 of the calculation is to consider the existing land use on the site, and Stage 3 is to consider the future land-use onsite. Using the ADAS Farmscoper tool, loading factors can be determined for all different agriculture uses within the catchment. These loading factors are further separated by the underlying soil drainage conditions and average rainfall and are measured in kg/ha/year.

4.7 The NEGM does not elaborate on how greenspace and woodland loading rates were derived, however, in previous NE Guidance[11], detail was provided on how TN loading factors for non-agricultural and non-urban land uses were calculated. Three main sources of TN were identified: atmospheric deposition, pet waste and TN fixation. It was estimated, based on several studies, that the catchment would retain 90% of all TN. This was studied in both the Solent catchment and the Stodmarsh catchment, and it was found that the numbers did not vary significantly. It is expected that this would be the case throughout England.

4.8 For woodland and heathland, the pet waste was discounted, and a total loading factor of 3 kgN/ha/year was therefore calculated. In the latest guidance, greenspace, open space, and woodland have all been given the same loading factor of 3 kgN/ha/year.

4.9 For TP, evidence suggested that non-agricultural, non-urban land uses do not leach TP. It was therefore conservatively assumed that woodland, greenspace, and similar land uses would leach TP at the limit of detection which, in some studies, was 0.02 kgP/ha/year.

[10] Ricardo and Natural England (February 2022) Nutrient Neutrality Generic Methodology
[11] Natural England (2020), 'Advice on Nutrient Neutrality for New Development in the Stour Catchment in Relation to Stodmarsh Designated Sites'

4.10 In the NEGM, urban loading factors were modelled using assumed[12] 'event mean concentrations' (EMC) of nutrients for rainfall events. The average runoff for a site can be calculated using the Modified Rational Method and multiplying the runoff by the EMC will give the nutrient load. This has been standardised for a 1 ha site so that a loading factor can be obtained in the same units of measurement as for agriculture and greenspace.

4.11 Using these loading factors, and the area of various land uses on the site, the existing and future nutrient load from diffuse sources can be calculated.

Stage 4 – Final Unmitigated Nutrient Budget

4.12 Stage 4 of the calculation is the final stage. At this point, the totals from Stage 1 and Stage 3 are added together, and the total from Stage 2 is subtracted. If there is a surplus (i.e., the proposed total is higher than the existing total), a buffer (factor of safety) of 20% is added to the total, and this is then referred to as 'the nutrient budget'. If the nutrient budget comes out as less than or equal to zero, then the development has achieved nutrient neutrality.

4.13 The calculations have been presented in Water Environment's bespoke calculator, as it is more readable and can incorporate mitigation scenarios. All the calculations set out in this section can be seen in full in Appendix B of this report.

Development Nutrient Load from Additional Wastewater

4.14 The primary source of nutrients from residential development is usually domestic wastewater. Typically, wastewater is conveyed from development to the public sewerage and onto the WwTW for treatment before discharge to surface waters.

4.15 In the case of the proposed development, wastewater would usually be conveyed to Sellindge WwTW which has a TP licence limit of 0.5 mgP/l and no limit for TN, and for the purposes of establishing a nutrient baseline, this has been assumed to be the case. Therefore, in line with the NEGM, the effluent concentrations have been taken as 0.45 mgP/l and 27 mgN/l.

4.16 In line with the NEGM, the national average occupancy of 2.4 has been used for houses. The proposed development is for the construction of up to 105 dwellings, which gives an average total future occupancy of 252 people.

4.17 The development will use a water use of 110 l/p/d, along with NEs advice to add an extra 10 l/p/d to the value to account for uncertainty in any future changes to fittings, therefore putting the total water use for the development at 120 l/p/d.

4.18 Using the information above, for 105 dwellings a wastewater nutrient load of 298.22 kgN/year and 4.97 kgP/year has been calculated for the proposed development scheme.

Land-Use Change

4.19 The site is within the Upper Stour Operational Catchment and lies within the River Great Stour nitrate vulnerable zone[13]. The greenfield runoff estimation tool on the HR Wallingford Website[14], gives a standard annual average rainfall (SAAR) for this site of 755 mm/year, and Cranfield University's Soilscapes tool[15] gives a soil drainage type of 'Naturally Wet'.

[12] The latest NE methodology quotes 'Mitchell, G., 2005. Mapping hazard from urban non-point pollution: A screening model to support sustainable urban drainage planning. Journal of Environmental Management, 74(1), pp. 1-9' in the definition of the so-called 'event mean concentrations'. However, the paper does not disclose how the event mean concentrations listed were calculated.
[13] https://mapapps2.bgs.ac.uk/ukso/home.html?layers=NVZEng [accessed 11/2023]
[14] Available at: uksuds.com
[15] Available at: http://www.landis.org.uk/soilscapes/# [Accessed on 11/2023]

4.20 The existing land is currently used to grow arable crops. Under the NEGM, the land use is classified as 'Cereals', with an area of 6.99 ha and an existing surface water nutrient load of 165.08 kgN/year and 4.77 kgP/year. Historic satellite imagery dating back to 2014 can be found in Appendix C to support this designation.

4.21 After redevelopment, the site will have the following land uses:

- Residential Urban: 3.64 ha with a nutrient load of 52.58 kgN/year and 5.65 kgP/year;
- Open Urban: 0.17 ha with a nutrient load of 1.45 kgN/year and 0.14 kgP/year;
- Greenspace: 3.10 ha with a nutrient load of 9.30 kgN/year and 0.06 kgP/year; and
- Water: 0.08 ha with a nutrient load of zero.

The future surface water nutrient load will therefore be 63.33 kgN/year and 5.85 kgP/year.

4.22 A plan has been prepared showing how this land use designation is broken up by space, and this is available in Appendix A. It should be noted that the residential urban area of 3.64 ha differs from the developable area of 3.47 ha shown in the DFP, and this is due to the inclusion of the access road as residential urban.

The Nutrient Budget

4.23 The existing nutrient load from the site is 165.08 kgN/year and 4.77 kgP/year, and the future nutrient load from the proposed development is 361.55 kgN/year and 10.82 kgP/year. Therefore, the future nutrient loading for the proposed development, due to increased wastewater load and land-use change, exceeds the existing nutrient load by 196.47 kgN/year and 6.05 kgP/year.

4.24 Including the recommended 20% buffer, these calculations set the 'nutrient budget' for the proposed development as 235.77 kgN/year and 7.26 kgP/year.

4.25 The following section outlines the proposed mitigation strategy for the reduction of this additional nutrient loading to zero, i.e. to establish nutrient neutrality.

5 PART 2: MITIGATION STRATEGY

5.1 As the development will result in an increase in nutrient load, mitigation will be required to achieve nutrient neutrality. The mitigation strategy presented in this section has been designed to reduce the nutrient budget to zero.

5.2 All calculations for the proposed mitigation strategy are included in full in Appendix B of this report.

Reduction in Load through Sustainable Drainage Systems

5.3 CIRIA's guidance for using SuDS to reduce TP load in surface water (C808) provides reduction rates for various types of SuDS.

5.4 Through the use of a bioretention area or a tree-pit (80% reduction of particulate phosphorus), combined with a bed/cage of adsorption media (90% reduction of dissolved phosphorus), a TP reduction of 84.5% can be achieved.

5.5 CIRIA has released new guidance on TN removal rates (C815). The guidance suggests that a TN removal rate of 30% can be achieved using an appropriate SuDS treatment train, which will be confirmed at the detailed design stage of the application.

5.6 Using these removal rates of 30% for TN and 84.5% for TP, the future surface water nutrient load would be reduced from 6.33 kgN/year and 5.85 kgP/year to 47.12 kgN/year and 0.96 kgP/year.

5.7 The SuDS elements of the strategy will be maintained according to the appropriate maintenance schedule as listed in the CIRIA SuDS Manual C753 to ensure that they will operate as expected in perpetuity.

5.8 In a previous technical note issued by Water Environment[16], it was concluded that water infiltrated to the ground in this location would be hydrogeologically disconnected from the Habitats Sites, due to the presence of the Gault Formation between the site and Stodmarsh. Upon consideration, this was agreed by NE.

5.9 Therefore, infiltration should be considered and implemented, if possible, at the detailed design stage of the application. This would mean that the future surface water nutrient load for both TN and TP can be set at zero, and the overall nutrient budget will be significantly reduced.

Reduction in Load through a Water Recycling Centre

5.10 The core of the mitigation strategy is to treat wastewater onsite using a Water Recycling Centre (WRC) that will be designed and operated by Severn Trent Connect (STC), who are an Ofwat-licenced water company.

5.11 STC have prepared a letter of support for the proposed wastewater treatment strategy which will confirm:

- STC are an Ofwat-regulated water company appointed by the Secretary of State to provide wastewater and surface water management services in England and Wales.
- After an assessment of all relevant site constraints and consideration of the scale of the development, STC will confirm that a WRC can be delivered and adopted on this site.

[16] Water Environment Ltd (March 2022) – Nutrient Neutrality Addendum Ref: 20086-NUT-TN-01-C01 [available through Ashford Borough Council]

- The treatment strategy will comprise an STC designed and built onsite WRC; which shall be adopted, maintained, and operated in the long-term by STC in their capacity as the local statutory wastewater undertaker.
- STC will operate the WRC to comply with an Environment Agency (EA) site-specific permit. (Including any other parameters set by the EA in consultation with NE).
- A detailed design of the WRC will be completed, and the STC system will be based on an advanced form of activated sludge treatment which doesn't require chemical dosing for effective treatment.
- STC will apply to the EA for the required permit having commenced the necessary studies (including a water quality and quantity study).

5.12 In line with the NEGM, for sewage to a WRC operated by a water company with a licence limit, the effluent concentration will be taken as 90% of the licence limit.

5.13 A licence will be sought to discharge at a limit of 7.5 mgN/l and 0.25 mgP/l.

5.14 Using these licence limits the wastewater nutrient load is reduced from 298.22 kgN/year and 4.97 kgN/year to 74.55 kgN/year and 2.49 kgP/year. Combined with the surface water mitigation measures, this is sufficient to achieve neutrality.

The Mitigated Nutrient Budget

5.15 In Part 1 of this report the nutrient budget for the proposed development was calculated as 235.77 kgN/year and 7.26 kgP/year.

5.16 Through the mitigation strategy detailed above, nutrient neutrality has been achieved for the development, and a nutrient surplus of 43.40 kgN/year and 1.32 kgP/year has been generated.

6 CONCLUSIONS

6.1 Following the procedure outlined in the NEGM it has been demonstrated, through the implementation of the proposed mitigation strategy, that the proposed development will be nutrient neutral with respect to the Habitats Site.

6.2 The nutrient budget can be mitigated through the onsite treatment of wastewater to a high standard and by reducing the future surface water load through the use of SuDS.

6.3 As demonstrated, there are multiple opportunities for the development to achieve nutrient neutrality. It is expected that a suitably worded condition can be applied that will restrict occupation of any phase of development, subject to the approval of a strategy to mitigate nutrient impacts for that phase. This approach will allow for flexibility in mitigation solutions and ensure that the development remains nutrient neutral through all phases of construction.

6.4 The SuDS elements of the strategy will be maintained according to the appropriate maintenance schedule as listed in the CIRIA SuDS Manual C753.

6.5 The onsite wastewater treatment will be performed through a system operated by STC, an Ofwat-licensed water company. They will be responsible for its maintenance and operation.

6.6 The mitigation strategy proposed for this development follows a similar suit to the applications of Kingsnorth Green and the Otterpool Park Project, with particular emphasis an onsite WwTW. These applications have received approval from NE and permits to discharge from the Environment Agency. Therefore, there are recent precedents of residential development being accepted as a solution for nutrient neutrality.

APPENDIX A: DRAWINGS

CSA Landscapes Ltd: Development Framework Plan No: CSA/5622/115 Rev N

Plan showing post-development land use designation

Rev	Date	By	Description
N	13.03.24	RC	DRAINAGE AMENDMENTS
M	08.11.23	RC	MINOR TEXT AMENDMENTS

CSA environmental
Dixies Barns, High Street,
Ashwell, Hertfordshire SG7 5NT
t 01462 743647
e ashwell@csaenvironmental.co.uk
w csaenvironmental.co.uk

Project	Land at Potten Farm, Sellindge
Title	Development Framework Plan
Client	Gladman Developments Ltd

Scale	1:2000 @ A2	Drawn	RC
Date	Nov 2022	Checked	RR
Drawing No.	CSA/5622/115	Rev	N


LANDSCAPE FEATURES
Existing mature tree belts and hedgerows are to be retained and will inform the layout to ensure that the new homes sit within a strong landscape framework.
PUBLIC RIGHTS OF WAY
Existing public footpath which crosses the Site will be retained along its current alignment.
SUSTAINABLE DRAINAGE SYSTEMS (SUDS)
INTEGRATION
Potential vehicular and pedestrian
Site access
ASHFORD ROAD
Potten Farm Shop
Duke's Head Public House
Legend:
Application Boundary (6.99ha)
Greenspace Land-use (3.10ha)
Open Urban Land-use (0.17ha)
Residential Urban Land-use (3.64ha)
Water Land-use (0.08ha)

APPENDIX B: CALCULATIONS

Water Environment Limited: Nutrient Neutrality Calculations Ref 20128-NUT-CA-01 C03:

- Sheet 1: Unmitigated
- Sheet 2: Mitigated

Nutrient Neutrality Calculations Unmitigated

Reference	*Revision*	*Sheet*
20128-NUT-CA-01	**C03**	**1**

Client	Gladman Developments Ltd
Project	Potten Farm, Sellindge
Author	Megan Ward
Checker	Christopher Garrard
Date	19/07/2024

WATER | ENVIRONMENT
Water Environment Limited ● 6 Coppergate Mews ● Brighton Road ● Surbiton ● London ● KT6 5NE
Tel: 020 8545 9720 ● Email: admin@waterenvironment.co.uk

Standard Average Annual Rainfall (mm)	755	Soil Type	Naturally Wet
Nitrate Vulnerable Zone	TRUE	Catchment	Upper Stour

Stage 1 - Total Nutrient Load from Development Wastewater

Measurement		Value	Unit	Reference
New Dwellings		105	number	Number of Houses taken from Development Framework Plan Dwg No: CSA/5622/115 Revision N.
Average Occupancy		2.4	persons/dwelling	
Future Population		252.0	persons	
Water Use		120	litres/person/day	
Wastewater Discharging to:	Sellindge WwTW	Post-2025	epoch	
		TN	TP	
Licence Limits (mg/l)		27.00	0.50	
Effluent Concentrations (mg/l)		27.00	0.45	
Future Wastewater Nutrient Load		**298.22** kgN/year	**4.97** kgP/year	

Stage 2 - Calculation of Existing Nutrient Load from Surface Water

Existing Land Use	Existing Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Cereals	6.99	165.08	4.77	
Existing Surface Water Nutrient Loads		**165.08** kgN/year	**4.77** kgP/year	

Stage 3 - Calculation of Future Nutrient Load from Surface Water

Future Land Use	Proposed Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Urban Land Uses				
Residential Urban	3.64	52.58	5.65	Developable Area taken from Development Framework Plan Dwg No: CSA/5622/115 Revision N.
Open Urban	0.17	1.45	0.14	
Reduction factor due to SuDS				
Urban Nutrient Load		54.03	5.79	
Non-Urban Land Uses				
Greenspace	3.10	9.30	0.06	
Water	0.08	0.00	0.00	
Non-Urban Nutrient Load		9.30	0.06	
Future Surface Water Nutrient Loads		**63.33** kgN/year	**5.85** kgP/year	

Stage 4 - Calculation of Nutrient Budget

Measurement	TN	TP	Explanation
Future Nutrient Load	361.55	10.82	The nutrient budget is equal to the future nutrient load minus the existing nutrient load
Existing Nutrient Load	165.08	4.77	
Nutrient Budget	196.47	6.05	
Nutrient Budget with 20% Buffer	**235.77** kgN/year	**7.26** kgP/year	

Nutrient Neutrality Calculations Mitigated

Reference	*Revision*	*Sheet*
20128-NUT-CA-01	**C03**	**2**

Client	Gladman Developments Ltd
Project	Potten Farm, Sellindge
Author	Megan Ward
Checker	Christopher Garrard
Date	19/07/2024

WATER | ENVIRONMENT
Water Environment Limited ● 6 Coppergate Mews ● Brighton Road ● Surbiton ● London ● KT6 5NE
Tel: 020 8545 9720 ● Email: admin@waterenvironment.co.uk

Standard Average Annual Rainfall (mm)	755	Soil Type	Naturally Wet
Nitrate Vulnerable Zone	TRUE	Catchment	Upper Stour

Stage 1 - Total Nutrient Load from Development Wastewater

Measurement		Value	Unit	Reference
New Dwellings		105	number	Number of Houses taken from Development Framework Plan Dwg No: CSA/5622/115 Revision N.
Average Occupancy		2.4	persons/dwelling	
Future Population		252.0	persons	
Water Use		120	litres/person/day	
Wastewater Discharging to:	Onsite WwTW		epoch	
		TN	TP	
Licence Limits (mg/l)		7.50	0.25	
Effluent Concentrations (mg/l)		6.75	0.23	
Future Wastewater Nutrient Load		**74.55** kgN/year	**2.49** kgP/year	

Stage 2 - Calculation of Existing Nutrient Load from Surface Water

Existing Land Use	Existing Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Cereals	6.99	165.08	4.77	
Existing Surface Water Nutrient Loads		**165.08** kgN/year	**4.77** kgP/year	

Stage 3 - Calculation of Future Nutrient Load from Surface Water

Future Land Use	Proposed Area (ha)	Nutrient Loads (kg/year)		Reference
		TN	TP	
Urban Land Uses				
Residential Urban	3.64	52.58	5.65	Developable Area taken from Development Framework Plan Dwg No: CSA/5622/115 Revision N.
Open Urban	0.17	1.45	0.14	
Reduction factor due to SuDS		30%	85%	
Urban Nutrient Load		37.82	0.90	
Non-Urban Land Uses				
Greenspace	3.10	9.30	0.06	
Water	0.08	0.00	0.00	
Non-Urban Nutrient Load		9.30	0.06	
Future Surface Water Nutrient Loads		**47.12** kgN/year	**0.96** kgP/year	

Stage 4 - Calculation of Nutrient Budget

Measurement	TN	TP	Explanation
Future Nutrient Load	121.68	3.44	The nutrient budget is equal to the future nutrient load minus the existing nutrient load
Existing Nutrient Load	165.08	4.77	
Nutrient Budget	-43.40	-1.32	
Nutrient Budget with 20% Buffer	**-43.40** kgN/year	**-1.32** kgP/year	The buffer is not applied to negative budgets

APPENDIX C: SUPPORTING DOCUMENTATION

- Historic Satellite Imagery
- Severn Trent Connect: Letter of Support

2014


7/2014
2 old school cottages
Microwave Service Company
A20
Rotten Farm Shop
Dukes Head
AGM Fencing
Harringe Ln
Moorstock Rd
Bulls Ln
Woodlands Rescue
Potten Cl
M20
Image © 2024 Maxar Technologies
Google Earth
Imagery Date: 7/4/2014 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2017


4/2017
2 old school cottages
Microwave Service Company
A20
Rotten Farm Shop
Dukes Head
AGM Fencing
Harringe Ln
Moorstock Rd
Bulls Ln
Woodlands Rescue
Potten Cl
M20
Google Earth
Imagery Date: 4/9/2017 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2018


9/2018
2 old school cottages
Motowave Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Moorstacks
Bulls Ln
Woodlands Rescue
Potten Cl
Haringe Ln
M20
Image © 2024 CNES / Airbus
Google Earth
Imagery Date: 9/1/2018 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2019


9/2019
2 old school cottages
Motowave Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Moorstacks
Bulls Ln
Woodlands Rescue
Potten Cl
Haringe Ln
M20
Image © 2024 CNES / Airbus
Google Earth
Imagery Date: 9/15/2019 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2020


5/2020
2 old school cottages
Microwave Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Harringe Ln
M20
Woodlands Rescue
Bulls Ln
Image © 2024 CNES / Airbus
Google Earth
Imagery Date: 5/7/2020 51°06'15.47" N 0°59'41.30" E elev 74 m eye alt 803 m

2021


3/2021
2 old school cottages
Microwave Service Company
A20
Potten Farm Shop
Dukes Head
AGM Fencing
Harringe Ln
M20
Bulls Ln
Woodlands Rescue
Google Earth
Imagery Date: 3/30/2021 51°06'23.91" N 0°59'46.75" E elev 64 m eye alt 910 m

Letter of support Wastewater strategy

Potten Farm; Sellindge, Kent

Author: William Mackveley
Date: April 2024

Letter of support: Wastewater strategy

ONSITE WASTEWATER STRATEGY FOR POTTEN FARM, SELLINDGE, KENT.

ST Connect have been appointed by Gladman to work alongside their technical advisors to develop a feasible foul water drainage and treatment option compatible with their overall Nutrient Neutrality mitigation strategy, at their proposed development known as Potten Farm, near Sellindge, Kent. It should be noted that this letter is concerned only with wastewater treatment and disposal, other options are further detailed in the main Nutrient Neutrality Assessment and Mitigation Strategy.

ST Connect

ST Connect are an Ofwat-regulated water company appointed by the Secretary of State to provide wastewater and surface water management services in England and Wales. We have a strong track record for designing, building, owning, and operating wastewater treatment assets (including foul and surface water sewerage infrastructure) and are part of the wider Severn Trent Group, which in its portfolio has one of the UK's largest water and sewerage companies.

We are familiar with the environmental challenges to developments resulting from both a chronic lack of available sewerage capacity, and nutrient pollution; as a result, we are helping our clients to develop effective wastewater management strategies. The company is well placed to do this, given our experience and effective relationships with the statutory environmental regulators.

Proposed wastewater treatment and disposal summary

Foul sewage from all properties will be collected and conveyed through a separate foul-only sewerage system to the onsite water recycling centre (WRC). Following treatment to the required standards, including nutrient removal levels of 0.25mg/l for Total Phosphorous and 7.50mg/l for Total Nitrogen; final effluent will be discharged into a drainage system connecting with the River East Stour.

In our role as environmental stewards having both assessed all relevant site constraints and considering the scale of the development, we are confident that an onsite WRC can be delivered and adopted on this site.

Our treatment option will comprise of an ST Connect designed and built onsite WRC; which shall be adopted, maintained, and operated in the long-term by ST Connect in our capacity as the local statutory wastewater undertaker.

ST Connect would operate the WRC in compliance with the requirements of a site-specific Environmental Permit as determined by the Environment Agency (EA) (including any parameters required by Natural England following a formal consultation).

Asset and treatment process resilience

Detailed designs of the WRC have not yet commenced, however ST Connect, will propose to construct a state-of-the-art facility, based on an advanced form of activated sludge treatment, see Design Statement below.

The system is particularly resilient to catchment contamination events or natural variation of inbound wastewater concentration, due to the significant dilution factors provided by the large balancing tank at the head of the works. The treatment processes will be configured to allow for bolt-on technologies to meet more stringent permits; should they become required in the future.

We will design in capacity and asset redundancy which shall all but remove the risk of permit compliance failure. In a worst-case scenario of significant system failure, raw and/or part-treated sewage shall be isolated and tankered to a suitable off-site facility for safe treatment and disposal.

CSOs and river pollution events

Combined Sewer Overflows (CSOs) are assets designed to divert blended foul and surface water sewage to nearby watercourses during intense rainfall to protect properties, sewerage networks, and sewage treatment works from hydraulic overloading. CSOs will not be installed at this development as surface waters will be collected and managed in their own drainage and attenuation systems – separate from the foul water drainage networks. As a result of this, there is no risk of untreated sewage entering the water environment during storm events.

Sludge management

Organic sludges generated during the treatment process which cannot be treated onsite will be periodically removed by tanker for further processing at a nearby sludge treatment centre to generate sustainable energy from biogas. The remaining by-product, sludge cake is sold as an organic fertiliser. It should be noted that were farmers within the Stodmarsh catchment to use this source of fertiliser, it would act as a direct replacement of other sources of fertilisers (such as inorganic chemical fertilisers).

Long-term asset performance

The onsite treatment system will be designed and built to our adoptable standards, and therefore be owned and operated by ST Connect in its capacity as the local wastewater undertaker; subject to a licence variation being granted by Ofwat. The assets will therefore be considered “public” assets by the EA, which the company shall have a duty to maintain and operate effectively in perpetuity in line with its licence obligations.

The treatment system shall have in place both planned and reactive operations and maintenance arrangements to ensure the good upkeep of assets and effective wastewater treatment. In addition, the facility will benefit from remote telemetry and sensors to monitor site condition and treatment processes effectiveness.

Environment Agency wastewater discharge permit

An environmental permit from the EA will be required in order to operate the onsite WRC. ST Connect will apply to the EA for the required permit having undertaken the necessary studies (including a water quality and quantity study). It is important to note that as a statutory wastewater undertaker, ST Connect is able to obtain discharge permits within sewered areas (within the geographic areas of appointment of other wastewater undertakers, such as Southern Water) – the EA don't distinguish between licence applications / variations made by ST Connect and those made by incumbent water companies.

Conclusion

ST Connect in its capacity as a competent sewerage undertaker, experienced in the construction and long-term operations of sewage treatment assets is satisfied that if selected, a public onsite wastewater treatment system can be designed, built, adopted, operated, and maintained within the development known as Potten Farm.

If a WRC is required a design and site-specific air quality and noise assessment of the WRC would be undertaken as part of any submitted Reserved Matters application.

We look forward to continuing to develop the wastewater treatment option for this development site and are happy to be able to contribute to Folkstone and Hythe District Council's housing delivery plans in a sustainable way.

Yours sincerely

William Mackveley
General Manager
Severn Trent Connect

Design statement

Onsite water recycling centre

Water recycling centre overview

This design statement provides an overview of the water recycling centre (WRC) at the proposed development known as Potten Farm near Sellindge, Kent.

Indicative wastewater treatment processes

Inlet flows

Wastewater arriving at the WRC passes through the inlet works, where a series of screens remove wipes, grit, and other matter not suitable for onward treatment.

Balance tank / fermenter

The screened wastewater is transferred to the covered balance tank / fermenter (BTF). The BTF serves two distinct purposes in the treatment cycle. Firstly, it is used to balance the incoming flows prior to being passed forward for processing in the Reactors. Its second function is to act as an anaerobic fermenter; crucial to enable the Phosphorus Accumulating Organisms present in the Reactors to super absorb Phosphorus.

Reactors

The Reactors use simultaneous fill and decant, whereby the treated water is discharged using a piston effect created by the introduction of the fermented, raw, screened sewage. This influent is introduced at the bottom of the tank where it is gently mixed with the settled biomass using the hyperboloid mixer. The sludge blanket remains undisturbed, whilst the clean effluent in the top of the tank is discharged.

Once the fill/decant stage is complete, and the influent has had appropriate contact time with the biomass, the aerobic and anoxic treatment stages are carried out. The duration and timing of these phases are varied dependent on specific site conditions and permit requirements.

Sludge thickening

The sludge generated by the process can be thickened using sludge thickening equipment. Thickened sludge is held in the aerated sludge storage tank, whilst supernatant is returned to the head of works.

Aerated sludge storage

Thickened sludge is stored within this tank and periodically aerated using a coarse bubble aeration grid to prevent the sludge thickening too much at the bottom of the tank and to prevent the sludge becoming septic and causing odour issues.

Final effluent discharge

The final effluent discharged from the reactors, flows through a sample chamber prior to discharging into drainage system outfalling into the Nail Bourne, a tributary of River Little Stour.

STC500

A detailed design of the proposed WRC has not yet commenced; however, the design will be based on ST Connect's standard designs for facilities of this scale; the closest of which is the "STC500", which utilises the above-described treatment processes.

The rendered image below is of an STC500.

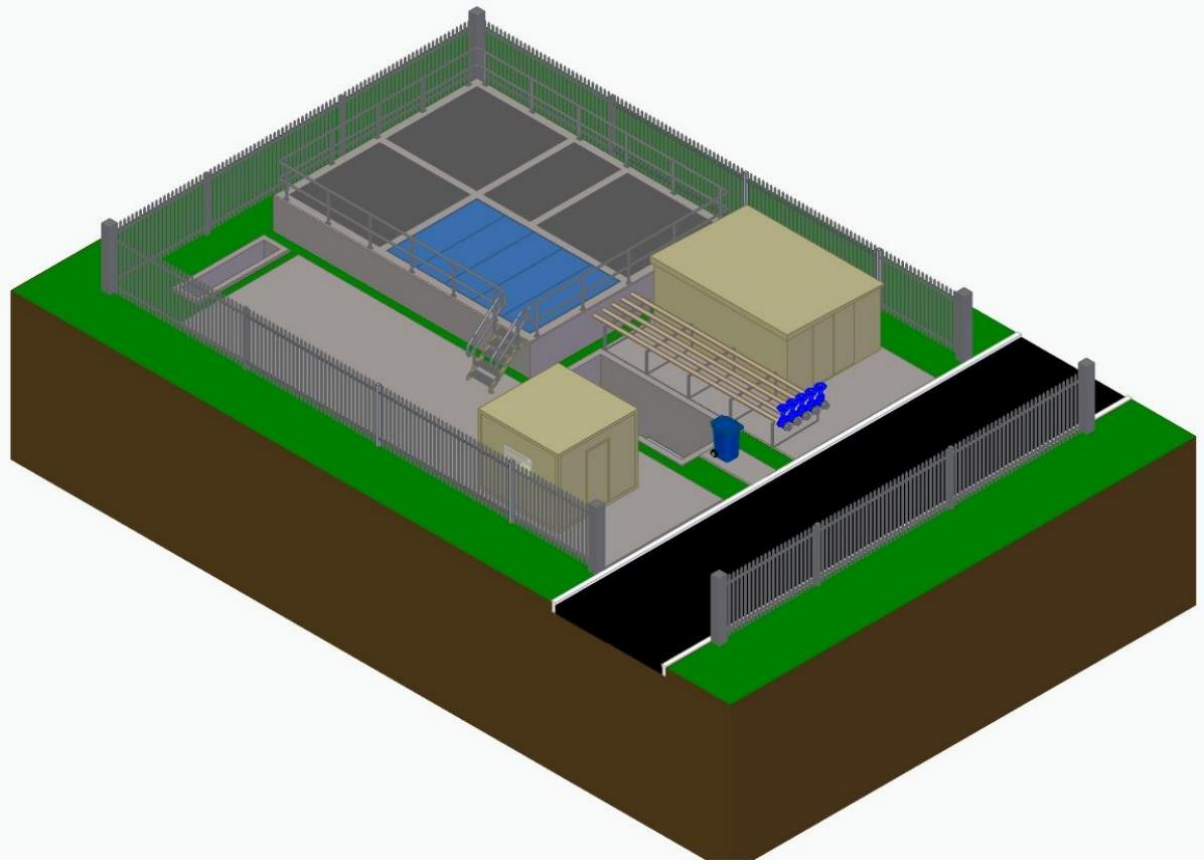


Figure 1 STC500 – overhead view

Noise

A site-specific noise impact assessment (NIA) for the development has not been undertaken with reference to an onsite WRC. However, a NIA was undertaken in January 2022 at a demonstrator WRC utilising the proposed treatment process to inform stakeholders on the minimum stand-off distances from these facilities. A full copy of the report can be found in Appendix 01.

There are various assets on the WRC which generate noise; the air blowers are responsible for generating the most powerful noise emissions on the plant – accordingly they shall be housed within acoustic enclosures to provide attenuation. The risk of adverse impact to Noise Sensitive Receptors (NSRs) such as local dwellings is minimal.

Odour

A site-specific odour impact assessment (OIA) for the development has not been undertaken with reference to an onsite WRC. However, an OIA was undertaken in January 2022 at a demonstrator WRC utilising the proposed treatment process to inform stakeholders on the minimum stand-off distances from these facilities.

The study was undertaken by a competent consultant in accordance with published guidance from the Department for Environment, Food & Rural Affairs, the Environment Agency, the Institute of Air Quality Management, and statements from bodies such as the Chartered Institution of Water and Environmental Management, and the UK Water Industry Research to determine the potential odour impact of the sewage treatment works on proposed developments. A full copy of the report can be found in Appendix 02.

The assets with the greatest potential for nuisance emissions are the inlet works, balance tank / fermenter and sludge holding tanks. These assets shall be designed and configured in a way which minimises their odour emissions. Examples include, covering the inlet works, sealing the balance tank / fermenter, and introducing an aeration system to the sludge holding tanks to prevent sludge becoming septic.

The combination of sniff testing and professional judgement has created a broad assessment of the potential odour from the WRC process and the potential impact on any proposed residential development in close proximity to a WRC. As such, it is not considered that the WRC would cause a loss of amenity, annoyance, nuisance or complaints for current or future occupiers of nearby residential dwellings.

Appendix 01: Noise Impact Assessment

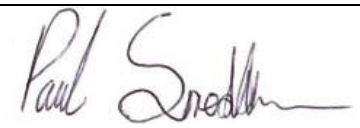
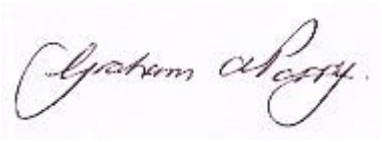
Report for:

Severn Trent Connect

Petersfield Demonstrator Water recycling centre

Noise Impact Assessment

Status: Final **Date: 26.01.2022**

Author	 Paul Sneddon Acoustic Consultant
Reviewed and Approved By	 Graham Parry Managing Director
Report For	Severn Trent Connect
Date	26.01.2021
Version Number	A4635/N/001
Status	Final

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1. INTRODUCTION

ACCON UK Limited (ACCON) has been commissioned by Severn Trent Connect to provide a Noise Impact Assessment to support planning applications where the Water recycling centre (WRC) may be in close proximity to existing or proposed residential developments.

In order to assess the noise impacts from the WRC, ACCON personnel carried out noise measurements at the Petersfield Demonstrator WRC, as identified in **Figure 1.1.**

Figure 1.1 - Aerial view of the existing Petersfield site

A Glossary of Acoustic Terminology is provided in **Appendix 1**.

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2. THE NATURE, MEASUREMENT AND EFFECT OF NOISE

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to characterise the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB (A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels, for example, from 60 dB (A) to 70 dB (A), would represent a doubling in 'loudness'. Similarly, a decrease in noise, for example, from 70 dB (A) to 60 dB (A), would represent a halving in 'loudness'. A change of 3 dB (A) is generally considered to be just perceptible[1]. **Table 2.1** details typical noise levels.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

[1] Institute of Environmental Management and Assessment (2014). Guidelines for environmental noise impact assessment.

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3. LEGISLATIVE/POLICY BACKGROUND

3.1. National Planning Policy Framework

The revised National Planning Policy Framework (NPPF as amended in July 2021) supersedes the 2012, 2018 and 2019 versions of the NPPF. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, make effective use of land, help to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.

Paragraph 185 of the NPPF states:

"*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*

a) *Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life (see Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food and Rural Affairs, 2010));*

b) *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

Additionally, Paragraph 187 states:

"*Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*"

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3.2. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The vision of the NPSE is to '*Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development*'.

The Noise Policy Statement for England (NPSE) aims to '*through the effective management and control of environmental neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.*'

Based on concepts from toxicology, it introduces three 'Effect Levels' relevant to the assessment of noise. These are:

- NOEL: No Observed Effect Level: This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise;
- LOAEL: Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected; and
- SOAEL: Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur.

3.3. Planning Practice Guidance

The Planning Practice Guidance for Noise (PPG-N) was published in March 2014 and most recently updated in July 2019. The PPG-N suggests that the most appropriate and cost-effective solutions to potential noise issues are best identified when good acoustic design is considered early in the planning process.

The PPG-N provides the following advice on how to determine the noise impact on development:

"*Plan-making and decision making need to take account of the acoustic environment and in doing so consider:*

- *Whether or not a significant adverse effect is occurring or likely to occur;*
- *Whether or not an adverse effect is occurring or likely to occur; and*
- *Whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek

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experienced specialist assistance when applying this policy." (Paragraph 003 Reference ID 30-003-20190722)

The document goes on to acknowledge the levels of noise exposure at which an effect may occur as provided in the NPSE and introduces a fourth effect level:

- UAE: Unacceptable Adverse Effect: Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise lead to psychological stress or physical effects.

Where residential development is proposed in the vicinity of existing businesses, community facilities or other activities that produce noise, the PPG-N advises that the applicant (or 'agent of change') will need to clearly identify the effects of the existing businesses that may cause a nuisance (including noise) and clearly define the mitigation measures being proposed to address any potential significant adverse effects that are identified. The agent of change needs to not only consider the current activities of the business, but the permitted activities too, even if they are not occurring at the time of the application being made. The PPG-N acknowledges that "*It can be helpful for developers to provide information to prospective purchasers or occupants about mitigation measures that have been put in place, to raise awareness and reduce the risk of post-purchase/occupancy complaints.*" (Paragraph 009 Reference ID 30-009-20190722).

It is important to understand that as the PPG-N does not specifically provide any advice with respect to noise levels/limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment and the PPG-N signposts a number of appropriate guidance documents.

3.4. British Standard BS 4142:2014

BS 4142:2014 *Methods for rating and assessing industrial and commercial sound* provides a method for the measurement and rating of industrial or commercial type noise sources and background noise levels outside dwellings. The 'rating level' (defined in the BS) is used to rate the noise level of the source (this is defined as the 'specific sound level') outside residential dwellings.

The rating level is determined by assessing the character of the noise and applying an acoustic feature correction, if appropriate, to the specific sound level. Corrections are applied for the tonality, impulsivity, intermittency or other distinctive characteristics of the noise source which can all increase the impact of noise.

The initial assessment described in BS 4142 to determine whether an adverse impact is likely is based on establishing the difference between the rating level and the background noise level outside the residential property of interest. The British Standard states that the following points should be considered:

- "*Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*

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- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*"

Where it is considered that the initial assessment of the impact needs to be modified due to the context in which the noise is occurring, BS 4142 suggests that all pertinent factors are taken into consideration, including:

i. "*The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound[2] levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

ii. *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*

iii. *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*

   i. *facade insulation treatment;*
   ii. *ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
   iii. *acoustic screening."*

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[2] The residual sound is defined as the ambient sound level at the assessment location in the absence of the specific sound source.

There is also a requirement within BS 4142:2014 to consider the uncertainty in the measurement and assessment procedure and it is stated that: "*The level of uncertainty associated with a measurement of sound level depends upon a number of factors, including:*

a. *the complexity of the sound source and the level of variability in sound emission from the source;*
b. *the complexity and level of variability of the residual acoustic environment;*
c. *the level of residual sound in the presence of the specific sound at the measurement location;*
d. *the location(s) selected for taking the measurements;*
e. *the distance between sources of sound and the measurement location and intervening ground conditions;*
f. *the number of measurements taken;*
g. *the measurement time intervals;*
h. *the range of times when the measurements have been taken;*
i. *the range of suitable weather conditions during which measurements have been taken;*
j. *the measurement method and variability between different practitioners in the way the method is applied;*
k. *the level of rounding of each measurement recorded; and*
l. *the instrumentation used.*"

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4. NOISE MEASUREMENT SURVEY

Noise measurements were carried out between 1315 hrs and 1356 hrs on Wednesday 12th January 2022 to determine the noise levels in close proximity to the existing plant at Petersfield WRC. The purpose of the noise measurement survey was to obtain source noise levels for inclusion in a detailed noise model.

At the start of the noise measurement period the weather was dry with approximately 10% cloud cover with a daytime temperature of 12˚C and wind travelling in a south-easterly direction at 1 m/s. At the end of the measurement period the weather was dry with approximately 10% cloud cover with a temperature of 12 ˚C with wind travelling in a south-easterly direction at 1 m/s.

4.1. Noise Monitoring

The noise measurements utilised a Rion NL-52 Sound Level Meter which holds a current certificate of calibration. Before and after the measurement period, the equipment was calibrated in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB).

Measurement Positions 1 - 7 were at the locations illustrated in **Figure 4.1** at a height of 1.2 – 1.5 m. Photographs of the measurement positions can be found in **Appendix 2** and specific source details can be found in **Table 5.1**.

Figure 4.1: Noise Measurement Locations

The ambient noise climate in close proximity to the WRC was dominated by the various plant.

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5. NOISE SOURCES

Plant on the site consists of several compressors. Each item of plant has been measured and is shown below **Table 5.1**.

Table 5.1: Source Noise Levels

Noise measurement locations	Noise Source	Distance from Source (m)	Noise Level @ 1 m (SPL) (dBA)
1	SBC Blower	1	86
2	Pump Z17B	1	66
3	Hyperclassic HMCA	1	59
4	SEW Geared Motor	1	67
5	Gamak AGM 80 8a	1	59
6	Z14A	1	57

It was noted that noise generated by operational motors was the significant noise source at each of the six measurement positions.

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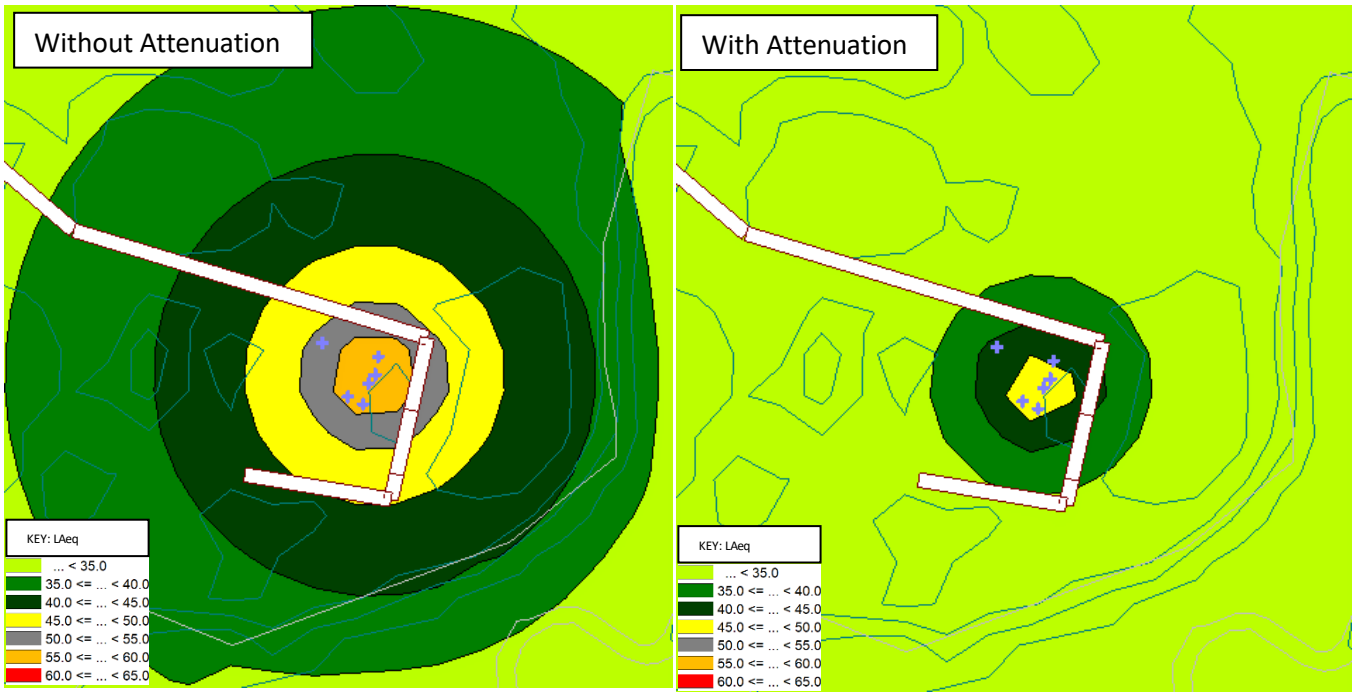
6. NOISE MODELLING

6.1. Methodology

The CadnaA noise modelling software has been utilised to calculate the external noise levels from the WRC. CadnaA is a three-dimensional noise model developed by DataKustik and has been extensively used by ACCON and others to develop noise models for a wide variety of situations and noise sources. CadnaA utilises ISO 9613 to predict noise from point, line and area sources.

Figure 6.1 – CadnaA noise model contour



The CadnaA image on the left of **Figure 6.1** identifies the predicted noise levels from the WRC at Petersfield in its current operational mode, assuming that all noise generating machinery (measured on site) is active simultaneously. The significant noise source on site was the SBC Blower unit. It can be determined that noise from the site currently falls below a typical background sound level (35 dB LA_{90}) at a distance of 85 - 90 metres.

The CadnaA image on the right of **Figure 6.1** illustrates the reduction in noise egress if the SBC Blower was within an attenuating enclosure with a performance of Rw 15 dB. This would reduce the noise of the SBC Blower to a similar level to that of other motor related noise sources on the site. In the attenuated scenario, it can be determined that noise from the motors would not exceed the typical rural daytime background sound level (35 dB LA_{90}) at a distance of 30 - 35 metres

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7. PLANT NOISE ASSESSMENT

7.1. BS 4142 Assessment

Subject to confirmation from an LPA, ACCON have determined that a BS4142 assessment would be an appropriate method for determining the acceptability of a WRC.

Table 7.1 provides a notional BS 4142 assessment of noise from the WRC.

Table 7.1: Noise Assessment of WRC - Unattenuated

Results	LAeq (10 metres)	LAeq (20 metres)	LAeq (40 metres)	LAeq (80 metres)
Typical Background Sound Level $L_{A90, 5min}$ (dB)	35	35	35	35
Specific Sound Level $L_{Aeq, Tr}$ (dB)	55	49	43	36
Acoustic Feature Correction (dB)	2	2	2	2
Rating Level $L_{Ar, Tr}$ (dB)	57	51	45	38
Difference between Rating Level and Background Sound Level (dB)	22	16	10	3
Initial Estimate of Impact	Significant adverse impact	Significant adverse impact	Significant adverse impact	Low risk of adverse impact

It can be identified from **Table 7.1** above that if the SBC blower unit remains unattenuated, the rating noise level from the WRC meets the criteria for low risk of adverse impact at a distance of 80m.

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It can be identified from **Table 7.2** that when the significant noise source on site is attenuated with an acoustic enclosure, the rating noise level from the WRC meets the criteria for low risk of adverse impact at a distance of 30 m.

Table 7.2: Noise Assessment of WRC – Attenuated Blower Unit

Results	LAeq (10 metres)	LAeq (20 metres)	LAeq (30 metres)
Typical Background Sound Level $L_{A90, 5min}$ (dB)	35	35	35
Specific Sound Level $L_{Aeq, Tr}$ (dB)	45	39	34
Acoustic Feature Correction (dB)	2	2	2
Rating Level $L_{Ar, Tr}$ (dB)	47	41	36
Difference between Rating Level and Background Sound Level (dB)	12	6	1
Initial Estimate of Impact	Significant risk of adverse impact	Adverse impact	Low risk of adverse impact

7.2. Uncertainty

The analysis has utilised a notional background noise level and it wil therefore be important to ensure that for any specific location for a WRC the background noise level is measured for inclusion in any subsequent BS 4142 assessment.

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8. CONCLUSION

A CadnaA noise model has been prepared to predict noise emanating from the WRC.

A BS 4142 assessment of the noise has concluded that if the significant noise sources on site are attenuated with a suitable acoustic enclosure, the risk of adverse impact to Noise Sensitive Receptors (NSRs) at a distance greater than 30 metres is low.

Where a larger WRC installation than the demonstrator WRC is planned and subject to an appropriate level of mitigation, principally to any blower units, then it should be possible to site any residential properties within 50 metres of the WRC.

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Appendix 1
Glossary of Acoustic Terminology

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Term	Description
'A'-Weighting	This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.
Decibel (dB)	This is a tenth (deci) of a bel. A decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.
Frequency	Frequency is related to sound pitch; frequency equals the ratio between velocity of sound and wavelength.
$L_{Aeq, T}$ (Ambient /Period Sound Level)	The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location. $L_{Aeq, T}$ can be measured directly with an integrating sound level meter.
$L_{A90, T}$ (Background Sound Level)	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time. The $L_{A90, T}$ is used to describe the background noise levels at a particular location.
Sound Power Level	The total sound energy radiated by a sound source in all directions. In decibels with a reference level of 1 $x10^{-12}$ Watts
Rating Level, $L_{Ar, Tr}$	The specific sound level plus any adjustment for the characteristic features of the sound.
Residual Sound Level, $L_r = L_{Aeq, T}$	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Specific Sound Level, $L_s = L_{Aeq, Tr}$	The equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.
T	Sometimes denoted RT, this is the reverberation time. The reverberation time is defined as the time in seconds taken for the sound pressure level to decay by 60 dB. This is measured within rooms to allow the determination of the level of acoustic absorption present.

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Appendix 2
Photographs of Measurement Positions

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Figure 1 - Measurement Position 1

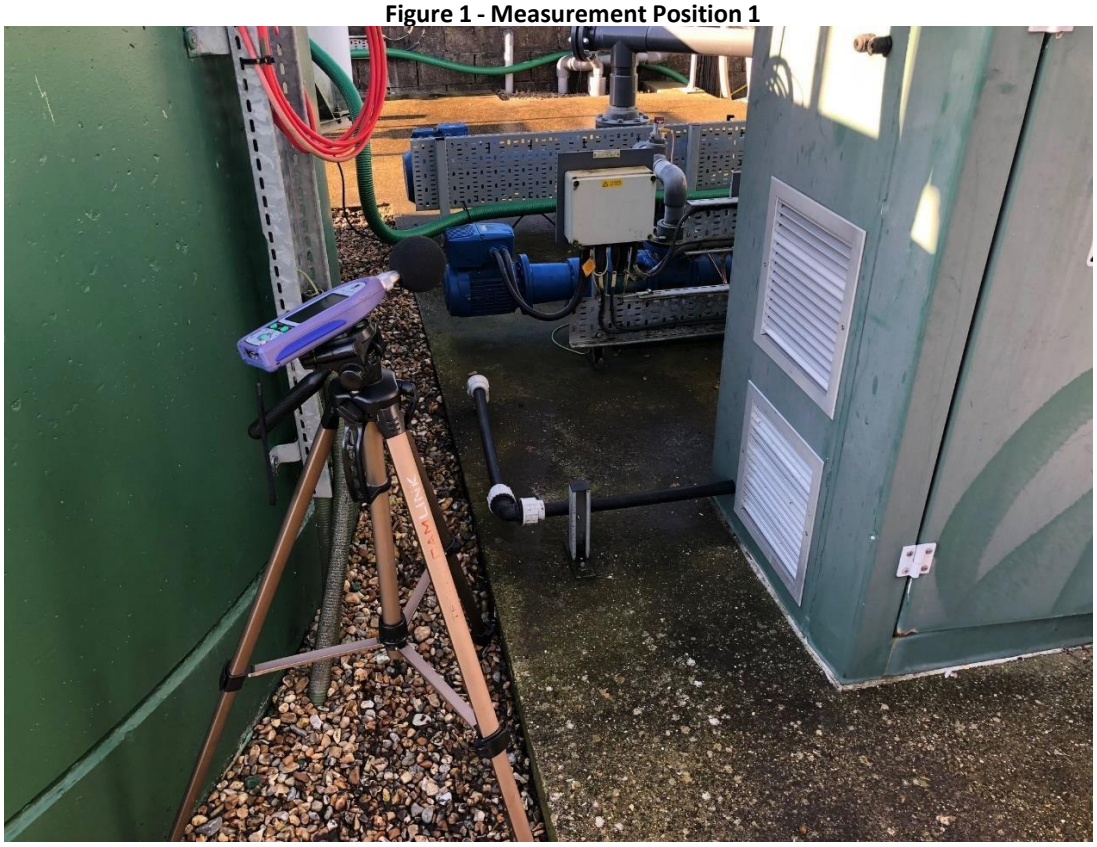


Figure 2 - Measurement Position 2

Figure 3 - Measurement Position 3

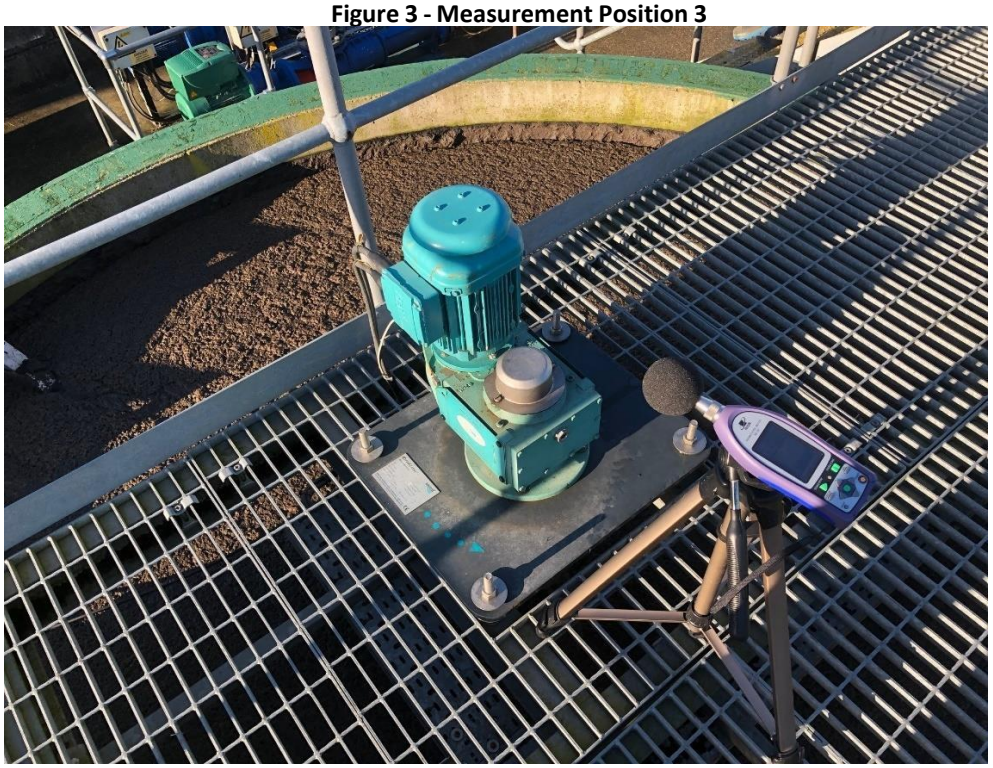


Figure 4 - Measurement Position 4

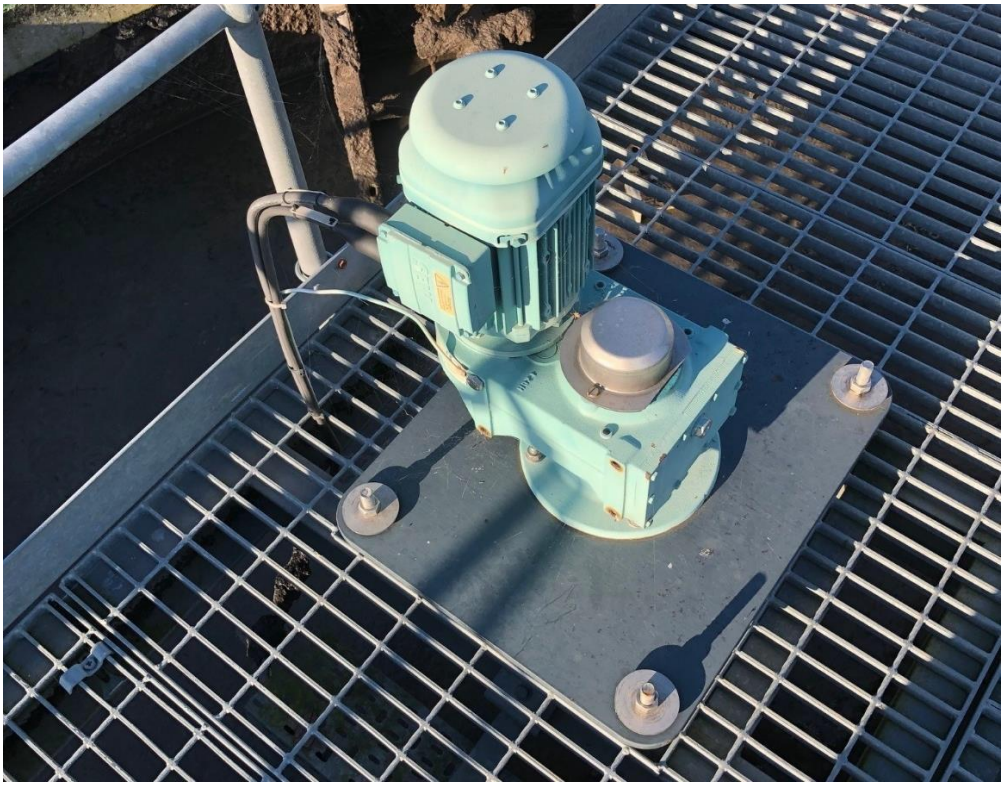


Figure 5 - Measurement Position 5

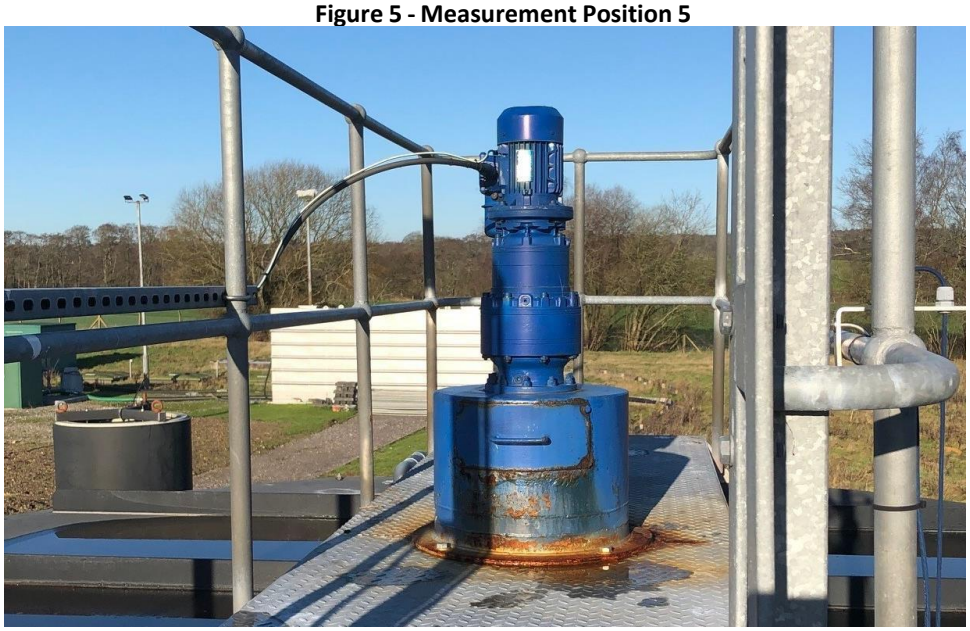
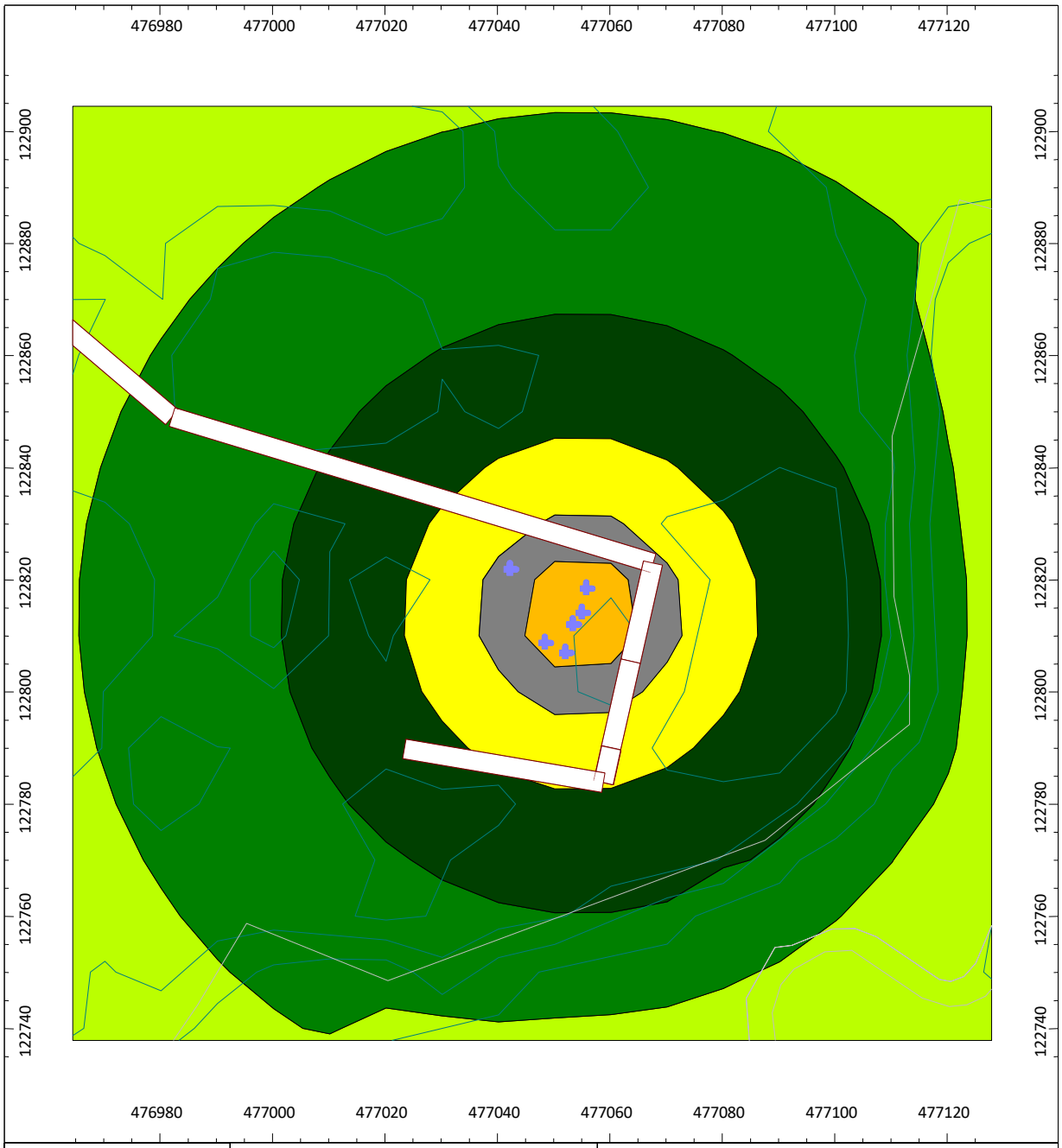


Figure 6 - Measurement Position 6



Daytime Noise Levels

LAeq,16hr

50.0 <= ... < 55.0

55.0 <= ... < 60.0

60.0 <= ... < 65.0

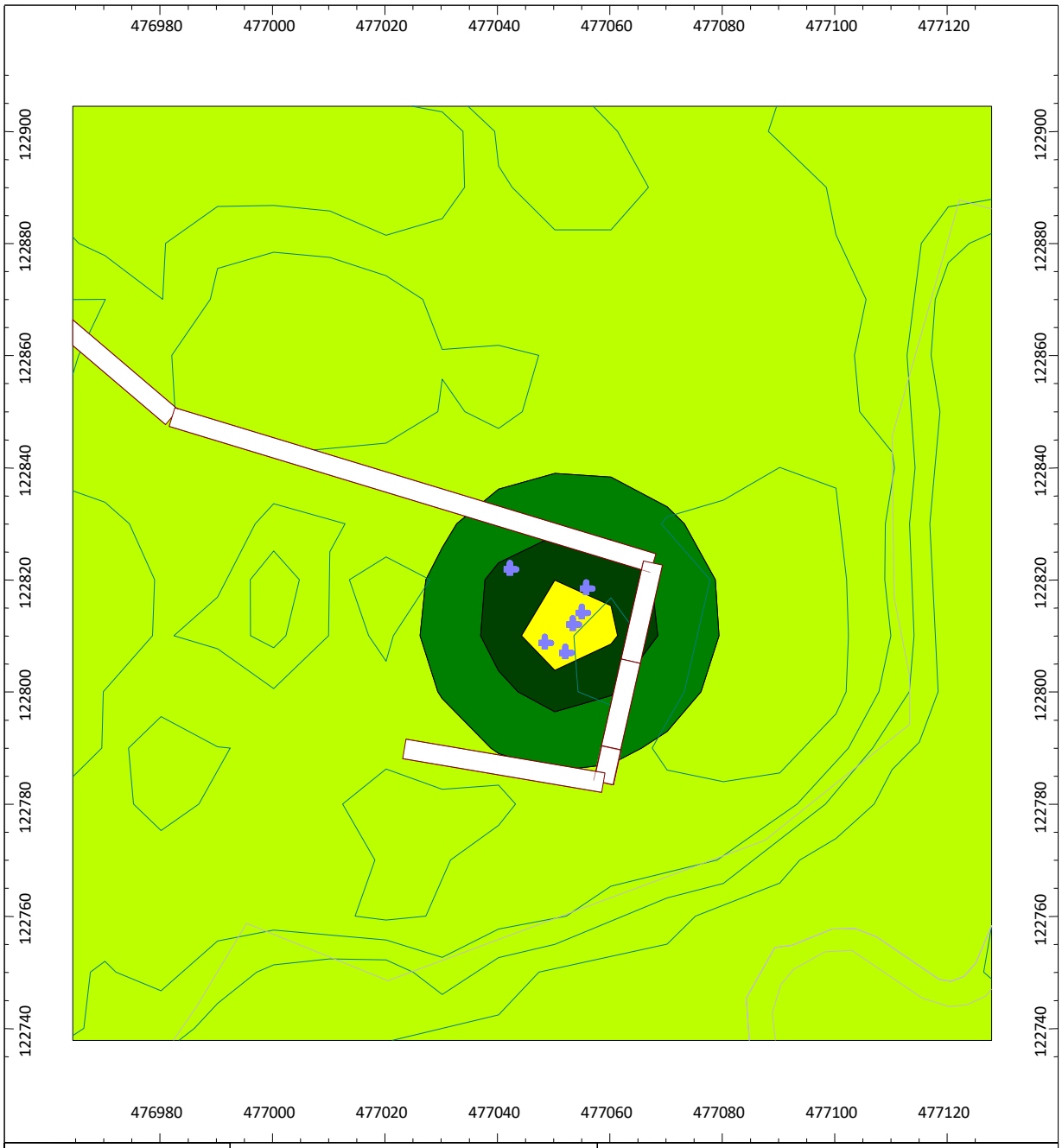
65.0 <= ... < 70.0

70.0 <= ... < 75.0

Petersfield WRC Unattenuated

accon UK ENVIRONMENTAL CONSULTANTS

Cadna A®



Daytime Noise Levels

LAeq,16hr

50.0 <= ... < 55.0

55.0 <= ... < 60.0

60.0 <= ... < 65.0

65.0 <= ... < 70.0

70.0 <= ... < 75.0

Petersfield WRC SBC Blower attenuated by acoustic enclosure (Rw 15 dB)

ACCON UK ENVIRONMENTAL CONSULTANTS

Cadna A®

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50.0 <= ... < 55.0

55.0 <= ... < 60.0

60.0 <= ... < 65.0

65.0 <= ... < 70.0

70.0 <= ... < 75.0

Report for:

476980 477000 477020 477040 477060 477080 477100 477120

Severn Trent Connect

Petersfield demonstrator water recycling centre

Odour Assessment

Status: Final **Date: 25.01.2022**

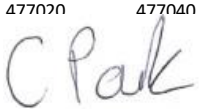
50.0 <= ... < 55.0

55.0 <= ... < 60.0

60.0 <= ... < 65.0

65.0 <= ... < 70.0

70.0 <= ... < 75.0

Author	 Christine Park Senior Air Quality Consultant
Reviewed and Approved By	 Graham Parry Managing Director
Report For	Severn Trent Connect
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1. INTRODUCTION

ACCON UK Limited (ACCON) have been commissioned by Severn Trent Connect to carry out an odour assessment to support planning applications where the waste water treatment works (WRC) may be in close proximity to existing or proposed residential development.

In order to assess the odour impacts from the WRC ACCON personnel have visited the Petersfield Demonstrator WRC, the location of which site is identified in **Figure 1.1**.

Figure 1.1: Site Location Plan

- Carried out qualitative odour assessments at and in the vicinity of the WRC;
- Carried out an odour impact assessment in accordance with published guidance from the Department for Environment, Food & Rural Affairs (DEFRA)[1], the Environment Agency (EA)[2], the Institute of Air Quality Management (IAQM)[3] and statements from bodies such as the Chartered Institution of Water and Environmental Management (CIWEM) and the UK Water

[1] *'Odour Guidance for Local Authorities'*, DEFRA (2010)

[2] IPPC H4 *'Odour Management'*, Environment Agency (2011)

[3] 'Guidance on the assessment of odour for planning' IAQM (2014)

Industry Research (UKWIR) to determine the potential odour impact of the sewage treatment works on the proposed development.

2. ODOUR BACKGROUND, POLICY, LEGISLATION AND GUIDANCE

Odour Legislation and Guidance considered in this Assessment

The following legislation and guidance were utilised as part of this assessment:

- Odour Guidance for Local Authorities', DEFRA (2010);
- IPPC H4 *'Odour Management',* Environment Agency (2011);
- 'Guidance on the assessment of odour for planning' IAQM (2014);
- Chartered Institute for Water and Environmental Management (CIWEM) Policy Statement (2011);
- Odour Control in Sewage Treatment (Technical Reference Document 01/WW/13/3) UK Water Industry Research (UKWIR) (2001); and
- Planning Precedent Decisions

Odour Background

2.1.1. Odour Definition

The DEFRA guidance defines odour as:

> *"An odour is the organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances. It is a property of odorous substances that make them perceptible to our sense of smell. The term odour refers to the stimuli from a chemical compound that is volatilised in air. Odour is our perception of that sensation and we interpret what the odour means. Odours may be perceived as pleasant or unpleasant. The main concern with odour is its ability to cause a response in individuals that is considered to be objectionable or offensive.*
>
> *Odours have the potential to trigger strong reactions for good reason. Pleasant odours can provide enjoyment and prompt responses such as those associated with appetite. Equally, unpleasant odours can be useful indicators to protect us from harm such as the ingestion of rotten food. These protective mechanisms are learnt throughout our lives. Whilst there is often agreement about what constitutes pleasant and unpleasant odours, there is a wide variation between individuals as to what is deemed unacceptable and what affects our quality of life."*

Odour is perceived by our brains in response to chemicals present in the air we breathe. Odour is the effect that those chemicals have upon us. Humans have a particularly developed sense of smell and they can detect odour even when chemicals are present in very low concentrations. Most odours are a mixture of many chemicals that interact to produce what we detect as an odour.

Different life experiences and natural variation in the population can result in different sensations and emotional responses by individuals to the same odorous compounds. Because the response to odour is synthesised in our brains, other senses such as sight and taste, and even our upbringing, can influence our perception of odour and whether we find it acceptable, objectionable or offensive

2.1.2. Odour Units

The concentration at which an odour is just detectable to a 'typical' human nose is referred to as the 'threshold' concentration. At the detectability threshold, the concentration of an odour is so low that it is not recognisable as any specific odour at all, but the presence of some very faint, odour can be sensed when the 'sample' odour is compared to a clean, odour-free sample of air.

Odours are a complex mixture of compounds and the concentration of the mixture is expressed in European odour units per cubic metre ($ou_E m^{-3}$ or ou_E/m^3) as defined by European standard BSEN 13725:2003 *'Air quality. Determination of odour concentration by dynamic olfactometry'.*

An odour at strength of 1 ou_E m^{-3} would only be detectable within the confines of an odour laboratory by the majority of the population. As odour concentrations increase, they become more noticeable. The following published guideline values[4] provide context to odour concentrations;

- $1ou_E m^{-3}$ = the point of detection;
- $5ou_E m^{-3}$ = is a faint odour;
- $10ou_E m^{-3}$ = is a distinct odour.

In the general environment however, the population are exposed to levels of 'background' odours from road traffic, vegetation and numerous other activities which can produce background odour concentrations between 5 to $60ou_E m^{-3}$.

The units for exposure to odour is given in terms of a percentile of averages over the course of a year. The current accepted method of assessing the impact of odour concentration in the UK at present is a 98_{th} percentile (C_{98}) of hourly averages. This allows for 2% (175 hours) of the year to be above the limit criterion.

2.1.3. Odour Exposure

Before an adverse effect (such as disamenity, annoyance, nuisance or complaints) can occur, there must be odour exposure. For odour exposure to occur all three links in the source-pathway-receptor chain must be present:

i. An emission source - a means for the odour to get into the atmosphere.

ii. a pathway - for the odour to travel through the air to locations off site, noting that:

- anything that increases dilution and dispersion of an odorous pollutant plume as it travels from source to receptor will reduce the concentration at the receptor, and hence reduce exposure.
- increasing the length of the pathway (e.g. by releasing the emissions from a high stack or at a distance) will – all other things being equal – increase the dilution and dispersion.

iii. The presence of receptors (people) that could experience an adverse effect, noting that people vary in their sensitivities to odour.

[4] IPPC H4 *'Odour Management',* Environment Agency (2011)

The scale of exposure (the impact) is determined by the parameters collectively known as the FIDO factors (Frequency, Intensity, Duration and Offensiveness; these are described in **Table 3.1**. The magnitude of the effect experienced is determined by the scale of exposure (**FIDOL**) and the sensitivity of the receptor (**L**, denoting the location, which is often taken to be a surrogate for the sensitivity and incorporates the social and psychological factors that can be expected for a given community.) **Figure 2.1** depicts how the human appraisal of the **FIDOL** factors and social and psychological factors determines whether an odour has an adverse odour impact and an objectionable effect. Different combinations of the **FIDO** factors can result in different exposures at a location. For example, odours may occur as a one-off, as frequent short bursts, or for longer, less- frequent periods, and may be said to give 'acute' or 'chronic' exposures respectively.

Table 2.1: Description of the FIDOL factors

Frequency	How often an individual is exposed to odour
Intensity	The individual's perception of the strength of the odour
Duration	The overall duration that individuals are exposed to an odour over time.
Odour unpleasantness	Odour unpleasantness describes the character of an odour as it relates to the 'hedonic tone' (which may be pleasant, neutral or unpleasant) at a given odour concentration/intensity. This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score.
Location	The type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'Location' factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

Source: IAQM, 2014

2.1.4. Adverse Effects of Odour

The odour effect to be concerned with is the negative appraisal by a human receptor of the odour exposure. This appraisal, occurring over a matter of seconds or minutes, involves many complex psychological and socio-economic factors. Once exposure to odour has occurred, the process can lead to adverse effects such as loss of amenity, annoyance, nuisance and possibly complaints. It is important to emphasise the technical differences between annoyance and nuisance:

- Annoyance – the adverse effect occurring from an immediate exposure; and
- Nuisance – the adverse effect caused cumulatively, by repeated events of annoyance.

Accordingly, in determining whether a site is suitable for development where a WRC may be installed it is important to understand the scale of the potential odour, over what period it may occur and importantly whether it will migrate from the source to the sensitive receptors on a regular basis such as to cause a loss of amenity or nuisance. Additionally, it is also important to understand the extent to which any exposure at a sensitive receptor, i.e. a proposed residential development, would occur.

Table 2.2: Receptor sensitivity to odours

High sensitivity receptor	Surrounding land where: • Users can reasonably expect enjoyment of a high level of amenity; and • People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium sensitivity receptor	Surrounding land where: • Users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or • People wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low sensitivity receptor	Surrounding land where: • The enjoyment of amenity would not reasonably be expected; or • There is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths and roads.

Source: IAQM, 2014

2.1.5. Odour from Water recycling centre

There are many chemical species that have been detected in sewage treatment works odours. In addition to hydrogen sulphide and other pollutants such as ammonia, there are a wide variety of organic sulphides and organic nitrogen-based compounds along with some oxygenated organic compounds and organic acids.

In addition to these compounds, there are many potential substances which may be released depending upon the quality of the influent, for example if it includes industrial effluent. The range of contaminants potentially present in industrial effluent is extensive but those which are likely to be of concern are already odorous liquids (such as sewage from food production), warm effluent which may accelerate anaerobic conditions and volatile organic compounds such as solvents and petroleum derivatives. The primary odours from sewage treatment works are biogenic due to the degradation of organic matter by microorganisms under anaerobic conditions. The development of anaerobic conditions in sewage is often referred to as 'septicity'. Septicity can be onset by elevated temperature, high biological oxygen demand, high sulphate levels and the presence of reducing chemicals. Anaerobic activity leads to the production of methane, hydrogen sulphide (H_2S), ammonia (NH_3), organic sulphur, thiols (mercaptans), amines, indole and skatole. During the fermentation phase of anaerobicity, volatile fatty acids, alcohols, aldehydes and ketones can be produced.

However, odour which is not typical of anaerobic conditions can also be generated by other mechanisms in a treatment works including:

- Volatile substances in the influent such as petroleum derivatives, solvents;

- Air stripping of volatile compounds and odours particularly from industrial effluent often at inlet works or during aeration;
- Aerobic odours – which are often described as a 'musty' odour; and
- Ammonia odour from reactions after liming of sludges or when sludges become re-wetted.

Hydrogen sulphide is often referred to as the cause of odour from sewage treatment works. Whilst hydrogen sulphide may be a principal component of the odour cocktail, there are other compounds which cannot be ignored. Because it is relatively easy to measure, H_2S is often used as a target indicator for odour but there are important limitations to this technique.

Odour Standards and Benchmarks

There are a number of sources of 'standards' for odour unit concentrations and the assessment of impacts. Malodours from WRC (particularly where sludge is used and processed) are considered to be potentially highly offensive and therefore careful consideration should be given to the placement of potential receptors.

2.1.6. Planning Precedents

There are a number of planning precedents that are able to inform this assessment. The first of these is the Newbiggin-by-the-Sea[5] Planning Inspectorate decision in 1993. The appeal addressed what was an appropriate odour exposure limit at a sensitive receptor and the appeal concluded that: "Whilst a particularly sensitive person could detect an emission level as low as $2ou_Em^{-3}$, it seems to be that adoption of a level of $5ou_Em^{-3}$ for the appeal site is both reasonable and cautious."

The decision in this Planning Inspectorate case was the origin of the now well-established empirical standard of $5ou_Em^{-3}$ (98^{th} percentile - $C_{98,\ 1\text{-hour}}$), which has been widely used in the sewage sectors in the UK to assess the likelihood of community annoyance. This impact criteria has been successfully applied within similar assessments, where odour from WRC has been assessed at adjacent residential receptors[6,7,8].

At a WRC managed by Southern Water, ACCON received the following comment from the EHO at the Local Planning Authority for that site:

> *"Further to the Technical Note produced in response to concerns expressed about odour, it is my view that the site is not ideal for residential development, however the developer has provided an assessment that predicts that odour …. will be within acceptable limits (C98, 1-hour <3ou$_E$/m^3). On this basis I am unable to object to the development on the grounds of odour."*

[5] Department of the Environment (July 1993) Appeal by Northumbrian Water Ltd: *Land Adjacent to Spital Burn, Newbiggin-by-the-sea, Northumberland. Case* ref: APP/F2930/A/92 206240.

[6] Planning Inspectorate – Appeal Reference: APP/P0240/A/09/2110667

[7] Planning Inspectorate – Appeal Reference: APP/E3525/A/11/2145235.

[8] High Court of Justice (2011). EWHC 3253 (TCC).

2.1.7. IAQM Guidance (2014, updated July 2018)

The IAQM document provides guidance on the odour impacts for planning purposes. As such, it gives details of relevant descriptors of effects and impacts, so that modelled odour concentrations can be quantified. **Table 2.3** compares the receptor sensitivity and relative odour exposure and provides a magnitude of effect.

Table 2.3: IAQM suggested descriptors for magnitudes of odour effects

Relative Odour Exposure (Impact)	Receptor Sensitivity: Low	Medium	High
Very Large	Moderate adverse	Substantial adverse	Substantial adverse
Large	Slight adverse	Moderate adverse	Substantial adverse
Medium	Negligible	Slight adverse	Moderate adverse
Small	Negligible	Negligible	Slight adverse
Negligible	Negligible	Negligible	Negligible

Applicable to odours at the "most offensive" end of the relative-unpleasantness spectrum

2.1.8. Assessment of Community Response to Odorous Emissions

Environment Agency (EA) Research and Development Technical Report P4-095/TR (2002) provides a scientific background to assist in identifying defensible numerical limits for regulating exposure to odours in the UK. This report recognises that the $C_{98,\ 1\text{-hour}} < 5\ ou_E m^{-3}$ exposure level is currently applied in the UK with the legal objective of avoiding nuisance. Not all aspects of sewage treatment have the potential to generate odour which is likely to be offensive and therefore have the potential to generate complaints.

2.1.9. UKWIR Research[9]

The UK Water Industry Research (UKWIR) organisation undertook research into the correlation between modelled odour impacts and the spatial distribution of odour complaints in the areas surrounding nine STW in the UK. The report includes the likely amount of complaints for a given odour concentration and concludes:

"The main source of research into odour impacts in the UK has been the sewage industry and the most in-depth study published study in the UK of the correlation between modelled odour impacts and human response (dose-effect) was published by UK Water Industry Research (UKWIR) in 2001. This was based on a review of the correlation between reported odour complaints and modelled odour impacts in relation to 9 sewage treatment works in the UK with ongoing odour complaints. The findings of this research (and subsequent UKWIR research) indicated the following:

- *At modelled exposures of below $C_{98,\ 1\text{-hour}}$ $5ou_E m^{-3,}$ complaints are relatively rare, at only 3% of the total registered;*

[9] Odour Control in Sewage Treatment (Technical Reference Document 01/WW/13/3) UK Water Industry Research (UKWIR) (2001)

- *At modelled exposures between $C_{98,\ 1\text{-}hour}$ $5ou_E m^{-3}$ and $C_{98,\ 1\text{-}hour}$ $10ou_E m^{-3}$, a significant proportion of total registered complaints occur; 38% of the total;*
- *The majority of complaints occur in areas of modelled exposure greater than $C_{98,\ 1\text{-}hour}$ $10ou_E^{-3,}$ 59% of the total."*

Therefore, the UKWIR research findings are consistent with the 'Newbiggin' standard and other planning precedents (**Section 2.1.6**) as any potential odour impact and annoyance is effectively controlled for the vast majority of the population at a 98th percentile hourly mean odour impacts of $5ou_E m^{-3}$ or less.

2.1.10. Environment Agency H4 Odour Guidance

The EA published guidelines on odour regulation, assessment and control (H4: Odour Management) in March 2011. In Appendix 3 (of H4), modelled odour concentration benchmark levels are presented for odours of varying degrees of offensiveness.

The guidance recommends that preferably five years of meteorological data (and a minimum of three), should be used to calculate the 98th percentile of the hourly mean odour concentrations, to assess varying meteorological conditions.

2.1.11. Chartered Institute for Water and Environmental Management (CIWEM)

CIWEM released a Policy Position Statement regarding odour in February 2011. The statement provides appropriate assessment criteria and benchmarks to determine the potential for odour nuisance and was as follows:

"Given the differing odour impact criteria available, the selection of the most appropriate criterion should be determined by the objective of the assessment (whether this be against a standard of avoidance of nuisance or 'significant pollution') and the nature of the odour under assessment. It is, therefore, the view of CIWEM that these and other odour impact criteria should be regarded as indicative guidelines and cannot be applied as over-arching statutory numerical standards. CIWEM considers that the following framework is the most reliable that can be defined on the basis of the limited research undertaken in the UK at the time of writing:

- *$C_{98,\ 1\text{-}hour}$ $>10ou_E/m^3$ – complaints are highly likely and odour exposure at these levels represents an actionable nuisance;*
- *$C_{98,\ 1\text{-}hour}$ $>5ou_E/m^3$, – complaints may occur and depending on the sensitivity of the locality and nature of the odour this level may constitute a nuisance; and*
- *$C_{98,\ 1\text{-}hour}$ $<3ou_E/m^3$, – complaints are unlikely to occur and exposure below this level are unlikely to constitute significant pollution or significant detriment to amenity unless the locality is highly sensitive or the odour highly unpleasant in nature."*

3. ASSESSMENT METHODOLOGY

Sniff Testing Methodology

The odours from the WRC were assessed against a fixed framework, which covers weather conditions, odour intensity, strength, frequency and characteristics. A number of locations were identified on and around the Petersfield Demonstrator WRC for assessment to account for typical odour exposure depending on the wind speed and direction. Each location was assessed for a fixed period of time (10 minutes) to enable the assessment of frequency.

3.1.1. *Assessment Quality Assurance*

To ensure that the odour assessment was carried out to a satisfactory standard the following quality assurance steps were taken:

- A suitably qualified and trained odour assessor (assessed against EN13725);
- An objective method of describing and measuring odours
- A standardised monitoring process and data reporting

In addition, the quality of the assessment was managed by utilising the following guidelines as detailed in 'Guidance on the assessment of odour for planning' IAQM, (2014):

- *The odour assessor should not carry out the assessment if they have a cold, sore throat, sinus trouble, etc;*
- *The odour assessor should not be hungry or thirsty;*
- *The odour assessor should not work within half an hour of the end of their last meal;*
- *The odour assessor should not smoke or consume strongly flavoured food or drink, including coffee, for at least half an hour before the field odour survey is carried out, or during the survey;*
- *The odour assessor should not consume confectionery or soft drinks for at least half an hour before the field odour survey is carried out, or during the survey;*
- *Scented toiletries, such as perfume/aftershave should not be used on the day of the field odour survey;*
- *The vehicle used during the field odour survey should not contain any deodorisers;*
- *If the odour assessor has had to travel a long distance, then a rest period should be taken before starting the survey; and*
- *To reduce the likelihood of odour fatigue, assessors should always carry out the field odour survey before making any works site visit, inspection or walk-through survey.*

Odour Benchmarks

As outlined in **Section 2.1.4**, receptor sensitivity and possible exposure to potential odours will vary depending on the land-use of the site. The land use will change the expectation of users of the land depending on the level of amenity and the time spent at the location.

As such, this assessment has considered the following criteria when assessing the impacts of the WRC on any proposed development. This enables the quantification of a 'stand-off' distance from the WRC depending on the land-use and sensitivity of the proposed receptor. The criteria have been determined from the recommendations of the CIWEM, IAQM guidance and planning precedents outlined in **Section 2.1**.

- High sensitivity receptors – considered suitable for any development, including residential: Applied benchmark of less than $C_{98,\ 1\text{-hour}}$ $3ou_E/m^3$;
- Medium sensitivity receptors – considered suitable for places of work, commercial/retail premises and playing/recreation fields: Applied benchmark of greater than $C_{98,\ 1\text{-hour}}$ $3ou_E/m^3$ but less than $C_{98,\ 1\text{-hour}}$ $5ou_E/m^3$; and
- Low sensitivity receptors – considered suitable for non-sensitive uses where exposure would be only transient, e.g. industrial use, farms, footpaths, car-parks and roads: Applied benchmark of greater than $C_{98,\ 1\text{-hour}}$ $5ou_E/m^3$.

Accordingly, where a WRC is proposed near occupiers of existing or proposed residential property the use is considered to be "high sensitivity receptors".

IAQM – Significance Criteria

Based upon the IAQM matrix and descriptors as presented within **Table 3.1**. **Table 3.1** outlines the relationship between modelled odour exposure level and the relevant receptor sensitivity. It should be noted that **Table 3.1** below is a conservative estimate of the impacts based on highly offensive odours. Therefore, less offensive odours would in all likelihood require a higher level of exposure to elicit the same response.

Table 3.1: IAQM odour effect descriptors for impacts predicted by modelling

Odour Exposure Level ou_E/m^3	Receptor Sensitivity		
	Low	**Medium**	**High**
>10	Moderate	Substantial	Substantial
5 - <10	Moderate	Moderate	Substantial
3 - <5	Slight	Moderate	Moderate
1.5 - <3	Negligible	Slight	Moderate
0.5 - <1.5	Negligible	Negligible	Slight
<0.5	Negligible	Negligible	Negligible

4. QUANTIFICATION OF ODOUR EMISSIONS

WRC Process Overview

The advanced activated sludge treatment process is distinctly different to other waste water treatment works in that odour emissions from the principal sources appears to be relatively low. Whilst, odour at other times of the year may be slightly elevated, for example when temperatures are elevated, it seems highly unlikely based on ACCON's experience that a WRC of the size and configuration of the Petersfield Demonstrator WRC could result in offensive odour likely to result in a loss of amenity or a nuisance beyond 10 – 15 metres from the site boundary.

Where the size of the WRC will be larger than the demonstrator WRC, as a precautionary measure based on a professional judgement, a maximum offset distance from the site boundary of 30 - 50 metres should be adopted for sensitive receptors.

5. RESULTS

Qualitative Assessment

A qualitative odour assessment was carried out on the 12th January 2022. Whilst any qualitative assessment can only ever represent a 'snapshot in time' of the operational and meteorological conditions on the day, it does provide very useful observations in respect of how odorous the WRC is and the extent to which odour could migrate offsite.

The two people carrying out the sniff testing on the site have previously had their detection threshold tested by Spectrum Environmental Limited and Silsoe Odours Limited. Their detection threshold was determined at 36.5ppb and 29.9ppb respectively for n-butanol (EN13725). What this means in practice is that both assessors have a range of odour sensitivity that covers the general population. Therefore, their judgements can be relied upon to determine the extent to which odour might be considered offensive such as to result in a nuisance or a loss of amenity to potential occupiers of the proposed property.

Full access to the WRC was made available and therefore it was possible to carry out sniff testing around the WRC and immediately above the various sources of odour. The principal identified sources of odour were the reactors and to a much lesser extent the balance tank. **Appendix 2** outlines each of the locations where sniff testing was carried out. **Table 5.1** outlines meteorological conditions on the day of the site visit.

Table 5.1: Meterological Conditions on Assessment Days

Date	Average Temperature	Average Wind Speed	Average Wind Direction
12th January 2022	12°C	1m/s	South westerly

Odour was detectable immediately adjacent the reactors and specifically when aeration was occurring. Additionally, odour was easily detectable above the reactors. At the balance tank odour was only just detectable.

Offsite depending on location odour was not detectable beyond a distance of 10 metres regardless of being upwind or downwind of the odour sources.

It is ACCON's consideration that the worst-case odour intensity value of 3, would be equivalent to a modelled odour level of $3ou_E/m^3$.

6. CONCLUSIONS

ACCON have carried out an odour assessment of the Demonstrator WRC at Petersfield. Sniff testing was carried out by qualified personnel in order to determine the odour intensity of the existing WRC operation.

It is ACCON's view that beyond the boundary of the plant odour would be highly unlikely to result in a loss of amenity at sensitive receptors e.g. occupiers of residential property.

Assuming that the emission rates remained typical for the WRC process it is very unlikely, that even when air temperatures are elevated during the summer months, that odour from the process would be at a level as to exceed $3ou_E/m^3$ and would in all likelihood be lower still.

The combination of sniff testing and professional judgement has created a broad assessment of the potential odour from the WRC process and the potential impact on any proposed residential development in close proximity to a WRC. As such, it is not considered that the WRC would cause a loss of amenity, annoyance, nuisance or complaints for future occupiers of residential development in close proximity to a WRC process, where it operates in a similar mode to the WRC at Petersfield. Additionally, where the WRC is designed to a larger capacity then an offset distance of 30-50 metres is recommended.

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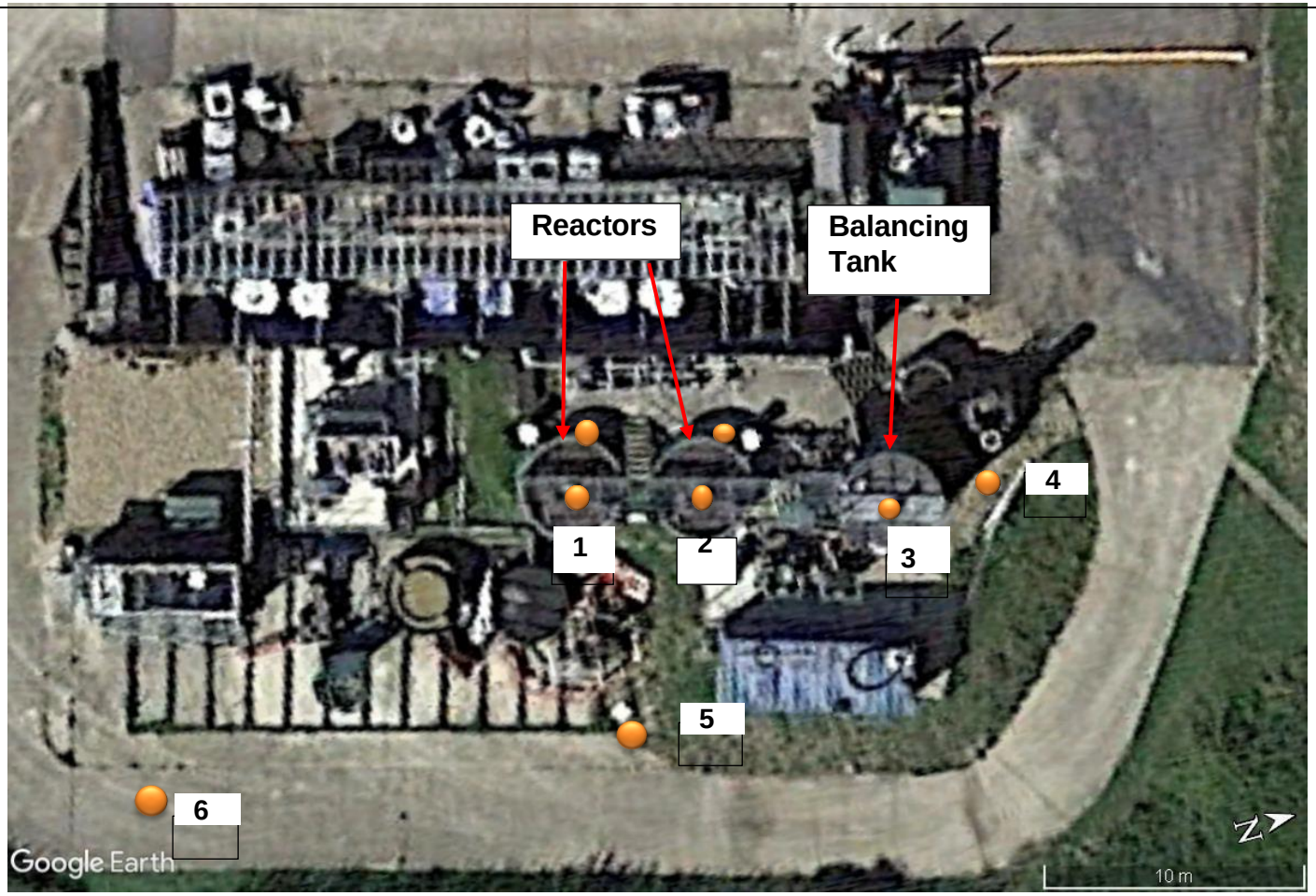
APPENDICES

Appendix 2: Qualitative Sniff Testing Locations



Legend

Sniff Test Locations

Client: Severn Trent Connect		Description: Qualitative Sniff Test Locations	Design	CP	21.01.2022	accon UK ENVIRONMENTAL CONSULTANTS
			Drawn	CP	21.01.2022	
Rev	Description:	Project:	Checked	GP	21.01.2022	*Appendix 2*

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: A	FINAL	Petersfield WRC	Approved	GP	21.01.2022	Scale Not to Scale

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Appendix 7: Odour Report Forms – 'Qualitative Sniff Tests'

Odour Report Form – *Adapted from IPPC H4 'Odour Management', Environment Agency (2011)*

Odour Report Form	**Date:** 12.01.2022	**Project**: Petersfield WRC		
Test Location	**1. Immediately adjacent reactor**	**2. Immediately adjacent Reactor**	**3. Above balancing tank**	**4. At ground level**
Commencement Time Hrs)	1310	1315	1320	1330
Weather Conditions	Sunny with SW low wind			
Temperature	12°C			
Wind Speed/Direction	0.5m/s, occasional gusts up to 1m/s			
Distance to Source	0.5m	0.5m	1.5m	2.5m to closest source, 9m to closest reactor
Plant Operational?	Yes			
Intensity (***VDI 3882, Part 14***)	1 - 2	3	0 - 1	0
Duration	Constant – no aeration	Constant with aeration occurring	Constant	Constant
Notes and Odour Characteristics	None	Sweet sewage smell	Just detectable. Tank has lid.	No detectable odour

Intensity Ref: German Standard VDI 3882, Part 14

0 No odour, **1** Very faint odour, **2** Faint odour, **3** Distinct odour, **4** Strong odour, **5** Very strong odour,

6 Extremely strong odour

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Odour Report Form

Odour Report Form	**Date:** 12.01.2021	**Project**: Petersfield WRC		
Test Location	**5. At ground level approximately 7.5m from reactors**	**1. 1.5m above reactor**	**2. 1.5m above reactor**	**5. At ground level approximately 7.5m from reactors**
Commencement Time Hrs)	1335	1340	1345	1350
Weather Conditions	Sunny with SW low wind			
Temperature	12°C			
Wind Speed/Direction	0.5m/s, occasional gusts up to 1m/s			
Distance to Source	7.5m	1.5m	1.5m	7.5m
Plant Operational?	Yes			
Intensity (***VDI 3882, Part 14***)	0	2	2	3 - 4
Duration	Constant	Constant	Constant not aerating	Constant
Notes and Odour Characteristics	No odour detectable	Very faint odour detectable – not offensive	Not offensive	None detectable

Intensity Ref: German Standard VDI 3882, Part 14

0 No odour, **1** Very faint odour, **2** Faint odour, **3** Distinct odour, **4** Strong odour, **5** Very strong odour,

6 Extremely strong odour

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Odour Report Form	**Date:** 12.01.2021	**Project**: Petersfield WRC		
Test Location	**2. Immediately adjacent Reactor**			
Time	1325			
Weather Conditions	Sunny with SW low wind			
Temperature	12°C			
Wind Speed/Direction	0.5m/s, occasional gusts up to 1m/s			
Distance to Source	0.5m			
Plant Operational?	Yes			
Intensity (***VDI 3882, Part 14***)	2 - 3			
Duration	Constant – no aeration			
Notes and Odour Characteristics	Distinct sewage smell			

Intensity Ref: German Standard VDI 3882, Part 14

0 No odour, **1** Very faint odour, **2** Faint odour, **3** Distinct odour, **4** Strong odour, **5** Very strong odour,

6 Extremely strong odour