



INDEPENDENT REVIEW OF SHADOW HRA AND RELEVANT APPENDICES

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1. INTRODUCTION

The November 2018 ruling by the Court of Justice of the European Union (CJEU), referred to as the Dutch Nitrogen Case or Dutch Case, ruled that increased atmospheric nitrogen deposition to Dutch European sites resulting from new plans and projects may pose a risk to “site integrity”, due to the link between nutrient enrichment and eutrophication. Natural England now considers that the CJEU judgement applies to increased nutrient loading to European sites in England and therefore, Competent Authorities need to consider the risk of likely significant effects that could arise from plans or projects that increase nutrient inputs to European sites. Without mitigation measures in place, new developments that increase nutrient loading to a European site will no longer be compliant with the Conservation of Habitats and Species Regulations 2017 (as amended), referred to as Habitats Regulations. Therefore, there is now demand for nutrient mitigation schemes to offset the impacts of new residential developments within the relevant catchment areas.

Natural England’s legal advice on Nutrient Neutrality made clear that nutrient loading impact pathways would need to be screened into a Habitats Regulations Assessment (HRA) for new developments that could increase nutrient discharge to European sites. Each new development that increases the number of overnight stays and thus increases the production of wastewater and associated nutrient loading, by *any amount* to European sites already in unfavourable condition due to nutrient loading, may not be legally consented.

In addition, following the People Over Wind ruling of the CJEU, mitigation measures cannot be incorporated at the screening stage of an HRA (Stage 1) and so, if likely significant effects on European sites are identified at screening due to increases in nutrient loads from new developments, the plan or project will need to progress to Stage 2 Appropriate Assessment (AA). An AA can incorporate mitigation measures into its assessment of adverse effects on site integrity. To assess whether a housing development requires the implementation of mitigation measures to prevent adverse effects from nutrient loading, Natural England requires developers/ Local Planning Authorities (LPAs) to produce a nutrient budget for the development. If the nutrient budget shows that the development will result in an increase in nutrients coming from the development compared with the current land use, mitigation will be required to ensure the development is “nutrient neutral”.

In August 2021, the applicant submitted a planning application for a residential development of 210 dwellings at Long Copse Lane, Emsworth, Havant (Planning Application Reference: APP/21/00893). The site falls within the Chichester Harbour fluvial catchment and without mitigation is likely to have an adverse effect on the site integrity of the Chichester and Langstone Harbours Special Protection Area (SPA) and other European sites. The site is largely in unfavourable condition, in part due to excess nitrogen levels. Thus, in accordance with the Dutch Nitrogen case, Havant Borough Council as the Competent Authority has a need to a) ascertain if the development will result in adverse effects on site integrity due to causing a net increase in nutrient loading to the site; and b) secure mitigation to offset any net increase in nutrient loading to the site, in order to demonstrate nutrient neutrality and prevent adverse effects on site integrity.

In support of the planning application, and on behalf of the applicant, Pegasus Group has produced the main Shadow HRA (sHRA) report. Ricardo Energy & Environment (Ricardo) was commissioned by Havant Borough Council to undertake an independent review of the sHRA and relevant appendices, to ensure that they are compliant with the Habitat Regulations (2017 as amended). The list of documents to be reviewed is as follows:

- The original sHRA completed by Pegasus dated March 2022;
- Updated sHRA and associated appendices completed by Pegasus dated September 2023
- sHRA – Response note to Independent Review by Pegasus dated March 2023; and
- sHRA – Additional Hydrogeological Assessment and Site Investigation information by H2Ogeo dated August 2023.

These will be considered to ensure that the documentation has been prepared in accordance with the HRA requirements and Natural England guidelines.

2. REVIEW OF DOCUMENTATION

2.1 THE ORIGINAL SHADOW HRA

2.1.1 Summary of document

The original sHRA (March 2022) was reviewed independently from the Response Note (March 2023). The overall completion and compliance of the sHRA will be determined by assessing how the Response Note (March 2023) has addressed issues outlined in the assessment below.

2.1.1.1 Stage 1: Screening Assessment

The sHRA (March 2022) assessed the potential effects of the proposed residential development at Land north of Long Copse Lane, Emsworth (Planning Application Reference: APP/21/00893), known hereafter, as the 'proposed development'. The proposed development is comprised of 210 dwellings and associated works include but are not limited to: road and pedestrian access, landscaping and supporting infrastructure.

The Stage 1 Screening Assessment was conducted on European sites within 10 km of the proposed development. Five European sites were identified in the Stage 1 Screening Assessment: Chichester and Langstone Harbour SPA and Ramsar site, Solent Maritime SAC, Kingley Vale SAC and Solent & Isle of Wight Lagoons SAC. In addition to the five sites listed above, Singleton Cocking Tunnels SAC was included in the screening assessment as per the advice in consultation with Natural England and Hampshire County Council¹. Conservation Objectives have been included for Chichester and Langstone Harbour SPA (not included for the Ramsar site), Solent Maritime SAC, Kingley Vale SAC, Solent & Isle of Wight Lagoons SAC and Singleton Cocking Tunnels SAC. Qualifying features for each site were not included in the assessment.

Likely significant effects were identified due to potential changes in water quality within the Chichester and Langstone Harbours SPA and Ramsar site. All other European sites were screened out regarding water quality.

2.1.1.2 Stage 2: Appropriate Assessment

The sHRA (March 2022) Stage 1 Screening Assessment identified the potential for likely significant effects due to changes in water quality within the Chichester and Langstone Harbours SPA and Ramsar site. Therefore, the proposed development progressed to Stage 2 Appropriate Assessment (AA). Specifically, surface and ground water pollution through construction and operation of the proposed development had the potential to cause an adverse effect on the Chichester and Langstone Harbours SPA and Ramsar site. It was proposed that the wastewater for the proposed development would be treated at Thornham Wastewater Treatment Works (WwTW) and discharged to Chichester Harbour.

The mitigation strategies discussed in the original sHRA (March 2022) relating to surface water quality included a surface water strategy, Sustainable Drainage System (SuDS) using petrol and oil interceptors and enhancements to basins in combination with an off-site mitigation solution. Open space forms part of the proposed design and layout of the site to include SuDS on the proposed development site². It is anticipated that by using oil and petrol interceptors along with the SuDS, excess sediment and other pollutants can be mitigated.

To off-set for nutrient input into the Solent catchment an off-site mitigation strategy has been proposed. This comprises conversion of arable (cereal crop) into 8 ha of woodland. It was stated that the off-site mitigation land is located in the same catchment as the Chichester and Langstone Harbours SPA and Ramsar site. The mitigation is estimated to result in a net reduction in nitrogen to the European sites as shown in Appendix 4 of the sHRA (March 2022).

Using the mitigation measures mentioned above, the sHRA concluded that there will be no adverse effects to the site integrity of the Chichester and Langstone Harbours SPA and Ramsar site alone or in combination.

¹ WSP, (January 2022) Lighting Technical Note to Supplement the Submitted Lighting Strategy (Appendix 6 of Original sHRA) & Pegasus Group (March 2022) Shadow Habitat Regulations Assessment. *Section 1.10 -1.11 and Section 5.2*

² It is anticipated that the mitigation required to offset nutrient input will be the offsite mitigation at Stansted Estate as it provides sufficient reduction of nutrients. As such, on-site mitigation has not been considered in regard to nutrient neutrality.

2.1.2 Has the documentation followed the correct HRA process?

The following recommendations were made during the initial review, INDEPENDENT REVIEW OF SHADOW HRA AND RELEVANT APPENDICES, carried out by Ricardo in February 2023.

2.1.2.1 Stage 1: Screening Assessment

It was recommended that the sHRA is updated to include a Stage 1 Screening summary table as it was unclear how the impact of water quality on European sites had been screened in or out (*para 6.3*). Specifically, clarification was recommended for the Solent Maritime SAC and the Solent & Isle of Wight Lagoons SAC as groundwater pollution, changes in abiotic conditions and changes in biotic conditions are listed as pressures for the sites in *Table 3.3 (page 22-23)*. A short reasoning as to why sites were screened in or out would be beneficial to ensure a robust assessment was undertaken. In addition to this, the qualifying features (habitats and species for which the site is designated) of the European sites were not included or independently assessed. As per Section D.2 *European site 'qualifying features'* of the DTA Handbook³, potential impact pathways to each qualifying feature must be assessed during the Stage 1 Screening Assessment and screened out as appropriate.

It was noted that the Stage 1 Screening Assessment of Chichester and Langstone Harbour SPA (UK0017073) and the Chichester and Langstone Ramsar Site (UK11013) were combined. It was recommended that these European sites were assessed separately, as the qualifying features and Conservation Objectives for the SPA and Ramsar Site are not the same and the potential impact pathway for changes in water quality must be assessed for each qualifying feature of each European site. In addition to this, the Solent and Dorset Coast SPA (Marine Components GB; UK9020330) was not included in the screening assessment. As the site falls within the 10 km search radius, it was recommended that the Solent and Dorset Coast SPA should be included in the Stage 1 Screening Assessment. In addition, a georeferenced map showing the locations of the European sites in relation to the proposed development was recommended to provide visual evidence of the European sites included in the screening.

2.1.2.2 Stage 2: Appropriate Assessment

The Stage 2 AA required more detail using scientific evidence to inform the conclusion that there will be no adverse effect on the site integrity of European sites. Mitigation measures identified at Stage 2 AA must go through an integrity test where there are “complete, precise and definitive findings”, as outlined in the DTA Handbook Section D.7¹. At the time of assessment, there was not sufficient information to inform the Competent Authority about the quantity and rate (net increase) of nitrogen loading into the catchment from the proposed development. Our report recommended that the estimated efficiency of each mitigation measure proposed should be stated, by quantifying how much excess nitrogen produced by the proposed development would be processed by each mitigation strategy. In addition, the duration of implementation and how success will be measured for each mitigation measure was requested. This will reduce uncertainty regarding the efficacy of the mitigation strategy proposed in preventing the net gain increase in nitrogen loading and avoidance of adverse effects on site integrity.

Information about the locations of the off-site mitigation and the WwTW was requested. This can be shown with a georeferenced map confirming that the off-site mitigation land and the proposed development land are within the same catchment. If the off-site mitigation and proposed development land is not within the same catchment, then Natural England must be consulted to gain their consent as per Natural England's ‘*Advice on Achieving Nutrient Neutrality for New Development in the Solent Region for Local Planning Authorities*’ (2020).

2.1.3 Conclusion

The Stage 1 Screening Assessment of the original sHRA (March 2022) was missing the qualifying features for each of the European sites. These qualifying features were requested for the assessment as they relate to the Conservation Objectives. These include species and habitats for designated sites and can be found in the respective citations for each site. In addition to this, a summary table of the sites and the impact pathways leading to likely significant effect should be included. A short description as to why a site has been screened in or out is recommended.

³ Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook. DTA Publications Limited, Wokingham, Berkshire.

The Stage 2 AA of the sHRA did not follow the correct HRA process and was missing key details to confidently inform the Competent Authority. More information regarding water quality mitigation and nutrient neutrality mitigation strategies was requested to demonstrate compliance with the Habitat Regulations.

The following section, **Section 2.2**, will provide an overview of how the Response Note (March 2023) will address the issues raised by the initial Independent Review (Ricardo, February 2023) of the original sHRA (Match 2022).

2.2 SHADOW HRA – RESPONSE NOTE TO INDEPENDENT REVIEW AND UPDATED SHADOW HRA

2.2.1 Summary of document

The sHRA Response Note (March 2023) and updated Shadow HRA (September 2023) by the Pegasus Group provides additional information relating to comments made in the original Independent Review conducted by Ricardo dated 15th February 2023. For the purpose of the review, the information provided in the response note will be considered in combination with the Original sHRA reviewed above. The additional information requested in the original sHRA independent review (February 2023) included:

- Qualifying features of designated sites.
- Summary table of screening and screening decisions.
- Site location map.
- Evidence of Natural England Consultation regarding off-site mitigation location.
- More detailed information for the Stage 2 Appropriate Assessment.
- Woodland Planting Scheme.
- S106 amendment: Land secured for a minimum of 80 years to be compliant.
- Site investigations (Considered in **Section 2.4** of this report).

2.2.2 Has the documentation followed the correct HRA process?

With the addition of the information provided in **Table 1** below, Ricardo finds that the documentation used to update the Original sHRA has followed the correct HRA process. Mitigation has been proposed to address uncertainty related to lag times in nutrient uptake. This mitigation includes decommissioning of agricultural land as early as reasonably possible (noting that the management and monitoring plan recommends at least one year in advance of first occupation) to compensate for any lags in nutrient uptake due to the underlying hydrogeology. Whilst the woodland itself is not related to nutrient neutrality, it is required to ensure that nutrient mitigation is secured in perpetuity. To ensure compliance with this recommendation, paragraph 7.1 of the Monitoring and Management Plan recommends that the woodland planting scheme is to be provided one year ahead of first occupation. The mitigation will be achieved through the decommissioning of 14.5ha of agricultural land. The woodland is being secured through a S106 agreement (Appendix 3 and 8, Pegasus September 2023).

Table 1: Summary of additional information supplied by the Pegasus Group. **Green**: sufficient information provided; **Amber**: information has been provided but additional information is required; **Red**: information has not been provided.

Report Section	Additional Information Required	Has sufficient information been provided?
sHRA Stage 1: Screening	Designated site Qualifying features	Yes – Provided in Table 1 of Response Note (Pegasus Group, March 2023) and during the screening found in the Updated sHRA (September 2023).
	Screening Summary Table	
	Screening decision making process	
	Map showing designated sites in relation to the Proposed Development	Yes – Provided in Appendix 1 of Response Note (Pegasus Group March 2023).

Report Section	Additional Information Required	Has sufficient information been provided?
Stage 2: Appropriate Assessment	Integrity Test	Yes – Information provided separately in updated Nutrient Balancing assessment (Tetra Tech, 2023).
S106	Woodland Planting Scheme	Yes – Upon consultation with Havant Borough Council the design of the woodland will be confirmed at a later phase in the scheme. The design of the woodland is not needed in the context of the nutrient mitigation assessment, as the rationale for the mitigation comes from taking the agricultural fields out of production. This decommissioning will result in the scheme being nutrient neutral. The woodland is needed to secure permanent land use change at the mitigation site. The current Monitoring and Management Scheme (Appendix 8 sHRA, September 2023) complies with the Natural England Consultation dated 09 June 2022 (Appendix 9 updated sHRA, September 2023).
	Land secured in perpetuity of at least 80 years	Yes – The applicant has amended the S106 agreement to secure the woodland for a minimum of 80 years. Specifically, the applicant has determined the in-perpetuity period will be 125 years or as otherwise agreed, noting the minimum of 80 years (Appendix 3 and 8 Updated sHRA September 2023).
Nutrient Balancing Assessment	Discretionary Advice Service (DAS)	Yes – Provided in Appendices 3-5 (Tetra Tech 2023).
Hydrogeological Assessment	Site investigation results	Yes – although some uncertainty surrounding lag time remains (H2OGeo, 2023). Section 2.4 of this report provides further detail on this matter to determine no adverse effects as part of the Appropriate Assessment. It is recommended that monitoring continues at existing boreholes between October and April for one year initially with the aim of capturing seasonal variation of nutrient concentrations in groundwater.

2.2.3 Conclusion

Ricardo concludes the additional information that has been supplied by the Pegasus Group is sufficient and that the documentation is now compliant with the Habitat Regulations (2017 as amended). The Stage 1

Screening provides the necessary information to robustly assess the Likely Significant Effects regarding water quality of the proposed development on Habitat Network Sites with hydrological connectivity.

The woodland planting scheme is not required to complete the Stage 2 Appropriate Assessment, as such, this aspect of the sHRA is compliant with the Habitat Regulations (2017) as amended. The Monitoring and Management Plan (Appendix 8 updated sHRA, September 2023) has been provided and satisfies the Natural England consultation requirements (Appendix 9 updated sHRA, September 2023) as highlighted in **Table 1**.

The site investigation results have increased the certainty of lag times, however reasonable scientific doubt remains, and Ricardo is unable to confirm that there will be no adverse effects to designated sites, as such this element is not compliant with the Habitat Regulations. This follows the precautionary principles as there is still uncertainty regarding lag times and drainage based on the site investigation results presented in **Section 2.4**.

In summary, the following information is required to determine no adverse effects in the Appropriate Assessment:

Following a precautionary approach, continual in-situ monitoring is to be conducted to inform the lag time mitigation and determine the seasonal variations in nutrient concentrations in groundwater. The monitoring should be carried out with a minimum of monthly visits between October and April for at least one year to capture the higher water levels and nutrient concentrations during the wetter months (See **Section 2.4**).

2.3 SHADOW HRA – UPDATED APPENDIX 4, NUTRIENT BALANCING ASSESSMENT

2.3.1 Summary of document

2.3.1.1 Proposed Development

The Nutrient Balancing Assessment⁴ was prepared by Tetra Tech to determine the changes in nitrogen outputs from existing to future land uses associated with the proposed development. The assessment was conducted using the following development design parameters:

- 210 residential dwellings;
- 8.16 ha urban land use;
- 0.145 ha open urban land;
- 5.615 ha greenspace;
- 0.55 ha retained woodland; and
- 0.10 ha of community food growing.

As the planning application is an outline application, only avoidance and mitigation packages of the nutrient budget has been submitted at this stage. The applicant will be required to submit a revised nutrient budget at the reserved matters stage of the planning process. This revised nutrient budget and mitigation plan will need to be secured through a legal agreement.

It is noted that a separate calculator has been supplied including planted woodland for Bechstein's Bat *Myotis bechsteinii* mitigation. This information has not been reviewed in this assessment as it cannot be used for the purpose of nutrient neutrality mitigation. The following sections only include the calculations and mitigation information provided for the conversion of cereal crops to woodland for nutrient neutrality mitigation.

The report concluded that there is no significant temporal lag from the mitigation site to the Chichester and Langstone Harbours. Ricardo does not agree with this statement as there is some remaining uncertainty around the overall hydrogeological regime across the wider area as set out in Table 1 and **Section 2.2.3** above. This is discussed further in Section 2.4. It should also be noted that the report references that there were 21 monitoring locations used in the site investigations. There were 18 monitoring locations as shown in **Section 2.4**.

⁴ Updated Appendix 4 - Nutrient Balancing Assessment by Tetra Tech dated September 2023

2.3.1.2 Nutrient Budget Calculator

The assumptions used to conduct the nutrient balancing assessment can be found in **Table 2**.

Table 2 Summary of nutrient budget calculator assumptions

Number of proposed units	210 residential dwellings
Average occupancy rate:	2.40 (2.23 was calculated using Havant Borough Council occupancy rates calculator although using the precautionary principle, the higher value was used for the assessment).
The total site area	14.57 ha
Current land use:	12.94 ha lowland grazing; 0.72 ha greenspace; 0.55 ha woodland; and 0.36 ha residential urban.
Future land use:	8.16 ha urban residential; 0.145 ha open urban; 5.615 ha greenspace; 0.55 ha woodland; and 0.1 ha community food growing.
Wastewater Treatment Works (WwTW)	Thornham WwTW with a consent limit of 8 mg/l. 8 mg/l was used in place of 10 mg/l as it assumed that deductible loading applies to the proposed development.
Surface Water Catchment	Arun and Western Streams
Standard annual average rain fall	750.1 – 800 mm
Soilscape category:	Impeded Drainage (Slowly permeable, seasonally wet slightly acidic but base rich loamy and clayey soils)
Nitrate Vulnerable Zone	Yes

The calculator used to determine the nutrient concentrations was the Solent Nutrient Budget Calculator. The results from the calculator showed that the total load from the development wastewater was 159.05 kg/TN/yr, the current land use load was 77.72 kg/TN/yr, the future land use load was 139.15 kg/TN/yr. The net change resulting from the proposed development was 220.48 kg/TN/yr. After applying the 20 % precautionary buffer as per the Nutrient Budget Calculator Guidelines⁵, the total load was **264.58 kg/TN/yr**. As the results of the Nutrient Budget Calculator indicated an increase in TN to the Solent Catchment Area, a mitigation strategy was required. The document states that there is hydrological connectivity from Thornham WwTW and the Chichester and Langstone harbours SPA via the Chichester Harbour Fluvial Catchment.

2.3.1.3 Mitigation Strategy

The mitigation strategy outlined in the Nutrient Balancing Assessment⁶ consists of off-site mitigation. The off-site mitigation is located to the north of the proposed development site at Stansted Park and is owned by the Stansted Estate. Nutrient neutrality will be achieved through the conversion of cereal crops to woodland to achieve a net decrease in TN to the catchment. The mitigation land is located on the Stansted Estate and will comprise 8.0 ha. The conversion of cereal crops to woodland would result in a net decrease in TN, as the total capacity of the mitigation land was 281.59 kg/TN/yr. The woodland is to be secured in perpetuity through planning obligation Section 106 agreement. Information on woodland management and monitoring is required as per Natural England Guidelines and to complete the Appropriate Assessment.

⁵ Ricardo and Natural England (2022) Havant Nutrient Budget Calculator Guidance from <https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/our-role-in-planning-and-development/principles-of-nutrient-neutrality-in-relation-to-development-or-water-discharge-permit-proposals/?lang=en>

⁶ Updated Appendix 4 - Nutrient Balancing Assessment by Tetra Tech dated September 2023

2.3.2 Has the documentation followed the correct HRA process?

The mitigation proposed in the Nutrient Balancing Assessment is feasible and follows Natural England Nutrient Neutrality Guidelines. Ricardo finds the assumptions listed in **Table 2** above, agreeable as evidence has been provided to validate the claims. The results from the Nutrient Budget Calculator have been validated by Ricardo and the nitrogen load resulting from the proposed development (264.58 kg/TN/yr) is accurate.

There is a requirement for the consent of off-site mitigation land to be outside the WwTW catchment by Natural England and the Local Planning Authority (Havant Borough Council)⁷. Catchment data included in the document (Appendix E) shows that some of the mitigation land sits outside of the Arun and Western Streams catchment. This has taken place via Natural England's Discretionary Advice Service (DAS) as described in **Table 1**⁸. The DAS provides confirmation of Natural England's acceptance of the off-site mitigation land location and sufficient water exchange between the neighbouring catchments. Evidence is provided regarding the water source for the proposed development relative to the deductible loading. As the required documents have been provided, the documentation has complied with Natural England Guidelines.

2.3.3 Conclusion

Information confirming the source of water for proposed development has been provided as within the Walderton supply zone⁹ which is entirely within the Solent catchment. The off-site mitigation land location has been agreed by Natural England via the DAS process.

Based on the information provided, the mitigation strategy is acceptable to mitigate the total of 264.58 kg/TN/yr that would otherwise cause adverse effects to the Chichester and Langstone harbours SPA and Chichester and Langstone Harbours Ramsar site. With the appropriate mechanism to secure the off-site mitigation land (updated Section 106 agreement¹⁰), the permanent conversion of cereal crops to woodland via planting at Stansted Park will lead to no adverse effects on the aforementioned European sites as the Nutrient Budget Calculator showed a total of 281.59.54 kg/TN/yr resulting in a net negative nitrogen load to the Solent Catchment.

2.4 SHADOW HRA – ADDITIONAL HYDROGEOLOGICAL ASSESSMENT AND SITE INVESTIGATION INFORMATION

2.4.1 Summary of document

The Hydrogeological Appraisal¹¹ indicates that the proposed mitigation land is situated on Chalk Formation, with some areas situated on the Lambeth Group.

A detailed assessment regarding the validity of the assumptions can be found in Ricardo's *Independent Review of Nutrient Mitigation Proposed at Stansted Park* (2023).

The land use change resulting from the woodland planting will result in a reduction of nitrates entering the surface water runoff and groundwater. The reduction would be seen within one year (as per the document's assumptions listed in the Hydrogeological Appraisal document⁹).

2.4.1.1 Site Investigations

Additional site investigations and laboratory testing have been completed by the applicant to address a number of concerns and uncertainties raised in Ricardo's independent review report¹². The site investigation works included laboratory testing of soil samples to determine moisture content, bulk density, Fraction of Organic Carbon (FOC), and solute concentrations for Total Nitrogen and Total Phosphorous. In addition to this, ground water boreholes were logged to determine the properties of the Chalk on the site. Falling head

⁷ ⁷ Natural England (2020) Advice on achieving nutrient neutrality for new development in the Solent region. V5 June 2020 Accessed at <https://cdn.havant.gov.uk/public/documents/Solent%20Nutrients%20V5%20June2020.pdf>

⁸ Originally provided in Appendices 2-5 of the Response Note (March 2023)

⁹ The Walderton Supply Zone sits entirely within the Solent catchment, as shown in Natural England Technical Information Note TIN211 (<http://publications.naturalengland.org.uk/publication/6522945605468160>)

¹⁰ The applicant has not provided an updated S106 agreement but has proposed to make the recommended amendments.

¹¹ H2OGeo (2023). Report on Field Investigations at Stansted Park, Rowlands Castle, Hampshire, PO9 6DX for a Nutrient Neutrality Feasibility Assessment. Ref. ID 20230403P1. August 2023

¹² Ricardo (2023). Independent Review of Nutrient Mitigation Proposed at Stansted Park. Report for Havant Borough Council. Ref. ID NNCP008; ED16771106. February 2023.

tests were taken from 1.0 – 21.0m depths to determine the vertical permeability, with ground water sampling and analysis to understand ground water solute concentrations. Three rounds of sampling were conducted over a three-month period. Groundwater elevation data was collected on an hourly basis for elevation monitoring.

The works carried out on site include:

The sinking of 11 shallow depth exploratory boreholes (WS01-11), 6 hand-dug pits and 1 rotary borehole (BH1). This was carried out to delineate the local stratigraphic sequence and the lateral extent of the superficial strata in order to address the uncertainties with the geological conceptual site model. The boreholes showed that the area is underlain by a thin layer of superficial deposits up to about 1.5m thick overlying Chalk strata.

The installation of 1 groundwater monitoring borehole (BH1) to 28.5m below ground level (bgl) to provide information on local groundwater levels. This was intended to address the uncertainties of the hydrogeological model. to confirm if the scheme was in line with the Natural England guidance for the Solent Region¹³. The monitoring showed that depth to groundwater is generally between about 15m and 20m below the existing ground level (bgl).

Hydraulic (falling head) testing in the exploratory holes to address uncertainties around potential travel time within the Source Protection Zone (SPZ). The results of the testing have shown permeabilities to be generally in the range of 10^{-4} to 10^{-6} m/s.

2.4.2 Has the documentation followed the correct HRA process?

The scientific validity review undertaken by Ricardo in February 2023¹⁴ raised a number of potential issues and concerns with the original hydrogeological appraisal of the site. These concerns largely revolved around the limited amount of site-specific baseline data relating to local stratigraphy, groundwater regime and water level needed to assess the validity of the proposed scheme. Similar concerns were also raised by Natural England in their letter to HBC dated 06/12/2021 included in the sHRA package¹⁵ and in Appendix 9 of the Updated sHRA, where it was recommended that these issues should be addressed as part of the Appropriate Assessment.

The follow-up site investigation and monitoring works carried out by the applicant between May and June 2023 sought to address these outstanding issues. These included:

Geological and hydrogeological conceptual model: the additional ground investigations carried out by the applicant has further delineated the ground conditions at the site, especially with respect to the stratigraphic sequence and depth to groundwater. The investigation has shown that superficial deposits are of limited thickness and mostly present towards the south-east of the site, while most of the site is directly underlain by the putty, highly weathered upper Chalk strata. Groundwater appears to be relatively deep between about 15m to 20m bgl, resulting in a thick unsaturated zone underneath the site. It is also noted however, that the investigation has encountered some fissures in the more competent Chalk below about 10m bgl which may provide faster pathways for percolating water. Ricardo notes however that groundwater monitoring data was collected only in one location (BH1) and as such there is some remaining uncertainty around the overall hydrogeological regime across the wider area.

Unsaturated zone travel time: the applicant has provided a set of calculations of hydraulic conductivity values at various depths as well as travel time estimates through the unsaturated zone. It can be observed that permeabilities in the upper, weathered Chalk strata are much lower compared to deeper, more competent bedrock. The weathered chalk does not usually display dual porosity

¹³ Natural England (2020) Advice on achieving nutrient neutrality for new development in the Solent region. V5 June 2020 Accessed at <https://cdn.havant.gov.uk/public/documents/Solent%20Nutrients%20V5%20June2020.pdf> on the 20/01/2023

¹⁴ Ricardo (2023). Independent Review of Nutrient Mitigation Proposed at Stansted Park. Report for Havant Borough Council. Ref. ID NNCP008; ED16771106. February 2023.

¹⁵ Natural England (2021). Planning consultation: Outline planning application for demolition of the existing buildings and the erection of a new residential scheme (C3 use of approximately 210 dwellings to include affordable housing) and associated landscaping, access and supporting infrastructure, all other matters reserved. 06/12/2021. Ref ID APP/21/00893 / 367544. Included as Appendix 9 of the updated Shadow HRA, September 2023.

typical of fissured chalk aquifers¹⁶, and its behaviour can be generally assumed to be closer to a silt or clay matrix.

The travel time calculations provided utilise an effective porosity range between 0.001% and 0.39%¹⁷ to determine the potential travel time. We note that the higher porosity value of 0.39% is related to the chalk matrix rather than bulk aquifer and is indicative of a prevalence of intergranular flow rather than fracture flow. Given the site investigation has identified a thick layer of weathered chalk with limited fissuring, this higher porosity value is likely to be more representative of typical site conditions within the upper few metres. It should be noted however that unsaturated zone (UZ) hydraulics are somewhat complex and are influenced by additional factors such as pore-water suction which can result at times in significant lag-time.

Previous research¹⁸ on chalk UZ hydraulics has shown that while unconfined chalk aquifers may exhibit a fast response to rainfall – as observed in the groundwater monitoring data included in the Hydrogeological Appraisal report¹⁹ – transport of solutes such as nitrate through the UZ can be a much slower process due to the other factors involved. Mathias *et al.* (2006) suggests an average solute transport speed of 0.8m per year. Given the above we find that while the applicant has significantly improved the overall understanding of local hydrogeological conditions, there are some residual uncertainties. These remaining issues relate to the complexities of transport time through the thick UZ and whether a solute could likely travel between ground level and the water table in less than a year.

Groundwater monitoring: groundwater level and groundwater quality monitoring has been carried out in a single well (BH1) at the offset site between May and July 2023. Given the complexities of UZ hydraulics and the remaining uncertainties on the lag time through the UZ, we note the current amount of groundwater monitoring is not sufficient to fully delineate the local hydrogeological regime. In particular, there is currently no monitoring data covering the winter period when both groundwater levels and nutrient concentrations are likely to be at the highest. Therefore, further data would be required to be able to delineate the baseline water quality and discern the proportion of nutrient lost to the aquifer.

Alignment with Natural England guidance: Ricardo's review in February 2023 highlighted non-compliance with Natural England's guidance²⁰ for the Solent Region regarding the catchment locations and requiring the water table to be no more than 5m from ground level. We understand however that the Applicant has confirmed they have engaged in extensive discussion with Natural England and that the scheme has been approved by them.

2.4.3 Conclusion

Ricardo has reviewed the updated H2OGeo Hydrogeological Assessment report (2023) which includes additional site investigation works and follow-up monitoring in response to the issues and uncertainties raised in our original independent review. The follow-up investigation and monitoring addresses most of the outstanding issues in the wider ground model and improves the overall scientific validity of the proposed mitigation scheme.

Some residual uncertainties remain on the estimated solute transport time across the UZ beneath the site and associated potential lag time. Furthermore, the limited amount of available groundwater monitoring means that it is not possible to discern what proportion of nutrient might be lost to the aquifer as opposed to rapid transport via surface water. Using a precautionary approach, it is recommended that the applicant continues preliminary monitoring at the off-site mitigation location. This should minimally include monthly site monitoring between October and April for one year to collect groundwater levels (dips/logger) and samples to allow the delineation of both the hydrogeological regime and water quality. This is considered critical to capture seasonal fluctuations in groundwater level and variations in nutrient concentrations, as both these factors affect lag time

¹⁶ Price, M. (1987). Fluid flow in the Chalk of England. Geological Society, London, Special Publications, Volume 34

¹⁷ Worthington, S., Foley, A. and Soley, R. (2019). Transient Characteristics of effective porosity and specific yield in bedrock aquifers. *Journal of Hydrology* 578

¹⁸ Mathias, S. A., Butler, A. P., Jackson, B. M., Weather, H. S. (2006). Transient simulations of flow and transport in the Chalk unsaturated zone. *Journal of Hydrology*, 330

¹⁹ H2OGeo (2023). Report on Field Investigations at Stansted Park, Rowlands Castle, Hampshire, PO9 6DX for a Nutrient Neutrality Feasibility Assessment. Ref. ID 20230403P1. August 2023

²⁰ Natural England (2020) Advice on achieving nutrient neutrality for new development in the Solent region. V5 June 2020 Accessed at <https://cdn.havant.gov.uk/public/documents/Solent%20Nutrients%20V5%20June2020.pdf> on the 20/01/2023

and nutrient transport dynamics. The monitoring rounds should also be carried out during periods of high groundwater levels/flow, i.e., following rainfall, to best capture variation of nutrient concentrations associated with percolating water. The additional monitoring is essential to confirm the assumptions in the report and to increase the certainty to comply with the Habitat Regulations (2017 as amended).

3. CONCLUSIONS

Is the documentation in line with the HRA principles?

Ricardo finds that most of the documents submitted amending the sHRA are now in line with HRA Principles. The Stage 1 Screening assessment (March 2023) has an appropriate amount of detail regarding qualifying features and water quality.

However, Ricardo concludes that there is not sufficient detail in the provided documentation to determine no adverse effects through the Stage 2 Appropriate Assessment and Integrity Test, specifically regarding groundwater site investigations.

The hydrogeology report has addressed most of the outstanding issues identified in the wider ground model and have improved the overall scientific validity of the environmental assessment. However, uncertainty surrounding lag time remains. As such, it is unclear when the agricultural land should be decommissioned to mitigate for lag times. Ricardo recommends additional monitoring measures using existing monitoring borehole to address the residual uncertainty with the nutrient uptake lag time.

Is all of the documentation required (re. WQ) provided?

Ricardo finds that all sHRA documentation regarding water quality, as summarized in **Table 1** of this report, has been provided in order to confidently inform the competent authority with the exception of the uncertainty regarding lag times. Conducting monitoring at existing boreholes during autumn-winter months (Oct-April) for a minimum of one year with monthly sampling is recommended to identify seasonal variations of groundwater levels and nutrient concentrations in groundwater. This will enable the capture of seasonal fluctuations in groundwater level and variations in nutrient concentrations to determine factors affecting lag time and nutrient transport dynamics.

This will be needed in order to determine if there is no adverse effects under Stage 2 of the Appropriate Assessment and Integrity Test. The new borehole data collected will need to be assessed to ensure confidence in no adverse effects.

Does further work need to be done in any area: provision or more documents, further modelling, etc?

Ricardo recommends additional mitigation measures using precautionary principles to address the uncertainty with the nutrient uptake lag time. This mitigation includes decommissioning of agricultural land at the mitigation area off-site with woodland planting to ensure permanent land use change to which the applicant has agreed.

Continued monitoring of the existing monitoring borehole is recommended in order to address residual uncertainty found in the updated Hydrogeological Appraisal report and outlined in the sections above. Continual monitoring using the existing monitoring well should continue to be carried out to delineate any changes in nutrient concentrations in the aquifer and confirm the assumptions in the report. This monitoring will also highlight any seasonal variations in groundwater levels and be used to inform the Appropriate Assessment.



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