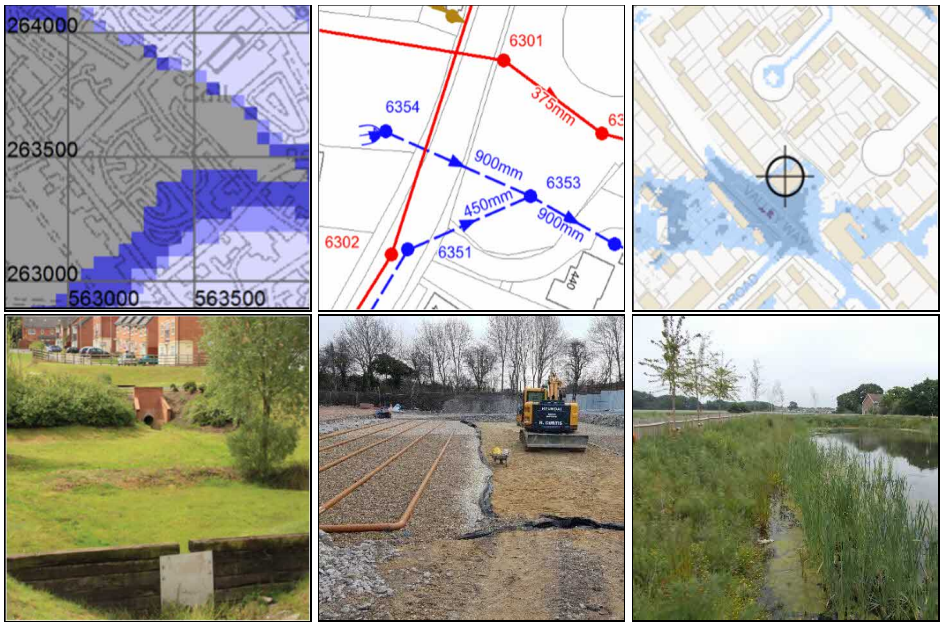


Nitrogen Nutrient Assessment

Land at Berrywood Lane, Bradley, Hants

Reference:	20048	
Issue:	**Date:**	
1	11/5/2020	
2	21/4/2021	*Updated for revised offset land use*
3	12/10/2021	*Reversion to original wildflower meadow mitigation*

Table of Contents

Appendices

1. Introduction

1.1 Instructions were received from the Darrell Alder to undertake an assessment of the nitrogen nutrient impact for the proposed development of a residential dwelling on land at Berrywood Lane, Bradley, Basingstoke, Hants.

1.2 This assessment has been undertaken by A P Traves BSc CEng MIStructE MCIH

2. Development Description & Location

2.1 The site comprises 0.2 Ha grazing paddock at Berrywood Lane, Bradley, Basingstoke, Hants and a further 0.6 Ha of grazing paddock to the west which it is proposed to change to low nitrogen wildflower meadow/ improved grassland described in section 5 of the John Wenman Phase 1 Habitat Survey. The site extents are indicated on Foxley Tagg Planning drawing FTP.001.A contained in Appendix A of this report.

2.2 It is proposed to develop a dwelling on the red line parcel identified on FTP.001.A and secure the rear land edged in blue as nitrogen nutrient offset land in the form of wildflower meadow/improved grassland described in section 5 of the John Wenman Phase 1 Habitat Survey and consistent with paragraphs 5.9-5.11 of NEv5. The proposed layout is identified on Foxle Tagg Planning drawing number FTP.002.B contained in Appendix A of this report.

3. Background to Nitrogen Nutrient Assessment

3.1 The background to the issue is set out in current natural England Advice note version 5 of June 2020 -Achieving Nutrient Neutrality for New Development in The Solent Region (NEv5). Reference should be made to NEv5 for a more in depth understanding which is summarised in the following paragraphs.

3.2 The Solent water environment is internationally important and is protected under the Water Environment Regulations and the Conservation of Habitats and Species Regulations, as well as national protections. There are high levels of nitrogen and phosphorus nutrients in these waters and the evidence indicates these nutrients are causing eutrophication of the waters (excess mats of dense green algae which deplete oxygen as these subsequently decay)

3.3 The total nutrient content comes from a number of component parts:

i. Agricultural use of fertilisers, particularly in the latter half of the 20th century
ii. General coastal background content
iii. Nitrate within final discharge from sewage treatment works
iv. Diffuse urban rainfall runoff from urban surfaces

3.4 Since the late 1980's and early 1990's the agricultural sector has reduced the nitrogen content in applied fertiliser by around 35%. However, the Chalk aquifers which underly the region and which are the dominant source of river flows into The Solent contain a massive amount of legacy nitrogen mainly in the form of soluble nitrate, from decades of previous agricultural practice. It is anticipated that it will take decades from now for the nitrogen content in groundwater to gradually reduce.

3.5 Nitrate in treated sewage is the natural product of the breakdown of ammonia contained in human waste. Historic practice was that the permitted concentration of ammoniacal nitrogen in the treated discharge was limited so that the ammonia to nitrate conversion occurred at the treatment works and took up oxygen within the works and did not subsequently take up oxygen from out of the waters into which discharge was made to protect the receiving waters from deoxygenation ,ie that the discharge made would have a low Biological Oxygen Demand (BOD).

3.6 It has been recognised by the Environment Agency, water companies and OFWAT for some time that improvement of the Total Nitrogen (TN) content of discharge needs to be addressed. The water industry works in 5 year spending cycles/programmes referred to as Asset Management Plans (AMPs) and these three parties agree between them how much investment (which comes from increases in sewage bills) can be made in any AMP and what will be delivered in terms of improvement for the investment permitted (affordable). Since the beginning of AMP4 in 2005 Southern Water have begun to systematically upgrade existing treatment works to provide 'nitrogen stripping'. This process has to be artificially 'forced' by careful and continuous control of the treatment process to create a low oxygen environment which 'debonds' the oxygen from the nitrate and stimulates the emission of gaseous nitrogen into the atmosphere (which is 78% nitrogen). This nitrogen release is thus stripped from the effluent that discharges into the receiving waters. It is not practicable to strip 100% of the nitrogen from the sewage, and the upgraded treatment works typically operate to a new TN permit level of around 10 mg/L compared to typical value of around 27 mg/L for traditional works without TN permit limits.

3.7 Treatment works upgrades are difficult and complex to plan and deliver in the context of three of the main constraints:

- There is little space at most works for the finished new infrastructure
- The existing works has to continue to operate during the upgrade and there is little room for this and the working space needed to construct the new infrastructure.
- The investment cashflow is regulated by OFWAT against bill increases and notwithstanding this there are a finite number of specialists to plan and deliver this so there can only be a limited rate at which the upgrades are delivered.

The economies of scale and immediate proximity to The Solent has dictated that it is the large coastal treatment works which have been prioritised by Southern Water in AMPs4-6 from 20005-2019. AMP7 investment and construction programme for 2020-2025 is now underway.

3.8 Wastewater Treatment Works (WwTW) upgrade programme is ongoing but in short it is not realistic to simply add a TN limit to existing permits as there will be no immediate change in performance of existing WwTWs. The upgrade programme will take decades to eventually deliver across the board improved TN performance.

3.9 The NEv5 methodology is aimed at planning permissions for proposed developments and does not address agricultural practice or the water industry AMP process. The NEv5 methodology is built off a single fundamental premise. This assumes that persons at work or using non-residential offices and commercial/retail premises must also live in the catchment. In the round this is a reasonable basis on which to look at the total sewage volume. However in zero rating commercial development from nitrogen loading it inherently means that residential developers fund the nitrogen nutrient mitigation of all non-residential commercial development in the region.

3.10 As set out in paragraph 3.4 there is a massive amount of largely agricultural legacy nitrogen in the Chalk aquifer below the region which forms the base flow to the rivers flowing into The Solent. The drinking water supplies in southern Hampshire are drawn from this groundwater and these rivers, and this typically contains 7-8 mg/L of nitrogen that does not stem from the proposed developments. The previous NEv2 methodology did not recognise that this represents around 85% of the nitrogen returned to the water environment from upgraded WwTWs and around 30% from traditional WwTWs. NEv5 gives a 2 mg/L allowance ie about 20% on upgraded WwTW effluent and 7% on traditional WwTW discharges. Whilst this is only partial recognition it is better that the previous NEv2 that made no recognition at all. In effect residential developers will therefore also be funding the mitigation of the unrecognised legacy nitrogen predominantly from historic agricultural practices.

3.11 Natural England nitrogen assessment methodology v5 June 2020 considers nitrogen for:

1) Land use with regard to nitrogen contained in surface water run-off and infiltration.
2) Sanitation with regard to nitrogen content in the final treated discharge from the WwTW serving the development.

The assessment compares pre and post development quantities on nitrogen for the land use (1) and sanitation (2) to establish a final figure and then adds a 20% buffer to this.

3.12 Natural England advise the NEv5 methodology is advised for all types of development that would result in a net increase in population served by a wastewater system, including new houses, student accommodation, tourism attractions and tourist accommodation.

4. Derivation of Sewage Load

4.1 The NEv5 methodology uses a blunt 2.4 average household occupancy and 110 litres per head per day (lhd) for housing.

5. Wastewater Treatment Works

5.1 The site is remote from the public foul water sewer network.

5.2 The proposed dwelling will require a Package Treatment Plant (PTP) to serve the new foul water load. This will be located to the rear of the proposed dwelling. The discharge point is not located within Source Protection Zone 1 (SPZ1) and is remote from sensitive receptors such that it is considered to meet the requirements of the General Binding Rules.

5.3 NEv4 paragraph 4.72 indicates that on average each person produces 3.5 Kg Total Nitrogen (TN) per year, which is transported by the 110 lhd water supply ie the effective raw concentration is some 87.17 mg/L.

5.4 Historically TN has not been a controlled parameter for public WwTW generally or for private PTPs specifically. Consequently there is relatively little data currently available from PTP manufacturers. We have approached a number and Klargester have confirmed that the dosing variant of their Biodisc plants up to 50 person size have been tested and have a confirmed performance for TN of 71.1% efficiency.

5.5 The subsequent nitrogen assessment calculations are based on use of a Klargester Biodisc +P PTP not exceeding 50 PT size. The associated performance certification is contained in Appendix B

6. Land Use Component

6.1 The assessed land currently comprises grazing land/paddocks. The proposed residential parcel will generate a very small increase in nitrogen load as a result of the change in use to urban fabric on that parcel. The proposed change of use of the rear blue lined/offset parcel to wildflower meadow/improved grassland will result in a significant reduction in nitrogen load from this parcel.

7. Nitrogen Assessment

7.1 The NEv5 sewage loading, PTP performance for TN and land use component have been input into the calculations contained in Appendix C.

7.2 The calculations also include the 2 mg/L allowance in water supply from NEv5 discussed in paragraph 4.41. The calculations also identify for the awareness of the LPA the actual nitrogen content removed from the environment in the water supply from the environment but not recognised in NEv5.

7.3 The calculations indicate that inclusive of the 20% buffer there would be a net nitrogen **decrease** of **2.76 KgTN/yr** from the proposed development.

8. Mitigation

8.1 NEv5 Figure 1 subdivides the overall Solent catchment into 6 sub catchments. A copy of this Figure is contained in Appendix C.

8.2 The site lies in the Itchen subcatchment and the proposed mitigation must also be located within this subcatchment so that neutrality is achieved within each subcatchment.

8.3 Section 5 of NEv5 sets out various types of hypothetical mitigation. However most of these are impractical for small numbers of dwellings in a rural context remote from the public sewer. These are briefly discussed below:

8.4 Upgrade of the public treatment works is not applicable as the site is remote from the public sewer network.

8.5 Installation of wetlands to treat foul and or surface water run-off from the site. Treatment will not remove 100% of the nitrogen so whether by public treatment works or private treatment plant there will always be some residual nitrogen within the final treated foul water discharge.

The regulatory hierarchy for discharge of site surface water run-off requires that infiltration discharge (eg sokaways and permeable pavements) is provided where possible. Nitrogen treatment wetlands need to permanently retain water and are contrary to national drainage policy on permeable sites.

On non-permeable sites a proportion of the rainfall events that occur within a year are short showers that result in the ground being wetted but do not develop any run-off. The amount of annual run-off (Hydraulically Effective Rainfall, HER) is generally in the region of about 2/3 of the annual rainfall. The amount of annual surface water run-off for a site is therefore finite and limited by the impermeably surfaced area and site HER. Compared to foul water the nitrogen content is also much lower and NEv5 Appendix 2 indicates that 3mg/L is deemed representative. For crude general illustration purposes, assuming a positively drained area of say 200m^2 per dwelling and assuming an HER of say 500mm per annum with the prescribed nitrogen concentration of 3mg/L this would suggest the finite amount of nitrogen within the surface water run-off to be around 0.3 Kg per dwelling. The nitrogen removal efficiency of stormwater wetlands varies and NEv5 Appendix 4 indicates a median removal rate from studies to be 37%. It is therefore implicit from this that the total mitigation potential for the illustration would be around 0.1 KgTN/yr. The corresponding illustrative buffered TN discharge for treated foul water effluent from 1 dwelling would be of the order of 2.9 KgTN/yr for traditional WwTW and around 0.8 KgTN/yr for a dwelling served by WwTWs with nitrogen removal technology. It is generally not possible to mitigate more than 3-12% of the residual foul water impact by treating 100% of the site surface water run-off, so other mitigation will usually be required anyway.

Nothwithstanding this the design of wetlands is a specialist activity and is not usually cost effective on a small site scale. There is also a significant land take for the wetlands and there would be a requirement to set up and maintain a secured maintenance programme for operation of the wetland in perpetuity.

8.6 Some urban city authorities (eg Portsmouth CC) have a retrofit mitigation scheme whereby the increase in foul water effluent conveyed to the public WwTW from the site is offset by reducing the discharge from older existing housing stock by retrofitting modern water appliances. Although the site is located in a rural setting it does not lie within Portsmouth CC jurisdiction and retrofit mitigation is not considered to be applicable to this site.

8.7 The most common approach is one of land use offset whereby the increase in nitrogen at the site is offset by a corresponding reduction in nitrogen elsewhere in the subcatchment eg by change of use from farm land to woodlands or community open space etc or other

recognised low nitrogen use. Some sites can achieve mitigation within their own site when farmland of relatively high existing nitrogen discharge is developed for housing such that the reduction in the nitrogen from the change in land use is greater than the increase from the new foul water loading. For all other developments the mitigation land and development land are at different locations. There are three potential approaches to securing the necessary mitigation land:

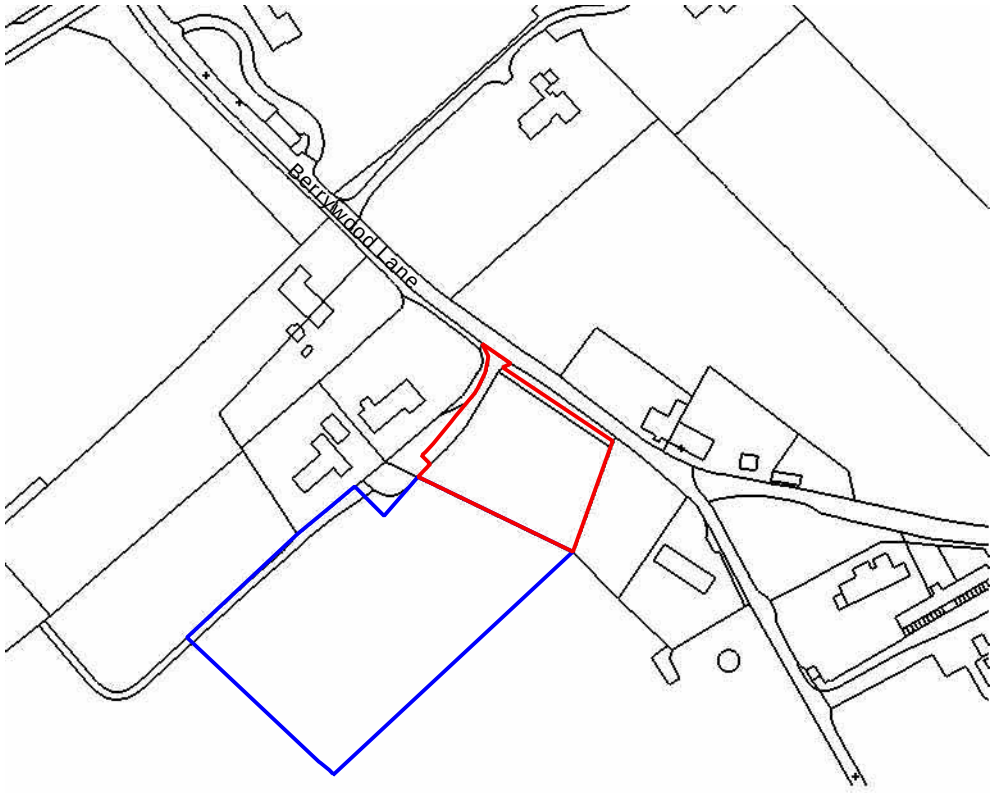
i. The applicant already controls a suitable area of private land.
ii. Some LPAs already control such land and buy in to their scheme can be made.
iii. Buy in to a third party scheme

It is a requirement that the change in use at the mitigation site is legally secured in perpetuity and that necessary maintenance to ensure the new low nitrogen usage is also secured.

8.8 For the proposed development the applicant already controls the blue lined land parcel to the west of the development parcel as indicated on Foxley Tagg Planning drawing FTP.001.A contained in Appendix A. As part of the application the applicant proposes to change this to a low nitrogen wildflower meadow/ improved grassland described in section 5 of the John Wenman Phase 1 Habitat Survey. **The net development will yield a net nitrogen nutrient reduction of 2.76 KgTN/yr and the proposed development therefore exceeds the balance point to achieve neutrality and no further mitigation is required**. The extent of the offset parcel is identifiable from Foxley Tagg Planning drawing FTP.001.A and the proposed use is defined in section 5 of the John Wenman Phase 1 Habitat Survey such that the LPA may secure this in perpetuity.

Appendix A

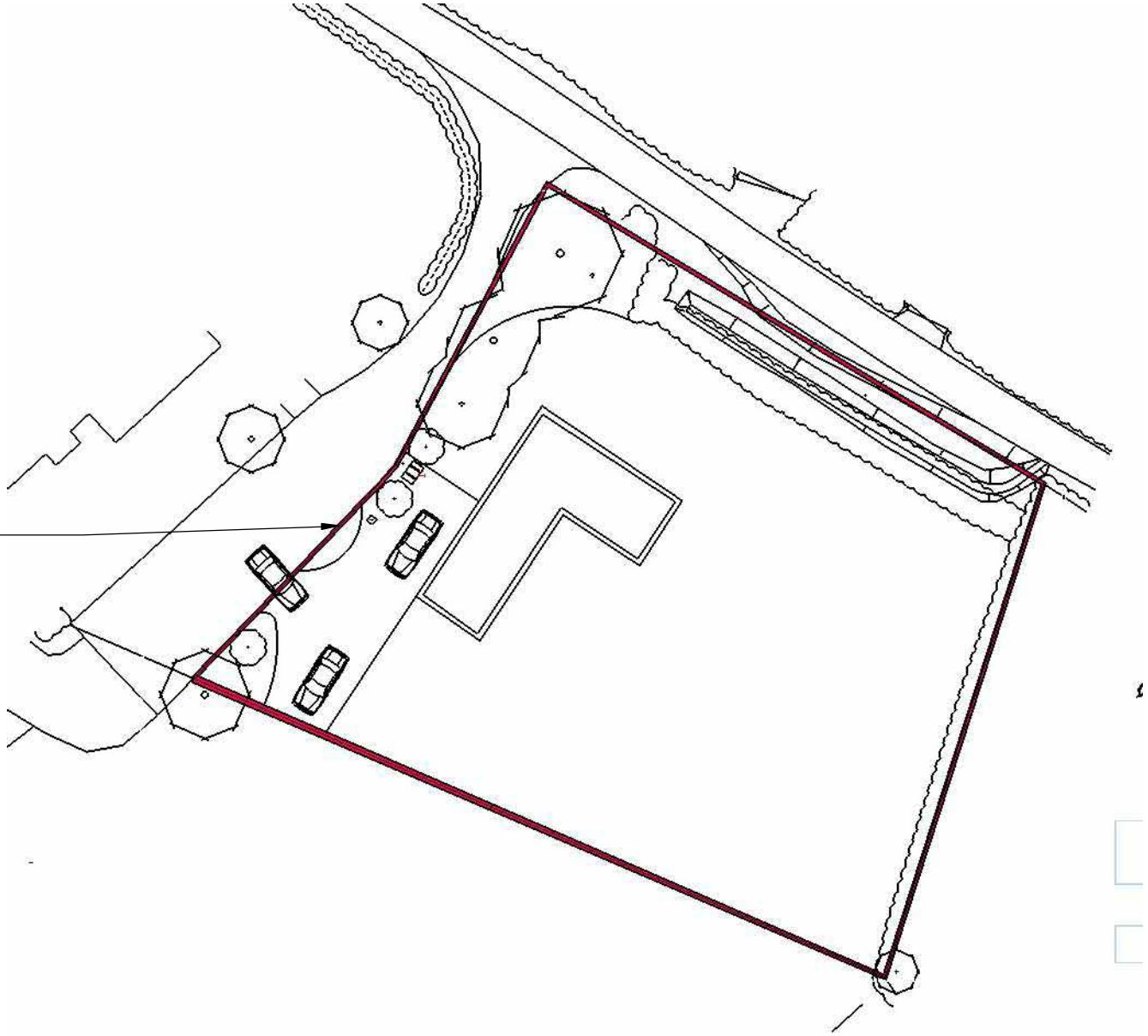
Site Location Plan



N

Scale: 1:2500 on A4
Ref: FTP.001.A
Site: Land SW of Berrywood Lane, Bradley

Proposed Site Layout



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Scale: 1:500 on A4
Ref: FTP.002.B
Site: Land at Berrywood Lane

FOXLEY TAGG PLANNING LIMITED

Appendix B

Prüfinstitut für Abwassertechnik GmbH

PERFORMANCE RESULTS

353.01C01

Kingspan Water & Energy Ltd.
College Road North, Aston Clinton, Aylesbury, HP22 5EW, UK

EN 12566-3, Annex B
Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system BioDisc BA +P
Rotating Biological Contactor (RBC) in a GRP tank with chemical dosing equipment

Test report PIA2019-353B47

Nominal organic daily load	0.28 kg BOD_5/d		
Nominal hydraulic daily load	0.9 m³/d		
Material	GRP		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	95.9 %	31 mg/l
	BOD_5	98.0 %	6 mg/l
	N_{tot}*	71.1 %	17.9 mg/l
	NH_4-N*	92.1 %	3.0 mg/l
	P_{tot}	95.5 %	0.3 mg/l
	SS	95.6 %	15 mg/l
Electrical consumption	1.5 kWh/d		

**determined for temperatures ≥ 12°C in the bioreactor*

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

Notified Body No.: 1739

Certified according to ISO 9001:2008

DAkkS Deutsche Akkreditierungsstelle D-PL-17712-01-00

[redacted]

Martina Wermter February 2019

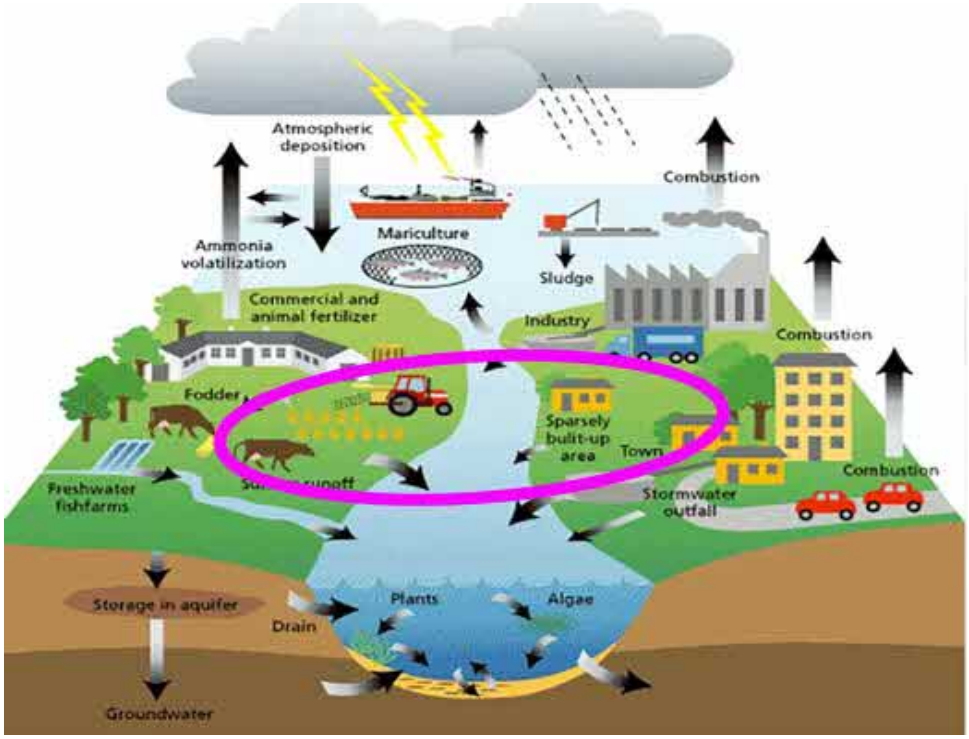
Appendix C

Aqua Callidus Consulting Ltd
52 Common Lane, Titchfield,
Hants, PO14 4BU

t: 07717 759149
www.aquacallidus.co.uk

Site Ref 20048: Land at Berrywood Lane

Development Nitrogen Assessment



Change in nitrogen content of runoff from the site

	Existing Land use type:	Nitrogen Load (kg/Ha)	Area (Ha)	Nitrogen discharge (Kg/yr)
1	Lowland Grazing/paddock	13.0	0.800	10.400
2	N/A	0.0	0.000	0.000
3	N/A	0.0	0.000	0.000
4	N/A	0.0	0.000	0.000
5	Urban area	14.3	0.000	0.000
6	SANG	5.0	0.000	0.000
7	Open space	5.0	0.000	0.000
	TOTAL SITE AREA (Ha)		0.800	10.400

Kg/yr Existing load

Land use load values taken Natural England values June 2020

Urban area = includes built form, gardens, road verges & any small areas of open space in the urban fabric

	Proposed Land use type:	Nitrogen Load (kg/Ha)	Area (Ha)	Nitrogen discharge (Kg/yr)
5	Urban area	14.3	0.200	2.860
6	SANG/Low nitrogen	5.0	0.600	3.000
7	Open space	5.0	0.000	0.000
	TOTAL SITE AREA (Ha)		0.800	5.860

Kg/yr Developed load

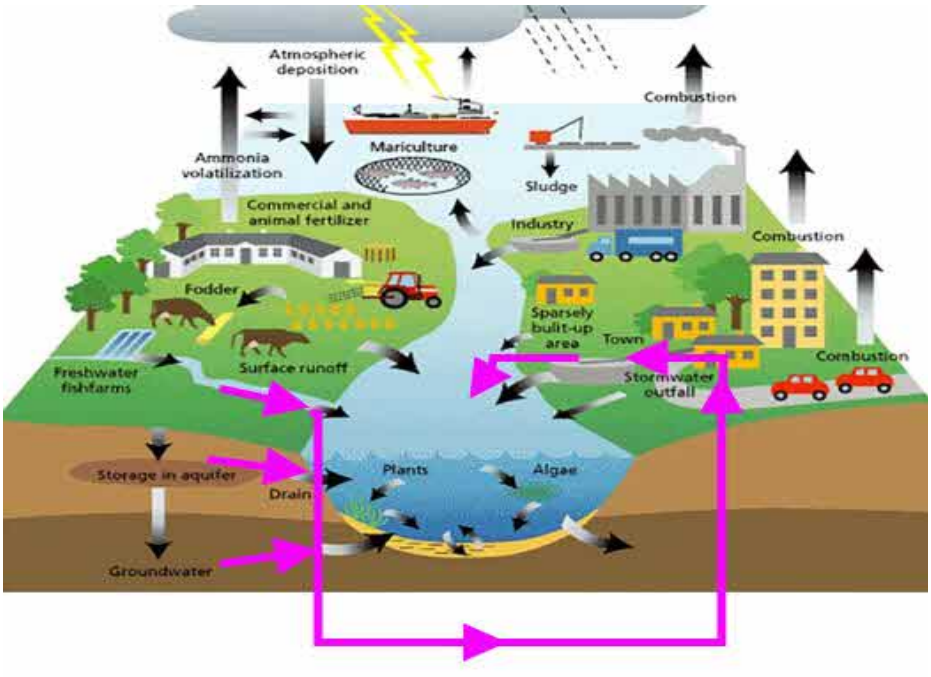
CHECK: Do existing and proposed land areas match? Yes

CHANGE IN NITROGEN LOAD FROM RUNOFF -4.540 Kg/yr

Aqua Callidus Consulting Ltd
52 Common Lane, Titchfield,
Hants, PO14 4BU

t: 07717 759149
www.aquacallidus.co.uk

Development Nitrogen Assessment



Nitrogen content in Package Treatment Plant (PTP) outfall

PTP module: Klagester Biodisc +P

Input nitrogen 3.5kg/person/yr	3.500	Kg/person/yr (87.17 mg/L)
Treatment efficiency	71.1	%
Output nitrogen:	1.012	Kg/person/yr
Deduct NEv5 allowance against water supply (2mg/L)	0.931	Kg/person/yr

Number of dwellings proposed	1		
Average poulation per dwelling	2.4		
Water consumption per capita	110	litres/person/day	
Daily water consumption	264	x 365 days = 96360	L/year

NITROGEN IN WATER DISCHARGED 2.235 Kg/yr Caution applies

Mains water provider: South East Water
Water supply zone/works: SWE Swaineshill

	Nitrate NO_3	Nitrite NO_2	Ammonia $NH4_3$
compound mg/L	31.41	0.01	0.004
as nitrogen mg/L	7.10	0.003	0.003

Nitrogen content taken from envirnoment	7.105		
of which omitted from 2mg/L allowance	5.105	mg/L	0.49 Kg/yr

nitrogen comprises both nitrogen from development + not from the development but from the external environment.
Residual non development part

Water supply values taken from Water Company, water supply zone data August 2019

Caution applies

TOTAL CHANGE IN NITROGEN = -4.540 & 2.235 = -2.305 Kg/yr

Apply 20% buffer ie factor by 1.2 x 1.20

+ values indicate increase to mitigate
- values indicate reduction ie tradeable credit

net reduction generating credit

-2.766 Kg/yr

Caution applies

Figure 1 Solent Catchment Area Contains public sector information licensed under the Open Government Licence v3.0