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Nutrient Neutrality Mitigation Strategy

Lidl Lampeter

Presented to: Lidl Great Britain Limited

Issued: May 2025

Lucion Contract Reference: 119796.642269

Report Details

Client	Lidl Great Britain Limited
Report Title	Nutrient Neutrality Mitigation Strategy
Site Address	Lidl Lampeter
Contract Reference	119796.642269
Lucion Contact	Rachel Shepherd (rachel.shepherd@luciongroup.com)

Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
5	Final	1st May 2025	Updates to NN strategy	Oliver Eglington Consultant	Rachel Shepherd Associate	Rachel Shepherd Associate

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1.0 Introduction

1.1 Appointment

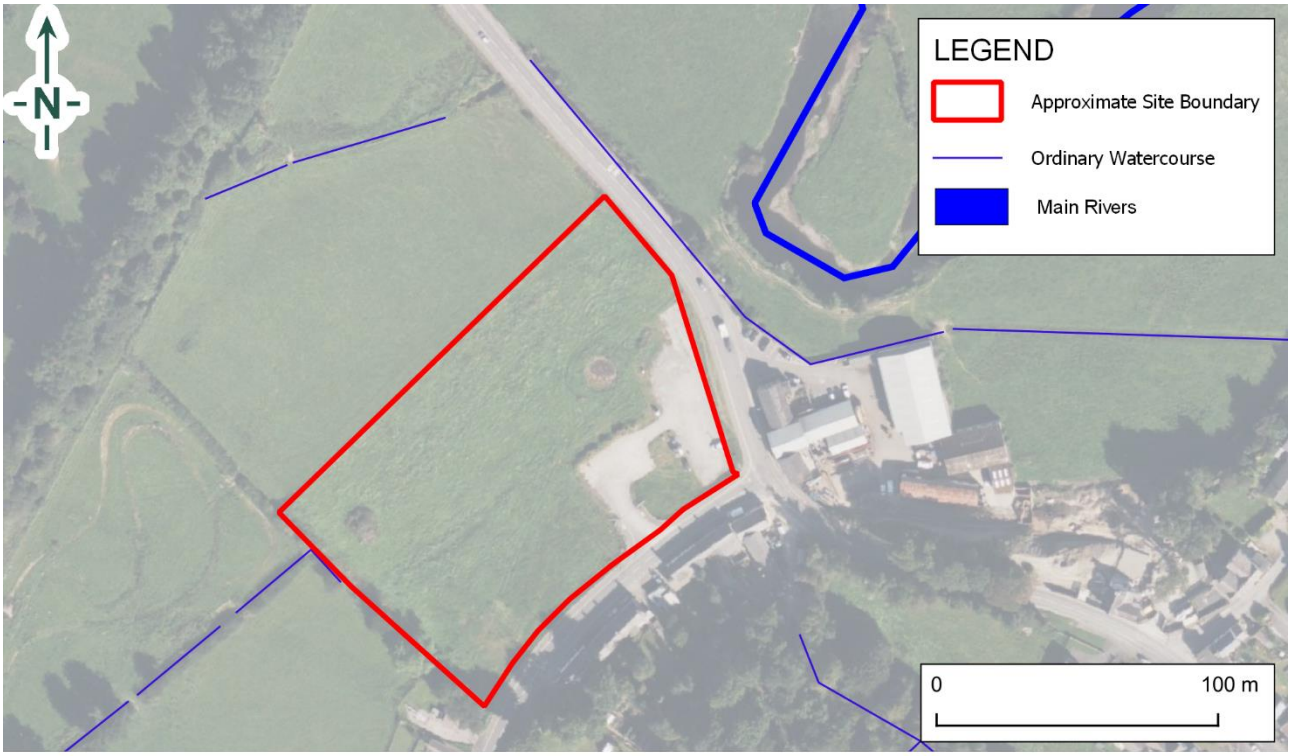
1.1.1 Lucion Delta-Simons Ltd ("Lucion") was instructed by Lidl Great Britain Limited (the "Client") to prepare a Nutrient Neutrality Mitigation Strategy (NNMS) for Land south of the A482 and west of the A485 Cwmann, Lampeter nr. SA48 8DT (the "Site") to inform a planning application for a new Lidl store and associated parking.

1.2 Context & Purpose

1.2.1 The Site is located within the catchment of the River Teifi, which is designated as a Special Area of Conservation (SAC) under the Conservation of Habitats and Species Regulations 2017. As such, any development which may have a 'Likely Significant Effect', such as increasing the nutrient load into freshwater bodies, an 'Appropriate Assessment' must be carried out in order to determine, with scientific certainty, that there will be no 'Adverse Effect on Integrity' on the designated SAC from the proposed development.

1.2.2 This Nutrient Neutrality Mitigation Strategy has been prepared for the Site to demonstrate the appropriate mitigation strategies to allow the Site to achieve nutrient neutrality and ensure that there will be no 'Adverse Effect on the Integrity' of the River Teifi.

1.2.3 The Site currently comprises a mix of greenfield and shrub land and previously developed brownfield land in the southeast, with a small area of standing water located in the east. The Site is centred at approximately E: 258210, N: 247359 and has a total area of approximately 1.48 Ha. A Site location plan is provided in Figure 1 below.



Service Layer Credits: Contains OS data © Crown Copyright and Database Right 2024, Bing Maps 2024.

Figure 1: Site Location Plan

2.0 Phosphorus Generated

2.1.1 This report has been prepared to provide an assessment of the net change in Phosphorus generated by the proposed development. Calculations to establish the nutrient loading have been conducted utilising the available Phosphorous Budget Calculator published by Ceredigion County Council for the Teifi River Special Area of Conservation (SAC) catchment. Each Stage below corresponds to the same numbered stage in the Phosphate Budget Calculator.

2.2 STAGE 1: TOTAL PHOSPHORUS INCREASE DUE TO POPULATION

2.2.1 The proposed development is for a supermarket unit with associated access and parking. The proposed development will introduce 10 new full-time employees, with 41% being from outside the hydrological catchment of the Site.

2.2.2 Based on the 2021 Census Data for Occupations, the distance travelled to work can be categorized into "10 km to less than 30 km" and "30 km and over" as outside the hydrological catchment, while the remaining distances are within. This classification reveals that 706 out of 1703 workers, or 41.46%, travel from outside the hydrological catchment.

2.2.3 As such, the development will result in an increase in wastewater discharge, resulting in an increase in Total Phosphorous (TP) being discharged from the Site.

2.2.4 Table 1 below demonstrates the increase in Phosphorus as a result of the proposed development, which would be discharged via the local sewer network to Lampeter Sewage Treatment Works (STW). Lampeter STW has a phosphate discharge limit of 5 mg TP/l. However, correspondence with Welsh Water in March 2025 confirms that the WwTW is currently failing to comply with the 95% quartile for its flows passed forward (FPF) performance. In line with the environmental regulator's National Environment Programme, the WwTW will achieve 95% quartile compliance with the FPF performance by 31st December 2025.

Table 1: Increase in Phosphorus discharge

Variable / Calculation	Value
Total Number of Employees Required for Commercial Use:	10
Percentage of Employees from Outside the Hydrological Catchment:	41
Water Usage (l/person/day):	120
Development Proposal (unit(s)):	1
Wastewater Treatment Works:	Lampeter STW
Phosphate Discharge Limit of PTP (mg TP/l)	5
Additional Population (persons):	4.1
Wastewater By Development (l/day):	492
Annual Wastewater TP Load (kg TP/year):	0.90 kg

2.3 STAGE 2: EXISTING (PRE-DEVELOPMENT) TOTAL PHOSPHORUS

2.3.1 Tables 2 and 3 evaluate the current Phosphorus discharged to the environment given the current Site use and the inputs into the Phosphorous Budget Calculator. The land use was classified as a mix of modified grassland (greenfield), shrub, water, and commercial land where the food van / hardstanding is currently located. It is noted that the annual rainfall was already in the Calculator, based on the Local Authority area.

Table 2: Inputs into the Phosphorus Budget Calculator

Local Authority:	Carmarthenshire
Soil Drainage Type:	Freely Draining
Annual Rainfall (mm)	1343

Table 3: Total Phosphorus from current land use

Existing Land Use Type(s):	**Area (ha):**	**Annual Phosphorus Nutrient Export (kg TP/yr)**
Green space	1.2133	0.02
Commercial / Industrial Land	0.1922	0.31
Shrub	0.0738	0.00
Water	0.0009	0.00
Total:	**1.4802**	**0.34**

2.4 STAGE 3: TOTAL PHOSPHORUS GENERATED BY PROPOSED DEVELOPMENT

2.4.1 Table 4 demonstrates the increase in Phosphorus discharged to the environment because of the change in land use resulting from the proposed development.

Table 4: Total Phosphorus from proposed land use

Proposed Land Use Type(s):	**Area (ha):**	**Annual Phosphorus Nutrient Export (kg TP/yr)**
Commercial / Industrial Land	1.48	2.41

2.5 STAGE 4: NET CHANGE IN TOTAL PHOSPHORUS

2.5.1 This stage calculates the net change in TP loading to the catchment from the proposed development. This is derived from calculating the difference between the load for the proposed development and that for the existing land uses. The phosphorus budget for the Site is calculated under the TP discharge limit for Lampeter STW.

2.5.2 The figures used throughout this model are based on scientific research, evidence and modelled catchments and represent the best available evidence. However, it is important that a precautionary buffer is used that recognises the uncertainty with these figures and ensures, with reasonable certainty, that there will be no adverse effect on the catchment. As such, a 20% precautionary buffer is added to the TP budget to be mitigated.

2.5.3 The below table summarises the net increase in Phosphorus because of the proposed development and the quantities requiring mitigation.

Table 5: Total Phosphorus budget for the development site

P Loading to WwTW	0.90 kg TP/yr
Net P Loading from Land Use Change:	2.07 kg TP/yr
P Budget:	2.97 kg TP/yr

P Budget + 20% Buffer:	**3.57 kg TP/yr**

2.6 NET INCREASE OF PHOSPHORUS

2.6.1 The proposed development will result in a net increase in Phosphorous. As such mitigation will be required in the order of 3.57 kg /yr TP.

2.6.2 Due to the spatially constricted nature of the Site, on-Site mitigation measures alone would not be sufficient to achieve nutrient neutrality. As such, a combination of on-Site and off-Site mitigation measures will be used to mitigate the loading of 3.57 kg/yr TP and achieve nutrient neutrality for the Site. These measures are detailed further in Sections 3, 4 and 5 of this report and will comprise:

- The inclusion of a retention basin on-Site;
- The replacement of an existing septic tank at a property on Falcondale Drive, SA48 7SB, with a GRAFUK One2Clean package treatment plant (off-Site); and
- The planting of apple trees on-Site to absorb excess nutrients from the soil (on-Site).

2.6.3 Located in Appendix B is a copy of the Phosphorus Budget Calculator utilised to generate the Phosphorus loadings detailed above.

3.0 Mitigation Measures

3.1 Retention Basin

3.1.1 As stated within CIRIA C808[1], a retention basin is similar to a detention basin, except that it is designed to have a permanent volume of standing water. When it rains, the water level temporarily increases and is released via the flow control device. A retention basin will therefore be incorporated into the final design of the Site to aid in nutrient mitigation.

3.2 Dissolved Phosphorus removal

3.2.1 It is understood that a retention basin can facilitate 50% removal of dissolved phosphorous (Taguchi et al, 2020[2], CIRIA C808).

3.3 Particulate Phosphorous removal

3.3.1 Sedimentation takes place in the permanent pool of water, removing 28% of the phosphorus. 55% TP in sediment and sediment removal in a retention basin is assigned an index of 0.5 in CIRIA C753[3] and CIRIA C808, and 55% of 50% = 28%.

3.4 Possible Phosphorus capture mechanisms

3.4.1 The primary phosphorous capture mechanism is sedimentation at the bottom of the pond. Plants in and around the pond will uptake phosphorous, the quantity of which will vary dependent on type and density of plants.

3.5 Maintenance

- Sediment may need to be removed from the bottom of the basin periodically.
- Inlet and outlet structures need to be kept clear and operational.
- Plants around the freeboard above the permanent water level can be mown and harvested and removed.

3.6 Hydraulics

3.6.1 All rainfall from the proposed development Site will enter the retention basin, and in high rainfall conditions the water level rises as the flow control device restricts the rate of discharge from the basin. In exceedance events the area around the basin may flood, however, the 600 mm freeboard provided within the pond will provide a considerable degree of additional storage over and above the design rainfall event.

3.7 Phosphorous Mitigation Provided by Retention Basin

3.7.1 As demonstrated within the Phosphorus Budget Calculator 2.41 kg/yr of TP would be generated from surface water flows associated with the proposed development, see Table 4 and Appendix B.

3.7.2 The dissolved P mitigated by the retention basin is:

2.41 x 0.5 = 1.205 kg TP/yr

3.7.3 The particulate P mitigated by the retention basin is:

2.41 x 0.28 = 0.675 kg TP/yr

[1] CIRIA Report C808: Using SuDS to Reduce Phosphorus in Surface Water Runoff (2024)
[2] Taguchi, V.J., Olsen, T.A., Natarajan, P., Janke, B.D., Gulliver, J.S., Finlay, J.C. and Stefan, H.G., 2020. Internal loading in stormwater ponds as a phosphorus source to downstream waters. *Limnology and Oceanography Letters*, *5*(4), pp.322-330.
[3] CIRIA Report C753 The SuDS Manual (2015)

3.7.4 Therefore, the total P in surface water runoff that is mitigated because of the retention basin on Site is:

0.675 + 1.205 = 1.88 kg TP/yr

3.7.5 The remaining P to be mitigated is:

3.57 – 1.88 = **1.69 kg TP/yr**

4.0 Septic Tank Replacement

4.1 Catchment Maps

4.1.1 It is proposed to develop a mitigation strategy that comprises off-Site measures for the calculated remaining Phosphorus loading of 1.69 kg/yr due to the constrained nature of the Site.

4.1.2 The off-Site measures proposed relate to the replacement of an existing septic tank at a property on Falcondale Drive, Lampeter, SA48 7SB, with a biological GRAFUK One2Clean package treatment plant. The project will be undertaken with the property owner's consent and to building control standards, discussions between the Client and the owner are already underway.

4.1.3 Correspondence with the Client has confirmed that the existing septic tank at the property discharges over ground to a drainage field. Runoff from the drainage field area would ultimately discharge to Nant Creuddyn, which subsequently discharges into Afon Teifi. As such, this arrangement will remain the same for the proposed package treatment plant.

4.1.4 The existing septic tank provides no restriction on phosphorous discharge, currently discharging at 1.17 kg TP/yr as demonstrated in Table 6 below. This was evaluated by using the residential settings on the Phosphorous Budget Calculator.

Table 6: Phosphorus discharge from existing septic tank.

Variable / Calculation	**Value**
Number of Units	1
Average Occupancy	2.3 persons per dwelling
Water use per person	120 l/person/day
Wastewater volume generated	**276 l/day**
Discharging – Septic Tank Default	11.6 mg TP/l
Total Phosphorus Load	1.17 kg TP/yr

4.1.5 As can be seen within Table 6, the wastewater generated from the existing septic tank is estimated to be 276 l/day. This is significantly less than the requirements of the 'General Binding Rules: small sewage discharge to the ground' which state the discharge to ground is to be no more than 2 cubic metres (2,000 litres) a day.

4.1.6 The package treatment plant proposed limits the Phosphorus discharge to 1.6 mg TP/l, equivalent to 0.16 kg/yr. The performance certificate for the proposed package treatment plant is located within Appendix C.

Table 7: Phosphorus discharge from the proposed off-Site package treatment plant

Variable / Calculation	**Value**
Number of Units	1
Average Occupancy	2.3 persons per dwelling
Water use per person	120 l/person/day

Wastewater volume generated	276 l/day
Discharging – Package Treatment Plant User Defined	1.6 mg TP/l
Total Phosphorus Load	0.16 kg TP/yr

4.1.7 The net effect of replacing the existing septic tank at the property on Falcondale Drive with the specified new package treatment plant provides a reduction in phosphorous discharge of:

1.17 – 0.16 = 1.01 kg TP/yr

Therefore, the remaining Phosphorus loading to be mitigated against is:

1.69 – 1.01 = 0.68 kg TP/yr.

4.1.8 It can be confirmed that the owners of this package treatment plant are to be responsible for the management and maintenance of the proposed upgraded plant to ensure its certainty as a mitigation option in perpetuity.

4.1.9 It is recommended that a package treatment plant is checked by a professional service engineer at least once a year to monitor sludge levels to prevent system overloading, test effluent quality, check system controls operation, and inspect the inside of the tank for any signs of wear or damage. GRAF UK offers a service agreement[4] to ensure the safe continued operation of the package treatment plant.

[4] https://www.grafuk.co.uk/sewage-treatment/maintenance/

5.0 Orchard

5.1.1 The remaining phosphorous loading generated from surface and foul water flows will need to be mitigated on-Site before being discharged to the Ordinary Watercourse and local sewer network respectively. As such, the remaining Phosphorus generated from surface and foul water flows, is to be mitigated through apple trees being planted on the landscaped area adjacent to the retention basin. The trees will be planted on the landscaped area adjacent to the retention basin, and will provide a further degree of treatment.

5.1.2 Within Table 8 is detailed the types of apples which could be utilised for the planting and their associated Phosphorus absorption rates. The absorption rates are taken from the Phosphorus Neutrality Assessment and Mitigation Strategy for the creation of two dwellings on land at Crossway Farm, Stoke St Gregory, Somerset prepared by Halpin Robins Ecology and Environmental Services in August 2022. This previous report is associated with planning application 36/21/0017 in Somerset Council, which was conditionally approved in January 2023. This strategy is included as Appendix D. The methodology was also used in a Nutrient Mitigation Strategy supporting planning application 24/0089 within Cumberland Council (Carlisle), which utilises apple trees above a drainage field as a mitigation option. This scheme received approval from the LPA and Natural England (NE) in January 2025. NE's comments relating to this strategy are included as Appendix E. The figures stated below are for mature trees and not saplings.

Table 8: Apple type Phosphorus absorption rates

Apple Type:	Phosphorus Absorption (kg/tree/yr):
Braeburn	0.0487
Cox	0.0687
Fuji	0.0487
Royal Gala	0.0560
Granny Smith	0.0113
Golden Delicious	0.0687

5.1.3 It is proposed to plant sapling Cox apple trees as they are most able to tolerate a colder climate. Cox Apples are widely distributed in the northern temperate zone and are generally very adaptable to the distinct seasons, including hot summers and cold winters. Therefore, overall, it is acknowledged that given the climate in the south of Wales this is the preferred apple species for the apple trees.

5.1.4 It is proposed to incorporate 15 sapling Cox trees into the final design of the development. The total additional nutrient mitigation is as follows:

15 x 0.0687 = 1.03 kg/yr TP

0.68 – 1.03 = -0.35 kg/yr TP

5.1.5 The inclusion of 15 Cox apple trees will therefore allow the Site to achieve nutrient neutrality as the remaining nutrient load will be absorbed before discharging off-Site.

5.1.6 The Client confirms that the 15 Cox apple trees are to be planted on Site prior to the commencement of construction.

5.2 Long Term Mitigation Site Management

5.2.1 The apple trees only have a limited lifespan of around 30 years and therefore the Client will need to incorporate tree restocking during the lifetime of the project. As such it is proposed to have a suitably qualified tree surveyor to inspect the health of the trees every 2 years with any trees needing replaced done so at this time. This is to be undertaken for the lifetime of the development to ensure that the mitigation proposed is maintained. It is also acknowledged that the apple trees will be planted prior to the development commencing.

5.2.2 It should be ensured that during the lifetime of the trees, any apples that fall to the ground are collected and removed to prevent the absorbed nutrients from re-entering the soil and continuing the nutrient cycle.

6.0 Summary

6.1.1 The proposed development will result in a net increase in Phosphorous. As such mitigation will be required in the order of **3.57 kg TP /yr**. To provide this nutrient mitigation and achieve nutrient neutrality, a combination of on-Site and off-Site mitigation measures will be used. These are laid out below:

- A retention basin will be utilised on-Site to provide mitigation for 1.88 kg TP/yr; and
- Off-Site mitigation is to be provided through the replacement of an existing septic tank with a GRAFUK One2Clean package treatment plant to provide mitigation of 1.01 kg TP/yr.

6.1.2 In addition, 15 Cox apple trees will be planted on-Site on a drainage field, which will provide an additional 1.03 kg/year of phosphorus removal.

6.1.3 On implementation of the on and off-Site mitigation measures listed above, the proposed development would achieve nutrient neutrality in terms of Total Phosphorous.

Appendix A – Limitations

Limitations

The recommendations contained in this Report represent Lucion professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Lucion does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Lucion obtained, reviewed and evaluated information in preparing this Report from the Client and others. Lucion conclusions, opinions and recommendations has been determined using this information. Lucion does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Lucion has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Lucion for the sole and exclusive use of the Client and for the specific purpose for which Lucion was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Lucion, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Lucion does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Lucion from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B – West Wales Nutrient Budget Calculator

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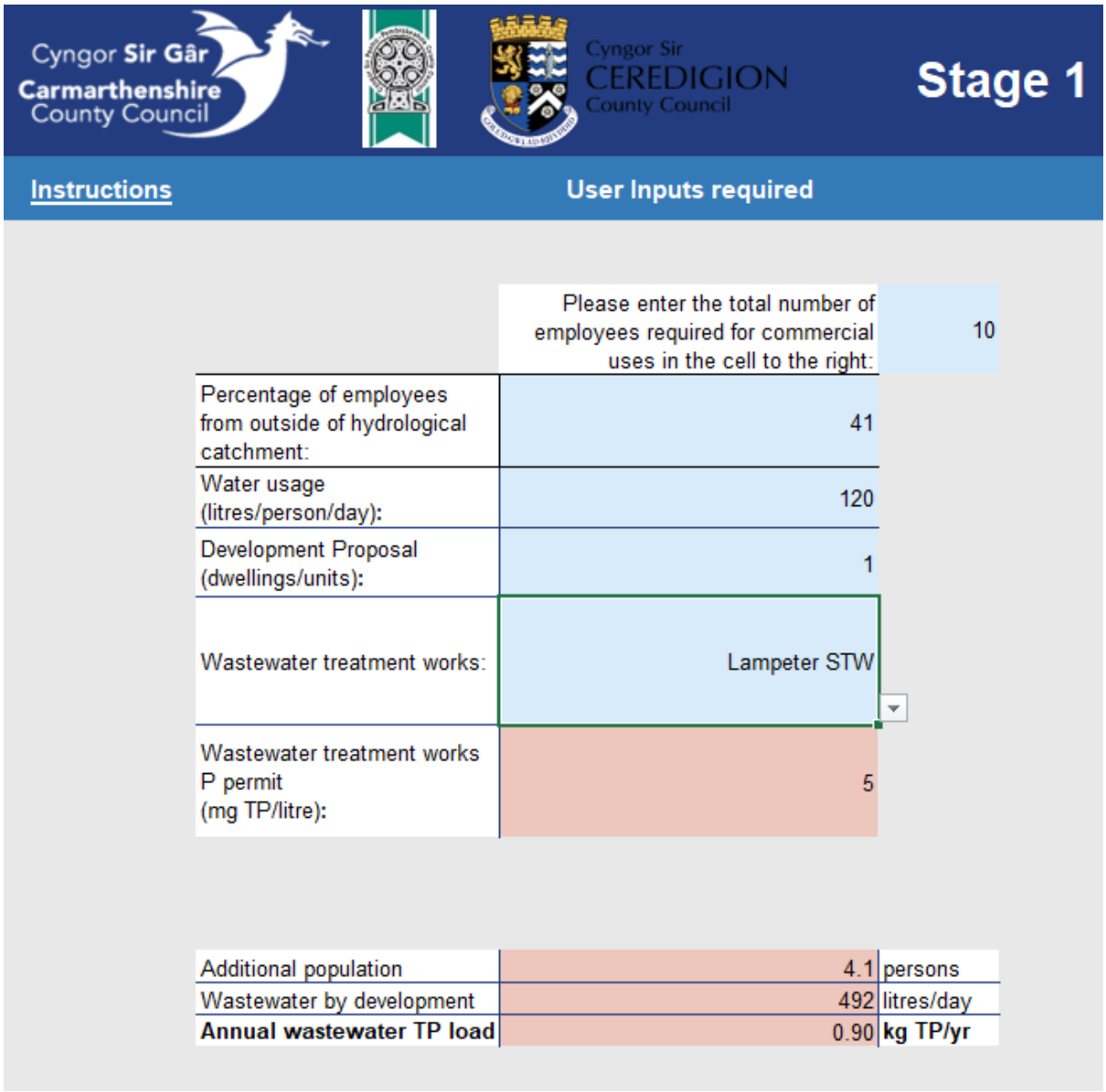
Stage 1



Cyngor Sir Gâr Carmarthenshire County Council

Cyngor Sir CEREDIGION County Council

Stage 1

Instructions

User Inputs required

	Please enter the total number of employees required for commercial uses in the cell to the right:	10
Percentage of employees from outside of hydrological catchment:	41	
Water usage (litres/person/day):	120	
Development Proposal (dwellings/units):	1	
Wastewater treatment works:	Lampeter STW	
Wastewater treatment works P permit (mg TP/litre):	5	

Additional population	4.1	persons
Wastewater by development	492	litres/day
Annual wastewater TP load	0.90	**kg TP/yr**

Stage 2

Existing Land Use Type(s)	Area (ha)	Annual phosphorus nutrient export (kg TP/year)
Greenspace	1.2133	0.02
Commercial/industrial land	0.1922	0.31
Shrub	0.0738	0.00
Water	0.0009	0.00
Total:	**1.4802**	**0.34**

Stage 3

New Land Use Type(s)	Area (ha)	Annual phosphorus nutrient export (kg TP/year)
Commercial/industrial land	1.48	2.41
Total:	1.48	2.41

Stage 4

P loading to WwTW:	0.90
Net P loading from land use change:	2.07
P budget:	2.97
P budget + 20% buffer:	3.57

The total annual phosphorus load to mitigate is:	**3.57 kg TP/year**

Appendix C – Package Treatment Plant Performance Certificate

Declaration of performance one2clean

Nr. 104/Translation

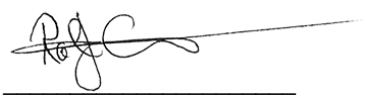
1. Unique identification code of the product-type	**one2clean**
2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4)	**one2clean 3-18 Inhabitants** **Type size and serial number on control cabinet type plate**
3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer	**EN 12566-3:2005+A2:2013: Prefabricated and/ on-site installations for the treatment of domestic waste water**
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5)	**Otto Graf GmbH Kunststofferzeugnisse** **Carl-Zeiss-Str. 2-6** **79331 Teningen** **Germany**
5. System or systems of assessment and verification of constancy of performance of the construction product as set out in Annex V	**System 3**
6. Name and identification number of the notified body	**PIA - Prüfinstitut für Abwassertechnik GmbH - NB 1739**

7. **Declared performance** (with regard to the harmonised standard EN 12566-3:2005+A2:2013)

	Performance			**Test report No.**
Cleaning capacity	Nominal organic daily dirt cargo BOD_5) = 0.06 kg/d per PE. Nominal daily inflow (Q_N) = 150 l per PE.			
Treatment efficiency	COD: BOD_5: NH_4-N: N_{tot}: P_{tot}: SS:	94,2 % 98,0 % 98,3 % 87,0 % 80,2 % 96,3 %	43 mg/l 7 mg/l 0.5 mg/l 8 mg/l 1.6 mg/l 14 mg/l	PIA2014-216B14.01
Watertightness	Passed			PIA2016-WD-1509-1050.02/ PIA2021-WD-2101-1002.03 (Carat S)
Stability	Passed			PIA2016-ST-PIT-1509-1050.02 (Carat S)
Durability	Passed			PIA2016-DH-1509-1050.02 (Carat S)
Reaction to fire	Class E			PIA2016-RF-1509-1050.02 (Carat S)
Release of dangerous substances	NPD			

8. **The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 7. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.**

Signed for and on behalf of the manufacturer by:



i.V. Ralf Oestreicher
Head of Product Division
- DIY / garden / waste water treatment -
Teningen, 22.03.2024

Appendix D – Somerset Nutrient Neutrality Mitigation Strategy

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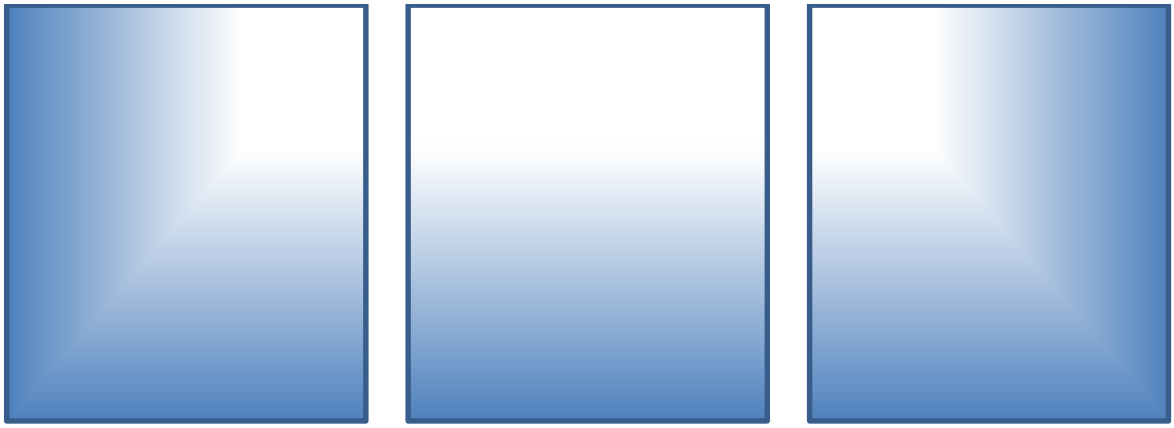
Ecology & Environmental Services

Phosphorus Neutrality Assessment and Mitigation Strategy

Creation of two dwellings on land at Crossway Farm, Stoke St Gregory, Somerset



Project No. and Report Ref.: **01/027/003/01_PNAMS**

Date: **16 August 2022**

HalpinRobbins Ltd
Greenfields, 64 Tone Hill
Wellington
Somerset, TA21 0AY
(01823) 299066
info@halpinrobbins.co.uk
www.halpinrobbins.co.uk

REVISION AND AMENDMENT REGISTER

Site/Job Name:	Creation of two dwellings on land at Crossway Farm, Stoke St Gregory, Somerset
Project Reference:	01/027/003/01
Report Type/Title:	Phosphorus and Nitrogen Neutrality Assessment
Client:	Cherwyn Developments Ltd
Document Reference:	01.027.003.01_Crossway _PNAMS
Primary Author:	Mr A Robbins BSc(Hons) MSc AssocMCIWM MCIEEM

Primary (v1) issue to client			
Reviewed by:	**Date:**	**Authorised by:**	**Date:**
Mrs S Lashly	**29 Nov 21**	**Mr A Robbins**	**29 Nov 21**

Revision Register				
Issue:	**Description of amendment:**	**Reviewed by:**	**Authorised by:**	**Date:**
2	Amendment of package treatment plant	Mrs S Lashly	Mr A Robbins	15-Dec-21
3	Inclusion of orchard planting mitigation	Mrs S Lashly	Mr A Robbins	08-Feb-22
4	Conversion of report into individual reports and inclusion of new guidance from Natural England and Somerset West and Taunton	Mrs S Lashly	Mr A Robbins	04-May-22
5	Amalgamation of reports back to single report and update based on Natural England advice including use of biological PTP only	Mrs S Lashly	Mr A Robbins	12-May-22
6	Inclusion of detail relating to package treatment plant monitoring and maintenance.	Mrs S Lashly	Mr A Robbins	16-Aug-22

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REVISION AND AMENDMENT REGISTER I

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1 OVERVIEW

HalpinRobbins Limited was commissioned to compile and supply a Phosphorus Neutrality Assessment and Mitigation Strategy for the creation of two residential dwellings on land at Crossway Farm, Stoke St Gregory, Somerset in support of a pending planning application.

The proposed works to be submitted to Somerset West and Taunton (SWaT) in the form of a single planning application.

1.1 Somerset West and Taunton (SWaT)

In accordance with the SWaT planning checklist, if a development is within the catchment of the Somerset Levels and Moors (SLaM) Special Protection Area (SPA) and Ramsar site the development may require a Habitats Regulations Assessment and the planning application submission is required to demonstrate how the development achieves nutrient (phosphorus) neutrality to comply with The Conservation of Habitats and Species Regulations 2017 and The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

The Somerset Levels and Moors SPA and Ramsar site is an Ecological Nature Network site in deterioration due to increased nutrient loads within its catchment.

If the development is assessed as likely to create an increased phosphorus loading within the catchment of the Somerset Levels and Moors SPA and Ramsar site, a complete mitigation package will be submitted in accordance with the Somerset Nutrient Information Request Sheet (V1) February 2021.

1.1.1 Interim Guidelines

In February 2021 Somerset's four district councils and the county council released interim guidelines on small scale thresholds and nutrient neutrality principles for the SLaM catchment. This document was intended to assess the likelihood of significant effects on the SLaM from developments and the proposed threshold criteria for development discharges that would be considered as insignificant and require no further assessment if met by the project.

Since publication, the guidelines have been updated and continue to be updated as new information and references are assessed and deemed relevant.

The current guidelines were published in May 2021 and contain nine threshold criteria that, if met, confirm the development as having a low risk to the SLaM and therefore would not require mitigation. The guidelines are only applicable to sites using package treatment systems and the criteria are:

The discharge to ground must be below 2 cubm per day and must meet all the following conditions:

a) The drainage field is more than 50m from the designated site boundary (or sensitive interest feature) and;
b) The drainage field is more than 40m from any surface water feature e.g. ditch, drain, watercourse and;
c) The drainage field in an area with a slope no greater than 15%, and;
d) The drainage field is in an area where the high-water table groundwater depth is at least 2m below the surface at all times and;
e) The drainage field will not be subject to significant flooding, e.g. it is not in flood zone 2 or 3 and;
f) There are no other known factors which would expedite the transport of phosphorus for example fissured geology, insufficient soil below the drainage pipes, known sewer flooding, conditions in the soil/geology that would cause remobilisation phosphorus, presence of mineshafts, etc and;
g) To ensure that there is no significant in combination effect, the discharge to ground should be at least 200m from any other discharge to ground and;
h) The percolation test has been performed of the proposed location of the drainage field with the resulting value lying within the required range under the Building Regulations 2010, which specify an average Vp value of between 12 and 100.

1.1.2 Nutrient Information Request Sheet

In February 2021 Somerset's four district councils and the county council released the nutrient information request sheet. This document provides details on the types of developments that are likely to be required to provide a Nutrient Balance Assessment, the level of detail required for the Nutrient Balance Assessment and where mitigation is required, the location and level of detail required to enable the councils to appraise the planning application.

1.1.3 Calculators

Royal Haskoning DHV Phosphorus Budget Calculator

In February 2021 Somerset's four district councils and the county council released a generic phosphorus calculator, **Royal Haskoning DHV Phosphorus Budget Calculator**, based the calculator developed for consideration of the Stodmarsh designated sites, published in November 2020. Since publication, the calculator has been updated and continues to be updated as new information and references are assessed and deemed relevant.

The calculator is a broad approach tool and is not meant for detailed assessment but to provide a guide. This is acknowledged within the guidance of the tool, which states:

"The tool has been designed so that the user is able to update the data and methods in light of any new research or understanding.

The information supplied in this tool is for guidance purposes only and is not intended to provide an exact budget calculation due to the limitations and assumptions of the model. The user is responsible for ensuring the accuracy and completeness of all data entered, be it manually or automatically, and used by this tool."

This acknowledgement within the calculator allows for other site-specific calculations to be provided, although deviation from the calculator requires justification.

Natural England, Somerset County Council and the local councils of Somerset have expressed preference that the Royal Haskoning DHV Phosphorus Budget Calculator be used for nutrient calculations and have requested that any deviation from this calculator be provided with suitable reasoning and evidence.

Farmscoper

In addition to the Royal Haskoning DHV Phosphorus Budget Calculator, it has been acknowledged by Natural England that Farmscoper is a suitable calculator to use when considering farmland and operations.

Farmscoper is a decision support tool that can be used to assess diffuse agricultural pollutant loads on a farm and quantify the impacts of farm mitigation methods on these pollutants.

The farm systems within the tool can be customised to reflect management and environmental conditions representative of farming across England and Wales. The tool contains over 100 mitigation methods, including many of those in the latest Defra Mitigation Method User Guide.

Farmscoper was originally developed under Defra project WQ0106. It was expanded under Defra Project SCF0104 to include additional pollutants and new workbooks.

Farmscoper is only suitable for considerations on land and does not have capacity to assess buildings or hard landscapes.

Assessment

For the purpose of this report the Royal Haskoning DHV Phosphorus Budget Calculator (V3.1) was used to determine the level of phosphorus load from the development, the mitigation was developed using a deviation from the calculator; reasoning and figures have been provided.

1.1.4 Technical Updates

On 16 March 2022 the Somerset authorities published six new technical updates and reports:

1. Somerset Levels: Catchment areas map
2. River Tone catchment
3. The Parrett catchment
4. The Brue catchment
5. Natural England letter dated 16 March 2022
6. The solutions report

Items 1 to 4 were updated catchment maps in relation to the SLaM, resulting in some small areas of land change to the surface water catchment and land affected. See appendix A for updated map.

Item 5 a letter from Natural England showing support for the new maps and solutions report.

Item 6 a report by Royal Haskoning DHV discusses the potential options for mitigation of phosphorus loads created by developments and potential environmental betterment practices within the catchment of the SLaM; no options within the report were confirmed as being accepted by Natural England or the Somerset Authorities.

On 16 March 2022 Natural England provided five new national advice documents comprising:

1. Water Quality and Nutrient Neutrality Advice (16 March 2022).
2. Nutrient Neutrality Principles (February 2022)
3. Nutrient Neutrality - A Summary Guide.
4. Natural England generic Nutrient Neutrality Methodology (February 2022)
5. Natural England generic catchment calculator (March 2022)

On 28 March 2022 Somerset Ecological Services confirmed that package treatment plants that use chemical dosing will not be accepted for developments due to the uncertainty around the impacts of the chemicals on the wider environment, particularly aquatic invertebrates, and the ongoing complexities to secure the correct application and use of the chemical in perpetuity.

On 29 April 2022 Somerset Ecological Services provided feedback that package treatment plants using chemical dosing, other than aluminium-based chemicals, will be acceptable providing the package treatment plant has an automatic shut-off valve. The valve being triggered if no chemical is present within the treatment plant.

1.2 Proposal

The area to be developed is c.0.323ha in size and comprises four agricultural barns used for storage and an open concrete yard with minimal surrounding vegetation.

The proposal will clear the site of all buildings and hard landscape before creating two new residential dwellings with associated parking, garden and amenity features, as well as an orchard containing 18 trees and additional hedgerow planting along the site's south, west and north boundaries.

Figure 1. Site Location

2 PHOSPHORUS BUDGET

2.1 Requirement

The development is within the catchment of the Somerset Levels and Moors SPA and Ramsar site and therefore requires consideration for phosphorus neutrality. See Appendix A for catchment map.

The development is on the outer perimeter of the mains sewer catchment for the Stoke St Gregory water treatment works (Permit 13290). Connection has been considered and deemed restrictive for this development therefore the proposal will be connecting to a package treatment plant for the treatment of its wastewater.

The proposed development has a pond within 12m and a ditch within 40m and therefore cannot comply with "item b" of the interim guidelines.

As the proposal is within the SLaM catchment and cannot comply with the interim guidelines it is considered to be "screened in" to the Habitat Regulations Assessment requirement for further investigation.

2.2 Phosphorus Load Calculation

The nutrient balance for the development has been calculated using the Royal Haskoning DHV Phosphorus Budget Calculator V3.1 (accessed on 11-May-2022).

For the purpose of the calculator the following details have been utilised:

- Number of dwellings being created: 2
- Area of development site: 0.323 hectares
- Current site use: Urban – 0.323ha
- Proposed site use: Urban – 0.323ha
- Discharge: Package Treatment Plant (PTP)
- PTP type: HABA BioEasy Flow
- PTP efficiency: 94.5% (see certificate in Appendix B)
- Soil type: Slightly acid loamy and clayey soils with impeded drainage
- Soil type source: Cranfield Soil and Agrifood Institute Soilscapes

2.3 Calculator Values

The results of the calculator are as follows:

- Phosphorus load from additional population: 0.29 kg/yr
- Phosphorus load from land use change: 0.00 kg/yr
- Phosphorus budget for development: 0.29 kg/yr
- Phosphorus budget with 20% buffer: 0.34 kg/yr (current)
  0.34 kg/yr (AMP7 - 2024)

See Appendix C for copy of Royal Haskoning DHV Phosphorus Budget Calculator V3.1 Stage 1 to 4.

2.4 Phosphorus Budget Conclusion

The development will result in an increase emission of 0.34 kg/yr into the catchment of the Somerset Levels and Moors SPA and Ramsar site.

Under the Habitat Regulations Stage 2 "Scoping" assessment the project will be deemed as likely to have an impact on SLaM and require a Stage 3 "Appropriate Assessment" (AA) to determine if, based on the precautionary principle, the impact will have an adverse effect on SLaM. Due to the increased release of Phosphorus and the current nutrient condition of the SLaM the AA will conclude that an adverse impact will occur.

When an adverse impact is predicted as part of an AA "mitigation and avoidance" measures (Stage 4) must be proposed before an appropriate assessment conclusion and report can be issued (Stage 5).

This project will require a Stage 4 assessment for the development of suitable mitigation and avoidance practices.

3 MITIGATION – STAGE 4

3.1 Mitigation Calculation

Currently there is no established or strategic approach to detailed mitigation in relation to nutrient neutrality therefore each project can be assessed on a case-by-case basis and can be tailored to its location and environment.

A generic board-brush calculation is available through the Royal HaskoningDHV but this cannot be tailored to meet specific sites and situations. This is detailed in the calculator information page which states, *"The tool has been designed so that the user is able to update the data and methods in light of any new research or understanding"* and *"The information supplied in this tool is for guidance purposes only and is not intended to provide an exact budget calculation due to the limitations and assumptions of the model. The user is responsible for ensuring the accuracy and completeness of all data entered, be it manually or automatically, and used by this tool."*

The mitigation proposed below has been developed to comply with current guidance, legislation, knowledge of the Somerset Levels and Moors Special Protection Area (SPA) and Ramsar site and understanding of biochemical and hydrological interactions; including provision to monitor the mitigation and package treatment plant performance.

3.2 Avoidance / Minimisation / Restoration / Offsetting

The requirement for any mitigation is for it to be in place in-perpetuity (minimum 80 years). The mitigation hierarchy follows avoidance, minimisation, restoration and offsets in order to reduce development impacts and control any negative effects on the environment.

Preferred options for nutrient mitigation as part of restoration and offsetting is via natural processes such as sorption, filtration or precipitation through green and blue infrastructure.

For this development, it is proposed to implement mitigation through creation of new habitats that will absorb additional nutrients.

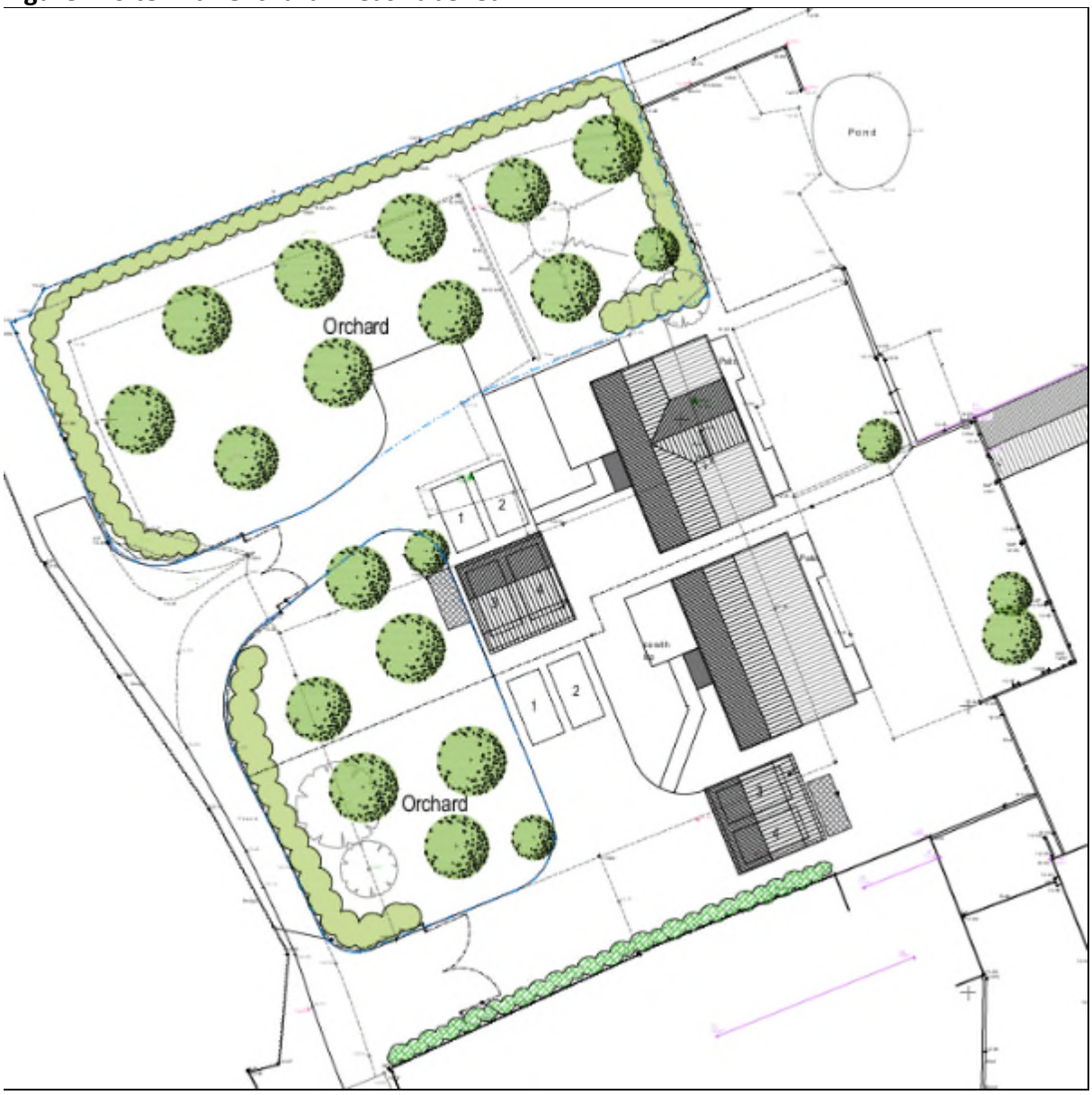
NOTE: Avoidance is not considered for this project as it would mean not progressing with the project or changing the wastewater treatment to a cesspit system which would require regular cleaning and tankering to a treatment facility. This would be considered to be just moving the problem rather than solving it.

3.3 Habitat Creation (Onsite)

To the immediate north and west of the proposed development site is an area that will be planted with 19 trees with an amenity grassland underneath.

On the west and north of the orchard will be a UK native species hedgerow; approximately 110m.

Figure 2. Site with Orchard Areas Labelled



It is proposed to mitigate the increased phosphorus load from the development through the creation of the orchard and hedgerow with careful selection of the species used.

3.3.1 Calculator Determination

Within the Royal Haskoning DHV Phosphorus Budget Calculator (PBC) V3.1 Stages 5 and 6 (mitigation) there is no option for the creation of a traditional orchard, the closest description is woodland "*Tree-covered areas which either arose naturally or as a result of plantations. This includes conifer woodland, mixed woodlands and broad-leaved woodlands*".

The generic woodland creation has already been used within the PBC calculations. See Appendix C for copy of Royal Haskoning DHV Phosphorus Budget Calculator V3.1 Stage 1 to 4.

3.3.2 Deviation

As the PBC does not account for the effect of different types of woodland there are many additional benefits to the planting of a traditional orchard above that of a generic woodland; the main three are:

- The woodland mitigation within the PBC is calculated using a land runoff coefficient that has many assumptions to produce a generic value of 0.02 kgP/yr.
- The woodland mitigation within the PBC is calculated using a land runoff coefficient. This takes no account of the actual absorption of the habitat but assumes that the run-off from the woodland will contain a certain amount of phosphorus regardless of the level of phosphorus that is being applied to the woodland through overland or underground flow/application.
- The woodland within the PBC is not a traditional orchard with cropping. Woodlands have a natural absorption of phosphorus within the biomass of the trees and shrubs but there is generally no regular crop harvesting and therefore no additional removal of phosphorus. A traditional orchard includes crop harvesting and wood pruning which will result in phosphorus removal both within the fruit and the cleared biomass (branches).

As the current PBC calculation is based on change in run-off coefficient and the area to be converted to orchard is currently hard landscaped the calculations have not been redone however the absorption mitigation will be developed to absorb the full phosphorus load from additional population; 0.34kgP/yr.

As traditional orchards can contain a variety of fruiting trees and it is considered that planting of a single type or variety of tree, if utilised for this proposal or in combination with other nature-based solutions across Somerset, would lead to unusable fruit gluts or biodiversity depletion through mono-crop application, HalpinRobbins have researched a variety of fruiting trees and the associate phosphorus absorption per tree.

Classification

In accordance with the Natural England Orchard Project and the UK Biodiversity Action Plan Priority Habitat Descriptions for Traditional Orchards to qualify as a traditional orchard the proposal must be a minimum size of five trees with crown edges less than 20m apart containing at mix that is dominated by primary individuals of apple, plum, pear, damson,

cherry, walnut and cobnut (hazelnut); other varieties and species can be included but must not be present in a greater number than the primary individuals.

(See Appendix D for further appraisal and reasoning and Appendix E for reference list).

3.3.3 Orchard - Crop

Assumptions and Considerations

Due to the number of varieties and variations of orchard trees, figures have been researched for commercial varieties. No ornamental varieties are included. Significantly more data is available for apple varieties and currently Braeburn and Granny smith represent the highest and lowest absorbing fruits with researched apple varieties.

Within fruiting trees there is consideration that they will absorb additional phosphorus after harvest, in preparation for winter (approximately 16.07 g ±1.10) and will return the majority of this to the ground from lead drop in autumn (approximately 10.00g ±1.10); the tree retaining the difference in its residual biomass (approximately 6g). There is insufficient proof of these figures currently and so they are not included in the calculations.

Table 1. Fruit Tree Values

Type / variety	Years to cropping		Pollinator tree	Phosphorus absorption in annual fruit crop per tree (kg/yr)			
	Min	Max		Av.	Dev.	Min	Max
Apples	2	10	Yes	0.0627	0.0123	0.0503	0.0750
Braeburn (apple)	2	7	Yes	0.0613	0.0127	0.0487	0.0740
Cox (apple)	2	7	Yes	0.0840	0.0153	0.0687	0.0993
Fuji (apple)	2	10	Yes	0.0647	0.0160	0.0487	0.0807
Royal Gala (apple)	2	10	Yes	0.0653	0.0093	0.0560	0.0747
Granny Smith (apple)	4	7	Yes	0.0167	0.0053	0.0113	0.0220
Golden Delicious (apple)	2	10	Yes	0.0840	0.0153	0.0687	0.0993
Apricots	6	7	No	0.0039	0.0004	0.0035	0.0043
Cherries, sweet	6	7	Yes	0.0021	0.0003	0.0018	0.0023
Figs	5	6	No	0.0005	0.0001	0.0004	0.0006
Peaches and nectarines	4	5	No	0.0058	0.0007	0.0051	0.0064
Pears	5	7	Yes	0.0015	0.0003	0.0013	0.0018
Plums and Damsons	3	5	Yes	0.0413	0.0016	0.0397	0.0429
Medlar	3	5	No	0.0065	0.0050	0.0060	0.0070
Quince	3	5	No	0.0030	0.0006	0.0024	0.0035
Chestnuts, sweet	5	7	Yes	0.0143	0.0050	0.0093	0.0193
Hazelnuts	5	6	Yes	0.0199	0.0121	0.0078	0.0319
Walnuts	10	12	No	0.2434	0.0854	0.1580	0.3287
Average				**0.0434**	**0.0107**	**0.0326**	**0.0541**

For the calculations a precautionary principle, as enshrined in *Article 191(2) of the Treaty on the functioning of the European Union* and defined in the *1992 Rio Declaration on Environment and Development,* has been applied to the calculations. The principle is applied to reduce the risk of non-compliance with the calculation conclusions and to improve certainty of result; only the minimum figures for absorption have been used.

Proposal

The proposed mitigation is to plant at minimum of 19 trees. The trees will be as follows:

Table 2. Site Specific Fruit Tree Values

Type / variety	Minimum Phosphorus absorption in annual fruit crop per tree (kg/yr)	Number of individuals	Minimum Phosphorus absorption in fruit crop per type (kg/yr)
Braeburn (apple)	0.0487	3	0.1460
Cherries, sweet	0.0018	3	0.0054
Pears	0.0013	3	0.0039
Plums and Damsons	0.0397	2	0.0793
Medlar	0.0060	1	0.0060
Quince	0.0024	2	0.0048
Sub Total			**0.2454**
Hazelnuts	0.0078	4	0.0312
Walnuts	0.1580	1	0.1580
Total			**0.4346**

Table 3. Tree Specifications at Time of Planting

Type / variety	Minimum height (m)	Minimum age (yrs)	Estimated mature height and crown spread (m)
Braeburn (apple)	1.5	2	3.0 by 3.5
Cherries, sweet	1.5	2	4.0 by 4.5
Pears	1.5	2	4.0 by 4.0
Plums and Damsons	1.5	2	4.0 by 4 0
Medlar	1.5	2	3.0 by 3.5
Quince	1.0	2	2.0 by 2.0
Hazelnuts	1.0	3	4.0 by 4.0
Walnuts	1.2	2	24.0 by 10.0

Larger trees will be planted furthest away from the dwellings for the protection of both the trees and dwellings.

The annual crop from the fruiting trees (19) proposed are sufficient to absorb the additional phosphorus load from the proposed development and the trees have been selected in quantity based on the pollination requirements and suitability for use by the occupants of the dwelling or other local areas residents that may be permitted to harvest the crop.

The addition of the walnut tree and hazelnut trees is to add an additional buffer to the orchard in terms of absorption and biodiversity. This will also help to account for environmental change that may cause variation in the cropping density of the trees and provide support should any tree have to be replaced over the in-perpetuity period.

The above does not include any additional phosphorus removal resulting from “mast” years or extrapolation of the information to cover the 80-to-100-year lifespan of the orchard.

The above assessment is also done based on standard fruit trees with a semi-vigorous and vigorous root stock; it does not take account of the use of bush fruit trees which have a higher cropping rate which can be almost double that of a standard tree.

3.3.4 Orchard – Above Ground Biomass

Assumptions and Considerations

There is a wide variety of research on tree biomass and use of phosphorus (P). Due to timing this has not been researched extensively and is provided here for consideration in addition to the cropping absorption.

The formula used to determine the above ground biomass is:

Log (Biomass) = 1.711 x Log (diameter at Breast Height in cm)
+ 0.680 x Log (Height in cm) – 0.918 *(Charkraborty T et al, 2016)*

Following the "precautionary principle" the smallest orchard tree at planting will be 100cm tall with a girth of 10cm (3.2cm diameter); equating to 20.24kg of biomass.

Current research values suggest that on nutrient rich soils the absorption of phosphorus by broadleaf trees is between 0.5 to 0.8mg per gram of biomass which drops to 0.12 to 0.21mg per gram of biomass on nutrient poor soils. These values are closely matched in the *Charkraborty T et al, 2016* on beech trees.

Following the "precautionary principle" lowest biomass absorption of 0.12mg per gram of biomass would suggest that the smallest orchard tree at planting (20.24kg) would start absorbing 0.0024kgP/yr at the point of planting.

This would equate to 0.0462kgP/yr across all 19 trees.

The above does not include any additional phosphorus removal underground biomass (fine and course roots) or extrapolation of the information to cover the 80-to-100-year lifespan of the orchard.

After 30 years the apple trees will be 300cm tall with a girth of 70cm (22.3cm diameter); equating to 1,184.11kg of biomass. This would potentially be drawing 0.1421 kgP/yr or 2.7kgP/yr across the 19 trees.

3.3.5 Hedgerow – Above Ground Biomass

Assumptions and Considerations

100m meters of hedgerow will be planted alongside the orchard. This will comprise a UK conservation mix of Blackthorn *Prunus spinosa*, Dog rose *Rosan canina*, Field rose *Rosa arvensis*, Common dogwood *Cornus sanguinea*, Field Maple *Acer campestre*, Spindle *Euonymous europeaus*, Hawthorn Crataegus *monogyna* and Cherry plum *Prunus cerasifera.*

Using the above calculation and following the "precautionary principle" these will be planted as 60cm whips in a single row (3 plants per m) and allowed to grow to a height of 1m above

ground level; 300 plants, 60cm tall, diameter 1cm at planting rising to 300 plants, 100cm tall, diameter 3cm.

Following the "precautionary principle" lowest biomass absorption of 0.12mg per gram of biomass would suggest that at planting the hedgerow biomass would be 25.5kg (0.085kg per whip x 300 whips) and would start absorbing 0.0031kgP/yr at the point of planting.

After 10 years the hedgerow biomass would equate to 5,438.4 Kg (18.128kg per plant x 300 plants) and would potentially be drawing 0.653kgP/yr.

The above does not include any additional phosphorus removal underground biomass (fine and course roots) or extrapolation of the information to cover the full 80-to-100-year lifespan of the orchard.

3.3.6 Orchard – Grassland Management

In the current location it is considered that the management of the grassland within the orchard will be managed through mechanised cutting with all arisings being left on site. This would neither add nor remove nutrients.

However, as the mitigation site must be considered for a period of 80-to-100 years the addition of nutrients cannot be ruled out and therefore the "precautionary principle" must be applied.

As traditional orchards are usually grazed by livestock it is proposed that a livestock focused grass management be included at a stocking rate of 0.4 livestock units per hectare per year. Within the 0.123ha orchard area this would be the equivalent of 0.05 livestock units per year (1 ewe for 5 months or 1 ewe and 1 lamb for 4 months).

It has been advised by Natural England to use the lowland grazing coefficient (taken from the Phosphorous Budget Calculator v3.1) to represent the input from this type of management. The coefficient is 0.12kgP/yr/ha and therefore, for the area of 0.123ha, the phosphorus input is 0.01kgP/yr.

3.4 Conclusion

The development will result in an increase in potential phosphorus emission into the catchment of the Somerset Levels and Moors SPA and Ramsar site of 0.34kgP/yr. With additional input from livestock grazing of the orchard this could rise to 0.35kgP/yr.

To balance the nutrient load increase from the proposed development mitigation will be provided within the development in the form of a traditional orchard, minimum 19 fruit and nut trees, and 100m of UK native hedgerow (c.300 whips).

This combination of planting can absorb 0.4346kgP/yr within the fruit crop, above the total phosphorus load of the development.

If including biomass absorption this absorption increases by 0.0493kgP/yr which, overtime has potential to rise to 3.4kgP/yr and more.

The establishment of the orchard and hedgerow will depend on the trees planted but it is anticipated that there will be a period no greater than 3 years between current conditions to the point of balanced mitigation. This mitigation planting will then increase, putting the mitigation into a Phosphorus load benefit.

As the offsetting site is located very close to the source of the nutrient load the mitigation has potential to absorb the developments phosphorus release.

Table 4a. Site Specific Fruit Tree Values

Type / variety	Number of individuals	Years after planting to crop	Phosphorus absorption (kg/yr)
Braeburn (apple)	3	1-2	0.1460
Cherries, sweet	3	1-2	0.0054
Pears	3	1-2	0.0039
Plums and Damsons	2	1-2	0.0793
Medlar	1	1-2	0.0060
Quince	2	1-2	0.0048
Sub Total			**0.2454**
Hazelnuts	4	1-2	0.0312
Walnuts	1	4-5	0.1580
Sub Total			**0.4346**
Orchard Biomass P absorption on planting	19	0	0.0462
Hedgerow Biomass P absorption on planting	300	0	0.0031
Total			**0.4839**

Table 4b. Site Specific Fruit Tree Values

Type / variety	Number of individuals	Years after planting to crop	Phosphorus absorption (kg/yr)
Orchard Biomass P absorption on planting	19	30	2.7000
Hedgerow Biomass P absorption on planting	300	10	0.6530
Total			**3.3530**

The proposed offsetting habitat has an additional benefit in that Traditional Orchards are considered a United Kingdom Priority Habitat and would result in a biodiversity gain on site, according to DEFRA Metric 3.1. (Assessment not supplied).

3.5 Mitigation Acceptance

On acceptance of the mitigation strategy the mitigation land will be mapped and recorded, and a monitoring and management plan will be put in place including PTP monitoring, and replacement of trees as required.

3.5.1 Variation of Mitigation

Should a phosphorus credit scheme become available the client may look to provide the phosphorus balance from the credit scheme rather than the proposed mitigation. This will be discussed with SWaT before any action is taken.

4 PACKAGE TREATMENT SYSTEM MANAGEMENT

Each property will be served by a single package treatment plant. Each plant will be a HABA BioEasyFlow. The management and monitoring below will be applicable to each installed package treatment plant and property.

4.1 Installation

On installation the new package treatment system will comply with current British Standards (BS EN 12566 for small sewage treatment plants) and shall be installed in compliance with current building regulations (Building Regulations Part H2: wastewater treatment systems and cesspools)

4.2 Management

The treatment system will be managed in accordance with the Environment Agency "General binding rules: small sewage discharge to a surface water".

Should this guidance be revoked or changed over the period of the systems use the management will adhere to the new guidance or regulations that replace them.

4.3 Desludging

The treatment plant will be desludged every two years, as per manufacturer's instructions. Should this be found to be inadequate the frequency will be increased to every year.

Desludging will be carried out by a registered waste carrier.

At the time of desludging, in line with the manufacturer's instructions, the package treatment plant will be inspected to ensure it is in good working order. This inspection will include, but is not limited to, leaks, cracks, blockages, smells and operation of motor, pump or other features.

Inspections will be carried out by a competent person, ideally an individual or company registered on the British Water's list of accredited service engineers.

4.4 Testing

Every year the outflow of the treatment system will be subject to a water quality test.

A single water sample will be taken from the outflow of the treatment system and sent to an MCert accredited laboratory for "total phosphorus" analysis.

- If the results remain below 0.8mg/l (See Appendix Treatment Certificate) the testing will remain annual.
- If the results are above 0.8mg/l the test will be repeated within 2 weeks.

Should the results remain above 0.8mg/l the local planning authority planning enforcement team will be informed and remedial action will be taken. Remedial action will start with the instruction of a qualified service engineer to inspect the treatment system.

The applicant acknowledges that the local authority reserves the right, alongside the Environment Agency, to 'spot check' the PTP efficiency at any time.

4.5 Recording

A record of all maintenance and management works will be kept by the operator of the package treatment plant (homeowner) and will be made available to the local authority or Environment Agency on request.

4.6 New Ownership

If the properties are sold the new operator (the owner or person responsible for the sewage treatment plant) will be informed in writing that a sewage discharge is in place and is related to a phosphorus mitigation strategy.

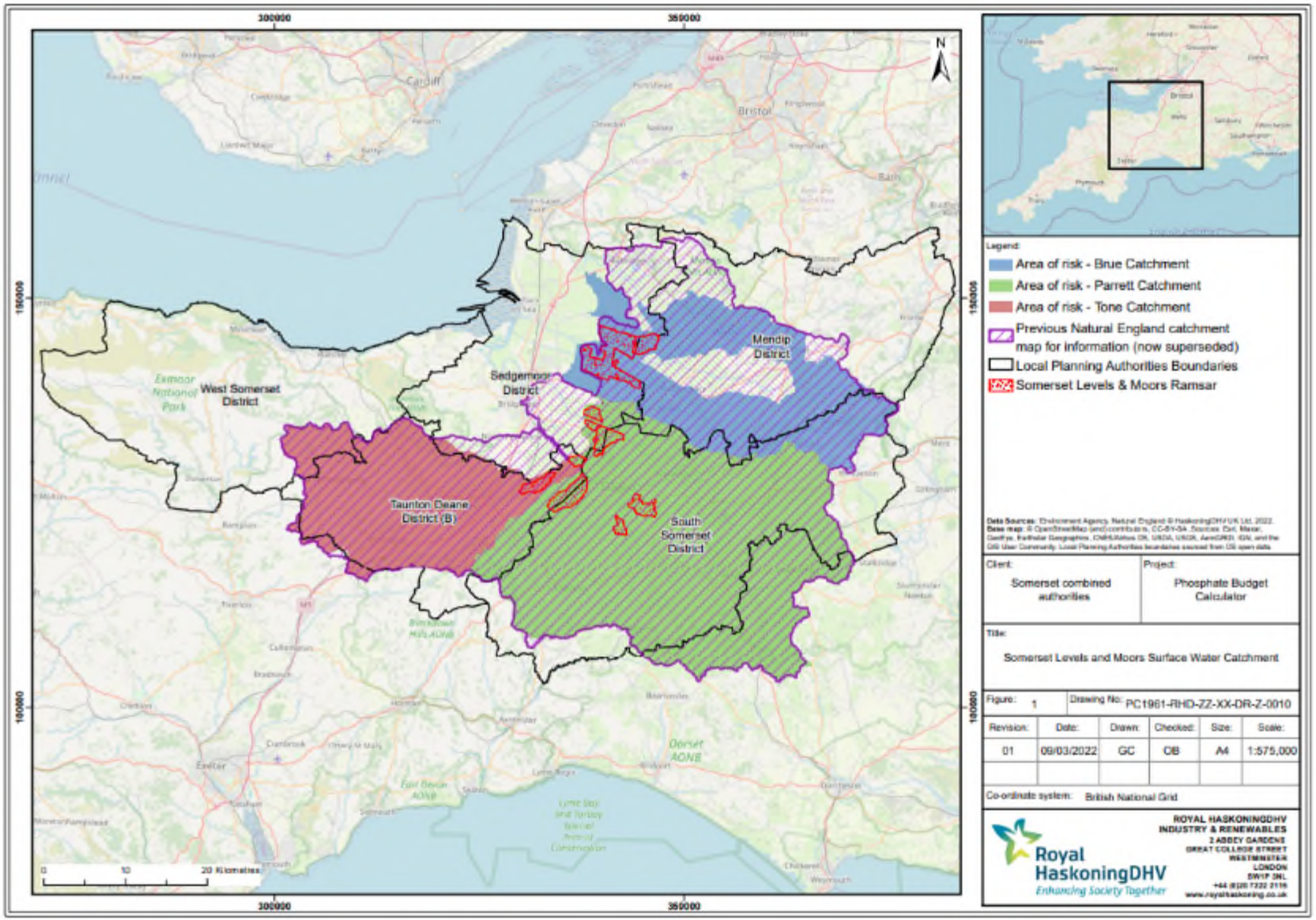
The details to be passed on will include:

- A description of the treatment plant and drainage system
- The location of the main parts of the treatment plant, drainage system and discharge point.
- Details of any changes made to the treatment plant and drainage system
- Details of how the treatment plant should be maintained and the maintenance manual, if relevant to the package treatment plant.
- The maintenance records
- Any communication with the local authority relevant to the treatment system.

5 APPENDICES

5.1 Appendix A – Somerset Levels and Moor Catchment Map

On following page


300000
350000
180000
N
Cardiff
Bristol
Bath
Exmoor National Park
West Somerset District
Sedgemoor District
Mendip District
Taunton Deane District (B)
South Somerset District
Dorset AONB
Blackdown Hills AONB
0
10
20 Kilometres
Legend:
Area of risk - Brue Catchment
Area of risk - Parrett Catchment
Area of risk - Tone Catchment
Previous Natural England catchment map for information (now superseded)
Local Planning Authorities Boundaries
Somerset Levels & Moors Ramsar
Client:
Somerset combined authorities
Project:
Phosphate Budget Calculator
Title:
Somerset Levels and Moors Surface Water Catchment
Figure: 1
Drawing No: PC1961-RHD-ZZ-XX-DR-Z-0010
Revision: 01
Date: 09/03/2022
Drawn: GC
Checked: OB
Size: A4
Scale: 1:575,000
Co-ordinate system: British National Grid
Royal HaskoningDHV
Enhancing Society Together
ROYAL HASKONINGDHV
INDUSTRY & RENEWABLES
2 ABBEY GARDENS
LONDON
SW1P 3NL

5.2 Appendix B – Bio Easy Flow Treatment Plant Certificate

Czech

PROTOCOL

ON THE ASSESSMENT OF PERFORMANCE OF THE PRODUCT

Registration No. 1017 – CPR – 11.381.333

In compliance with Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, and in compliance with Commission Delegated Regulation (EU) No 568/2014, this protocol is issued for the construction product:

Domestic wastewater treatment plant up to 50 equivalent inhabitants

Type series: BIO EASY FLOW (rotomoulding): 1RLM, 2RLM, 3RLM, 4RLM, 5RLM, 6RLM, 7RLM, 8RLM, 9RLM, 10RLM, 12RLM

BIO EASY FLOW (pipes spiro): 15RLM, 20RLM, 25RLM, 30RLM, 35RLM, 40RLM, 45RLM, 50RLM

BIO EASY FLOW (concrete): 4RLM, 5RLM, 6RLM, 7RLM, 8RLM, 9RLM, 10RLM, 12RLM, 15RLM, 20RLM, 25RLM, 30RLM, 35RLM, 40RLM, 45RLM, 50RLM

HABA RL Sp. z o.o. Sp. Komandytowa
Ul. Zdrojowa 51, 62-065 Grodzisk Wielkopolski, Poland
Company registration No.: 368989081

Place of production: see above

On the basis of testing, calculations, tabulated values and documentation within system 3 according to Annex V 1.4 CPR, TÜV SÜD Czech s.r.o. assessed the relevant characteristics of the product described in Annex ZA of the standard

EN 12566-3:2005 + A2:2013

The number of pages of this Protocol inclusive the title-page: 4

Essential characteristics	Performance			Harmonised technical specification
Treatment efficiency at tested organic daily load BOD_5 = 0,22 kg/day	BOD_5 COD SS N_{TOTAL} P_{TOTAL}	99,0 % 97,4 % 94,6 % 84,1 % 94,5 %	3,3 mgO_2/l 21,2 mgO_2/l 12,8 mg/l 5,6 mg/l 0,8 mg/l	EN 12566-3:2005+A2:2013
Watertightness (water test)	pass			EN 12566-3:2005+A2:2013
Load bearing capacity (calculation)	BIO EASY FLOW (rotomoulding): Backfill 1,0-1,5 m; WET 0,50-0,85 m acc. to type BIO EASY FLOW (pipes spiro): Backfill 1,6 m; WET 1,0 m BIO EASY FLOW (concrete) Backfill 0,0 m, WET 1,3-2,2 m acc. to type			EN 12566-3:2005+A2:2013
Durability (PE) Durability (concrete)	Pass (test methods: EN ISO 1133-1:2011, EN ISO 1183-1:2012, EN ISO 527-2:2012+Ap1:2013 PN-EN 1917:2004/AC:2009)			EN 12566-3:2005+A2:2013

Prague, date 03.08.2018

TÜV SÜD Czech s.r.o. NOTIFIED BODY 1017

on behalf of Notified Body 1017
Pavla Nerandžičová
Head of Certification Department

TÜV SÜD Czech s.r.o. • Novodvorská 994 • 142 21 Prague 4 • Czech Republic • certification@tuv-sud.cz

5.2.1 Bio Easy Flow Treatment Plant Internal Imagery

5.3 Appendix C – Royal Haskoning DHV Calculator

Stage 1 — Calculate Total Phosphorous (TP) in (Kg/year) derived from the development as a result of increased population

*Note: This calculation should only include the **additional** units resulting from the proposed development, including any development that will result in overnight accommodation. For land not currently in residential use, this will be the total units proposed by the development. However, for land already in residential use, this should only be the increase in units.*

1. Calculate the additional population	Value	Unit
Number of units as flats, care-home, residential institution proposed		dwellings
Average occupancy	1.65	persons/dwelling
Number of houses proposed	2	dwellings
Average occupancy	2.4	persons/dwelling
Number of **additional** rooms above 6 residents (sui generis) for houses in multiple occupation		dwellings
Average occupancy	1.65	persons/dwelling
Number of rooms in a hotel or guest house proposed		dwellings
Average occupancy	1.65	persons/dwelling
Number of weeks open per year (1-52)		Weeks
Average occupancy rate (1-100)		%
Total population increase generated by the development	**5**	**Persons**

Note: The national average occupancy rate of 2.4 persons per dwelling is used for in this model. The number of proposed units should be evidenced. In the case of hotel and guest house average occupancy rates should also be evidenced. Developments that do not fall within these classifications such contact the council and bespoke calculations may be used.

Please select how the sewage from the proposed development will be handled, noting that a development must be handled by either wastewater treatment plants or package treatment, and cannot be handled by both.

Is sewage to be handled by wastewater treatment works? **No**

Is sewage to be handled by Package Treatment plants? **Yes**

2a. TP budget that would exit the Wastewater Treatment Works (WwTW) after treatment

Note: If the sewage is to be treated by wastewater treatment plants then the user should select "Yes" in the list above. If package treatment plants are to be used instead, then the user should select "No" above.

This is the process of collecting wastewater from houses and guiding it, via the sewage network, to WwTW (also known as sewage works). The Phosphorous concentration of the influent is calculated by multiplying the number of people by the expected water usage per day. The Phosphorous concentration within the effluent is calculated by applying the discharge level of the appropriate WwTW. The Phosphorous loading is expressed in kg/year.

Calculate the wastewater volume generated	Value	Unit
Total population increase generated by the development	0	Persons
Water use per person	110	Litres/person/day
Wastewater volume generated by the development	**0**	**Litres/day**

2b. TP budget for Package Treatment Plants (PTPs)

Note: If the sewage is to be treated by package treatment plants then the user should select "Yes" in the list above. If wastewater treatment plants are to be used instead, then the user should select "No" above.

Packaged wastewater treatment plants are pre-manufactured treatment facilities used to treat wastewater in smaller communities or on individual properties. This concept is defined as decentralized wastewater treatment. The Phosphorous influent is calculated by multiplying the number of people by the expected loading per person. The Phosphorous effluent is calculated by applying the PTP reduction efficiency. The Phosphorous loading is expressed in kg/year.

Calculate TP load prior to treatment	Value	Unit
Total population increase generated by the development	5	Persons
Average Phosphorous loading per person	0.99	Kg/person/year
Total Phosphorous prior to treatment	**4.75**	**Kg/year**

Confirm receiving WwTW and permit limit	Value	Unit
Select the WwTW the development will connect to	Adscom	
WwTW discharge level	**5.00**	**mg/L**

Note: Please use the drop down lists to select the WwTW that the proposed development will be connected to. If the WwTW is not known, then please select 'Unknown' from the drop down list.

Calculate TP load after treatment	Value	Unit
Receiving PTP reduction efficiency	94	%
Total Phosphorous discharge after PTP treatment	0.29	Kg/year

Note: The user mist input the reduction efficiency of the PTP. The efficiency of the PTP used must be evidenced. The evidence should include the test result documents from the lab (in English) and/ or measured effluent concentrations from real world applications. If the efficiency is unknown then a precautionary value of 90% can be used.

Calculate the TP discharged by the WwTW	Value	Unit
TP discharged by WwTW	0	mg/day
TP discharged by WwTW	0.0000	Kg/day
Phosphorous loading from WwTW	**0.00**	**Kg/year**

Calculate TP load from development wastewater with on-site PTP	Value	Unit
PTP Total Phosphorous load	**0.29**	**Kg/year**

3.	Calculate the additional population TP load	Value	Unit
	Total Phosphorous load from additional population	**0.29**	**Kg/year**

Stage 2 Calculate existing (pre-development) TP from current land use of the development

Note: Where development sites include existing areas that are to be retained, these areas can be excluded from the calculations in both Stages 2 and 3.

1.	Total area of development site	Value	Unit
	Enter the total area of the development site	**0.323**	**Hectares**

2.	Identify current land uses of the development site	Value	Unit
	Identify the drainage type of the soil on site		
	Is the soil type free draining?	No	

Note: Identify the soil drainage type from the Viewer, and use the criteria table in the Help tab to identify if the soil is either permeable or impermeable

Urban development	0.323	Hectares
Mineral workings and quarries		Hectares
Open space / Greenfield		Hectares
Allotments and city farms		Hectares
Sports and leisure facilities		Hectares
Transport tracks and ways		Hectares
Transport terminals		Hectares
Cereals		Hectares
Dairy		Hectares
Cropping		Hectares
Horticulture		Hectares
Pig Farming		Hectares
Lowland Grazing / paddock		Hectares
Mixed livestock		Hectares
Poultry Farming		Hectares
General Arable		Hectares
Improved grass		Hectares
Unimproved grass		Hectares
Woodland (e.g. conifer, mixed, broad-leaved)		Hectares
shrub / heathland / bracken / bog		Hectares
freshwater marsh		Hectares
Meadow / semi natural grassland		Hectares
Sum total of land uses	**0.323**	**Hectares**

Note: The sum total of land uses must equal the development site area - the box will colour red if the areas do not match.

3.	Calculate TP from current land usage	Value	Unit
	TP load from current land usage	**0.27**	**Kg/year**

Stage 3 **Calculate TP for the proposed development**

Note: This section should include all land uses within the proposed development. Where the proposed scheme is to create new wetlands, woodlands, nature reserves, etc. within the development site area, then this should be included within this section. Any offsite mitigation, proposed by either the developer or the Council should not be included below, and should instead be inputted in Stage 5 (if mitigation is required).

1.	Total area of development site	Value	Unit
	Total area of the development site	**0.323**	**Hectares**

2.	Identify proposed land uses of the development site	Value	Unit
	Urban development	0.323	Hectares
	Open Space / Greenfield		Hectares
	Woodland		Hectares
	Nature reserve		Hectares
	Heathland / Bog		Hectares
	Allotment		Hectares
	Meadow/semi-natural grassland		Hectares
	Sports and Leisure facilities		Hectares

Note: The sum total of land uses must equal the development site area inputted in stage 1 - the box will colour red if the areas do not match. Wetland refers to specific wetland off a watercourse - for more information refer to the land use definitions in the help tab.

3.	Designed Wetlands / SuDS		
	Wetland / SuDS area		Hectares
	Banking coefficient		Kg/ha/year

Note: Please input the banking coefficient calculated for the designed wetland / SuDS. The calculated value should be justifiable.

	Sum total of land uses	**0.323**	**Hectares**

4.	Calculate TP from proposed land usage	Value	Unit
	TP load from proposed land usage	**0.27**	**Kg/year**

5.	Calculation of gross P loading	Value	Unit
	Gross TP load from current and proposed land usage	**0.29**	**Kg/year**

Note: this step is for illustrative purposes when iteratively creating mitigation land on-site

Stage 4 **Calculate the net change in Phosphorous load from the proposed development**

Note: This stage calculates the net change in total phosphorous load to the catchment from the proposed development. This is derived by calculating the difference between the total phosphorous load calculated for the proposed development (wastewater, urban area, open space etc.) and that for the existing land uses. The phosphorous budget for the site has been calculated under current and AMP7 WwTW permit levels.

		Current	AMP7		Summary	
					No. of dwellings	2
1.	Identify the Phosphorous load from additional population	Value	Value	Unit	PTP efficiency (%)	94
	Phosphorous loading from additional population	**0.29**	**0.29**	**Kg/year**		
2.	Calculate net change in Phosphorous load from land use change	Value	Value	Unit	TP current land use	0.27
	Phosphorous load from land use change	**0.00**	**0.00**	**Kg/year**	TP proposed land use	0.27
3.	Calculate phosphorous budget for the development site	Value	Value	Unit		
	Phosphorous budget for the site	**0.29**	**0.29**	**Kg/year**		
4.	Calculate phosphorous budget precautionary buffer	Value	Value	Unit		
	Buffer amount	20	20	%		
	Phosphorous precautionary buffer	**0.06**	**0.06**	**Kg/year**		

Note: The figures used throughout this model are based on scientific research, evidence and modelled catchments and represent the best available evidence. However, it is important that a precautionary buffer is used that recognises the uncertainty with these figures and ensures, with reasonable certainty, that there will be no adverse effect on site integrity. As such, a 20% precautionary buffer is built into the calculation.

5.	**Total phosphorous budget for the development site**	Value	Value	Unit		
	Total Phosphorous budget for the site	**0.34**	**0.34**	**Kg/year**		

Current WwTW Permit levels

Development will generate additional Phosphorous (Mitigation required) - Please progress to Stage 5

AMP7 WwTW Permit levels

Development will generate additional Phosphorous (Mitigation required) - Please progress to Stage 6

5.4 Appendix D – Deviation Reasoning

Natural England and the Local authorities have expressed preference for all phosphorus nutrient appraisals in Somerset, to be undertaken with the Royal HaskoningDHV Calculator and deviation should only be undertaken if sufficient evidence can be provided for the deviation and assumptions of the deviation.

The following content of this appendix represents the reasoning behind the deviation provided in the report and Appendix E provides the background research undertaken to date.

Export Coefficient

The Royal HaskoningDHV Calculator does not publish the source of its reference material.

Reference material was confirmed verbally by Natural England and local authority representatives during Joint Somerset Council's Presentations and Agent Panel meetings to be primarily based on the research paper:

- Hammond, J. and White, P. (2006). Updating the Estimate of the Source of Phosphorus in UK Waters: Defra funded project WT0701CSF.

This paper was a desk-based study to identify current sources of phosphorus loads to UK waters.

The paper discusses phosphorus loading in terms of "*export coefficients*"; specific to the paper, an export coefficient is defined as "*the total annual load of phosphorus delivered from a given habitat to any given sampling location within the habitat's catchment*".

The paper is very detailed and thorough in its research and delivery and frequently admits that the export coefficients are very hard to generalise for habitats. Reference text:

> *"Since export coefficients seek to integrate all the physical processes operating on P fluxes within the catchment, they do not afford much insight to the complex biological or physical dynamics of P fluxes in the environment*."
>
> *"Values for export coefficients for different land use categories differ widely. In this report we have categorised land use using the LCM2000 classification scheme (Table 02.01), but export coefficients are available for other land use classification schemes, such as CORINE (Table 01.02) and ITE (Table 01.03).*
>
> *Example Broadleaf Woodland*
>
> - *LCM* *0.02 to 0.07 Kg TP/ha/yr*
> - *CORINE* *0.26 ± 0.14 (0.12 to 0.40) Kg TP/ha/yr*
> - *ITE* *0.02 Kg TP/ha/yr"*
>
> *"It is evident that many factors influence the value of an export coefficient for a particular land use category. These factors include, for example, vegetation or crop*

specific management practices, the topology of the landscape, hydrological connectivity and the timing, amount, and intensity of rainfall."

The export coefficients for sites can vary significantly and can only provide a general assessment if carried through into the Royal HaskoningDHV calculator which states on the information page:

"The tool has been designed so that the user is able to update the data and methods in light of any new research or understanding"

"The information supplied in this tool is for guidance purposes only and is not intended to provide an exact budget calculation due to the limitations and assumptions of the model. The user is responsible for ensuring the accuracy and completeness of all data entered, be it manually or automatically, and used by this tool."

The Royal HaskoningDHV Calculator uses export coefficients and takes no account of the actual absorption of any given habitat or the plants within or any management practices applied to the land. This assumes that all land within a certain habitat classification, regardless of nutrient load, composition and environment will generate the same concentration of run-off emission.

The woodland within the Royal HaskoningDHV Calculator is not a traditional orchard with cropping. Woodlands have a natural absorption of phosphorus within the biomass of the trees and shrubs but there is generally no regular crop harvesting and therefore no additional removal of phosphorus. A traditional orchard includes crop harvesting and wood pruning which will result in phosphorus removal both within the fruit and the cleared biomass (branches). Because of this management and fruiting behaviour there is consideration that orchards can be planted and managed to absorb and remove large phosphorus loads from the environment.

Absorption – Soil Type

Phosphorous can and will be naturally absorbed by the soils of any habitat, the rate of which will depend on many factors including mineral content, particle size and hydrology. This deviation does not consider the soil variations and does not consider the soil absorption.

Absorption – Tree Type (evergreen vs broadleaf)

Insufficient information is currently available to prove the difference, scientifically and statistically, in phosphorus absorption between evergreen and broadleaf trees although *ad hoc* and unverified figures suggest that evergreen phosphorus absorption is approximately half that of broadleaf trees per year; 0.6g P/yr evergreen and 1.1g P/yr broadleaf. As this data cannot yet be proved to be statistically valid it has not been included in the absorption assessment.

Absorption – Fruiting Tree (Above Ground Biomass)

There is a wide variety of research on tree biomass and use of phosphorus. This research is ongoing.

Currently the formula used to determine the above ground biomass of broadleaf trees is:

Log (Biomass) = 1.711 x Log (diameter at Breast Height in cm)
+ 0.680 x Log (Height in cm) – 0.918 *(Charkraborty T et al, 2016)*

Following the "precautionary principle" the smallest orchard tree at planting will always be used to determine the orchard biomass. This is currently a tree 100cm tall with a girth of 10cm (3.2cm diameter); equating to 20.24kg of biomass.

Current research values suggest that on nutrient rich soils the absorption of phosphorus by broadleaf trees is between 0.5 to 0.8mg per gram of biomass which drops to 0.12 to 0.21mg per gram of biomass on nutrient poor soils. These values are closely matched in the *Charkraborty T et al, 2016* on beech trees.

Following the "precautionary principle" lowest biomass absorption of 0.12mg per gram of biomass is used and this would suggest that the smallest orchard tree at planting (20.24kg) would start absorbing 0.0024kgP/yr at the point of planting.

This would equate to 0.0462kgP/yr across all 19 trees.

The above does not include any additional phosphorus removal underground biomass (fine and course roots) or extrapolation of the information to cover the 80-to-100-year lifespan of the orchard.

After 30 years the apple trees will be 300cm tall with a girth of 70cm (22.3cm diameter); equating to 1,184.11kg of biomass. This would potentially be drawing 0.1421 kgP/yr or 2.7kgP/yr across the 19 trees.

Absorption – Non-Fruiting Tree (Above Ground Biomass)

UK conservation mix hedgerow plant comprising a mix of Blackthorn *Prunus spinosa*, Dog rose *Rosan canina*, Field rose *Rosa arvensis*, Common dogwood *Cornus sanguinea*, Field Maple *Acer campestre*, Spindle *Euonymous europeaus*, Hawthorn Crataegus *monogyna* and Cherry plum *Prunus cerasifera* has potential to absorb phosphorus within its biomass.

Using the same formula as "Fruiting Tree (Above Ground Biomass)" and following the "precautionary principle" the biomass absorption can be calculated for hedgerows. Following "precautionary principles" only a single line of 60cm whips (3 plants per m) should be considered at planting stage and using the lowest biomass absorption of 0.12mg per gram of biomass it suggests that a planted hedgerow biomass per m would be 0.255kg (0.085kg per whip x 3 whips) and would start absorbing 0.00003kgP/yr at the point of planting.

After 10 years the hedgerow whips would be a minimum of 1m in height with a diameter of 3cm. At this size the biomass per m would be would to 54.38kg and would potentially be drawing 0.0065kgP/yr.

The above does not include any additional phosphorus removal by underground biomass (fine and course roots).

Absorption – Fruiting Tree (fruit biomass)

Due to the commercial interest in fruits in the UK and across the world there are multiple research papers, land management guides and other peer reviewed sources to provide a statistically valid assessment of the potential cropping rate of fruiting trees with some sources being specific about cultivar requirements.

When reviewing the information sources all references where traced where practical to do so to ensure that the primary source had not been mis-represented. This was undertaken regardless of the peer-review status of the document.

Many sources considered species and cultivars that were not suitable for the United Kingdom and specifically Somerset. These fruit types and cultivars were removed from the listing of potential fruiting trees.

Table 5. Fruit Tree Values

Type / variety	Years to cropping		Pollinator tree	Phosphorus absorption in annual fruit crop per tree (kg/yr)			
	Min	Max		Av.	Dev.	Min	Max
Apples	2	10	Yes	0.0627	0.0123	0.0503	0.0750
Braeburn (apple)	2	7	Yes	0.0613	0.0127	0.0487	0.0740
Cox (apple)	2	7	Yes	0.0840	0.0153	0.0687	0.0993
Fuji (apple)	2	10	Yes	0.0647	0.0160	0.0487	0.0807
Royal Gala (apple)	2	10	Yes	0.0653	0.0093	0.0560	0.0747
Granny Smith (apple)	4	7	Yes	0.0167	0.0053	0.0113	0.0220
Golden Delicious (apple)	2	10	Yes	0.0840	0.0153	0.0687	0.0993
Apricots	6	7	No	0.0039	0.0004	0.0035	0.0043
Cherries, sweet	6	7	Yes	0.0021	0.0003	0.0018	0.0023
Figs	5	6	No	0.0005	0.0001	0.0004	0.0006
Peaches and nectarines	4	5	No	0.0058	0.0007	0.0051	0.0064
Pears	5	7	Yes	0.0015	0.0003	0.0013	0.0018
Plums and Damsons	3	5	Yes	0.0413	0.0016	0.0397	0.0429
Medlar	3	5	No	0.0065	0.0050	0.0060	0.0070
Quince	3	5	No	0.0030	0.0006	0.0024	0.0035
Chestnuts, sweet	5	7	Yes	0.0143	0.0050	0.0093	0.0193
Hazelnuts	5	6	Yes	0.0199	0.0121	0.0078	0.0319
Walnuts	10	12	No	0.2434	0.0854	0.1580	0.3287
Average				**0.0434**	**0.0107**	**0.0326**	**0.0541**

See Appendix E for reference list.

For the calculations a precautionary principle, as enshrined in *Article 191(2) of the Treaty on the functioning of the European Union* and defined in the *1992 Rio Declaration on Environment and Development,* has been applied to the calculations. The principle is applied to reduce the risk of non-compliance with the calculation conclusions and to improve certainty of result; only the minimum figures for absorption have been used.

This provides sufficient buffer within the calculations to accommodate years when the fruiting and cropping may be negatively affected by climate events. The absorption values that have been used are the minimum calculated:

Table 6. Minimum Values for Trees and Cultivars.

Type	Minimum absorption values in fruits
Fruits	
Apples	0.0503
Braeburn (apple)	0.0487
Cox (apple)	0.0687
Fuji (apple)	0.0487
Royal Gala (apple)	0.0560
Granny Smith (apple)	0.0113
Golden Delicious (apple)	0.0687
Apricots	0.0035
Cherries, sweet	0.0018
Figs	0.0004
Peaches and nectarines	0.0051
Pears	0.0013
Plums and Damsons	0.0397
Medlar	0.0060
Quince	0.0024
Nuts	
Chestnuts	0.0093
Hazelnuts	0.0078
Walnuts	0.1580

The above figures are based on standard fruit trees with a semi-vigorous and vigorous root stock; it does not take account of the use of bush fruit trees which have a higher cropping rate which can be almost double that of a standard tree.

The calculations do not include any extrapolation of the information to cover the 80-to-100-year lifespan of the orchard or inclusion of “mast” years.

Tree Selection

As traditional orchards can contain a variety of fruiting trees and it is considered that planting of a single type or variety of tree, if utilised for any single proposal or in combination with other nature-based solutions across Somerset, would lead to unusable fruit gluts or biodiversity depletion through mono-crop application tree selection is based on Phosphorus absorption per tree and site diversification for crop, pollinators and other wildlife.

Absorption – Fruiting Tree (Post-harvest)

Ad hoc and unverified figures suggest that, on average, a fruiting tree will absorb 16.07 g (±1.10) after the crop harvest in preparation for the winter and will return 10.00g (±1.10) to the ground from leaf drop in autumn; tree retaining c.6g. As this data cannot yet be proved to be statistically valid it has not been included in the absorption assessment.

Grassland Management – Nutrient Input

In most small sites the management of the grassland will be through mechanised cutting with all arisings being left on site; neither adding nor removing nutrients.

However, as mitigation sites must be considered for a period of 80-to-100 years the addition of nutrient cannot be ruled out and therefore the "precautionary principle" must be applied.

As traditional orchards are usually grazed by livestock it is proposed that a livestock focused grass management be included for calculations at a stocking rate of 0.4 livestock units per hectare per year.

It has been advised by Natural England to use the lowland grazing coefficient (taken from Phosphorous Budget Calculator v3.1) to represent the input from this type of management. The coefficient is 0.12kgP/yr/ha on free draining soils and 0.22kgP/yr/ha on poor or impeded drainage soils.

The calculated value is taken away from the absorption value of the orchard.

5.5 Appendix E – Reference List

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Appendix E – NE Comments for Previous Strategy (Carlisle)

From: Nathan Morris <Nathan.Morris@carlisle.gov.uk>
Sent: 07 Jan 2025 09:15:29
To: livedms_myemails@carlisle.gov.uk
Cc:
Subject: FW: Appn Ref; 24/0089 Land between 36 and 44 Broomfallen Road, Scotby, Carlisle CA4 8DE
Attachments:

From: Hayes, Alex <Alexandra.Hayes@naturalengland.org.uk>
Sent: Thursday, January 2, 2025 12:07 PM
To: Barbara Percival <Barbara.Percival@carlisle.gov.uk>
Subject: RE: Appn Ref; 24/0089 Land between 36 and 44 Broomfallen Road, Scotby, Carlisle CA4 8DE

Dear Barbara,

Thank you for re-consulting Natural England on this application.

To mitigate the 1.39 Kg TP/year pre-2030 and 0.22 Kg TP/year post-2030, the applicant has proposed a number of mitigation measures – a soakaway, a septic tank upgrade, and planting apple trees on the drainage field of the PTP. This is sufficient for the development to be Nutrient Neutral and for there to be no likely significant effect on the River Eden SAC.

It is recommended that a pre-commencement planning condition is included in any planning permission requiring the installed PTP is the same model as assessed in the calculator, and details of the management and maintenance of the PTP, and how this will be funded for the lifetime of the development. At the end of its design life, the PTP should be replaced with a similar or better performing PTP or alternative solution that maintains nutrient neutrality.

Kind regards, Alex

Alex Hayes
Business Management Higher Officer
Plans For Places Team
Cumbria Area Team, Natural England
Ghyll Mount, Business Park, Gillan Way, Penrith CA11 9BP

www.gov.uk/natural-england

Natural England: Building partnerships for Nature's recovery

From: Barbara Percival <Barbara.Percival@Cumberland.gov.uk>
Sent: 17 December 2024 15:06
To: Hayes, Alex <Alexandra.Hayes@naturalengland.org.uk>
Subject: Appn Ref; 24/0089 Land between 36 and 44 Broomfallen Road, Scotby, Carlisle CA4 8DE

Good afternoon Alex

I refer to your email of the 12th December and attach for your further comments a revised NN Mitigation Strategy.

Hope you have a lovely Christmas.

Kind regards

Barbara Percival MSc
(Working days Monday to Wednesday)
Planning Officer | Planning
Inclusive Growth and Placemaking | Cumberland Council
Civic Centre | Rickergate | Carlisle | CA3 8QG

T. 01228 817109
E. Barbara.Percival@cumberland.gov.uk
cumberland.gov.uk