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Weetwood
Development • Planning • Environment

The Green, Rossett

Surface Water Drainage Phosphorus Removal

Briefing Note

Project ref:	6550 – The Green, Holt Road, Rossett, Wrexham, LL12 0DS
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Executive Summary

1. The annual post development foul phosphate load is 0.07 kg/year. This is based on using a Marsh Treatment system, per specification undertaken by Apex Architecture and Design Ltd and shown on a drawing by HWA (Structural Engineers) Ltd (ref: 19994-12, March 2025). Product information is included in Annex 4, showing the 0.2 mg TP/l P permit rating which is entered as 'user defined.'

2. The post development surface water total Phosphorus loading is 0.15 kg per year. Using a 66% reduction factor based on use of rain gardens and a gravel filled soakaways (Annex 2), this reduces the post development surface water phosphate load to 0.05 kg /year.

3. Total post development Phosphorus loading is therefore 0.12 kg/year which provides a modest improvement over the agreed pre-development load of 0.14 kg/year, therefore no mitigation is required.

Project Background

4. Weetwood Services Ltd ('Weetwood') has been instructed by Apex Architecture and Design Ltd (on behalf of Hengari Ltd) to prepare a Briefing Note in association with the proposed redevelopment of The Green, Holt Road, Rossett ("the site") for residential use.

5. Weetwood were appointed to review and provide technical support to address nutrient neutrality with particular reference to phosphate reduction for post-development surface water runoff. 'Activity A' of Weetwood's fee proposal (reference 6550/2025-10-14/GW/FP2) was to produce a Briefing Note to summarise the findings and 'Activity B' was to produce an indicative surface water drainage design in order to submit a pre-application SAB enquiry to Wrexham County Borough Council.

6. The pre-development phosphate baseline figure agreed with Wrexham County Borough Council is 0.14 kg/year.

7. The purpose of this Briefing Note is to record the findings of the above. It is not a substitute for a 'Drainage Statement' or equivalent document as is typically produced for a planning application.

Ground Conditions

8. Ground conditions were found to comprise of varying thickness of made ground associated with the site's present development, underlain by granular drift deposits comprising sands and gravels.

9. Infiltration testing has been undertaken by Sub Surface North West Ltd in accordance with the guidelines in BRE365 in November 2024. The lowest infiltration rate of 1.81×10^{-4} m/s (0.65 m/hr) was used for design of all infiltration structures.

10. Groundwater monitoring was undertaken from July 2024 to November 2024. Groundwater depth was found to seasonally vary from 3 m below ground level to 2 m below ground level. Maximum groundwater levels when equating recorded depths to the topographical survey was recorded to be 13.11 m AOD.

Principles of Phosphorus Removal from Surface Water Drainage Components for Residential Developments

11. The principles of Phosphorus removal from surface water runoff for residential developments are set out in the document CIRIA C808[1]. The constraints of this guidance are outlined in section 1.3 *"there is currently a lack of UK data to provide definitive evidence for conclusive reduction figures."*

12. The principles of Phosphorus capture and removal from surface water runoff for residential developments is stated in CIRIA C808, 2.2 can be summarised as

    a. Infiltrate where feasible and where no risk of pollution of groundwater

    b. Remove sediment

    c. Treat with actively growing vegetation

    d. Include Phosphorus specific treatment media

Previous Surface Water Drainage Design

13. The previous surface water drainage design was produced by HWA (Structural Engineers) Ltd (ref: 19994-12, March 2025). This shows paved areas infiltrating runoff directly to ground via permeable paving and roof drainage infiltrating to ground through geo-cellular storage crates.

14. Whilst permeable paving may provide some particulate phosphorus removal (CIRIA C808, Table 2.20) it does not provide adequate treatment to avoid the need for additional mitigation. It should also be noted that the design does not include sediment capture, and that permeable paving was proposed at gradients greater than 1:20 where it is deemed to no longer function.

Nutrient Budget Calculator Inputs

15. A plot of the Nutrient Budget Calculator for Special Areas of Conservation is included in Annex 3.

16. For Stage 2 the soil has been set to freely draining (as infiltration has been proved to be feasible by testing) and rainfall has been set to be 850-900 mm/year which is the average annual rainfall figure for the UK (default value). The existing areas are taken as 0.110 of commercial industrial land (area associated with current site use) and 0.080 hectares of greenspace.

17. For Stage 3 the post development areas for commercial/industrial land has been reduced to 0.000 hectares. Residential land is calculate to be 0.083 hectares based on the positively drained impermeable area used for the drainage calculations and 0.125 hectares of greenspace.

18. For Stage 3S:

    - The proposed surface water drainage includes linear rain gardens for the access road drainage, which through the use of a geosynthetic membrane and engineered soils and vegetation would provide sediment and pollutant removal, before infiltrating runoff to ground via a gravel layer under the inspection pipe. CIRIA C808, Table 2.20 deems bioretention zones to have a 44% total Phosphorus capture/removal rate.

    - The individual property driveways and roofs drain to gravel filled soakaway chambers via a silt trap located in each properties back garden. CIRIA C808, Table 2.20 deems Filter Strips, which would be assumed to have an equivalent phosphorus removal capacity, to have a 22% total Phosphorus capture/removal rate.

    - For the purposes of the Nutrient Budget Calculator spreadsheet the above is assumed to be a multi-stage treatment train with a total Phosphorus removal potential of 66%, this being the 44% total Phosphorus capture/removal rate for bioretention zones and 22% total Phosphorus capture/removal rate for gravel filled soakaway combined.

[1] Using SuDS to reduce Phosphorus in surface water runoff, CIRIA Report C808, Updated 2024

Methods of removal not considered feasible

19. Retention basins and reed beds, which provide higher percentage removal potential including dissolved phosphorus, has been discounted due to the nature of the site layout.

20. Stormwater Filters were considered although the only specific proprietary phosphorus removal filter available on the UK market is the Spel Filter. The standard unit is 1.6m deep and 1.8m diameter and designed for high use application. Unfortunately, due to the required depth, this would not allow for a 1 metre buffer zone between recorded groundwater levels and the underside of soakaway as per the requirements of C808. Raising site levels to the extent required is not considered feasible. There is also the issue that long term specialist maintenance (i.e. replacement of filters within the chamber) would be required which would likely not be feasible for a residential development.

21. Phosphorus specific treatment media was also considered although not required for neutrality they may be considered to provide further enhancement if requested. No product appears to be widely available or readily used on the UK market at present. The recommendation for this in C808 appears to be based on research done by;

    - Bodus and McDonald *'End-of-pipe filter to reduce phosphorus concentrations from the effluent of green infrastructure underdrains'* which recommends a mixture of gravel (40%), sand (30%), coarse iron filings (10%), and activated alumina beads (20%),
    - Svedaite, Baltakys and Dambrauskas *"Opoka as a Natural Material for Phosphorus Removal: Properties and Applications"* which uses a sedimentary rock called Opoka, which is sold under the brand name 'Polonite' as a type of filter media.

22. Whilst neither product is widely available or used in the UK, it is understood that Polonite is available from Polonite Noridc, based in Sweden. If a higher phosphorus removal rate is required (Polonite states that this is typically 70–90% removal rate) the use of Polonite could be used in place of gravel in the soakaway manholes and rain gardens. The manufacturer states that the product typically has a lifespan of 5–10 years.

SAB Approval

23. Planning policy requires that all development should incorporate sustainable drainage systems (SuDS) to appropriate operational standards and with maintenance arrangements in place unless there is clear evidence that this would be inappropriate.

24. The responsibility within the local authority for ensuring that SuDS are integrated into new developments sits with the SuDS Approving Body (SAB). Given that the proposed development will include more than one house, SAB approval of the surface water drainage strategy will be required prior to construction.

25. The approval of SuDS for new development by the SAB is independent of the planning process. SAB approval requires submission of a suite of detailed design surface water drainage and landscape drawings, hydraulic calculations and relevant supporting information. Given this requirement typically SAB approval is sought post-planning once planning permission is approved and the layout is fixed by that permission. There is little incentive to gain SAB approval for a site that does not have planning permission, particularly given that changing the site layout would affect the drainage design, effectively rendering the SAB approval void. Pre-SAB applications are typically made at pre-planning stage.

26. SAB applications should demonstrate that the statutory standards can in principle be satisfied and that, where feasible, SuDS have been incorporated within the design of the proposed scheme. Specifically for this scheme it is unlikely SAB approval would be problematic given;
    - Standard S1 - Infiltration drainage confirmed to be feasible and used on site.
    - Standard S2 - Infiltration drainage confirmed to be feasible and used on site.
    - Standard S3. - It is proposed to incorporate linear rain gardens and gravel filled soakaways
    - Standard S4 - The proposals include raingardens and landscaped areas/tress which will provide amenity benefits to the site.
    - Standard S5 – Raingardens and landscaped areas/trees will utilise native and non-native vegetation to support pollinators which will provide bio-diversity benefits to the site.

- Standard S6 - Outline maintenance arrangement provided below. Full maintenance details would be provided in SUDS Maintenance Schedule as part of the SAB Approval.

27. A Pre-SAB Enquiry will be submitted in conjunction with planning, Full SAB Approval will be sought post planning.

Adoption and Maintenance of SuDS

28. SuDS elements which serve one property will be the responsibility of the owner of the property.

29. SuDS elements which serve more than one property may be adopted and maintained by the SAB, in accordance with the Statutory Standards for SuDS, or may be maintained under management agreement.

30. An indicative maintenance schedule is presented in Table 1.

Table 1: Maintenance Requirements

Schedule	Required action	Frequency
Infiltration Manhole / Silt Trap		
Remedial action	Replace gravel fill, if performance deteriorates or failure occurs	As required but likely to be > 30 years
	Replacement of clogged geotextile (will require reconstruction)	
Monitoring	Inspect inlet/outlet to ensure that they are in good condition and operating as designed	Annually
	Check infiltration manhole to ensure emptying is occurring	
Occasional maintenance	Empty silt trap	As required but likely to be > 10 years
Rain Gardens		
Regular maintenance	Remove sediments, litter, surface debris and weeds	Yearly
	Open inspection chamber lids and note any sediment accumulation if poor operation suspected or following large storm	As required but likely to be > 5 years
	Replace any plants, to maintain planting density.	
Occasional maintenance	Infill any holes or scour in the filter, improve erosion protection if required	
	CCTV camera survey of perforated pipe within rain garden to check for silt accumulation and any signs of poor operation	
Remedial actions	Remove and replace filter and vegetation above	As required but likely to be > 20 years

Conclusion

31. With reference to the Nutrient Budget Calculator for Special Areas of Conservation (Annex 1)

- The Nutrient Budget Calculator for Special Areas of Conservation shows that the annual post development foul phosphate load is 0.07 kg/year. This is based on using a Marsh Treatment system, per specification undertaken by Apex Architecture and Design Ltd and shown on a drawing by HWA (Structural Engineers) Ltd (ref: 19994-12, March 2025). Product information is included in Annex 4, showing the 0.2 mg TP/l P permit rating which is entered as 'user defined.
- The Nutrient Budget Calculator for Special Areas of Conservation shows the post development surface water total Phosphorus loading is 0.15 kg per year. Using a 66% reduction factor based on use of rain gardens and a gravel filled soakaways (Annex 2), this reduces the post development surface water phosphate load to 0.05 kg /year.
- The Nutrient Budget Calculator for Special Areas of Conservation shows the total post development Phosphorus loading is therefore 0.12 kg/year which provides a modest improvement over the agreed pre-development load of 0.14 kg/year, therefore no mitigation is required.

This document has been prepared solely as a Briefing Note for Hengari Ltd and is confidential to Hengari Ltd. Weetwood Services Ltd accepts no responsibility or liability for any use that is made of this document other than by Hengari Ltd for the purposes for which it was originally commissioned and prepared.

ANNEX 1

Nutrient Budget Calculator

Nutrient Budget Calculator for Special Areas of Conservation (SACs) in Wales

This calculator was created by Ricardo Energy and Environment and Arup for Welsh Government.

This is the English version of the calculator. This calculator is also available in Welsh/Cymraeg.

This calculator contains 6 worksheets with 11 tables in total.

This is the instructions cover sheet. It tells you how to use the calculator and gives an overview of each worksheet.

You can move between worksheets using the tabs at the bottom of the page.

If you use screen reading software, you can use 'Ctrl' + 'Page Down' keys to move between the tabs.

If you use a keyboard only, to open any link in this cover sheet first select the cell with the link and then press the 'Shift' + 'F10' keys or the 'Fn' + the 'Menu' keys, then press the letter 'O' twice to highlight 'Open Hyperlink' and press 'Enter'.

If you use a keyboard only, access dropdown lists by clicking the dropdown arrow or pressing the 'Alt' + 'Down' keys when the cell is selected.

Table of Contents

Topic of each worksheet	Link to each worksheet
Stage 1: additional nutrient loading from wastewater	Stage 1: additional nutrient loading from wastewater
Stage 2: nutrient loading from pre-existing landcovers	Stage 2: nutrient loading from pre-existing landcovers
Stage 3: nutrient loading from new landcovers	Stage 3: nutrient loading from new landcovers
Stage 3S: nutrient load removed through sustainable urban drainage systems (SuDS)	Stage 3S: nutrient load removed through SuDS
Staoe 4: final nutrient budget calculation	Stage 4: final nutrient budget calculation

General information about the calculator

This calculator helps you calculate a nutrient budget for a new development within one of the nine Special Areas of Conservation (SACs) within Wales.

The development categories include: residential; commercial; tourism; leisure and public service infrastructure. The planning permission use classes have been categorised into each development category. These can be found in the guidance that accompanies this calculator.

The nutrient budget for a site is calculated in 4 key stages with an additional optional stage in which information about the SuDS features on the site can be entered. Each stage is implemented in worksheets 2 to 6 of this calculator.

The instructions for completing each stage of the nutrient budget methodology are shown in cell A2 of each worksheet. Additional instructions may also be in cell A3.

Each worksheet is connected through a set of formulas which calculate the final nutrient budget. The formulas use a set of lookup tables to find relevant values to determine the nutrient loading at each stage.

Before a nutrient budget can be completed using the methodology, certain site-specific details for the development site need to be determined and entered into Stage 1, Stage 2, Stage 3, and Stage 3S (if applicable).

The total phosphorus (TP) budget and total nitrogen (TN) generated is calculated automatically once all required inputs have been entered into Stage 1, Stage 2, Stage 3, and Stage 3S (if applicable). The calculation involves adding the values from Stage 1 and the result of Stage 3 subtract Stage 3S (if applicable), and then subtracting the values from the Stage 2. A 20% precautionary buffer is then added to the result. This calculation is completed automatically in the Stage 4 worksheet. This equation can be summarised as:

(Stage 1 - Stage 2 + (Stage 3 - Stage 3S)) * 1.2 = Stage 4

The pre-populated values in this calculator have been identified through extensive research and modelling. The values are based on the best available evidence and are suitably precautionary to account for any uncertainty. This nutrient budget calculator can be used as supporting evidence for a Habitat Regulations Assessment (HRA). Specifically, this calculator can be used within an appropriate assessment to assess the likely significant effects of a proposal on the integrity of the site and its conservation objectives. It is highly unadvisable to edit the values in this tool without a sufficient evidence base to justify any changes.

When using this tool, it is recommended that you save a new copy of this workbook for each nutrient budget calculation, in order to retain a default blank copy. It may also be useful to open two calculators with one showing the instructions and one showing the calculator.

Notes on Stage 1: additional nutrient loading from wastewater

The Stage 1 Worksheet contains 2 tables that are used to calculate the nutrient load associated with the additional wastewater generated as a result of the development.

The first table under the heading 'Wastewater load input data' requires you to enter key information about the development and the water infrastructure. This table contains a mix of user inputs and values that are calculated automatically depending on the user inputs.

The first table contains a postcode search function that allows you to find the appropriate LPA and the rainfall for the site if a valid postcode is entered that is within the SAC catchment. Entering the postcode for the site, or the nearest postcode, will generate site specific information. This automatically generated information can be used instead of manually entering the relevant data. However it is your responsibility to confirm this information is correct.

The amount of wastewater generated needs to be calculated using the following:
- the SAC relevant to the development
- project type (residential, commercial, tourism, public service infrastructure or leisure)
- number of additional dwellings/units being created
- the local planning authority (LPA)
- an average occupancy rate (if applicable)
- number of people/customers/employees per unit
- a per capita water usage figure per person/customer/employee
- the number of customers/users & employees (if applicable)
- the percentage of customers/users & employees from outside the catchment (if applicable)
- the water usage per customer/user (if applicable)

You must select the Special Area of Conservation (SAC) for the calculator to function correctly.

You must select the project type because it determines which inputs are required to calculate the amount of wastewater generated. The project types are representative of the planning permission uses classes. The appropriate project type for each planning permission use class can be found in the guidance that accompanies this calculator.

The average occupancy rate for residential developments is dependent on the postcode entered or the LPA selected. The default water usage values is preset in the worksheet. The default setting for the average occupancy rate is preset in the worksheet and automatically generated dependant on the LPA. You can change this value if there is sufficient evidence that the development will be different to the national average. The per capita water usage is also present in the worksheet, this value should remain unchanged unless other efficiency measures are used. The number of new developments is not preset and must be a whole number.

You must select the wastewater treatment works (WwTW) that will receive the wastewater from the development. If you are unsure which WwTW will receive the wastewater, please obtain this information from Dwr Cymru/Welsh Water in order to complete this calculator. If connecting to a sewerage network is unfeasible and a septic tank or package treatment plant is being used, please select the appropriate option.

The WwTW are correct at the time of publication but may be subject to change in the future. If required, these values will be updated at a later date accordingly.

If you are using a septic tank or package treatment plant and the total nitrogen (TN) or total phosphorus (TP) final effluent concentrations are specified by the manufacturer, select 'Septic Tank user defined' or 'Package Treatment Plant user defined' and enter the manufacturer specified value in the cell where prompted (in mg/l).

The second table under the heading 'Final calculation of nutrient load from wastewater' contains the calculation of the nutrient load from additional wastewater generated by the development.

Notes on Stage 2: nutrient loading from pre-existing landcovers

The Stage 2 Worksheet contains 2 tables that are used for calculating the annual nutrient load from existing (pre-development) landcovers within the redline boundary of the development.

The first table under the heading 'Physical characteristics' requires user inputs. You must select the predominant soil drainage present within the redline boundary of the site. The rainfall value will be automatically generated if the user has entered a valid postcode in 'Stage 1'. You must select whether the rainfall value is correct. If the rainfall value is not correct, or if a valid postcode has not been entered, you must select the rainfall value from the dropdown list. The sources of the soil drainage type and the rainfall can be found in the table under the heading 'Sources of information required for Stage 2' that follows this text.

The second table under the heading 'Pre-existing landcovers' requires user inputs. You must select the most appropriate landcovers from a dropdown list of 18 landcover types to represent the landcover present on the site before the development. You must also enter the area of each landcover in hectares. The dropdown list contains 10 agricultural landcover types and 8 non-agricultural landcover types to represent the landcovers present on the site before development. The descriptions of each landcover type can be found in the guidance that accompanies this calculator. You must determine which landcover types are present within the redline boundary of the development before completing this tool. If there is a landcover within the development area that is not in the dropdown list please select the most similar landcover type.

Sources of information required for Stage 2

Description of information	Link to source of information
Soil drainage: The drainage associated with the predominant soil type within the development site can be found using the Soilscapes Map.	Soilscapes
Rainfall: The annual average rainfall that the development will receive can be found using the National River Flow Archive. You must first select any flow gauging station. You must navigate to the 'Catchment info' tab and select the spatial data type to view as 'Rainfall'. You can scroll around the map to find your development. Clicking the link will take the user to the 'Usk at Chainbridge' station.	National River Flow Archive (Usk at Chainbridge)

Notes on Stage 3: nutrient loading from new landcovers

The Stage 3 Worksheet contains one table which is used to calculate the annual nutrient load from new (post-development) landcovers within the redline boundary of the development. The type(s) and area(s) of landcover present on the new development is required to generate nutrient loads associated with the current landcovers on the site.

The second table under the heading 'New landcovers' requires user inputs. You must select the most appropriate landcovers from a dropdown list of 18 landcover types to represent the landcover present on the site following the development. You must also enter the area of each landcover in hectares. The dropdown list contains 10 agricultural landcover types and 8 non-agricultural landcover types to represent the landcovers present on the site before development. The descriptions of each landcover type can be found in the guidance that accompanies this calculator. You must determine which landcover types are present within the redline boundary of the development before completing this tool. If there is a landcover within the development area that is not in the dropdown list please select the most similar landcover type.

Notes on Stage 3S: nutrient load removed through SuDS

The Stage 3S Worksheet contains one table in which you can enter key information about the use of SuDS to treat the runoff from the site and reduce the nutrient loading from new landcovers.

In this section the user will need to enter information about the SuDS features used to calculate the amount of nutrients removed through SuDS treatment of surface runoff. This section must only be completed if SuDS are compliant with the national standards and are being implemented under the requirement of the Flood and Water Management Act 2010 (Schedule 3). Any SuDS that are being implemented in addition to the site plans for the purposes of mitigation must not be considered in the nutrient budget calculation for the site. In this instance, it is instead recommended that a second calculation is populated - the People over Wind judgment means that it is no longer possible to apply mitigation measures at the screening stage.

The landcovers and areas present on the new site will be automatically populated from Stage 3.

You will need to:
- enter the catchment area that drains to the SuDS as a proportion of the new landcovers
- choose the SuDS features used
- enter the nutrient removal rates as a percentage

It is recommended that the surface area of the SuDS features are included within the area of the landcover that they drain. If required, you can split the landcover up in Stage 3 to demonstrate multiple drainage configurations.

You can select a SuDS feature from a list of 23 options. If a SuDS management train that comprises multiple SuDS features is being implemented you should select the appropriate option from the start of the list. Otherwise, you should select the individual SuDS feature being used. If the appropriate SuDS feature cannot be found in the list, select the most relevant alternative.

The nutrient removal rates should be entered as a whole number percentage between 0-100. You must be able to provide evidence for the removal rates you have entered. This is likely to require the submission of a drainage assessment and a detailed design of the SuDS features.

The amount of nutrients removed through SuDS is automatically calculated using the landcovers and associated loads from Stage 3, the drainage area, and the nutrient removal rates. The total load removed through SuDS is incorporated into the final nutrient budget calculation. Selecting the type of SuDS feature used is to ensure that the nutrient budget calculator matches the SuDS design detailed in the planning application.

Further information on SuDS can be found in the table under the heading 'Sources of information on SuDS and how to design them for nutrient removal' that follows this text.

Sources of information on SuDS and how to design them for nutrient removal

Description of information	Link to source of information
National standards for sustainable drainage systems (SuDS) can be found here:	National standards for sustainable drainage systems (SuDS)
Ciria's Using SuDS to reduce nitrogen in surface water runoff (C815) can be found here:	Using SuDS to reduce nitrogen in surface water runoff (C815)
Ciria's Using SuDS to reduce phosphorus in surface water runoff (C808f) can be found here:	Using SuDS to reduce phosphorus in surface water runoff (C808f)

Notes about the final annual nutrient budget

The Staoe 4 Worksheet contains 2 tables which calculate the TP budget and the amount of TN generated.

The final stage automatically calculates the final nutrient budget using the results from Stage 1 to Stage 3S using the following equation:
(Stage 1 - Stage 2 + (Stage 3 - Stage 3S)) * 1.2 = Stage 4

The first table under the heading 'Total phosphorus budget' calculates the amount of TP that you need to mitigate.

The second table under the heading 'Total nitrogen generated' calculates the amount of TN generated.

Stage 1 - additional nutrient loading from wastewater

This sheet contains 2 tables. The tables are separated by a heading, which describes the following table.

The first table labelled 'Wastewater load input data' requires user inputs. Cells A8, A9, A13, A17 to A20, A22 to A23 are automatically generated and will state 'Not applicable' unless the required user inputs have been entered. You will need to fill in cells B6, B7, B10 to B12 and B14 to B23, unless the description states 'Not applicable'. Cells B8, B9, B13 are automatically generated and will state 'Not applicable' unless the user inputs have been entered. If the user does not enter a postcode in cell B7, cells A9 and B9 will state 'Not applicable', however this data can be selected in Cell B6 in Stage 2. Cells B24 and B25 are automatically generated and will state '0.00' unless the user inputs have been entered.

The second table labelled 'Final calculation of nutrient load from wastewater' does not require any user inputs. Cells B28 to B31 are automatically generated and will state '0.00' unless the user inputs have been entered in the second table labelled 'Wastewater load calculation table'.

How to fill in the table 'Wastewater load calculation table':
Cell B6: Select the Special Area of Conservation (SAC) from the dropdown list.
Cell B7: Enter the postcode, or the nearest postcode, for the proposed development site. This input is optional.
Cell B10: Select the project type or development type from the dropdown list.
Cell B11: Enter the number of additional units being created.
Cell B12: Enter the Local Planning Authority the development is within, if a valid postcode has not been entered into cell B7.
Cell B14: Select 'Yes' if the default occupancy rate is being used for the development if the project type is residential from the dropdown list. Select 'No' if the default occupancy rate does not apply to the residential development.
Cell B15: Enter the average occupancy rate of the development if the default occupancy rate is not automatically generated in cell B13.
Cell B16: Enter the water usage per resident or customer/user in litres per person per day. This value should be kept at 120 for residents unless other efficiency measures are used.
Cell B17: Enter the percentage of customers/users coming from outside the catchment if the project type is not residential. The default value is set to 100%.
Cell B18: Enter the number of employees per unit if the project type is not residential.
Cell B19: Enter the water usage per resident or customer/user in litres per person per day. The default value is 120.
Cell B20: Enter the percentage of employees coming from outside the catchment if the project type is not residential. The default value is set to 100%.
Cell B21: Select the connecting wastewater treatment works (WwTW) from the dropdown list.
Cell B22: Enter the certified value of total phosphorus (TP) if you select 'Package Treatment Plant user defined' or 'Septic Tank user defined' in cell B21. Otherwise the default values for these sewarage systems will be used in the calculation of the nutrient load associated with wastewater.
Cell B23: Enter the certified value of total nitrogen (TN) if you select 'Package Treatment Plant user defined' or 'Septic Tank user defined' in cell B21. Otherwise the default values for these sewerage systems will be used in the calculation of the nutrient load associated with wastewater.

Wastewater load input data

Description of required information	Data entry column - user inputs required
Special Area of Conservation (SAC):	River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid
Postcode:	
Not applicable	**Not applicable**
Not applicable	**Not applicable**
Project type:	Residential
Development proposal (number of additional units):	3
Local Planning Authority (LPA):	Wrexham County Borough Council
Default occupancy rate:	**2.33**
Is this default value being used?	Yes
Not applicable	
Water usage per resident (litres/person/day):	139
Not applicable	
Not applicable	
Not applicable	
Not applicable	
Wastewater treatment works:	Package treatment plant (PTP) user defined
Enter the bespoke P permit (mg TP/l):	0.2
Enter the bespoke N permit (mg TN/l):	72.9
Phosphorus permitted limit (mg TP/l):	**0.20**
Nitrogen permitted limit (mg TN/l):	**72.90**

Final calculation of nutrient load from wastewater

Description of values generated	Values generated
Additional population:	**6.99**
Annual wastewater production (litres):	**354880.55**
Annual phosphorus load (kg TP/year):	**0.07**
Annual nitrogen load (kg TN/year):	**25.87**

Stage 2 - nutrient loading from pre-existing landcovers

This sheet contains 2 tables. The tables are separated by a heading, which describes the following table.

The first table labelled 'Physical characteristics' requires user inputs. You will need to fill in cells B5, B7 and B8 unless the description states 'Not applicable'. Cell B6 is automatically generated and will state 'Not applicable' unless a valid postcode has been entered into the previous worksheet.
The second table labelled 'Pre-exisiting landcovers' requires user inputs. You will need to fill in cells A11 to B25. Cells B26 and C11 to D26 are automatically generated and will state '0.00' unless the required user inputs have been entered. Row 26 automatically calculates the 'Total' sum of cells B11 to B25 in cell B26, C11 to C25 in C26, and D11 to D25 in D26.

How to fill in the table 'Physical characteristics':
Cell B5: Select the appropriate soil drainage for the site from the dropdown list.
Cell B7: Select 'Yes' if the automatically populated rainfall value is correct for the site if a valid postcode has been entered into the worksheet titled 'Stage 1'. Select 'No' if the automatically populated rainfall value is incorrect if a valid postcode has been entered into the worksheet titled 'Stage 1'.
Cell B8: Select the annual average rainfall the development will receive from the dropdown list if a valid postcode has not been entered into the worksheet titled 'Stage 1'.

How to fill in the table 'Pre-existing landcovers':
Cells A11 to A25: Select the current (pre-development) land covers present within the redline boundary of the site.
Cells B11 to B25: Enter the area in hectares of each land cover.

Physical characteristics

Description of required information	Data entry column - user inputs required
Soil drainage:	Freely draining
Not applicable	**Not applicable**
Not applicable	
Rainfall (mm/year):	850.1 - 900

Pre-existing landcovers

Landcover	Area (hectares)	Phosphorus load (kg TP/year)	Nitrogen load (kg TN/year)
Commercial/industrial land	0.11	**0.14**	**0.96**
Greenspace	0.08	**0.00**	**0.24**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
		0.00	**0.00**
Total:	**0.19**	**0.14**	**1.20**

Stage 3 - nutrient loading from new landcovers

This sheet contains one table. A heading describes the table.

The table is labelled 'New landcovers'. You will need to fill in cells A5 to B19. Cells B20, C5 to D19 are automatically generated and will state '0.00' unless the required user inputs have been entered. Cells E5 to E19 are automatically populated and will state 'Not applicable' unless the total area of the landcovers does not match the total area of the landcovers in the worksheet titled 'Stage 2'. Row 20 automatically calculates the 'Total' sum of cells B5 to B19 in cell B20, C5 to C19 in C20, and D5 to D19 in D20.

How to fill in the table 'New landcovers':
Cells A5 to A19: Choose the new (post-development) land covers present within the redline boundary of the site.
Cells B5 to B19: Enter the area in hectares of each land cover.

New landcovers

Landcover	Area (hectares)	Phosphorus load (kg TP/year)	Nitrogen load (kg TN/year)	Notes on data
Commercial/industrial land	0	**0.00**	**0.00**	**Stage 3 area larger than Stage 2**
Residential land	0.083	**0.15**	**1.35**	**Stage 3 area larger than Stage 2**
Greenspace	0.125	**0.00**	**0.38**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
		0.00	**0.00**	**Stage 3 area larger than Stage 2**
Total:	**0.21**	**0.15**	**1.73**	**Not applicable**

Stage 3S - nutrient load removed through SuDS

This sheet contains one table. A heading describes the table.
The table is labelled 'SuDS information'. SuDS stands for sustainable urban drainage systems.

Cells A5 to A19 are automatically populated with landcovers entered into the worksheet titled 'Stage 3' and will state 'Not applicable' if landcovers have not been entered into the corresponding cells in the worksheet titled 'Stage 3'. Cells B5 to B20 are automatically populated with the area in hectares of the landcovers entered into the worksheet titled 'Stage 3' and will state '0.00' if areas have not been entered into the worksheet titled 'Stage 3'. You will need to fill in cells C5 to F19. Cells G5 to H20 are automatically calculated and will state '0.00' unless the required inputs have been entered. Row 20 automatically calculates the 'Total' sum of cells B5 to B19 in cell B20, the sum of cells G5 to G19 in cell G20 and the sum of cells H5 to H19 in cell H20.

How to fill in the table 'SuDS information':
Cells C5 to C19: Enter the size of the catchment area that drains to the SuDS feature as a proportion (%) of the landcover in the areas (in hectares).
Cells D5 to D19: Select the SuDS feature that is being used to treat the run off from the dropdown list.
Cells E5 to E19: Enter the phosphorus removal rate of the nutrient inputs as a percentage (%).
Cells F5 to F19: Enter the nitrogen removal rate of the nutrient inputs as a percentage (%).

SuDS information

Landcover	Area (hectares)	Proportion of landcover area served by SuDS feature (%)	SuDS feature	P removal rate for SuDS feature	N removal rate for SuDS feature	Phosphorus load removed through SuDS (kg TP/year)	Nitrogen load removed through SuDS (kg TN/year)
Commercial/industrial land	**0.00**	100				**0.00**	**0.00**
Residential land	**0.08**	100	Multi-stage management train (2+)	66		**0.10**	**0.00**
Greenspace	**0.13**	100	Soakaway / infiltration systems	0		**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Not applicable	**0.00**					**0.00**	**0.00**
Total:	**0.21**	**Not applicable**	**Not applicable**	**Not applicable**	**Not applicable**	**0.10**	**0.00**

Stage 4 - final nutrient budget calculation

This sheet contains 2 tables. The tables are separated by a heading, which describes the following table. The tables are automatically calculated using the outputs from the previous stages.

The first table labelled 'Total phosphorus budget' presents the calculations that underpin the final total phosphorus (TP) budget in cell B10. The second table labelled 'Total nitrogen generated' presents the calculations that underpin the final total nitrogen (TN) budget in cell B18.

You do not need to fill in any cells in the tables. Cells B5 to B10 and B13 to B18 are automatically calculated. Cells B5 to B9 and cells B13 to B17 will state '0.00' unless user inputs have been entered to all of the required stages. Cell B10 will state 'No TP mitigation needed' if the phosphorus budget is less than 0.00 kilograms TP per year. Cell B18 will state 'No additional TN generated' if the nitrogen budget is less than 0.00 kilograms TN per year.

Total phosphorus budget

Description of phosphorus values generated	Values generated
Stage 1 phosphorus load (kg TP/year):	**0.07**
Stage 2 phosphorus reduction (kg TP/year):	**0.14**
Stage 3 phosphorus load (kg TP/year):	**0.15**
Stage 3S phosphorus load removed through SuDS (kg TP/year):	**0.10**
Phosphorus budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	**0.00**
Phosphorus budget + 20% buffer	**0 kg TP/year requires mitigation**

Total nitrogen generated

Description of nitrogen values generated	Values generated
Stage 1 nitrogen load (kg TN/year):	**25.87**
Stage 2 nitrogen reduction (kg TN/year):	**1.20**
Stage 3 nitrogen load (kg TN/year):	**1.73**
Stage 3S nitrogen load removed through SuDS (TN kg/year):	**0.00**
Nitrogen budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	**26.40**
Nitrogen budget + 20% buffer:	**31.68 kg TN/year will be generated**

ANNEX 2

Surface Water Drainage Layout

N

TOTAL SITE AREA = 0.208 ha (APPROX.)

PROPOSED IMPERMEABLE AREA = 0.083 ha

INFILTRATION RATE = 1.81 x 10^{-4} m/s (0.65 m/hr)

RAIN GARDEN- LEFT SIDE CHANNEL

(NODES RG1, RG2 AND RG3)

100Ø INSPECTION PIPE, 18.56 m LONG x 0.8 m DEEP

30% VOIDS = 1.15 m³
CL = 15.80, IL = 15.20, UNDERDRAIN = 15.00

INFILTRATION TO GROUND

RAIN GARDEN- RIGHT SIDE CHANNEL

(NODES RG4, RG5 AND RG6)

100Ø INSPECTION PIPE, 22.80 m LONG x 0.8 m DEEP

30% VOIDS = 1.74 m³
CL = 15.80, IL = 15.20, UNDERDRAIN = 15.00

INFILTRATION TO GROUND

ROAD LEVELS ARE TO BE DESIGNED IN CAMBER SUCH THAT THE ROAD FALLS TOWARDS RAIN GARDENS, EITHER FLUSHED KERBS OR BEANY BLOCK KERBS TO BE USED.

PLOT 1

FFL 15.70

PLOT 1
FFL = 15.700 Finished floor level
SSL = 15.475 Structural slab level
RDL = 15.125 Reduced dig level under beams
TFL = 15.100 Top foundation level
BFL = Bottom foundation level (varies)

PLOT 2

FFL 15.55

PLOT 2
FFL= 15.550 Finished floor level
SSL = 15.325 Structural slab level
RDL = 14.975 Reduced dig level under beams
TFL = 14.950 Top foundation level
BFL = Bottom foundation level (varies)

PLOT 3

FFL 15.40

PLOT 3
FFL = 15.400 Finished floor level
SSL = 15.175 Structural slab level
RDL = 14.825 Reduced dig level under beams
TFL = 14.800 Top foundation level
BFL = Bottom foundation level (varies)

DRIVEWAY

INFILTRATION TANK 1

(1.8 mØ PERFORATED MANHOLE CHAMBER, GRAVEL FILLED HOUSE SOAKAWAY WITH 100Ø INSPECTION PIPE)

(30% VOIDS, 150Ø CONNECTION) = 2.18 m³
CL= 15.50
IL= 14.45

INFILTRATION RATE = 1.81 x 10^{-4} m/s (0.65 m/hr)

INFILTRATION TANK 2

(1.8 mØ PERFORATED MANHOLE CHAMBER, GRAVEL FILLED HOUSE SOAKAWAY WITH 100Ø INSPECTION PIPE)

(30% VOIDS, 150Ø CONNECTION) = 2.42 m³
CL= 15.30
IL= 14.20

INFILTRATION RATE = 1.81 x 10^{-4} m/s (0.65 m/hr)

INFILTRATION TANK 3

(1.8 mØ PERFORATED MANHOLE CHAMBER, GRAVEL FILLED HOUSE SOAKAWAY WITH 100Ø INSPECTION PIPE)

(30% VOIDS, 150Ø CONNECTION) = 2.76 m³
CL= 15.05
IL= 14.11

INFILTRATION RATE = 1.81 x 10^{-4} m/s (0.65 m/hr)

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS. ANY DISCREPANCIES, ERRORS OR OMISSIONS TO BE BROUGHT TO THE ATTENTION OF WEETWOOD.
2. ANNUAL EXCEEDANCE PROBABILITY RAINFALL EVENTS:
   - 100.0% (1:1) AEP RAINFALL EVENT
   - 43.5% (QBAR) AEP RAINFALL EVENT
   - 3.3% (1:30) AEP RAINFALL EVENT
   - 1.0% (1:100) AEP RAINFALL EVENT
3. PROPOSED SITE LAYOUT TAKEN FROM APEX ARCHITECTURE 'SITE PLAN PROPOSED 1:200' DRAWING (REF: 325-02 REV D, AUG 24).
4. EXISTING LEVEL INFORMATION TAKEN FROM CHESHIRE SURVEYS LTD 'TOPOGRAPHIC SURVEY' (REF: 0633-4749-01-01-01, MAY 24).
5. INFILTRATION RATES AND GROUND WATER MONITORING TAKEN FROM SUB SURFACE NORTH WEST LTD 'GROUND INVESTIGATION REPORT' (REF: 7992B, NOV 24).

DRAINAGE KEY

- PROPOSED SURFACE WATER SEWER
- PROPOSED DRAINAGE CHANNEL
- PROPOSED SURFACE WATER MANHOLE/PPIC
- PROPOSED RAIN GARDEN
- SITE BOUNDARY
- OVERLAND FLOW ROUTE
- GL=1.000 PROPOSED EXTERNAL LEVELS (BY OTHERS)

REV	DATE	DESCRIPTION	DRAWN BY	CHECK BY
P1	26.11.25	INITIAL ISSUE	DSH	TB

Weetwood
Development • Planning • Environment

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Client: HENGARI LTD

Drawing Status: PLANNING	Date: NOV 2025
	Scale (A1): 1:100
Project: THE GREEN, ROSSETT	Drawn by: DSH
	Check by: TB
Drawing Number: 6550-WTWD-00-XX-DR-D-1101	Revision: P1

Drawing Title: INDICATIVE SURFACE WATER DRAINAGE LAYOUT

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS. DO NOT SCALE FROM THIS DRAWING.

ANNEX 3

Surface Water Drainage Soakaway Design

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓	30	0.007	5.00	15.250	Manhole	Adoptable	600	336885.664	357308.155	0.700
✓	31	0.009	5.00	15.250	Manhole	Adoptable	600	336876.196	357301.287	0.820
✓	32	0.006	5.00	15.250	Manhole	Adoptable	600	336885.019	357289.898	0.940
✓	33			15.250	Manhole	Adoptable	600	336892.072	357295.268	1.020
✓	34			15.150	Manhole	Adoptable	1200	336894.369	357292.346	0.950
✓	TANK3			15.050	Junction			336897.042	357289.102	0.940
✓	DUMMY3			15.050	Manhole	Adoptable	100	336898.310	357287.828	0.950
✓	10	0.005	5.00	15.550	Manhole	Adoptable	600	336862.689	357293.502	0.750
✓	11	0.006	5.00	15.550	Manhole	Adoptable	600	336853.973	357286.941	0.850
✓	12	0.007	5.00	15.550	Manhole	Adoptable	600	336862.923	357275.597	0.950
✓	13			15.550	Manhole	Adoptable	600	336867.772	357279.266	1.000
✓	14			15.500	Manhole	Adoptable	1200	336870.306	357276.201	1.000
✓	TANK1			15.500	Junction			336873.387	357272.516	1.050
✓	DUMMY1			15.500	Manhole	Adoptable	100	336874.861	357270.861	1.070
✓	20	0.007	5.00	15.400	Manhole	Adoptable	600	336874.630	357300.147	0.750
✓	21	0.007	5.00	15.380	Manhole	Adoptable	600	336870.340	357296.685	0.830
✓	22			15.400	Manhole	Adoptable	600	336866.049	357293.224	0.900
✓	23	0.006	5.00	15.400	Manhole	Adoptable	600	336874.658	357282.073	1.000
✓	24			15.400	Manhole	Adoptable	600	336878.993	357285.586	1.050
✓	25			15.300	Manhole	Adoptable	1200	336881.448	357282.629	1.000
✓	TANK2			15.300	Junction			336883.867	357279.711	1.100
✓	DUMMY2			15.300	Manhole	Adoptable	100	336885.546	357278.009	1.120
✓	RG6	0.003	5.00	15.800	Junction			336871.752	357307.770	0.600
✓	RG4	0.004	5.00	15.800	Junction			336856.860	357295.474	0.600

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Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓	RG5	0.004	5.00	15.800	Junction			336864.296	357301.781	0.650
✓	RG1	0.004	5.00	15.800	Junction			336856.922	357304.459	0.600
✓	RG3	0.004	5.00	15.800	Junction			336871.081	357315.292	0.600
✓	RG2	0.004	5.00	15.800	Junction			336864.359	357310.057	0.650
✓	DUMMY0			15.800	Manhole	Adoptable	1200	336866.205	357307.677	0.800
✓	DUMMY OUTFALL			15.800	Junction			336868.498	357309.618	0.850

Links

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
?	1.000	30	31	11.697	0.600	Colebrook-White	14.550	14.430	0.120	97.5	150	Circular	5.19	48.5
?	1.001	31	32	14.407	0.600	Colebrook-White	14.430	14.310	0.120	120.1	150	Circular	5.45	47.5
?	1.002	32	33	8.865	0.600	Colebrook-White	14.310	14.230	0.080	110.8	150	Circular	5.61	46.9
?	1.003	33	34	3.717	0.600	Colebrook-White	14.230	14.200	0.030	123.9	150	Circular	5.68	46.7
?	1.004	34	TANK3	4.203	0.600	Colebrook-White	14.200	14.110	0.090	46.7	150	Circular	5.72	46.5
?	1.005	TANK3	DUMMY3	1.797	0.600	Colebrook-White	14.110	14.100	0.010	179.7	150	Circular	5.77	46.4
?	2.000	10	11	10.909	0.600	Colebrook-White	14.800	14.700	0.100	109.1	150	Circular	5.19	48.5
?	2.001	11	12	14.450	0.600	Colebrook-White	14.700	14.600	0.100	144.5	150	Circular	5.48	47.4
?	2.002	12	13	6.081	0.600	Colebrook-White	14.600	14.550	0.050	121.6	150	Circular	5.59	47.0

Name	US Node	DS Node	Vel (m/s)	Flow (l/s)	Σ Area (ha)
1.000	30	31	1.018	0.9	0.007
1.001	31	32	0.916	2.1	0.016
1.002	32	33	0.954	2.8	0.022
1.003	33	34	0.901	2.8	0.022
1.004	34	TANK3	1.476	2.8	0.022
1.005	TANK3	DUMMY3	0.746	2.8	0.022
2.000	10	11	0.961	0.7	0.005
2.001	11	12	0.834	1.4	0.011
2.002	12	13	0.910	2.3	0.018

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Links

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
?	2.003	13	14	3.977	0.600	Colebrook-White	14.550	14.500	0.050	79.5	150	Circular	5.65	46.8
?	2.004	14	TANK1	4.803	0.600	Colebrook-White	14.500	14.450	0.050	96.1	150	Circular	5.73	46.5
?	2.005	TANK1	DUMMY1	2.216	0.600	Colebrook-White	14.450	14.430	0.020	110.8	150	Circular	5.76	46.4
?	3.000	20	21	5.513	0.600	Colebrook-White	14.650	14.550	0.100	55.1	150	Circular	5.07	48.9
?	3.001	21	22	5.513	0.600	Colebrook-White	14.550	14.500	0.050	110.3	150	Circular	5.16	48.6
?	3.002	22	23	14.088	0.600	Colebrook-White	14.500	14.400	0.100	140.9	150	Circular	5.44	47.6
?	3.003	23	24	5.580	0.600	Colebrook-White	14.400	14.350	0.050	111.6	150	Circular	5.54	47.2
?	3.004	24	25	3.843	0.600	Colebrook-White	14.350	14.300	0.050	76.9	150	Circular	5.60	47.0
?	3.005	25	TANK2	3.790	0.600	Colebrook-White	14.300	14.200	0.100	37.9	150	Circular	5.63	46.8
?	3.006	TANK2	DUMMY2	2.391	0.600	Colebrook-White	14.200	14.180	0.020	119.5	150	Circular	5.68	46.7
?	4.000	RG6	RG5	11.400	0.600	Colebrook-White	15.200	15.150	0.050	228.0	100	Filter Drain	5.38	47.8
?	5.000	RG4	RG5	11.400	0.600	Colebrook-White	15.200	15.150	0.050	228.0	100	Filter Drain	5.38	47.8
?	4.001	RG5	DUMMY0	3.000	0.600	Colebrook-White	15.150	15.000	0.150	20.0	100	Circular	5.41	47.7
?	6.000	RG1	RG2	9.280	0.600	Colebrook-White	15.200	15.150	0.050	185.6	100	Filter Drain	5.28	48.2
?	7.000	RG3	RG2	9.280	0.600	Colebrook-White	15.200	15.150	0.050	185.6	100	Filter Drain	5.28	48.2

Name	US Node	DS Node	Vel (m/s)	Flow (l/s)	Σ Area (ha)
2.003	13	14	1.128	2.3	0.018
2.004	14	TANK1	1.025	2.3	0.018
2.005	TANK1	DUMMY1	0.954	2.3	0.018
3.000	20	21	1.357	0.9	0.007
3.001	21	22	0.956	1.8	0.014
3.002	22	23	0.844	1.8	0.014
3.003	23	24	0.950	2.6	0.020
3.004	24	25	1.148	2.5	0.020
3.005	25	TANK2	1.640	2.5	0.020
3.006	TANK2	DUMMY2	0.918	2.5	0.020
4.000	RG6	RG5	0.505	0.4	0.003
5.000	RG4	RG5	0.505	0.5	0.004
4.001	RG5	DUMMY0	1.734	1.4	0.011
6.000	RG1	RG2	0.561	0.5	0.004
7.000	RG3	RG2	0.561	0.5	0.004

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Links

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
?	6.001	RG2	DUMMY0	3.000	0.600	Colebrook-White	15.150	15.000	0.150	20.0	100	Circular	5.30	48.1
?	4.002	DUMMY0	DUMMY OUTFALL	3.000	0.600	Colebrook-White	15.000	14.950	0.050	60.0	100	Circular	5.46	47.5

Name	US Node	DS Node	Vel (m/s)	Flow (l/s)	Σ Area (ha)
6.001	RG2	DUMMY0	1.734	1.6	0.012
4.002	DUMMY0	DUMMY OUTFALL	0.996	3.0	0.023

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	11.697	97.5	150	Circular	15.250	14.550	0.550	15.250	14.430	0.670
1.001	14.407	120.1	150	Circular	15.250	14.430	0.670	15.250	14.310	0.790
1.002	8.865	110.8	150	Circular	15.250	14.310	0.790	15.250	14.230	0.870
1.003	3.717	123.9	150	Circular	15.250	14.230	0.870	15.150	14.200	0.800
1.004	4.203	46.7	150	Circular	15.150	14.200	0.800	15.050	14.110	0.790
1.005	1.797	179.7	150	Circular	15.050	14.110	0.790	15.050	14.100	0.800
2.000	10.909	109.1	150	Circular	15.550	14.800	0.600	15.550	14.700	0.700
2.001	14.450	144.5	150	Circular	15.550	14.700	0.700	15.550	14.600	0.800
2.002	6.081	121.6	150	Circular	15.550	14.600	0.800	15.550	14.550	0.850

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	30	600	Manhole	Adoptable	31	600	Manhole	Adoptable
1.001	31	600	Manhole	Adoptable	32	600	Manhole	Adoptable
1.002	32	600	Manhole	Adoptable	33	600	Manhole	Adoptable
1.003	33	600	Manhole	Adoptable	34	1200	Manhole	Adoptable
1.004	34	1200	Manhole	Adoptable	TANK3		Junction	
1.005	TANK3		Junction		DUMMY3	100	Manhole	Adoptable
2.000	10	600	Manhole	Adoptable	11	600	Manhole	Adoptable
2.001	11	600	Manhole	Adoptable	12	600	Manhole	Adoptable
2.002	12	600	Manhole	Adoptable	13	600	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.003	3.977	79.5	150	Circular	15.550	14.550	0.850	15.500	14.500	0.850
2.004	4.803	96.1	150	Circular	15.500	14.500	0.850	15.500	14.450	0.900
2.005	2.216	110.8	150	Circular	15.500	14.450	0.900	15.500	14.430	0.920
3.000	5.513	55.1	150	Circular	15.400	14.650	0.600	15.380	14.550	0.680
3.001	5.513	110.3	150	Circular	15.380	14.550	0.680	15.400	14.500	0.750
3.002	14.088	140.9	150	Circular	15.400	14.500	0.750	15.400	14.400	0.850
3.003	5.580	111.6	150	Circular	15.400	14.400	0.850	15.400	14.350	0.900
3.004	3.843	76.9	150	Circular	15.400	14.350	0.900	15.300	14.300	0.850
3.005	3.790	37.9	150	Circular	15.300	14.300	0.850	15.300	14.200	0.950
3.006	2.391	119.5	150	Circular	15.300	14.200	0.950	15.300	14.180	0.970
4.000	11.400	228.0	100	Filter Drain	15.800	15.200	0.500	15.800	15.150	0.550
5.000	11.400	228.0	100	Filter Drain	15.800	15.200	0.500	15.800	15.150	0.550
4.001	3.000	20.0	100	Circular	15.800	15.150	0.550	15.800	15.000	0.700
6.000	9.280	185.6	100	Filter Drain	15.800	15.200	0.500	15.800	15.150	0.550
7.000	9.280	185.6	100	Filter Drain	15.800	15.200	0.500	15.800	15.150	0.550

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.003	13	600	Manhole	Adoptable	14	1200	Manhole	Adoptable
2.004	14	1200	Manhole	Adoptable	TANK1		Junction	
2.005	TANK1		Junction		DUMMY1	100	Manhole	Adoptable
3.000	20	600	Manhole	Adoptable	21	600	Manhole	Adoptable
3.001	21	600	Manhole	Adoptable	22	600	Manhole	Adoptable
3.002	22	600	Manhole	Adoptable	23	600	Manhole	Adoptable
3.003	23	600	Manhole	Adoptable	24	600	Manhole	Adoptable
3.004	24	600	Manhole	Adoptable	25	1200	Manhole	Adoptable
3.005	25	1200	Manhole	Adoptable	TANK2		Junction	
3.006	TANK2		Junction		DUMMY2	100	Manhole	Adoptable
4.000	RG6		Junction		RG5		Junction	
5.000	RG4		Junction		RG5		Junction	
4.001	RG5		Junction		DUMMY0	1200	Manhole	Adoptable
6.000	RG1		Junction		RG2		Junction	
7.000	RG3		Junction		RG2		Junction	

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.001	3.000	20.0	100	Circular	15.800	15.150	0.550	15.800	15.000	0.700
4.002	3.000	60.0	100	Circular	15.800	15.000	0.700	15.800	14.950	0.750

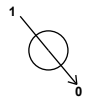
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.001	RG2		Junction		DUMMY0	1200	Manhole	Adoptable
4.002	DUMMY0	1200	Manhole	Adoptable	DUMMY OUTFALL		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
30	336885.664	357308.155	15.250	0.700	600	Manhole	Adoptable		0	1.000	14.550	150	Circular
31	336876.196	357301.287	15.250	0.820	600	Manhole	Adoptable		1	1.000	14.430	150	Circular
									0	1.001	14.430	150	Circular
32	336885.019	357289.898	15.250	0.940	600	Manhole	Adoptable		1	1.001	14.310	150	Circular
									0	1.002	14.310	150	Circular
33	336892.072	357295.268	15.250	1.020	600	Manhole	Adoptable		1	1.002	14.230	150	Circular
									0	1.003	14.230	150	Circular
34	336894.369	357292.346	15.150	0.950	1200	Manhole	Adoptable		1	1.003	14.200	150	Circular
									0	1.004	14.200	150	Circular

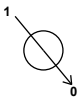
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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
TANK3	336897.042	357289.102	15.050	0.940		Junction		1	1.004	14.110	150	Circular
												
								0	1.005	14.110	150	Circular
DUMMY3	336898.310	357287.828	15.050	0.950	100	Manhole	Adoptable	1	1.005	14.100	150	Circular
												
10	336862.689	357293.502	15.550	0.750	600	Manhole	Adoptable					
												
								0	2.000	14.800	150	Circular
11	336853.973	357286.941	15.550	0.850	600	Manhole	Adoptable	1	2.000	14.700	150	Circular
												
								0	2.001	14.700	150	Circular
12	336862.923	357275.597	15.550	0.950	600	Manhole	Adoptable	1	2.001	14.600	150	Circular
												
								0	2.002	14.600	150	Circular
13	336867.772	357279.266	15.550	1.000	600	Manhole	Adoptable	1	2.002	14.550	150	Circular
												
								0	2.003	14.550	150	Circular
14	336870.306	357276.201	15.500	1.000	1200	Manhole	Adoptable	1	2.003	14.500	150	Circular
												
								0	2.004	14.500	150	Circular
TANK1	336873.387	357272.516	15.500	1.050		Junction		1	2.004	14.450	150	Circular
												
								0	2.005	14.450	150	Circular

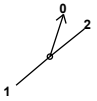
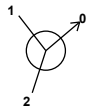
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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
DUMMY1	336874.861	357270.861	15.500	1.070	100	Manhole	Adoptable	 1	2.005	14.430	150	Circular
20	336874.630	357300.147	15.400	0.750	600	Manhole	Adoptable	 0	3.000	14.650	150	Circular
21	336870.340	357296.685	15.380	0.830	600	Manhole	Adoptable	 1 0	3.000 3.001	14.550 14.550	150 150	Circular Circular
22	336866.049	357293.224	15.400	0.900	600	Manhole	Adoptable	 1 0	3.001 3.002	14.500 14.500	150 150	Circular Circular
23	336874.658	357282.073	15.400	1.000	600	Manhole	Adoptable	 1 0	3.002 3.003	14.400 14.400	150 150	Circular Circular
24	336878.993	357285.586	15.400	1.050	600	Manhole	Adoptable	 1 0	3.003 3.004	14.350 14.350	150 150	Circular Circular
25	336881.448	357282.629	15.300	1.000	1200	Manhole	Adoptable	 1 0	3.004 3.005	14.300 14.300	150 150	Circular Circular
TANK2	336883.867	357279.711	15.300	1.100		Junction		 1 0	3.005 3.006	14.200 14.200	150 150	Circular Circular

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
DUMMY2	336885.546	357278.009	15.300	1.120	100	Manhole	Adoptable	 1	3.006	14.180	150	Circular
RG6	336871.752	357307.770	15.800	0.600		Junction		 0	4.000	15.200	100	Filter Drain
RG4	336856.860	357295.474	15.800	0.600		Junction		 0	5.000	15.200	100	Filter Drain
RG5	336864.296	357301.781	15.800	0.650		Junction		 1 2 0	5.000 4.000 4.001	15.150 15.150 15.150	100 100 100	Filter Drain Filter Drain Circular
RG1	336856.922	357304.459	15.800	0.600		Junction		 0	6.000	15.200	100	Filter Drain
RG3	336871.081	357315.292	15.800	0.600		Junction		 0	7.000	15.200	100	Filter Drain
RG2	336864.359	357310.057	15.800	0.650		Junction		 1 2 0	7.000 6.000 6.001	15.150 15.150 15.150	100 100 100	Filter Drain Filter Drain Circular
DUMMY0	336866.205	357307.677	15.800	0.800	1200	Manhole	Adoptable	 1 2 0	6.001 4.001 4.002	15.000 15.000 15.000	100 100 100	Circular Circular Circular

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
DUMMY OUTFALL	336868.498	357309.618	15.800	0.850		Junction		1	4.002	14.950	100	Circular



SuDS Carriers

Link	US Node	DS Node	Link Type	Base Inf Coef (m/hr)	Sides Inf Coef (m/hr)	Safety Factor	Time to Half Empty (mins)
4.000	RG6	RG5	Filter Drain	0.65000	0.00000	2.0	1
5.000	RG4	RG5	Filter Drain	0.65000	0.00000	2.0	1
6.000	RG1	RG2	Filter Drain	0.65000	0.00000	2.0	1
7.000	RG3	RG2	Filter Drain	0.65000	0.00000	2.0	1

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Detailed	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x
Summer CV	0.750	Skip Steady State	x	Starting Level (m)			

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	10	0	100	30	10	0
30	0	10	0				

Node DUMMY0 Online Pump Control

Flap Valve	x	Invert Level (m)	15.000	Switch off depth (m)	0.010
Replaces Downstream Link	✓	Switch on depth (m)	0.100		

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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	8.000	0.000

Node DUMMY1 Online Pump Control

Flap Valve	x	Invert Level (m)	14.430	Switch off depth (m)	0.010
Replaces Downstream Link	✓	Switch on depth (m)	0.100		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	8.000	0.000

Node DUMMY2 Online Pump Control

Flap Valve	x	Invert Level (m)	14.180	Switch off depth (m)	0.010
Replaces Downstream Link	✓	Switch on depth (m)	0.100		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	8.000	0.000

Node DUMMY3 Online Pump Control

Flap Valve	x	Invert Level (m)	14.100	Switch off depth (m)	0.010
Replaces Downstream Link	✓	Switch on depth (m)	0.100		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	8.000	0.000

Node TANK1 Lined Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.65000	Porosity	0.30	Ring Diameter (m)	1.800	Depth (m)	
Side Inf Coefficient (m/hr)	0.65000	Invert Level (m)	14.450	Pit Width (m)	2.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	75	Pit Length (m)	2.000	Number Required	1

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Node TANK2 Lined Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.65000	Porosity	0.30	Ring Diameter (m)	1.800	Depth (m)	
Side Inf Coefficient (m/hr)	0.65000	Invert Level (m)	14.200	Pit Width (m)	2.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	90	Pit Length (m)	2.000	Number Required	1

Node TANK3 Lined Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.65000	Porosity	0.30	Ring Diameter (m)	1.800	Depth (m)	
Side Inf Coefficient (m/hr)	0.65000	Invert Level (m)	14.110	Pit Width (m)	2.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	121	Pit Length (m)	2.000	Number Required	1

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Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 98.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	30	11	14.569	0.019	0.6	0.0095	0.0000	OK
15 minute winter	31	11	14.460	0.030	1.4	0.0156	0.0000	OK
15 minute winter	32	10	14.345	0.035	2.0	0.0150	0.0000	OK
15 minute winter	33	11	14.267	0.037	1.9	0.0106	0.0000	OK
30 minute winter	34	25	14.254	0.054	2.4	0.0614	0.0000	OK
30 minute winter	TANK3	26	14.252	0.142	2.7	0.4220	0.0000	OK
30 minute winter	DUMMY3	26	14.252	0.152	0.8	0.0012	0.0000	OK
15 minute winter	10	10	14.817	0.017	0.5	0.0074	0.0000	OK
15 minute winter	11	10	14.726	0.026	1.1	0.0115	0.0000	OK
15 minute winter	12	11	14.633	0.033	1.6	0.0149	0.0000	OK
15 minute winter	13	11	14.581	0.031	1.6	0.0087	0.0000	OK
30 minute winter	14	25	14.558	0.058	1.3	0.0656	0.0000	OK
30 minute winter	TANK1	27	14.553	0.103	1.7	0.3061	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	30	1.000	31	0.6	0.326	0.033	0.0219	
15 minute winter	31	1.001	32	1.4	0.500	0.086	0.0406	
15 minute winter	32	1.002	33	1.9	0.593	0.115	0.0291	
15 minute winter	33	1.003	34	1.9	0.692	0.122	0.0105	
30 minute winter	34	1.004	TANK3	2.7	0.749	0.104	0.0477	
30 minute winter	TANK3	1.005	DUMMY3	0.8	0.322	0.059	0.0313	
30 minute winter	TANK3	Infiltration		0.5				
30 minute winter	DUMMY3	Pump		0.0				0.0
15 minute winter	10	2.000	11	0.5	0.298	0.028	0.0174	
15 minute winter	11	2.001	12	1.0	0.405	0.067	0.0360	
15 minute winter	12	2.002	13	1.6	0.589	0.100	0.0167	
15 minute winter	13	2.003	14	1.6	0.636	0.081	0.0101	
30 minute winter	14	2.004	TANK1	1.3	0.575	0.071	0.0452	
30 minute winter	TANK1	2.005	DUMMY1	0.8	0.364	0.045	0.0313	
30 minute winter	TANK1	Infiltration		0.4				

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Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 98.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	DUMMY1	28	14.553	0.123	0.8	0.0010	0.0000	OK
15 minute summer	20	11	14.666	0.016	0.6	0.0080	0.0000	OK
15 minute winter	21	11	14.578	0.028	1.2	0.0131	0.0000	OK
15 minute summer	22	11	14.529	0.029	1.2	0.0081	0.0000	OK
15 minute winter	23	10	14.434	0.034	1.8	0.0142	0.0000	OK
15 minute winter	24	11	14.382	0.032	1.7	0.0090	0.0000	OK
30 minute winter	25	26	14.334	0.034	1.4	0.0380	0.0000	OK
30 minute winter	TANK2	25	14.330	0.130	1.7	0.3877	0.0000	OK
30 minute winter	DUMMY2	25	14.333	0.153	0.9	0.0012	0.0000	OK
15 minute winter	RG6	11	15.219	0.019	0.3	0.0021	0.0000	OK
15 minute summer	RG4	10	15.221	0.021	0.4	0.0030	0.0000	OK
15 minute winter	RG5	11	14.978	-0.172	1.0	0.0426	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	DUMMY1	Pump		0.0				0.0
15 minute summer	20	3.000	21	0.6	0.370	0.025	0.0091	
15 minute winter	21	3.001	22	1.2	0.521	0.071	0.0127	
15 minute summer	22	3.002	23	1.2	0.453	0.080	0.0374	
15 minute winter	23	3.003	24	1.7	0.609	0.104	0.0160	
15 minute winter	24	3.004	25	1.7	0.753	0.086	0.0089	
30 minute winter	25	3.005	TANK2	1.7	0.764	0.058	0.0357	
30 minute winter	TANK2	3.006	DUMMY2	0.9	0.368	0.057	0.0404	
30 minute winter	TANK2	Infiltration		0.5				
30 minute winter	DUMMY2	Pump		0.0				0.0
15 minute winter	RG6	4.000	RG5	0.3	0.316	0.076	0.0108	
15 minute summer	RG4	5.000	RG5	0.4	0.330	0.089	0.0122	
15 minute winter	RG5	4.001	DUMMY0	0.0	0.000	0.000	0.0000	
15 minute winter	RG5	Infiltration (5.000)		0.5				
15 minute winter	RG5	Infiltration (4.000)		0.5				

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Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 98.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RG1	10	15.219	0.019	0.4	0.0029	0.0000	OK
15 minute summer	RG3	10	15.219	0.019	0.4	0.0029	0.0000	OK
15 minute summer	RG2	11	14.985	-0.165	1.1	0.0547	0.0000	OK
15 minute summer	DUMMY0	1	15.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	DUMMY OUTFALL	1	14.950	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RG1	6.000	RG2	0.4	0.346	0.081	0.0096	
15 minute summer	RG3	7.000	RG2	0.4	0.346	0.081	0.0096	
15 minute summer	RG2	6.001	DUMMY0	0.0	0.000	0.000	0.0000	
15 minute summer	RG2	Infiltration (7.000)		0.5				
15 minute summer	RG2	Infiltration (6.000)		0.5				
15 minute summer	DUMMY0	Pump	DUMMY OUTFALL	0.0				0.0

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Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	30	51	14.655	0.105	1.3	0.0530	0.0000	OK
60 minute winter	31	51	14.655	0.225	3.0	0.1180	0.0000	SURCHARGED
60 minute winter	32	51	14.655	0.345	4.1	0.1459	0.0000	SURCHARGED
60 minute winter	33	52	14.655	0.425	3.6	0.1202	0.0000	SURCHARGED
60 minute winter	34	52	14.655	0.455	3.2	0.5143	0.0000	SURCHARGED
60 minute winter	TANK3	52	14.655	0.545	2.7	1.6236	0.0000	SURCHARGED
60 minute winter	DUMMY3	52	14.655	0.555	0.5	0.0044	0.0000	OK
60 minute winter	10	51	14.872	0.072	0.9	0.0309	0.0000	OK
60 minute winter	11	51	14.872	0.172	2.0	0.0752	0.0000	SURCHARGED
60 minute winter	12	51	14.871	0.271	3.3	0.1208	0.0000	SURCHARGED
60 minute winter	13	51	14.871	0.321	2.7	0.0909	0.0000	SURCHARGED
60 minute winter	14	52	14.871	0.371	3.2	0.4198	0.0000	SURCHARGED
60 minute winter	TANK1	52	14.871	0.421	3.0	1.2555	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	30	1.000	31	1.3	0.410	0.072	0.1802	
60 minute winter	31	1.001	32	3.0	0.595	0.185	0.2536	
60 minute winter	32	1.002	33	3.6	0.613	0.215	0.1561	
60 minute winter	33	1.003	34	3.2	0.668	0.200	0.0654	
60 minute winter	34	1.004	TANK3	2.7	0.833	0.104	0.0740	
60 minute winter	TANK3	1.005	DUMMY3	0.5	0.415	0.038	0.0316	
60 minute winter	TANK3	Infiltration		0.8				
60 minute winter	DUMMY3	Pump		0.0				0.0
60 minute winter	10	2.000	11	0.9	0.355	0.053	0.1415	
60 minute winter	11	2.001	12	2.0	0.475	0.136	0.2544	
60 minute winter	12	2.002	13	2.7	0.650	0.169	0.1071	
60 minute winter	13	2.003	14	3.2	0.590	0.163	0.0700	
60 minute winter	14	2.004	TANK1	3.0	0.654	0.163	0.0846	
60 minute winter	TANK1	2.005	DUMMY1	0.7	0.403	0.041	0.0390	
60 minute winter	TANK1	Infiltration		0.7				

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Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	DUMMY1	52	14.871	0.441	0.7	0.0035	0.0000	OK
60 minute winter	20	51	14.695	0.045	1.3	0.0222	0.0000	OK
60 minute winter	21	51	14.695	0.145	2.6	0.0680	0.0000	OK
60 minute winter	22	51	14.695	0.195	2.6	0.0552	0.0000	SURCHARGED
60 minute winter	23	51	14.695	0.295	3.7	0.1223	0.0000	SURCHARGED
60 minute winter	24	52	14.695	0.345	3.3	0.0975	0.0000	SURCHARGED
60 minute winter	25	52	14.695	0.395	3.6	0.4464	0.0000	SURCHARGED
60 minute winter	TANK2	52	14.695	0.495	3.6	1.4746	0.0000	SURCHARGED
60 minute winter	DUMMY2	52	14.695	0.515	1.9	0.0041	0.0000	OK
15 minute winter	RG6	10	15.236	0.036	1.1	0.0039	0.0000	OK
15 minute summer	RG4	10	15.241	0.041	1.4	0.0060	0.0000	OK
15 minute winter	RG5	14	15.099	-0.051	3.8	0.6773	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	DUMMY1	Pump		0.0				0.0
60 minute winter	20	3.000	21	1.3	0.469	0.054	0.0605	
60 minute winter	21	3.001	22	2.6	0.641	0.155	0.0966	
60 minute winter	22	3.002	23	2.6	0.558	0.174	0.2480	
60 minute winter	23	3.003	24	3.3	0.697	0.194	0.0982	
60 minute winter	24	3.004	25	3.6	0.756	0.177	0.0677	
60 minute winter	25	3.005	TANK2	3.6	0.887	0.124	0.0667	
60 minute winter	TANK2	3.006	DUMMY2	1.9	0.418	0.116	0.0421	
60 minute winter	TANK2	Infiltration		0.7				
60 minute winter	DUMMY2	Pump		0.0				0.0
15 minute winter	RG6	4.000	RG5	1.1	0.453	0.268	0.0268	
15 minute summer	RG4	5.000	RG5	1.4	0.487	0.344	0.0319	
15 minute winter	RG5	4.001	DUMMY0	0.0	0.000	0.000	0.0115	
15 minute winter	RG5	Infiltration (5.000)		0.8				
15 minute winter	RG5	Infiltration (4.000)		0.8				

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Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RG1	10	15.238	0.038	1.4	0.0056	0.0000	OK
15 minute winter	RG3	10	15.238	0.038	1.4	0.0056	0.0000	OK
15 minute winter	RG2	13	15.168	0.018	4.1	0.8605	0.0000	OK
15 minute winter	DUMMY0	17	15.095	0.095	0.9	0.1075	0.0000	OK
15 minute summer	DUMMY OUTFALL	1	14.950	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RG1	6.000	RG2	1.4	0.509	0.311	0.0250	
15 minute winter	RG3	7.000	RG2	1.4	0.509	0.311	0.0250	
15 minute winter	RG2	6.001	DUMMY0	0.9	1.029	0.064	0.0117	
15 minute winter	RG2	Infiltration (7.000)		0.7				
15 minute winter	RG2	Infiltration (6.000)		0.7				
15 minute winter	DUMMY0	Pump	DUMMY OUTFALL	0.0				0.0

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Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	30	58	15.038	0.488	2.2	0.2456	0.0000	FLOOD RISK
60 minute winter	31	58	15.038	0.608	4.8	0.3187	0.0000	FLOOD RISK
60 minute winter	32	59	15.038	0.728	5.6	0.3080	0.0000	FLOOD RISK
60 minute winter	33	59	15.038	0.808	4.9	0.2286	0.0000	FLOOD RISK
60 minute winter	34	59	15.038	0.838	4.2	0.9475	0.0000	FLOOD RISK
60 minute winter	TANK3	59	15.038	0.928	4.4	2.7653	0.0000	FLOOD RISK
60 minute winter	DUMMY3	59	15.038	0.938	1.4	0.0075	0.0000	OK
60 minute winter	10	58	15.183	0.383	1.6	0.1644	0.0000	SURCHARGED
60 minute winter	11	58	15.183	0.483	3.3	0.2117	0.0000	SURCHARGED
60 minute winter	12	58	15.183	0.583	4.5	0.2595	0.0000	SURCHARGED
60 minute winter	13	59	15.183	0.633	4.0	0.1791	0.0000	SURCHARGED
60 minute winter	14	59	15.183	0.683	3.7	0.7723	0.0000	SURCHARGED
60 minute winter	TANK1	59	15.183	0.733	3.1	2.1843	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	30	1.000	31	2.1	0.444	0.116	0.2059	
60 minute winter	31	1.001	32	3.8	0.597	0.234	0.2536	
60 minute winter	32	1.002	33	4.9	0.579	0.290	0.1561	
60 minute winter	33	1.003	34	4.2	0.640	0.266	0.0654	
60 minute winter	34	1.004	TANK3	4.4	0.936	0.170	0.0740	
60 minute winter	TANK3	1.005	DUMMY3	1.4	0.466	0.106	0.0316	
60 minute winter	TANK3	Infiltration		1.0				
60 minute winter	DUMMY3	Pump		0.0				0.0
60 minute winter	10	2.000	11	1.5	0.385	0.087	0.1921	
60 minute winter	11	2.001	12	2.6	0.489	0.175	0.2544	
60 minute winter	12	2.002	13	4.0	0.641	0.249	0.1071	
60 minute winter	13	2.003	14	3.7	0.580	0.186	0.0700	
60 minute winter	14	2.004	TANK1	3.1	0.716	0.169	0.0846	
60 minute winter	TANK1	2.005	DUMMY1	1.3	0.419	0.079	0.0390	
60 minute winter	TANK1	Infiltration		0.9				

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Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	DUMMY1	59	15.183	0.753	1.3	0.0060	0.0000	OK
60 minute winter	20	58	15.012	0.362	2.2	0.1769	0.0000	SURCHARGED
60 minute winter	21	58	15.012	0.462	4.4	0.2164	0.0000	SURCHARGED
60 minute winter	22	58	15.012	0.512	3.9	0.1450	0.0000	SURCHARGED
60 minute winter	23	59	15.012	0.612	5.0	0.2541	0.0000	SURCHARGED
60 minute winter	24	59	15.012	0.662	4.3	0.1874	0.0000	SURCHARGED
60 minute winter	25	59	15.012	0.712	3.9	0.8053	0.0000	FLOOD RISK
60 minute winter	TANK2	59	15.012	0.812	4.1	2.4202	0.0000	FLOOD RISK
60 minute winter	DUMMY2	59	15.012	0.832	1.6	0.0067	0.0000	OK
30 minute winter	RG6	26	15.300	0.100	1.4	0.0110	0.0000	SURCHARGED
30 minute winter	RG4	26	15.301	0.101	1.8	0.0148	0.0000	SURCHARGED
30 minute winter	RG5	26	15.300	0.150	7.2	1.7444	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	DUMMY1	Pump		0.0				0.0
60 minute winter	20	3.000	21	2.2	0.528	0.091	0.0971	
60 minute winter	21	3.001	22	3.9	0.687	0.229	0.0971	
60 minute winter	22	3.002	23	3.3	0.558	0.222	0.2480	
60 minute winter	23	3.003	24	4.3	0.689	0.259	0.0982	
60 minute winter	24	3.004	25	3.8	0.723	0.186	0.0677	
60 minute winter	25	3.005	TANK2	4.1	0.925	0.140	0.0667	
60 minute winter	TANK2	3.006	DUMMY2	1.6	0.418	0.096	0.0421	
60 minute winter	TANK2	Infiltration		0.9				
60 minute winter	DUMMY2	Pump		0.0				0.0
30 minute winter	RG6	4.000	RG5	1.4	0.492	0.353	0.0892	
30 minute winter	RG4	5.000	RG5	1.8	0.529	0.454	0.0892	
30 minute winter	RG5	4.001	DUMMY0	3.1	0.515	0.225	0.0235	
30 minute winter	RG5	Infiltration (5.000)		0.8				
30 minute winter	RG5	Infiltration (4.000)		0.8				

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Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	RG1	26	15.301	0.101	1.8	0.0148	0.0000	SURCHARGED
30 minute winter	RG3	26	15.301	0.101	1.8	0.0148	0.0000	SURCHARGED
30 minute winter	RG2	26	15.300	0.150	5.4	1.4245	0.0000	SURCHARGED
30 minute winter	DUMMY0	26	15.300	0.300	6.1	0.3393	0.0000	SURCHARGED
15 minute summer	DUMMY OUTFALL	1	14.950	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	RG1	6.000	RG2	1.8	0.551	0.409	0.0726	
30 minute winter	RG3	7.000	RG2	1.8	0.551	0.409	0.0726	
30 minute winter	RG2	6.001	DUMMY0	3.5	0.915	0.254	0.0235	
30 minute winter	RG2	Infiltration (7.000)		0.7				
30 minute winter	RG2	Infiltration (6.000)		0.7				
30 minute winter	DUMMY0	Pump	DUMMY OUTFALL	0.0				0.0

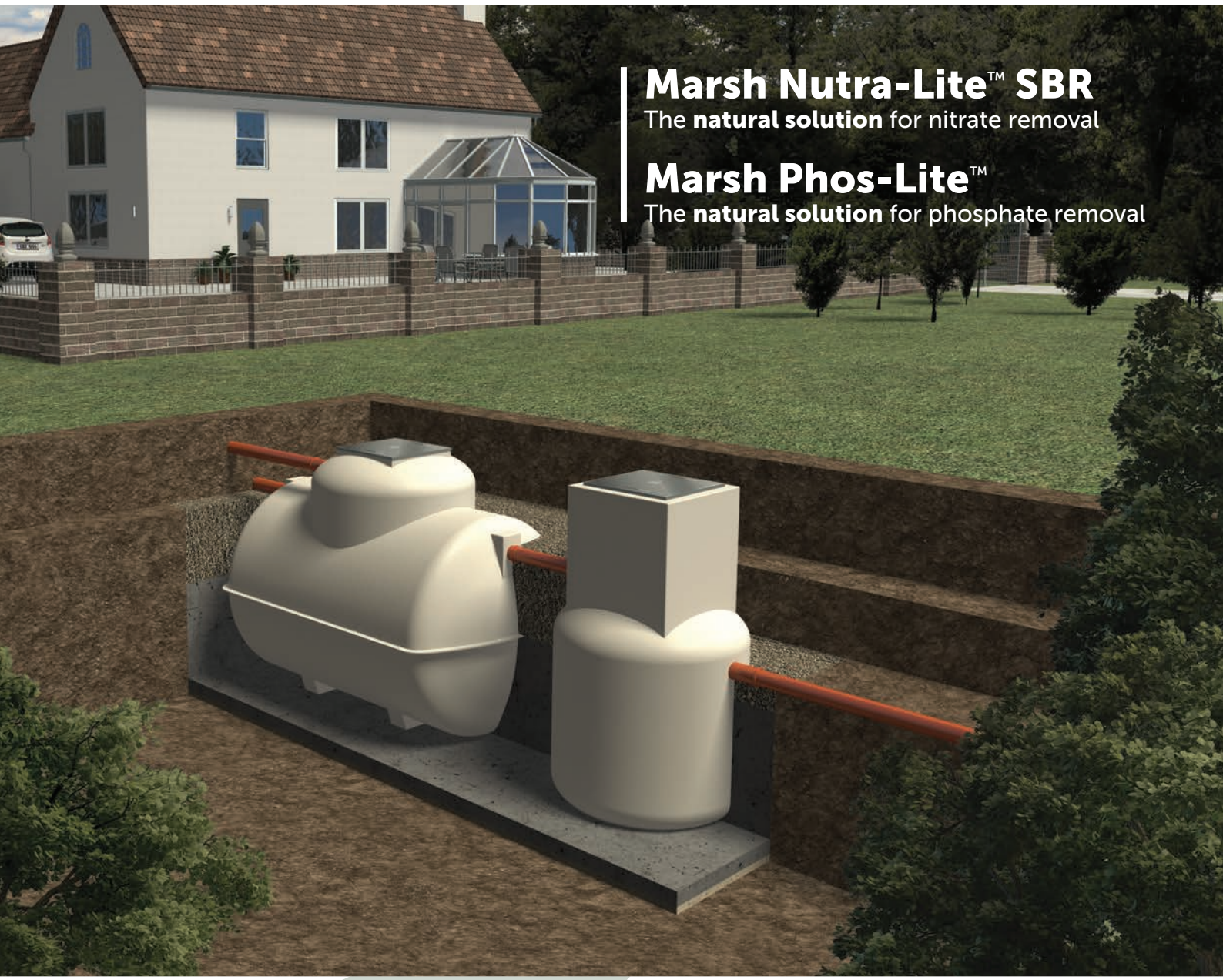
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ANNEX 4

Marsh Natural Solutions Information

Marsh Natural Solutions™

For phosphate and nitrate reduction



MADE IN BRITAIN®

Environmental compliance *without* chemical dosing

MARSH

Marsh Nutra-Lite SBR

The **natural solution** for advanced sewage treatment, phosphate and nitrate removal

Marsh Nutra-Lite SBR
Advanced sewage treatment plant

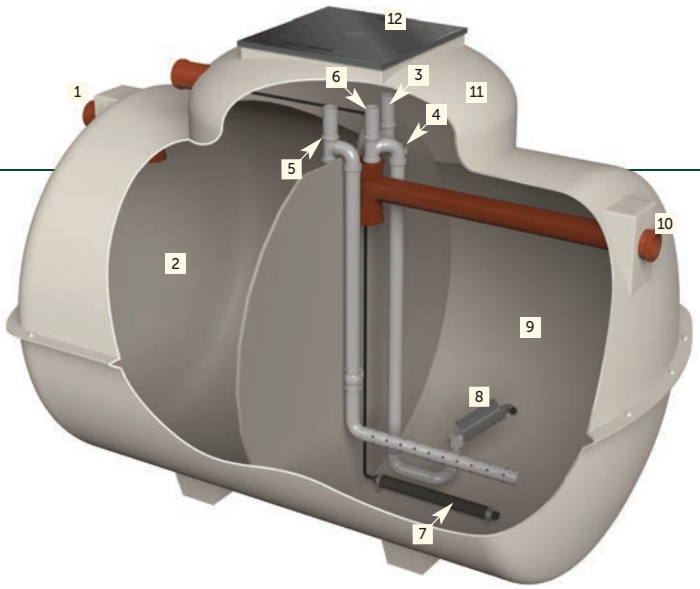

Certificate

MI Nutra-Lite

Key benefits

- 84% biological reduction of nitrates
- Exceeds nitrate targets to enable site development
- Certified performance in reducing COD, BOD, and Suspended Solids

SBR technology for superior nitrate reduction



Overview

Marsh Industries proudly presents the Marsh Nutra-Lite, an advanced Sequential Batch Reactor (SBR) sewage treatment plant designed to enhance effluent quality for off-mains wastewater systems and significantly reduce biological nitrates.

The Nutra-Lite is available in capacities catering to sites for up to 50 people. with state-of-the-art technology and rigorously tested, the Nutra-Lite sets a new standard for sustainable wastewater management.

Can be supplied as a complete system, combined with the Marsh Phos-Lite. See page 5 for Phos-Lite details.

Features

Outstanding discharge quality

The Nutra-Lite boasts the highest overall discharge quality of any plant available today. A unique self-cleaning, self-sealing sediment reduction valve ensures total control over suspended solids. No mechanical parts provide reliability and efficiency.

Nutra-Lite not only excels in phosphate and nitrate removal but also significantly reduces other key effluent constituents:

COD	95.8%	33mg/l
BOD	98.7%	4 mg/l
TNb	83.9%	11.1mg/l
NH_4n	99.1%	0.5mg/l
Ptot	34.3%	6mg/l
SS	97.1%	11mg/l

SBR technology for superior nitrate reduction

The Nutra-Lite harnesses SBR technology, achieving an impressive 84% biological reduction in nitrates. Unlike traditional methods, no chemicals or carbon are used – just biological processes.

Remote configuration and adaptability

Unique to Marsh Industries, the Nutra-Lite can be adapted to seasonal changes in biological treatment, ensuring optimal year-round performance. Remote configuration allows adjustments based on ongoing nitrate reduction research.

Secure telemetry and alarm monitoring

All Nutra-Lite plants feature bi-directional communication for maintenance and monitoring. Telemetry options include mobile connectivity or homeowner Wi-Fi/internet.

Efficiency and cost savings

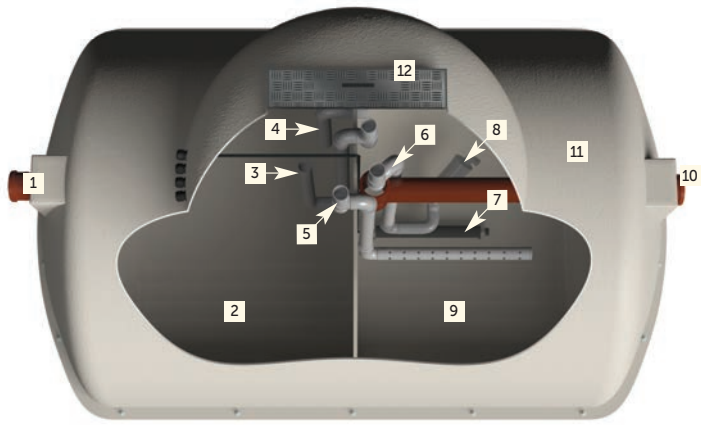
A single compressor minimises electrical power consumption without compromising performance. Economy mode further reduces running costs during process changeovers.

Certified performance

Rigorously tested at the world-leading notified test centre, PIA GmbH, in Aachen, Germany, the Nutra-Lite is certified to BS EN 12566-3 after 50 weeks of continuous testing. This system holds accreditation to EN12566-3 Annex B for systems of up to 50 Population Equivalent (PE) and complies with the UK Forward for BSEN12566-3, demonstrating its reliability and effectiveness.

Material strength and fire safety

Marsh Industries' GRP material successfully meets the requirements of EN ISO 11925-2:2010 standards and is tested for direct flame impingement. All units come with a 25-year structural guarantee.



Key

1 Inlet
2 Primary chamber
3 Inflow air-lift pipework
4 Overflow pipework
5 Recirculation air-lift pipework
6 Outflow air-lift pipework
7 Air diffuser
8 Sediment reduction valve
9 Secondary chamber
10 Outlet
11 Heavy duty GRP shell
12 Access cover

Specifications

Model	PE	Length	Width	Height	Inlet		Outlet	
(Pop)		+/-50mm	+/-50mm	+/-50mm	Invert	Ø	Invert	Ø
NL6	4-6PE	2602	1680	1865	550	110	625	110
NL10	7-10PE	2862	1952	2139	550	110	625	110
NL16	11-16PE	4252	1952	2284	600	110	675	110
NL25	17-25PE	5240	1952	2284	600	160	675	160

Tank configurations and components are shown for illustration purposes only

Marsh Phos-Lite

The **natural solution** for phosphate removal

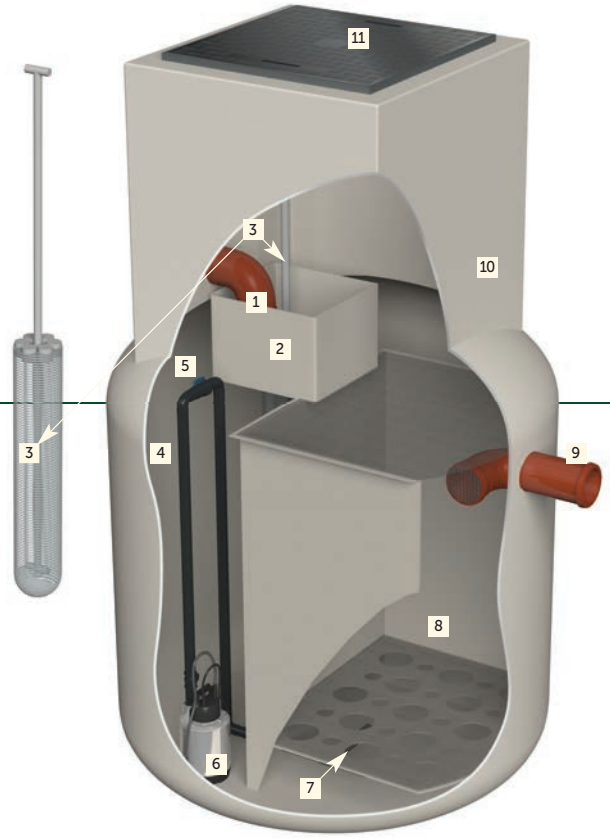
Addressing critical environmental concerns
Phosphate pollution leads to harmful algal blooms that deplete oxygen and disrupt aquatic ecosystems. Marsh Industries' state-of-the-art Phos-Lite system reduces phosphate levels to 0.2mg/l, far exceeding current standards. This solution was rigorously tested and certified at PIA GmbH test facility in Aachen, Germany.



Key benefits

- Phosphate reduction without chemical dosing
- Achieves phosphate levels of 0.2mg/l
- Exceeds phosphate targets to enable development
- Certified performance in reducing COD, BOD, and Suspended Solids

Innovative technology for cleaner water



Overview

Marsh Phos-Lite is a groundbreaking product designed to efficiently remove phosphate from wastewater. Utilising a unique adsorption process, Phos-Lite binds phosphorus to the surface of its media, which is composed of naturally occurring elements. This ensures long-term performance across varying flow rates and influent concentrations.

Recommended for up to 35PE (population equivalent), Phos-Lite is fully scalable to meet larger demands. The plant is engineered for maximum retention time, guaranteeing stable, low effluent phosphorus concentrations certified by PIA GmbH at 0.2mg/l.

With an electrical consumption of just 0.03 kWh/d, Phos-Lite operates at very low cost. This innovative tertiary treatment solution seamlessly connects to the outlet of both new and existing treatment plants.

Features

Enhanced effluent quality

Phos-Lite not only excels in phosphate removal but also significantly reduces other key effluent constituents.

The Marsh Nutra-Lite treats effluent to the following standards:

BOD	4mg/ltr
Suspended Solids	11mg/ltr
Ammonia	0.5mg/ltr

When the Marsh Nutra-Lite and Marsh Phos-Lite are combined, the effluent quality is further improved to:

BOD	1.62mg/ltr
Suspended Solids	4.3mg/ltr
Ammonia	0.38mg/ltr
PTot	0.26mg/ltr
TNb	10.5mg/ltr

Test results achieved when combined with the Marsh Ensign:EL

COD	56.1%	23 mg/l
BOD	59.5%	4 mg/l
TNb	5.5%	29.6 mg/l
NH4n	24%	0.4 mg/l
Ptot	95.9%	0.2 mg/l
SS	61.1%	4 mg/l

Long-term performance

Designed to retain up to 8.5kg of phosphorus in a 6PE domestic plant (British Water Flows and Load 4), the Marsh Phos-Lite offers reliable performance. Media performance will be assessed at pre-determined intervals and replaced if necessary. The longevity of the media will be influenced by the actual flows and loads entering the plant.

Natural, non-dosing solution

The plant uses Phos-Lite pellets, a natural mineral media, to reduce phosphate levels, simplifying operations and reducing the environmental impact of chemical use.

Cost-effective and low maintenance

The non-dosing approach minimises the need for frequent maintenance and chemical adjustments, leading to cost savings over the plant's lifetime.

Enhanced compliance

By achieving phosphate levels of 0.2mg/l, the plant ensures compliance with environmental standards, allowing water companies to meet regulatory obligations.

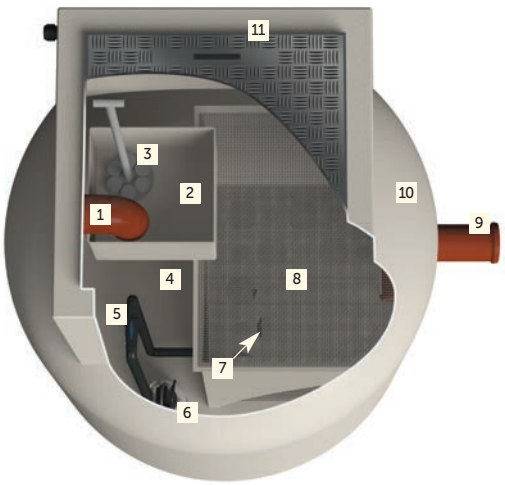
Ease of integration

The plant is designed for seamless integration into existing systems, making it versatile for new installations and retrofits. Builders' merchants will find this product a valuable addition to their offerings, catering to the growing demand for environmentally responsible wastewater treatment solutions.

Material strength and fire safety

Marsh Industries' GRP material successfully meets the requirements of EN ISO 11925-2:2010 standards and is tested for direct flame impingement. All units come with a 25-year structural guarantee.

Tank configurations and components are shown for illustration purposes only



Key

1 Inlet
2 Inlet chamber
3 Filter sock (hidden from view)
4 Primary chamber
5 Flow control valve
6 Submersible pump
7 Pipework outflow (beneath lower shelf)
8 Phos-Pellet chamber
9 Outlet
10 Heavy duty GRP shell
11 Access cover

Specifications

Model	PE	Dia Ø	Height	Inlet		Outlet	
		+/-50mm	+/-50mm	Invert	Ø	Invert	Ø
PL4	4PE	1200	1865	665*	110	1085	110
PL6	6PE	1200	1865	665*	110	1085	110
PL8	8PE	1200	2139	665*	110	1085	110
PL10	10PE	1200	2139	665*	110	1085	110
PL12	12PE	1500	2284	715*	110	1085	110
PL16	16PE	1500	2284	715*	110	1085	110
PL20	20PE	1500	2284	715*	110	1085	110
PL25	25PE	1500	2284	715*	160	1085	160

** Inlet invert subject to outlet invert on preceding sewage treatment plant*

Testing and certification



Reliable, tested and trusted

The Marsh Nutra-Lite has undergone rigorous testing and earned accreditation in line with EN12566-3 Annex B standards, while Phos-Lite has achieved accreditation in accordance with EN12566-7 test Annex A. These comprehensive assessments were conducted by Prüfinstitut für Abwassertechnik (PIA) GmbH in Aachen, Germany, for wastewater treatment systems accommodating up to 50 PE. This certification confirms the reliability and effectiveness of the products in meeting the demands of wastewater treatment systems for environmentally sensitive sites. All Marsh systems comply with the UK Forward for BSEN12566-3.

The Marsh Nutra-Lite has achieved accreditation in accordance with EN12566-3 Annex B

the Marsh Phos-Lite has achieved accreditation in accordance with EN12566-7 test Annex A.

For combined Nutra-Lite and Phos-Lite performance see table on page 5



Enhanced structural integrity

40% Stronger GRP Material

Marsh Industries places a significant emphasis on the durability and reliability of its products, as evidenced by the meticulous assessment of structural integrity. In line with the testing protocol outlined in ENISO 179-1/1eA: 2010-11, comprehensive evaluations were conducted to gauge the robustness of Marsh Industries' glass reinforced plastic (GRP) materials in comparison to similar materials used by competing manufacturers.

To establish a comprehensive benchmark, three distinct material samples were subjected to rigorous impact testing. These samples included Marsh GRP material in its original form (consisting of virgin unfilled resin), a variant incorporating calcium fillers, and another variant enriched with sand filler. The testing process involved analysing 12 samples of each material, all measuring 80x10x5mm. The pendulum energy utilised for impact assessment was set at 15J, with an accompanying impact velocity of 3.8m/s.

The findings were resoundingly in favour of Marsh Industries' GRP material, showcasing an impressive 40% increase in strength when compared to the other materials under scrutiny. This outcome underscores the superior quality and structural resilience inherent in Marsh's GRP material.

Material fire safety

Marsh Industries upholds the highest standards in product safety and adherence to regulations, as demonstrated by its material fire resistance testing. The focus of this evaluation was to ascertain the ignitability of products when exposed to direct flame impingement. Rigorous testing procedures were carried out to ensure compliance with EN ISO 11925-2:2010 standard.

The testing regimen encompassed practical scenarios designed to gauge the material's response to flame exposure. Marsh Industries' GRP material successfully passed all aspects of the fire resistance tests, achieving EN ISO 11925-2:2010 standard.

Natural England and the Environment Agency's guide to nutrient neutrality

Nutrient neutrality

Nutrient neutrality is a policy aimed at controlling the levels of nutrients, particularly nitrogen and phosphorus, entering water bodies from human activities. Excessive nutrients from agriculture, wastewater, and urban runoff can cause environmental issues such as eutrophication, leading to algal blooms that damage water quality, biodiversity and ecosystems.

In the UK, this issue has become particularly important in areas with protected habitats, like Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), which are governed by the Habitats Regulations. Natural England and the Environment Agency are key regulatory bodies involved in ensuring that new developments do not increase nutrient pollution in sensitive areas.

Natural England's role

Natural England is responsible for advising local planning authorities on protecting natural environments, particularly designated sites. It provides guidance on nutrient neutrality for new housing and other developments near sensitive water bodies.

Key points

- **Guidance to Local Planning Authorities (LPAs):** Natural England advises LPAs to ensure that development projects demonstrate nutrient neutrality, especially near vulnerable habitats.
- **Nutrient budgeting:** Developers must calculate the nutrient load (nitrogen and phosphorus) that their project will contribute to the water system. Natural England provides frameworks and tools to help assess these impacts.
- **Mitigation:** If nutrient neutrality cannot be demonstrated directly, mitigation measures must be proposed. This can include creating wetlands, woodland planting, or upgrading wastewater treatment processes to reduce nutrient runoff.

The Environment Agency's role

The Environment Agency is responsible for monitoring and regulating water quality in rivers, lakes, and coastal waters. It oversees how water companies, agriculture and urban areas contribute to nutrient pollution, and works to limit these impacts.

Key points

- **Water quality regulation:** The Environment Agency sets and enforces limits on nutrient levels entering water bodies through permits for discharges (eg, from sewage treatment plants).
- **Catchment-based approach:** It often takes a catchment-based approach, focusing on the health of entire river systems to manage nutrient levels.
- **Agricultural regulation:** The Agency also regulates nutrient management in farming, providing guidance on land use and fertiliser application, and promoting sustainable practices to limit runoff into water bodies.

Nutrient neutrality in planning

In areas where nutrient pollution is an issue, new developments must not increase the nutrient load on the environment. LPAs, supported by Natural England's guidance, are required to ensure that planning permissions are granted only if projects can prove nutrient neutrality.

Key points

- **Nutrient Nneutrality assessments:** Developers must submit assessments to prove their developments won't add to nutrient levels.
- **Mitigation measures:** If developments would add nutrients to the environment, they must propose mitigations such as buffer zones, sustainable drainage systems (SuDS), or contributions to strategic mitigation schemes.

Impacts on development

Nutrient neutrality has had a significant impact on housing developments in certain regions, particularly around the Solent, Somerset Levels and the River Wye. Delays and increased costs can occur due to the need for nutrient assessments and mitigation strategies.

Long-term goals

Both Natural England and the Environment Agency aim to:

- Improve water quality and protect vulnerable habitats.
- Ensure sustainable development without compromising environmental health.
- Support the creation of mitigation solutions that balance development needs with environmental protection.

Overall, nutrient neutrality regulations, enforced by Natural England and the Environment Agency, play a crucial role in safeguarding sensitive ecosystems from the harmful effects of nutrient pollution.

Marsh Natural Solutions

Enabling development in environmentally sensitive areas

Marsh Industries provides innovative, sustainable, wastewater treatment solutions to support nutrient neutrality. Our 'Natural Solutions' range effectively reduces pollutants and nutrients, such as nitrate, phosphate and ammonia, ensuring compliance with strict standards set by environmental regulators.

As industry leaders, we develop cutting-edge products that meet and exceed regulatory requirements, ensuring cleaner and safer water. Our commitment to research and development keeps us at the forefront of wastewater treatment technology.

Choose **Marsh Natural Solutions** for efficient, sustainable, and compliant wastewater management. Together, we can create cleaner, healthier waterways.



Contact our eco-friendly team on

01933 654582

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to discuss your project's unique requirements

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