



NUTRIENT BUDGET CALCULATOR GUIDANCE

A guide on how to calculate a phosphorus budget
for a development

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GLOSSARY

Abbreviation	Definition
CCC	Carmarthenshire County Council
P	Phosphorus
TP	Total Phosphorus
SAC	Special Areas of Conservation
CJEU	Court of Justice of the European Union
LPA	Local Planning Authority
NRW	Natural Resources Wales
WwTW	Wastewater Treatment Works
PTP	Package Treatment Plants
ST	Septic Tank
HRA	Habitat Regulations Assessment
AA	Appropriate Assessment
LSE	Likely Significant Effects
WFD	Water Framework Directive
SuDS	Sustainable Urban Drainage Systems

1 THE REQUIREMENT FOR NUTRIENT NEUTRALITY

1.1 THE DUTCH CASE

The recent (2018) ruling in the European Court of Justice¹ referred to as 'The Dutch Case' or 'The Dutch Nitrogen Cases' resulted in a change to how the Habitat Regulations (as amended, 2017) are applied to plans or projects in the catchments of European Designated sites (hereafter, European sites) that are under pressure from pre-existing levels of nutrients.

The Dutch Case was concerned with the potential detrimental effects of agricultural practices in the Netherlands on European Designated sites. However, the legal interpretation of The Dutch Case now requires local planning authorities to consider the impacts from new plans and projects that may generate additional nutrient inputs to European sites.

1.2 WHAT DOES THE DUTCH CASE MEAN?

The Carmarthenshire County Council (CCC) administrative boundary contains various European sites that are under pressure from existing high nutrient inputs. The additional nutrient load from the increase in wastewater and/or the change in land use created by a new plan or project can create an 'impact pathway' that will exacerbate the problems related to nutrient loading that are currently seen in Carmarthenshire's European sites. This impact pathway is shown diagrammatically in Figure 1. The impact pathway for nutrients from a new development will result in a Habitats Regulations Assessment (HRA) finding 'Likely Significant Effects' on the ecology of CCC's European sites due to increased nutrient inputs. The two key nutrients that are output by new developments are nitrogen (N) and phosphorus (P). All sites of concern in CCC are under pressure from P.

Where an HRA finds likely significant effects on a European site due to excessive nutrient inputs it may not be possible to conclude no adverse effect on site integrity in an HRA appropriate assessment unless mitigation of nutrients to achieve 'nutrient neutrality' is secured.

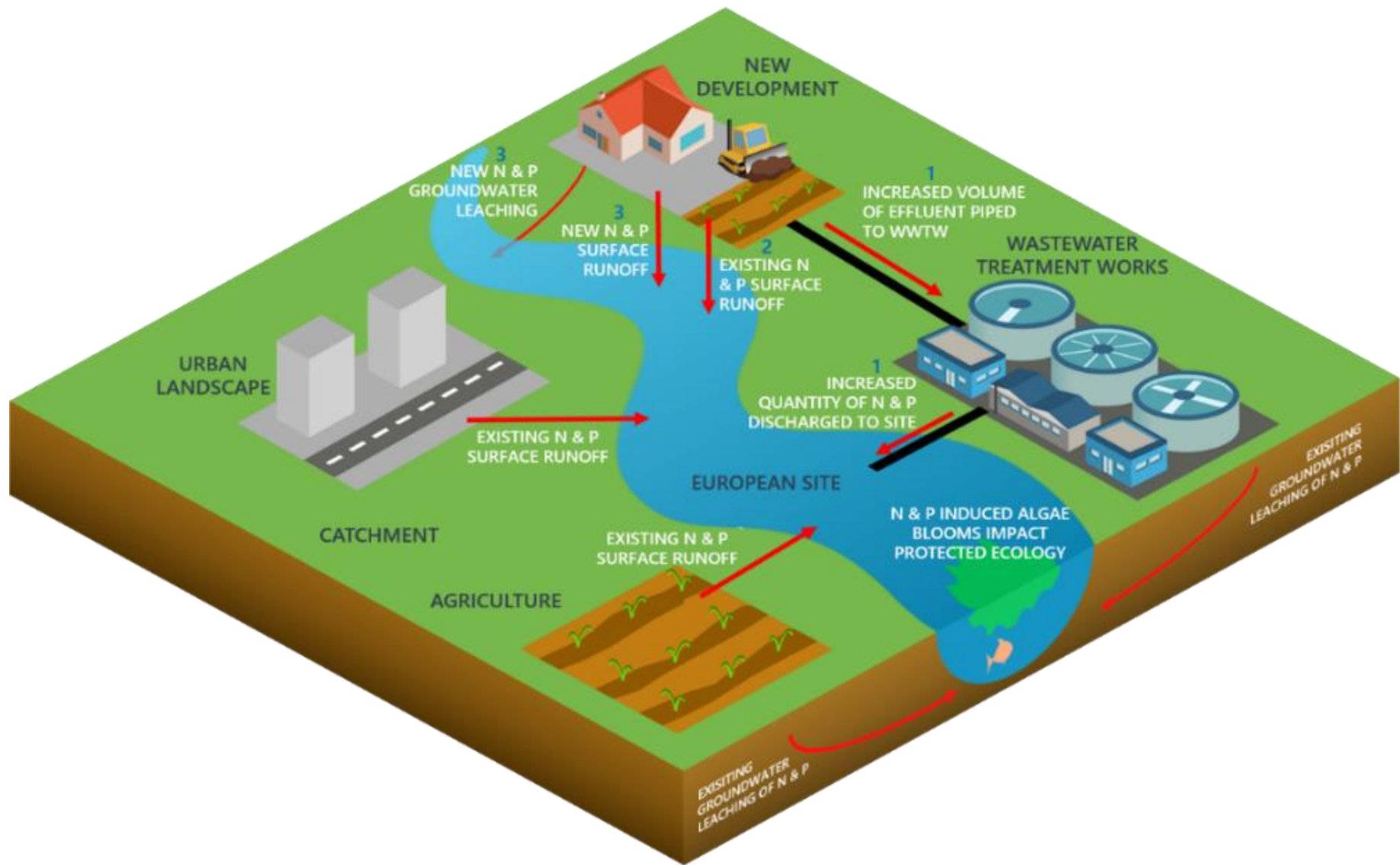
The first step in an appropriate assessment that is applying nutrient neutrality is to understand whether a development will cause additional nutrient inputs to a European site. This requires calculation of the amount of nutrients a new residential development will create, otherwise known as a nutrient budget.

If a nutrient budget shows that a new development will increase the nutrient input to any of the sites and it is not possible to conclude no adverse effect on site integrity alone or in combination, then this is the amount of nutrients that require mitigating on an annual basis to achieve nutrient neutrality and therefore enable a conclusion of no adverse effect on site integrity.

This guidance document accompanies the Carmarthenshire Nutrient Budget Calculator which has been designed to enable developers in Carmarthenshire to calculate nutrient budgets for residential developments. The following sections of this document provide step-by-step instructions on how to complete a nutrient budget using the calculator.

¹ Joined Cases C-293/17 and C-294/17 *Coöperatie Mobilisation for the Environment UA and Others v College van gedeputeerde staten van Limburg and Other* (the Dutch Nitrogen cases)

Figure 1 Diagram showing potential nutrient impact pathways



1.3 EUROPEAN SITES IN CARMARTHENSHIRE COUNTY

The Afonydd Cleddau / Cleddau Rivers Special Area of Conservation (SAC), Afon Tywi / River Tywi SAC, the Afon Teifi / River Teifi SAC and the Afon Gwy / River Wye SAC are European sites that are in unfavourable condition or are close to unfavourable condition due to excessive P levels. Parts of the catchments of these European sites are within the CCC administrative boundary. If a development is within these catchments, a P budget will need to be completed in order to consider if the developer will cause adverse effects on site integrity due to increased nutrient loading to Carmarthenshire's SAC rivers. Figure 2 shows the location of these sites.

These rivers support a wide range of habitats and species between them, including:

- an abundance of water-crowfoots; white-flowered species can be found as floating mats typically in the first half of summer.
- Fish species such as Brook Lamprey, Sea Lamprey, River Lamprey, Bullhead, Atlantic Salmon, Twaite Shad, and Allis Shad.
- White-clawed crayfish.
- Otters.
- Floating water plantain.

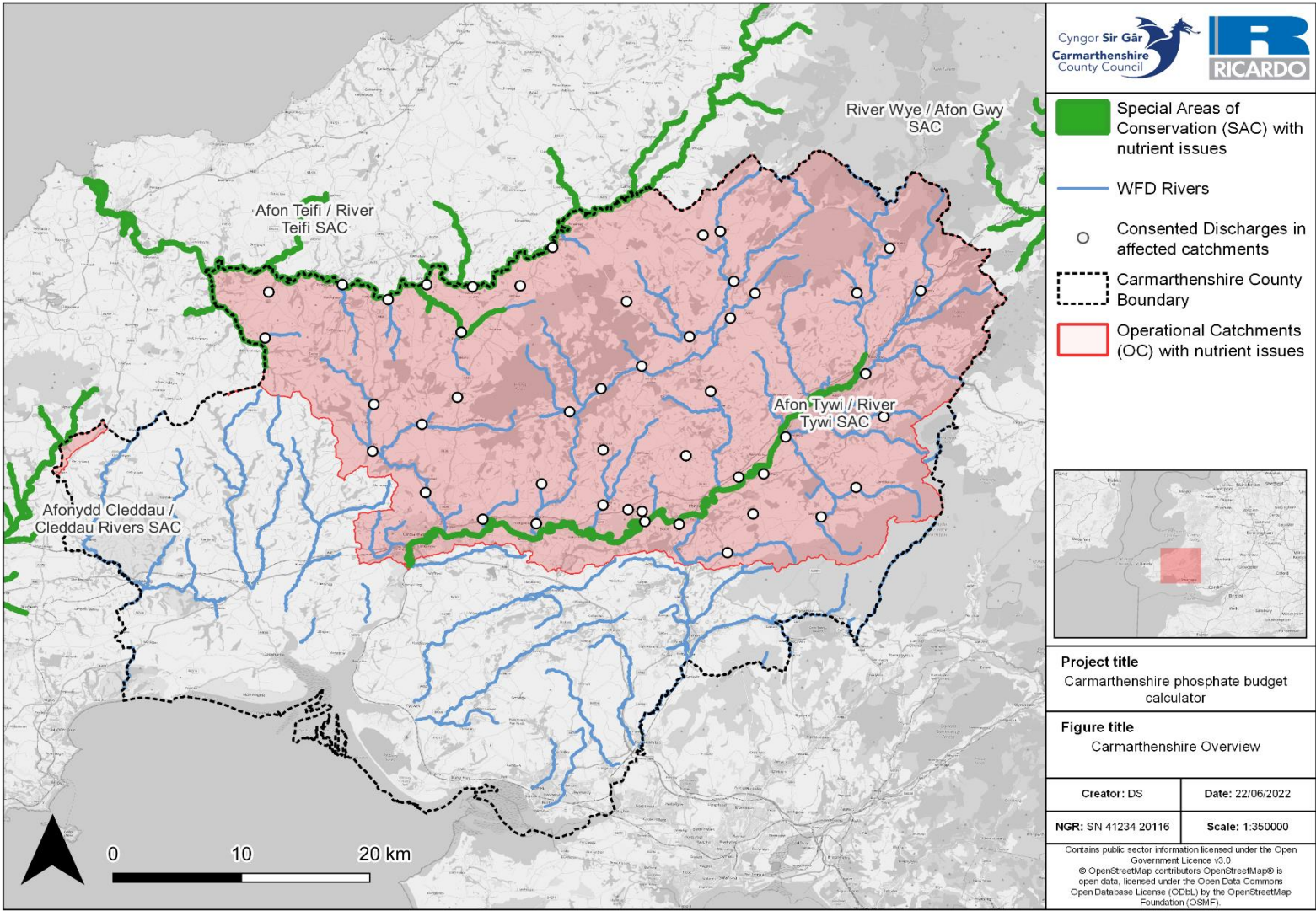
Increased levels of P entering aquatic environments via surface water and groundwater can severely threaten the sensitive habitats and species that are within each SAC. The elevated levels of nutrients can cause eutrophication, leading to algal blooms which disrupt normal ecosystem function and cause major changes in the aquatic community. These algal blooms can result in reduced levels of oxygen within the water, which in turn can lead to the death of many aquatic organisms including invertebrates and fish.

The habitats and species within these rivers that result in their respective designations as a SAC are referred to as 'qualifying features'. Not all of these qualifying features will be sensitive to changes in nutrients within these rivers. When completing an HRA involving nutrient neutrality, CCC must identify and screen out qualifying features that are not sensitive to nutrients via an HRA. Developers will be asked to submit information to support this process.

More detailed information on the qualifying features of the SAC can be found in the following links:

- [Afonydd Cleddau/ Cleddau Rivers](#)
- [Afon Teifi/ River Teifi](#)
- [Afon Tywi/ River Tywi](#)
- [River Wye/ Afon Gwy](#)

Figure 2 A map showing the Carmarthenshire County Council administrative boundary, the European Designated sites with nutrient issues and the area that drains to the sites.



1.4 WHAT IS THIS GUIDANCE FOR?

This guidance document accompanies the Carmarthenshire County Council nutrient budget calculator. The nutrient budget calculator is used to calculate the change in nutrient input from a new residential development to the Afonydd Cleddau / Cleddau Rivers SAC, Afon Tywi / River Tywi SAC, the Afon Teifi / River Teifi SAC and the Afon Gwy / River Wye SAC. The calculator can be used to inform an AA which is looking to apply nutrient neutrality to show whether a new development will require nutrient mitigation and if so, the amount of P loading that requires offsetting through mitigation measures to enable a conclusion of no adverse effect on site integrity, alone or in combination.

The guidance document contains the following:

- Step-by-step instructions on how to collect the specific data required as inputs to the tool.
- Instructions on how to use the tool.

1.5 WHO IS THE GUIDANCE FOR?

This guidance is for anyone who needs to complete a nutrient budget calculation to support an AA of residential development in the CCC administrative boundary. The tool is primarily aimed at developers who need to complete a nutrient budget calculation to support a planning application and Local Planning Authorities who need to understand the mitigation requirements for future development or assess planning applications. It could also be used by communities or environmental groups wanting to understand the impacts of a local development on the nutrient inputs to the sites of concern.

The key factors to consider when assessing whether the nutrient neutrality approach is required for a new development are:

1. Whether the development is within a catchment that drains to an affected European site.
2. Whether the receiving Wastewater Treatment Works discharges to an affected European site.
3. Whether the development will lead to an increase in 'overnight stays.'

If the answer is yes to either 1, or the answer is yes to 2 *and* 3 as outlined above, a nutrient budget calculator will need to be completed in order to assess whether development will increase nutrient loading to a European site identified in Section 1.3.

If unsure whether the development is within a catchment that drains to an affected European site, please follow the instructions in Appendix 1. If unsure whether the receiving WwTW drains to a European site, please check if the WwTW is in the dropdown list in Stage 1 of the calculator or the table in Appendix 2. An increase in overnight stays is defined as any development that will increase the number of people that will stay overnight compared to the previous land use on the development area.

2 OVERVIEW OF THE NUTRIENT BUDGET CALCULATOR

The nutrient budget calculator is based in Microsoft Excel and comprises eleven worksheets:

- **Introduction** – the cover page of the tool.
- **Background** – information on nutrient neutrality.
- **Instructions** – concise guidance on how to use the tool.
- **Development site details** – a worksheet to enter site-specific details for auditing purposes.
- **Stage 1** – a worksheet that calculates the additional nutrient loading from wastewater based on development specific information inputted by the user.
- **Stage 2** – a worksheet that calculates the P loading from the existing, pre-development, land use based on development-specific information inputted by the user.
- **Stage 3** – a worksheet that calculates the P loading from the new, post-development, land use based on development-specific information inputted by the user.
- **Stage 4** – a worksheet that calculates the P loading that needs to be mitigated in order prove nutrient neutrality based on the outputs from Stage 1 – Stage 3.
- **Landcover descriptions** – a worksheet that provides details and further information about the different landcover types that can be entered into the tool.
- **Mitigation Options** – a worksheet that provides brief information on potential mitigation options and the key factors that affect the efficacy of such solutions to mitigate P.
- **Lookups** – a worksheet that contains a series of lookup tables used in the calculator.

To calculate the nutrient loading to a European site, the user will need to navigate the tool and input key information into the appropriate cells at each stage. The instructions worksheet contains instructions on which cells require user inputs and how to find this information. The key stages of the calculation can be seen in the diagrams in Figure 3 and Figure 4. The key inputs to each stage of the nutrient budget calculations are shown in Figure 5.

Figure 3 Diagram demonstrating the key stages of the nutrient budget calculator

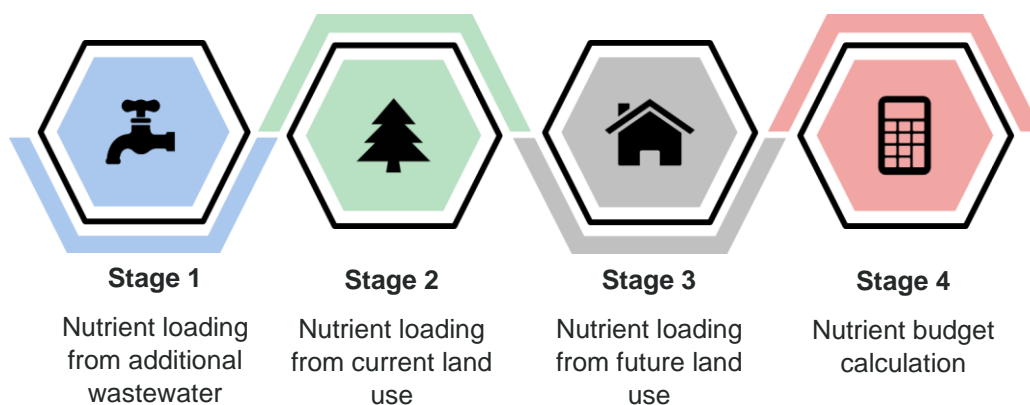


Figure 4 Diagram showing the overall equation used to calculate the phosphorus loading to a European site

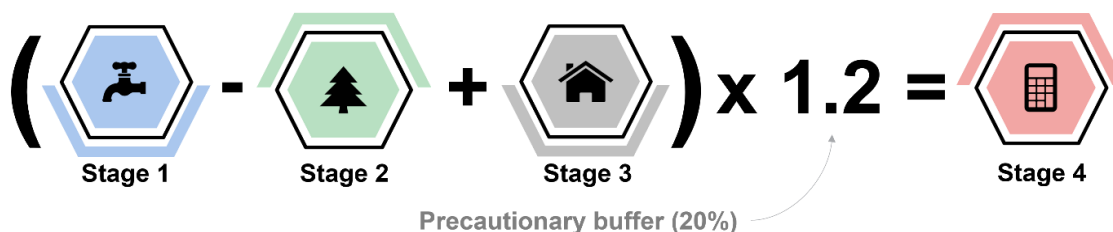
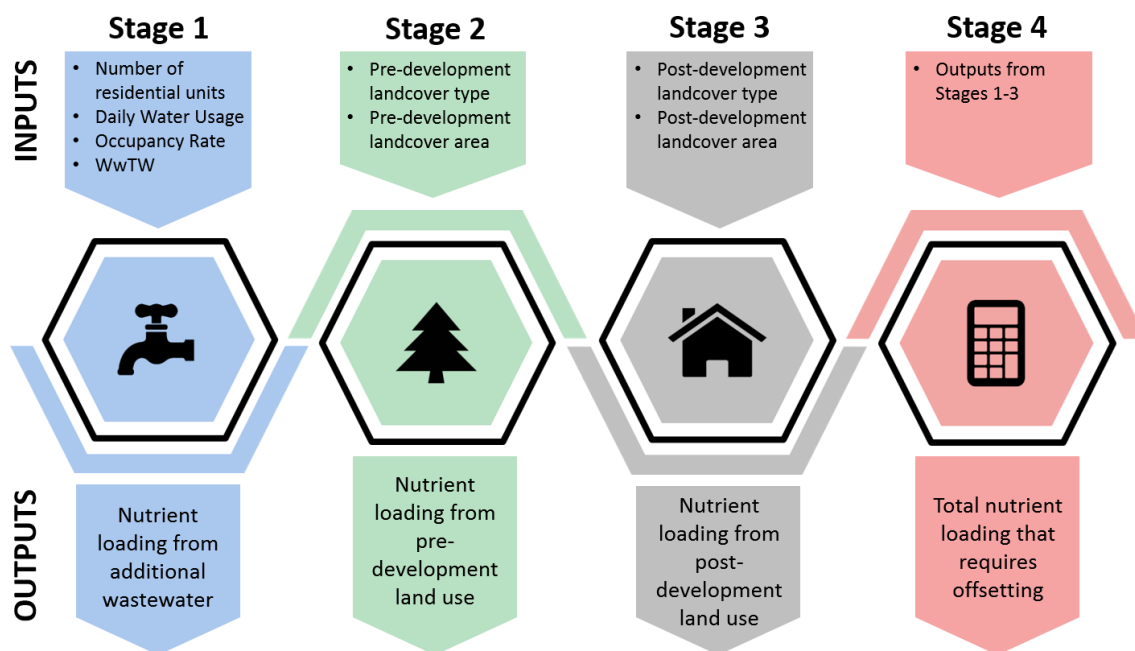


Figure 5 Diagram showing the inputs and outputs associated with each stage of the calculator



3 DATA COLLECTION AND PREPARATION

The nutrient budget calculator requires a set of inputs as shown in Figure 5. This section does not provide instructions on how to gather development specific information, such as the number of properties being constructed, the area of the development, the pre-existing landcover etc. as this should be known by the developer and should be detailed in the planning application. If this information is not known, please find out this information first. The subsections below provide guidance on how to identify certain inputs that are needed to complete the calculations for each stage of the nutrient budget calculations. The information required is available from free to access data sources². Most of the required inputs are for factors that are specific to the location of a development site or the hydrological catchments of the Afonydd Cleddau / Cleddau Rivers SAC, Afon Tywi / River Tywi SAC, the Afon Teifi / River Teifi SAC and the Afon Gwy / River Wye SAC.

3.1 STAGE 2 & 3 LANDCOVER TYPES USED IN THE TOOL

This guidance document does not provide instructions on how to identify landcover types. To assist with converting the previously identified landcover types to landcover types that can be entered into this tool, please see Table 1³.

Table 1 Table detailing the landcover types available for use in the tool.

Land use types used in the calculator tool	Description
Cereals	Agricultural areas on which cereals, combinable crops and set aside are farmed.
General	Agricultural areas on which arable crops (including field scale vegetables) are farmed.
Horticulture	Agricultural areas on which fruit (including vineyards), hardy nursery stock, glasshouse flowers and vegetables, market garden scale vegetables, outdoor bulbs and flowers, and mushrooms are farmed.
Indoor Pig farming	Agricultural areas on which pigs farmed indoors.
Outdoor Pig farming	Agricultural areas on which pigs farmed outdoors.
Poultry	Agricultural areas on which poultry are farmed.
Dairy	Agricultural areas on which dairy cows are farmed.
Less Favoured Area (LFA) grazing	Agricultural areas on which cattle, sheep and other grazing livestock are farmed in locations where agricultural production is difficult. An area is classified as an LFA holding if 50 per cent or more of its total area is classed as LFA.
Lowland grazing	Agricultural areas on which cattle, sheep and other grazing livestock are farmed. A holding is classified as lowland if less than 50 per cent of its total area is in the LFA.
Mixed	Agricultural areas in which none of the above categories are farmed or where it is too difficult to select a single category to describe the farm type.

² Correct at the time of writing. These data sources are available from web sources that currently have government funding but it should be noted that these datasets may become unavailable if funding is removed.

³ To view the specific definitions of the robust farm types, see: Farm Classification in the United Kingdom. Available here: http://farmbusinesssurvey.co.uk/DataBuilder/UK_Farm_Classification_2014_Final.pdf, accessed on: 12/12/2021

Land use types used in the calculator tool	Description
Greenspace	Natural and semi-natural outdoor spaces provided for recreational use where fertilisers will not be applied and dog waste is managed, e.g. semi-natural parks. This does not include green infrastructure within the built urban environment, such as gardens, or grass verges, as these are included in the residential urban land category.
Woodland	Natural and semi-natural outdoor wooded areas.
Shrub	Natural and semi-natural outdoor shrubland area.
Water	Areas of surface water that remain inundated all year round, including rivers, ponds, permanently inundated SuDS features and lakes.
Residential land	Areas of houses and associated infrastructure. This is inclusive of residential roads, driveways, grass verges, gardens and blue-green SuDS infrastructure ⁴ .
Commercial/industrial land	Areas that are used for industry. These are businesses that typically manufacture, process or otherwise generate products. Included in the definition of industrial land are factories and storage facilities as well as mining and shipping operations.
Open land – built environment	Area of land in urban areas used for various purposes, e.g. main roads, built facilities such as schools, sports centres, areas used for leisure and recreation - this may include open land, e.g. caravan sites, camping sites, sports fields, playgrounds, public squares.
Community food growing	Areas that are used for local food production, such as allotments.

3.2 STAGE 2: INSTRUCTIONS FOR FINDING THE SOIL DRAINAGE TYPE ASSOCIATED WITH THE PREDOMINANT SOIL TYPE WITHIN THE DEVELOPMENT SITE

- Go to this link: <http://www.landis.org.uk/soilscapes/#>
- Find your development site location on the map by using the search bar on the right side of the map in the 'Search' tab. Searching a location should generate a pop-up window in which you can view the soil information by clicking 'View soil information'. If this is not an option then click on the relevant soil type on the map and click on the 'Soil information' tab on the right-hand side of the map, below the 'Search' tab.
- The 'Soil drainage type' value can be found in the 'Soil information' under the title 'Drainage:'
- Make a note of this soil type and select the relevant soil drainage type from the drop-down list in the 'Soil drainage type' cell when you get to this part of the calculator tool.

3.3 STAGE 2 & 3: INSTRUCTIONS FOR FINDING THE ANNUAL AVERAGE RAINFALL THAT THE DEVELOPMENT SITE WILL RECEIVE

- Go to this link: <https://nrfa.ceh.ac.uk/data/station/spatial/60010>

⁴ Following the precautionary principle blue-green SuDS are incorporated into the Residential land type as they are likely to have similar nutrient inputs as the surrounding residential land.

- This link will bring the user to the Tywi at Ty Castell catchment information page.
- Click on the dropdown list next to the title 'Select spatial data type to view:' on the left of the map and select 'Rainfall'.
- Select the Legend tab.
- Zoom in on the map to find the location of the development and find the corresponding rainfall range from the Legend. Note that you cannot search this map using location information and will need to 'surf' around the map to find your development site location.
- Make a note of the relevant rainfall band for your site and use it to select this rainfall band from the drop-down list in the 'Average annual rainfall' cell when you get to this part of the calculator tool.

Note: some of the values you select above will also be used in the Stage 3 calculations, however you only need to add the above details to the table in Stage 2 of the calculator and the required values for stage 3 will be carried through automatically.

4 HOW TO USE THE CALCULATOR

4.1 GENERAL TIPS

The key in Figure 6 shows the colour coding used to highlight which cells need to be completed. When a cell is selected, instructions on how to fill out the cell that is selected are shown in Figure 7. Where user inputs are required, the information needs to be based on best available evidence that these inputs are accurate in perpetuity⁵ and are suitable precautionary.

Some cells will have values pre-populated, like the 'Water usage' input. The instructions for each cell will detail if an alternative value can be used. The values already included in this tool have been chosen based on extensive research to determine suitable inputs to the nutrient budget that meet the HRA tests of beyond reasonable scientific doubt, in perpetuity and in accordance with the precautionary principle. It is highly inadvisable to edit the values in this tool without a sufficient evidence base to justify any changes. If any pre-populated cells are changed the onus is on the user to prove that these values are accurate and defensible.

It is advisable to retain a default copy of this calculator tool workbook which has not had any development details added. "Save as" a new copy each time you calculate a budget for a new development in case any of the default values in the in the workbook get overwritten and are needed again.

Figure 6 Key for the calculator

	Values to be entered by the user
	Fixed or calculated values
	Lookup tables

Figure 7 Screenshot demonstrating cells that require user inputs typically contain dialogue boxes with instructions

Average occupancy rate:	2.3
Water usage (litres/person/day):	
Development Proposal (dwellings):	
Wastewater treatment works:	

The average occupancy rate (people per dwelling) should not be edited unless there is sufficient evidence.

⁵ The currently established definition of in perpetuity for the purposes of nutrient neutrality is 80-125 years.

4.2 STAGE SPECIFIC USER INPUTS

4.2.1 Stage 1: calculate the new nutrient load associated with the additional wastewater

Date of first occupancy

The user will need to enter the estimated date of first occupancy of the development. This is for auditing purposes.

Average occupancy rate

This value is the average amount of people per dwelling/unit. The default setting is 2.3 people per dwelling/unit. This is based on the average Carmarthenshire County Council occupancy rate according to the 2011 census, as well as the Welsh national average occupancy rate and the estimated population growth used by Dŵr Cymru for forward planning purposes. This value should not be changed unless the user can provide sufficient evidence that the development will have a different occupancy rate. If there is a mix of different sized dwellings/units and there is evidence that proves beyond reasonable scientific doubt that these will have different occupancy rates in perpetuity, the user can input a different occupancy rate. The methodology for calculating this revised occupancy rate will also need to be submitted as supporting evidence to the nutrient budget output.

Number of dwellings/units

The user will need to enter the number of dwellings that will be within the development at the time of completion. Please note that, as mentioned in Section 1.5, this methodology is concerned with any residential development that increases the number of overnight stays. Therefore, if a development involves constructing additional dwellings/units in place of those that were pre-existing, only the additional dwellings/units are input to the calculator.

Water usage per person

This value is the estimated average water usage per person. This is set to a default of 120 litres/person/day which is 10 litres higher than the Building Regulations⁶ standard set by the Welsh Ministers of 110 litres/person/day of wholesome water where a dwelling/unit is erected. The standard is based on a 'fittings approach' where water efficiency compliance is achieved through water efficient fittings. The extra 10 litres/person/day is a precautionary approach to account for water usage variations and account for any potential future changes to the water fittings in perpetuity. If a dwelling/unit is formed by a material change of use of a building, then this value should be changed to 135 litres/person/day. Again, this value is 10 litres/person/day above the Building Regulations standard of 125 litres/person/day in order to be precautionary for the same reasons identified above.

Wastewater Treatment Works (WwTW)

The user will need to select the receiving WwTW to which the development will connect. If required, this information can be obtained from the sewerage undertaker for the development site. If it is not feasible to connect to mains sewerage and a septic tank (ST) or package treatment plant (PTP) is being used, please select this option. Please be aware that if the total phosphorus (TP) final effluent concentrations (in mg/l) are specified by the manufacturer, please select 'Septic Tank user defined' or 'Package Treatment Plant user defined' and enter the specified value in the cell where prompted. If you do not have a TP value provided by the manufacturer, select the 'Septic Tank default' or 'Package Treatment Plant default' option and a value will be provided automatically.

If the receiving WwTW to which the development will connect is not on the dropdown list, please check that this information is correct by contacting the sewerage undertaker. Once confirmed that your development is connecting to a WwTW that discharges to one of the European sites listed in Section 1.3 and that is not provided in the dropdown list, please notify CCC. If a PTP or ST is being used and

⁶ See: Amendments to Approved Documents G, available here: [building-regulations-guidance-part-g-sanitation-hot-water-safety-and-water-efficiency-amendments.pdf \(gov.wales\)](https://gov.wales/building-regulations-guidance-part-g-sanitation-hot-water-safety-and-water-efficiency-amendments.pdf), accessed on: 12/12/2021

the user is unsure whether it will drain to a European site, please check if the development is within an affected catchment following the instructions in Appendix 1.

Note: if an ST or PTP is being used then a comprehensive maintenance regime is required as part of the application process. If the ST or PTP which is being used has phosphate stripping capabilities, chemical dosing may be required. If chemical dosing is required, a robust management plan that details how chemicals are stored, the dilution rates, dosing frequencies, that any chemicals used will not have an environmental impact etc. must also accompany the planning application. PTPs with chemical dosing may not be appropriate in all cases.

4.2.2 Stage 2: calculate the annual phosphorus load from the existing (pre-development) land use on the development site

In this section some environmental information about the development will need to be entered as well as the type and area of landcover that is being developed. The environmental information required is described above in Section 3.2.

Only the types and areas of land that are being altered by the development should be entered. For example, if two hectares of agricultural land within a ten-hectare development site are being retained in agricultural use, this area should not be included in the calculations.

In the 'Existing land use type(s)' column of the main table in Stage 2 of the calculator, each cell has a drop-down list of land use types. This list contains ten agricultural landcover types to choose from and eight different non-agricultural land cover types that may be present on a pre-development site. Please find out what land use types are within the development, as well as the areal extent (in hectares) of each land use type, before completing this tool. If there is a land use within the development area that is not in the list, please select the most similar land use type from those available. Table 1 in Section 3.1 provides a description of the different land use types available within the calculator tool.

4.2.3 Stage 3: calculate the annual phosphorus load from new (post-development) land use on the development site

In this section the user will need to select the type and area of the landcover present on the development site after the development has been completed.

In the 'New land use type(s)' column of the main table in Stage 3 of the calculator, each cell has a drop-down list of land use types containing eight non-agricultural land use types that may be present on the post-development site. Please find out what land use types are within the development, as well as the areal extent (in hectares) before completing this part of the tool. If there is a land use within the development area that is not in the list (see Table 1 in Section 3.1 for land use type descriptions), please select the most similar land use type.

4.2.4 Stage 4: the nutrient budget

The final stage automatically uses the results from Stages 1-3 and calculates the nutrient budget using the equation shown in Figure 3. No user inputs are required in this stage beyond those entered in Stage 1 - Stage 3. The output in Stage 4, adjacent to the cell that reads "The total annual phosphorus load to mitigate is:", shows how much nutrient mitigation is required in kilograms per year to achieve nutrient neutrality.

As Figure 4 shows, the output from Stage 4 of nutrient budget calculations is the balance of new sources of P from a development minus the existing sources of P from the pre-development site. This balance is multiplied by 1.2, i.e. increased by 20%, which is termed the 'precautionary buffer'.

The 20% precautionary buffer is applied to account for the uncertainties that underlie the inputs to Stages 1-3 of the nutrient budget calculations, as well as accounting for some potential nutrient sources associated with new development that cannot be readily quantified. To cover all possible inputs to a nutrient budget with a high enough certainty to remove the need for the precautionary buffer would require extensive site-specific investigations. The 20% precautionary buffer is a means of accounting for the uncertainties within the nutrient budget calculations and providing confidence that mitigation of

the nutrient budget will remove the risk of adverse effects on site integrity in the Afonydd Cleddau / Cleddau Rivers SAC, Afon Tywi / River Tywi SAC, the Afon Teifi / River Teifi SAC and the Afon Gwy / River Wye SAC.

4.3 EXAMPLE SCENARIOS

This section contains hypothetical examples of planning applications and the way in which key details related to these example developments would be entered as inputs to the nutrient budget calculator. These examples are based on initial feedback on the calculator and aim to provide further clarification on how to apply the calculator in practice.

Box 1: Planning scenario A

A **hypothetical** 2.5-hectare school site is being converted to 20 residential dwellings with gardens in 1.8 hectares, 0.5 hectares of a community park and 0.2 hectares of surface water as a pond.



- The previous 1.25-hectare school site (including playground and car park) is entered as the landcover type 'Open urban land'. The 1.25 hectare playing field is entered as 'Greenspace'.
- The 20 residential dwellings, including the road, roadside verges and gardens are entered as 1.8 hectares of residential land.
- The 0.5-hectare park is entered as 0.5 hectares of greenspace.
- The 0.2-hectare pond is entered as 0.2 hectares of water.

Note: The wastewater generated by the new development is classified as additional wastewater to the European site because it would increase the number of overnight stays in the catchment

Box 2: Planning scenario B

A **hypothetical** 0.2-hectare land parcel used for grazing sheep is being converted to 2 residential dwellings with gardens.



- The previous land is entered as 0.2 hectares of 'Lowland grazing'.
- The new land is entered as 0.2 hectares of residential land.

Box 3: Planning scenario C

A **hypothetical** 0.1-hectare residential plot with one pre-existing dwelling is being converted to 3 residential dwellings.



- The area is entered as 0.1 hectares of residential land with **2 dwellings**. Only two dwellings are entered because one already existed, therefore only two dwellings lead to an increase in overnight stays.

Box 4: Planning scenario D

A **hypothetical** 1.1-hectare land parcel used for grazing cattle is being converted to a caravan site for tourism. The developer has supplied robust evidence that shows the average occupancy rate will be 1 persons per unit with a total of 30 units occupied at this rate all year round and a daily water usage of 50 litres/person/day, all inputs continuing in perpetuity.



- The Stage 1 inputs are changed accordingly as the developer has provided evidence that proves beyond all reasonable scientific doubt that these inputs are accurate in perpetuity.
- The previous land use is entered as 'Lowland grazing'.
- The new land use is entered as 'Open urban land', which accounts for the mixed land use between accommodation and leisure, without the kinds of nutrient inputs associated with standard residential land use.

5 MITIGATION OPTIONS

There are a number of different mitigation options and for each of these options there are various factors that influence a) the scale of nutrient removal; and b) the longevity of nutrient removal that is required for mitigation to be deemed compliant as part of an HRA. As such, there is a need to identify and carefully plan mitigation measures that not only have potential to remove nutrients from the environment but will also pass the tests set by an HRA of nutrient neutrality.

For a mitigation scheme to be deemed compliant with the Habitats Regulations, it will be required to pass the following tests:

- The scale of nutrient reductions that can be achieved by a mitigation scheme are based on best available evidence.
- The available evidence for a mitigation scheme suggests the scheme will be effective beyond reasonable scientific doubt.
- The estimates for nutrient reductions suggested for the scheme are precautionary, in line with the Precautionary Principle.
- The reductions in nutrient loading can be secured in perpetuity which, for the purposes of a housing development, is considered to be 80-125 years.

The Mitigation Options worksheet in the nutrient budget calculator tool provides examples of mitigation measures and the factors that affect nutrient removal ability, though these are not specific to any development, or to the output from the nutrient budget. This part of the nutrient budget calculator does not provide an indication of what specific mitigation measures the user will need to use and should be used to provide an initial list of potential solutions that will require further investigation. The effectiveness of a single type of nutrient mitigation solution can be affected by:

- The design specifics of the mitigation solution.
- The physical location: soil characteristics, geology, topography, hydrological connectivity and other location-specific factors that can have an effect on the nutrient removal capability.
- The incoming nutrient inputs.
- The maintenance regime.
- Seasonality.

The uncertainty of a selected mitigation solution can be reduced by:

- Providing a sound underlying scientific rationale for the nutrient removal processes active within the mitigation solution.
- Carefully designing an appropriate and robust solution that is tailored to the location based on the best available evidence.
- Ensuring the estimates of nutrient removal are suitably precautionary, i.e. they do not overestimate the potential nutrient removal benefit.
- Detailing the key management and maintenance steps in order to ensure functionality in perpetuity.
- Monitoring / sampling of the proposed location of the mitigation solution.

6 REFERENCES

Front page image credits:

Afon Tywi / River Tywi

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Satellite Image screenshots:

World Imagery. Esri, Maxar, Earthstar Geographics, USDA FSA, USGS, Aerogrid, IGN, IGP, and the GIS User Community. "World Imagery Map". February 18, 2022.

<https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9>

APPENDICES

Appendix 1 Instructions on how to identify whether the wastewater produced by the development will affect a European site due to this wastewater being discharged within an affected hydrological catchment

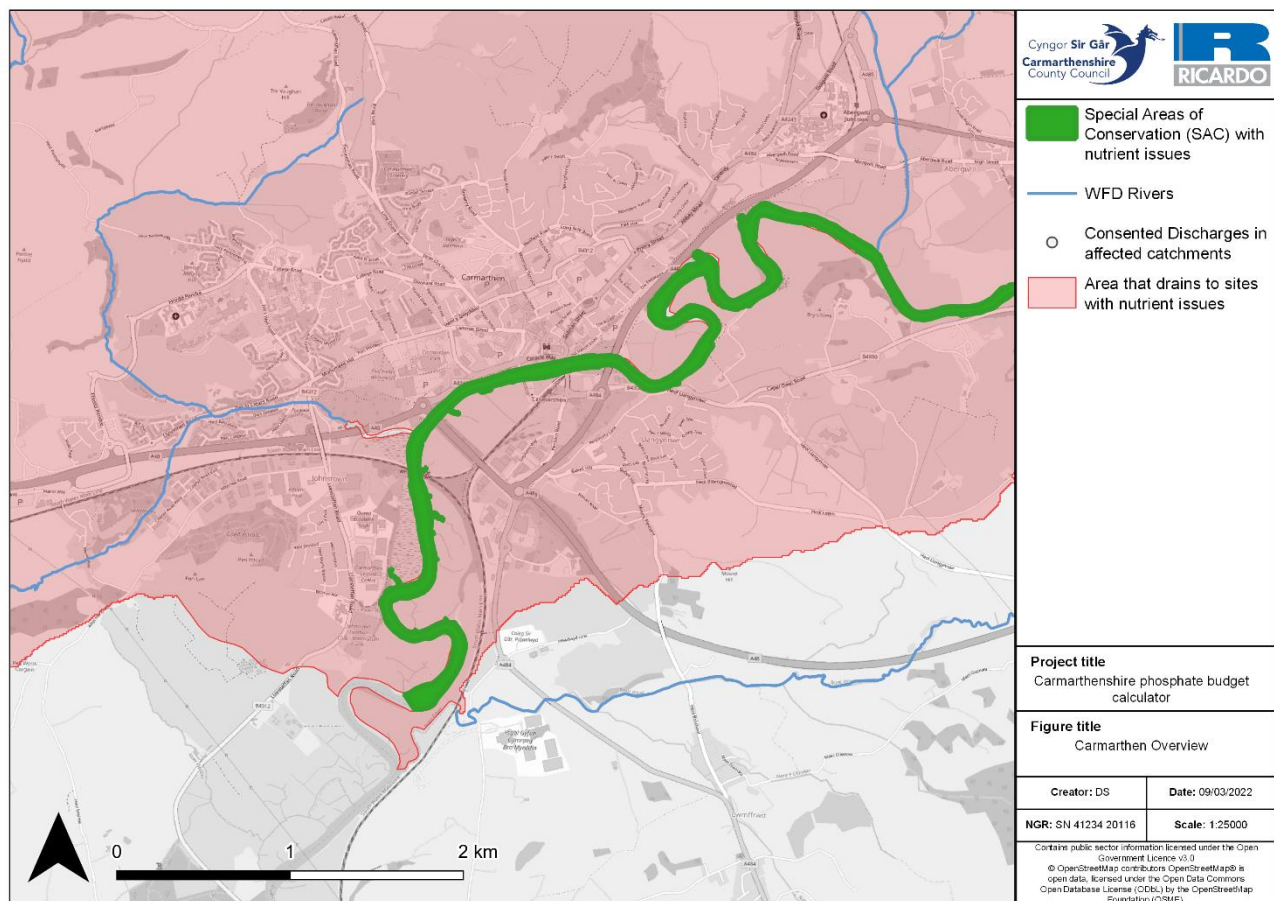
- Go to this link: <https://waterwatchwales.naturalresourceswales.gov.uk/en/>
- Click on the Web Mapping Application titled “WFD Cycle 2 (2018) Rivers and water-bodies in Wales”
- Once the map and legend loads, navigate to the layer list and turn on the layer titled “River Waterbody Catchments Interim (2018)”
- In the top left type in the name or the postcode of the area where the development is, find the correct location and click on the map to display information on the layer
- Make note of the Waterbody Catchment next to the “WB_NAME” category, or the Waterbody Catchment ID next to the “WATERBODY_ID”.
- If the Waterbody Catchment identified using the link can be found in the table below then the site will have an affect on a European site.

Note: There are areas of Carmarthen that drain to Afon Tywi SAC but do not have a Waterbody Catchment in the link provided above. Please see the map below this table to identify these areas.

Waterbody Catchment ID	Waterbody Catchment Name	Operational Catchment
GB110060036130	Alltwalis - headwaters to confluence with Gwili	Tywi
GB110060036070	Annell - headwaters to confluence with Cothi	Tywi
GB110060029350	Annell - headwaters to confluence with Tywi	Tywi
GB110062039030	Bargod - headwaters to confluence with Teifi	Teifi
GB110060035950	Bran - conf with Crychan to conf with Tywi	Tywi
GB110060036180	Bran - confluence with Ydw to confluence with Tywi	Tywi
GB110060035970	Bran - headwaters to confluence with Crychan	Tywi
GB110060036220	Bran - headwaters to confluence with Ydw	Tywi
GB110060029280	Cennen - headwaters to confluence with Tywi	Tywi
GB109055036680	Cledan - source to conf R Irfon	Irfon
GB110060029040	Cloidach - headwaters to confluence with Cothi	Tywi
GB110060036020	Clydach - headwaters to confluence with Cothi	Tywi
GB110060029300	Clydach - headwaters to confluence with Sawdde	Tywi
GB110062039200	Clywedog - headwaters to confluence with Teifi	Teifi
GB110060036040	Cothi - conf with Twrch to confluence with Marlais	Tywi
GB110060036050	Cothi - headwaters to confluence with Twrch	Tywi
GB110060036300	Cothi - headwaters to confluence with Tywi	Tywi
GB110060035960	Crychan - headwaters to confluence with Bran	Tywi
GB110060029070	Crychiau - headwaters to confluence with Gwili	Tywi
GB110062039041	Cych - headwaters to confluence with Teifi	Teifi
GB110060036260	Ddu - headwaters to confluence with Dulais	Tywi

Waterbody Catchment ID	Waterbody Catchment Name	Operational Catchment
GB110060036360	Doethie - Pysgotwr Fawr conf to conf with Tywi	Tywi
GB110060036400	Doethie - headwaters to conf with Pysgotwr Fawr	Tywi
GB110060036140	Duad - headwaters to confluence with Gwili	Tywi
GB110062039060	Duar - headwaters to confluence with Teifi	Teifi
GB110060036210	Dulais - conf with Ddu to confluence with Tywi	Tywi
GB110060036230	Dulais - headwaters to confluence with Ddu	Tywi
GB110060036330	Dulais - headwaters to confluence with Tywi	Tywi
GB110060029310	Dulas - conf with Sannan to confluence with Tywi	Tywi
GB110060036190	Dulas - headwaters to confluence with Sannan	Tywi
GB110060036320	Dunant - headwaters to confluence with Tywi	Tywi
GB110061038290	E. Cleddau - conf with Wern to conf with Syfynwy	Eastern Cleddau
GB110061038320	Eastern Cleddau - headwaters to conf with Wern	Eastern Cleddau
GB110060036120	Gochen - headwaters to confluence with Duad	Tywi
GB110060036030	Gorlech - headwaters to confluence with Cothi	Tywi
GB110060036370	Gwenffrwd - headwaters to confluence with Tywi	Tywi
GB110060036340	Gwenlais - headwaters to confluence with Tywi	Tywi
GB110060029080	Gwili - Duad conf to conf with Tywi at spring TL	Tywi
GB110060036110	Gwili - conf with Alltwalis to conf with Duad	Tywi
GB110060036100	Gwili - headwaters to confluence with Alltwalis	Tywi
GB110060035940	Gwydderig - headwaters to confluence with Bran	Tywi
GB110060036080	Marlais - headwaters to conf Cothi	Tywi
GB110060036290	Marlais - headwaters to confluence with Tywi	Tywi
GB110060036000	Marlais (Brechfa) - headwaters to conf Cothi	Tywi
GB110060036060	Melinddwr - headwaters to confluence with Marlais	Tywi
GB110060029380	Myddfai - headwaters to confluence with Tywi	Tywi
GB110060036310	Mynys - headwaters to confluence with Tywi	Tywi
GB110060035990	Pib - headwaters to confluence with Marlais	Tywi
GB110060036390	Pysgotwr Fawr - headwaters to conf with Doethie	Tywi
GB110060036200	Sannan - headwaters to confluence with Dulas	Tywi
GB110060029370	Sawdde - conf with Clydach to confluence with Tywi	Tywi
GB110060029340	Sawdde - headwaters to confluence with Clydach	Tywi
GB110062039000	Siedi - headwaters to confluence with Teifi	Teifi
GB110062038980	Talog - headwaters to confluence with Tyweli	Teifi
GB531006013400	Tawelon - headwaters to tidal limit	Taf
GB110062043566	Teifi - Afon Breninig to Afon Dulas	Teifi
GB110062043563	Teifi - Afon Ceri to estuary	Teifi

Waterbody Catchment ID	Waterbody Catchment Name	Operational Catchment
GB110062043564	Teifi - Afon Clettwr to Afon Ceri	Teifi
GB110062043565	Teifi - Afon Dulas to Afon Clettwr	Teifi
GB109055036690	Tirabad Dulas - source to conf R Irfon	Irfon
GB110060036090	Twrch - headwaters to confluence with Cothi	Tywi
GB110062039020	Tyweli - confluence with Talog to confluence with Teifi	Teifi
GB110062038950	Tyweli - headwaters to confluence with Talog	Teifi
GB110060036350	Tywi - conf with Doethie to conf with Llandovery Bran	Tywi
GB110060036250	Tywi - conf with Llandovery Bran to conf with Cothi.	Tywi
GB110060029290	Tywi - confluence with Cothi to spring tidal limit	Tywi
GB110060036380	Tywi - Llyn Brianne to confluence with Doethie	Tywi
GB110060036240	Ydw - headwaters to confluence with Bran	Tywi



Appendix 2 Table of Wastewater Treatment Works

Wastewater Treatment Works	Wastewater Treatment Works
Abergorlech WwTW Llandeilo	Glanyrafon STW Whitemill
Alltwalis STW	Golden Grove WwTW Llandeilo
Bethlehem STW Bethlehem Llandeilo	Gwynfe STW Capel
Brechfa WwTW	Heol Timothy STW Ffaldybrenin
Bro Dolau STW Rhydcymerau	Llandovery Wastewater Treatment
Bro Nant STW Nantyffin Brechfa	Llandysul WwTW
Broad Oak WwTW Fe Broad Oak	Llanfihangel-ar-arth STW
Bronwydd STW	Llanfynydd STW
Bryndulais STW	Llangadog STW
Bryngwyn WwTW Gwynfe Rd Llandeilo	Llangathen STW
Caio STW	Llanpumpsaint WwTW
Capel Iwan STW	Llansawel WwTW
Cilycwm WwTW	Llanybydder WwTW Ceredigion
Crugybar STW Crugybar Llandeilo	Myddfai WwTW Myddfai
Cwm Ifor WwTW	Pencader STW
Cwmduad STW	Pentrecwrt STW
Cwrt Henri STW	Pont-Ar-Gothi & Nantgaredig WwTW
Cynghordy WwTW	Pumpsaint STW
Cynwyl Elfed WwTW	Rhandirmwyn STW
Danrhelyg STW Newcastle Emlyn	Salem STW
Drefach/Velindre WwTW	Talley WwTW Llandeilo
Farmers STW	Trapp STW
Felingwm WwTW	Twynllanan STW
Ffairfach STW	



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