



# Nutrient Budget Calculator Guidance Document

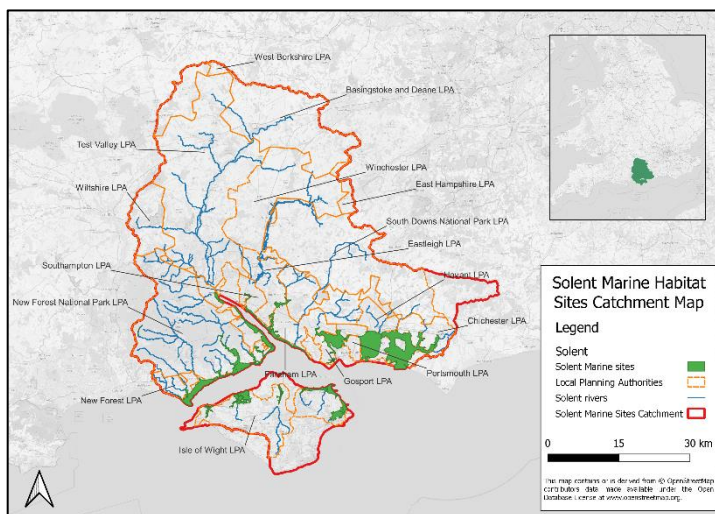
Guidance for completion of a nutrient budget using the nutrient budget calculator tool

*Prepared by Ricardo Energy and Environment on behalf of Natural England*

## Solent Marine European Sites

The Solent Marine Habitats sites comprise a range of Special Areas of Conservation, Special Protection Areas and Ramsar sites with water pollution and eutrophication considered a threat to its condition.

The Solent is a complex site encompassing a major estuarine system on the south coast of England. The Solent and its inlets are unique in Britain and Europe for their hydrographic regime with double tides, as well as for the complexity of the marine and estuarine habitats present within the area.



The rich intertidal mudflats, saltmarsh, shingle beaches and adjacent coastal habitats, including grazing marsh, reedbeds and damp woodland, support nationally and internationally important numbers of migratory and over-wintering waders and waterfowl such as ringed plover and sandwich terns, as well as important breeding gull and tern populations.

Increased levels of nitrogen and phosphorus entering aquatic environments via surface water and groundwater can severely threaten these sensitive habitats and species within the SPA. 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 species and habitats within the Solent Marine sites that result in their designations are referred to a 'qualifying features.' Not all of these qualifying features will be sensitive to changes in nutrients within the site. When completing an HRA involving nutrient neutrality, the Competent Authority (normally Local Planning Authority for developments) must identify and screen out qualifying features that are not sensitive to nutrients via a Habitats Regulations Assessment. Developers will be asked to submit information to support this process.

More detailed information on the qualifying features of the Habitats site have previously been provided by Natural England.

## The requirement for Nutrient Neutrality

Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Ramsar sites are some of the most important areas for wildlife in the United Kingdom. They are internationally important for their habitats and wildlife and are protected under the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations). At some of these sites, there are high levels of nitrogen and phosphorus input to the protected water environment with sound evidence that these nutrients are causing eutrophication at these designated sites. These nutrient inputs currently mostly come either from agricultural sources or from wastewater from existing housing and other development. The resulting effects on ecology from an excessive presence of nutrients are impacting on protected habitats and species.

There is uncertainty as to whether new growth will further deteriorate designated sites, and/or make them appreciably more difficult to restore. The potential for future housing developments to exacerbate these impacts creates a risk to their potential future conservation status.

One way to address this uncertainty is for new development to achieve nutrient neutrality. Nutrient neutrality is a means of ensuring that development does not add to existing nutrient burdens and this provides certainty that the whole of the scheme is deliverable in line with the requirements of the Habitats Regulations.

## Key Principles

The principles underpinning Habitats Regulations Assessments are well established<sup>1</sup>. At the screening stage, plans and projects should only be granted consent where it is possible to exclude, on the basis of objective information, that the plan or project will have significant effects on the sites concerned<sup>2</sup>. Where it is not possible to rule out likely significant effects, plans and projects should be subject to an appropriate assessment. That appropriate assessment must contain complete, precise and definitive findings which are capable of removing all reasonable scientific doubt as to the absence of adverse effects on the integrity of the site<sup>3</sup>.

Natural England has been reviewing the available evidence on Habitats sites which are in unfavourable condition due to elevated nutrient levels. Where plans or projects will contribute additional nutrients to Habitats sites which are close to or already in unfavourable condition for nutrients, then a robust approach to the Habitats Regulations Assessment (HRA) of the effects of plans and projects is required.

Where sites are close to or already in unfavourable condition for nutrients, it may be difficult to grant consent for new plans and projects that will increase nutrient levels at the Habitats site. Nutrient neutrality provides a means of effectively mitigating the adverse effects associated with increased nutrients from new plans and projects, by counter-balancing any additional nutrient inputs to ensure that there is no net change in the amount of nutrients reaching the features which led to a Habitats site being designated.

Where new residential development is proposed, the additional nutrient load from the increase in wastewater and/or the change in the land use of the development land created by a new residential development can create an impact pathway for potential adverse effects on Habitats sites that are already suffering from problems related to nutrient loading. This impact pathway is shown diagrammatically in Figure 1. HRAs of new residential developments therefore need to consider whether nutrient loading will result in 'Likely Significant Effects' (LSE) on a Habitats site. If an HRA

---

<sup>1</sup> See, amongst others Case C-127/02 *Waddervereniging and Vogelsbeschermingvereniging (Waddenzee)*; *R (Champion) v North Norfolk DC* [2015] E.K.S.C. 52 (Champion); C-323/17 *People Over Wind, Peter Sweetman v Coillte Teoranta (People Over Wind)*; C-461/17 *Brian Holohan and Others v An Bord Pleanála (Holohan)*; Joined Cases C-293/17 and C-294/17 *Coöperatie Mobilisatie for the Environment UA and Others v College van gedeputeerde staten van Limburg and Other* (the Dutch Nitrogen cases);

<sup>2</sup> Case C-127/02 *Waddervereniging and Vogelsbeschermingvereniging (Waddenzee)*

<sup>3</sup> Case 164/17 *Grace & Sweetman v An Bord Pleanála (Grace & Sweetman)*

cannot exclude a LSE due to nutrient loading, the Appropriate Assessment (AA) will need to consider whether this nutrient load needs to be mitigated in order to remove adverse effects on the Habitats site.

For those developments that wish to pursue neutrality, Natural England advises that a nutrient budget is calculated for new developments that have the potential to result in increases of nitrogen/phosphorus entering the international sites. A nutrient budget calculated according to this methodology and demonstrating nutrient neutrality is, in our view, able to provide sufficient and reasonable certainty that the development does not adversely affect the integrity, by means of impacts from nutrients, on the relevant internationally designated sites. This approach must be tested through the AA stage of the HRA. The information provided by the applicant on the nutrient budget and any mitigation proposed will be used by the local planning authority, as competent authority, to make an AA of the implications of the plan or project on the Habitats sites in question.

The nutrient neutrality calculation includes key inputs and assumptions that are based on the best available scientific evidence and research. It has been developed as a pragmatic tool. However, for each input there is a degree of uncertainty. For example, there is uncertainty associated with predicting occupancy levels and water use for each household in perpetuity. Also, identifying current land / farm types and the associated nutrient inputs is based on best available evidence, research and professional judgement and is again subject to a degree of uncertainty.

It is our advice to local planning authorities to take a precautionary approach in line with existing legislation and case law when addressing uncertainty and calculating nutrient budgets. This should be achieved by ensuring nutrient budget calculations apply precautionary rates to variables and adding a buffer to the Total Nitrogen/Total Phosphorus figure calculated for developments. A precautionary approach to the calculations and solutions helps the local planning authority and applicants to demonstrate the certainty needed for their assessments.

By applying the nutrient neutrality methodology, with the buffer, to new development, the competent authority may be satisfied that, while margins of error will inevitably vary for each development, this approach will ensure that new development in combination will avoid significant increases of nitrogen load from entering the internationally designated sites.<sup>4</sup>

A HRA must be capable of removing all reasonable scientific doubt as to the absence of adverse effects on a Habitats site. Absolute certainty is not required, but the methodology used to evaluate potential adverse effects (and the measures intended to mitigate them) must effectively address any reasonable scientific doubt to achieve the required degree of certainty.

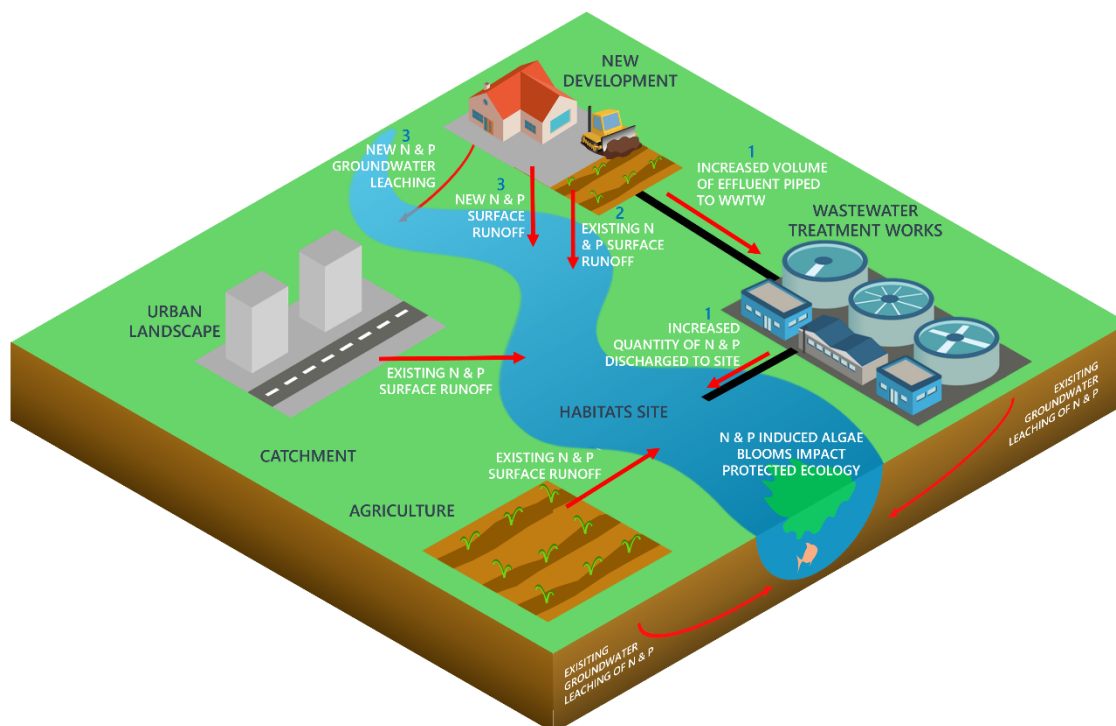
The first step in an AA that is applying nutrient neutrality is to understand whether a development will cause additional nutrient inputs to the Solent Marine sites. This requires calculation of the amount of nutrients a new residential development will create, otherwise known as a nutrient budget.

If a nutrient budget shows that a new development will increase the nutrient input to the Solent Marine 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 to be reached.

---

<sup>4</sup> This approach was expressly endorsed in *R (Wyatt) v Fareham BC* [2021] EWHC 1434 (Admin)

Figure 1: Diagram demonstrating the potential nutrient impact pathways from a new development to a Habitats site. An increase in nitrogen and phosphorus availability in aquatic ecosystems can lead to various problems, such as algae blooms, which can have detrimental impacts on the ecology of a Habitats site.



## What is this guidance for?

This guidance document accompanies the Solent Marine sites nutrient budget calculator. The nutrient budget calculator is used to calculate the change in nutrient input from a new residential development to the Solent Marine sites. 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 nitrogen loading that requires counterbalancing 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.

## 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 Solent Marine sites catchment. 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 Solent Marine sites.

## Summary of how the calculator works.

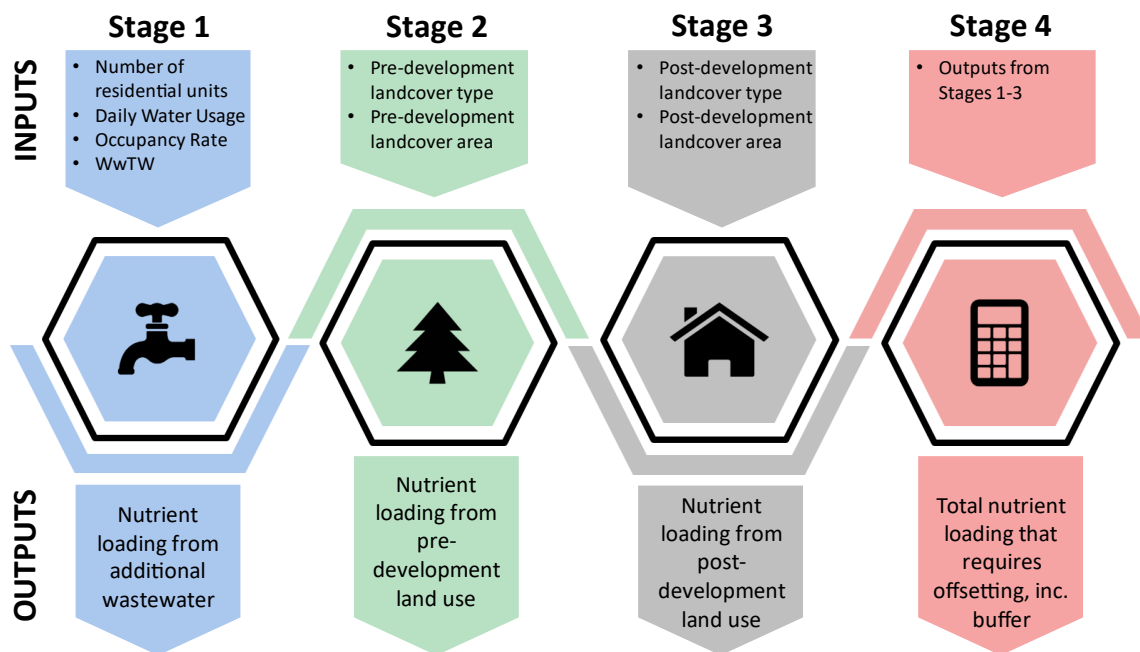
### Overview

The nutrient budget calculator requires a set of inputs in order to calculate a new development's nutrient budget. The calculations are completed in four stages:

1. Calculate the increase in nutrient loading that comes from a development's wastewater.
2. Calculate the pre-existing nutrient load from current land use on the development site.
3. Calculate the future nutrient load from land use on the development site post-development.
4. Calculate the net change in nutrient loading from the development to the Solent Marine sites with the addition of a buffer. The net change in nutrient loading + the buffer is the nutrient budget.

These key inputs and outputs for each stage can be shown schematically in Figure 2.

Figure 2: Schematic showing the key inputs and outputs associated with each stage of the nutrient budget calculation methodology



*Note: the values that come pre-entered in this tool have been chosen based on research to select inputs that meet the HRA tests of beyond reasonable scientific doubt, best available evidence, in perpetuity and were chosen 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.*

## Data Collection and preparation

The nutrient budget calculator requires a set of inputs as shown in Figure 2. This section does not provide instructions on how to gather development specific information, such as the number of properties being constructed, as this should be known by the developer and should be detailed in the planning application. 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 sources<sup>5</sup>. Most of the required inputs are for factors that are specific to the location of a development site or the hydrological catchment of the Solent Marine sites.

**The instructions below are divided by the stage where the data will be required. We advise that you collect and note down this data before starting to input information into each stage of the nutrient budget calculator.**

**Stage 2 & 3: Instructions for finding the Operational Catchment that the development is located within**

- Go to this link: <http://environment.data.gov.uk/catchment-planning/>
- Search the location by place name, postcode etc. This will give a high-level view of the area. Use the zoom feature to find the exact location of the development.
- Click on the light blue area on the map in which the development is located. This will bring the user to the Operational Catchment page
- Make a note of the name of the Operational Catchment and select it from the dropdown list in the 'Catchment' cell when you get to this part of the calculator tool.

**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.

**Stage 2: 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/42019>
- This link will bring the user to the Itchen at Tanners Brook at Millbrook flow gauge 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.

---

<sup>5</sup> Correct at the time of writing. These data sources are available from websites that currently have government funding but it should be noted that these datasets may become unavailable if funding is removed.



## Stage 2: Instructions for finding out whether the development is in a Nitrate Vulnerable Zone (NVZ)

- Go to this link <http://mapapps2.bgs.ac.uk/ukso/home.html?layers=NVZEng>
- Enter the location of the development site in the search bar.
- Once the area has been located, click on the map where the development is located to find out if it is within an NVZ.
- Make a note of this information. It will be needed to select 'Yes' or 'No' from the 'Within Nitrate Vulnerable Zone (NVZ)' 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.*

## How to use the calculator:

### General tips

- The key below 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.
- 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.
- 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.

#### Key:

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

...	Instructions	Site Information	<b>Stage 1</b>	Stage 2	Stage 3	...
			<b>Water usage</b> (litres/person/day):	120		
			<b>Development Proposal</b> (dwellings):	100	Please enter the total number of dwellings that will be on the development site as of the completion date of the project.	

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

In this section the user will need to enter:

- The date of first occupancy. *This is because some wastewater treatment works may be due an upgrade in 2025 that will change the nitrogen or phosphorus output from this works, which will in turn change the output from this stage of the calculations. If this is the case, it will be apparent in the calculated values if there is an upgrade to a treatment works that affects the nutrient budget.*

- The average occupancy rate of the development will need to be entered in people per dwelling for residential dwellings or units for other types of overnight accommodation which would result in an increase in overnight accommodation. The default setting for residential dwellings is the national occupancy rate of 2.4 people per dwelling. **Only change this value if there is sufficient evidence that a different occupancy rate is appropriate** (see Occupancy Rate Guidance section below for when a local or regional occupancy rate is acceptable).
- The number of dwellings / units<sup>6</sup> that will be within the development at the time of completion.
- The wastewater treatment works that the development will connect to. 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 nitrogen (TN) or 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 or TN value provided by the manufacturer, select the 'Septic Tank default' or 'Package Treatment Plant default' option and a value will be provided automatically.

### Occupancy Rate Guidance:

As set out in the guidance below, the Local Planning Authority/Competent Authority will need to ensure that the occupancy rate is appropriate to development within their Authority area. **It is therefore recommended that the occupancy rate is agreed with the Local Planning Authority before completing the nutrient budget calculation.**

Competent authorities must satisfy themselves that the residents per dwelling/unit value used in this step of the calculation reflects local conditions in their area. The residents per dwelling value can be derived from national data providing it reflects local conditions. However, if national data does not yield a residents per dwelling/unit value that reflects local occupancy levels then locally relevant data should be used instead. Whichever figure is used, it is important to ensure it is sufficiently robust and appropriate for the project being assessed. **It is therefore recommended that project level Appropriate Assessments specifically include justification for why the competent authority has decided upon the occupancy rate that has been used.**

Further guidance is provided below.

### National occupancy data

When using national occupancy data, the Office of National Statistics (ONS) national average value for the number of residents per dwelling of 2.4 is recommended. This value is derived from 2011 census data and is subject to change when the 2021 Census becomes available. This value can be used if the Local Planning Authority is satisfied that:

- It is appropriate for the level and type of housing development that is expected to come forward in the Local Planning Authority's area (a strategic assessment should be made of the development anticipated to come forward over the Local Plan period to ensure the use of average figures will not under/overestimate the level of impact)
- It corresponds to the local average in the area (it is not likely to overestimate or underestimate occupancy)

---

<sup>6</sup> The term 'dwellings' has a specific legal meaning derived from the use classes order. To ensure that all relevant forms of development which would result in an increase in overnight accommodation such as hotel rooms, short term holiday lets etc are considered in the HRA process the term units is used

- It is based on data that is robust and doesn't underestimate the level of impact over time.

It may not be appropriate to use the national average occupancy rate for development types which are not included in the ONS data, such as student accommodation or houses in multiple occupation. For such developments, the Local Planning Authority should specify an appropriate occupancy rate in the project level Appropriate Assessment and explain how this figure was derived.

### **Locally relevant occupancy data**

If the national average occupancy rate does not correspond with local conditions, then a locally relevant average residents per dwelling value may be more appropriate. If a Local Planning Authority decides to use a locally relevant value, that value needs to be supported by robust and sufficient evidence which should be included in the project level Appropriate Assessment. Key sources of evidence include:

- The average occupancy rate from the census for the relevant local administrative area, e.g. the county.
- The average occupation figures used by the Local Planning Authority to calculate population growth due to Local Plan development.
- The average occupation figures used by the local water company to plan for population growth and the impact on water resources and sewage treatment.

A local / regional average occupancy rate can be used provided that it is from a robust source which can show trends over a protracted period of time— such as from ONS derived data or from the annual English Housing Survey. Figures derived from data collected over short periods of time will not be acceptable as short-term data is unlikely to provide the required degree of certainty. The Local Planning Authority should ensure that any trend in occupancy rates or estimates of the average number of persons per household used will continue for perpetuity and would not underestimate the level of impact over time. A local / regional average occupancy rate would therefore need to be based on figures over at least a 5-year period<sup>7</sup>.

Local Planning Authorities will also need to satisfy themselves that a locally derived occupancy figure is appropriate for the level and type of housing development that is expected (a strategic assessment should be made of the development anticipated to come forward over the Local Plan period to ensure the use of average figures will not under/overestimate the level of impact).

### **Occupancy rates based on dwelling type**

Should the nature or scale of development associated with a particular project proposal suggest that the use of an average occupancy rate is not appropriate, then the Local Planning Authority may decide to adopt an occupancy rate based on the dwelling types proposed for that particular project, provided it meets the criteria outlined above. This may be appropriate where a project proposer seeks consent for a development comprising certain dwelling types (e.g. flats and small 1 and 2 bed dwellings). If the Local Planning Authority decides to adopt a local approach based on determining occupancy rate by dwelling type, that approach should be used for all planning applications, rather than reverting back to the use of an average occupancy rate. This will ensure that the Local Planning Authority doesn't inadvertently underestimate total occupancy levels (and consequently water quality impacts) across its area by applying a lower residents per dwelling/unit value for developments comprising smaller units but failing to adopt a higher residents per dwelling/unit value for developments comprising larger units or a mix of units.

---

<sup>7</sup> The figure of 5 years has been chosen as the minimum period of time over which occupancy rates can be calculated from as local plans and WRMPs are reviewed every 5 years, so represents a long enough period of time to capture any trends or changes.

## Consistency in applying occupancy rates

The same occupancy rate should be used where there are several different impacts on Habitat sites which require strategic mitigation. The strategic approaches developed with local planning authorities to deal with in combination impacts on international sites elsewhere typically calculate mitigation requirements and contribution requirements based on current national average occupancy rates. Local Planning Authorities may decide to use a locally derived average occupancy rate instead, but this local occupancy rate must be used consistently across each type of impact and each Habitats site affected. Local Planning Authorities should not use different occupancy rates in their HRAs for the same dwelling types / size of units. Whilst the impacts will be different, occupancy rates will have been used to estimate the scale of impact and subsequently the scale of mitigation required on the protected sites. The types of impact will typically last in perpetuity. Care is therefore needed to ensure the adoption of an alternative occupancy rate based on an assessment of net population additions to a locality for nutrient budgeting does not undermine other existing strategic approaches, particularly where there are overlapping impacts within the locality.

*Note: When 2021 Census data is available, the 2.4 value will be updated.*

*Note: if an ST or PTP is being used then a comprehensive maintenance regime is required as part of the application process. Please consult your Local Planning Authority for further advice on how to specify this maintenance regime and demonstrate that it is appropriately secured. 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.*

## Stage 2 - calculate the annual nutrient load from 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](#).

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 the same 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 drop-down list of land use types. This list contains seven agricultural land cover 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 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. Table 1 provides a description of the different land use types available within the calculator tool.

Table 1: Table of land use types included within the tool and their descriptions.

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.
Pig	Agricultural areas on which pigs farmed.
Poultry	Agricultural areas on which poultry are farmed.
Dairy	Agricultural areas on which dairy cows are farmed.
LFA	Agricultural areas on which cattle, sheep and other grazing livestock are farmed in locations where agricultural production is difficult. An area is classified as a Less Favoured Area (LFA) holding if 50 per cent or more of its total area is classed as LFA.
Lowland	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 classed as a lowland grazing area.
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.
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 sports fields, 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, including rivers, ponds and lakes.
Residential urban land	Areas of houses and associated infrastructure. This is inclusive of roads, driveways, grass verges and gardens.
Commercial/industrial urban 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 urban land	Area of land in urban areas used for various purposes, e.g. leisure and recreation - may include open land, e.g. sports fields, playgrounds, public squares or built facilities such as sports centres.
Community food growing	Areas that are used for local food production, such as allotments.

### Stage 3: calculate the annual nutrient 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 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 for land use type descriptions), please select the most similar land use type.

## Stage 4: calculate the net change in nutrient loading for the site and the final annual nutrient budget for the development site:

This final stage automatically uses the results from Stages 1-3 and calculates the nutrient budget using the equation shown in Figure 3.

As Figure 3 shows, the output from Stage 4 of nutrient budget calculations is the balance of new sources of nitrogen from a development minus the existing sources of nitrogen from the pre-development site. To ensure the final figure is robust and suitably precautionary this balance is multiplied by 1.2, i.e. increased by a 20%, buffer'.

The 20% 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 buffer would require extensive site-specific investigations. The 20% 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 Solent Marine sites.

The output in Stage 4 shows how much nutrient mitigation is required in kilograms per year to achieve nutrient neutrality.

If there are two values due to an upgrade occurring at the wastewater treatment works the development is connecting to, the calculator will show the total amount of nutrient mitigation that is needed before and after the upgrade.

Figure 3: The equation used to calculate the nutrient budget.

