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Utopia City, Bryn Lane, Wrexham Industrial Estate.

Phosphate Assessment

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Introduction

- 1.0 Tier Consult have been appointed by Net World Sports, to undergo a phosphate assessment for the development of Utopia City (which is subject to a live planning application, reference: P/2023/0497) following guidance from Natural Resources Wales and Wrexham County Borough Council

2.0 Site Description and Development Proposal

- 2.1 The site is located in Wrexham, Wales. The approximate National Grid Reference for the centre of the site is SJ385509 with coordinates Easting: 338459, Northing: 351072 at postcode LL13 9RX.
- 2.2 The proposed development is 37.20 ha

3.0 Stage 1: Additional Nutrient Loading from Wastewater

- 3.1 The Stage 1 worksheet calculates the additional phosphorus load associated with wastewater generated by the proposed development (Appendix A). Two tables are used to estimate the load based on site-specific inputs and pre-set calculation parameters.
- 3.2 Within the phosphate assessment, user inputs are highlighted in lilac, while calculated fields appear in light orange. Inputs include site location, local planning authority, rainfall data, and wastewater treatment details.
- 3.3 Based on the proposed floor areas, a maximum occupancy of 4,236 employees has been estimated. Based on flows and loads the water usage per employee is 50 litres/person/day. An estimated 25% of employees are assumed to reside outside the sensitive catchment. Using these parameters, the calculated annual total phosphorus (TP) load from wastewater equates to 19.34 kg TP/year. As the development is being delivered in two phases, a phosphate assessment has been undertaken for each phase individually. This results in a TP load of 10.64 kg TP/year for Phase 1, as presented in Appendix G, and 8.70 kg TP/year for Phase 2, as presented in Appendix H.
- 3.4 The Five Fords Wastewater Treatment Works (WwTW) has been identified as the receiving works for the site, and its phosphorus discharge permit limit has been applied within the assessment tool.

4.0 Stage 2: Nutrient Loading From Pre-Existing Landcovers

- 4.1 The Stage 2 worksheet quantifies the baseline phosphorus load from existing land uses within the red line boundary prior to development (Appendix B).
- 4.2 Soil characteristics were derived from the Soilscape database, which identifies the site as having impeded drainage. Rainfall data were obtained from the National River



Flow Archive (NRFA), with higher rainfall values generally correlating to increased phosphorus export potential.

4.3 The baseline landcover was categorised using ARUP's Nutrient Budget Calculator guidance, as referenced in the Welsh Government Nutrient Budget Calculator (Appendix F), into four land use categories:

- Lowland grazing
- Residential land
- Open land / built environment
- Mixed landcover

Based on the areas, a phosphorus load for each landcover is calculated and added together to give an overall phosphorus load for the pre-existing landcover of 49.39 kg TP/year. Of this total, 27.07 kg TP/year relates to Phase 1, and 22.32 kg TP/year relates to Phase 2.

5.0 **Stage 3: Nutrient Loading From New Landcovers.**

5.1 The Stage 3 worksheet estimates phosphorus export from the proposed (post-development) land uses within the site boundary (Appendix C).

5.2 The development has been subdivided into three land use categories:

- Commercial / industrial land
- Open land / built environment
- Residential land

Based on the areas, a phosphorus load for each landcover is calculated and added together to give an overall phosphorus load for the post development of 41.13 kg TP/year. Of this total, 22.52 kg TP/year relates to Phase 1, and 18.61 relates to Phase 2.

6.0 **Stage 3S: Nutrient Load Removed through SuDS**

6.1 The Stage 3S worksheet quantifies phosphorus removal achieved through Sustainable Drainage Systems (SuDS) implemented across the site, as per the submitted planning application. (Appendix D).

6.2 SuDS mitigation values were applied based on the proportion of runoff from each landcover draining to a specific SuDS feature. Removal efficiencies for both particulate and dissolved phosphorus were taken from the CIRIA C808F: "Using SuDS to Reduce Phosphorus in Surface Water Runoff" and the SuDS Manual (C753). Each feature's overall phosphorus removal rate was adjusted using the CIRCA index, as recommended by NRW.



- 6.3 Based on the proposed SuDS features, Phase 1 provides a phosphorus mitigation of 0.40 kg TP/year, while Phase 2 achieves a mitigation of 0.29 kg TP/year.

7.0 Stage 4: Total Phosphorus Budget

- 7.1 The Stage 4 worksheet automatically calculates the final nutrient budget using the results from Stages 1–3S (Appendix E)

- 7.2 The final phosphorus budget is determined using the following equation:

$$(\text{Stage 1} - \text{Stage 2} + (\text{Stage 3} - \text{Stage 3S})) \times 1.2 = \text{Total Phosphorus Budget}$$

This formula accounts for:

- The additional wastewater loading (Stage 1)
- The net change in phosphorus export between pre- and post-development land uses (Stage 3 – Stage 2)
- The phosphorus removal achieved through SuDS mitigation (Stage 3S)
- A 20% precautionary buffer, as required by NRW guidance to account for modelling uncertainty.

Based on the calculation, the total phosphorus mitigation required is 12.46 kg TP/year, inclusive of the 20% buffer. This results in a mitigation requirement of 6.83 kg TP/year for Phase 1 and 5.64 kg TP/year for Phase 2..

8.0 Conclusion & Results

- 8.1 Based on the Stage 4 results, the phosphate assessment indicates that 12.46 kg TP/year must be mitigated to achieve a phosphorus-neutral balance for the development.
- 8.2 Comparison of the Stage 2 (pre-development) and Stage 3 (post-development) results demonstrates that the existing landcover generates a higher phosphorus export than the proposed post-development condition. Consequently, the implementation of Sustainable Drainage Systems (SuDS) provides an additional reduction in phosphorus loading, further improving the site's nutrient balance.
- 8.3 The majority of the residual phosphorus load of 12.46 kg TP/year arises primarily from the additional wastewater generated by site occupation. This value is based on a conservative assessment assuming maximum site occupancy and a relatively high proportion (25%) of employees commuting from outside the catchment. In practice, these assumptions are likely to overestimate the actual phosphorus contribution. A lower operational population would correspondingly reduce the Stage 1 wastewater phosphorus load and hence decrease the overall mitigation requirement.



Appendix A Stage 1 Worksheet

Special Area of Conservation (SAC):	River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid
Postcode:	LL13 9RX
Local Planning Authority (LPA):	Wrexham County Borough Council
Rainfall:	698
Project type:	Commercial
Development proposal (number of additional units):	1
Not applicable	
Not applicable	Not applicable
Not applicable	
Number of customers / users per unit:	
Water usage per customer / user (litres/person/day):	
Percentage of customers / users from outside catchment:	
Number of employees (per unit):	4236
Water usage per employee (litres/person/day):	50
Percentage of employees from outside catchment:	25
Wastewater treatment works:	Five Fords STW
Not applicable	
Not applicable	
Phosphorus permitted limit (mg TP/l):	1.00
Nitrogen permitted limit (mg TN/l):	27.00
Final calculation of nutrient load from wastewater	
Description of values generated	Values generated
Additional population:	1059.00
Annual wastewater production (litres):	19339987.50
Annual phosphorus load (kg TP/year):	19.34



Appendix B

Stage 2 Worksheet

Soil drainage:	Impeded drainage	
Rainfall identified using postcode (mm/year):	698	
Is this rainfall value correct?	No	
Rainfall (mm/year):	900.1 - 950	
Pre-existing landcovers		
Landcover	Area (hectares)	Phosphorus load (kg TP/year)
Lowland grazing	1.29	1.56
Residential land	0.5714	1.06
Open land – built environment	0.71	0.71
Mixed	34.63	46.06
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Appendix C

Stage 3 Worksheet

Landcover	Area (hectares)	Phosphorus load (kg TP/year)
Commercial/industrial land	10.8	14.63
Open land – built environment	22.245	22.10
Open land – built environment	3.32	3.30
Open land – built environment	0.549	0.55
Residential land	0.2947	0.55
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Total:	37.21	41.13



Appendix D

Stage 3S Worksheet

Landcover	Area (hectares)	Proportion of landcover area served by SuDS feature (%)	SuDS feature	P removal rate for SuDS feature	Phosphorus load removed through SuDS (kg TP/year)
Commercial/industrial land	10.80			#N/A	0.00
Open land – built environment	22.25			#N/A	0.00
Open land – built environment	3.32	100	Porous Pavement	16.5	0.54
Open land – built environment	0.55	100	Swale	27.5	0.15
Residential land	0.29			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Not applicable	0.00			#N/A	0.00
Total:	37.21	Not applicable	Not applicable	Not applicable	0.70



Appendix E Stage 4 Worksheet

Total phosphorus budget	
Description of phosphorus values generated	Values generated
Stage 1 phosphorus load (kg TP/year):	19.34
Stage 2 phosphorus reduction (kg TP/year):	49.39
Stage 3 phosphorus load (kg TP/year):	41.13
Stage 3S phosphorus load removed through SuDS (kg TP/year):	0.70
Phosphorus budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	10.38
Phosphorus budget + 20% buffer	12.46 kg TP/year requires mitigation



Appendix F

Nutrient Budget Calculator Guidance

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 are farmed indoors.
Outdoor Pig farming	Agricultural areas on which pigs are 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. This farm type does not include horticultural crops or outdoor pig farming.
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 for residential developments, or the open land – built environment category for all other development types.
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, and lakes.



Land use types used in the calculator tool	Description
Residential land	Areas of houses and associated infrastructure. This is inclusive of residential roads, driveways, grass verges, gardens and SuDS infrastructure that drains a residential development 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	Areas 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, and public squares.
Community food growing	Areas that are used for local food production, such as allotments.



Appendix G

Stage 4 Worksheet Phase 1

Description of phosphorus values generated	Values generated
Stage 1 phosphorus load (kg TP/year):	10.64
Stage 2 phosphorus reduction (kg TP/year):	27.07
Stage 3 phosphorus load (kg TP/year):	22.52
Stage 3S phosphorus load removed through SuDS (kg TP/year):	0.40
Phosphorus budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	5.69
Phosphorus budget + 20% buffer	6.83 kg TP/year requires mitigation



Appendix H

Stage 4 Worksheet Phase 2

Total phosphorus budget	
Description of phosphorus values generated	Values generated
Stage 1 phosphorus load (kg TP/year):	8.70
Stage 2 phosphorus reduction (kg TP/year):	22.32
Stage 3 phosphorus load (kg TP/year):	18.61
Stage 3S phosphorus load removed through SuDS (kg TP/year):	0.29
Phosphorus budget ((Stage 1 - Stage 2) + (Stage 3 - Stage 3S)):	4.70
Phosphorus budget + 20% buffer	5.64 kg TP/year requires mitigation