

# ROGER WAY, OLD SARUM, SALISBURY

## NUTRIENT NEUTRALITY ASSESSMENT

HYD945



**BETTS HYDRO**  
CONSULTING ENGINEERS

For

Persimmon Homes (Wessex)



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## Executive Summary

As part of a planning application for residential development on land near Roger Way and Crosier Close, nutrient neutrality has been reviewed for the proposed development in order to satisfy Natural England (NE). Under the Habitats Regulations, Planning Authorities must consider the phosphorus impact of proposed developments on water quality within Special Areas of Conservation (SAC) river catchments.

The application consists of two aspects; 41 dwellings on a greenfield area near Roger Way and the creation of 7 apartments through the conversion of commercial space on the ground floor of a building (all other floors are residential).

For the apartment conversion, as there is no direct changes to the external building only wastewater calculations are considered, The new Roger Way development (41 dwellings) features consideration for land uses and associated nutrient loads.

A nutrient budget for the Roger Way Site is calculated to be **4.09kg/TP/year** including for the consideration of water quality treatment from Sustainable Drainage Systems (SuDS). The apartment conversion has a budget **of 0.68kg/TP/year**. A total of **4.77kg/TP/year** for both sites.

As the nutrient budget shows an increase in nutrients entering the SAC relative to the existing situation, mitigation is required to be secured. Should the development obtain credits or produce credits through offsetting, the development can be considered appropriate.

If Petersfinger Wastewater Treatment Works (WwTW) were to be upgraded to the Technical Achievable Limit (TAL) of 0.25mg/l in 2030 the nutrient budget for the Roger Way Site is calculated to be 0.91kg/TP/year. The apartment conversion has a budget of 0.17kg/TP/year. A total of 1.08kg/TP/year for both sites.

If Wiltshire Council does not include the site in their strategic appropriate assessment, then the purchase of credits or direct offsetting by the developer is required. Credits purchased or generated for the pre-2030 period would provide a surplus of credits post 2030 due to upgrades at the receiving Petersfinger WwTW. The developer would retain the right to use this credit surplus for use on other developments.

## 1.0 Context

1.1 Special Areas of Conservation (SAC) are important for their habitats and wildlife and are protected under the Conservation of Habitats and Species Regulations (2017). Some of these sites have high levels of nitrogen and phosphorus discharge into the protected watercourses which can lead to eutrophication. The sources of these nutrients mostly come from agriculture and from wastewater. The potential for future housing developments to exacerbate the impacts creates a risk.

1.2 Annex C, Table 2 of the Natural England (NE) Nutrient Neutrality Guidance shows the Hampshire Avon SAC is a habitat site in unfavourable condition due to excessive phosphorus and requires a Habitat Regulations Assessment (HRA) where nutrient neutrality is a potential solution to enable development to proceed.

1.3 The Annex E flow chart of HRA processes within the NE Nutrient Neutrality Guidance has been reviewed for the proposed development. Based on the development it would be commensurate to undertake an appropriate assessment as there likely would be a significant effect due to wastewater discharging to the SAC via the wastewater treatment works. The Annex E flow chart is included within **Appendix A**.

## 2.0 Introduction

2.1 A review of the nutrient budget for development located in Old Sarum to the north-east of Salisbury has been undertaken in accordance with Natural England's Nutrient Neutrality Guidance (issued March, 2022) as required by Wiltshire Council. The application consists of two aspects: 41 new dwellings and the conversion of a ground floor to 7 apartments.

2.2 The existing building features a ground floor designated currently as a doctor's surgery. The floors above this are currently apartments. An aerial plan is shown within **Figure 1** and a location plan is also provided within **Appendix B**. The apartment conversion is shown off Crosier Close and the site for new dwellings shown off Roger Way.

2.3 For the purpose of this assessment, the proposed dwellings are referred to as 'Roger Way site' whereas the proposed works off Crosier Close are referred to as 'apartment conversion'.



Figure 1: Aerial Image of Development Site (Google Maps, 2024)

## Topography

2.4 The Roger Way site generally falls from the eastern boundary to the western boundary of the site. Levels range from 74.6mAOD in the north-east corner of the site down to 73.19mAOD in the south-western corner. A mound is shown on the site which is approximately 2m higher than the surrounding ground (level of 77.03mAOD).

2.5 At the apartment building, the ground level adjacent to the existing building is 78.5mAOD.

## Geology

2.6 Based on British Geological Survey (BGS) data, the underlying ground conditions include Seaford Chalk Formation bedrock geology. overlaid by clay, silt, sand and gravel superficial geology. The soil type is classed as loamy lime rich freely draining soils based on Cranfield soilscales data.

## Hydrology

2.7 There are no waterbodies within the site boundaries. Infiltration is feasible and it is proposed plots at the Roger Way drain to an infiltration basin. Infiltration testing to BRE Digest 365 confirms infiltration is feasible on site as shown with **Appendix C**.

## Wastewater Infrastructure

2.8 It is understood that the Wastewater Treatment Works (WwTW) that currently serves the apartment building and would serve the Roger Way site is the Petersfinger WwTW (operated by Wessex Water) that discharges treated water into the River Avon. The treatment works are located 5.4km to the south-east of the site. A review of the online DEFRA maps highlights that the River Avon is designated as a Special Area of Conservation (SAC), Annex B of the Natural England (NE) Nutrient Neutrality Guidance shows the catchment to be subject to the nutrient neutrality strategy.

2.9 Based on review of the Rivers Trust, 'raw sewerage in our rivers map', the Petersfinger WwTW (permit number 401382), operated by Wessex Water spilled 4 times for a total of 31.55 hours in 2022. The Hurdcott WwTW also operated by Wessex Water and located 1.3km to the east of the site, spilled 149 times for a total of 2346.5 hours into the River Bourne.

### 3.0 Levelling Up and Regeneration Bill

3.1 The Levelling Up and Regeneration Bill has been passed as of February 2024. The new bill ensures water companies upgrade wastewater treatments works within designated SAC's by 2030. Developers and local authorities can consider this as certain for the purposes of an assessment under the Habitats Regulations.

3.2 Wastewater treatment works serving a catchment above 2000 dwellings will require to be upgraded to the Technical Achievable Limit (TAL) by 2030. For phosphorus the TAL is considered to be 0.25mg/l. This will reduce costs of nutrient mitigation and should result in a lower post development values for nutrient budgets post 2030.

3.3 In addition funding is being granted for Defra to provide mitigation schemes in which developers will be able to purchase nutrient credits. The scheme will not be a requirement but an option to discharge mitigation requirements more efficiently.

3.4 It will be made clear in planning guidance that judgements on deliverability of sites should take account of strategic mitigation schemes and immediate benefits on mitigation burdens once legislation requiring water treatment upgrades comes into force.

3.5 The Department for Levelling Up, Housing and Communities (DLUHC) will revise planning guidance to reflect that sites affected by nutrient pollution forming part of housing land supply calculations are capable of being considered deliverable for the purposes of housing land supply calculations, subject to relevant evidence to demonstrate deliverability. It will be for decision takers to make judgements about impacts on delivery timescales for individual schemes in line with the National Planning Policy Framework.

3.6 The Habitats Regulations Assessment provisions apply to any consent, permission, or other authorisation, this may include post-permission approvals, reserved matters or discharges of conditions.

3.7 Under the recent requirements of Natural England, new development within the catchment of the SAC is required to be supported by evidence that nutrient loading will not be increased in the period up to 2030 after which improvements at the sewage treatments and nutrient credit schemes are implemented. The nutrient pathways towards the SAC are summarised within **Figure 2**:

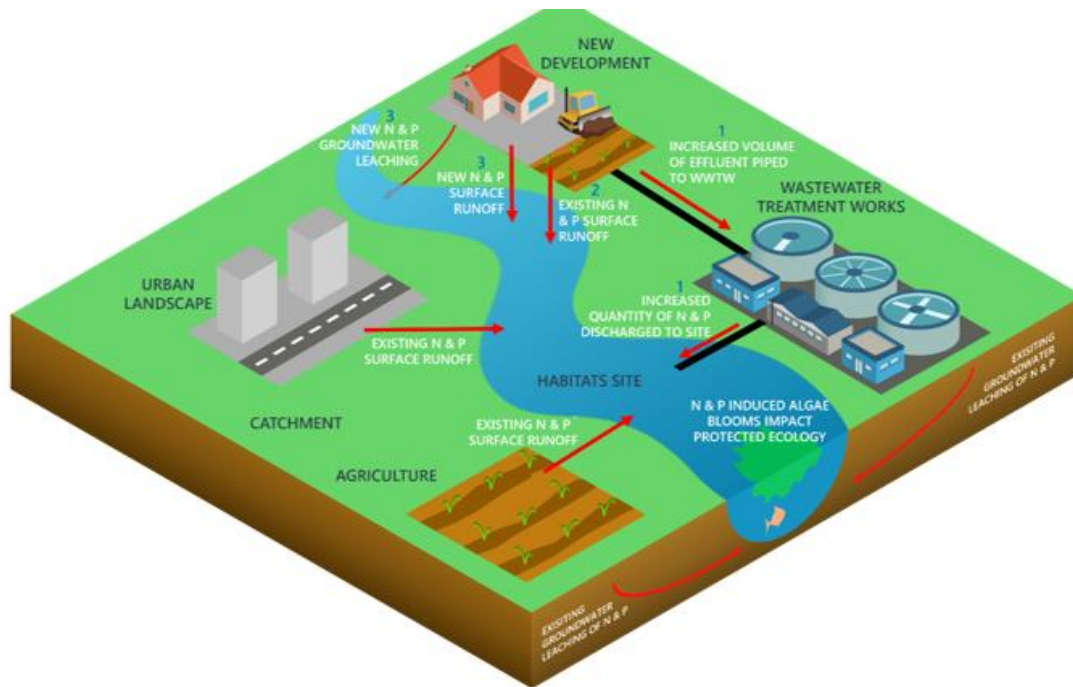
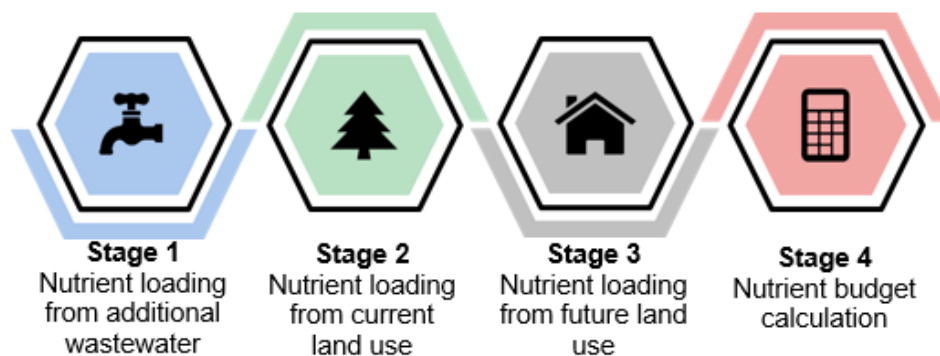


Figure 2: Nutrient Impact Pathway (Natural England, 2022)

3.8 This assessment reviews the net nutrient budget for phosphorus within the catchment of the Hampshire Avon SAC. The stages for this calculation consider the additional wastewater generated, the current nutrient load from the existing land use and the future nutrient load from future land use as outlined below:



3.9 The Nutrient Neutrality Budget Calculator for the River Avon SAC provided by Wiltshire Council has been utilised to define the nutrient losses at each stage as shown in **Appendix D**.

3.10 In terms of the apartment conversion for the purposes of this assessment only Stage 1 (nutrient loading from additional wastewater) has been calculated. As the building and infrastructure have already been constructed there are no Stage 2 and Stage 3 calculations.

## 4.0 Stage 1: Nutrient Load From Additional Wastewater

### Step 1 Additional Wastewater

4.1 Persons living in a new residential development will generate wastewater. Wastewater is enriched in nutrients and, following treatment, if the additional wastewater discharges to a Habitats site it will increase nutrient loadings, posing risks to the ecology of the site. In general development of properties with overnight stays will likely increase the nutrient load to the SAC as it provides a direct route to the habitat via the pipe network and wastewater treatment works.

The key inputs within this stage are shown in **Table 1**, based on information provided by Persimmon Homes (water usage information is provided within **Appendix E**).

Table 1: Stage 1 inputs (Betts Hydro, 2024)

| Roger Way Site                               |                     |
|----------------------------------------------|---------------------|
| No. of Dwellings                             | <b>41 dwellings</b> |
| Water Efficiency (litres per person per day) | <b>109 l/p/d</b>    |
| Occupancy (persons per dwelling)             | <b>2.4ppd</b>       |
| Annual Megalitres of Wastewater              | <b>3.9ml/yr</b>     |
| Apartment Conversion                         |                     |
| No. of Dwellings                             | <b>7 apartments</b> |
| Water Efficiency (litres per person per day) | <b>104 l/p/d</b>    |
| Occupancy (persons per dwelling)             | <b>2.4ppd</b>       |
| Annual Megalitres of Wastewater              | <b>0.6ml/yr</b>     |

\*The apartments show a reduced water usage relative to the dwellings, this is due to no external water use.

### Step 2 Determine the concentration of nutrients in wastewater and calculate additional nutrient load

4.2 This input is the estimated nutrient concentration in the treated wastewater generated by the new development.

4.3 Wastewater from a new development is preferably discharged to a mains sewer for treatment at a wastewater treatment works (WwTW). In a WwTW, nutrients are removed by treatment processes. For some WwTW, the removal of nutrients from wastewater is achieved by a dedicated process to comply with a permitted concentration of nitrogen or phosphorus in the treated wastewater that leaves a WwTW, ensuring that the nutrient levels will not exceed the permit limit. Other WwTW will not have permitted limits on the concentration of nutrients in their final discharges.

4.4 The relevant WwTW for the site is identified as Petersfinger WwTW. Information provided by Wiltshire Council details the permit for Salisbury Petersfinger WwTW. The permit limit is 1mg/TP/litre for phosphorus. Post 2030 a permit limit of 0.25mg/l is relevant due to upgrades at the treatment works.

Current Permit for Phosphorus (mgTP/l) – **1**

Future (2030) Permit for Phosphorus (mgTP/l)– **0.25 \*Technical Achievable Limit (TAL)**

Default Nutrient Concentration (mgTP/l) x annual water use (l/year) = nutrient loa

**Table 2** shows the Stage 1 nutrient load.

*Table 2: Stage 1 Nutrient Budget (Betts Hydro, 2024)*

|                                                             |                     |
|-------------------------------------------------------------|---------------------|
| Petersfinger WwTW Permit Pre 2030 Permit with 90% headroom  | <b>0.9mg/l</b>      |
| Petersfinger WwTW Permit Post 2030 Permit with 90% headroom | <b>0.225mg/l</b>    |
| <b>Roger Way Site</b>                                       |                     |
| S1 Pre-2030 Budget                                          | <b>3.53kg/TP/yr</b> |
| S1 Post 2030                                                | <b>0.88kg/TP/yr</b> |
| <b>Apartment Conversion</b>                                 |                     |
| S1 Pre-2030 Budget                                          | <b>0.57kg/TP/yr</b> |
| S1 Post 2030                                                | <b>0.14kg/TP/yr</b> |

\*There is a possibility the site connects to Hurdcott WwTW rather than Petersfinger WwWT, as both facilities have the same treatment permit levels there is no significance should the other WwTW be appropriate.

## 5.0 Stage 2: Nutrient Loading From Current Land Use

5.1 This input determines the amount of nutrients that are currently exported from the development site. These nutrients will be offset against the new nutrient load generated by the development in wastewater. The ground conditions indicate freely draining ground conditions.

5.2 The methodology to calculate the nutrient load from current land use depends on the development site and whether it includes a mix of urban areas or non-urban areas. For non-urban areas the export coefficient is determined using the below factors:

1. The farm type or farm types that are currently on your development site.
2. The area of the farm in hectares that is used by each farm type.
3. The Operational Catchment that your development site is located in.
4. The soil characteristics for your development site.
5. The average annual rainfall for your development site.
6. Whether your development site is in Nitrate Vulnerable Zone (NVZ).

5.3 Point 1 and 2 require direct input from the developer/land owner/tenant to determine farm type and areas of these types. The remaining points can be identified through online tools. Farmscoper software is used define a nutrient coefficient using data from the below farm types:

-  Cereals
-  General
-  Horticulture
-  Pig
-  Poultry
-  Dairy
-  Mixed
-  Lowland Grazing

5.4 Based on aerial imagery and information provided from Persimmon Homes, the existing Roger Way site is split into greenspace and open urban land (based on the wider site compound located on the site). A land type plan is shown within (**Appendix F**). The coefficient values are taken from the Avon nutrient budget calculator.

Land Area: 1ha

Soil Characteristics: Freely Draining

Nitrate Vulnerability Zone: Yes

Operational Catchment: Avon Hampshire

Average Rainfall: 750-800 (779mm)

*Table 3: Stage 2 Roger Way Site Existing Land Use Nutrient Export (Betts Hydro, 2024)*

| Land Type       | Area (ha) | Stage 2 load (kgTP/yr) |
|-----------------|-----------|------------------------|
| Greenspace      | 0.87      | 0.11                   |
| Open Urban Land | 0.13      | 0.02                   |
| Total           | 1         | 0.13                   |

The total existing phosphorus nutrient load = **0.13kg/year**

## 6.0 Stage 3: Nutrient Loading From Future Land Use

6.1 Once a development site has been built, the land uses on the site will have an associated nutrient export. Stage 3 of the nutrient budget accounts for the export of nutrients from the new land use(s) on the development site.

6.2 The same approaches shown in Stage 2 are applied in Stage 3. Each land use on the post-development site requires to be categorised to determine the relevant nitrogen or phosphorus export coefficient. The sum of the nutrient exports for each land use is the total nutrient export from land uses on the development site. Unlike the future phosphorus exported directly from wastewater this stage quantifies diffuse nutrient pollution from different land uses using rainfall data and land use co-efficients within the Natural England calculator.

6.3 The proposed development site has been broken down in **Table 4**. A proposed land use plan is shown within **Appendix E**.

*Table 4: Stage 3 Roger Way Site New Land Use Nutrient Export (Betts Hydro, 2024)*

| New Land Use Type      | Area (ha) | Annual Phosphorus nutrient export (kg TP) |
|------------------------|-----------|-------------------------------------------|
| Residential urban land | 0.83      | 1.29                                      |
| Water                  | 0.02      | 0.00                                      |
| Open Urban Land        | 0.15      | 0.12                                      |
| Total                  | 1         | 1.41                                      |

The total future land use nutrient load = **1.41kg TP Year**

## 7.0 Sustainable Drainage Systems (SuDS)

7.1 SuDS should be considered on most sites and also be considered as part of nutrient budget calculations. SuDS provide a multiple benefits including enhancing biodiversity, water attenuation, water quality treatment and amenity.

7.2 The Roger Way site surface water drainage is managed via infiltration. Plot drainage and highways are proposed to drain to an infiltration basin. (see **Appendix H** for drainage strategy and impermeable areas plan). Infiltration testing onsite confirms rates between  $1 \times 10^{-4}$  to  $7.4 \times 10^{-5}$  m/s.

7.3 According to CIRIA C808 document 'Using SuDS to reduce phosphorus in surface water' (extracts in **Appendix I**). For all surface water flows that are infiltrated and there is low risk to groundwater provided by the soil, the phosphorus in the run-off is considered to be captured and removed from the water environment.

7.4 The residential urban land areas designated on the site are designated with 100% of the catchment draining to the onsite SuDS. In addition open urban land (public grassed areas) are also expected to drain via infiltration

7.5 The criteria to be able apply this 100% reduction in nutrient loss is outlined in CIRIA C808 and shown in **Table 5** below.

Table 5: CIRIA C808 Infiltration Pollution Considerations

|                                                                                                                                                                                      |                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. The SuDS device will not be subject to flooding, i.e. not Flood Zone 2 or 3.                                                                                                      | <b>The site is located within fluvial Flood Zone 1.</b>                                                                                                                                                                                                |
| 2. The SuDS device is in an area where the high water groundwater depth is at least 1m below the base of the proposed infiltration device (Taking into account seasonal variations). | <b>The ground investigation report within Appendix I shows ground water was not encountered during ground investigation and is therefore located greater than 1m from the base of the proposed infiltration device.</b>                                |
| 3. The total pollution risk score for the SuDS device is <180 as referenced in table 26.6 in CIRIA C753                                                                              | <b>Based on information within the ground investigation report the risk to and from ground water pollution is considered low. The land use of roof run-off, commercial roofs and low traffic road is considered a low hazard to pollution indices.</b> |
| 4. The SuDS device is at least 5m away from any surface water feature                                                                                                                | <b>The SuDS features are located more than 5m from watercourse features and 10m from any structures as required for areas with Chalk geology</b>                                                                                                       |

7.6 Based on satisfying the criteria outlined in the CIRIA guidance, areas that drain to ground can be considered to achieve a 100% reduction in phosphate exports to the river environment. Based on the land use types within the stage 3 calculation. Residential urban land and open urban land drain to ground. The effect of SuDS on the nutrient budget is detailed in the nutrient budget calculator in **Appendix C**.

## 8.0 Stage 4: Calculating The Nutrient Budget

8.1 Stage 1-3 have calculated the nutrient export from the different sources within the development for pre- and post-development and future occupation. Each of Stages 1-3 provides a value for the production of phosphorus in kg per year. The balance, or net change, in the amount of phosphorus that be produced by the development once built and occupied is the nutrient budget for that development.

8.2 The methodology adopts a precautionary approach to the nutrient budget calculation. To ensure robustness an additional 20% buffer is added to the final figure.

8.3 The Roger Way development's nutrient budget = Stage 1 output - Stage 2 output + Stage 3 output. **Table 6** shows the nutrient budget for the Roger Way Site, the apartment conversion and total budget.

| Roger Way Total Nutrient Budget (Pre-2030)             |                                           |                                                            |                                           |
|--------------------------------------------------------|-------------------------------------------|------------------------------------------------------------|-------------------------------------------|
| Stage 1 Wastewater from new development (Kg/TP/yr)     | Stage 2 Existing Land Use Load (kg/TP/yr) | Stage 3 Future Land Use Load (kg/TP/yr) Including for SuDS | Nutrient Budget (w 20% buffer) (kg/TP/yr) |
| 3.53                                                   | 0.13                                      | 0                                                          | <b>4.09</b>                               |
| Roger Way Total Nutrient Budget (Post-2030)            |                                           |                                                            |                                           |
| Stage 1 Wastewater from new development (Kg/TP/yr)     | Stage 2 Existing Land Use Load (kg/TP/yr) | Stage 3 Future Land Use Load (kg/TP/yr)                    | Nutrient Budget (w 20% buffer) (kg/TP/yr) |
| 0.88                                                   | 0.13                                      | 0                                                          | <b>0.91</b>                               |
| Apartment Conversion Total Nutrient Budget (Pre-2030)  |                                           |                                                            |                                           |
| Stage 1 Wastewater from new development (Kg/TP/yr)     | Stage 2 Existing Land Use Load (kg/TP/yr) | Stage 3 Future Land Use Load (kg/TP/yr)                    | Nutrient Budget (w 20% buffer) (kg/TP/yr) |
| 0.57                                                   | N/A                                       | N/A                                                        | <b>0.68</b>                               |
| Apartment Conversion Total Nutrient Budget (Post-2030) |                                           |                                                            |                                           |
| Stage 1 Wastewater from new development (Kg/TP/yr)     | Stage 2 Existing Land Use Load (kg/TP/yr) | Stage 3 Future Land Use Load (kg/TP/yr)                    | Nutrient Budget (w 20% buffer) (kg/TP/yr) |
| 0.14                                                   | N/A                                       | N/A                                                        | <b>0.17</b>                               |
| Total Budget Pre 2030                                  |                                           | Total Budget Post 2030                                     |                                           |
| <b>4.77kg/TP/yr</b>                                    |                                           | <b>1.08 kg/TP/yr</b>                                       |                                           |

The final nutrient pre-2030 output is **4.77kg TP/Year**

## 9.0 Conclusion

9.1 The development has the potential to have a significant effect on the SAC, therefore an appropriate assessment of nutrient neutrality has been undertaken in accordance with the Annex E HRA flow diagram in the Natural England Guidance (the Annex E decision tree is shown within **Appendix A** and **Figure 3** of this assessment).

9.2 A nutrient budget for the Roger Way site (41 dwellings) is calculated to be 4.09kg/TP/year including for the consideration of water quality treatment from Sustainable Drainage Systems (SuDS). When only considering the post 2030 budget 0.91kg/TP/year is calculated.

9.3 The apartment conversion has only considered phosphate loads from the stage 1 wastewater loads. This is because there are no external changes to the building. The pre-2030 nutrient load is 0.68kg/TP/year and the post 2030 load is 0.17kg/TP/year.

9.4 The total budget for both sites is **4.77kg/TP/year** pre-2030 and **1.08kg/TP/year** post 2030. There is therefore a requirement to mitigate for an increase in nutrients.

9.5 As the nutrient budget shows an increase in nutrients entering the SAC relative to the existing situation, mitigation is required to be secured. Should the development obtain credits or produce credits through offsetting, the development can be considered appropriate.

9.6 If Wiltshire Council do not include the site in their strategic appropriate assessment, then the purchase of credits or direct offsetting by the developer is required. Credits purchased or generated for the pre-2030 period would provide a surplus of credits post 2030 due to upgrades at the receiving Petersfinger WWTW. The developer would retain the right to use this credit surplus for use on other developments. It is understood Wiltshire Council are currently providing a credit service for this part of the Avon catchment.

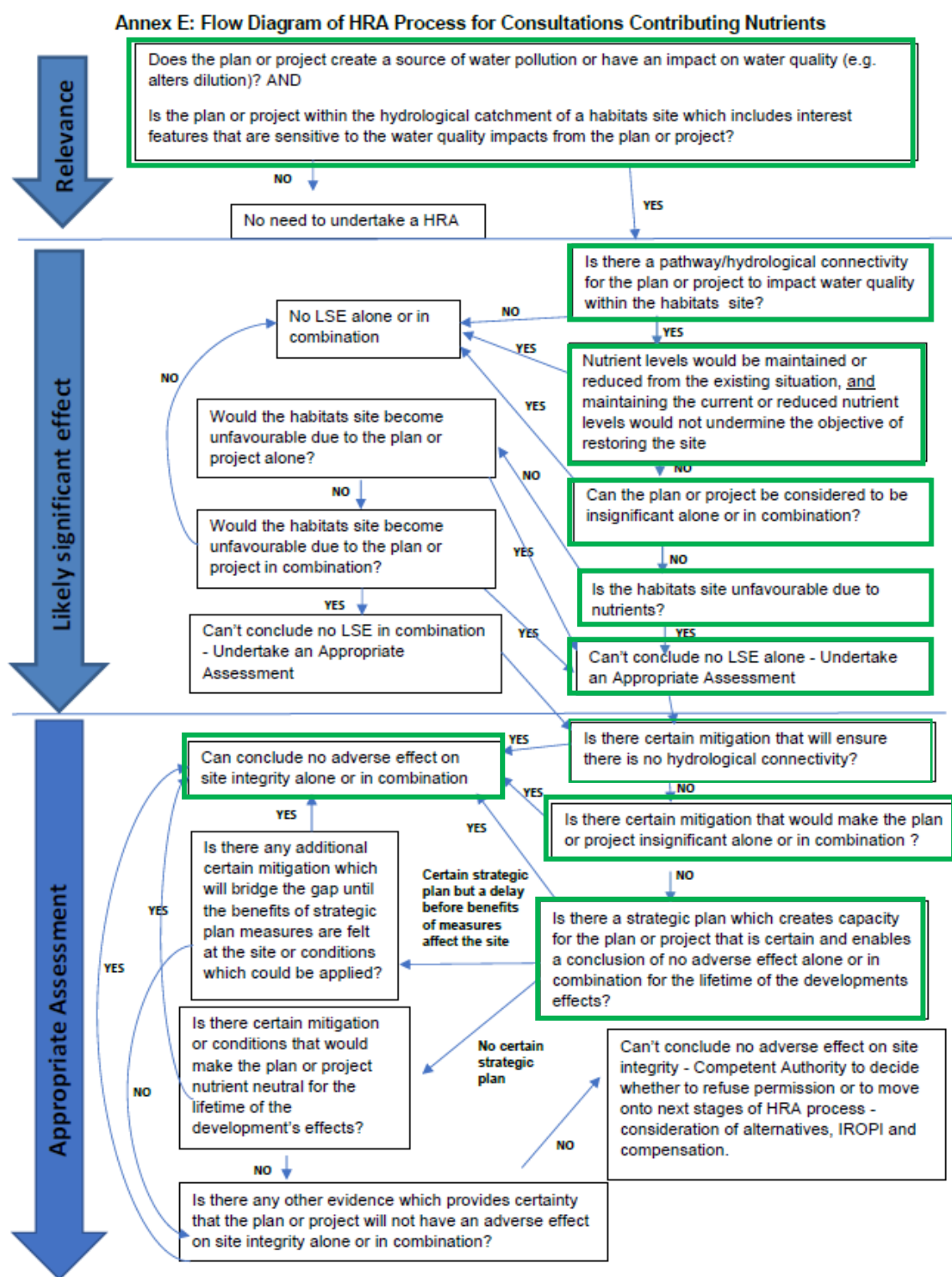
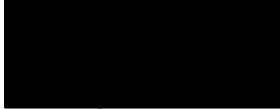


Figure 3: Flow Diagram of HRA Processes (Natural England, 2022)

I trust that the above information is useful, however if you have any further queries, please do not hesitate to contact us.

Yours sincerely



**Patrick Taylor** BSc (Hons) FRGS  
Flood Risk Modeller

**Attached:**

*Appendix A – Natural England Guidance Annex E HRA Flow Diagram*  
*Appendix B – Location Plan*  
*Appendix C – Infiltration Test Results*  
*Appendix D – Nutrient Budget Calculator*  
*Appendix E – Water Usage Information*  
*Appendix F - Existing Land Use Plan*  
*Appendix G - New Land Use Plan*  
*Appendix H– Drainage Strategy Drawing*  
*Appendix I – CIRIA Extracts*

***APPENDIX A -NATURAL ENGLAND GUIDANCE ANNEX E HRA FLOW DIAGRAM***

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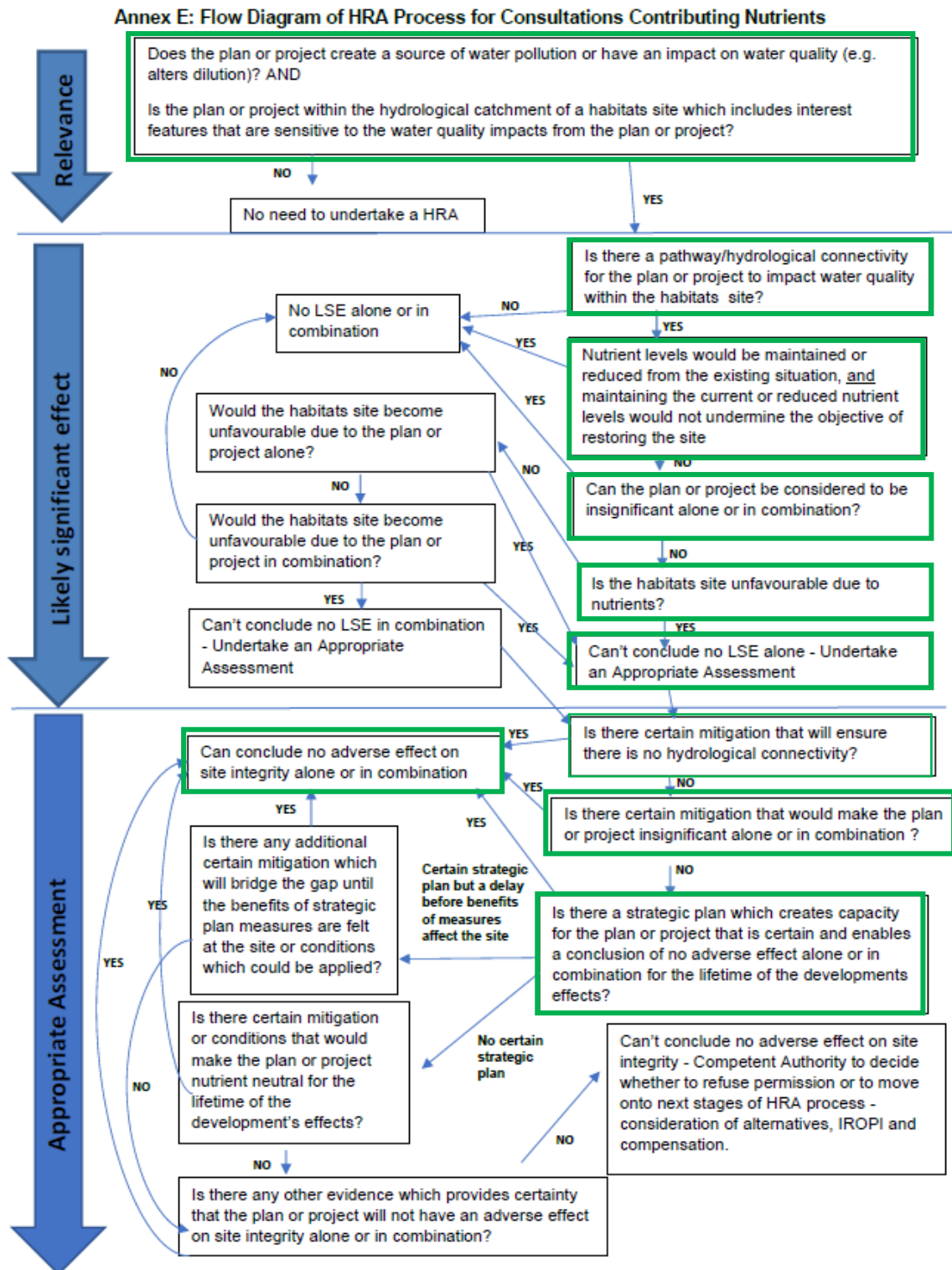
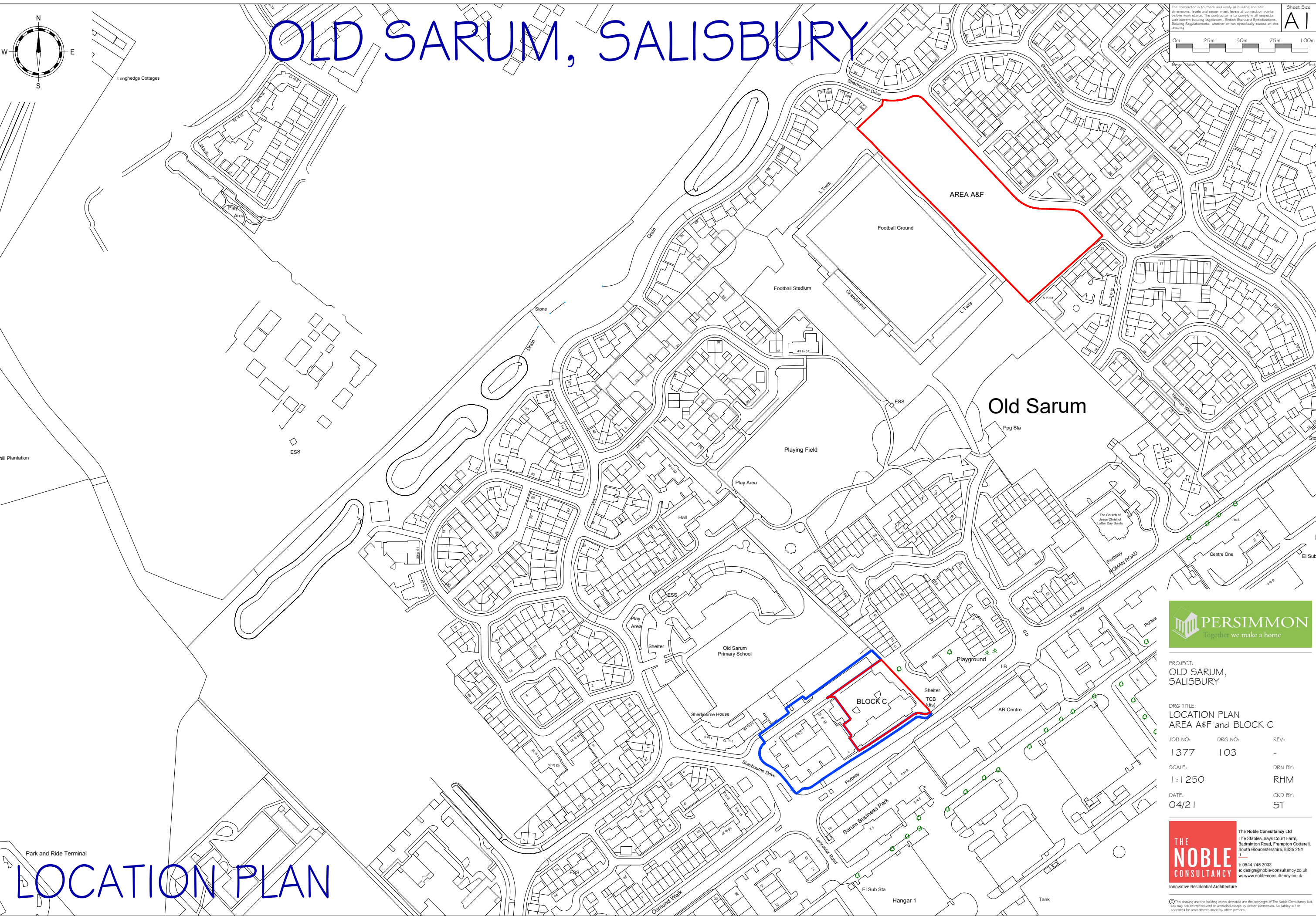


Figure 3: Flow Diagram of HRA Processes (Natural England, 2022)

***APPENDIX B – LOCATION PLAN***

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LOCATION PLAN

OLD SARUM

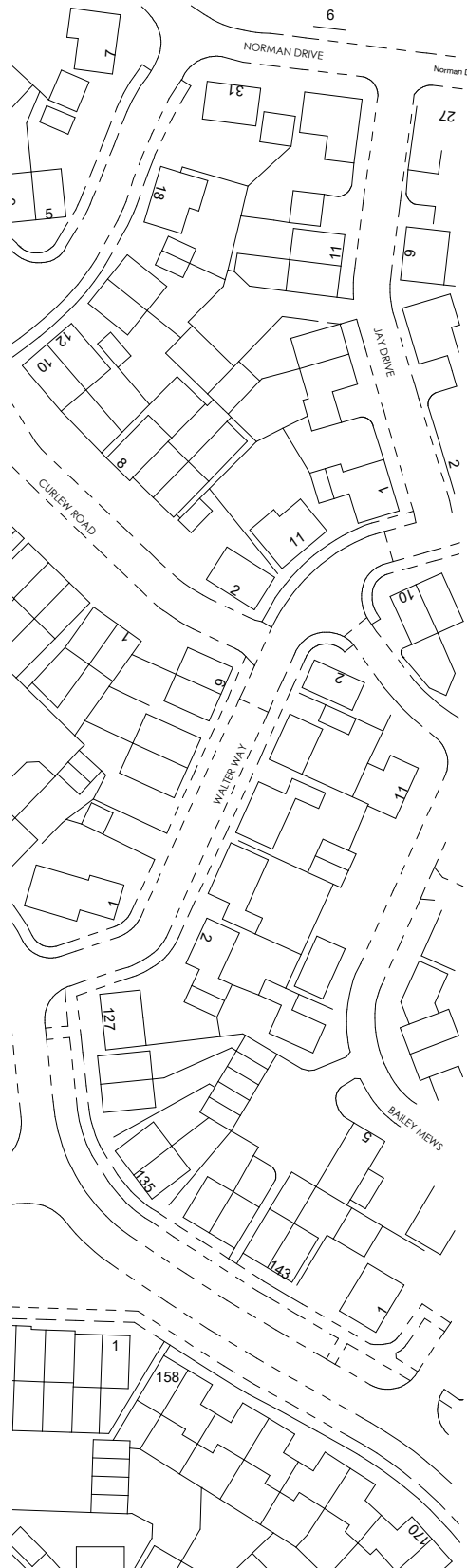


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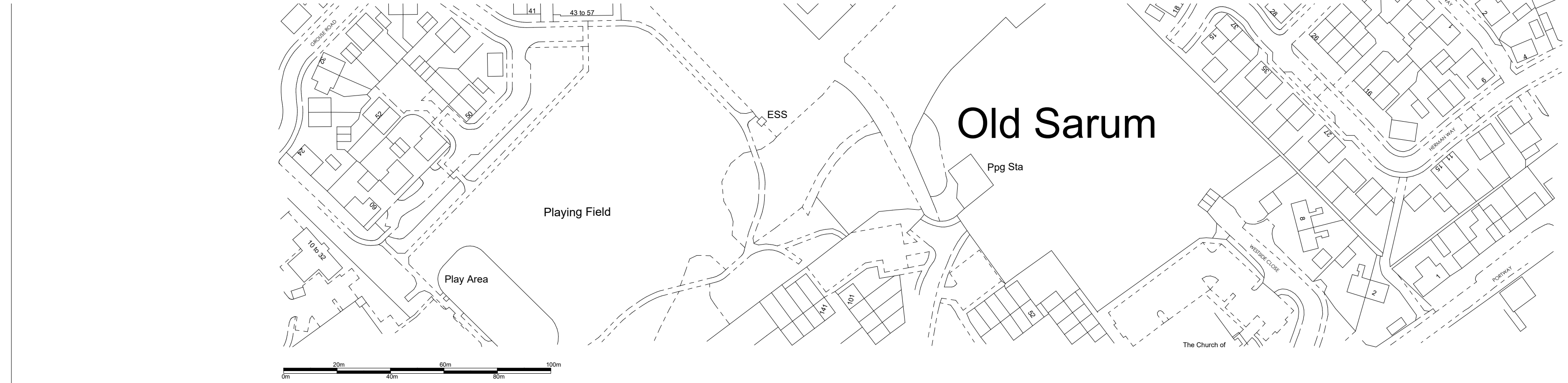
Persimmon Homes (Wessex)  
Verona House, Tetbury Hill  
Malmesbury, Wiltshire. SN16 9JR

Tel: 01666 824721  
Fax: 01666 826152

www.persimmonhomes.com



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| 162.101                                                                                                                                                                                        |         |          | -         |    |
| DRAWING TITLE                                                                                                                                                                                  |         |          |           |    |
| SITE LOCATION PLAN                                                                                                                                                                             |         |          |           |    |
| LAND OFF SHERBOURNE DRIVE / ROGER WAY, OLD SARUM                                                                                                                                               |         |          |           |    |
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**APPENDIX C – INFILTRATION TEST RESULTS**



## **APPENDIX H**

### **INFILTRATION TEST RESULTS**

## Infiltration Test

**Project Name:** Old Sarum, Salisbury  
**Project Ref.:** GEG-23-786  
**Trial Pit:** IT01  
**Test No.:** Test 3 of 3

|                                        |         |
|----------------------------------------|---------|
| Depth of Pit (cm):                     | 174.00  |
| Depth of Water at Start of Depth (cm): | 73.00   |
| Date of Test:                          | 26.4.23 |

[illegible]

---

*End of Test*

With Reference to: **Graph F-3**

| Parameter                                  | Symbol           | Calculation                                      | Units | IT01            |
|--------------------------------------------|------------------|--------------------------------------------------|-------|-----------------|
| Effective Depth of Trial Pit               | $d_p$            |                                                  | m     | 1.01            |
| Width of Trial Pit                         | $w$              |                                                  | m     | 0.70            |
| Length of Trial Pit                        | $l$              |                                                  | m     | 1.70            |
| Volume of Trial Pit                        | $V$              | $= d_p \times w \times l$                        | $m^3$ | 1.20            |
| Volume of Trial Pit at 50% Effective Depth | $V_{50\%}$       | $= V \times 0.5$                                 | $m^3$ | 0.60095         |
| Internal Surface Area of Trial Pit*        | $a_{p50\%}$      | $= l \times w + d_p \times (w + l)$              | $m^2$ | 3.61            |
| Time to reach 75% Effective Depth          | $T_{p75\%}$      |                                                  | min   | 2.60            |
| Time to reach 25% Effective Depth          | $T_{p25\%}$      |                                                  | min   | 20.00           |
| Time 25% - 75%                             | $T_{p75\%-25\%}$ | $= T_{p25\%} - T_{p75\%}$                        | min   | 17.4            |
| Infiltration Rate                          | $f$              | $= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$ | m/s   | <b>1.59E-04</b> |

\*To 50% Effective Depth (including base)

Notes:

[1] Base of pit at 1.74 m following slight collapse during Test 2.

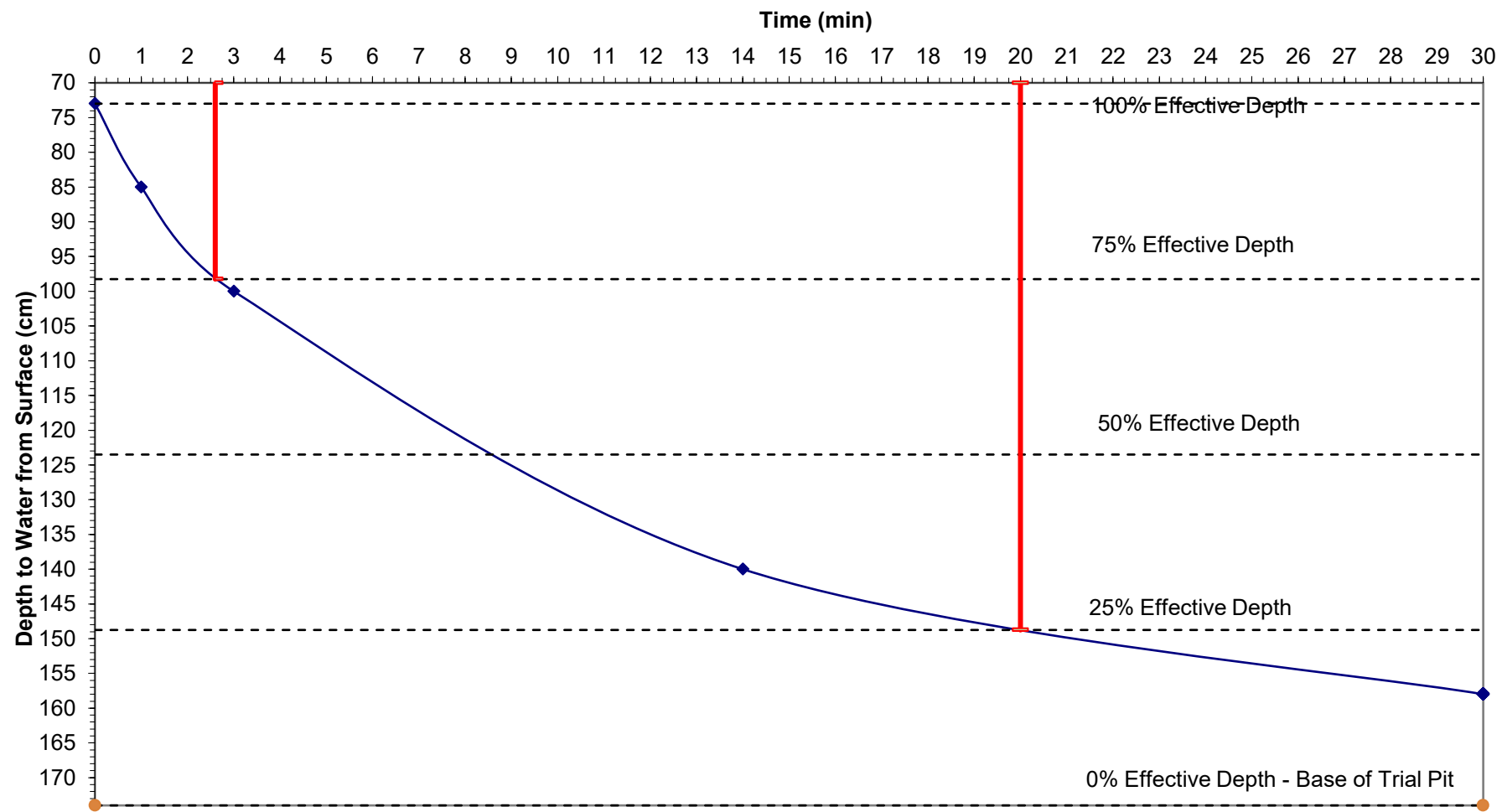
Site Engineer: JM  
Drafted by: JM  
Checked by: MP

Graph F-3

GEG-23-786

Old Sarum, Salisbury

IT01



## Infiltration Test

**Project Name:** Old Sarum, Salisbury  
**Project Ref.:** GEG-23-786  
**Trial Pit:** IT03  
**Test No.:** Test 3 of 3

|                                        |         |
|----------------------------------------|---------|
| Depth of Pit (cm):                     | 137.00  |
| Depth of Water at Start of Depth (cm): | 79.00   |
| Date of Test:                          | 26.4.23 |



Geo  
Environmental  
Group

[illegible]

---

*End of Test*

With Reference to: **Graph F-9**

| Parameter                                  | Symbol           | Calculation                                      | Units | IT03            |
|--------------------------------------------|------------------|--------------------------------------------------|-------|-----------------|
| Effective Depth of Trial Pit               | $d_p$            |                                                  | m     | 0.58            |
| Width of Trial Pit                         | $w$              |                                                  | m     | 0.70            |
| Length of Trial Pit                        | $l$              |                                                  | m     | 2.60            |
| Volume of Trial Pit                        | $V$              | $= d_p \times w \times l$                        | $m^3$ | 1.06            |
| Volume of Trial Pit at 50% Effective Depth | $V_{50\%}$       | $= V \times 0.5$                                 | $m^3$ | 0.5278          |
| Internal Surface Area of Trial Pit*        | $a_{p50\%}$      | $= l \times w + d_p \times (w + l)$              | $m^2$ | 3.73            |
| Time to reach 75% Effective Depth          | $T_{p75\%}$      |                                                  | min   | 6.00            |
| Time to reach 25% Effective Depth          | $T_{p25\%}$      |                                                  | min   | 53.00           |
| Time 25% - 75%                             | $T_{p75\%-25\%}$ | $= T_{p25\%} - T_{p75\%}$                        | min   | 47              |
| Infiltration Rate                          | $f$              | $= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$ | m/s   | <b>5.01E-05</b> |

\*To 50% Effective Depth (including base)

Notes:

[1] Base of pit at 1.37 m following slight collapse during Test 2.

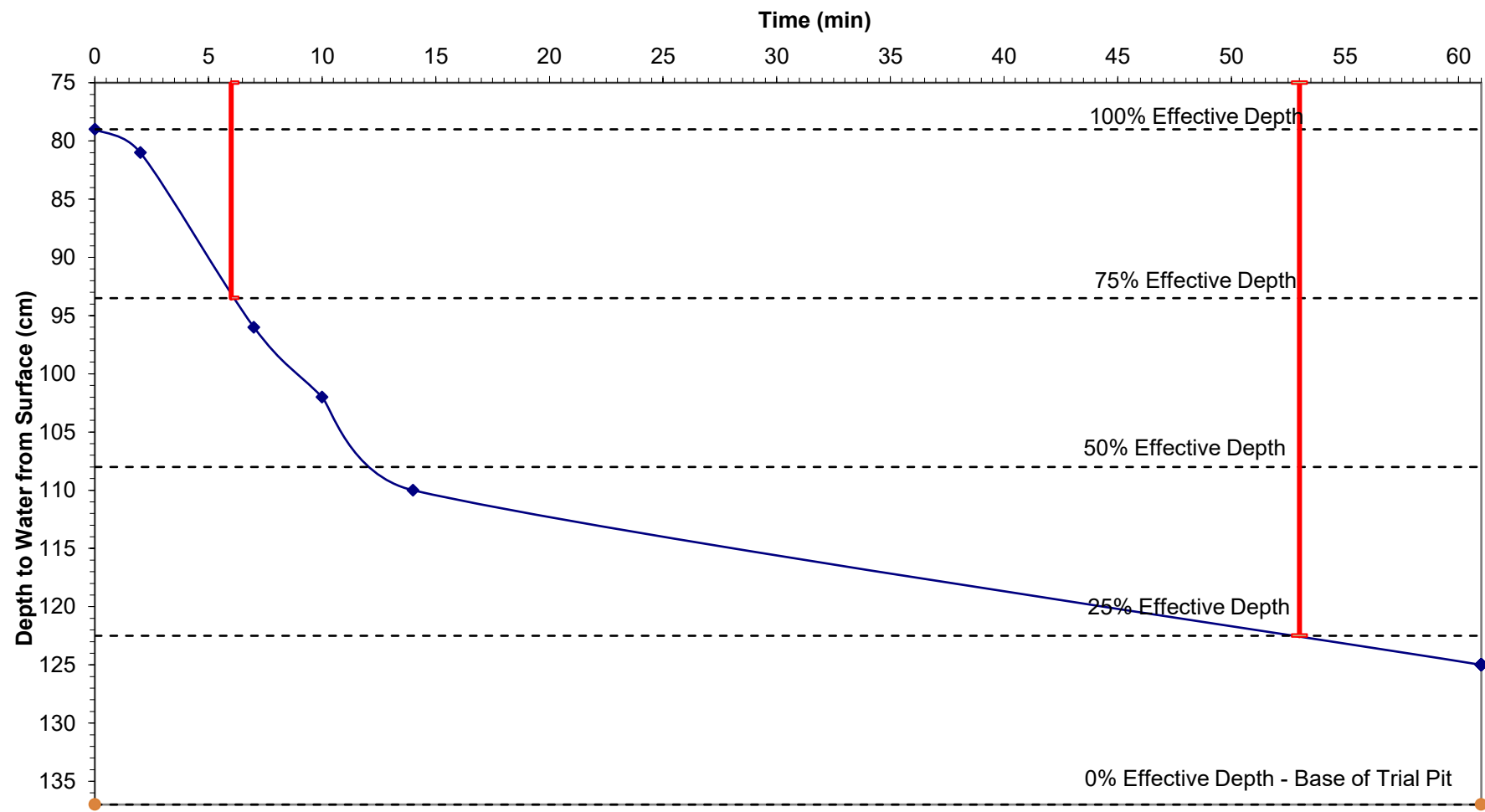
Site Engineer: JM  
Drafted by: JM  
Checked by: MP

Graph F-9

GEG-23-786

Old Sarum, Salisbury

IT03



## Infiltration Test

**Project Name:** Old Sarum, Salisbury  
**Project Ref.:** GEG-23-786  
**Trial Pit:** IT04  
**Test No.:** Test 1 of 3

|                                        |         |
|----------------------------------------|---------|
| Depth of Pit (cm):                     | 190.00  |
| Depth of Water at Start of Depth (cm): | 64.00   |
| Date of Test:                          | 26.4.23 |



Geo  
Environmental  
Group

[illegible]

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*End of Test*

With Reference to: **Graph F-10**

| Parameter                                  | Symbol           | Calculation                                      | Units | IT04            |
|--------------------------------------------|------------------|--------------------------------------------------|-------|-----------------|
| Effective Depth of Trial Pit               | $d_p$            |                                                  | m     | 1.26            |
| Width of Trial Pit                         | $w$              |                                                  | m     | 0.70            |
| Length of Trial Pit                        | $l$              |                                                  | m     | 1.60            |
| Volume of Trial Pit                        | $V$              | $= d_p \times w \times l$                        | $m^3$ | 1.41            |
| Volume of Trial Pit at 50% Effective Depth | $V_{50\%}$       | $= V \times 0.5$                                 | $m^3$ | 0.7056          |
| Internal Surface Area of Trial Pit*        | $a_{p50\%}$      | $= l \times w + d_p \times (w + l)$              | $m^2$ | 4.02            |
| Time to reach 75% Effective Depth          | $T_{p75\%}$      |                                                  | min   | 4.60            |
| Time to reach 25% Effective Depth          | $T_{p25\%}$      |                                                  | min   | 17.90           |
| Time 25% - 75%                             | $T_{p75\%-25\%}$ | $= T_{p25\%} - T_{p75\%}$                        | min   | 13.3            |
| Infiltration Rate                          | $f$              | $= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$ | m/s   | <b>2.20E-04</b> |

\*To 50% Effective Depth (including base)

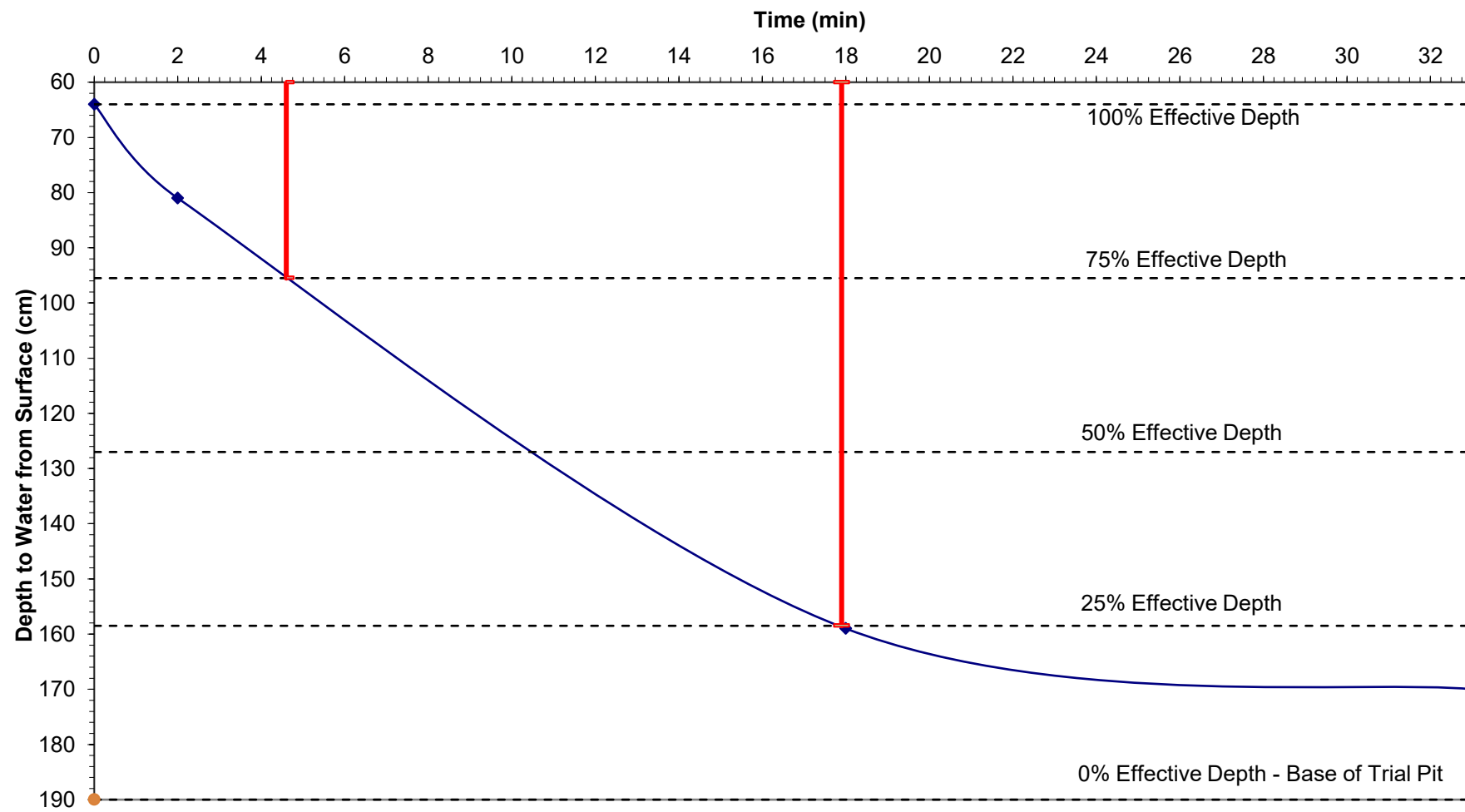
Site Engineer: JM  
Drafted by: JM  
Checked by: MP

Graph F-10

GEG-23-786

Old Sarum, Salisbury

IT04



## Infiltration Test

**Project Name:** Old Sarum, Salisbury  
**Project Ref.:** GEG-23-786  
**Trial Pit:** IT04  
**Test No.:** Test 2 of 3

|                                        |         |
|----------------------------------------|---------|
| Depth of Pit (cm):                     | 170.00  |
| Depth of Water at Start of Depth (cm): | 71.00   |
| Date of Test:                          | 26.4.23 |



Geo  
Environmental  
Group

[illegible]

---

*End of Test*

With Reference to: **Graph F-11**

| Parameter                                  | Symbol           | Calculation                                      | Units | IT04            |
|--------------------------------------------|------------------|--------------------------------------------------|-------|-----------------|
| Effective Depth of Trial Pit               | $d_p$            |                                                  | m     | 0.99            |
| Width of Trial Pit                         | $w$              |                                                  | m     | 0.70            |
| Length of Trial Pit                        | $l$              |                                                  | m     | 1.60            |
| Volume of Trial Pit                        | $V$              | $= d_p \times w \times l$                        | $m^3$ | 1.11            |
| Volume of Trial Pit at 50% Effective Depth | $V_{50\%}$       | $= V \times 0.5$                                 | $m^3$ | 0.5544          |
| Internal Surface Area of Trial Pit*        | $a_{p50\%}$      | $= l \times w + d_p \times (w + l)$              | $m^2$ | 3.40            |
| Time to reach 75% Effective Depth          | $T_{p75\%}$      |                                                  | min   | 8.40            |
| Time to reach 25% Effective Depth          | $T_{p25\%}$      |                                                  | min   | 47.00           |
| Time 25% - 75%                             | $T_{p75\%-25\%}$ | $= T_{p25\%} - T_{p75\%}$                        | min   | 38.6            |
|                                            |                  |                                                  |       |                 |
| Infiltration Rate                          | $f$              | $= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$ | m/s   | <b>7.05E-05</b> |

\*To 50% Effective Depth (including base)

Notes:

[1] Base of pit at 1.70 m following slight collapse during Test 1.

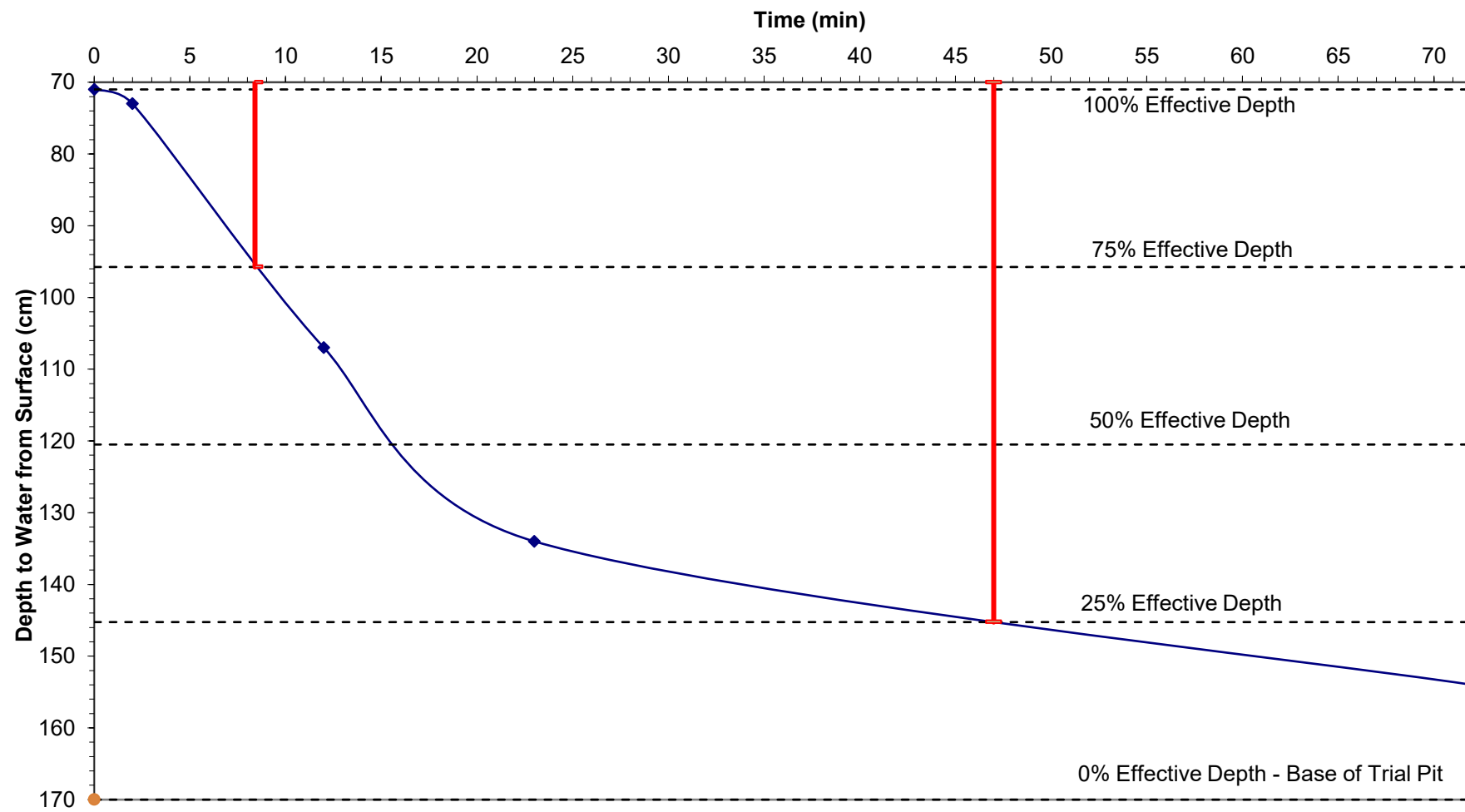
Site Engineer: JM  
Drafted by: JM  
Checked by: MP

Graph F-11

GEG-23-786

Old Sarum, Salisbury

IT04



## Infiltration Test

**Project Name:** Old Sarum, Salisbury  
**Project Ref.:** GEG-23-786  
**Trial Pit:** IT06  
**Test No.:** Test 2 of 3

|                                        |         |
|----------------------------------------|---------|
| Depth of Pit (cm):                     | 140.00  |
| Depth of Water at Start of Depth (cm): | 46.00   |
| Date of Test:                          | 27.4.23 |



Geo  
Environmental  
Group

[illegible]

*End of Test*

With Reference to: **Graph F-17**

| Parameter                                  | Symbol           | Calculation                                      | Units | IT06            |
|--------------------------------------------|------------------|--------------------------------------------------|-------|-----------------|
| Effective Depth of Trial Pit               | $d_p$            |                                                  | m     | 0.94            |
| Width of Trial Pit                         | $w$              |                                                  | m     | 0.60            |
| Length of Trial Pit                        | $l$              |                                                  | m     | 1.80            |
| Volume of Trial Pit                        | $V$              | $= d_p \times w \times l$                        | $m^3$ | 1.02            |
| Volume of Trial Pit at 50% Effective Depth | $V_{50\%}$       | $= V \times 0.5$                                 | $m^3$ | 0.5076          |
| Internal Surface Area of Trial Pit*        | $a_{p50\%}$      | $= l \times w + d_p \times (w + l)$              | $m^2$ | 3.34            |
| Time to reach 75% Effective Depth          | $T_{p75\%}$      |                                                  | min   | 10.00           |
| Time to reach 25% Effective Depth          | $T_{p25\%}$      |                                                  | min   | 44.00           |
| Time 25% - 75%                             | $T_{p75\%-25\%}$ | $= T_{p25\%} - T_{p75\%}$                        | min   | 34              |
|                                            |                  |                                                  |       |                 |
| Infiltration Rate                          | $f$              | $= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$ | m/s   | <b>7.46E-05</b> |

\*To 50% Effective Depth (including base)

Notes:

[1] Base of pit at 1.40 m following slight collapse during Test 1.

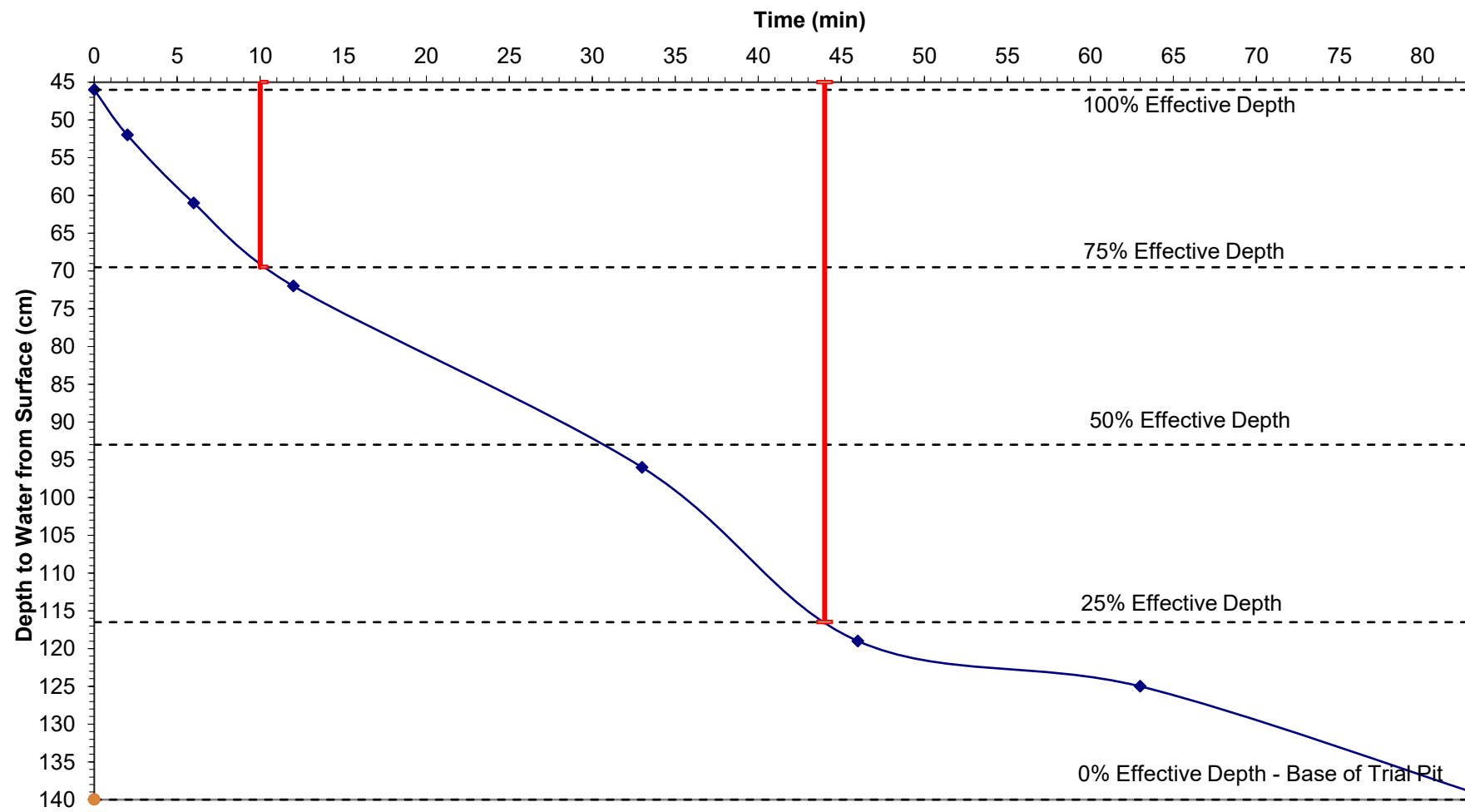
Site Engineer: AT  
Drafted by: JM  
Checked by: MP

Graph F-17

GEG-23-786

Old Sarum, Salisbury

IT06



**APPENDIX D – NUTRIENT BUDGET CALCULATOR**

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Nutrients from wastewater

This sheet contains two tables. The tables are seperated by a heading in the 'Headings 2' style, which describes the following table. The first table 'Table\_3\_Water\_Infrastructure' may contain blank cells in rows 11 to 12 and column C. User inputs are required for cells B5 to B9. In addition, user inputs are required in C10 depending on the information entered by the user. The second table 'Table\_4\_Wastewater\_Load' may contain blank cells in rows 19 to 22. No user inputs are required in this table.

You can enter the average occupancy rate of the development in cell B6. The default rate is 2.4, this should not be edited without sufficient evidence.

You can enter the water usage in cell B7. This value should be kept at 120 unless other efficiency measures are used.

You can enter the total number of dwellings/units that will be within the development site as of the project completion date in cell B8.

You can choose the receiving WwTW from the drop-down list in cell B9. The drop-down lists can be accessed by clicking the arrow or pressing the 'Alt' + 'Down' keys when the cell is selected. If the user selects 'Package Treatment Plant user defined' or 'Septic Tank user defined', the user must enter their certified value of TP in cell C10. Otherwise the default values will be used in the calculation of the nutrient load associated with wastewater.

Nutrient permits may be changing for the WwTW selected by the user as of 01/01/2025, or 01/04/2030. If the date of first occupancy is in-between changing permit dates, multiple permit limits may be automatically generated in cell B10 to B12. If applicable, up to three values for the nutrient loading associated with wastewater will be calculated for the loading will be presented in cell B10, B11, or B12.

| Water infrastructure information                           |                   |                              |
|------------------------------------------------------------|-------------------|------------------------------|
| Description of required information                        | Data entry column | Additional data entry column |
| Date of first occupancy (dd/mm/yyyy):                      |                   |                              |
| Average occupancy rate (people/dwelling or people/unit):   | 2.40              |                              |
| Water usage (litres/person/day):                           | 109               |                              |
| Development Proposal (dwellings/units):                    | 41                |                              |
| Wastewater treatment works:                                | Hurdcott WwTW     |                              |
| Current wastewater treatment works P permit (mg TP/litre): | 1                 |                              |
|                                                            |                   |                              |
| Post 2030 WwTW P permit (mg TP/litre):                     | 0.25              |                              |
| Final calculation of nutrient load from wastewater         |                   |                              |
| Description of values generated                            | Values generated  |                              |
| Post-2030 Stage 1 Nutrient Loading                         |                   |                              |
| Additional population (people):                            | 98.4              |                              |
| Wastewater by development (litres/day):                    | 10725.6           |                              |
| Annual wastewater TP load (kg TP/yr):                      | 0.88              |                              |
| Pre-2030 Stage 1 Nutrient Loading                          |                   |                              |
| Annual wastewater TP load (kg TP/yr):                      | 3.53              |                              |
|                                                            |                   |                              |
|                                                            |                   |                              |

### Nutrients from current land use

This sheet contains two tables. The tables are separated by a heading in the 'Headings 2' style, which describe the following table. The first table 'Table\_5\_Site\_Information' requires user inputs in cells B5 to B8. The second table 'Table\_6\_Current\_Land\_Uses' requires user inputs in cells A11 to A27 and B11 to B27. The remaining columns are automatically calculated. The final Column (Column D) titled 'Notes on data' will remain empty unless the data automatically generated data has been extrapolated.

You can choose the Operational Catchment the site is located within from the drop-down list in cell B5. The drop-down lists can be accessed by clicking the arrow or pressing the 'Alt' + 'Down' keys when the cell is selected.

You can choose the soil drainage type associated with the predominant soil type within the development site from the drop-down list in cell B6.

You can choose the annual average rainfall the development will receive from the drop-down list in cell B7. If the rainfall volume is not on the list, please select the nearest value.

You can choose whether the development is in a Nitrate Vulnerable Zone (NVZ) from the drop-down list in cell B8.

You can choose the existing (pre-development) land use type(s) from the drop-down list in cells A11-A27. You can enter the area(s) (in hectares) of each land use type in cells B11-B27.

The nutrient load from current land uses is shown in cell C11-C27.

The total nutrient load from current land uses is shown in cell C28.

### Current land use information

| Description of required information   | Data entry Column |
|---------------------------------------|-------------------|
| Operational Catchment:                | Avon Hampshire    |
| Soil drainage type:                   | Freely draining   |
| Annual average rainfall (mm):         | 750.1 - 800       |
| Within Nitrate Vulnerable Zone (NVZ): | Yes               |

### Current land uses

| Existing land use type(s) | Area (ha) | Annual phosphorus export (kg TP/yr) | Notes on data |
|---------------------------|-----------|-------------------------------------|---------------|
| Open urban land           | 0.13      | 0.11                                |               |
| Greenspace                | 0.87      | 0.02                                |               |
|                           |           |                                     |               |
|                           |           |                                     |               |
|                           |           |                                     |               |
|                           |           |                                     |               |
|                           |           |                                     |               |
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|                           |           |                                     |               |
|                           |           |                                     |               |
|                           |           |                                     |               |
|                           |           |                                     |               |
| Totals:                   | 1         | 0.13                                |               |

## Nutrients from future land use

This sheet contains one table. The table 'Table\_7\_Future\_Land\_Uses' requires user inputs in cells A5 to A21 and B5 to B21. The remaining columns are automatically calculated.

You can choose the future (post-development) land use type(s) of landcover present on the new site from the drop-down list in cells A5-A21. The drop-down lists can be accessed by clicking the arrow or pressing the 'Alt' + 'Down' keys when the cell is selected.

You can enter the area(s) (in hectares) of each land use type in cells B5-B21.

The nutrient load from future land uses is shown in cell C5-C21.

The total nutrient load from future land uses is shown in cell C22.

## Future land uses

| New land use type(s)   | Area (ha) | Annual phosphorus export (kg TP/yr) |
|------------------------|-----------|-------------------------------------|
| Residential urban land | 0.83      | 1.29                                |
| Water                  | 0.02      | 0.00                                |
| Open urban land        | 0.15      | 0.12                                |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
|                        |           |                                     |
| Totals:                | 1         | 1.41                                |

This sheet contains one table. Table 6\_SUDS\_Features requires user inputs in cells A4 to G26 and F4 to H26 if the user is including SUDS to remove nutrients from the surface runoff. The remaining columns are automatically calculated.

You can enter the area(s) (in hectares) of each new land use type within the SuDS catchment area in cells B4-B28.

The annual TP and TN loads associated with the landcovers in the SuDS catchment area are automatically calculated in cells D4-D28 and E4-E28, respectively.

The nutrient removal rates associated with the SuDS features can be entered into G4-G28 and H4-H28 for TP and TN, respectively. These values must be identified by the user and must be specific to the SuDS features being implemented.

The 'Notes on data' column (Column K) does not require user inputs. This cell will be blank unless the cumulative area of each landcover within the SuDS catchment area exceeds the area of the landcovers entered into the worksheet titled 'Nutrients\_from\_future\_land\_use'.

The total nutrient load removed through the SuDS features is shown in cell I20 for TP and I20 for TN.

| New land use type(s) within SuDS catchment area | SuDS catchment<br>area (ha) | Percentage of<br>flow entering the<br>SuDS (%) | Annual<br>phosphorus<br>inputs to SuDS<br>feature(s)<br>(kg T/yr) | Name of SuDS feature(s)                          | TP removal rate for<br>features - user<br>specified (%) | Annual phosphorus<br>load removed by<br>SuDS<br>(kg TP/yr) | Notes on data |
|-------------------------------------------------|-----------------------------|------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------|---------------|
| Residential urban land                          | 0.83                        | 100.00                                         | 1.29                                                              | Plot Drainage and highways to infiltration basin | 100.00                                                  | 1.29                                                       |               |
| Open urban land                                 | 0.15                        | 100.00                                         | 0.12                                                              | Drain via infiltration to ground                 | 100.00                                                  | 0.12                                                       |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
|                                                 |                             |                                                |                                                                   |                                                  |                                                         |                                                            |               |
| Totals:                                         | 0.98                        |                                                | 1.41                                                              |                                                  |                                                         | 1.41                                                       |               |

## Final nutrient budgets

This worksheet contains one table 'Table\_9\_Final\_Nutrient\_Budgets'. This table is automatically populated using the outputs from the previous worksheets. It presents calculations that underpin the final annual nutrient budget for the development site. If applicable, up to three values for the nutrient budget may be presented in cells B10, B12, or B14. Some cells may be empty if there are no changing permits.

### Total nutrient budget calculations

| Description of values generated                             | Values generated |
|-------------------------------------------------------------|------------------|
| Wastewater TP load (kg TP/year):                            | 0.88             |
| Net land use TP change (kg TP/year):                        | -0.13            |
| TP budget:                                                  | 0.75             |
| TP budget + 20% buffer:                                     | 0.91             |
| <b>Annual Nutrient Budget</b>                               |                  |
| The total annual phosphorus load to mitigate is (kg TP/yr): | 0.91             |
| <b>Pre-2030 Nutrient Budget</b>                             |                  |
| The total annual phosphorus load to mitigate is (kg TP/yr): | 4.09             |
|                                                             |                  |
|                                                             |                  |

Nutrients from wastewater

This sheet contains two tables. The tables are seperated by a heading in the 'Headings 2' style, which describes the following table. The first table 'Table\_3\_Water\_Infrastructure' may contain blank cells in rows 11 to 12 and column C. User inputs are required for cells B5 to B9. In addition, user inputs are required in C10 depending on the information entered by the user. The second table 'Table\_4\_Wastewater\_Load' may contain blank cells in rows 19 to 22. No user inputs are required in this table.

You can enter the average occupancy rate of the development in cell B6. The default rate is 2.4, this should not be edited without sufficient evidence.

You can enter the water usage in cell B7. This value should be kept at 120 unless other efficiency measures are used.

You can enter the total number of dwellings/units that will be within the development site as of the project completion date in cell B8.

You can choose the receiving WwTW from the drop-down list in cell B9. The drop-down lists can be accessed by clicking the arrow or pressing the 'Alt' + 'Down' keys when the cell is selected. If the user selects 'Package Treatment Plant user defined' or 'Septic Tank user defined', the user must enter their certified value of TP in cell C10. Otherwise the default values will be used in the calculation of the nutrient load associated with wastewater.

Nutrient permits may be changing for the WwTW selected by the user as of 01/01/2025, or 01/04/2030. If the date of first occupancy is in-between changing permit dates, multiple permit limits may be automatically generated in cell B10 to B12. If applicable, up to three values for the nutrient loading associated with wastewater will be calculated for the loading will be presented in cell B10, B11, or B12.

| Water infrastructure information                           |                   |                              |
|------------------------------------------------------------|-------------------|------------------------------|
| Description of required information                        | Data entry column | Additional data entry column |
| Date of first occupancy (dd/mm/yyyy):                      |                   |                              |
| Average occupancy rate (people/dwelling or people/unit):   | 2.40              |                              |
| Water usage (litres/person/day):                           | 104               |                              |
| Development Proposal (dwellings/units):                    | 7                 |                              |
| Wastewater treatment works:                                | Hurdcott WwTW     |                              |
| Current wastewater treatment works P permit (mg TP/litre): | 1                 |                              |
| Post 2030 WwTW P permit (mg TP/litre):                     | 0.25              |                              |
| Final calculation of nutrient load from wastewater         |                   |                              |
| Description of values generated                            | Values generated  |                              |
| Post-2030 Stage 1 Nutrient Loading                         |                   |                              |
| Additional population (people):                            | 16.8              |                              |
| Wastewater by development (litres/day):                    | 1747.2            |                              |
| Annual wastewater TP load (kg TP/yr):                      | 0.14              |                              |
| Pre-2030 Stage 1 Nutrient Loading                          |                   |                              |
| Annual wastewater TP load (kg TP/yr):                      | 0.57              |                              |
|                                                            |                   |                              |
|                                                            |                   |                              |



## ***APPENDIX E – WATER USAGE INFORMATION***

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| Installation Type                          | Unit of Measure                            | Capacity/Flow rate<br>(1)                                                          | Use Factor<br>(2) | Fixed use<br>(litres/person/day)<br>(3) | Litres/person/day<br>= [(1)x(2)] + (3)<br>(4) |
|--------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------|-------------------|-----------------------------------------|-----------------------------------------------|
| WC (single flush)                          | Flush Volume (litres)                      |                                                                                    | 4.42              | 0.00                                    | 0                                             |
| WC (dual flush)                            | Full flush Volume (litres)                 | 4                                                                                  | 1.46              | 0.00                                    | 5.84                                          |
|                                            | Part flush Volume (litres)                 | 2.6                                                                                | 2.96              | 0.00                                    | 7.70                                          |
| WC (multiple fittings)                     | Average effective flushing Volume (litres) |                                                                                    | 4.42              | 0.00                                    | 0                                             |
| Taps (excluding kitchen/utility room taps) | Flow rate (litres/min)                     | 5.00                                                                               | 1.58              | 1.58                                    | 9.48                                          |
| Bath (where shower also present)           | Capacity to overflow(litres)               | 176.00                                                                             | 0.11              | 0.00                                    | 19.36                                         |
| Shower (where bath also present)           | Flow Rate(litres / minute)                 | 6.00                                                                               | 4.37              | 0.00                                    | 26.22                                         |
| Bath Only                                  | Capacity to overflow(litres)               |                                                                                    | 0.50              | 0.00                                    | 0                                             |
| Shower Only                                | Flow Rate (litres/minute)                  |                                                                                    | 5.60              | 0.00                                    | 0                                             |
| Kitchen/Utility room sink taps             | Flow rate (litres/minute)                  | 5.00                                                                               | 0.44              | 10.36                                   | 12.56                                         |
| Washing Machine                            | (Litres/kg dry load)                       | 8.17                                                                               | 2.1               | 0.00                                    | 17.16                                         |
| Dishwasher                                 | (Litres/place setting)                     | 1.25                                                                               | 3.6               | 0.00                                    | 4.50                                          |
| Waste disposal unit                        | (Litres/use)                               | <input type="checkbox"/> Present                                                   | 3.08              | 0.00                                    | 0                                             |
| Water Softener                             | (Litres/person/day)                        |                                                                                    | 1.00              | 0.00                                    | 0                                             |
|                                            | (5)                                        | Total Calculated use (litres/person/day)<br>=SUM(column 4)                         |                   |                                         | 102.82                                        |
|                                            | (6)                                        | Contribution from greywater (litres/person/day)                                    |                   |                                         | 0                                             |
|                                            | (7)                                        | Contribution from rainwater (litres/person/day)                                    |                   |                                         | 0                                             |
|                                            | (8)                                        | Normalisation factor                                                               |                   |                                         | 0.91                                          |
|                                            | (9)                                        | Total internal water consumption<br>= [(5)-(6)-(7)]x(8)<br>(litres/person/day)     |                   |                                         | 93.57                                         |
|                                            | (10)                                       | External water use                                                                 |                   |                                         | 5.0                                           |
|                                            | (11)                                       | Total water consumption (Building Regulation 17.K)<br>=(9)+(10)(litres/person/day) |                   |                                         | 98.6                                          |

| Installation Type         | Make/Model (mandatory)              | Litres/Person/Day |
|---------------------------|-------------------------------------|-------------------|
| WC (dual flush)           | Ideal Standard iLife                | 13.54             |
| Taps                      | Flow restricted to 5 litres per min | 9.48              |
| Baths (shower(s) present) | Ideal Standard iLife                | 19.36             |
| Showers (bath(s) present) | Flow restricted to 6 litres per min | 26.22             |
| Kitchen Taps              | Flow restricted to 5 litres per min | 12.56             |
| Washing Machines          |                                     | 17.16             |
| Dishwasher                |                                     | 4.50              |



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[System Requirements](#)

***APPENDIX F – EXISTING LAND USE PLAN***

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DO NOT SCALE

- Site Boundary
- Open Urban Land
- Greenspace

|     |          |    |                       |     |
|-----|----------|----|-----------------------|-----|
| A   | 10/04/24 | PT | PRELIMINARY FOR ISSUE | DK  |
| REV | DATE     | BY | DESCRIPTION           | CHK |

DRAWING STATUS: PRELIMINARY



**BETTS HYDRO**  
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY  
Tel: 01244 288178enquiries@betts-associates.co.uk



**Persimmon**  
Together, we make your home

PROJECT:  
  
ROGER WAY  
OLD SARUM

TITLE:  
  
EXISTING LAND USE PLAN

|                       |                            |              |                |
|-----------------------|----------------------------|--------------|----------------|
| DATE:<br>APR 24       | SCALE @ SIZE:<br>1:2000@A3 | DRAWN:<br>PT | CHECKED:<br>DK |
| PROJECT No:<br>HYD881 | DRAWING No:<br>101         | REV:<br>A    |                |

## ***APPENDIX G – NEW LAND USE PLAN***

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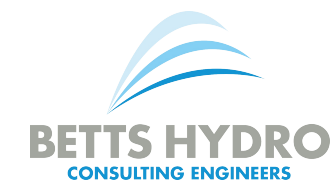


DO NOT SCALE

- Site Boundary
- Residential Urban Land
- Water
- Open Urban Land

|     |          |    |                       |     |
|-----|----------|----|-----------------------|-----|
| A   | 10/04/24 | PT | PRELIMINARY FOR ISSUE | DK  |
| REV | DATE     | BY | DESCRIPTION           | CHK |

DRAWING STATUS: PRELIMINARY



Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY  
Tel: 01244 288178enquiries@betts-associates.co.uk



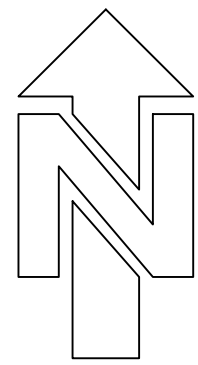
PROJECT: ROGER WAY  
OLD SARUM

TITLE: PROPOSED LAND USE PLAN

|                       |                            |              |                |
|-----------------------|----------------------------|--------------|----------------|
| DATE:<br>JAN 23       | SCALE @ SIZE:<br>1:2000@A3 | DRAWN:<br>PT | CHECKED:<br>DK |
| PROJECT No:<br>HYD881 | DRAWING No:<br>102         | REV:<br>A    |                |

## **APPENDIX H – DRAINAGE STRATEGY DRAWING**

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DO NOT SCALE

LEGEND

- SITE BOUNDARY
- DRAINED AREA  
HOUSE / GARAGE ROOF  
AREA = 2160m<sup>2</sup>
- DRAINED AREA  
DRIVEWAY / PARKING  
AREA = 1193.3m<sup>2</sup>
- DRAINED AREA  
ROAD  
AREA = 1134.3m<sup>2</sup>

|     |             |    |          |
|-----|-------------|----|----------|
| P1  | FIRST ISSUE | FA | 13.10.23 |
| 1MK | REVISION    | BY | DATE     |

DRAWING STATUS

PRELIMINARY

DRAWING TITLE

IMPERMEABLE AREA  
PLAN

PROJECT

LAND NORTH OF BUNTING  
LANE, OLD SARUM,  
WILTSHIRE  
SP4 6FH

**simpson | tws**  
1.08, 60 Grays Inn Road,  
London,  
WC1X 8LU  
T: 020 7253 2626  
E: mail@simpsoneng.com  
W: www.simpsoneng.com

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| Drawn<br>FA | Ch'd<br>LJK | Scales<br>1:500 @ A1 | Date<br>SEP 23 |
|-------------|-------------|----------------------|----------------|

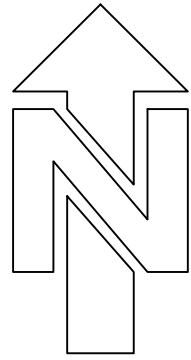
Purpose of Issue

FOR PLANNING

|                           |                         |                |
|---------------------------|-------------------------|----------------|
| Project Number<br>P23-295 | Drawing Number<br>SK106 | Revision<br>P1 |
|---------------------------|-------------------------|----------------|



DO NOT SCALE



- DRAINAGE LEGEND**
- Existing surface water pipe
  - Existing foul water pipe
  - Foul water sewer, to be adopted under S104 agreement
  - Surface water sewer, to be adopted by Highway Authority
  - Surface water drain, to be adopted by Highway Authority
  - Adoptable water manhole
  - Adoptable water manhole
  - Surface water manhole, to be adopted by Highway Authority
  - Trapped road gully, to be adopted by Highway Authority
  - Denotes extent of permeable block paved car park

- ENGINEERING NOTES**
- This drawing to be read in conjunction with all relevant Architects, Engineers and Subcontractors drawings and details.
  - This drawing is based on topographical survey by Benjamin Moore Land Surveys Ltd.  
Drawing Number 1141-613  
Dated 11/09/23
  - All levels relate to levels given on survey drawing.

- SURFACE WATER DESIGN NOTES**
- It is understood that ground conditions are suitable for infiltration drainage techniques. Therefore, it is proposed to drain surface water infiltration.
  - Surface water runoff from roof and impermeable driveways is directed into an underground drainage system, which is then conveyed to an infiltration basin (349.67m<sup>2</sup>) for all storm events up to and including a 1 in 100 year + 45% allowance for climate change.
  - Permeable driveways/parking are designed to facilitate the infiltration of surface water into the ground, ensuring they can accommodate surface water runoff from permeable driveways for all storm events up to and including a 1 in 45% allowance for climate change. All permeable drives are proposed to have a minimum of 260mm deep porous sub-base.
  - Runoff from adoptable road is directed to a network of below ground drainage which connects to surface water sewer situated at Rogers Way.
  - Foul water from the development is proposed to discharge into the foul water sewer located at Rogers Way.

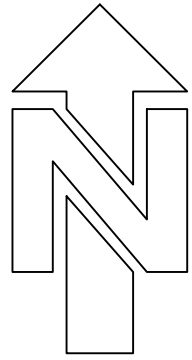
ADOPTABLE DRAINAGE IS  
SUBJECT TO APPROVAL

P23-295-SK102 DRAINAGE LAYOUT SHEET 1

P23-295-SK103 DRAINAGE LAYOUT SHEET 2

SITE LOCATION PLAN  
NTS

|                                                                                                                                                                                                                 |                |            |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|----------|
| P1                                                                                                                                                                                                              | FIRST ISSUE    | FA         | 16.10.23 |
| MK                                                                                                                                                                                                              | REVISION       | BY         | DATE     |
| DRAWING STATUS                                                                                                                                                                                                  |                |            |          |
| PRELIMINARY                                                                                                                                                                                                     |                |            |          |
| DRAWING TITLE                                                                                                                                                                                                   |                |            |          |
| DRAINAGE STRATEGY<br>SHEET 2                                                                                                                                                                                    |                |            |          |
| PROJECT                                                                                                                                                                                                         |                |            |          |
| LAND NORTH OF BUNTING<br>LANE, OLD SARUM,<br>WILTSHIRE<br>SP4 6FH                                                                                                                                               |                |            |          |
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| London, Henley-on Thames, Gloucester and Exeter                                                                                                                                                                 |                |            |          |
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| FA                                                                                                                                                                                                              | LJK            | 1:200 @ A1 | SEP 23   |
| Purpose of Issue                                                                                                                                                                                                |                |            |          |
| FOR PLANNING                                                                                                                                                                                                    |                |            |          |
| Project Number                                                                                                                                                                                                  | Drawing Number | Revision   |          |
| P23-295                                                                                                                                                                                                         | SK103          | P1         |          |



DO NOT SCALE

DRAINAGE LEGEND

- Existing surface water pipe
- Existing foul water pipe
- Foul water sewer, to be adopted under S104 agreement
- Surface water sewer, to be adopted under S104 agreement
- Surface water drain, to be adopted by Highway Authority
- Adoptable foul water manhole
- Adoptable water manhole
- Surface water manhole, to be adopted by Highway Authority
- Trapped road gully, to be adopted by Highway Authority
- Denotes extent of permeable block paved car park.

ENGINEERING NOTES

- This drawing to be read in conjunction with all relevant Architects, Engineers and Subcontractors drawings and details.
- This drawing is based on topographical survey by Benjamin Moore Land Surveys Ltd.  
Drawing Number 1141-613  
Dated 11/09/23
- All levels relate to levels given on survey drawing.

SURFACE WATER DESIGN NOTES

- It is understood that ground conditions are suitable for infiltration drainage techniques. Therefore, it is proposed to drain surface water infiltration.
- Surface water runoff from roof and impermeable driveways is directed into an underground drainage system, which is then conveyed to an infiltration basin (349.67m<sup>2</sup>) for all storm events up to and including a 1 in 100 year + 45% allowance for climate change.
- Permeable driveways/parking are designed to facilitate the infiltration of surface water into the ground, ensuring they can accommodate surface water runoff from permeable driveways for all storm events up to and including a 1 in 45% allowance for climate change. All permeable drives are proposed to have a minimum of 260mm deep porous sub-base.
- Runoff from adoptable road is directed to a network of below ground drainage which connects to surface water sewer situated at Rogers Way.
- Foul water from the development is proposed to discharge into the foul water sewer located at Rogers Way.

ADOPTABLE DRAINAGE IS  
SUBJECT TO APPROVAL

|    |             |    |          |
|----|-------------|----|----------|
| P1 | FIRST ISSUE | FA | 16.10.23 |
| MK | REVISION    | BY | DATE     |

DRAWING STATUS

PRELIMINARY

DRAWING TITLE

DRAINAGE STRATEGY  
SHEET 1

PROJECT

LAND NORTH OF BUNTING  
LANE, OLD SARUM,  
WILTSHIRE  
SP4 6FH



T: 020 7253 2626  
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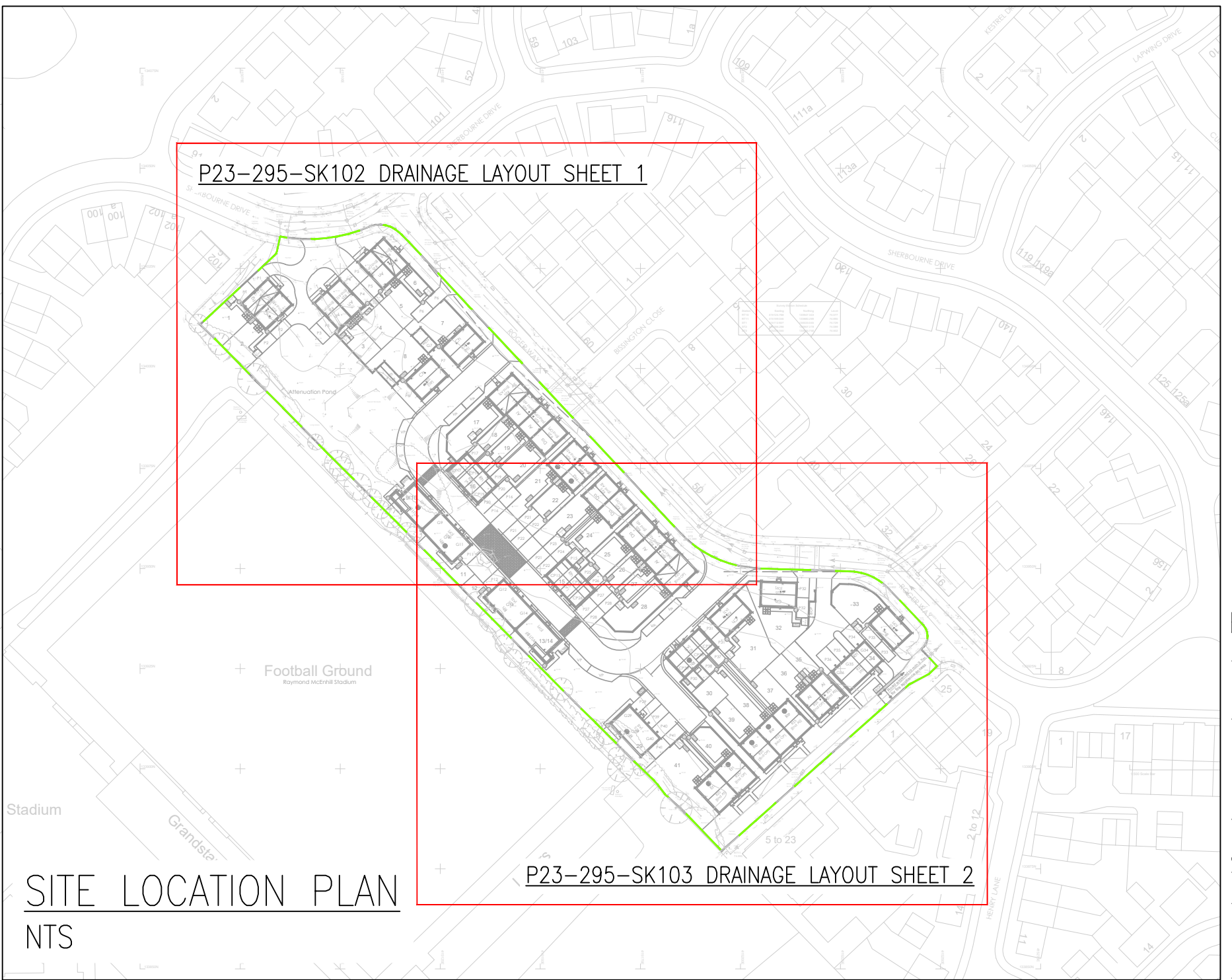
London, Henley-on-Thames, Gloucester and Exeter

|       |       |            |        |
|-------|-------|------------|--------|
| Drawn | Ch'kd | Scales     | Date   |
| FA    | LJK   | 1:200 @ A1 | SEP 23 |

Purpose of Issue

FOR PLANNING

|                |                |          |
|----------------|----------------|----------|
| Project Number | Drawing Number | Revision |
| P23-295        | SK102          | P1       |



***APPENDIX I –***

***CIRIA EXTRACTS***

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## 2 The schedule

### 2.1 SITE INVESTIGATION

The nature of the site is extremely important to the design of an effective SuDS management train. Before any SuDS scheme is considered four aspects of the site should be understood, and a site investigation should be completed to gather the necessary information. These four aspects are:

- 1 Soil type, soil permeability, pre-existing nutrient content and the capacity for the infiltration of surface water on site.
- 2 Depth to seasonal water table.
- 3 Vulnerability of underlying groundwater.
- 4 The type, location, flow rate and size of any receiving watercourse.

It is impossible to effectively design the SuDS management train for the site, and to quantify the capacity for phosphorus capture, without having this information.

### 2.2 THE PRINCIPLES OF PHOSPHORUS CAPTURE AND REMOVAL FOR RESIDENTIAL DEVELOPMENTS

- 1 Where stormwater runoff from residential developments can be infiltrated to ground, and where soil conditions allow that infiltration to occur without a risk of groundwater pollution, then it should be maximised across the development and used as the first step in phosphorus pollution control. For all flows that are effectively infiltrated, and where groundwater protection is provided by the soil, the phosphorus in that runoff is considered to be captured and removed from the water environment (see Table 2.1, row 4 for design criteria).
- 2 Stormwater runoff that cannot be infiltrated should be treated in SuDS devices. The first step of treatment should be sediment capture. This can remove a considerable proportion of the phosphorus in the runoff and will protect further treatment devices from it accumulating.
- 3 A treatment device that includes vegetation will capture a proportion of the dissolved phosphorus and provide an additional opportunity for particulate phosphorus to settle out.
- 4 Any treatment train design should start by maximising the opportunity for infiltration, then provide the opportunity for sedimentation and reduction in suspended solids, and finally to include actively growing plants to take up some of the dissolved phosphorus.
- 5 Some of these devices and processes can be enhanced by the inclusion of phosphorus-specific treatment media.

### 2.3 FACTORS TO CONSIDER WHEN USING SUDS FOR P REMOVAL

Table 2.1 summarises the factors that should be taken into consideration when designing a SuDS management train for P removal, regardless of the SuDS components used.

Table 2.1 Factors to consider for all sites, regardless of SuDS components used

|   |                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Previous land use                                                                                                                                                                                                                   | It is important that the impact of previous land use on the phosphorus concentration in the soil is understood. If land was previously in agricultural or horticultural use, or used for sports activities, it may have had fertilisers or manure added so the soil may contain 'legacy' phosphorus. This should be considered before SuDS schemes are designed to reduce phosphorus pollution in local rivers, streams and groundwater. It cannot be assumed that land designated for development has low soil phosphorus concentrations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2 | The influent to the system or device must contain phosphorus pollution in adequate levels to achieve the anticipated treatment. If the TP level in the influent is too low, then the anticipated level of treatment may not be met. | Particularly when off-site treatment devices or SuDS management trains are being proposed, it is essential to check that the influent will contain enough TP to allow the treatment to be effective. Most devices that claim a percentage removal efficiency, require a TP level in the influent that is similar to that which was used during the product testing or field trials.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3 | Treatment flow rate or volume to be treated by the nutrient removal devices                                                                                                                                                         | Site-specific treatment flow rate should be agreed before the SuDS management train is designed.<br>CIRIA C753 suggests that all runoff from sub-annual rainfall events is treated, which is calculated using the 1 in 1 year 15-minute rainfall event for the site. SuDS management trains cannot be designed to treat all flows off site, including severe storms, so the designer should agree on the proportion of runoff that will be treated. However, Natural England assess the phosphorus reduction in the entire volume of water running off the site in one year (calculated using the Standardised Annual Average Rainfall [SAAR]).<br>To align these two design methods, a proportion of the volume of rainfall in the SuDS management train should be treated to remove a known (or estimated) mass of phosphorus. This should then be combined with the untreated runoff from less frequent heavier rainfall events to achieve an overall annual reduction in phosphorus leaving the site.<br>The overall annual phosphorus removal mass can then be calculated and submitted to Natural England.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4 | TP removal by infiltration to the ground                                                                                                                                                                                            | The Minnesota Stormwater Manual states that TP removal is assumed to be 100% for all water that infiltrates to ground or into an infiltration device (MPCA, 2022a). However, in the UK, Natural England will not accept infiltration where it causes pollution of groundwater, especially where local geology means that all streams and lakes are groundwater fed or that Groundwater Dependent Terrestrial Ecosystems (GWDTE) are potentially affected.<br>To avoid this risk of pollution, stormwater that infiltrates to ground can only be assumed to reduce phosphorus pollution if certain criteria are met:<br>1 The SuDS device will not be subject to significant flooding, ie it is not in flood zone 2 or 3.<br>2 The SuDS device is in an area where the high-water table groundwater depth is at least 1 m below the base of the proposed infiltration device (taking account of seasonal variations and any underlying trends).<br>3 The total pollution risk score for the SuDS device (calculated in accordance with Highways England (2020) and Table 28.6 of C753 (Woods Ballard et al, 2015) is <180.<br>4 The SuDS device is at least 5 m away from any surface water feature, including a river, stream or lake.<br>Note that the criteria for surface water runoff are different to those used for septic tanks or package treatment plants discharging to ground as concentrations of P are much lower in runoff than in wastewater, the soil dries between discharges, vegetation takes up P and the catchment area is smaller, giving a lower annual load of P per cubic meter of soil. |
| 5 | The SuDS management train should be designed to manage both particulate phosphorus and dissolved phosphorus. The design should demonstrate which of the devices capture particulate P, DP, or both and the quantity of TP captured  | The Minnesota Minimal Impact Design Standards (MIDS) best management practice (BMP) calculator assumes 55% of total phosphorus in stormwater runoff occurs as particulate phosphorus (PP) and 45% occurs as DP, for a PP:DP ratio of 55:45 (MPCA, 2022b). This value is based on a nationwide study carried out in 2005.<br>Using this ratio, the performance of devices, which remove sediment reducing the associated amount of TP, can be calculated, eg if a pond removes 70% of the TSS in stormwater, then it removes 38% of TP (55% of 70%).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |