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Totteridge Academy Farm
N20 8AZ

Foul and Surface Water Drainage Strategy

February 2021

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1. INTRODUCTION

1.1 This document has been prepared in support of a planning application for a new city farm at Totteridge Academy, Barnet Lane, N20 8AZ. The location of the site is shown in Figure 1 below.

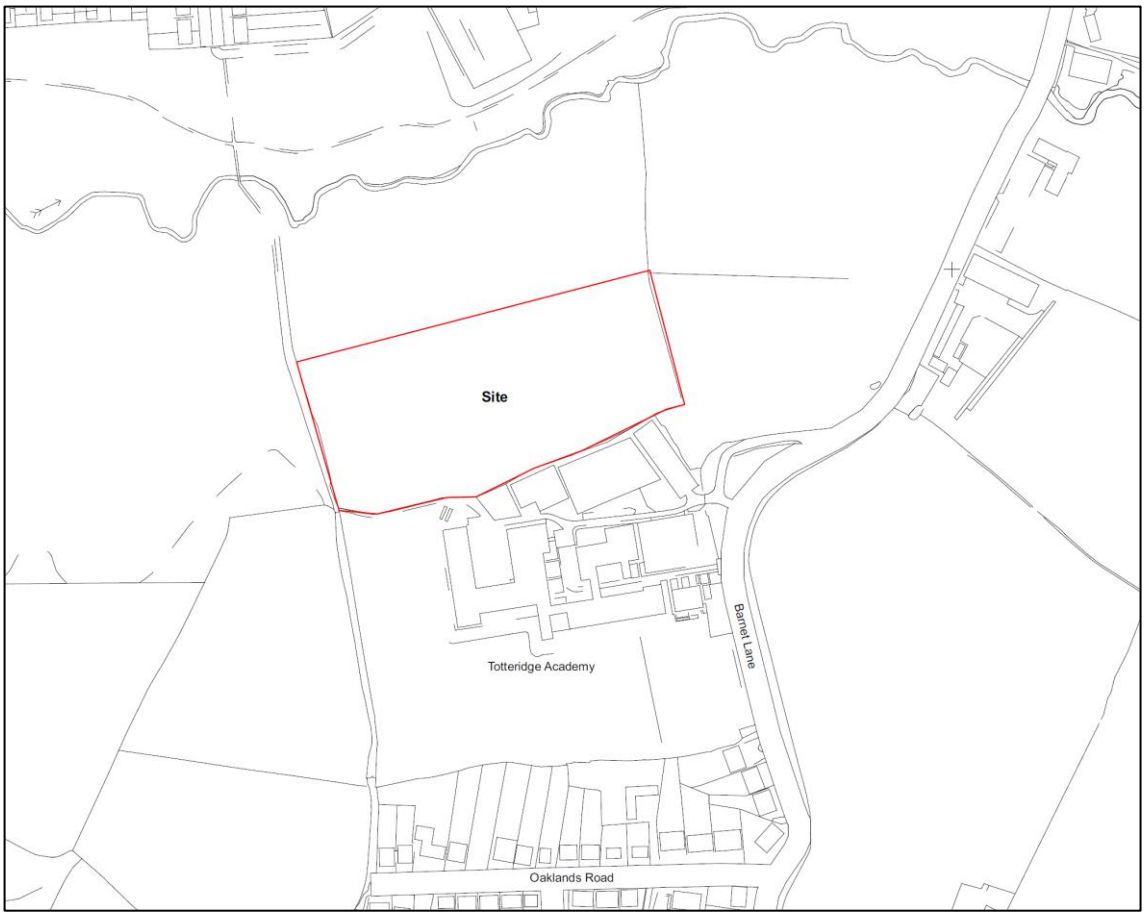


Figure 1. Location Plan

1.2 The existing site is greenfield land.

[B] 1.3 It is proposed to develop a new farm comprising a number of structures as follows:

- **1nr 175m^2 barn;**
- **3nr 45m^2 polytunnels;**
- **1nr 158m2 classroom;**
- **1nr 51m^2 greenhouse;**
- **1nr 51m^2 livestock shelter**.

1.4 Drawings of the development relevant to this report are included in Appendix A.

2. SUSTAINABLE DRAINAGE PRINCIPLES FOR THE DEVELOPMENT

2.1 The surface water management strategy will adhere to the principles set out in DEFRA's Non-Statutory Technical Standards for Sustainable Drainage Systems. A summary of how the strategy complies with each section of the standards is included in Section 11 of this report.

[B] 2.2 Options for disposal of surface water have been considered in accordance with the drainage hierarchy set out in the London Plan. A summary of proposed features is shown in Table 2.1.

Disposal Method	**Comment**
1. Store rainwater for later use.	**Two ponds will be used to capture runoff for irrigation and drinking water for livestock.**
2. Use infiltration techniques.	Unlikely to be practicable – refer to Section 5 below.
3. Attenuate rainwater in ponds or open surface water features.	**Proposed.**
4. Attenuate rainwater by storing in tanks for gradual release.	Incorporated in the design.
5. Discharge rainwater direct to a watercourse.	Incorporated in the design.
6. Discharge rainwater to a surface water sewer.	Not required.
7. Discharge rainwater to a combined sewer.	Not required.

Table 2.1 – Summary of Drainage Hierarchy

3. EXISTING FLOWPATHS

3.1 Flowpaths across the existing site are shown in Figure 2.

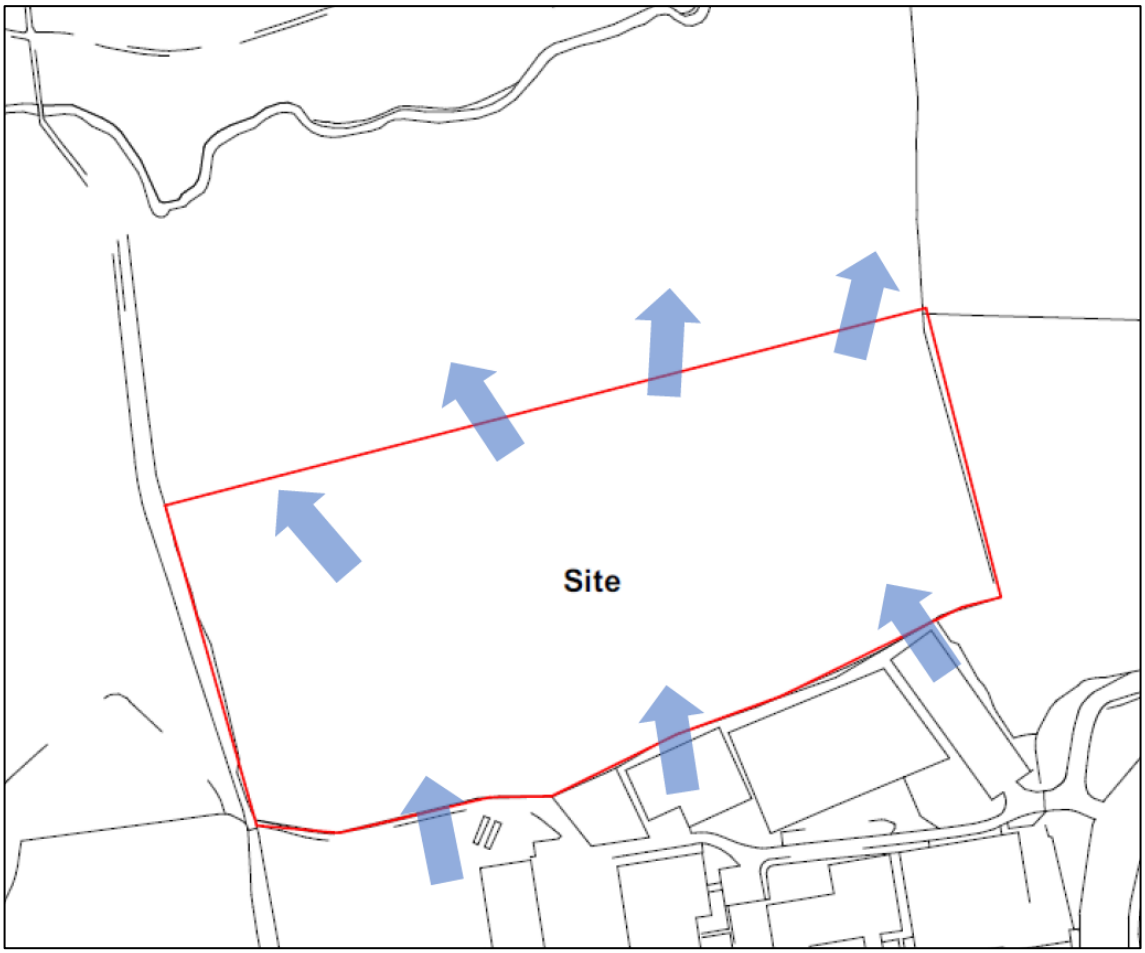


Figure 2. Flowpaths Across the Existing Site

4. PROPOSED DESTINATION FOR SURFACE WATER POST-DEVELOPMENT

4.1 It is not practicable to dispose of runoff by means of infiltration (see Section 5 below). Therefore, it is proposed to discharge runoff from the site to the Dollis Brook watercourse to the north.

5. GROUND INVESTIGATION RESULTS

5.1 No ground investigation has been carried out for the proposed development. However, four boreholes were drilled for the adjacent academy in January 1993. The logs are consistent across each borehole and show approximately 500mm of topsoil above firm ochre-brown mottled clay to a depth of at least 15m. The BGS maps indicate this geology (London Clay with no superficial deposits) exists across the site of the proposed farm.

5.2 The Soilscapes database also shows the site as having impeded drainage.

5.3 On the basis of the above, infiltration has been precluded as a means of disposal.

6. EXISTING WATERCOURSES

6.1 The Dollis Brook flows in a west to east direction approximately 130m to the north of the site.

7. EXISTING AND PROPOSED SURFACE WATER SEWERS AND PUMPING STATIONS

7.1 There are no public sewers on the site although it is understood the adjacent academy is served by a public sewer in Barnet Lane.

7.2 No pumping stations are proposed.

8. SURFACE WATER FLOWS ONTO THE SITE AND FLOWPATHS THROUGH THE DEVELOPMENT

8.1 The extract from the Gov.UK flood maps in Figure 3 shows the western boundary of the site to lie in the path of surface water runoff from higher ground to the south. It is proposed to use this area as a livestock enclosure. Therefore, the flowpath will be unimpeded and the runoff will not present a risk to users of the site.

Figure 3. Extract from Gov.UK Map Showing Risk of Surface Water Flooding

8.2 Surface water flows around the site will be unaltered by the proposed development.

8.3 Surface water flow paths through the proposed development are described in Section 18 below.

9. OFFSITE WORKS REQUIRED TO MITIGATE FLOOD RISK

[B] 9.1 No off-site works are required.

10. SENSITIVE RECEPTORS

10.1 The EA's groundwater vulnerability maps show the site is not within a groundwater source protection zone.

10.2 The site does not lie within a critical drainage area.

11. COMPLIANCE WITH THE DEFRA NON-STATUTORY TECHNICAL STANDARDS

11.1 Table 11.1 indicates which section of this report provides evidence of compliance with DEFRA's non-statutory technical standards for sustainable drainage systems.

Section	Report Reference
S1	Not Applicable – no surface water bodies in vicinity of site
S2	Section 16
S3	Not Applicable – greenfield development
S4	Section 16
S5	Not Applicable – greenfield development
S6	Section 16
S7	Section 16
S8	Section 16
S9	Section 18
S10	Section 23
S11	Section 22-23
S12	Section 7
S13	Section 23
S14	Section 23

Table 11.1 – Summary of Compliance with Technical Standards

12. CONSENTS REQUIRED

12.1 No consents are required for the disposal of surface water from the site.

[B] 13. SURFACE WATER STORAGE VOLUMES AND LOCATIONS

13.1 An initial estimate of required storage has been made using the HR Wallingford online estimation tool (see Appendix C), which shows that approximately **31m^3** of storage is required to attenuate runoff from the site.

13.2 Further details of the drainage arrangements are described below and shown on the drawings in Appendix A.

14. TREATMENT TRAIN COMPONENTS

14.1 With regard to pollution, the worst-case land use for the development are the roofs of the buildings. Table 26.2 of the SUDS Manual indicates these areas require treatment equivalent to the following indices:

- 0.30 for Total Suspended Solids;
- 0.20 for Metals;
- 0.05 for Hydrocarbons.

14.2 All runoff will be attenuated in ponds prior to discharge to the watercourse, the indices for which are as follows:

- 0.7 for Total Suspended Solids;
- 0.7 for Metals;
- 0.5 for Hydrocarbons.

15. PROPOSED LANDSCAPING AND VEGETATIVE SYSTEMS

[B] 15.1 **The ponds will be landscaped to encourage biodiversity.**

16. DESIGN CALCULATIONS

16.1 Greenfield Runoff

[B] 16.1.1 Approximately **0.057ha** of impermeable area will be connected to the proposed drainage system. The greenfield runoff rates from this area have been estimated using the HR Wallingford Greenfield Runoff Estimation Tool and are summarised below. A copy of the calculation is included in Appendix B.

Return Period (years)	Runoff (l/s)
Qbar	**0.27**
1	**0.23**
30	**0.62**
100	**0.85**

Table 16.1 – Summary of Greenfield Runoff Rates

16.2 Brownfield Runoff

16.2.1 Not applicable – greenfield site.

[B] 16.3 Proposed Peak Flow Rates

16.3.1 **It is proposed to attenuate runoff from the entire site in two ponds. Water from each pond will be used for irrigation and to provide drinking water for livestock. Each pond will have a high-level overflow to a stone-filled trench along the northern boundary. In the event that the infiltration/evapotranspiration capacity of the trench is exceeded runoff will flow towards the Dollis Brook in the form of sheet-flow.**

[B] 16.4 Surface Water Volumes

16.4.1 The proposed development will result in an increase in the volume of runoff from the site for the 100yr-6hr rainfall event of approximately **12m^3.**

16.5 Storage Requirements

Interception Storage

[B] 16.5.1 Approximately **2.9m^3** of interception storage is required to retain on site all runoff from impermeable surfaces for rainfall events up to 5mm. **This will be provided in the ponds and stone-filled trench.**

Attenuation Storage

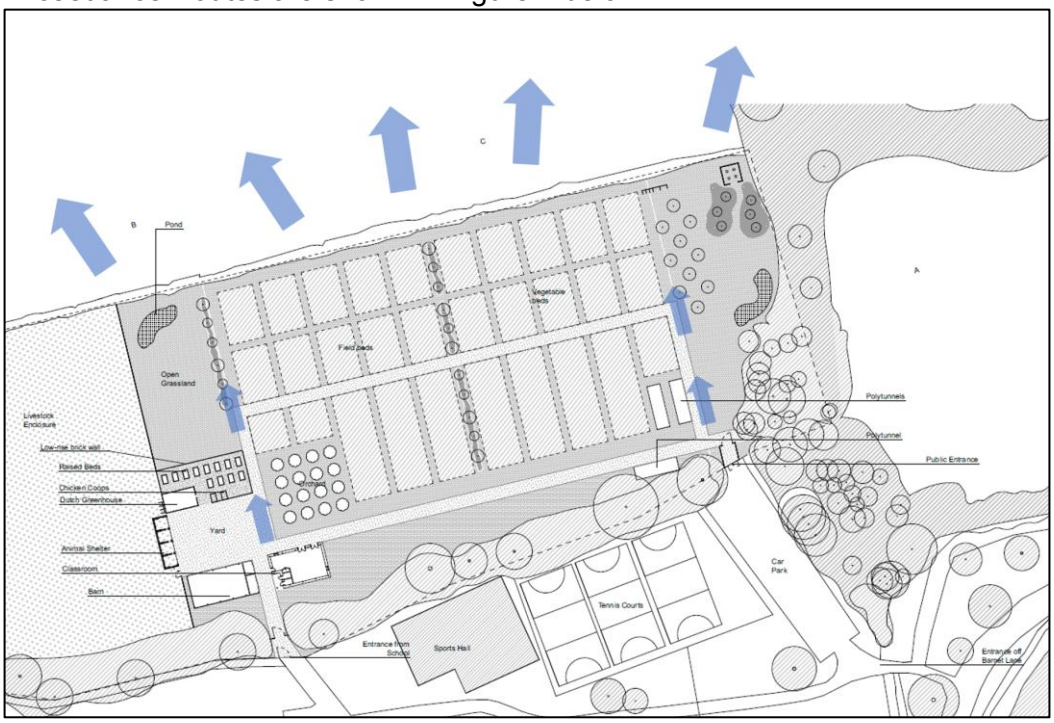
[B] 16.5.2 **From the calculation included in Appendix C it can be seen that approximately 51m^3 of attenuation storage is required, assuming a constant daily demand of 1000l/s for irrigation and livestock drinking water. This will be provided in the ponds.**

17. MULTI-USE AREAS

[B] 17.1 The ponds will provide biodiversity benefits as well as rainwater storage.

18. EXCEEDANCE ROUTES

18.1 Exceedance Routes are shown in Figure 4 below.



[B] Figure 4. Exceedance Routes

19. TEMPORARY DRAINAGE DURING CONSTRUCTION

19.1 Opportunities to construct the attenuation trench early in the construction programme will be investigated at detailed design stage.

20. CLIMATE CHANGE ALLOWANCES

20.1 EA guidance on climate change allowances requires that both the 20% and 40% increase in rainfall intensity scenarios be investigated.

[B] 20.2 **In the event that climate change results in an unacceptable frequency of overtopping of the infiltration trench, permission will be sought to construct an outfall to the River Dollis.**

21. FUTURE DEVELOPMENT ALLOWANCES

21.1 No allowance has been made for the potential impact of urban creep.

22. SUDS MAINTENANCE

22.1 The surface water drainage system will be maintained by the manager of the site.

22.2 Maintenance schedules for the proposed trench and ponds are shown in the following tables.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	As required

Table 22.1 - Maintenance Schedule for Ponds © CIRIA

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Table 22.2 - Maintenance Schedule for Attenuation Trench © CIRIA

22.3 The indicative design life/replacement frequency of the various components of the drainage system is shown in Table 22.3. The cost of replacement components and the maintenance activities shown in Tables 22.1-2 will be factored into management costs.

Component Type	Indicative Design Life
Wash or replace aggregate and replace permeable membrane	20-30years

Table 22.3 – Design Life/Replacement Frequency of Components

23. STRUCTURAL INTEGRITY OF SUDS

23.1 All drainage infrastructure will be located to ensure there is no requirement for special support for adjacent foundations, either during the construction or future excavation of the infrastructure.

23.2 Any required connection works will be carried out by appropriately licensed contractors.

23.3 All SuDS components will be designed in accordance with the guidance and specifications in the SuDS Manual.

23.4 Prior to completion of the construction all above ground works will be visually inspected for compliance with the specification and all pipes will be surveyed using CCTV.

24. FOUL DRAINAGE ARRANGEMENTS

24.1 The only facilities generating domestic foul water will be the WCs. It is proposed to install waterless toilets on the site, thereby negating the need for a connection to the public sewer.

24.2 Waste arising from the WCs and agricultural processes will be managed in accordance with relevant legislation.

APPENDIX A
DRAWINGS

Site Plan
SK001 Surface Water Drainage Layout

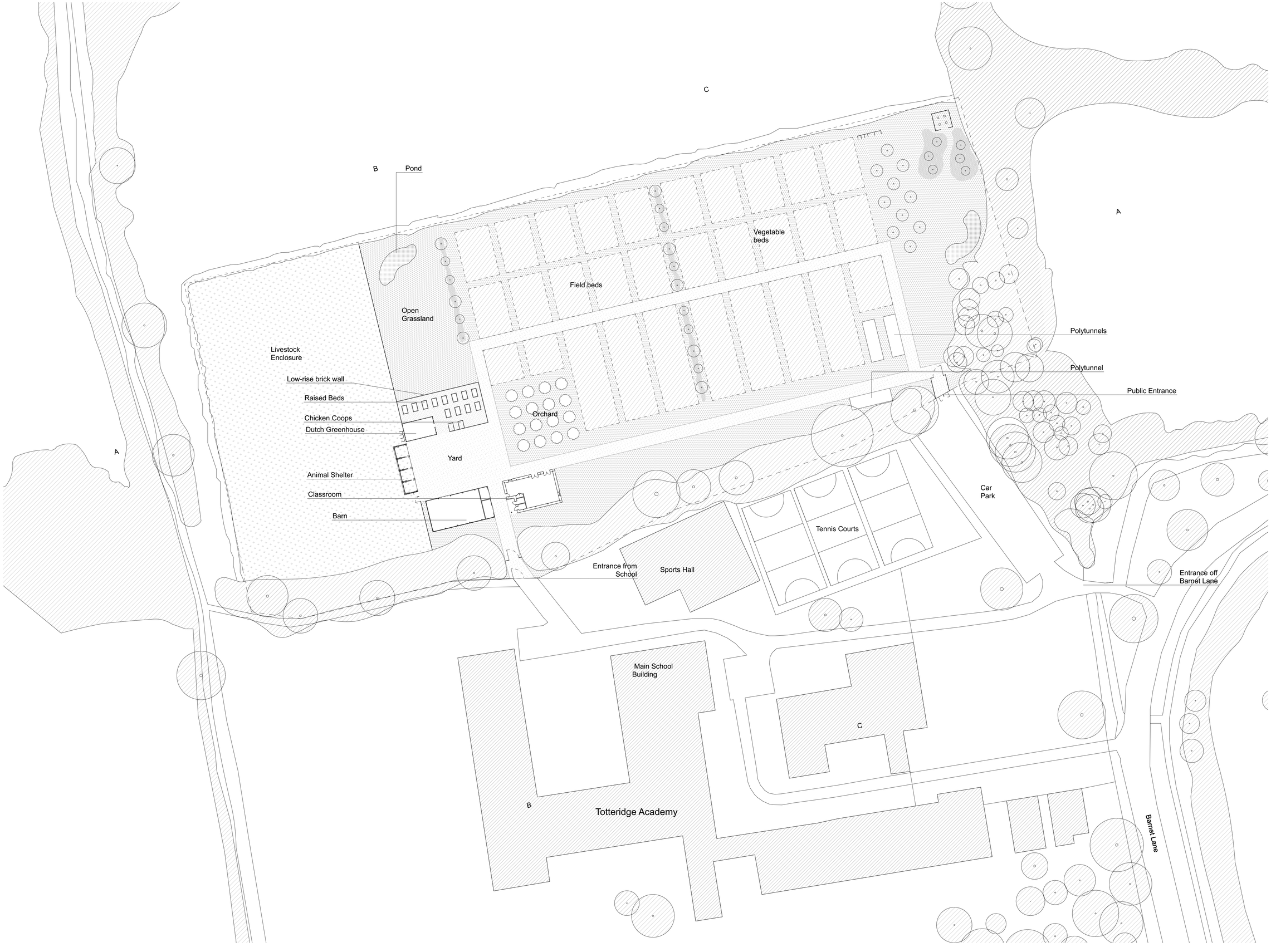
1. All dimensions and levels to be checked on site before commencing work.

2. This drawing to be read in conjunction with all relevant contract documents.

3. Do not scale from this drawing, use figured dimensions only.

4. Report any errors, contradictions or omissions to the designer as soon as possible

Rev.	No.	Change	Date
A	03	Planning Issue	25/01/2021



N

0 5 10 15 20

Planning

Drawing
Proposed Site Plan

Project
Totteridge Academy Farm

Client
GROW

Date
08/02/2021

Drawing No
1003_03_101_01

Drawn by
GS

Scale
1:500 @ A1

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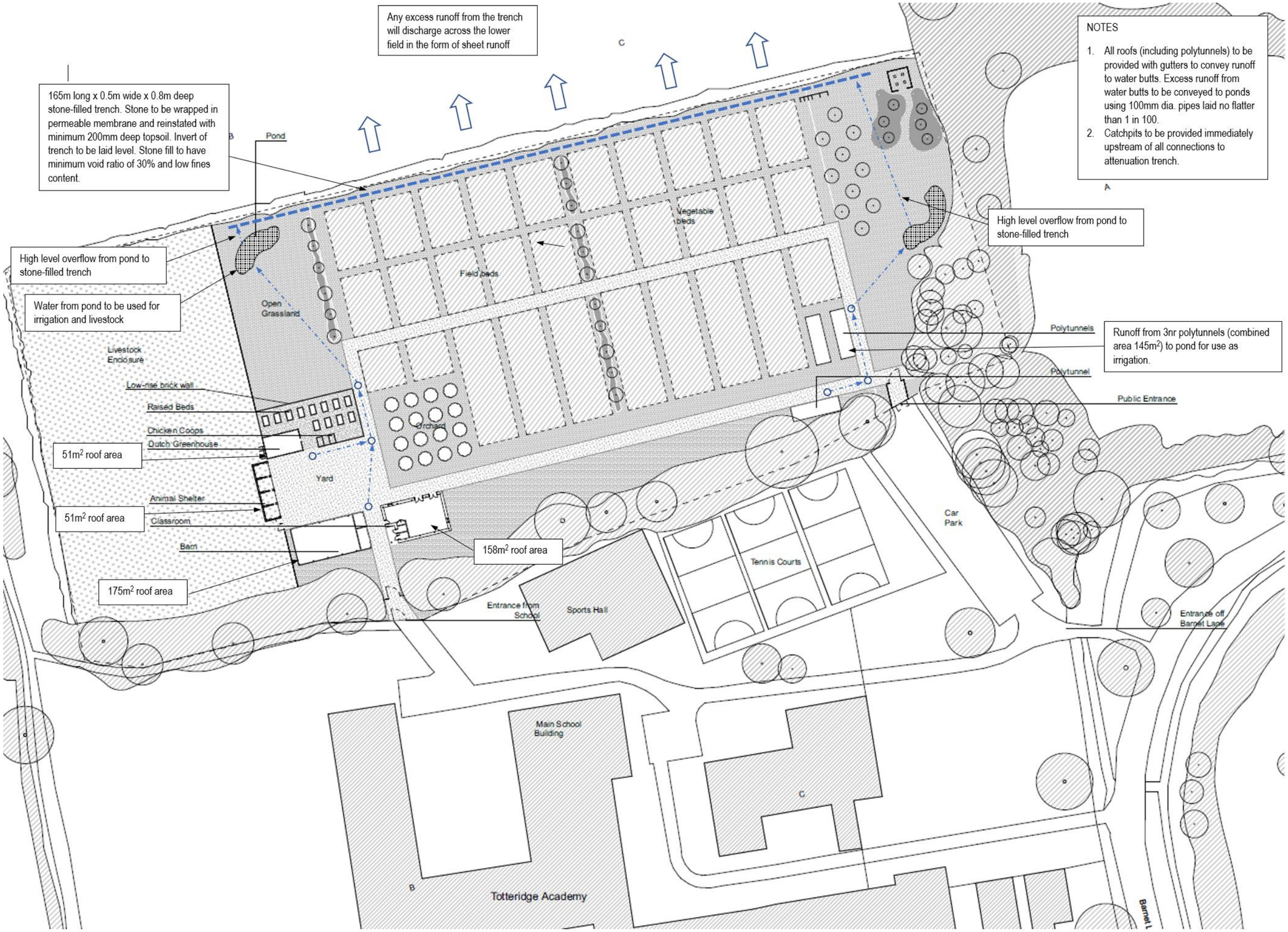

Revisions A 20.12.2019 – Initial Issue B 11.02.2021 – Ponds added	Project Nr 0438 Drg Nr/Rev SK001/B Status Planning Issue	CLIENT GROW PROJECT Totteridge Farm, N20 8AZ DRG TITLE **Surface Water Drainage Arrangements** SCALE As shown	SOUTH LODGE OLD DAWLISH ROAD EXMINSTER DEVON EX6 8AT Telephone: +44(0)1392 824616 Email: admin@pitmanassociates.com pitmanassociates.com

APPENDIX B
CALCULATIONS

1. **Greenfield Runoff Rates**
2. **Initial Estimate of Storage Volumes**
3. **Rainwater Harvesting**

1. Greenfield Runoff Rates

Pro-rata for

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Karl Pitman
Site name:	Totteridge Farm (Proposed)
Site location:	N20 8AZ

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.64007° N
Longitude:	0.20006° W
Reference:	3075148543
Date:	Dec 19 2019 09:43

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	684	684
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	4.7	4.7
1 in 1 year (l/s):	3.99	3.99
1 in 30 years (l/s):	10.81	10.81
1 in 100 year (l/s):	14.99	14.99
1 in 200 years (l/s):	17.57	17.57

Pro-rata for 0.057ha
Qbar = 0.22l/s
1yr = 0.19l/s
30yr = 0.51l/s
100yr = 0.70l/s

2. Initial Estimate of Storage Volumes

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Karl Pitman
Site name:	Totteridge Farm
Site location:	N20 8AZ

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.64013° N
Longitude:	0.20042° W
Reference:	1847780574
Date:	Feb 11 2021 14:46

Site characteristics

Total site area (ha):	0.057
Significant public open space (ha):	0
Area positively drained (ha):	0.057
Impermeable area (ha):	0.057
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.06
Net impermable area for storage volume design (ha):	0.06
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	94.71
FEH / FSR conversion factor:	1.23	1.23
SAAR (mm):	684	684
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.27	0.27
Q_{BAR} for net site area (l/s):	0.27	0.27

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.0
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	1

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	1	1
1 in 30 years (l/s):	1	1
1 in 100 year (l/s):	1	1

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m³):	31	31
Long term storage 1/100 years (m³):	0	0
Total storage 1/100 years (m³):	31	31

3. Rainwater Harvesting

The following calculation shows that for a constant demand of 1,000 litres/day, approximately 51m3 of storage is required. This will be provided in the two ponds.

Pitman Associates Ltd		Page 1
South Lodge Exminster Devon EX6 8AT		
Date 11/02/2021 17:35 File Attenuation Trench.SRCX	Designed by Karl Checked by	
XP Solutions	Source Control 2020.1	

Rainwater Harvesting

Annual Demand

Daily requirement per person (l)	50.0
Number of persons	20

Annual Yield

Collection area (m²)	570
Runoff Coefficient	0.900
AAR (mm)	600
Hydraulic Filter Efficiency	0.90
Depression Storage (mm)	0.0
Number of Rainfall Events/Year	150

Feasibility

Annual non-potable water demand (l)	365000.0
Annual rainfall yield (l)	277020.0

Demand exceeds rainfall yield, rainwater harvesting is feasible for storm water control under BS8515:2009+A1:2013 detailed design approach.

Volume

Return Period (years)	100
Region	England and Wales
M5-60 (mm)	21.000
Ratio R	0.436
Storm Duration (mins)	360
Normal rainwater harvesting (%)	5.0

Results

Total Rainfall Depth (mm)	57
CS	0.886
Additional Rainfall Depth Allowance (Ad)	29.696
Effective proportion of additional storage available for increasing tank size from 1m3 (CP50)	0.962
Rainfall depth for 1m³ of storage tank (sP50)	1.555
Total Storage Volume (m³)	51.270
Available Stormwater Control Storage Volume (m³)	48.706