

**CHARLIE'S PLACE, LAND OFF SODOM
LANE, GRITENHAM**

DRAINAGE STRATEGY

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1. INTRODUCTION

Introduction

- 1.1. SDS Consulting has been commissioned by the client to provide a Drainage Strategy – discharge of conditions report following granted development won on appeal. This report has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF), the associated Planning Policy Guidelines (PPG) and local policy requirements.

Planning

- 1.2. Planning has been granted following a successful appeal to planning application PL/2023/00900. The appeal (reference APP/Y3940/W/25/3360013) places the following conditions on drainage –

Condition 3: Surface Water

Prior to any above ground building works, and before any caravans are placed on the site, a scheme for the discharge of surface water from the site, incorporating sustainable drainage principles, shall be submitted to, and approved in writing by the local planning authority. The details shall demonstrate that the proposed vehicular access over the ditch shall be constructed such that surface water drainage shall not discharge onto the highway. No caravan shall be occupied until the scheme has been fully implemented in accordance with the approved details. The approved drainage scheme shall be permanently retained thereafter.

Condition 6: Foul Water

None of the caravans or day rooms hereby permitted shall be occupied until works for the disposal of sewage have been provided on the site to serve the development hereby permitted, in accordance with details that have first been submitted to and approved in writing by the local planning authority.

Objectives & Scope

- 1.3. The objective of this report is:
- Review all sources of flood risk and the sequential location of the site.
 - Determine the pre and post development conditions for surface water runoff.
 - Detail a drainage strategy for the management and maintenance of the surface water generated from the proposed development.
- 1.4. The scope of this Drainage Strategy is to enable the discharge of conditions.

Limitations

- 1.5. The general limitations of this report are that:
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- This report is based on information available at the time of preparation. There is potential for further information to become available, which may create a need to modify conclusions drawn in this report.
- The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by SDS Consulting Ltd has not been independently verified by SDS Consulting Ltd, unless otherwise stated in the Report.

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2. SITE CONTEXT

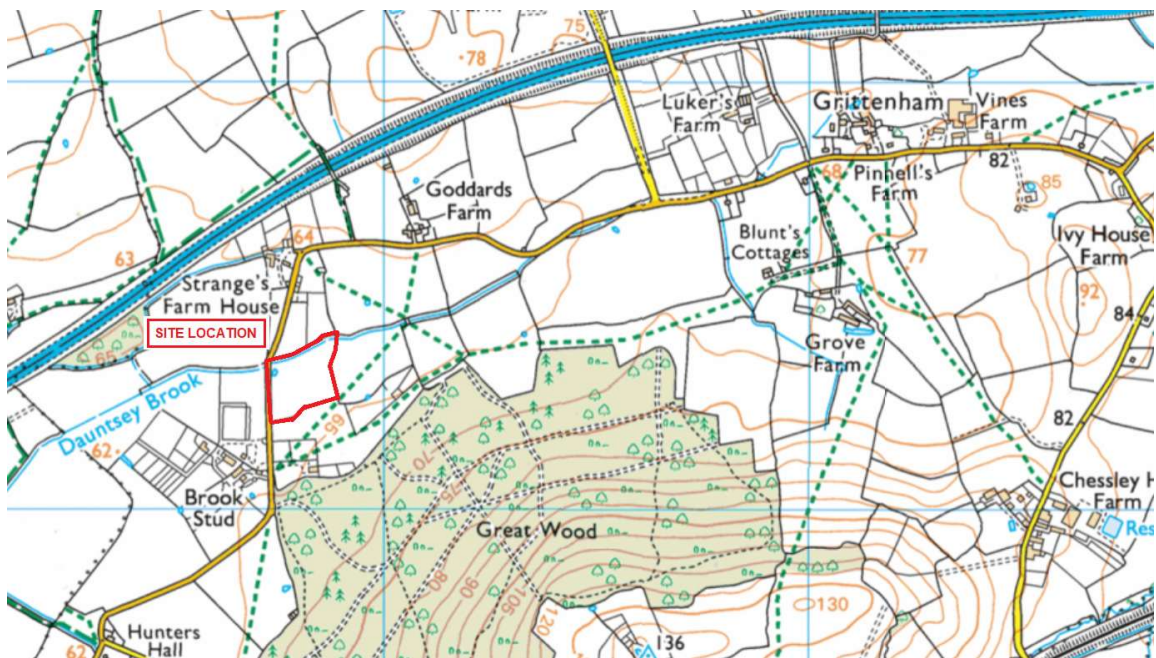
Development Proposals

- 2.1. The development proposals, in which this Drainage strategy is written for, comprise a change of use of land and the creation of a new traveller's site on land at Charlie's Place, Sodom Lane, Grittenham, Wiltshire.
- 2.2. Refer to Willis & Co drawing JL-JH-02 C entitled 'Site Plan' in **Appendix A**.

Site Location

- 2.3. The development is located on land to the west of Sodom Lane, Grittenham, Wiltshire. The closest post code is SN15 4JT and the national grid reference is SU 01794 82348.
- 2.4. The site is accessed from Sodom Lane to the west of the site via a field gate located approximately 25m south of Dauntsey Brook.
- 2.5. The site is greenfield site with some agricultural use and storage facilities. The site is bound by Sodom Lane to the west, Dauntsey Brook to the north and open fields to the east and south. The site is located as per **Figure 1** below.

Figure 1: Site Location Plan



Topography

- 2.6. A Topographical Survey was undertaken by Building Design Surveys in November 2023, a copy of drawing BDS-12-23 is reproduced in **Appendix B**.
- 2.7. The site falls to the north west towards Dauntsey Brook. The highest elevation is to the south east of the site at a level of 64.870m AOD. The lowest elevation is 62.570m AOD to the north west of the site adjacent to Dauntsey Brook.

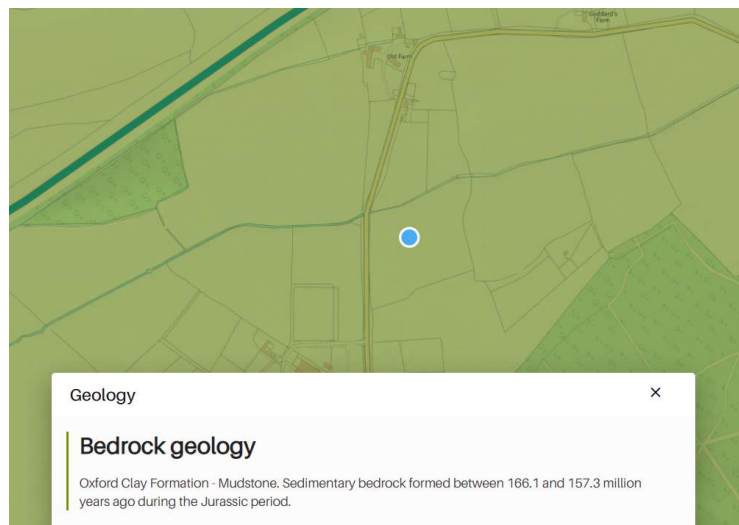
Hydrology

- 2.8. The site is bound by Dauntsey Brook to the north of the site, Dauntsey Brook is a tributary of the River Avon.
- 2.9. Dauntsey Brook discharges in a westerly direction and has confluence with the River Avon to the south east of Lower Seagry

Geology

- 2.10. The published geological information available through the British Geological Society (BGS) online records indicates that the site is underlain by bedrock of the Oxford Clay Formation. Superficial deposits of Alluvium are located along Dauntsey Brook. **Figure 2** shows an extract from the British Geological Survey map for the site location

Figure 2: BGS Geological Map



- 2.11. No intrusive ground investigations have been undertaken within the site.

Existing Drainage

- 2.12. The site is not served by positive drainage networks

3. FLOOD RISK

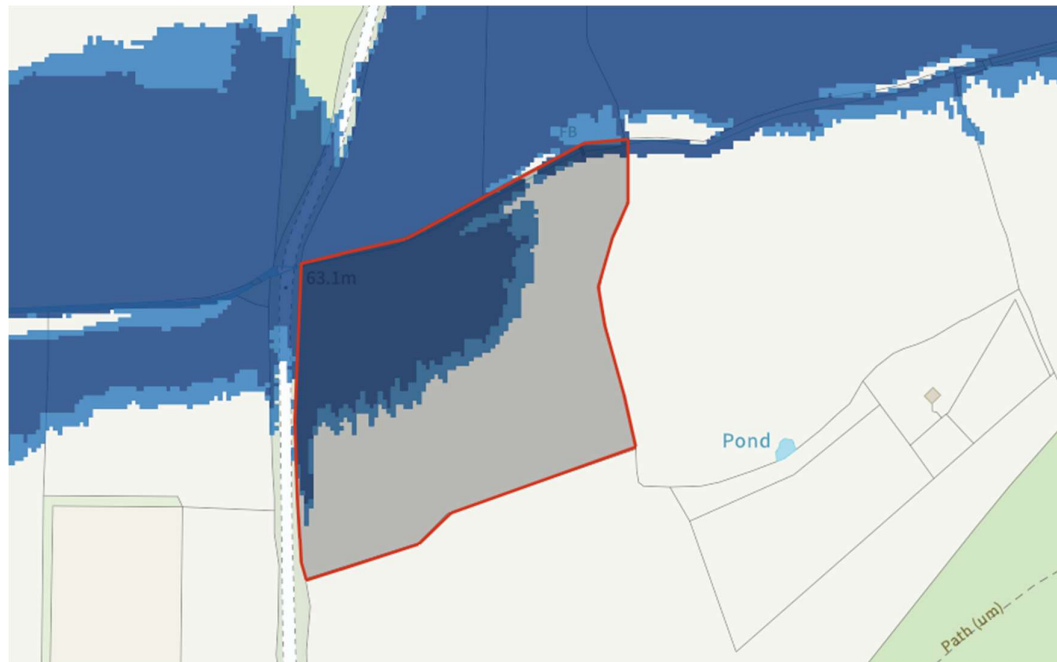
- 3.1. SDS Consulting report 6578-RP01 Issue 02 'Flood Risk Assessment' reviews the sites flood risk. The text below summarises the FRA report and identifies any changes from updated flood risk mapping.

Sources of Flood Risk

Fluvial Flooding

- 3.2. **Figure 3** provides an extract of the Flood Risk Map for planning which identifies that the site is located in Flood Zone 1-3. Flood zone 3 is shown to the north west of the site. The proposed development is located in the southern edge of the site at the furthest point from the flood extents.

Figure 3: Environment Agency's Flood Map for Planning

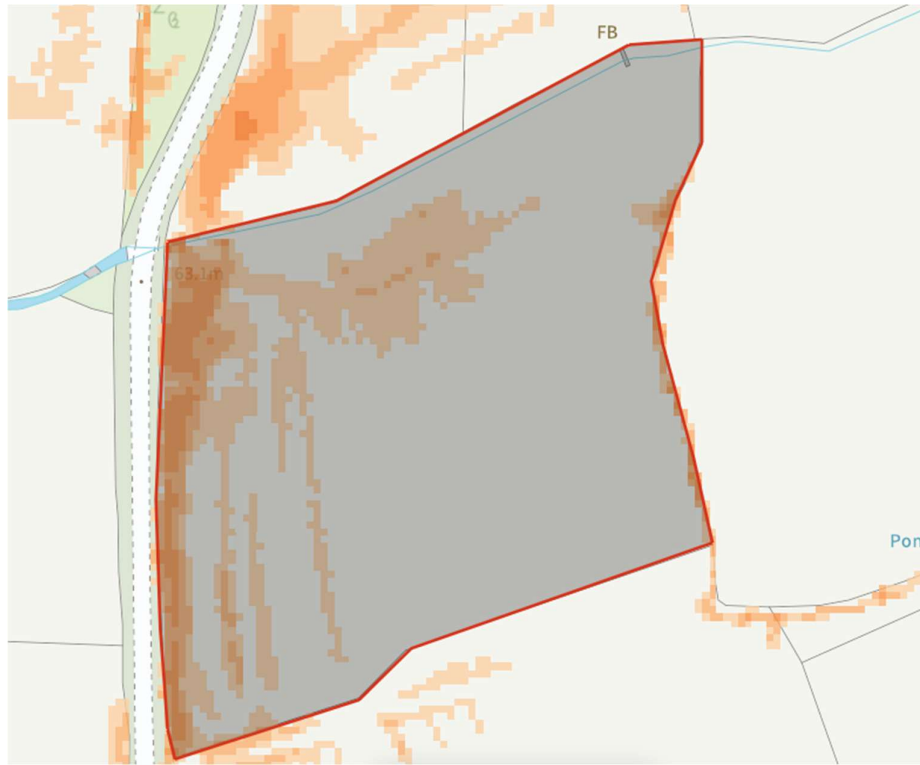


- 3.3. It is noted that the FRA for the site was undertaken prior to the release of the updated NaFRA flood modelling – the FRA identified a large omission in the Environment Agency Flood data with no mapped extents across the site. A reasonable assessment of pluvial flood risk was undertaken in relation to the application site with the development being sequentially located.

Pluvial Flooding

- 3.4. The Environment Agency's Risk of Flooding from Surface Water Map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead.
- 3.5. **Figure 4** shows the extent of surface water flood risk as per the Environment Agency mapping. The mapping identifies there is surface water ponding and flow routes to the west of the site. The flows are in a northerly direction to the watercourse.

Figure 4: Environment Agency - Risk of Flooding from Surface Water Map (1:1000yr)



Flooding from Groundwater

- 3.6. There are no records of groundwater flooding in the site or the surrounding area.

Flooding from Overwhelmed Sewers and Drainage Systems

- 3.7. There are no recorded flooding incidents of sewer flooding.

Flooding from Artificial Sources

- 3.8. The Environment Agency's Risk of Flooding from Reservoirs Map indicates the site is unaffected by flooding from any reservoirs.

4. SURFACE WATER MANAGEMENT

Design Principles

- 4.1. Key design principles in the following guidance documents steer the approach to managing surface water runoff at sites:
- Building Regulations hierarchy of drainage (H3);
 - Interim Code of Practice for SuDS; and
 - CIRIA best practice guidance, including the use of the 'SUDS management train'
- 4.2. Building Regulations hierarchy of drainage outlines the preferred methods for the disposal of surface water with infiltration methods being the preferred option. If this is not possible the next favoured option is to drain to an existing watercourse. If neither of these options are feasible, the regulations state that rainwater discharge should be directed to a sewer.
- 4.3. The Interim Code of Practice for SUDS provides guidance about the hydraulic design criteria for Sustainable drainage systems. This in general refers to both peak rate of runoff and the volume of runoff, post development. Prior to mitigation measures such as the use of SuDS attenuation features, both the volume and peak rate of runoff may increase post development.
- 4.4. The design principles for surface water management extend beyond simple hydraulic criteria. CIRIA guidance promotes the use of the SUDS management train, a concept where SUDS techniques are used to treat, convey and store surface water runoff. This approach is considered as part of the SUDS selection methodology.

National Standards for Sustainable Drainage Systems (SuDS)

- 4.5. The new 2025 SuDS standards replace the narrower, hydraulics-focused 2015 guidance with a broader, multifunctional framework. The updated approach introduces seven national standards that give greater weight to water quality, amenity, biodiversity, and long-term maintenance, reflecting SuDS' wider role in shaping sustainable, resilient places.
- 4.6. The seven new National SuDS Standards are summarised as –

1. Runoff destinations

Discharge must follow the discharge hierarchy:

Priority 1. Collected for non-potable use.

Priority 2. Infiltrated to ground.

Priority 3. Discharged to an above ground surface water body.

Priority 4. Discharged to a surface water sewer, or another piped surface water drainage system.

Priority 5. Discharged to a combined sewer.

Evidence is required to justify use of lower priority discharge locations.

2. Management of everyday rainfall (interception)

Apply a 'SuDS approach' so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems.

3. Management of extreme rainfall and flooding

A 'SuDS approach' shall be adopted to address the management of development runoff during extreme rainfall, including allowances for climate change and urban creep to:

- protect people and property on the development from flooding of the surface water drainage system*
- mitigate any increased flood risk to people and property adjacent to or downstream of the development*
- protect the receiving water body from morphological damage or minimise the impact on sewer capacity*

4. Water quality

Apply a 'SuDS approach' that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runoff to adequately address water quality risks from the development.

5. Amenity

A 'SuDS approach' shall be adopted that maximises benefits for amenity through the creation of multi-functional places and landscapes.

6. Biodiversity

A 'SuDS approach' shall be adopted to ensure the surface water drainage system maximises biodiversity benefits throughout the development lifecycle.

7. Design of drainage for construction, operation, maintenance, decommissioning and structural integrity

A 'SuDS approach' shall be adopted to ensure that surface water drainage systems are designed so they can be easily and safely constructed, operated and maintained taking account of the need to minimise negative impacts on natural resources and the environment.

Wiltshire Council Betterment Strategy (2024)

- 4.7. Table 2.1 of the Wiltshire Council Betterment Strategy (June 2024) identifies the requirements for greenfield sites and states –

Where full disposal of surface water via infiltration is not viable, the LLFA expect to see that the discharge rates restricted to provide betterment over the greenfield conditions.

- With regards the control of surface water discharges from new development, Wiltshire Council requires post development discharges from greenfield sites to provide 30% betterment over pre-development discharges for all storm events between the 1 in 1year and 1 in 100year return period events.*
- For greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.*

National Standards for SuDS

Standard 1 - Runoff destinations

- 4.8. In accordance with the National Standards for SuDS, the following priority discharge hierarchy is to be reviewed -

- Priority 1. Collected for non-potable use.
- Priority 2. Infiltrated to ground.
- Priority 3. Discharged to an above ground surface water body.
- Priority 4. Discharged to a surface water sewer, or another piped surface water drainage system
- Priority 5. Discharged to a combined sewer.

Collected for non potable use

- 4.9. Due to the non permanent residential status and limited structures, the use of rainwater harvesting and water butts is not applicable.

Infiltrated to ground

- 4.10. The ground conditions are clay which are unlikely to support infiltration SuDS. It is noted that there is no site specific ground investigation – a review of nearby BGS borehole records identify stiff clays.

Discharges to an above ground surface water body

- 4.11. A ditch is located to the west of the site that discharges in a northerly direction to Dauntsey Brook. This ditch, or discharge directly to Dauntsey brook, is to be utilised for the surface water discharge location.

Discharged to a surface water sewer, or another piped surface water drainage system

- 4.12. Not considered

Discharged to a combined sewer

- 4.13. Not considered

Standard 2 -Management of everyday rainfall (interception)

- 4.14. Guidance requires that the first 5mm of rainfall does not result in discharge from the site. Guidance advises the use of rainwater harvesting or infiltration and the retention of water in SuDS which is to be 'lost to soils or the atmosphere'.

- 4.15. The national standards for SuDS suggest the following methods for compliance which are reviewed on a site specific basis.

- Green Roofs or Walls – Not considered
- Rainwater harvesting – Not proposed
- Soakaways / Infiltration SuDs – ground conditions have negated the use of infiltration SuDS
- Permeable surfaces – gravel pitch areas are permeable surfaces and measure a total of 1500m². National standards for SuDS deem compliance where no additional area is added.
- Swales – a ditch is provided for the outfall and measures 175m in length with a 0.5m base width. This would entail that 87.5m² of suitable base area is provided which can serve 437.5m² of impermeable area (where applying the 1/5th rule). The day room roof areas measure 260m².
- Infiltration trenches – ground conditions have negated the use of infiltration SuDS
- Detention basins – proposed for the site and provides a base plan area of 10m² which can serve 50m² of impermeable area.
- Bioretention areas and rain gardens – potential for use
- Attenuation ponds – do not provide interception

- 4.16. The inclusion of permeable services, a detention basin and the outfall ditch / swale provides sufficient interception storage this making the site compliant with standard 2.

Standard 3 - Management of extreme rainfall and flooding

- 4.17. The following text reviews the requirement of the design to meet standard 3.

Climate Change

- 4.18. The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.
- 4.19. The peak rainfall intensity allowances to be used when designing urban drainage systems have been obtained from the environment agencies web based resource tool 'Climate change allowances for peak rainfall' by searching the development management catchment for the surrounding area.
- 4.20. The site is located in the Avon Bristol & North Somerset Management Catchment, the catchment allowances have reproduced in **Table A**. Both the central and upper end allowances need to be assessed to understand the range of impact.

Table A: Peak rainfall intensity allowance

Avon Bristol & North Somerset Management Catchment peak rainfall allowances	3.3% Annual exceedance		1% Annual exceedance	
	'2050s' (up to 2060)	'2070s' (2061 to 2125)	'2050s' (up to 2060)	'2070s' (2061 to 2125)
Central	20%	25%	25%	25%
Upper End	35%	40%	40%	45%

- 4.21. Surface water drainage design will allow for 25% climate change within the 30 year return period storms and 45% for the 100 year return period storms.

Surface Water Flow Balancing

Catchment Areas

- 4.22. The full site red line boundary measures 220990m² of which the proposed development comprises 2820m² impermeable area with 55% impermeable runoff (track and pitches as gravel), and 100m² of 100% impermeable area from the day room roofs.

Greenfield Runoff Rate

- 4.23. Greenfield runoff rates have been calculated as represented in **Table B** – calculations can be found in **Appendix C**. Greenfield runoff rates are very low due to the development size.

Table B: Greenfield Runoff Rates

Return Period (Years)	1	2	30	100
Greenfield Runoff Rates (l/s)	8.4	10.0	21.0	26.2
Greenfield Runoff Rates (l/s/ha)	3.82	4.55	9.55	11.91

Post development unattenuated Peak Runoff Rate

- 4.24. Where assessing the redeveloped sites peak runoff rate, including allowance for climate change and changes in impermeable areas, the unattenuated peak runoff rate is as presented in Table C (calculated utilising the Modified Rational Method $Q=2.78CiA$ Where

Q = flow (l/s), I = rainfall intensity (mm/hr), A = Impermeable Area (ha), C = runoff coefficient

- 4.25. The impermeable area used in the calculations is determined to be $2820m^2 \times 0.55 + 100m^2 = 1651m^2$

Table C: Post development site Modified Rational Method impermeable runoff.

Return Period	C	I	A	Flow (l/s)
1:1 year	0.95	28.809	0.165	57.71
1:30 year (+30%cc)	0.95	77.748	0.165	155.75
1:100 year (+45%cc)	0.95	132.593	0.165	265.618

- 4.26. If the site were to discharge at unattenuated rates, the post development site would increase flows due to the new impermeable area and allowance for climate change.

Discharge rate

- 4.27. In accordance with Wiltshire Council betterment policy, the pre development greenfield runoff rate is to have a 30% betterment applied. Where referring to the impermeable area of the site, the allowable discharge is calculated and shown in Table D.

Table D: Calculated allowable discharge

Return Period (Years)	1	2	30	100
Greenfield Runoff Rates (l/s)	8.4	10	21	26.2
Greenfield Runoff Rates (l/s/ha)	3.82	4.55	9.55	11.91
Development Area (ha)	0.165	0.165	0.165	0.165
Greenfield runoff for development area	0.630	0.751	1.576	1.965
Betterment rate (%)	30%	30%	30%	30%
Allowable discharge rate (l/s)	0.441	0.526	1.103	1.376

- 4.28. Surface water discharge is not to exceed 0.526l/s for all other events (QBAR is the approximate equivalent to the 1 in 2.3 year storm event)

Surface Water Drainage Strategy

- 4.29. In view of the requirements of the NPPF, PPG, and design parameters and constraints associated with redeveloping this site, a surface water drainage strategy design has been devised and hydraulically modelled to demonstrate that the scheme can be suitably implemented without increasing the level of flood risk, when the surface water drainage system experiences a 1:100-year rainfall event (including 45% allowance for climate change).
- 4.30. The surface water drainage scheme has been designed to ensure:

- Sustainable Urban Drainage systems are wholly incorporated within the scheme.
- Consideration is given for the improvement of water quality within the design.

- The designed drainage scheme can satisfactorily retain a critical 1 in 100 Year storm event with climate change.
- 4.31. Surface water drainage is to discharge via a detention basin with the restricted outfall being discharged towards Dauntsey Brook via a ditch connection.
- 4.32. Caravan pitch areas are assumed to be gravelled, surface water flows are to be collected in a filter drain which discharges to the drainage network.
- 4.33. Refer to drawing 6578-C-SK01. 'Drainage Strategy' in **Appendix D** for the layout of the surface water network.
- 4.34. The hydraulic assessment provides various scenarios up to and included the critical 1 in 100 Year storm event with additional 45% allowance for climate change. The simulations confirm that the storm can be managed and maintained within the site without flooding. The hydraulic models of the proposed surface water network and SuDS devices can be found in **Appendix E**.

Exceedance

- 4.35. Exceedance flows will follow the natural topography of the site and discharge in northerly direction.
- 4.36. Indicative exceedance flow routes are shown on drawing 6578-C-SK01. 'Drainage Strategy' in **Appendix D**

Surcharged outfall

- 4.37. Refer to hydraulic modelling results in Appendix E for surcharged outfall simulations. There is no impact of the 100 year flood level (63.174mAOD) on the function of the drainage network and no additional storage volume is required.

Standard 4 - Water quality

- 4.38. In terms of water quality, the proposed surface water system offers a suitable level of mitigation in accordance with Environment Agency, DEFRA and CIRIA guidance.
- 4.39. The CIRIA SuDS Manual C753, 2015 details an approach for establishing the hazard posed by the intended land use activities and the extent to which the proposed SuDS components can reduce and mitigate the contamination risk to the receiving waterbody. Referring to Table 26.2 – 'Pollution hazard indices for different land use classifications' (CIRIA C753, 2015) the proposed development and land use results in a low pollution hazard, therefore a 'simple index' method can be used to make a qualitative assessment of the proposed SuDS management.
- 4.40. To ensure that there is adequate treatment, all SuDS components utilised should have a pollution mitigation index that equals or exceeds the pollution hazard index. In reference to Table 26.2, the pollution hazard index for the roof areas and parking / roads is -

TSS = 0.7, Metals = 0.6, Hydrocarbons = 0.45.

Figure 5: CIRIA C753, 2015. Table 26.2 – 'Pollution hazard indices for different land use classifications'

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Notes

- 1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).
- 2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

4.41. In reference to Table 26.3 – 'Indicative SuDS mitigation indices for discharges to surface waters' (CIRIA C753, 2015) the inclusion of a filter drains and a detention basin provides mitigation totalling:

$$TSS = 0.9, \text{Metals} = 0.9, \text{Hydrocarbons} = 1.0$$

Figure 6: CIRIA C753, 2015. Table 26.3 – 'Indicative SuDS mitigation indices for discharges to surface waters'

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

- 1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.
- 2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
- 3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
- 4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.
- 5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: <http://tinyurl.com/qf7yuj7>
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

Standard 5 – Amenity

Detention Basin

- 4.42. The main amenity of detention basins is their potential for dual-use landscaping, transforming them from functional drainage structures into multi-purpose spaces that enhance their surroundings. They can be designed as attractive recreational areas, such as parks or playing fields, and can be landscaped with vegetation to provide habitats for wildlife and improve the visual appeal of an area. They also offer environmental benefits like reducing flood risk, improving water quality through sediment settlement, and contributing to biodiversity.
- 4.43. Recreational spaces: When dry, they can be used for parks, public open spaces, playing fields, or as a location for seating and other amenities.
- 4.44. Enhanced visual appeal: Proper landscaping, planting, and design can make basins a visually pleasing part of the community landscape, rather than just empty, functional depressions.
- 4.45. Educational opportunities: They can serve as educational resources for the public about water management, biodiversity, and sustainable drainage systems.
- 4.46. Improved water quality: They help treat runoff by allowing sediment and particulate pollutants to settle out before the water is released.
- 4.47. Biodiversity and habitats: They can create valuable habitats for wildlife, especially when designed to be wet and planted with vegetation, which increases local biodiversity.
- 4.48. Climate change mitigation: They can help reduce urban air quality issues through evapotranspiration and absorb carbon dioxide.

Standard 6 – Biodiversity

Detention Basin

- 4.49. The biodiversity of detention basins can be enhanced through design, they can provide a range of habitats that support wildlife. By creating niches with varied conditions from frequently wet zones to dry areas, these basins can attract a wide variety of plants and animals. To maximize biodiversity, it is recommended to use native, flood-tolerant species and mimic natural wetland plant communities.

Standard 7 - Design of drainage for construction, operation, maintenance, decommissioning and structural integrity

Construction

- 4.50. The site is small and as such the drainage works will be installed as per the phasing of works. It is recommended that the detention basin and outfall are installed at the earlier stages of construction.

Management & Maintenance

- 4.51. Maintenance refers to the inspections required to identify performance issues and plan maintenance as required, operation and maintenance of the drainage system, landscape management and waste management associated with contaminated silt and other waste materials resulting from maintenance.

- 4.52. CIRIA C753 The SuDS Manual provides information in Chapter 32 for the operation and maintenance of SuDS. The maintenance activities are broadly defined as regular, occasional and remedial maintenance. It is noted that some scenarios may require one-off maintenance activities. The SuDS Manual defines maintenance as –
- Regular Maintenance: consists of basic tasks carried out to a frequent and predictable schedule, including inspections/monitoring, silt or oil removal if required more frequently than once a year, vegetation management, sweeping or surfaces and litter / debris removal.
 - Occasional maintenance: comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the regular tasks.
 - Remedial maintenance: describes the intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised with good design, constructions and regular maintenance activities.
- 4.53. Maintenance regimes are to be reviewed on an annual basis to ensure that the approach adopted is meeting its objectives.
- 4.54. All those responsible for the maintenance operations should adhere to the relevant health and safety legislation for the activities listed within this report (including lone working, if relevant). Method statements and risk assessments should always be completed prior to the undertaking of any works.

Indicative Maintenance & Management Plan

Gravity Drains & Catchpits

- 4.55. Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal. If maintenance is not undertaken for long periods, deposits can become hard-packed and require more effort to remove.

Detention Basin

- 4.56. Detention basins are surface storage basins or facilities that provide flow control through attenuation of stormwater runoff. They also facilitate some settling of particulate pollutants.
- 4.57. Detention basins are normally dry and in certain situations the land may also function as a recreational facility. However, basins can also be mixed, including both a permanently wet area for wildlife or treatment of the runoff and an area that is usually dry to cater for flood attenuation.
- 4.58. Detention basins will require ongoing regular maintenance to ensure continuing operation to design performance standards. The undertaking of maintenance should be relatively straightforward for landscaping contractors.
- 4.59. Table 22.1 of the CIRIA SuDS, reproduced in **Figure 7** below, provide the operation and management requirements for a detention basin.

Figure 7: CIRIA C753, 2015. Table 22.1

TABLE 22.1 Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Flow Control Chambers

- 4.60. The flow control chamber proposed for this site is a Hydro Brake which has no moving parts and are self-activating requiring minimal maintenance. The bypass disc is the only manually operated element and is applicable for use in the event of a blockage or issue with the drainage network. It is recommended that the chamber is inspected monthly for three months after installation and bi-annually thereafter to verify the condition and operation of the unit and check for blockages within the chamber or flow control device.
- 4.61. Any silt or debris found during inspections should be removed and cleaned out with the use of a sump vacuum cleaner.
- 4.62. The table below gives a summary of the operation and maintenance requirements for flow control devices –

CONTROL CHAMBERS	
Regular Maintenance	Frequency
Check there is no physical damage and that control is functioning. Ensure bypass arrangements are functional. Remove Debris and silt. Undertake inspection after autumnal leaf fall to ensure functionality of control and that there are no blockages	Monthly
Remedial Works	Frequency
Repair physical damage if required / replace unit is damaged	As required
Monitoring	Frequency
Inspect chamber and flow control units to ensure that they are in good condition and operating as designed.	Annually and after large storms

Blockages & Spillages

Blockage

- 4.63. In the event of a blockage within the drainage network, the key risk is that of flooding to the surrounding area. The extent and location of flooding is dependent upon the location of the blockage and the associated storm event.
- 4.64. In the event of a blockage within the network, the network is to be drained down by use of suction equipment and the blockage removed.
- 4.65. If a blockage does occur and results in flooding, the exceedance flow routes are anticipated to flow in a westerly direction.

Spillages

- 4.66. Due to the nature of the development, the likelihood of a spillage is minimal.
- 4.67. Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency with residual spillage allowed to bio-remediate in the drainage system.
- 4.68. In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s) downstream of the spillage with a bung. Contact the Environment Agency immediately.

Responsibility

- 4.69. The definition of responsibility is determined by adoptions, private responsibility and shared responsibility typically determined within a management company. The extent of the responsibilities is defined by the layout and the areas offered for adoption.

Plot Owners

- 4.70. Due to the designation and ownership of the site and plots, the individual plot owners will have ownership for the drainage network, rain gardens / io retention and permeable paving that is solely utilised by the plot.

5. FOUL DRAINAGE

Existing drainage

- 5.1. There are no foul drains or public sewers serving the site or within the local vicinity of the site.

Foul Drainage Strategy

Additional foul flow & population equivalents

- 5.2. The development comprises of four caravan pitches and two day rooms. For the purpose of sizing a sewage treatment plant, the population equivalent is determined to be 16P assuming 4 persons per caravan.

Foul treatment

- 5.3. A sewage treatment plant is proposed for the collection and treatment of foul flows. Sewage treatment plants introduce bacteria to the cleaning process to break down waste into a cleaner effluent before it is discharged.
- 5.4. A Klargester BioDisc, Tricel Novo or similar approved will be required for installation – alternative manufacturers are to provide a sewage treatment plant that is sufficient for the population equivalent.

Effluent Discharge location

- 5.5. Effluent discharge is proposed to utilise the surface water outfall ditch with ultimate discharge to Dauntsey Brook. The discharge is from domestic dwellings only
- 5.6. The daily discharge is calculated to be 1.65m³ a day where assuming that the caravans are calculated as 4 number 3 bedroom dwellings. This is less than that of the 5m³ daily maximum under the general binding rules thus compliance is met.
- 5.7. The foul proposals are in accordance with the general binding rules

Foul Drainage Layout

- 5.8. Refer to drawing 6578-C-001 in **Appendix D** for the proposed foul drainage arrangements to support the site.

6. CONCLUSIONS

- 6.1. The development proposals, in which this drainage strategy is written for, comprise a change of use of land and the creation of a new traveller's site on land at Charlie's Place, Sodom Lane, Grittenham, Wiltshire. The key conclusions are
- Published flood risk mapping identifies that the site is located in Flood Zone 1-3 with the proposed development area being located within flood zone 1
 - Risk of Flooding from Surface Water is shown to the west and north of the site and do not affect the proposed development
 - Surface water drainage is to discharge to Dauntsey Brook via a detention basin. Surface water flows are restricted to greenfield runoff rates
 - This report provides sufficient information to prove a viable means of surface water management. Surface water drainage has been developed in line with local and national policy requirements.
 - Foul drainage is to utilise a sewage treatment plant with effluent discharge to Dauntsey brook via the surface water outfall ditch
- 6.2. Sufficient information and design has been presented in this report to discharge condition 3 & 6 of planning approval via appeal (reference APP/Y3940/W/25/3360013)
- 6.3. The overall conclusions drawn from this Drainage strategy report is that the development would be appropriately safe for its lifetime taking account of the vulnerability classification and the development would not increase flood risk elsewhere.

APPENDICES

APPENDIX A



OS 100060020



Willis & Co. Chartered Town Planners 30 The Causeway, Chippenham, Wiltshire, SN15 3DB. Telephone: 01249 444975 Facsimile: 01249 655556 Email: Willisplan@aol.com			
Client;	Mr J. Lee.		
Title;	Land at Manor Farm, Sodom Lane, Grittenham, Wiltshire SN15 4JY.		
	Site Plan.		
Scale;	1:1250 @ A3	Date;	November 2022
		Drawing no;	JL-JH-02
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APPENDIX B

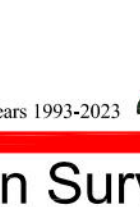




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The Studio - Merton College, 67 London Road, Galley
 Wiltshire, SN1 4AA
enquiries@bds.co.uk

Project Name: **Charlie's Place**
Sodom Lane Grittenham SN15 4JY

Drawing Title:
 Topographic Survey

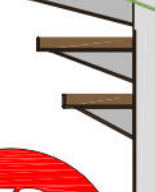
Client:
Mr John Lee

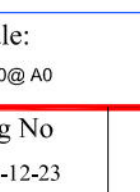
Date:	Scale:	
November 2023	1:2500 A0	

Drawn	Checked	Dwg No	Rev
P-J-S	G-H	BDS-12-23	

Notes:
 Survey Grid based on OS
 Levels based on OSGM-16

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APPENDIX C

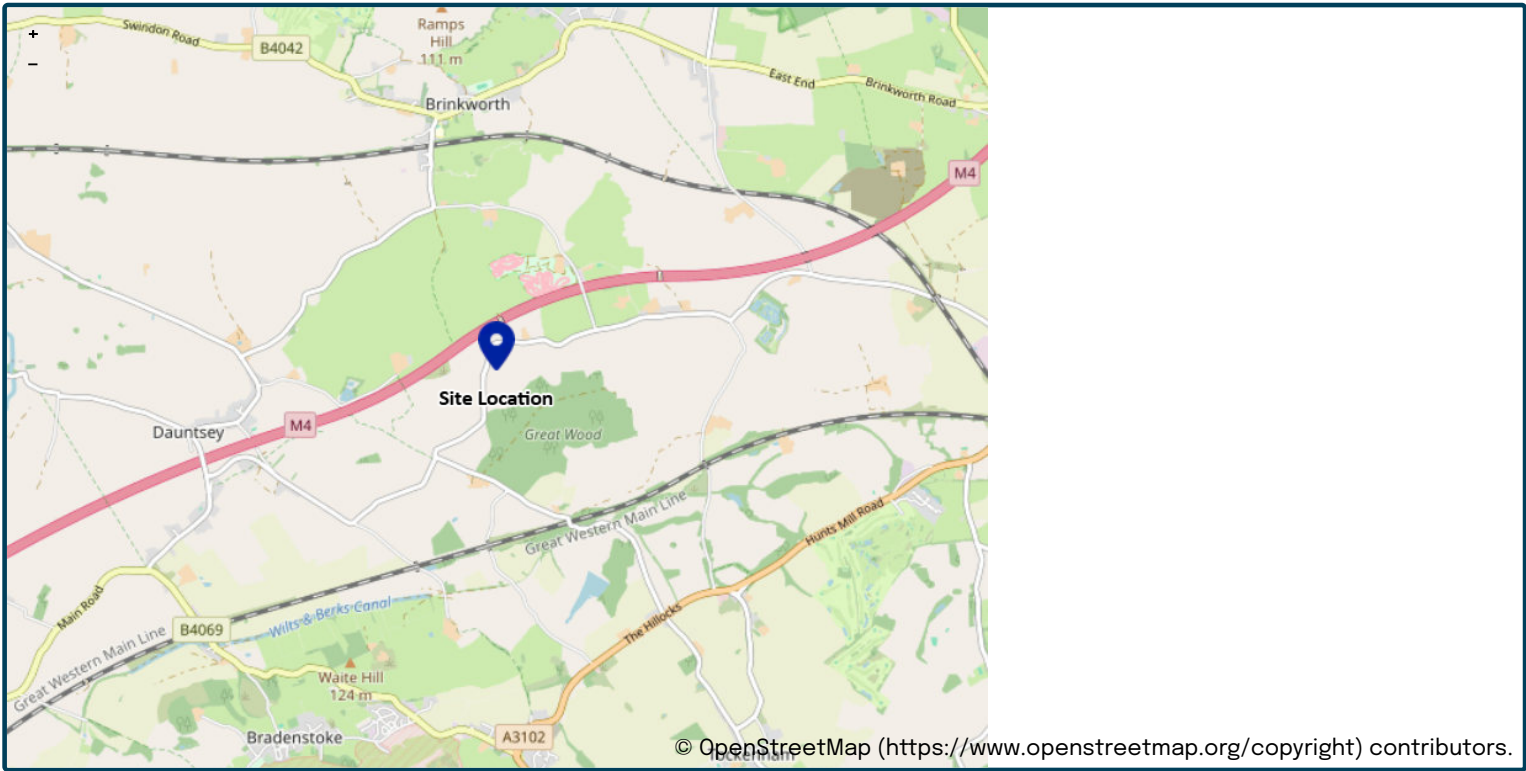
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	01/12/2025
Calculated by	M Dyer
Reference	6578
Model version	2.2.2

Location

Site name	Land at Sodoms Lane
Site location	Grittenham



Site easting (British National Grid)	401844
Site northing (British National Grid)	182221

Site details

Total site area (ha)	2.2	ha
----------------------	----------------------------------	----

Greenfield runoff

Method

Method	IH124	
IH124		
	<u>My value</u>	<u>Map value</u>
SAAR (mm)	708 mm	708
How should SPR be derived?	WRAP soil type	
WRAP soil type	4	4
SPR	0.47	
QBar (IH124) (l/s)	10.8 l/s	

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	8	8
1 year growth factor	0.78	
2 year growth factor	0.93	
10 year growth factor	1.49	
30 year growth factor	1.95	
100 year growth factor	2.43	
200 year growth factor	2.78	

Results

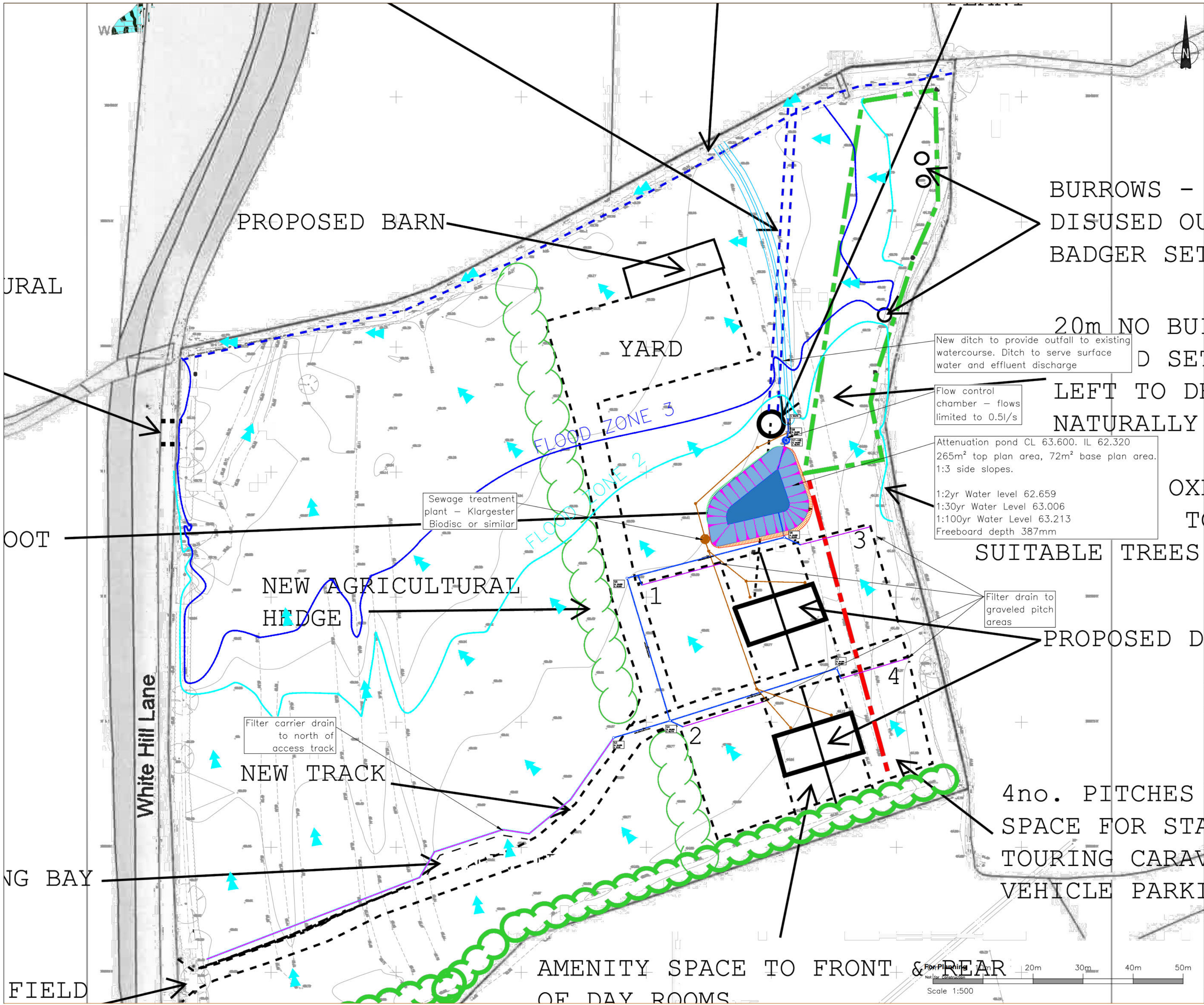
Method	IH124	
Flow rate 1 year (l/s)	8.4 l/s	
Flow rate 2 year (l/s)	10.0 l/s	
Flow rate 10 years (l/s)	16.0 l/s	
Flow rate 30 years (l/s)	21.0 l/s	
Flow rate 100 years (l/s)	26.2 l/s	
Flow rate 200 years (l/s)	29.9 l/s	

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

APPENDIX D



NOTES:
1. Drawing for information only – not for construction

OX
T

Exceedance Route Arrow

B	24/06/26	Design amended for LLFA comments	MTD	TL
A	09/04/26	Flood zones added - pond banking shown	MTD	TL
Rev	Date	Description	Initials	Check

SDS
consulting
civil & structural engineers

E: enquiries@sds-consulting.co.uk W: www.sds-consulting.co.uk

CLIENT:

Mr J. LEE
c/o WILLS & Co

PROJECT
CHARLIES PLACE, LAND OFF SODOM LANE, GRITTENHAM

DRAWING

DRAINAGE STRATEGY

Drawing No. **6578-C-SK01** REV B

Status **For Planning**
Not for Construction

Job Number	6578	Date	DEC 2025
Scale	1:500 @ A2		
Drawn By	MTD	Checked By	TL

APPENDIX E

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	30	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.035	5.00	64.250	600	401863.101	182285.773	0.650
S2	0.024	5.00	63.700	600	401736.674	182227.290	0.800
S3	0.007	5.00	63.600	600	401818.489	182271.887	0.800
S4	0.039	5.00	63.800	600	401829.777	182275.296	1.090
S5	0.035	5.00	63.600	600	401821.157	182303.790	1.070
S6	0.029	5.00	63.600	600	401852.520	182312.354	1.279
POND			63.600	1200	401850.107	182321.429	1.280
S7-HB			63.600	1200	401852.961	182331.342	1.285
S8			63.600	600	401853.406	182332.939	1.300
9_OUT			63.250		401853.387	182335.655	0.975

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S4	34.932	0.600	63.600	62.710	0.890	39.2	150	5.36	50.0
2.000	S2	S3	93.180	0.600	62.900	62.800	0.100	931.8	300	8.06	50.0
2.001	S3	S4	11.792	0.600	62.800	62.710	0.090	131.0	300	8.21	50.0
1.001	S4	S5	29.769	0.600	62.710	62.530	0.180	165.4	225	8.70	50.0
1.002	S5	S6	32.511	0.600	62.530	62.321	0.209	155.6	225	9.21	50.0
1.003	S6	POND	9.390	0.600	62.321	62.320	0.001	9390.0	225	10.46	50.0
1.004	POND	S7-HB	10.316	0.600	62.320	62.315	0.005	2063.2	225	11.07	50.0
1.005	S7-HB	S8	1.658	0.600	62.315	62.300	0.015	110.5	150	11.10	50.0
1.006	S8	9_OUT	2.716	0.600	62.300	62.275	0.025	108.6	150	11.15	50.0

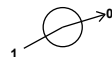
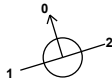
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.611	28.5	4.7	0.500	0.940	0.035	0.0
2.000	0.507	35.8	3.3	0.500	0.500	0.024	0.0
2.001	1.372	97.0	4.2	0.500	0.790	0.031	0.0
1.001	1.014	40.3	14.2	0.865	0.845	0.105	0.0
1.002	1.046	41.6	19.0	0.845	1.054	0.140	0.0
1.003	0.126	5.0	22.9	1.054	1.055	0.169	0.0
1.004	0.279	11.1	22.9	1.055	1.060	0.169	0.0
1.005	0.955	16.9	22.9	1.135	1.150	0.169	0.0
1.006	0.963	17.0	22.9	1.150	0.825	0.169	0.0

Pipeline Schedule

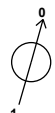
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	34.932	39.2	150	Circular	64.250	63.600	0.500	63.800	62.710	0.940
2.000	93.180	931.8	300	FilterCarrier	63.700	62.900	0.500	63.600	62.800	0.500
2.001	11.792	131.0	300	Circular	63.600	62.800	0.500	63.800	62.710	0.790
1.001	29.769	165.4	225	Circular	63.800	62.710	0.865	63.600	62.530	0.845
1.002	32.511	155.6	225	Circular	63.600	62.530	0.845	63.600	62.321	1.054
1.003	9.390	9390.0	225	Circular	63.600	62.321	1.054	63.600	62.320	1.055
1.004	10.316	2063.2	225	Circular	63.600	62.320	1.055	63.600	62.315	1.060
1.005	1.658	110.5	150	Circular	63.600	62.315	1.135	63.600	62.300	1.150
1.006	2.716	108.6	150	Circular	63.600	62.300	1.150	63.250	62.275	0.825

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	600	Manhole	1 STANDARD	S4	600	Manhole	1 STANDARD
2.000	S2	600	Manhole	1 STANDARD	S3	600	Manhole	1 STANDARD
2.001	S3	600	Manhole	1 STANDARD	S4	600	Manhole	1 STANDARD
1.001	S4	600	Manhole	1 STANDARD	S5	600	Manhole	1 STANDARD
1.002	S5	600	Manhole	1 STANDARD	S6	600	Manhole	1 STANDARD
1.003	S6	600	Manhole	1 STANDARD	POND	1200	Manhole	1 STANDARD
1.004	POND	1200	Manhole	1 STANDARD	S7-HB	1200	Manhole	1 STANDARD
1.005	S7-HB	1200	Manhole	1 STANDARD	S8	600	Manhole	1 STANDARD
1.006	S8	600	Manhole	1 STANDARD	9_OUT		Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	401863.101	182285.773	64.250	0.650	600				
						0	1.000	63.600	150
S2	401736.674	182227.290	63.700	0.800	600				
						0	2.000	62.900	300
S3	401818.489	182271.887	63.600	0.800	600				
						1	2.000	62.800	300
						0	2.001	62.800	300
S4	401829.777	182275.296	63.800	1.090	600				
						1	2.001	62.710	300
						2	1.000	62.710	150
						0	1.001	62.710	225
S5	401821.157	182303.790	63.600	1.070	600				
						1	1.001	62.530	225
						0	1.002	62.530	225
S6	401852.520	182312.354	63.600	1.279	600				
						1	1.002	62.321	225
						0	1.003	62.321	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
POND	401850.107	182321.429	63.600	1.280	1200		1	1.003	62.320	225
S7-HB	401852.961	182331.342	63.600	1.285	1200		1	1.004	62.315	225
S8	401853.406	182332.939	63.600	1.300	600		1	1.005	62.300	150
9_OUT	401853.387	182335.655	63.250	0.975			1	1.006	62.275	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	35	0	0
100	45	0	0

Node S7-HB Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	62.315	Product Number	CTL-SHE-0031-5000-1200-5000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.5	Min Node Diameter (mm)	1200

Node POND Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	62.315
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	72.0	0.0	1.280	265.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	63.648	0.048	6.4	0.0653	0.0000	OK
15 minute winter	S2	12	62.976	0.076	4.4	0.0672	0.0000	OK
15 minute winter	S3	12	62.844	0.044	4.8	0.0201	0.0000	OK
15 minute winter	S4	11	62.813	0.103	16.8	0.1030	0.0000	OK
960 minute winter	S5	930	62.659	0.129	1.7	0.1208	0.0000	OK
960 minute winter	S6	930	62.659	0.338	2.1	0.2487	0.0000	SURCHARGED
960 minute winter	POND	930	62.659	0.339	2.0	33.6671	0.0000	SURCHARGED
960 minute winter	S7-HB	930	62.659	0.344	0.3	0.3890	0.0000	SURCHARGED
15 minute winter	S8	25	62.315	0.015	0.3	0.0041	0.0000	OK
15 minute winter	9_OUT	24	62.289	0.014	0.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S4	6.3	0.742	0.221	0.3082	
15 minute winter	S2	2.000	S3	3.8	0.378	0.106	0.9503	
15 minute winter	S3	2.001	S4	4.5	0.399	0.047	0.1610	
15 minute winter	S4	1.001	S5	16.7	0.867	0.414	0.5727	
960 minute winter	S5	1.002	S6	1.7	0.207	0.041	1.0289	
960 minute winter	S6	1.003	POND	2.0	0.194	0.406	0.3735	
960 minute winter	POND	1.004	S7-HB	0.3	0.066	0.031	0.4103	
960 minute winter	S7-HB	1.005	S8	0.3	0.350	0.019	0.0015	
15 minute winter	S8	1.006	9_OUT	0.3	0.365	0.018	0.0023	4.5

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	63.681	0.081	16.3	0.1099	0.0000	OK
15 minute winter	S2	14	63.059	0.159	11.2	0.1400	0.0000	OK
15 minute winter	S3	12	63.054	0.254	18.6	0.1163	0.0000	OK
15 minute winter	S4	12	63.051	0.341	34.5	0.3405	0.0000	SURCHARGED
960 minute winter	S5	945	63.006	0.476	4.1	0.4463	0.0000	SURCHARGED
960 minute winter	S6	945	63.006	0.685	4.8	0.5043	0.0000	SURCHARGED
960 minute winter	POND	945	63.006	0.686	4.8	86.1673	0.0000	SURCHARGED
960 minute winter	S7-HB	945	63.006	0.691	0.4	0.7818	0.0000	SURCHARGED
960 minute winter	S8	945	62.316	0.016	0.4	0.0046	0.0000	OK
960 minute winter	9_OUT	945	62.291	0.016	0.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S4	16.1	1.045	0.567	0.4765	
15 minute winter	S2	2.000	S3	12.2	0.444	0.341	4.4575	
15 minute winter	S3	2.001	S4	21.0	0.569	0.216	0.7902	
15 minute winter	S4	1.001	S5	32.0	0.942	0.795	1.1839	
960 minute winter	S5	1.002	S6	3.9	0.223	0.095	1.2930	
960 minute winter	S6	1.003	POND	4.8	0.236	0.960	0.3735	
960 minute winter	POND	1.004	S7-HB	0.4	0.081	0.035	0.4103	
960 minute winter	S7-HB	1.005	S8	0.4	0.371	0.023	0.0017	
960 minute winter	S8	1.006	9_OUT	0.4	0.389	0.023	0.0027	22.9

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	13	63.861	0.261	22.8	0.3553	0.0000	SURCHARGED
15 minute winter	S2	12	63.616	0.716	26.4	0.6326	0.0000	FLOOD RISK
15 minute winter	S3	13	63.574	0.774	33.6	0.3546	0.0000	FLOOD RISK
15 minute winter	S4	13	63.574	0.864	47.1	0.8620	0.0000	FLOOD RISK
15 minute winter	S5	12	63.350	0.820	57.8	0.7684	0.0000	FLOOD RISK
1440 minute winter	S6	1410	63.213	0.892	4.4	0.6569	0.0000	SURCHARGED
1440 minute winter	POND	1410	63.213	0.893	4.3	126.1598	0.0000	SURCHARGED
1440 minute winter	S7-HB	1410	63.213	0.898	0.4	1.0161	0.0000	SURCHARGED
1440 minute winter	S8	1410	62.317	0.017	0.4	0.0049	0.0000	OK
1440 minute winter	9_OUT	1410	62.292	0.017	0.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S4	21.8	1.284	0.767	0.6150	
15 minute winter	S2	2.000	S3	16.5	0.443	0.460	6.5617	
15 minute winter	S3	2.001	S4	24.0	0.529	0.248	0.8304	
15 minute winter	S4	1.001	S5	44.2	1.112	1.098	1.1839	
15 minute winter	S5	1.002	S6	60.5	1.522	1.456	1.2930	
1440 minute winter	S6	1.003	POND	4.3	0.214	0.867	0.3735	
1440 minute winter	POND	1.004	S7-HB	0.4	0.050	0.040	0.4103	
1440 minute winter	S7-HB	1.005	S8	0.4	0.383	0.026	0.0019	
1440 minute winter	S8	1.006	9_OUT	0.4	0.402	0.026	0.0030	35.0

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	30	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.035	5.00	64.250	600	401863.101	182285.773	0.650
S2	0.024	5.00	63.700	600	401736.674	182227.290	0.800
S3	0.007	5.00	63.600	600	401818.489	182271.887	0.800
S4	0.039	5.00	63.800	600	401829.777	182275.296	1.090
S5	0.035	5.00	63.600	600	401821.157	182303.790	1.070
S6	0.029	5.00	63.600	600	401852.520	182312.354	1.279
POND			63.600	1200	401850.107	182321.429	1.280
S7-HB			63.600	1200	401852.961	182331.342	1.285
S8			63.600	600	401853.416	182332.939	1.300
9_OUT			63.250		401853.387	182335.655	0.975

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S4	34.932	0.600	63.600	62.710	0.890	39.2	150	5.36	50.0
2.000	S2	S3	93.180	0.600	62.900	62.800	0.100	931.8	300	8.06	50.0
2.001	S3	S4	11.792	0.600	62.800	62.710	0.090	131.0	300	8.21	50.0
1.001	S4	S5	29.769	0.600	62.710	62.530	0.180	165.4	225	8.70	50.0
1.002	S5	S6	32.511	0.600	62.530	62.321	0.209	155.6	225	9.21	50.0
1.003	S6	POND	9.390	0.600	62.321	62.320	0.001	9390.0	225	10.46	50.0
1.004	POND	S7-HB	10.316	0.600	62.320	62.315	0.005	2063.2	225	11.07	50.0
1.005	S7-HB	S8	1.658	0.600	62.315	62.300	0.015	110.5	150	11.10	50.0
1.006	S8	9_OUT	2.716	0.600	62.300	62.275	0.025	108.6	150	11.15	50.0

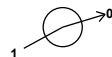
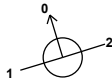
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.611	28.5	4.7	0.500	0.940	0.035	0.0
2.000	0.507	35.8	3.3	0.500	0.500	0.024	0.0
2.001	1.372	97.0	4.2	0.500	0.790	0.031	0.0
1.001	1.014	40.3	14.2	0.865	0.845	0.105	0.0
1.002	1.046	41.6	19.0	0.845	1.054	0.140	0.0
1.003	0.126	5.0	22.9	1.054	1.055	0.169	0.0
1.004	0.279	11.1	22.9	1.055	1.060	0.169	0.0
1.005	0.955	16.9	22.9	1.135	1.150	0.169	0.0
1.006	0.963	17.0	22.9	1.150	0.825	0.169	0.0

Pipeline Schedule

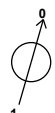
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	34.932	39.2	150	Circular	64.250	63.600	0.500	63.800	62.710	0.940
2.000	93.180	931.8	300	FilterCarrier	63.700	62.900	0.500	63.600	62.800	0.500
2.001	11.792	131.0	300	Circular	63.600	62.800	0.500	63.800	62.710	0.790
1.001	29.769	165.4	225	Circular	63.800	62.710	0.865	63.600	62.530	0.845
1.002	32.511	155.6	225	Circular	63.600	62.530	0.845	63.600	62.321	1.054
1.003	9.390	9390.0	225	Circular	63.600	62.321	1.054	63.600	62.320	1.055
1.004	10.316	2063.2	225	Circular	63.600	62.320	1.055	63.600	62.315	1.060
1.005	1.658	110.5	150	Circular	63.600	62.315	1.135	63.600	62.300	1.150
1.006	2.716	108.6	150	Circular	63.600	62.300	1.150	63.250	62.275	0.825

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	600	Manhole	1 STANDARD	S4	600	Manhole	1 STANDARD
2.000	S2	600	Manhole	1 STANDARD	S3	600	Manhole	1 STANDARD
2.001	S3	600	Manhole	1 STANDARD	S4	600	Manhole	1 STANDARD
1.001	S4	600	Manhole	1 STANDARD	S5	600	Manhole	1 STANDARD
1.002	S5	600	Manhole	1 STANDARD	S6	600	Manhole	1 STANDARD
1.003	S6	600	Manhole	1 STANDARD	POND	1200	Manhole	1 STANDARD
1.004	POND	1200	Manhole	1 STANDARD	S7-HB	1200	Manhole	1 STANDARD
1.005	S7-HB	1200	Manhole	1 STANDARD	S8	600	Manhole	1 STANDARD
1.006	S8	600	Manhole	1 STANDARD	9_OUT		Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	401863.101	182285.773	64.250	0.650	600				
						0	1.000	63.600	150
S2	401736.674	182227.290	63.700	0.800	600				
						0	2.000	62.900	300
S3	401818.489	182271.887	63.600	0.800	600				
						1	2.000	62.800	300
						0	2.001	62.800	300
S4	401829.777	182275.296	63.800	1.090	600				
						1	2.001	62.710	300
						2	1.000	62.710	150
						0	1.001	62.710	225
S5	401821.157	182303.790	63.600	1.070	600				
						1	1.001	62.530	225
						0	1.002	62.530	225
S6	401852.520	182312.354	63.600	1.279	600				
						1	1.002	62.321	225
						0	1.003	62.321	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
POND	401850.107	182321.429	63.600	1.280	1200		1	1.003	62.320	225
S7-HB	401852.961	182331.342	63.600	1.285	1200		1	1.004	62.320	225
							0	1.005	62.315	150
							1	1.006	62.315	150
S8	401853.416	182332.939	63.600	1.300	600		1	1.005	62.300	150
9_OUT	401853.387	182335.655	63.250	0.975		0	1.006	62.300	150	
						1	1.006	62.275	150	

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	35	0	0
100	45	0	0

Node S7-HB Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	62.315	Product Number	CTL-SHE-0031-5000-1200-5000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.5	Min Node Diameter (mm)	1200

Node POND Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	62.315
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	72.0	0.0	1.280	265.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.60%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	63.648	0.048	6.4	0.0653	0.0000	OK
15 minute winter	S2	12	62.976	0.076	4.4	0.0672	0.0000	OK
15 minute winter	S3	12	62.844	0.044	4.8	0.0201	0.0000	OK
15 minute winter	S4	11	62.813	0.103	16.8	0.1030	0.0000	OK
1440 minute winter	S5	1470	62.768	0.238	1.3	0.2231	0.0000	SURCHARGED
1440 minute winter	S6	1500	62.768	0.447	1.5	0.3291	0.0000	SURCHARGED
1440 minute winter	POND	1620	62.768	0.448	1.5	48.2142	0.0000	SURCHARGED
1440 minute winter	S7-HB	1530	62.768	0.453	0.0	0.5128	0.0000	SURCHARGED
1440 minute winter	S8	1650	62.768	0.468	0.0	0.1325	0.0000	SURCHARGED
15 minute summer	9_OUT	1	125.449	63.174	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S4	6.3	0.742	0.221	0.3082	
15 minute winter	S2	2.000	S3	3.8	0.378	0.106	0.9503	
15 minute winter	S3	2.001	S4	4.5	0.399	0.047	0.1610	
15 minute winter	S4	1.001	S5	16.7	0.867	0.414	0.5727	
1440 minute winter	S5	1.002	S6	1.2	0.173	0.029	1.2930	
1440 minute winter	S6	1.003	POND	1.5	0.171	0.295	0.3735	
1440 minute winter	POND	1.004	S7-HB	0.0	0.052	0.004	0.4103	
1440 minute winter	S7-HB	1.005	S8	0.0	0.086	0.002	0.0292	
1440 minute winter	S8	1.006	9_OUT	0.0	0.000	0.000	0.0478	0.0

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 97.60%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	63.681	0.081	16.3	0.1099	0.0000	OK
1440 minute winter	S2	1560	63.114	0.214	0.5	0.1891	0.0000	OK
1440 minute winter	S3	1530	63.114	0.314	0.7	0.1438	0.0000	SURCHARGED
1440 minute winter	S4	1530	63.114	0.404	2.3	0.4032	0.0000	SURCHARGED
1440 minute winter	S5	1620	63.114	0.584	2.9	0.5471	0.0000	SURCHARGED
1440 minute winter	S6	1620	63.114	0.793	3.5	0.5836	0.0000	SURCHARGED
1440 minute winter	POND	1680	63.114	0.794	3.4	106.1342	0.0000	SURCHARGED
1440 minute winter	S7-HB	1650	63.114	0.799	0.1	0.9036	0.0000	SURCHARGED
1440 minute winter	S8	1650	63.114	0.814	0.0	0.2304	0.0000	SURCHARGED
15 minute summer	9_OUT	1	125.449	63.174	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S4	16.1	1.045	0.567	0.4765	
1440 minute winter	S2	2.000	S3	0.5	0.191	0.015	5.7871	
1440 minute winter	S3	2.001	S4	0.7	0.202	0.007	0.8304	
1440 minute winter	S4	1.001	S5	2.1	0.413	0.052	1.1839	
1440 minute winter	S5	1.002	S6	2.9	0.176	0.069	1.2930	
1440 minute winter	S6	1.003	POND	3.4	0.204	0.684	0.3735	
1440 minute winter	POND	1.004	S7-HB	0.1	0.051	0.007	0.4103	
1440 minute winter	S7-HB	1.005	S8	0.0	0.110	0.002	0.0292	
1440 minute winter	S8	1.006	9_OUT	0.0	0.000	0.000	0.0478	0.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.60%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	13	63.861	0.261	22.8	0.3553	0.0000	SURCHARGED
15 minute winter	S2	12	63.616	0.716	26.4	0.6326	0.0000	FLOOD RISK
15 minute winter	S3	13	63.574	0.774	33.6	0.3546	0.0000	FLOOD RISK
15 minute winter	S4	13	63.574	0.864	47.1	0.8620	0.0000	FLOOD RISK
15 minute winter	S5	12	63.350	0.820	57.8	0.7684	0.0000	FLOOD RISK
1440 minute winter	S6	1680	63.331	1.010	4.3	0.7431	0.0000	FLOOD RISK
1440 minute winter	POND	1650	63.331	1.011	4.3	151.6293	0.0000	FLOOD RISK
1440 minute winter	S7-HB	1560	63.331	1.016	0.1	1.1488	0.0000	FLOOD RISK
1440 minute winter	S8	1590	63.331	1.031	0.0	0.2917	0.0000	FLOOD RISK
15 minute summer	9_OUT	1	125.449	63.174	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S4	21.8	1.284	0.767	0.6150	
15 minute winter	S2	2.000	S3	16.5	0.443	0.460	6.5617	
15 minute winter	S3	2.001	S4	24.0	0.529	0.248	0.8304	
15 minute winter	S4	1.001	S5	44.2	1.112	1.098	1.1839	
15 minute winter	S5	1.002	S6	60.5	1.522	1.456	1.2930	
1440 minute winter	S6	1.003	POND	4.3	0.214	0.862	0.3735	
1440 minute winter	POND	1.004	S7-HB	0.1	0.050	0.008	0.4103	
1440 minute winter	S7-HB	1.005	S8	0.0	0.109	0.002	0.0292	
1440 minute winter	S8	1.006	9_OUT	0.0	0.000	0.000	0.0478	0.0