H+H Drainage

Tremayne, Mortimer's Cross, Herefordshire HR6 9TG
Phone: 0845 2008421. Mobile: 07837 628764

Surface Water Drainage Strategy

The Proposed Dwelling at Wye Stud Farm, Hollow Farm Road, Dinedor Herefordshire HR2 6PE

6th July 2023

Prepared by Alex Taysum-Hunter

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SUMMARY OF REPORT

The purpose of the work is to demonstrate that surface water drainage arrangements comply with Core Strategy of Herefordshire County Council, Natural England and National Planning Policy Framework.

The site is located within the River Wye Catchment SAC (The White Zone). The River Wye is a Special Area of Conservation (SAC). SAC's are amongst the most important and sensitive sites across the European Union and are afforded the highest levels of protection under the Habitat Regulations.

The River Wye SAC is in place to maintain or, where necessary, restore the river to high ecological status, including its largely unmodified and undisturbed physical character, so that all of its special features are able to sustain themselves in the long-term as part of a naturally functioning ecosystem.

Allowing the natural processes of erosion and deposition to operate without undue interference and maintaining or restoring connectivity maintains the physical river habitat, which forms the foundation for this ecosystem. The quality and quantity of water, including natural flow variability, and the quality of adjacent habitats are maintained or restored to a level necessary to maintain the features in favourable condition for the foreseeable future.

The presence of the River Wye SAC and its special wildlife enhances the economic and social values of the area by providing a high-quality environment for ecotourism, outdoor activities and peaceful enjoyment by local people and visitors. The river catchment's functions of controlling flooding and supplying clean water are recognised and promoted through appropriate land management. The river is a focus for education to promote increased understanding of its biodiversity and the essential life support functions of its ecosystems.

The key outcomes of the work are to ensure that surface water from the proposed development do not have an adverse effect on the River Wye SAC or the surrounding area.

This report outlines the design of the surface water strategy, including attenuation and soak-aways.

Surface water runoff is to be managed by the methods outlined in the Surface Water Drainage Strategy.

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Site Location and conditions

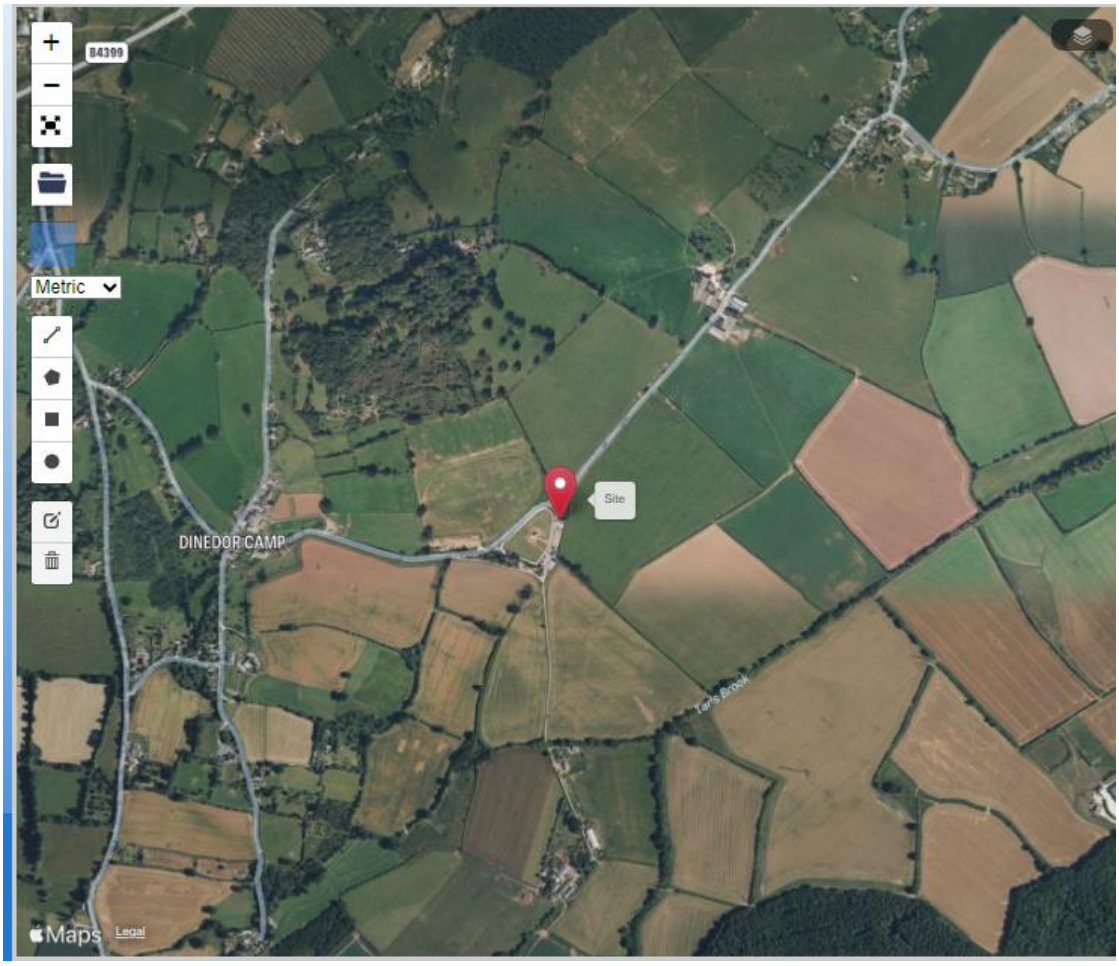
Wye Stud Farm, Hollow Farm Road, Dinedor, Herefordshire HR2 6PE

SO 52684 35885

X (Easting): 352684
Y(Northing): 235885

Latitude: 52.019361
Longitude: -2.6909291

What3words: sofas.sleep.powder



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As can be seen below, there is no record of fluvial flooding at this site.

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The following plan shows that there is no surface water flooding at this site.

This site is located within a Nitrate Vulnerable Zone (NVZ).

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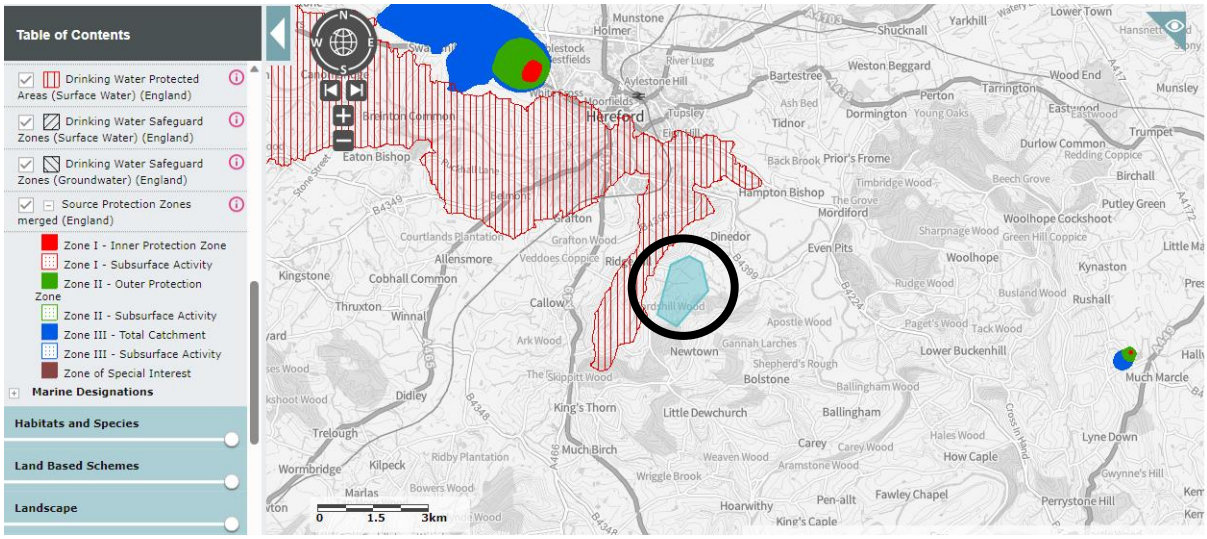
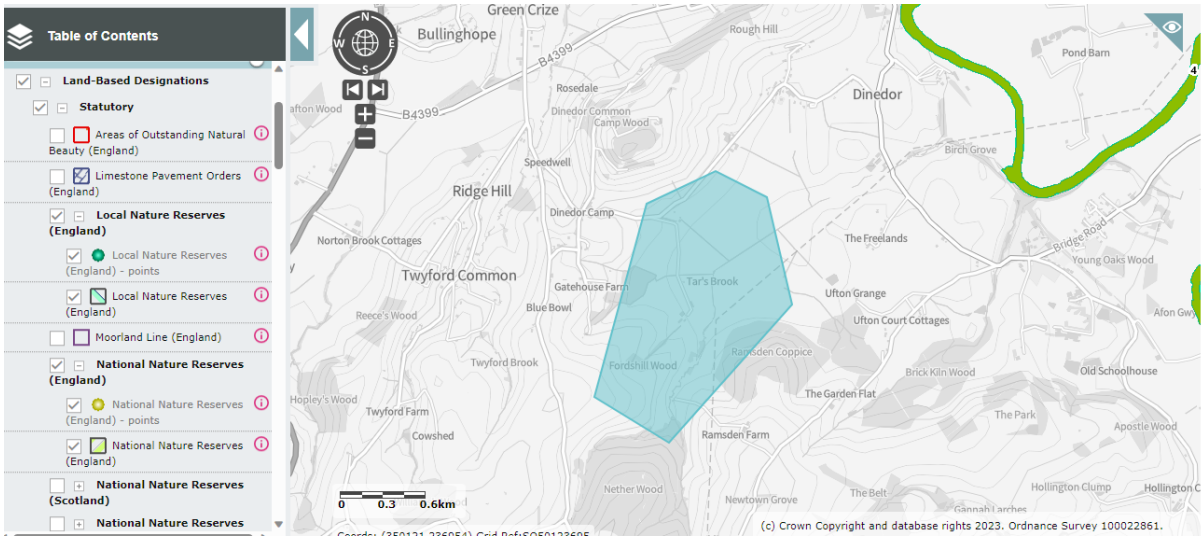
As can be seen below, there are no SPZ1 or SPZ2 designations within 3km of this site.



In addition, we can confirm that there are no Designated Areas within 500m of this Small Sewage Discharge (SSD).



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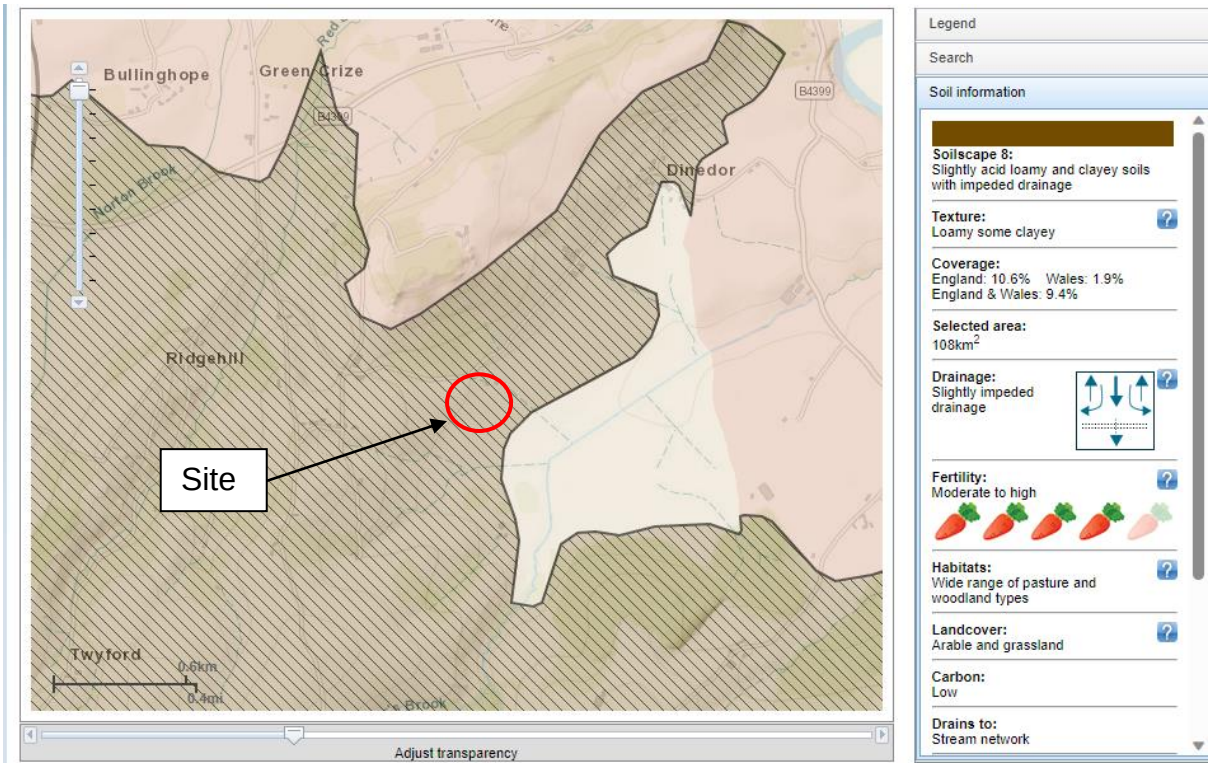
The following Soilscape Mapping provided by Cranfield University on behalf of DEFRA shows that the site of the proposed development falls on HOST soil class 8, which is described as *"Slightly acid loamy and clayey soils with impeded drainage*".



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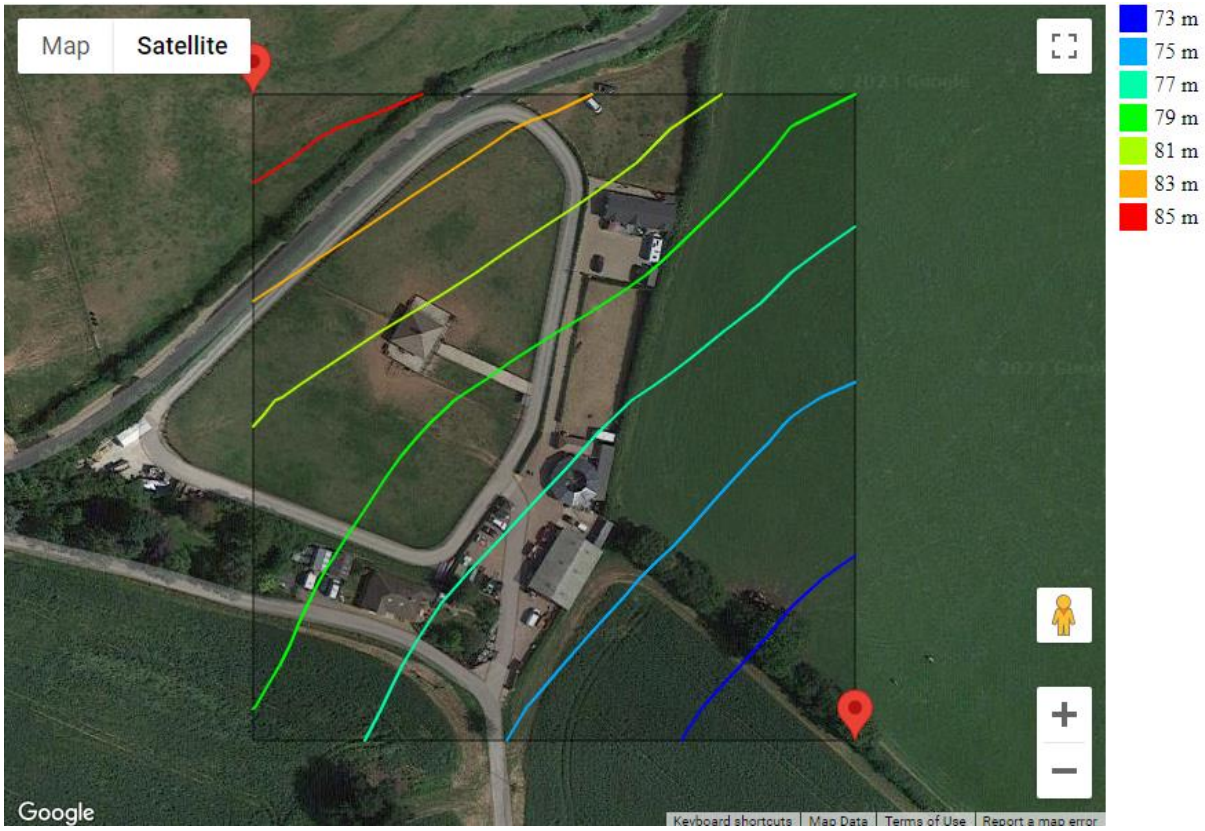
As can be seen below, the test area is sloping to the Southeast, towards the local watercourse network.



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Ground testing and on-site investigation

Site investigations were undertaken on the 21st June 2023. As noted in the recent report, dated 22nd June 2023, the infiltration test hole failed to drain:

Ref: Proposed Stud Manager's Dwelling – Wye Stud Farm, Dinedor, Hereford HR2 6PE

As requested, we have carried out a percolation test although it was abandoned after 4 and a half hours. The water level didn't appear to drop at all in the first 4 and a half hours and some 18 hrs after the test commenced, the water level had only dropped approximately 25mm.

A trial pit of 0.45m wide x1.5m long x 1.5m deep was formed on Wednesday 21st June 2023. The percolation test commenced the same day and was left over night and observed in the morning. There was no rainfall during the test. We had no preconceived view on how the test would go, but were mindful that another area of Dinedor had failed percolation tests. This may be why the existing chalet discharges into Tar's Brook.

We inspected the trial pit prior to the test being undertaken and confirm it was 1.5m deep with clean, straight sides and the ends were still to be tidied up. A screw was placed in the post 225mm (25% of the effective depth) up from the bottom of the trail pit and another 675mm (75% of the effective depth) up from the bottom of the trail pit. The trail pit was filled to the 675mm level because we were unsure that if we filled the trial pit to the level of the effective depth, it would be days, if not weeks before it would drop to the 675mm level where the timings are to start. This was an experimental strategy, which proved to be the correct strategy.

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Photo of trial pit prior to water

Photo of trial pit as excavated and showing the water level at the 75% of effective depth level.

Photo of trial pit water level some 4.5 hrs after the start of the test.

Photo of trial pit water level some 18 hrs after the start of the test.

We instructed the test to be formerly abandoned after 4 and a half hours due to the zero drop in water level and it was clear that the water would not drop the required 450mm in the 12hr period.

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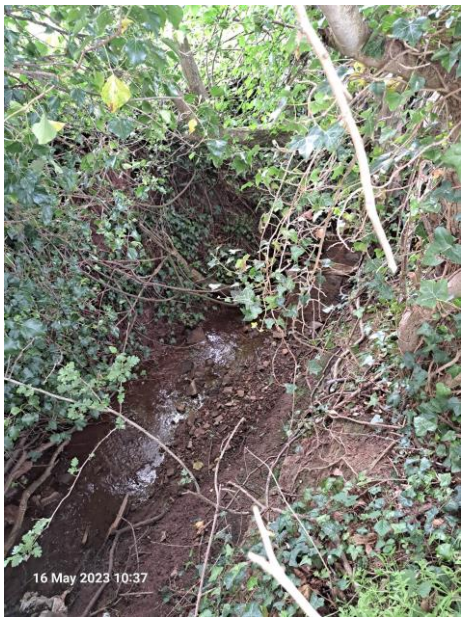
As noted in the recent foul drainage report, dated 4th June 2023, the Tar's Brook borders the property.As can be seen below, the Tar's Brook is a permanent watercourse.



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As can be seen below, the Tar's Brook borders the property on two sides:

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Surface Water Design

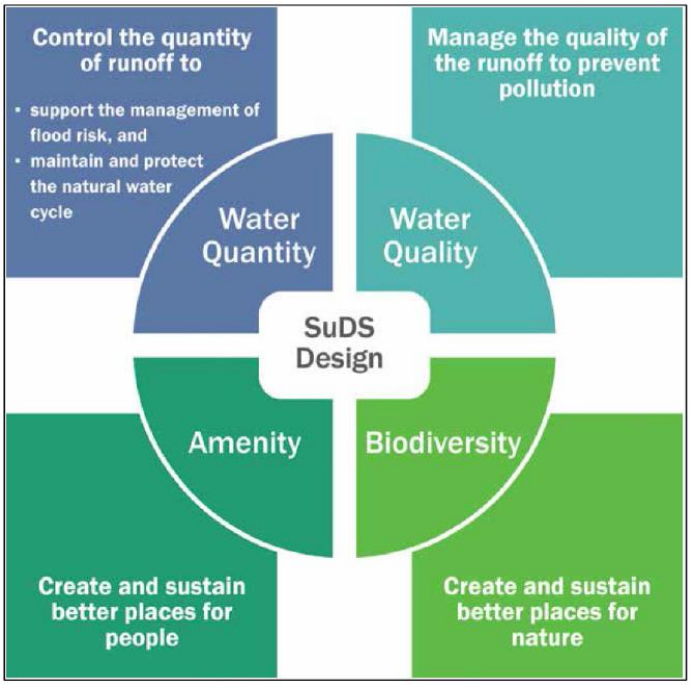
The primary concerns of any proposed surface water management are laid out in SuDS and should be considered to ensure minimal impact to the surrounding area.

Sustainable (urban) Drainage Systems

To satisfy the requirements of current best national surface water management guidance, SuDS are required to manage, attenuate and treat surface water runoff before discharging from the site.

Current best practice guidance relating to sustainable surface water management is outlined in the SuDS Manual (CIRIA, 2015) which provides details on the use of SuDS for managing surface water runoff.

There are four main categories of SuDS which are referred to as the 'four pillars of SuDS design' as shown below:



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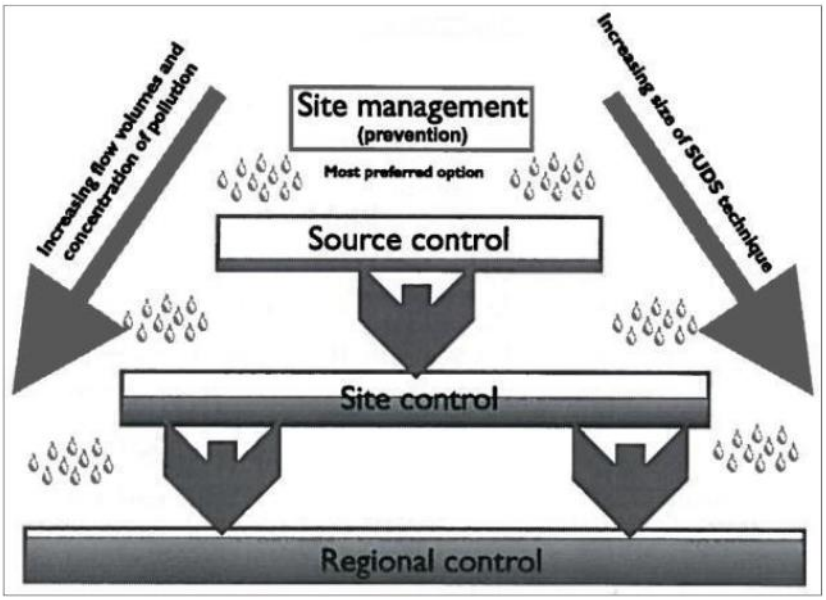
The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train':



SuDS Management Train

1. **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
2. **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting, permeable paving and green roofs).
3. **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one / several soakaways, below ground storage units or attenuation ponds for the whole site).
4. **Regional Control** – management of runoff from several sites, typically in a retention pond or wetland.

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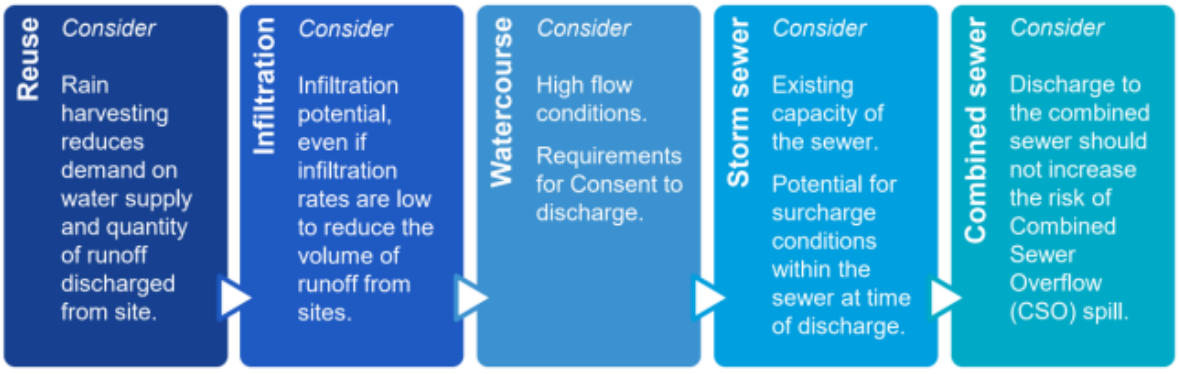
It is generally accepted that the implementation of SuDS as opposed to conventional drainage systems, provides a number of benefits by:

1. Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
2. Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
3. Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
4. Reducing potable water demand through rainwater harvesting;
5. Improving amenity through the provision of public open spaces and providing biodiversity and wildlife habitat enhancements; and
6. Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

Proposed Surface Water Discharge Location(s)
In accordance with CIRIA Report C753, the hierarchy of preferred disposal options for surface water runoff from development sites is as follows:

1. Infiltration to Ground;
2. Discharge to Surface Waters; or
3. Discharge to Sewer.

Wherever possible, this Drainage Hierarchy must be employed in an effort to reduce run-off and localised flooding:



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As demonstrated by the previous report, the local soils will not support a surface water soak-away. As such, the roof water from the proposed dwelling should be discharged to the local permanent watercourse.

The discharge of surface water to this local watercourse and the watercourse network is in line with the Drainage Hierarchy. However, it is imperative that any such discharges must be attenuated and managed to discharge at no more than Green Field Run Off rate.

With reference to CIRIA C753, post development surface water runoff generated by the site (via building roofs, access roads and external car parking areas) is considered to have a 'very low' to 'low' *Pollution Hazard Level* as set out below:

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		Total Suspended Solids (TSS)	*Metals*	*Hydro-Carbons*
Residential Roofs	Very Low	0.2	0.2	0.05
Residential Car Parks	Low	0.5	0.4	0.4

Due to the low pollution hazard, we do not consider roof water pollution to be a risk to the local environment.

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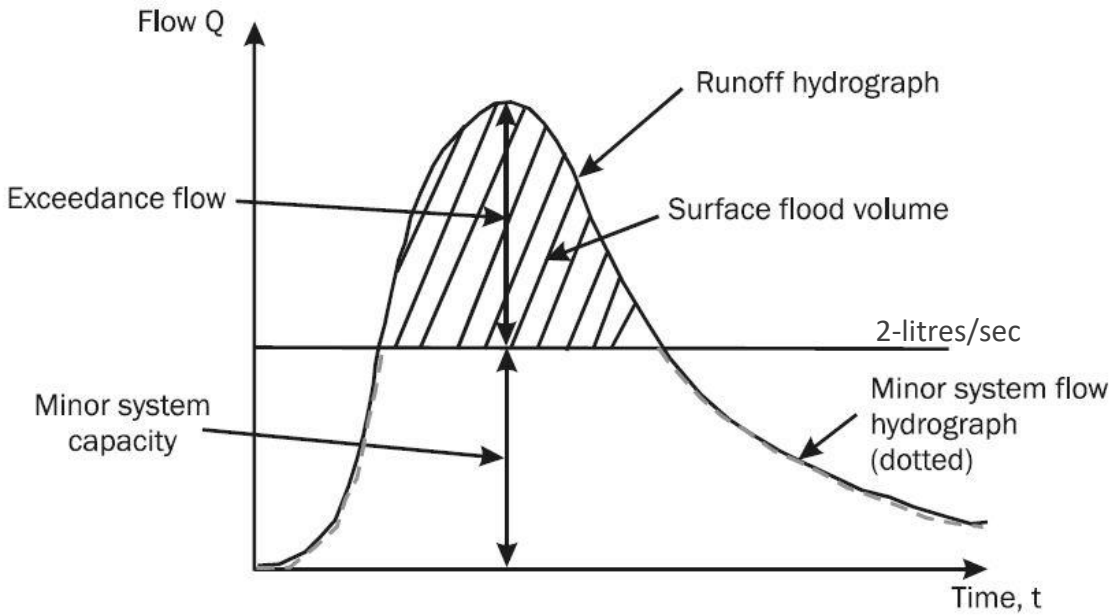
Attenuation:

The proposed development is for a new dwelling with an impermeable roof area of 274m^2. Therefore, the proposed surface water drainage system must be designed for a total impermeable area of 274m^2.

Any discharge to the local watercourse must be made at less than Greenfield run-off rate. Therefore, in order to comply with local and national guidelines, surface water discharges must be attenuated and managed to less than 2-litres/second (Greenfield Run-off).

The following calculation sheet demonstrates that a flow management system, with a managed outflow of 2-litres/second (greenfield run off) would require a minimum of 8.99m^3 of attenuation when allowing an additional 40% for climate change and for a 1 in 100-year storm event.

As noted, the discharged surface water must then be managed to 2-litres/second. As demonstrated below, this attenuation will reduce the potential exceedance flow (surface water flooding).



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I ♥ SEWAGE.co.uk		**Wye Stud Farm proposed dwelling roof**		Revision	
		Job No:		Page:	**C/01**
Section:	**Attenuation**	Prepared By:	**Alex Hunter**	Date:	**04/07/2023**

GENERAL DATA	
site location:	**England and Wales**
60 min rainfall depth of 5 year return period 'R' *[mm]* =	**20**
M5-60 to M5-2d rainfall ratio 'r' =	**0.50**
proposed discharge rate 'v_1' *[litre/s]* =	**2.00**
proposed discharge rate 'v_2' *[litre/s]* =	**5.00**
allowance for climate change:	**40%**

SUMMARY OF CALCULATIONS		
required storage volume for discharge rate 'v_1' =	**8.99**	m^3
required storage volume for discharge rate 'v_2' =	**5.26**	m^3

AREA DATA		impermeability *[%]*	effective area *[m^2]*
impermeable area 'A_1' *[m^2]* =	**274**	100.00	274
landscaping and/or green roof area 'A_2' *[m^2]* =	**0**	**80.00**	0
other partially permeable area 'A_3' *[m^2]* =	**0**	**20.00**	0
AREA DRAINED TO ATTENUATION TANK =	**274 m^2**		

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_1

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M50-D Z2	M50-D rainfalls *[mm]*	M50-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from attenuation tank *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	3.61	1.61	17.59	4.82	1.86	20.28	5.56	0.60	4.96
10	0.54	10.80	1.22	18.49	5.07	1.66	25.07	6.87	1.92	29.07	7.97	1.20	6.77
15	0.65	13.00	1.23	22.42	6.14	1.68	30.58	8.38	1.96	35.64	9.76	1.80	7.96
30	0.82	16.40	1.24	28.47	7.80	1.71	39.22	10.75	2.00	45.95	12.59	3.60	**8.99**
60	1.00	20.00	1.24	34.72	9.51	1.73	48.44	13.27	2.03	56.84	15.57	7.20	8.37
120	1.19	23.80	1.24	41.32	11.32	1.72	57.39	15.72	2.01	67.13	18.39	14.40	3.99
240	1.38	27.60	1.23	47.51	13.02	1.71	66.06	18.10	1.99	76.86	21.06	28.80	0.00
360	1.51	30.20	1.22	51.56	14.13	1.70	71.83	19.68	1.97	83.22	22.80	43.20	0.00
600	1.68	33.60	1.21	56.88	15.59	1.68	78.95	21.63	1.94	91.31	25.02	72.00	0.00
1440	2.03	40.60	1.19	67.57	18.51	1.64	93.01	25.49	1.89	107.15	29.36	172.80	0.00

** Z2 is a growth factor from M5 rainfalls*

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_2

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M30-D Z2	M30-D rainfalls *[mm]*	M30-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from attenuation tank *[m^3]*	required storage *[m^3]*
5	0.39	7.80	1.21	13.18	3.61	1.46	15.97	4.37	1.86	20.28	5.56	1.50	4.06
10	0.54	10.80	1.22	18.49	5.07	1.50	22.62	6.20	1.92	29.07	7.97	3.00	4.97
15	0.65	13.00	1.23	22.42	6.14	1.51	27.52	7.54	1.96	35.64	9.76	4.50	**5.26**
30	0.82	16.40	1.24	28.47	7.80	1.53	35.16	9.63	2.00	45.95	12.59	9.00	3.59
60	1.00	20.00	1.24	34.72	9.51	1.54	43.21	11.84	2.03	56.84	15.57	18.00	0.00
120	1.19	23.80	1.24	41.32	11.32	1.54	51.17	14.02	2.01	67.13	18.39	36.00	0.00
240	1.38	27.60	1.23	47.51	13.02	1.52	58.85	16.12	1.99	76.86	21.06	72.00	0.00
360	1.51	30.20	1.22	51.56	14.13	1.51	63.94	17.52	1.97	83.22	22.80	108.00	0.00
600	1.68	33.60	1.21	56.88	15.59	1.50	70.40	19.29	1.94	91.31	25.02	180.00	0.00
1440	2.03	40.60	1.19	67.57	18.51	1.46	83.21	22.80	1.89	107.15	29.36	432.00	0.00

** Z2 is a growth factor from M5 rainfalls*

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With the previous information in mind, and as demonstrated by the on-site infiltration testing, the local soils in the test area are unlikely to facilitate any infiltration, any minor infiltration would be limited.

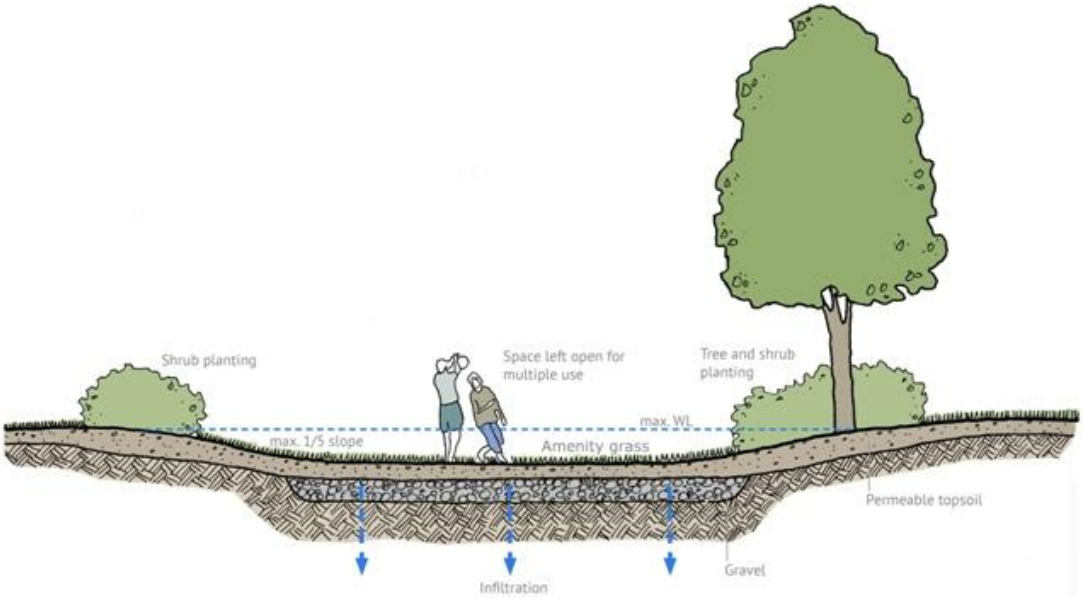
Noting that the test area is pasture, it would be beneficial to the local environment to install an attenuation basin. Such a basin will provide at least $9m^3$ of attenuation without the expense of tankage or attenuation crates. In addition, the attenuation basin will continue to be managed as pasture for horses.

As can be seen in the previous calculation data spreadsheet, the required attenuation basin must be at least $9m^3$. However, the basin must be accessible for horses and agricultural machinery.

With this in mind, a shallow attenuation basin would need to be at least 500mm deep and 3m wide x 6m long in size (base dimensions) with gently sloping sides of gradient 1:5 or less.

The following diagram shows that the attenuation basin will be installed with gently sloping sides of gradient 1:5 or less.

The infiltration basin is primarily a dry basin or deprssion designed to promote infitlration into the ground. Plants (grass) in the infiltration basin should be able to withstand periods of ponding and dry periods.



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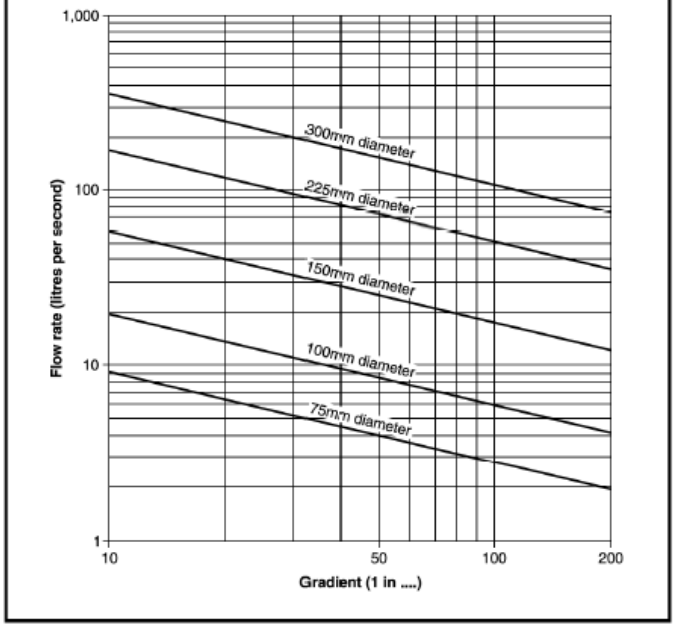
Flow Management

The attenuation pond will be excavated in order to present at least 9m^3 of attenuation. The attenuated surface water would then be managed to a maximum flow rate of 2-litres/second.

Downstream of the attenuation pond, a section of smaller diameter drain should be installed. As can be seen from the following extract from Building Regulations, a 75mm diameter drain laid at a gradient of 1:200 has full discharge capacity of less than 2-litres/second.

Therefore, by installing an outfall drain of 75mm diameter at a gradient of 1:200, the managed flow rate can be achieved without the installation of a flow management chamber.

Diagram 3 **Discharge capacities of rainwater drains running full**



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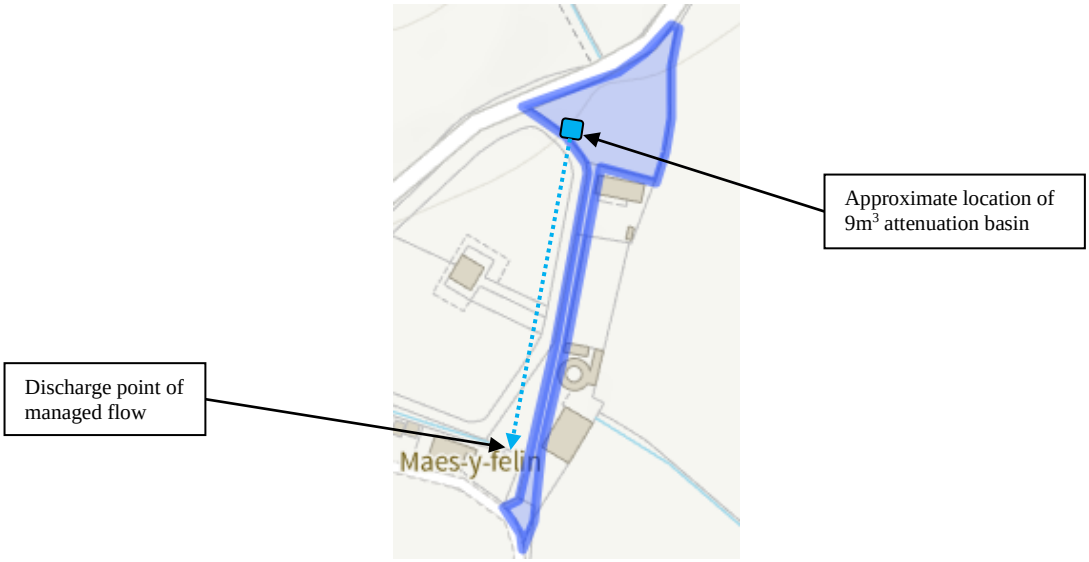
The proposed attenuation basin will reduce both localised flooding and potential run-off pollution. In addition, there are ecological benefits to local environment. The proposed attenuation pond will encourage a diversity of plant and wildlife, but the attenuated flow will also balance the flow in the local watercourse; as such, it is likely that any minor flood events will be reduced which will be beneficial to invertebrates and other small animals.

The following picture shows a simple infiltration basin in an urban area:

The managed flow will be discharged to the Tar's Brook.



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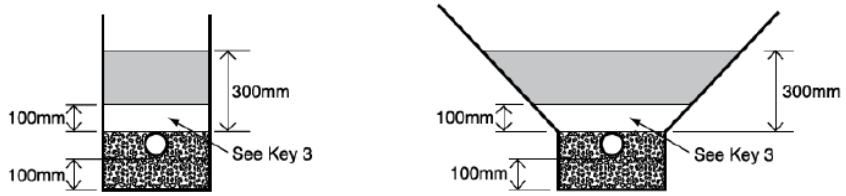
All new underground pipework will be installed in line with Building Regulations Part H2. All new drains will be laid in BSEN1401 110mm diameter uPVC pipework:

b) Flexible pipes



Detail for vee trench

Key

1 Selected fill: free from stones larger than 40mm, lumps of clay over 100mm, timber, frozen material, vegetable matter.

2 Granular material – For rigid pipes the granular material should conform to BS EN 1610 Annex B Table B.15 and should be single size material or graded material from 5mm up to a maximum size of 10mm for 100mm pipes, 14mm for 150mm pipes, 20mm for pipes from 150mm up to 600mm diameter and 40mm for pipes more than 600mm diameter. Compaction fraction maximum 0.3 for class N or B and 0.15 for class F.

3 Selected fill or granular fill free from stones larger than 40mm.

In addition, the surface water drainage will include inspection chambers at 30m intervals and at intersections and changes-of-direction, in line with Building Regulations Part H. All domestic inspection chambers within the development will be pre-formed uPVC and will comply with BSEN7158:

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Surface Water Disposal Conclusion.

Considering SuDS and the specifics of this site, and after completing the necessary infiltration tests and on-site observations, we can confirm that the resulting roof water must be attenuated and discharged to the local watercourse network.

The proposed surface water drainage system will consist of the following:

- Roof water from the dwelling will be discharged via rainwater goods and underground pipework conforming to Building Regulations Part H.
- The resulting surface water flow will be piped by means of underground pipework to a new attenuation basin.
- The new attenuation basin will have a base size of at least $9m^3$.
- The attenuation basin will be 0.5m deep with sloping sides no steeper than 1 in 5.
- The attenuation basin will have a single outfall drain with a headwall arrangement.
- The outfall drain will be 75mm in diameter so as to manage flow to no more than 2-litres/second.
- The outfall drain will be extended to the local watercourse (The Tar's Brook).
- An anti-vermin flap valve will be fitted to the end of the outfall drain.
- All new surface water drainage features will be maintained as shown in the following table and highlighted in green.

H+H Drainage

Tremayne, Mortimer's Cross, Herefordshire HR6 9TG
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SuDS/Drainage Maintenance Actions:

Drainage Feature	Required Action	Frequency
Access chambers, catchpits, silt traps, gullies and headwalls.	Remove weeds. Assess condition and repair if required. Remove debris/silt.	Monthly. After heavy storm events.
Flow Management Chamber	Assess condition and repair if required. Remove debris/silt. Check operation.	Monthly. After heavy storm events.
Outfall	Assess condition and repair if required. Remove debris/silt.	Monthly. After heavy storm events.
Soak-away	Visual check of the surrounding area.	Monthly.
Rainwater Harvester	Assess condition and repair is required. Remove debris & clean inlet filter. Manufacturer-recommended maintenance visit	Monthly. Monthly. Yearly.
Rainwater goods	Assess condition and repair. Clean gutters.	Monthly. Yearly / as required.
Infiltration Basin	Assess condition and repair if required. Cut / mow plants if required. Remove debris/silt.	Monthly Yearly / as required.
Attenuation Basin	Assess condition and repair if required. Cut / mow plants if required. Remove debris/silt.	Monthly Yearly / as required.
Permeable Hardstandings	Assess condition and repair if required. Remove weeds and debris.	Monthly Yearly / as required.