

H+H Drainage

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

Surface & Foul Water Drainage Strategy

Long Nursery Coppice,
New Radnor,
Powys, LD8 2RE

5th February 2024

Prepared by Alex Taysum-Hunter



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SUMMARY OF REPORT

The purpose of the work is to demonstrate that foul water drainage arrangements comply with Core Strategy of Powys County Council, Natural Resources Wales and National Planning Policy Framework.

The site is located within the River Wye Catchment. 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.

As can be seen in the following map, the site lies within the River Lugg Sub-Catchment.

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

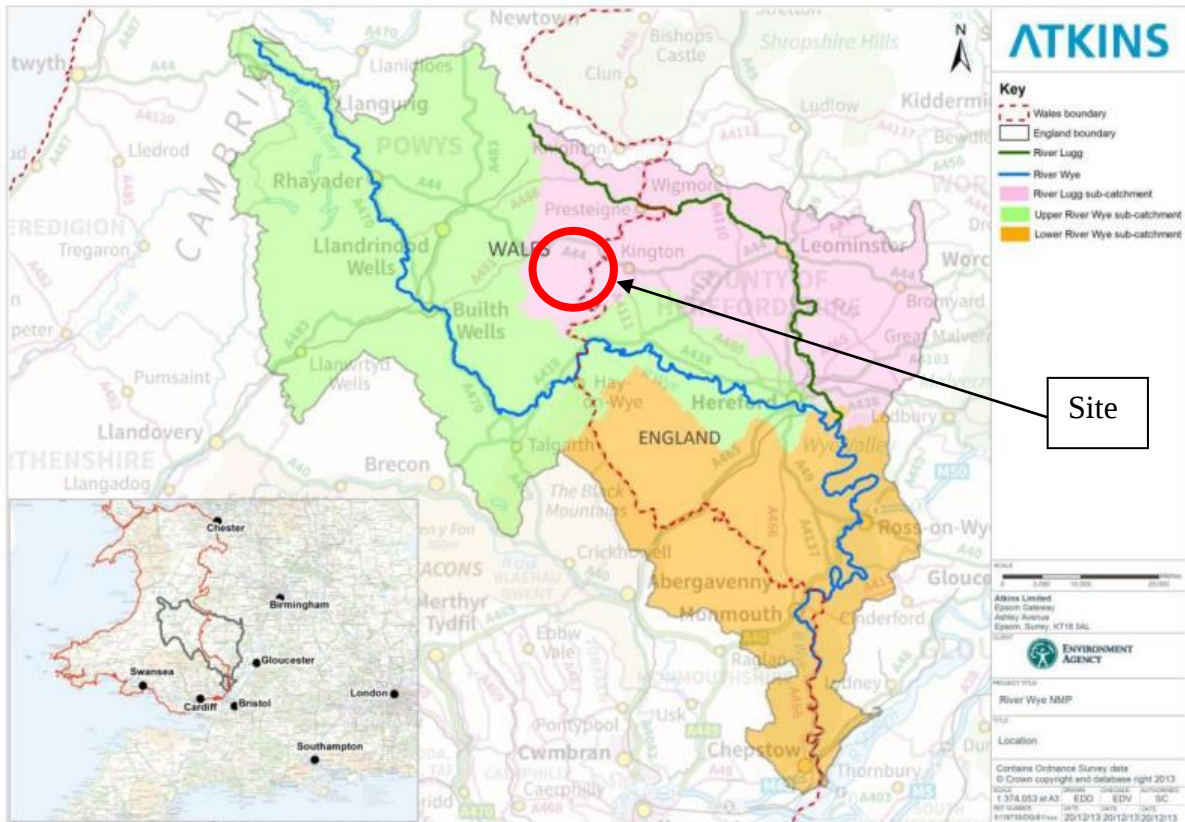
This report outlines the design of the surface water and foul drainage systems including packaged sewage treatment plants, drainage fields and soak-aways.



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Site Location and conditions

Long Nursery Coppice, New Radnor, Powys, LD8 2RE

SO 22329 60025

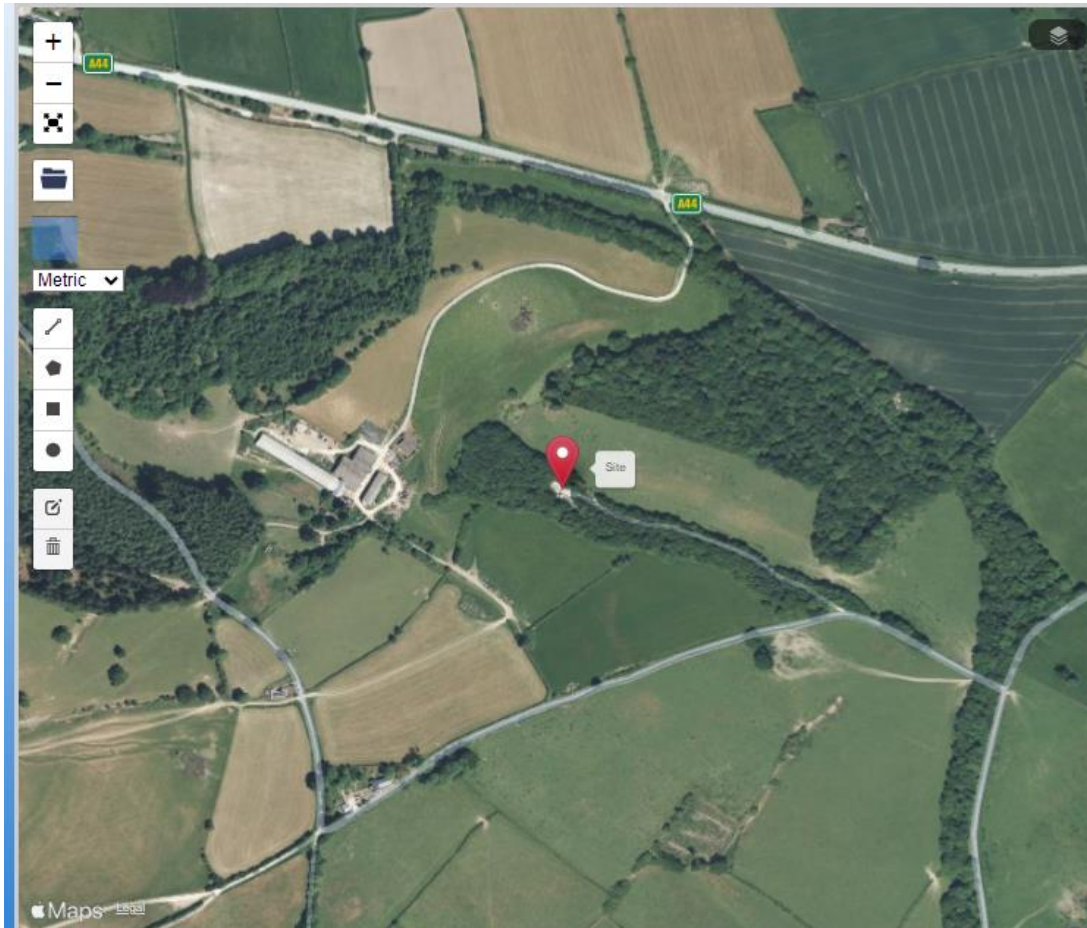
X (Easting): 322329

Y(Northing): 260025

Latitude: 52.232921

Longitude: -3.1387102

What3words: tonight.performed.amending



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



Neither fluvial flooding nor surface water flooding effect this site due to the topography of the site and the surrounding area.

The site is NOT located within the Nitrate Vulnerable Zone (NVZ).



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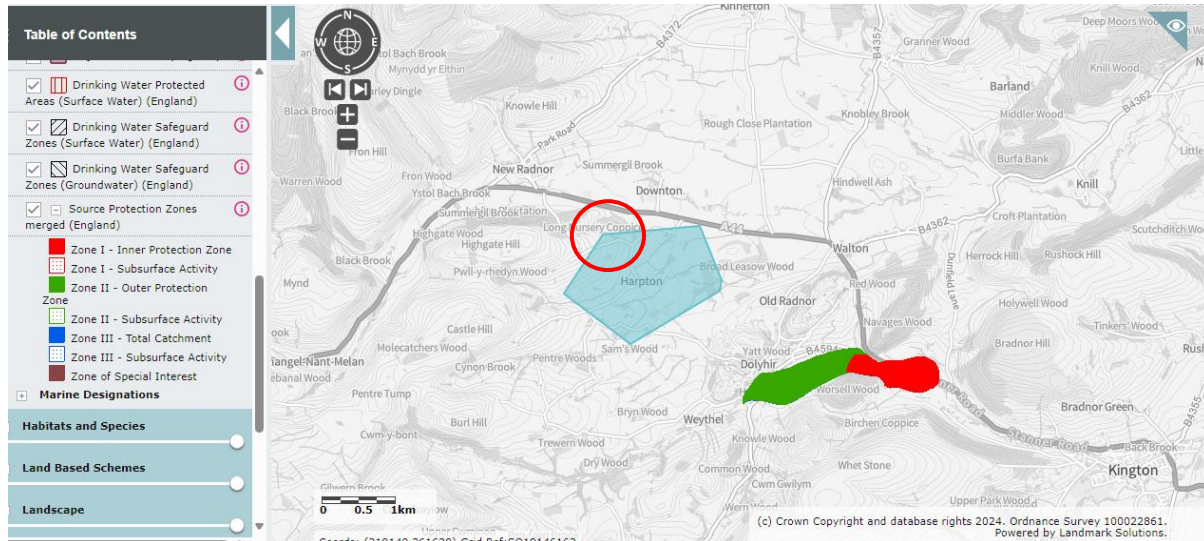
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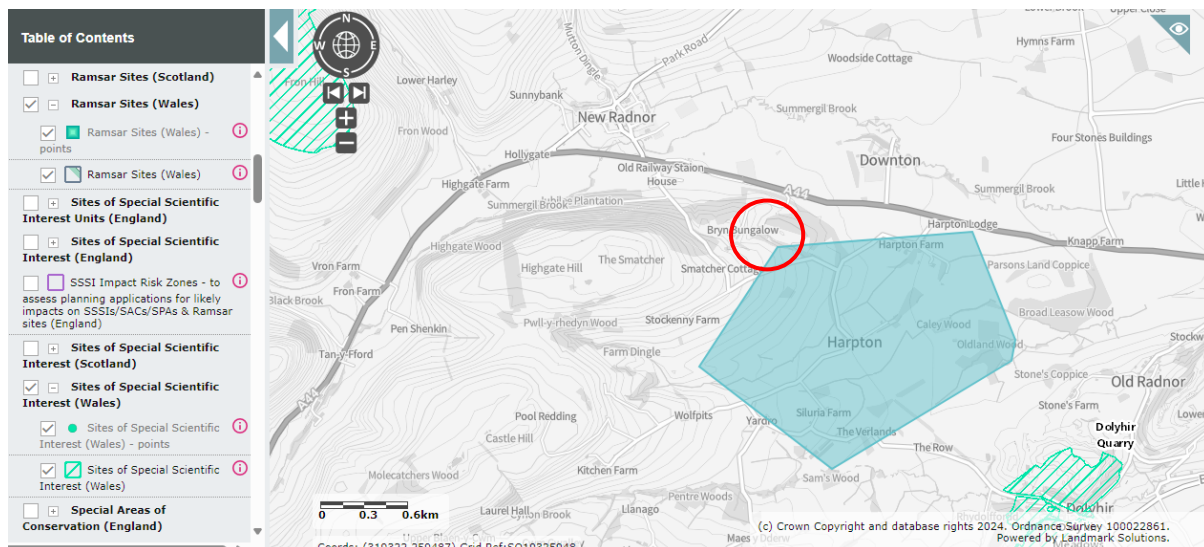
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As can be seen below, the site is located more than 2km away from the nearest Source Protection Zone 1 (SPZ1).



As can be seen below, there are no Designated Areas or Priority Habitats within 500m of this site.



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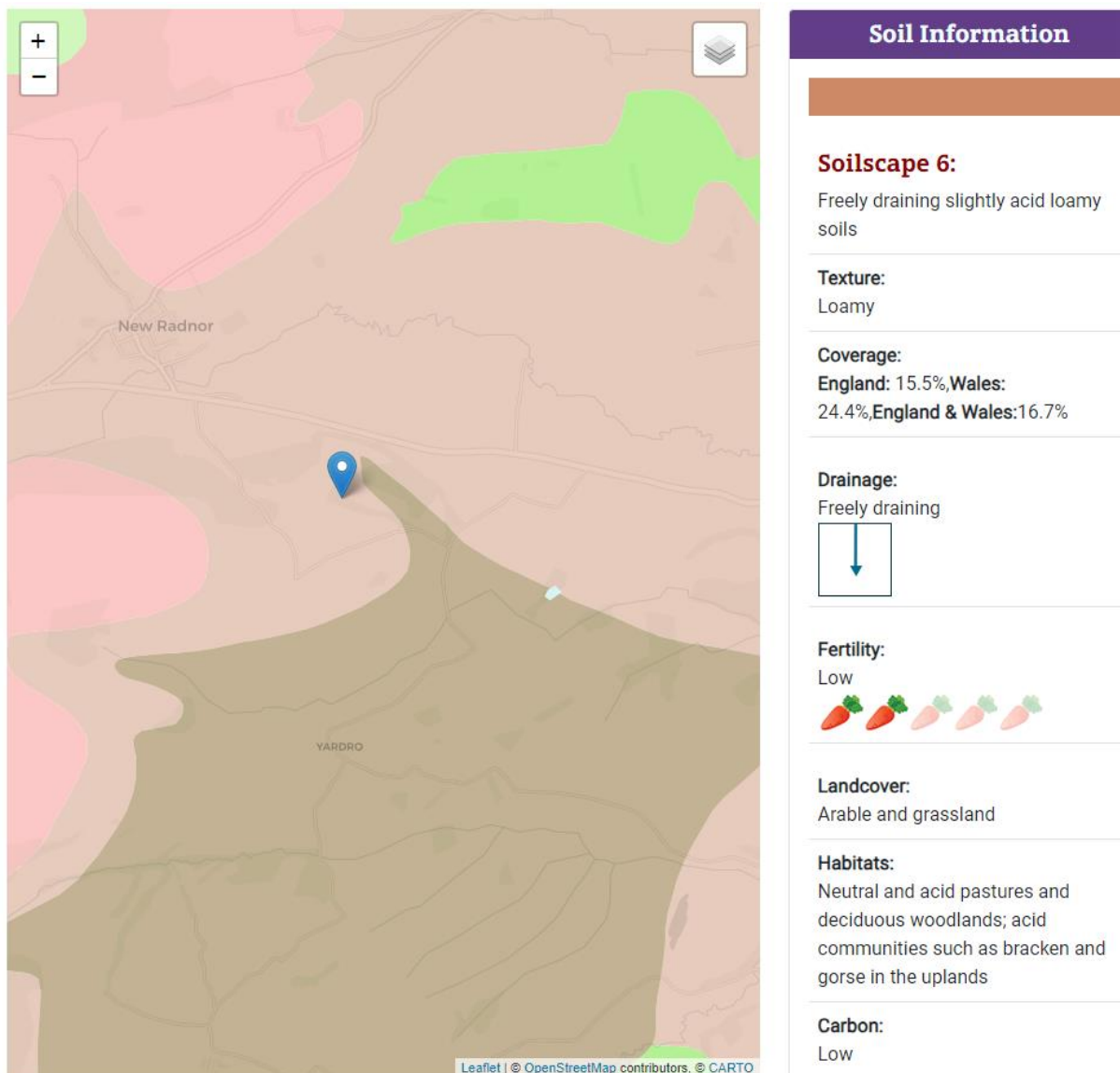
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The following Soilscape Mapping provided by Cranfield University on behalf of DEFRA shows that the site of the proposed development falls on HOST soil class 6, which is described as "*Freely draining slightly acid loamy soils*".



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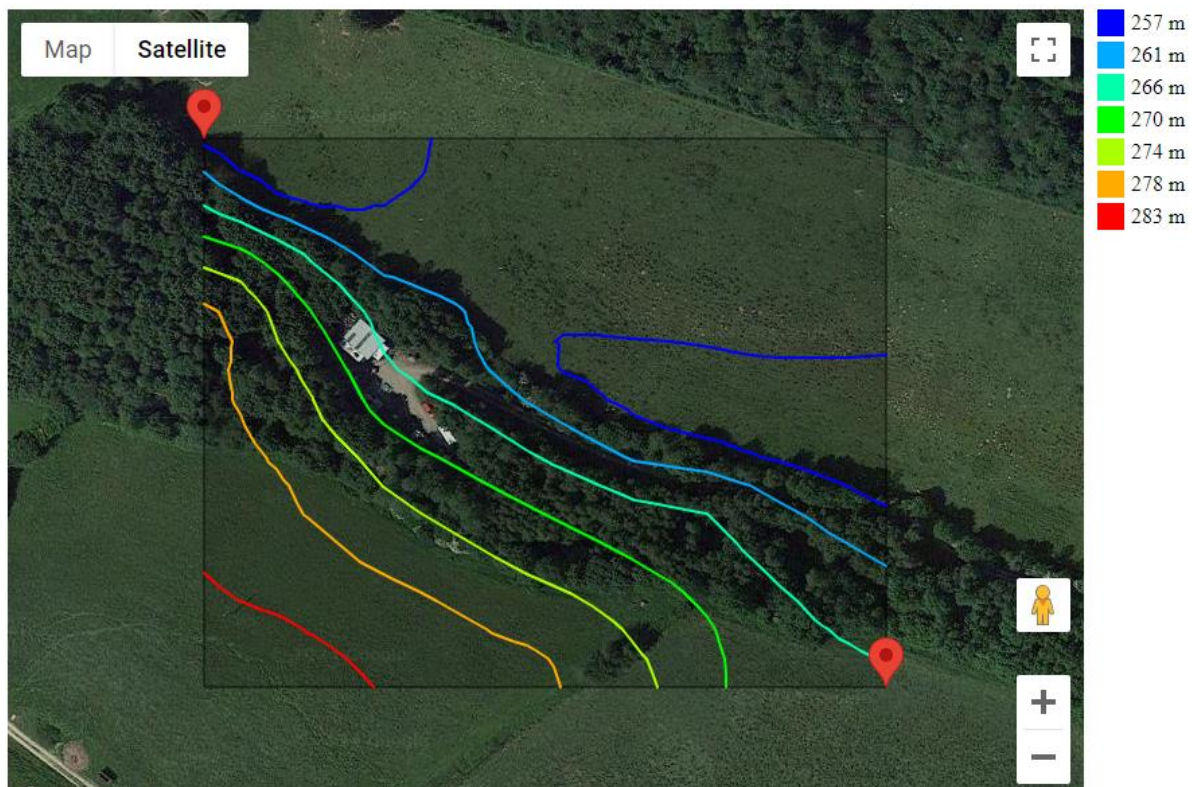


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As can be seen below, the site is North sloping, however the infiltration and percolation tests were completed on areas of level ground.



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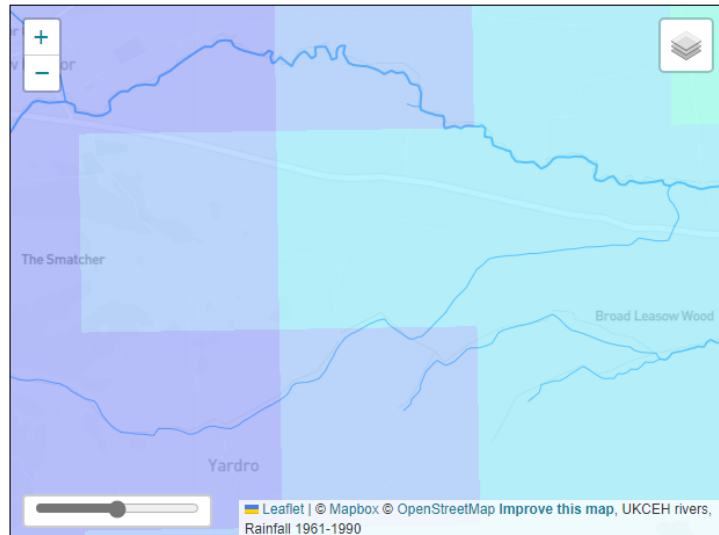
The following Rainfall information shows that the Annual Rainfall for this site is 950-1000mm.

Select spatial data type to view: Rainfall

Catchment statistics **Legend**

Rainfall 1961-1990

500 - 525 mm
525 - 550 mm
550 - 575 mm
575 - 600 mm
600 - 625 mm
625 - 650 mm
650 - 675 mm
675 - 700 mm
700 - 750 mm
750 - 800 mm
800 - 850 mm
850 - 900 mm
900 - 950 mm
950 - 1000 mm
1000 - 1100 mm
1100 - 1200 mm
1200 - 1400 mm



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As noted by Natural Resources Wales, any proposed drainage fields should be at least 200m away from any other foul effluent discharges to ground. As can be seen below, there are no dwellings within this 200m radius.



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Natural Resources Wales

'If any part of the building(s) your treatment plant serves is within 30 metres of a public sewer, the Natural Resource Wales (NRW) will not allow you to start a new discharge from a sewage treatment plant under the general binding rules.

If you are building a development of more than one property, this distance must be multiplied by the number of properties, eg if there are 3 properties then the distance will be 3 x 30 metres = 90 metres.

If there is a good reason why you can't connect to the sewer (eg there is a river or a hill in the way) then you must apply for a permit so that NRW can decide whether to allow you to use a sewage treatment plant instead.'

The proposed development is for one dwelling. Using the NRW parameter, we can see that a Public Foul Sewer within 30m ($1 \times 30\text{m} = 30\text{m}$) would be considered the favoured option.

We can confirm that there is no Public Foul Sewer within 30m of the proposed site.

Considering the location and general site conditions, the development is unable to connect to the Public Foul Sewer and so a private off-mains foul drainage system is the preferred solution.



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As previously mentioned, the proposed development is located in the Upper Wye Catchment. Due to the current levels of phosphate in the River Lugg and River Wye, every effort should be made to ensure that no additional phosphates, nitrates or other pollutants enter the local watercourse or ditch/watercourse network.



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The following developments can be screened out as not likely to have a significant effect on a river SAC in relation to phosphorus inputs as there is unlikely to be a source of additional phosphorus or pathway for impacts:

- any development that does not increase the volume of foul wastewater
- any development that improves existing water quality discharges by reducing the phosphorus load of wastewater, or by decreasing the volume of wastewater produced (e.g. by improvements to existing wastewater treatment infrastructure)
- private sewage treatment systems discharging domestic wastewater to ground, built to the relevant British Standard (BS 6297:2007+A1:2008) as long as the maximum daily discharge rate is less than 2 cubic metres (m³), the drainage field is located more than 40m from any surface water feature such as a river, stream, ditch or drain and is located more than 50m from a SAC boundary.

Also, to ensure that there is no significant in combination effect, the discharge to ground should be at least 200m from any other discharge to ground. The density of discharges to ground should also not be greater than 1 for every 4ha (or 25 per km²).

Developments connecting to an existing public wastewater treatment works that has the capacity and associated phosphorus stripping facility to accommodate additional wastewater is unlikely to increase phosphorus inputs to an SAC beyond what has already been assessed and permitted by NRW.

We can confirm that there is no Dwr Cymru Welsh Water Public Foul Sewer near to the proposed tourist accommodation site. Therefore, the installation of a private off-mains foul drainage system is the correct solution.



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Ground testing and on-site investigation

Site investigations were undertaken on 1st February 2024.

Initially, a ground water level assessment trial hole (GWLA) was excavated to a depth of 2.6m below local ground level.

We can confirm that no ground water was encountered at 2.6m below ground level.

The GWLA trial hole was left open for one hour and there was no ground water ingress.

The GWLA trial hole demonstrated that there is 100mm of made-up hardstanding with a stoney clay subsoil beneath. This stoney clay subsoil was found to extend for the full depth of the excavation.



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Percolation tests

Two percolation test holes were excavated in accordance with BS.6297. These test holes were filled with test water and the results were recorded.

As can be seen from the results sheet, these tests were completed at a depth of 650mm below ground level.



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Site Name: Long Nursery Coppice

Date: 01/02/2024

Weather conditions: Fair

Hole reference	Hole Depth	Water Drop	Time (secs)	Av. Drop
P1				
Test 1	650mm	150	2100	14
Test 2	650mm	150	2700	18
Test 3	650mm	150	2700	18
			Hole Average:	16.67

Hole reference	Hole Depth	Water Drop	Time (secs)	Av. Drop
P2				
Test 1	650mm	150	2400	16
Test 2	650mm	150	2400	16
Test 3	650mm	150	2400	16
			Hole Average:	16



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Calculation of soak-away (Summary & Calculation sheet)

Site Name: Long Nursery Coppice

Date: 01/02/2024

Weather conditions: Fair

Average calculation

Hole reference	Depth below ground		Average time
1	650mm		16.67
2	650mm		16.00
3			
4			
5			
6			
7			
8			
9			
		Vp:	16.34

Assumed maximum population: 6pe

Method of treatment: Package Sewage Treatment Plant

Standard of treatment: Secondary

GBR factor: 0.2

ASSUMED POPULATION X AVERAGE TIME X FACTOR A =

6 x 16.34 x 0.20 = 19.61

Minimum Drainage field (Sewage treatment) : 20m²



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BRE Digest 365 Infiltration Tests.

One infiltration test hole was excavated. This infiltration test hole was excavated in line with BRE Digest 365.

The infiltration test hole 1 (IFT1) was excavated to a depth of 1200mm below ground level and was 500mm wide x 1400mm long.

The infiltration test hole was then filled with water and the water drop was recorded; the results are shown in the following calculations spreadsheet.



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Long Nursery Coppice

Section:		Prepared By:	Alex Hunter	Date:	05/02/2024
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ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
	450	600	2000
width of trench [mm]:	29.97	23.96	8.46
required trench length [m]:			
	ring soakaways		
	1050	1200	1350
diameter of ring [mm]:	2.04	2.05	2.05
required pit diameter [m]:			

* Based on effective depth and number of pits as in Soakaway Data table

SUMMARY OF CALCULATIONS

critical design rainfall duration 't _{crit} ' =	240	min
required storage volume 'V _{req} ' =	13.71	m ³
provided storage volume 'V _{prov} ' =	13.72	m ³
utilisation factor =	1.00	.OK
required time to discharge 50% 't ₅₀ ' =	8.58	hours
utilisation factor =	0.36	.OK

GENERAL DATA

site location: England and Wales	(?)
soakaway type: geocellular units	(?)
impermeable area drained to soakaway 'A' [m ²] =	220
60 min rainfall depth of 5 year return period 'R' [mm] =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.50
allowance for climate change:	40%

SOAKAWAY DATA

soakaway width 'W' [m] =	5.00
soakaway length 'L' [m] =	3.50
total depth from ground level 'D _g ' [m] =	1.20
depth to drain invert level 'D _d ' [m] =	0.40
soakaway effective depth 'D _{eff} ' [m] =	0.80
free volume in infill aggregate [%] =	98

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base:	20%
available on-site infiltration test results: ☒ Yes ☐ No	(?)
use soakage trial pit table below	(?)
internal surface area of trial pit 'a _{p50} ' [m ²] =	2.22
storage volume between 75-25% 'V _p ' [m ³] =	0.28
time for water to fall from 75-25% 't _p ' [min] =	97.50
soil infiltration rate 'f' [m/s] =	2.16E-05

SOAKAGE TRIAL PIT DATA

soakage trial pit width 'W _i ' [m] =	0.50
soakage trial pit length 'L _i ' [m] =	1.40
total depth from ground level 'D _{tb} ' [m] =	1.20
depth to pipe invert level 'D _{ip} ' [m] =	0.40
soakage trial pit effective depth 'D _{teff} ' [m] =	0.80
free volume in infill aggregate [%] =	100

NOTE: faces of excavation assumed to be vertical

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION (?)

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M30-D			M100-D			outflow from soakaway [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.39	7.80	1.21	13.18	2.90	1.46	15.97	3.51	1.86	20.28	4.46	0.07	4.40
10	0.54	10.80	1.22	18.49	4.07	1.50	22.62	4.98	1.92	29.07	6.40	0.13	6.26
15	0.65	13.00	1.23	22.42	4.93	1.51	27.52	6.05	1.96	35.64	7.84	0.20	7.64
30	0.82	16.40	1.24	28.47	6.26	1.53	35.16	7.74	2.00	45.95	10.11	0.40	9.71
60	1.00	20.00	1.24	34.72	7.64	1.54	43.21	9.51	2.03	56.84	12.50	0.80	11.71
120	1.19	23.80	1.24	41.32	9.09	1.54	51.17	11.26	2.01	67.13	14.77	1.60	13.17
240	1.38	27.60	1.23	47.51	10.45	1.52	58.85	12.95	1.99	76.86	16.91	3.20	13.71
360	1.51	30.20	1.22	51.56	11.34	1.51	63.94	14.07	1.97	83.22	18.31	4.80	13.51
600	1.68	33.60	1.21	56.88	12.51	1.50	70.40	15.49	1.94	91.31	20.09	7.99	12.09
1440	2.03	40.60	1.19	67.57	14.87	1.46	83.21	18.31	1.89	107.15	23.57	19.19	4.39

* Z2 is growth factor from M5 rainfalls

SOAKAGE TRIAL PIT INFILTRATION TEST RESULTS (?)

water level measurement N°:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Soakage Trial 1	time [min] =	0	30	60	90	120	150													
	depth to water [m] =	0.60	0.86	0.95	1.01	1.05	1.10													
Soakage Trial 2	time [min] =	0	30	60	90	120	150	180												
	depth to water [m] =	0.60	0.83	0.92	0.99	1.03	1.06	1.11												
Soakage Trial 3	time [min] =																			
	depth to water [m] =																			

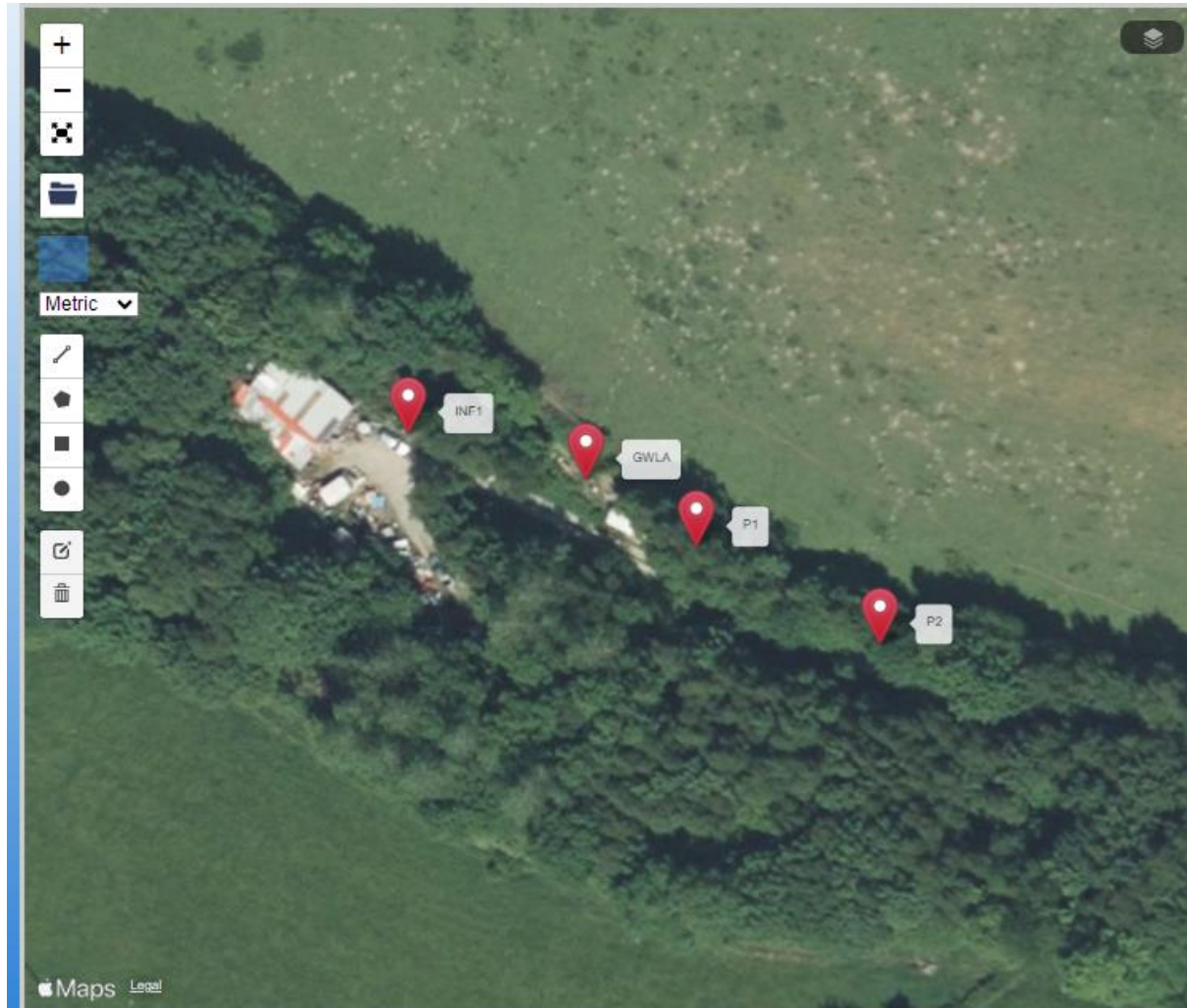


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Test Hole Locations



Grid Reference	X (Eastings)	Y (Northings)	Latitude	Longitude	Description
SO 22339 60025	322339	260025	52.232923	-3.1385597	INF1
SO 22362 60019	322362	260019	52.232870	-3.1382283	GWLA
SO 22376 60010	322376	260010	52.232793	-3.1380219	P1
SO 22399 59997	322399	259997	52.232682	-3.1376785	P2



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Surface Water Design

The test area is a wood/coppice.

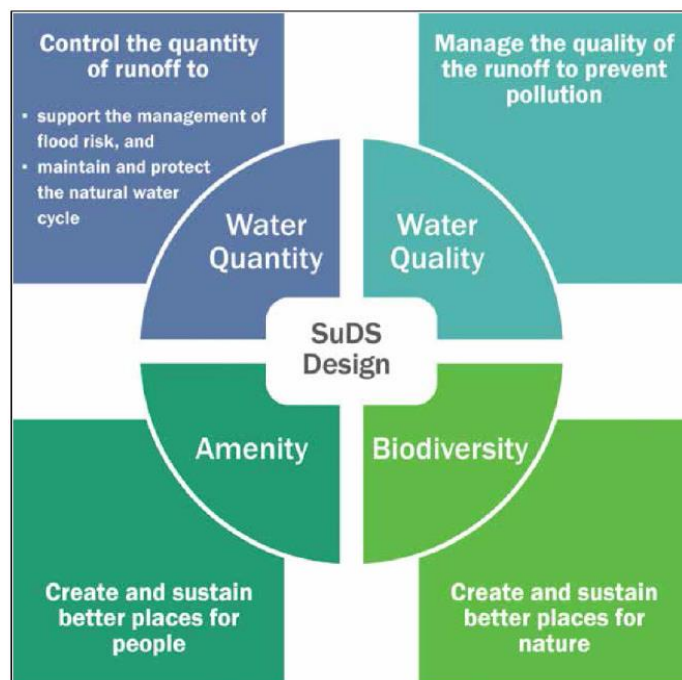
The primary concerns of any proposed surface water management are laid out in SuDS and should be considered to ensure minimal impact to the surrounding area.

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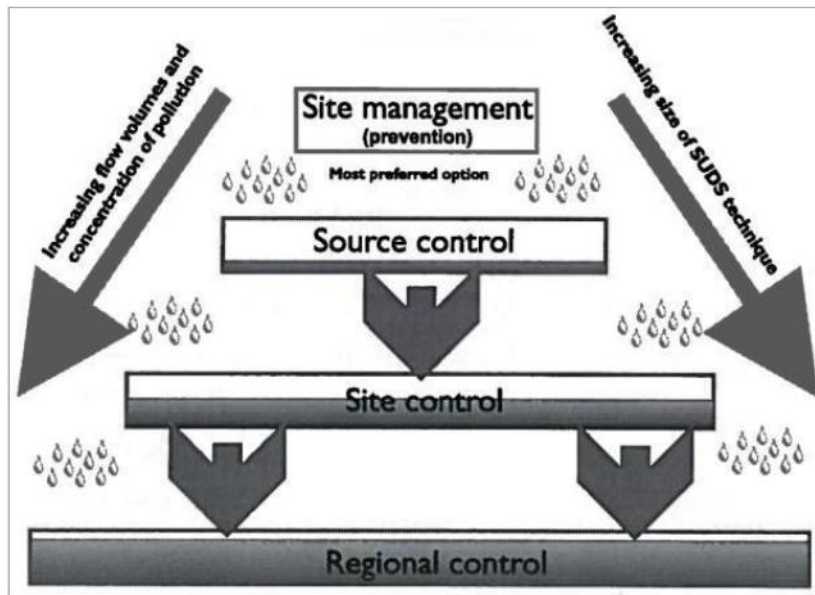
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The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train':



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:

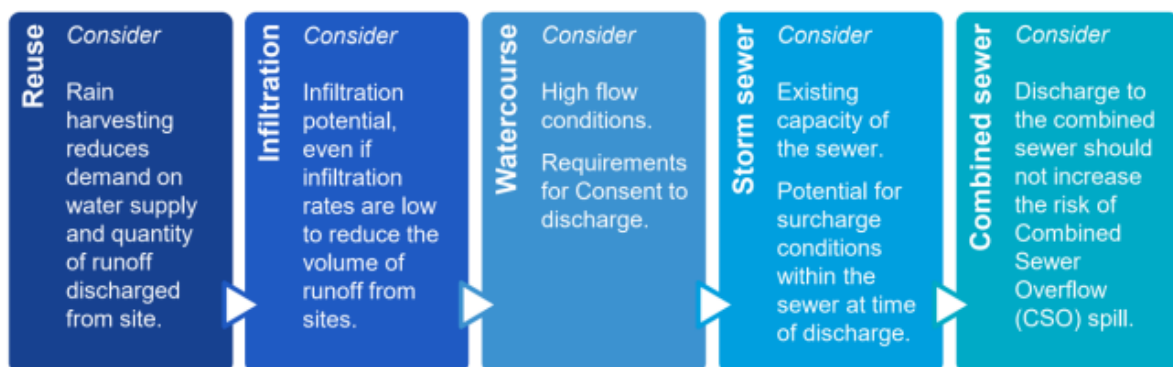
1. Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
2. Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
3. Improving water quality over conventional surface water sewers by removing pollutants 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 calculations, the local soils will support a surface water soak-away. As such, the roof water from the proposed development should be discharged to ground. Considering the previous infiltration test results, it is generally regarded that the favoured method of surface water disposal is infiltration to ground in line with the Drainage Hierarchy.

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 in the following excerpt:

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.

Noting that the floor area of the proposed dwelling is 195m², it is necessary to allow for a larger roof area.

As previously demonstrated, the roof water from a proposed dwelling roof area of 220m² should be discharged to ground via a new drainage field. This soak-away will be constructed using attenuation crates and must be at least 5m x 3.5m x 1.2m deep and must have an inlet pipe invert of no more than 400mm below ground level, as demonstrated in the previous calculation spreadsheet.

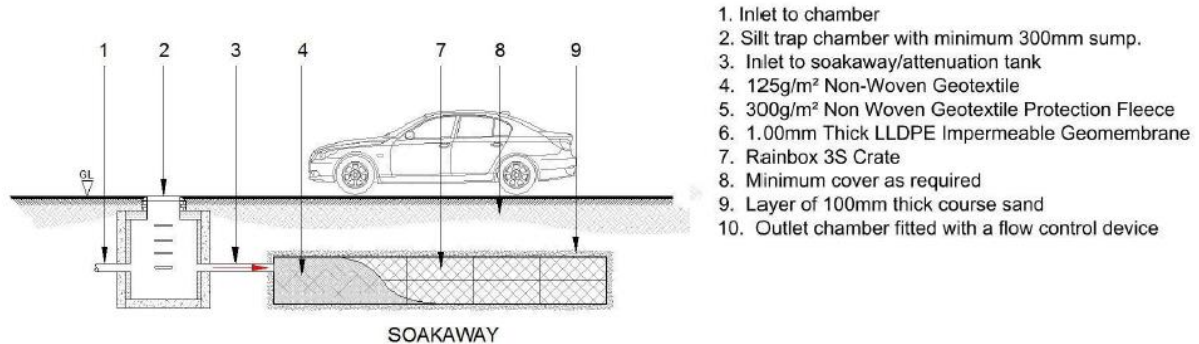


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Surface water is directed to the crate structure via a silt trap chamber. As the crate structure fills, water begins to exfiltrate from the tank into the surrounding ground. The crate structure must be surrounded with a permeable non-woven geotextile to prevent any ingress of silt to the crate structure.

The new soak-away will be located more than 5m away from any building/ structure in the area near to the recent infiltration test.

In addition to roof water, surface water will need to be managed from the proposed permeable driveway and paths.

All new hardstandings and paths will be constructed to be permeable. As previously demonstrated by the on-site testing, the soils at this site were found to be permeable at shallow depths and therefore these hardstandings should be laid as permeable surfaces.

Where the hardstandings are laid, SuDS recommends the use of non-infiltration systems where appropriate. As shown in the following diagram, there are many ways of designing such permeable paths and driveways:



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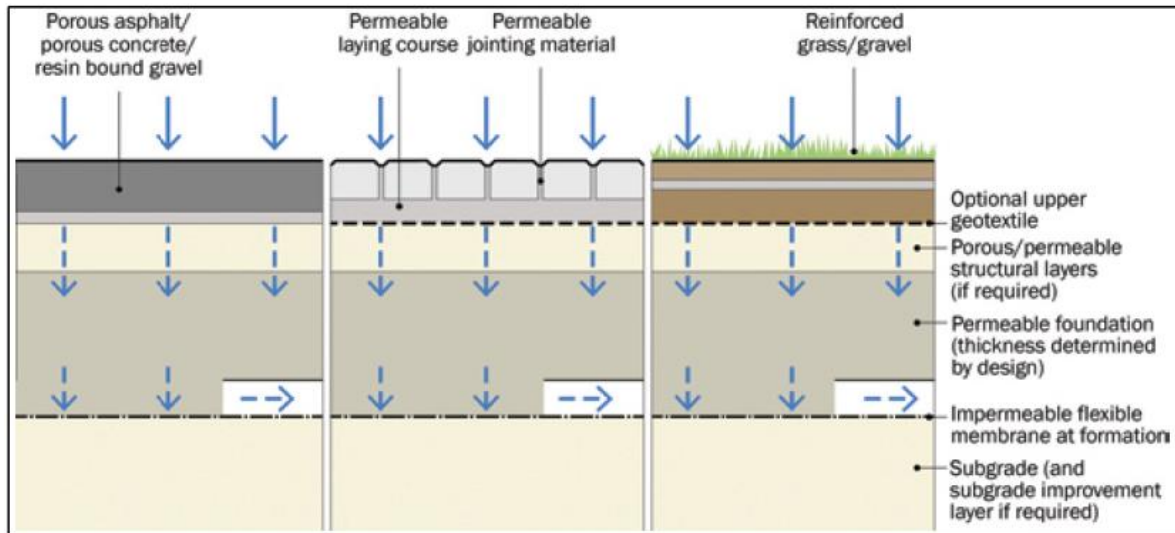
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By installing the driveway and paths as permeable surfaces, any run-off will be reduced as will run-off pollution. This method of drainage will have a minimal impact on the local habitat, and the permeable surface will attenuate the surface water thus reducing any current green field run-off rate. In addition, this type of hardstanding would be in-keeping with the surrounding area.



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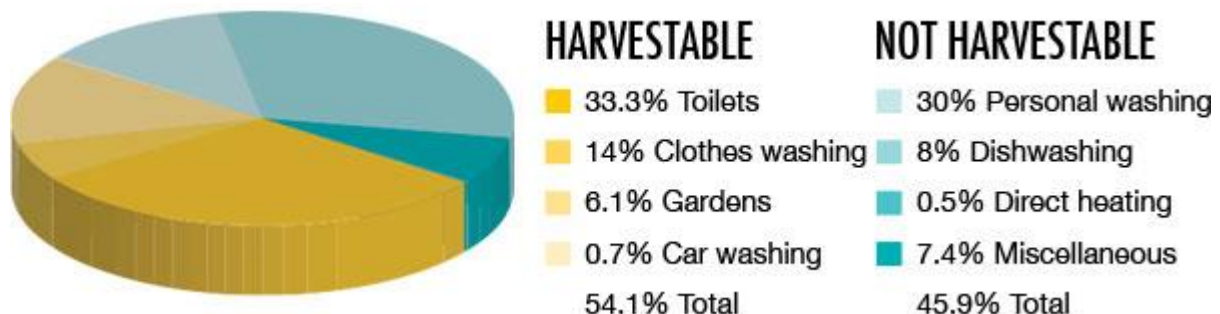
Rainwater Harvesting:

In order to reduce the discharge rate of surface water further, private rainwater harvesting should be installed at the new dwelling. Such rainwater harvesting will reduce the amount of roof water discharged to ground. This will in turn reduce the discharge of water to the Lugg Catchment and present further benefits for the environment and reduce water bills.

The harvested roof water can be used for non-potable needs within the building. These include w/c flushing, washing machines and irrigation.

As can be seen in the following chart, rainwater harvesting has the potential to reduce mains water usage by approximately 50%. In turn, this means that there is the potential to reduce runoff by up to 450-litres per day per house.

The chart below shows a rough breakdown of water use within a typical household. It also gives you an idea of how much is harvestable.



It should be noted that only roof water should be discharged to the rainwater harvester system.



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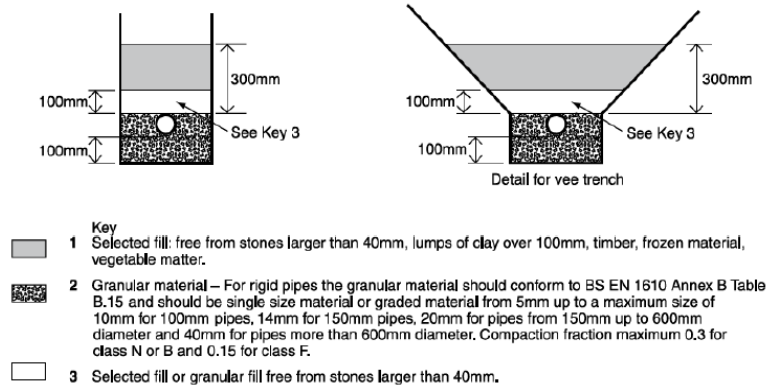
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All new rainwater goods (gutters and downpipes) will be installed in line with Building Regulations Part H3.

All new private underground pipework will be installed in line with Building Regulations Part H3. All new drains will be laid in BSEN1401 110mm diameter uPVC pipework:

b) Flexible pipes



In addition, the drain 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 Strategy Conclusion.

Considering SuDS and the specifics of this site, it is favourable to discharge surface water to ground. Therefore, the surface water drainage system will be designed as follows:

- Roof water from the proposed building will be discharged via rainwater goods and underground pipework conforming to Approved Document H.
- Roof water from the proposed dwelling will be piped via roof water gullies in order to reduce debris entering the soak-away system.
- A private rainwater harvester will be installed and the rainwater harvester will be plumbed into the dwelling for non-potable use.
- The resulting exceedance flow of roof water from the rainwater harvester will be piped to a new soak-away via a catchpit in order to further reduce debris entering the attenuation system.
- The soak-away will be constructed using wrapped geo-cellular crates and will be at least 5m wide x 3.5m long x 1.2m deep with a maximum inlet invert depth of 400mm below ground level.
- A silt trap will be installed immediately upstream on the soak-away. This chamber or silt trap will be maintained correctly to prevent debris entering the soak-away.
- All new driveways and paths will be constructed to be permeable. By doing so, any run-off will be reduced. In addition, these porous surfaces will also reduce run-off pollution.
- The surface water drainage system will be maintained as necessary. This will include cleaning/emptying of silt traps and gullies, cleaning/inspecting of manhole chambers as required, and general maintenance of the soak-away system as noted in the following table as taken from CIRIA guidance and highlighted in green.



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SuDS/Drainage Maintenance Actions:

Drainage Feature	Required Action	Frequency
Access chambers, catchpits, silt traps and gullies.	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.



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Permeable Hardstanding Maintenance

Regular maintenance	Surface brushing for appearance and to reduce silt accumulation	Monthly
	Brushing and suction sweep or jet wash and suction sweep particularly for block pavement in autumn after leaf fall	Annually
	Mow grass edges to paving at 35-50mm and remove weeds and leaves	As required
	Check outlets and control structures	Monthly depending on detail
Occasional tasks	Jetting and suction where silt has accumulated in joints or voids. Replace grit and vibrate surface to lock for permeable block paving	As required
Remedial work	Where sinkage or surface damage occurs uplift blocks, remove grit bedding layer, geotextile if present and reinstate to design profile	As required



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Foul Water / Sewage Treatment System Design

As previously identified, there is no local Public Foul Sewer.

Using the following flow diagram, the site can be assessed:

As can be seen from the flow diagram, the favoured option would be to connect the foul drainage system to the **local Public Sewer**. However, as previously mentioned, there is no available public foul Sewer near to this site. Therefore, connection to the local Public Foul Sewer is not possible at this site.

Following the flow diagram, a septic tank would be favoured. However, the installation of a **packaged sewage treatment plant** would reduce the size of the necessary drainage field and would lengthen the potential lifespan of the drainage field.

In addition, the resulting secondary treated effluent contains far less pollutants than septic tank effluent and the effluent contains reduced phosphorous and nutrients.



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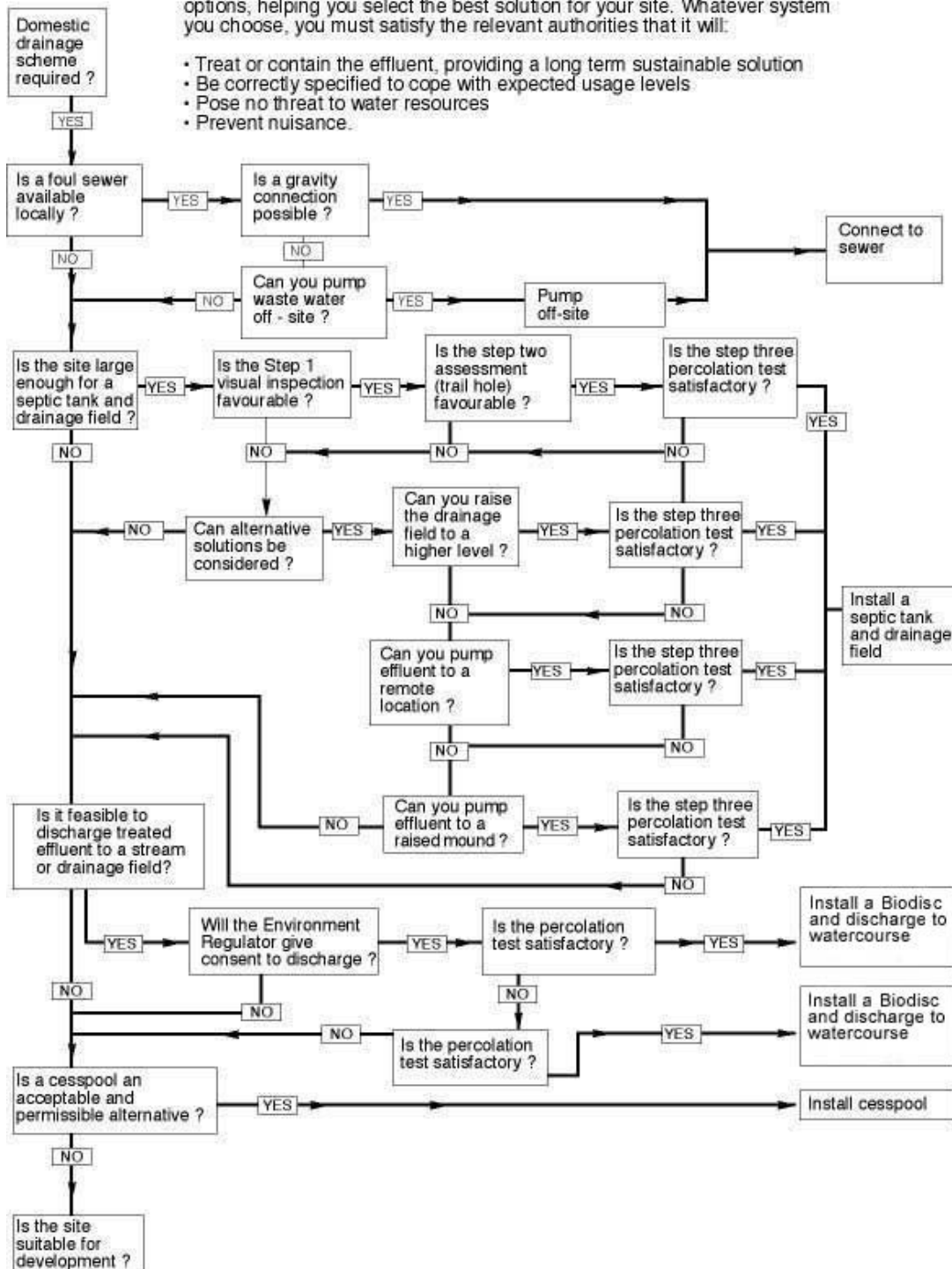
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Site assessment and system selection

The flow chart below gives an overview of the principal off-mains drainage options, helping you select the best solution for your site. Whatever system you choose, you must satisfy the relevant authorities that it will:

- Treat or contain the effluent, providing a long term sustainable solution
- Be correctly specified to cope with expected usage levels
- Pose no threat to water resources
- Prevent nuisance.



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Packaged Sewage Treatment Plant

The proposed dwelling will have 4-bedrooms. The domestic sewage discharge loading must be designed in line with British Water Flows and Loads 4.

In line with British Water Flows & Loads 4, the potential population of this dwelling is 6-persons (6pe). Therefore, the proposed off-mains foul drainage system must be designed for a potential population of 6-persons (6pe).

5 Domestic housing

- A treatment system for a single house with **up to and including 3 bedrooms** shall be designed for a minimum population (P) of 5 people.
- The size of a treatment system for a single house with more than 3 bedrooms shall be designed by adding **1 P for each additional bedroom** to the **minimum single house value of 5 P**, eg:
 - house with 3 bedrooms = **minimum 5 P system**
 - house with 4 bedrooms = **minimum 6 P system (5+1)**
 - house with 6 bedrooms = **minimum 8 P system (5+3)**.
- For groups of small 1 and 2 bedroom houses or flats
 - flat with 1 bedroom = **allow 3 P**
 - flat with 2 bedrooms = **allow 4 P**
- A treatment system serving a group of houses shall be designed by adding together the P values for each house calculated independently, eg:
 - for a group of two houses (3 and 4 bedrooms, respectively) the system shall be for a minimum of 11 P (5+6)
- **If the calculated total P for a group of houses exceeds 12 P then some reduction may be made** to allow for the balancing effects on daily flow of a group of houses (round UP not down)
 - **Where the total is 13-25 P** multiply the total by 0.9 to give an adjusted P value, e.g. if there are four four-bedroom houses the total P will be 24 P (4 x 6) and the adjusted P will be 22 P (24 x 0.9 = 21.6)
 - **Where the total is 26-50 P** multiply the total by 0.8 to give an adjusted P value, e.g. if there are four three-bedroom houses and three four-bedroom houses the total P will be 38 P (4 x 5 and 3 x 6) and the adjusted P will be 31 P (38 x 0.8 = 30.4)
- Where there are larger groups of houses, the P should be estimated using both the expected total load and the flow, considering both peak and total flow
- These are minimum recommended population (P) loads, they should not be modified downwards, upward modification may be necessary because of particular characteristics of each property or groups of properties.
- The above assessments of population (P) should be used for both existing and new properties



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It should be noted that the proposed sewage treatment plant must be located at least 7m away from the dwelling. In addition, the packaged sewage treatment plant must be within 30m of a tanker access hardstanding.

The resulting secondary treated effluent will be discharged from the sewage treatment plant to a new drainage field.

Natural Resources Wales specify that a sewage treatment plant must conform to BSEN.12566-3. As such, the proposed packaged sewage treatment plant is a Graf One2clean SBR packaged sewage treatment plant.

As can be seen from the following extract, the One2clean packaged sewage treatment plant can be supplied to serve a potential population of 2-7 persons and the unit conforms to BSEN.12655-3.

Two-tank system one2clean / one2clean plus

Q Webcode G5105

Q Webcode G5114

Inhabitants [max.]	Max. daily flow [l/d]	Max. organic load [kg BOD ₅ /d]	Total volume [l]	Volume [l]	Length* [mm]	Width* [mm]	Height [mm]	Weight [kg]
2 – 7	1,050	0.42	5,400	2 x 2,700	4760	1556	1690	240
8 – 10	1,500	0.6	7,500	2 x 3,750	5160	1755	1880	300
11 – 14	2,100	0.84	9,600	2 x 4,800	5160	1985	2110	370
15 – 18	2,700	1.08	13,000	2 x 6,500	5380	2190	2390	440

In addition, as demonstrated by the following PIA Certificate, this packaged sewage treatment plant can reduce phosphate levels to only 1.6mg/L.



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Prüfinstitut für
Abwassertechnik
GmbH

PERFORMANCE RESULTS

Otto Graf GmbH
Carl-Zeiss-Str. 2 - 6, 79331 Teningen, Germany
EN 12566-3
Small wastewater treatment systems for up to 50 PT
Small wastewater treatment system one2clean
SBR plant in one two-zone polypropylene tank
Test report PIA2014-216B14.01.e

Nominal organic daily load*	0.27	kg/d		
Nominal hydraulic daily load	0.75	m ³ /d		
Material	polypropylene			
Treatment efficiency (nominal sequences)		Efficiency		Effluent
	COD	94.2 %		43 mg/l
	BOD ₅	98.0 %		7 mg/l
	SS	98.3 %		14 mg/l
	NH ₄ -N**	98.3 %		0.5 mg/l
	N _{tot} **	87.0 %		7.9 mg/l
	P _{tot}	80.2 %		1.6 mg/l
Electrical consumption	0.63	kWh/d		
*at a test influent of ≥ 300 mg/l BOD ₅ (mean)				
**determined for temperatures $\geq 12^{\circ}\text{C}$ in the biosector				

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration
of performance nor the CE marking.



Notified body
No.: 1738



Certified according to
ISO 9001:2008



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Prüfinstitut für Abwassertechnik GmbH
Eimer Lischke
November 2014



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Drainage Field.

Percolation tests have been completed in line with BS.6297 and Approved Document H. As can be seen from the previous calculations, the percolation tests have demonstrated that the local soils will support a drainage field. The Vp of the tested soil is 16.34mm/s.

With this in mind, the new drainage field should be located in the test area, and we can see that a drainage field of at least 20m² is required:

Population equivalence x Vp x factor 0.2 =

$$6 \times 16.34 \times 0.2 = 19.608\text{m}^2$$

(Values should be rounded up in line with British Water Flows & Loads 4)

Total minimum drainage field area = 20m²

As demonstrated by the percolation tests, the drainage field would need to be at least 20m². In addition, the percolation testing has demonstrated that the new drainage field must have an invert depth (D1) of no more than 650mm below ground level.

Noting the previous information, the new drainage field should be laid as a continuous loop drainage field in line with Approved Document H and should have an invert (D1) of 650mm below ground level.

Due to the topography of the site, a gravity foul drainage system will be installed. It should be noted that the new drainage field must be constructed along the contours of the sloping ground, in line with BS.6297.



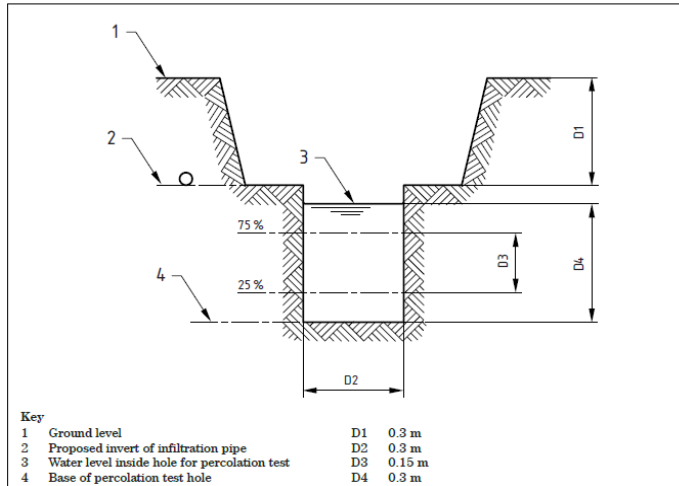
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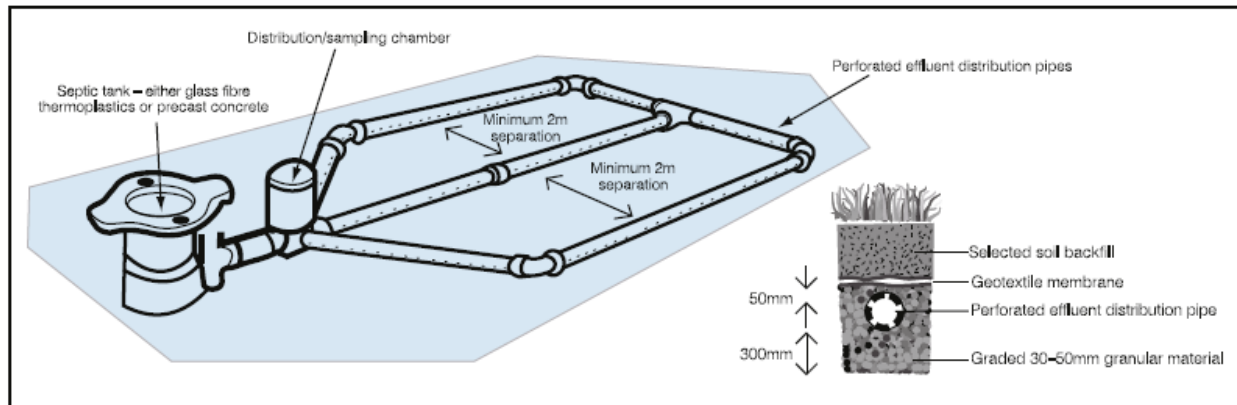
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Figure 2 Cross-section of typical percolation test hole



Dimension D1 = 650mm in line with BS.6297

Continuous loop drainage field:



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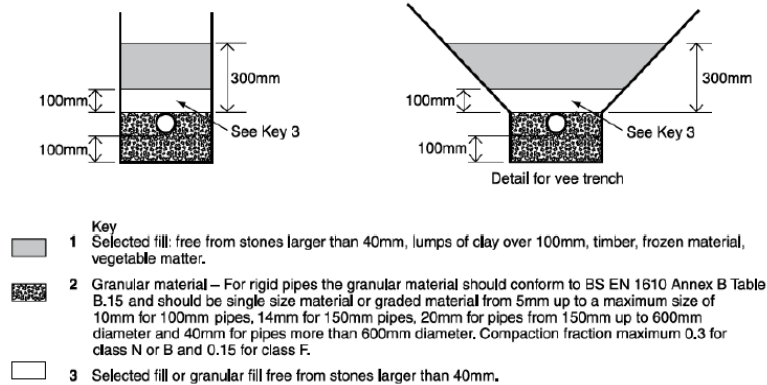
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All new underground pipework will be installed in line with Approved Document H2.
All new drains will be laid in BSEN1401 110mm diameter uPVC pipework:

b) Flexible pipes



In addition, the foul drain 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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Nutrient Neutrality

As previously mentioned, the proposed development is located in the Upper Wye Catchment. Due to the current levels of phosphate in the River Lugg and River Wye, every effort must be made to ensure that no additional phosphates, nitrates or other pollutants enter the local watercourse or ditch/watercourse network.

Natural Resources Wales has stated that the following developments can be screened out as not likely to have a significant effect on a river SAC in relation to phosphorus inputs as there is unlikely to be a source of additional phosphorus or pathway for impacts:

- any development that does not increase the volume of foul wastewater
- any development that improves existing water quality discharges by reducing the phosphorus load of wastewater, or by decreasing the volume of wastewater produced (e.g. by improvements to existing wastewater treatment infrastructure)
- private sewage treatment systems discharging domestic wastewater to ground, built to the relevant British Standard (BS 6297:2007+A1:2008) as long as the maximum daily discharge rate is less than 2 cubic metres (m3), the drainage field is located more than 40m from any surface water feature such as a river, stream, ditch or drain and is located more than 50m from a SAC boundary.

The site has an existing dwelling that is served by an off-mains foul drainage system.

As noted by Natural Resources Wales, developments can be screened out as not likely to have a significant effect on a river SAC in relation to phosphorus inputs if the proposed development improves the existing water quality output.

As noted, the existing dwelling is served by a septic foul drainage system. As such, and as noted by Natural England, the septic effluent is likely to discharge 11.6mg/litre of phosphate (O'Keeffe et al 2015). By installing a new Graf One2Clean packaged sewage treatment plant, this discharge can be reduced to 1.6mg/litre, as demonstrated by the previous PIA test certificate.



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Foul Water Disposal Conclusion.

After considering the site location and geology, the on-site testing has shown that the site is suitable for an off-mains foul drainage system.

The evidence shows that the foul sewage treatment system should be designed as follows:

- The foul drainage must be kept separate to the surface water and roof water drainage system.
- The foul drainage from the proposed barn conversions and the existing dwelling will be laid to a Graf One2clean packaged sewage treatment plant sized for a potential population of at least 6pe.
- The packaged sewage treatment plant will be located at least 7m from all habitable parts of all dwellings.
- The packaged sewage treatment plant will be located within 30m of a tanker access hardstanding.
- The packaged sewage treatment plant will require a pumped outlet (Manufacturer's standard unit).
- The resulting effluent will be discharged to a 20m² continuous loop drainage field laid at a 650mm deep invert (D1).
- The drainage field will be located within the percolation test area.
- The foul drainage system will be maintained in line with the Manufacturer's Guidelines and the Environment Agency General Binding Rules.



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Natural Resources Wales Consent to Discharge

Using British Water Flows & Loads 4, we can see that the proposed development has a design population of 6-persons and each person can discharge up to 150-litres/person/day.

With this in mind, we can see that the daily design discharge will be 900-litres/day:

$6pe \times 150\text{-litres} = 900\text{-litres per day.}$

Natural Resources Wales states that any discharge to surface water (a watercourse) of more than 5,000-litres per day will require a Permit to Discharge. **In addition, any discharge to ground (a drainage field/mound) of more than 2,000-litres per day will require a Permit to Discharge.**

A small sewage discharge (SSD) is a discharge of domestic sewage effluent of 2 cubic metres or less per day to ground from septic tanks or small sewage treatment plants, or 5 cubic meters or less per day to surface water from small sewage treatment plants

As this proposed development has a design discharge of 900-litres per day, a Permit to Discharge will NOT be required from Natural Resources Wales.



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Ongoing Maintenance

Once the sewage treatment system has been installed. It will need to be Commissioned and maintained.

H+H Drainage would be pleased to complete the initial Commissioning in line with Manufacturers Guidelines and The Environment Agency guidelines.

The installed equipment will require monthly 'maintenance checks' to be undertaken by the homeowner(s) or operator(s).

Sewage Treatment Plant:

The sewage treatment plant will require desludging at least 12-monthly; depending on usage. The frequency will depend on usage; H+H drainage will be able to measure the sludge density in order to initiate the correct desludging regime.

In accordance with the General Binding Rules, the sewage treatment plant will require maintenance in line with the Manufacturer's Guidelines. As British Water Accredited Engineers, H+H drainage will complete this maintenance annually.

In order to conform to the General Binding Rules and to ensure that the off-mains sewage system is maintained correctly, a maintenance agreement should be undertaken once the new system has been installed.

Following is a copy of such an example maintenance agreement.



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Annual Maintenance agreement

MAINTENANCE AND SERVICING OF SMALL WASTEWATER TREATMENT SYSTEMS (PACKAGE PLANTS) UP TO 50 POPULATION (PE) AND LARGER SYSTEMS UP TO 1000 PE.

Customer: #####

Site Address: #####

H+H Drainage herewith agree to complete a scheduled maintenance visit (in accordance with the manufacturer's instructions and British Water Guidelines) at ##### **MONTHLY** intervals on the following equipment:

1x ##### Sewage Treatment Plant

1x ##### Pumping station

H+H Drainage also agree to replace any minor parts (up to the value of **£50.00** excluding VAT) where necessary in order to maintain operations and prevent pollution. Where parts costs exceed £50.00 excluding VAT, H+H Drainage will first attain permission from you before fitting new parts. Any parts supplied/fitted are to be invoiced additionally.

H+H Drainage will complete and submit a maintenance record sheet for each visit completed, as specified in the General Binding Rules. In addition, H+H Drainage will retain a duplicate copy of each maintenance record sheet.

The Customer will provide a clean water supply and a 230-volt domestic power supply at the sewage treatment plant. In addition, the Customer will grant H+H Drainage access to the plant(s) when necessary.

Exemptions:

H+H Drainage cannot be held responsible for any failures of the sewage treatment plant. In addition, H+H Drainage cannot be held responsible for the standard of final effluent leaving the sewage treatment plant. In order to maintain a high standard of discharge effluent, we ask all users of the sewage treatment plant to follow the attached guidelines.

Further, we ask all users of the sewage treatment plant not to flush items or chemicals that may be dangerous to our operators and engineers.



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Where new parts are required, H+H Drainage cannot be held responsible for late deliveries or delays, although every effort will be made to order by express delivery where necessary

Payment Terms:

All invoices exclude VAT. (unless stated otherwise)

Invoices are due for payment within 14-days from the date of invoice.

Any price increases by H+H Drainage will be notified prior to on-site works.

Termination.

The Client will give at least 30-days' notice of termination.

H+H Drainage will give at least 30-days' notice of termination.

The Agreement

This document, hereto signed by both parties shall constitute the entire binding agreement between H+H Drainage and the Customer. The Customer represents that they are the owner of the sewage treatment plant(s), or joint owner, subject to this agreement.

'Please complete the necessary maintenance visits on the sewage treatment plant(s) as per this agreement and current pollution Law;

Signed (On behalf of the Customer):

Position:

Date:

Signed (on behalf of H+H Drainage):

Position:

Date:



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H+H Drainage is the trading name of Taysum-Hunter Ltd.
Registered in England & Wales, Registration number 7357577



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HOW TO KEEP YOUR SEWAGE TREATMENT PLANT RUNNING SWEETLY

Sewage treatment plants use colonies of live natural micro-organisms to break down pollutants in domestic sewage. Many chemicals found in the household can inhibit or kill these micro-organisms, particularly if used in excessive amounts.

Bear in mind that treatment plants serving a few houses do not have the benefit of dilution that occurs at a large sewage works. A bottle of bleach tipped down the toilet in Birmingham would be virtually lost amongst the millions of gallons of sewage arriving at city's treatment works; a bottle of bleach in a plant serving half a dozen houses could be a lethal dose.

If the micro-organisms are damaged, they will usually recover in time. But in the meanwhile, one of the more obvious symptoms is an unpleasant smell, so it is in residents' interest to avoid this.

Generally speaking, all common household cleaning fluids are acceptable, provided they are used in accordance with the makers' instructions and stipulated concentrations.

The following are some of the most common chemicals found in household situations. It is not an exhaustive list and the golden rule is "If in doubt - leave it out." Bear in mind too that it isn't only the toilet that is connected to the treatment plant; anything that goes down the sink, bath etc. also ends up there.

Washing machine and dishwasher detergents, washing up liquids:

Perfectly all right in normal concentrations and usage. Problems can occur if, for instance, you are washing the jerseys of the local rugby club's five teams! Excess amounts of biological detergent can affect the biomass development. So, if you have to do unusual amounts of clothes washing it would be a good idea to spread it over a few days.

Floor cleaners, disinfectants and bleaches:

These are safe to use in accordance with the makers recommendations and in the minimum necessary concentration. Do not pour neat disinfectant or bleach down the sink or outside gullies. If these are smelly it usually indicates a buildup of decaying material or a plumbing problem and should be dealt with accordingly.

Nappy disinfectants and bottle sterilizing fluids eg. Milton:

When disposing of the used fluid, ensure that it is well diluted with water. The easiest way of doing this is usually to flush it away down the toilet.

Waste disposal units:

These do not inhibit the micro-organisms, but, depending on use, they can present the treatment plant with considerable extra load. Much better to compost your vegetable peelings etc. - it's cheaper and environmentally friendly.



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Home beer and wine making.

This presents a similar problem to waste disposal units. The treatment plant has to work as hard to treat one pint of beer tipped down the drain as it does to treat all the normal waste produced by one person in 24 hours. See also the notes above regarding Sterilizing fluids.

THE FOLLOWING MUST NOT BE DISCHARGED INTO THE DRAINS OF EITHER A SEWAGE TREATMENT PLANT OR SEPTIC TANK.

Motor oil, grease, anti-freeze, brake fluid etc.

Motor oil and grease are basically fats. Fat build-up is the most common reason for treatment plant failure, while anti-freeze and brake fluid are poisonous to microscopic organisms.

Cooking oil and fat.

Fat build-up is the most common reason for treatment plant failure. The human body, cooking and washing all result in fats and oils being discharged into the treatment plant, so it is best to keep fats to a minimum where possible.

Weed-killers, insecticides, fungicides and other gardening chemicals.

Fluids that kill germs in the kitchen, bathroom or garden also kill useful germs in your sewage treatment plant.

Paint, thinners, white spirit, turpentine, creosote etc.

Medicines

Take unused medicines to a pharmacist for safe disposal.

Photographic developing fluids.

Nappies, sanitary towels, wipes, syringes, soft toys, tennis balls etc.

It may seem a bit obvious to say this, but it is amazing what gets flushed down the loo from time to time. Although such items are not directly damaging to the micro-organisms, they can cause problems, not the least of which is simple blockage of the drains.

Even so-called disposable nappies, flushable-wipes, thread, kitchen paper-towel and sanitary towels often do not degrade fully in the treatment plant and can lead to malfunction, so it is best to dispose of them by other means.

In an ideal world, only toilet tissue and human waste should be flushed!

Finally, it is now a legal requirement to ensure that your sewage treatment plant is maintained correctly. This includes regular desludging/emptying and an annual maintenance visit by a British Water Accredited Engineer.



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