GeoSmart Information

SuDSmart Design

Sustainable Drainage Assessment

Site Address

Woodville Garage
14 Gresford Road
Wrexham
LL12 0NW

Grid Reference

333398, 356230

Report Prepared for

Robert Whitney

Date

2024-08-09

Report Status

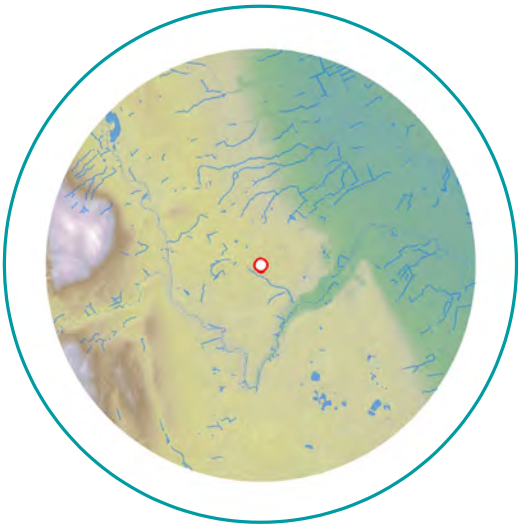
FINAL

Site Area

0.10 ha

Report Reference

77196.01R2



Discharge to highway drain

The proposed development should discharge via the adjacent highway drainage network at 1 l/s as agreed with Wrexham Highways.

Report Author

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1 Executive summary

A Detailed Drainage Design has been completed to ensure surface water runoff can be managed effectively over the lifetime of the development.

SuDS suitability

Risk	Issue	Result
Discharge Location	What is the infiltration potential at the Site?	Low
	What is the potential to discharge to surface water features?	Low
	What is the potential to discharge to sewers?	Low
	What is the potential to discharge to highway drains?	High
Flooding	What is the fluvial flood risk at the Site?	Negligible
	What is the pluvial flood risk at the Site?	Very Low
	What is the groundwater flood risk at the Site?	Negligible
Pollution	Is the groundwater a protected resource?	No
	Is the surface water feature a protected resource?	No

Compliance with Welsh Standards

In January 2019 the Flood and Water Management Act 2010 (schedule 3) came into effect and requires new developments in Wales to incorporate SuDS features that comply with national standards. The Welsh government has published 6 statutory standards for SuDS which are outlined below; confirmation of how the proposed SuDS strategy meets these standards is included below.

S1. Surface water runoff destination

Collection for use

Rainwater harvesting butts are proposed at the downpipes which will seek to collect and utilise rainwater creating an area of enhanced biodiversity / amenity value.

Infiltration to ground

The Site has moderate potential for infiltration, with potentially permeable underlying superficial deposits (Devensian Till) and bedrock (Salop Formation). Based on the site investigation and groundwater flood risk mapping shallow groundwater is unlikely to be an

issue at the Site. Infiltration testing was undertaken by Sub Surface in February 2024, however a soil infiltration rate could not be calculated due to the low permeability of the strata. Therefore, infiltration to ground is not considered feasible.

The Site is not located within an SPZ, however a separate phase 1 contaminated land report prepared by GeoSmart (ref: 77196) indicates the Site has a moderate risk of contamination.

Discharge to surface water feature

OS mapping confirms that there are no surface water features within 100m of the Site, therefore discharge in this manner is not considered to be feasible.

Discharge to surface water sewer

A Welsh Water asset location plan obtained for the Site (Appendix C) confirms that the nearest surface water sewer to the Site is located approximately 70 m to the northeast of the Site, however discharging to this feature would require crossing third-party land, and is therefore not feasible.

Discharge to highway drainage network

According to Google Streetview highway gullies are located within Gresford Road indicating the presence of a highway drainage network. Wrexham Highways have confirmed that a connection into the highway system at 1 l/s is acceptable and is therefore proposed.

Discharge to combined sewer

A Welsh Water asset location plan obtained for the Site (Appendix C) confirms that there is a public combined sewer approximately 85 m to the northwest of the Site, however discharging to this feature would require crossing third-party land, and is therefore not feasible.

Discharge to foul sewer

A Welsh Water asset location plan confirms there is a foul sewer adjacent to the northeast of the Site.

Based on the above findings, surface water is proposed to discharge to the adjacent highway drains at 1 l/s, subject to agreement from the utility provider.

S2. Surface water runoff hydraulic control

Surface water runoff from the proposed development is proposed to discharge to the adjacent highway drains at a controlled discharge rate of 1 l/s. A flow control device has been proposed. Permeable paving is proposed for all hardstanding to provide source control.

S3. Water Quality

The proposed development is of Very Low-Low pollution hazard according to Table G3.1 of the Sustainable Drainage Systems Standards for Wales (2018). A separate phase 1 contaminated land assessment has been prepared by GeoSmart, which considers the contamination risks to the proposed development (ref: 77196).

Features should be established to provide sufficient treatment stages in order to suitably mitigate any potential contaminants contained within surface water runoff as a result of the development. Facilities should also be established such that in the event of a spillage the risk of contamination is restricted to the Site to prevent onward transmission of pollutants.

S4. Amenity

The proposed rainwater harvesting butts provide amenity benefits. Captured water from the rainwater harvesting butts can be used to water trees, vegetation and crops and ensure their long-term viability as amenity features.

Rain planters are proposed to provide additional amenity benefits.

S5. Biodiversity

The proposed rainwater harvesting butts provide biodiversity benefits by providing a security of water supply. Captured water can be used to water trees, vegetation and crops and ensure their long-term viability as habitats for wildlife.

Rain planters are proposed to provide additional biodiversity benefits.

S6. Design of drainage for Construction, Operation and Maintenance and Structural Integrity

During the construction phase of the development, careful consideration must be given to the implementation of the proposed SUDS features.

Appropriate drainage features such as temporary attenuation systems should be considered to help manage runoff from the Site during the construction phase. Bunds could also be used to prevent runoff from the Site and to direct the runoff into the attenuation features.

The management and maintenance of the SuDS features should be undertaken by contractors appointed by the owners/managers of the Site.

SAB Comments

A pre application response was received on the 3rd June 2024. The below sets out these comments and confirms how the updated report and drainage design cover these comments.

S0 - General Comments

S0.1 – Permeable paving colour in key and drawing does not match – Both the permeable paving in the key, on the proposed layout drawing and on the contributing areas key are all coloured Cyan.

S0.2 – Please clarify what blue line with perpendicular lines is. This is listed as underground drainage pipe. Is this a perforated pipe for driveways? – The blue line with perpendicular lines is a perforated pick up drain located within the permeable paving. This is shown on the key. The goal of these pick up drains is to collect runoff that enters the permeable paving system and convey it into the nearby manhole.

S0.3 – Please justify why permeable paving and channel drain is required. – The permeable paving is proposed to provide attenuation of surface water runoff with also providing filtration. The lined paving will store runoff within its sub base prior to being conveyed into the manhole system and into the highway drain via the flow control. The channel drains are proposed at the edge of the paving to collect surface water runoff from the surface and convey it into the drainage network. This is to prevent flooding of the adjacent highway.

S1. Surface water runoff destination

S1.1 – Surface water run off destination must follow S1 Surface water runoff destination Priority Level 1: Surface water runoff is collected for use; Priority Level 2: Surface water runoff is infiltrated to ground; Priority Level 3: Surface water runoff is discharged to a surface water body; Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system; Priority Level 5: Surface water runoff is discharged to a combined sewer. Discharge of surface water to a foul sewer network is not acceptable or in line with the standards set within the Welsh Government Guidance see G1.36 within the guidance document https://www.gov.wales/sites/default/files/publications/2019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf. An alternative method of surface water disposal must be submitted with the full application or an automatic refusal will be given. – Wrexham Highways have subsequently accepted a surface water connection into their system at 1 l/s. Therefore, a connection into the foul sewer is no longer required and a connection into the highway drainage network is proposed as per step 4 of the drainage hierarchy.

S2. Surface water runoff hydraulic control

S2.1 – Surface water calculations should be included with the full submission. Calculations should be included for up to 1 in 100 year +40% cc event. – Calculations for the 2 year, 30 year, 100 year and 100 year plus 40% CC event have been included within Appendix B.

S3. Water Quality

S3.1 – No Comment

S4. Amenity

S4.1 – Please consider the use of above ground features such as swales, attenuation pond and rain gardens within the full application. – Rain planters have been proposed beneath the front RWP's to provide amenity benefits from above ground SuDS features.

Other above ground features such as swales and ponds are not considered feasible due to spatial constraints at the Site. Rain gardens are not proposed due to the garden areas being located at the rear of the Site, in the opposite direction of the proposed discharge route.

Furthermore, the use of rain gardens alone would not provide enough surface water attenuation and therefore permeable paving or an attenuation tank would be required as well, vastly increasing the cost of the proposed drainage scheme.

S5. Biodiversity

S5.1 – It is noted that the scale of the development may constrain the layout, however, please provide further consideration with regards to biodiversity within the Full Application. – As above, rain planters have been proposed beneath the front RWP's to provide amenity benefits from above ground SuDS features.

S6. Design of drainage for construction, operation and maintenance

S6.1– No Comment

Legend:

- RWP — Rain water pipe
- RWHB — Rain water harvesting butt
- Surface water drain
- Sub-base perforated pick-up drain
- OL LD — Linear drain with outlet
- Surface manhole with: S1 / CL 86.920 / IL 86.170 — Reference number / Cover level / Invert level
- Flow control at manhole
- Assumed falls
- Exceedance flow routes
- 86.92+ — LiDAR spot levels
- FFL 87.07+ — FFL as provided
- Permeable Paving
- Rain Planter
- Foul drain
- SVP — Soil vent pipe
- Foul manhole with: F1 / CL 86.725 / IL 86.025 — Reference number / Cover level / Invert level
- Public foul sewer

N

Building roof 195m² (100%)

Permeable paving (Type C non-infiltrating) 560m² (100%)

Surface water to discharge to the nearby highway drain at 1 l/s via new connection, as agreed with Wrexham Highways. Contractor to confirm the position and invert of the highway drainage network are suitable prior to commencement.

Foul water to discharge to the nearby foul sewer (manhole ref: SJ33564201) via new connection, as agreed with Welsh Water. Contractor to confirm the position and invert of the manhole are suitable prior to commencement.

Tanked permeable paving to have minimum 0.3m depth of hydraulic storage sub-base, OGCR or gravel with 30% voids. Sub-base to have base gradient of 1:100. Base of sub-base to fall towards pick-up features, outlet pipe to have flexible top hat arrangement or other as designed and specified by manufacturer. Permeable paving structural design to be provided by manufacturer, final design to be confirmed by manufacturer. Perforated drains to sit at base of sub-base or in trenches, base of sub-base to fall towards perforated pick-up drains.

Hydrobrake control to discharge 1 l/s at 0.7m design head.

Rain planters proposed to provide amenity and biodiversity benefits. Overflow to spill onto permeable paving.

RWP's to spill directly onto the permeable paving surface.

Foul design is based on 2 WC's (2.5 DU each), 2 wash basins (0.6 DU each), 1 bath (1.3 DU), 1 kitchen sink (1.3 DU), a dishwasher (0.8 DU) and household washing machine (0.8 DU) for a sum of 10.4 DU per dwelling.

Public foul sewer

1.004 150Ø 1:62 · 1.002 100Ø 1:47 · 3.001 150Ø 1:31 · 1.003 150Ø 1:54 · 3.000 150Ø 1:49 · 2.001 100Ø 1:12 · 1.002 150Ø 1:142 · 3.000 100Ø 1:38 · 2.000 150Ø 1:39 · 1.001 150Ø 1:134 · 1.001 100Ø 1:56 · 3.000 100Ø 1:14 · 2.000 150Ø 1:48 · 1.000 100Ø 1:42

F6_OUT IL 85.275 · S6 CL 86.500 IL 85.850 · S8 Non return valve CL 86.700 IL 85.625 · S7 CL 86.700 IL 85.725 · F4 CL 86.725 IL 85.950 · F6 CL 86.700 IL 85.550 · S4 CL 86.500 IL 85.775 · F3 CL 86.875 IL 86.175 · S5 CL 86.920 IL 86.170 · F5 CL 86.875 IL 86.175 · S2 CL 86.500 IL 85.850 · F2 CL 86.575 IL 85.850 · S3 CL 86.920 IL 86.170 · S1 CL 86.920 IL 86.170 · F1 CL 86.725 IL 86.025

Contributing Areas
Scale 1:200 @ A1

Proposed Surface and Foul Water Drainage Layout
Scale 1:100 @ A1

0 2m 4m 6m 8m 10m
10mm = 1m (1:100 @ A1)

Surface Water Drainage Strategy:

- Surface water drainage strategy consists of rainwater harvesting butts, rain planters, lined permeable paving and a hydrobrake.
- Surface water will be discharged to the nearby highway drain via a controlled rate of 1 l/s, as agreed with Wrexham Highways. This is because infiltration to ground has proven infeasible and no alternative discharge location such as watercourses are available.

Foul Water Drainage Strategy:

- Foul water should be discharged to the foul sewer beneath Gresford Road, subject to agreement by the utility provider.

Notes:

1. Do not scale from this drawing.
2. All dimensions are in millimeters unless otherwise stated.
3. This drawing to be read in conjunction with all other relevant drawings and documents.
4. All drainage to be constructed to SSG Design and Construction Guidance, current British standards and building regulations and other relevant standards.
5. Exact locations of soil vent pipes and other internal drainage down pipes to be confirmed by architect.
6. Exact locations of rain water downpipes and other internal drainage down pipes to be confirmed by architect / M&E engineer. Internal SVPs and other internal foul drainage to be designed by M&E engineer. Rain water pipes to discharge directly to permeable paving surface. Above ground drainage and pipes to be designed by M&E engineer.
7. Contractor to confirm locations of existing services prior to commencement on site and to arrange for any necessary diversions, lowering or protection works as required.
8. All specialist drainage components such as attenuation tanks, flow control and pumping stations to be designed and installed as per manufacturers requirements.
9. Cover levels to be confirmed by landscape architect. Cover levels and invert levels are in meters unless otherwise stated. If cover levels change from assumed then drainage design should be re-assessed.
10. Extent of linear drainage channel to perimeter of building and thresholds to highway boundary to be confirmed by architect, design as per manufacturer. Linear channels to have rodding access, sump and grated cover. Linear drains to manufacturer design.
11. Private surface water pipes to be 100Ø with minimum fall of 1:100 unless otherwise stated.
12. Private foul pipes to be 100mm Ø with minimum fall of 1:40 unless a WC is connected then minimum gradient 1:80, unless otherwise stated.
13. Permeable paving and outlets to be as manufacturer design and recommendations.
14. Proposed ground levels will influence the storage capacity of the permeable paving and the position of the drainage pick up features. When proposed ground levels are complete the permeable paving design should be reviewed to ensure sufficient storage is provided and that the drainage pick up features are positioned correctly.
15. Permeable paving sub-base should fall towards the drainage pick up features. Perforated pick up drains should fall towards the discharge point.
16. Minimum cover to thermoplastic pipes in garden or patio areas 0.6m, in driveway 0.9m, in road 1.2m, otherwise concrete protection will be required.
17. Access chamber cover class A15 for garden and patio, B125 for driveway, C250 for lightly trafficked roads or small private carparks.
18. Design should be reviewed in light of any additional information or on validation or otherwise of any assumptions.
19. As the Site has previously been developed an existing suitable discharge point may already be present on the site. A survey of the existing drainage should be undertaken to confirm.
20. Design is for planning purposes only and not for construction. Design should be confirmed prior to construction to ensure all available information is considered and any assumed information should be verified.

Rev	Date	Detail	Drwn	Chkd
P03	09.08.24	SAB comments	DS	WW
P02	26.04.24	Surface water design	DS	WW
P01	29.09.22	Initial issue	JR	MG

Client: Robert Whitney

Project: Woodville Garage

Drawing Title: Proposed Surface and Foul Water Drainage Layout

GeoSmart Information
Suite 9-11, 1st Floor, Old Bank Buildings, Bellstone, Shrewsbury, SY1 1HU

Drawn by:	Checked by:	Date:
JR	MG	Sept. 2022

Scale:	Status:
1:100, 1:200 @ A1	Preliminary

Drawing No:	Issue:
77196 100	P03



	Asset Type	Maintenance Schedule (and Frequency)	Party Responsible
	Permeable pavements	Regular maintenance: • Brushing and vacuuming (three time per year) • Trimming any roots and surrounding grass and weeds that may be causing blockages (annually or as required) Monitoring: • Initial inspection (monthly) • Inspect surface for poor performance or ponding (annually or after large storm events)	Privately owned and maintained by house owners or specialist asset management company as agreed / appointed by house owners.
	Underground drainage pipe network and manholes / catchpits	Regular maintenance: • Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber (annually) • Cleaning of gutters and any filters on downpipes (annually) • Trimming any roots that may be causing blockages (annually or as required) Monitoring: • Inspect silt traps and note rate of sediment accumulation (monthly in the first year and then annually)	
	Linear drainage channel Rain water pipe	Regular maintenance: • Remove sediment and debris from grating, channel and sump (monthly or as required) • Trimming any roots and surrounding grass blockages (as required) Monitoring: • Inspect inlets and outlets for blockages or silt accumulation (monthly or after a heavy storm)	
	Hydrobrake	Regular maintenance: • Remove silts from the Hydrobrake chamber sump (annually) • Remove any debris obstructing the inlet, outlet or control ensuring the emergency drain down mechanism if replaced correctly (annually) Monitoring: Inspect the hydrobrake control from the surface for signs of blockage or damage (as required) • Inspect the Hydrobrake chamber sump for build up of silt and the inlet and outlet for debris (annually) • Check the emergency drain down mechanism is in good working order (annually)	
	Rainwater harvesting water butt	Regular maintenance: • Clean tank, inlets, outlets, gutters, roof drain filters and withdrawal devices (annually or as required) • Empty water butt and clean interior, removing any sludge, algea or sediments (annually or as required) Monitoring: • Inspect tank for debris and sediment build up (annually and following poor performance) • Inspect inlets, outlets and overflow (annually and following poor performance)	
	Rain Planter	Regular maintenance: • Remove litter and debris (monthly or as required) • Manage other vegetation and remove nuisance plants (monthly at start then as required) • Repair / rehabilitate outlet, as required • Water (as required, in periods of drought) • Remove silt build-up from inlets and surface and replace mulch if necessary (annually, or as required) Monitoring: • Inspect structure and pipework for blockages and clear if required (monthly or as required) • Inspect silt accumulation rates and establish appropriate removal frequencies (half yearly) • Inspect inlets and outlets (monthly) • Check plant health and manage appropriately (annually)	

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P02	09.08.24	SAB Comments	DS	WW
P01	26.04.24	Initial issue	DS	MG

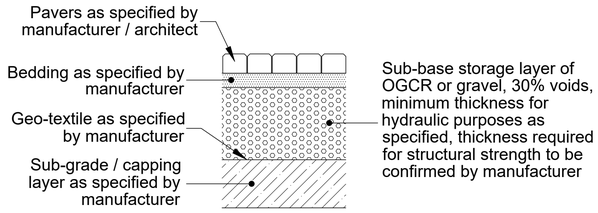
Client: Robert Whitney

Project: Woodville Garage

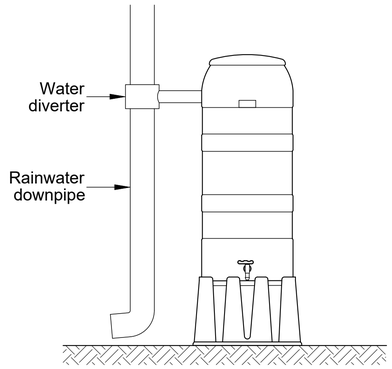
Drawing Title: Proposed Management and Maintenance Plan

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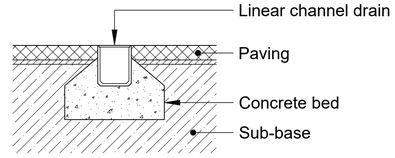
Drawn by:	Checked by:	Date:
DS	MG	Apr. 2024
Scale: N.T.S		Status: Preliminary
Drawing No: 77196 101		Issue: P02



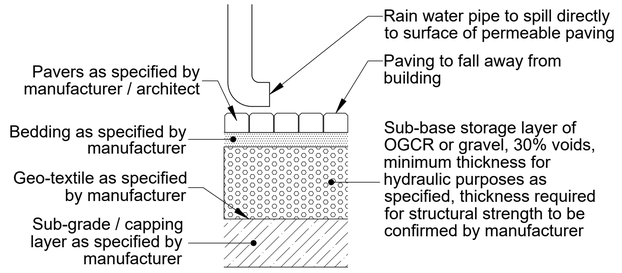
Typical Permeable Paving Detail



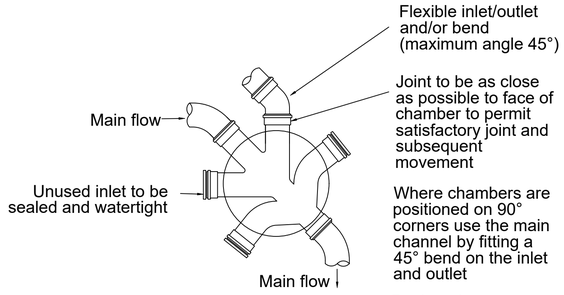
Typical Rain Water Harvest Butt



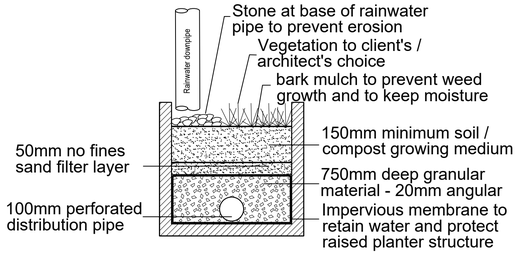
Typical linear drain



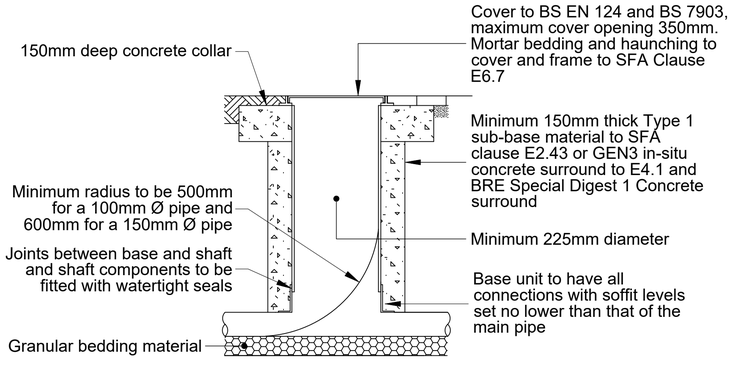
Typical Rain Water Pipe Direct Discharge to Permeable Paving Detail



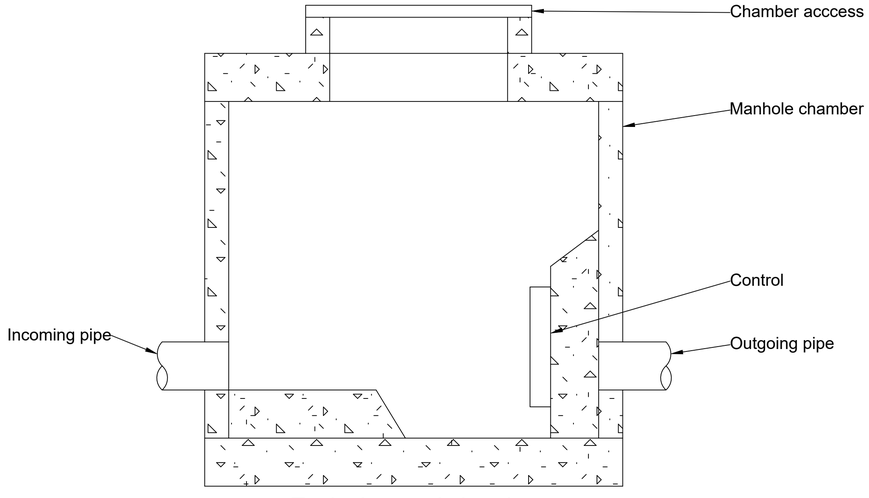
Typical base layout of Type 3 chambers



Raised Planter Detail



Typical Inspection Chamber
(Driveways, paved areas)



Typical control chamber
(Design to be specified by manufacturer)

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P02	09.08.24	SAB comments	DS	MG
P01	26.04.24	Initial issue	DS	MG

Client: Robert Whitney

Project: Woodville Garage

Drawing Title: Proposed Drainage Details

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Drawn by:	Checked by:	Date:
DS	MG	Apr. 2024
Scale: N.T.S		Status: Preliminary
Drawing No: 77196 102		Issue: P02

2 Site analysis

Site location

Figure 1. Aerial Imagery (Bluesky, 2023)

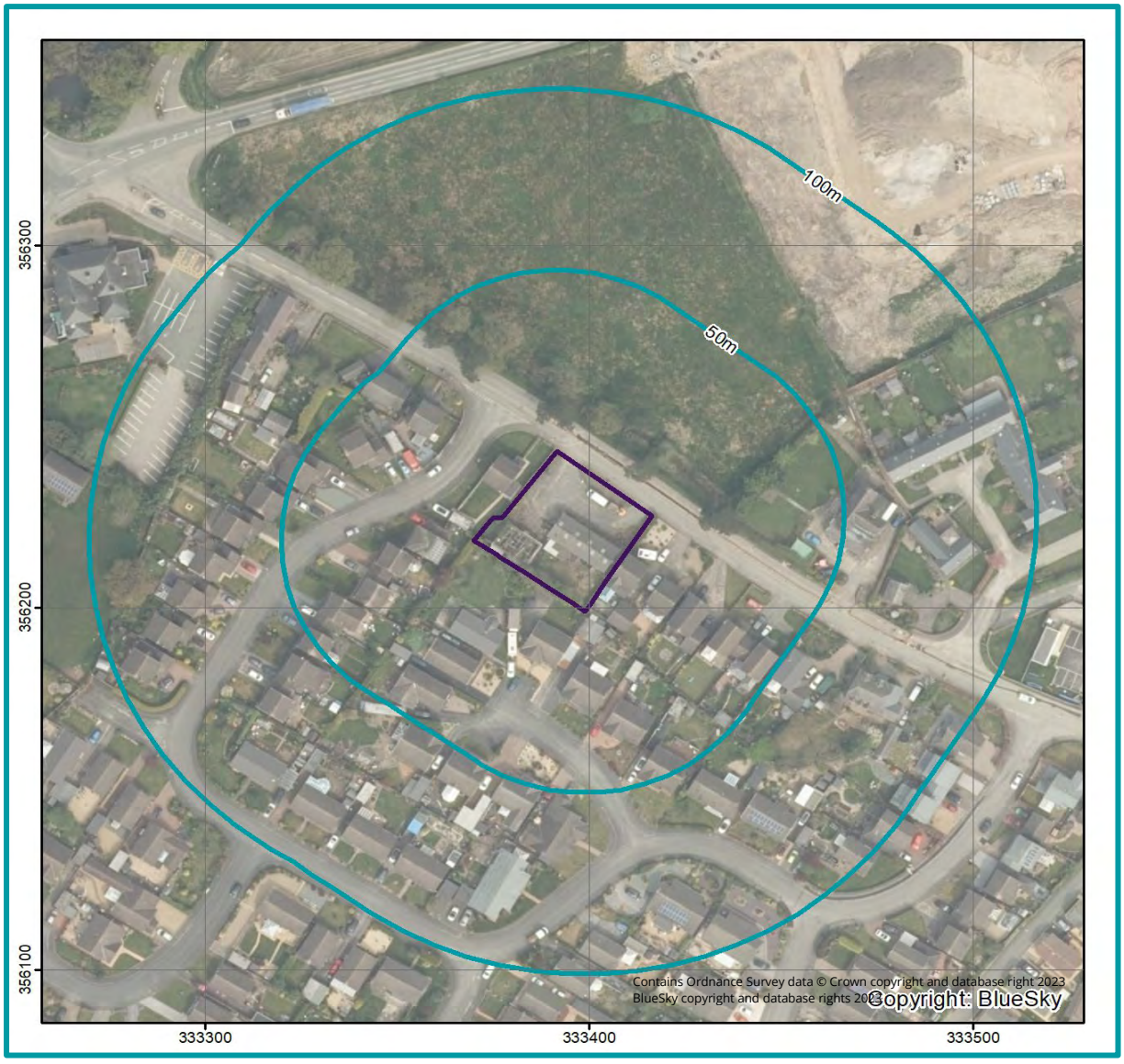


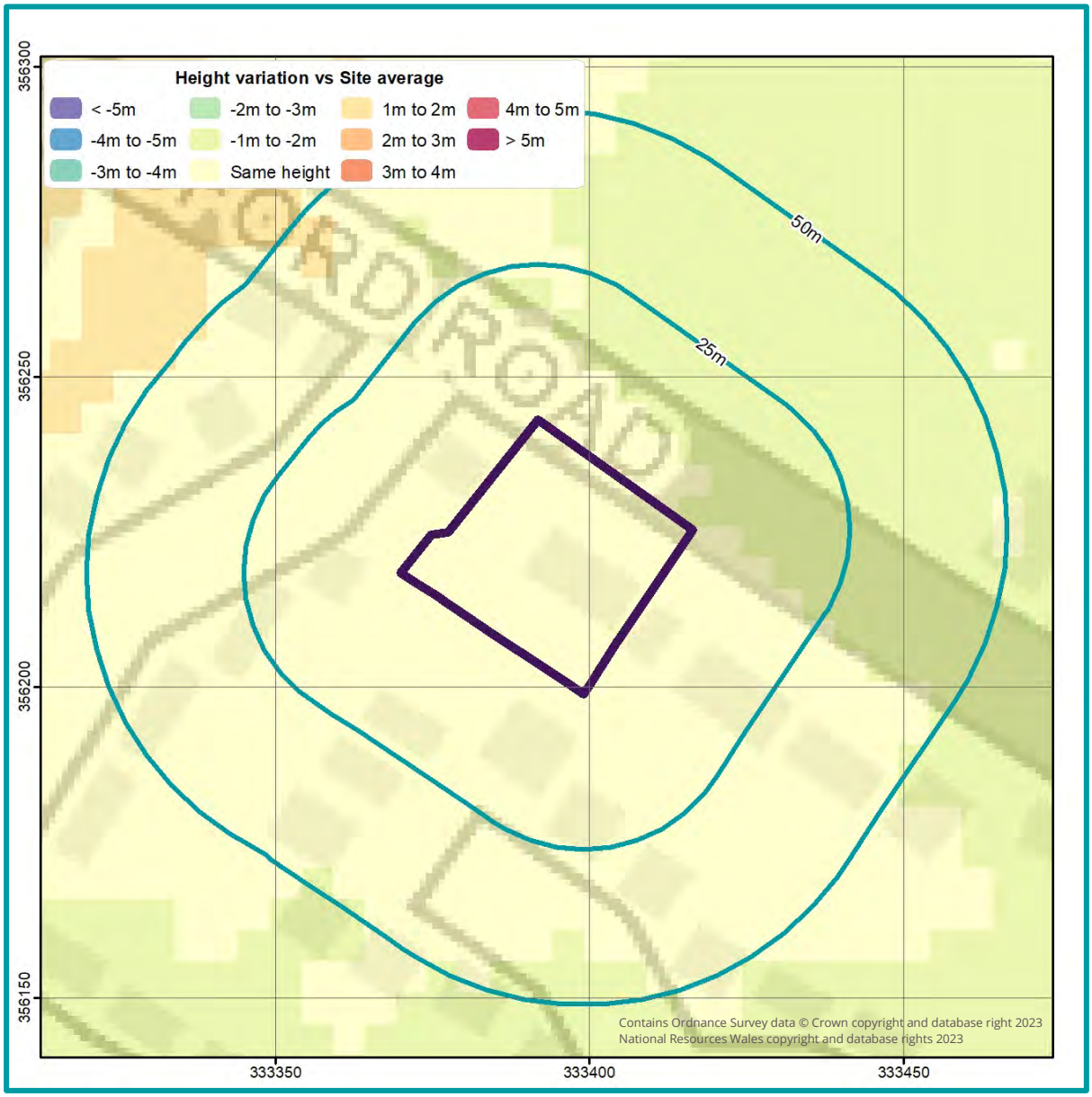
Figure 2. SuDS infiltration suitability (SD50) map (GeoSmart, 2023)



The GeoSmart SuDS Infiltration Suitability Map (SD50) screens the potential for infiltration drainage at the Site and indicates where further assessment is recommended. The map combines information on the thickness and permeability of the underlying material and the depth to the high groundwater table. It supports conceptual Site drainage design and the planning of further Site investigation.

There is a Moderate potential for infiltration SuDS across the Site. It is likely that the underlying geology at the Site has variable permeability. However, infiltration testing was undertaken by Sub Surface in February 2024, confirming a soil infiltration rate could not be calculated due to the low permeability of the strata (Appendix D).

Figure 3. Site topography (GeoSmart, 2023)



An assessment of the topography at the Site has been undertaken using LiDAR DTM5 elevation data to identify the general slope and any localized depressions. The mapping shows a comparison between average ground levels on the Site with ground levels in the surrounding area. The mapping confirms the overall Site is generally level.

Further analysis could be undertaken by visiting the Site or by collecting additional topographic survey to provide further confirmation of ground levels.

Figure 4. Source protection zone map (EA, 2023)



An assessment of the EA's groundwater Source Protection Zones (SPZs) has been undertaken within the vicinity of the Site and confirms the Site is not located within an SPZ.

Infiltration, if possible, is likely to be acceptable providing risk screening identifies suitable mitigation measures, if required, to prevent an impact on water quality from the proposed or historical land use and contaminated land.

A separate phase 1 contaminated land report has been prepared by GeoSmart which considers the contamination risks to the proposed development (ref: 77196).

If further analysis is required, this would involve a review of Site specific contaminated land data. If hazards are identified, it is recommended that the Local Authority and National Resources Wales are contacted to confirm the susceptibility of any SPZs within the wider area.

Figure 5. Surface water features map (EA, 2023)

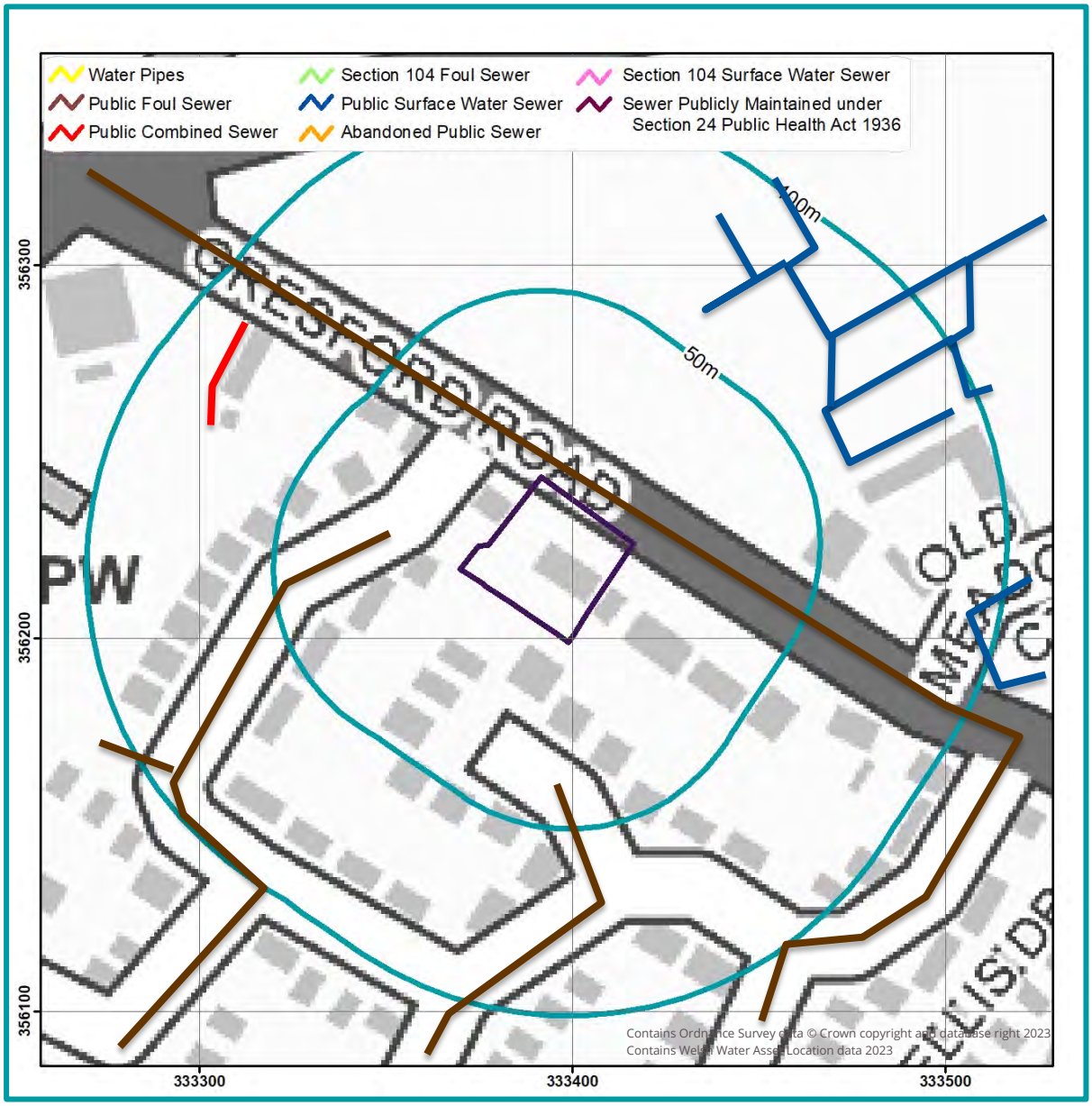


The mapping above confirms that there are no surface water feature within 100 m of the Site. Therefore, discharge to surface water is unlikely to be appropriate.

According to DEFRA's MagicMap, the Site is not within 250m of a SSSI or SPA.

Further analysis could be undertaken by visiting the Site or by contacting the Local Council and National Resources Wales (NRW) to confirm the presence, location and condition of any mapped or additional unmapped surface water features.

Figure 6. Sewer features map (OS & Welsh Water, 2023)



GeoSmart has undertaken an assessment of the location of sewer features within the vicinity of the Site. There is a public surface water sewer, located approximately 70 m to the northeast of the Site and a combined sewer approximately 85 m to the northwest of the Site. However, discharging to these features would require crossing third-party land, and therefore discharge to sewer is not feasible.

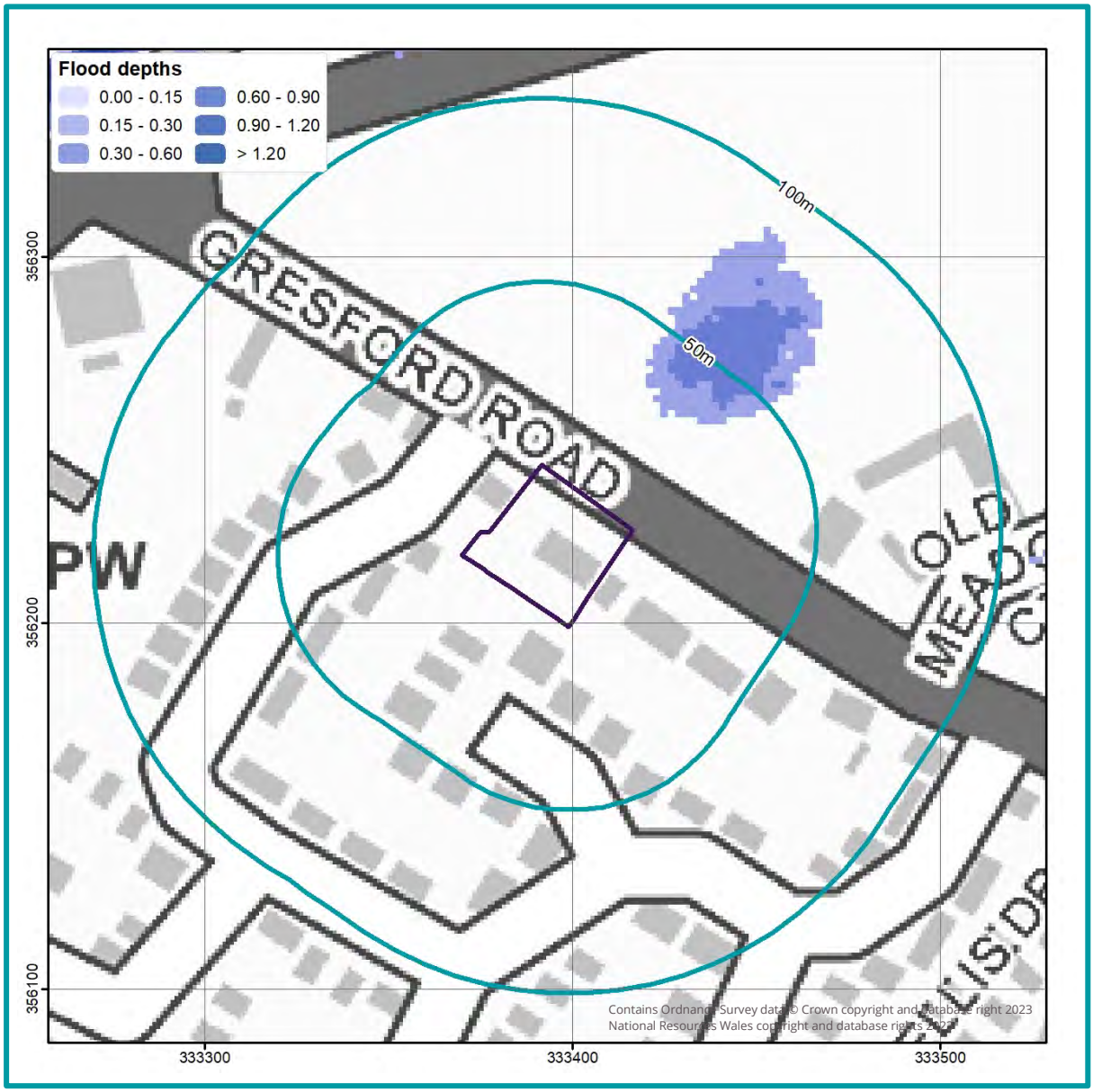
It is noted that there is a foul sewer adjacent to the northeast of the Site.

Figure 7. Risk of flooding from rivers & sea map (NRW, 2023)



According to the NRW's Flood Risk Wales mapping, the Site has a Very Low risk of flooding from fluvial or coastal flooding, with less than 0.1% annual probability of flooding, therefore the SuDs design is unlikely to be affected.

Figure 8. Risk of surface water flooding map (NRW, 2023)



GeoSmart have undertaken an assessment of the risk of flooding from surface water (pluvial) sources within the vicinity of the Site using the NRW's Flood Risk from Surface Water and Small Watercourses mapping.

The above map shows the extent and depth of flooding during the >3.3% annual probability (AEP) (1 in 30 year – High risk), 3.3 – 1% AEP (1 in 100 year – Medium risk) and 1 – 0.1% AEP (1 in 1000 year – Low risk) events. This confirms that there are no areas of the Site which would be affected by surface water flooding.

Further analysis could be undertaken by visiting the Site or by contacting the Local Council and NRW to confirm the pluvial flood risk, flood depths and velocities where applicable.

Figure 9. Groundwater flood risk (GW5) map (GeoSmart, 2023)



GeoSmart have undertaken an assessment of the risk of flooding from groundwater within the vicinity of the Site. GeoSmart's Groundwater Flood Risk Screening (GW5) map confirms the Site has a Negligible risk of groundwater flooding during a 1% annual probability (1 in 100 year) event.

3 Site context

Site information

The purpose of this report is to assess the potential for disposing of surface water through a Sustainable Drainage System (SuDS) for the site of Woodville Garage, 14 Gresford Road, Wrexham, LL12 0NW (the Site). The Site is located to the north of Wrexham in a setting of residential use. The land is relatively level across the Site, with ground levels ranging between 86.41 mAOD and 87.05 mAOD. This is based upon a Site specific topographic survey undertaken by Scott Architecture Ltd (2022). Site plans and drawings are provided in Appendix A.

Development

The Site is currently occupied by an inactive vehicle repair garage with associated hardstanding and modest softstanding. The existing buildings appear to be in a poor state of repair. Development proposals comprise the demolition of the existing buildings and the construction of three detached residential dwellings with associated gardens.

Geology, permeability and thickness

British Geological Survey (BGS) national superficial and bedrock geology mapping confirms the geological formations underlying the Site and each formation may have a range of permeability.

Table 1. Site Geology

Geology present on-Site		Potentially permeable?
Superficial geology (Figure 11)	Devensian Till – Diamicton (TILLD)	✓
Bedrock geology (Figure 12)	Salop formation – sandstone, mudstone and conglomerate (SAL)	✓

The permeability of the underlying material at the Site shown within the BGS mapping is moderate.

BGS Borehole Records

According to the BGS website there are no relevant boreholes within 250 m of the Site from which the underlying geology can be inferred.

Site Investigation

A Site Investigation and soakaway testing was undertaken by Sub Surface in February 2024. A trial pit (TP1) was excavated in the northwest of the Site, confirming the underlying geology to be comprised of made ground to a depth of 0.60 m below ground level (bgl) underlain by silty sandy gravelly clay to a depth of 1.60 m bgl, where the trial pit record ends. Infiltration testing was conducted on-Site, however a soil infiltration rate could not be calculated due to the low permeability of the strata (Appendix D).

Figure 10. Superficial Geology (BGS, 2023)

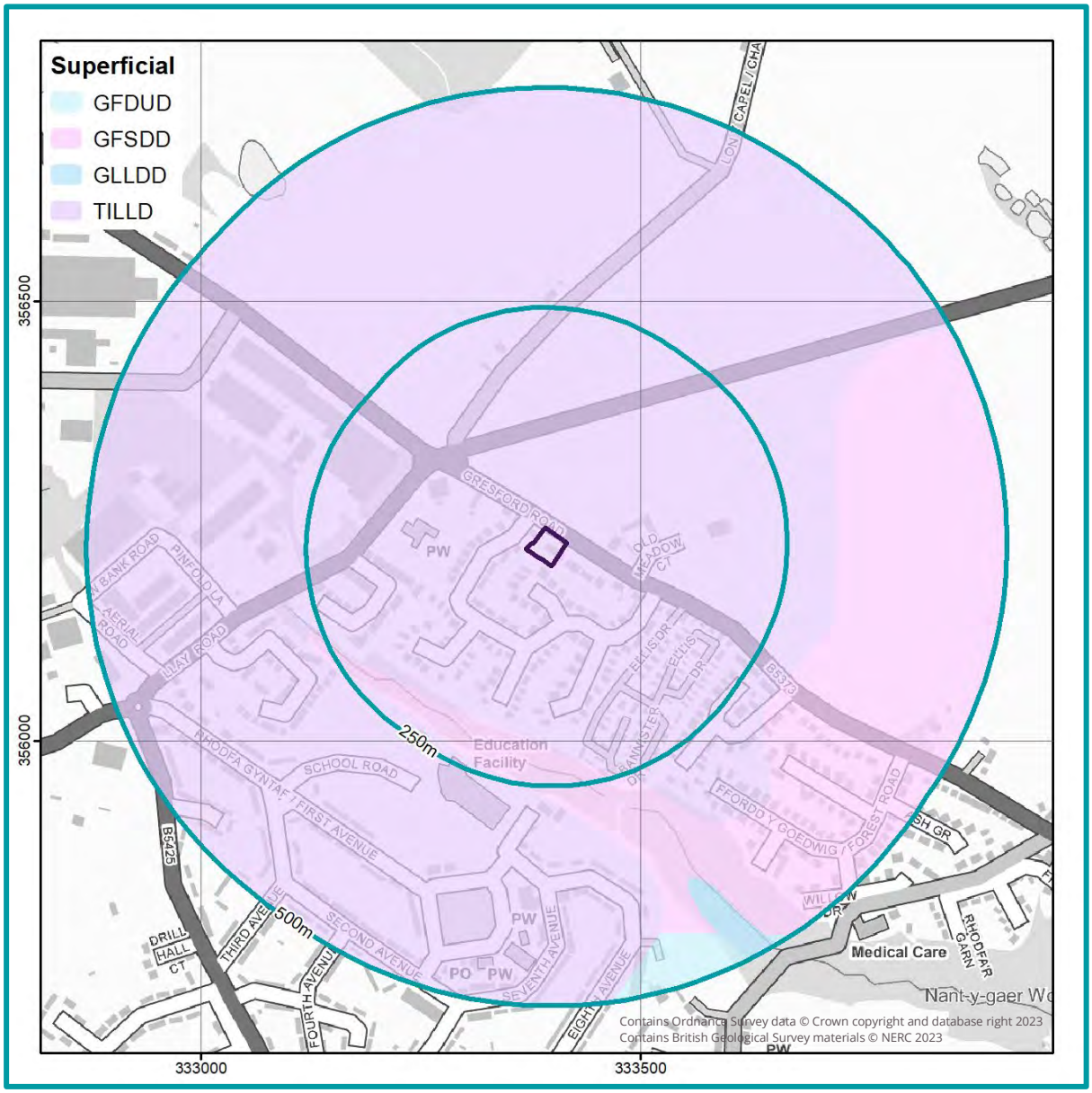
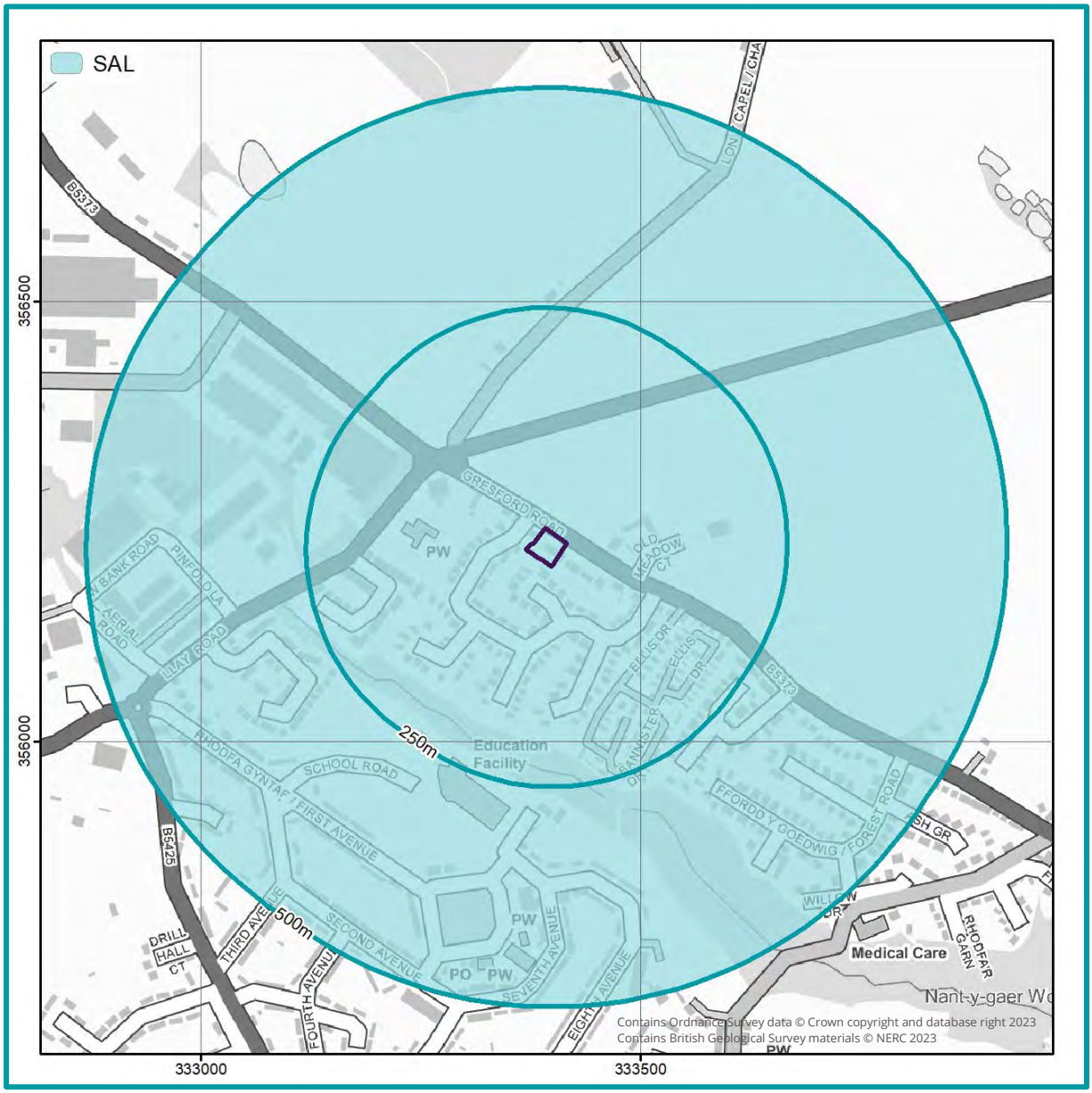


Figure 11. Bedrock Geology (BGS, 2023)



Depth to groundwater

The SuDS system should be designed to operate in periods of extreme groundwater levels.

According to and GeoSmart's Groundwater Flood Risk (GW5) map, shallow groundwater is unlikely to be an issue at the Site.

The on-Site trial pit record did not encounter groundwater during excavation (Sub Surface, 2024).

Infiltration features are not proposed at the Site, given the low permeability of the underlying geology.

Ground conditions

Infiltration SuDS features are not proposed at the Site as infiltration testing confirmed infiltration to ground is not feasible (Sub Surface, 2024). Therefore a detailed investigation into the ground conditions is not required.

Water quality

The Site does not lie within an SPZ and infiltration features are not proposed. A phase 1 contaminated land assessment has been carried out separately by GeoSmart (ref: 77196), which considers the contamination risks to the proposed development (ref: 77196).

4 SuDS Approval and Adoption



The Flood and Water Management Act 2010 (Schedule 3) requires new developments to include Sustainable Drainage Systems (SuDS) features that comply with national standards.

Schedule 3 of the Flood and Water Management Act 2010 (FWMA) establishes SuDS Approval Bodies (SABs) in county councils. The Act gives us statutory responsibility for approving and adopting the approved drainage systems.

The SAB is established to:

- Evaluate and approve drainage applications for new developments where construction work has drainage implications, and
- Adopt and maintain surface water drainage systems according to Section 17 of Schedule 3 (FWMA).

An application demonstrating compliance with the Statutory SuDS Standards for the design, construction, operation and maintenance of surface water drainage systems serving new developments, must be submitted to the SAB.

Applications may be submitted to the SAB for determination either directly as a free-standing application or alongside the planning application.

It is important to note that construction work which has drainage implications must not be commenced unless the drainage system for the work has been approved by the SAB.

The SAB approves and adopts any part of a drainage system that serves more than a single property.

Developers will need to enter into a legal adoption agreement as a part of the SAB consent process.

The SAB approves but will not adopt a drainage system in a publicly maintained road. Publicly maintained roads are those to which section 41 of the Highways Act 1980 applies.

Where a connection to an existing public sewer is required, an adoption agreement must be in place prior to any connection being made to the public sewer.

Lined permeable paving is proposed at the Site, but as such is not likely to be adopted by the Council or the utility provider, in line with the Sewerage Sector Guidance (Water UK, 2020). Therefore, the management and maintenance of the proposed SuDS features will be undertaken as follows:

The management and maintenance of the SuDS features, in line with the details and schedules outlined in Section 11 (Table 12) of this report, will be undertaken by contractors appointed by the owners and occupiers of the new residential building, where payments of the works will form part of the property deeds and / or rental agreements.

5 National & local policy context



National Guidance

National guidance and policy

The Flood and Water Management Act 2010 (Schedule 3), which came into effect in Wales on 7 January 2019, requires new developments to include SuDS features that comply with national standards.

The Order commencing Schedule 3 of the Flood and Water Management Act 2010 for Wales was made on 1 May 2018 and the Welsh Statutory Instruments laid before the National Assembly of Wales on the 15th of October 2018. The legislation, along with the regulations necessary for its implementation, will come into effect on 7 January 2019.

- All new developments of more than 1 house or where the construction area is 100m^2 or more, will require sustainable drainage systems (SuDS) for managing surface water.
- Drainage systems for all new developments must be designed and built in accordance with statutory SuDS standards.
- Local authorities will become the SuDS Approving Body (SAB).
- SuDS schemes must be approved by the local authority acting in its SAB role before construction work begins. The SAB will have a duty to adopt compliant SuDS so long as it is built and functions in accordance with the approved proposals, including any SAB conditions of approval.

CIRIA SuDS Manual (C753) (2015)

A development should utilise sustainable drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the drainage hierarchy.

Sustainable Drainage System Standards for Wales (2018)

Surface water runoff destination:

Priority Level 1: Surface water runoff is collected for use;

Priority Level 2: Surface water runoff is infiltrated to ground;

Priority Level 3: Surface water runoff is discharged to a surface water body;

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;

Priority Level 5: Surface water runoff is discharged to a combined sewer.

Infiltration to ground:

Infiltration systems can be designed for any scale of event and any size of runoff area. The larger the event or contributing area, the larger the required storage volume and/or infiltration area will be. The optimum size will depend on the rate of infiltration, the space available and cost of storage, and the feasibility and costs associated with managing events larger than that for which the system is designed.

The infiltration component should discharge from full to half-full within a reasonable time so that the risk of it not being able to manage a subsequent rainfall event is minimized. Where components are designed to manage the 1 in 10 year or 1 in 30 year event, it is usual to specify that half emptying occurs within 24 hours. If components are designed to infiltrate events greater than the 1 in 30 year event, designing to half empty in 24 hours can result in very large storage requirements and, with agreement from the drainage approving body, it may be appropriate to allow longer half emptying times. This decision should be based on an assessment of the performance of the system and the risk and consequences of consecutive rainfall events occurring.

Discharge to combined sewer:

Surface runoff not discharged in accordance with Levels 1 to 4 may be discharged to a public combined sewer with the agreement of the sewerage undertaker; providing it has capacity to accommodate the additional flows.

The risks associated with surface water runoff entering the combined sewer and resultant possible pollution from backflow or surcharge should be guarded against, including consideration of the use of non-return valves at appropriate locations. Provision should be made for separation and removal of sediments and oils before connection to a combined sewer.

Runoff rates:

Reducing the impact of surface water runoff from the development on flood risk associated with the receiving water body, is based on limiting the peak runoff rate and runoff volume for extreme events. The 1:100 year return period rainfall event is the criterion normally used.

Aiming to replicate greenfield runoff rates for extreme events helps ensure that the flood risk associated with the receiving watercourse/sewer is not increased by the development.

Where controlling runoff to greenfield volumes is considered unachievable, then the runoff volume should be reduced as much as possible and any additional volume should be stored and released at a low rate which will not increase downstream flood risk (normally 2 l/s/ha is considered an appropriate rate).

Climate change guidance

The climate change allowances for rainfall runoff and surface water flooding in Wales is based upon the NRW's Flood Consequences Assessments: Climate Change Allowances (NRW, 2021). This confirms that as the development lifespan is likely to be 100 years, the following applies:

Table 2. Table 4: Climate change rainfall allowances

Applies across all of Wales	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

6 Storage, volume and peak flow rate

Suggested minimum and aspirational storage requirements for an attenuation SuDS scheme for the development footprint are set out below, with more detail provided in subsequent sections. Storage volumes may be reduced (but not below the minimum level) if the design incorporates off-Site discharge.

Table 3. Storage requirements at the proposed development Site (Discharge runoff to highway drain)

Attenuation scenario		Attenuation required (m^3)	Explanation
Discharge runoff to highway drain	1 in 100 year including 40% CC	61.53	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year event including a 40% allowance for climate change*.

*See Appendix B for associated runoff and discharge calculations. Discharge rates all restricted as close as possible to greenfield rates in their respective events.

Surface water runoff

An increase in impermeable area on-Site will result in greater rainfall runoff. Reduction in runoff will help mitigate flood risk both on and off-Site. Further information on the surface water runoff calculations is provided in Section 12 'Background Information'.

Guidance

The Non-Statutory Technical Guidance for SuDS (Defra, March 2015) states:

"Where reasonably practicable, 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. Where reasonably practicable, for developments which have been previously developed, 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 must be constrained to a value as close as is reasonably practicable

to the Greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event."

Table 4. Change in impermeable area associated with the development

Total Site area	1035 m^2
Impermeable area (and as a percentage of the total area of the proposed development footprint of 1035 m^2)	
Pre-development	Post-development
978 m^2 (95%)	755 m^2 (73%)
Impermeable land use: Existing buildings and areas of hardstanding Permeable land use: Softstanding areas	New impermeable land use: New dwellings and paved areas New permeable land use: Lawn areas

Guidance

"The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event' and 'flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development"

(Defra, March 2015, non-statutory guidance).

7 Runoff destination

Options for the destination for the runoff generated on-site have been assessed in line with the prioritisation set out in the Building Regulations Part H document (HM Government, 2010) and the Statutory SuDS Standards for Wales (S1) (2018). The drainage hierarchy is as follows:

Priority Level 1) Surface water runoff is collected for use;

Priority Level 2) Surface water runoff is infiltrated to ground;

Priority Level 3) Surface water runoff is discharged to a surface water body;

Priority Level 4) Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;

Priority Level 5) Surface water runoff is discharged to a combined sewer.

Priority Level 1: Surface water runoff collection

Rainwater harvesting butts are proposed at the downpipes which will seek to collect and utilise rainwater creating an area of enhanced biodiversity / amenity value.

Priority Level 2: Surface water runoff infiltrated to ground

The Site has moderate potential for infiltration, with potentially permeable underlying superficial deposits (Devensian Till) and bedrock (Salop Formation). Based on the site investigation and groundwater flood risk mapping shallow groundwater is unlikely to be an issue at the Site. Infiltration testing was undertaken by Sub Surface in February 2024, however a soil infiltration rate could not be calculated due to the low permeability of the strata. Therefore, infiltration to ground is not considered feasible.

The Site is not located within an SPZ, however a separate phase 1 contaminated land report prepared by GeoSmart (ref: 77196) indicates the Site has a moderate risk of contamination.

Priority Level 3: Surface water runoff discharge to a surface water body

According to OS mapping, there are no surface water features located within the vicinity of the Site and therefore discharge to surface water feature is not feasible.

Priority Level 4: Surface water runoff discharge to a surface water sewer, highway drain, or another drainage system

A Welsh Water asset location plan obtained for the Site (Appendix C) confirms that the nearest surface water sewer to the Site is located approximately 70 m to the northeast of the Site, however discharging to this feature would require crossing third-party land, and is therefore not feasible.

According to Google Streetview highway gullies are located within Gresford Road indicating the presence of a highway drainage network. Wrexham Highways have confirmed that a connection into the highway system at 1 l/s is acceptable and is therefore proposed.

Priority Level 5: Surface water runoff discharge to a combined sewer

A Welsh Water asset location plan obtained for the Site (Appendix C) confirms that there is a public combined sewer approximately 85 m to the northwest of the Site, however discharging to this feature would require crossing third-party land, and is therefore not feasible.

Guidance

*"**G1.1.** As much of the runoff as possible (subject to technical or cost constraints) should be discharged to each destination before a lower priority destination [level] is considered.*

***G1.2.** Depending on the site characteristics, drainage from different parts of the site could have different drainage destinations.*

***G1.3.** Depending on the quantity of runoff and the potential for a particular destination to manage that runoff, small events may discharge to a higher level while larger events may need to make use of lower priority destinations."*

(Statutory National Standards for SuDS. Welsh Government. October 2018)

8 Water quality

A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution. This can be effectively managed by an appropriate "train" or sequence of SuDS components that are connected in series. The frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals and various organic and inorganic contaminants). Therefore, the first 5-10 mm of rainfall (first flush) should be adequately treated with SuDS.

The minimum number of treatment stages will depend on the sensitivity of the receiving water body and the potential hazard associated with the proposed development SuDS Manual (CIRIA, 2015). The proposed development is a combination of very low (roof water) to low hazard (runoff from car parking and road). The Site does not lie within an SPZ and therefore additional treatment stages are not required.

Table 5. Level of hazard

Hazard	Source of hazard
Very Low	Residential roof drainage
Low	Residential, amenity uses including low usage car parking spaces and roads, other roof drainage.
Medium	Commercial, industrial uses including car parking spaces and roads (excluding low usage roads, trunk roads and motorways).
High	Areas used for handling and storage of chemicals and fuels, handling of storage and waste (incl. scrap-yards).

The recommended minimum number treatment stages suggested for the different runoff waters identified for the proposed development is highlighted in the table below.

Table 6. Minimum number of treatment stages for runoff

		Sensitivity of the receiving water body		
		Low	Medium	High
Hazard	Low	1	1	1
	Med	2	2	2
	High	3	3	3

9 SuDS Maintenance

Regular maintenance is essential to ensure effective operation of the SuDS features over the intended lifespan of the proposed development. The SuDS Manual (C753) (CIRIA, 2015) provides a maintenance schedule for SuDS with details of the necessary required actions as shown in the table below.

As the SuDS features will be wholly located on the Site itself, all maintenance responsibilities will be with the Site owner. Responsibility for maintenance will be set out as part of the deeds of the property with funding also supplied by the owner. Estimated costs for annual maintenance have been taken from Cost Estimation for SuDS – Summary of evidence report SC080039/R9 (EA/JBA Consulting 2015).

Table 7. SuDS operation and recommended maintenance requirements

Asset type	Maintenance schedule and frequency	Estimates Installation cost	Annual estimated maintenance cost
Simple rainwater harvesting (water butts)	Annual - cleaning inlets, outlets, gutters and tanks	£100 - £243 per property (includes installation and connection pipe)	Negligible
Permeable Pavements	Regular maintenance: •Brushing and vacuuming (three time per year) •Trimming any roots and surrounding grass and weeds that may be causing blockages (annually or as required) Monitoring: •Initial inspection (monthly) •Inspect surface for poor performance or ponding (annually or after large storm events)	£30-£40 per m^2 of permeable surface	£0.5 - £1 / m3 of storage volume

10 Client checklist

A drainage strategy should now be compiled on the basis of the information provided. Prior to installation of the Site drainage system it is recommended that the client carries out the following checks to confirm the development proposals. GeoSmart would be able to support with any updates required to the drainage scheme, please contact us and we would be happy to provide you with a proposal to undertake the work.

Table 8. Potential SuDS limitations

Conditions in Non-Statutory Technical Standards (Defra, 2015), limitations to infiltration SuDS	Do these conditions arise at the Site?
Is the surface runoff greater than the rate at which water can infiltrate into the ground?	
Is there an unacceptable risk of ground instability?	
Is there an unacceptable risk of mobilising contaminants?	
Is there an unacceptable risk of pollution to groundwater?	
Is there an unacceptable risk of groundwater flooding?	
Is the infiltration system going to create a high risk of groundwater leakage to the combined sewer?	

Table 9. SuDS design considerations

Confirm that potential flooding on-Site in excess of the design storm event and exceedance flow routes have been considered.	
Review options for the control of discharge rates (e.g. hydrobrake).	
Confirm the owners/adopters of the drainage system. Consider management options for multiple owners.	
Is there an unacceptable risk of pollution to groundwater?	
Review access and way leave requirements.	
Review maintenance requirements.	

Health and safety considerations for SuDS

GeoSmart reports may include outline strategies or designs to support with development plans. Any drawings or advice provided do not comprise any form of detailed design. Implementation of any conceptual scheme options may constitute 'Construction Work' as defined by CDM Regulations (2015).

The CDM Regulations place specific Health and Safety duties on those commissioning, planning and undertaking construction works. If you are uncertain what this means you should seek the advice of your architect, builder or other competent professional.

GeoSmart does not provide health and safety advisory services but we are required to advise you of your general responsibilities under CDM (visit http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/ for more information).

Please remember that detailed design work should be undertaken by a competent professional who might be your engineer, architect, builder or another competent party.

11 Methodology and limitations of study

This report assesses the feasibility of infiltration SuDS and alternative drainage strategies in support of the Site development process. From April 6th 2015 SuDS are regulated by Local Planning Authorities and will be required under law for major developments in all cases unless demonstrated to be inappropriate. What is considered appropriate in terms of costs and benefits by the Planning Authority will vary depending on local planning policy, and Site setting. The Lead Local Flood Authority will require information as a statutory consultee on major planning applications with surface water drainage implications. The National Planning Policy Framework requires that new developments in areas at risk of flooding should give priority to the use of SuDS and demonstrate that the proposed development does not increase flood risk downstream to third parties.

How was the suitability of SuDS estimated for the Site?

There are a range of SuDS options available to provide effective surface water management that intercept and store excess runoff. When considering these options, the destination of the runoff should be assessed using the order of preference outlined in the Building Regulations Part H document (HM Government, 2010) and Defra's National Standards for SuDS (2015):

1. Discharge to the ground;
2. Discharge to a surface water body;
3. Discharge to a surface water sewer;
4. Discharge to a local highway drain; and
5. Discharge to a combined sewer.

Data sets relating to each of the potential discharge options have been analysed to assess the feasibility of each option according to the hierarchy set out above. Hydrogeological characteristics for the Site are assessed in conjunction with the occurrence of SPZ's to assess infiltration suitability. The Site has been screened to determine whether flood risk from groundwater, surface water, fluvial or coastal sources may constrain SuDS. The distance to surface water bodies and sewers has been reviewed gauge whether these provide alternative options.

GeoSmart SuDS Infiltration Suitability Map (SD50)

The GeoSmart SuDS Infiltration Suitability Map (SD50) screens the suitability for infiltration drainage in different parts of the Site and indicates where further assessment is recommended. In producing the SuDS Infiltration Suitability Map (SD50), GeoSmart used data from the British Geological Survey on groundwater levels, geology and permeability to screen

for areas where infiltration SuDS may be suitable. The map classifies areas into 3 categories of High, Medium and Low suitability for infiltration SuDS. This can then be used in conjunction with additional data on Site constraints to give recommendations for SuDS design and further investigation.

The primary constraint on infiltration potential is the minimum permeability of the underlying material and in some cases the range in permeability may be considerable, ranging down to low. The map classifies these areas as moderate infiltration suitability requiring further investigation. In cases where the thickness of the receiving permeable horizon is less than 1.5 meters then additional Site investigation is recommended. If the Site is at risk of groundwater flooding for up to the 1% annual occurrence the map classifies these areas as moderate infiltration suitability requiring further investigation.

The GeoSmart SuDS Infiltration Suitability Map (SD50) is a national screening tool for infiltration SuDS techniques but a Site specific assessment should be used before final detailed design is undertaken. Further information on the GeoSmart SuDS Infiltration Suitability Map (SD50) is available at geosmartinfo.co.uk

How is the suitability to discharge to sewers and watercourses calculated?

The suitability to discharge to discharge to sewers and watercourses has been calculated using the distance from the Site to both. For example, where the Site is within 50 m of a surface water body. Discharge to surface water is potentially appropriate subject to land access arrangements and a feasibility assessment. Where the Site is within 50 m of a sewer, discharge to sewer is potentially appropriate subject to land access arrangements and a feasibility assessment. The utility company should be contacted to agree connection feasibility and sewer capacity.

Further information relating to sewers available in the area can be found in Appendix C.

What is a Source Protection Zone?

NRW have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied. The zones are used to set up pollution prevention measures in areas which are at a higher risk. The shape and size of a zone depends on the condition of the ground, how the groundwater is removed, and other environmental factors. Inner zone (Zone 1) is defined as the 50 day travel time from any point below the water table to the source (minimum radius of 50 metres). Outer zone (Zone 2) is defined by a 400 day travel time. Total catchment (Zone 3) is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.

How was surface water runoff estimated from the Site?

In accordance with The SuDS Manual (C753) (CIRIA, 2015), the Greenfield runoff from the Site has been calculated using the IoH124 method and is assumed representative of the runoff generated on the undeveloped surfaces that are affected by the proposed development. The method used for calculating the runoff complies with the NPPF (MHCLG, 2021). For the impermeable surfaces, it has been assumed that 100% runoff will occur (calculations provided in Appendix B). Rainfall data is derived from the Flood Estimation Handbook (FEH), developed by NERC (2009). Only areas affected by the proposed development are considered in the flow and volume calculations. Permeable areas that remain unchanged are not included in the calculations as it is assumed these will not be actively drained and attenuated.

What is the peak discharge rate?

An estimation of peak runoff flow rate and volume is required to calculate infiltration, storage and discharge requirements. The peak discharge rate is the maximum flow rate at which surface water runoff leaves the Site during a particular storm event, without considering the impact of any mitigation such as storage, infiltration or flow control. Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. If all drainage is to infiltration there will be no discharge off-Site. Discharging all flow from Site at the existing 1 in 100 event would increase flood risk during smaller events. Flow restriction is generally required to limit the final discharge from Site during all events as a basic minimum to the green field QBAR rate. A more complex flow restriction which varies the final discharge rate from the Site depending on the storm event will reduce the volume of storage required on-Site. Drainage to infiltration SuDS is subtracted from the total discharge off-Site to achieve a beneficial net affect.

What is the total discharge volume?

The total discharge volume is calculated on the basis of the surface water runoff that has the potential to leave the Site as a result of the assumed 6 hour duration design storm event. The runoff is related to the underlying soil conditions, impermeable cover, rainfall intensity and duration of the storm event. The total volume generated by the current Site is compared to the potential total volume from the developed Site (not taking into consideration any mitigation). The difference provides the minimum total volume that will need to be stored and infiltrated on-Site or released at a controlled rate. Guidance indicates that the total discharge volume should never exceed the runoff volume from the development Site prior to redevelopment for that event and should be as close as is reasonably practicable to the Greenfield runoff volume.

12 Background SuDS information



SuDS control surface water runoff close to where it falls. SuDS are designed to replicate, as closely as possible, the natural drainage from the Site before development to ensure that the flood risk downstream does not increase as a result of the Site being developed, and that the Site will have satisfactory drainage under current and likely future climatic conditions. SuDS provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban runoff at source; and combine water management with green space with benefits for amenity, recreation and wildlife. Government planning policy and planning decisions now include a presumption in favour of SuDS being used for all development Sites, unless they can be shown to be inappropriate.

For general information on SuDS see our website: http://geosmartinfo.co.uk/

Infiltration SuDS

Government policy for England is to introduce sustainable drainage systems (SuDS) via conditions in planning approvals. Guidance indicates that capturing rainfall runoff on-Site and infiltrating it into the ground (infiltration SuDS) is the preferred method for managing surface water without increasing flood risk downstream.

The greatest benefit to general flood risk is if all runoff is infiltrated on-Site, however, this may not be feasible due to physical and economic constraints in which case infiltration may be considered as a part of an integrated drainage solution. The final design capacity for an infiltration SuDS system depends on the Site constraints and the requirements of the individual Planning Authority and the Lead Local Flood Authority.

The capacity of the ground to receive infiltration depends on the nature, thickness and permeability of the underlying material and the depth to the high groundwater table. The final proportion of the Site drained by infiltration will depend on topography, outfall levels and a suitable drainage gradient. It is important to note that, even if the whole Site cannot be drained by infiltration, the use of partial infiltration is encouraged, with the remainder of runoff discharged via other SuDS systems.

Types of infiltration SuDS

Infiltration components include infiltration trenches, soakaways, swales and infiltration basins without outlets, rain gardens and permeable pavements. These are used to capture surface water runoff and allow it to infiltrate (soak) and filter through to the subsoil layer, before returning it to the water table below.

An infiltration trench is usually filled with permeable granular material and is designed to promote infiltration of surface water to the ground. An infiltration basin is a dry basin or depression designed to promote infiltration of surface water runoff into the ground. Soakaways are the most common type of infiltration device in the UK where drainage is often connected to over-sized square or rectangular, rubble-filled voids sited beneath lawns.

According to the guidance in Building Research Establishment (BRE) Digest 365 (2016) a soakaway must be able to discharge 50% of the runoff generated during a 1 in 10 year storm event within 24 hours in readiness for subsequent storm flow. This is the basic threshold criteria for a soakaway design and the internal surface area of the proposed soakaway design options should be calculated on this basis by taking into account the soil infiltration rate for the Site.

Developers need to ensure their design takes account of the construction, operation and maintenance requirements of both surface and subsurface components, allowing for any machinery access required.

SuDS maintenance and adoption

Regular maintenance is essential to ensure effective operation of the soakaway(s) over the intended lifespan of the proposed development. A maintenance schedule for SuDs is required. Sewerage undertakers or Local Authorities may adopt SuDS and will require maintenance issues to be dealt with in accordance with their Management Plan. If the SuDS will not be adopted other provision is required with associated financial implications. Maintenance is a long-term obligation requiring the upkeep of all elements of the SuDS, including mechanical components (e.g. pumps), as well as inspections, regular maintenance and repair.

Additional background SuDS information can be found on our website: http://geosmartinfo.co.uk/

13 References and glossary

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GeoSmart Information

Glossary

General terms

Attenuation	Reduction of peak flow and increased duration of a flow event.
Combined sewer	A sewer designed to carry foul sewage and surface water in the same pipe.
Detention basin	A vegetated depression, normally is dry except after storm events, constructed to store water temporarily to attenuate flows. May allow infiltration of water to the ground.
Evapotranspiration	The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.
FEH	Flood Estimation Handbook, produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology).
Filter drain or trench	A linear drain consisting of a trench filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water, but may also be designed to permit infiltration.
First flush	The initial runoff from a site or catchment following the start of a rainfall event. As runoff travels over a catchment it will collect or dissolve pollutants, and the "first flush" portion of the flow may be the most contaminated as a result. This is especially the case for intense storms and in small or more uniform catchments. In larger or more complex catchments pollution.
Flood plain	Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions (see Environment Agency's Policy and practice for the protection of flood plains for a fuller definition).
Greenfield runoff	This is the surface water runoff regime from a site before development, or the existing site conditions for brownfield redevelopment sites.
Impermeable surface	An artificial non-porous surface that generates a surface water runoff after rainfall.
Permeability	A measure of the ease with which a fluid can flow through a porous medium. It depends on the physical properties of the medium, for example grain size, porosity and pore shape.

Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.
Sewerage undertaker	This is a collective term relating to the statutory undertaking of water companies that are responsible for sewerage and sewage disposal including surface water from roofs and yards of premises.
Soakaway	A subsurface structure into which surface water is conveyed to allow infiltration into the ground.
Treatment	Improving the quality of water by physical, chemical and/or biological means.

The terms included in this glossary have been taken from CIRIA (2015) guidance.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2023 BlueSky copyright and database rights 2023
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2023 Ordnance Survey data © Crown copyright and database right 2023
Flood Risk (RoFRS/Pluvial/Surface Water Features/SPZ)	National Resources Wales copyright and database rights 2023 Ordnance Survey data © Crown copyright and database right 2023
Flood Risk (Groundwater) and SuDS infiltration suitability (SD50)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2023) Contains British Geological Survey materials © NERC 2023 Ordnance Survey data © Crown copyright and database right 2023
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14 Appendices

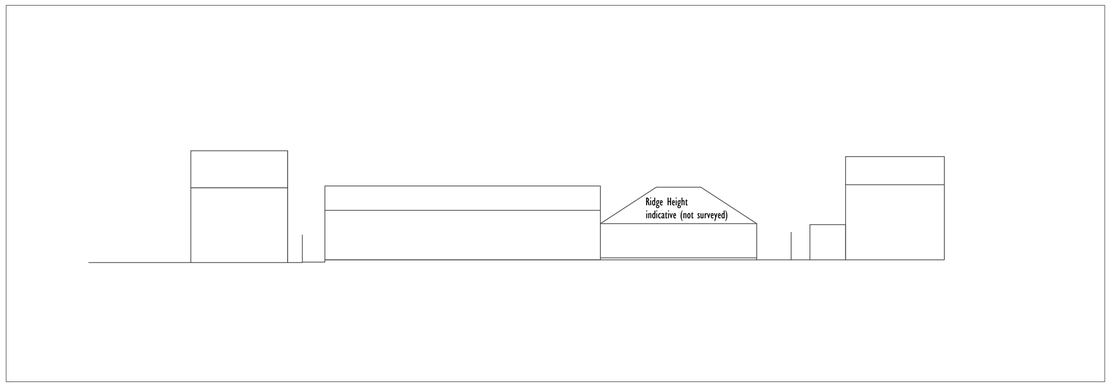


GeoSmart Information

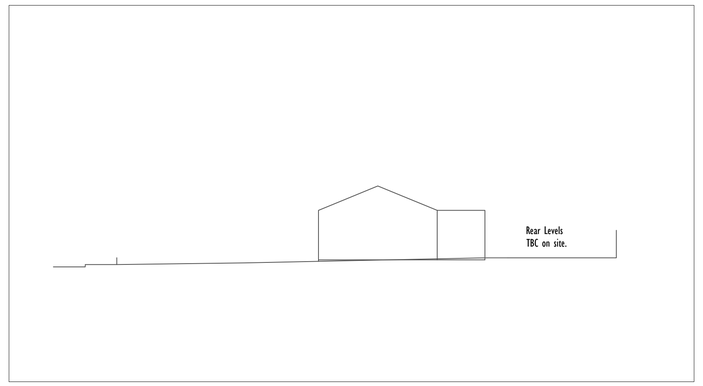
Appendix A



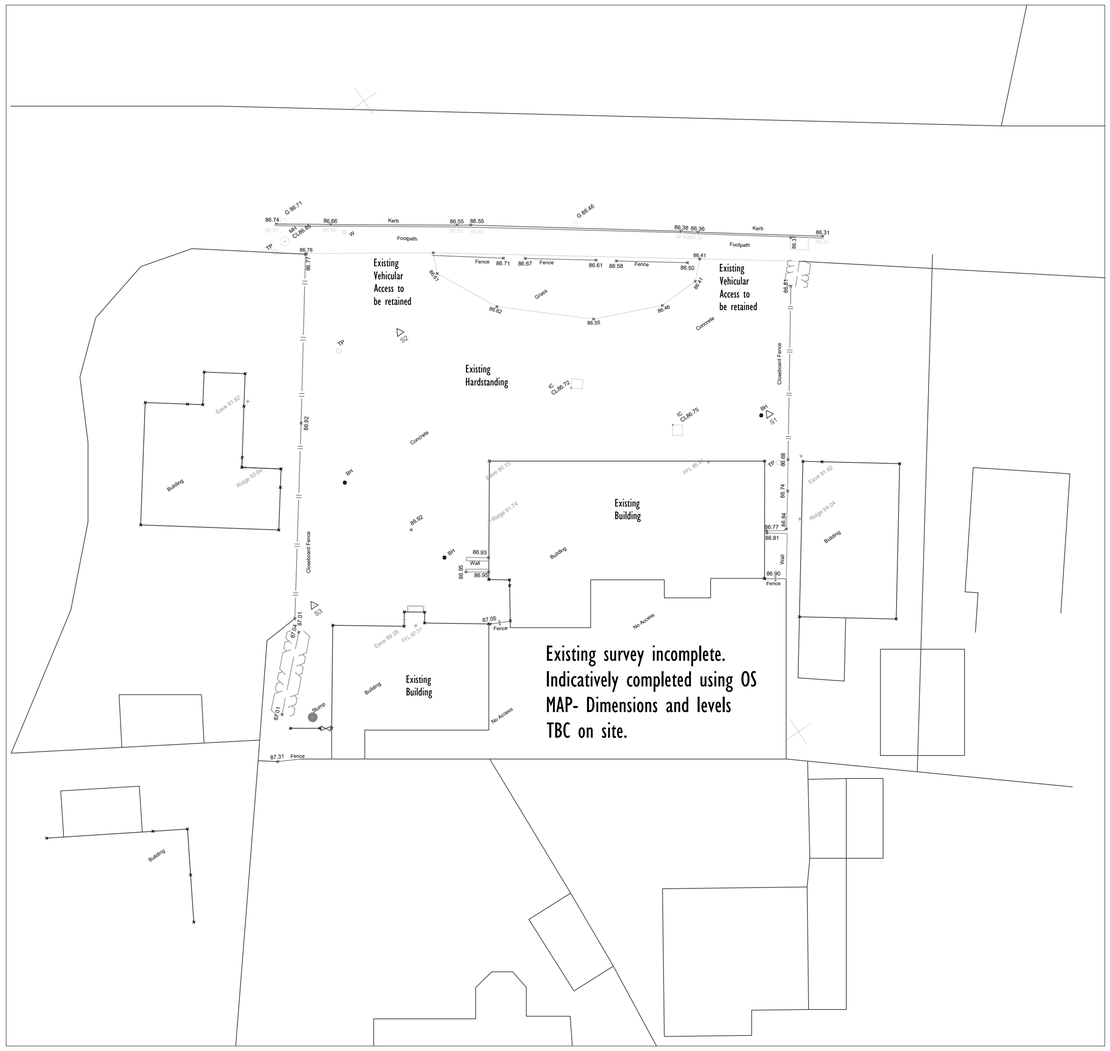
Site plans



Indicative Site Section
West to East (1:200)



Indicative Site Section
North to South (1:200)



Site Plan
(1:200)

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Cheshire, CW6 0AT

CLIENT: Mr R. Whitney (Roof Plus)

PROJECT:
22008- Woodville Garage, 14 Gresford Road, Llay, LL12 0NW

DRAWING TITLE:
Existing Plans

Scale: 1:200@A1

JOB No. 22008

DRAWING No. 22008-EX-101

STATUS: EXISTING

REVISION	DATE
0	04.05.22

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STRUCTURAL INFORMATION

for all structural information refer to structural engineers drawings and details., drawings to be read in conjunction with all other specialist drawings all dimensions to be checked on site before works and fabrication of components commence.all discrepancies to be reported to the architectural designer at the first opportunity.

MATERIALS

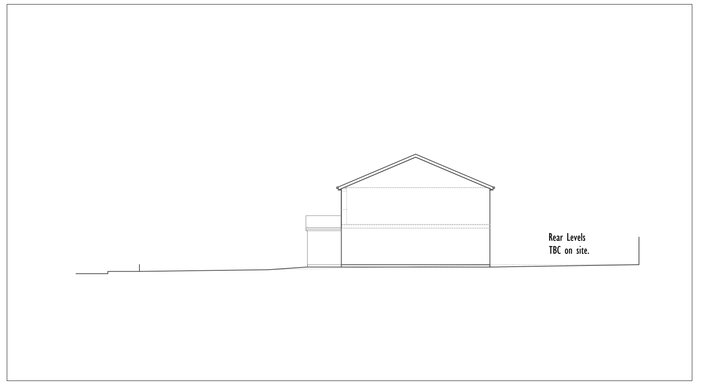
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All Dimensions and Levels to be checked on site

Community Infrastructure Levy Forms to be completed and confirmation received from council prior to commencement that all required information has been received. If these forms are not completed prior to commencement then the Levy will become due and no relief will be possible.



Indicative Site Section
West to East (1:200)



Indicative Site Section
North to South (1:200)



Site Plan
(1:200)

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PROJECT:
22008- Woodville Garage, 14 Gresford Road, Llay, LL12 0NW

DRAWING TITLE:
Proposed Plans

Scale: 1:200@A1

JOB No. 22008

DRAWING No. 22008-PL-101

STATUS: PLANNING

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Impact on neigbouring property Right of Light advised to be assessed before commencement of proposed work

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No vehicular gates to access points.

No vehicular gates to access points.

No vehicular gates to access points.

Existing Vehicular Access to be retained

Proposed New Vehicular Access

Existing Vehicular Access to be retained

Approx internal finished floor level +87.070

Approx ridge level +94.420

Driveway

Driveway

Driveway

Nothing within 2.4M within the front highway to be allowed to be taller or to be allowed to grow taller than 1M for visibility when accessing and existing the properties.

All proposed surface water and waste drainage to be strictly in accordance with accompanying specialist information.

Footpath

Kerb

Footpath

Kerb

Concrete

Closeboard Fence

Wall

1.8M tall fence

1.8M tall fence with gate

Indicative VW Golf 2020 4285x1789mm

WC

Hallway

Reception Room

Store

Dining Area

Kitchen

Paved Area

Patio Area

Lawn

No.1

No.2

No.3

Building

Eave 91.62

Ridge 93.66

Eave 91.62

Ridge 94.04

Building

Stump

Fence

Building

Existing survey incomplete. Indicatively completed using OS MAP- Dimensions and levels TBC on site.

Site Plan
(1:100)

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22008- Woodville Garage, 14 Gresford Road, Llay, LL12 0NW

DRAWING TITLE:
Proposed Plans 2

Scale: 1:100@A1

JOB No. 22008

DRAWING No.22008-PL-102

STATUS: PLANNING

REVISION	DATE
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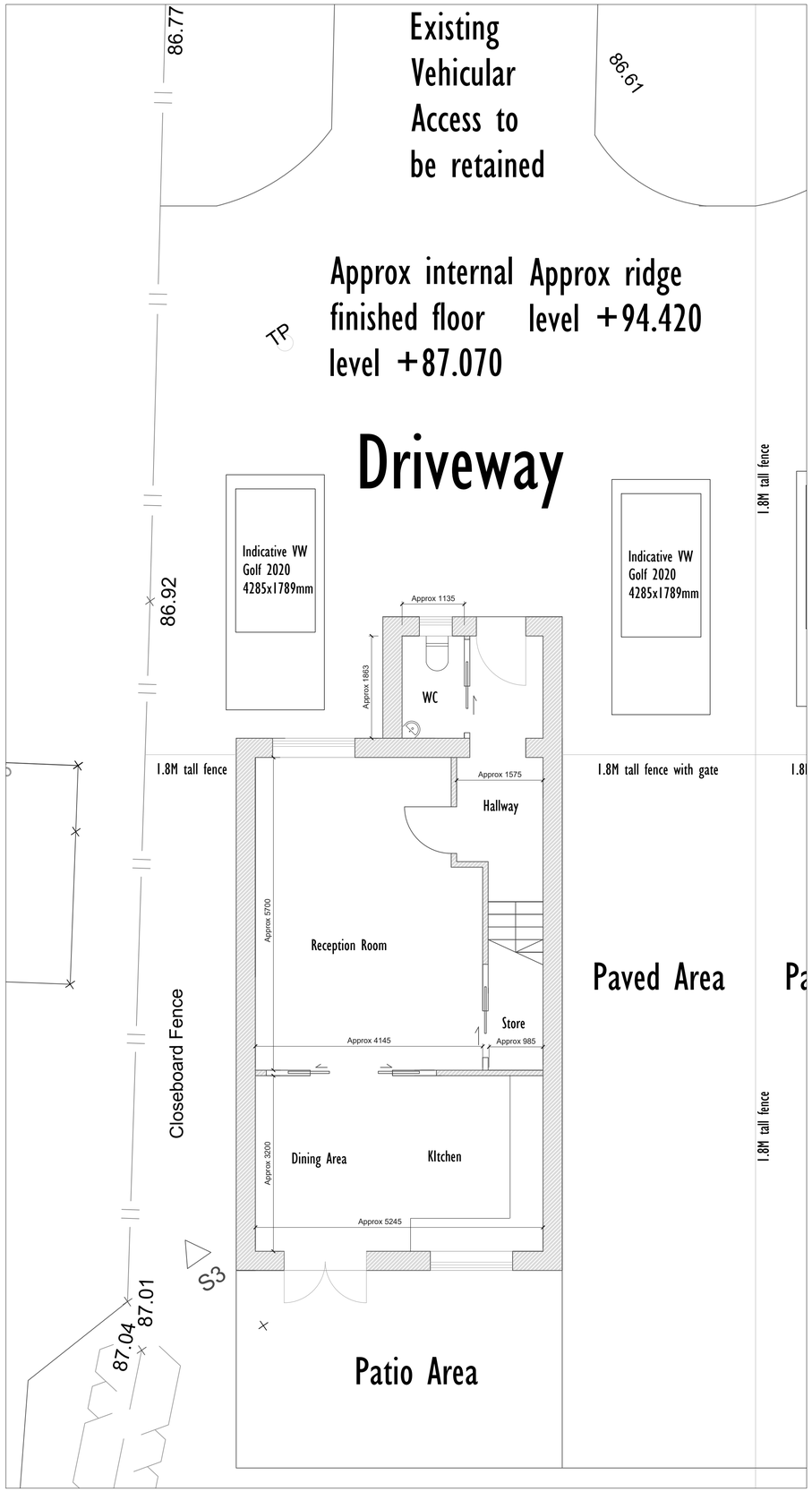
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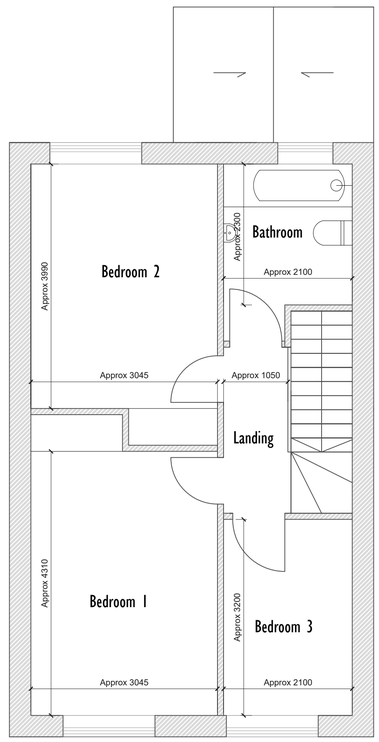
All Dimensions and Levels to be checked on site

Impact on neigbouring property Right of Light advised to be assessed before commencement of proposed work

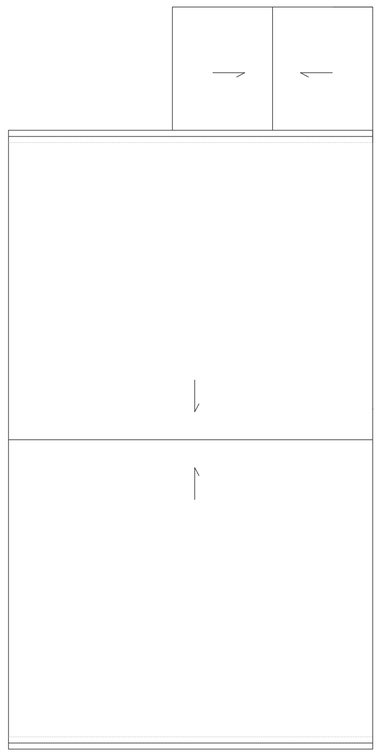
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Ground Floor Plan (1:50)



First Floor Plan (1:50)



Roof Plan (1:50)

Roof Plan (1:50)

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PROJECT:
22008- Woodville Garage, 14 Gresford Road, Llay, LL12 0NW

DRAWING TITLE:
Proposed Plans 3

Scale: 1:50@A1

JOB No. 22008

DRAWING No.22008-PL-103

STATUS: PLANNING

REVISION	DATE
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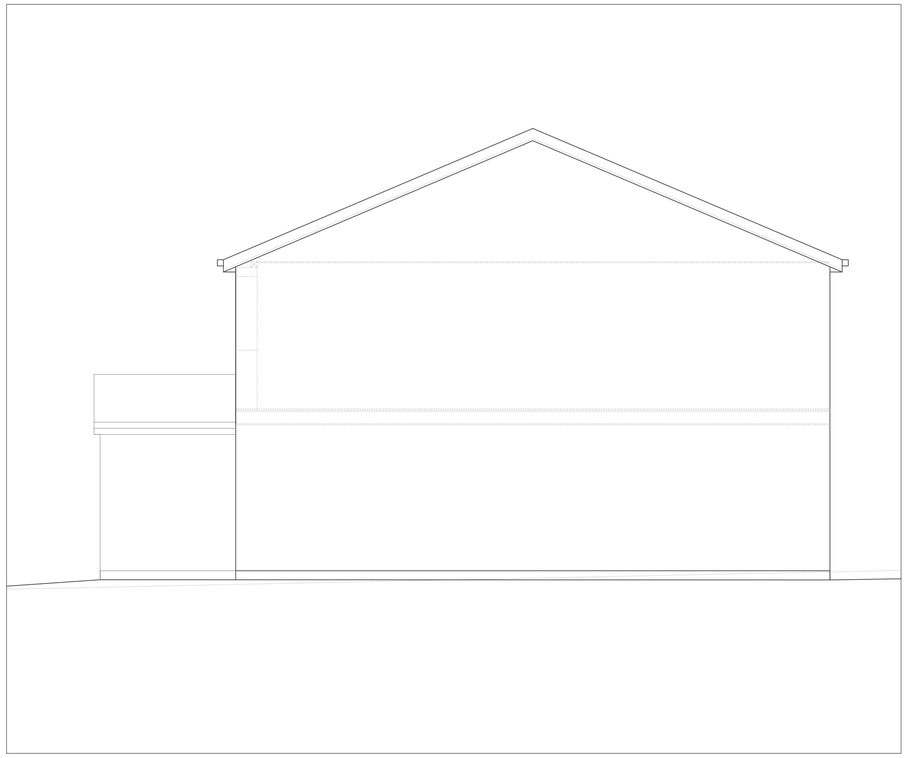
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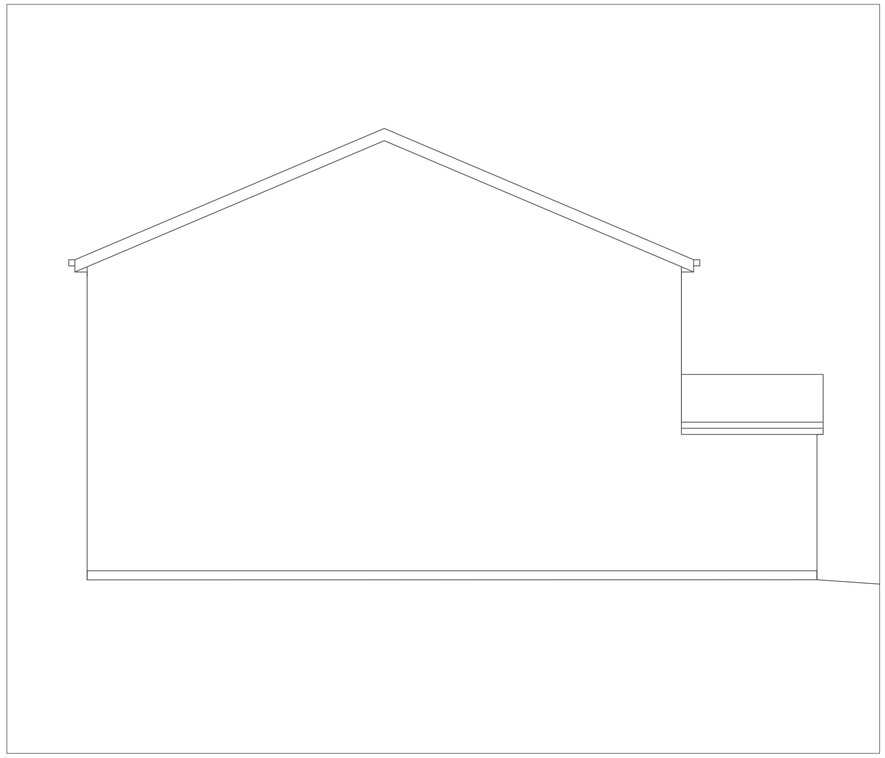
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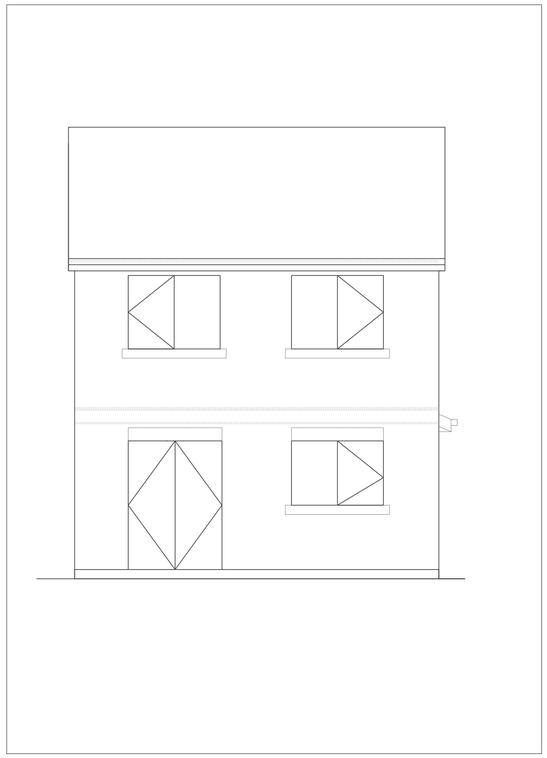
Side West Elevation
(1:50)



Side East Elevation
(1:50)



Front Elevation
(1:50)



Rear Elevation
(1:50)

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DRAWING TITLE:
Proposed Elevations

Scale: 1:50@A1

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GeoSmart Information

Appendix B



Rainfall runoff calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	0.600
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	200.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.008	5.00	86.920	600	333646.174	356211.752	0.750
2	0.017	5.00	86.500	600	333654.897	356224.477	0.650
3	0.008	5.00	86.920	600	333637.952	356217.494	0.750
4	0.016	5.00	86.500	600	333646.772	356230.331	0.725
5	0.008	5.00	86.920	600	333628.073	356224.357	0.750
6	0.018	5.00	86.500	600	333637.691	356236.544	0.650
7			86.700	600	333640.977	356234.394	0.975
8			86.700	1200	333644.263	356238.695	1.075
8_OUT			86.700	600	333646.000	356243.000	1.150

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	1	2	15.428	0.600	86.170	85.850	0.320	48.2	150	5.18	46.3
1.001	2	4	10.014	0.600	85.850	85.775	0.075	133.5	150	5.37	45.7
2.000	3	4	15.575	0.600	86.170	85.775	0.395	39.4	150	5.16	46.3
1.002	4	7	7.077	0.600	85.775	85.725	0.050	141.5	150	5.51	45.2
3.000	5	6	15.525	0.600	86.170	85.850	0.320	48.5	150	5.18	46.3
3.001	6	7	3.927	0.600	85.850	85.725	0.125	31.4	150	5.22	46.2
1.003	7	8	5.413	0.600	85.725	85.625	0.100	54.1	150	5.58	45.0
1.004	8	8_OUT	4.642	0.600	85.625	85.550	0.075	61.9	100	5.65	5.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.452	25.7	1.3	0.600	0.500	0.008	0.0	23	0.764
1.001	0.868	15.3	4.1	0.500	0.575	0.025	0.0	53	0.737
2.000	1.607	28.4	1.3	0.600	0.575	0.008	0.0	22	0.819
1.002	0.842	14.9	8.0	0.575	0.825	0.049	0.0	78	0.857
3.000	1.448	25.6	1.3	0.600	0.500	0.008	0.0	23	0.762
3.001	1.802	31.8	4.3	0.500	0.825	0.026	0.0	37	1.263
1.003	1.370	24.2	12.2	0.825	0.925	0.075	0.0	75	1.372
1.004	0.980	7.7	1.4	0.975	1.050	0.075	0.0	29	0.739

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	✓	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

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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	0	0	0
100	0	0	0
100	40	0	0

Node 8 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	85.625	Product Number	CTL-SHE-0051-1000-0700-1000
Design Depth (m)	0.700	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	85.850	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	11.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	85.850	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Node 6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	85.850	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	13.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Node 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	86.470	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	3.000	Inf Depth (m)	
Porosity	0.30	Length (m)	13.000		

Node 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	86.470	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	3.000	Inf Depth (m)	
Porosity	0.30	Length (m)	13.000		

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Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	86.470	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	3.000	Inf Depth (m)	
Porosity	0.30	Length (m)	13.000		

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Results for 2 year Critical Storm Duration. Lowest mass balance: 98.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	86.192	0.022	1.2	0.0063	0.0000	OK
240 minute summer	2	164	85.950	0.100	1.3	1.6726	0.0000	OK
15 minute summer	3	11	86.191	0.021	1.2	0.0060	0.0000	OK
240 minute summer	4	160	85.950	0.175	1.6	1.5436	0.0000	SURCHARGED
15 minute summer	5	11	86.192	0.022	1.2	0.0063	0.0000	OK
240 minute summer	6	160	85.950	0.100	1.4	1.9662	0.0000	OK
240 minute summer	7	160	85.950	0.225	1.7	0.0635	0.0000	SURCHARGED
240 minute summer	8	160	85.949	0.324	1.9	0.3668	0.0000	SURCHARGED
15 minute summer	8_OUT	1	85.550	0.000	1.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	1.2	0.458	0.047	0.0713	
15 minute summer	2	1.001	4	2.2	0.373	0.142	0.1322	
15 minute summer	3	2.000	4	1.2	0.282	0.042	0.1434	
15 minute summer	4	1.002	7	3.7	0.598	0.248	0.1246	
15 minute summer	5	3.000	6	1.2	0.558	0.047	0.0721	
15 minute summer	6	3.001	7	2.9	0.535	0.090	0.0517	
15 minute winter	7	1.003	8	4.0	0.627	0.165	0.0953	
240 minute summer	8	Hydro-Brake®	8_OUT	1.0				15.6

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Results for 30 year Critical Storm Duration. Lowest mass balance: 98.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	86.206	0.036	3.2	0.0101	0.0000	OK
180 minute winter	2	176	86.089	0.239	2.4	6.3162	0.0000	SURCHARGED
15 minute summer	3	10	86.204	0.034	3.2	0.0096	0.0000	OK
180 minute winter	4	176	86.089	0.314	2.7	5.7695	0.0000	SURCHARGED
15 minute summer	5	10	86.206	0.036	3.2	0.0101	0.0000	OK
180 minute winter	6	176	86.089	0.239	2.5	7.4469	0.0000	SURCHARGED
180 minute winter	7	176	86.089	0.364	2.0	0.1030	0.0000	SURCHARGED
180 minute winter	8	176	86.089	0.464	2.5	0.5247	0.0000	SURCHARGED
15 minute summer	8_OUT	1	85.550	0.000	1.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	3.2	0.572	0.123	0.1432	
15 minute summer	2	1.001	4	2.4	0.385	0.159	0.1762	
15 minute winter	3	2.000	4	3.0	0.290	0.104	0.1592	
15 minute winter	4	1.002	7	3.5	0.636	0.233	0.1246	
15 minute winter	5	3.000	6	3.0	0.618	0.116	0.1449	
15 minute winter	6	3.001	7	2.5	0.630	0.080	0.0691	
15 minute winter	7	1.003	8	3.9	0.780	0.163	0.0953	
180 minute winter	8	Hydro-Brake®	8_OUT	1.0				22.2

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Results for 100 year Critical Storm Duration. Lowest mass balance: 98.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	86.210	0.040	4.0	0.0113	0.0000	OK
180 minute winter	2	176	86.164	0.314	3.0	8.8089	0.0000	SURCHARGED
15 minute summer	3	10	86.208	0.038	4.0	0.0107	0.0000	OK
180 minute winter	4	180	86.164	0.389	3.3	8.0364	0.0000	SURCHARGED
15 minute summer	5	10	86.210	0.040	4.0	0.0113	0.0000	OK
180 minute winter	6	180	86.164	0.314	3.2	10.3912	0.0000	SURCHARGED
180 minute winter	7	180	86.164	0.439	1.6	0.1242	0.0000	SURCHARGED
180 minute winter	8	180	86.164	0.539	2.3	0.6094	0.0000	SURCHARGED
15 minute summer	8_OUT	1	85.550	0.000	1.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	4.0	0.577	0.155	0.1603	
30 minute winter	2	1.001	4	1.8	0.373	0.116	0.1763	
15 minute summer	3	2.000	4	4.0	0.313	0.140	0.1643	
15 minute winter	4	1.002	7	3.9	0.594	0.262	0.1246	
15 minute winter	5	3.000	6	3.8	0.601	0.147	0.1586	
15 minute winter	6	3.001	7	3.2	0.628	0.102	0.0691	
15 minute winter	7	1.003	8	3.0	0.804	0.125	0.0953	
180 minute winter	8	Hydro-Brake®	8_OUT	1.0				21.7

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.14%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	1	448	86.320	0.150	0.7	0.0424	0.0000	OK
480 minute winter	2	448	86.320	0.470	2.1	13.9888	0.0000	FLOOD RISK
480 minute winter	3	440	86.320	0.150	0.7	0.0424	0.0000	OK
480 minute winter	4	440	86.320	0.545	2.4	12.7490	0.0000	FLOOD RISK
480 minute winter	5	448	86.320	0.150	0.7	0.0423	0.0000	OK
480 minute winter	6	448	86.320	0.470	2.2	16.5008	0.0000	FLOOD RISK
480 minute winter	7	448	86.320	0.595	1.2	0.1683	0.0000	SURCHARGED
480 minute winter	8	448	86.319	0.694	2.1	0.7852	0.0000	SURCHARGED
15 minute summer	8_OUT	1	85.550	0.000	1.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	5.6	0.587	0.217	0.1719	
15 minute winter	2	1.001	4	3.1	0.386	0.204	0.1763	
15 minute summer	3	2.000	4	5.6	0.423	0.196	0.1718	
15 minute summer	4	1.002	7	3.1	0.660	0.209	0.1246	
15 minute winter	5	3.000	6	5.3	0.663	0.205	0.1712	
15 minute summer	6	3.001	7	2.8	0.638	0.087	0.0691	
30 minute summer	7	1.003	8	4.2	0.775	0.173	0.0953	
480 minute winter	8	Hydro-Brake®	8_OUT	1.0				40.3

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Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.600
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Dwellings	Units	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
1	0	10.0	86.725	Adoptable	333658.671	356215.343	0.700
2	0		86.575	Adoptable	333662.327	356221.672	0.725
3	0	10.0	86.875	Adoptable	333639.792	356227.238	0.700
4	0		86.725	Adoptable	333644.757	356234.277	0.775
5	0	10.0	86.875	Adoptable	333643.939	356224.401	0.700
6	0		86.700	Adoptable	333648.795	356231.440	1.150
6_OUT			86.525	Adoptable	333651.578	356244.154	1.250

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	1	2	7.309	1.500	86.025	85.850	0.175	41.8	100
1.001	2	6	16.689	1.500	85.850	85.550	0.300	55.6	100
2.000	3	4	8.614	1.500	86.175	85.950	0.225	38.3	100
2.001	4	6	4.935	1.500	85.950	85.550	0.400	12.3	100
3.000	5	6	8.552	1.500	86.175	85.550	0.625	13.7	100
1.002	6	6_OUT	13.015	1.500	85.550	85.275	0.275	47.3	100

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.570	1.031	8.1	1.6	0.600	0.625	0.000	0	10.0	0.0	30	0.794
1.001	0.521	0.893	7.0	1.6	0.625	1.050	0.000	0	10.0	0.0	32	0.717
2.000	0.578	1.078	8.5	1.6	0.600	0.675	0.000	0	10.0	0.0	29	0.817
2.001	0.856	1.902	14.9	1.6	0.675	1.050	0.000	0	10.0	0.0	22	1.224
3.000	0.846	1.806	14.2	1.6	0.600	1.050	0.000	0	10.0	0.0	23	1.187
1.002	0.649	0.969	7.6	2.7	1.050	1.150	0.000	0	30.0	0.0	42	0.891

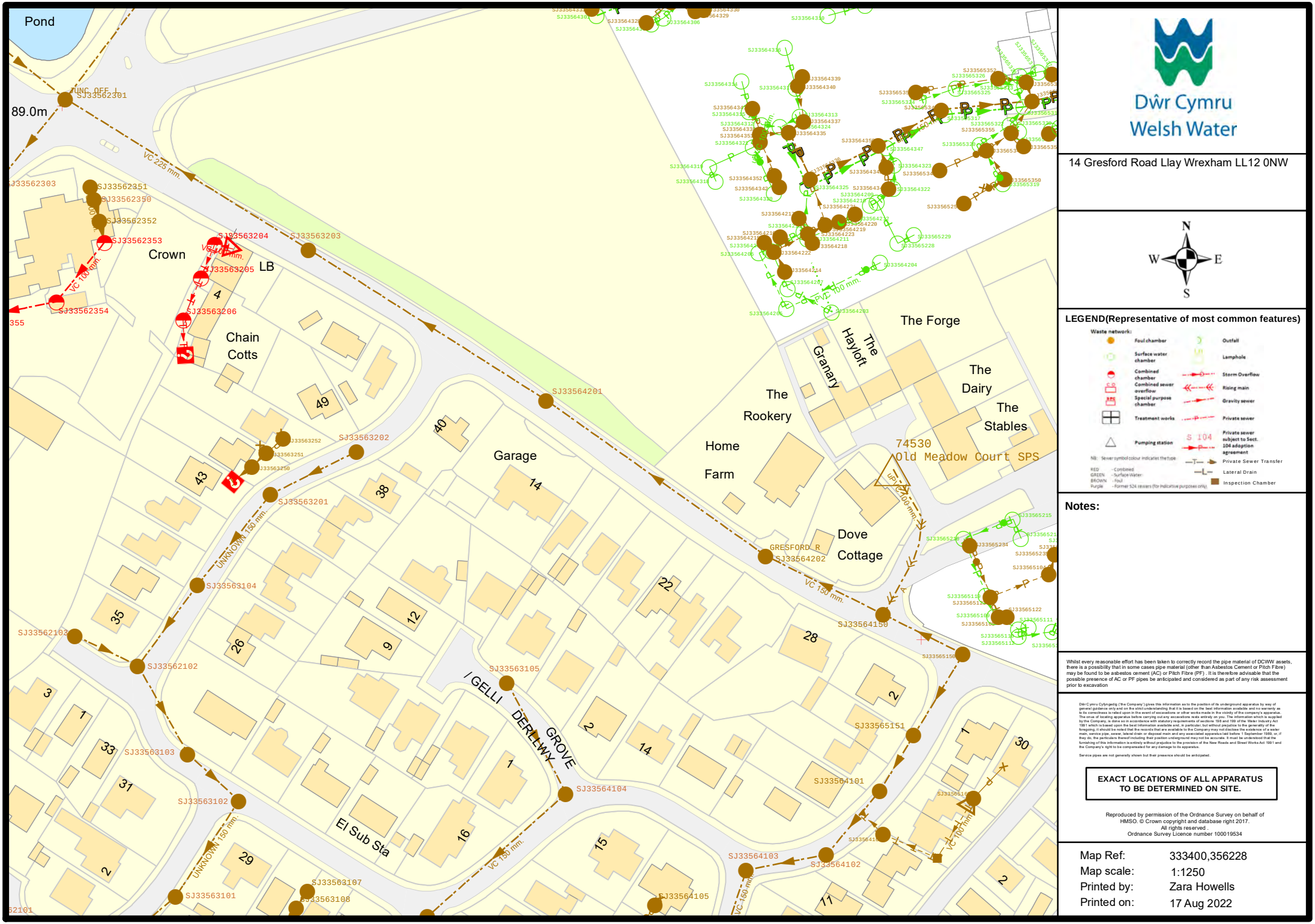
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GeoSmart Information

Appendix C



Welsh Water Asset Location Plan



Dŵr Cymru
Welsh Water

14 Gresford Road Llay Wrexham LL12 0NW

N
W E
S

LEGEND(Representative of most common features)

Waste network:

	Foul chamber		Outfall
	Surface water chamber		Lamphole
	Combined chamber		Storm Overflow
	Combined sewer overflow		Rising main
	Special purpose chamber		Gravity sewer
	Treatment works		Private sewer
	Pumping station	S 104	Private sewer subject to Sect. 104 adoption agreement
			Private Sewer Transfer
			Lateral Drain
			Inspection Chamber

NB: Sewer symbol colour indicates the type.
RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref:	333400,356228
Map scale:	1:1250
Printed by:	Zara Howells
Printed on:	17 Aug 2022

GeoSmart Information

Appendix D



Site investigation / infiltration testing

SUB SURFACE
SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Insitu Test Results

Site: WOODVILLE GARAGE, GRESFORD ROAD, LLAY, WREXHAM, LL12 0NW

Client: ROOF PLUS LIMITED

Engineer:

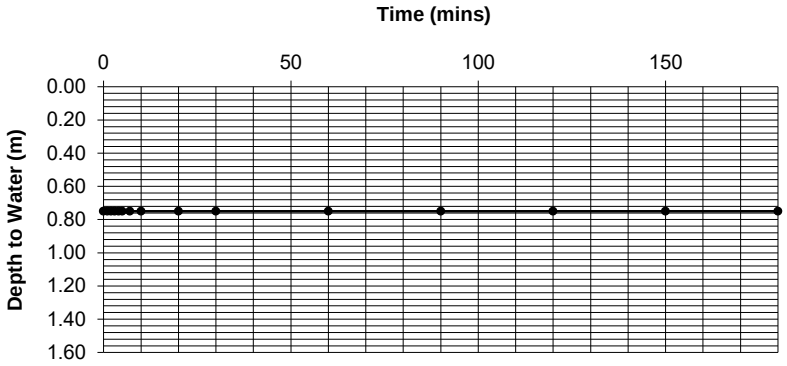
Job Number: 7916

Sheet: 1 / 1

SOAKAWAY TEST

Position: TP1

Test Number: 1
Date: 27/02/24



Time (min)	Depth (m)
0	0.75
1	0.75
2	0.75
3	0.75
4	0.75
5	0.75
7	0.75
10	0.75
20	0.75
30	0.75
60	0.75
90	0.75
120	0.75
150	0.75
180	0.75

Length of pit:	L =	2.60	m
Width of pit:	W =	0.50	m
Depth of pit	D =	1.60	m
Base area of pit:	A =	1.30	m^2
100% effective depth	D100 =	0.75	m
75% effective depth	D75 =	0.96	m
50% effective depth	D50 =	1.18	m
25% effective depth	D25 =	1.39	m
time to D75	T75 =	-	sec
time to D25	T25 =	-	sec
time from D75 to D25 (T25 - T75)	t_{p75-25} =	-	sec
volume between D75 & D25 (A x (D25 - D75))	V_{p75-25} =	0.55	m^3
surface area to D50 inc. base ((2x(D-D50)x(W+L)) + A)	a_{p50} =	3.94	m^2

SOIL INFILTRATION RATE **f =** $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f = - m/sec

Test Strata: See TP1 Log.

Remarks: Unable to calculate Soil Infiltration Rate due to low permeabilty of strata.

SUB SURFACE

SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Site	Trial Pit Number
WOODVILLE GARAGE, GRESFORD ROAD, LLAY, WREXHAM, LL12 0NW	TP1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
MECHANICAL EXCAVATION	2.60m x 0.50m		ROOF PLUS LIMITED	7916
	Location AS PLAN	**Dates** 27/02/2024	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.15-0.25	B				(0.30)	MADE GROUND: grass over grey clayey silty sandy fine to coarse gravel sized fragments of stone, brick and concrete		
0.40-0.60	B				0.30 (0.30)	MADE GROUND: firm greyish brown gravelly sandy silty clay. Gravel sized fragments are fine to medium stone, concrete and brick		
0.80-1.00	B				0.60 (0.90)	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is subrounded to rounded fine to coarse sandstone, mudstone and siltstone		
1.20-1.40	B							
1.50-1.60	B		27/02/2024:DRY		1.50 (0.10) 1.60	Stiff brown and occasional grey mottled slightly gravelly slightly sandy silty CLAY. Gravel is subangular to subrounded fine to medium coal, sandstone, siltstone and mudstone		
						Complete at 1.60m		

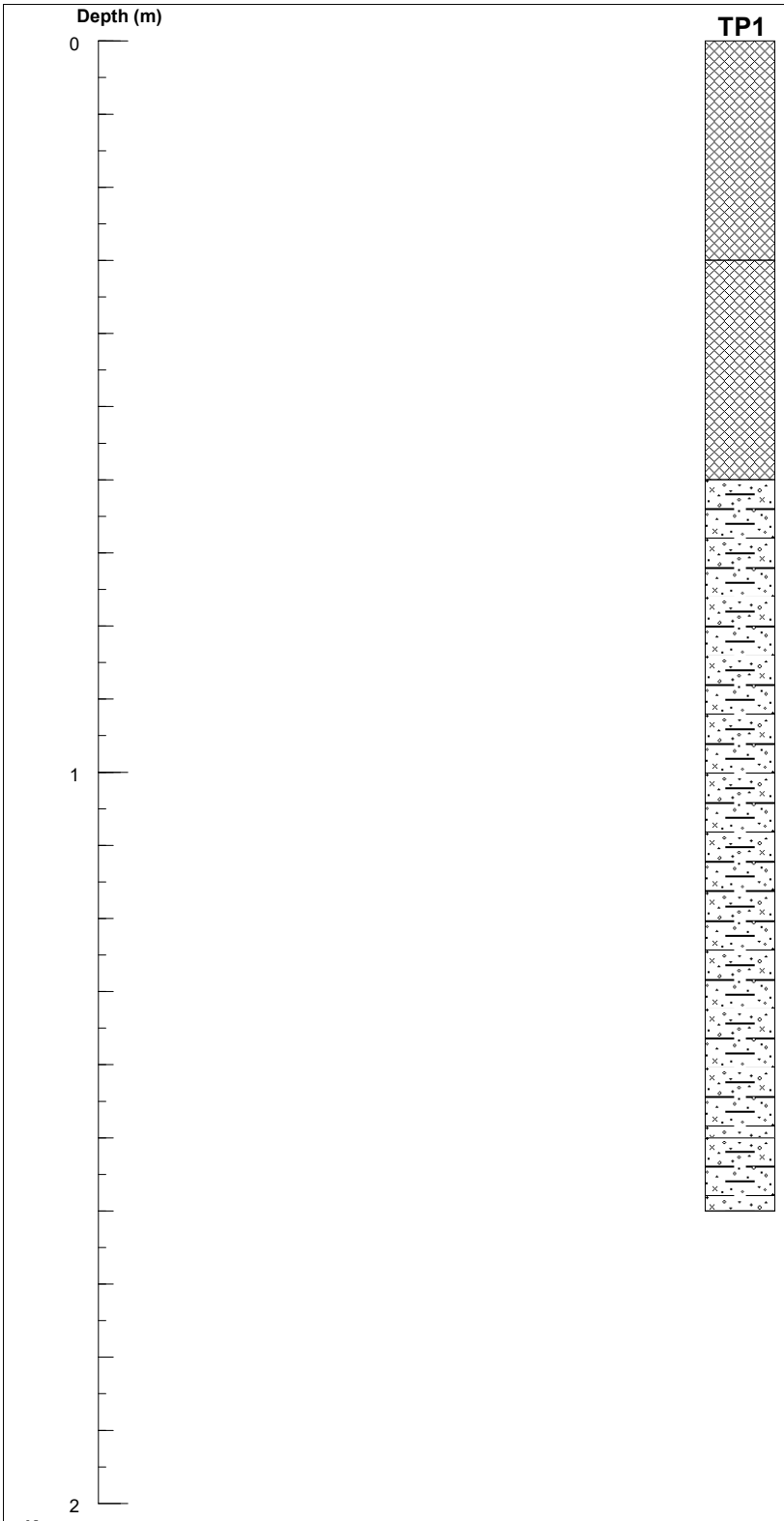
Plan

Remarks

Pit sides remained vertical and stable
No groundwater encountered
On completion backfilled with arisings

Scale (approx)	Logged By	Figure No.
1:25	HB	7916.TP1

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Key

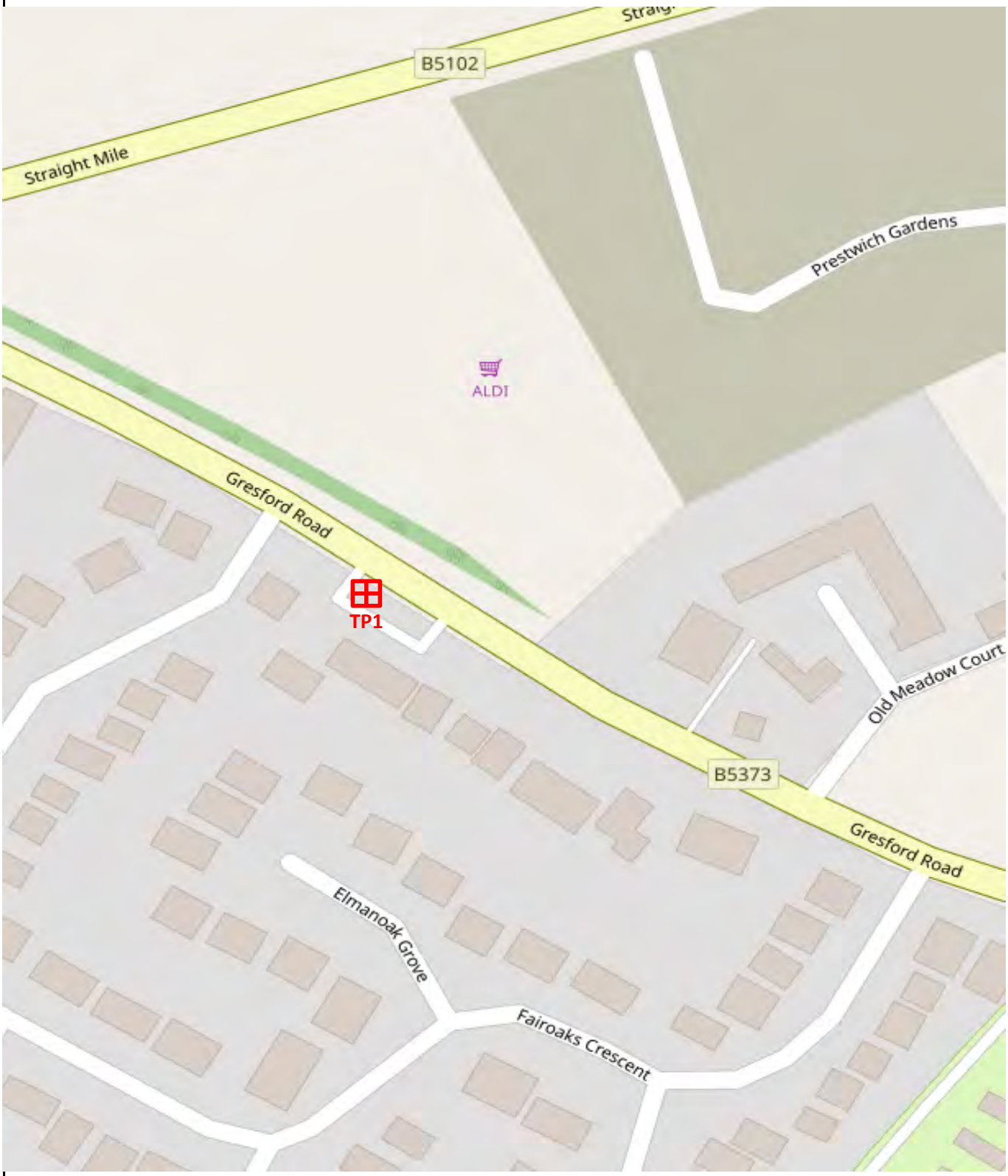
- Groundwater Strike
- Strike Rise Level
- MADE GROUND
- Silty sandy gravelly CLAY

SUB SURFACE
SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Nominal Section

Site	Date Drawn	Date Checked	Sheet	Job Number
WOODVILLE GARAGE, GRESFORD ROAD, LLAY, WREXHAM, LL12 0NW	13/03/2024		1/1	7916
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
ROOF PLUS LIMITED			1:10[V]	7916.1

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SUB SURFACE SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907				Soakaway Location Plan
Site WOODVILLE GARAGE, GRESFORD ROAD, LLAY, WREXHAM, LL12 0NW	Date Drawn 05/03/2024	Date Checked -	Orientation N	Job No. 7916
Client ROOF PLUS LIMITED	Drawn By SS	Checked By -	Scale -	Figure No. 1

GeoSmart Information

Appendix E



CCTV Survey

KMF DRAINAGE LTD
BROUGHTON
CHESTER
Tel: 01244 537415, Fax:

Project-information

Project name:	Contract number:	Contact:	Date:
TIER CONSULT	1		22/09/2017

Client	**TIER CONSULT**
Contact:	**STEVE LEWIS**
Position:	
Road	**RICHMOND HOUSE SANDPIPER COURT**
Town	**CHESTER BUSINESS PARK**
County	**CHESTER**
Telephone:	
Fax:	
Mobile:	
E-Mail:	

Site	**TIER CONSULT**
Contact:	
Position:	
Road	**OLD GARAGE GRESFORD ROAD**
Town	**LLAY WREXHAM**
County	
Telephone:	
Fax:	
Mobile:	
E-Mail:	

Contractor	**KMF DRAINAGE LTD**
Contact:	
Position:	
Road	**2 MARLWOOD PLACE**
Town	**BROUGHTON**
County	**CHESTER**
Telephone:	**01244 537415**
Fax:	
Mobile:	**0771 8098603**
E-Mail:	**kmf-drainage@live.co.uk**

KMF DRAINAGE LTD
BROUGHTON
CHESTER
Tel: 01244 537415, Fax:

Inspection report

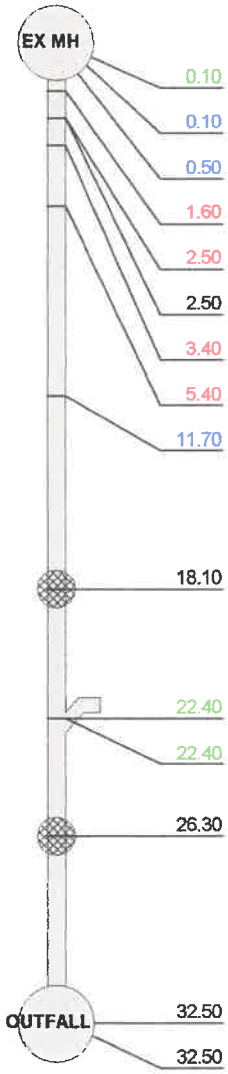
Date:	Job N°:	Weather:	Operator:	section number:	PLR:
22/09/2017				1	EX MH X
Present:	Vehicle:	Camera:	Preset:	Cleaned:	Grade:

Road:	GRESFORD ROAD	Division:		start MH:	EX MH
Place:	OLD GARAGE	District:		end MH:	OUTFALL
Location:		Tape No.:	1	Total length:	32.5 m

Purpose:	Structural defects	Size/Shape:	Barrel 100
Use:		Material:	Vitrified clay Pipe length: 1m
Catchment:		Lining:	
		Category:	

Comment:

Location details:



1:250 position	code	observation	counter	photo	grade
0.10	MH	Manhole Remark: EX MH	00:00:00		(Constr) 0
0.10	WL	Water level, 5 % height/diameter	00:00:00		(Serv) 0
0.50	LR	Line of Sewer deviates right	00:00:00		(Serv) 0
1.60	JDL	Joint displaced. Large	00:00:00		(Struct) 2
2.50	JDL	Joint displaced. Large	00:00:00		(Struct) 2
2.50	GO	General Observation RUBBER SEAL FROM JOINT	00:00:00		(Misc) 0
3.40	JDM	Joint displaced. Medium	00:00:00		(Struct) 1
5.40	JDM	Joint displaced. Medium	00:00:00		(Struct) 1
11.70	LL	Line of Sewer deviates left	00:00:00		(Serv) 0
18.10	GO	General Observation MANHOLE 1	00:00:00		(Misc) 0
22.40	CN	Connection, at 09 o'clock, dia 100 mm	00:00:00		(Constr) 0
22.40	CN	Connection, at 09 o'clock, dia 100 mm	00:00:00		(Constr) 0
26.30	GO	General Observation MANHOLE 2	00:00:00		(Misc) 0
32.50	GO	General Observation MANHOLE 3	00:00:00		(Misc) 0
32.50	FH	Finish Survey	00:00:00		(Misc) 0

Structural Defects	Constructional Features
Service Defects	Miscellaneous Features

GeoSmart Information

Appendix F



Wrexham Highways Correspondence

From: SAB
To: David South
Subject: RE: SAB - Highway Connection Queries
Date: 05 August 2024 08:52:03
Attachments: image003.png
image004.png
image005.png
image006.png
image007.png
image008.png
image010.png
image001.png

Hi David,

We would accept a discharge rate to the highway drain at 1l/s. We have had some maintenance works done on this line over the last couple of years and are happy that it has the capacity to take these additional loads. We would ask that the maintenance plan for the permeable paving is robust as we have had some issues with failures on other sites within the County.

As for the phosphate reduction kit issue, we believe that would be an issue you would have to take up with Welsh Water.

Please get in touch if you have any further questions.

Kind Regards,

James Davies
Wrexham County Borough Council
Network Drainage Officer

01978 729733
Cyngor Bwrdeistref Sirol Wrecsam, Neuadd y Dref, Ystrad Ddiwydiannol, Wrecsam LL13 9PW
Wrexham County Borough Council, Abbey Road, Wrexham Industrial Estate, LL13 9PW
wrecsam.gov.uk | wrexham.gov.uk
twitter.com/cbswrecsam | twitter.com/wrexhamcbc
facebook.com/cyngorwrecsam | facebook.com/wrexhamcouncil

Ysgrifennwch ataf yn Gymraeg neu Saesneg
Please write to me in Welsh or English

From: David South <DavidSouth@geosmartinfo.co.uk>
Sent: 02 August 2024 16:33
To: SAB <SAB@wrexham.gov.uk>
Subject: RE: SAB - Highway Connection Queries

Hi James,

Thanks for your email, our SAB reference is SAB_PRE_2024_0501. I've attached the comments.

The permeable paving is there for storage rather than having a tank and the linear drain is to prevent runoff from entering the highway uncontrolled.

My main enquiry was related to the comment in S1.1 regarding the surface water connection to the foul sewer. You say that that isn't allowed and that an automatic refusal will be given but the only other option is to connect to the highway drain. Infiltration testing showed it didn't work and there are no watercourse or other sewers nearby.

I was therefore wondering if a connection to the highway drain at 1l/s was acceptable? If you want me to resend the drainage drawing or calculations then please let me know.

I will note that Welsh Water have confirmed that since they agreed to a connection previously, they will accept our connection. I've attached the email confirming that.

On a separate note, we previously had to provide a phosphate reduction kit for the foul water but my client has been told since that the sewer had been upgraded and phosphate was no longer a concern. Do you know if a phosphate reduction kit would still be required?

Kind regards,
David

GeoSmart Information

David South
Senior Consultant
t. 01743 298 100

davidsouth@geosmartinfo.co.uk
geosmartinfo.co.uk
Suite 9-11,1st floor, Old Bank Buildings, Bellstone, Shrewsbury, SY1 1HU
Registered in England & Wales: No. 5475394. Registered address: as above

-

From: SAB <SAB@wrexham.gov.uk>
Sent: Friday, August 2, 2024 3:46 PM
To: David South <DavidSouth@geosmartinfo.co.uk>
Subject: SAB - Highway Connection Queries

Hi David,

I have been passed your email regarding highway connections.

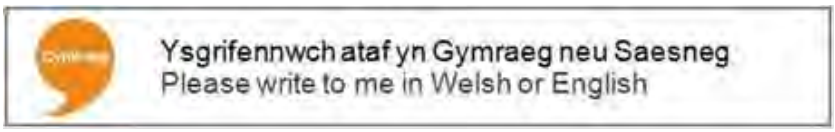
Any questions regarding the highway connections should be directed to the SAB team at this email address.

We are based within the same office as the highway teams and we will be able to deal with any queries that you have. If you could remember to quote any SAB reference numbers that you have when you contact us it would be appreciated.

Kind Regards,

James Davies
Wrexham County Borough Council
Network Drainage Officer

01978 729733
Cyngor Bwrdeistref Sirol Wrecsam, Neuadd y Dref, Ystrad Ddiwydiannol, Wrecsam LL13 9PW
Wrexham County Borough Council, Abbey Road, Wrexham Industrial Estate, LL13 9PW
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Rydym yn croesawu gohebiaeth yn Gymraeg. Byddwn yn ymateb i unrhyw ohebiaeth yn Gymraeg ac ni fydd hyn yn arwain at unrhyw oedi.

Ewch i weld - mi fedrwch chi dalu, rhoi gwybod, gwneud cais, dweud eich dweud, a dod o hyd i wybodaeth ar-lein yn www.wrecsam.gov.uk. Arbedwch bapur - meddyliwch cyn argraffu!

Mae'r neges e-bost hon ac unrhyw atodiadau wedi eu bwriadu ar gyfer yr unigolyn neu'r sefydliad y'i cyfeirir atynt yn unig. Am yr amodau llawn ynglŷn â chynnwys a defnyddio'r neges e-bost hon, ac unrhyw atodiadau, cyfeiriwch at www.wrecsam.gov.uk/top_navigation/disclaimersw.htm

We welcome correspondence in Welsh. We will respond to any correspondence in Welsh and this will not lead to any delay.

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Ewch i weld - mi fedrwch chi dalu, rhoi gwybod, gwneud cais, dweud eich dweud, a dod o hyd i wybodaeth ar-lein yn www.wrecsam.gov.uk. Arbedwch bapur - meddyliwch cyn argraffu!

Mae'r neges e-bost hon ac unrhyw atodiadau wedi eu bwriadu ar gyfer yr unigolyn neu'r sefydliad y'i cyfeirir atynt yn unig. Am yr amodau llawn ynglŷn â chynnwys a defnyddio'r neges e-bost hon, ac unrhyw atodiadau, cyfeiriwch at www.wrecsam.gov.uk/top_navigation/disclaimersw.htm

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Information on confidence levels and ways to improve this report can be provided for any location on written request to info@geosmart.co.uk or via our website. Updates to our model are ongoing and additional information is being collated from several sources to improve the database and allow increased confidence in the findings. Further information on groundwater levels and flooding are being incorporated in the model to enable improved accuracy to be achieved in future versions of the map. Please contact us if you would like to join our User Group and help with feedback on infiltration SuDS and mapping suggestion.

Important consumer protection information

This search has been produced by GeoSmart Information Limited, Suite 9-11, 1st Floor, Old Bank Buildings, Bellstone, Shrewsbury, SY1 1HU.

Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

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The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom.
- sets out minimum standards which firms compiling and selling search reports have to meet.
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals.
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
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- act with integrity and carry out work with due skill, care and diligence.
- at all times maintain adequate and appropriate insurance to protect consumers.
- conduct business in an honest, fair and professional manner.
- handle complaints speedily and fairly.
- ensure that products and services comply with industry registration rules and standards and relevant laws.
- monitor their compliance with the Code.

GeoSmart Information

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award up to £5,000 to you if the Ombudsman finds that you have suffered actual financial loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs contact details:

The Property Ombudsman scheme

Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk.

Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

martinlucass@geosmartinfo.co.uk

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