DRAINAGE STRATEGY

Surface Water + Foul Water

Tregwheal, Landulph Cross
Saltash, Cornwall, PL12 6QQ

Report Prepared for

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Report Prepared by

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GEOTECHNICAL SITE ENGINEERS

Report Status Sheet

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EXECUTIVE SUMMARY

SOAKAWAY (INFILTRATION) ✖

CONTROLLED DISCHARGE TO WATERCOURSE ✓

CONTROLLED DISCHARGE TO SEWER ✖

Scope:	Drainage Strategy where surface water from impermeable surface (new residential dwelling plus driveway and parking) is attenuated with controlled discharge into adjacent watercourse due to unsuitable ground for soakaway structures with infiltration. Foul water is discharged from a Sewage Treatment Plant into adjacent flowing watercourse in NE corner of site with seasonal (partial) drainage field on the approach due to unsuitable ground conditions for a drainage field.
FRA:	The site lies within Flood Zone 1. Flood Zones 2 & 3 are further beyond to the east and south of lower elevation corresponding to Tamar Estuary and so will not affect the site. The central region of the site has a low (<0.1-1%) risk from surface flooding of <300mm depths. With a FFL >0.30m above existing ground level, substantial planting (rain garden concept to absorb) and a functional drainage strategy this low risk can be incorporated and effectively managed into the proposed development.
SuDS area:	Impermeable area of the new residential dwelling is 110m^2, parking is 22.50m^2 and new driveway section is 67.50m^2 resulting in a total impermeable area of 200m^2 on this occasion.
Geology:	BGS geological records (2024) indicate bedrock geology comprising Tavy Formation – Slate whilst to the NE is superficial geology comprising Tidal River or Creek Deposits.
Discharge to Soakaway:	Not a viable option based on encountered ground conditions with negligible permeability (standing water) and/or shallow perched groundwater/throughflow and not being compliant with BRE Digest 365 or CIRIA and thus soakaways are discounted.
Discharge to Watercourse:	*Surface:* Attenuation with controlled discharge to watercourse. The Greenfield Runoff rates (1:30 years) are 0.45l/s and 0.76l/s (IH124 & FEH) – too small to be practically achievable especially when considering blockages thus a maximum offsite discharge rate of 1l/s based on the size of impermeable area, adjacent watercourse having a low to high risk of surface flooding and the receiving watercourse downstream being Flood Zone 2 & 3. A 1:100-year storm with 50% climate change using r = 0.30 (in-land from coast) and discharge rate of 1l/s results in a required attenuation volume of 6.33m^3 which can be achieved via a 7500 litre/7.50m^3 tank. Based on site conditions and volume requirements, a below ground attenuation tank is considered. An example of the tank required is from the manufacturers Freeflush Ltd whilst the flow control device is a Flowbrake fixed head floating open orifice. The flow of 1l/s is achieved through the standard orifice and maintained at this rate due to the fixed depth of 200mm head between the float and the orifice regardless of the water level within the tank. If the client wishes to harvest rainwater for use within the garden area and/or the new residential dwelling a larger tank can be utilised with harvesting within the lower chamber. (Smart) water butts could be considered for (additional) harvesting purposes and to reduce the volume of water being discharged to the watercourse. As the adjacent watercourse is not a Main River, Environmental Permits or Consent are not required from the Environment Agency. Necessary consent has been agreed with the 3rd party landowner. *Foul:* Discharge from STP into flowing watercourse in NE corner of site with recommended 12-15m long seasonal (partial) drainage field on the approach. Necessary consent has been agreed with the 3rd party landowner.
Discharge to Sewer:	Not a viable option as there is no surface water drain or combined sewer within the vicinity of the site and thus discounted.

LIMITATIONS AND EXCEPTIONS

THIS REPORT HAS BEEN PREPARED FOR THE SOLE INTERNAL USE AND RELIANCE OF MR & MRS M KITNEY. THIS REPORT SHALL NOT BE RELIED UPON OR TRANSFERRED TO OTHER PARTIES WITHOUT THE EXPRESS WRITTEN AUTHORISATION OF STG ENGINEERING LTD. IF ANY UNAUTHORISED THIRD PARTY COMES INTO POSSESSION OF THIS REPORT THEY RELY ON IT AT THEIR OWN RISK AND THE AUTHORS OWE THEM NO DUTY OF CARE OR SKILL.

The findings and opinions conveyed via this Drainage Strategy report are based on information obtained from a variety of sources as detailed within this report, and which STG Engineering Ltd believes are reliable. Nevertheless, STG Engineering Ltd cannot and does not accept any liability for the detailed accuracy, errors or omissions in such information it has relied upon.

The report represents the findings and opinions of an experienced geotechnical consultant.
STG Engineering Ltd does not provide legal advice and the advice of lawyers may also be required.

It is possible that STG Engineering Ltd's assessments, while deemed fully appropriate, may have failed to identify a variation of the strata (e.g further SW of TP01 or further NW of TSAH). Assuming such variations exist, this information could not have been considered in the formulation of STG Engineering Ltd's findings and opinions.

In preparing this report, it has been assumed all relevant and other information has been provided. This report is not required to identify insufficiencies or mistakes in the information provided by the user/owner (impermeable areas, boundaries, status of watercourse through summer months etc) or from any other source but have sought to compensate for those where obvious in the light of other information.

The Findings were specifically limited to the role STG Engineering Ltd was employed to undertake, as detailed and discussed within this report in accordance with the specified standards.

STG Engineering Ltd do not design or install SuDS (attenuation tanks etc).

1 INTRODUCTION

1.1 Background

STG Engineering Ltd was commissioned by Mr & Mrs M Kitney (hereby referred to as the client) via GRC Planning & Development Consultant to undertake a Drainage Strategy for both surface water and foul water in accordance with BRE Digest 365 and the Environment Agency (EA) plus Building Control Approved Document H respectively for a proposed new residential dwelling at Tregwheal, Landulph Cross.

1.2 Site Location and Description

Tregwheal is located at Landulph Cross, Saltash, Cornwall, PL12 6QQ as a rectangular parcel of land (hereby referred to as the site) trending NE-SW within the small village of Landulph Cross in a rural setting.

The site is currently occupied with an existing residential dwelling in the central southern region, driveway in the western region whilst the remainder of the site is laid to garden with lawn and established vegetation particularly in the southern region and along the boundaries plus several outbuildings including a greenhouse which are scheduled to be removed. The site is a double plot and is scheduled to be split into two with a new residential dwelling constructed in the northern plot with each plot benefitting from a driveway and a NE-SW trending garden.

The site gradient falls ~10° to the NW corresponding to being the southern flank of a NE-SW trending V-shaped valley noting an increasing gradient beyond the eastern boundary. There is an overall gradient to the NE as is the catchment gradient of the area corresponding to valley.

The site is surrounded by sparse residential properties to the south and west associated with Landulph Cross with pasture/arable fields further beyond whilst woodland is to the north and east with River Tamar further beyond.

1.3 Specification for the Works

1.3.1 Surface Water

Best current practice should be used to determine suitable Sustainable Drainage Systems (SuDS) where possible. Surface water runoff from the proposed impermeable areas should seek to meet the following design objectives:

- Infiltration to ground as close as possible to the source to recharge the groundwater and watercourses base flow (depending on ground condition and existing site uses);
- Attenuate and control surface water runoff from proposed impermeable areas to the equivalent of the Greenfield runoff rate;
- Manage surface water runoff from the site so that it does not increase and where possible reduces flood risk to third parties;
- Improve the quality of surface water discharge.

Several SuDS are ideally used throughout a site, linked together to form a SuDS train providing treatment, control and attenuation processes.

1.3.2 Foul

If a domestic property or business is not connected to the mains sewer (first option in the drainage hierarchy from the National Planning Practice Guidance and Building Regulations Approved Document H2) then a small wastewater treatment system which can either discharge into the ground via a drainage field (or alternative secondary treatment method e.g reed bed) or into a flowing surface water feature (hereby referred to as watercourse) is required. It must be stressed that effluent (un-treated, partially treated or treated) cannot be discharged to a surface water soakaway structure.

The proposed new residential dwelling is within the garden of Tregwheal with an existing private foul drainage and so a new separate foul water drainage system comprising a Sewage Treatment Plant (STP) is being considered.

2 SITEWORKS

2.1 Overview

Two trial pits (annotated TP01 and TSAH) were undertaken under the supervision of STG Engineering Ltd. TP01 was in the proposed location of the soakaway corresponding to the NE region of the northern plot of lower elevation whilst TSAH was in the proposed location of the drainage field in the adjacent field of higher elevation beyond the eastern boundary in 3rd party land (Appendix A1).

TP01 encountered groundwater (perched and/or throughflow) within inferred Tidal River or Creek Deposits corresponding to bottom of valley and thus soakaway testing was not undertaken (See Section 3). The garden area to the SW is of a higher elevation (nominal 2m) and so does not support a gravity flow system and with the consideration for existing trees to be retained and a substantial new planting scheme along the southern and western regions plus necessary separation distances from buildings & boundaries there was no further suitable areas on site. Consequently, the entire site was tested and/or discounted.

TSAH encountered bedrock at a shallow depth and thus percolation testing was not undertaken (See Section 4). The area of the adjacent 3rd party field to the SE was already allocated to the existing drainage fields of Tregwheal and the neighbouring property of Grimsdale. The area of the adjacent 3rd party field to the NW was already allocated to the existing drainage field of the neighbouring property of Chapel Coombe and the bottom of the valley with unsuitable ground conditions was allocated for the forthcoming surface water drainage strategy. Consequently, the entire adjacent 3rd party field was tested and/or discounted.

The co-ordinates of the trial pits (displayed on the geological logs) were obtained with a hand-held Global Positioning System (GPS) with an accuracy of 3-5m.

Due to being private 3rd party land, the absence of underground services was confirmed by the client therefore a utility search was not undertaken by STG Engineering Ltd prior to sitework. It was noted there was no major underground services within the location of the proposed soakaway structure or drainage field. An E-W trending overhead is located through the central region of the site.

Risk Assessment and Methods Statements (RAMS) and Permit to Work were produced by STG Engineering Ltd prior to sitework and are kept on file and can be made available if required.

An excavator (Takeuchi TB014) plus a tractor and bowser supplied with clean harvested rainwater water to undertake the infiltration tests were sourced locally by STG Engineering Ltd.

2.2 Duration of Works

The two trial pits were performed on the 16th January 2024 and upon completion of sitework were re-instated that afternoon.

2.3 Weather Conditions

The weather during the sitework on the 16th January was dry and sunny with initial frosty conditions. Some wet weather (not adverse) was noted in the two weeks prior associated with the time of year corresponding to winter with adverse weather/storms corresponding to end of December 2023.

3 SURFACE WATER DRAINAGE

3.1 Flood Risk Assessment

The site has a very low risk (<0.1% each year) of flooding from rivers or the sea as defined by the Environment Agency (EA) as shown in Appendix A2. It is noted Flood Zones 2 & 3 are to the east and south corresponding to Tamar Estuary but based on a distance >500m and of >20m lower elevation, they are deemed to not affect the site.

Pluvial (surface) flooding occurs when the intensity of rainfall exceeds infiltration into the ground. This occurs either when the surface is impermeable e.g roads and roofs or when the ground becomes saturated after periods of continued rainfall. The EA extent of surface flooding indicates the central region of the site has a low risk (0.1-1%) with depths of <300mm and velocity >0.25m/s indicating minimal duration which originates in the NW-SE trending road along western boundary as shown in Appendix A3. With consideration of a substantial planting scheme to absorb (rain garden concept) plus FFL >0.30m above existing ground level and the surface water to now be effectively managed this low risk is not inferred to affect the site.

Further beyond to the NE corresponding to a flowing watercourse is medium (1-3%) to high (>3.3%) risks with depths up to >900mm with a velocity of >0.25m/s indicating minimal duration. Confined to the watercourse channel that flows NE away from the site of lower elevation these risks are not deemed to affect the site.

Overall, the site is Zone 1, <1 hectare and does not have critical drainage problems (classified as a Critical Drainage Area – CDA) as notified by the EA so no FRA is required.

3.2 SuDS Area

GRC Planning & Development Consultant confirmed the impermeable area of the proposed new dwelling as 110m^2, double parking space as 22.50m^2 and section of new driveway as 67.50m^2 resulting in a total impermeable area of 200m^2 on this occasion.

Due to the encountered geology (cohesive strata with negligible permeability) the concept of permeable parking and driveway has been discounted.

As the site is within a rural location corresponding to the small village of Landulph Cross the concept of urban creep (increase impermeable area by 10%) does not need to be considered on this occasion.

3.3 Discharge to Soakaway

3.3.1 Geology

The geological records (British Geological Survey (GeoIndex), 2024) indicate no superficial geology and the bedrock geology to comprise Tavy Formation – Slate. This Devonian sedimentary bedrock is pale green and grey-green slaty silty mudstone with minor thin fine-grained sandstone beds and lenses.

Further beyond to the NE corresponding to watercourse and Tamar Estuary is Tidal River or Creek Deposits – Clay & Silt. These Quaternary deposits are mainly silt and clay deposited within channels in tidal flats and lagoons.

3.3.2 TP01 Geology

This is a single large trial pit performed by a mechanical excavator 0.50m wide x 2.00m x long x 2.20m below existing ground level (begl) within the proposed location of the soakaway corresponding to garden area of ~46m AOD (Appendix A1).

The trial pit confirmed the findings of the geological records and identified a sequence of Topsoil over cohesive Subsoil over cohesive inferred Tidal River or Creek Deposits of varying strata and thickness corresponding to bottom of V-shaped valley noting bedrock geology was not encountered. As stated in Section 2.1, no further trial pits could be undertaken based on site conditions, usage and higher elevations to the north and south.

A summary of the ground conditions of TP01 is presented in Table 1 below whilst a geological log is presented in Appendix B and the photographs are presented in Appendix C.

Table 1: Summary of Ground Conditions (TP01)

Depth (m)	Geological Description (BS 5930:2015)
0 – 0.30	Brown occasionally mottled orange slightly sandy slightly gravelly CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (TOPSOIL)
0.30 – 0.60	Light brown occasionally mottled orange slightly gravelly silty CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (SUBSOIL)
0.60 – 0.90	Firm grey mottled orange silty CLAY (inferred TIDAL RIVER OR CREEK DEPOSITS)
0.90 – 1.60	Soft to firm orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (inferred TIDAL RIVER OR CREEK DEPOSITS)
1.60 – 1.80	Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (inferred TIDAL RIVER OR CREEK DEPOSITS)
1.80 – 2.20	Firm grey occasionally mottled orange slightly sandy slightly gravelly CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (inferred TIDAL RIVER OR CREEK DEPOSITS)

3.3.3 Groundwater

Groundwater was encountered in TP01 as a slight seepage from 1.60m begl (44.40m AOD) corresponding to a variation stratum of the Tidal River or Creek Deposits and after >20mins standing time there was 0.10m of water indicating a rest level of 2.10m begl. Due to a rate of slight seepage, it is inferred with a greater standing time there would be a rest level of 1.60m begl and thus strike would equal rest level.

Based on the shallow depth, it is inferred to be throughflow/perched groundwater; unconfined body of groundwater between the water table and ground surface separated by an unsaturated zone when subsurface water percolating downward is held by a bed or lens of low-permeability material (underlying cohesive Tidal River or Creek deposits). Perched groundwater may be either permanent, where recharge is frequent enough to maintain a saturated zone above the perching bed, or temporary, where intermittent recharge is not great or frequent enough to prevent the perched water from disappearing with time as a result of drainage over the edge or through the perching bed. Despite the time of year and prior adverse weather, based on the geological nature of the soil and the presence of two ponds to the NE of lower elevation that are present throughout the year including a number of springs, issues and sinks this inferred perched groundwater is believed to permanent. Consequently, this presence of groundwater needs to be considered particularly during the winter months and/or after adverse weather.

In accordance with BRE Digest 365, groundwater should not be encountered within the excavated trial pit(s) and thus why infiltration testing within TP01 was not undertaken on this occasion. Furthermore, the presence of standing water indicates negligible/no permeability of the underlying soils.

In accordance with The SuDS Manual C753, the maximum groundwater levels are to be >1m below the base of a soakaway structure and should always be adopted. Consequently, any soakaway structure would have to be founded <0.60m deep in TP01 corresponding to cohesive Subsoil (especially when considering higher levels in winter and/or after adverse weather). With negligible permeability based on cohesive nature there would be inadequate time for emptying to half volume within 24hrs (as per BRE Digest 365). Furthermore, there would be insufficient cover without raising the site >0.50m to create the necessary cover indicating insufficient effective storage depths. Finally, the soft to firm consistency of the Tidal River or Creek deposits indicates it may not be capable of supporting a loaded soakaway structure and could lead to subsidence at surface.

Consequently, based on TP01 not being complaint in accordance with BRE Digest 365 or CIRIA, soakaway structures can be discounted as a viable option of surface water disposal.

3.4 Discharge to Watercourse

3.4.1 General

As infiltration by a soakaway is not a feasible option, we move down the drainage hierarchy to controlled discharge to a watercourse where attenuation and/or consent may be required.
A NE trending watercourse (ordinary watercourse of stream status) flows away from the site through a wooded area as a tributary of the N-S trending River Tamar (Main River Status).
The designated flat-bottom channel of >1.20m wide x >0.60m deep (Photographs in Appendix C) has adequate volume capacity to receive additional water. Anecdotal information from the adjacent 3rd party landowner – farmer who has lived in Landulph Cross all his life (>80yrs) has stated that this watercourse has a flow all year round and it is believed that the source of water is a natural spring/issue to the SE of higher elevation.
Although the initial watercourse is not Flood Zone 2 or 3, based on the receiving waterbody (River Tamar) being Flood Zone 2 & 3 in conjunction with low-high risk of surface water flooding, controlled discharge is deemed required on this occasion.
Consent is required for access across the 3rd party land to the watercourse noting this is above the remit of this report and that of STG Engineering Ltd. However, it is understood that at the time of writing this report the client and landowner have made the necessary legal arrangements.

3.4.2 Greenfield Runoff Rate

The offsite discharge is limited to Greenfield runoff rate. Both IH124 and FEH calculations have been undertaken and are presented in Appendix D1. The calculated Greenfield runoff rate (1: 30-years) is 0.12l/s and 0.16l/s respectively. These can be considered too small to be practically achievable especially when considering blockages etc thus a maximum offsite discharge rate of 1l/s is considered.

3.4.3 Attenuation Tank

Attenuation for 200m^2 impermeable area has been designed for a 1:100-year return period plus 50% climate change as per current guidance from CCC/EA using r = 0.30 (in-land location).
Based on a proposed discharge rate of 1l/s an attenuation volume of 6.63m^3 is required (Appendix D2). For completeness, a discharge rate of 1.50l/s requires an attenuation volume of 4.99m^3 should a higher rate be considered.

With consideration for site conditions, storage size requirements and available space underground attenuation tanks are considered to be the most viable on this occasion. The proposed location of the attenuation tank is to the NE north of the new residential corresponding to garden area (Appendix A1). This is a secure and suitable location with sufficient access for maintenance of lower elevation allowing gravity flow system where rainwater is directed via a series of gutters, hoppers and downpipes from roofs and Aco-drains (or similar) from driveway and parking area. The tank would be positioned away from (substantial) vegetation with associated root networks that could otherwise cause damage.

It must be stressed this location is not finalised but merely suggested at this planning stage and during construction a more convenient/suitable location may be adopted.
Although the attenuation tank location corresponds to Flood Zone 1 consideration is given to flooding (fluvial and surface). However, being a sealed unit underground, any flooding will not affect the attenuation tank, other than temporary loss of access for maintenance etc during periods of flooding. Consequently, a silt trap on the approach is recommended at higher elevation to the SE corresponding to the main dwelling noting a degree of protection as any surface water flooding would be deflected around the building.

An attenuation tank with capacity of 7500 litres/7.50m^3 has been proposed which exceeds the maximum requirement by 12%. This is considered appropriate from the risk of loss of storage from sedimentation; 10% is for tanks at risk of sedimentation and/or hard to maintain noting a system taking only roof runoff would take 250 years to suffer a 10% loss of storage volume.
With the element of oversizing (or a larger attenuation tank considered by the client) there is the option of rainwater harvesting within the lower chamber of this attenuation tank for use within the garden area and/or the residential dwelling. This is not a stipulation but is something that can be considered by the client.

An example of the underground attenuation tank is shown in Appendix E1 noting the dimensions are 3.60m long x 2.25 wide x 1.25m high for main chamber (and 1.565m including manhole/lid).
The tank is normally positioned on a concrete base (thickness/design/grade is above the remit of STG Engineering Ltd) and surrounded with either concrete or granular backfill. However, the manufacturers installation instructions should take precedence.
Any overlying Made Ground should be avoided as a founding stratum.
The tank should be installed above groundwater levels thereby preventing increased lateral load from the groundwater on the side of the tank and possible risk of floatation of the tank which occurs when the uplift buoyancy force from the groundwater exceeds the combined weight of the tank and the overlying soil. With consideration of a strike/inferred rest level of 1.60m begl (and potentially shallower during winter months and/or adverse weather) then it is recommended that the tank is installed at a depth of 1.25m begl (excluding any concrete base). Whilst the main body of the tank is underground, the offset manhole would protrude but would easily be mitigated with a landscaping process of this garden area. If future site conditions and/or client requirements permit, then it would be advisable to install at a shallower depth e.g 1m begl with a greater degree of landscaping to ensure tank is above any winter/perched groundwater levels especially when considering the concept of climate change and thus inferred low risk from lateral load and floatation.
The relevant BBA certificates and/or CE Marking plus suitable load capacity for lateral load is above the remit of STG Engineering Ltd and this report.

The flow control device of the attenuation tank is a Flowbrake fixed head floating open orifice (Appendix E2) from the manufacturers Freeflush Ltd. The flow of 1l/s is achieved through the standard orifice and maintained at this respective rate due to the fixed depth of 200mm head

between the float and the orifice regardless of the water level within the tank as shown within the pictorials on page 3 in Appendix E2. The presence of a basket filter within the inlet at the top of the tank in conjunction to a strainer on the fixed head floating orifice plus silt trap on the approach at higher elevation (3-stage measure) prevent blockages.

The outfall from the attenuation tank would discharge into the watercourse to the NE of the site at 1l/s. Being a controlled rate is deemed to not affect the site, surrounding rural area or receiving waterbody with a Flood Zone 2 & 3 status via flooding.
Becoming roof structures and driveway/parking where rainwater can be easily collected and managed (rather than contributing to surface flooding) this is deemed a betterment from prior situation of uncontrolled surface water discharge by reducing flood risk overall. Therefore, the pre and post development peak runoff flow rate will not change/increase.
It is recommended that a one-way valve is installed at the outfall to prevent the ingress of any water/debris/sediment into this underground surface water drainage system. Furthermore, it is recommended that the outfall is the base of the waterbody channel thereby preventing scour/erosion of the watercourse bank. Consideration should also be given to the use of (Smart) water butts to not only increase the concept of rainwater harvesting but also reduce the volume of water discharged during/after a storm event.

3.4.4 Geotechnical Implications

As soakaway structures are not being considered there is no requirement to consider the geotechnical implications from the infiltration of water. However, the geotechnical implications for an underground attenuation tank are discussed below:

- The consistency (inferred soft to firm strength) of the underlying soils indicates the ground is soft which could compact (removal of air between the soil particles) when loaded and/or prone to differential settlement. Furthermore, the cohesive nature indicates a medium to high plasticity (subject to laboratory testing to confirm) which is prone to shrinking (contracting) and expanding (heave/swell) depending on the water content based on the seasons and abstraction by any nearby vegetation (existing vegetation to be retained plus new scheduled planting) which could lead to differential movement of the attenuation structure (and STP).
- The site is not within a mining area (except local quarries/pits) and thus there are not considered any underground features (shafts, adits) which may affect the stability of the attenuation structure.
- There are no underlying calcareous rock formations (e.g. chalk) which can slowly dissolve over time leading to instability of an overlying attenuation structure.

Overall, if the necessary consideration is given to a high plasticity soil and the requirement of a reinforced concrete base with input from a structural engineer, it is inferred that the proposed use of underground attenuation structures can be adopted. However, it should be noted that if the ground conditions differ considerably from that encountered in TP01 when undertaking the excavation for the attenuation tank then professional advice should be sought prior to installation.

3.4.5 Geo-environmental Implications

The potential for an attenuation tank to cause or accelerate the leaching of contamination to the groundwater and/or underlying soils is considered very low being a sealed unit collecting clean rainwater from the proposed roof structures and driveway with 1-2 cars only. The proposed location of the attenuation tank corresponds to natural ground. Furthermore, there was no evidence (visual or olfactory) of any contamination within the excavated trial pits and no evidence of potential contamination sources upslope of the site (sparse residential properties with pasture/arable fields further beyond.

3.4.6 Environmental Permit/Consent

The EA are responsible for maintenance, improvement or construction work on main rivers (larger rivers and streams) to manage flood risk. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses. The Lead Local Flood Authority for the area is Cornwall County Council (CCC).

An Environmental Permit under the Environment Permitting Regulations from the EA is not required as the initial watercourse to the NE of the site is not designed a Main River (Appendix A4) and the proposed development is not within 8m of a designated Main River or 16m from a tidal defence. Furthermore, the activity of a residential dwelling is not a regulated flood risk activity. Consent from the EA is not required as the discharge relates to uncontaminated water; clean rainwater from roofs/driveway.

3.4.7 Operations and Maintenance

To ensure the effective long-term operation of the drainage system, it is important that there is regular and ongoing inspection and maintenance of the system to ensure continuing operation. This prevents issues such as blockages and means that the implemented and existing system can operate as designed. For the SuDS techniques (below ground attenuation tank), ongoing regular maintenance will be required to ensure continuing operation to design performance standards. Gutters and hoppers should be cleaned out annually to prevent blockages noting the presence of nearby trees thereby preventing overspilling; gutter guards could be installed to prevent the ingress of debris.

The SuDS Manual C753 gives a generic guidance for a maintenance schedule of an attenuation tank (Appendix F). The schedules provide a list of required maintenance procedures along with the frequency at which it needs to occur. It should be noted that the manual states that it provides guidance on the type of operational and maintenance requirements that may be appropriate and that the list of actions is not exhaustive, and some actions may not always be required.

3.5 Discharge to Sewer System

There is no SWW infrastructure of either surface water drains or combined sewers within the vicinity (>100m) of the site as shown in Appendix A5 and thus this option can be discounted.

3.6 Exceedance Flow Routes

Consideration has been given to the exceedance pathways and overland flow routes from the proposed development in the event of rainfall in excess of the design standard of the surface water drainage management system (Appendix A6).

Despite the low risk from surface water through the central region of the site which originates on the NW-SE trending road along western boundary, with the presence of Aco-drains (or similar) on proposed driveway and dwelling with gutters/downpipes, drainage is now managed thereby helping to mitigate this risk. Furthermore, entry to the site is inferred to be the existing driveway from the adjacent road so if a mound/hump was constructed at the entrance this would prevent the surface water from entering the site and keep it confined to the road infrastructure with drainage via the installed highway drains.

Due to the northern, southern and western boundaries being of a higher elevation they do not need to be considered for exceedance flows or boundary treatments to prevent overland flows from affecting neighbouring land and properties.

Based on the topography of the site all routes would be to the NE and predominantly absorbed by the existing and scheduled vegetation (rain garden concept). However, it is envisaged that not all exceedance flows would be absorbed and as the eastern boundary is a wooden post and rail style fence this affect the neighbouring 3rd party land of lower elevation and thus a boundary treatment is deemed required. Consequently, if additional planting (further absorption) and/or a nominal 0.30m high soil bund is constructed along this eastern boundary (utilising the excavated spoil from both the forthcoming attenuation tank and sewage treatment plant thereby avoiding the concept of exporting this material offsite as waste with the necessary waste classification testing) this would prevent flows from leaving the site. The concept of a soil bund may not be in keeping with the aesthetics of the area or practical when considering the presence of a gate to the adjacent field and so 0.30m high kick boards along the bottom of the existing fence could be considered (unless a new closed fence along entire western boundary was considered during the construction stage).

3.7 Surface Water Management During Construction

Due to site elevations/topography, any generated surface water would flow NE into garden area for absorption (rain garden concept) noting the open eastern boundary.

Consequently, the appointed building contractor should manage and direct any surface water to stay confined to the site for absorption via the use of sandbags/temporary bund structure (or similar).

4 FOUL WATER DRAINAGE

4.1 General

The specification and sizing of the Sewage Treatment Plant (STP) is above the remit of this report and that of STG Engineering Ltd. Being a 3-bedroom residential dwelling, it is inferred that a 6-person plant would be utilised and correctly sized in accordance with British Water Code of Practice (Flows & Loads 43) and certified to BS 12566/3.

It is noted that the STP should be >7m from residential building, >2.50m from boundaries and within 30m of vehicular access for emptying/maintenance. The proposed location in Appendix A1 satisfies both planning purposes and Building Regulations Approved Document H2. Consideration should be given to the founding of the STP based on underlying medium to high plasticity soils, unless a higher elevation corresponding to bedrock beyond the inferred Tidal River or Creek Deposits at bottom of V-shaped valley can be achieved.

4.2 General Binding Rules

As the wastewater treatment system is installed and discharging on or after 1st January 2015 it is considered a 'new discharge' and by law must comply with General Binding Rules (GBR) from the Environment Agency (EA).

The sewage must be domestic in nature (Rule 3), the discharge must not cause pollution of surface water or groundwater (Rule 4), the system must be installed and operated in accordance with the manufacturers specification (Rule 10), there must be regular maintenance of the system (Rule 11) and the new discharge must be >30m from an existing public sewer system (Rule 15).

There is no SWW infrastructure within 100m vicinity of the site as shown in Appendix A5 and thus permits a private sewerage system. Please note this information is correct at the time of writing this report and does not consider any infrastructure addition (or removal) by SWW.

4.3 Discharge to Ground

4.3.1 General

For discharge to ground via a drainage field, when considering the necessary 15m separation from dwellings, 10m from watercourse/ditch and 2m from boundaries there is no available space within the allocated site boundaries (Appendix A1). Furthermore, a drainage field cannot be positioned beneath a driveway thereby ruling out the entire southern region of the site. Consequently, the adjacent 3rd party field was considered with prior 3rd party approval to undertake percolation testing including the initial Trial Site Assessment Hole (TSAH).

4.3.2 TSAH Geology

This is a single large trial pit performed by a mechanical excavator 0.80m wide x 1.20m x long x 1.60m below existing ground level (begl) within the central region of the proposed drainage field corresponding to adjacent field at ~47.50m AOD (Appendix A1).

The trial pit confirmed the findings of the geological records and identified a sequence of Topsoil over granular Residual Soil (weathered Tavy Formation) onto Bedrock noting limitations of excavator and density is based upon observations in trial pit only and no field tests or in-situ tests were performed. Inferred Tidal River or Creek Deposits were not encountered at this higher elevation confirming the presence is confined to the bottom of the V-shaped NE-SW trending valley.
As stated in Section 2.1, no further trial pits could be undertaken based on site conditions with three other separate drainage fields, usage and elevations.
A summary of the ground conditions of TSAH is presented in Table 2 below whilst a geological log is presented in Appendix B and the photographs are presented in Appendix C.

Table 2: Summary of Ground Conditions (TSAH)

Depth (m)	Geological Description (BS 5930:2015)
0 – 0.20	Brown slightly sandy gravelly CLAY with occasional rootlets. Gravel is angular to sub-angular fine to occasionally coarse slate/shale (TOPSOIL)
0.20 – 1.60	Medium dense brownish grey slightly silty GRAVEL & COBBLES of angular to sub-angular fine to coarse slate/shale (RESIDUAL SOIL) (weathered Tavy Formation)

This trial pit identified bedrock from a depth of 1.60m begl and in accordance with BS6297: 2007 a drainage field must not be sited upon rock and must have 1.50m of unsaturated soil below the invert level (1.20m below the gravel trenches) to allow secondary treatment of the effluent through the ground within the aerobic soil profile thereby preventing short circuiting into the groundwater.
The granular nature of the overlying Residual Soil with very low cohesive content would indicate a rapid percolation with a Vp of <12 and thus not compliant with either BS6297: 2007 or Building Regs Doc H2 as there would be insufficient time for secondary treatment.
When considering depth of bedrock, the invert would have to be 0.10m begl with top of pipe at existing ground level. A minimum of 0.20m cover is required above the geotextile membrane indicating a landscaping process of >0.25m is required. Furthermore, based on the steep slope angle (~20°) there is the high risk of critical cross-section (infiltrated wastewater breaks out of the ground surface) and thus additional landscaping (>0.50m) would be required to mitigate this risk. However, the adjacent field is used for grazing and whilst there is consent to undertake percolation testing with a drainage field below the surface, the 3rd party landowner would not accept landscaping >0.50m of his pasture field.
Furthermore, the presence of three separate drainage fields serving the three existing properties are within 50m of the proposed drainage field and thus does not comply with Rule 23 (new discharge is not within 50m of any other small sewage discharge - October 2023) of the GBRs indicating an EA environmental permit (water discharge activity) would be required.
Overall, based on the points highlighted above discharge to ground via a drainage field is not a viable option and can be discounted.

4.4 Discharge to Watercourse

A suitable flowing watercourse is noted beyond the NE corner of the site and is thus considered for the outfall from the STP.

There are further specific GBRs for discharge to a watercourse and include:

- The discharge must be 5m^3 (5000 litres) or less per day (Rule 2) – The new residential dwelling has 3 bedrooms thus the calculated daily discharge is 0.75m^3 (Appendix A7).
- The sewage must receive treatment from a STP (Rule 6);
- The discharge must not be in or within 500m of a Special Area of Conservation (SAC), Special Protection Area (SPA), biological Site of Special Scientific Interest (SSSI) or Ramsar Site (Rule 17) – The results from the EA search indicate the site is not within 500m of a SAC, SPA, Ramsar or SSSI (Appendix A8) noting all four allocations are to the east and south corresponding to Tamar Estuary at a distance of >700m.
- The discharge must be made to a watercourse that normally has a flow throughout the year (Rule 19) – both the client and 3rd party landowner have both confirmed the water course has a flow all year round.

Overall, the GBRs are met and thus an EA environmental permit (water discharge activity) is not required on this occasion.

The installation of a seasonal (partial) drainage field is recommended on the approach to the watercourse (Rule 20) and comprises a 12-15m long x 0.60m wide x 0.60m deep trench. Within the trench rigid perforated 110mm pipe is laid upon 0.30m thick 40mm clean stone and then covered 0.05m above the pipe with the clean stone. A geotextile membrane is laid upon the clean stone and the remainder of the trench is backfilled with soil. The benefit of this partial drainage field is to allow dispersal into the ground during hot dry periods when there may be less dilution in the watercourse. Furthermore, the presence of the surface water outfall from attenuation tank can actually help sustain a flow in the watercourse and thereby promote dilution for the foul water outfall downstream.

Overall, discharge to flowing watercourse beyond the NE corner is a viable option as shown in Appendix A1. Consent across this 3rd party land is required but as stated in Section 3.4.1 the client and landowner have made the necessary legal arrangements.

Despite the foul drainage arrangement of Tregwheal to be existing and pre-dates 2015 (believed to be ~30 years old), based on encountered ground and site conditions and with consideration of Rule 23, it would be prudent to suggest that the client considers upgrading the existing septic tank for Tregwheal to a STP with discharge to the flowing watercourse beyond the NE corner and thereby disregarding the non-compliant drainage field which would most likely need replacing in the near future based on inferred age. The combined discharge from Tregwheal and the new property would not exceed 5000 litres and thus compliant with Rule 22 (new discharge does not use the same discharge point as any other discharge if the combined volume would exceed the GBR limit - October 23) of the GBRs.

REFERENCES

BRE Digest 365 – Soakaway Design. Revised 2016;

British Geological Survey (GeoIndex). 2024;

Building Regulations. 2015. Drainage and waste disposal – Approved Document H;

British Standards Institution. 2015. Code of Practice for ground investigations. BS 5930:2015. BSI, London;

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British Standards Institution. 2007. Eurocode 7 – Geotechnical Design, Part 1 General Rules, BS EN 1997-1. BSI, London;

British Standards Institution. 2007. Eurocode 7 – Geotechnical Design, Part 2 Ground Investigation and Testing, BS EN 1997-2. BSI, London;

CIRIA C753. The SuDS Manual. 2015. London;

Drawings: LAH Design Ltd – Drawing No. 5083 001 (Location Plan) & Drawing No. 5083 003 (Indicative Site Plan);

https://flood-map-for-planning.service.gov.uk/

https://check-long-term-flood-risk.service.gov.uk/

https://magic.defra.gov.uk/

https://swwim.southwestwater.co.uk/

https://www.uksuds.com/tools/greenfield-runoff-rate-estimation

Appendix A: Figures

A1: Annotated Site Plans (A & B)

A2: Flood Map (EA)

A3: River/Surface Flooding (EA)

A4: Main River Map

A5: SWW Infrastructure Map

A6: Exceedance Flow Routes

A7: Daily Discharge Calculator

A8: SPA, SAC, SSSI (Magic Map)

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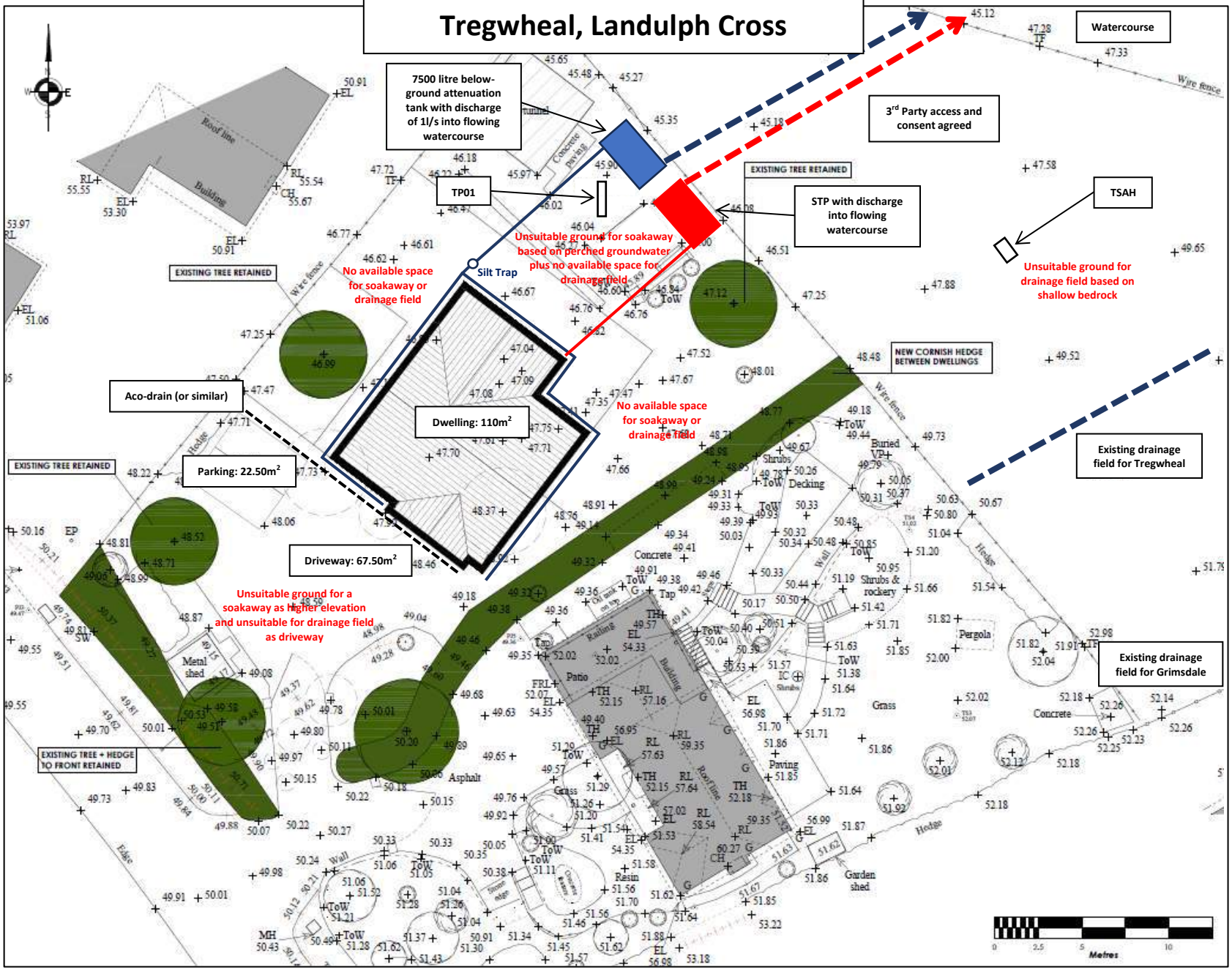
ANNOTATED SITE PLAN A

Tregwheal, Landulph Cross



This plan is indicative only and is not to be used for construction purposes. *Reproduced with permission from LAH Design Ltd*

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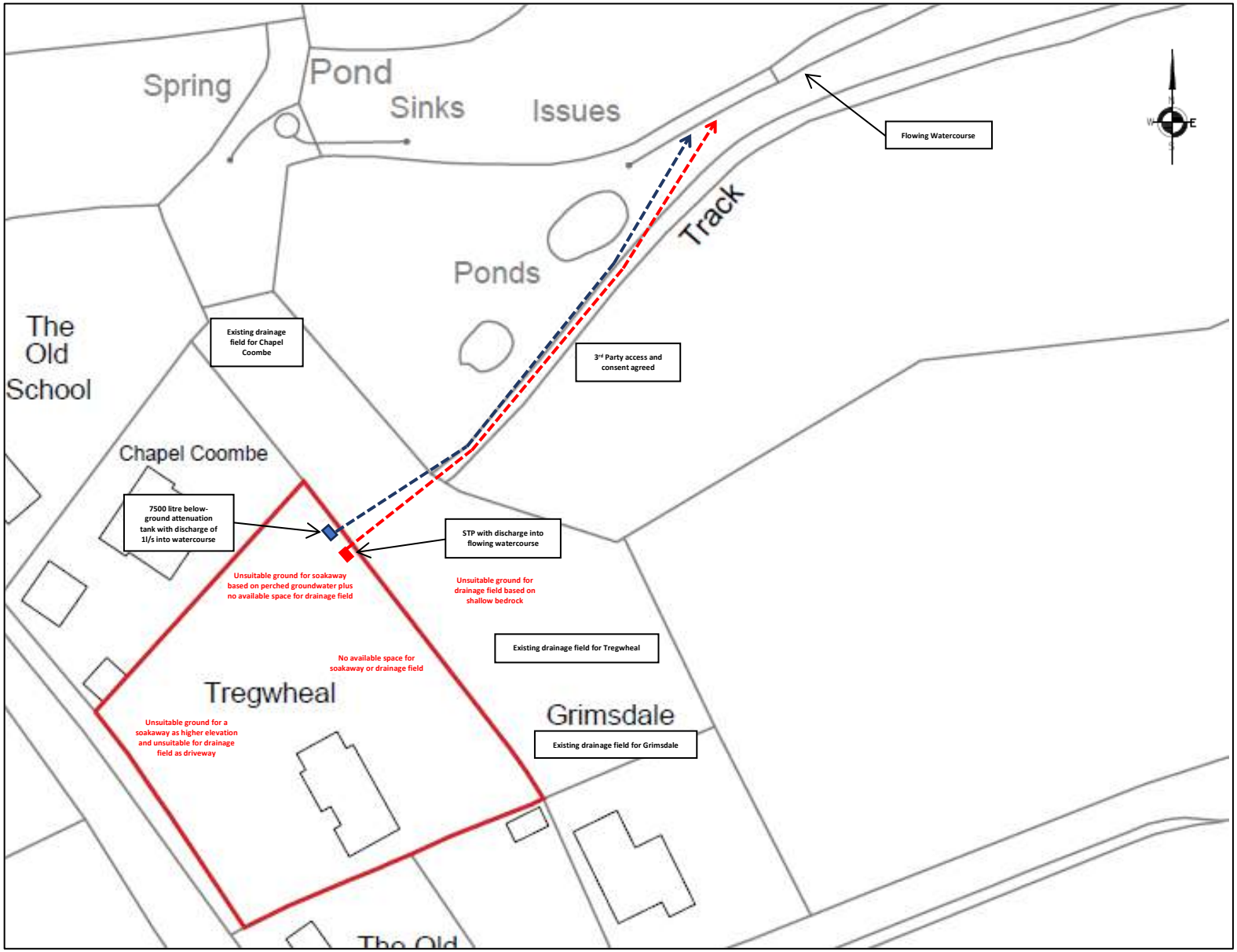
ANNOTATED SITE PLAN B

Tregwheal, Landulph Cross



This plan is indicative only and is not to be used for construction purposes. *Reproduced with permission from LAH Design Ltd*

Flood map for planning

Your reference	Location (easting/northing)	Created
Tregwheal	**242627/62530**	**10 Feb 2024 18:08**

Your selected location is in flood zone 1, an area with a low probability of flooding.

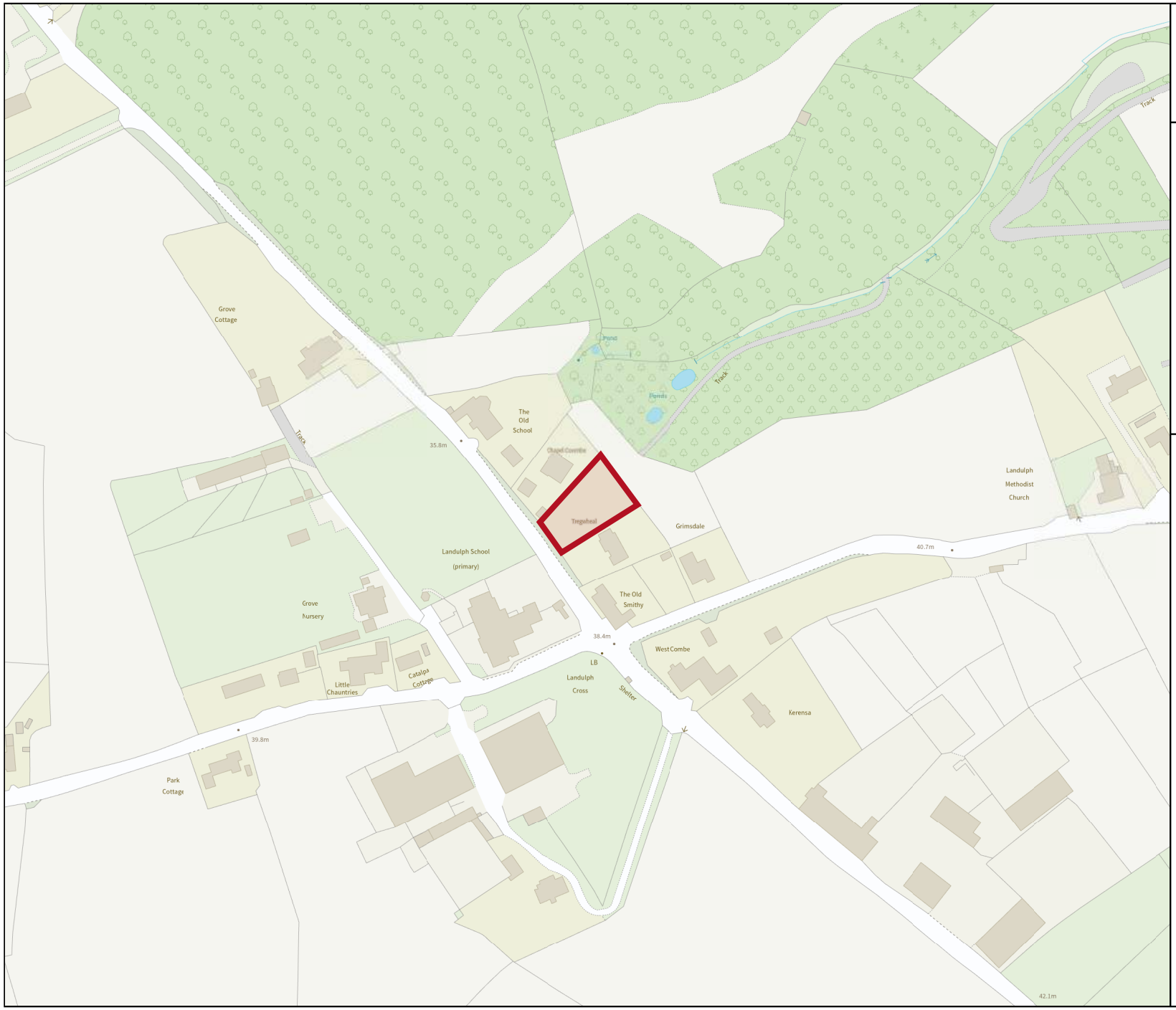
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Tregwheal

Location (easting/northing)
242627/62530

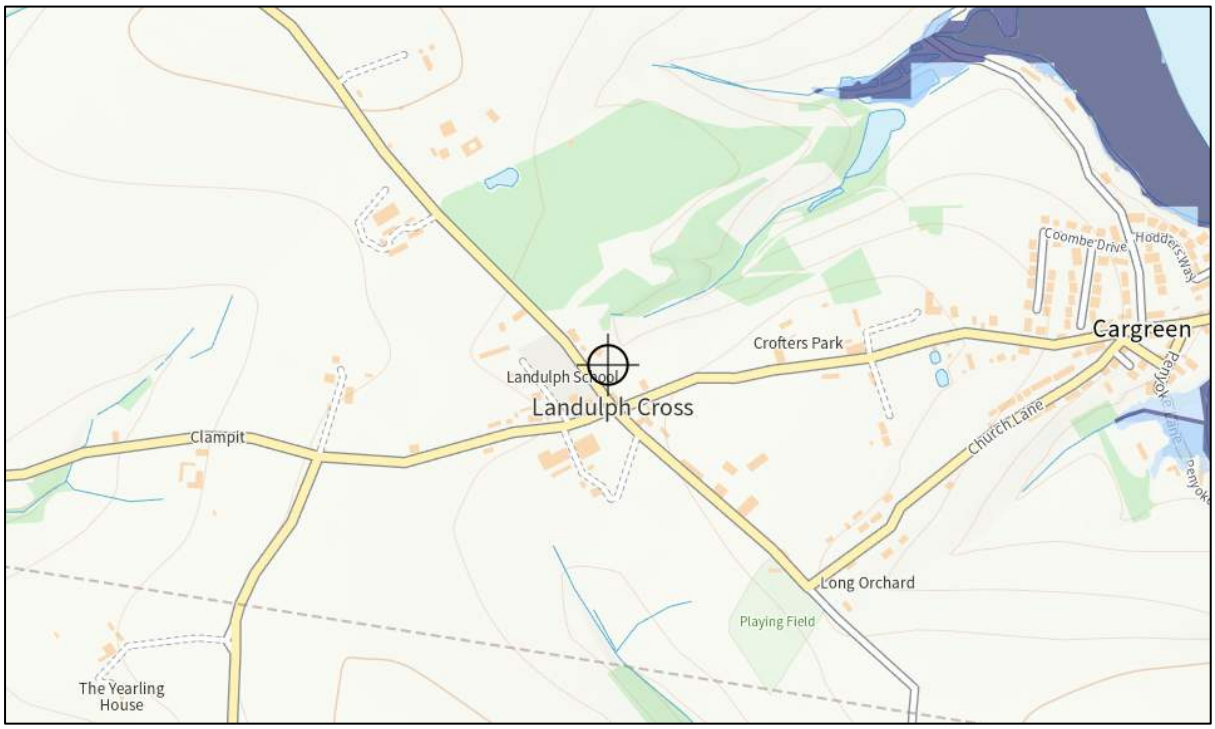
Scale
1:2500

Created
10 Feb 2024 18:08

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

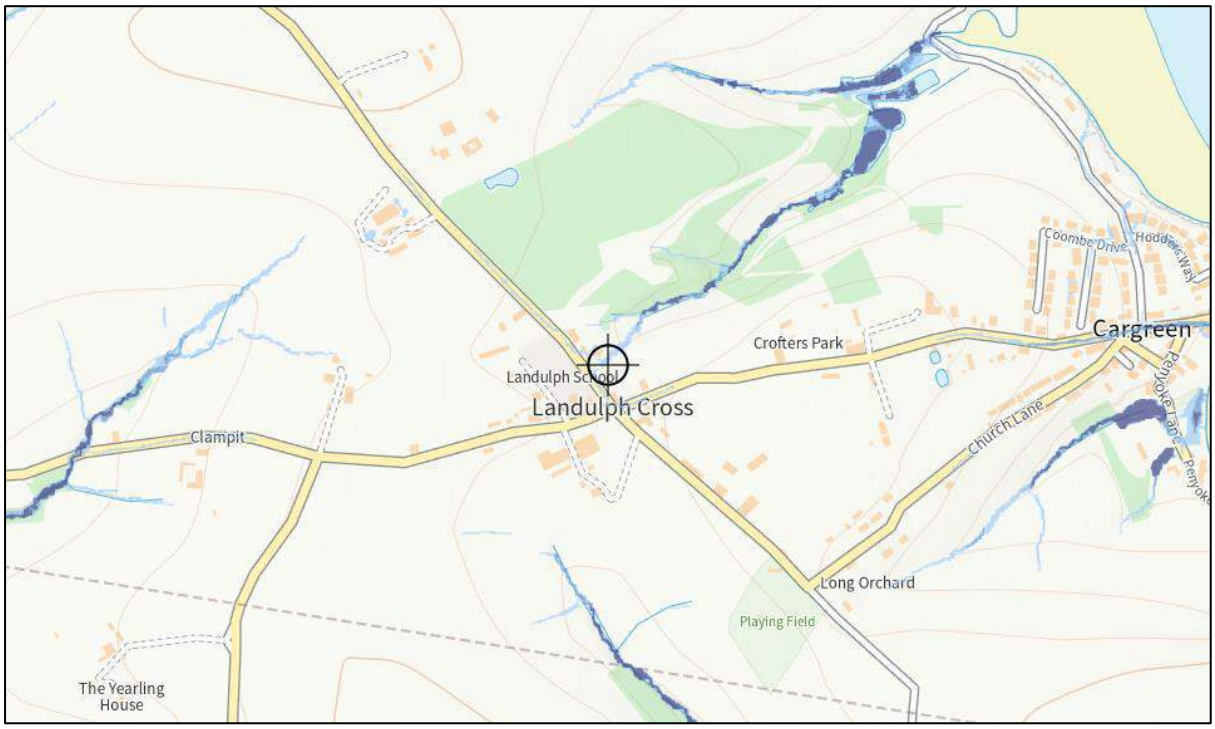
0 20 40 60m

EXTENT OF RIVER/SEA FLOODING



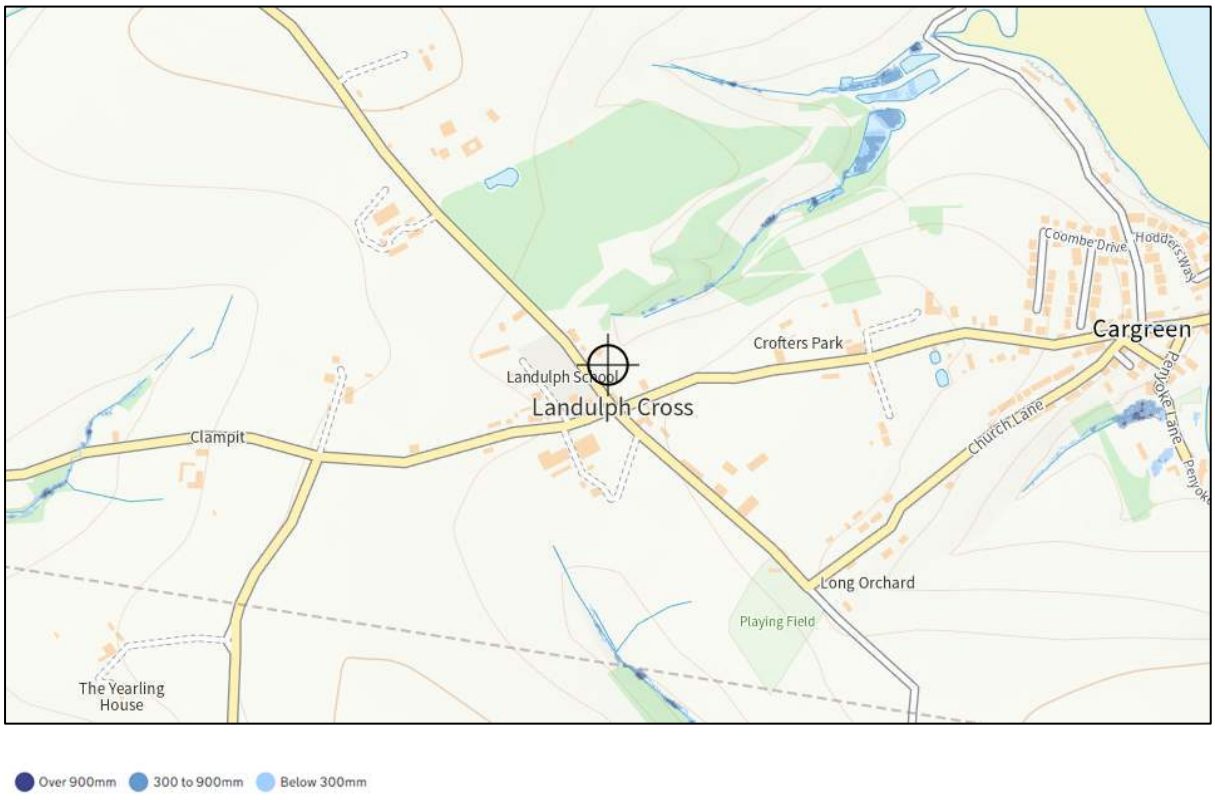
High Medium Low Very low

EXTENT OF SURFACE WATER FLOODING



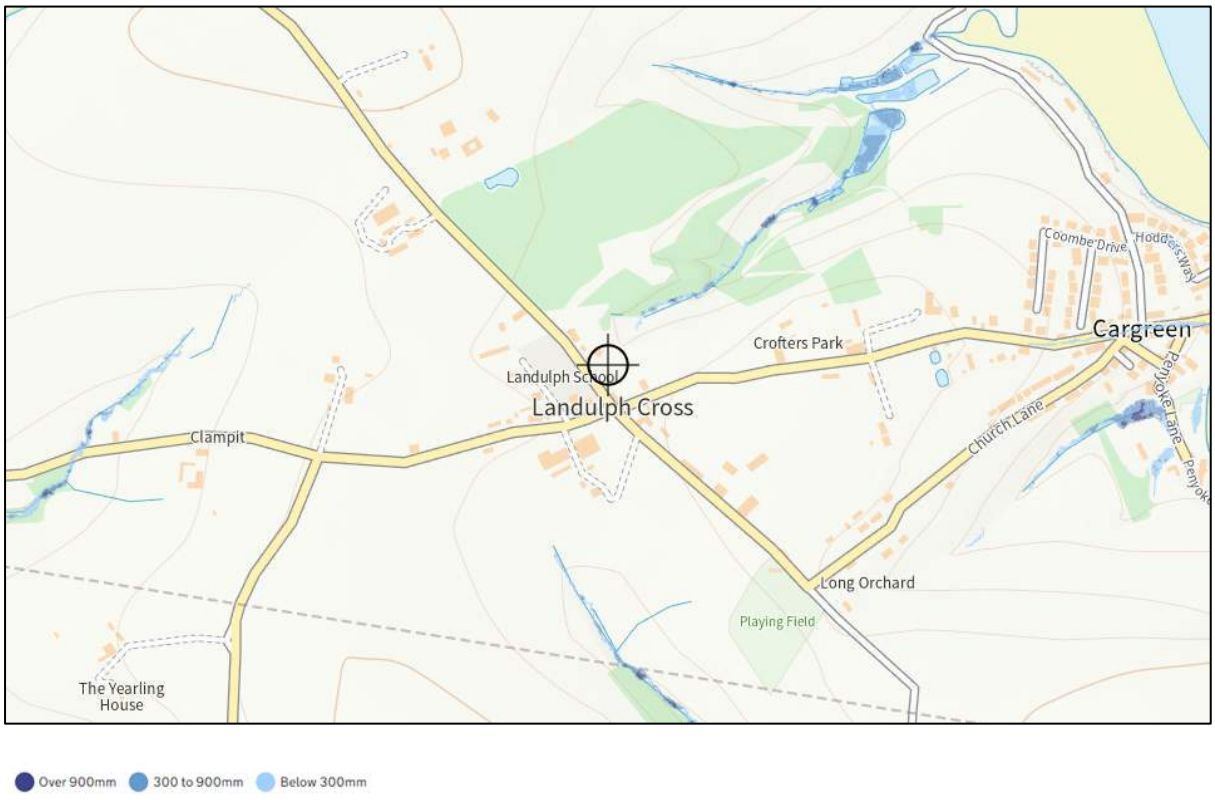
High Medium Low Very low

SURFACE WATER FLOODING – HIGH RISK DEPTH

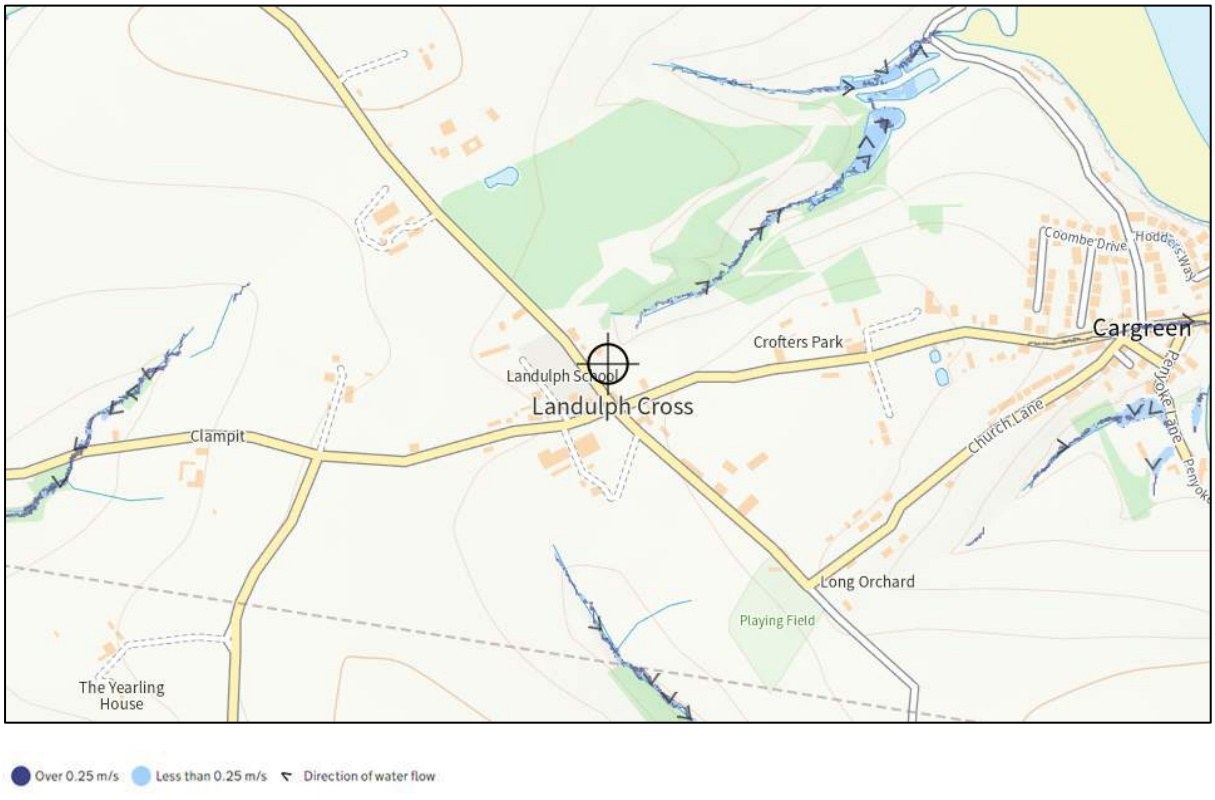


SURFACE WATER FLOODING – HIGH RISK VELOCITY

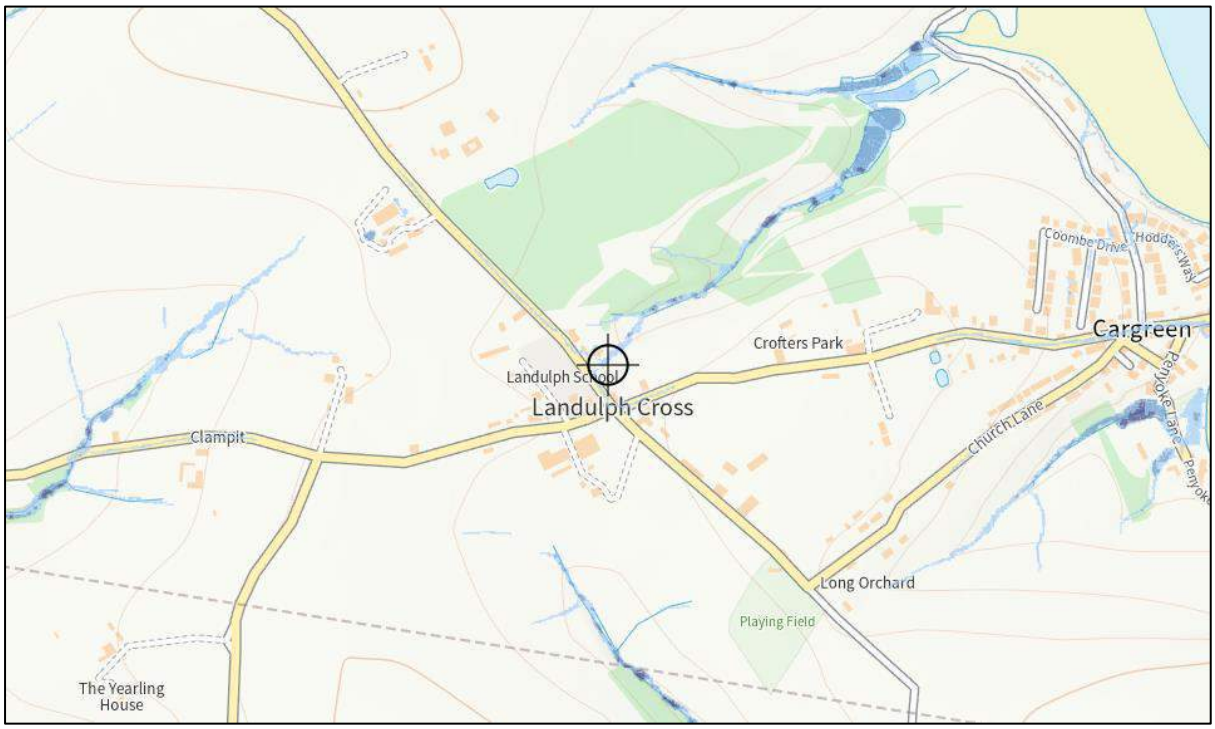
SURFACE WATER FLOODING – MEDIUM RISK DEPTH



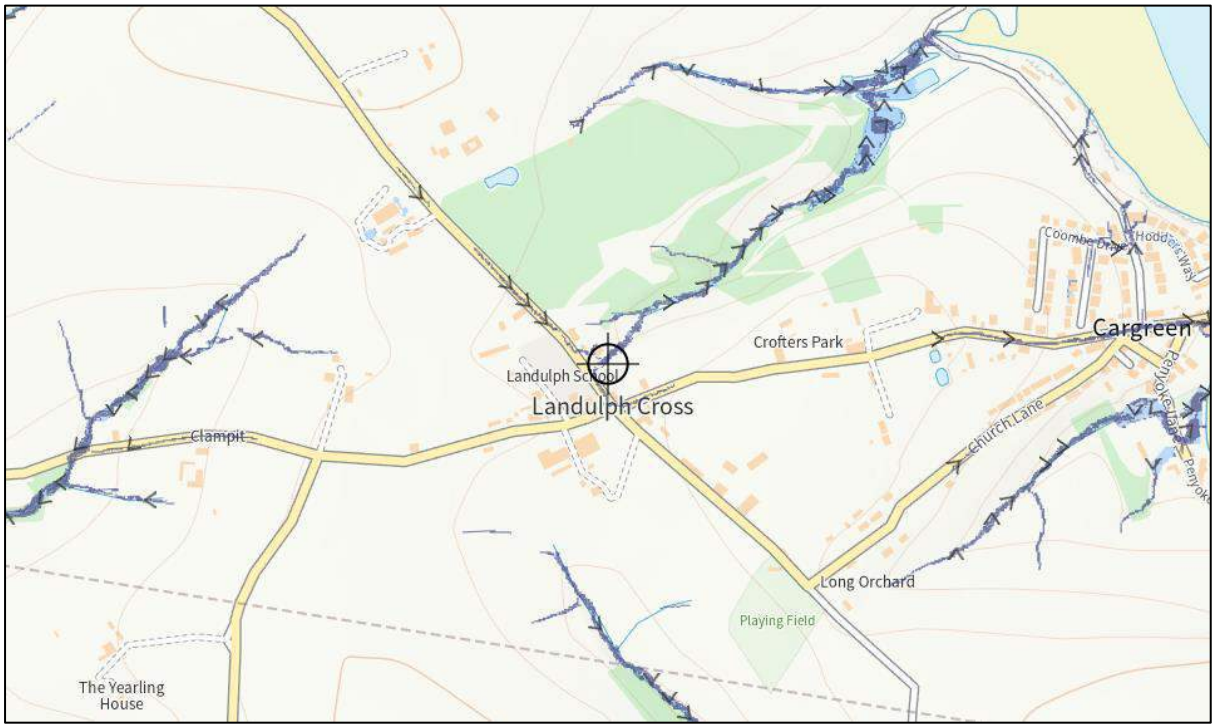
SURFACE WATER FLOODING – MEDIUM RISK VELOCITY



SURFACE WATER FLOODING – LOW RISK DEPTH

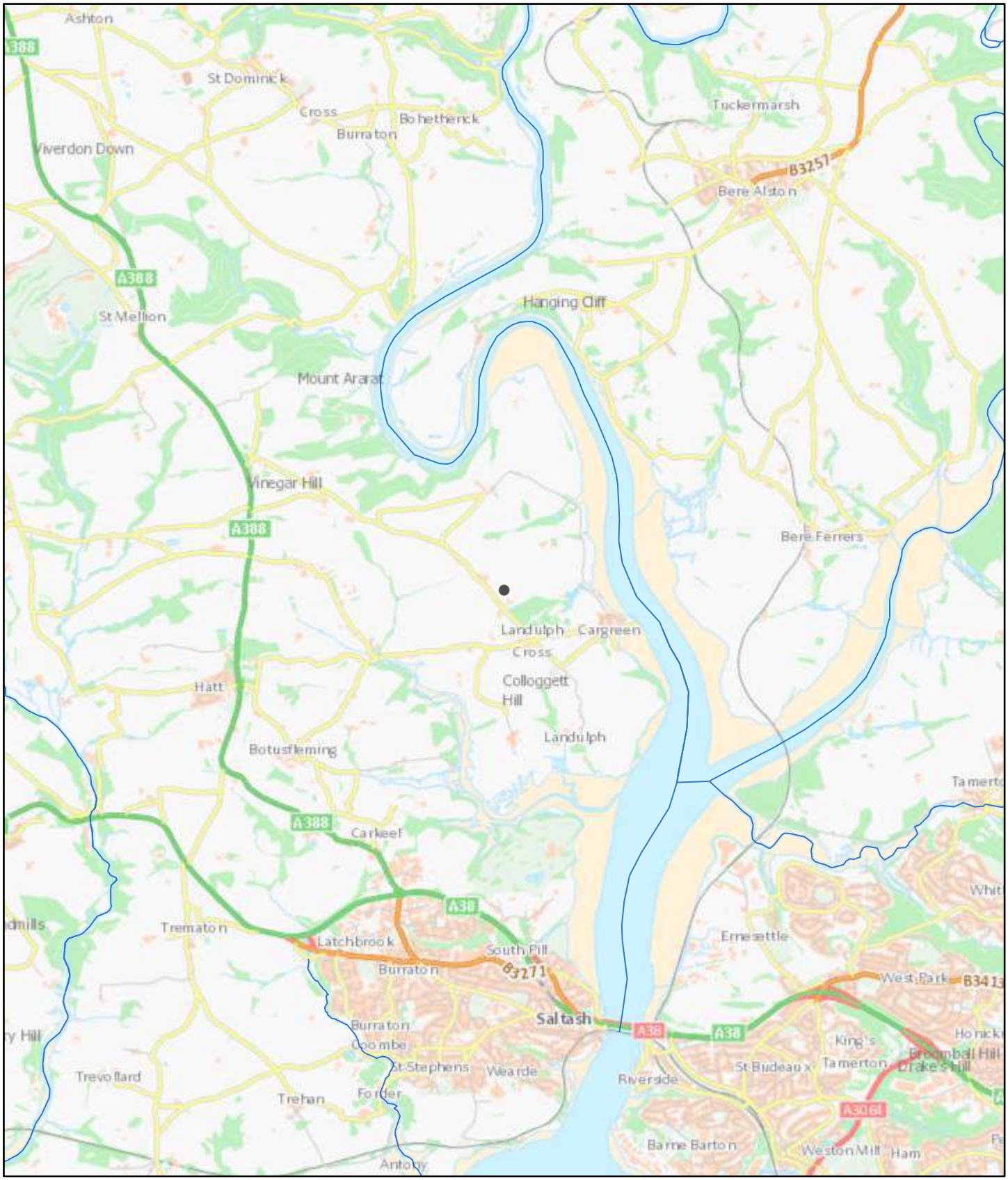


SURFACE WATER FLOODING – LOW RISK VELOCITY



Courtesy of EA (flood-warning-information)

Main River Map: Rationalising Main River Network



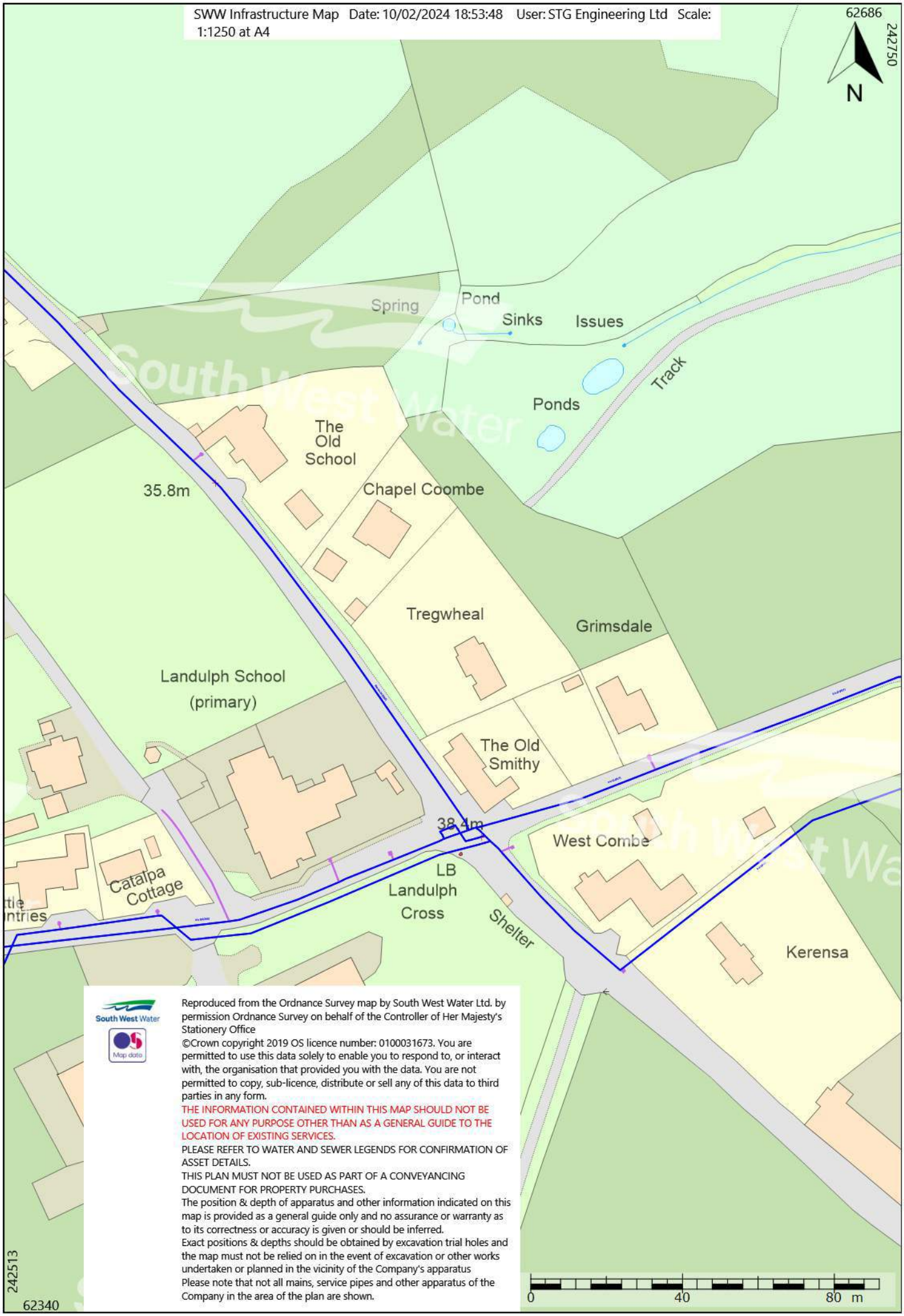
2/10/2024, 6:18:02 PM

1:50,000

0 0.42 0.85 1.7 mi

0 0.5 1 2 km

Statutory Main River Map


SWW Infrastructure Map Date: 10/02/2024 18:53:48 User: STG Engineering Ltd Scale: 1:1250 at A4
62686
242750
N
Spring
Pond
Sinks
Issues
Track
Ponds
The Old School
Chapel Coombe
35.8m
Tregwheal
Grimsdale
Landulph School (primary)
The Old Smithy
38.4m
West Combe
Cataipa Cottage
LB
Landulph Cross
Shelter
Kerensa
South West Water
Map data
Reproduced from the Ordnance Survey map by South West Water Ltd. by permission Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office
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THE INFORMATION CONTAINED WITHIN THIS MAP SHOULD NOT BE USED FOR ANY PURPOSE OTHER THAN AS A GENERAL GUIDE TO THE LOCATION OF EXISTING SERVICES.
PLEASE REFER TO WATER AND SEWER LEGENDS FOR CONFIRMATION OF ASSET DETAILS.
THIS PLAN MUST NOT BE USED AS PART OF A CONVEYANCING DOCUMENT FOR PROPERTY PURCHASES.
The position & depth of apparatus and other information indicated on this map is provided as a general guide only and no assurance or warranty as to its correctness or accuracy is given or should be inferred.
Exact positions & depths should be obtained by excavation trial holes and the map must not be relied on in the event of excavation or other works undertaken or planned in the vicinity of the Company's apparatus
Please note that not all mains, service pipes and other apparatus of the Company in the area of the plan are shown.
242513
62340
0
40
80 m

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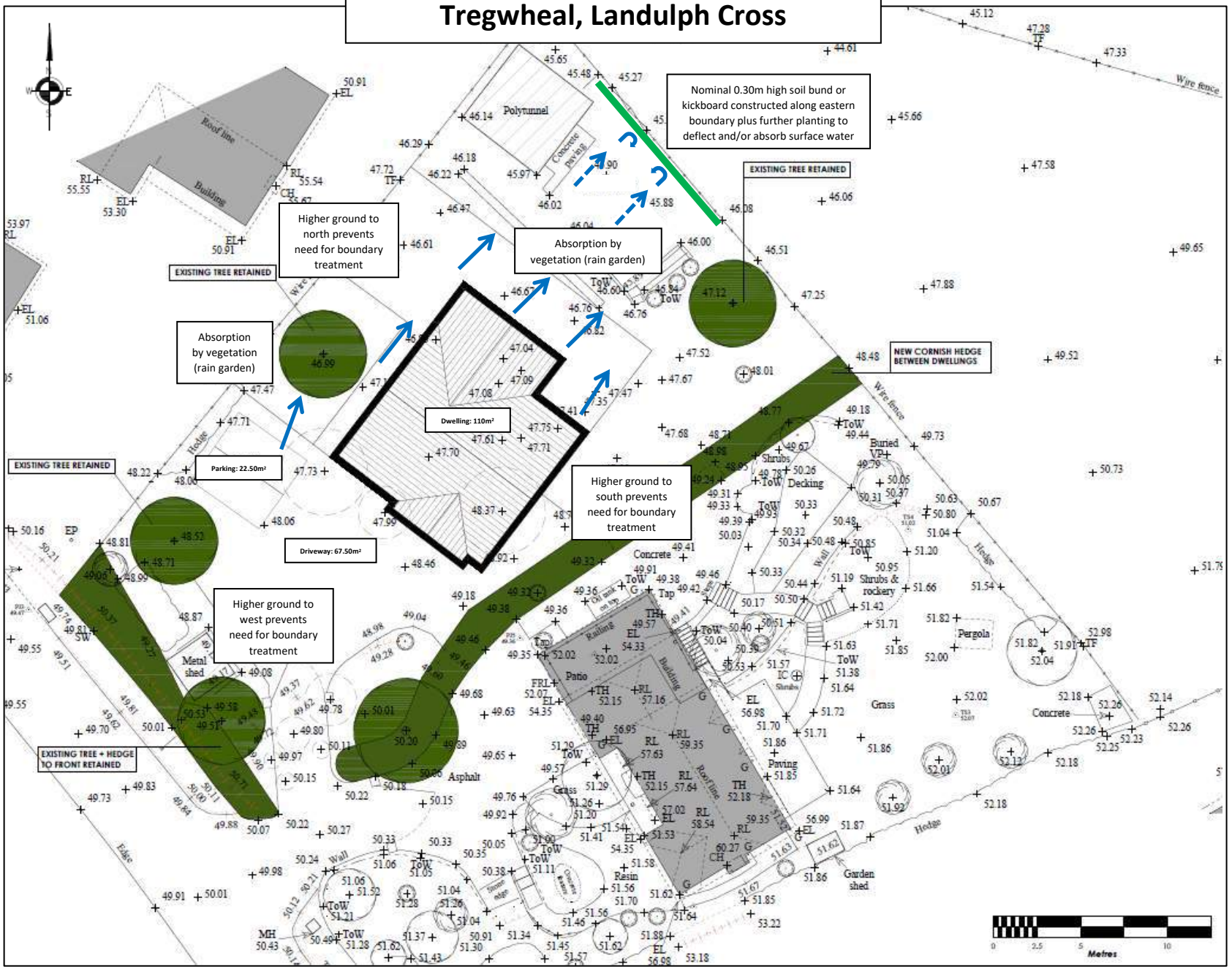
EXCEEDANCE FLOW ROUTES

Tregwheal, Landulph Cross



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DAILY DISCHARGE CALCULATOR

Tregwheal, Landulph Cross

Daily discharge calculator for domestic properties

V2.0 July 2019

Use this calculator to work out how much effluent your septic tank or small sewage treatment plant will discharge a day when it's being used to treat the sewage from one or more houses or flats.

Number of properties	1	→	Enter the number of properties which are connected to the plant
Number of bedrooms	3	→	Enter the total number of bedrooms for all of the properties and press return
Cubic metres a day	0.75	→	**This is how much treated sewage your plant will discharge a day**

For example, if you have 2 houses sharing a septic tank, one with 3 bedrooms and the other with 4, enter 2 for the number of properties, 7 for the number of bedrooms, and this will give you a result of 1.65 cubic metres a day.

Source – Environment Agency (EA)

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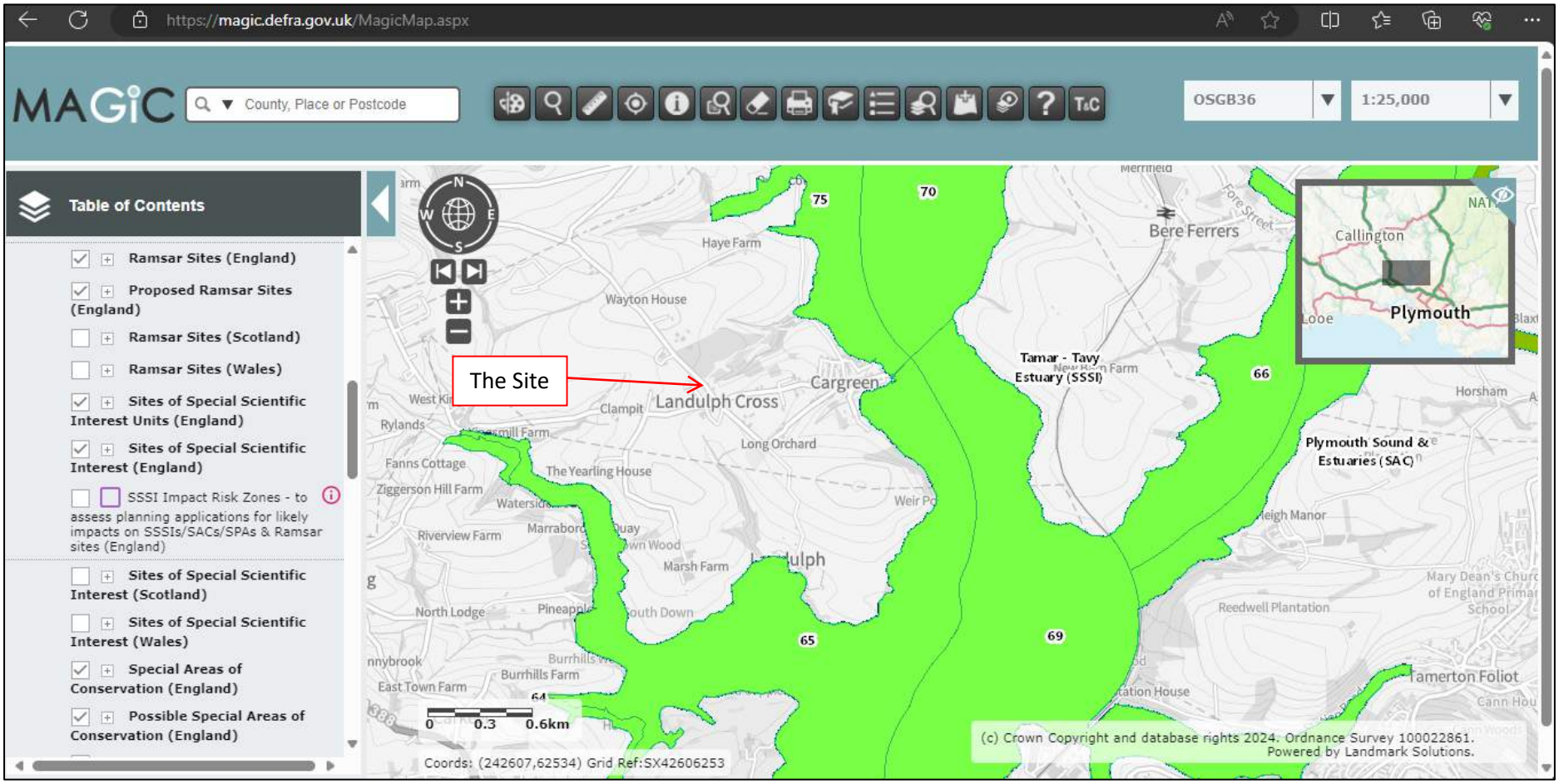
SAC, SPA, SSSI, Ramsar

Tregwheal, Landulph Cross



Source – Environment Agency (Magic Map)

Appendix B: Logs

B1: TP01

B2: TSAH

STG ENGINEERING LTD GEOTECHNICAL SITE ENGINEERS	**Project Name:** Tregwheal	**Project Number:** STG1428	**Plant Used:** Takeuchi TB014	**TP01**
	Stability: Stable	**Support:** None	**Weather:** Sunny/Frosty	
Trial Pit Log	**E:** 42634 **N:** 62544 (SX)	**Date:** 16/01/2024	**Logged By:** ST	**Page Number:** Sheet 1 of 1

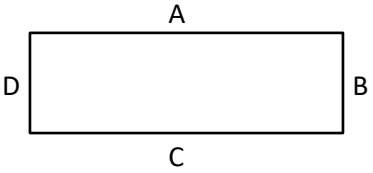
Sample and In Situ Testing			Stratum Details	
Depth (m)	Type	Test Results	Depth (m)	Stratum Description
				Brown occasionally mottled orange slightly sandy slightly gravelly CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (TOPSOIL)
			0.30	Light brown occasionally mottled orange slightly gravelly silty CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (SUBSOIL)
			0.60	Firm grey mottled orange silty CLAY (inferred TIDAL RIVER OR CREEK DEPOSITS)
			0.90	Soft to firm orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (inferred TIDAL RIVER OR CREEK DEPOSITS)
			1.60	Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (inferred TIDAL RIVER OR CREEK DEPOSITS)
			1.80	Firm grey occasionally mottled orange slightly sandy slightly gravelly CLAY. Gravel is angular to sub-angular fine to occasionally coarse shale (inferred TIDAL RIVER OR CREEK DEPOSITS)
			2.20	Trial Pit terminated at 2.20m (required depth)

1 2 3

Sample and Test Types:

D	Small disturbed sample (500ml)	SV	Shear Vane (SL810)
BB	Large disturbed sample (>5kg)	PP	Pocket Penetrometer
AJ	Amber jar (250ml)	SH	Schmidt Hammer
V	Vial (60ml)	GP	Geological Pick

Strike of Face A	010 degrees
Length of Face A	2.00m
Width of Face B	0.50m



Groundwater Observations (level and rate of inflow):
Slight seepage at 1.60m resulting in 0.10m standing water after >20mins

Remarks:
Infiltration Test Hole corresponding to garden area of lower elevation
Consistency based upon difficulty of excavating and observations in trial pit only and no field tests or in-situ tests performed

STG ENGINEERING LTD GEOTECHNICAL SITE ENGINEERS	**Project Name:** Tregwheal	**Project Number:** STG1428	**Plant Used:** Takeuchi TB014	**TSAH**
	Stability: Stable	**Support:** None	**Weather:** Sunny	
Trial Pit Log	**E:** 42654 **N:** 62544 (SX)	**Date:** 16/01/2024	**Logged By:** ST	**Page Number:** Sheet 1 of 1

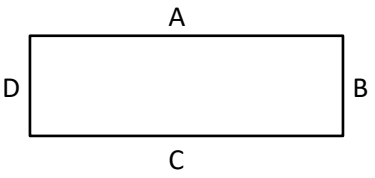
Sample and In Situ Testing			Stratum Details	
Depth (m)	Type	Test Results	Depth (m)	Stratum Description
			0.20	Brown slightly sandy gravelly CLAY with occasional rootlets. Gravel is angular to sub-angular fine to occasionally coarse slate/shale (TOPSOIL)
			1.60	Medium dense brownish grey slightly silty GRAVEL & COBBLES of angular to sub-angular fine to coarse slate/shale (RESIDUAL SOIL) (weathered Tavy Formation)
				Trial Pit terminated at 1.60m (achievable depth)

1 2 3

Sample and Test Types:

D	Small disturbed sample (500ml)	SV	Shear Vane (SL810)
BB	Large disturbed sample (>5kg)	PP	Pocket Penetrometer
AJ	Amber jar (250ml)	SH	Schmidt Hammer
V	Vial (60ml)	GP	Geological Pick

Strike of Face A	150 degrees
Length of Face A	1.20m
Width of Face B	0.80m



Groundwater Observations (level and rate of inflow):
None

Remarks:
Trial Site Assessment Hole within central region of proposed drainage field corresponding to higher elevation
Density based upon difficulty of excavating and observations in trial pit only and no field tests or in-situ tests performed
Inferred Bedrock at 1.60m begl noting limitations of excavator

Appendix C: Photographs

C1: 16th January 2024

Photo 1: Completed TP01 from Face B looking 010 N

Photo 2: Completed TP01 from Face A looking 280 W

Photo 3: Completed TP01 from Face C looking 100 E

Photo 4: Spoil of TP01 (0 – 0.30m) looking 010 N

Photo 5: Spoil of TP01 (0.30 – 0.60m) looking 010 N

Photo 6: Spoil of TP01 (0.60 – 0.90m) looking 010 N

Photo 7: Spoil of TP01 (0.90 – 1.60m) looking 010 N

Photo 8: Spoil of TP01 (1.60 – 1.80m) looking 010 N

Photo 9: Spoil of TP01 (1.80 – 2.20m) looking 010 N

Photo 10: TP01 from Face B showing 0.10m of standing water after >20mins

Photo 11: TP01 from Face A showing 0.10m of standing water after >20mins

Photo 12: TP01 from Face C showing 0.10m of standing water after >20mins

Photo 13: Flowing Watercourse beyond NE corner looking SW

Photo 14: Flowing Watercourse beyond NE corner looking NE

Photo 15: Completed TSAH from Face A looking 150 SE

Photo 16: Completed TSAH from Face C looking 240 SW

Photo 17: Spoil of TSAH (0 – 0.20m) looking 150 SE

Photo 18: Spoil of TSAH (0.20 – 1.60m) looking 150 SE

Appendix D: Calculation Sheets

D1: Greenfield Runoff Rates (IH124 & FEH)

D2: Attenuation – 200m^2

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Simon Tyrrell
Site name:	Tregwheal
Site location:	Landulph Cross

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

Site Details

Latitude:	50.44196° N
Longitude:	4.21741° W
Reference:	1906955887
Date:	Feb 16 2024 06:44

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.02

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	1128	1128
Hydrological region:	8	8
Growth curve factor 1 year:	0.78	0.78
Growth curve factor 30 years:	1.95	1.95
Growth curve factor 100 years:	2.43	2.43
Growth curve factor 200 years:	2.78	2.78

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.06	0.06
1 in 1 year (l/s):	0.05	0.05
1 in 30 years (l/s):	0.12	0.12
1 in 100 year (l/s):	0.15	0.15
1 in 200 years (l/s):	0.18	0.18

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Simon Tyrrell
Site name:	Tregwheal
Site location:	Landulph Cross

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

Site Details

Latitude:	50.44196° N
Longitude:	4.21741° W
Reference:	2235081148
Date:	Feb 16 2024 06:46

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 0.02

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	14
BFI / BFIHOST:	0.702
Q_{MED} (l/s):	0.08
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	1128	1128
Hydrological region:	8	8
Growth curve factor 1 year:	0.78	0.78
Growth curve factor 30 years:	1.95	1.95
Growth curve factor 100 years:	2.43	2.43
Growth curve factor 200 years:	2.78	2.78

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.08	0.08
1 in 1 year (l/s):	0.06	0.06
1 in 30 years (l/s):	0.16	0.16
1 in 100 year (l/s):	0.2	0.2
1 in 200 years (l/s):	0.23	0.23

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Tregwheal, Landulph Cross		Revision	
Job No:	**STG1428**	Page:	**STG/01**
Section: **Attenuation Tank**	Prepared By:	**ST**	Date: **10/02/2024**

GENERAL DATA	
site location:	**England and Wales**
60 min rainfall depth of 5 year return period 'R' *[mm]* =	**17**
M5-60 to M5-2d rainfall ratio 'r' =	**0.30**
proposed discharge rate 'v_1' *[litre/s]* =	**1.00**
proposed discharge rate 'v_2' *[litre/s]* =	**1.50**
allowance for climate change:	**50%**

SUMMARY OF CALCULATIONS		
required storage volume for discharge rate 'v_1' =	**6.63**	m^3
required storage volume for discharge rate 'v_2' =	**4.99**	m^3

AREA DATA		impermeability *[%]*	effective area *[m^2]*
impermeable area 'A_1' *[m^2]* =	**200**	100.00	200
landscaping and/or green roof area 'A_2' *[m^2]* =		**80.00**	0
other partially permeable area 'A_3' *[m^2]* =		**20.00**	0
AREA DRAINED TO ATTENUATION TANK =			**200 m^2**

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_1

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M50-D Z2	M50-D rainfalls *[mm]*	M50-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from attenuation tank *[m^3]*	required storage *[m^3]*
5	0.34	5.78	1.19	10.36	2.07	1.57	13.65	2.73	1.81	15.68	3.14	0.30	2.84
10	0.49	8.33	1.21	15.12	3.02	1.62	20.24	4.05	1.87	23.36	4.67	0.60	4.07
15	0.59	10.03	1.22	18.36	3.67	1.65	24.83	4.97	1.91	28.74	5.75	0.90	4.85
30	0.77	13.09	1.23	24.20	4.84	1.68	33.00	6.60	1.96	38.47	7.69	1.80	5.89
60	1.00	17.00	1.24	31.62	6.32	1.71	43.66	8.73	2.01	51.15	10.23	3.60	**6.63**
120	1.25	21.25	1.24	39.53	7.91	1.73	55.06	11.01	2.03	64.55	12.91	7.20	5.71
240	1.57	26.69	1.23	49.37	9.87	1.71	68.59	13.72	2.00	79.93	15.99	14.40	1.59
360	1.78	30.26	1.22	55.34	11.07	1.70	77.09	15.42	1.97	89.32	17.86	21.60	0.00
600	2.12	36.04	1.20	64.97	12.99	1.66	89.94	17.99	1.92	103.89	20.78	36.00	0.00
1440	2.84	48.28	1.17	84.98	17.00	1.59	115.17	23.03	1.82	132.08	26.42	86.40	0.00

** Z2 is a growth factor from M5 rainfalls*

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v_2

rainfall duration *[min]*	rainfall factor Z1	M5-D rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow *[m^3]*	M50-D Z2	M50-D rainfalls *[mm]*	M50-D inflow *[m^3]*	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow *[m^3]*	outflow from attenuation tank *[m^3]*	required storage *[m^3]*
5	0.34	5.78	1.19	10.36	2.07	1.57	13.65	2.73	1.81	15.68	3.14	0.45	2.69
10	0.49	8.33	1.21	15.12	3.02	1.62	20.24	4.05	1.87	23.36	4.67	0.90	3.77
15	0.59	10.03	1.22	18.36	3.67	1.65	24.83	4.97	1.91	28.74	5.75	1.35	4.40
30	0.77	13.09	1.23	24.20	4.84	1.68	33.00	6.60	1.96	38.47	7.69	2.70	**4.99**
60	1.00	17.00	1.24	31.62	6.32	1.71	43.66	8.73	2.01	51.15	10.23	5.40	4.83
120	1.25	21.25	1.24	39.53	7.91	1.73	55.06	11.01	2.03	64.55	12.91	10.80	2.11
240	1.57	26.69	1.23	49.37	9.87	1.71	68.59	13.72	2.00	79.93	15.99	21.60	0.00
360	1.78	30.26	1.22	55.34	11.07	1.70	77.09	15.42	1.97	89.32	17.86	32.40	0.00
600	2.12	36.04	1.20	64.97	12.99	1.66	89.94	17.99	1.92	103.89	20.78	54.00	0.00
1440	2.84	48.28	1.17	84.98	17.00	1.59	115.17	23.03	1.82	132.08	26.42	129.60	0.00

** Z2 is a growth factor from M5 rainfalls*

Appendix E: Attenuation Details

E1: Attenuation Tank

E2: FlowBrake (Freeflush Ltd)

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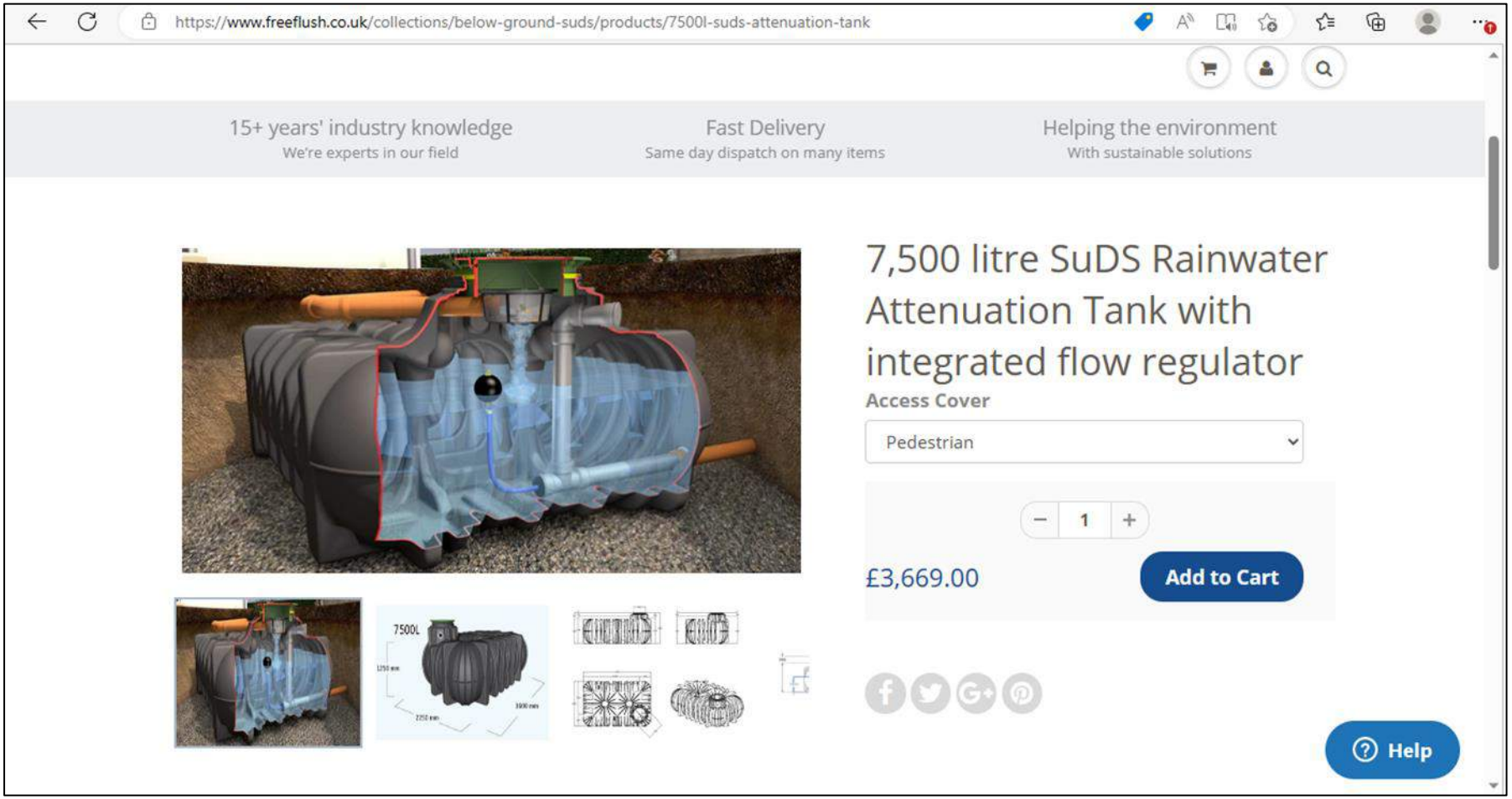
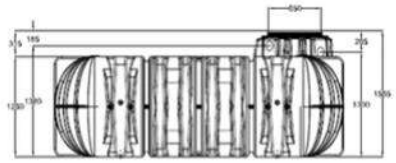
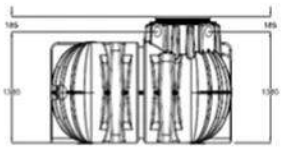
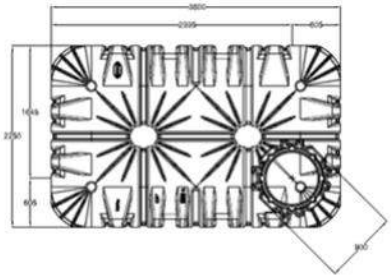
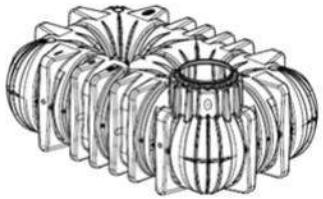
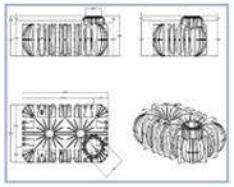
ATTENUATION TANK DETAILS
Tregwheal, Landulph Cross



https://www.freeflush.co.uk/collections/below-ground-suds/products/7500l-suds-attenuation-tank



7,500 litre SuDS Rainwater Attenuation Tank with integrated flow regulator

Access Cover

Pedestrian

1

£3,669.00

Add to Cart

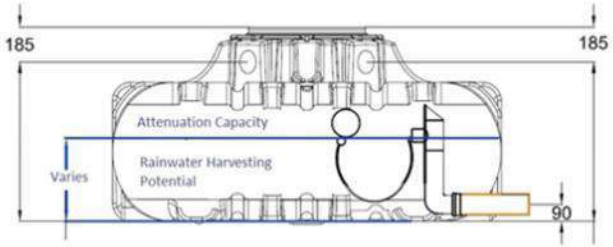
Help

https://www.freeflush.co.uk/collections/below-ground-suds/products/7500l-suds-attenuation-tank

15+ years' industry knowledge
We're experts in our field

Fast Delivery
Same day dispatch on many items

Helping the environment
With sustainable solutions



7,500 litre SuDS Rainwater Attenuation Tank with integrated flow regulator

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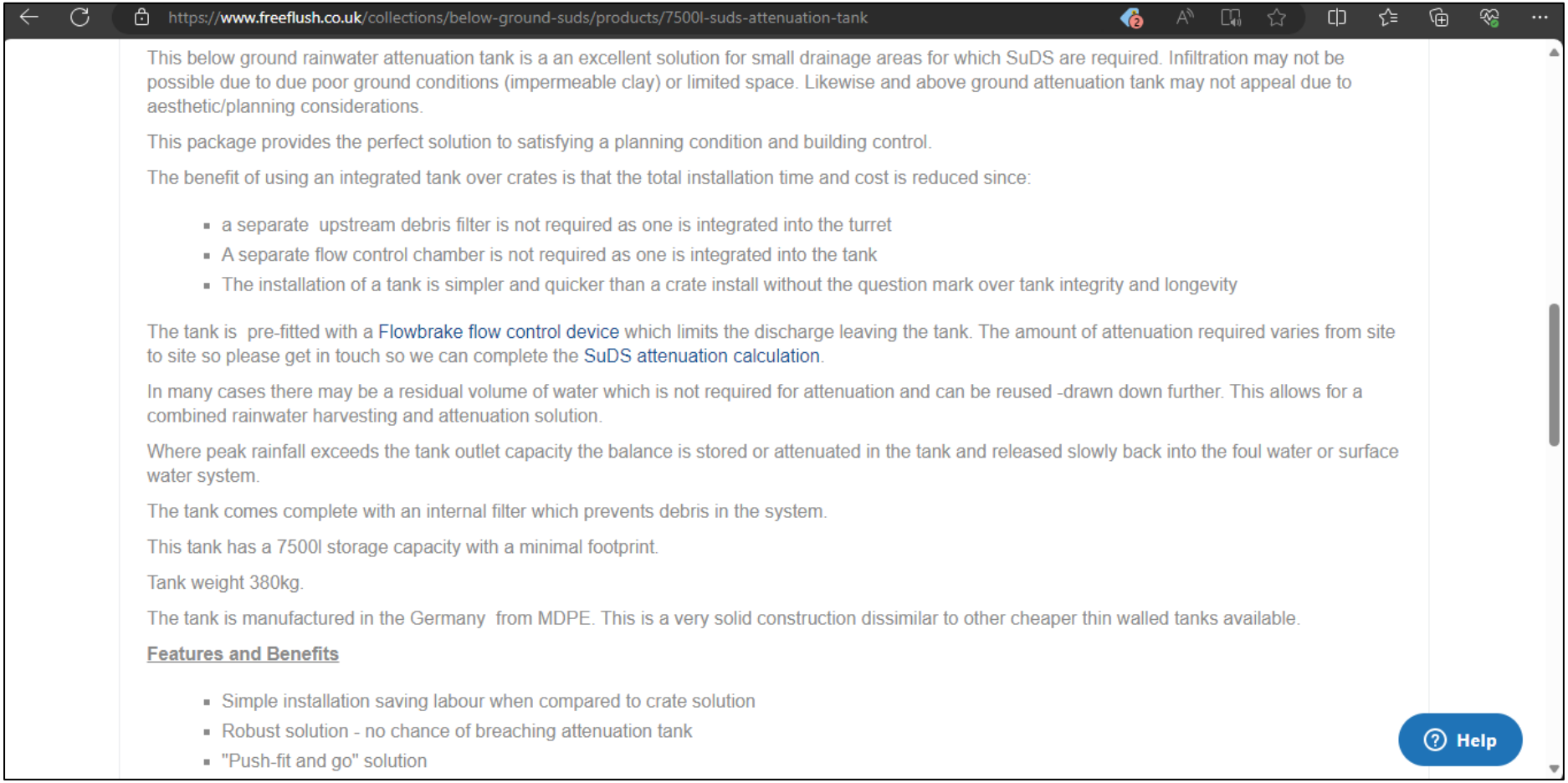
Help


https://www.freeflush.co.uk/collections/below-ground-suds/products/7500l-suds-attenuation-tank
This below ground rainwater attenuation tank is a an excellent solution for small drainage areas for which SuDS are required. Infiltration may not be possible due to due poor ground conditions (impermeable clay) or limited space. Likewise and above ground attenuation tank may not appeal due to aesthetic/planning considerations.
This package provides the perfect solution to satisfying a planning condition and building control.
The benefit of using an integrated tank over crates is that the total installation time and cost is reduced since:
a separate upstream debris filter is not required as one is integrated into the turret
A separate flow control chamber is not required as one is integrated into the tank
The installation of a tank is simpler and quicker than a crate install without the question mark over tank integrity and longevity
The tank is pre-fitted with a Flowbrake flow control device which limits the discharge leaving the tank. The amount of attenuation required varies from site to site so please get in touch so we can complete the SuDS attenuation calculation.
In many cases there may be a residual volume of water which is not required for attenuation and can be reused -drawn down further. This allows for a combined rainwater harvesting and attenuation solution.
Where peak rainfall exceeds the tank outlet capacity the balance is stored or attenuated in the tank and released slowly back into the foul water or surface water system.
The tank comes complete with an internal filter which prevents debris in the system.
This tank has a 7500l storage capacity with a minimal footprint.
Tank weight 380kg.
The tank is manufactured in the Germany from MDPE. This is a very solid construction dissimilar to other cheaper thin walled tanks available.
Features and Benefits
Simple installation saving labour when compared to crate solution
Robust solution - no chance of breaching attenuation tank
"Push-fit and go" solution
Help

FlowBrake™

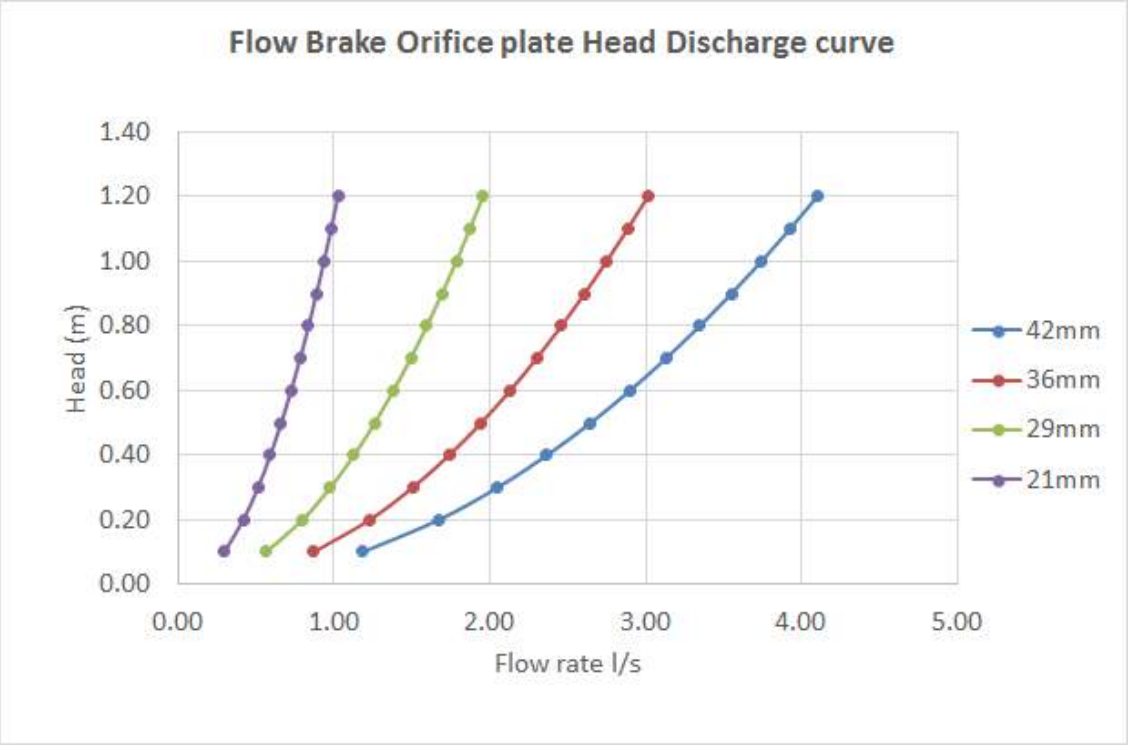
FlowBrake

With the advent of SuDS and the requirement for flow regulation, Freeflush Ltd have designed and developed a number of flow regulation devices:

1. FlowBrake 110mm Orifice plate
2. FlowBrake Fixed head floating open orifice
3. FlowBrake fixed head floating orifice with strainer
4. FlowBrake Vortex flow regulator (TBC 2022)

1. FlowBrake 110mm Orifice plate

As the name suggests the FlowBrake Orifice allows a simple orifice control and is suitable in situations where a varying head discharge condition is permitted. The Orifice is fabricated from PVC and the orifice designed in accordance with BS1042 and can simply be placed within any standard 110mm socket. Since the orifice does not provide filtration, upstream mitigation in the form of combined grit trap and basket filters are recommended upstream of the attenuation tank.



2 &3. FlowBrake fixed head floating open orifice/ FlowBrake fixed head orifice with strainer

FlowBrake Fixed head floating orifice flow attenuation device provides an elegant solution for fixed discharge flow attenuation and is available in both “open orifice” or with strainer.

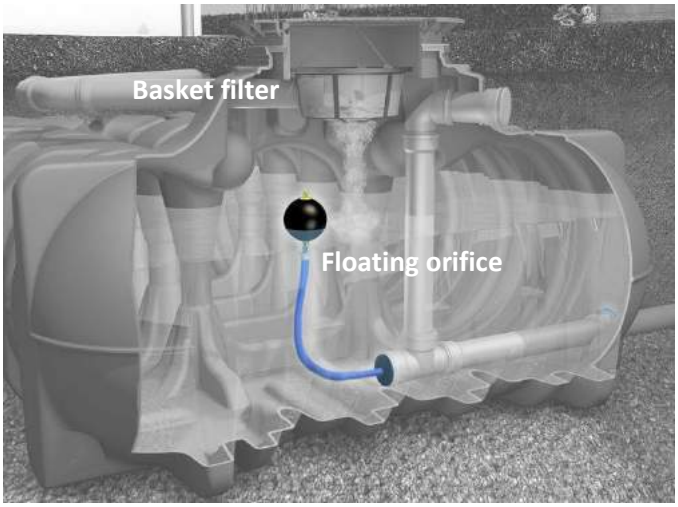
The float ensure the orifice remains a fixed depth beneath the surface of the water (200mm head) regardless of the tank level ensuring a fixed head and thus fixed flow.

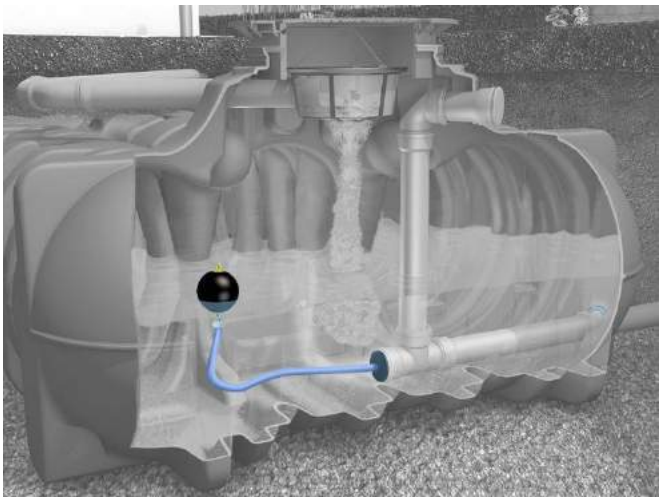
The open orifice flow device is suitable where upstream mitigation in the form of combined grit trap and basket filters are in place upstream of the attenuation tank.

The floating orifice with strainer tend to be used in smaller application where a local authority is using water butts to provide attenuation –lower discharge flows are required and upstream filtration may not be in place.

Fixed head open orifice –standard flow is set 1 l/s (32mm orifice) –other flow rates

Fixed head floating orifice with strainer– standard flow is set 0.2 l/s (19mm orifice)other flow rates available





Fixed head floating orifice in an attenuation tank. In high and low position head over orifice remains the same ensuring constant discharge.

Appendix F: Excerpt from The SuDS Manual CIRIA C753

F1: Table 21.3 (Attenuation Tank Maintenance)

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

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