coopers
chartered consulting engineers

Our ref: 7956_FCA

Flood Consequences Assessment and Drainage Strategy

for

Land off Mold Road

Gwersyllt, Wrexham

For : Castle Green Homes Ltd
Unit 20, St Asaph Business Park
St Asaph
Denbighshire
LL17 0LJ

21 November 2022

Document Verification

Project Title	Land Off Mold Road, Gwersyllt, Wrexham
Project Number	7956
Document Title	Flood Consequences Assessment and Drainage Strategy
Document Number	7956_FCA_Issue 3
This document is not to be used for contractual or engineering purposes unless the document verification sheet is signed where indicated by the approver of the document.	

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Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
7956_FCA _Issue 3	21/11/2022	Flood Consequences Assessment	A Jones	P R Sykes

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1.0 Introduction

Coopers (Chester) Ltd, (Coopers) have been appointed by Castle Green Homes Ltd to assess the risk of flooding and to provide a Drainage Strategy for a site off Mold Road in Gwersyllt, Wrexham. Castle Green Homes Ltd are proposing a new housing development, comprising of approximately 90 No. dwellings.

Castle Green Homes Ltd are planning the construction of a mixture of semi-detached and detached residential properties with associated access road, parking, vehicular access and landscaping subject to conditions. It is understood the site does not currently benefit from any planning decision.

This flood consequences assessment (FCA) evaluates the proposals with regards to flood risk, identifying and appraising potential flood risk both to and from the whole site. Coopers have carried out the following:

i. Assessment of the development potential of the site in line with the Welsh Government's Technical Advice Note 15: Development and Flood Risk (TAN15) and;
ii. An assessment of surface water runoff and drainage strategy

Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 No. properties or the construction area is more than 100sq.m. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems.

2.0 Site Characteristics

2.1 Site Location

The site is a parcel of agricultural land in Gwersyllt, Wrexham. The site is situated off Mold Road at approximate grid reference SJ322525.

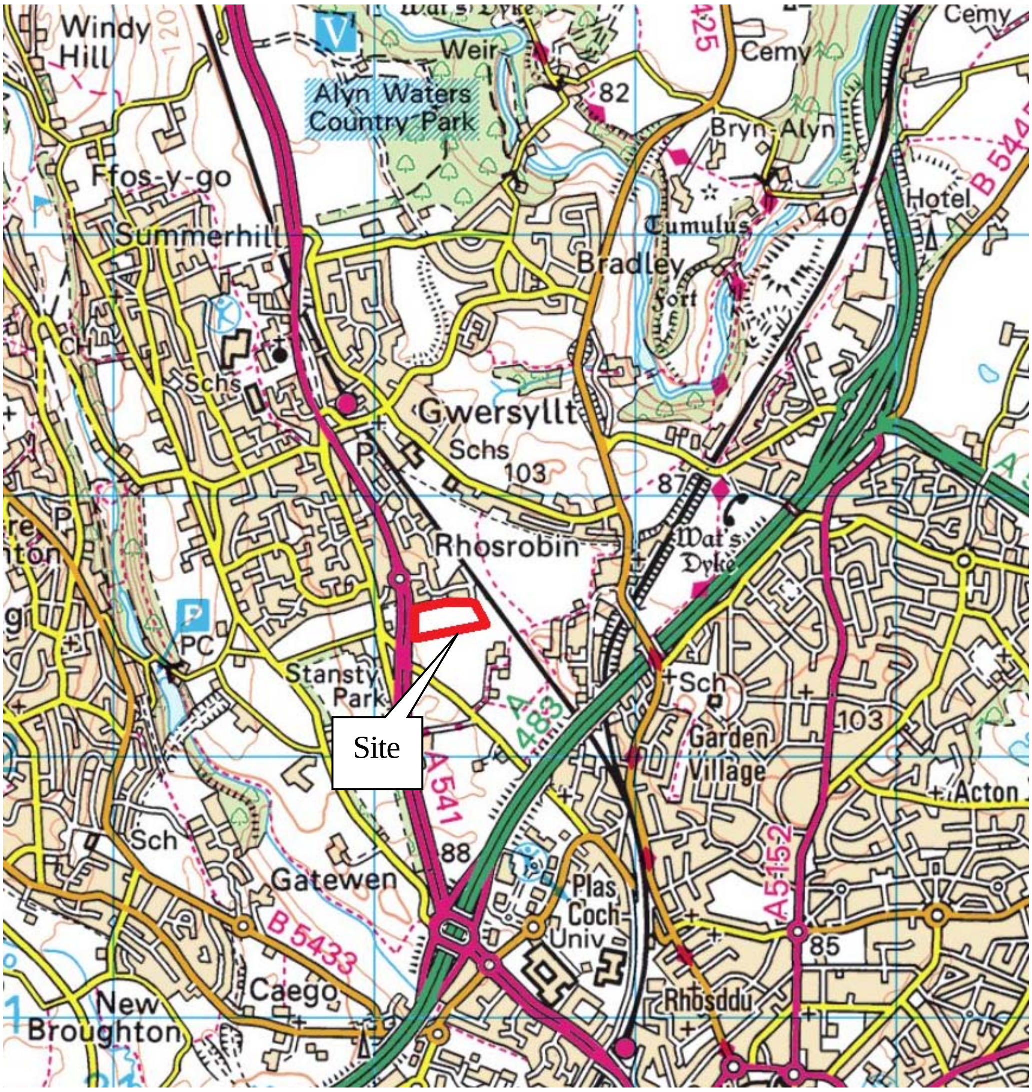


Figure 1 – Site Location

2.2 Site Description

The site covers an area of 3.13 Hectares and consists of a single agricultural field.

The topography of the site varies from a highpoint of 95.5m AOD at the western end of the site, which falls to 84.5m AOD to the east. Refer to topographical survey in Appendix 1.

3.0 Sources of Flood Risk Information

3.1 The Welsh Government Development Advice Map

The Welsh Government Development Advice Map shows the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 1 in 1000 (0.1%) annual probability of flooding in any given year.

The proposed residential development is considered to be a 'highly vulnerable' development in accordance with Figure 2 of the Welsh Governments Technical Advice Note 15. Highly vulnerable development is considered to be appropriate within Flood Zone A.

3.2 Natural Resources Wales

The NRW Flood Map shows the site is located within Flood Zone 1 – an area considered to have the lowest probability of fluvial flooding. It is assessed as having a less than 0.1% annual probability of flooding in any given year.

It should be noted that the Flood Map only covers flooding from rivers and the sea. Flooding can occur at any time and in any place from sources such as rising groundwater levels, burst water mains, blocked road drains, run-off from hillsides, sewer overflows, etc.

Figure 2 – Natural Resources Wales Flood Map for Planning (River and Sea)

The Natural Resources Wales long term flood risk map indicates the site has a low risk of flooding from Surface Water. There is a depression of approximately 0.5m deep located towards the eastern end of site which is currently shown to be at risk of surface water flooding. This is only taking flows from within the site and will be mitigated by regrading of the site. Post development there will be no surface water flood risk within the site and no increased flood risk outside the site boundary.

Figure 3 – Natural Resources Wales Surface Water Flooding Map

3.3 Wrexham LLFA

The Wrexham County Borough Council Local Flood Risk Management Strategy (June 2014) contains no records of any flooding at or near to the site. WCBC have confirmed they have no information of any known historical flooding within the vicinity of the site. Refer to Appendix 3 correspondence.

4.0 Sources of Flood Risk

4.1 Fluvial

Extreme fluvial flood events have the potential to cause rapid inundation of the site whilst posing a threat to welfare and users. As outlined in Section 3.2; the site is within Flood Zone 1 and is therefore not at risk from extreme fluvial or tidal flooding. Therefore, the risk from extreme fluvial flooding to the site is considered to be low.

4.2 Infrastructure Failure (Existing and Proposed)

The failure of infrastructure such as culverts or bridges could increase the risk of flooding at the site. The risk of flooding is considered as very low.

4.3 Overland Flow

Overland flow occurs when the infiltration capacity of the ground is exceeded in a storm event. This can result in water travelling as a sheet flow overland or excess water being conveyed from location to another via local road networks. Due to the topography of the site sloping to the southern end of the site and the road layout / proposed public open space, overland flow is not considered a significant risk. Overland flows from the site will be significantly reduced post development with the incorporation of positive drainage and an internal road network.

4.4 Sewer Flooding

If the capacity of the sewers is exceeded in an extreme event, or a blockage occurs, surcharging of the network can result in surface flooding. Welsh Water sewer plans which are included in Appendix 3, indicate that there are currently no existing adopted sewers located within the site boundary.

We have requested any information Welsh Water may have on any known flooding within the vicinity of the site and are currently waiting for a response.

The overall risk from sewer flooding is considered as low.

4.5 Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from the underlying superficial deposits, bedrock or from springs.

There is currently no site investigation information for review at this stage so potential for groundwater flooding will need to be assessed when data is available.

At this stage the overall risk from groundwater flooding is considered as low.

4.6 Coastal Flooding

The site is not located in proximity of any tidal waterway or within close proximity to the sea and is therefore not at risk from tidal inundation.

4.7 Reservoirs

The site is not located in proximity of any reservoirs. Additionally, the NRW maps indicate the site is not at risk of flooding from reservoirs.

Figure 4 – Natural Resources Wales Reservoir Flooding Map

5.0 Surface Water Drainage

5.1 General

The design for a surface water drainage system for the proposed development will be guided by the principles set out in the Welsh Government's 'Recommended non-statutory standards for sustainable drainage (SuDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems' (2017)

The SuDS Standards Wales sets out the following hierarchy for 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.

Note that Priority Level 1 is the preferred (highest priority) and that 4 and 5 should only be used in exceptional circumstances.

5.2 Existing Surface Water Drainage

The site does not benefit from any existing drainage and will rely on infiltration and surface water run-off to dispose of surface water flows. The flows will follow topography and will fall in a easterly direction towards the watercourse located outside the site boundary.

5.3 Existing Site Runoff

The greenfield run-off rates for the site has been calculated using the HR Wallingford Greenfield runoff rate estimation tool. The default soil type is 2 which would indicate a freely draining permeable soil (sand / gravel). As we don't have any site investigation information at this stage, we have also run the greenfield run-off calculation for soil type 3 (mixed areas of permeable and impermeable) and soil type 4 (impermeable)

Soil Type 2 (Default)	Sand / gravel	QBAR = 5.95 l/s
Soil Type 3 (mixed)	Sand / gravel / clay	QBAR = 9.38 l/s
Soil Type 4 (impermeable)	Clay	QBAR = 15.76 l/s

Refer to Appendix 4 for calculations

5.4 Proposed Surface Water Drainage and Runoff Rates

Priority Level 1

Whilst rainwater harvesting has been considered for the proposed development it should be noted that any device enabling water re-use cannot be taken into account when sizing attenuation as the storage facility may be full when a storm event occurs. Therefore, an overflow to an infiltration device (where ground conditions allow) or to a watercourse / sewer will be required.

Castle Green Homes Ltd are not proposing to incorporate rainwater harvesting within the development; however, they are proposing to install a water butt to each dwelling which will allow for water collection for garden re-use.

Priority Level 2

There is currently no site investigation available for review. However local geology mapping and knowledge of nearby sites indicates that there is potential for infiltration techniques to dispose of surface water flows from the development. We understand the St Giles Park development to the north of the site has some plots of the western half draining to private soakaways with the remainder of the development draining to the watercourse along the eastern boundary alongside the railway.

BGS borehole information available for the surrounding area shows a mix of till / sands and gravels.

Infiltration tests will need to be undertaken to determine potential for priority level 2 techniques. It should be noted that whilst slow rates may not be good enough to drain the site during a 100-year storm event they will potentially provide for slow infiltration SuDS components to deal with low flow events and provide for 5mm interception. Permeable paving (partial infiltration) and bioretention components such as tree pits and rain gardens can be considered appropriate.

Refer to Appendix 2 for infiltration consideration information.

Priority Level 3

The nearest main river is the River Alyn approximately 1.2km to the north east of the site.

There is an ordinary watercourse flowing in a southeast direction along the eastern site boundary. This runs to the west of the railway and consists of infiltration basins, open watercourses / culverts and serves the 2 developments to the north developed by Morris Homes (St Giles Park) and Redrow Homes (Hardwick Drive). The development site drains towards this watercourse via overland flows as levels on the western end of the site are at 95.5m AOD falling to 84.5m AOD to the east. The greenfield flow rate and volume of surface water currently being passed forward to this watercourse will depend on the soil type and its permeability characteristics.

There is also a watercourse flowing southeast along the southern boundary of the development site. This takes from highway drainage from Old Mold Road and the Gower Homes development (Maes Gwyrdd). This watercourse discharges into the ordinary watercourse flowing in a southeast direction along the eastern site boundary.

Refer to topographical survey in Appendix 1 and Coopers Drawing No. 7956/SK01 for details of the existing drainage arrangement.

Priority Level 4

The nearest surface water water sewers recorded on the Welsh Water sewer maps are within the St Giles Park development to the north of the development. These are part of a large diameter on-line attenuation system before the flows are passed forward to the ordinary watercourse. A gravity connection into the surface water sewers from the development site will not be achievable.

There will also be a highway drainage network within the A541 (Mold Road) to the west of the development site. However, this is unlikely to provide a gravity connection from surface water flows within the site due to site levels.

As a connection into a higher priority level is possible a connection into the surface water sewer / highway drain should not be considered.

Priority Level 5

The nearest combined sewer is approximately 200m north of the development in Hardwick Drive (Redrow development). A gravity connection into the surface water sewers from the development site will not be achievable.

As a connection into a higher priority level is possible a connection into the combined sewer should not be considered.

5.5 SuDS Approval Bodies

Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 No. properties or the construction area is more than 100sq.m. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems.

Every SuDS application should go to every attempt to satisfy the Principles and Standards of the legislation. When vetting an application, the SAB officer will look at the clear red line boundary area of the site when considering space for SuDS and water management features and not the space that's left on the proposed site layout.

The principles are as follows:

SuDS schemes should aim to:

1. *manage water on or close to the surface and as close to the source of the runoff as possible;*
2. *treat rainfall as a valuable natural resource;*
3. *ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it;*
4. *manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development;*
5. *take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep;*
6. *use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system (rather than using a single "end of pipe" feature, such as a pond, to serve the whole development);*
7. *maximise the delivery of benefits for amenity and biodiversity;*
8. *seek to make the best use of available land through multifunctional usage of public spaces and the public realm;*
9. *perform safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance;*
10. *avoid the need for pumping where possible; and*
11. *be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.*

Applicants seeking SAB Approval must demonstrate how they have complied with these principles or provide justification for any departure.

As noted in 5.4 there is no site investigation report or infiltration test results for review at this stage, so whilst the preferred option would be to discharge all surface water via infiltration, we have developed a strategy based on the site being underlain with clay. This would give us a design flow rate of 15.7 l/s and would require an attenuated surface water design before flows are passed forward to the watercourse at a restricted flow rate.

The surface water strategy presented in Appendix 1 is providing all attenuation within a SuDS basin at the end of the network with a hydro brake flow control device to restrict the flows. This is considered to be a ‘end of pipe solution’ and whilst it complies with standards for quantity it provides limited compliance to other criteria such as water quality, amenity and biodiversity. Therefore, incorporation of additional source control SuDS components such as water butts, permeable paving and bio retention (tree pits and rain gardens) will need to be considered further at detailed design stage.

5.6 Foul Drainage

We are proposing to discharge all foul flows into the foul gravity network within the St Giles Park development to the north of the development site. However, a gravity connection will not be achievable and therefore a foul pumping station will be required at the eastern (lower) end of the site allowing flows to then be pumped along a rising main to a suitable discharge point within the St Giles Park foul public sewer network.

We are currently waiting for a response from a Welsh Water pre-planning enquiry that foul flows can be accommodated within the St Giles Park gravity foul public sewer.

6.0 Conclusions and Recommendations

The site is located in Flood Zone 1 and has been shown to be at low risk of flooding from rivers, surface water, groundwater, sewers and climate change. Therefore, mitigation measures are not considered necessary for any future development at the site.

All potential sources of flooding have been considered as part of this report. There are no known records of historical flooding at the site.

No site investigation or infiltration tests have currently been undertaken to confirm the ground conditions and underlying soils, but local geology mapping and available data for neighbouring sites indicates there is potential to drain at least a portion of the site via infiltration. We advise undertaking the necessary site investigations as soon as possible.

The surface water strategy presented in Appendix 1 is providing all attenuation within a SUDS basin with a flow control device to restrict the flows. This is based on no infiltration and all flows discharging into this network. Following site investigation and infiltration tests there may be opportunity to reduce this volume if infiltration components are incorporated into the design.

All surface water run-off from highways, roof and private drives will be collected into gravity piped networks, temporarily stored in a SuDS basin and will discharge at a restricted rate into the watercourse which mimics the existing situation.

Additional on-site source control components such as permeable paving and bioretention components (tree pits and rain gardens) should be considered further at detailed design stage for compliance with the 5mm interception criteria.

The design flow rate will be based on greenfield flow rates and will be confirmed once the soil classification for the development site has been established using confirmed data and not a theoretical soil type.

The development will increase the impermeable area of the site. This results in an increase in surface water runoff rates and volumes. In order to ensure the increase in runoff will not have an impact elsewhere flow restrictions and on-site attenuation will be incorporated into the design.

The provision of trapped highway gullies, the SUDS detention basin and additional source control components will provide adequate treatment to surface water flows prior to discharge to the watercourse.

All foul sewers should be designed in accordance with Sewers for Adoption 7th Edition / Welsh Ministers Standards and will be subject to S104 Agreement.

A SuDS Maintenance and Management Plan should be produced to outline the activity and frequency of inspections and maintenance works required on any SuDS components subject to SAB Approval / Adoption.

This Flood Consequences Assessment and Drainage Strategy should be submitted to the Local Planning Authority in support of the planning application.

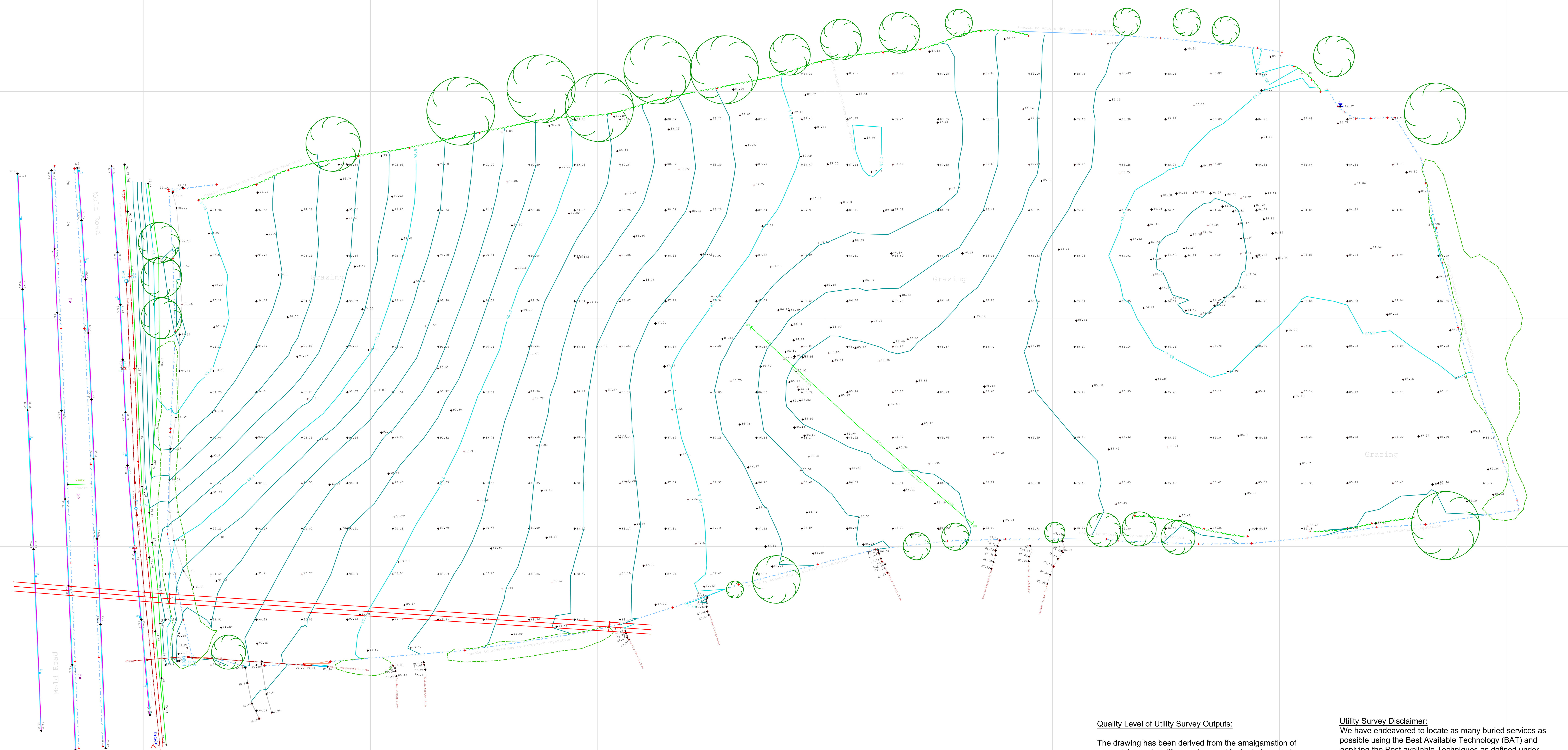
Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 No. properties or the construction area is more than 100sq.m. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems.

Appendix 1

Reference Drawings

Drawing No.	Revision	Title
B444-00_Figure 01	01	Topgraphic and GPR Utiltity Survey
7956 / SK01	D	Drainage Strategy
7956 / SK02	B	Highway and Drainage Longsections
7956 / SK03	B	SW Impermable Areas
		Welsh Water Sewer Records



Quality Level of Utility Survey Outputs:

The drawing has been derived from the amalgamation of several data sets: utility service provider buried asset plans, visual confirmation by way of lifting manholes, and measuring depth, type and location of services, electromagnetic detection, and GPR scans.

All the data sets have been allocated a "weighting" based upon the likely accuracy and confidence. The final amalgamation is performed by polynomial rubber sheet distortion of service provider assets plans for a 'best fit' to resemble on-site survey data findings as close as possible

The accuracy of the horizontal location of each utility is defined by Table 1 'Quality level of survey outputs PAS128(normative)' for QL-B2P = +/-0.25m or +/-40% of detected depth whichever is greater.

The accuracy of the verticall location of each utility as defined by Table 1 'Quality level of survey outputs PAS128(normative)' for QL-B2P = +/-40% of detected depth.

Care should be taken by designers when utilising the findings within this drawing, and should confirm depths by visual confirmation/verification using vacuum excavation or slit trench technology if a higher degree of accuracy is required to meet the design brief specification.

Utility Survey Disclaimer:
We have endeavored to locate as many buried services as possible using the Best Available Technology (BAT) and applying the Best available Techniques as defined under guidance from the The Survey Association (TSA) and the British Standard PAS128 for Utility Surveys.

However, the user of this drawing should be aware that the results found using Best Available Technology are subject to errors and tolerances resulting from geophysical properties of the subsurface (which can be a significant limitation/inhibiter to the survey) , out of the control of the operator, being surveyed/scanned. In addition survey findings are interpreted on site in real-time and thus are subject to interpretative and subjective variations. This information is given without warranty, the accuracy thereof cannot be guaranteed.

The accuracy of the findings indicated within this drawing, cannot be guaranteed or indemnified, and should only be used as a guide as defined by the Health & Safety Executives (HSE) guideline - HSG47.

Lines on this drawing indicating the presence of buried services may actually be indicating the presence of closely bundled cables or pipelines, therefore the user of this drawing should not assume that a single line is indicative of the number of services within the area. In addition services below detected utilities may be masked from detection by the shadow cast from shallower depth services.

Metal pipes, communication cables and earth bonds can 'present' electromagnetic fields similar to that of high voltage and low voltage cables under load, if alternating electromagnetic fields are in close proximity from other power cables or sub-stations etc.

The designation of the services (i.e. is the detected service a water pipe or as pipe?) is open to interpretation and is based upon a number of references such as visible surface features (water stop valves, or gas meter) and utility provider records (indicating whether high voltage or low voltage). The best technology deployed is limited in its ability to define the exact type of service. The user of this drawing should prove, by means of safe-excavation, the type of service if critical to the design.

Equipment Deployed:
IDS Dual Frequency Ground Penetrating Radar (GPR) with on-site operator interpretation.

Radiodetection RD8000 & T10 Electromagnetic Generator and Precision Cable Locator.

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Survey Control Markers have been established for Topographic Mapping purposes only and should not be used for Construction or Setting-Out without written approval from CWLS Ltd

Legend

RS	Road Sign
GY	Road Gulley
LP	Lighting Column or Post
EP	Electric Transmission Pole
GP	Gate Post
	Gate
	Tree/Large Shrub
5	PGM / Site Control Station
MH	Manhole Cover Circular
MH	Manhole Cover Rectangular
	Kerb Channel Line
	Kerb Top/Back
	Verge
	Fenceline
	Extents of Vegetation Canopy

Station	Easting	Northing	Level
1	332157.252	352364.969	91.145
2	332145.818	352375.469	92.508
3	332109.614	352388.312	94.094
4	332106.210	352412.092	93.906
5	332102.207	352455.922	93.571
6	332098.169	352499.726	93.178
7	332095.771	352539.062	92.890

BURIED ASSETS DETECTED ON SITE:

LINETYPE	SERVICE DESCRIPTION
BT BT	TELECOMMUNICATIONS (BT)
CATV	TELECOMMUNICATIONS (CATV)
TELE	TELECOMMUNICATIONS (OTHER)
G G	GAS
TCSU	TRAFFIC CONTROL SENSOR UNIT
SL SL	STREET LIGHTING
LV	LOW VOLTAGE
HV	HIGH VOLTAGE
W W	WATER
FWD	FOUL WATER DRAINAGE
SWD	SURFACE WATER DRAINAGE
FWRM	FOUL WATER RISING MAIN
CS	COMBINED SEWER
OF	OIL/FUEL
U(GPR)	UNKNOWN UTILITY (GPR)
U(EML)	UNKNOWN UTILITY (RADIO)

EOT END OF TRACE A/R ASSUMED ROUTE

Issue	Date	By	Chkd	Appd
01	07/12/21	CW	TB	CW

Carl Williams Land Surveys Ltd
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Client
Castle Green Homes

Job Title
Land off Mold Road
Gwersyllt

Drawing Title
Topographic & GPR Utility Surveys

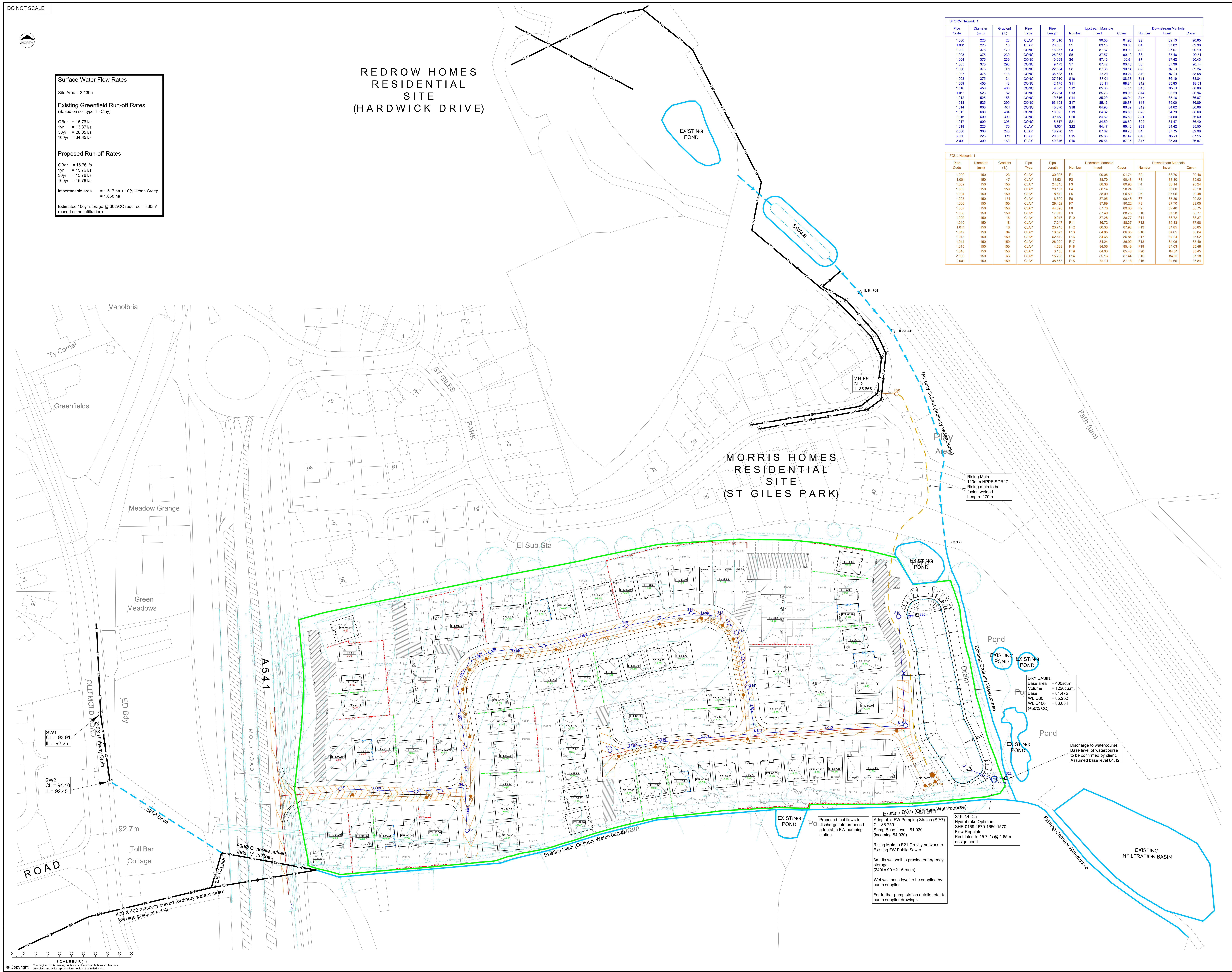
Scale at A1 1:500

Plot ID

Drawing Status
For Information

Job No	Drawing No	Issue
B444-00	**Figure 01**	**01**

DO NOT SCALE



Surface Water Flow Rates

Site Area = 3.13ha

Existing Greenfield Run-off Rates
(Based on soil type 4 - Clay)

QBar = 15.76 l/s
1yr = 13.87 l/s
30yr = 28.05 l/s
100yr = 34.35 l/s

Proposed Run-off Rates

QBar = 15.76 l/s
1yr = 15.76 l/s
30yr = 15.76 l/s
100yr = 15.76 l/s

Impermeable area = 1.517 ha + 10% Urban Creep
= 1.668 ha

Estimated 100yr storage @ 30%CC required = 860m³
(based on no infiltration)

STORM Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	225	23	CLAY	31.810	S1	90.50	91.95	S2	89.13	90.65
1.001	225	16	CLAY	20.535	S2	89.13	90.65	S4	87.82	89.98
1.002	375	170	CONC	16.957	S4	87.67	89.98	S5	87.57	90.19
1.003	375	239	CONC	26.052	S5	87.57	90.19	S6	87.46	90.51
1.004	375	239	CONC	10.993	S6	87.46	90.51	S7	87.42	90.43
1.005	375	296	CONC	9.473	S7	87.42	90.43	S8	87.38	90.14
1.006	375	301	CONC	22.584	S8	87.38	90.14	S9	87.31	89.24
1.007	375	118	CONC	35.583	S9	87.31	89.24	S10	87.01	88.58
1.008	375	34	CONC	27.610	S10	87.01	88.58	S11	86.19	88.84
1.009	450	43	CONC	12.175	S11	86.11	88.84	S12	85.83	88.51
1.010	450	400	CONC	9.593	S12	85.83	88.51	S13	85.81	88.06
1.011	525	52	CONC	23.264	S13	85.73	88.06	S14	85.29	86.94
1.012	525	158	CONC	19.616	S14	85.29	86.94	S17	85.16	86.87
1.013	525	399	CONC	63.103	S17	85.16	86.87	S18	85.00	86.89
1.014	600	401	CONC	45.670	S18	84.93	86.89	S19	84.82	86.68
1.015	600	404	CONC	10.095	S19	84.82	86.68	S20	84.79	86.60
1.016	600	399	CONC	47.451	S20	84.62	86.60	S21	84.50	86.60
1.017	600	396	CONC	8.717	S21	84.50	86.60	S22	84.47	86.40
1.018	225	170	CLAY	9.031	S22	84.47	86.40	S23	84.42	85.50
2.000	300	240	CLAY	18.270	S3	87.82	89.76	S4	87.75	89.98
3.000	225	171	CLAY	20.802	S15	85.83	87.47	S16	85.71	87.15
3.001	300	163	CLAY	40.346	S16	85.64	87.15	S17	85.39	86.87

FOUL Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	150	23	CLAY	30.993	F1	90.06	91.74	F2	88.70	90.48
1.001	150	47	CLAY	18.531	F2	88.70	90.48	F3	88.30	89.93
1.002	150	150	CLAY	24.848	F3	88.30	89.93	F4	88.14	90.24
1.003	150	150	CLAY	20.107	F4	88.14	90.24	F5	88.00	90.50
1.004	150	150	CLAY	8.572	F5	88.00	90.50	F6	87.95	90.48
1.005	150	151	CLAY	8.300	F6	87.95	90.48	F7	87.89	90.22
1.006	150	150	CLAY	29.452	F7	87.89	90.22	F8	87.70	89.05
1.007	150	150	CLAY	44.590	F8	87.70	89.05	F9	87.40	88.75
1.008	150	150	CLAY	17.810	F9	87.40	88.75	F10	87.28	88.77
1.009	150	16	CLAY	9.213	F10	87.28	88.77	F11	86.72	88.37
1.010	150	18	CLAY	7.247	F11	86.72	88.37	F12	86.33	87.98
1.011	150	16	CLAY	23.745	F12	86.33	87.98	F13	84.85	86.85
1.012	150	94	CLAY	18.527	F13	84.85	86.85	F16	84.65	86.84
1.013	150	150	CLAY	62.512	F16	84.65	86.84	F17	84.24	86.92
1.014	150	150	CLAY	26.029	F17	84.24	86.92	F18	84.06	85.49
1.015	150	150	CLAY	4.599	F18	84.06	85.49	F19	84.03	85.48
1.016	150	150	CLAY	3.163	F19	84.03	85.48	F20	84.01	85.45
2.000	150	63	CLAY	15.795	F14	85.16	87.44	F15	84.91	87.18
2.001	150	150	CLAY	38.663	F15	84.91	87.18	F16	84.65	86.84

Note

1. This is a preliminary design demonstrating a drainage solution is achievable to discharge flows from the proposed development.
2. The specification in all respects shall be in accordance with the current Wrexham CBC Specification and Construction publication in force in the county at the time of construction.

Legend

Site Boundary

Existing

HD Existing Highway Sewer
FW Existing Foul Sewer
SW Existing Surface Water Sewer
Ordinary Watercourse
Culvert

Proposed

Adoptable Surface Water Sewer
Adoptable Foul Sewer
FFL 47.40 Slab Level
WALL Wall
UB Underbuild
FOE Flag On Edge
Rising Main
+0.85 -0.95 Depth of fill (Existing to Proposed)

Note:
Retention of 300mm and above has been shown for strategy stage. Small retaining features and underbuild of up to 225mm will also be required at other locations and will be shown at detailed design stage

S T R A T E G Y

Rev.	Date	Revision	By	Appd.
D	18.11.22	Updated to suit revised layout	PW	AJ
C	07.09.22	Updated to suit revised layout	AJ	AJ
B	04.05.22	Updated to suit revised layout	PW	AJ
A	05.04.22	Dry Basin moved to suit client comment	PW	AJ

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Park House
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CH4 9QU

Client
Castle Green

Project
MOLD ROAD, GWERSYLLT, WREXHAM.

Title
Drainage Strategy

DRAWING NUMBER	SCALE at A0	1:500	
7956 / SK01	DATE	25.03.22	REVISION
	DRAWN	PW	D
	CHECKED	AJ	

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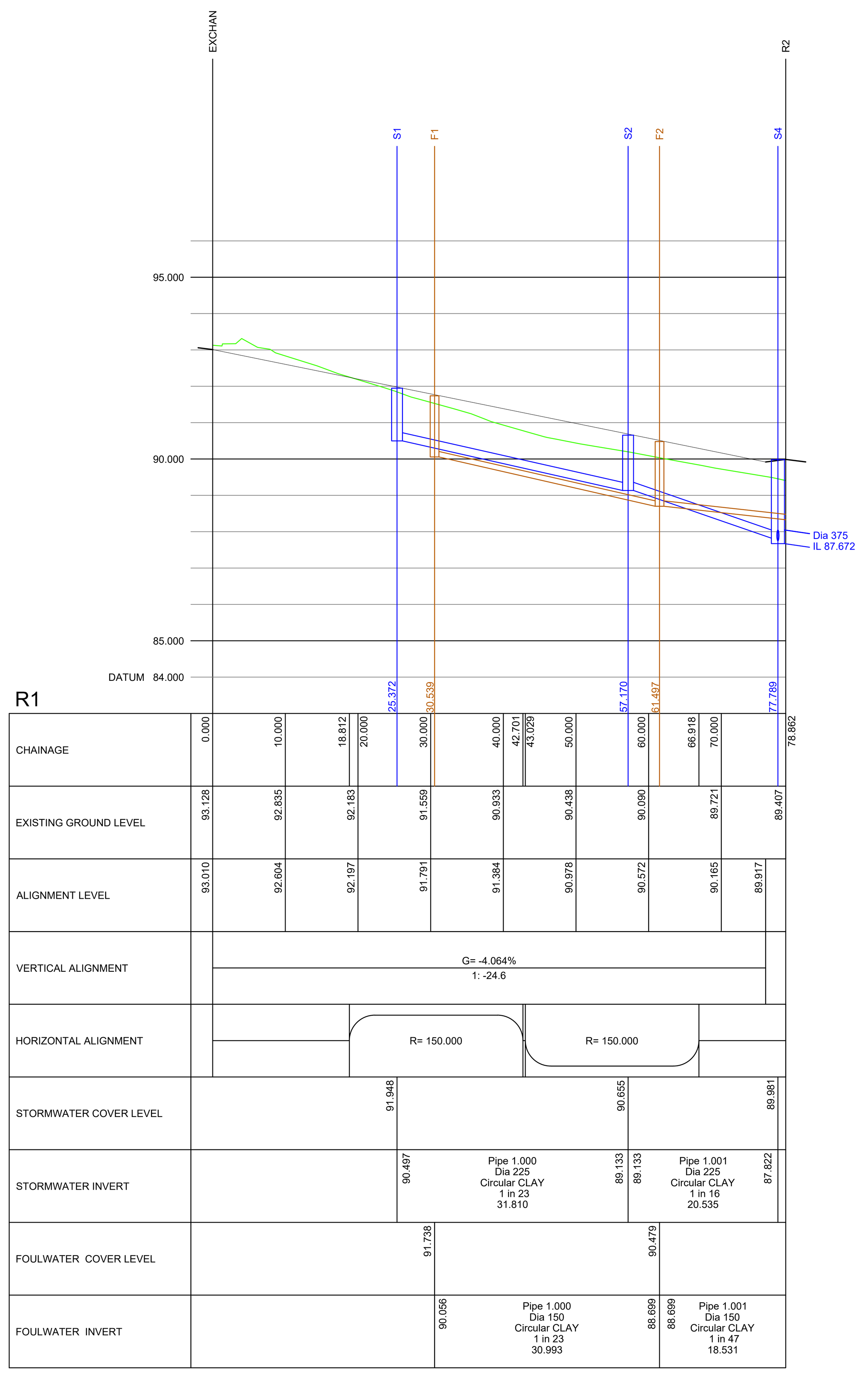
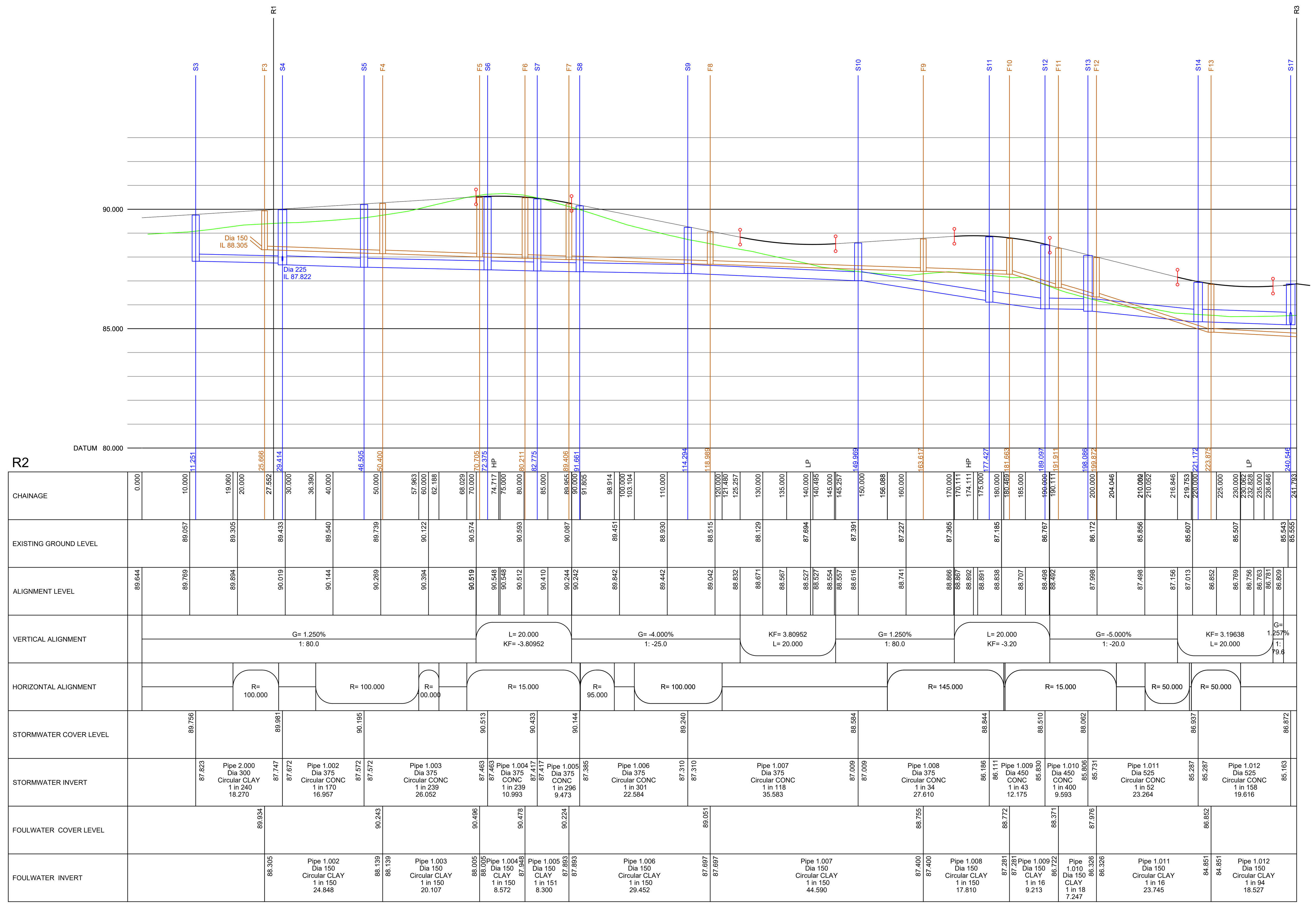
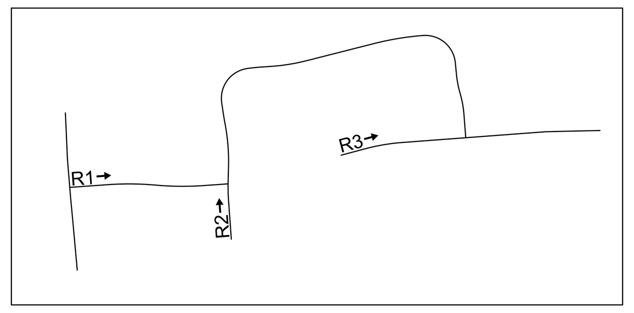
DO NOT SCALE



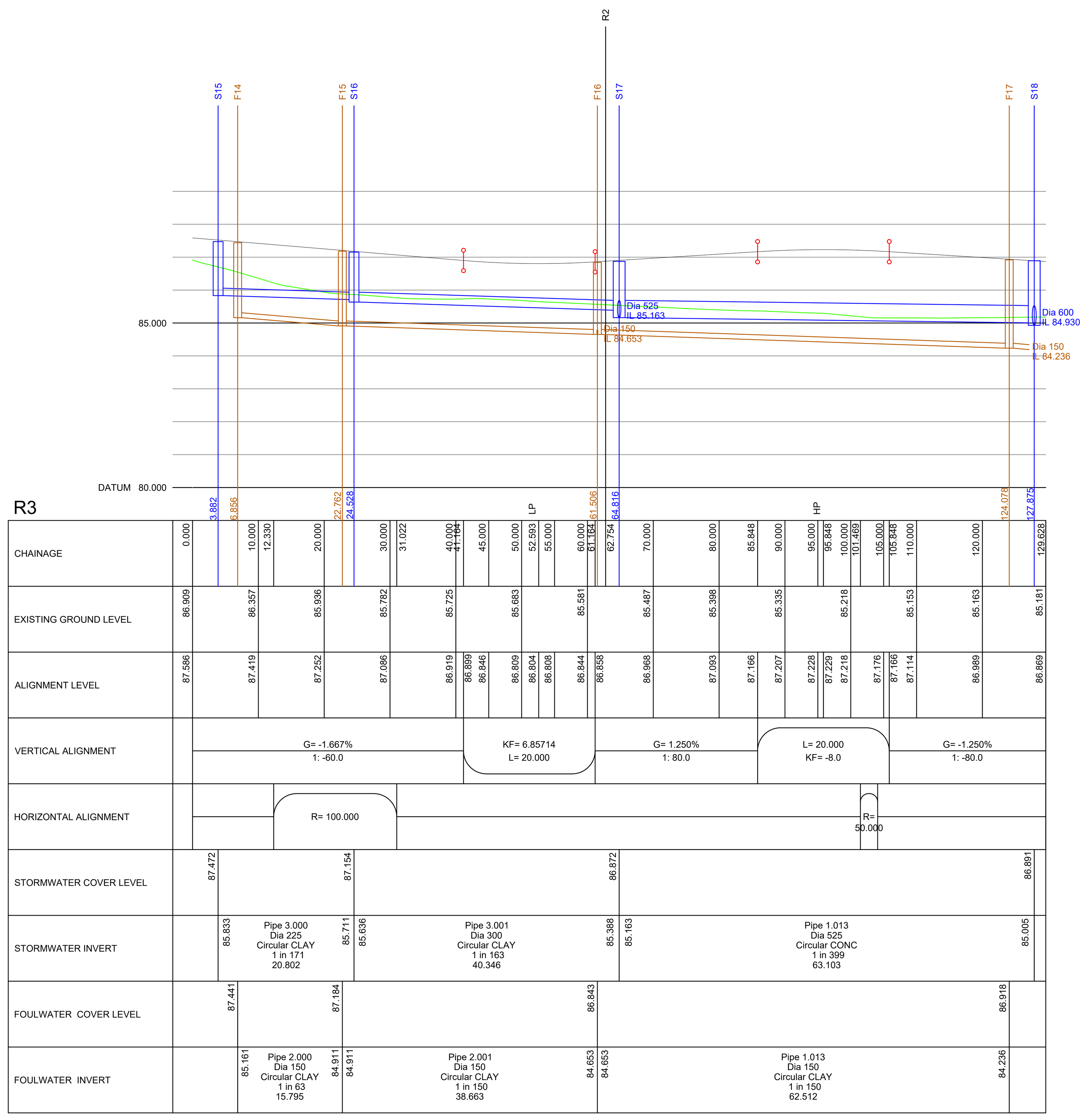


Class 'S' bed and surround to all pipes unless stated otherwise.
Class 'Z' bed and surround to pipes where cover < 1.2m as indicated on longsections.

All connections are soffit to soffit



KEY PLAN



Notes

1. All dimensions are in millimetres unless otherwise shown.
2. All adoptable drainage shall be constructed in accordance with 'Sewers for Adoption' 7th Edition, Welsh Ministers Standards and Welsh Water Details and Guidelines.
3. All private drainage works are to comply fully with Part H of the Building Regulations.
4. All existing invert levels to be checked by the contractor at the start of works and any other discrepancies notified to the Engineer prior to commencing works. All levels are based on topographical survey information provided by others.
5. It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works.
6. The Contractor shall adhere to the CDM Regulations at all times.
7. Only trained personnel shall be permitted to enter confined spaces.
8. All materials to bear the relevant B.S. Kitemark and comply fully with the Sewers for Adoption 7th Specification. All concrete & concrete products must use Sulphate resistant cement (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur to withstand a class 3 condition).
9. All opening notices etc. as required under Highways Acts etc. are to be obtained prior to commencement of works. All works are to be inspected by L.A., NHBC or Welsh Water as applicable.
10. Trench backfill in highways to within 1m of highway shall, as directed by the Highway Authority be a suitable granular material all in accordance with Sewers for Adoption.
11. Cover loadings shall be as detailed on the Manhole Schedule.
12. Drain trenches should not be excavated lower than the foundations of any building nearby unless either:
    a) The trench is within 1m of the foundation, the trench is filled with concrete up to the lowest level of the foundation, or
    b) Where the trench is further than 1m from the building, the trench is filled with concrete to a level bellow the lowest level for the building equal to the distance from the build, less 150mm.
13. All SVP and RWP connections are indicative and shall be confirmed by the client.
14. Pipe gradients out of the building to connecting manhole to be laid at 1:40 in accordance with Building Regulations, Part H, Table 6.
15. Where pipe sizes are not indicated :
    100Ø to be used for foul
    100Ø to be used for surface water unless stated otherwise.
16. Minimum surface water gradients shall be:
    100Ø laid at 1:100 with the exception of the first connection which shall be minimum 1:60
    150Ø laid at 1:150
17. Minimum 100Ø foul drainage gradient to be 1:80 with the exception of the first connection which shall be minimum 1:40.
18. Manhole covers to be marked FWS or SW as appropriate.
19. All manhole covers and frames shall comply with BS EN124. All adoptable manholes and chambers shall comply with Sewers for Adoption 7th Edition. Covers in roads to be grade D400 and be 150mm deep. Manhole covers in car parking areas and drives to be grade B125 and covers in landscaping areas to be grade A15. All to be sized in accordance with Building Regulations Part H, Tables 11 & 12. "In-fill" type covers should not be used. Where a cover is located in an area of block paving, the bottom of the frame should be 150mm deep.
20. Precast concrete rings to be reinforced.
21. Backdrops in private manholes / inspection chambers to be internal
22. Private drains laid under adopted / private roads to be Class S granular bed and surround with a minimum of 1.2m cover, where this cannot be achieved a Class Z concrete bed and surround shall be provided.
23. Private drains located under landscape areas or driveways / car parking bays to be Class B granular bed and surround with a minimum 0.6m cover, where this cannot be achieved a Class Z concrete bed and surround shall be provided.
24. Pipes have not been designed to accommodate construction traffic loading. The contractor is responsible for providing adequate protection to the pipes during construction.
25. Slab levels shall not be varied without reference to the Engineer for guidance.
26. The developer must self-vet and certify that the design criteria, material standards and workmanship specifications for the proposed adoptable sewers are in accordance with those set out in "Sewers for Adoption" 7th Edition (SFA 7th), The Welsh Ministers Standards and the requirement of DCWW as the Statutory Sewerage Undertaker.
27. Subject to a Section 104 Adoption Agreement being complete, a Section 106 application to connect must be made to DCWW the developer shall be given 21 days notice prior to connection. The works may only be undertaken by an SSIP Health & Safety approved contractor.

STRATEGY

Rev.	Date	Revision	By	Appd.
B	18.11.22	Updated to suit revised layout	PW	AJ
A	04.05.22	Updated to suit revised layout	PW	AJ

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Chester
CH4 9QU

Client
Castle Green

Project
MOLD ROAD, GWERSYLLT, WREXHAM.

Title
Highway and Drainage Longsections

DRAWING NUMBER	SCALE at A0	1:500 H, 1:100 V	
7956 / SK02-1	DATE	25.03.22	REVISION
	DRAWN	PW	B
	CHECKED	AJ	

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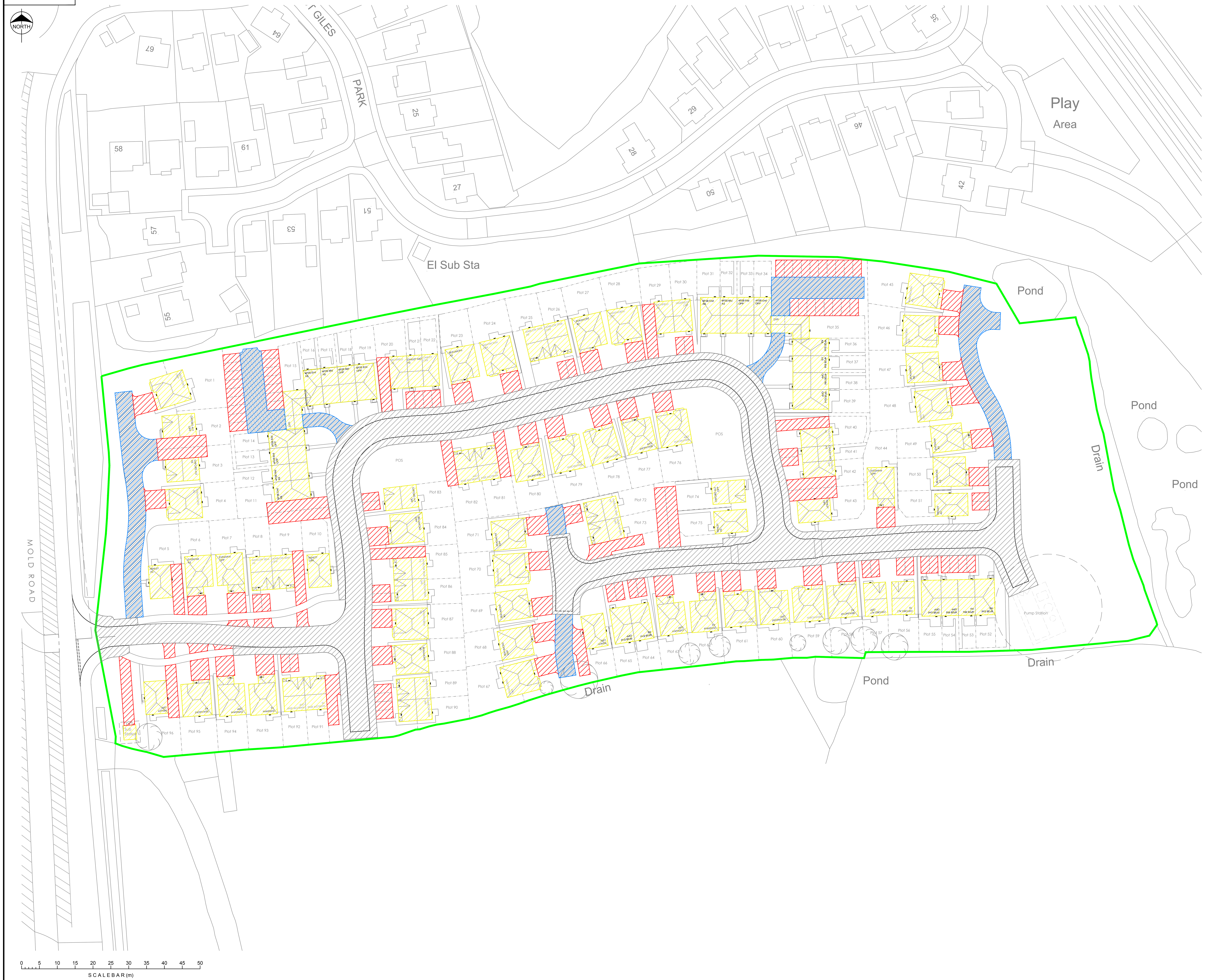

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SW Areas

Plots	6090
Drives	2970
Highway	4270
Shared Area	1210
TOTAL	14,540
(+10%)	15,990

STRATEGY

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Client

Castle Green

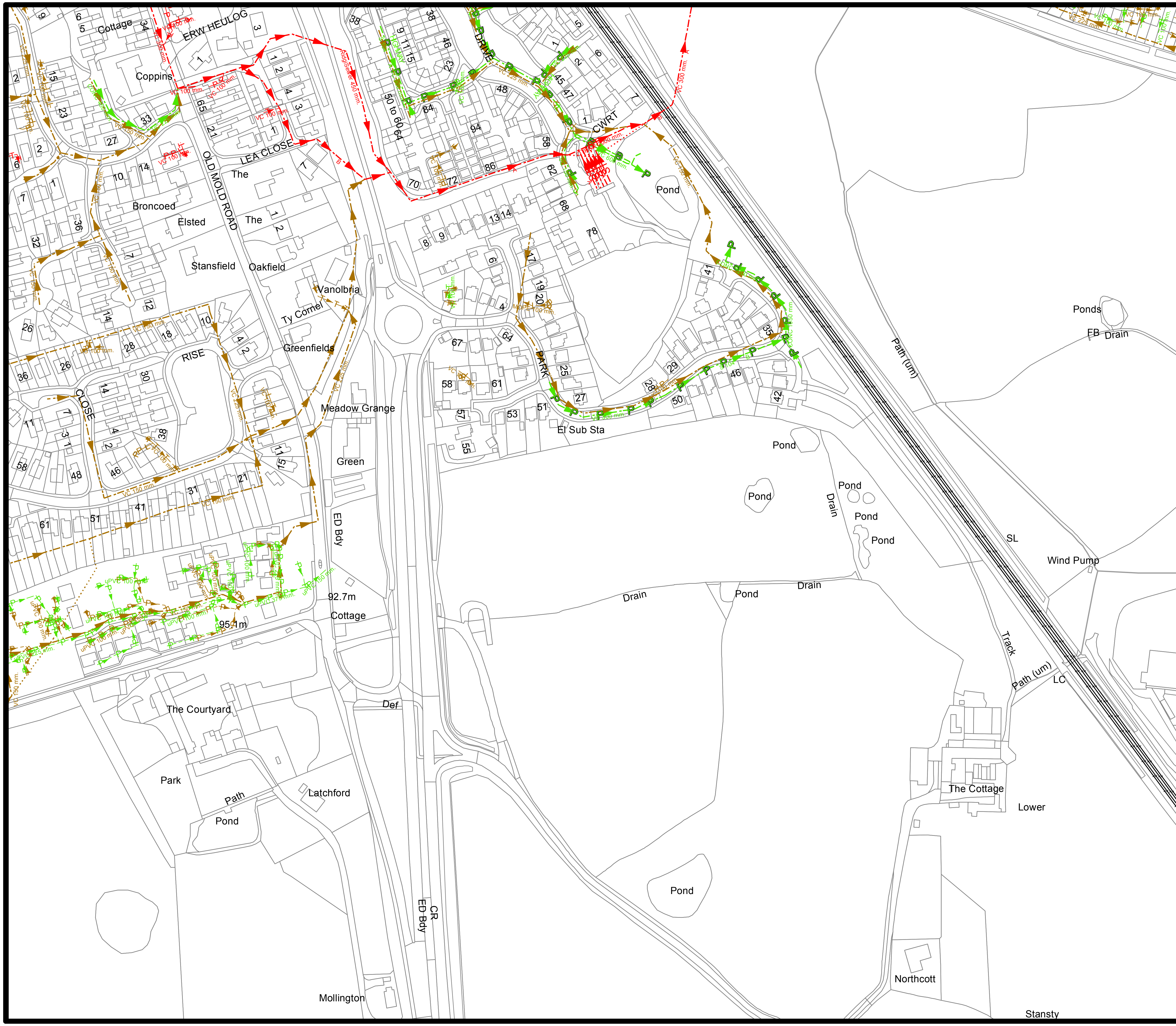
Project

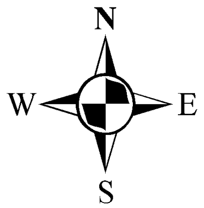
MOLD ROAD, GWERSYLLT, WREXHAM.

Title

Impermeable Areas

DRAWING NUMBER	SCALE at A1	1:250	REVISION
7956 / SK03	DATE	29.03.22	B
	DRAWN	PW	
	CHECKED	AJ	





Dŵr Cymru
Welsh Water

Stansty Fields, 96 Mold Road

N
W E
S

LEGEND(Representative of most common features)

Waste network:

	Foul chamber		Outfall
	Surface water chamber	LH	Lamphole
	Combined chamber		Storm Overflow
C O	Combined sewer overflow		Rising main
SPC	Special purpose chamber		Gravity sewer
	Treatment works	P	Private sewer
	Pumping station	S 104 P	Private sewer subject to Sect. 104 adoption agreement
		T	Private Sewer Transfer
		L	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:	332214,352550
Map scale:	1:2500
Printed by:	John Emma
Printed on:	13 Mar 2020

Appendix 2

Infiltration Consideration

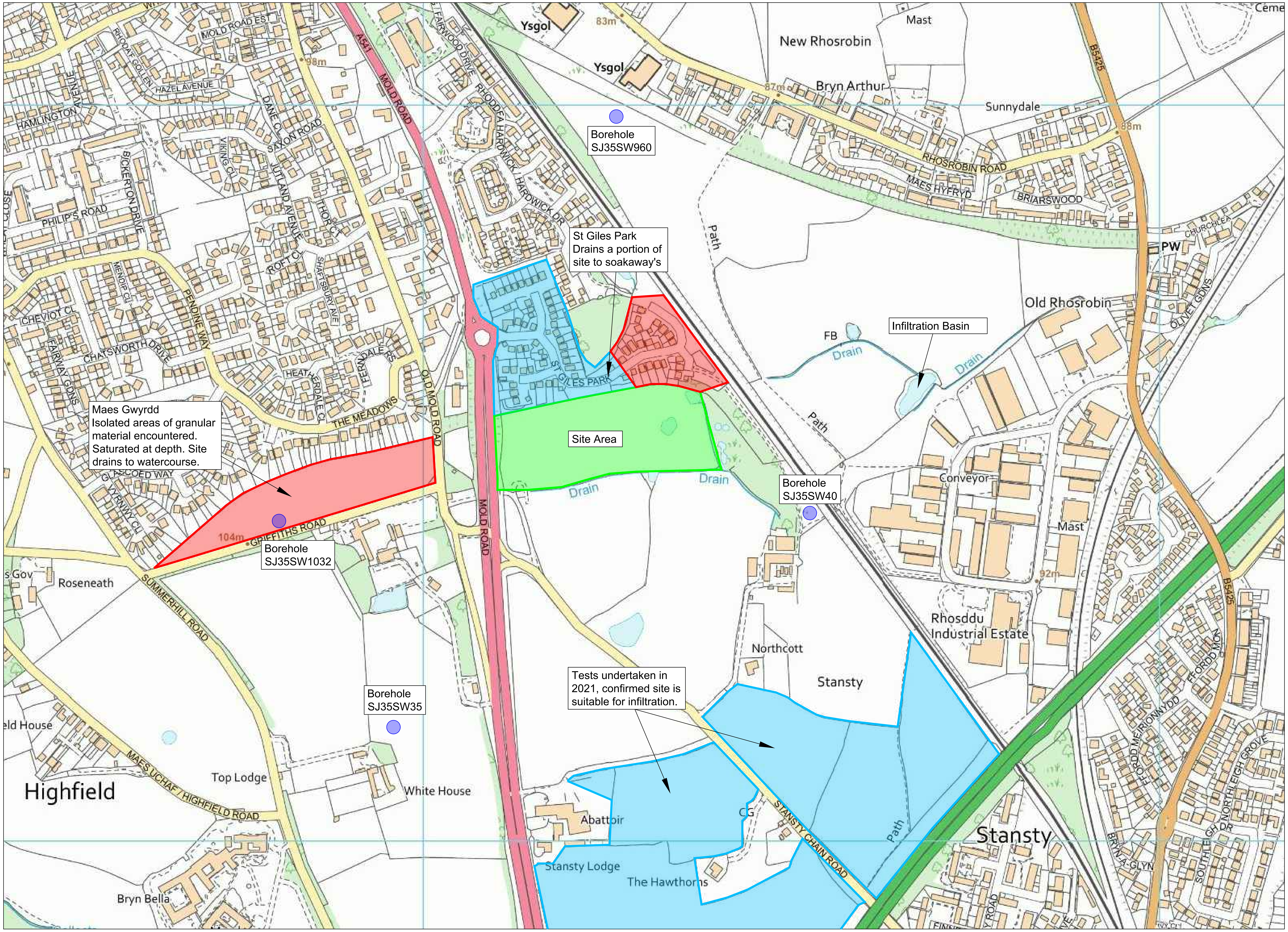
Drawing No.	Revision	Title
7956 / SK04	-	Infiltration Consideration

BGS Borehole Information

BGS Geology Mapping

DO NOT SCALE

NORTH



STRATEGY

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Web: http://coopers.co.uk

Client
Castle Green

Project
MOLD ROAD, GWERSYLLT, WREXHAM.

Title
Consideration of Infiltration

DRAWING NUMBER	SCALE at A1	1:1000	REVISION
7956 / SK04	DATE	29.03.22	-
	DRAWN	PW	
	CHECKED	AJ	

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SJ 35 SW 35 **3191 5214** **South of Stansty Park, Gwersyllt** 1" no. 121 **Block B**

Surface level (+98.4 m) +323 ft
Water not struck
Shell and auger 8-in (203 mm) diameter
March 1977

Overburden 1.0 m
Mineral 2.0 m
Waste 0.9 m
Mineral 13.6 m
Bedrock 0.4 m+

British Geological Survey British Geological Survey British Geological Survey

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.3	0.3
	Clay, sandy with coarse subrounded pebbles and cobbles of quartzite, limestone, sandstone and igneous material	0.7	1.0
Glacial Sand and Gravel	**a** 'Clayey' sandy gravel Gravel: coarse with fine and cobbles. Composed of subrounded to rounded quartzite with limestone and some quartz, sandstone, chert and igneous material Sand: medium with coarse and fine, subangular to subrounded, reddish brown	2.0	3.0
	Clay, red-brown, slightly sandy with pebbles and cobbles at the top. Becomes less sandy and pebbly with depth passing into laminated clay with silt and sand partings	0.9	3.9
	b Gravel, contains a thin pebbly clay between 13.5 m and 13.7 m Gravel: fine and coarse with cobbles, subangular to rounded quartzite and limestone with sandstone, igneous material and traces of quartz, chert and other sediments Sand: buff, fine, medium and coarse, subrounded quartz and quartzite with traces of coal	13.6	17.5
Coal Measures	Mudstone, pale grey, silty	0.4+	17.9

British Geological Survey British Geological Survey

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1–4	+4–16	+16–64	+64
a	13	39	48	1.0–2.0	18	11	29	10	12	20	0
				2.0–3.0	8	7	16	6	17	36	10
				Mean	13	9	22	8	15	28	5
b	7	40	53	3.9–4.9	15	46	19	5	4	11	0
				4.9–5.9	3	6	7	6	9	26	43
				5.9–6.9	2	2	6	18	23	22	27
				6.9–7.9	2	6	11	14	25	32	10
				7.9–8.9	2	5	8	17	38	30	0
				8.9–9.9	3	14	16	7	13	24	23
				9.9–10.9	2	9	11	10	19	32	17
				10.9–11.9	3	6	14	16	21	17	23
				11.9–13.5	6	4	6	10	14	48	12
				13.7–15.5	11	20	23	12	15	19	0
				15.5–16.5	13	31	22	11	12	11	0
				16.5–17.5	6	22	21	21	11	11	8
				Mean	7	14	14	12	16	24	13
a+b	8	39	53	Mean	8	13	15	11	16	25	12

COMPOSITION

British Geological Survey British Geological Survey British Geological Survey

	Depth below surface (m)	Percentages by weight in +8 mm fraction						
		Quartz	Quartzite	Sandstone	Limestone	Other sediments	Igneous	Chert, flint
a	1.0–3.0	2	72	2	17	3	3	1
b	3.9–6.9	Trace	50	2	45	3	1	Trace
	6.9–9.9	Trace	63	17	12	2	6	Trace
	9.9–13.5	Trace	43	6	39	1	12	Trace
	13.7–17.5	1	53	1	28	1	16	1

SJ 35 SW 40 **3252 5244** **Lower Stansty, Gwersyllt** 1" no. 121 **Block B**

Surface level (+85.8 m) +282 ft
Groundwater conditions not recorded
Shell and auger 8-in (203 mm) diameter
March 1977

Overburden 3.9 m
Mineral 8.3 m
Waste 4.1 m
Mineral 7.7 m+

British Geological Survey

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground, ashes and slag	3.0	3.0
Boulder Clay	Clay, orange-brown to grey with occasional thin sandy laminae and coarse sandstone clasts	0.9	3.9
Glacial Sand and Gravel	Gravel, becomes sandy and clayey at the base Gravel: fine and coarse, with cobbles between 6.9 m and 7.9 m. Subrounded quartzite with sandstone, limestone, volcanics and some quartz Sand: brown, fine, medium and coarse, subangular to subrounded	8.3	12.2
Glacial Silt	Clay, alternating with silt and clayey sand	4.1	16.3
Glacial Sand and Gravel	Gravel Gravel: coarse and fine with cobbles, subrounded quartzite with volcanics, sandstone, limestone and some quartz, chert and other sediments Sand: coarse, medium and fine, subrounded	7.7+	24.0

British Geological Survey

GRADING

	Mean for deposit *percentages*			Depth below surface (m)	*percentages*						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$
a	6	42	52	3.9–4.9	2	3	15	18	33	29	0
				4.9–5.9	1	5	7	12	33	42	0
				5.9–6.9	2	12	17	15	27	27	0
				6.9–7.9	2	4	6	12	28	25	23
				7.9–8.9	3	10	13	18	32	24	0
				8.9–9.9	2	4	6	18	27	43	0
				9.9–12.2	15	53	10	6	11	5	0
				Mean	6	18	11	13	25	24	3
b	4	31	65	16.3–16.8	4	2	2	6	21	48	17
				16.8–17.5	3	6	28	37	24	2	0
				17.5–19.0	2	7	11	8	27	34	11
				19.0–20.0	3	4	12	6	10	46	19
				20.0–21.5	8	12	9	6	17	29	19
				21.5–24.0	4	7	12	14	35	28	0
				Mean	4	7	12	12	25	31	9
a+b	5	37	58	Mean	5	13	12	12	25	27	6

COMPOSITION

	Depth below surface (m)	Percentages by weight in +8 mm fraction						
		Quartz	Quartzite	Sandstone	Limestone	Other sediments	Igneous	Chert, flint
a	3.9–6.9	3	66	9	6	2	14	Trace
	6.9–12.2	2	76	4	7	4	5	1
b	16.3–19.0	1	46	20	22	5	5	1
	19.0–24.0	2	64	4	20	1	8	1

SJ35SW 960

HOLST & CO. LTD.

SITE INVESTIGATION DEPT.
5-7 NEW YORK ROAD
LEEDS 2

3229
S302

Contract No. 16907/B.369.
Location Wrexham - Rhosrobin J.T.C.
Client Denbigh County Architect.

Borehole No. 1
Ground Level
Date 20th January, 1965.

BOREHOLE LOG

STRATA	Legend	Depth below Ground Level	Thickness of Strata	Type of Sample	c. lb./sq. ft.	Ø deg.	m.c. %	y lb./cu. ft	N
Top Soil.		1'6"	1'6"						
Soft Brown Sand with Slight Clay and Stones.		2'6"	1'0"						
Stiff Brown Clay with Sand.		4'6"	2'0"	3'6" ▯	1800		27	120	
Brittle Reddish Clay with Pebbles and Sand.		11'0"	6'6"						

Water struck at | Maximum Observed Water Level

Undisturbed Sample ▯
Disturbed Sample o
Water Sample Δ
Penetration Test I

c = Cohesion
Ø = Angle of Internal Friction
m.c = Moisture Content
y = Dry Density
N = Standard Penetration Value

Water levels may be subject to seasonal or tidal variation and should not be taken as constant.

British Geological Survey

STRATA SURVEYS LTD.,
HOLMES CHAPEL ROAD,
MIDDLEWICH, CHESHIRE. CW10 0JB
Telephone: 0606 84 4637 Fax: 0606 84 6657

Trial Pit No. : 3
Sheet No. 1 Of 1.
Depth 0 to 4 metres.
Dates : 31st August 1990

Job Number : 5687 Location : Ty Gwyn Lane, Wrexham.
Client : Whelmar (Chester) Ltd

Equipment and Methods
JCB 3CX Hydraulic Excavator. 333182
Engineer : nfj 352430

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	NMC	Cu	Remarks
				0.00					
Grass over dark brown sandy Topsoil			(0.40)		0.20	D 1			
				0.40					
very compact dry light brown clayey fine grained SAND			(0.50)						
				0.90					
stiff and very stiff reddish brown very sandy CLAY with bands of finer-medium grained sand.			(1.10)						
				2.00					
compact reddish brown fine-medium-coarse grained SAND with fine -medium rounded gravel occasional rounded cobble			(1.50)						
				3.50					End of Pit
End of Trial Pit									

Key
Pp Pocket Penetrometer

Sample Types
U Undisturbed
D Disturbed
B Bulk Disturbed
W Water

Progress / Water Levels
Borehole Depth
Water Level
Water Strike

In-Situ Tests
V Vane Test
Pb Plate Bearing Test
CBR In-Situ CBR Test

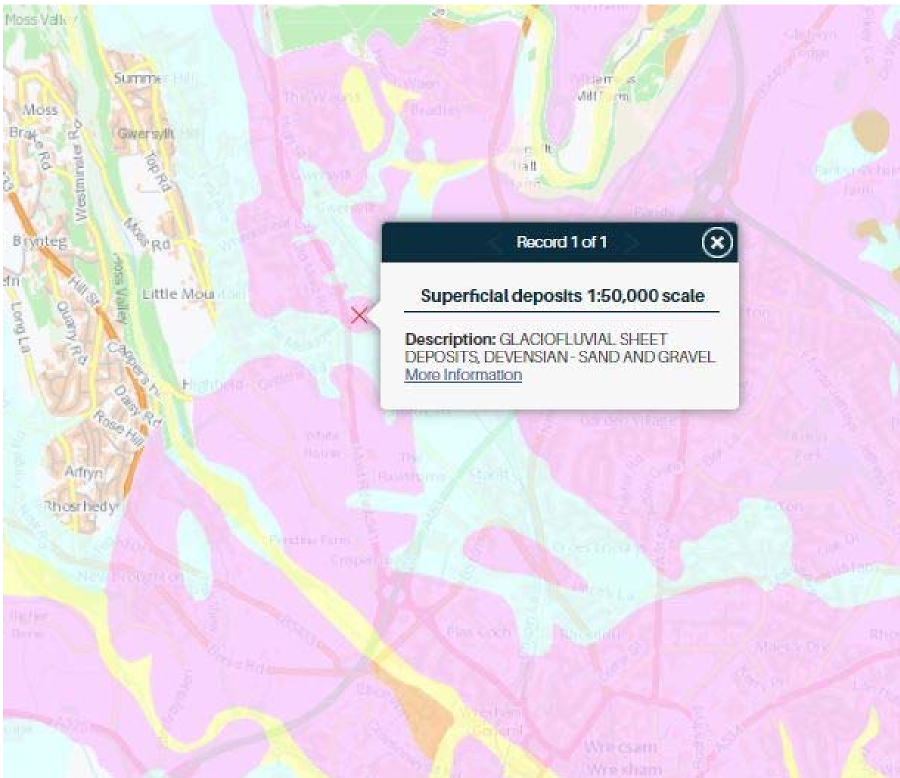
General Remarks
No water encountered during excavation.

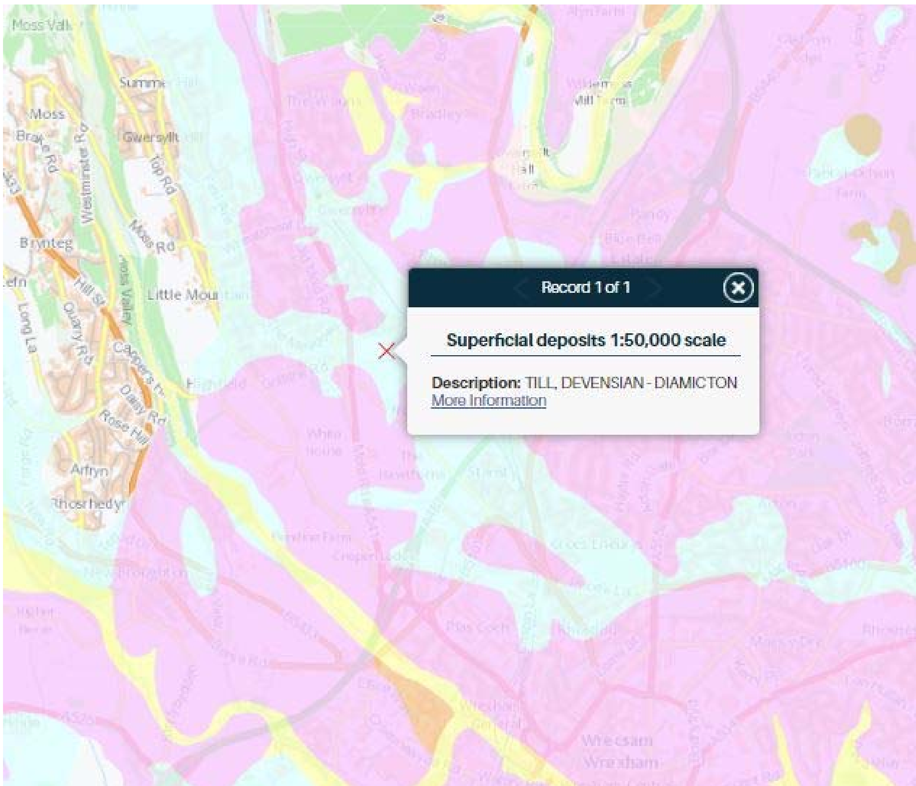
Sketch/Plan

British Geological Survey

7956 Land off Mold Road, Gwersyllt, Wrexham

BGS Geology Mapping Information





Appendix 3

Correspondence

Dwr Cymru Welsh Water Historical Flooding

Wrexham County Borogh Council Historical Flooding

Natural Resources Wales Historical Flooding

Andy Jones

From: Environmental Information Requests <EnvironmentalInformationRequests@dwrcymru.com>
Sent: 11 March 2022 15:20
To: Andy Jones
Subject: RE: FCA Land off Mold Road, Gwersyllt, Wrexham

Dear Mr Jones

Request for information

We refer to your request for information which was received on 4th March 2022.

We are dealing with your request as one made under the Environmental Information Regulations 2004 ("the Regulations*").*

In accordance with the Regulations, we will respond to your request within 20 working days of the date of receipt.

For completeness, we advise that the Information Commissioner's Office states that the time period for responding should be calculated from the day after the request is received.

In the meantime, if you have any queries, please contact us on email at
EnvironmentalInformationRequests@dwrcymru.com

We have assigned reference EIR/1086/2022 to your request. Please kindly note this in all correspondence with us regarding this matter.

Yours sincerely,
Dŵr Cymru Welsh Water

From: Andy Jones <ajones@coopers.co.uk>
Sent: 04 March 2022 10:53
To: Sewerage Services <Sewerage.Services@dwrcymru.com>
Subject: FCA Land off Mold Road, Gwersyllt, Wrexham

******** External Mail ********
7956 Land off Mold Road, Gwersyllt, Wrexham
FCA Historical Flood Information

To whom it may concern

We are undertaking a Flood Consequences Assessment and Drainage Strategy for the above site (see attached Site Location Plan) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FCA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

Regards

Andy Jones
Senior Infrastructure Engineer

Andy Jones

From: SAB <SAB@wrexham.gov.uk>
Sent: 07 March 2022 13:59
To: Andy Jones
Subject: RE: FCA Land off Mold Road, Gwersyllt, Wrexham

Hi Andy,

I'll be dealing with these requests from now on.

Our systems are showing no historical flooding incidents and no underground sewers at the site.

The below map shows surface water flooding in relation to 1 in 30, 1 in 100 and 1 in 1000 year events.

If there is anything else you require let me know.

Regards,

James

From: Andy Jones <ajones@coopers.co.uk>
Sent: 04 March 2022 11:07
To: SAB <SAB@wrexham.gov.uk>
Subject: FCA Land off Mold Road, Gwersyllt, Wrexham

Hi James

Any idea who this email should be directed to? Either a email address or person would be helpful

Thanks

Andy

7956 Land off Mold Road, Gwersyllt, Wrexham
FCA Historical Flood Information

To whom it may concern

We are undertaking a Flood Consequences Assessment and Drainage Strategy for the above site (see attached Site Location Plan) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FCA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

Regards

Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
🖷: (01244) 684911
✉: ajones@coopers.co.uk
Web: http://www.coopers.co.uk

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 yngl?n ? chynnwys a defnyddio?r neges e-bost hon, ac unrhyw atodiadau, cyfeiriwch at www.wrecsam.gov.uk/top_navigation/disclaimersw.htm

Andy Jones

From: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Sent: 10 March 2022 15:13
To: Andy Jones
Subject: RE: ATI23023a Land off Mold Road, Gwersyllt, Wrexham

Dear Mr Jones,

Further to your recent email, please note that we do not have any detailed modelling for this location.

Self Service Open Data:

You can now make the most of open data provided **free online:**

- Please see the Flooding pages on the NRW website for the NRW Flood Risk Map Viewer and the Development Advice Map/Flood Map for Planning. You will find many spatial risk layers including the Flood Risk Assessment Wales (FRAW) maps, reservoir hazard data, Recorded Flood Extents, flood defences and more.

- **DataMapWales:** Spatial data is free to download, view and use within your own GIS system. The flood datasets include: Flood Risk Assessment Wales (FRAW) Maps, Flood Map for Planning (FMfP), Recorded Flood Extents, Flood Defences, Areas Benefitting from Flood Defences, FMfP TAN 15 Defences Zones and LIDAR data.

- Please note that you can find a GIS layer of our flood models in the Flood Map for Planning viewer. This is not an exhaustive list but does give a good idea as to the most relevant models for an area. This can be accessed via the following link: https://flood-map-for-planning.naturalresources.wales/. Select the 'Detailed Map' tab and the layer in question is called 'NRW Local Model Manager'.

Please Note the Following:

- Extreme Sea Level Information around the Welsh coastline is available from: Coastal Design Sea Levels - Coastal Flood Boundary Gauge Data (2018)

- All information supplied will need to be verified by the recipient **PRIOR** to using in a Flood Consequences Assessment (FCA). We would expect to see a review of hydrology, in-channel survey, floodplain topography etc. to demonstrate the data is suitable for the purposes of producing an FCA. Please see our website for further information on Modelling for Flood Consequence Assessments and Developing hydraulic models for flood risk.

- Climate change allowances will need to be applied carefully to ensure compliance with Welsh Government climate change allowances and flood consequence assessments.

- For Coastal and Estuarine sites NRW will require assessment of wave overtopping. It is up to the developer to justify why an assessment *isn't* required.

- Shoreline Management Plan (SMP) information is available on our website via our Flood Risk Viewer Map and also on Welsh Government's DataMapWales Portal. You may need to consider the policy implications of the SMP when assessing the suitability and sustainability of new development on your site of interest. For proposed development sites in Gwynedd & Anglesey a Local Development Plan Policy (POLICY ARNA 1: Coastal Change Management) sets out how the Local Planning Authority will consider new development proposals within a Coastal Change Management Area. We recommend that you contact the relevant Planning Authority for further information and guidance in relation to this.

- **Pre-application Advice:** As part of our advice service to developers, NRW offer a free initial opinion on your proposal. However, in cases where you would like to access any extra advice that falls outside of our statutory duties, we can only offer this as part of our Discretionary Planning Advice Service (DPA Service). For more information regarding free service and our discretionary planning can be found in the following links: Welsh Version / English version.

Your request for our free or charged discretionary advice service needs to be accompanied by the relevant 'Request Form' which is available to download from our website. You will then need to send the form to northplanning@cyfoethnaturiolcymru.gov.uk who will coordinate our response.

Apologies we could not have been of any further assistance to you in this matter.

Yn gywir / Yours sincerely,

Michelle Lewis

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 653577
Symudol / Mobile: 07917243096
Office Location Llys Afon, Hwlffordd / Office Location River Court, Haverfordwest
Cwsmer, Cyfarthrebu a Masnach - Customer, Communications and Commercial
Oriau gwaith arferol/Normal working hours – Mon-Fri, 9 to 5

Yn falch o arwain y ffordd at ddyfodol gwell i Gymru trwy reoli'r amgylchedd ac adnoddau naturiol yn gynaliadwy.

Proud to be leading the way to a better future for Wales by managing the environment and natural resources sustainably.

cyfoethnaturiol.cymru / naturalresources.wales

Twitter | Facebook | LinkedIn | Instagram

From: Data Distribution
Sent: 07 March 2022 17:22
To: 'Andy Jones' <ajones@coopers.co.uk>
Subject: ATI23023a Land off Mold Road, Gwersyllt, Wrexham

Dear Mr Jones,

Thank you for your email concerning the above.

For historical mapping, please see this datalink - http://lle.gov.wales/catalogue/item/HistoricFl/?lang=en

Please note that we do not produce product 4s anymore. Please see the attached documentation for further information on this.

We can provide if the data is available, a product 5 which is the flood model report which is free of charge. Also a product 6 if available, which is the flood model raw output data which is also free of charge. You would need the appropriate software to analyse the results, more information on this is in the attached. We could also provide product 7 which is the full flood model for a fee of £180.00 inclusive of VAT.

Please also accept this as an acknowledgement that your request has been received.

It can take up to 20 working days to supply data that is not available online, therefore if you have any queries on your data request, please contact us.

For further information on what you can expect from us, please visit our website:

Natural Resources Wales / Contact us or call the Customer Hub on 0300 065 3000 (open 9am-5pm, Monday to Friday).

We will therefore be in touch in due course and provide if available, products 5 & 6 and advise on product 7.

Yn gywir / Yours sincerely,

Michelle Lewis

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 653577
Symudol / Mobile: 07917243096
Office Location Llys Afon, Hwlffordd / Office Location River Court, Haverfordwest
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cyfoethnaturiol.cymru / naturalresources.wales

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From: Andy Jones <ajones@coopers.co.uk>
Sent: 04 March 2022 10:54
To: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Subject: FCA Land off Mold Road, Gwersyllt, Wrexham

7956 Land off Mold Road, Gwersyllt, Wrexham
FCA Historical Flood Information

To whom it may concern

We are undertaking a Flood Consequences Assessment and Drainage Strategy for the above site (see attached Site Location Plan) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FCA report.

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Appendix 4

MicroDrainage Calculation

Source Control Greenfield Run-off Calculation

Preliminary Surface Water Design

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Andy Jones
Site name:	Mold Road
Site location:	Wrexham

Site Details

Latitude:	53.06577° N
Longitude:	3.01267° W
Reference:	3655278701
Date:	Mar 17 2022 16:38

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.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.88

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	2	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	779	779
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

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):	5.95	15.76
1 in 1 year (l/s):	5.23	13.87
1 in 30 years (l/s):	10.59	28.05
1 in 100 year (l/s):	12.97	34.35
1 in 200 years (l/s):	14.63	38.76

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 7956 SW01 REV B.SWS

Pipe Sizes 7956 SW01 REV B Manhole Sizes 7956 SW01 REV B

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.309	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	400

Designed with Level Soffits

Network Design Table for 7956 SW01 REV B.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	31.810	1.364	23.3	0.084	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	20.535	1.311	15.7	0.084	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	18.270	0.076	240.4	0.040	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	16.957	0.100	169.6	0.084	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	26.052	0.109	239.0	0.128	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	10.993	0.046	239.0	0.084	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	9.473	0.032	296.0	0.084	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	22.584	0.075	301.1	0.084	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	35.583	0.301	118.2	0.084	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	27.610	0.823	33.5	0.084	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.009	12.175	0.281	43.3	0.084	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	9.593	0.024	399.7	0.084	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.19	90.497	0.084	0.0	0.0	0.0	2.72	108.2	11.4
1.001	50.00	5.30	89.133	0.168	0.0	0.0	0.0	3.32	132.1	22.7
2.000	50.00	5.30	87.823	0.040	0.0	0.0	0.0	1.01	71.4	5.4
1.002	50.00	5.51	87.672	0.292	0.0	0.0	0.0	1.39	153.4	39.5
1.003	50.00	5.88	87.572	0.420	0.0	0.0	0.0	1.17	129.0	56.9
1.004	50.00	6.03	87.463	0.504	0.0	0.0	0.0	1.17	129.0	68.2
1.005	50.00	6.18	87.417	0.588	0.0	0.0	0.0	1.05	115.7	79.6
1.006	50.00	6.55	87.385	0.672	0.0	0.0	0.0	1.04	114.7	91.0
1.007	50.00	6.90	87.310	0.756	0.0	0.0	0.0	1.67	183.9	102.4
1.008	50.00	7.05	87.009	0.840	0.0	0.0	0.0	3.14	346.5	113.7
1.009	50.00	7.12	86.111	0.924	0.0	0.0	0.0	3.10	492.3	125.1
1.010	50.00	7.27	85.830	1.008	0.0	0.0	0.0	1.01	160.7	136.5

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Network Design Table for 7956 SW01 REV B.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.011	23.264	0.444	52.4	0.084	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.012	19.616	0.124	158.2	0.084	0.00	0.0	0.600	o	525	Pipe/Conduit	
3.000	20.803	0.122	170.5	0.084	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	40.346	0.248	162.7	0.084	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.013	63.103	0.158	399.4	0.085	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.014	45.670	0.114	400.6	0.085	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.015	10.095	0.025	403.8	0.085	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.016	47.451	0.119	398.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.017	8.717	0.022	396.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.018	9.031	0.053	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.011	50.00	7.40	85.731	1.092	0.0	0.0	0.0	3.10	671.0	147.9
1.012	50.00	7.58	85.287	1.176	0.0	0.0	0.0	1.78	385.0	159.2
3.000	50.00	5.35	85.833	0.084	0.0	0.0	0.0	1.00	39.7	11.4
3.001	50.00	5.89	85.636	0.168	0.0	0.0	0.0	1.23	86.9	22.7
1.013	50.00	8.53	85.163	1.429	0.0	0.0	0.0	1.11	241.3	193.5
1.014	50.00	9.15	84.930	1.514	0.0	0.0	0.0	1.21	342.2	205.0
1.015	50.00	9.29	84.816	1.599	0.0	0.0	0.0	1.21	340.9	216.5
1.016	50.00	9.95	84.616	1.599	0.0	0.0	0.0	1.21	343.1	216.5
1.017	50.00	10.07	84.497	1.599	0.0	0.0	0.0	1.22	344.2	216.5
1.018	50.00	10.22	84.475	1.599	0.0	0.0	0.0	1.00	39.8«	216.5

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Manhole Schedules for 7956 SW01 REV B.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	91.948	1.451	Open Manhole	1500	1.000	90.497	225				
2	90.655	1.522	Open Manhole	1500	1.001	89.133	225	1.000	89.133	225	
3	89.756	1.933	Open Manhole	1500	2.000	87.823	300				
4	89.981	2.309	Open Manhole	1800	1.002	87.672	375	1.001	87.822	225	
								2.000	87.747	300	
5	90.195	2.623	Open Manhole	1500	1.003	87.572	375	1.002	87.572	375	
6	90.513	3.050	Open Manhole	1500	1.004	87.463	375	1.003	87.463	375	
7	90.433	3.016	Open Manhole	1500	1.005	87.417	375	1.004	87.417	375	
8	90.144	2.759	Open Manhole	1500	1.006	87.385	375	1.005	87.385	375	
9	89.240	1.930	Open Manhole	1500	1.007	87.310	375	1.006	87.310	375	
10	88.584	1.575	Open Manhole	1500	1.008	87.009	375	1.007	87.009	375	
11	88.844	2.733	Open Manhole	1500	1.009	86.111	450	1.008	86.186	375	
12	88.510	2.680	Open Manhole	1800	1.010	85.830	450	1.009	85.830	450	
13	88.062	2.331	Open Manhole	1800	1.011	85.731	525	1.010	85.806	450	
14	86.937	1.650	Open Manhole	1800	1.012	85.287	525	1.011	85.287	525	
15	87.472	1.639	Open Manhole	1500	3.000	85.833	225				
16	87.154	1.518	Open Manhole	1500	3.001	85.636	300	3.000	85.711	225	
17	86.872	1.709	Open Manhole	1800	1.013	85.163	525	1.012	85.163	525	
								3.001	85.388	300	
18	86.891	1.961	Open Manhole	1800	1.014	84.930	600	1.013	85.005	525	
19	86.681	1.865	Open Manhole	1800	1.015	84.816	600	1.014	84.816	600	
20	86.600	1.984	Open Manhole	1800	1.016	84.616	600	1.015	84.791	600	175
21	86.600	2.103	Open Manhole	1800	1.017	84.497	600	1.016	84.497	600	
22	86.400	1.925	Open Manhole	2400	1.018	84.475	225	1.017	84.475	600	
23	85.500	1.078	Open Manhole	0		OUTFALL		1.018	84.422	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	332122.947	352506.950	332122.947	352506.950	Required	
2	332154.737	352505.822	332154.737	352505.822	Required	
3	332176.033	352489.442	332176.033	352489.442	Required	
4	332175.186	352507.693	332175.186	352507.693	Required	
5	332175.119	352524.650	332175.119	352524.650	Required	

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Manhole Schedules for 7956 SW01 REV B.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
6	332172.071	352550.523	332172.071	352550.523	Required	
7	332177.170	352560.261	332177.170	352560.261	Required	
8	332185.719	352564.342	332185.719	352564.342	Required	
9	332208.184	352566.652	332208.184	352566.652	Required	
10	332242.723	352575.207	332242.723	352575.207	Required	
11	332269.829	352580.456	332269.829	352580.456	Required	
12	332281.916	352578.994	332281.916	352578.994	Required	
13	332288.758	352572.269	332288.758	352572.269	Required	
14	332293.417	352549.476	332293.417	352549.476	Required	
15	332235.860	352522.903	332235.860	352522.903	Required	
16	332256.344	352526.533	332256.344	352526.533	Required	
17	332296.531	352530.109	332296.531	352530.109	Required	
18	332359.543	352533.499	332359.543	352533.499	Required	
19	332356.596	352579.075	332356.596	352579.075	Required	
20	332366.650	352578.154	332366.650	352578.154	Required	
21	332379.901	352532.591	332379.901	352532.591	Required	
22	332386.777	352527.234	332386.777	352527.234	Required	

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Manhole Schedules for 7956 SW01 REV B.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
23	332395.762	352528.145			No Entry	

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PIPELINE SCHEDULES for 7956 SW01 REV B.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	91.948	90.497	1.226	Open Manhole	1500
1.001	o	225	2	90.655	89.133	1.297	Open Manhole	1500
2.000	o	300	3	89.756	87.823	1.633	Open Manhole	1500
1.002	o	375	4	89.981	87.672	1.934	Open Manhole	1800
1.003	o	375	5	90.195	87.572	2.248	Open Manhole	1500
1.004	o	375	6	90.513	87.463	2.675	Open Manhole	1500
1.005	o	375	7	90.433	87.417	2.641	Open Manhole	1500
1.006	o	375	8	90.144	87.385	2.384	Open Manhole	1500
1.007	o	375	9	89.240	87.310	1.555	Open Manhole	1500
1.008	o	375	10	88.584	87.009	1.200	Open Manhole	1500
1.009	o	450	11	88.844	86.111	2.283	Open Manhole	1500
1.010	o	450	12	88.510	85.830	2.230	Open Manhole	1800
1.011	o	525	13	88.062	85.731	1.806	Open Manhole	1800
1.012	o	525	14	86.937	85.287	1.125	Open Manhole	1800
3.000	o	225	15	87.472	85.833	1.414	Open Manhole	1500
3.001	o	300	16	87.154	85.636	1.218	Open Manhole	1500
1.013	o	525	17	86.872	85.163	1.184	Open Manhole	1800
1.014	o	600	18	86.891	84.930	1.361	Open Manhole	1800
1.015	o	600	19	86.681	84.816	1.265	Open Manhole	1800
1.016	o	600	20	86.600	84.616	1.384	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	31.810	23.3	2	90.655	89.133	1.297	Open Manhole	1500
1.001	20.535	15.7	4	89.981	87.822	1.934	Open Manhole	1800
2.000	18.270	240.4	4	89.981	87.747	1.934	Open Manhole	1800
1.002	16.957	169.6	5	90.195	87.572	2.248	Open Manhole	1500
1.003	26.052	239.0	6	90.513	87.463	2.675	Open Manhole	1500
1.004	10.993	239.0	7	90.433	87.417	2.641	Open Manhole	1500
1.005	9.473	296.0	8	90.144	87.385	2.384	Open Manhole	1500
1.006	22.584	301.1	9	89.240	87.310	1.555	Open Manhole	1500
1.007	35.583	118.2	10	88.584	87.009	1.200	Open Manhole	1500
1.008	27.610	33.5	11	88.844	86.186	2.283	Open Manhole	1500
1.009	12.175	43.3	12	88.510	85.830	2.230	Open Manhole	1800
1.010	9.593	399.7	13	88.062	85.806	1.806	Open Manhole	1800
1.011	23.264	52.4	14	86.937	85.287	1.125	Open Manhole	1800
1.012	19.616	158.2	17	86.872	85.163	1.184	Open Manhole	1800
3.000	20.803	170.5	16	87.154	85.711	1.218	Open Manhole	1500
3.001	40.346	162.7	17	86.872	85.388	1.184	Open Manhole	1800
1.013	63.103	399.4	18	86.891	85.005	1.361	Open Manhole	1800
1.014	45.670	400.6	19	86.681	84.816	1.265	Open Manhole	1800
1.015	10.095	403.8	20	86.600	84.791	1.209	Open Manhole	1800
1.016	47.451	398.7	21	86.600	84.497	1.503	Open Manhole	1800

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PIPELINE SCHEDULES for 7956 SW01 REV B.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.017	o	600	21	86.600	84.497	1.503	Open Manhole	1800
1.018	o	225	22	86.400	84.475	1.700	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.017	8.717	396.2	22	86.400	84.475	1.325	Open Manhole	2400
1.018	9.031	170.0	23	85.500	84.422	0.853	Open Manhole	0

Free Flowing Outfall Details for 7956 SW01 REV B.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.018	23	85.500	84.422	0.000	0	0

Simulation Criteria for 7956 SW01 REV B.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.309		

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Online Controls for 7956 SW01 REV B.SWS

Hydro-Brake® Optimum Manhole: 22, DS/PN: 1.018, Volume (m^3): 10.6

Unit Reference	MD-SHE-0169-1570-1650-1570
Design Head (m)	1.650
Design Flow (l/s)	15.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	169
Invert Level (m)	84.475
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.650	15.7	Kick-Flo®	1.034	12.6
Flush-Flo™	0.483	15.6	Mean Flow over Head Range	-	13.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	6.0	1.200	13.5	3.000	20.8	7.000	31.3
0.200	13.8	1.400	14.5	3.500	22.4	7.500	32.3
0.300	15.0	1.600	15.4	4.000	23.9	8.000	33.4
0.400	15.5	1.800	16.3	4.500	25.3	8.500	34.4
0.500	15.6	2.000	17.2	5.000	26.6	9.000	35.3
0.600	15.5	2.200	18.0	5.500	27.9	9.500	36.3
0.800	14.9	2.400	18.7	6.000	29.0		
1.000	13.1	2.600	19.5	6.500	30.2		

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Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m^3)	Pipe Volume (m^3)	Storage Structure Volume (m^3)	Total Volume (m^3)
1.000	1	2.564	1.265	0.000	3.829
1.001	2	2.690	0.816	0.000	3.506
2.000	3	3.416	1.291	0.000	4.707
1.002	4	5.876	1.873	0.000	7.749
1.003	5	4.635	2.877	0.000	7.513
1.004	6	5.390	1.214	0.000	6.604
1.005	7	5.330	1.046	0.000	6.376
1.006	8	4.876	2.494	0.000	7.370
1.007	9	3.411	3.930	0.000	7.341
1.008	10	2.783	3.049	0.000	5.833
1.009	11	4.830	1.936	0.000	6.766
1.010	12	6.820	1.526	0.000	8.345
1.011	13	5.932	5.036	0.000	10.968
1.012	14	4.199	4.246	0.000	8.445
3.000	15	2.896	0.827	0.000	3.723
3.001	16	2.683	2.852	0.000	5.534
1.013	17	4.349	13.660	0.000	18.009
1.014	18	4.990	12.913	0.000	17.903
1.015	19	4.746	2.854	0.000	7.600
1.016	20	5.049	13.416	0.000	18.465
1.017	21	5.351	2.465	0.000	7.816
1.018	22	8.708	0.359	1223.388	1232.456
Total		101.522	81.948	1223.388	1406.858

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7956 SW01 REV B.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm)	18.000	Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.315	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					90.544
1.001	2	15 Winter	1	+0%	100/15 Summer				89.191
2.000	3	15 Winter	1	+0%	30/15 Summer	100/15 Summer			87.877
1.002	4	15 Winter	1	+0%	30/15 Summer				87.799
1.003	5	15 Winter	1	+0%	30/15 Summer				87.738
1.004	6	15 Winter	1	+0%	30/15 Summer				87.672
1.005	7	15 Winter	1	+0%	30/15 Summer				87.644
1.006	8	15 Winter	1	+0%	30/15 Summer				87.607
1.007	9	15 Winter	1	+0%	30/15 Winter				87.482
1.008	10	15 Winter	1	+0%	100/15 Summer				87.137
1.009	11	15 Winter	1	+0%	30/15 Winter				86.274
1.010	12	15 Winter	1	+0%	30/15 Summer				86.174
1.011	13	15 Winter	1	+0%	100/15 Summer				85.885
1.012	14	15 Winter	1	+0%	30/15 Summer	100/15 Winter			85.511
3.000	15	15 Winter	1	+0%	100/15 Summer				85.912
3.001	16	15 Winter	1	+0%	100/15 Summer				85.732
1.013	17	15 Winter	1	+0%	30/15 Summer				85.444
1.014	18	15 Winter	1	+0%	30/15 Winter				85.244
1.015	19	15 Winter	1	+0%	100/15 Summer				85.171
1.016	20	15 Winter	1	+0%	30/15 Winter				84.926
1.017	21	15 Winter	1	+0%	30/60 Winter				84.851
1.018	22	240 Winter	1	+0%	1/60 Summer				84.792

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7956 SW01 REV B.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.178	0.000	0.10			9.7	OK	
1.001	2	-0.167	0.000	0.15			17.8	OK	
2.000	3	-0.246	0.000	0.07			4.5	OK	4
1.002	4	-0.248	0.000	0.25			30.7	OK	
1.003	5	-0.209	0.000	0.38			42.1	OK	
1.004	6	-0.166	0.000	0.51			49.5	OK	
1.005	7	-0.148	0.000	0.68			57.0	OK	
1.006	8	-0.153	0.000	0.65			63.6	OK	
1.007	9	-0.203	0.000	0.43			70.6	OK	
1.008	10	-0.247	0.000	0.25			77.2	OK	
1.009	11	-0.287	0.000	0.28			83.8	OK	
1.010	12	-0.106	0.000	0.94			89.9	OK	
1.011	13	-0.371	0.000	0.19			96.0	OK	
1.012	14	-0.301	0.000	0.38			101.8	OK	1
3.000	15	-0.146	0.000	0.27			9.6	OK	
3.001	16	-0.204	0.000	0.22			17.8	OK	
1.013	17	-0.244	0.000	0.54			119.9	OK	
1.014	18	-0.286	0.000	0.40			119.0	OK	
1.015	19	-0.245	0.000	0.66			121.6	OK	
1.016	20	-0.290	0.000	0.40			120.1	OK	
1.017	21	-0.246	0.000	0.66			118.4	OK	
1.018	22	0.092	0.000	0.47			15.1	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7956 SW01 REV B.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.315 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%					90.571
1.001	2	15 Winter	30	+0%	100/15 Summer				89.233
2.000	3	15 Winter	30	+0%	30/15 Summer	100/15 Summer			88.349
1.002	4	15 Winter	30	+0%	30/15 Summer				88.339
1.003	5	15 Winter	30	+0%	30/15 Summer				88.236
1.004	6	15 Winter	30	+0%	30/15 Summer				88.141
1.005	7	15 Winter	30	+0%	30/15 Summer				88.039
1.006	8	15 Winter	30	+0%	30/15 Summer				87.902
1.007	9	15 Winter	30	+0%	30/15 Winter				87.701
1.008	10	15 Winter	30	+0%	100/15 Summer				87.225
1.009	11	15 Winter	30	+0%	30/15 Winter				86.575
1.010	12	15 Winter	30	+0%	30/15 Summer				86.390
1.011	13	15 Winter	30	+0%	100/15 Summer				86.019
1.012	14	15 Winter	30	+0%	30/15 Summer	100/15 Winter			85.938
3.000	15	15 Winter	30	+0%	100/15 Summer				85.967
3.001	16	15 Winter	30	+0%	100/15 Summer				85.881
1.013	17	15 Winter	30	+0%	30/15 Summer				85.824
1.014	18	15 Winter	30	+0%	30/15 Winter				85.536
1.015	19	30 Winter	30	+0%	100/15 Summer				85.416
1.016	20	240 Winter	30	+0%	30/15 Winter				85.258
1.017	21	240 Winter	30	+0%	30/60 Winter				85.254
1.018	22	240 Winter	30	+0%	1/60 Summer				85.252

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7956 SW01 REV B.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.151	0.000	0.23			23.7	OK	
1.001	2	-0.125	0.000	0.41			48.7	OK	
2.000	3	0.226	0.000	0.17			10.6	SURCHARGED	4
1.002	4	0.292	0.000	0.60			74.4	SURCHARGED	
1.003	5	0.289	0.000	0.94			105.1	SURCHARGED	
1.004	6	0.303	0.000	1.28			124.3	SURCHARGED	
1.005	7	0.247	0.000	1.70			142.8	SURCHARGED	
1.006	8	0.142	0.000	1.64			160.2	SURCHARGED	
1.007	9	0.016	0.000	1.04			171.7	SURCHARGED	
1.008	10	-0.159	0.000	0.61			186.3	OK	
1.009	11	0.014	0.000	0.68			202.7	SURCHARGED	
1.010	12	0.110	0.000	2.29			219.4	SURCHARGED	
1.011	13	-0.237	0.000	0.46			235.5	OK	
1.012	14	0.126	0.000	0.93			250.0	SURCHARGED	1
3.000	15	-0.091	0.000	0.64			23.2	OK	
3.001	16	-0.055	0.000	0.57			45.7	OK	
1.013	17	0.136	0.000	1.32			290.5	SURCHARGED	
1.014	18	0.006	0.000	0.99			294.1	SURCHARGED	
1.015	19	0.000	0.000	1.54			286.5	OK	
1.016	20	0.042	0.000	0.33			99.5	SURCHARGED	
1.017	21	0.157	0.000	0.53			95.1	SURCHARGED	
1.018	22	0.552	0.000	0.48			15.6	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7956 SW01 REV B.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000	Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.315	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 50

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+50%					90.604
1.001	2	15 Winter	100	+50%	100/15 Summer				90.345
2.000	3	15 Winter	100	+50%	30/15 Summer	100/15 Summer			89.767
1.002	4	15 Winter	100	+50%	30/15 Summer				89.920
1.003	5	15 Winter	100	+50%	30/15 Summer				89.907
1.004	6	15 Winter	100	+50%	30/15 Summer				89.792
1.005	7	15 Winter	100	+50%	30/15 Summer				89.623
1.006	8	15 Winter	100	+50%	30/15 Summer				89.406
1.007	9	15 Winter	100	+50%	30/15 Winter				89.079
1.008	10	15 Winter	100	+50%	100/15 Summer				88.435
1.009	11	15 Winter	100	+50%	30/15 Winter				87.786
1.010	12	15 Winter	100	+50%	30/15 Summer				87.507
1.011	13	15 Winter	100	+50%	100/15 Summer				87.173
1.012	14	15 Winter	100	+50%	30/15 Summer	100/15 Winter			86.937
3.000	15	15 Winter	100	+50%	100/15 Summer				86.940
3.001	16	15 Winter	100	+50%	100/15 Summer				86.849
1.013	17	15 Winter	100	+50%	30/15 Summer				86.727
1.014	18	15 Winter	100	+50%	30/15 Winter				86.082
1.015	19	480 Winter	100	+50%	100/15 Summer				86.042
1.016	20	480 Winter	100	+50%	30/15 Winter				86.040
1.017	21	480 Winter	100	+50%	30/60 Winter				86.036
1.018	22	480 Winter	100	+50%	1/60 Summer				86.034

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7956 SW01 REV B.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.118	0.000	0.45			45.8	OK	
1.001	2	0.987	0.000	0.62			73.9	SURCHARGED	
2.000	3	1.644	10.768	1.18			72.4	FLOOD	4
1.002	4	1.873	0.000	0.96			119.1	FLOOD RISK	
1.003	5	1.960	0.000	1.27			142.9	FLOOD RISK	
1.004	6	1.954	0.000	1.75			170.2	SURCHARGED	
1.005	7	1.831	0.000	2.38			200.5	SURCHARGED	
1.006	8	1.646	0.000	2.30			225.1	SURCHARGED	
1.007	9	1.394	0.000	1.48			244.9	FLOOD RISK	
1.008	10	1.051	0.000	0.89			271.0	FLOOD RISK	
1.009	11	1.225	0.000	1.00			298.2	SURCHARGED	
1.010	12	1.227	0.000	3.37			323.7	SURCHARGED	
1.011	13	0.917	0.000	0.68			348.2	SURCHARGED	
1.012	14	1.125	0.285	1.37			369.4	FLOOD	1
3.000	15	0.882	0.000	0.90			32.6	SURCHARGED	
3.001	16	0.913	0.000	0.79			63.9	SURCHARGED	
1.013	17	1.039	0.000	2.02			444.3	FLOOD RISK	
1.014	18	0.552	0.000	1.55			459.5	SURCHARGED	
1.015	19	0.626	0.000	0.63			117.5	SURCHARGED	
1.016	20	0.824	0.000	0.39			116.9	SURCHARGED	
1.017	21	0.939	0.000	0.65			116.5	SURCHARGED	
1.018	22	1.334	0.000	0.48			15.6	SURCHARGED	

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