



Wrexham County Borough Council

DERWENT CRESCENT, GARAGE SITE 2, ACTON, WREXHAM

Flood Risk Review and Drainage Strategy





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1 INTRODUCTION

1.1 COMMISSION

WSP were appointed by Wrexham County Borough Council (WCBC) to undertake a Flood Risk review (FRR) and Drainage Strategy (DS) to support the proposed redevelopment of a disused garage site off Derwent Crescent, Acton in Wrexham.

This report reviews the published flood risk information at the site and also provides an outline drainage strategy. The following were included in the production of this report:

- Consultations with WCBC and Dwr Cymru Welsh Water (DCWW) to obtain information relating to local flood risk issues for the site;
- Desktop review of all the potential sources of flooding at the site (i.e. fluvial, tidal, highways, groundwater, reservoir, sewers, canal, surface water); and
- Foul drainage and surface water runoff management for the proposed development.

This document has also been prepared in support of a Sustainable Drainage Approval Body (SAB) pre-planning application with WCBC.

1.2 POLICY CONTENT

This report has been prepared in accordance with the relevant national, regional and local requirements and guidance of the following publications and organisations:

- Technical Advice Note (TAN 15: Development and Flood Risk dated October 2004 issued by Welsh Government);
- Welsh Government Guidance – Statutory standards for sustainable drainage systems (designing, constructing, operating and maintaining surface water drainage systems) – 2018;
- Guidance for Pre-Application Approval and Full Application Approval of SuDS on new developments in accordance with The Sustainable Drainage (Approval and Adoption Procedure (Wales) Regulations 2018;
- Wrexham County Borough Council Flood Risk Management Plans 2016–2021;
- Building Regulations 2010 (Part H3);
- Sewers for Adoption 7th Edition;
- Planning Policy Wales Edition 11 (December 2018) issued by Welsh Government;
- Welsh Ministers Standards for Foul Sewers and Lateral Drains;
- The Sustainable Drainage Systems (SuDS) Manual C753, CIRIA;
- SuDS Wales; and
- Wrexham County Borough Council Management of Surface Water generated from new development (January 2020).

1.3 LIMITATIONS

The findings and opinions conveyed in this report are based on information obtained from a variety of sources, as detailed, which WSP believes are reliable. Nevertheless, WSP cannot and does not guarantee the authenticity or reliability of the information it has relied upon from these sources.

This report has been written on behalf of the Client and no responsibility is accepted to any Third Party for all or any part. This report should not be relied upon or transferred to any other parties without the express written authorisation of WSP. 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. WSP disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above contract.

This report has been prepared by WSP with all reasonable skill and care within the terms of the Contract with the Client and considering the information made available by the Client, as the manpower and resources devoted to it by agreement with the Client. It should be noted that the insurance market applies different tests to properties in relation to both determining premiums and, more fundamentally, determining the insurability of properties for flood risk. Those undertaking development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurance (ABI) to seek further guidance prior to commencing development. WSP do not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

The findings of this report have been based on data available at the time of study and on the review of available information that has been undertaken to date. They relate to the current development proposals as outlined in Appendix A. Should the proposed end use of the site change after the completion of this assessment, then the findings of this report will need to be reviewed and updated accordingly.

This report does not constitute a Flood Consequences Assessment in line with the requirements of TAN15. It provides a high-level desktop review of potential flood risk at the site.

2 EXISTING SITE AND DEVELOPMENT PROPOSALS

2.1 SITE LOCATIONS AND DESCRIPTIONS

The proposed development site is located off Derwent Crescent in Acton, Wrexham. The site has an approximate area of 0.031ha (of which 0.022 is hardstanding) and is centred at National Grid Reference SJ337515 (E: 333747, N: 351575).

The site is rectangular in shape and is situated within a residential area. The current use is a residential car park with an approximate area of 90m² of greenfield space. The site is bounded to: the north by Acton Park Way, the east by Derwent Crescent and the south and west by dwellings. A site location plan is shown in Figure 2-1 below.



Figure 2-1 – Site Location Plan (Source: Open Street Map, 2021)

A topographic survey undertaken by Battlefield Land Surveys (WRE12697 12/07/21) has been reviewed as part of this report and is included in Appendix A. The levels of the main site features are summarised as follows below:

- Site levels – Falls generally from north to south with levels ranging from 92.33mAOD to 90.34mAOD;
- Derwent Crescent road levels – The adjacent road levels fall generally from north to south with levels ranging from 91.77mAOD to 90.04mAOD; and
- Existing site access levels from Derwent Crescent – Fall from north to south ranging from 90.81mAOD to 90.41mAOD with a gradient of 1 in 54.

2.2 PROPOSED DEVELOPMENT

The proposed scheme consists of a single 2 storey dwelling and associated off road parking located within the site boundary. Based upon the development plans provided by the Client (included in Appendix B), the approximate final impermeable area of the development is in the region of 0.014ha. The existing and proposed impermeable areas are included in Table 2-1 below and in Appendix C.

Table 2-1 – Existing and Proposed Impermeable Areas

Proposal	Permeable (m ²)	Impermeable (m ²)
Existing	90	220
Proposed	170	140

2.3 GEOLOGY AND HYDROLOGY

A review of available geological and hydrogeological data on the British Geological Survey (BGS) was undertaken as part of this report in order to establish an understanding of the underlying geology and hydrogeology at the site. The geology present at the site is summarised in the below table 2-2:

Table 2-2 – Geological Summary

Geology	Geological Description	Source
Bedrock Geology	Salop Formation – Mudstone, Sandstone and Conglomerate. Sedimentary Bedrock formed approximately 272 to 310 million years ago in the Permian and Carboniferous periods. Local environment previously dominated by rivers.	British Geology Survey (online)
Superficial Geology	Glaciofluvial Sheet Deposits, Devensian – Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions.	British Geology Survey (online)
Soil Type	Freely draining slightly acid loamy soils.	Soilscapes (Landis.org.uk)

In the absence of phase 1 and phase 2 ground investigation data, a review of the borehole record SJ35SW/17A 316m to the south of the site was carried out (included in Appendix D). This record indicated that the general area to the south of the site comprises of underlying sands and gravels with clay between 0.15m BGL – 10.0m BGL with no recorded standing or seepage of groundwater. However, it should be noted that the level of which the borehole was drilled was 84mAOD which is 6mAOD lower than the development site. The precise geological data should be determined from the undertaking of a ground investigation prior to detailed design.

A review of the data available on Defra's MAGIC Map was also undertaken; the granular deposits are designated as a Secondary A Aquifer within the site and the surrounding area. The bedrock aquifer is classified as unproductive within the site and is not located within a ground water source protection zone.

On the basis of the above, it is indicated that the site may be suitable for the use of an infiltration-based drainage system as a means of disposal of surface water generated by the site. It is however recommended that BRE365 infiltration testing is carried out on the site to establish an appropriate infiltration rate to be used as part of the future detailed SuDS design.

2.4 EXISTING DRAINAGE

2.4.1. PUBLIC SEWERS

A review of the sewer and drainage survey undertaken by Invek Surveys (Appendix E) indicated the presence of two 150mm diameter vitrified clay (VC) combined sewers adjacent to the western boundary of the site with manhole reference SJ33517503. This sewer currently runs through the site from the north western corner.

2.4.2. EXISTING SITE DRAINAGE

The DCWW sewer records (Appendix F) and Invek drainage survey plans confirmed that there are no standalone surface water drainage sewer networks within the vicinity of the site. The surface water run-off collected within the existing gulleys at the site are conveyed directly to the DCWW combined water network.

It was also noted that, from the south eastern corner of the site, there are two highway road gulleys on Derwent Crescent. These drain towards the south through a 150mm diameter PVC surface water pipe before discharging to a DCWW combined water sewer located 64m west on Oak Drive.

From a review of imagery provided by Invek it would appear that this drain is inadequate for any surface water connections due to the condition and construction makeup.

3 CONSULTATIONS

3.1 WREXHAM COUNTY BOROUGH COUNCIL (WCBC)

Consultation has been undertaken with WCBC as the SuDS Approval Body (SAB) and Lead Local Flood Authority (LLFA); their response is included within Appendix G. WCBC stated the following in their response (*Italics*):

- Any known surface water or foul sewer flooding issues at this area? ***There are no surface water issues recorded in this area. For foul records please redirect this to Welsh Water.***
- Any historical surface water flooding issues at the site? **No**
- Any groundwater flooding or emergence issues and information about local groundwater infiltration potential of the general area? **No**
- Any known highway flooding issues? **No**
- Does the site lie near or within a Critical Drainage Area? **No**
- Are there any known culverted watercourses on site or within its vicinity? **No**
- Any known ground contamination issues, which may affect any future surface water drainage design using infiltration techniques? ***We do not hold contaminated land information please contact environmental health for this information.***
- Based on recent local development, in this area, could you please advise if soakaways are generally feasible or effective for surface water management? ***There has been no recent development in this area.***
- In the event that discharge to a sewer is the only feasible option at the site, please could you specify a surface water discharge rate and attenuation volume requirements which would be acceptable in this instance? ***If discharge to a sewer is the only viable option, then approval from Welsh Water will be required.***
- Are there any specific SuDS features (attenuation and water quality) that WCBC would generally specify for a residential development of this scale? ***Please refer to the SuDS Guidance documents.***

3.2 DWR CYMRU WELSH WATER (DCWW)

A DCWW Developers enquiry (included in Appendix H) and consultations with Developer Services were carried out as part of this study. The response can be summarised as follows:

- Any known surface water or foul sewer flooding issues in this area? ***We do not have surface water sewers in vicinity of site, there have been no sewer flood incidents within 50 meters of the site. There has been one within 70 but this was not DG5***
- Are any properties within this area on the DG5 flooding register? **No**
- Are there any plans for the construction of new foul and / or surface water sewers in this area for flood risk management purposes? ***Not that I am aware of***
- Is there any on-going Section 104 adoptions or Section 185 sewer diversions currently being undertaken in the area? ***None within the vicinity of the site***
- Is there any capital development sewer upgrading schemes planned in this area in the near future? ***Not that I am aware of***

- Although it is not indicated on the sewer record that any foul/combined sewers run through the site, are you aware of any unrecorded DCWW assets within the site boundary which may require diversion or relocating as part of the proposed residential development? ***We only mark on our plans assets that are known. We would advise the completion of utility surveys to take place prior to commencement of operational development.***
- DCWW have provisionally confirmed their acceptance of foul flows generated by the development being communicated with the combined sewer network within the site.

DRAFT

4 FLOOD RISK REVIEW

A desktop review of available flood risk data was carried out as part of this drainage strategy to understand the flood risk at the site from the relevant sources. This is summarised in Table 4-1 below.

4.1 SUMMARY TABLE

Table 4-1 – Flood Risk Summary

Source	Risk	Description and Comments	Information Source
Fluvial	N/A	There are no culverted or open watercourses within the immediate vicinity of the site that present a fluvial flood risk.	NRW – FRA Wales Map (Aug 2021)
Surface Water	Low Risk	Derwent Crescent (road) and the site boundary appears to be at surface water flooding risk during a 1000yr rainfall event due to their topographic levels (Appendix D). The risk presented to the site could be significantly reduced by the installation of surface water drainage along the site entrance to mitigate exceedance flows from intruding on the site from the adjoining road.	WCBC SW Flood Map (Aug 2021)
Tidal	N/A	The site is located inland and therefore no tidal flood risk is considered.	NRW – FRA Wales Map (Aug 2021)
Reservoir	N/A	There are no reservoirs located within the surrounding areas of the site boundary. Therefore, there is no reservoir flood risk.	NRW – FRA Wales Map (Aug 2021)
Groundwater	Very Low Risk	The WCBC Preliminary Flood Risk Assessment holds no records of past groundwater flooding within the county.	WCBC FRMP (2016-2021)
Sewers	Very Low Risk	DCWW did not provide any information regarding the risk of flooding from the sewers surrounding the site. As the proposed building will be set 150mm above the external ground levels at the site the risk of flooding from sewers is considered to be low.	DCWW Sewer Records (2021)
Canal	N/A	There are no canals located within the surrounding areas of the site boundary. Therefore, there is no canal flood risk.	NRW – FRA Wales Map (Aug 2021)

5 DRAINAGE PROPOSALS

5.1 FOUL DRAINAGE

The foul drainage disposal is proposed to follow the requirements of Building Regulations 2010 Part H (2015 Edition), Drainage and Waste Disposal and Sewers for Adoption 7th Edition.

Part H1 of the above document contains the following requirements:

“An adequate system of drainage shall be provided to carry foul water from appliances within the building on to the following, listed in order of priority”

- (a) A public sewer or where that is not reasonably practicable;
- (b) A private sewer communicating with a public sewer, or where that is not reasonably practicable,
- (c) Either a septic tank which has appropriate form of secondary treatment or another wastewater treatment system; or, where that is not reasonably practicable; and
- (d) A cesspool.

5.1.1. CONNECTION TO A PUBLIC SEWER

A review of the DCWW sewer records indicates the presence of a 150mm diameter VC combined sewer that is located within the neighbouring property 12m to the west of the site. The drainage connectivity survey by Invek indicates that the combined sewer runs from a chamber in the neighbouring property to the west to an unnamed chamber (extra 03 – Invek) within the southern portion of the site.

Due to the space limitations of the site with regards to the nature of the proposed development, it appears that the proposed building footprint will clash with the existing combined sewer alignment. Therefore, the approximate 18.5m length of combined sewer will need to be diverted around the building whilst adhering to DCWW specific diversion requirements including easements, construction and hydraulic design standards.

Based on the proposed site layout plan at the time of writing, it appears that the most appropriate mode of connection of the foul from the proposed development would be to construct a new chamber over the existing 150mm VC sewer within the western side of the site and reconnect at the southern part of the site downstream of SJ33517503. This would be subject to a Section 185 agreement with DCWW under the Water Industry Act 1991, which should be designed and administrated in tandem with the detailed design phase of the project. A build over agreements (BOS) could be explored, however, these are predominantly only accepted for extensions to existing dwellings and is therefore unlikely to be accepted by DCWW. We would advise that further consultations are carried out with DCWW prior to detailed design.

An indicative foul drainage strategy proposal drawing is included within Appendix I of this report. This shows a gravity connection from the proposed development to the local sewer. This also shows a proposed S185 diversion option for the existing foul sewer which currently crosses the site.

5.2 SURFACE WATER DRAINAGE

5.2.1. SURFACE WATER DRAINAGE POLICY AND GUIDANCE

The Welsh Government Planning Policy Wales guidance states the following “flood risk is a material planning consideration”. Technical Advice Note 15: Development and Flood Risk (TAN15, 2004) also states that “surface water is a material consideration and explains that development should not create additional runoff compared with the undeveloped situation and re-development schemes should also aim to reduce run-off where possible.”

The aim of a surface water drainage strategy is to focus on the capture and management of surface water within the site boundary and ensure compliance with the requirements and guidance of the following publications and organisations:

- Welsh Government Guidance – Statutory standards for sustainable drainage systems (designing, constructing, operating and maintain surface water drainage systems) – 2018;
- Guidance for Pre-Application Approval and Full Application Approval of SuDS on new developments in accordance with The Sustainable Drainage (Approval and Adoption Procedure) (Wales) Regulations 2018;
- Wrexham County Borough Council Flood Risk Management Plan 2016-2021;
- Building Regulations 2010 (Part H3);
- Sewers for Adoption 7th Edition;
- Planning Policy Wales Edition 11 (December 2018) issued by Welsh Government;
- Welsh Ministers Standards for Foul Sewers and Lateral Drains;
- The new Sustainable Drainage Systems (SuDS) Manual C753, CIRIA;
- RainScape – Dwr Cymru Welsh Water;
- SuDS Wales; and
- Wrexham County Borough Council Management of Surface Water generated from new development (January 2020).

In accordance with the above, surface water drainage systems are required to consider quantity, quality, amenity and biodiversity whilst preventing any likelihood of flooding to the site or adjacent sites. WCBC’s SAB guidance recommends that surface water runoff shall discharge to one of the following, listed in order of priority:

1. Surface water runoff is collected for use (rainwater harvesting);
2. Discharge to the ground;
3. Discharge to a surface water body;
4. Discharge to a surface water sewer; and
5. To a combined sewer where there are absolutely no other options and only where agreed in advance with the relevant sewerage undertaker.

It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local run-off profile by using systems that can either attenuate run-off and reduce peak flow rates or positively impact on the existing flood profile.

5.2.2. RAINWATER COLLECTED FOR REUSE (SAB S1)

Although the potential use of a rainwater harvesting system for a development of this scale is limited, there are options of installing a non-potable harvesting system to be used for toilet facility flushes and use within the landscaped area within the site boundary. It is advised that options for SAB S1 compliance is reviewed by the Client prior to detailed design and subsequent full SAB application and approval.

5.2.3. DISCHARGE TO THE GROUND (SAB S2)

From a review of the BGS borehole record SJ35SW/17A to the south of the site, it appears the underlying geology largely comprises of sand, gravel and clay. Generally, this would be considered suitable for the use of infiltration drainage, however, it is advised that BRE365 soakaway testing is conducted on site to establish a precise infiltration rate and subsequently the feasibility of using a soakaway system to drain the surface water generated by the site. Based on preliminary figures provided by C753 (SuDS Manual), strata of this nature could see an infiltration rate in the region of 1×10^{-7} m/s. To cater for 100yr + 40% CC storage volume and an indicative infiltration rate of 1×10^{-7} m/s, an infiltration crate system in the order of 4.8x4.8x0.66m would be sufficient. The siting of a system of this size would need to be reviewed against the requirements of The Building Regulations (2010) part H3 during the detailed design of the scheme prior to full SAB application.

On the basis of the above information, the option of drainage discharge into the ground is therefore considered to be potentially suitable but will require further review following BRE 365 tests on site.

5.2.4. DISCHARGE TO A SURFACE WATER BODY (SAB S3)

There are no known ordinary or main river watercourses within the immediate proximity of the site. A review of the NRW mapping also indicates that the closest surface water body to the site is the Afon Gwenfro approximately 1.4km to the south of the site. This is not suitable as a means of draining the surface water from the site, particularly in a heavily populated residential area, therefore this option is discounted. It should be noted that there are no known surface water culverts located within the vicinity of the site, therefore the option to discharge via a surface water culvert is discounted.

5.2.5. DISCHARGE TO A SURFACE WATER SEWER (SAB S4)

A review of the DCWW sewer records indicates that the area is not served by a standalone surface water sewer system. The Invek drainage survey confirmed road gulleys within the public highway are communicated with the wider combined sewer network. Two highway drainage surface water gulleys were identified to the south east of the site at the entrance to a neighbouring property; however, photographic evidence confirmed that these would not be suitable to cater for the surface water flows from the proposed development. It is also likely that the flows from this discharge to the DCWW combined network within the highway to the south. This option has therefore been discounted.

5.2.6. DISCHARGE TO A COMBINED SEWER (SAB S5)

In order to facilitate the construction of the proposed development building, a Section 185 sewer diversion will be required. This should be diverted around to the south west corner of the building whilst maintaining a 3m easement from a permanent structure before reconnecting into the existing sewer pipe downstream of existing chamber extra-03 as identified by Invek. The controlled surface water connection to the sewer should be via a hydro-brake chamber within the paved area within the southern portion of the site which will discharge by gravity. As provisionally proposed by DCWW, the forward flow discharging surface water into the sewer should be restricted to between 2 and 5L/s. This new connection would also be subject to a Section 106 consent to discharge with DCWW which should be in place prior to construction phase.

An indicative surface water drainage strategy drawing is included with Appendix I

5.2.7. SUDS OPTIONS

As part of the detailed drainage design, there are other sustainable drainage methods that can be considered to comply with the requirements of SuDS Manual (CIRIA C753, November 2015). This will also ensure that the treatment train proposed will be appropriate and proportionate with the level of pollution risk prior to the discharge of the surface water runoff from the proposed development.

Based upon the latest proposed development plans, the following SuDS methods would be suitable for use at the proposed development:

- Permeable paving within the car park to the front of the building;
- Infiltration storage crates beneath the car park (if soakaway drainage permits at detailed design stage);
- Rainwater gardens adjacent to the permeable area adjacent to the building; and
- Catchpit chambers to intercept silts and debris.

5.2.8. RUN-OFF RATES

The existing greenfield and brownfield run-off rates for the site have been calculated using the ICP SuDS Mean Annual Flood tool on Windes Micro Drainage; these are summarised in Table 5-1 below and also included in Appendix J

Table 5-1 – Summary of Existing Greenfield Run-off Rates

Return Period	Discharge Rates (L/s)
Qbar (1 in 2.2)	0.1
1 in 1 year	0.1
1 in 30 years	0.2
1 in 100 years	0.3
1 in 100 years + 40% CC	0.42

As the existing site is developed and the totality of the area within the redline boundary is impermeable, the brownfield discharge rate has been estimated using the Modified Rational Method, this is as follows:

$$Q = C I A$$

Q = Discharge (L/s)

C = Coefficient of Runoff (1.0)

I = Rainfall Per Hour (50mm)

A = Area (0.031ha)

$$Q = 1.55\text{L/s}$$

5.2.9. DISCHARGE RATES AND ATTENUATION REQUIREMENTS

Acknowledging that the existing brownfield run-off rate for the site using the Modified Rationale Method is 1.55L/s, it should be noted that this is unsuitable for forward flow restriction devices such as Hydro-brakes due to the possible issue of siltation build up. It is generally recommended that a minimum of 2L/s is used to reduce the risk of blockages. Therefore, a discharge rate of 2L/s has been used for the basis of the drainage strategy storage and discharge calculations. This rate has provisionally been accepted by DCWW in the event that soakaway testing to BRE365 reveal that the site is not appropriate for infiltration.

The attenuation requirements have been determined using Microdrainage Windes for the 100 year + 40% climate change events, using a maximum discharge rate of 2L/s as stipulated by DCWW. It has been estimated that the below ground attenuation providing between 1.3m³ and 3.6m³ of storage volume would be required to provide suitable capacity for the proposed development (Table 5-2 below) and included in Appendix L. This could be provided using a permeable paving underground attenuation crate system beneath the car parking spaces parallel to the front elevation of the building. However, this remains subject to detailed design and review against The Building Regulations (2010) Part H3.

It would be possible to reduce the total volume of attenuation required by including rainwater harvesting within the proposed development. Additionally, if BRE365 testing permits, a partial infiltration system could be provided as part of the overall site attenuation to marginally reduce the total discharge rate to the existing DCWW combined sewer system.

Table 5-2 – Summary of Indicative Attenuation Volumes

Discharge Rate (L/s)	Indicative Attenuation Volume (m ³)
2	1.3 – 3.6

5.2.10. WATER QUALITY

The SuDS Manual (CIRIA C753, November 2015) introduced a slightly different approach compared to the previous version for the water quality management of surface water. The manual describes risks posed by the surface water runoff to the receiving environment as a function of:

- The pollution hazard at a particular site (i.e. the pollution source);
- The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels (i.e. the pollutant pathway); and
- The sensitivity of the receiving environment (the environment receptor).

The proposed land uses requiring surface water drainage for this site are as follows:

- Roof areas – surface water discharge to roof sump gully's before discharging through the permeable paving car park into an attenuation crate; and
- Car parking area – surface water discharge to permeable paving, catchpits and rain gardens.

Table 26.2 of the SuDS Manual C753 assigns pollution hazard indices for different land use classification. The roof water and car parking areas pollution have hazard levels ranging from “Very Low” to “Low” levels of contamination. Proposed sump gullies are therefore deemed to be sufficient to remove the suspended sediments from the roof and car park surface water for a development of this size and nature. Permeable paving for the car parking areas, if suitable, for this site would also provide additional treatment to the runoff prior to discharge.

5.2.11. BIODIVERSITY AND AMENITY

This section presents general information on potential amenity and biodiversity benefits related to the proposed open SuDS features.

Amenity is one of the four pillars of SuDS design and focuses on the usefulness and aesthetic elements of the SuDS design associated with features at or near the surface. The integration of SuDS with enhanced provision of amenity and biodiversity within the proposed site provides the following benefits:

- Efficient use of space through multi-functionality;
- Usability through the integrated use of landscaping space;
- Visual aesthetics and biodiversity interest as part of the integrated site design;
- Enhancement of wildlife habitats; and
- Management train filtration of silt and sediment providing improvement to water quality.

SuDS provisions should be considered at the early stages of site layout master planning to ensure adequate volumes can be attenuated, treated and conveyed between SuDS features such rainwater gardens and attenuation systems. These are typically located within proposed soft landscaped areas, where possible.

The Garage Site 2 development site layout masterplan has provided space at the northern and eastern boundary adjacent to Derwent Crescent where open SuDS could be included. However, given the existing topography of the site in relation to the building positioning, it is unlikely open SuDS storage could be located within the northern portion of the site within the green area. Therefore, a raingarden has been proposed as part of the drainage strategy to provide biodiversity enhancement.

5.2.12. RESIDUAL RISKS AND EXCEEDANCE FLOWS AND RUNOFF IN EXCESS OF DESIGN CRITERIA

The outline surface water drainage scheme for this development is proposed to comply with the requirements of Sewers for Adoption, i.e. no surcharge in the 1 in 1-year event and no flooding in the 1 in 30-year event.

It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible. It is practicable to minimise the risk by careful design of the layout of the development such that internal flooding is avoided. Areas of hardstanding can be laid to fall away from buildings with flows directed to areas where damage and disruption to buildings, assets and operations are minimised.

The amenity and landscaped areas could also be used to accommodate residual flows beyond the design 1 in 100 year plus climate change event, without causing flooding elsewhere. This should be investigated during detailed design stages. To minimise risk of internal flooding, the finished floor level should be set at a minimum of 150mm above the external ground levels.

5.2.13. GENERAL MAINTENANCE REQUIREMENTS

The surface water drainage proposals for this site should include the following maintenance measures:

- Cleaning the sump of the gullies, linear drainage channels and roof sump gullies to improve the quality of the water;
- Cleaning and maintenance of flow control device and its sump to maintain effective drainage;
- Inspection, cleaning and maintenance of the below ground attenuation systems to remove any silt and debris in accordance with the manufacturer's instructions; and
- Maintenance of the rainwater gardens.

The frequency of the cleaning and maintenance inspections will be agreed with the site owner/operator's maintenance team. In addition, a drainage maintenance plan needs to be included as part of a full SAB application to accompany the detailed surface water drainage design.

6 CONCLUSIONS AND RECOMMENDATIONS

The flood risk review has identified that the site is at low risk of surface water flooding during a 1 in 1000-year return period event. Flooding from other sources including fluvial, groundwater, reservoir, canals and sewers is considered to be between “very low” and “low”.

A drainage connectivity survey by Invek confirmed that a combined water sewer flows beneath the footprint of the proposed building. As BOS agreements are only accepted for extension to existing dwellings, it is likely that DCWW would require that a Section 185 sewer diversion is undertaken ahead of the proposed development and the detailed design phase.

During the pre-development enquiries with DCWW, they confirmed that foul water discharge from the proposed development would be accepted into their sewer system downstream of manhole SJ33517503 by gravity, this would be subject to a Section 106 agreement following an agreed Section 185 sewer diversion.

SAB S1 compliance (rainwater for reuse) is possible at the site which can be discharged by gravity and could be utilised for non-potable water consumption at the development. This should be explored further at detailed design stage and prior to full SAB application. Geological data near the site indicates that surface water disposal using a soakaway-based drainage system may be possible due to the nature of the underlying geology, however this should be confirmed following the undertaking of ground investigations including infiltration testing to BRE365 guidance. Surface water disposal to a watercourse was discounted as there are no surface water bodies within the proximity of the site. Similarly, discharge to a standalone surface water drain/sewer was discounted as there are no suitable surface water sewer systems within the proximity of the site.

Should soakaways not be feasible, DCWW has provisionally accepted a discharge rate between 2 and 5L/s to the existing combined sewer to the south of the site. Based on a 2L/s discharge rate, to cater for 100yr + 40% CC event, up to 3.6m³ of surface water attenuation would be required. This could be located within the parking bays to the front of the proposed building. A forward flow restriction device could be located adjacent to the south elevation discharging the water to the final chamber of the proposed S185 diversion built over the existing sewer. This would be subject to a Section 106 discharge consent with DCWW prior to construction.

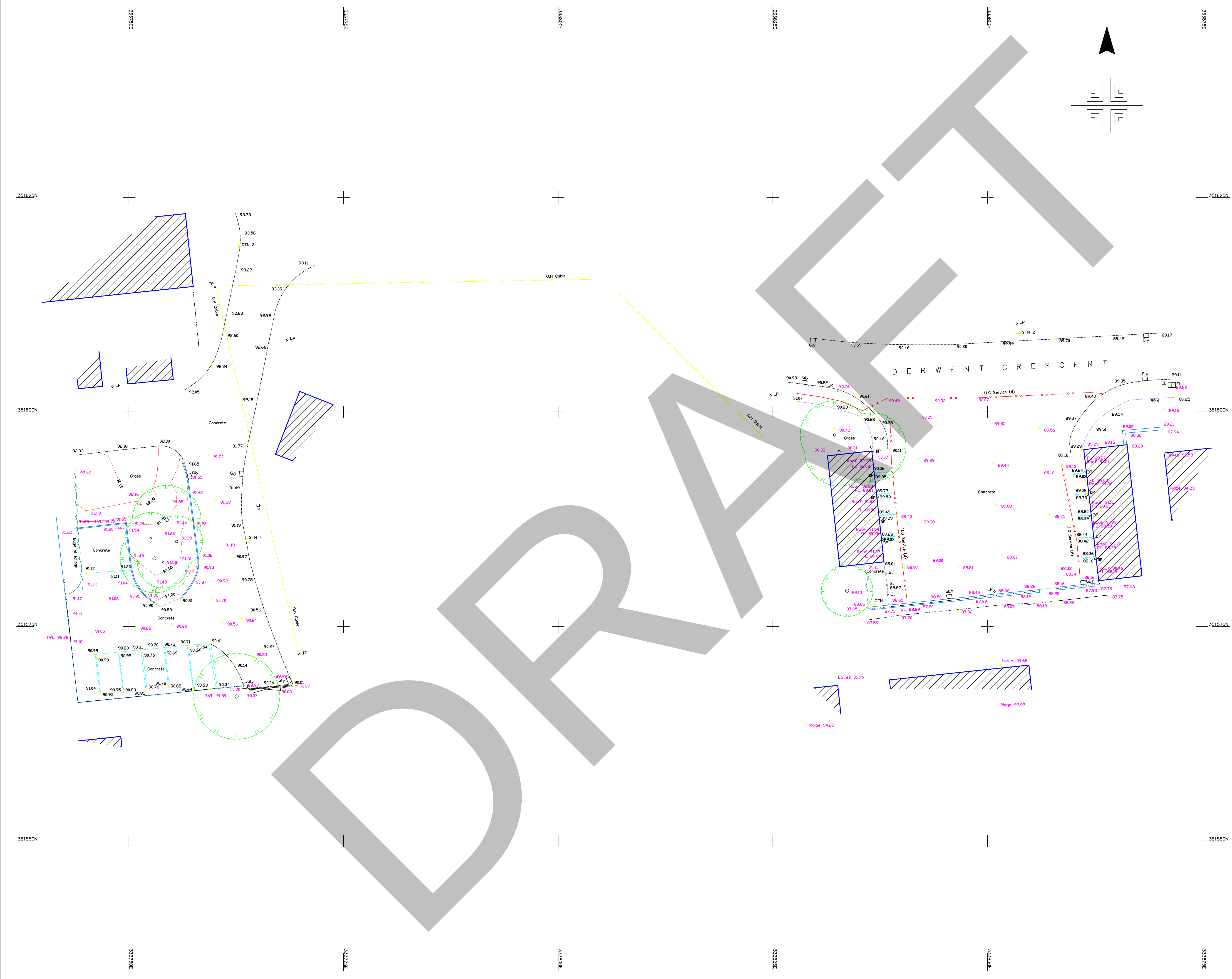
6.1 RECOMMENDATIONS

It is recommended that the proposal presented within this drainage strategy and the appended outline design drainage drawings are taken forward to the relevant pre-SAB applications and subsequent detailed design stages. It is also advised that the applicable adoptions, applications and consents such as S185 and S106 are submitted promptly following the completion of the detailed drainage design at the relevant stages to avoid any delays.

Appendix A

TOPOGRAPHIC SURVEY

WSP



Legend

BL BOLLARD

BS BUS STOP

CATV CABLE TV COVER

CL COVER LEVEL

CPS CONCRETE PAVING SLAB

DP DRAIN PIPE

DK DROP KERB

EL ELECTRICITY COVER

EP ELECTRICITY POLE

ER EARTH ROD

FH FIRE HYDRANT

FL FLOOR LEVEL

FS FLAG STAFF

G GAS COVER

GLY GULLY

GSV GAS STOP VALVE

IC INSPECTION COVER

IL INVERT LEVEL

LB LITTER BIN

LP LAMP POST

MKR MARKER

NB NOTICE BOARD

P POST

PH POST HOLE

PLP PEDESTRIAN LAMP POST

RE RODDING EYE

RS ROAD SIGN

STN SURVEY STATION

STY STAY WIRE

T TELECOMMUNICATIONS COVER

TL TRAFFIC LIGHT

TP TELEGRAPH POLE

TWL TOP OF WALL LEVEL

UTL UNABLE TO LIFT

UTM UNABLE TO MEASURE

VP VENT PIPE

WL WATER LEVEL

WP WASTE PIPE

WSV WATER STOP VALVE

FENCE TYPES

B/W BARBED WIRE

C/B CLOSE BOARD

P/W POST AND WIRE

P/R POST AND RAIL

C/L CHAIN LINK

C/P CHESTNUT PALE

C/W CHICKEN WIRE

M/R METAL RAIL (SECURITY TYPE)

P/F PANEL FENCE

C/I CORRUGATED IRON

I/R IRON RAILING

RWL RETAINING WALL

Notes

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ANY SERVICES SHOWN ARE AS LOCATED BY EITHER GROUND PENETRATING RADAR (GPR) OR BY RADIO DETECTION SCANNER IN EITHER ACTIVE (A) OR PASSIVE MODE (P). DUE TO SUBSOIL CONDITIONS AND OTHER FACTORS THE UNDERGROUND SERVICE INFORMATION SHOWN MAY NOT REPRESENT A COMPREHENSIVE RECORD AND ALL CONTRACTORS SHOULD PROCEED WITH CAUTION BEFORE EXCAVATION

xx --- xx DENOTES OVERHEAD CABLES

* --- * DENOTES UNDERGROUND SERVICES

LEVELS AT ROAD KERBS ARE TAKEN AT CHANNEL LEVELS UNLESS OTHERWISE REQUESTED

STATION CO-ORDINATES

STN 1 E 333836.810 N 351577.584 H 88.853

STN 2 E 333853.691 N 351609.151 H 90.012

STN 3 E 333762.792 N 351619.352 H 93.517

STN 4 E 333763.644 N 351585.224 H 91.171

BATTLEFIELD LAND SURVEYS LTD

3 YEOMANRY ROAD

BATTLEFIELD ENTERPRISE PARK

SHREWSBURY

SHROPSHIRE SY1 3EH

TEL/FAX 01743 443388

EMAIL MAILBOX@BLSURVEYS.CO.UK

Client

WREXHAM COUNTY BOROUGH COUNCIL

Title

DERWENT CRESCENT WREXHAM

Scale

Date

Job No

Dwg No

Rev.

1 : 200

12/07/21

12697

01

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Surveyed by

Checked

Scanned

Levels are related to . . .

RDL / JG

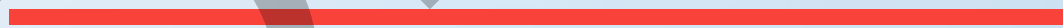
RDL

YES

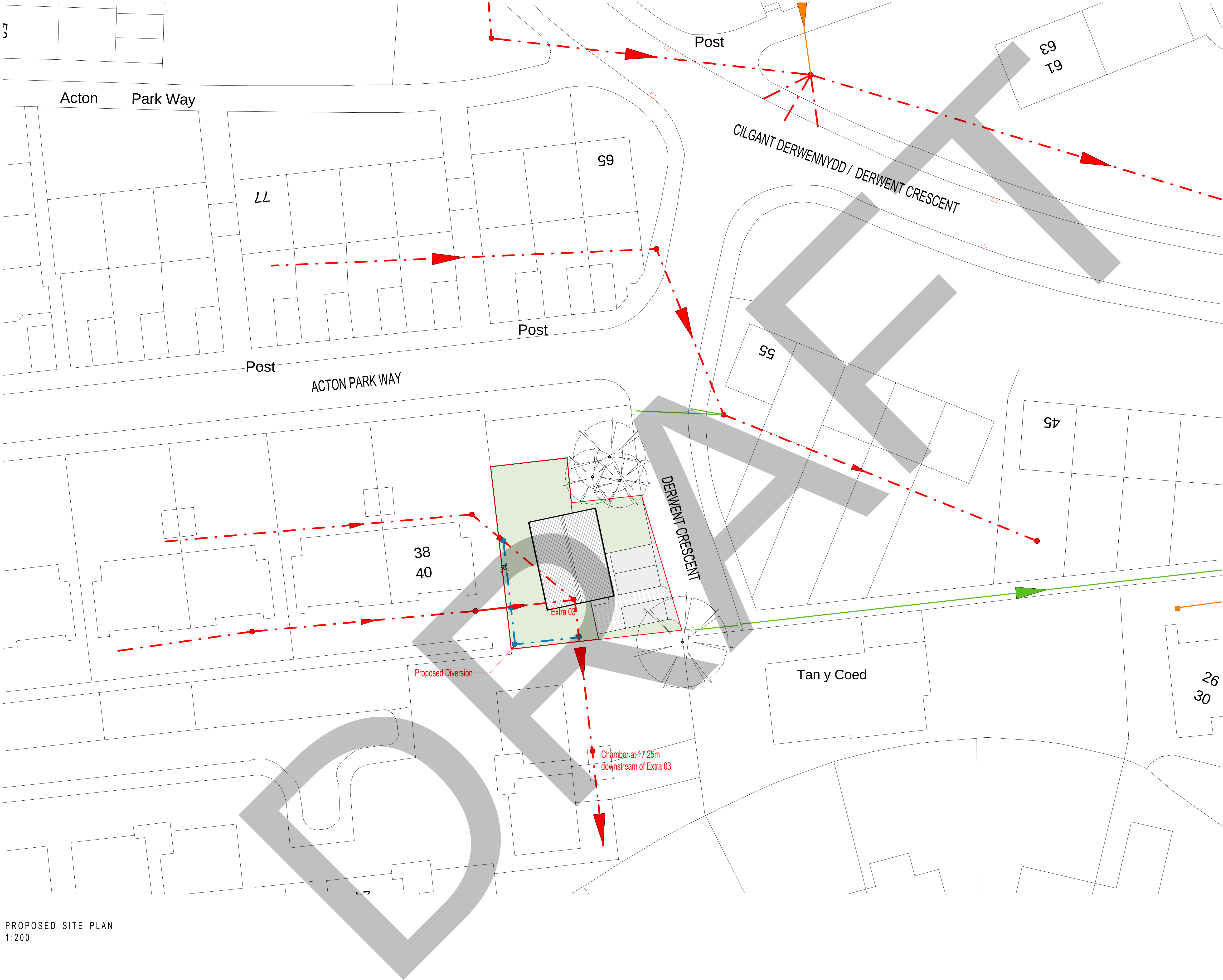
OS DATUM (VRS)

Appendix B

SITE LAYOUT



WSP



Construction (Design and Management) Regulations
Design risk assessments are carried out throughout the design stage of this project in accordance with company procedures and manuals. Where reasonably possible all areas of risk applicable to design and end use of the construction have been identified and then eliminated, mitigated or recorded as a residual risk. Note that general risks of which a competent designer or contractor should be aware are not included. This drawing is to be read in conjunction with the Pre-construction Information and all related documents prepared in accordance with the current Construction (Design and Management) Regulations 2015 and all applicable Health and Safety legislation as currently amended.

- Drainage Legend:
- Combined Sewer
 - Foul Sewer
 - SW Sewer
 - Combined Down Pipe
 - Foul Down Pipe
 - Rain Water Down Pipe

P03	Revised Issue	AJ KOH KOH	21/09/2021
P02	Revised Issue	CH KOH KOH	01/09/2021
P01	Initial Issue	CH CB KOH	30/07/2021
REV.	DESCRIPTION	(DRAWN BY) (CHECKED BY) (APPROVED BY)	DATE
RIBA PLAN OF WORK 2013 WORKSTAGE	LEVEL OF MODEL DEFINITION (LoD)		
Stage 3 - Spatial Coordination	LoD 3 - Approximate Model		
PURPOSE OF ISSUE - SUITABLE FOR ...	BS1192 STATUS		
Information	Status S3 - Review & Comment		

lawray architects
penseiri

CARDIFF 029 2052 8140
LONDON 0207 138 3560
WREXHAM 01978 357 887
www.lawray.co.uk
CLIENT
WCBC

PROJECT TITLE
Acton Housing WCBC

DRAWING TITLE
Derwent Crescent 2 - Proposed Site Plan

PROJECT No
19545
SCALE @ A1
1 : 200

DRAWING No	PROJECT	ORIGINATOR	VOLUME	LEVEL	TYPE	ROLE	REVISION
BS1192:2007 +A2:2016/8 BS EN 62060	AHW-LAW-X-X-DR-	A-069002	P03				

DO NOT SCALE
Any discrepancy or query concerning this drawing should be referred to the Architect
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Registered Office: Greenmeadow Springs, 1 Cae Gwynedd, Tongwynlais, CARDIFF CF15 7AB
Reg. Co. No. 2724178, VAT Reg. No. 134 2148 06

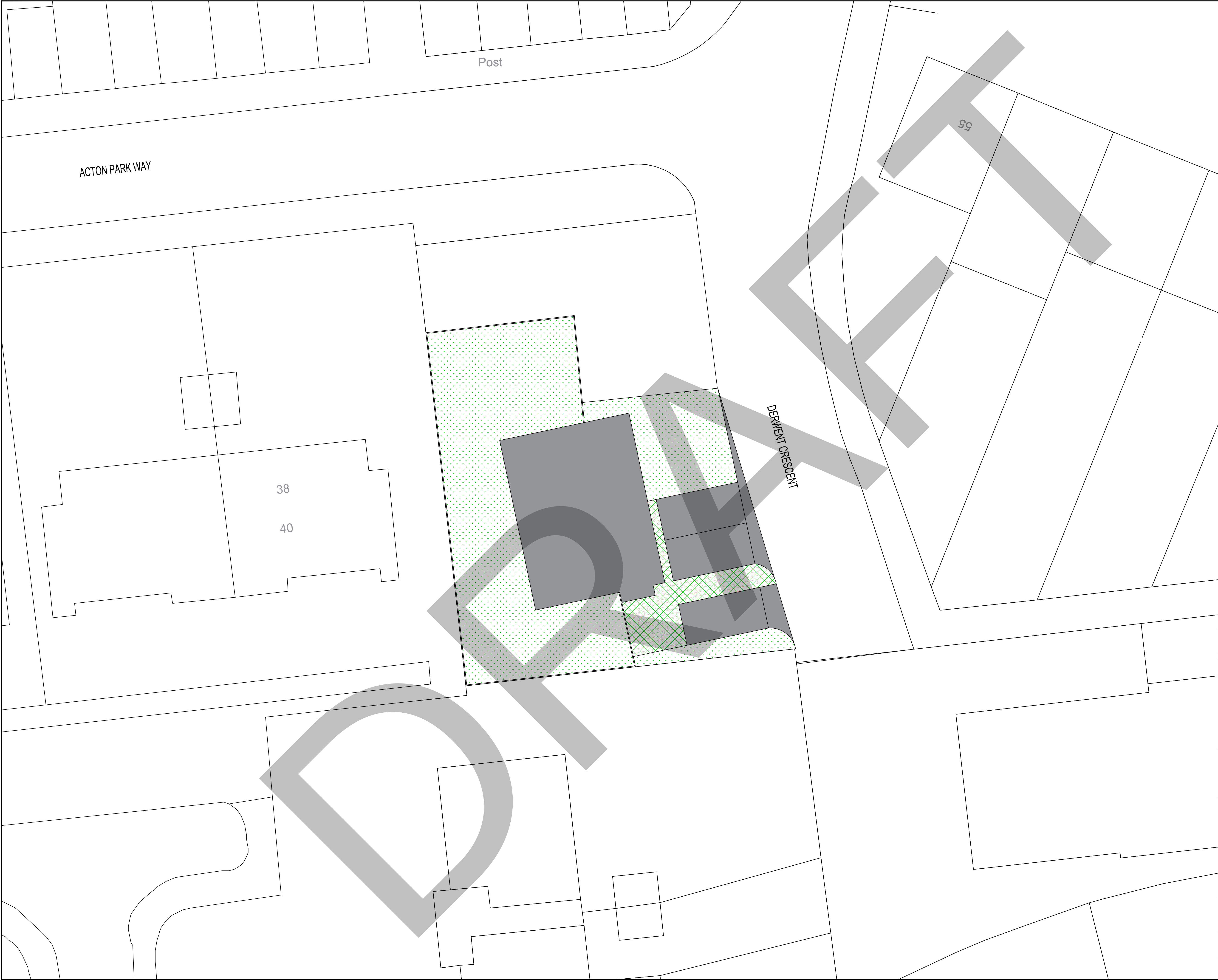
PROPOSED SITE PLAN
1:200



Appendix C

PERMEABLE AND IMPERMEABLE AREA

wsp



File name: \\UK\WSPGROUP\COMMON\DATA\PROJECTS\70086693\70086693-DR-101.DWG, printed on 21 October 2021 10:35:12 by James Adam

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NOTES

- DO NOT SCALE
- ALL MEASUREMENTS ARE IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE TO METRES ABOVE ORDNANCE DATUM.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS, REPORTS AND SPECIFICATION.
- THIS SKETCH IS BASED UPON THE LATEST SITE LAYOUT PLAN PROPOSAL PROVIDED BY LAWIRAY ARCHITECTS (AHW-LAW-X-Z-DR-A-069002), DATED 21.09.2021

IMPERMEABLE AREA (ROOF AND PAVED) - 119.4m²

PERMEABLE PAVING - TO BE DRAINED IF SOAKAWAY IS NOT FEASIBLE - 20.9m²

PERMEABLE AREA (SOFT LANDSCAPING) - 174.3m²

DRAFT
FOR REVIEW

REV	DATE	BY	DESCRIPTION	CHK	APP
-----	------	----	-------------	-----	-----

DRAWING STATUS: S3 - FOR REVIEW



Opus House, Yale Business Village, Wrexham Technology Park, Wrexham, LL13 7YL, UK
T+ 44 (0) 1978 368 100
wsp.com

CLIENT:



SITE/PROJECT:

DERWENT CRESCENT, ACTON - WREXHAM

TITLE:

PERMEABLE AND IMPERMEABLE AREAS
GARAGE 2

SCALE @ A1: 1:100	CHECKED: CR	APPROVED: VM
PROJECT NO: 70086693	DESIGNED: CR	DRAWN: AJ
DATE: SEPTEMBER 2021		REV: P01

70086693-WSP-DR-101

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Appendix D

BOREHOLE RECORD

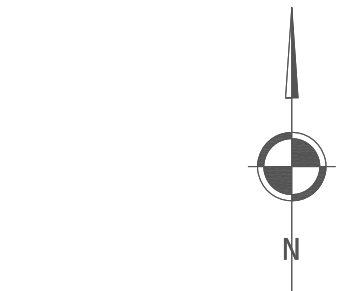
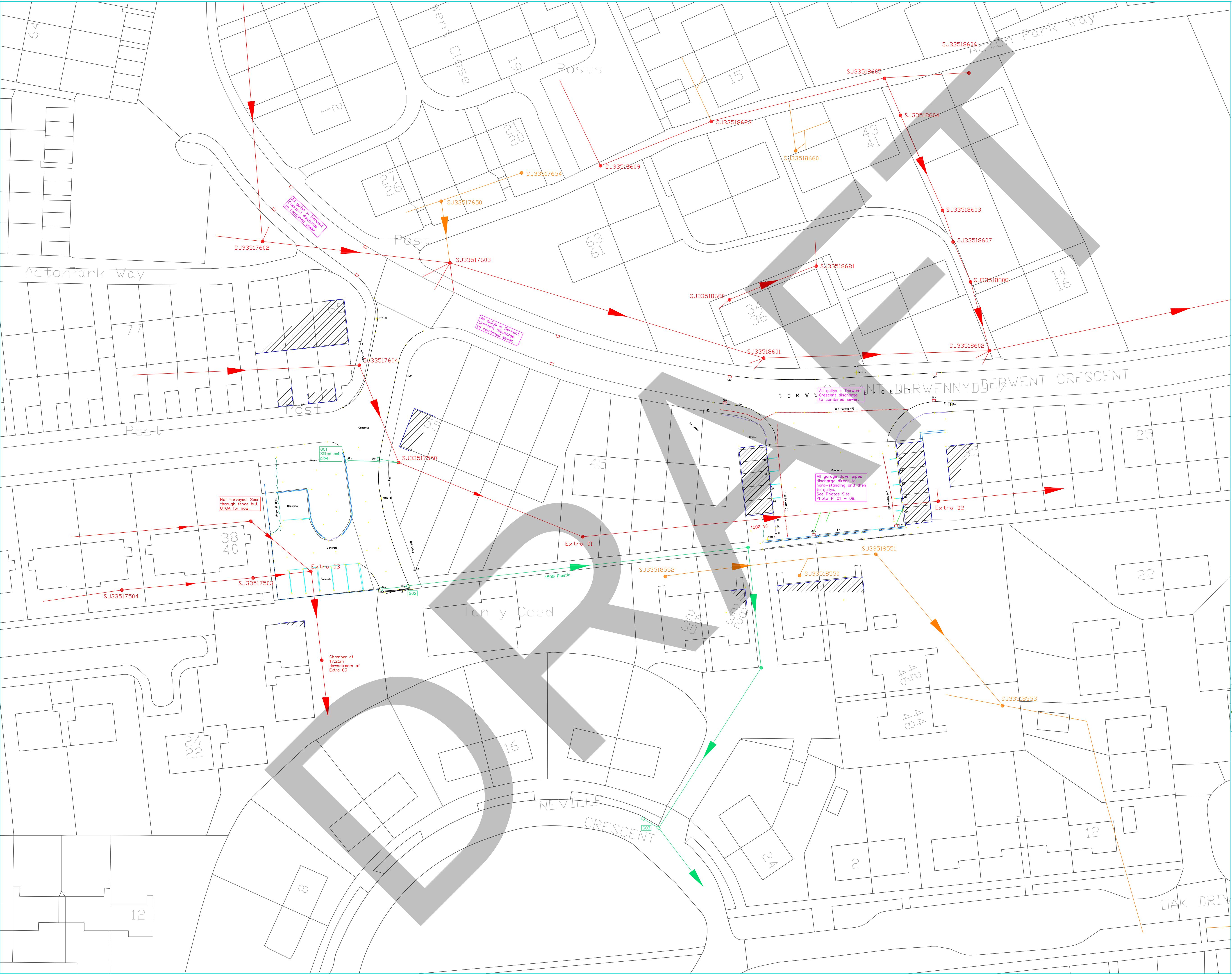
WSP



Appendix E

INVEK SURVEY

WSP



Legend/Notes:

- Combined Sewer
- Foul Sewer
- SW Sewer
- Assumed Sewer (Not Proven)
- Rising Main
- Highway Drainage
- Culvert Sewer
- Open Water Course
- Overflow Line
- Treated Line
- RWD Rain Water Down Pipe
- FDP Foul Down Pipe
- CDP Combined Down Pipe
- GWP Grey Water Down Pipe
- Highway Gully
- Septic Tanks
- Direction of overland flows
- Spot levels
- Air Valve
- Hatchbox
- Capped End
- Penstock

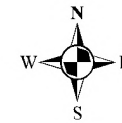
smas* CHAS BUILDER'S PROFILE
INVEK SURVEYS LTD.
Warrington Business Park, Long Lane, Warrington, Cheshire, WA2 8TX
Tel: 01925 244376 Fax: 01925 241517
Email: kevin@invek.com - www.invek.com

Client WSP	
Drawing Title Derwent Crescent, Acton Drainage Layout	
Scale(s) N.T.S	Drawn PW
Date 01.09.21	Checked RD
Job Number 1842	Approved KN
Sheet Size, Drawing Number & Revision A1_1842/01_Rev_00	

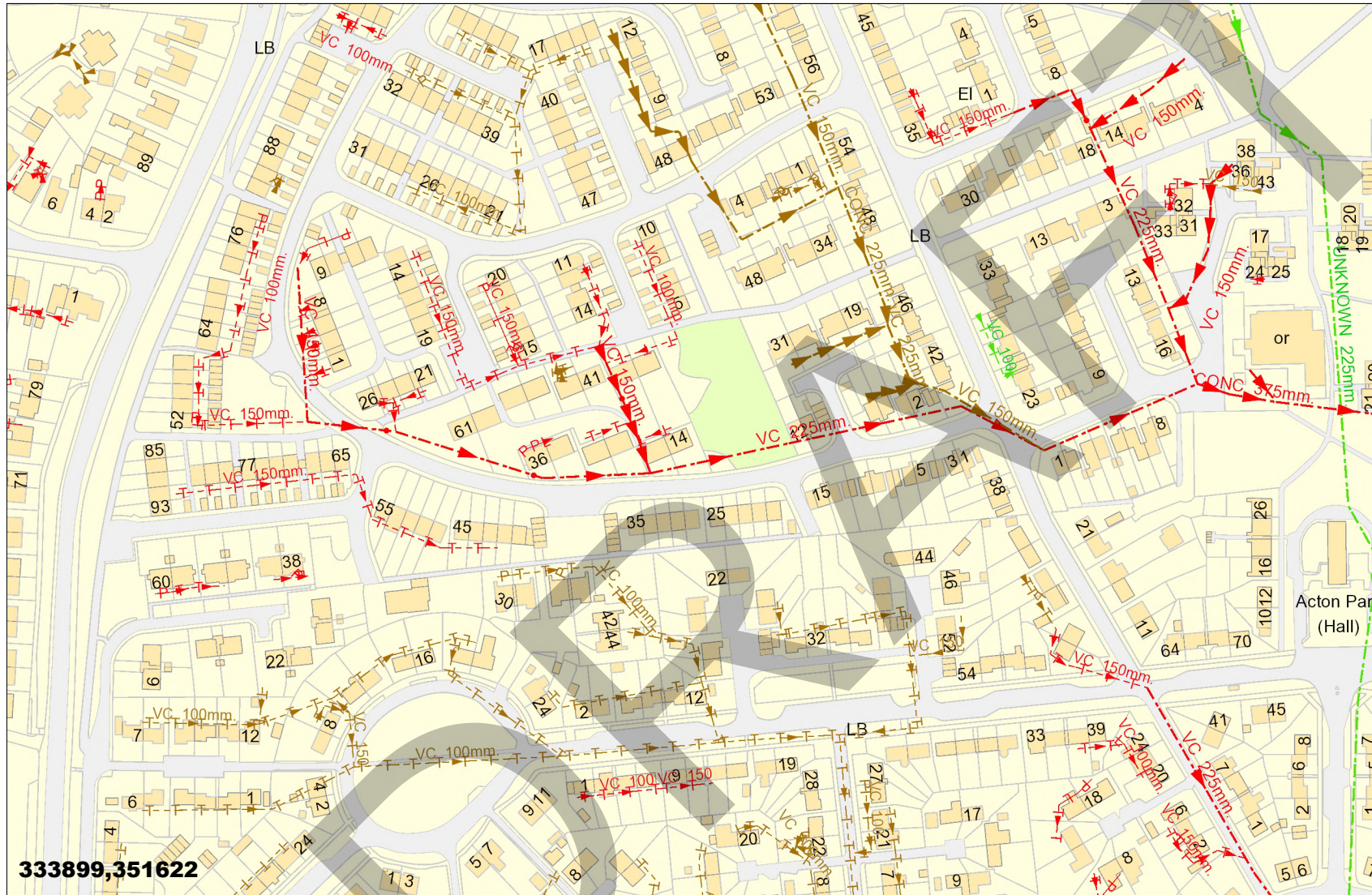
Appendix F

DCWW SEWER RECORDS

WSP



Scale: 1: 2500



LEGEND

Clean Water

- Sluice Val
 - Air Val, SINGLE
 - Tap
 - Pressure Reducing Valve
 - Meter
 - BULK Meter
 - FH
 - Cap
 - Existing Main
 - NON COMPANY
- Sewerage External**
- Foul
 - Surface Water
 - Combined
 - Rising Main
 - Private
 - Treatment Works
 - Pumping Station
 - Special Purpose
 - Unknown End
 - Change, Combined Overflow
 - Outfall, FOUL
 - Lamp Hole, Foul
 - Private Sewer Transfer
 - Lateral Drain
 - Inspection Chamber

333899,351622

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.

**EXACT LOCATION OF
ALL APPARATUS TO
BE DETERMINED ON
SITE**

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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

Appendix G

WREXHAM COUNTY BOROUGH COUNCIL CONSULTATION

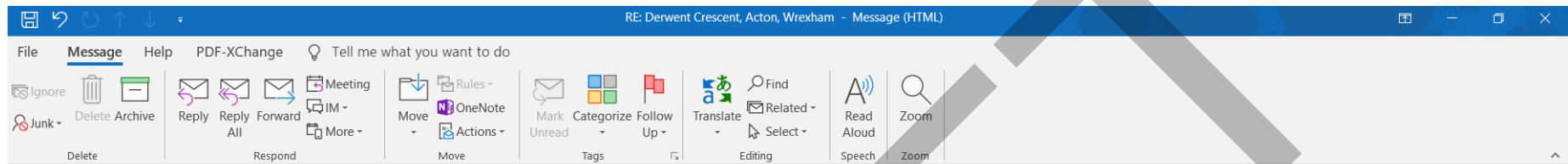


The image is a screenshot of a Microsoft Outlook email client window. The title bar at the top reads "RE: Site 2, Acton, Wrexham - Message (HTML)". The Outlook ribbon is visible, showing tabs for "File", "Message", "Help", "PDF-XChange", and "Tell me what you want to do". The "Message" tab is active, displaying various action icons like "Ignore", "Delete", "Archive", "Reply", "Reply All", "Forward", "More", "Move", "Rules", "OneNote", "Actions", "Mark Unread", "Categorize", "Follow Up", "Translate", "Find", "Related", "Select", "Read Aloud", "Speech", "Zoom", and "Zoom In". The email header shows the subject "RE: Site 2, Acton, Wrexham" and the sender "SAB <SAB@wrexham.gov.uk>". The recipients are "To: Potts, Rebecca" and "Cc: Kevin Edwards". The email body starts with "Dear Rebecca" and "In response to the questions below". It contains a list of questions and answers regarding flood risk assessment. The answers are: "There are no surface water issues recorded in this area. For foul records please redirect this to Welsh Water.", "No", "No", "No", "No", "No", "We so not hold contaminated land information please contact environmental health for this information", "There has been on recent development in this area.", "If discharge to sewer is the only viable option then approval from welsh water will be required.", and "Please refer to the SuDS Guidance documents http://old.wrexham.gov.uk/english/planning_portal/sab/sab.htm". The email is signed by "Carole Wright - BA MBCS" and "Swyddog Technegol Cefnogi Llifogydd - Technical Flood Support Officer -".

Appendix H

DCWW CONSULTATION

WSP



RE: Derwent Crescent, Acton, Wrexham



Rhodri Perry <Rhodri.Perry@dwrcymru.com>
To: Potts, Rebecca

Reply Reply All Forward ...

Fri 24/09/2021 16:00

Hi Rebecca,

Thank you for patience with reply, please see comments below. If you have any additional queries please let me know.

- Any known surface water or foul sewer flooding issues in this area – **We do not have surface water sewers in vicinity of site, there have been no sewer flood incidents within 50 metres of the site. There has been one within 70 but this was not DG5**
- Are any properties within this area on the DG5 flooding register – **No**
- Are there any plans for the construction of new foul and / or surface water sewers in this area for flood risk management purposes? **Not that I am aware of**
- Is there any on-going Section 104 adoptions or Section 185 sewer diversions currently being undertaken in the area? **None within the vicinity of the site**
- Is there any capital development sewer upgrading schemes planned in this area in the near future? **Not that I am aware of**
- Although it is not indicated on the sewer record that any foul/combined sewers run through the site, are you aware of any unrecorded DCWW assets within the site boundary which may require diversion or relocating as part of the proposed residential development? – **We only mark on our plans assets that are known. We would advise the completion of utility surveys to take place prior to commencement of operational development.**

Thank you,

Rhodri



Rhodri Perry
Development Control Officer | Developer Services
Dŵr Cymru Welsh Water

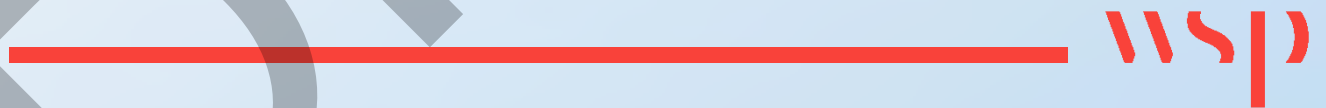
Appendix I

PROPOSED DRAINAGE STRATEGY



Appendix J

EXISTING GREENFIELD RUNOFF



WSP Group Ltd		Page 1
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.		
Date 05/08/2021 11:55	Designed by UKJXP400	
File	Checked by	
XP Solutions	Source Control 2019.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	0.036	Urban	0.000
SAAR (mm)	759	Region Number	Region 6

Results l/s

QBAR Rural	0.2
QBAR Urban	0.2
Q1 year	0.1
Q1 year	0.1
Q30 years	0.4
Q100 years	0.6

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Appendix K

POST DEVELOPMENT RUNOFF

WSP

WSP Group Ltd		Page 1
.		
.		
.		
Date 05/08/2021 11:54	Designed by UKJXP400	
File	Checked by	
XP Solutions	Source Control 2019.1	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 1 Soil 0.450 Area (ha) 0.022 Urban 0.000 SAAR (mm) 759 Region Number Region 6 Results l/s QBAR Rural 0.1 QBAR Urban 0.1 Q1 year 0.1 Q1 year 0.1 Q30 years 0.2 Q100 years 0.3		
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Appendix L

STORAGE CALCULATION VARIABLES

WSP

 **Quick Storage Estimate** [-] [Max] [X]

Variables

FSR Rainfall

Return Period (years)

Region

M5-60 (mm)

Ratio R

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr) 

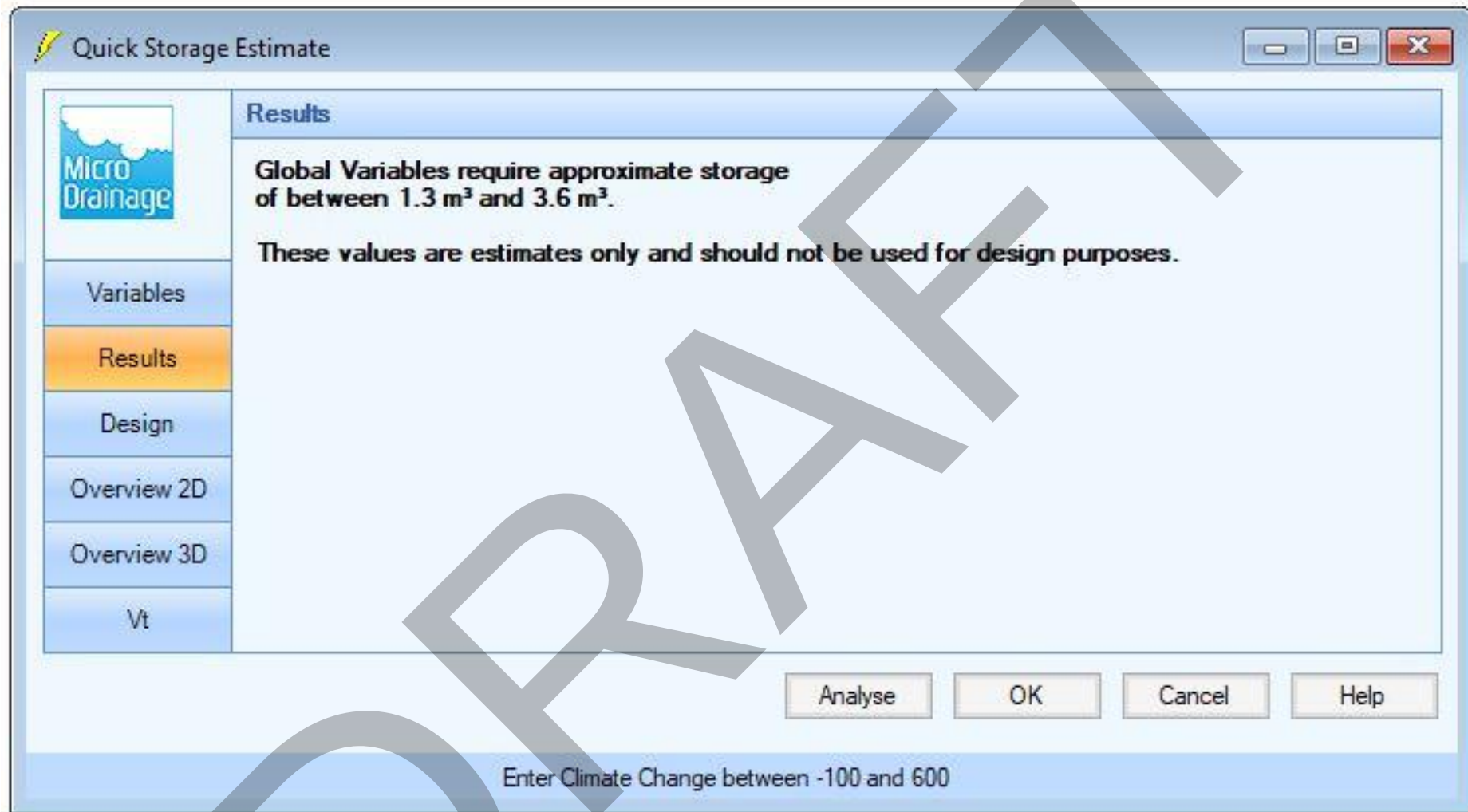
Safety Factor

Climate Change (%)

Enter Climate Change between -100 and 600

Appendix M

STORAGE CALCULATION RESULTS





Opus House
Yale Business Village
Wrexham Technology Park
Wrexham

wsp.com

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