



OAKWOOD LODGE, WYTHENSHAW

FLOOD RISK ASSESSMENT



07 January 2022

Oakwood Lodge - Flood Risk Assessment

AJP Ref: 219-242

PREPARED BY JAMES ROGERS



Oakwood Lodge - Flood Risk Assessment

WYTHENSHAW COMMUNITY HOUSING GROUP - OAKWOOD LODGE, WYTHENSHAW



	Originator:	Approved:	Date:
Record of Approval	J.Marshall Senior Civil Engineer	Approved	17/01/2022
Version	Author:	Change Description:	
P01	J.Rogers	Original Issue	07/01/2022

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Alan Johnston Partnership Ltd.

Company No. 13204766

Oakwood Lodge, Wythenshawe

Flood Risk Assessment

1.0 INTRODUCTION

This Flood Risk Assessment (FRA) has been prepared on behalf of Wythenshawe Community Housing Group in connection with a planning application for a new housing development. The proposed site is located to the north-east of Sharston Industrial Area, Wythenshawe. This FRA is required as the total area of the proposed development site is over 0.5ha in area.

This FRA has been prepared in accordance with the general requirements of the National Planning Policy Framework and the Technical Guidance to the National Planning Policy Framework, both published by the Department for Communities and Local Government. This involves the identification of flood risk to new development(s) on the site, the possible effect of this development on flood risk elsewhere and the investigation of the impact on the development as a result of increased fluvial flows and larger pluvial events due to increased impermeable areas and climate change.

The purpose of this report is to present a site specific assessment of flood risk based on available information, to identify relevant flood levels affecting the site with respect to a particular probability of flooding. The flood levels identified are dependent on the correctness of the current conditions, as stated in this report and the prediction of future climatic conditions implicit in the National Planning Policy Framework.

For any size of storm event, the procedure will always yield a probability that the event will occur in any year, albeit the probability is smaller for larger events. The predicted storm event has a probability of occurrence in any year and the derived flood level has an associated probability of exceedance. This means that there is always a risk that property flooding could occur one or more times in any year.

Therefore, this report should not be interpreted or relied upon as providing a guarantee against flooding. There is always a residual risk that flooding will occur and it is not possible to predict a zero risk of flooding.

In accordance with National Planning Policy Framework (NPPF) and the associated Technical Guidance document, flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g. reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

2.0 SITE DESCRIPTION

The proposed development site is located to the north-east of Sharston Industrial Area, Wythenshawe at National Grid reference SJ 83413 89487. The location of the existing site is illustrated in Appendix A and the extent of the area to which the application relates is also shown on the existing site plan enclosed in Appendix B.

The proposed development site covers a total area of approximately 0.614ha and is currently a brownfield site, consisting of one large central building, and access road, small car park with the remaining being landscaped areas. The site is bounded by a nursery to the south west with a large metal mesh fence surrounding the remaining site.

Due to the site being relatively level, there is little to no fall. Most levels sit between 35.20mAOD and 35.80mAOD. An existing site plan is included in Appendix B to illustrate the site at the present day and the topographic survey is included in Appendix C.

2.1 Geology

The British Geological Survey 1:50,000 Bedrock geology maps show that the site comprises of superficial deposits of Superficial Glacial Till, with the underlying bedrock reported to be of the Wilmslow Sandstone Formation. The strata as indicated on the BGS maps are outlined in the drawing attached in Appendix D.

Both of these factors would indicate to the possibility that the ground is permeable and infiltration is viable. However given the fact that the site is brownfield and is awaiting demolition, the permeability of the surface may be compromised. Further investigation will be needed for confirmation.

2.2 Hydrogeology

The DEFRA groundwater maps indicate that the site is in a medium-high risk area for ground water vulnerability. Borehole records from a site investigation are recommended to confirm the presence of a shallow groundwater body. They also indicate that the development site is not situated within a groundwater Source Protection Zone (SPZ).

2.3 Hydrology

The nearest open watercourse to the proposed development site is a small lake on a golf course, which is located approximately 380m west of the site, just before the M60. The nearest designated main river is the River Mersey which is located approximately 420m west of the site, just beyond the M60. The site is not located in an area identified by the Environment Agency (EA) as at risk of flooding from rivers and streams, and is classified as flood zone 1.

3.0 PROPOSED DEVELOPMENT

The proposed developments is to build a small housing estate to consist of 20 semi-detached homes with corresponding gardens, driveways and communal greenspace. To enable a viable scheme, the proposed site levels are constrained by the existing residencies surrounding the site. Therefore, site levels are likely to remain similar to the existing. The proposed site plan is attached in Appendix E.

4.0 PLANNING POLICY

The National Planning Policy Framework (NPPF) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account flood risk at all stages of the development.

4.1 Sequential and Exception Test

Based on the sites location in Flood Zone 1, the development is deemed appropriate according to NPPF therefore the development is appropriately situated and the Sequential Test is not required.

4.2 Exception Test

NPPF classifies the development as 'More Vulnerable' but as the site is located within Flood Zone 1 the Exception Test is not required.

5.0 FORMS OF FLOODING

The Technical Guidance to the National Planning Policy Framework requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Environment Agency Flood Risk map is included as Appendix F1.

It can be seen from the map that the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

5.2 Flooding from the Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 35.20mAOD, i.e. well above tidal flood levels.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The Environment Agency Surface Water Flooding map is included in Appendix F2. It can be seen from the map that the whole of the site is classified as having a very low risk of surface water flooding. There is a small level of flooding to the north of the site but is far enough away to not affect the site itself. Further correspondence from the Environment Agency will need to be provided to confirm of any historical flooding incidents in the immediate vicinity of the site.

5.4 Flooding from Groundwater

Confirmation of flooding from groundwater will need to be provided by borehole records from by a ground investigation report. For the purposes of this report the flood risk shall be considered to be medium-high risk as per the DEFRA maps.

5.5 Flooding from Sewers

A record of Public Sewers surrounding and serving the development site has been obtained from United Utilities and this is included in Appendix G. A pre-development enquiry with United Utilities will be required to confirm the flooding history of the area. If they have confirmed that there are no historical flooding incidents relating to the public sewers in the immediate vicinity of the site then the site itself is considered to be at low risk of flooding from sewers.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Environment Agency Flood Reservoir Flood Risk map is included in Appendix F3. It can be seen from the map that the site is not at risk of flooding from reservoirs. The closest reservoir or open waterbody is the lake as part of, which is located approximately 270m west of the site.



6.0 PROPOSED DEVELOPMENT

6.1 Effect of Development on Flood Risk

As previously outlined in Section 2.0, the existing site covers an area of 0.614ha and is a brownfield site. A comparison between the existing and proposed impermeable areas has been made using the existing and proposed site plans. The drawing attached in Appendix H indicates the pre and post development impermeable areas.

The results are summarised below;

Total Development Site Area (ha)	Existing Impermeable Area (ha)	Proposed Impermeable Area (ha)
0.614	0.471	0.494

Therefore, the changes to the existing site will increase the impermeable area. This increase in the impervious area within the proposed site will lead to an increase in the;

- Volume of surface water ponding on the site
- Volume of surface water runoff leaving the site or discharging into surrounding areas
- Peak discharge rate from the site.

Accordingly, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.2 Existing Drainage Systems

As can be seen from the United Utilities map and Utilities Survey drawings, attached in Appendix G, there is an existing United Utilities 900mm diameter combined water sewer located along Longley Lane to the south of the development site. The sewer flows east to west prior to discharging into a 1200mm brick sewer located at the junction of Sharston Road and Longley Lane. To the west of the site there is a 1000mm highway drain running through the north-west of the development from South to North.

Given that there is already a functioning building on site and a nursery adjacent to it, it is very likely that there are already existing drainage services. This is further reinforced by the presence of manholes and gulley's on the entrance road as indicated by the topographical survey. Following these manholes on the survey it indicates that the possible existing services discharge into the combined sewer along Longley Lane.

It is recommended that a CCTV survey of the existing systems is completed to confirm the feasibility of utilising any existing drainage connections from the existing development to the surrounding public sewer systems. The CCTV survey would also demonstrate that the existing drainage systems are still operational and currently discharge to the surrounding public sewer systems.

6.3 Proposed Drainage Strategy

As outlined above in section 6.1, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2010) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- ◆ Discharge via infiltration

- ◆ Discharge to watercourse
- ◆ Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed site should infiltrate where possible. Confirmation of feasibility will need to be confirmed by a site appraisal report indicating the strata of the made ground. Although geological surveys indicate suitable ground for infiltration, the presence of the previous buildings and its subsequent demolition may make the ground impractically impermeable.

As the possibility of infiltration has temporarily dismissed until further investigation, the intention for the development would be to discharge to watercourse. The nearest sensible watercourse the River Mersey which is located approximately 420m east of the site. Due to the distance across various plots of third-party land and properties, discharging to watercourse has been deemed impractical.

Therefore, the currently available practical solution for discharge of the surface water is discharge to public sewer. However, as indicated on the Historic Public Sewer map, attached in Appendix G, the nearest public sewers are located along Bronington Close to the east. As access to these sewers is restricted given the houses and garden space in between therefore the only practical solution is discharge to the combined public sewer on Longley Lane.

While every effort to utilise any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Design Construction Guidance (DCG), the requirements for the design of a new surface water drainage systems are as follows:

- ◆ Below ground piped drainage to be sized to accommodate the 1 in 2 year (50% AEP) design storm without surcharge.
- ◆ System to be designed not to flood any part of the site in a 1 in 30 year (3% AEP) design storm.
- ◆ For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100 year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst case impacts of climate change. This is in accordance with new advice, issued by the Environment Agency, which updates previous climate change allowances outlined in the National Planning Policy Framework.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30 year event. Additionally, any surface water run-off from events

that exceed the design capacity of the new drainage system, up to and including the 1 in 100 year (+40%) event, will be retained on-site in safe storage areas.

Due to the size of the car park area and the number of proposed spaces, it is envisaged that measures to prevent oil and other contaminants being passed forward to the existing combined water sewer, will not be required.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

To comply with Section 3.4.1 of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide a minimum 50% betterment on the existing surface water brownfield runoff rates is to be applied. Discussions with the LLFA should be undertaken to confirm that the proposed surface water discharge rate and overall drainage strategy is acceptable.

As the proposed drainage strategy complies with the LLFA requirements within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide, it is envisaged that United Utilities will accept the proposed surface water discharge rate and overall drainage strategy. However, this should be confirmed via a pre-development enquiry and further discussions with United Utilities.

Given the LLFA requirement identifying a minimum 50% betterment on the existing surface water brownfield runoff rates, an assessment of the existing surface water run-off from the brownfield site has been completed using a simple three pipe network modelled in Micro Drainage.

For the 0.614ha site, using an existing impermeable area of 0.494ha, the existing brownfield discharge rates for various return periods are outlined in the table below. The brownfield runoff assessment is attached in Appendix I.

Rainfall Return Period (years)	Existing Brownfield Runoff Rate (L/s)	Proposed Maximum Runoff Rate (L/s)
2 year	59.9	30.0
30 year	90.4	45.2
100 year	90.7	45.4

The proposed maximum runoff rates after applying 50% betterment, as per the Lead Local Flood Authority's requirements, are also outlined within the table above. However, as can be seen the 2 year proposed maximum runoff rate is 30.0 L/s. However given the size of the site a runoff rate of 30.0 L/s is proportionately quite high and will be discharging into a combined sewer through a network, realistically the maximum runoff rate will be closer to 5.0 L/s.

The 5.0 L/s discharge restriction is generally accepted as the minimum discharge rate to avoid the need for very small orifices, which due to their minimal size are prone to

blockage. The 5.0 L/s discharge rate is in compliance with the Environment Agency document; 'Rainfall runoff management for developers', Report SC030219.

This is further supported by United Utilities, as the guidance notes within the United Utilities Section 104 adoption agreement states that for any flow control device, "*The minimum acceptable orifice size is 100mm.*" and to achieve this minimum orifice diameter a maximum discharge rate of 5.0 L/s is required. Further correspondence with United Utilities will be needed to agree a suitable discharge rate.

Using a total post development impermeable area of 0.494ha at the restricted discharge rate of 30.0 L/s, for the 1 in 100 year + 40% return period design storm, a storage volume of 37.5m³ is required. For a restricted discharge rate of 5.0 L/s, for the 1 in 100 year + 40% return period design storm, a storage volume of 89m³ is required. The preliminary attenuation storage assessments are attached in Appendix J1 and J2. It is likely that the a value between 37.5 and 89 will be agreed upon following further correspondence from United Utilities regarding the maximum allowable discharge rate.

As seen in the Drainage Strategy Drawing, attached in Appendix K an attenuation tank has been included into the design. It has been located underneath the new communal space to the south of the site as it is near the outfall and has room change size following confirmation of an acceptable discharge rate from United Utilities. It may be possible to provide all the necessary storage via the pipes and manholes but this is subject to confirmation during modelling.

As outlined below, all other SuDS techniques have been considered for this development;

SuDS Technique	Suitable for This Development?	Reasoning
Green Roof	✗	Not suitable due to minimal roof area available.
Rainwater Harvesting	✗	Impractical due to minimal roof area available and pumping requirement for high multi-storey building.
Basins & Ponds	✗	Unsuitable due to available space on proposed site.
Filter Strips & Swales	✗	Unsuitable due to impermeable strata and lack of available space.
Infiltration Techniques	✗	Feasibility will be determined depending on the Impermeability of the strata.
Permeable Surfaces	✗	Unsuitable due to minimal available areas.
Tanked Systems	✓	Suitable and incorporated.

The surface water drainage strategy and discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

6.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank
3. Cesspool

The foul water system shall be designed in accordance with;

- ◆ BS EN 752:2008 (Drain and sewer systems outside buildings)
- ◆ Sewers for Adoption (7th Edition)
- ◆ Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).
- ◆ BS EN 12056-2:2000 (Drainage systems inside buildings)
- ◆ Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

As with the surface water runoff it is envisaged that the foul water runoff will also be discharging into the 900mm combined sewer running along Longley Lane to the south of the site. Therefore, as can be seen in the Drainage Strategy Drawing, attached in Appendix K, the proposed foul water drainage will convey the flow along the access road where it will combine with the restricted surface water runoff.

Further discussions with United Utilities, in the form of a pre-development enquiry should be undertaken to confirm that the foul water can discharge at unrestricted rates. The foul water drainage strategy and unrestricted discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

6.3.3 Outline Drainage Strategy

The drawing attached in Appendix K indicates the outline drainage strategy. It is envisaged that during the demolition of the existing buildings and construction of the new development the existing drainage systems will be abandoned. However, should the CCTV survey of the existing systems indicate that an existing connection to the surrounding public sewer systems may be suitable for re-use, the drainage strategy should be revised to utilise any suitable existing connections.

Following confirmation from the CCTV survey, it is envisioned that both foul and surface water networks will be attached to the existing networks running south along the access road. These are assumed to be being discharged into the 900mm combined sewer on Longley Lane. This assumption has been made as both foul and surface water drainage is needed to service the existing building and adjacent nursery with manhole covers along the access road travelling in the direction of the 900mm sewer.

Just before discharging into the existing drainage system on Longley Lane, it is proposed to include a vortex flow control chamber limiting the flow rate to the required rate set by United Utilities. It may be possible that there are already flow control systems in place. However given the age of the development this is unlikely. This will need to be confirmed via a CCTV survey.

Due to the expected invert levels of the existing United Utilities combined water sewer on Park Avenue, it is envisaged that both the proposed foul and surface water systems will be discharged via gravity, with no need for pumping. However, a CCTV of the existing drainage systems is required to confirm this.

6.4 Managing Residual Flood Risk

There is a finite risk that the design flood conditions required by current design standards are exceeded by an extreme and rare event. However, with the design measures reported such a risk is low and the exceedance flow path routes required to channel flows around the development buildings will be such that no specific flood risk management procedures are envisaged to be necessary.

7.0 CONCLUSIONS

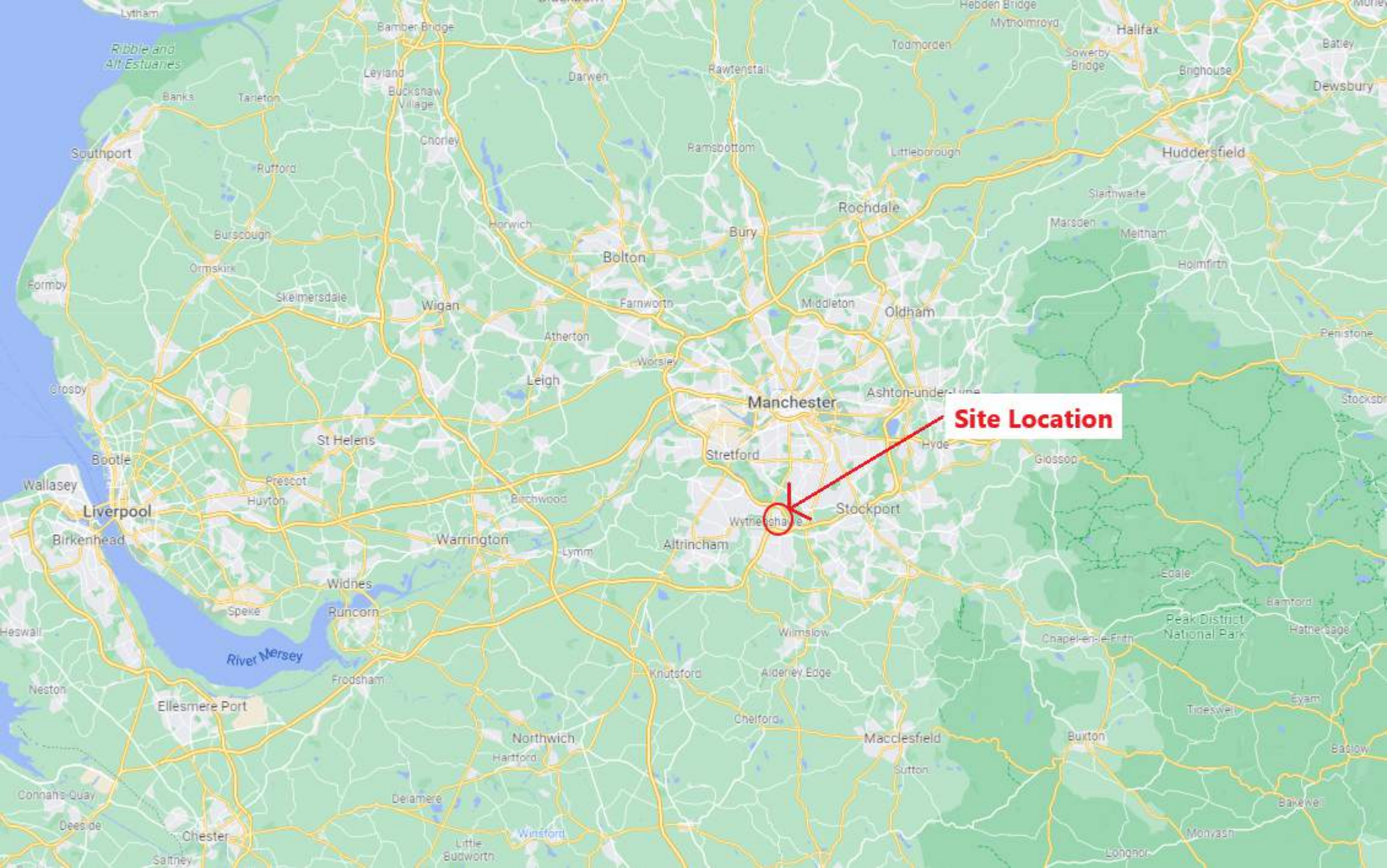
- The site is located within Flood Zone 1 with a low probability of flooding.
- The site is at a low risk of flooding from surface water/reservoirs.
- The site is at a medium-high risk of flooding from groundwater.
- Despite the information provided by the geological maps, the likely hardcore from demolition has created uncertainty surrounding the feasibility of using infiltration SUDS techniques. Therefore, infiltration testing in accordance with BRE365, should be completed to provide certainty on the use of infiltration SUDS techniques.
- Surface water discharge from the proposed site should discharge to the existing United Utilities 900mm diameter combined water sewer located along Longley Lane, to the south of the site.
- The surface water discharge is to be restricted to the discharge rate set by United Utilities, during the 100 year plus 40% climate change design storm, to comply with United Utilities requirements. Detailed discussions with Manchester City Council and United Utilities should be completed to ensure agreement of this figure and the overall approach.
- Foul water discharge from the proposed site also discharges, at unrestricted rate to the existing United Utilities 900mm diameter combined water sewer located along Longley Lane, to the south of the site. Discussions with Manchester City Council and United Utilities should be completed to ensure agreement of the foul water discharge rate and the overall approach.

8.0 RECOMMENDATIONS

- A full ground investigation of the site is required to confirm groundwater levels, impermeability and strata to determine the feasibility of infiltration
- A CCTV is required to confirm the presence and nature of existing drainage travelling along the access road.
- Information received from the Pre-Development enquiry from United Utilities should be used to aid and inform both surface and foul water designs. Recommendations and considerations should also aim to be included.
- Infiltration testing in accordance with BRE365 should be completed to provide clarity on the potential use of infiltration SUDS techniques to dispose of surface water runoff.
- A below ground cellular storage tank and flow control device should be utilised to ensure surface water flows are limited to the specified discharge rate.
- Correspondence with the Environment Agency should be conducted to gather history of any previous flooding events in the area.



Appendix A – Site Location Plan



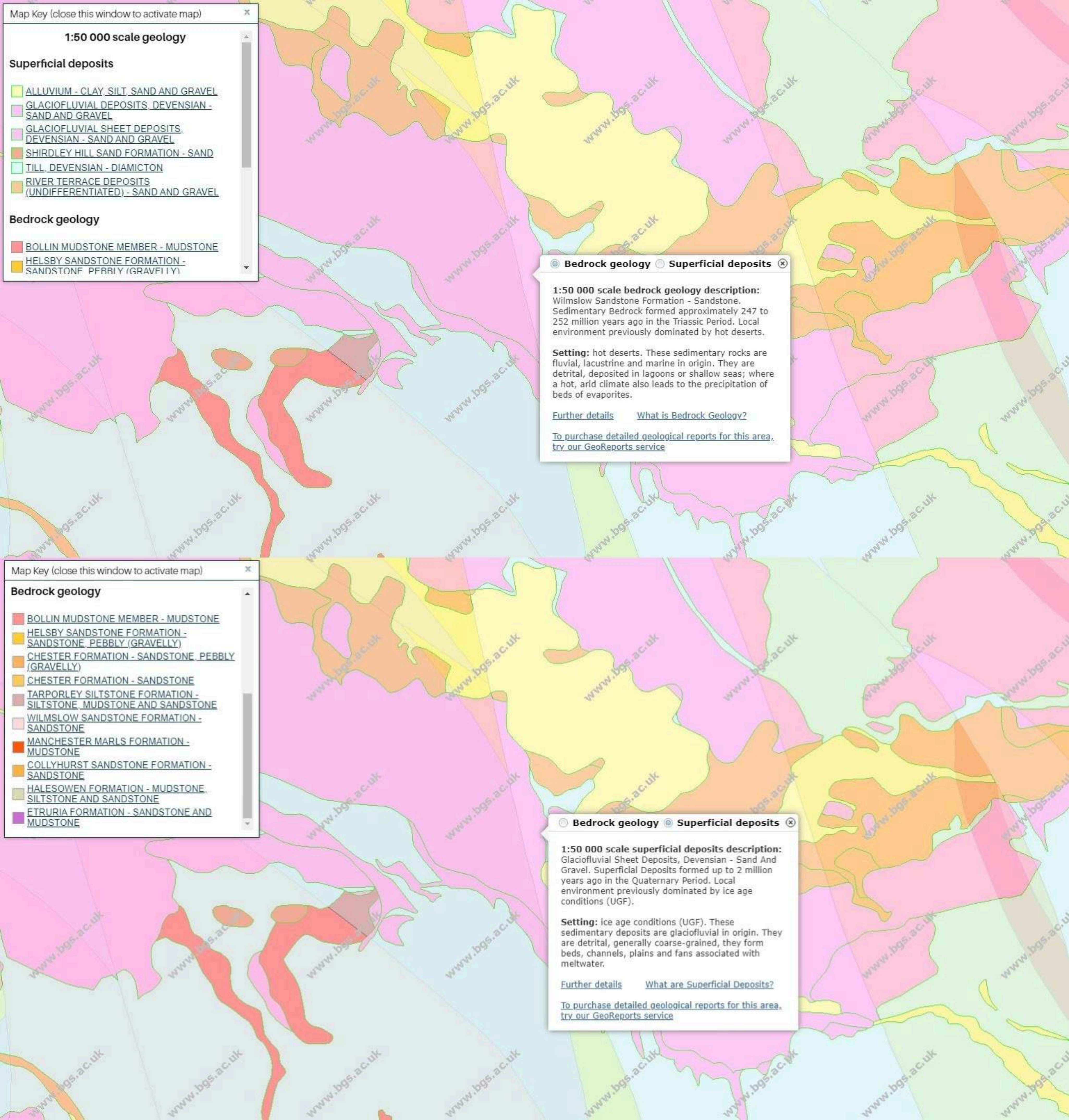
Site Location

Appendix B – Existing Site Plan



Appendix C – Topographic Survey

Appendix D – Geological Map



Map Key (close this window to activate map) x

1:50 000 scale geology

Superficial deposits

ALLUVIUM - CLAY, SILT, SAND AND GRAVEL

GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL

GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN - SAND AND GRAVEL

SHIRDLEY HILL SAND FORMATION - SAND

TILL, DEVENSIAN - DIAMICTON

RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND AND GRAVEL

Bedrock geology

BOLLIN MUDSTONE MEMBER - MUDSTONE

HELSEBY SANDSTONE FORMATION - SANDSTONE, PEBBLY (GRAVELLY)

☒ Bedrock geology ☐ Superficial deposits x

1:50 000 scale bedrock geology description:
Wilmslow Sandstone Formation - Sandstone. Sedimentary Bedrock formed approximately 247 to 252 million years ago in the Triassic Period. Local environment previously dominated by hot deserts.

Setting: hot deserts. These sedimentary rocks are fluvial, lacustrine and marine in origin. They are detrital, deposited in lagoons or shallow seas; where a hot, arid climate also leads to the precipitation of beds of evaporites.

[Further details](#) [What is Bedrock Geology?](#)

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Map Key (close this window to activate map) x

Bedrock geology

BOLLIN MUDSTONE MEMBER - MUDSTONE

HELSEBY SANDSTONE FORMATION - SANDSTONE, PEBBLY (GRAVELLY)

CHESTER FORMATION - SANDSTONE, PEBBLY (GRAVELLY)

CHESTER FORMATION - SANDSTONE

TARPORLEY SILTSTONE FORMATION - SILTSTONE, MUDSTONE AND SANDSTONE

WILMSLOW SANDSTONE FORMATION - SANDSTONE

MANCHESTER MARLS FORMATION - MUDSTONE

COLLYHURST SANDSTONE FORMATION - SANDSTONE

HALESOWEN FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE

ETRURIA FORMATION - SANDSTONE AND MUDSTONE

☐ Bedrock geology ☒ Superficial deposits x

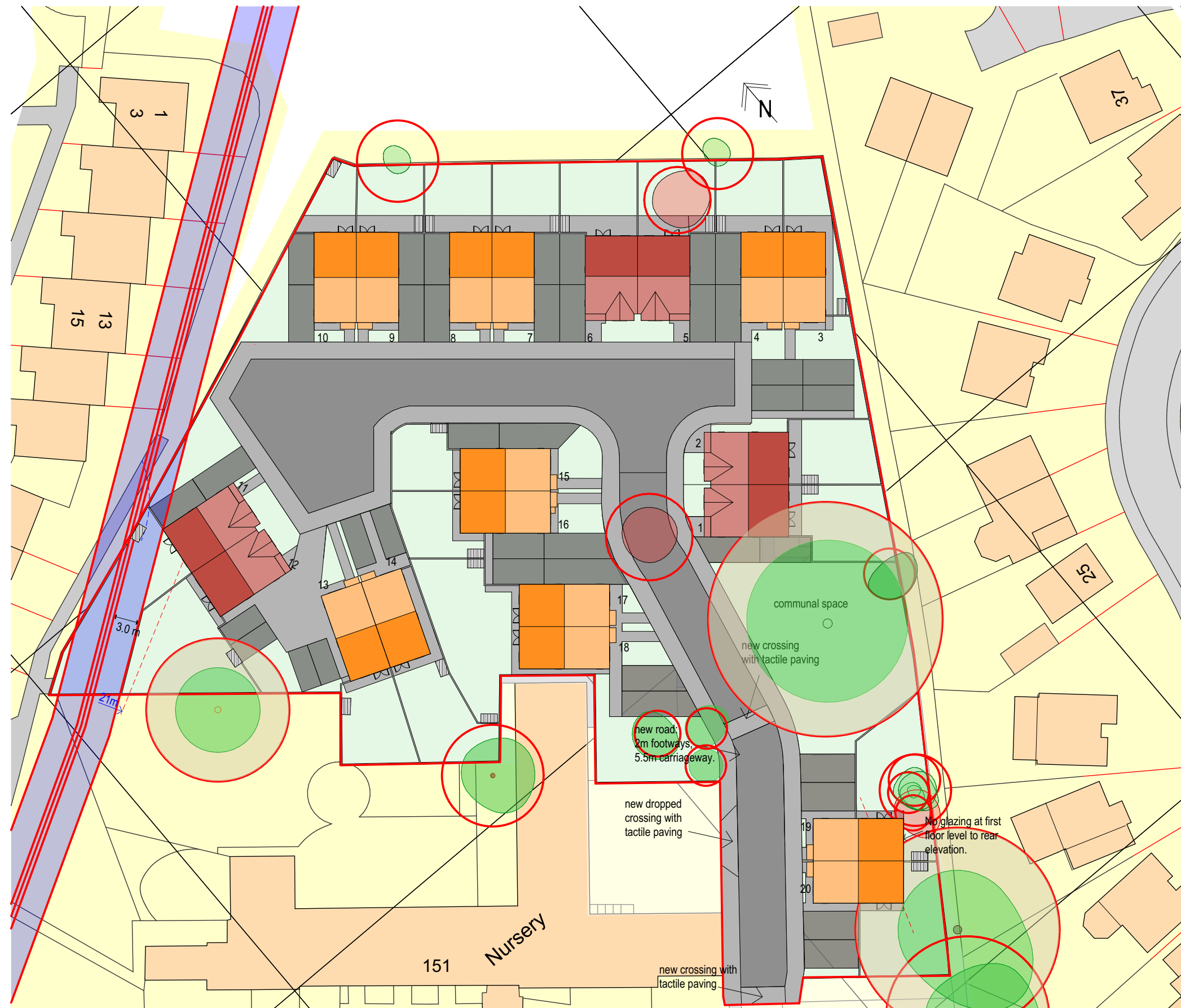
1:50 000 scale superficial deposits description:
Glaciofluvial Sheet Deposits, Devensian - Sand And Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions (UGF).

Setting: ice age conditions (UGF). These sedimentary deposits are glaciofluvial in origin. They are detrital, generally coarse-grained, they form beds, channels, plains and fans associated with meltwater.

[Further details](#) [What are Superficial Deposits?](#)

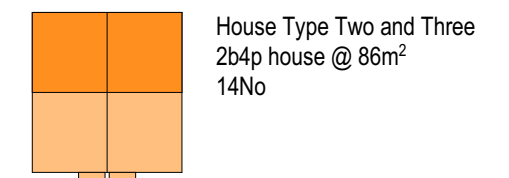
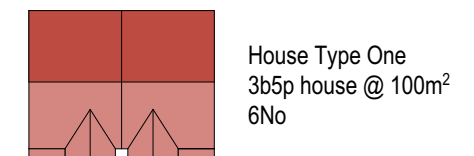
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Appendix E – Proposed Site Plan



Key

- root penetration zone to trees to be removed
- root penetration zone to trees to be retained
- trees to be retained
- trees to be removed
- 3.0 m easement zone from 1m dia drainage pipe
- Area overlapping root protection zone -pile foundations
- 1.8m high timber fence
- secure cycle storage



Rev. | | |

Client
WCHG

Project
Oakwood Lodge

Title
Proposed Site Plan

Scale	Date	Stage
1:500	12.10.21	

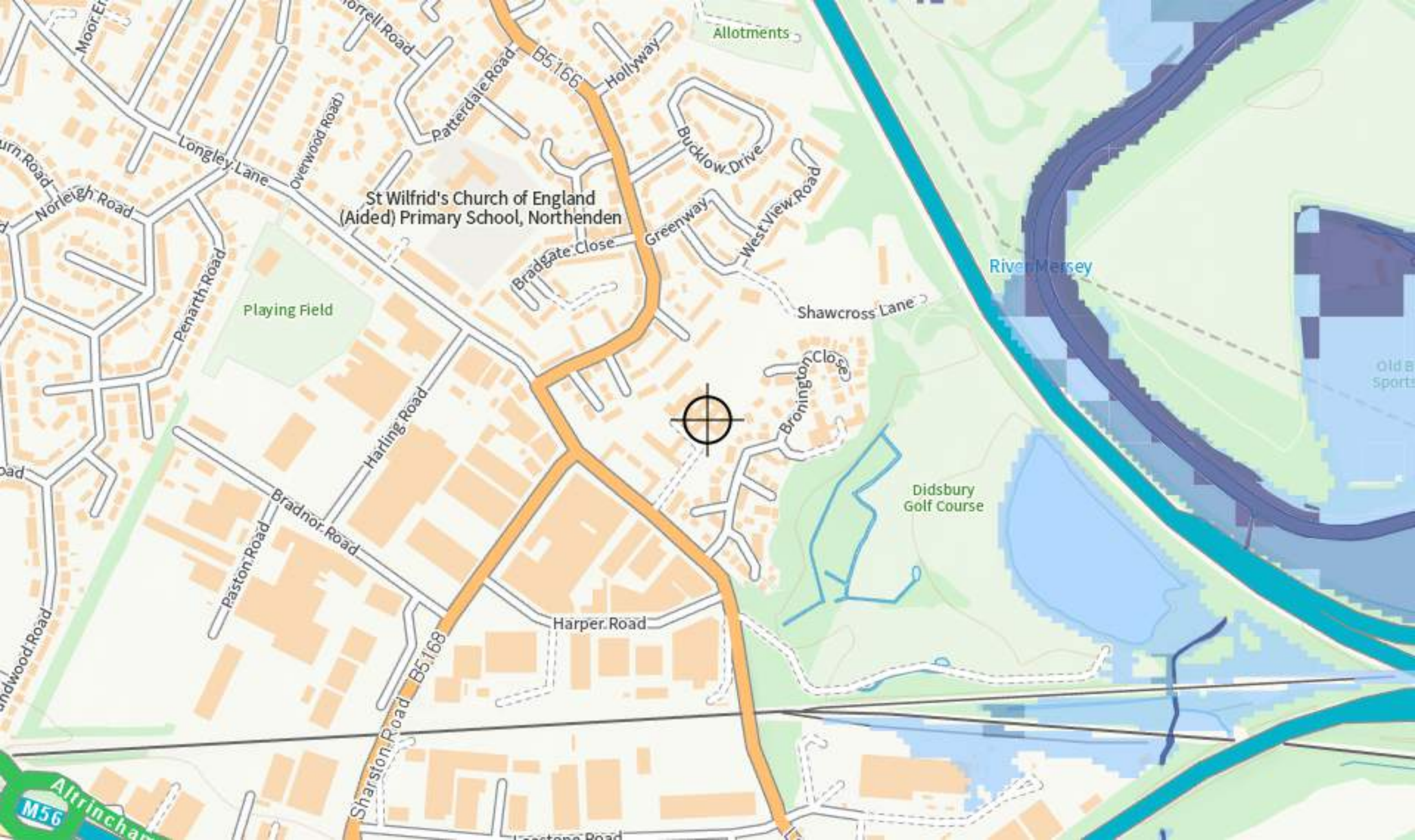
Job No	Drawing No	Rev.	Drawn
5415	P-01	-	SB



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 Only use figured dimensions. All dimensions to be checked on site prior to construction.

Appendix F1 – Extent of Flooding From Rivers or the Sea



St Wilfrid's Church of England
(Aided) Primary School, Northenden

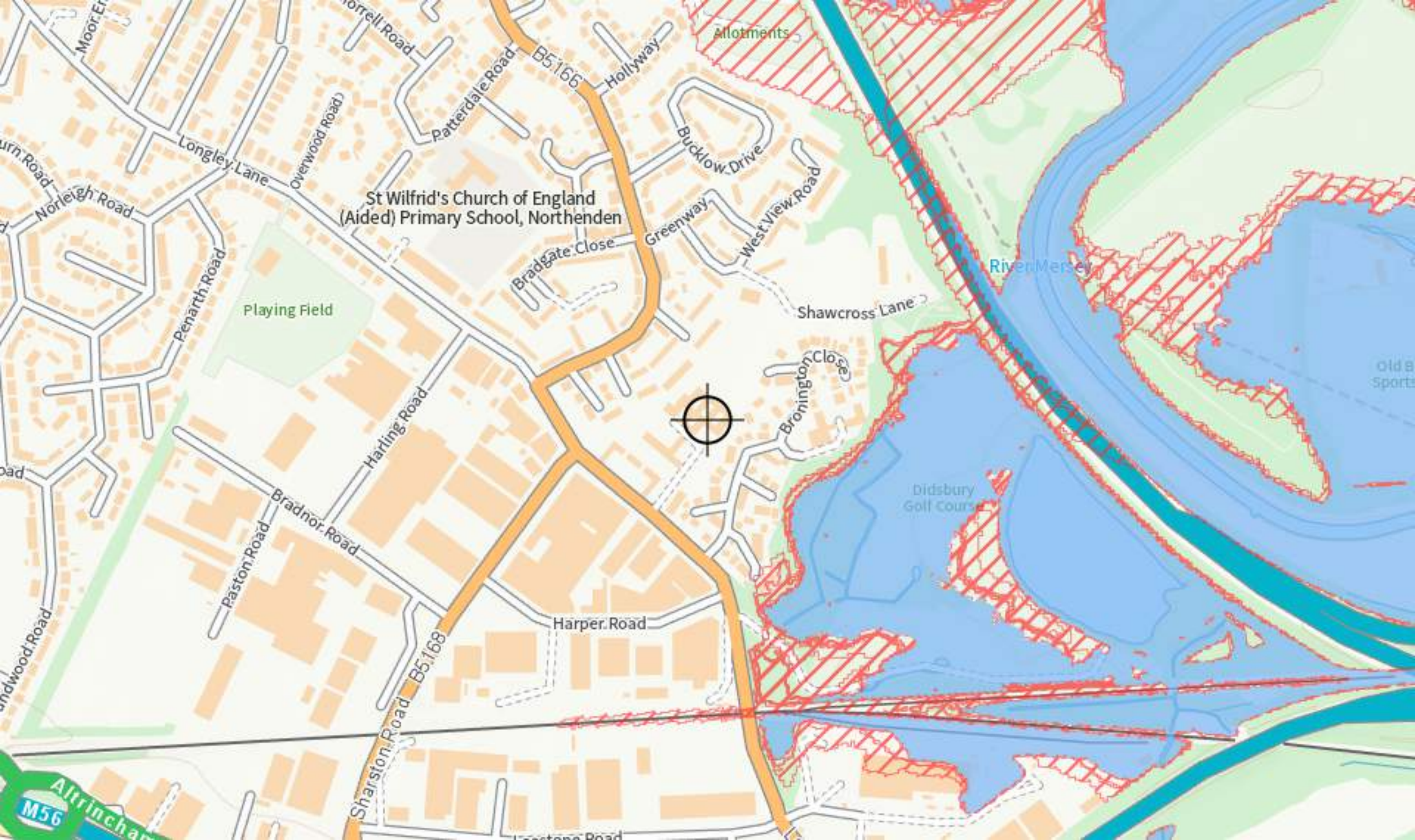
River Mersey

Didsbury
Golf Course

Old B
Sports

Altrincham
M56

Appendix F2 – Extent of Flooding From Surface Water



St Wilfrid's Church of England
(Aided) Primary School, Northenden

Playing Field

River Mersey

Old B
Sports

Didsbury
Golf Course

Harper Road

Sharston Road B5168

Bradnor Road

Penarth Road

Longley Lane

Overwood Road

Patterdale Road

Hollyway

Bucklow Drive

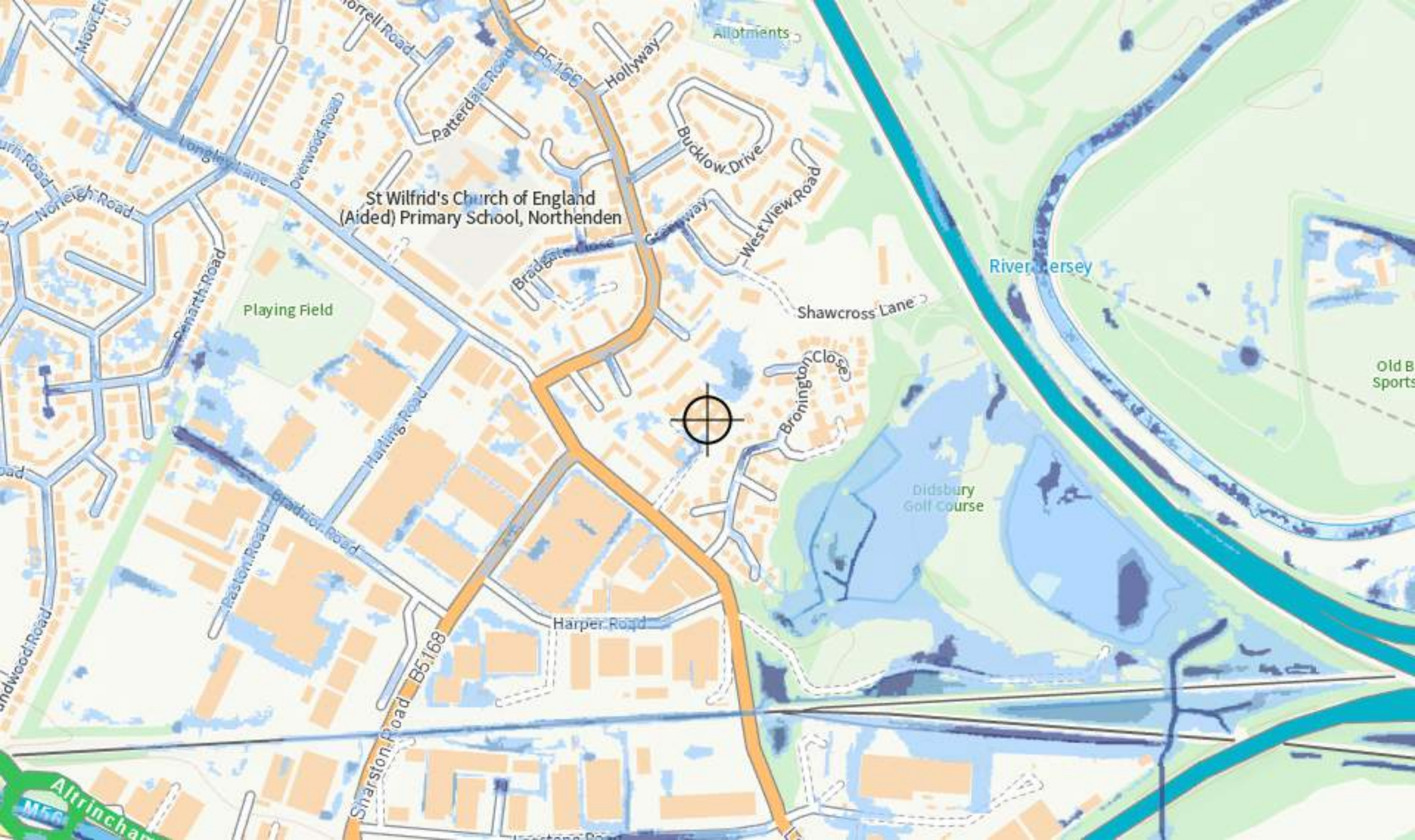
West View Road

Shawcross Lane

Bronington Close



Appendix F3 – Extent of Flooding From Reservoirs



St Wilfrid's Church of England
(Aided) Primary School, Northenden

Playing Field

River Mersey

Shawcross Lane

Bronington Close

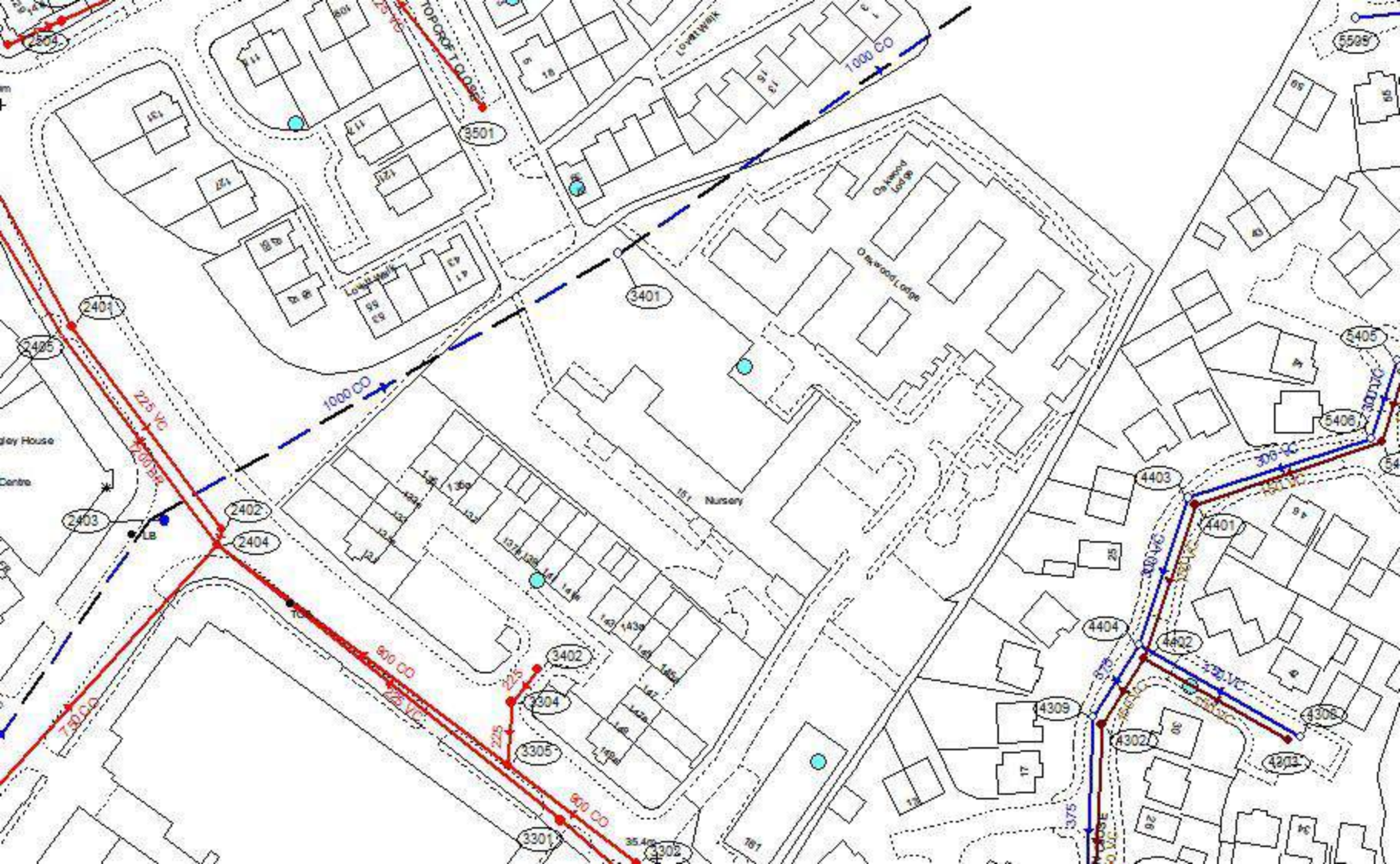
Didsbury
Golf Course

Harper Road

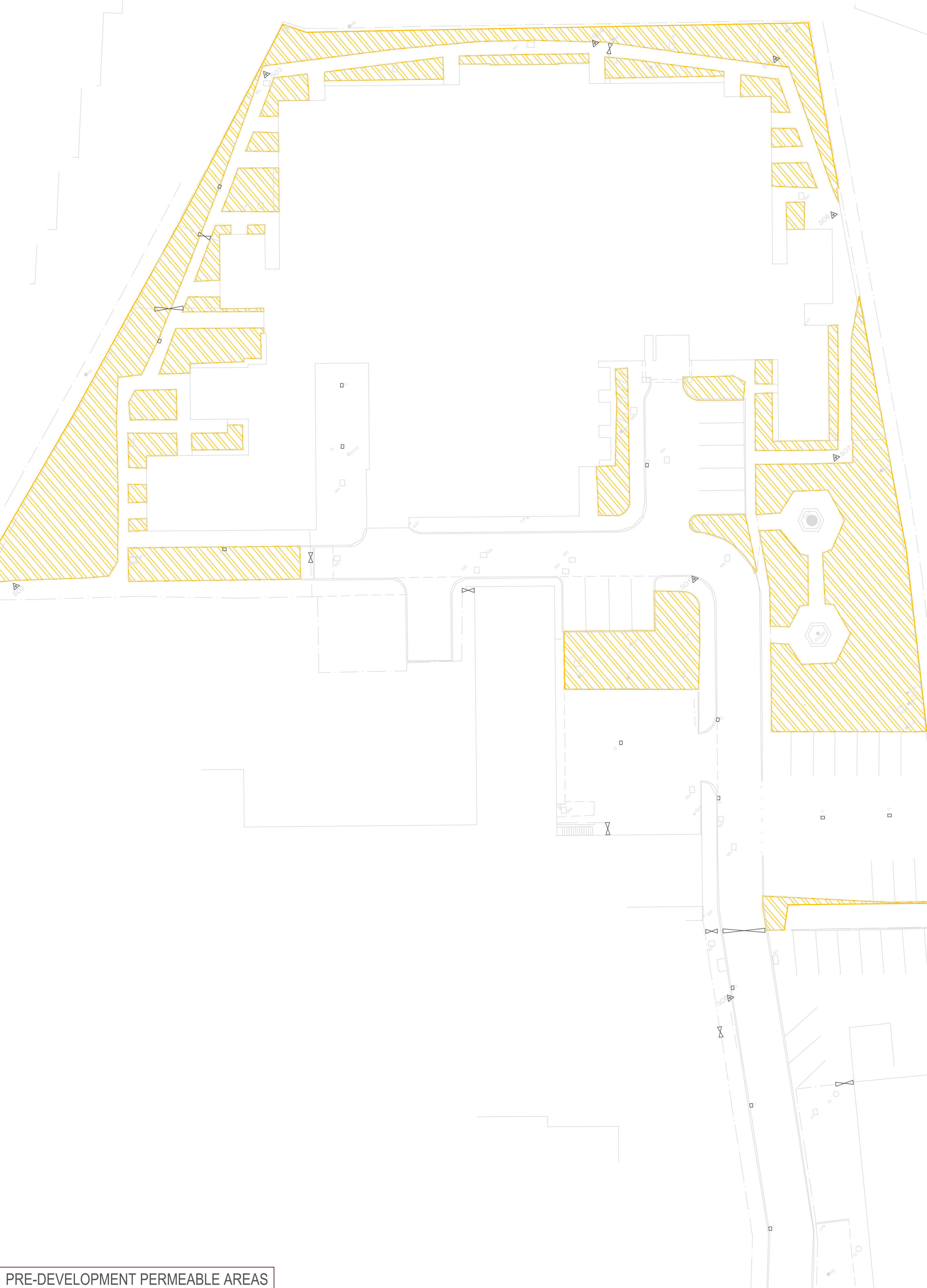
Sharston Road B5168

Altrincham
M56

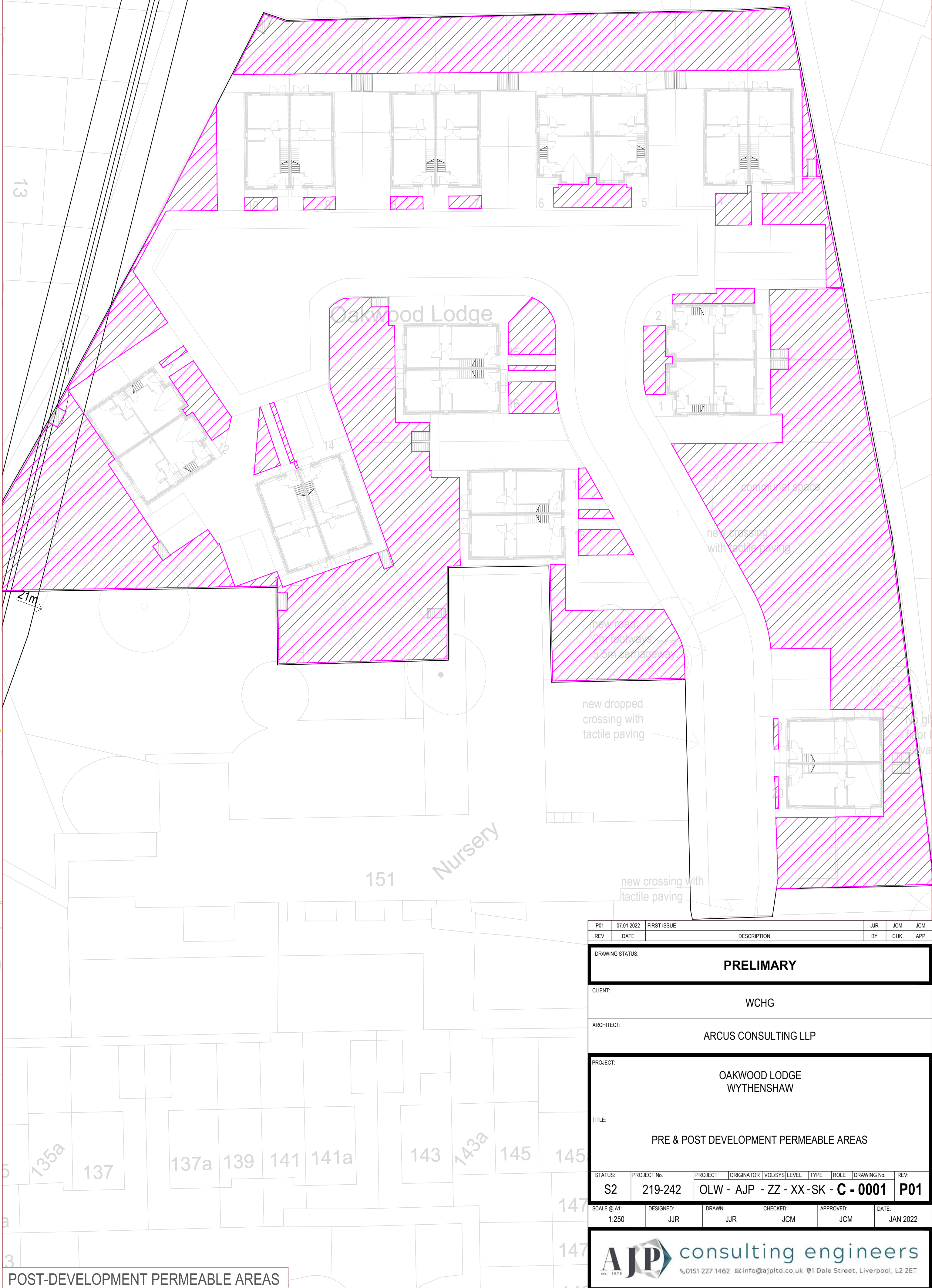
Appendix G – United Utilities Historic Public Sewer Records



Appendix H – Pre & Post Development Impermeable Areas Drawing



PRE-DEVELOPMENT PERMEABLE AREAS



Appendix I – Existing Brownfield Runoff Calcs

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XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.381	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.366	4-8	0.128

Total Area Contributing (ha) = 0.494

Total Pipe Volume (m³) = 1.193

Network Design Table for Storm

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	10.000	0.171	58.5	0.494	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	10.000	0.171	58.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	10.000	0.171	58.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.10	9.000	0.494	0.0	0.0	0.0	1.71	68.1	66.9
1.001	50.00	5.19	8.829	0.494	0.0	0.0	0.0	1.71	68.1	66.9
1.002	50.00	5.29	8.658	0.494	0.0	0.0	0.0	1.71	68.1	66.9

Simulation Criteria for Storm

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 Coefficient	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 Online Controls	0	Number of Storage Structures	0
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

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XP Solutions	Network 2019.1	

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.381		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coefficient 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 0 Number of Storage Structures 0 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 0.381 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s)

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

US/MH		Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth
PN	Name								(m)	(m)
1.000	1 15 Winter		1	+0%	30/15 Summer	30/15 Summer			9.207	-0.018
1.001	2 15 Winter		1	+0%	30/15 Summer				9.010	-0.044
1.002	3 15 Winter		1	+0%	30/15 Summer				8.839	-0.044

		Flooded		Pipe		Level	
PN	US/MH Name	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Exceeded
1.000	1	0.000	1.00		56.7	OK	9
1.001	2	0.000	1.00		56.7	OK	
1.002	3	0.000	1.00		56.7	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coefficient 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 0 Number of Storage Structures 0 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 0.381 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

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

	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level	Depth
									(m)	(m)
1.000	1	15 Winter	30	+0%	30/15 Summer	30/15 Summer			10.005	0.780
1.001	2	15 Summer	30	+0%	30/15 Summer				9.572	0.518
1.002	3	15 Summer	30	+0%	30/15 Summer				9.139	0.256

	US/MH	Flooded		Pipe		Level
PN	Name	Volume	Flow / Overflow	Flow	Status	Exceeded
		(m³)	Cap. (l/s)	(l/s)		
1.000	1	5.221	1.60	90.7	FLOOD	9
1.001	2	0.000	1.59	90.4	SURCHARGED	
1.002	3	0.000	1.59	90.4	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coefficient 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 0 Number of Storage Structures 0 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 0.381 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

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

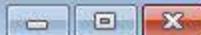
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level	Depth
									(m)	(m)
1.000	1	15 Winter	100	+0%	30/15 Summer	30/15 Summer			10.019	0.794
1.001	2	15 Winter	100	+0%	30/15 Summer				9.579	0.525
1.002	3	30 Summer	100	+0%	30/15 Summer				9.140	0.257

	US/MH	Flooded		Pipe		Level
PN	Name	Volume	Flow / Overflow	Flow	Status	Exceeded
		(m³)	Cap. (l/s)	(l/s)		
1.000	1	18.646	1.60	90.9	FLOOD	9
1.001	2	0.000	1.60	90.9	SURCHARGED	
1.002	3	0.000	1.60	90.7	SURCHARGED	

Appendix J1 – Preliminary Storage Estimate for 30.0 L/s Discharge



Quick Storage Estimate



Variables

Results

Design

Overview 2D

Overview 3D

Vt

Results

Global Variables require approximate storage of between 22 m³ and 53 m³.

These values are estimates only and should not be used for design purposes.

Analyse

OK

Cancel

Help

Enter Area between 0.000 and 999.999

Appendix J2 – Preliminary Storage Estimate for 5.0 L/s Discharge



Variables

Results

Design

Overview 2D

Overview 3D

Vt

Results

Global Variables require approximate storage of between 68 m³ and 110 m³.

These values are estimates only and should not be used for design purposes.

Analyse

OK

Cancel

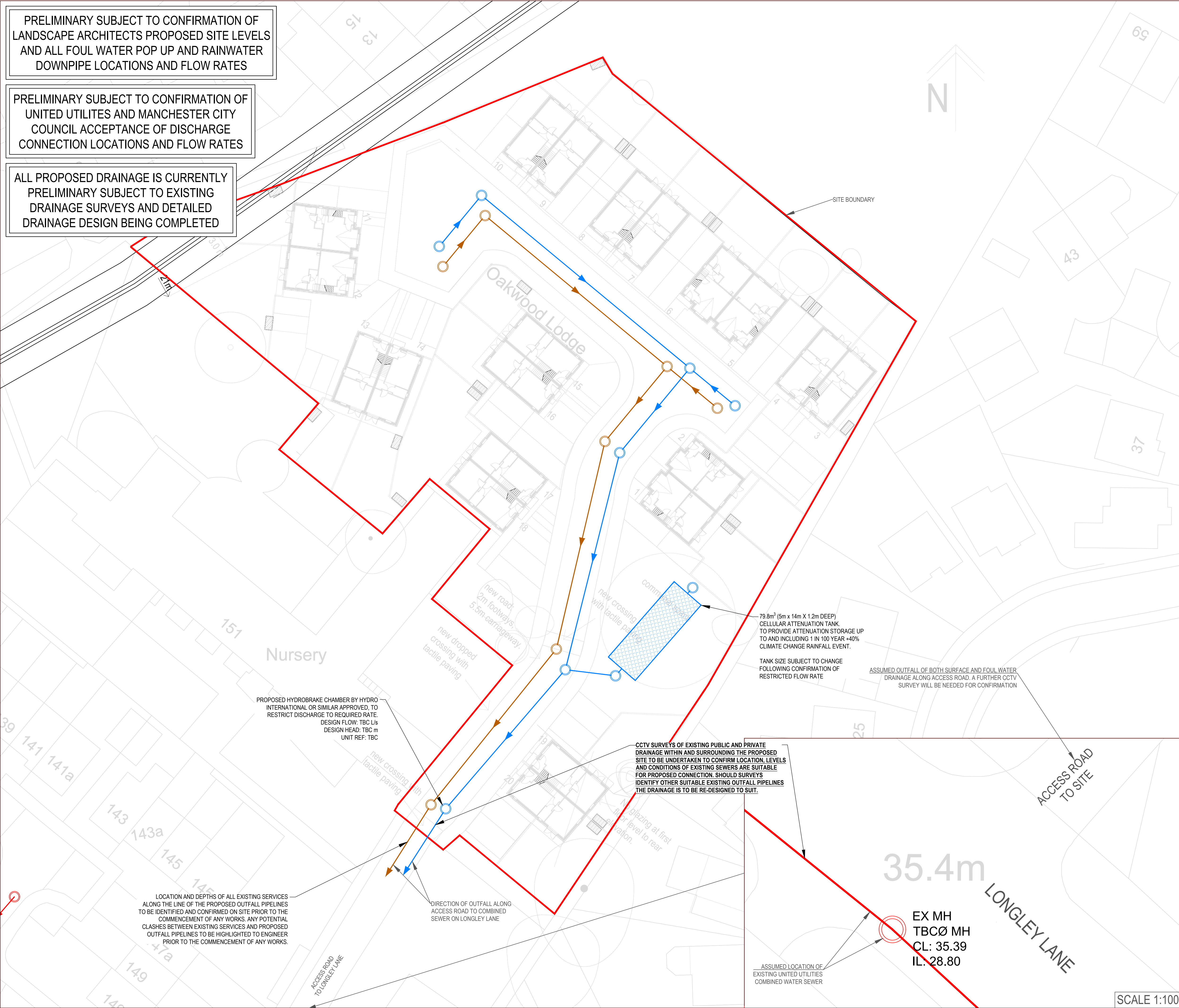
Help

Appendix K – Drainage Strategy Drawing

PRELIMINARY SUBJECT TO CONFIRMATION OF
LANDSCAPE ARCHITECTS PROPOSED SITE LEVELS
AND ALL FOUL WATER POP UP AND RAINWATER
DOWNPIPE LOCATIONS AND FLOW RATES

PRELIMINARY SUBJECT TO CONFIRMATION OF
UNITED UTILITES AND MANCHESTER CITY
COUNCIL ACCEPTANCE OF DISCHARGE
CONNECTION LOCATIONS AND FLOW RATES

ALL PROPOSED DRAINAGE IS CURRENTLY
PRELIMINARY SUBJECT TO EXISTING
DRAINAGE SURVEYS AND DETAILED
DRAINAGE DESIGN BEING COMPLETED



- IMPORTANT NOTES**
- SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES SHOULD NOT BE SCALED FROM THIS DRAWING.
 - ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
 - THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm
 - 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. THE RATES SHALL INCLUDE FOR HAND DIG AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
 - THE OUTSIDES OF ALL SEWERS SHALL BE A MINIMUM OF 1.0m FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 0.5m FROM KERB LINES
 - EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES
 - ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES
 - ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. 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
 - 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 THE NETWORK OPERATOR AS APPLICABLE.
 - WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
 - A CLASS 3 BED AND SURROUND MUST BE USED FOR SUCH PIPES. 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 CL 4.3.4.
 - SLAB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE
 - DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS APPROVED DOCUMENT H. 110mm U.P.V.C. PIPES LAID TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.

	FOUL	S.W.
HEAD RUN	1 IN 40	1 IN 60
ELSEWHERE	1 IN 80	1 IN 100
 - ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE
 - ALL MANHOLE COVERS TO BE RECESSED TO ACCEPT FINISH AS DETAILED BY LANDSCAPE ARCHITECT
 - SLOW REST BENDS TO BE USED IN ALL LOCATIONS MADE UP FROM 2No. 45 DEG BENDS (600mm TO INVERT FROM FFL)
 - MANHOLE POSITIONS AND ACCESS COVERS TO BE ACCURATELY SET-OUT BY LANDSCAPE ARCHITECT TO SUIT EXTERNAL FINISHES
 - ALL DRAINS CAST THROUGH FOUNDATIONS TO HAVE ROCKER PIPES ON BOTH SIDES OF FOUNDATION
 - ALL POP UP POSITIONS TO BE CONFIRMED SET OUT DIMENSIONS TO BE AGREED & PROVIDED BY OTHERS
 - ALL DISCHARGE RATES TO BE CONFIRMED BY M&E DESIGNER
 - ALL SURFACE WATER COLLECTION FEATURES TO BE CONFIRMED BY THE LANDSCAPE ARCHITECT
 - STORAGE HAS BEEN PROVIDED IN A CELLULAR STORAGE TANK AND UP-SIZED MANHOLES AND PIPES.
 - EXISTING SEWER DEPTHS HAVE BEEN APPROXIMATED FROM LIMITED INFORMATION. NEW CONNECTIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION OF ANY DRAINAGE WORKS.
 - LANDSCAPE ARCHITECT TO CONFIRM GULLY AND DRAINAGE CHANNEL LOCATIONS TO LANDSCAPED AREAS.
 - EXISTING NETWORK(S) TO BE CONFIRMED FOLLOWING CONFIRMATION VIA CCTV SURVEY
 - CCTV SURVEY OF EXISTING SITE DRAINAGE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY WORKS STARTING ON SITE

LEGEND

- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL WATER MANHOLE
- PROPOSED SURFACE WATER PPIC
- PROPOSED FOUL WATER PPIC
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- ASSUMED PUBLIC COMBINED WATER SEWER MANHOLE
- ASSUMED PUBLIC COMBINED WATER SEWER DRAINAGE

P01	NYI	FIRST ISSUE		JJR	JCM	JCM
REV	DATE	DESCRIPTION		BY	CHK	APP

DRAWING STATUS:

PRELIMINARY

CLIENT: WCHG

ARCHITECT: ARCUS CONSULTING LLP

PROJECT: OAKWOOD LODGE WYTHENSHAW

TITLE: OUTLINE DRAINAGE STRATEGY

STATUS:	PROJECT No:	PROJECT	ORIGINATOR	VOL/SYS/LEVEL	TYPE	ROLE	DRAWING No:	REV:
S2	219-242	OLW - AJP - ZZ - XX - DR - C - 0001						P01

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:250	JJR	JJR	JCM	JCM	JAN 2022

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