



RUSSELL ROAD, WHALLEY RANGE

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

*Shepherd Gilmour Infrastructure Ltd.
3rd Floor Phoenix House,
45 Cross Street,
Manchester,
M2 4JF*



Report Title: Russell Road, Whalley Range
Flood Risk Assessment & Drainage Strategy

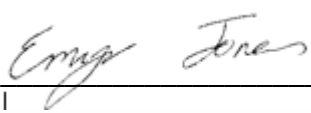
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Prepared by: _____
Dean O'Reilly BSc (Hons)

Checked & Approved:  _____
Emyr Jones B.Eng (Hons)

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A	31.05.2024	DOR	Updated site plan. Infiltration results added
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SECTION I SITE INVESTIGATION

INTRODUCTION

- I.1. This Flood Risk Assessment & Drainage Strategy has been prepared by Shepherd Gilmour Infrastructure Ltd (SGi) on behalf of Great Places Housing Group, to support the proposed redevelopment of the former Spire Manchester Hospital site, in Whalley Range.
- I.2. The Flood Risk Assessment has been prepared in accordance with the Flood Risk and Coastal Change Planning Practice Guidance (PPG) and the National Planning Policy Framework (NPPF). It contains information from sources such as the Environment Agency (EA), Local Sewerage Undertaker, District Council and Site Owner.
- I.3. The Drainage Statement has been prepared in line with the Non-Statutory Technical Standards for Sustainable Drainage (NSTSSD) and CIRIA Report C753. It also defines the outline proposal for the disposal of surface water runoff and foul effluent from the site.

EXISTING SITE DESCRIPTION

- I.4. The proposed development site (PDS) covers an area of approximately 0.9 hectares and fronts onto Russell Road, Whalley Road, and Carlton Road. The site was recently demolished, but formerly contained a U-shaped building with a circulation road and pockets of car parking.

Nearest Postcode: M16 8AJ

OS Coordinates: E382613, N395180

- I.5. The site can be found using the location data in **Figure I.1**.

PROPOSED SITE LAYOUT

- I.6. The Client's proposals for the PDS consist of two buildings (extra care apartments & shared ownership) which are linked together along with their own associated hard and soft landscaping.
- I.7. A copy of the proposed site plan has been shown in **Figure I.3** with a larger scale plan included within **Appendix A**.



Figure 1.1 Site Location Plan (Google Earth)

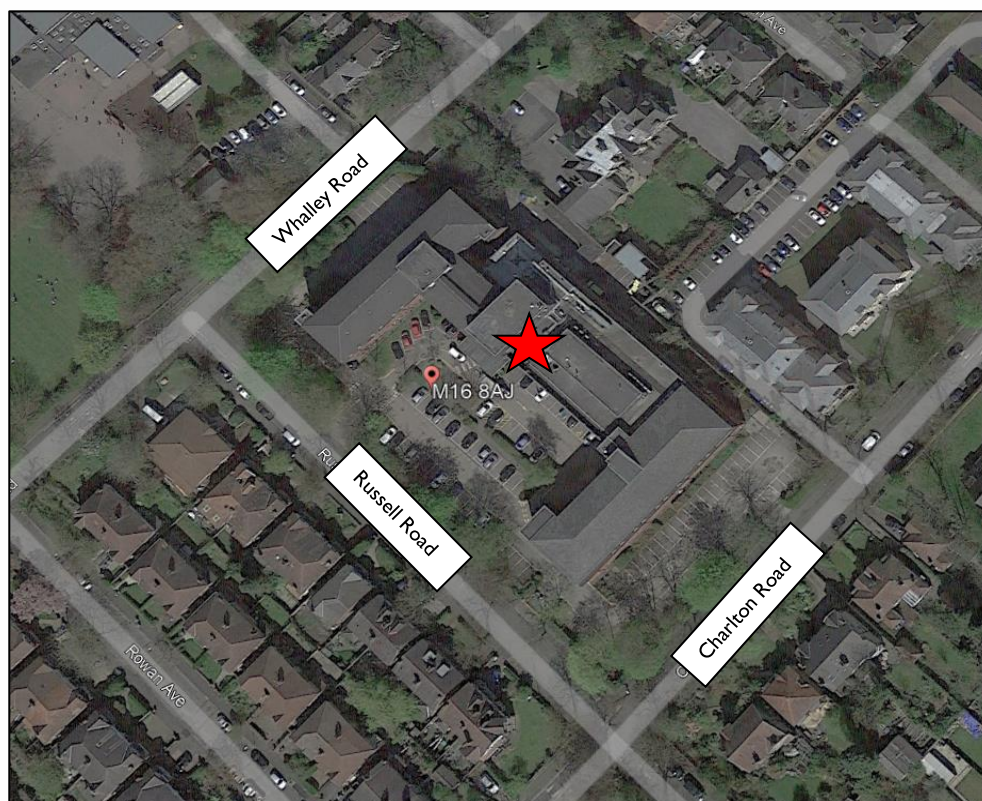


Figure 1.2 Site Location Plan 2019-2020 (Google Earth)

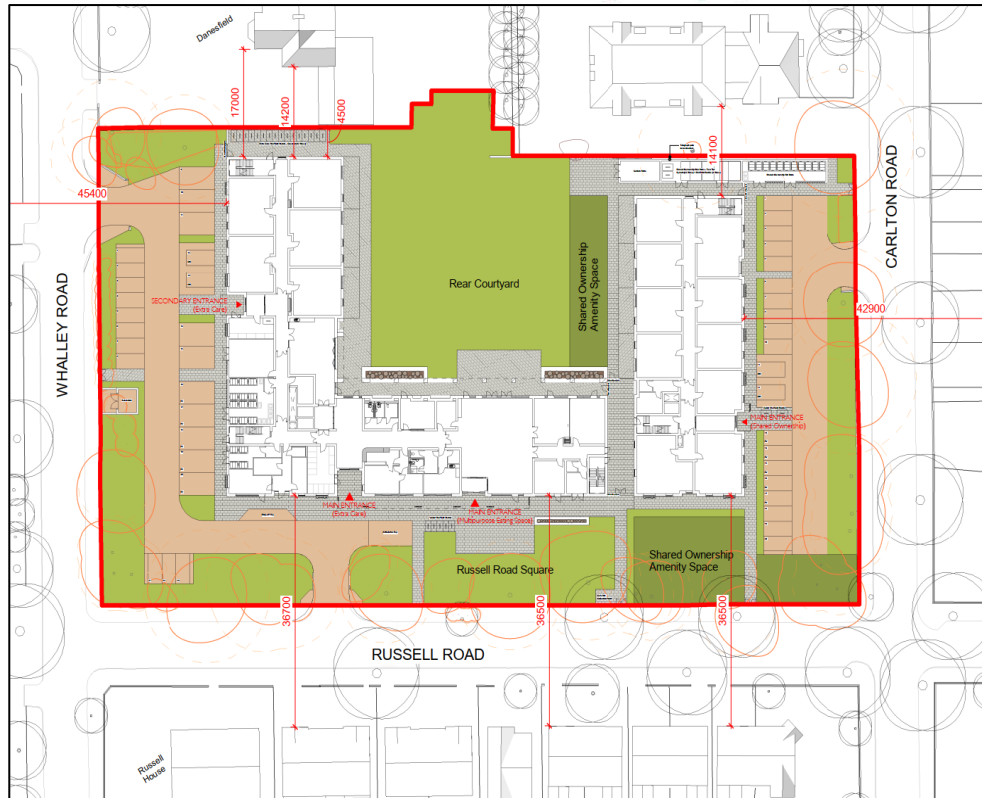


Figure I.3 Proposed Site Plan (Triangle Architects)

SECTION 2 POTENTIAL SOURCES OF FLOODING

2.1. There are several sources of flooding which can impact a site. Each of these sources of risk will be reviewed in this section of the report.

- Fluvial/Tidal,
- Ground Water,
- Artificial Waterbodies (canals, reservoirs etc) and,
- Pluvial.

2.2. Any sources of flooding which could impact the PDS will be discussed in further detail in **Section 3 & 4**.

FLUVIAL/TIDAL FLOOD RISK

Gov.UK Website

2.3. The Gov.UK website provides a flood risk service which allows for a PDS to be quickly checked against fluvial/tidal flooding. An abstract of the information is shown in **Figure**

2.1.

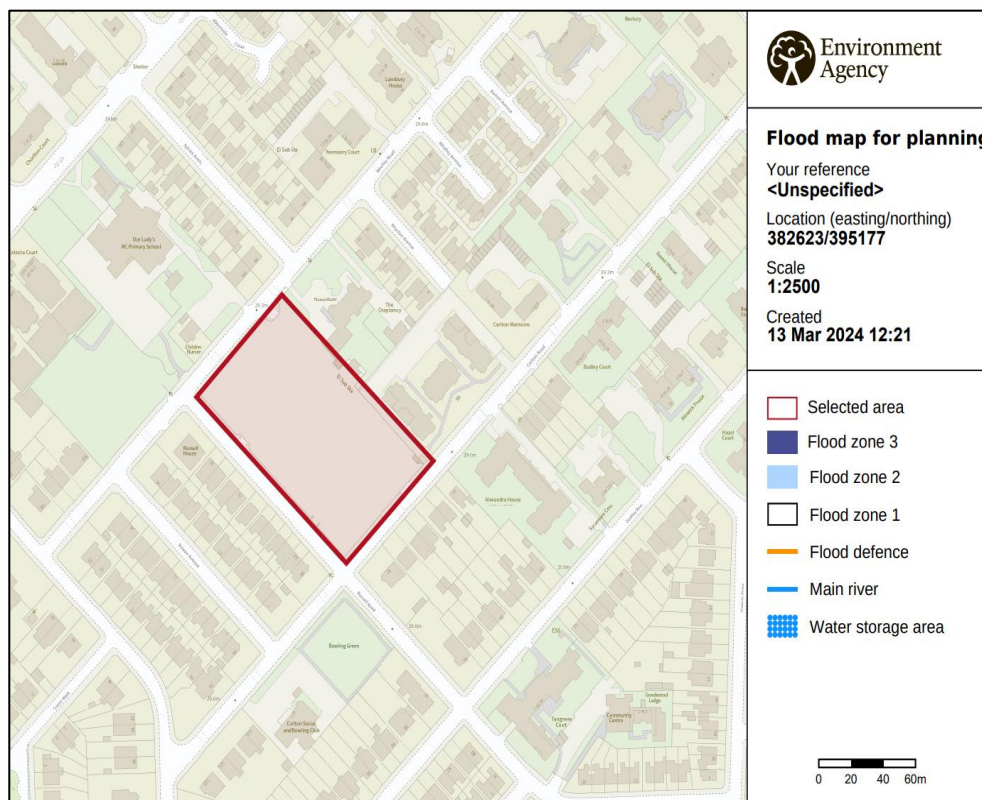


Figure 2.1 Flood Map (Gov.UK)

2.4. The Gov.UK flood maps indicate that the PDS is in Flood Zone I (low probability).

- *Flood Zone 1 – Low Probability*
Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as ‘clear’ on the Flood Map – all land outside Zones 2 and 3)
- *Flood Zone 2 – Medium Probability*
Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
- *Flood Zone 3 – High Probability*
Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)

Strategic Flood Risk Assessment

2.5. The NPPF requires Local Planning Authorities to produce Strategic Flood Risk Assessments in support of their Local Plan. These form the basis for preparing appropriate policies for flood risk management within the area and provide the framework for assessing areas of developable land.

2.6. The PDS is within the SFRA for Manchester City, Salford City and Trafford. The initial SFRA (Level 1) was published in March 2010 and the more detailed (Level 2) was released in 2011.

SFRA Reference: 2009s0290 Final Level 1 SFRA March 2010

SFRA Reference: 2009s0290 Final MST Level 2 SFRA March 2011

2.7. These maps have been superseded by the GOV.UK maps, but the SFRA flood data also confirms that the PDS is in Flood Zone 1.

Ordinary Watercourse

2.8. Ordinary watercourses do not form part of a ‘main river’ and can consist of rivers, ditches, swales, drains etc. These watercourses are the responsibility of the riparian owner who must ensure that:

- *Flows can pass freely without obstruction, pollution, or diversion (affecting the rights of others).*
- *The banks and bed of the watercourse are maintained (including vegetation).*
- *Any approved onsite watercourse structures are maintained.*

- 2.9. According to the SFRA maps there are no ordinary watercourses on or around the vicinity of the site. The freely available historic OS maps also do not highlight anything onsite.

CANAL FLOOD RISK

- 2.10. Water levels within a canal structure are maintained and regulated sluice gates along the route of the canal. Whilst a breach or overtopping is unlikely to happen, the potential risk should be assessed within the FRA.

Canal & River Trust

- 2.11. Many of the canals in England and Wales are owned, maintained, and operated by the Canal & River Trust (CRT). The closest CRT canal to the PDS is the Rochdale Canal which is approximately 2.4km to the north. The maps within the SFRA indicate that the PDS is located outside of any breach zone/model.

Bridgewater Canal

- 2.12. The Bridgewater Canal is owned and maintained by the Bridgewater Canal Company and is approximately 1.6km to the northwest. The maps within the SFRA indicate that the PDS is located outside of any breach/model.

GROUNDWATER FLOOD RISK

- 2.13. Unlike flooding from rivers and the sea, groundwater does not pose a significant risk to life. It is more associated with damage to the building, due to the flooding persisting over several weeks.
- 2.14. The SFRA map (abstract in **Figure 2.2**) indicates that the PDS could be at risk from rebounding groundwater levels. Any groundwater issues will need to be investigated and confirmed during the Phase II Site Investigation.
- 2.15. Any potential issues from this source will then be mitigated during the detailed design.

ARTIFICIAL WATERBODIES

- 2.16. The reservoirs in the area are owned and operated by United Utilities and are covered by the Reservoirs Act 1975. Whilst the probability of a catastrophic dam failure occurring is relatively low the consequences of such an event are severe.
- 2.17. Indicative Reservoir flood plans are made available on the Gov.UK and show that the PDS could be at risk in the event of a breach.

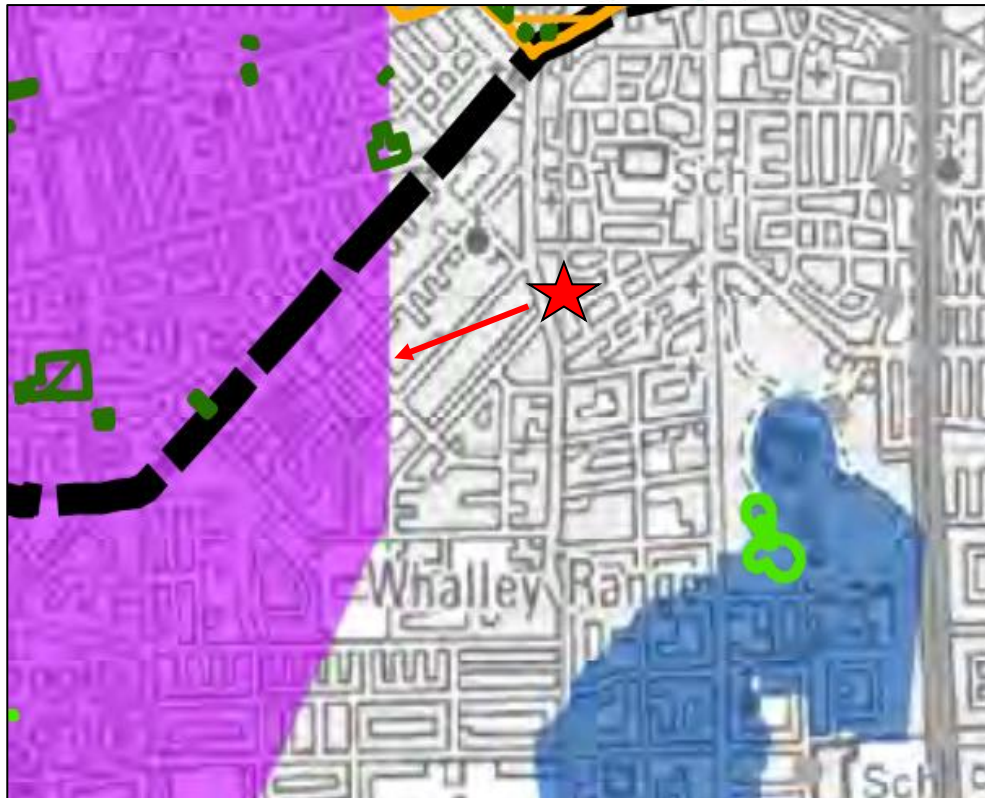


Figure 2.2 Groundwater Flood Risk Map (SFRA Map 2.1)

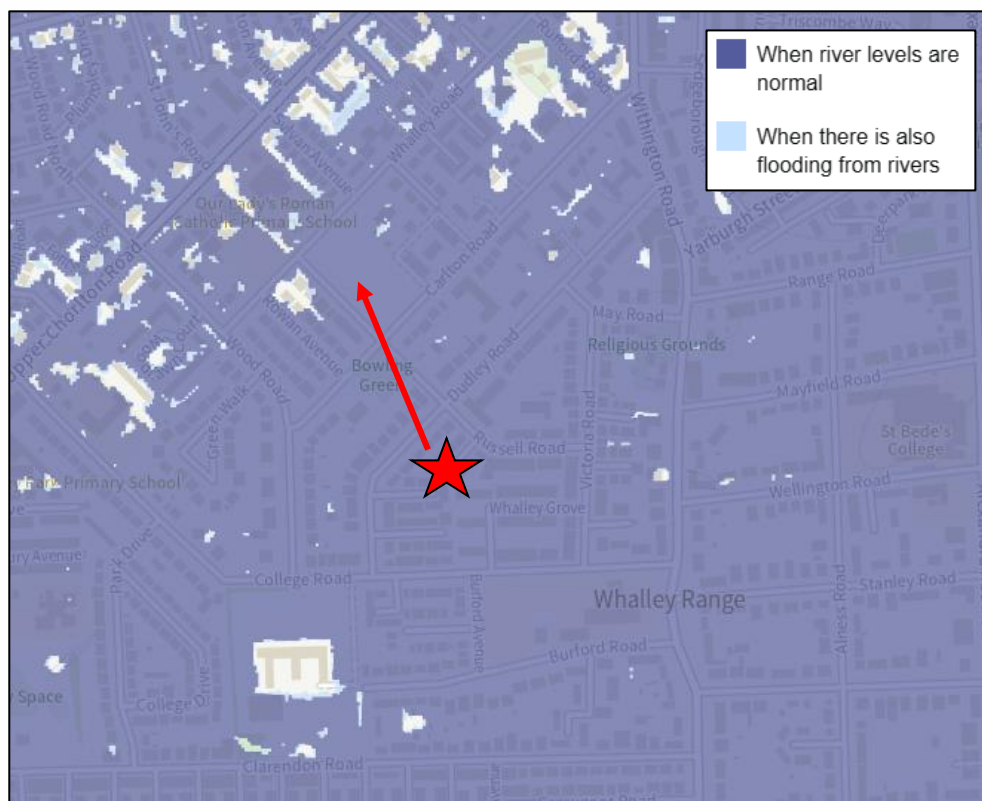


Figure 2.3 Reservoir Flood Risk Map (Gov.UK)

PLUVIAL RUNOFF

- 2.18. Pluvial flooding is defined as ‘flooding from rainfall generated overland flow before the runoff enters any watercourse or sewer.’ It is usually associated with high-intensity rainfall events but can also occur during low-intensity events when the ground is saturated/frozen or has low permeability.
- 2.19. The map provided by Gov.UK (**Figure 2.4**) indicates that the PDS is at “very low” to “low” risk of pluvial flooding. The “low” risk is due to a low spot in the middle of the site and is likely due to the demolition works.

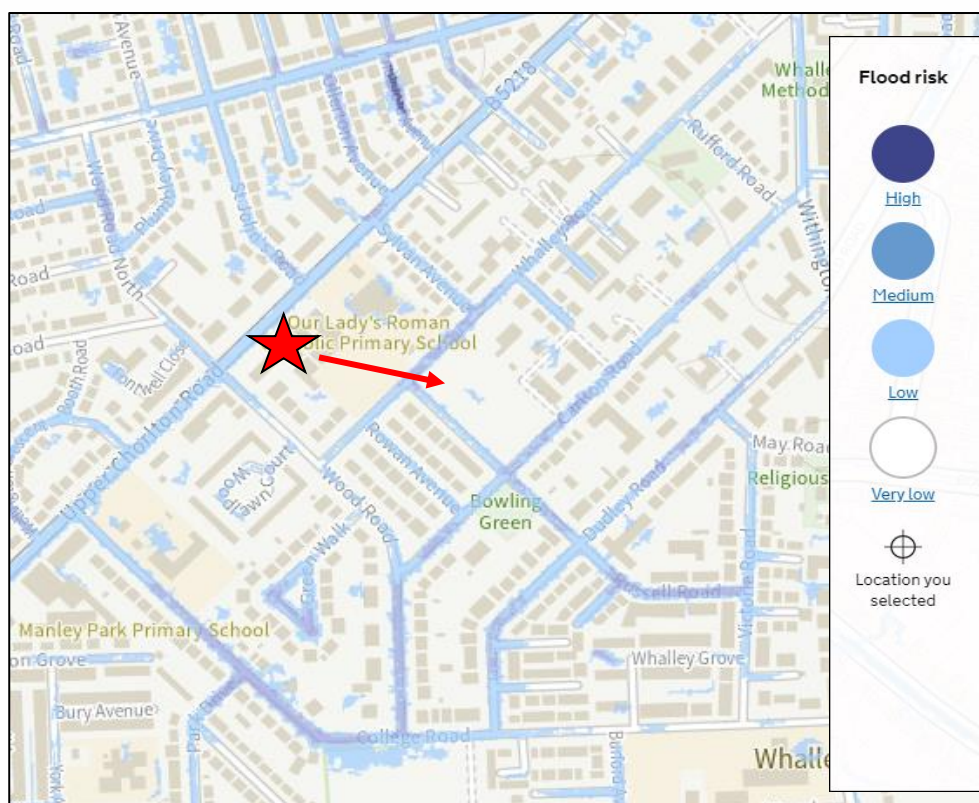


Figure 2.4 Pluvial Flood Risk Map (Gov UK)

CRITICAL DRAINAGE AREA

- 2.20. Critical Drainage Areas (CDA) are areas that are particularly sensitive to an increase in surface water runoff, either as direct overland flow or from the existing sewer network.
- 2.21. The maps within the SFRA indicate that the PDS is located within a CDA known as the Conurbation Core (**Figure 2.5**).

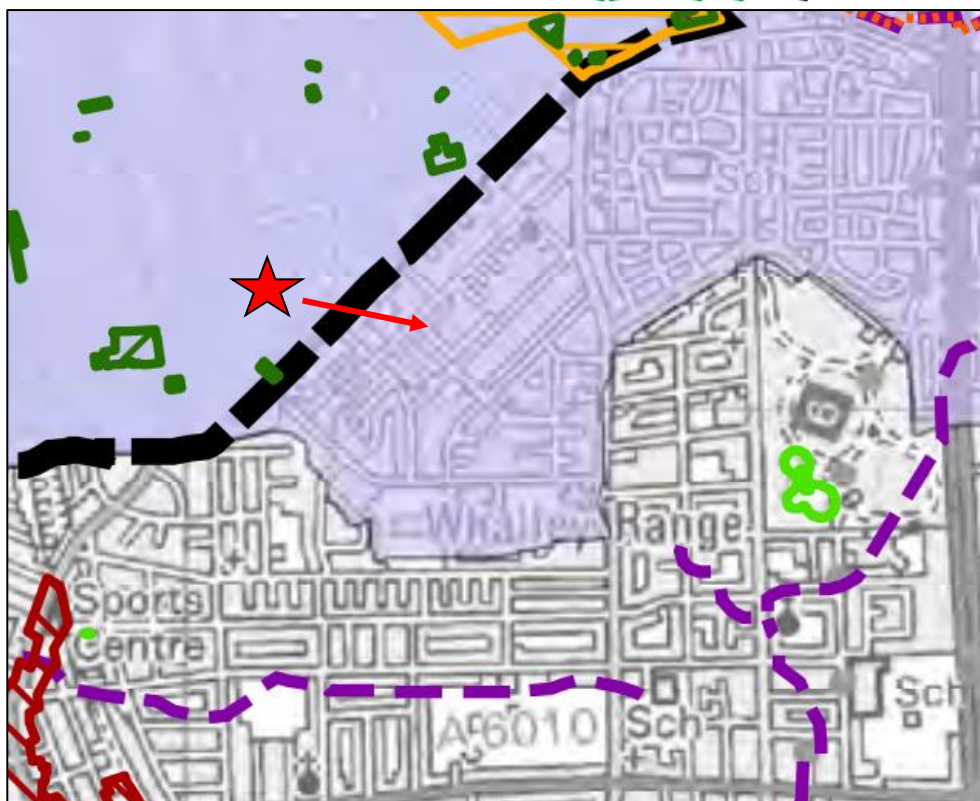


Figure 2.5 CDA Flood Risk Map (SFRA Map 4.5)

FLOOD RISK OVERVIEW

2.22. The potential sources of flooding which could be experienced have been summarised in **Table 2.1**. Those posing the greatest flood risk to the site have been investigated further in **Section 3** to determine the potential mitigation measures.

Source of Flooding	Potential Flood Risk	Site Description
Fluvial/Tidal	Low/Negligible	The PDS is in Flood Zone I
Ordinary Watercourse	No Ordinary Watercourses Identified	No information is available.
Canal	No Information Available	The PDS is outside of any breach analysis that has been undertaken within the SFRA
Ground Water	Risk Identified	Any ground water issues are to be confirmed during the Phase 2 Site Investigation and mitigated during the detailed design.
Artificial Waterbodies (Reservoir)	Risk Identified	In the event of a breach. The PDS is shown to be at risk.
Pluvial Runoff	Low	The Gov.UK Maps confirm the PDS is at very low to low risk of pluvial flooding.
Critical/Sensitive Drainage Areas	Yes	The SFRA has confirmed the PDS is in CDA

Table 2.1 Potential Sources of Flooding Overview

SECTION 3 FLOOD RISK ANALYSIS

GROUNDWATER FLOODING

- 3.1. The SFRA maps indicate that the PDS could be at risk of groundwater flooding (**Figure 2.2**).

Mitigation Measures

- 3.2. These maps are a guide, and the risk of groundwater flooding will be confirmed by/during the intrusive site investigation. Any risks that are highlighted by this work will be mitigated during the detailed design stage.

Groundwater Flooding = To be confirmed

ARTIFICIAL WATERBODIES

- 3.3. The reservoirs in the UK have an extremely good safety record and are carefully maintained. However, the Gov.UK maps indicate that the PDS could be at risk during a breach (**Figure 2.3**).

Mitigation Measures

- 3.4. The maps are prepared for emergency planning purposes and reflect a credible worst-case scenario. This means that if a reservoir failure did occur, it would most likely be far less severe than the scenario shown on the map.
- 3.5. Proposing any mitigation measure to defend against such an event would be impractical and cost prohibitive. So, a residual risk from this source would remain.

Reservoir Flooding = Residual risk remains

PLUVIAL FLOODING

- 3.6. The Gov.UK maps indicate that the risk of pluvial flooding onsite is Very Low. The map does show a small area of Low Risk in the centre of the site, but this is most likely a low spot following the demolition of the hospital (**Figure 2.4**).

Mitigation Measures

- 3.7. Regardless of the risk on site, all new hardstanding areas should aim to slope/shed runoff away from sensitive areas when possible. The proposed Finished Floor Levels (FFL) of the PDS should also aim to be a minimum of 150mm above the surrounding ground levels.

3.8. If raising the proposed FFL above the surrounding ground is not feasible. Then the proposals should provide the following evidence at the detailed design stage;

- *External levels plan to indicate how surface water runoff is directed away from sensitive areas or intercepted by runoff-capturing devices.*
- *A detailed surface water drainage design that shows all necessary storm periods can be adequately catered for below ground.*

Pluvial Flooding = Low Risk after redevelopment

CRITICAL DRAINAGE AREAS

3.9. The SFRA maps indicate that the PDS is located with the Conurbation Core CDA (Figure 2.5).

Mitigation Measures

3.10. The SFRA and Local Flood Risk Management Strategy both confirm that redevelopments within this CDA should provide a 50% betterment in surface water runoff to gradually reduce the flood risk in the area.

Within Critical Drainage Areas, and consistent with Core Strategy policy EN14 Flood Risk, developers should aim to minimise surface water runoff from developments, and achieve at least the following runoff rates:

- Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, including consideration of climate change
- A 50% runoff rate reduction for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, including consideration of climate change

Figure 3.1 Brownfield Site Runoff Restrictions (Core Strategy EN14)

CDA Flooding = Risk addressed as required by EN14

SECTION 4 FLOOD ZONE REQUIREMENTS

Development Flood Zone

4.1. Based on the information available, the PDS is located within Flood Zone 1.

- Flood Zone 1 – Low Probability

Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as ‘clear’ on the Flood Map – all land outside Zones 2 and 3)

Proposed Development Type

4.2. In accordance with the National Planning Policy Framework Practice Guidance on flooding. The development proposals would be classed as more vulnerable and are permitted within Flood Zones 1.

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓
2	✓	Exception Test Required	✓	✓	✓
3a	Exception Test Required	x	Exception Test Required	✓	✓
3b	Exception Test Required	x	x	x	✓

Key: ✓ Development is appropriate x Development should not be permitted

Table 4.1 Flood Risk Classification (NPPF)

Policy Aims

4.3. Despite being in Flood Zone 1, developers and Local Authorities should still seek opportunities to reduce the overall level of flood risk in the area through the layout and form of development and the appropriate application of sustainable drainage techniques.

4.4. Sustainable drainage techniques along with an outline drainage plan are discussed in further detail in **Section 5 & 6**.

Finished Floor Level Restrictions

4.5. No FFL restrictions in Flood Zone 1

Flood Compensation Review

4.6. No compensation required in Flood Zone 1

Flood Resilient Construction

4.7. No restrictions in Flood Zone 1



Safe Access and Egress from the Site

4.8. Not required for Flood Zone I

Flood Warning & Evacuation Plan

4.9. Not required for Flood Zone I

PUBLIC SEWERS

5.1. Public sewers in the area are owned and maintained by United Utilities (UU). A copy of their sewer records has been included with in **Appendix B**.

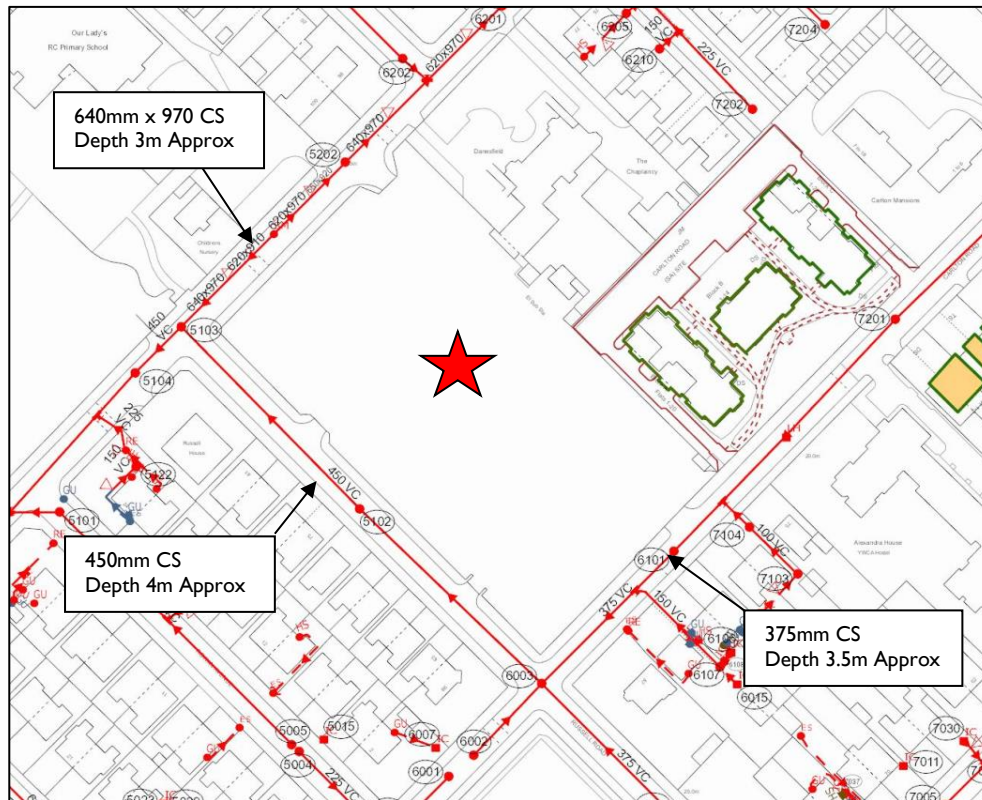


Figure 5.1 Sewer Records (United Utilities)

Surface Water Sewers

5.2. No surface water sewers in the vicinity of the PDS.

Foul Water Sewers

5.3. No foul water sewers in the vicinity of the PDS.

Combined Water Sewers

5.4. Three combined water sewers are adjacent to the PDS. UU records indicate these are;

- A 640x970mm egg-shaped sewer on the northwest boundary. The sewer is around 3m deep.
- A 375mm diameter sewer on the southeast boundary. The sewer is around 3.5m deep.
- A 450mm diameter sewer on the southwest boundary. The sewer is around 4m deep.

Sewer Diversions

5.5. There are no assets shown within the PDS so, no sewer diversions are expected.

PRIVATE DRAINAGE

As-Built Records

5.6. There are no records available.

GPR Survey

- 5.7. The client has instructed Survey Systems to carry out a GPR survey onsite. The survey has located most of the existing drainage to provide an insight into how the former site was drained.
- 5.8. The former site was drained by two combined networks that split the site. The first network drains the northern half of the site and discharges to Whalley Road via a 300mm pipe (brown network). The southern half of the site is drained to Carlton Road via a 225mm pipe (purple network).
- 5.9. A copy of the original GPR survey has been included within **Appendix C** and a simplified version has been shown in in **Figure 5.3**.



Figure 5.2 GPR Survey (Survey Solutions)

SECTION 6 SUSTAINABLE DRAINAGE STRATEGY

- 6.1. The general requirement set out by the NSSDS 2011 and NSTSSD 2015 technical documents is that 'the development must not increase the risk of flooding elsewhere.' In practical terms, this means that the proposed development runoff rate must provide a betterment or be equal to the calculated greenfield rate.

EXISTING SURFACE WATER RUNOFF RATE

- 6.2. Calculating the surface water runoff from a brownfield site is not an exact science. It's based on several assumptions and can be estimated using the following methods.

Modified Rational Method

- 6.3. The Modified Rational Method can be used to calculate the existing runoff rate from a site. It requires the existing impermeable area, an approximate time of concentration and a couple of variables from the Wallingford Procedure.
- 6.4. An existing impermeable area plan i.e., the areas benefiting from positive drainage has been included within **Appendix D**.



Figure 6.1 Existing Site Review

	m ²	ha
Site Boundary	9400	0.9400
Impermeable Area	6885	0.6885
Percentage	0.73	

Table 6.1 Existing Site Analysis

Return Period (Years)	1	2	5	30	100
Rainfall Intensity (mm/h)	42	54	70	99	122

Table 6.2 Return Period Rainfall Intensity

Volume Wallingford Variables	Value
M5-60 minute rainfall depth	19mm
Ratio of M5-60 to M5-2 day rainfalls	0.28
Average Annual Rainfall (SAAR)	858mm
Winter Rain Acceptance Potential (SOIL)	Soil Type 4 (0.45)
Urban Catchment Wetness Index (UCWI)	90
Time of Concentration (mins)	5

Table 6.3 Wallingford Procedure Volume 3 Variables

6.5. The peak flow rate as calculated by the Modified Rational Method is as follows:

$$Q_{\text{Brownfield}} (\text{I/s}) = 2.78 \times C_v \times C_r \times R_i \times \text{Area}$$

Where; $PIMP = \text{Percentage of impermeable area} = 100 \%$

$$P_r = 0.829 PIMP + 25 \text{ SOIL} + 0.078 \text{ UCWI} - 20.7 = 80.47$$

$$C_v = \text{Volumetric runoff coefficient} = \frac{P_r}{PIMP} = 0.805$$

$$C_r = \text{Routing coefficient (Urban Areas)} = 1.3$$

$$R_i = \text{Rainfall Intensity 1 Year} = 42$$

$$\text{Area} = \text{Impermeable Area} = 0.6885$$

$$Q_{\text{Brownfield}} (\text{I/s}) = 2.78 \times 0.805 \times 1.3 \times 42 \times 0.6885 = 84$$

Return Period (Years)	1	2	5	30	100
Peak Runoff Rate (I/s)	84	108	140	198	244

Table 6.4 Existing Peak Runoff Rates

Colebrook Formula

- 6.6. The GPR survey has identified two outfall pipes that connect to United Utilities Sewers. Using the GPR data provided we have been able to calculate the capacity of the existing pipes.

	Pipe One	Pipe Two
Pipe Size (m)	0.300	0.225
Upstream Invert (m)	27.480	28.810
Downstream Invert (m)	26.540	25.720
Lateral Distance (m)	18.000	8.250
Approximate Grade*	1 in 100* (1 in 20)	1 in 100* (1 in 3)
Capacity (Ks 1.5)	116 l/s	54 l/s

Table 6.5 Existing Pipe Capacity

**The existing pipe gradients are deemed excessive and suggest that there is a backdrop at the United Utilities manhole. A 1 in 100 gradient has been deemed more suitable/will better reflect the current arrangement.*

Allowable Runoff Rate

- 6.7. The flow rates in **Table 6.4** indicate the peak runoff that could be generated in each return period. However, it is unlikely that the underground network was designed to serve the more extreme events.
- 6.8. The capacity of the outfall pipes shown in **Table 6.5** suggests the underground network could have been designed for a 5-year return period. The flow rate from the PDS will therefore be restricted to this flow rate with the required betterment (**Figure 3.1**).

5 Year Peak Runoff Rate (l/s)	140 l/s
Required Betterment	50% Minimum
Proposed Peak Runoff (l/s)	70 l/s

Table 6.6 Proposed Peak Runoff Rates

PROPOSED RUNOFF DESTINATION

Surface Water Hierarchy

- 6.9. Paragraph 080 of the Flood Risk and Coastal Change Guidance within the Planning Practice Guidance sets out the following hierarchy of surface water runoff destinations:
- Discharge into the ground (infiltration),
 - Discharge to a surface waterbody,

- iii. Discharge to a surface water sewer,
- iv. Discharge to a combined sewer.

Discharge into the ground.

- 6.10. There were six infiltration tests carried out as part of the site investigation works. Four of these tests failed and remaining two completed but with low results. The results have been summarised below and infiltration will be relied upon where possible. But an outfall to the surrounding sewer network will be required.
- 6.11. This is due to the depth of made ground on the site, the existing tree constraints and the depth of the natural sand and gravels occurring on the site.

Test	Infiltration Rate	Verdict
SAI01	3.66E-05	Low
SAI02	2.05E-05	Low
SAI03	Fail	N/A
SAI04	Fail	N/A
SAI05	Fail	N/A
SAI06	Fail	N/A

Table 6.7 Soil Classification

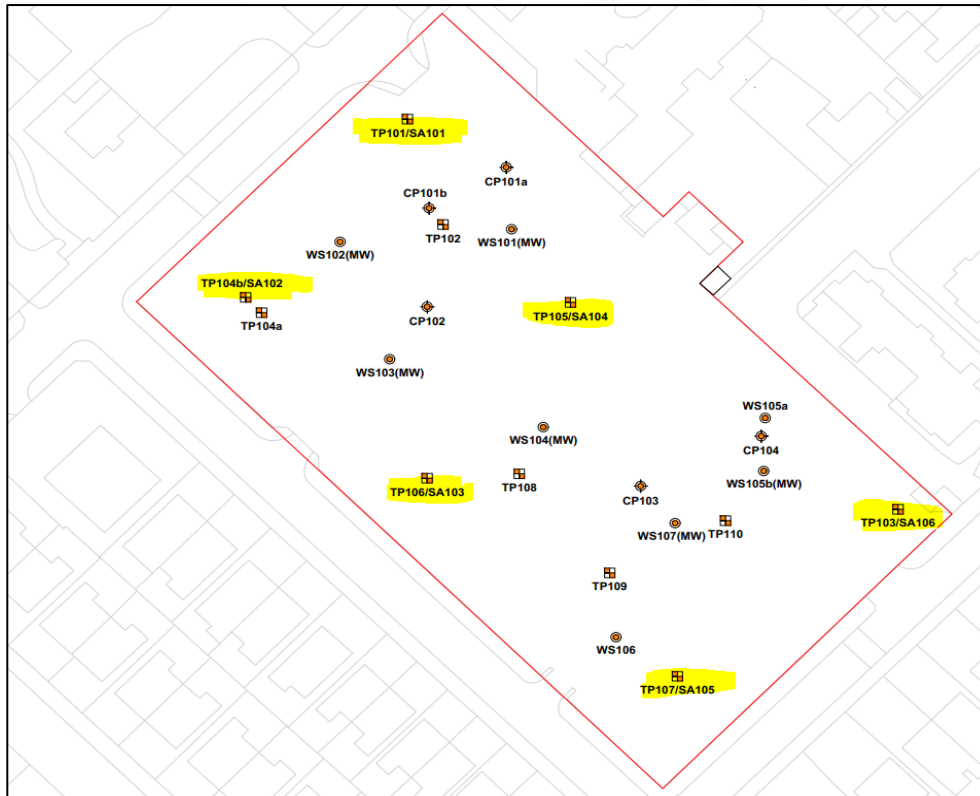


Figure 6.2 – Test Location Plan

Discharge to a surface water body

6.12. No surface water bodies on or around the site.

Discharge to a surface water sewer

6.13. No surface water sewers on or around the site.

Discharge to a combined sewer

6.14. The discharge rate to the sewer(s) will be limited to the calculated brownfield rate with a 50% betterment (**Table 6.6**).

SUSTAINABLE DRAINAGE TECHNIQUES

6.15. SuDS are suitable for low and high-density developments. One or more of the techniques noted in **Table 6.8** could be used and will be specified during the detailed design stage to treat/control the runoff.

SuDS Technique		Proposed Development Suitability
Porous pavements	Description	Pavements constructed with porous paving can provide runoff storage within the sub-base and runoff treatment.
	Suitability	Porous pavements could be used to infiltrate/store some of the surface water runoff. It also provides a form of water quality treatment and will be a benefit to the overall scheme.
Filter drains	Description	Granular-filled linear trenches with a perforated pipe installed at the base.
	Suitability	Filter drains can be used to control/prevent surface water runoff leaving the PDS.
Swales	Description	Relatively shallow naturally landscaped channels that convey and/or infiltrate the surface water runoff.
	Suitability	Unlikely to be suitable due to the land take and existing root protection zones
Retention Ponds	Description	Partially filled permanent water bodies that have been designed to provide temporary surface water storage during critical events.
	Suitability	Unlikely to be suitable due to the land take and existing root protection zones
Detention Basin	Description	Naturally vegetated depression. Designed to store surface water runoff on a temporary basis during critical events.
	Suitability	Unlikely to be suitable due to the land take and existing root protection zones
Soakaways	Description	Drainage structures that are designed to store and infiltrate runoff into the ground.
	Suitability	Subject to infiltration results.
Green Roofs	Description	Vegetated roof areas that reduce and runoff and increase times of concentration.
	Suitability	Suitability subject to Architects proposals
Underground Storage	Description	Attenuation structures installed below ground to provide surface water storage.
	Suitability	Suitable in hard and soft landscaped areas.

Table 6.8 SuDS Techniques

CLIMATE CHANGE ALLOWANCE

- 6.16. The PDS is located within the Irwell Management Catchment. The Environment Agency current guidance recommends that a climate change allowance of **40%** is used during a 3.3% AEP event and an allowance of **45%** is used during the 1% AEP event.
- 6.17. These allowances will be added to rainfall intensities during the detailed design stage.

SECTION 7 PRELIMINARY DRAINAGE STRATEGY

- 7.1. A preliminary drainage strategy has been produced to identify any major issues that may affect the foul and surface water drainage for the proposed development. All recommendations are preliminary at this stage and should be developed/investigated further during the detailed application stage.
- 7.2. A preliminary drainage layout for the PDS, utilising SuDS where possible has been included in **Appendix E**.

SURFACE WATER STRATEGY

SW Networks

- 7.3. We have proposed that the PDS will be served by three new underground networks.
- Network 1 – Southern Car Park,*
- Network 2 – Building and landscape realm,*
- Network 3 - Northern Car Park.*
- 7.4. Network 1 is a simple system that consist of a lined pervious pavement structure (System-C Ciria C753) which has an outfall to United Utilities Sewer. The discharge rate will be restricted to Circa 5 l/s and excess runoff will be attenuated within the open graded sub-base.
- 7.5. Network 1 is traditional underground system that will collect and convey runoff and will outfall to United Utilities Sewer. The discharge rate will be restricted to Circa 65 l/s and excess runoff will be attenuated within the underground cellular tank.
- 7.6. Network 3 is also simple system that consist of a lined pervious pavement structure (System-C Ciria C753), but then discharges runoff into the ground via an infiltration trench. The infiltration trench will be formed with cellular to maximise the storage and to access the sand and gravels (circa 1m+).

SW Catchments

- 7.7. **Figure 7.1** shows the proposed split of SW runoff across the site. These areas have been treated as 100% impermeable at this stage and is considered a worst-case scenario. These catchments will be firmed up/rationalised during the detailed design stage.



Figure 7.1 Preliminary Catchment Split

Preliminary Drainage Model

7.8. Microdrainage simulation results for the preliminary design have been included within **Appendix F**. These results show that the preliminary design is feasible and that the required betterment can be provided.

Return Period (Years)		1	2	5	30	100
Existing Runoff Rate (l/s)		84	108	140	198	244
Max Discharge Rate (l/s)		70 (Table 6.6)				
Proposed Runoff Rate (l/s)	Network 1 Pipe 1001	3.5	4.2	4.4	4.6	4.7
	Network 2 Pipe 2004	27.9	28.0	29.1	41.5	58.1
	Network 3 N/A	0	0	0	0	0
	Total	31.4	32.2	33.5	46.1	62.8
Betterment Achieved		62.6	70.2%	76.1%	76.7%	74.3%

Table 7.1 Simulation Results

Note: Proposed external levels for the PDS are not available at this stage. So, we have used 39.200m as the cover level for each chamber on site. This represents the lowest level on the site and is deemed to be the worst-case scenario.

Note: Climate change allowance of 40% for the 3.3% AEP and 45% for the 1% AEP have been included.

SW Attenuation

7.9. The exact storage requirements/volume will be confirmed at the detailed design stage. But the preliminary model indicates that 125m³ of cellular storage will be required in addition to the storage within the pervious pavements.

Water Quality

- 7.10. The PDS will only be allowed to discharge clean/treated surface water runoff. The exact treatment process will be confirmed during the detailed design stage.
- 7.11. At this stage we would recommend that the vehicular hard standing areas are formed as permeable pavements so that open graded sub-base can cleanse the runoff. Runoff within the sub-base can then either infiltrate into the ground (System A - Subject to made ground) or will discharge to the underground network (System C).
- 7.12. Runoff from the proposed buildings will be directed straight to the underground network. Depending upon the proposed roof covering proposed there may need to be a form of treatment. This will be confirmed during the detailed design stage.

Surcharged Outfall

- 7.13. During the detailed design stage, we would recommend that the surface water network is simulated with a 1m surcharge (above the existing pipe soffit). This will provide the PDS within an additional safeguard should the offsite sewers be overloaded during an extreme event.

Outfall Protection

- 7.14. During extreme events the offsite combined sewer could become surcharged and may force effluent to backflow into the onsite surface water network. The outfall for the surface water runoff should therefore be protected with a non-return valve or similar.

FOUL WATER STRATEGY

Network

- 7.15. The foul water effluent generated by the new development will be collected and conveyed by a new underground network to the combined water sewer within Whalley Road or Charlton Road.
- 7.16. The exact connection point(s) will be confirmed during the detailed design stage.

Foul Water Flows

- 7.17. The proposed flow rate must be agreed with United Utilities during the detailed design stage. Any proposed drainage should also be designed in accordance with Building Regulations Document H1 and Sewers for Adoption 7th Edition.

SECTION 8 FUTURE DRAINAGE MAINTENANCE

General Drainage Maintenance

- 8.1. The end-users will be provided with as-built plans to ensure that the proposed developments private drainage undergoes a regular maintenance regime (either as required or every 2-5 years). This includes, jetting, vacuumation and a visual/CCTV survey to check the structural condition of pipes and manholes.

SuDS Maintenance (If Required)

- 8.2. The maintenance for the onsite SuDS elements will be split into the following sections and will be undertaken by an appointed Maintenance Company once the scheme/plot has been completed.
- *Regular (weeding/inspections/sweeping/litter removal/grass cutting),*
 - *Occasional (sediment removal/vacuum brushing) and*
 - *Remedial maintenance (repair and replacement).*
- 8.3. The Maintenance Company will be employed by the end user of the site and will be provided an Operation and Maintenance manual. This manual will outline the location(s) of any drainage infrastructure and detail the maintenance that is required. It will also include the associated cost, and how often each activity should be carried out.
- 8.4. Records must be kept by the Maintenance Company and the end user for any maintenance works undertaken and must be available for inspection when requested.

Site Specific SuDS elements

- 8.5. The design of the onsite surface water drainage networks will be carried out during the detailed design stage. But we envisage that the design will include the following SuDS elements.
- *Permeable Pavement,*
 - *Underground storage,*
 - *Proprietary Unit: A Downstream Defender or equivalent (if required)*
- 8.6. The maintenance required for each of the above SuDS elements is shown below in **Table 8.1.**

Operation and Maintenance Activity	Suds Component												
	Pond	Wetland	Detention Basin	Infiltration Basin	Soakaway	Infiltration Trench	Filter Drain	Cellular Storage	Permeable Pavement	Swales	Filter Strip	Green Roof	Proprietary Systems
Regular Maintenance – Monthly Basis													
Inspection	●	●	●	●	●	●	●	●	●	●	●	●	●
Litter and debris removal	●	●	●	●	○	●	●	○	●	●	●		○
Grass cutting	●	●	●	●	○	●	●	○	○	●	●		
Weed and invasive plant control	○	○	○	○		○	○		○		○	●	
Shrub management	○	○	○	○					○	○	○		
Shoreline vegetation management	●	●	○										
Aquatic vegetation management	●	●	○										
Occasional Maintenance – Annually or as required													
Sediment management	●	●	●	●	●	●	●	●	●	●	●		●
Vegetation replacement	○	○	○	○						○	○	●	
Vacuum sweeping and brushing									●				
Remedial Maintenance – As required													
Structure rehabilitation/repair	○	○	○	○	○	○	○	○	○	○	○	○	
Infiltration surface reconditioning				○	○	○	○		○	○	○		

● Will be required ○ May be required

Table 8.1 SuDS Maintenance Management

SECTION 9 CONCLUSION

- 9.1. A Flood Risk Assessment & Drainage Strategy is required to satisfy all requirements of the National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Change Planning Practice Guidance (PPG).
- 9.2. This report as far as reasonably practical; has concluded the following:
 - a) The PDS is within Flood Zone I (low probability of fluvial flooding).
 - b) The development proposals are categorised as more vulnerable and are suitable in this Flood Zone.
 - c) The pluvial flood maps highlight a small area of risk on the PDS. But following the onsite works (reprofiling and new drainage network) the risk will be mitigated.
 - d) The PDS is located within an area at risk of groundwater flooding. The intrusive site investigation work will confirm the potential risk and mitigation measures will be proposed during the detailed design stage,
 - e) There is a residual risk of flooding from a reservoir in the event of a catastrophic worst case event.
 - f) The proposed surface water runoff rate from the development must be restricted to the calculated brownfield runoff rate with a 50% betterment (**Table 6.6**)
 - g) The proposed surface water network must include a climate change allowance of 40% during the 3.3% AEP and 45% during the 1% AEP.
 - h) The surface water runoff from the development must be adequately treated before it can be discharging from the site.
 - i) The onsite surface water network should be simulated against a 1m submerged outfall and be protected against backflow.
 - j) The proposed onsite drainage system will provide a betterment over the current arrangement/will decrease the risk of offsite flooding via overland flows.
 - k) The PDS should not commence until a detailed scheme for surface and foul water drainage has been submitted to and approved by the Local Planning Authority.
 - l) The existing outfalls must be inspected via a CCTV survey to locate/trace and check the structural condition.



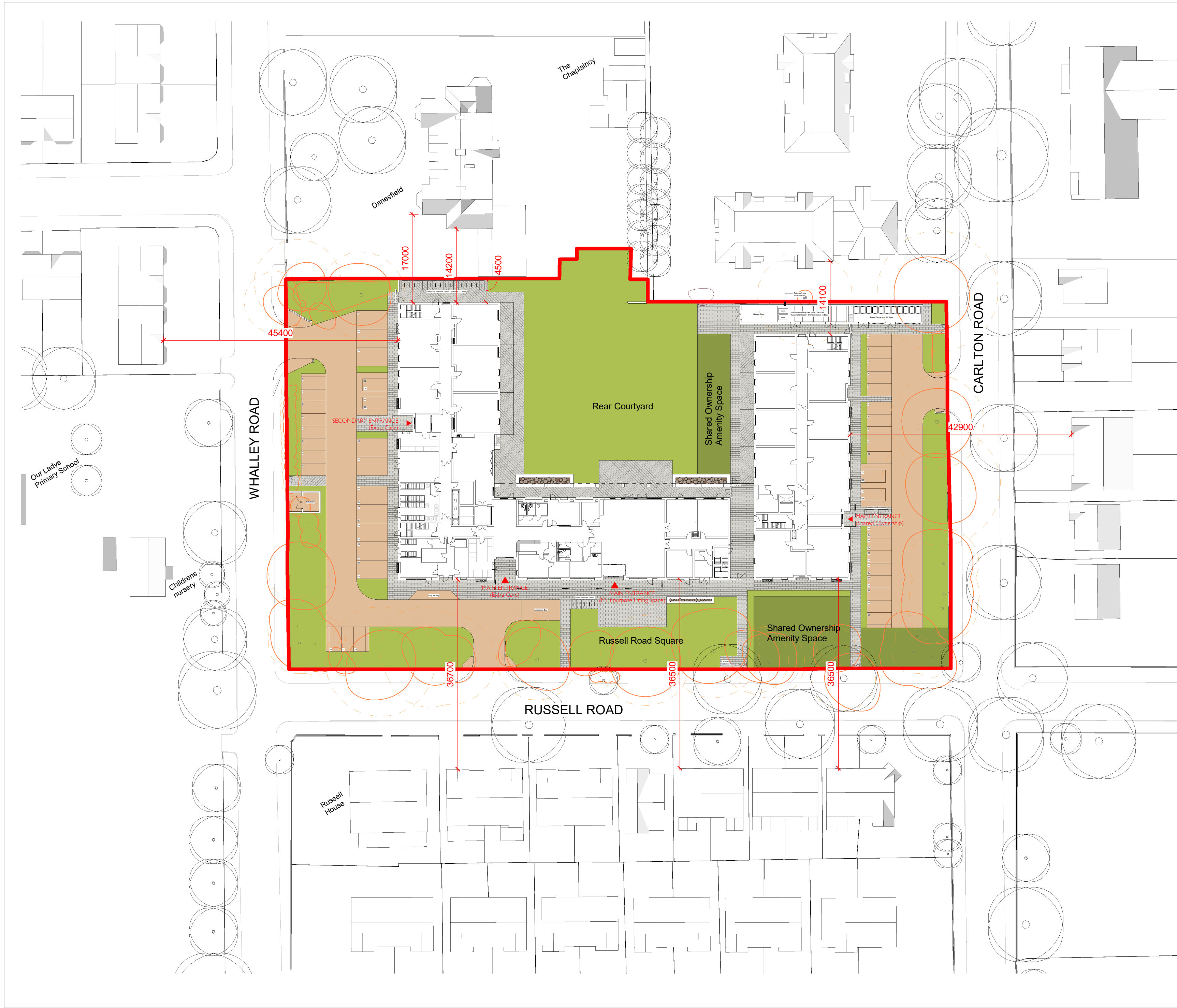
m) The allowable foul and surface water discharge rates must be approved by United Utilities via a S106 & S104 application.

- 9.3. SGi considers the proposed scheme to be acceptable in planning terms, with regards to flood risk and recommends that the Local Planning Authority accept this Flood Risk Assessment and Drainage Strategy in support of the Planning Application.

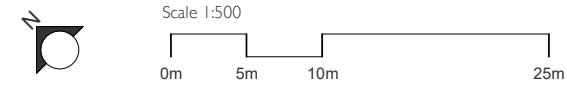


Shepherd Gilmour
Consulting Engineers

APPENDIX A1



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 - REPORT ERRORS & OMISSIONS TO ARCHITECT.
 - WHERE AN ITEM IS COVERED BY DRAWINGS OF DIFFERENT SCALE, THE LARGER SCALE DRAWING TO BE WORKED TO. DO NOT SCALE FROM THE DRAWING. FIGURED DIMENSIONS TO BE WORKED TO IN ALL CASES.
 - CHECK ALL DIMENSIONS ON SITE.
 - DRAWING TO BE READ IN CONJUNCTION WITH THE HEALTH & SAFETY PLAN, AND ALL RELEVANT RISK ASSESSMENTS AND THE FOLLOWING DRAWINGS:



NB.: Please refer to Landscape Plan for detailed landscaping proposals

H	08.07.24	MM	General updates in-line with ongoing design & co-ordination
G	10.06.24	MM	General updates in-line with ongoing design & coordination. External stores altered. Additional path added to Russell Road.
F	17.05.24	JM	General updates in-line with ongoing design & coordination
E	09.05.24	MM	Shared Ownership parking and amenity space altered. Ambulance bay size increased.
D	03.05.24	MM	Block plans updated. Site Plan updated.
C	11.03.24	JM	General Updates. Issued for Planning Pre-app meeting

Rev	Date	By	Remarks
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Client:							
Great Places Housing Group							
Project No. / Project Name:							
22-036 / Russell Road Extra Care Housing							
Drawing Name:							
Site Plan							
Drawing Purpose:							
INFORMATION							
Project:	Origin:	Vol/No:	Sheet:	Title:	Role:	Org No.:	Revision
RUS	TR	22-036	00	R	2	2010	H
Status:	File:	Drawn:	Check:	Date:			
1 : 500		JM	MM	JAN 2024			



Tel: 0161 272 3500
E-mail: studio@trianglearchitects.co.uk
Web: www.trianglearchitects.co.uk
Twitter: @TriangleArch

Lower Ground Floor,
4 Jordan Street,
Manchester,
M15 4PY



Shepherd Gilmour
Consulting Engineers

APPENDIX B1

Warren Chan

Phoenix House
Cross Street,
Manchester,
M2 4JF

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: Russell Road
Our Ref: UUPS-ORD-537097
Date: 14/12/2023**

Dear Sirs

Location: 81 RUSSELL ROAD, MANCHESTER, M16 8AR

I acknowledge with thanks your request dated 08/12/2023 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



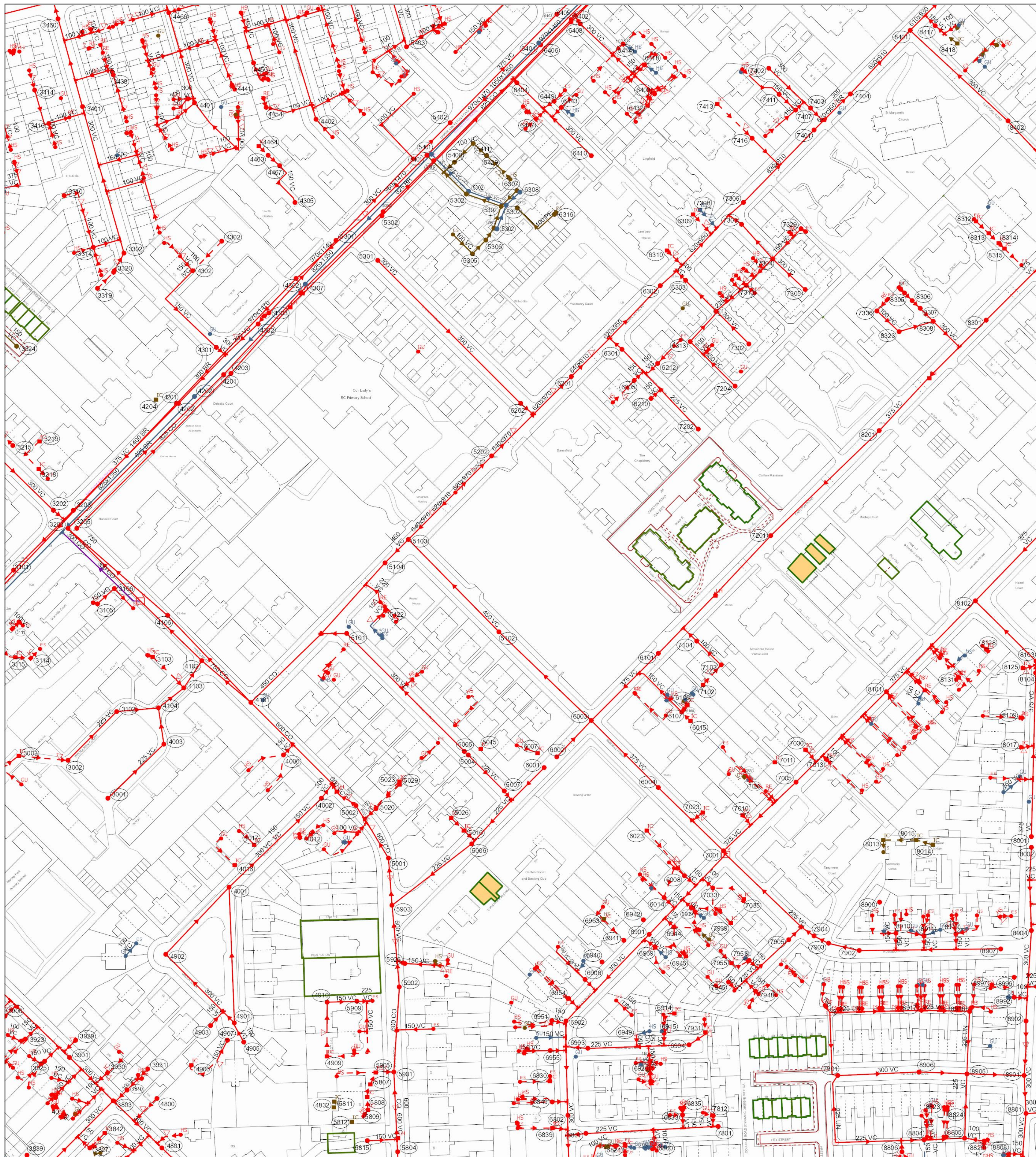
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
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- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
8862	29.4	CO	27.36	100			VC	23.3929	1 in 23
8862	29.4	CO	27.36	100			VC	7.150877	1 in 23
4201	29.44	CO	25.09	825			BR	125.9055	1 in 106
4403	30.01	CO	26.72	100			VC	73.5557	1 in 306
4450		CO		100			VC	19.40056	1 in 306
6008		CO		100			VC	8.242734	1 in 306
5306		CO		100			VC	7.965588	1 in 306
5302	29.04	SW	26.57	100			VC	52.5259	1 in 748
5302	30.08	SW	0	225			VC	29.1321	1 in 138
7904	29.95	CO	25.87	225			VC	6.602325	1 in 138
8201	29.32	CO	25.93	375			VC	83.45058	1 in 596
6901		CO		150			VC	7.805602	1 in 596
7905	29.84	CO	26.2	225			VC	9.899495	1 in 596
6003	29.61	CO	26.41	150			VC	7.108499	1 in 596
5305		FO		150			VC	10.50762	1 in 596
5401	29.99	CO	26.01	300			VC	100.0156	1 in 1429
4006	29.71	CO	24.28	150			VC	7.721068	1 in 1429
6202	29.32	CO	26.71	300			VC	9.219444	1 in 1429
4101	29.41	CO	24.5	300			VC	38.4983	1 in 384
6001	28.97	CO	26.21	225			VC	25.45584	1 in 384
8104	29.12	CO	26.41	225			VC	14.21387	1 in 1421
8905	29.26	CO	26.21	300			VC	31.63562	1 in 117
4003	29.61	CO	27.6	150			VC	20.23735	1 in 75
6108		CO		150			VC	32.70474	1 in 75
4302	29.61	CO	27.16	150			VC	60.45727	1 in 61
6302	29.61	CO	27.16	150			VC	65.12171	1 in 61
8001	28.86	CO	26.86	375			VC	91.23025	1 in 305
4106	29.38	CO	24.48	450			VC	73	1 in 450
4903	29.62	CO	27.28	150			VC	10.45667	1 in 129
5301	29.62	CO	27.28	300			VC	111.7229	1 in 129
6313	29.63	CO	28.08	150			VC	22.22181	1 in 90
3301	29.63	CO	28.08	225			VC	43.13931	1 in 225
8904	28.88	CO	26.05	300			VC	50.09075	1 in 1252
6954		CO		150			VC	7.529939	1 in 85
7302	29.57	CO	27.33	150			VC	25.45584	1 in 85
4101	29.41	CO	24.61	450			VC	66.48308	1 in 554
5302	29.6	CO	26.01	600			VC	39.97098	1 in 440
3302	29.68	CO	27.65	300			VC	84.20316	1 in 281
7401	29.85	BR	26.15	600			BR	16.3478	1 in 368
5104		CO		450			VC	106.8541	1 in 368
7948	28.97	CO	25.35	150			VC	2.95348	1 in 471
6903	29.18	CO	25.94	300			VC	70.74802	1 in 471
5411		FO		100			VC	21.0238	1 in 471
4901	28.64	CO	26.69	300			VC	14.60678	1 in 2189
6406	29.48	BR	24.38	970			BR	87.5642	1 in 2189
8805		CO		225			VC	35.52072	1 in 1004
4202	29.71	CO	26.56	625			VC	103.5229	1 in 1004
7303	29.72	CO	26.89	300			VC	79.7584	1 in 17
5403	29.76	CO	27.69	300			VC	8.602325	1 in 241
5007	29.83	CO	26.05	225			VC	69.87139	1 in 85
7305	29.68	CO	26.05	225			VC	8.403124	1 in 85
6004	28.98	CO	25.57	375			VC	24.76884	1 in 748
7404	29.82	CO	26.01	600			VC	52.3259	1 in 221
4901	28.64	CO	26.69	300			VC	46.10405	1 in 221
8912		CO		150			VC	74.99228	1 in 987
4202	29.48	BR	24.16	1400			VC	8.957338	1 in 987
3202	29.37	CO	27.09	300			VC	187.5114	1 in 987
3105		CO		150			VC	7.814219	1 in 987
6404	29.91	CO	25.44	150			VC	12.40392	1 in 987
5408		CO		150			VC	6.53971	1 in 987
5101	29.37	CO	25.12	300			VC	2.82427	1 in 987
4301	29.57	CO	26.01	300			VC	8.08054	1 in 987
6906		CO		150			VC	6.403124	1 in 987
6909		CO		225			VC	8.347221	1 in 987
7612		CO		150			VC	8.611216	1 in 987
6418		CO		150			VC	6.057906	1 in 987
8102	29.26	CO	26.24	375			VC	7.953653	1 in 987
8306		CO		100			VC	70.00714	1 in 438
4302	29.6	CO	27.5	300			VC	7.171173	1 in 438
4407		CO		150			VC	6.270505	1 in 438
4910		CO		150			VC	24.75884	1 in 438
5102	29.33	CO	25.16	150			VC	27.69493	1 in 438
6901	28.94	CO	25.75	300			VC	11.42129	1 in 950
8910		CO		150			VC	16.44891	1 in 950
7329		CO		150			VC	9.359598	1 in 950
6414		CO		150			VC	22.84123	1 in 950
7033		CO		100			VC	8.143984	1 in 950
6307		FO		150			VC	8.003128	1 in 950
6905		CO		150			VC	12.38367	1 in 950
7402	30.08	CO	27.22	300			VC	6.785655	1 in 60
7336		CO		100			VC	31.82766	1 in 60
4104	29.62	CO	27.33	225			VC	16.70122	1 in 77
4401	29.76	CO	26.54	300			VC	17.80446	1 in 77
3101	29.31	CO	26.84	375			VC	2.445297	1 in 485
6903	29.83	CO	26.03	225			VC	89.19869	1 in 485
8305		CO		100			VC	12.04159	1 in 485
7304		CO		150			VC	5.847642	1 in 502
7313		CO		225			VC	21.74684	1 in 502
7001	29.01	CO	25.68	375			VC	34.68887	1 in 502
7948		VC		150			VC	50.20956	1 in 502
3110		CO		100			VC	2.921105	1 in 502
7416		CO		300			VC	2.921105	1 in 502
4001	29.9	CO	26.35	300			VC	21.39973	1 in 377
3460		CO		300			VC	30.09388	1 in 377
3401	29.84	CO	25.93	300			VC	9.893416	1 in 377
3416		CO		100			VC	33.94112	1 in 377
6401	29.95	CO	24.45	100			VC	20.32047	1 in 502
7403	29.89	CO	26.65	300			VC	82.26969	1 in 20
4202	29.51	SW	24.21	825			VC	9.899495	1 in 1035
7407		CO		150			VC	200.1225	1 in 1035
4002	29.18	CO	26.14	300			VC	6.36934	1 in 1035
5303	29.6	CO	26.76	300			VC	10	1 in 1035
5103	29.37	CO	25.01	450			VC	7.071088	1 in 1035
5308		CO		150			VC	18.38478	1 in 1035
5020		CO		150			VC	10.44929	1 in 1035
8969		CO		150			VC	8.627673	1 in 1035
8303		CO		150			VC	7.487369	1 in 1035
6902	28.92	CO	26.6	300			VC	19.89889	1 in 1035
5302		SW		150			VC	34.02173	1 in 1035
8301	29.58	CO	26.13	375			VC	22.80362	1 in 447
3114		CO		150			VC	84.87806	1 in 447
7304	29.75	CO	27.25	225			VC	15.37395	1 in 447
844		CO		150			VC	20.7329	1 in 447
6902	28.84	CO	25.68	300			VC	4.48442	1 in 650
5302	29.63	CO	23.88	825			VC	52.01316	1 in 650
7903	28.81	CO	26.86	225			VC	49.5862	1 in 534
7201	29.16	CO	26.76	375			VC	8.84472	1 in 473
3304	30.21	FO	26.96	150			VC	89.83026	1 in 61
5122		CO		150			VC	21.02748	1 in 61
3627		CO		150			VC	6.9178	1 in 61
5926		CO		150			VC	9.291721	1 in 61
7301	29.8	CO	27.02	300			VC	4.563423	1 in 100
6201	29.43	CO	26.17	400			VC	24.04163	1 in 100
7013		CO		100			VC	15.95333	1 in 100
6833		CO		150			VC	2.915885	1 in 100
8402	30.02	CO	27.03	300			VC	7.265518	1 in 121
3114	29.95	CO	26.1	600			VC	73.59348	1 in 121
6801	28.95	CO	26.08	225			VC	55.85951	1 in 121
3910		CO		100			VC	10.04988	1 in 121
8917		CO		225			VC	8.62962	1 in 121
3625		CO		150			VC	26.8941	1 in 583
5001	28.95	CO	26.75	600			VC	11.14318	1 in 583
6449		CO		150			VC	17.46286	1 in 583
8911		CO		150			VC	7.315446	1 in 583
5902	28.8	CO	24.96	600			VC	7.723622	1 in 231
8307		CO		100			VC	10.16707	1 in 767
8002	28.94	CO	26.11	300			VC	23.98979	1 in 767
8103	29.27	CO	26.46	375			VC	46.04561	1 in 673
8902		CO		100			VC	47.15372	1 in 673
4902	28.61	CO	26.51	300			VC	10.83735	1 in 318
5402	29.69	CO	23.8	825			VC	50.93133	1 in 318
4102	29.35	CO	24.51	750			VC	108.6036	1 in 573
4406		CO		300			VC	47.38143	1 in 573
6402	29.95	CO	23.7	825			VC	12.6818	1 in 519
5401	29.75	CO	24.33	900			VC	275.236	1 in 519
5804	29.73	CO	24.86	300			VC	48.20997	1 in 604
3106		CO		150			VC	22.02771	1 in 2302
6405	29.98	CO	23.61	150			VC	15.31109	1 in 386
5301	29.58	CO	27.2	300			VC	127.3129	1 in 386
4201	29.98	CO	27.27	375			VC	62.24147	1 in 460
8308		CO		300			VC	62.73451	1 in 460
3901	28.71	CO	24.83	600			VC	20.18661	1 in 1570



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APPENDIX C1

Q-LEVEL	DESCRIPTION	ACC.	Q-LEVEL	DESCRIPTION
Q1-D	Sample problems taken from records.	Analysed	Q1-R2	Reproduce a virtual toolbar using only the <i>Analysed</i> techniques.
Q1-C	Visual evidence of remote evidence not attributable to geographical techniques.		Q1-R1	Reproduce a virtual toolbar using multiple <i>Analysed</i> techniques.
Q1-R4	Unattributed source present in record as an <i>Analysed</i> artefact.	Q1-C, Q1-D	Q1-A	Reproduce a virtual toolbar - unattributed by open excavation, malware analysis (optional) <i>Analysed</i> .
Q1-R3	Forensic evidence by one geographical technique but not <i>Analysed</i> in prior depth information.			

DRAINAGE SURVEY
All accessible Manholes and Inspection chambers have had their respective covers lifted with pipe sizes, inverts, chamber sizes/types and service data recorded from ground level. All connections from DPs, Gullies, Drains, VPs, REs and lampholes have been proven wherever possible using audible connections (AC) and/or sonde instrumentation where applicable. Where these methods have proved unsuccessful then assumed (AR) straight line connections will be shown.

CCTV DRAINAGE SURVEY
All accessible Manholes and Inspection chambers have had their respective covers lifted with pipe sizes, inverts, chamber sizes/type and service data recorded from ground level. Pipework has been traced, accessed and collected for post processing. Drainage layout, including manhole covers not located by topographical survey, may be taken from CCTV chainage and will be shown as indicative only.

Electricity
Elec cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

British Telecoms
BT cables will have been predominantly located using EMIL methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required. Due to current laws and legislation protecting all BT apparatus, cabling can only be located remotely. We therefore compare all our telecom findings against record information to produce the final service layout. In some instances, where high amount of cable ducts are present, we may only be able to identify a linear centre peak signal rather than identifying all the individual duct positions. For further information regarding Telecoms apparatus, please contact Openreach directly.

Cable TV & Communications
CTV and/or Com cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

Fibre Optic
FO cables will have been predominantly located using GPR methodology. This is due to the materials used within fibre optic cabling. In some rare instances, tracer cabling or conductive non fibre optic cabling will be present within some or all ducting. When this is the case, both EML and GPR methodology will be combined to identify service network and achieve greater quality levels.

Lighting, Traffic Signal & Security Cables
LC, TS and/or Sec cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

Gas & Water Inc. Fuel Pipes and Hot Water Pipes

GM/GS and/or VM/WWS pipe work will have been attempted and located using both EML & GPR methodology with electronically derived depths shown for the former and depths to crown levels shown for the latter.

When the Gas/Water pipe work is constructed using conductive materials, then we are able to use multiple geophysical techniques to identify service network and achieve greater quality levels. When a non conductive material is used, GPR methodology will be employed to locate and plot the final service layout.

Ground Penetrating Radar
GPR methodology is used to identify and locate all non metallic, non conductive piping and cabling. We also employ GPR to obtain a greater accuracy levels on EML locate services. The GPR has a greater success rate on pipe or service diameter upward of Ø63mm, C63mm, as size increments increase, so does the chance of detection. The GPR can produces varying results and as such, wouldn't be used as an independent utility surveying instrument.

Unidentified Traces
All UITS will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required. Every effort has been made to identify the service but in this instance, is not achievable. We recommend excavation work to determine identity and depth where applicable.

Scarring (QL-C)
Scarring has been identified on site with a potential of an undetectable service present.

Assumed Routes & Taken from Records (GL-B4/C)
Assumed routes (AR) are shown if there is evidence that a service exists but we are unable to trace it whilst on site. The surveyor will attempt to locate various risers/cavities/meters (service evidence) etc. around site area to successfully determine an assumed route between these points. If there is little evidence on site but they believe a service is still present, then a common sense approach to an assumed route shall be employed.

Taken from records (TFR) are service routes that are taken from STAT record plans or previous survey information and overlaid onto our drawings.

The sewers with high levels of silt or blockages to be jetted to extend the CCTV drainage survey, if any of these areas are deemed critical or of high importance.

[illegible]

All below ground details shown have been identified from above ground without excavation. Survey Solution use electro-magnetic and/or ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not infallible and we recommend trial excavations are carried out for verification of positions, depths and identification.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no items have been identified during our investigations. All reasonable care and normal good practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access can not be achieved for tracing may not be shown and alternative locating methods should be used.

Survey Solutions has used all reasonable care to research available service records but the completeness or use of the service records supplied to or by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features annotated as 'taken from records' (TFR).

Depths obtained using electro-magnetic or GPR are effected by ground conditions and should be treated as indicative only. Electro-magnetic depths to utilities and services are generally taken to the centre of a feature, GPR depths to the top of a feature and drainage depth shown to inverts, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should be treated as approximate. Pipe dimensions which have not been obtained visually will be taken from records when available.

points, unless otherwise stated. The numbers of cables in runs will not be shown unless specifically requested. All services are below ground unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of either the topographical survey or base mapping on this project.

All critical dimensions and measurements should be checked and verified with any

The contractor must check and verify all site and building dimensions, levels, utilities

© Land Survey Solutions Limited hold the copyright to all the information contained within this document and their written consent must be obtained before copying or using the data other than for the purpose it was originally supplied.

Do not scale from this drawing.

This survey has been carried out in accordance with PAS 128: 2014 & our version of the Royal Institution of Chartered Surveyors (RICS) specification for Measured Surveys of Land, Buildings and Utilities. Our survey extents have been agreed and confirmed with formal acceptance of 63211 from TRIANGLE ARCHITECTS LTD. If you have any queries regarding the final services layout, please may we ask you to carefully read all the information within this title block in its entirety before continuing to do so.

TOPOGRAPHICAL SURVEY DATE 12/12/2023		
SURVEY TYPE	DESCRIPTION	EFFECT ON SURVEY RESULTS
TOPO	LSS supplied	
OUTDATED		
OS		
NTS		

GENERAL SITE CONDITIONS	
POOR	
ADDITIONAL INFORMATION	EFFECT ON SURVEY RESULTS

PREREQUISITE FOR PAS 128: 2014 SURVEY TYPE B		
COMMISSIONED: YES		
UTILITY	AVAILABILITY	UTILITY COMPANY PROVIDER
SEWER	YES	UNITED UTILITIES
WATER MAIN	YES	UNITED UTILITIES
GAS MAIN	YES	CADENT GAS
TELECOM	YES	BRITISH TELECOMS
CABLE TV	NO	N/A
ELECTRICITY	YES	ELECTRICITY NORTH WEST
OIL PIPES	NO	N/A
OTHER	NO	N/A

REV	DESCRIPTION	DRAWN	CHECKED	APPR	SURVEY DATE
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PROJECT TITLE
LAND OFF RUSSELL ROAD,
WHALLEY RANGE, M16 8AJ

DRAWING DETAIL
UTILITIES AND DRAINAGE SURVEY.
SHEET 1 OF 1

CLIENT TRIANGLE ARCHITECTS LTD				SCALE 1:200
SURVEYOR TH OB	SURVEY DATE 15/12/2023	CHECKED BY DR	APPROVED BY DR	DWG STATUS FINAL
DRAWING NUMBER 63211MCUG-01			REVISION	ISSUE DATE 21/12/2023





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APPENDIX D1



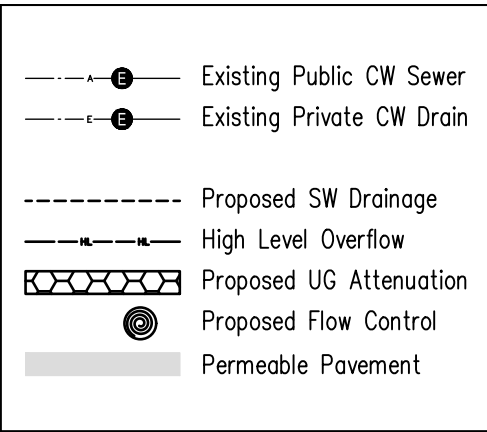
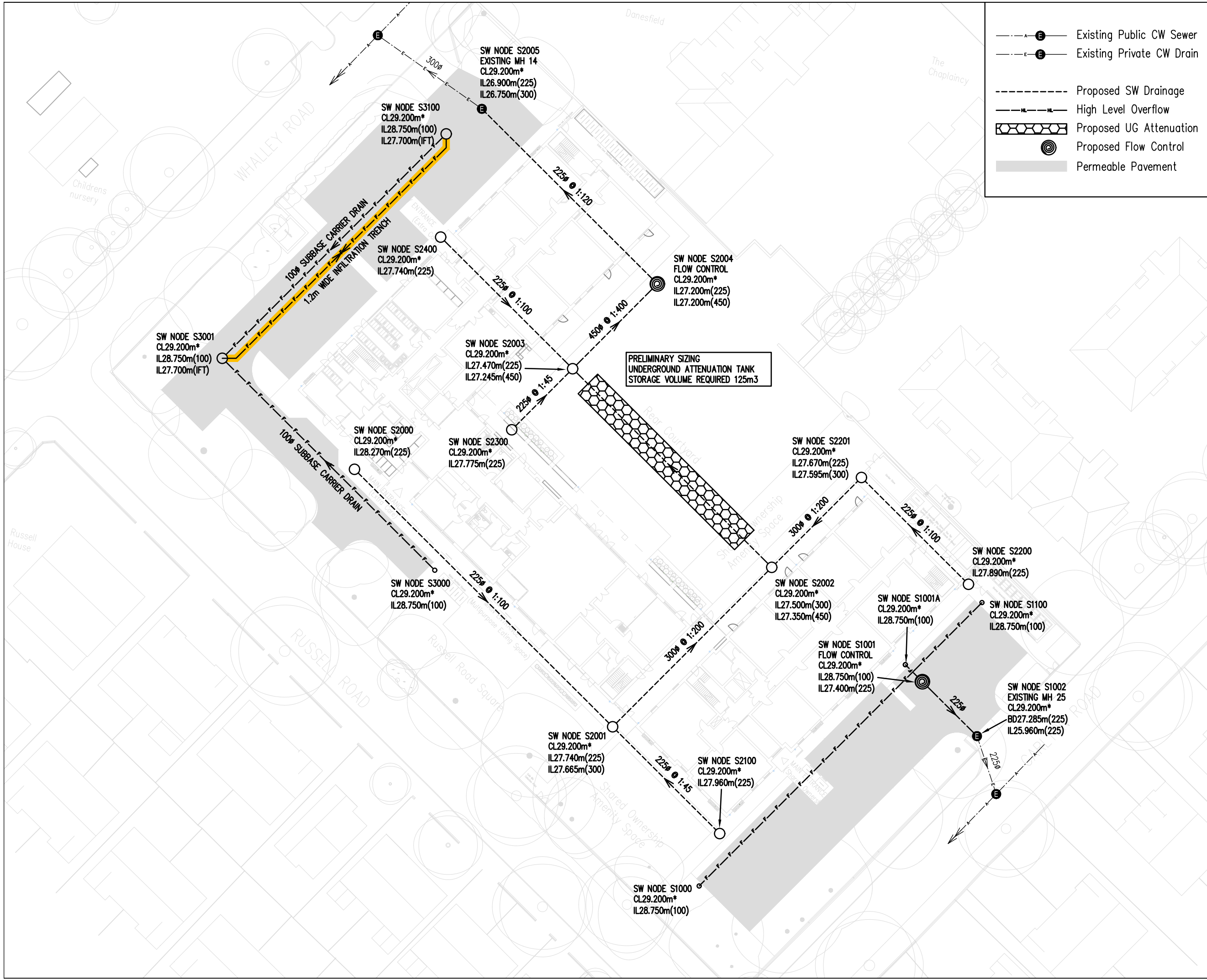
- Site Boundary = 9400m2
 - Existing building = 2965m2
 - Existing hardstanding* = 3920m2
 - Existing landscaping = 2515m2
- *Positively Drained Hardstanding

Rev.	Description	Rev. by	Date
SGI Shepherd Gilmour Consulting Engineers 3rd Floor Phoenix House, 45 Cross Street, Manchester, M2 4JF T: 0161 837 1500 W: www.sginfrastructure.co.uk			
Client			
Great Places Housing Group			
Architect			
Triangle Architects			
Project			
Russell Road. Whalley Range			
Title			
Existing Site Review			
Date	15/03/2024	Drawn By	DOR
Size	A3	Checked By	
Scale	NTS	Approved By	
Dwg. No.			Rev.
C1811-DS-100			1

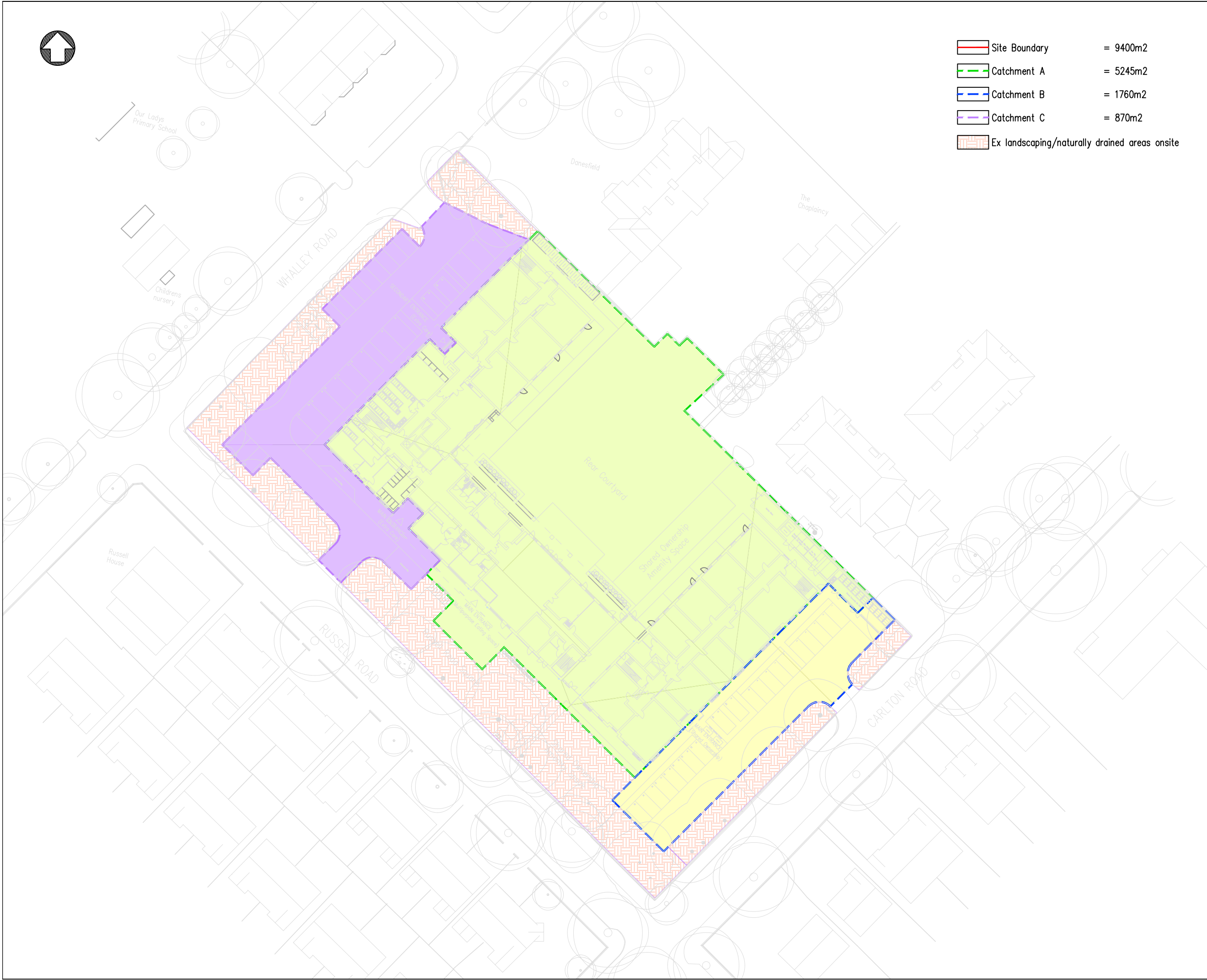


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APPENDIX E1



Rev.	Description	Rev. by	Date
 Shepherd Gilmour Consulting Engineers 3rd Floor Phoenix House, 45 Cross Street, Manchester, M2 4JF T: 0161 837 1500 W: www.sginfrastructure.co.uk			
Client			
Great Places Housing Group			
Architect			
Triangle Architects			
Project			
Russell Road, Whalley Range			
Title			
Preliminary SW Strategy			
Date	15.03.2024	Drawn By	DOR
Size	A3	Checked By	
Scale	1/500	Approved By	
Dwg. No.			Rev
C1811-DS-102			B



- Site Boundary
-
- = 9400m2

Catchment ACatchment BCatchment CEx landscaping/naturally drained areas onsite

Rev.	Description	Rev. by	Date
SGi Shepherd Gilmour Consulting Engineers 3rd Floor Phoenix House, 45 Cross Street, Manchester, M2 4JF T: 0161 837 1500 W: www.sginfrastructure.co.uk Client Great Places Housing Group Architect Triangle Architects Project Russell Road. Whalley Range Title Preliminary SW Catchment Plan Date15.03.2024 SizeA3 ScaleNTS Drawn ByDOR Checked By Approved By Dwg. No.C1811-DS-101 Rev B			



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APPENDIX F1

SGi Consulting		Page 1
4th Floor, Colchester House 40 Peter Street Manchester, M2 5GP		
Date 31/05/2024 10:52	Designed by sgicivils	
File C1811-DS-102 RevA.MDX	Checked by	
Micro Drainage		Network 2020.1.3

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	43.838	0.001	43838.0	0.061	2.50	0.0		0.030	→ ↓ →		Porous Car Park	
2.000	14.344	0.001	14344.0	0.026	2.50	0.0		0.030	→ ↓ →		Porous Car Park	
1.001	11.170	0.115	97.1	0.000	0.00	0.0		0.030	o	375	Pipe/Conduit	
1.002	58.578	0.586	100.0	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
3.000	12.490	0.305	41.0	0.029	2.50	0.0	0.600		o	225	Pipe/Conduit	
4.000	21.908	0.220	99.6	0.039	2.50	0.0	0.600		o	225	Pipe/Conduit	
4.001	18.392	0.095	193.6	0.023	0.00	0.0	0.600		o	300	Pipe/Conduit	
5.000	52.815	0.530	99.7	0.063	2.50	0.0	0.600		o	225	Pipe/Conduit	
6.000	21.908	0.220	99.6	0.026	2.50	0.0	0.600		o	225	Pipe/Conduit	
5.001	32.629	0.165	197.8	0.052	0.00	0.0	0.600		o	300	Pipe/Conduit	
4.002	40.736	0.105	388.0	0.190	0.00	0.0		0.035	→_/		Pond/Tank	
7.000	27.002	0.270	100.0	0.055	2.50	0.0	0.600		o	225	Pipe/Conduit	
3.001	17.369	0.045	386.0	0.048	0.00	0.0	0.600		o	450	Pipe/Conduit	
3.002	35.902	0.300	119.7	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	30.00	28.751	0.061	0.0	0.0	0.0	0.02	20.1	11.0
2.000	50.00	9.10	28.751	0.026	0.0	0.0	0.0	0.04	35.1	4.7
1.001	50.00	30.00	27.400	0.087	0.0	0.0	0.0	0.70	77.1	15.7
1.002	50.00	30.00	25.960	0.087	0.0	0.0	0.0	1.31	52.0	15.7
3.000	50.00	2.60	27.775	0.029	0.0	0.0	0.0	2.05	81.5	5.2
4.000	50.00	2.78	27.890	0.039	0.0	0.0	0.0	1.31	52.1	7.0
4.001	50.00	3.05	27.595	0.062	0.0	0.0	0.0	1.13	79.6	11.2
5.000	50.00	3.17	28.270	0.063	0.0	0.0	0.0	1.31	52.1	11.4
6.000	50.00	2.78	27.960	0.026	0.0	0.0	0.0	1.31	52.1	4.7
5.001	50.00	3.66	27.665	0.141	0.0	0.0	0.0	1.11	78.8	25.5
4.002	50.00	4.64	27.350	0.393	0.0	0.0	0.0	0.69	2556.0	71.0
7.000	50.00	2.84	27.740	0.055	0.0	0.0	0.0	1.31	52.0	9.9
3.001	50.00	4.92	27.245	0.525	0.0	0.0	0.0	1.03	163.6	94.8
3.002	50.00	5.42	27.200	0.525	0.0	0.0	0.0	1.19	47.5«	94.8

STORM SEWER DESIGN by the Modified Rational Method

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)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.003	100.989	1.010	100.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	13.126	0.131	100.2	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.003	50.00	6.49	26.750	0.525	0.0	0.0	0.0	1.57	111.1	94.8
1.003	50.00	30.00	25.299	0.612	0.0	0.0	0.0	1.57	111.0	110.5

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.061	0.061	0.061
2.000	-	-	100	0.026	0.026	0.026
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.029	0.029	0.029
4.000	-	-	100	0.039	0.039	0.039
4.001	-	-	100	0.023	0.023	0.023
5.000	-	-	100	0.063	0.063	0.063
6.000	-	-	100	0.026	0.026	0.026
5.001	-	-	100	0.052	0.052	0.052
4.002	-	-	100	0.190	0.190	0.190
7.000	-	-	100	0.055	0.055	0.055
3.001	-	-	100	0.048	0.048	0.048
3.002	-	-	100	0.000	0.000	0.000
3.003	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.612	0.612	0.612

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		29.200	25.168	0.000	0	0

SGi Consulting		Page 4
4th Floor, Colchester House 40 Peter Street Manchester, M2 5GP		
Date 31/05/2024 10:52 File C1811-DS-102 RevA.MDX	Designed by sgicivils Checked by	
Micro Drainage Network 2020.1.3		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 1001, DS/PN: 1.001, Volume (m³): 59.0

Unit Reference	MD-SCU-0060-5000-1800-5000
Design Head (m)	1.800
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	60
Invert Level (m)	27.400
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	5.0	Kick-Flo®	0.090	1.3
Flush-Flo™	0.087	1.3	Mean Flow over Head Range	-	3.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	0.800	3.4	2.000	5.3	4.000	7.3	7.000	9.5
0.200	1.8	1.000	3.8	2.200	5.5	4.500	7.7	7.500	9.8
0.300	2.2	1.200	4.1	2.400	5.7	5.000	8.1	8.000	10.1
0.400	2.5	1.400	4.4	2.600	5.9	5.500	8.5	8.500	10.4
0.500	2.8	1.600	4.7	3.000	6.4	6.000	8.8	9.000	10.7
0.600	3.0	1.800	5.0	3.500	6.8	6.500	9.2	9.500	11.0

Hydro-Brake® Optimum Manhole: 2004, DS/PN: 3.002, Volume (m³): 7.6

Unit Reference	MD-SCU-0217-6500-2000-6500
Design Head (m)	2.000
Design Flow (l/s)	65.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	217
Invert Level (m)	27.200
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	65.0	Kick-Flo®	0.325	27.2
Flush-Flo™	0.252	28.0	Mean Flow over Head Range	-	43.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.1	0.400	30.0	0.800	41.8	1.400	54.7	2.000	65.0
0.200	23.5	0.500	33.3	1.000	46.5	1.600	58.3	2.200	68.1
0.300	27.6	0.600	36.4	1.200	50.8	1.800	61.8	2.400	71.0

Hydro-Brake® Optimum Manhole: 2004, DS/PN: 3.002, Volume (m³): 7.6

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
2.600	73.8	4.000	91.0	5.500	106.3	7.000	119.6	8.500	131.6
3.000	79.1	4.500	96.4	6.000	111.0	7.500	123.7	9.000	135.3
3.500	85.3	5.000	101.5	6.500	115.4	8.000	127.7	9.500	138.9

Storage Structures for Storm

Porous Car Park Pipe: 1.000

Manning's N	0.030	Width (m)	10.0
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	43.8
Membrane Percolation (mm/hr)	1000	Slope (1:X)	43838.0
Max Percolation (l/s)	121.8	Depression Storage (mm)	5
Safety Factor	1.0	Evaporation (mm/day)	3
Porosity	0.30	Membrane Depth (mm)	130
Invert Level (m)	28.751		

Under Drain Details			
Depth above Invert Level (m)	0.000	Number of Pipes	1
Diameter (m)	0.150	Manning's N	0.030

Porous Car Park Pipe: 2.000

Manning's N	0.030	Width (m)	10.0
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	14.3
Membrane Percolation (mm/hr)	1000	Slope (1:X)	14344.0
Max Percolation (l/s)	39.8	Depression Storage (mm)	5
Safety Factor	1.0	Evaporation (mm/day)	3
Porosity	0.30	Membrane Depth (mm)	130
Invert Level (m)	28.751		

Under Drain Details			
Depth above Invert Level (m)	0.000	Number of Pipes	1
Diameter (m)	0.150	Manning's N	0.030

Tank or Pond Pipe: 4.002

Manning's N 0.035 Invert Level (m) 27.350

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	125.0	0.600	125.0	1.200	125.0	1.800	0.0	2.400	0.0
0.100	125.0	0.700	125.0	1.201	0.0	1.900	0.0	2.500	0.0
0.200	125.0	0.800	125.0	1.400	0.0	2.000	0.0		
0.300	125.0	0.900	125.0	1.500	0.0	2.100	0.0		
0.400	125.0	1.000	125.0	1.600	0.0	2.200	0.0		
0.500	125.0	1.100	125.0	1.700	0.0	2.300	0.0		

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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 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

									Water	Surcharged	Flooded	
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume
PN	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)
1.000	1000	15	Summer	1	+0%					28.820	-0.250	0.000
2.000	1100	15	Summer	1	+0%					28.792	-0.278	0.000
1.001	1001	120	Summer	1	+0%	1/30	Summer			28.247	0.472	0.000
1.002	1002	120	Summer	1	+0%					25.999	-0.186	0.000
3.000	2300	15	Summer	1	+0%	30/60	Summer			27.821	-0.179	0.000
4.000	2200	15	Summer	1	+0%	100/30	Summer			27.954	-0.161	0.000
4.001	2201	15	Summer	1	+0%	30/30	Summer			27.676	-0.219	0.000
5.000	2000	15	Summer	1	+0%	100/15	Summer			28.350	-0.145	0.000
6.000	2100	15	Summer	1	+0%	100/15	Summer			28.012	-0.173	0.000
5.001	2001	15	Summer	1	+0%	30/15	Summer			27.787	-0.178	0.000
4.002	2002	60	Summer	1	+0%					27.455	-1.745	0.000
7.000	2400	15	Summer	1	+0%	30/60	Summer			27.816	-0.149	0.000
3.001	2003	60	Summer	1	+0%	30/15	Summer			27.454	-0.241	0.000
3.002	2004	60	Summer	1	+0%	1/30	Summer			27.438	0.013	0.000
3.003	2005	60	Summer	1	+0%					26.853	-0.197	0.000
1.003	DUMMY	60	Summer	1	+0%					25.419	-0.180	0.000

				Half Drain	Pipe		
	US/MH	Flow /	Overflow	Time	Flow		Level
PN	Name	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded
1.000	1000	0.02		10	2.1	OK	
2.000	1100	0.03		6	3.2	OK	
1.001	1001	0.05			3.5	SURCHARGED	
1.002	1002	0.07			3.5	OK	
3.000	2300	0.09			6.2	OK	
4.000	2200	0.17			8.3	OK	
4.001	2201	0.16			10.8	OK	
5.000	2000	0.25			12.5	OK	

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

		Half Drain		Pipe			
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
6.000	2100	0.12			5.5	OK	
5.001	2001	0.34			24.7	OK	
4.002	2002	0.01			23.7	OK	
7.000	2400	0.24			11.6	OK	
3.001	2003	0.23			28.2	OK	
3.002	2004	0.62			27.9	SURCHARGED	
3.003	2005	0.26			27.9	OK	
1.003	DUMMY	0.34			30.9	OK	

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2 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 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume
									(m)	(m)	(m³)
1.000	1000	15 Summer	2	+0%					28.831	-0.239	0.000
2.000	1100	15 Summer	2	+0%					28.799	-0.271	0.000
1.001	1001	120 Summer	2	+0%	1/30 Summer				28.629	0.854	0.000
1.002	1002	120 Summer	2	+0%					26.003	-0.182	0.000
3.000	2300	15 Summer	2	+0%	30/60 Summer				27.826	-0.174	0.000
4.000	2200	15 Summer	2	+0%	100/30 Summer				27.963	-0.152	0.000
4.001	2201	15 Summer	2	+0%	30/30 Summer				27.689	-0.206	0.000
5.000	2000	15 Summer	2	+0%	100/15 Summer				28.363	-0.132	0.000
6.000	2100	15 Summer	2	+0%	100/15 Summer				28.019	-0.166	0.000
5.001	2001	15 Summer	2	+0%	30/15 Summer				27.805	-0.160	0.000
4.002	2002	60 Summer	2	+0%					27.511	-1.689	0.000
7.000	2400	15 Summer	2	+0%	30/60 Summer				27.828	-0.137	0.000
3.001	2003	60 Summer	2	+0%	30/15 Summer				27.510	-0.185	0.000
3.002	2004	60 Summer	2	+0%	1/30 Summer				27.500	0.075	0.000
3.003	2005	30 Winter	2	+0%					26.853	-0.197	0.000
1.003	DUMMY	120 Summer	2	+0%					25.422	-0.177	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level
							Exceeded
1.000	1000	0.03		11	3.2	OK	
2.000	1100	0.05		6	4.6	OK	
1.001	1001	0.06			4.2	SURCHARGED	
1.002	1002	0.08			4.2	OK	
3.000	2300	0.12			8.1	OK	
4.000	2200	0.23			10.8	OK	
4.001	2201	0.20			13.9	OK	
5.000	2000	0.32			15.9	OK	

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

		Half Drain		Pipe			
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
6.000	2100	0.15			7.1	OK	
5.001	2001	0.44			31.8	OK	
4.002	2002	0.01			27.2	OK	
7.000	2400	0.31			15.0	OK	
3.001	2003	0.25			30.6	OK	
3.002	2004	0.62			28.0	SURCHARGED	
3.003	2005	0.26			28.0	OK	
1.003	DUMMY	0.35			32.2	OK	

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5 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 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

									Water	Surcharged	Flooded	
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume
PN	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)
1.000	1000	15	Summer	5	+0%					28.843	-0.227	0.000
2.000	1100	15	Summer	5	+0%					28.807	-0.263	0.000
1.001	1001	120	Summer	5	+0%	1/30	Summer			28.782	1.007	0.000
1.002	1002	120	Summer	5	+0%					26.005	-0.180	0.000
3.000	2300	15	Summer	5	+0%	30/60	Summer			27.833	-0.167	0.000
4.000	2200	15	Summer	5	+0%	100/30	Summer			27.974	-0.141	0.000
4.001	2201	15	Summer	5	+0%	30/30	Summer			27.702	-0.193	0.000
5.000	2000	15	Summer	5	+0%	100/15	Summer			28.377	-0.118	0.000
6.000	2100	15	Summer	5	+0%	100/15	Summer			28.028	-0.157	0.000
5.001	2001	15	Summer	5	+0%	30/15	Summer			27.829	-0.136	0.000
4.002	2002	60	Summer	5	+0%					27.589	-1.611	0.000
7.000	2400	15	Summer	5	+0%	30/60	Summer			27.841	-0.124	0.000
3.001	2003	60	Summer	5	+0%	30/15	Summer			27.588	-0.107	0.000
3.002	2004	60	Summer	5	+0%	1/30	Summer			27.577	0.152	0.000
3.003	2005	60	Summer	5	+0%					26.856	-0.194	0.000
1.003	DUMMY	60	Summer	5	+0%					25.425	-0.174	0.000

		Half Drain		Pipe			
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
1.000	1000	0.04		11	5.0	OK	
2.000	1100	0.06		6	6.3	OK	
1.001	1001	0.06			4.4	SURCHARGED	
1.002	1002	0.09			4.4	OK	
3.000	2300	0.15			10.5	OK	
4.000	2200	0.29			13.9	OK	
4.001	2201	0.26			17.8	OK	
5.000	2000	0.41			20.6	OK	

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

		Half Drain		Pipe			
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
6.000	2100	0.19			9.2	OK	
5.001	2001	0.57			41.2	OK	
4.002	2002	0.01			28.9	OK	
7.000	2400	0.40			19.5	OK	
3.001	2003	0.26			32.1	OK	
3.002	2004	0.65			29.1	SURCHARGED	
3.003	2005	0.27			29.1	OK	
1.003	DUMMY	0.37			33.5	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 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

PN	US/MH		Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume
	Name	Storm							(m)	(m)	(m ³)
1.000	1000	120 Summer	30	+40%					28.888	-0.182	0.000
2.000	1100	120 Summer	30	+40%					28.886	-0.184	0.000
1.001	1001	120 Summer	30	+40%	1/30 Summer				28.886	1.111	0.000
1.002	1002	120 Summer	30	+40%					26.006	-0.179	0.000
3.000	2300	120 Summer	30	+40%	30/60 Summer				28.023	0.023	0.000
4.000	2200	120 Summer	30	+40%	100/30 Summer				28.022	-0.093	0.000
4.001	2201	120 Summer	30	+40%	30/30 Summer				28.026	0.131	0.000
5.000	2000	15 Summer	30	+40%	100/15 Summer				28.453	-0.042	0.000
6.000	2100	15 Summer	30	+40%	100/15 Summer				28.060	-0.125	0.000
5.001	2001	120 Summer	30	+40%	30/15 Summer				28.024	0.059	0.000
4.002	2002	120 Summer	30	+40%					28.027	-1.173	0.000
7.000	2400	120 Summer	30	+40%	30/60 Summer				28.031	0.066	0.000
3.001	2003	120 Summer	30	+40%	30/15 Summer				28.029	0.334	0.000
3.002	2004	120 Summer	30	+40%	1/30 Summer				28.069	0.644	0.000
3.003	2005	120 Summer	30	+40%					26.883	-0.167	0.000
1.003	DUMMY	120 Summer	30	+40%					25.454	-0.145	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1000	0.06		68	7.3	OK	
2.000	1100	0.05		68	5.4	OK	
1.001	1001	0.06			4.6	SURCHARGED	
1.002	1002	0.09			4.6	OK	
3.000	2300	0.12			8.2	SURCHARGED	
4.000	2200	0.23			11.0	OK	
4.001	2201	0.24			16.2	SURCHARGED	
5.000	2000	0.84			41.8	OK	

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

		Half Drain		Pipe			
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
6.000	2100	0.40			19.0	OK	
5.001	2001	0.54			39.0	SURCHARGED	
4.002	2002	0.02			39.0	OK	
7.000	2400	0.32			15.5	SURCHARGED	
3.001	2003	0.40			48.6	SURCHARGED	
3.002	2004	0.93			41.5	SURCHARGED	
3.003	2005	0.39			41.8	OK	
1.003	DUMMY	0.51			46.1	OK	

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 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 2, 5, 30, 100
Climate Change (%) 0, 0, 0, 40, 45

									Water	Surcharged	Flooded		
	US/MH			Return	Climate	First (X)		First (Y)	First (Z)	Overflow	Level	Depth	Volume
PN	Name	Storm	Period	Change		Surcharge		Flood	Overflow	Act.	(m)	(m)	(m³)
1.000	1000	120	Summer	100	+45%						28.961	-0.109	0.000
2.000	1100	120	Summer	100	+45%						28.959	-0.111	0.000
1.001	1001	120	Summer	100	+45%	1/30	Summer				28.959	1.184	0.000
1.002	1002	120	Summer	100	+45%						26.006	-0.179	0.000
3.000	2300	120	Summer	100	+45%	30/60	Summer				28.971	0.971	0.000
4.000	2200	120	Summer	100	+45%	100/30	Summer				28.984	0.869	0.000
4.001	2201	120	Summer	100	+45%	30/30	Summer				28.975	1.080	0.000
5.000	2000	120	Summer	100	+45%	100/15	Summer				29.009	0.514	0.000
6.000	2100	120	Summer	100	+45%	100/15	Summer				28.993	0.808	0.000
5.001	2001	120	Summer	100	+45%	30/15	Summer				28.987	1.022	0.000
4.002	2002	120	Summer	100	+45%						28.968	-0.232	0.000
7.000	2400	120	Summer	100	+45%	30/60	Summer				28.980	1.015	0.000
3.001	2003	120	Summer	100	+45%	30/15	Summer				28.966	1.271	0.000
3.002	2004	120	Summer	100	+45%	1/30	Summer				28.945	1.520	0.000
3.003	2005	120	Summer	100	+45%						26.907	-0.143	0.000
1.003	DUMMY	120	Summer	100	+45%						25.483	-0.116	0.000

		Half Drain		Pipe			
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
1.000	1000	0.06		90	7.1	FLOOD RISK	
2.000	1100	0.05		89	5.1	FLOOD RISK	
1.001	1001	0.06			4.7	FLOOD RISK	
1.002	1002	0.09			4.7	OK	
3.000	2300	0.15			10.3	FLOOD RISK	
4.000	2200	0.31			15.0	FLOOD RISK	
4.001	2201	0.28			19.5	FLOOD RISK	
5.000	2000	0.48			24.1	FLOOD RISK	

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

		Half Drain		Pipe			
		US/MH	Flow /	Overflow	Time	Flow	Level
PN	Name	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded
6.000	2100	0.21			10.0	FLOOD RISK	
5.001	2001	0.64			45.9	FLOOD RISK	
4.002	2002	0.02			55.6	FLOOD RISK	
7.000	2400	0.40			19.4	FLOOD RISK	
3.001	2003	0.49			60.3	FLOOD RISK	
3.002	2004	1.30			58.1	FLOOD RISK	
3.003	2005	0.54			58.1	OK	
1.003	DUMMY	0.69			62.7	OK	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

- Indicates pipe length does not match coordinates
 « - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	43.475	0.001	43475.0	0.039	2.50	0.0	0.030	→ ↓ →		Porous Car Park	
2.000	45.920	0.001	45920.0	0.097	2.50	0.0	0.030	→ ↓ →		Porous Car Park	
1.001	45.000#	0.001	45000.0	0.000	0.00	0.0	0.030	→ _ →		Infiltration Trench	
1.002	7.000	0.001	7000.0	0.000	0.00	0.0	0.030	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	30.00	28.750	0.039	0.0	0.0	0.0	0.02	9.7	7.0
2.000	50.00	30.00	28.750	0.097	0.0	0.0	0.0	0.02	19.3	17.5
1.001	50.00	30.00	27.200	0.136	0.0	0.0	0.0	0.07	130.2	24.6
1.002	50.00	30.00	27.199	0.136	0.0	0.0	0.0	0.03	0.3«	24.6

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.039	0.039	0.039
2.000	-	-	100	0.097	0.097	0.097
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.136	0.136	0.136

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		29.200	27.198	0.000	0	0

Online Controls for Storm

Pump Manhole: DUMMY, DS/PN: 1.002, Volume (m³): 78.4

Invert Level (m) 27.199

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	0.0000	1.400	0.0000	2.600	0.0000	3.800	0.0000	5.000	0.0000
0.400	0.0000	1.600	0.0000	2.800	0.0000	4.000	0.0000	5.200	0.0000
0.600	0.0000	1.800	0.0000	3.000	0.0000	4.200	0.0000	5.400	0.0000
0.800	0.0000	2.000	0.0000	3.200	0.0000	4.400	0.0000	5.600	0.0000
1.000	0.0000	2.200	0.0000	3.400	0.0000	4.600	0.0000	5.800	0.0000
1.200	0.0000	2.400	0.0000	3.600	0.0000	4.800	0.0000	6.000	0.0000

Storage Structures for Storm

Porous Car Park Pipe: 1.000

Manning's N	0.030	Width (m)	5.0
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	43.5
Membrane Percolation (mm/hr)	1000	Slope (1:X)	43475.0
Max Percolation (l/s)	60.4	Depression Storage (mm)	5
Safety Factor	1.0	Evaporation (mm/day)	3
Porosity	0.30	Membrane Depth (mm)	130
Invert Level (m)	28.750		

Porous Car Park Pipe: 2.000

Manning's N	0.030	Width (m)	10.0
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	45.9
Membrane Percolation (mm/hr)	1000	Slope (1:X)	45920.0
Max Percolation (l/s)	127.6	Depression Storage (mm)	5
Safety Factor	1.0	Evaporation (mm/day)	3
Porosity	0.30	Membrane Depth (mm)	130
Invert Level (m)	28.750		

Infiltration Trench Pipe: 1.001

Manning's N	0.030	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.07380	Trench Length (m)	45.0
Infiltration Coefficient Side (m/hr)	0.07380	Slope (1:X)	45000.0
Safety Factor	1.0	Cap Volume Depth (m)	1.550
Porosity	0.95	Cap Infiltration Depth (m)	0.000
Invert Level (m)	27.200		

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 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

 Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

US/MH			Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level (m)	Depth (m)
1.000	3000	15 Summer	1	+0%					28.830	-0.240
2.000	3100	15 Summer	1	+0%					28.840	-0.230
1.001	3001	360 Summer	1	+0%	100/180 Summer				27.489	-1.261
1.002	DUMMY	360 Summer	1	+0%	1/30 Summer				27.489	0.190

Flooded				Half Drain Pipe			Level	
US/MH	Volume	Flow /	Overflow	Time	Flow	Status	Exceeded	
PN	Name	(m³)	Cap.	(l/s)	(mins)	(l/s)		
1.000	3000	0.000	0.03		11	1.6	OK	
2.000	3100	0.000	0.03		11	4.1	OK	
1.001	3001	0.000	0.00		71	2.6	OK	
1.002	DUMMY	0.000	0.00			0.0	SURCHARGED	

SGi Consulting		Page 6
4th Floor, Colchester House 40 Peter Street Manchester, M2 5GP		
Date 31/05/2024 12:30	Designed by sgicivils	
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Micro Drainage	Network 2020.1.3	

2 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 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

 Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
1.000	3000	15 Summer	2	+0%					28.842	-0.228
2.000	3100	15 Summer	2	+0%					28.853	-0.217
1.001	3001	360 Summer	2	+0%	100/180 Summer				27.582	-1.168
1.002	DUMMY	360 Summer	2	+0%	1/30 Summer				27.582	0.283

Flooded				Half Drain Pipe					
PN	US/MH Name	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	3000	0.000	0.04		11	2.4	OK		
2.000	3100	0.000	0.05		12	6.4	OK		
1.001	3001	0.000	0.00		71	2.5	OK		
1.002	DUMMY	0.000	0.00			0.0	SURCHARGED		

5 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 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

US/MH			Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level	Depth
1.000	3000	15 Summer	5	+0%					28.855	-0.215
2.000	3100	15 Summer	5	+0%					28.867	-0.203
1.001	3001	360 Summer	5	+0%	100/180 Summer				27.702	-1.048
1.002	DUMMY	360 Summer	5	+0%	1/30 Summer				27.702	0.403

Flooded				Half Drain Pipe			Level	
US/MH	Volume	Flow /	Overflow	Time	Flow	Status	Exceeded	
PN	Name	(m³)	Cap.	(l/s)	(mins)	(l/s)		
1.000	3000	0.000	0.06		12	3.7	OK	
2.000	3100	0.000	0.08		12	9.8	OK	
1.001	3001	0.000	0.00		71	2.8	OK	
1.002	DUMMY	0.000	0.00			0.0	SURCHARGED	



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 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

 Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
1.000	3000	15 Summer	30	+40%					28.899	-0.171
2.000	3100	15 Summer	30	+40%					28.916	-0.154
1.001	3001	480 Summer	30	+40%	100/180 Summer				28.387	-0.363
1.002	DUMMY	480 Summer	30	+40%	1/30 Summer				28.387	1.088

Flooded				Half Drain Pipe					
PN	US/MH Name	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	3000	0.000	0.22		11	13.0	OK		
2.000	3100	0.000	0.29		11	35.7	FLOOD RISK		
1.001	3001	0.000	0.01		95	4.8	OK		
1.002	DUMMY	0.000	0.00			0.0	SURCHARGED		

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 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 1.000
 Region England and Wales Ratio R 0.280 Cv (Winter) 1.000

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

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 5, 30, 100
 Climate Change (%) 0, 0, 0, 40, 45

US/MH			Return Climate		First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level (m)	Depth (m)
1.000	3000	15 Summer	100	+45%					28.921	-0.149
2.000	3100	15 Summer	100	+45%					28.939	-0.131
1.001	3001	480 Summer	100	+45%	100/180 Summer				28.881	0.131
1.002	DUMMY	480 Summer	100	+45%	1/30 Summer				28.897	1.598

Flooded				Half Drain Pipe				Level
US/MH	Volume	Flow /	Overflow	Time	Flow			Exceeded
PN	Name	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status	
1.000	3000	0.000	0.35		11	20.5	FLOOD RISK	
2.000	3100	0.000	0.44		10	54.5	FLOOD RISK	
1.001	3001	0.000	0.01		100	6.4	SURCHARGED	
1.002	DUMMY	0.000	0.00			0.0	SURCHARGED	