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Withington Community Hospital CDC Scheme

CCS Project No: HE-014

for

Manchester University NHS Foundation Trust & BAM

Surface Water Management Plan

Suite 2, 1st Floor.

XYZ Building

2 Hardman Boulevard

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Manchester, M3 3AQ

[redacted]

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1 Introduction

This surface water management report has been prepared by CCS Consulting in support of a full planning application for a new Endoscopy & Cardiorespiratory Development building at Withington Community Hospital, Manchester, M20 2LR (hereafter referred to as the 'Site').

The report describes and demonstrates how the surface water run-off rate and volume from the post development site will be managed to adhere to National and local planning policy, regulations, and relevant design guidance, which include:

National Planning Policy Framework (NPPF), December 2023 Paragraphs 153-158'

National Planning Practice Guidance (NPPG), released in March 2014 and updated in August 2022.

National Standards for Sustainable Drainage Systems (SuDS) set out by the Department for Environment, Food & Rural Affairs (DEFRA) (2015).

CIRIA (2010) Planning for SuDS – Making it Happen C687.

CIRIA SuDS Manual C753 (2015).

And local policies including:

Manchester City, Salford City and Trafford Councils Level 1 SFRA (May 2010).

Manchester City, Salford City and Trafford Councils Level 2 SFRA (March 2011).

Manchester City Council – Local Flood Risk Management Strategy (March 2014).

Manchester Local Development Framework – Core Strategy Development Plan (July 2012).

Manchester City Council, acting as Lead Local Flood Authority (LLFA), need to be satisfied that the design and drainage principles of the proposed development will address the surface water management and risk of flooding within the site; will ensure that the drainage is managed and maintained for its lifetime to prevent flooding; and will ensure that the development will not increase the risk of flooding to neighbouring land and property.

The report is formatted such that it identifies and references appropriate design parameters, shows by calculation how the proposed drainage strategy can meet the various requirements and ultimately controls, mitigates and reduces future flood risk both on and off site.

2 Planning Policies and Guidance

2.1 National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

The NPPF (December 2023) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. This document is used to form this surface water management report, with particular attention to Paragraphs 153 to 158 Planning for Climate Change.

NPPG, Paragraph 055 (Reference ID:7-055-20220825) states that sustainable drainage systems (SuDS) are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible, where they provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban run-off at source; and to combine water management with green space with benefits for amenity, recreation, and wildlife.

Further to this NPPG, Paragraph 056 (Reference ID:7-056-20220825) states that the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable which (in order) are into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain, or another drainage system; to a combined sewer.

2.2 Flood and Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

2.3 Manchester Local Development Framework – Core Strategy Development Plan

Relevant Policy EN 08 states:

'All new development will be expected to be adaptable to climate change in terms of the design, layout, siting, and function of both buildings and associated external spaces. In achieving developments which are adaptable to climate change developers should minimise flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability, and will be permitted to use green infrastructure elements such as green roofs.

Relevant Policy EN 14 states:

‘All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required’.

Relevant Policy EN 17 states:

‘Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological; Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses; Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site; Development should, where feasible and appropriate, seek to open up any culverted or hidden watercourse beneath the site to improve the ecological status of that watercourse’.

3 Site Setting and Description

3.1 Site Location

The Site is part of Withington Community Hospital and is in residential area of West Didsbury, which is approximately 1.5km south-west of Mauldeth Road station, approximately 1km west of Brennage station, and is bound by existing hospital car parking and building leading to Nell Lane the north, Burton Road to the east, Fielden Road to the south, and hospital buildings leading onto Elizabeth Slinger Road to the west. The address of the site is Withington Community Hospital, Manchester, M20 2LR, with co-ordinates for the centre of the site being, Easting: 383735, Northing: 392005.

3.2 Existing Site and Topography

As detailed on the topographical survey in Appendix A, the Site is currently undeveloped and consists of trees, shrubs, and grassed areas, and therefore is deemed to be greenfield. The site has a general fall from the centre towards the Site boundary, where the levels range from approximately 34.24m AOD to approximately 32.49m AOD.

3.3 Proposed Development

The proposed site is shown on the development plans in Appendix B, with a full description of the Site being stated by the Architect. In brief, and in relation to this surface water management report, the proposed development is to build a new hospital building to the central / eastern area of the site, with car parking to the west, and pedestrian with soft landscaping throughout.

3.4 Ground Conditions

The ground conditions can be determined by the British Geological Survey (BGS) website, where it shows the Site to have superficial deposits of Glaciofluvial deposits (sands and gravels) over bedrock consisting of Wilmslow Sandstone Formation (sandstone).The BGS website also shows borehole log data adjacent to the Site in Burton Road (see Appendix C), which shows made ground to a depth of 2.20m, over coarse sand to a depth of 3.90m, over clay. The borehole also indicates ground water level rising in the coarse sand layers up to 3.00m bgl.

3.5 Waterbody / Rivers / Canals

There are no known waterbodies, rivers, or canals near to the development site, with the nearest being the river Mersey approximately 250m to the south, and Platt Brook approximately 2.5 km to the north.

3.6 On-Site Drainage and Public Sewers

As detailed on the United Utilities asset plan in Appendix D, there is an 825 x 1200mm surface water sewer in Burton Road (west of site), a 525mm diameter combined water sewer in Burton Road (west of site), and a 300mm diameter combined water sewer in Fielden Road (south of site).

As the site is undeveloped it is believed that there are no drainage networks within the development / site boundary. The topographical survey however identifies existing foul and surface water networks serving the existing hospital building to the north. In particular, and relevant to this report, the topographical survey shows a 225mm diameter surface water network which is believed to discharge to the surface water sewer in Burton Road.

3.7 Surface Water Management Areas

The Site boundary area is approximately **3,090m ² / 0.390 ha.**

The pre-development surface water run-off from within the site boundary will discharge off the site at a greenfield rate, with an urban factor of 0.

Surface water run-off from the building, car parking and pedestrian areas equate to **2,400m² / 0.240 ha** and will form the surface water management area, with the surface water run-off form the soft-landscaping areas continuing to discharge off the site at a natural / greenfield rate.

4 Surface Water Management Principles

The surface water for the development site is to be managed so that it adheres to the current national regulations and local authority requirements.

4.1 Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown:

- Discharge into the ground (infiltration).
- Discharge to a surface water body.
- Discharge to a surface water sewer, highway drain or other drain.
- Discharge to combined sewer.

4.2 The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are:

- Prevention - Prevention of run-off by good site design and reduction of impermeable areas.
- Source Control - Dealing with water where and when it falls (e.g. infiltration techniques).
- Site Control - Management of water in the local area (e.g. swales, detention basins).
- Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

4.3 Design Principles

The design principles for the surface water management of the development will be to:

- Ensure that people, property, and critical infrastructure are protected from flooding.
- Ensure that the development does not increase flood risk off site.
- Ensure that SuDS can be economically maintained for the development.

4.4 Peak Surface Water Flow

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

S2 *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

4.5 Volume Control

DEFRA National Non-statutory technical standards for sustainable drainage systems states:

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer, or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

4.6 Flood Risk within Development

DEAFRA National Non-statutory technical standards for sustainable drainage systems states:

'S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property'.

4.7 Pollution / Water Quality

The SuDS design for the development site will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with Ciria SuDS Manual C753, Chapter 4.

4.8 Designing for Exceedance

The development site design will be such that when SuDS features fail or are exceeded, exceedance flows do not cause flooding of properties on or off site. This is achieved by completely containing the surface water within the drainage system (including areas designed to hold or convey water) for all events up to a 1 in 30-year event. The design of the site ensures that flows from rainfall more than a 1

in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

5 Surface Water Run-Off Destination

The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

Table 1 - Surface Water Run-off Feasibility

Run-Off Destination	**Feasible / Required**	**Description**
Discharge to Ground	No	Based on the BGS data, the ground at the development site is consists of made ground over coarse sand and clay layers. Coarse sand is suitable material for infiltration, however, the BGS data identifies ground water to be 3.00m bgl (above clay strata) which is 0.80m below made ground. In accordance with CIRIA 753 Infiltration structures/ soakaways are to be at least 1.0m above known known groundwater levels. This will make any infiltration structure / soakaway being within made ground which is not feasible due to ground stability and risk of contamination. Therefore, based on the relatively shallow ground water and the presence of made ground, discharge of surface water to ground is not feasible.
Discharge to Surface Water Body	No	There are no known waterbodies near to the development site, and therefore this is not a feasible discharge destination.
Discharge to Surface Water Sewer	Yes	As the ground is not suitable for infiltration, and there are no known waterbodies near the development site, the only alternative is to discharge the surface water from the post development site into the surface water sewer within Burton Road via the existing 225mm surface water drainage network within the hospital site.

Discharge to Highway or Other Drain	No	There are no known highway drains near to the development site, and therefore this is not a feasible discharge destination.
Discharge to Combined Water Network	No	There are combined water sewers to the west and south of the site. However, as the surface water is to discharge to the surface water sewer, this discharge destination is not required.

6 SuDS Feasibility

To reduce the surface water run-off to the greenfield rate, SuDS methods are to be introduced to the post development design.

SuDS methods as per the Sustainable Drainage System (SuDS) hierarchy, and the Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015, that can be used are detailed below:

Table 2 - SuDS Methods & Requirements

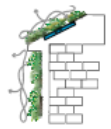
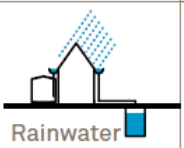
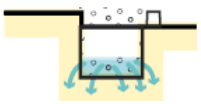
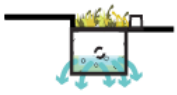
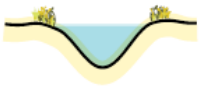
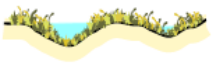
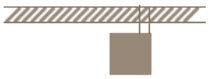
	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 Open space	Dependant on runoff volumes and soils.
 Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 Open space	Minimum length 5 metres.
Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 Street/open space	Can typically drain double its area.
 Bioretention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

Table 3 - SuDS Methods & Requirements continued

	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account for width to allow safe maintenancce typically 2-3 metres wide.
 Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 Open space	Dependant on runoff volumes and soils.
 Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	 Open space	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the post developed site are summarised in the table below:

Table 4 - SuDS Method Feasibility

SuDS Method	Feasibility	Description
Green Roofs	No	The new building roof has not been structurally designed for the weight of green / living roofs, and therefore it is not a feasible SuDS method.
Rainwater Harvesting	No	Rainwater harvesting for water re-use has not been considered for the development due to the cost of a dual pipe network, and that water supply is crucial to this type of development (hospital / healthcare).
Soakaway	No	Based on the BGS data, the ground at the development site is consists of made ground over coarse sand and clay layers. Coarse sand is suitable material for infiltration, however, the BGS data identifies ground water to be 3.00m bgl (above clay strata) which is 0.80m below made ground. In accordance with CIRIA 753 Infiltration structures/ soakaways are to be at least 1.0m above known known groundwater levels. This will make any infiltration structure / soakaway being within made ground which is not feasible due to ground stability and risk of contamination. Therefore, based on the relatively shallow ground water and the presence of made ground, the use of soakaways is not a feasible SuDS method.

Filter Strips	**Yes**	There is potential to have filter drains within the soft landscaping areas of the site, which will take the surface water run-off from all the pedestrian areas. The filter drain will not discharge the surface water to ground but will convey the surface water to the main network via perforated pipes within the trench (formed of 20mm no fines aggregate).
Permeable Paving	**Yes**	There is potential to have permeable paving within the car park areas of the site, which will take the surface water run-off from the car park area. The permeable paving system will not discharge the surface water to ground but will convey the surface water to the main network via perforated pipes within the granular sub-base (formed of 20mm no fines aggregate), and act as attenuation.
Swale / Pond / Bioretention Areas	No	The soft-landing areas throughout the site are relatively small and will be used for new trees and planting. Therefore, there are no suitable areas within the site doer swales, ponds, or bioretention areas.
Underground Storage	**Yes**	The surface water run-off from the development site will be restricted. The restricted rate will be lower than the surface water run-off rate, therefore there will be a requirement to have further underground storage in the form of cellular units

7 Development Greenfield Run-Off Rates and Volume

To minimise the surface water run-off from the new development areas of the site, it is preferred that the post development surface water run-off be restricted to the equivalent greenfield run-off rate and volumes.

7.1 Greenfield Run-Off Rate

The Flood Estimation Handbook (FEH) is often used for the calculation of the greenfield run-off rate, however, relevant documents state that to calculate the greenfield run-off rates on small catchments less than 25km², the IH 124 QBAR equation (and the equation for the instantaneous time to peak for the unit hydrograph approach) is to be used. The IH method is based on the Flood Studies Report (FSR) approach and is developed for use on catchments less than 25km². It yields the Mean Annual Maximum Flood (QBAR). This reference also recommends the use Ciria C753 Table 24.2 to generate Growth Factors. These are used to convert QBAR to different return periods for different regions in the UK. The input variables to establish QBAR are:

Return Period (years)	Results based on a range of return periods and the specified RP.
Area	Catchment Area (ha) which is adjusted to km2 for use in the equation.
SAAR	Average annual rainfall in mm (1941-1970) from FSR figure II.3.1.
Soil	Procedure Volume 3. Soil classes 1 to 5 have Soil Index values of 0.15, 0.3, 0.4, 0.45 and 0.5 respectively.
Urban	Proportion of area urbanised expressed as a decimal.
Region Number	Region number of the catchment based on FSR Figure I.2.4.
QBAR(l/s)	

The output variables to establish QBAR are calculated using the following formula (equation yields m³/s):

QBAR = 0.00108 x AREA0.89 x SAAR1.17 x SOIL2.17

The IH 124 Variables (taken from FSR) that are specific to this site are as follows:

Area = 50.00 ha (required area for calculation)

SAAR = 864

Soil = 0.450

Urban Factor = 0.00

Region Number = 10

The calculations in Appendix E, show the rate for 50.00ha is 281.0 l/s, but is to be reduced to reflect the surface water management area (0.240 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

QBAR = 1.35 l/s (5.62 l/s/ha)

Ciria C753 Table 24.2 identifies the growth factors for each of the storm events, based on the known QBAR figure. The growth factors from the table vary depending on the site location. In this case hydrometric area (Region Number) is 10.

Based on the figures shown in the table, the growth factors, and the existing greenfield run-off rates for each of the storm events for the development areas of the site are as follows:

Table 5 - Storm event growth factors & run-off rates

Storm Event	QBAR	Growth Factor (C753 Table 24.2)	Greenfield Run-off Rate
Q_1	1.35 l/s	0.87	**1.2 l/s**
Q_{30}	1.35 l/s	1.70	**2.3 l/s**
Q_{100}	1.35 l/s	2.08	**2.8 l/s**

7.2 Greenfield Run-Off Volume

The greenfield run-off volume for the 100-year, 6-hour storm event has also been calculated in the MicroDrainage software using the data from the FEH 2013, with the results shown in Appendix E.

The FEH 2013 data and variables used to calculate the greenfield run-off volume at the Site location area as follows:

Site Location = GB 383735 392005 SJ 83735 92005

Area = 0.240 ha

SAAR	=	839
CWI	=	119.230
SPR Host	=	47.000
URBTEXT	=	0

Based on these calculation results (Appendix E), the greenfield run-off volume for the surface water management area of the Site is:

$Q_{100\ (6\text{-}Hour)}$ = 81.18m³ (338.24m³/ha)

8 Below Ground Drainage Networks and SW Management Calculations

8.1 Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance summarised in Figure 1 below.

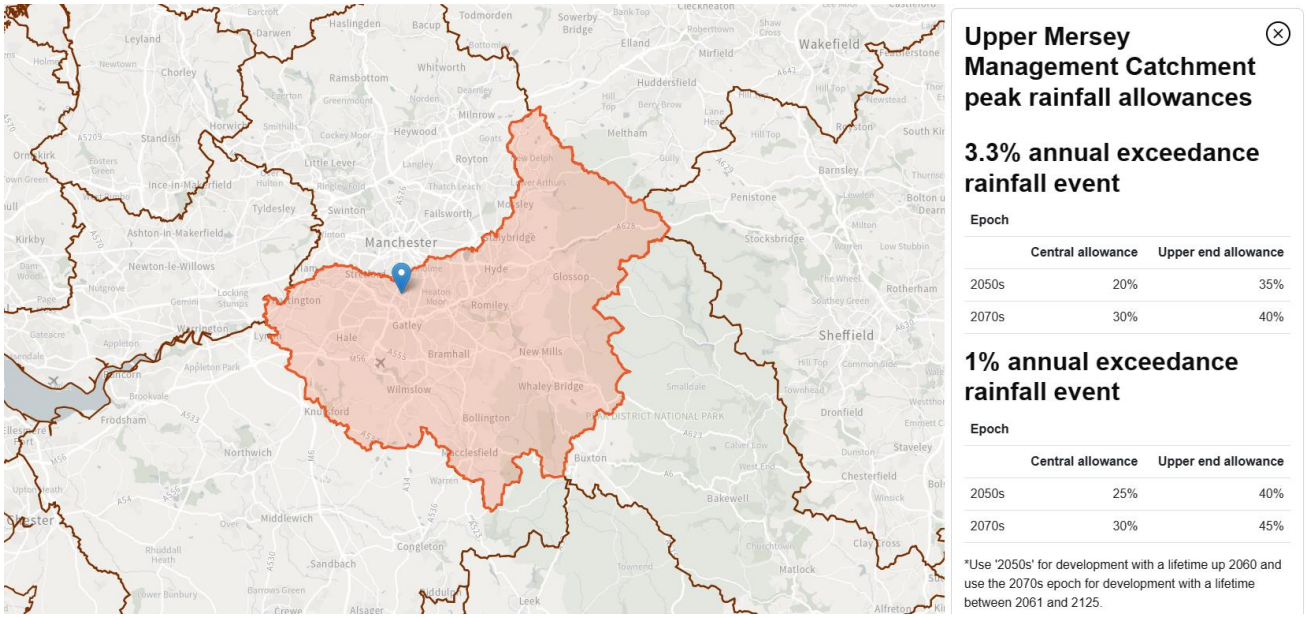


Figure 1 - DEFRAs – Climate Change Allowances

The lifetime of the hospital building is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance. Therefore, the climate change allowance for the surface water run-off will be **40%** and **45%** for the 30-year and 100-year storm respectively.

8.2 Surface Water Network Calculations

The calculations to determine the post development surface water run-off rates and required infiltration structure volume, are based on the post development surface water run-off area of 0.240 ha, and the rainfall data given by the FEH 2013.

8.3 Surface Water Drainage Network and Management

As shown on the below ground drainage layout drawing in Appendix F, the proposed surface water main network will consist of 375mm diameter pipes; 1500mm diameter manholes; permeable paving;

filter drains; a 1500mm diameter flow control chamber containing a hydro-brake; and an attenuation tank in the form of cellular units.

The surface water run-off from the new roof areas will discharge to the main network via rainwater pipes with trap gullies; the surface water run-off from the pedestrian area will discharge to the main drainage via filter drains, and the surface water run-off from the car parking areas will discharge to the main drainage via the permeable paving systems.

The surface water network will flow towards the western boundary of the site and will discharge through the cellular units and the flow control chamber prior to connection / discharge to the existing 225mm diameter surface water pipe and subsequently United Utilities surface water sewer in Burton Road.

The surface water will surcharge the drainage network when being restricted and will discharge into cellular units and permeable paving sub-base, where the water will be stored to prevent flooding. Post storm event, the water levels in the SuDS features will drop and flow back to the network and through the control chamber to the surface water system.

8.4 Surface Water Run-Off Rate

For the surface water run-off from the development site to be at the greenfield run-off rate, they are to be restricted to 1.2 l/s for the 1 in 2-year storm event, 2.3 l/s for the 1 in 30-year storm event including 40% allowance / climate change, and 2.8 l/s for the 1 in 100-year storm event including 45% allowance / climate change.

This is to adhere to Ciria document C753 – The SuDS Manual which states that: *'the flow controls / orifice design should be designed so that it has simplicity on operation, and has resistance to clogging, blocking or mechanical failure'.*

For this development, and based on the guidance, greenfield rates and greenfield run-off volume, the suitable / minimum size of the flow control opening (hydro-brake opening) is deemed to be 73mm, with a design flow of 2.8 l/s (100-year greenfield rate).

As shown in the output calculation from the MicroDrainage computer software in Appendix G, if the hydro-brake opening is set at 80mm, the design flow at 2.80 l/s, with a design head of 1.200m, the maximum surface water run-off rates for each storm event will be as follows:

Strom	-	**Rate**	-	**Critical Storm Event**
Q_1	-	2.7 l/s	-	15-minute winter storm duration
$Q_{30 + CC}$	-	2.7 l/s	-	360-minute winter storm duration
$Q_{100 + CC}$	-	2.8 l/s	-	480-minute winter storm duration

A summary of the post development surface water run-off rates compared to the greenfield rates are as follows:

Greenfield Rate to Post Development Rate

Strom	-	**Greenfield**	-	**Post Dev**	-	**Difference**
Q_1	-	1.2 l/s	-	2.7 l/s	-	**Increase**
Q_{30}	-	2.3 l/s	-	2.7 l/s	-	**Increase**
Q_{100}	-	2.8 l/s	-	2.8 l/s	-	**Equivalent**

The results show that the post development run-off rates are an increase of the 1-year and 30-year greenfield rates but are equivalent to the 100-year greenfield rate.

Therefore, as the greenfield rates for extreme storms have not been exceeded, the discharge rates are deemed to be acceptable, as they meet the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S3).

8.5 Surface Water Run-Off Volume

The surface water run-off volumes for the post development site have also been calculated for 1 in 100-Year the 6-hour duration (Inc. 45% allowance / climate change), using the peak surface water discharge rate, whereas detailed in the MicroDrainage calculation in Appendix G, where the volume equates to:

$Q_{100\ (6\text{-}Hour)}$ = 2.8 l/s x (60x60x6) = 60,480 litres = **60.48m³**

A summary of the post development run-off volumes compared to the greenfield volume is as follows:

Greenfield Volume to Post Development Volume

Strom	-	**Greenfield**	-	**Post Dev**	-	**Difference**
Q_{100}	-	81.18m³	-	60.48m³	-	**Reduction**

The post development surface water run-off volume is a reduction of the greenfield volume for the same storm event and duration.

Therefore, the discharge volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S4 + S6).

8.6 Surface Water Attenuation Calculations

As stated above, the post development run-off rates are restricted, there will be a requirement for surface water attenuation.

Ciria SuDS Manual 2015, Paragraph 10.2.4 states that: *'Exceedance flows (i.e. flows in excess of those for which the system is designed) should be managed safely in above-ground space such that risks to people and property are acceptable'.*

Attenuation structure formed of below ground attenuation tank in the form of cellular units, and the sub-base of the permeable paving.

As detailed in the MicroDrainage calculations (Appendix G) and below ground drainage strategy layout (Appendix F) the attenuation volume and details for the SuDS method are as follows:

Cellular Units

Tank Length	-	15.50m
Tank Width	-	11.00m
Tank Area	-	170.50m²
Tank Depth	-	1.20m
Tank Volume	-	204.60m³
Tank Porosity	-	0.95
Attenuation Volume	**-**	**194.37m³**

Permeable Paving Sub-Base

Sub-Base Area	-	130.00m²
Sub-Base Depth	-	0.30m
Sub-Base Volume	-	39.00m³
Sub-Base Porosity	-	0.95
Attenuation Volume	**-**	**11.70m³**

The MicroDrainage calculations (Appendix G) show that with surface water network ad these SuDS methods and volumes, no flooding will occur for all storms up to and including the 100-year + 45% storm event.

9 Maintenance Requirements

The management and maintenance of the surface water drainage networks and SuDS features will be by estate management of the clinical site, where the maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening. The details of the management and maintenance to be carried out is as follows:

9.1 Surface Water Drainage Network, Flow Control and Cellular Units

Table 6 - Flow Control and Cellular Units

Operation	**Frequency**
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from manholes (where may cause risk performance)	Monthly
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year
Remove sediment from pipework by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	Annually and after large storms

9.2 Permeable Paving and Filter Drains

Table 7 - Permeable Paving and Filter Drains

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from on surface of filter drain and permeable paving or near system (where may cause risk performance)	Monthly
Rainfall infiltration into permeable paving and / or filter drain is ensured working effectively.	As required, but at least twice a year

9.3 Linked and Further Maintenance Activities

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new residential landscaped / garden areas.

A log of all maintenance activities is to be kept and made available to the local planning authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

10 Surface Water Design Exceedance

In the unlikely event of an extreme storm greater than 100-year + 45% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur.

Surface water flow paths to follow existing and proposed ground topography, where water will flow towards the development boundaries, and into Burton and Fielden Road.

Flood water will flow away from the proposed building and will not flow directly towards existing dwellings / properties outside the development boundary. The flood water within the roads will be contained due to the road having a gradient (water to flow along road) and upstand kerbs.

11 Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment.

11.1 Access Road Car Park Areas Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level	=	Low
C753 Table 26.2 Pollution Hazard Index:		
Total Suspended Solid (TSS)	=	0.5
Metals	=	0.4
Hydrocarbons	=	0.4
Pollution Hazard Index	=	**1.30**

11.2 Access Road and Car Park Areas Pollutant Mitigation

Mitigation Measures:

Filter Drain and Permeable Paving

Permeable Paving Pollutant Mitigation Indices:

Total Suspended Solid (TSS)	=	0.7
Metals	=	0.6
Hydrocarbons	=	0.7
SuDS Mitigation Indices	=	**2.00**

The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

12 Development Management and Construction Phase

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, and flow control chamber are to be the first part of the drainage network to be built. This will ensure that the surface water discharge is suitably restricted without pollutants or flooding.

12.1 Construction Environment Management Plan

Full details of the construction environment management plan (CEMP) must be confirmed by the chosen contractor who have been appointed for the development. Therefore, it is recommended that this is a planning condition, with the assurance that a CEMP will confirm to the requirements of CIRIA 753 – The SuDS Manual – Chapter 31. The construction programming for SuDS, however, for the development site will include:

12.2 Construction Access

The main construction traffic will access the site from the existing roads to be west and south of the site and will ensure that traffic over the proposed cellular units will be avoided.

12.3 Sediments and Traps

Sediment basins and traps are to be installed before any major site earthworks take place, with further sediment traps and silt fences being installed as the earthworks progresses. This will keep sediment contained on site at appropriate locations.

12.4 Run-Off Control Measures

Run-off control measures are to be used in conjunction with sediment traps to divert water around planned earthworks areas to remove silts. Any surface water upstream of the site is to be diverted around the development areas, and to discharge to the existing drainage system. The surface water run-off destination for the diverted surface water will continue as existing.

12.5 Main Surface Water Run-Off Systems

The main drainage network, cellular units, flow control chamber, and outfall to existing drainage network are to be built prior to any phase of construction of site. Surface water from each of the phased area is to discharge to the new drainage network, where the water is adequately restricted, and water quality maintained before discharging to the river. Temporary inlet and outlet protection measures and appropriate silt traps are to be installed to prevent silt ingress into the main drainage network.

12.6 Clearing and Earthworks

Clearing and earthworks will only start when adequate erosion and sediment control measures are in place. Once the development areas are cleared, earthworks will follow immediately to ensure that the ground cover can be re-established quickly. Adjacent land to that being developed will be left undisturbed for as long as possible.

12.7 Surface Stabilisation Measures

Surface stabilisation measures will be applied to completed areas, channels ditches and other disturbed areas after the land is cleared and profiled. Permanent stabilisation measures will be installed as soon as possible after final profiling.

12.8 Construction of Permeable Surfacing

Construction of permeable paving is to be left to the later stages of construction. Unsuitable sediment is to be removed from surfacing prior to installation of sand binder layer and paving.

13 Conclusion / Summary

13.1 SuDS Principles and Discharge Destination

All feasible SuDS methods, and surface water discharge destination have been assessed, with the feasible SuDS methods being permeable paving, filter drains, cellular units and a flow control chamber, and the surface water destination being to a surface water sewer via an existing drainage network.

13.2 Peak Flow Control

The results show that the post development run-off rates are an increase of the 1-year and 30-year greenfield rates but are equivalent to the 100-year greenfield rate. Therefore, as the greenfield rates for extreme storms have not been exceeded, the discharge rates are deemed to be acceptable, as they meet the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems.

13.3 Volume Control

The post development surface water run-off volume is a reduction of the greenfield volume for the same storm event and duration. Therefore, the discharge volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems.

13.4 Flood Risk within the Development

The MicroDrainage calculations show that with these SuDS methods and volumes, no flooding will occur for all storms up to and including the 100-year + 45% storm event.

13.5 Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be by estate management of the clinical site, where the maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening.

13.6 Surface Water Design Exceedance

In the unlikely event of an extreme storm greater than 100-year + 45% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur. Surface water flow paths to follow existing and proposed ground topography, where water will flow towards the development boundaries, and into Burton and Fielden Road.

Flood water will flow away from the proposed building and will not flow directly towards existing dwellings / properties outside the development boundary. The flood water within the roads will be contained due to the road having a gradient (water to flow along road) and upstand kerbs.

13.7 Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment. The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

13.8 Construction Environment Management Plan

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, and flow control chamber are to be the first part of the drainage network to be built. This will ensure that the surface water discharge is suitably restricted without pollutants or flooding.

Appendix A - Topographical Survey



Drainage/Services Legend

Foul	CCTV	Ducting	
Surface	Electric	Service depth (m)	
Combined	Street lighting	Pipe diameter (mm)	
Drainage (unspecified)	Traffic management	End of trace	
British telecom	Gas	Unable to trace	
Telecom	Water	Utility Survey Boundary	
Fibre optics	Fuel		
CATV	Unknown / misc		

Drainage pipe size data has been determined from the surface, in order to comply with confined spaces health and safety legislation. Please regard this data as approximate.

PAS128 Quality Levels

Please refer to PAS128:2014 Table 1 - "Quality level of survey outputs (normative)"

for in anticipated accuracy of quality levels.

All utilities are located to PAS128 QL-B2 unless otherwise stated.

The following table identifies the PAS128 quality level based on the text

notes shown on the drawing:

Annotation found on drawing	PAS128 Quality Level
Added from records	PAS128 QL-D
Trench scar, street furniture, visual note/reference to utility	PAS128 QL-C
Assumed route	PAS128 QL-B4
Unable to obtain depth	PAS128 QL-B3
QL-B1	PAS128 QL-B1
QL-B3P	PAS128 QL-B3P
QL-B2P	PAS128 QL-B2P
QL-B1P	PAS128 QL-B1P

QL-A Exposed & vertical position verification by trial excavation

Quality levels ending with a "P" refer to a utility that has been located with post

processed Ground Penetrating Radar (GPR).

Drawing caveats, please note:

LSS carry out surveys in accordance with site procedures using approved detectors.

Depth data is limited by the accuracy of the detection equipment. Average accuracy is +/- 10% of depth with GPR and +/- 5% of the depth with electromagnetic technologies.

It is LSS's procedure to use statutory undertakers plans prior to and during the survey as a guide for the survey team.

In accordance with British Telecom's national policy survey companies are not permitted to raise BT inspection chamber covers.

Drainage routes between manholes, if not able to be traced by LSS's survey methodologies, are assumed to be direct lines between manholes.

Locate advise that excavations in the vicinity of services are carried out with due diligence, please refer to HSG47.

TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	ER	Earth Rod	RSD	Roller Shutter Door
AB	Air Brick	ET	EP+Transformer	RSJ	Rolled Steel Joint
AR	Assumed Route	FB	Flower Bed	SI	Sign Post
AV	Air Valve	FBD	Floor Board Direction	SP	Arch Spring Point Height
BB	Bellaire Beacon	FH	Fire Hydrant	SV	Stop Valve
BH	Bore Hole	FL	Floor Level	SW	Surface Water
BL	Bed Level	FP	Flag Pole	SY	Cable Stay
BO	Bollard	FS	Foul Water	Tac	Tactile Paving
BT	British Tel	GG	Gully Grate	TC	Telephone Cover
BS	Bus Stop	GV	Gas Valve	TH	Trial Pit
BU	Bush	HH	Head Height	THL	Threshold Level
B/W	Barbed Wire Fence	IC	Inspection Cover	TL	Traffic Light
BX	Box (Utilities)	IL	Invert Level	ToW	Top of Wall
C/B	Close Board Fence	IR	Iron Railings	TP	Telegraph Pole
CH	Cill Height	KO	Kerb Outlet	TS	Traffic Signal Cover
CL	Cover Level	LP	Lamp Post	TV	Cable TV Cover
C/L	Chain Link Fence	MH	Manhole	UB	Universal Beam
C-Lev	Ceiling Level	MP	Marker Post	UC	Unknown Cover
Col	Column	NB	Name Board	UK	Unknown Tree
C/P	Chestnut Paling Fence	OHL	Overhead Line (approx)	UMG	Unmade Ground
CR	Cable Riser	Pan	Panel Fence	USB	Under Side Beam
C/W	Chicken Wire	PB	Post Box	UTL	Unable To Lift
DC	Drainage Channel	PM	Parking Meter	UTS	Unable To Survey
DH	Door Head Height	PO	Post	VP	Vent Pipe
DL	Dilapidated	P/R	Post & Rail Fence	WB	Waste Bin
DP	Down Pipe	P/W	Post & Wire Fence	WH	Weep Hole
DR	Drain	P/Wall	Partition Wall	WL	Water Level
EBx	Electric Box	RE	Rodding Eye	WM	Water Meter
EC	Electric Supply Cover	RL	Ridge Level	WO	Wash Out
EL	Eaves Level	RP	Reflector Post	FC	Floor to Ceiling Height
EP	Electric Pole	RS	Road Sign	FC	Floor to False Ceiling Ht

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL
0001	383716.801	392062.132	32.511
0002	383760.220	392035.947	32.758
0003	383781.220	392006.940	33.158
0004	383814.281	392015.657	33.092
0005	383775.903	391960.552	33.143
0006	383678.219	392008.554	32.815
0007	383717.219	392035.554	32.511
004A	383803.274	392013.986	32.784
03A1	383762.190	392002.477	33.066

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS
LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING
0845 040 5969
survey-solutions.co.uk
IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH
NOTTINGHAM YEOVIL

PROJECT TITLE
Withington Community Hospital

DRAWING DETAIL
UTILITY SURVEY
Sheet 1 of 1

CLIENT				SCALE
NHS Foundation Trust - Manchester University				1:200
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
JDS	Dec 2022	AG JDS	JDS	FINAL
DRAWING NUMBER			REVISION	ISSUE DATE
45019MCUG-01				23/12/22

Appendix B - Proposed Site Plan

Ground Floor GA Plan
1 : 100

GENERAL NOTES:

DAY Architectural Ltd accepts no responsibility for any costs, losses or claims whatsoever arising from these drawings, specifications and related documents unless there is full compliance with the Client or any unauthorised user of the following:

1 All boundaries, dimensions and levels are to be checked on site before construction and any discrepancies reported to the Architect / Designer.
2 Partial Service: Any discrepancies with site or other information is to be advised to the Architect / Designer and direction and / or approval is to be sought before the implementation of the detail.
3 Block and site plans are reproduced under license from the Ordnance Survey.
4 Do not scale this drawing.
5 For the purpose of coordination, all relevant parties must check this information prior to implementation and report any discrepancies to the Architect / Designer.

REV	DESCRIPTION	DATE	REV BY
P3	STAGE 2 ISSUE	28.03.24	MA
P2	Issued for Information	22.03.24	MA
P1	Issued for Information	19.03.24	MA

CLIENT: Manchester University Hospital NHS Foundation Trust

PROJECT: CDC - Cardiorespiratory, Withington Community Hospital

DRAWING: Proposed Site Plan

SCALE: 1 : 100 @ A0

FIRST ISSUED: 19.03.24

PROJECT	CLIENT REF	DRAWN BY	CHECKED BY
1342-22	22182	MA	SDB

ORIGIN	VOLUME	LEVEL	TYPE	ROLE	NUMBER	REVISION
DAY	WCH127	00	DR	A	**02002**	P3

SUITABILITY: INFORMATION

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DAY

Appendix C - British Geological Survey Data

MANCHESTER CITY COUNCIL

CITY ENGINEER AND SURVEYORS DEPARTMENT

SJ895W654
8383 9203

SITE INVESTIGATION FOR		DATE COMMENCED	22-2-87
LOCATION	Burton Road	BORING METHOD	Cable Percussive
BOREHOLE No.	2	BORING DIAMETER	150 mm
GRID REFERENCE		SCALE:	1:50 m

DATE	CASING DEPTH (m)	WATER LEVEL MORNING & EVENING	DEPTH OF STRATA BELOW GL	Reduced Level	DESCRIPTION	No. and Type of Sample	SAMPLE DEPTH PENETRATION From	SAMPLE DEPTH PENETRATION To	No. of Blows	Legend
			0.40		Bituminous surfacing onto concrete					
			0.70		Brown-black silt, sand, ash, cinders, gravel, brick, clay etc. MADEGROUND	D1	0.50			
21-2-87	0.00	DRY	1.40		Very loose grey-brown very gravelly fine to coarse SAND with clay lenses	D2 P1 B1	1.00 1.55 1.80	 1.85 2.20	3	
22-2-87			2.20		MADEGROUND					
			2.70		Very loose grey-brown gravelly fine to coarse SAND	P2 B2	2.35 2.70	2.65 3.20	1	
			3.90		Medium-dense brown slightly silty and very gravelly fine to coarse SAND	P3 W1	3.35 3.65	3.65	11	
					Stiff/very stiff brown silty and sandy CLAY with silt and sand laminae and lenses and fine to medium gravel becoming firm/ stiff silty and slightly sandy laminated CLAY with occasional fine gravel below 5.20 m and stiff below 6.0 m	D3 U1 D4 U2 D5 U3 D6	4.00 4.30 4.85 5.20 5.75 6.00 6.55	 4.75 5.65 6.45		
22-2-87	4.50	DRY	6.55		END OF BOREHOLE					

WATER OBSERVATIONS DURING BORING

DEPTH OF WATER ENTRY (m)	ESTIMATED SEE PAGE	STANDING LEVEL (m)	DEPTH OF CASING WHEN SEALED (m)
3.20	–	3.00	–

WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION

DATE	WATER LEVEL	DEPTH OF CASING

REMARKS:– Water encountered at 3.20 m rising to 3.00 m after 15 minutes. Borehole dry on completion.

SAMPLE TEST KEY

D – DISTURBED SAMPLE B – BULK SAMPLE U – UNDISTURBED SAMPLE
P – SPT SAMPLE W – WATER SAMPLE

NOTE: WHERE FULL 0.3 PENETRATION HAS NOT BEEN ACHIEVED, THE NUMBER OF BLOWS FOR THE QUOTED PENETRATION IS GIVEN (NOT N – VALUE)

ALL DEPTHS AND REDUCED LEVELS IN (m) UNLESS OTHERWISE STATED

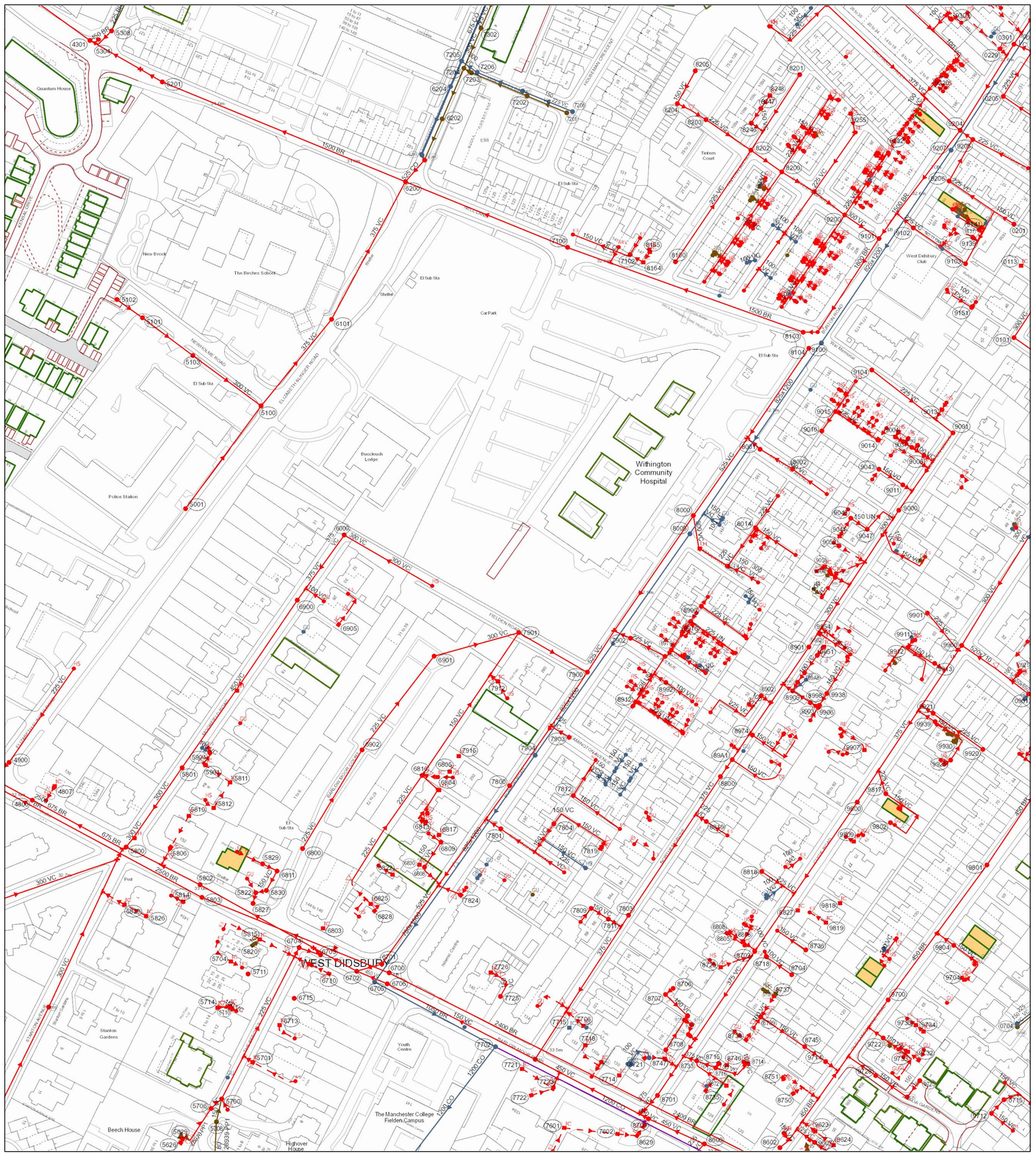
REMARKS

COMMERCIAL
IN CONFIDENCE

M/c 5931

British Geological Survey

Appendix D - United Utilities Asset Plan



Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
7205		SW		675			CO	15.46672	
8979		CO		225			UN	5.269934	
8002		CO	0	300			VC	21.09502	
5308	31.61	CO	26.43	450			BR	10.47266	1 in 524
7904	33.18	SW	24.89	825			BR	76.84399	1 in 285
8701	33.58	CO	25.94	375			VC	10.63015	1 in 30
8710		CO	0	150			VC	2.834257	
8709		CO	0	150			VC	4.549199	
5700	33.41	CO	30.56	225			VC	5.587059	1 in 7
5703	33.41	CO	30.56	225			VC	86.77925	1 in 106
7302		FO		300			VC	24.28513	
9800	33.21	CO	26.62	375			VC	100.6876	1 in 280
9139		CO		150			VC	3.412462	
5100	32.09	CO	28.07	375			VC	61.84658	1 in 326
8941		CO		300			VC	11.54543	
9817		CO		225			VC	13.43007	
9607		CO		225			VC	12.15411	
4700	32.16	CO	27.12	300			VC	90.37699	
6200	31.83	CO	25.97	1500			BR	146.0038	1 in 2086
0101	32.42	CO	29.11	300			VC	64.63745	1 in 646
6704	33.25	CO	29.71	225			VC	12.64911	1 in 53
9100	32.78	SW	25.62	825			BR	128.7051	1 in 1170
9151		CO		100			PVC	3.873909	
9912		CO		150			VC	17.47439	
7801	33.1	CO		225			VC	9.926783	
9101	32.78	CO	26.04	1800			BR	31.06445	
8001	32.69	CO	28.98	300			VC	9.219544	
8948		CO		100			VC	6.599341	
9700	33.78	CO	30.8	450			BR	93.00538	1 in 266
9137		CO		150			VC	2.40768	
8712		CO	0	375			VC	4.69746	
7702	33.48	SW	24.32	1200			CO	85.60374	1 in 49
8718		CO		100			VC	3.123873	
7203		FO		150			VC	4.791372	
8714		CO	0	150			VC	21.04261	
9938		CO		150			VC	7.715778	
9309		CO		100			VC	3.638474	
8745		CO		150			VC	14.28587	
8005	32.92	SW	25.26	825			BR	150.0833	1 in 417
8916		CO		225			UN	19.05672	
8707		CO	0	150			VC	17.11178	
8902		CO		225			VC	6.520931	
5800	32.76	CO	25.28	675			BR	59.06036	1 in 295
6800	32.79	CO	31.16	225			VC	64.14047	1 in 173
0901	32.93	CO	27.29	550			BR	22.80351	1 in 114
6902	32.41	CO	30.78	225			VC	65.60488	1 in 140
6702	33.4	CO	0	675			BR	27.29469	
5102	31.82	CO	28.76	300			VC	17.20465	1 in 246
4900	32.54	CO	25.81	225			VC	5.656854	1 in 15
7102		CO		150			VC	34.76199	
9103	32.4	CO	29.42	225			VC	35.22803	1 in 50
7701		CO	0	150			VC	92.13034	
8810		CO		225			VC	7.136762	
8996		CO		225			VC	6.387374	
8818		CO		225			VC	21.9079	
9102	32.66	CO	28.7	225			VC	12.04159	1 in 5
8103	32.68	CO	26.22	1500			BR	139.1761	1 in 696
9714		CO		150			VC	8.509656	
7204		FO		300			VC	30.64482	
9141		CO		150			VC	1.726775	
6811		CO		150			VC	12.54253	
0301	32.61	CO	26.35	1500			BR	56.60389	1 in 5660
0925		CO		100			VC	6.949621	
8800	33.04	CO	28.41	375			VC	92.35857	1 in 138
9903		CO		150			VC	5.079826	
9954		CO		225			VC	1.04784	
8733		CO	0	375			VC	7.611504	
6203		SW		450			CO	3.479422	
8901	32.76	CO	28.99	300			VC	75.54648	
5304	31.56	CO	26.41	450			BR	5.150233	
6706	33.42	CO	25.46	450			VC	18.38478	
5822		CO		150			VC	6.108181	
9206	32.41	CO	29.47	225			VC	26.41969	
7804		CO		150			VC	10.63828	
9804		CO		150			VC	11.52608	
9712		CO		150			VC	10.46695	
8909		CO		150			VC	6.258584	
5708		FO		150			VC	12.96276	
9906		CO		150			VC	1.387729	
8711		CO	0	150			VC	5.784056	
5803	32.89	CO	23.12	2500			BR	223.7074	1 in 2237
9725		CO		150			VC	11.50056	
9900	32.99	CO	26.71	375			VC	104.561	1 in 1307
8205	32.41	CO	30.92	150			VC	20.59126	1 in 66
8203		SW	0	225			VC	24.26864	
9207	32.71	SW	26.11	825			BR	128.969	1 in 269
5001		CO	0	300			VC	70.80254	
6700	33.57	CO	23.39	2500			BR	112.1606	1 in 510
9802		CO		150			VC	43.78787	
8600	33.69	CO	25.64	450			VC	34.0147	
9722		CO		150			VC	9.937824	
8201	32.24	CO	29.92	225			VC	49.93014	1 in 70
8602	33.85	CO	31.33	450			BR	101.8442	1 in 196
9921		CO		225			VC	7.765248	
7903	33.16	CO	29.96	225			VC	11.6619	1 in 3
9035		CO		100			VC	5.837942	
9205	32.51	CO	29.71	225			VC	8.602325	1 in 21
5801	32.58	CO	26.13	300			VC	53.83729	1 in 88
8704		CO		100			VC	17.18688	
8974		CO		150			VC	1.709394	
8912		CO		225			UN	29.96889	
4301	31.38	CO	25.86	1500			BR	70.10715	1 in 2337
9045		CO		150			UN	10.99521	
6701	33.57	CO	25.58	525			VC	14.56022	
6204		SW		675			CO	40.88557	
9920		CO		225			VC	34.08365	
7811		CO		150			VC	8.257854	
9925		CO		150			VC	16.17339	
8739		CO		150			VC	29.43753	
7900	33.12	CO	25.77	525			VC	76.27988	1 in 1090
5802	32.99	CO	26.39	675			BR	46.06517	1 in 42
9067		CO		100			VC	9.065479	
9047		CO		150			UN	20.03611	
8998		CO		150			VC	11.81484	
9726		CO		150			VC	21.23095	
8806		CO		100			VC	8.535551	
6202		FO		375			CO	24.73613	
6809		CO		150			VC	16.58604	
9939		CO		150			VC	11.26034	
9000	32.59	CO	29.58	300			VC	34.37835	
0201	32.45	CO	31.55	150			VC	13.0384	1 in 32
8204	32.51	CO	30.59	150			VC	8.944272	1 in 81
7202		FO		150			VC	33.61888	
7809		CO		150			VC	11.34898	
9006		CO		100			VC	5.924034	
9202	32.56	CO	28.65	300			VC	21.40093	1 in 97
9001	32.69	CO	30.07	225			VC	52.43091	1 in 109
5801	33.44	CO	30.44	450			BR	87.92042	1 in 105
9913		CO		150			VC	6.898971	
8700	33.64	CO	0	450			VC	5.830952	
6808		CO		150			VC	12.9111	
8708		CO	0	150			VC	19.36541	
5830		CO		150			VC	5.892676	
8004	32.76	CO	29.73	300			VC	37.11625	1 in 62
5829		CO		150			VC	8.867601	
9951		CO		100			VC	11.7848	
7901	32.76	CO	27.77	300			VC	43.909	1 in 46
4800	32.54	CO	25.07	675			BR	93.05993	1 in 3102
9043		CO		150			VC	15.80206	
8000	32.89	CO	25.88	525			VC	105.125	1 in 1051
9232		CO		0			UN	6.457997	1 in
7812		CO		150			VC	23.39453	
8246		CO		150			VC	8.079077	
8203	32.49	CO	30.36	225			VC	30.23243	1 in 69
7800	33.2	CO	25.69	525			VC	121.8312	1 in 1218
7201		FO		150			VC	23.85251	
9104	32.78	CO	30.51	225			VC	57.00877	1 in 136
0708		FO	0	150			VC	24.03535	
6703	33.33	CO	25.4	675			BR	5.656854	
0715		CO		150			VC	8.882497	
5101	32.08	CO	28.69	300			VC	35	1 in 152
8104	32.65	CO	26.01	525			VC	112.8958	1 in 941
5201	31.47	CO	25.89	1500			BR	13.89244	1 in 1389
0205	32.55	CO	30.47	225			VC	29.68164	1 in 24
8100	32.37	CO	30.01	225			VC	74.88658	1 in 92
8702	33.44	CO	26.24	375			VC	59.07793	
6705	33.43	SW	24.34	1050			BR	76.05919	
6901	32.69	CO	30.26	300			VC	48.76474	1 in 89
9901	32.85	CO	30.62	225			VC	27.01851	
7207		SW		300			VC	27.31854	
8202	32.36	CO	29.18	300			VC	20.80868	1 in 95
9037		CO		100			VC	8.207281	
9015		CO		225			VC	13.14927	
8736		CO		150			VC	19.05305	
7902	32.91	CO	29.68	225			VC	9.848858	
6201		SW		525			CO	16.07158	
8200	32.49	CO	28.94	300			VC	21.09504	1 in 75
8847		CO		100			VC	5.527167	
6816		CO		150			VC	95.76697	
7206		CO		300			VC	10.6815	
5904		CO		150			VC	3.194099	
8700	33.64	CO	25.02	450			VC	71.11962	
5103	32.08	CO	28.44	300			VC	47.20169	1 in 175
7803	33.32	CO	27.73	375			VC	99.19737	
7100	32.19	CO	26.01	1500			BR	97.07862	1 in 2427
9204	32.7	CO	26.35	1500			BR	66.40371	1 in 391
7208		SW		225			VC	29.96804	
9011		CO		150			VC	6.231285	
8715		CO	0	375			VC	2.843984	
8706		CO	0	150			VC	5.405731	
9200	32.55	CO	28.42	300			VC	23.02173	1 in 288
8992		CO		100			VC	8.321389	
6101	31.95	CO	27.86	375			VC	86.88602	1 in 235
9728		CO		150			VC	18.65594	
8716		CO	0	375			VC	11.23654	
8247		CO		150			VC	9.668074	
6000	31.79	CO	27.09	375			VC	44.67338	1 in 893
6900	32.22	CO	27.13	450			VC	112.8958	1 in 114

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined, blue - surface water, brown - foul, purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Withington Community Hospital,

Scale: 1:1250 **Date:** 16/01/2023

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Appendix E - Greenfield Run-Off Rates and Volume Calculations

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	864	Region Number	Region 10

Results l/s

QBAR Rural	281.0
QBAR Urban	281.0
Q1 year	244.5
Q1 year	244.5
Q2 years	261.7
Q5 years	334.4
Q10 years	387.8
Q20 years	441.8
Q25 years	460.8
Q30 years	476.4
Q50 years	519.8
Q100 years	584.5
Q200 years	663.1
Q250 years	688.4
Q1000 years	854.2

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Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 383735 392005 SJ 83735 92005
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	0.240
SAAR (mm)	839
CWI	119.230
SPR Host	47.000
URBEXT (USER)	0.0000

Results

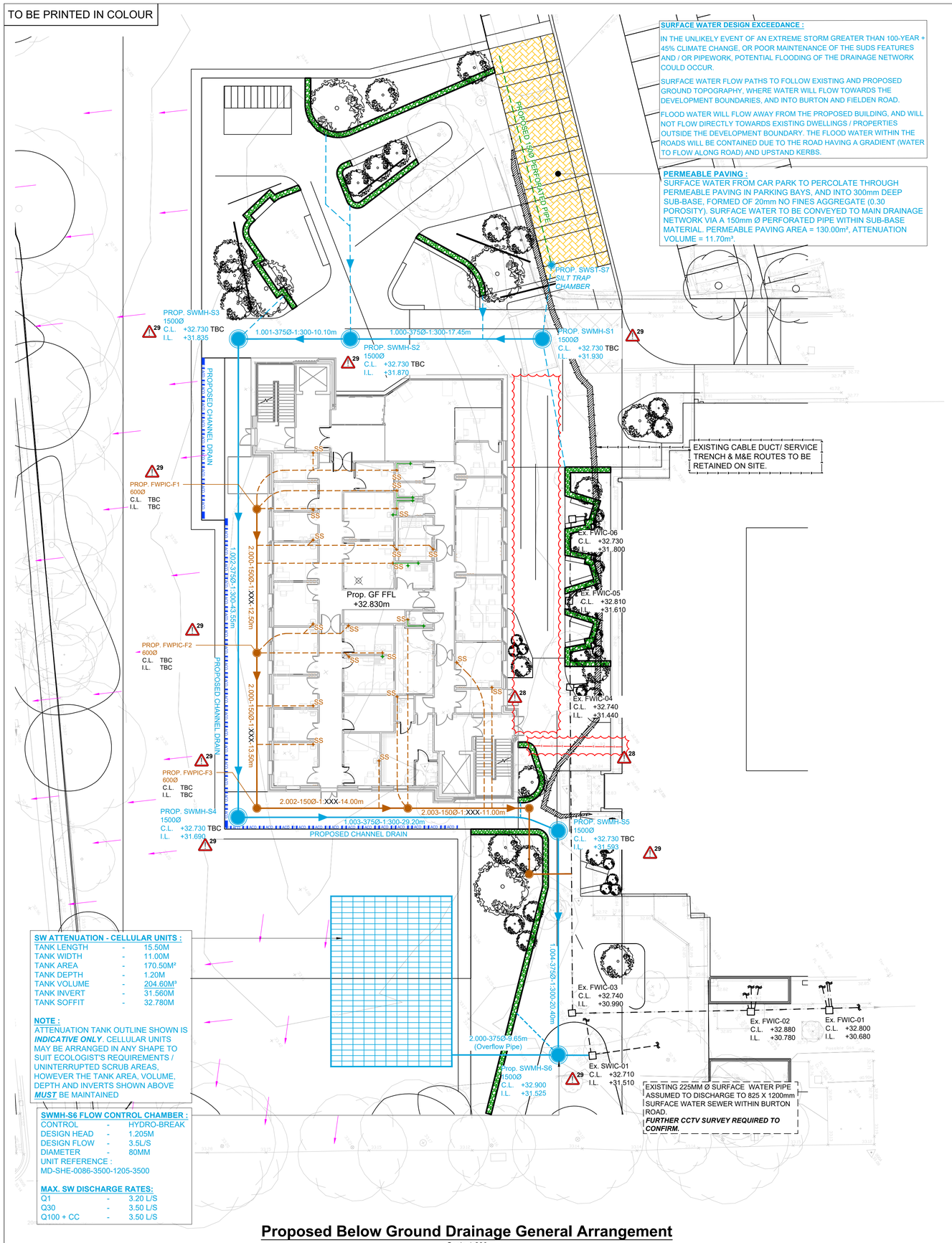
Percentage Runoff (%)	50.13
Greenfield Runoff Volume (m^3)	81.178

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Appendix F - Below Ground Drainage Strategy Layout and Details

TO BE PRINTED IN COLOUR

A1



SURFACE WATER DESIGN EXCEEDANCE :

IN THE UNLIKELY EVENT OF AN EXTREME STORM GREATER THAN 100-YEAR + 45% CLIMATE CHANGE, OR POOR MAINTENANCE OF THE SUDS FEATURES AND / OR PIPEWORK, POTENTIAL FLOODING OF THE DRAINAGE NETWORK COULD OCCUR.

SURFACE WATER FLOW PATHS TO FOLLOW EXISTING AND PROPOSED GROUND TOPOGRAPHY, WHERE WATER WILL FLOW TOWARDS THE DEVELOPMENT BOUNDARIES, AND INTO BURTON AND FIELDEN ROAD.

FLOOD WATER WILL FLOW AWAY FROM THE PROPOSED BUILDING, AND WILL NOT FLOW DIRECTLY TOWARDS EXISTING DWELLINGS / PROPERTIES OUTSIDE THE DEVELOPMENT BOUNDARY. THE FLOOD WATER WITHIN THE ROADS WILL BE CONTAINED DUE TO THE ROAD HAVING A GRADIENT (WATER TO FLOW ALONG ROAD) AND UPSTAND KERBS.

PERMEABLE PAVING :

SURFACE WATER FROM CAR PARK TO PERCOLATE THROUGH PERMEABLE PAVING IN PARKING BAYS, AND INTO 300mm DEEP SUB-BASE, FORMED OF 20mm NO FINES AGGREGATE (0.30 POROSITY). SURFACE WATER TO BE CONVEYED TO MAIN DRAINAGE NETWORK VIA A 150mm Ø PERFORATED PIPE WITHIN SUB-BASE MATERIAL. PERMEABLE PAVING AREA = 130.00m², ATTENUATION VOLUME = 11.70m³.

SW ATTENUATION - CELLULAR UNITS :

TANK LENGTH	-	15.50M
TANK WIDTH	-	11.00M
TANK AREA	-	170.50M²
TANK DEPTH	-	1.20M
TANK VOLUME	-	204.60M³
TANK INVERT	-	31.560M
TANK SOFFIT	-	32.780M

NOTE :
ATTENUATION TANK OUTLINE SHOWN IS ***INDICATIVE ONLY***. CELLULAR UNITS MAY BE ARRANGED IN ANY SHAPE TO SUIT ECOLOGIST'S REQUIREMENTS / UNINTERRUPTED SCRUB AREAS, HOWEVER THE TANK AREA, VOLUME, DEPTH AND INVERTS SHOWN ABOVE ***MUST*** BE MAINTAINED

SWMH-S6 FLOW CONTROL CHAMBER :

CONTROL	-	HYDRO-BREAK
DESIGN HEAD	-	1.205M
DESIGN FLOW	-	3.5L/S
DIAMETER	-	80MM

UNIT REFERENCE :
MD-SHE-0086-3500-1205-3500

MAX. SW DISCHARGE RATES:

Q1	-	3.20 L/S
Q30	-	3.50 L/S
Q100 + CC	-	3.50 L/S

Proposed Below Ground Drainage General Arrangement

Scale 1:200

HAZARD & WARNING NOTES:

01 *EXCAVATION WORKS IN THE VICINITY OF EXISTING SERVICES. KNOWN BELOW GROUND SERVICES AND OBSTRUCTIONS.*

02 *REQUIREMENT FOR GAS PROTECTION MEASURES.*

06 *DRAINAGE WORKS EXCAVATION. DURING THE INSTALLATION OF NEW DRAINAGE RUNS, POTENTIAL WORKS IN CONFINED SPACES. DANDER TO OPERATIVES WORKING ON SITE FROM SEWAGE.*

16 *MECHANICAL & ELECTRICAL (M&E) DESIGN IN ABEYANCE. AWAITING PROPOSED RISER, LOUVRE, AND ABOVE GROUND DRAINAGE REQUIREMENTS.*

23 *SURFACE WATER MANAGEMENT PLAN (SWMP) TO BE REVISED FOLLOWING SCHEME RELAUNCH/ REVISED PROPOSALS AND CONFIRM FLOOD RISK REQUIREMENTS.*
PENDING INSTRUCTION FROM BAM/ RECEIPT OF REVISED EXTERNAL WORKS PROPOSALS.

28 *EXISTING HV CABLE/ DUCT IDENTIFIED ON SITE. PROPOSED REROUTING WORKS (DESIGN & DETAILING) TO BE CONFIRMED BY ELECTRICITY NORTH WEST (ENW) PRIOR TO CONSTRUCTION. BELOW GROUND DRAINAGE DESIGN/ EXTERNAL WORKS SUBJECT TO CHANGE FOLLOW RECEIPT OF PROPOSALS.*

29 *ALL EXTERNAL WORKS LEVELS TO BE CONFIRMED BY LANDSCAPE ARCHITECT. PROPOSED BELOW GROUND DRAINAGE ARRANGEMENT SUBJECT TO CHANGE FOLLOW RECIEPT OF LEVELS & FURTHER COORDINATION WITH EXISTING INVERT LEVELS.*

Drainage Legend

- Denotes Development Boundary
- Denotes Existing Combined Drain
- Denotes Existing Foul Water Drain
- Denotes Existing Surface Water Drain
- Denotes Redundant Drain - *To be Removed/ Capped - Usage as Per Existing Line Types*
- Denotes Proposed Combined Drain
- Denotes Proposed Primary Foul Water Drain
- Denotes Proposed Secondary Foul Water Drain - All Runs to be 100Ø U.N.O.
- Denotes Proposed Surface Water Drain
- Denotes Proposed Secondary Surface Water Drain - All Runs to be 100Ø U.N.O.
- Denotes Proposed Channel/ Slot Drain
- Denotes Proposed Foul Water Pump Rising Main
- Denotes Proposed Surface Water Pump Rising Main
- Denotes Proposed Foul Water Drain to be Installed & Capped to Allow for Future Connection
- Denotes Proposed Surface Water Drain to be Installed & Capped to Allow for Future Connection
- Denotes Proposed Filter Drain/ Rain Garden
- Denotes Exceedance Flow Routes
- Denotes Existing RWP/ SVP - As Noted ***(Shown Indicatively - Final Locations TBC on Site)***
- Denotes Proposed FW Ground Floor Penetration ***(Shown Indicatively - Final Locations as per Architects Set Out)***
- Denotes Proposed RWP Location As Provided by Architect ***(Shown Indicatively - Final Locations as per Architects Set Out)***
- Denotes Above Ground Foul Water Drain (Proposed) ***- Shown Indicatively Final Arrangement TBC by M&E Contractor***

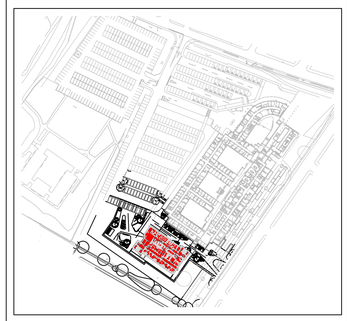
MH	Denotes Manhole Location
PPIC	Denotes Inspection Chamber Location
FG	Denotes Foul Water Gully Location
SVP	Denotes Soil Vent Pipe Location
SS	Denotes Stub Stack Location
G	Denotes Gully
RE	Denotes Rodding Eye Location
BIG	Denotes Back Inlet Gully
BD	Denotes Back Drop Location
WB	Denotes Proposed Water Butt
F.A.	Denotes Pipe/ Penetration From Above.
A.G.	Denotes Pipe Run Above Ground Floor Level
AAV	Denotes Air Admittance Valve - ***Final Spec. / Details TBC by M&E Contractor.***

- Denotes Existing Below Ground LV Cable/ Ducting
- Denotes Existing Below Ground HV Cable/ Ducting

notes :

1. IF THIS DRAWING HAS BEEN RECEIVED ELECTRONICALLY IT IS THE RECIPIENTS RESPONSIBILITY TO PRINT THE DOCUMENT TO THE CORRECT SCALE
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE. IT IS RECOMMENDED THAT INFORMATION IS NOT SCALED OFF THIS DRAWING
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEYPLAN



REV.	DESCRIPTION	DATE	DRW.	CHK.
P1	ISSUED FOR COMMENT	22.04.24	MDS	LC

NHS Manchester University NHS Foundation Trust

APPOINTED PARTY LOGO/INFORMATION

ccs consulting MANCHESTER • LONDON • LEEDS

PROJECT
CDC - CARDIORESPIRATORY, WITHINGTON COMMUNITY HOSPITAL

TITLE
PROPOSED BELOW GROUND DRAINAGE PLAN

STATUS	PURPOSE OF ISSUE
S1	FOR COMMENTS

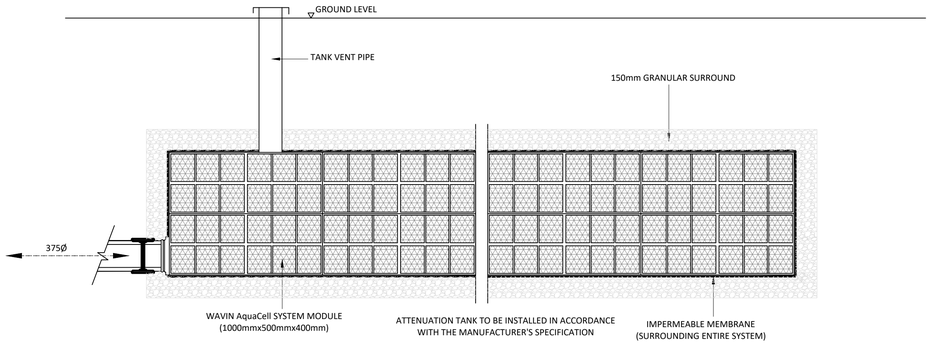
DRAWN BY	CHECKED BY	DATE
JF	KLE	APRIL '24

SCALE (@A1)	PROJECT NUMBER
AS SHOWN	HE-014

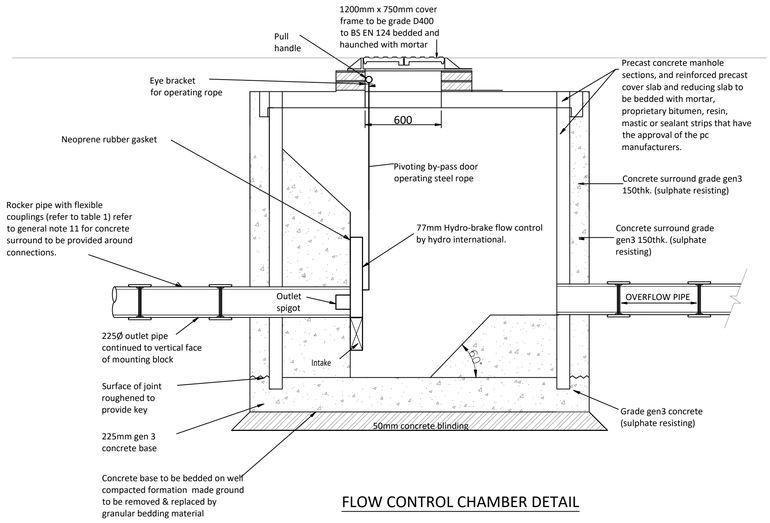
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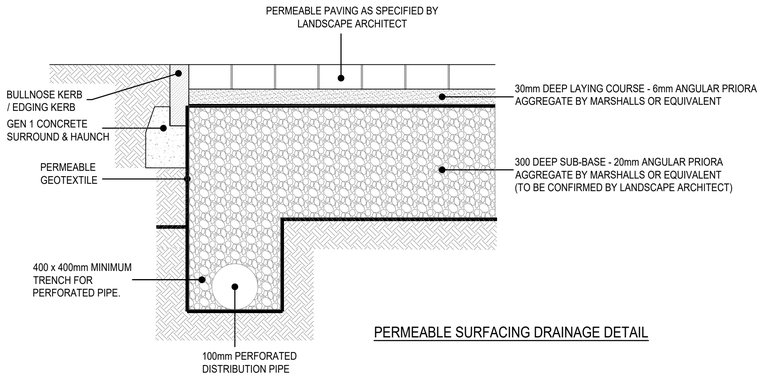
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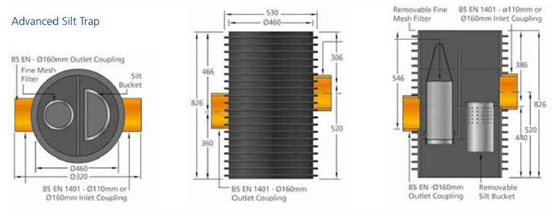
TYPICAL ATTENUATION TANK DETAIL



FLOW CONTROL CHAMBER DETAIL



PERMEABLE SURFACING DRAINAGE DETAIL

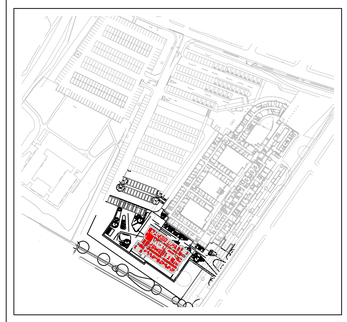


SILT TRAP DETAIL

notes :

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KEYPLAN



REV.	DESCRIPTION	DATE	DRW.	CHK.
P1	ISSUED FOR COMMENT	22.04.24	MDS	LC

NHS Manchester University NHS Foundation Trust

APPOINTED PARTY LOGO/INFORMATION

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PROJECT
CDC - CARDIORESPIRATORY, WITHINGTON COMMUNITY HOSPITAL

TITLE
PROPOSED BELOW GROUND DRAINAGE DETAILS

STATUS	PURPOSE OF ISSUE
S1	FOR COMMENTS

DRAWN BY	CHECKED BY	DATE
JF	KLE	APRIL '24

SCALE (@A1)	PROJECT NUMBER
N.T.S	HE-014

FILE DRAWING NUMBER	REV.
22182-CCS - WCH127- XX- DR - S - 93001	P1

Appendix G - Surface Water Network / Management Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 383735 392005 SJ 83735 92005
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	45
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.157	4-8	0.083

Total Area Contributing (ha) = 0.240

Total Pipe Volume (m³) = 14.706

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

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)

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	17.450	0.060	290.8	0.039	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	10.100	0.035	288.6	0.022	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	43.550	0.145	300.3	0.097	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	29.200	0.097	301.0	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	20.400	0.068	300.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	9.650	0.035	275.7	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	2.800	0.015	186.7	0.017	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.28	31.930	0.039	0.0	0.0	2.4	1.06	116.8	7.7
1.001	50.00	5.43	31.870	0.061	0.0	0.0	3.7	1.06	117.2	12.0
1.002	50.00	6.13	31.835	0.158	0.0	0.0	9.6	1.04	114.9	31.0
1.003	50.00	6.60	31.690	0.223	0.0	0.0	13.6	1.04	114.8	43.8
1.004	50.00	6.93	31.593	0.223	0.0	0.0	13.6	1.04	115.0	43.8
2.000	50.00	5.15	31.560	0.000	0.0	0.0	0.0	1.09	120.0	0.0
1.005	50.00	6.96	31.525	0.240	0.0	0.0	14.6	1.32	146.1	47.1

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	32.730	0.800	Open Manhole	1500	1.000	31.930	375				
S2	32.730	0.860	Open Manhole	1500	1.001	31.870	375	1.000	31.870	375	
S3	32.730	0.895	Open Manhole	1500	1.002	31.835	375	1.001	31.835	375	
S4	32.730	1.040	Open Manhole	1500	1.003	31.690	375	1.002	31.690	375	
S5	32.730	1.137	Open Manhole	1500	1.004	31.593	375	1.003	31.593	375	
S6	33.000	1.440	Open Manhole	1500	2.000	31.560	375				
S7	32.900	1.375	Open Manhole	1500	1.005	31.525	375	1.004	31.525	375	
								2.000	31.525	375	
EX SWIC-01	32.710	1.200	Open Manhole	0		OUTFALL		1.005	31.510	375	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	375	S1	32.730	31.930	0.425	Open Manhole	1500
1.001	o	375	S2	32.730	31.870	0.485	Open Manhole	1500
1.002	o	375	S3	32.730	31.835	0.520	Open Manhole	1500
1.003	o	375	S4	32.730	31.690	0.665	Open Manhole	1500
1.004	o	375	S5	32.730	31.593	0.762	Open Manhole	1500
2.000	o	375	S6	33.000	31.560	1.065	Open Manhole	1500
1.005	o	375	S7	32.900	31.525	1.000	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	17.450	290.8	S2	32.730	31.870	0.485	Open Manhole	1500
1.001	10.100	288.6	S3	32.730	31.835	0.520	Open Manhole	1500
1.002	43.550	300.3	S4	32.730	31.690	0.665	Open Manhole	1500
1.003	29.200	301.0	S5	32.730	31.593	0.762	Open Manhole	1500
1.004	20.400	300.0	S7	32.900	31.525	1.000	Open Manhole	1500
2.000	9.650	275.7	S7	32.900	31.525	1.000	Open Manhole	1500
1.005	2.800	186.7	EX SWIC-01	32.710	31.510	0.825	Open Manhole	0

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)
1.005	EX SWIC-01	32.710	31.510	0.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	45.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 383735 392005 SJ 83735 92005
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S7, DS/PN: 1.005, Volume (m³): 5.4

Unit Reference	MD-SHE-0077-2800-1200-2800
Design Head (m)	1.200
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	31.525
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.8	Kick-Flo®	0.683	2.2
Flush-Flo™	0.336	2.7	Mean Flow over Head Range	-	2.4

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)
0.100	2.1	1.200	2.8	3.000	4.3	7.000	6.4
0.200	2.6	1.400	3.0	3.500	4.6	7.500	6.6
0.300	2.7	1.600	3.2	4.000	4.9	8.000	6.8
0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.0
0.500	2.6	2.000	3.5	5.000	5.4	9.000	7.2
0.600	2.4	2.200	3.7	5.500	5.7	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.9		
1.000	2.6	2.600	4.0	6.500	6.1		

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Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	26.0
Max Percolation (l/s)	36.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	32.350	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: S6, DS/PN: 2.000

Invert Level (m)	31.560	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	170.5	0.0	2.600	0.0	0.0
0.200	170.5	0.0	2.800	0.0	0.0
0.400	170.5	0.0	3.000	0.0	0.0
0.600	170.5	0.0	3.200	0.0	0.0
0.800	170.5	0.0	3.400	0.0	0.0
1.000	170.5	0.0	3.600	0.0	0.0
1.200	170.5	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S1	1.414	1.927	11.700	15.041
1.001	S2	1.520	1.116	0.000	2.635
1.002	S3	1.582	4.810	0.000	6.392
1.003	S4	1.838	3.225	0.000	5.063
1.004	S5	2.009	2.253	0.000	4.262
2.000	S6	2.545	1.066	205.168	208.779
1.005	S7	2.430	0.309	0.000	2.739

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Volume Summary (Static)

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
Total		13.337	14.706	216.868	244.911

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S1	1.414	1.762	11.700	14.875
1.001	S2	1.520	0.950	0.000	2.470
1.002	S3	1.582	4.644	0.000	6.226
1.003	S4	1.838	3.059	0.000	4.897
1.004	S5	2.009	2.087	0.000	4.097
2.000	S6	2.545	0.900	205.168	208.613
1.005	S7	2.430	0.226	0.000	2.656
Total		13.337	13.629	216.868	243.834

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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	45.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 383735 392005 SJ 83735 92005
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	2	+0%	30/15 Summer				32.018
1.001	S2	15 Winter	2	+0%	30/15 Summer				31.988
1.002	S3	15 Winter	2	+0%	30/15 Summer				31.980
1.003	S4	15 Winter	2	+0%	30/15 Summer				31.959
1.004	S5	15 Winter	2	+0%	30/15 Summer				31.918
2.000	S6	240 Winter	2	+0%	30/15 Winter				31.767
1.005	S7	15 Winter	2	+0%	30/15 Summer				31.868

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	-0.287	0.000	0.09		8	8.6	OK	
1.001	S2	-0.257	0.000	0.15			12.6	OK	
1.002	S3	-0.230	0.000	0.28			29.8	OK	
1.003	S4	-0.106	0.000	0.34			34.6	OK	
1.004	S5	-0.050	0.000	0.26			25.4	OK	
2.000	S6	-0.168	0.000	0.02		184	2.2	OK	
1.005	S7	-0.032	0.000	0.03			2.7	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	45.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 383735 392005 SJ 83735 92005
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	30	+40%	30/15 Summer				32.412
1.001	S2	15 Winter	30	+40%	30/15 Summer				32.403
1.002	S3	15 Winter	30	+40%	30/15 Summer				32.387
1.003	S4	360 Winter	30	+40%	30/15 Summer				32.355
1.004	S5	360 Winter	30	+40%	30/15 Summer				32.353
2.000	S6	360 Winter	30	+40%	30/15 Winter				32.352
1.005	S7	360 Winter	30	+40%	30/15 Summer				32.352

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.107	0.000	0.23		4	21.9	SURCHARGED	
1.001	S2	0.158	0.000	0.33			28.9	SURCHARGED	
1.002	S3	0.177	0.000	0.79			83.6	SURCHARGED	
1.003	S4	0.290	0.000	0.21			21.3	SURCHARGED	
1.004	S5	0.385	0.000	0.22			21.2	SURCHARGED	
2.000	S6	0.417	0.000	0.03		515	2.8	SURCHARGED	
1.005	S7	0.452	0.000	0.03			2.7	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	45.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 383735 392005 SJ 83735 92005
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	360 Winter	100	+45%	30/15 Summer				32.729
1.001	S2	480 Winter	100	+45%	30/15 Summer				32.729
1.002	S3	480 Winter	100	+45%	30/15 Summer				32.729
1.003	S4	480 Winter	100	+45%	30/15 Summer				32.727
1.004	S5	480 Winter	100	+45%	30/15 Summer				32.725
2.000	S6	480 Winter	100	+45%	30/15 Winter				32.724
1.005	S7	480 Winter	100	+45%	30/15 Summer				32.724

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.424	0.000	0.05		317	5.1	FLOOD RISK	
1.001	S2	0.484	0.000	0.08			6.7	FLOOD RISK	
1.002	S3	0.519	0.000	0.16			17.3	FLOOD RISK	
1.003	S4	0.662	0.000	0.23			23.6	FLOOD RISK	
1.004	S5	0.757	0.000	0.24			23.2	FLOOD RISK	
2.000	S6	0.789	0.000	0.03		789	2.8	FLOOD RISK	
1.005	S7	0.824	0.000	0.03			2.8	FLOOD RISK	

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