



Project No

23-2405

Project

**Land at Levenshulme Road
Gorton, Manchester**

Title

Surface Water Management Report

Date

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Revision

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Contents	Page
1. Introduction	3
2. Planning Policies and Guidance	4
3. Site Setting and Description	5
4. Surface Water Management Principles	6
5. Surface Water Run-Off Destination	8
6. SuDS Feasibility	9
7. Development Greenfield Run-Off Rates and Volume	12
8. Below Ground Drainage Networks and SW Management Calculations	14
9. Maintenance Requirements	17
10. Surface Water Design Exceedance	18
11. Water Quality	18
12. Development Management and Construction Phase	19
13. Conclusion / Summary	20

Appendices

Appendix A	-	Site Location Plan
Appendix B	-	Existing Site Plan
Appendix C	-	Proposed Site Plan
Appendix D	-	British Geological Survey Data
Appendix E	-	United Utilities Asset Plan
Appendix F	-	Greenfield Run-Off Rates and Volume Calculations
Appendix G	-	Below Ground Drainage Layout and Details
Appendix H	-	Surface Water Network / Management Calculations
Appendix I	-	Pollutant Control Chamber

1. Introduction

This surface water management report has been prepared by CCS Consulting in support of a detailed drainage design for a new residential development at Levenshulme Road, Gorton, Manchester, M18 7NF (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), July 2021 Paragraphs 153-158 and 159-169;
- National Planning Practice Guidance (NPPG);
- Principles of Sustainable drainage systems (SuDS) set out by DEFRA (2011);
- CIRIA (2010) Planning for SuDS;
- Ciria SuDS Manual C753 (2015);
- Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015);
- 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 (July 2021) 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, and Paragraphs 159 to 169 Planning for Flood Risk.

NPPG, Paragraph 051 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 080 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 in a residential area of Groton, which is approximately 5km south-east of Manchester city centre, approximately 100m south-east of Ryder Brow train station, and as shown on the site location plan in Appendix A, is bound by railway lines to the north-west, Lowfell Walk to the south, and Levenshulme Road to the west. The nearest postcode to the site is M18 7NF, with co-ordinates for the centre of the site being - Easting: 388685, Northing: 395445.

3.2. Existing Site and Topography

As detailed on the existing site plan in Appendix B, 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 north to south, where the levels range from approximately 67.33m AOD to approximately 65.47m AOD.

3.3. Proposed Development

The proposed site is shown on the development plans in Appendix C, 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 21-unit apartment building and 6-residential dwellings to the north and east of the Site, with an access road from Levenshulme Road leading to parking to the south, driveways and access areas to the front of the buildings / dwellings, and patio areas leading to private gardens and soft-landscaping to the rear of the buildings / dwellings.

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 Till, Devensian (diamicton) over bedrock consisting of Collyhurst Sandstone Formation (sandstone). The BGS website also shows borehole log data 150m south of the Site in Sandown Crescent (see Appendix D), which shows the ground to predominantly consist of clay.

3.5. Waterbody / Rivers / Canals

The nearest water body is a small stretch of a watercourse to the south of the Site which forms part of the surface water sewer system site. The nearest main waterbody is the Gore Brook approximately 250m to the north.

3.6. On-Site Drainage and Public Sewers

As detailed on the United Utilities asset plan in Appendix E, there is a 600mm diameter culverted watercourse in Lowfell Walk to south of the Site, and 300mm diameter combined and surface water sewers in Levenshulme Road to west of the Site).

As the Site is undeveloped, it is believed that there are no drainage networks within the development boundary.

3.7. Surface Water Management Areas

The Site boundary area is approximately **5,060m² / 0.506 ha**.

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

Surface water run-off from the building / dwellings, access road, driveways, parking bays, footpaths and patio areas equate to **3,000m² / 0.300 ha** and will form the surface water management area, with the surface water run-off from the garden and 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

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

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 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.*

4.6. Flood Risk within Development

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

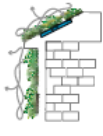
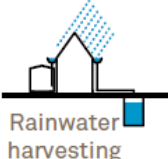
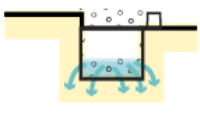
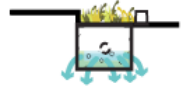
The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

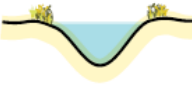
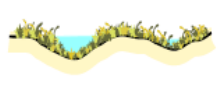
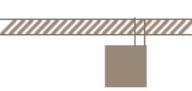
Run-Off Destination	Feasible / Required	Description
Discharge to Ground	No	Based on the BGS data, the ground at the Site predominantly consists of clay. Clay is known to have exceptionally low or no infiltration value and therefore discharge of the surface to ground is not feasible.
Discharge to Surface Water Body	Yes	There is a 600mm diameter culverted watercourse to the south of the south of the Site within Lowfell Walk The levels of the culverted watercourse are believed to be suitable for discharge by gravity, and therefore this surface water discharge destination is feasible
Discharge to Surface Water Sewer	No	There is a 300mm surface water sewer in Levenshulme Road to the west of the Site. However, as it is feasible to discharge to the culverted watercourse, discharge to this sewer is not required.
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 is a 300mm combined water sewer in Levenshulme Road to the west of the Site. However, as it is feasible to discharge to the culverted watercourse, discharge to this sewer 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:

	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.

	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 maintenance 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:

SuDS Method	Feasibility	Description
Green Roofs	No	The proposed residential dwelling and apartment building roofs are pitched, and have not been structurally designed for living / green roof systems. Therefore, this is not a suitable SuDS method.
Rainwater Harvesting	Yes	<p>The new dwellings and apartment building has not been designed for a dual pipe system to incorporate individual rainwater harvesting systems.</p> <p>However, water butts can be incorporated into some of the rainwater pipes, where the water can be used for irrigation.</p>
Soakaway	No	<p>Based on the BGS data, the ground at the Site predominantly consists of clay.</p> <p>Clay is known to have exceptionally low or no infiltration value and therefore the use of soakaways is no feasible</p>
Filter Strips	Yes	<p>Filter drain systems can be formed in the garden of the dwellings at the edge of the footpath and patio areas.</p> <p>The filter drain along the footpath and patios will take the</p>

		<p>surface water run-off from these areas, will not discharge the surface water directly to ground, but will be conveyed via a perforated pipe in a granular trench into the main drainage network.</p> <p>Filter drains will reduce the surface water run-off rate from the patio areas and will act as a pollutant control.</p>
Permeable Paving	No	<p>Due to the gradient of the road and parking bays, permeable paving cannot be utilised within the site. Therefore, is not a feasible SuDS method.</p>
Swale / Shallow Pond	No	<p>There are limited external garden areas that aren't either used for private gardens or landscaping consisting of existing trees and / or new planting.</p> <p>Therefore, due to the small areas of the site, the use of swales or ponds is not feasible.</p>
Hardscape Storage	No	<p>The external areas will be used for permeable paving or small footpath / patio areas, and therefore are limited areas for hardscape storage to be formed.</p>
Underground Storage	Yes	<p>The surface water run-off from the development site will be restricted.</p> <p>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</p>

7. Development Greenfield Run-Off Rates and Volume

To minimise the surface water run-off from 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 km ² 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):

$$\text{QBAR} = 0.00108 \times \text{AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17}$$

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 F, show the rate for 50.00ha is 281.0 l/s, but is to be reduced to reflect the surface water management area (0.300 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

$$\text{QBAR} = 1.70 \text{ l/s (5.62 l/s/ha)}$$

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:

Storm Event	QBAR	Growth Factor (C753 Table 24.2)	Greenfield Run-off Rate
Q ₂	1.70 l/s	0.93	1.6 l/s
Q ₃₀	1.70 l/s	1.70	2.9 l/s
Q ₁₀₀	1.70 l/s	2.08	3.4 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 F.

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

Site Location	=	GB 388687 395445 SJ 88687 95445
Area	=	0.300 ha
SAAR	=	891
CWI	=	121.752
SPR Host	=	47.000
URBTEXT	=	0.00

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

Q _{100 (6-Hour)}	=	106.82m³ (356.07m ³ /ha)
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8. Below Ground Drainage Networks and SW Management Calculations

8.1. Climate Change Allowance

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.

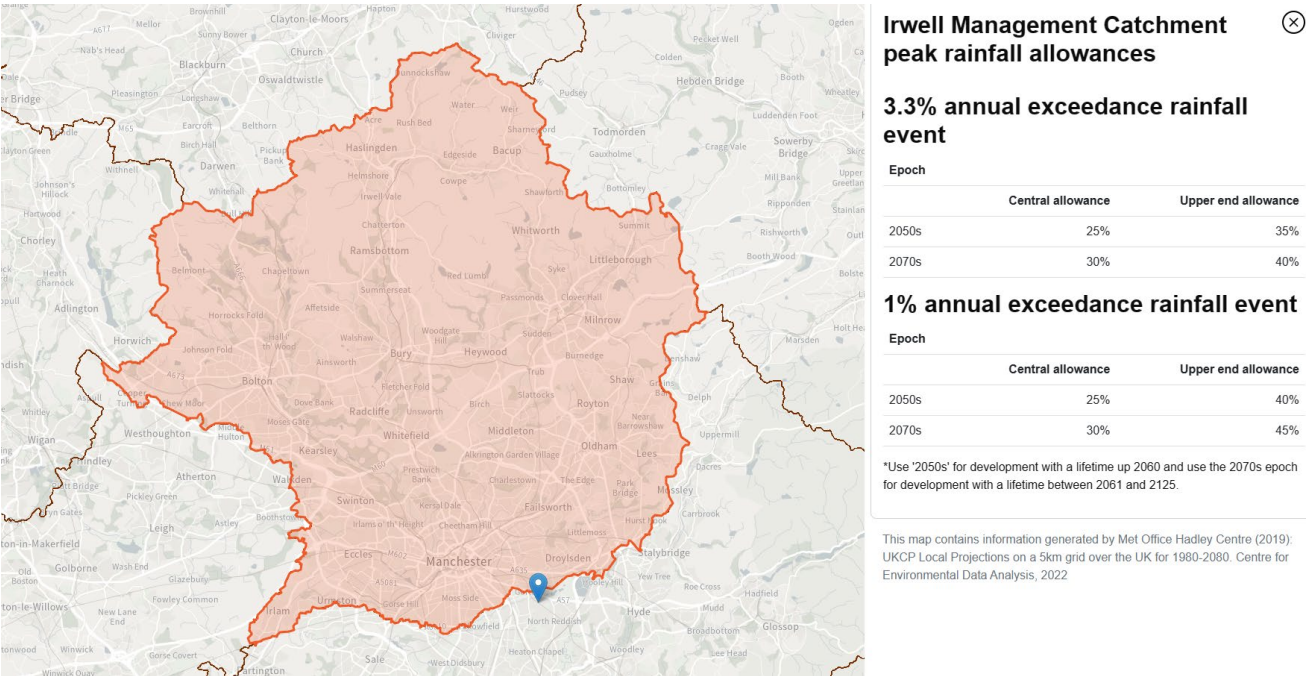


Figure 1 - Department for Environment Food & Rural Affairs – Climate Change Allowances

The lifetime of the extension 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 pre and post development surface water run-off will be 40% and 45% for the 30-year and 100-year storms, respectively.

8.2. Surface Water Network Calculations

The calculations to determine the post development surface water run-off rates are based on the surface water run-off area of 0.300 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 G, the proposed surface water main network will consist of 150mm to 375mm diameter pipes, 460mm inspection and silt trap chambers, 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 access road, driveway and parking areas will discharge to the main drainage via trapped gullies, and the surface water run-off from the footpath and patio areas will discharge to the main drainage via the filter drains

The surface water network will flow towards the southern boundary of the site, and will discharge through the cellular units, flow control and pollutant control chamber prior to connection / discharge to the existing 600mm diameter culverted watercourse.

The surface water will surcharge the drainage network when being restricted, and will discharge back into the upstream network and cellular units, where the water will be stored to prevent flooding.

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 1.6 l/s for the 1 in 1-year storm event; 2.9 l/s for the 1 in 30-year storm event including 40% climate change, and 3.4 l/s for the 1 in 100-year storm event including 45% 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 76mm, with a design flow of 3.4 l/s (100-year greenfield rate).

As shown in the output calculation from the MicroDrainage computer software in Appendix H, if the hydro-brake opening is set at 76mm, the design flow at 3.4 l/s, with a design head of 1.900m, the maximum surface water run-off rates for each storm event will be as follows:

Strom	-	Rate	-	Critical Storm Event
Q ₂	-	2.6 l/s	-	240-minute winter storm duration
Q _{30 + CC}	-	2.6 l/s	-	360-minute winter storm duration
Q _{100 + CC}	-	3.4 l/s	-	360-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	-	1.6 l/s	-	2.6 l/s	-	63% Increase
Q ₃₀	-	2.9 l/s	-	2.6 l/s	-	10% Reduction
Q ₁₀₀	-	3.4 l/s	-	3.4 l/s	-	Equivalent

The results show that the post development run-off rates are an increase of the 1-year greenfield rate, but are the are reduction of the 30-year greenfield rate, and the equivalent to the 1000-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 still meet the requirements set out in the Non-Statutory Technical Standards for Sustainable Drainage Systems.

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. 40% CC), using the peak surface water discharge rate, whereas detailed in the MicroDrainage calculation in Appendix H, where the volume equates to:

$$Q_{100 \text{ (6-Hour)}} = 3.4 \text{ l/s} \times (60 \times 60 \times 6) = 73,440 \text{ litres} = \mathbf{73.44m^3}$$

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	-	106.82m	-	73.44m ³	-	31% Reduction

The post development surface water run-off volume is a 31% reduction of the greenfield volume for the same storm event and duration.

Therefore, the discharge volume deemed to be acceptable, as it meets the requirements set out in the Non-Statutory Technical Standards for Sustainable Drainage Systems.

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.

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

Cellular Units

Attenuation Tank Length	-	21.00m
Attenuation Tank Width	-	7.50m
Attenuation Tank Area	-	157.50m ²
Attenuation Tank Depth	-	1.20m
Attenuation Tank Volume	-	189.00m³

The MicroDrainage calculations (Appendix H) show that with this SuDS method / volume, and the proposed surface water drainage network, 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 undertaken by contractors appointed by the owners / residents of the new units in the apartment building and residential dwellings, where payments of the works will form part of the property deeds and / or rental agreements, and part of the overall service charge / ground rent for the Site (including communal areas).

This is common practice for multi-unit residential buildings / development. The maintenance and management will be carried out as follows:

9.1. Surface Water Drainage Network, 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

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 south-west boundary and into Levenshulme Road.

Flood water will flow away from the proposed buildings / dwellings and will not flow directly towards existing dwellings / properties outside the development boundary prior to discharge to Levenshulme Road. The flood water within the road 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, Parking, Driveway, Footpath and Patio 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, Parking, Driveway, Footpath and Patio Areas - Pollutant Mitigation

Mitigation Measures:

Pollutant Control Chamber

Permeable Paving Pollutant Mitigation Indices:

Total Suspended Solid (TSS)	=	0.8
Metals	=	0.8
Hydrocarbons	=	0.8
SuDS Mitigation Indices	=	2.40

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) has to 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 Levenshulme Road to be west 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 culverted watercourse. 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 the culverted watercourse 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 culverted watercourse. 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 waterbody (culverted watercourse).

13.2. Peak Flow Control

The post development run-off rates are an increase of the 1-year greenfield rate, but are the are reduction of the 30-year greenfield rate, and the equivalent to the 1000-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 still meet the requirements set out in the Non-Statutory Technical Standards for Sustainable Drainage Systems.

13.3. Volume Control

The post development surface water run-off volume is a 31% 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 Non-Statutory Technical Standards for Sustainable Drainage Systems.

13.4. Flood Risk within the Development

The MicroDrainage calculations (Appendix H) show that with this SuDS method / volume, and the proposed surface water drainage network, 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 undertaken by contractors appointed by the owners / residents of the new units in the apartment building and residential dwellings, where payments of the works will form part of the property deeds and / or rental agreements, and part of the overall service charge / ground rent for the Site (including communal areas).

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 south-west boundary and into Levenshulme Road. Flood water will flow away from the proposed buildings / dwellings and will not flow directly towards existing dwellings / properties outside the development boundary prior to discharge to Levenshulme Road. The flood water within the road 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

Location Plan



Appendix B

Existing Site Plan



01 Existing Site Plan
01 Scale 1:250 @ A1

General Notes
01: Dimensions must not be scaled from this drawing. If in doubt, please ask.
02: All dimensions are in millimetres unless noted otherwise.
03: All dimensions should be verified on site before proceeding with the work.
04: TADW Architects shall be writing in of any discrepancies.
05: © TADW Limited (UK) 2015

Legend			
Abbreviations where applicable:			
AB	Air Brick	JTN	Junction Box
AV	Air Valve	KL	Keep Lift
BB	Belted Beacon	KO	Keel Gully
BC	Building Canopy	LFB	Lifeway
BH	Borehole	LP	Lamp Post
BL	Bed Level	MB	Mooring Bollard
BM	Bench Mark	ME	Meter Manhole
BNDY	Boundary	MH	Manhole
BO	Bollard	MK	Marker
BS	Bi-Stem (Tree)	MS	Multi-Stem (Tree)
BST	Bus Stop	MY	Mercury Manhole
BT	British Telecom Manhole	NP	Notice Board
BW	Brick Wall	NP	Road Name Plate
C	Crest	OB	Out Building
CCTV	Closed Circuit Television	OS	Ordnance Survey
CL	Ceiling Level	PB	Pillar Box
CONC	Concrete	PED	Pedestrian Pad
CP	Concrete Post	P	Pipe
CR	Cycle Rack	PM	Parking Meter
CTV	Cable Television Manhole	PO	Post Office Manhole
CUL	Culvert	PP	Power Point
DK	Drop Kerb	RE	Rodding Eye
DP	Drain Pipe	RS	Road Sign
DPC	Damp Proof Course	RS	Retaining Wall
DR	Drain	RWP	Rainwater Pipe
DWB	Drip Waste Bin	SCP	Stand Pipe
EB	Electricity Box	SK	Soakaway
EL	Electricity Manhole	SOF	Soft Level
EP	Electricity Pole	SMH	Surface Water Manhole
ER	Earthing Rod	ST	Stop Tap
FB	Flowed Bed	ST	Stump (Tree)
FBR	Foot Bridge	SV	Stop Valve
FCL	False Ceiling Level	SVP	Sol Vent Pipe
FLL	Finished Floor Level	SW	Surface Water
FIR	Fence Iron Railing	SY	Stay (Eg. Pylon, TP)
FL	Floor Level	SYM	Temporary Benchmark
FMH	Foul Water Manhole	TCB	Telephone Call Box
FP	Flag Pole	TH	Threshold Level
FPC	Fence Post & Chain	TL	Traffic Light
FPP	Fence Post & Panel	TW	Top of Wall
FR	Fence Post & Rail	TT	Telegraph Pole
FRW	Fence Post & Wire	TPT	Trail Pit
FSB	Fence Safety Barrier	TS	Tri-Stem (Tree)
FW	Foul Water	TSI	Traffic Signal Manhole
FWM	Fence Wire Mesh	UB	Under Beam
GAS	Gas Valve	UTR	Unable To Raise
GP	Ground Level	VP	Vent Pipe
GP	Gate Post	WB	Waste Bin
GU	Gully	WCL	Window Cill Level
H	Height	WHL	Window Head Level
HY	Hydrant	WL	Wall Level
IS	Information Sign	WM	Water Meter

General Legend:

Tree 00.35MSH6 Survey Station STNX OSBM/TBM Gate Borehole Trial Pit

Survey Control:

	-E/X-	-N/Y-	-H/Z-
STN1	388624.902	395457.070	66.149
STN2	388640.383	395378.273	64.956

Relative to Ordnance Survey grid via Active Network RTK GPS Plane Table Grid

Disclaimer - West Coast Geomatics Limited 2022:

This survey has been produced with its accuracy commensurate with the indicated scale and should only be used for its original intended purpose. Any scaling should only be undertaken using a stable media print produced using the original data. No responsibility is accepted to any third party for the whole or part of its contents. All data remains in the ownership of West Coast Geomatics Limited. Any discrepancies between this survey and any other information should be reported to West Coast Geomatics Limited.

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P2	Topographical survey incorporated	30.03.22	KM	MH
P1	Issued for comment	20.12.21	MH	BB
Issue	Description	Date	Drawn	Checked

Drawing Status
P - Planning | T - Tender | C - Construction | R - As Record

For Approval

tadw architects

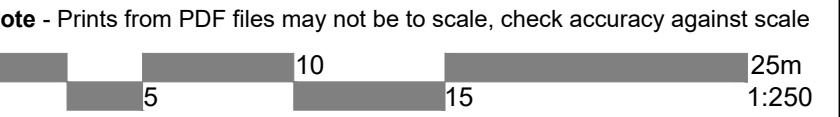
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Client **Watson Construction Ltd**

Job **Levenshulme Road Gorton**

Title **Existing Site Plan**

Scale **1:250 @ A1**



Job Number	Drawing Number	Issue
B958	01	P2

Appendix C

Proposed Site Plan



Boundary /Wall Types

- TYPE A**
 (Boundary wall at access road junction with Levenshulme Road)
 New 1.2m high boundary consisting of 600mm high brick wall, topped with 600mm high black powder coated metal railings
- TYPE B**
 (Separation of rear gardens)
 1.8 m high boundary comprising 1.5m high close boarded timber fence infill panel on 300mm concrete base panel between concrete posts. Concrete base panels to allow for passage of hedgehogs, as per latest landscape plan.
 - height of timber fence panels and concrete base panels may vary - Refer to Structural Engineer's drawings.
- TYPE C**
 (Rear/side private gardens adjacent to railway)
 2.1 m high boundary comprising Jakoustic absorptive acoustic 1.8m high close boarded timber fence panel (with min surface density 33 kg/m²) on 300mm concrete base panel between concrete posts - height of timber fence panels and concrete base panels may vary - Refer to Structural Engineer's drawings.
- TYPE D**
 (Boundary fence adjacent to site perimeter)
 2.1 m high boundary comprising 1.8m high close boarded timber fence infill panel (with min surface density 10 kg/m²) on 300mm concrete base panel between concrete posts - height of timber fence panels and concrete base panels may vary - Refer to Structural Engineer's drawings.
- TYPE E**
 (Boundary fence fronting properties on Lowfell Walk)
 2.1 m high boundary comprising 2.1m high black powder coated metal railings, with shrubs/planting - Refer to latest landscape drawing for planting specification
- TYPE F**
 (Boundary fence fronting Plots 3-6)
 1.2 m high boundary comprising 1.2m high black powder coated metal railings
- TYPE G**
 Existing metal wired fencing to be made good where required
- TYPE H**
 (Separation of rear gardens overlooking car parking bays behind Plots 1 and 2)
 1.8 m high boundary comprising 1.5m high 'hit and miss' timber fence infill panel on 300mm concrete base panel between concrete posts. Concrete base panels to allow for passage of hedgehogs, as per latest landscape plan.
 - height of timber fence panels and concrete base panels may vary - Refer to Structural Engineer's drawings.

General Notes
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05: © TADW Limited (UK) 2015

Schedule of Accommodation

- 11no. 2B3P apartments at 61sqm each
- 20no. 1B2P apartments at 50sqm each
- 6no. 2B3P two storey houses at 70sqm each

Total 37 units

Legend

Development site boundary

Surface Finishes

- Grassed Area (200mm mowing strip where lawn meets buildings)
- Footpaths, pavements and paved areas
- Block paving to parking bays and raised crossings / rumble strips on access road.
- Tarmac to adopted road and parking courtyards

Refer to Landscape Plan by Trevor Bridge Associates for landscaping proposals

- EVCP Electric vehicle charging point
- Secure external bike storage container

DESIGN CONSIDERATIONS

- Plots 1 to 6 - 2 storey 2b3p houses.
- Plot 7 - Plot 37 - 3 storey apartment block
- Single apartment building split into two blocks, each with separate main entrances and single stair arrangement
- Site boundary to be confirmed
- Apartment sizes comply with NDSS sizes
- Apartment block respects overlooking distances with surrounding properties
- Apartment block to be predominantly brick elevations
- Access into development for pedestrians and cars via new road crossing off Levenshulme Road
- New access road to be adopted up to rumble strip
- It is assumed refuse vehicles will access the site for bin collections
- 84% parking provision (including visitor spaces)
- Secure communal bike store provided
- A number of existing trees to be removed to enable development
- Generally timber fencing and metal railings to site boundary in line with SBD standards

P19	Car parking space to Plot 4 relocated	03.01.23	KM	MH
P18	Amended following Highways' comments. New access road to be unadopted. Boundary at side of Plot 2 changed to Type H boundary. External bike store added to Plots 1-6 rear gardens.	14.12.22	KM	MH
P17	Planning application submission	19.10.22	KM	MH
P16	Site plan layout updated	07.10.22	KM	MH
P15	Apartment buildings combined into single block	22.08.22	KM	MH
P14	House types amended. Apartments separated into two blocks	17.08.22	KM	MH
P13	House types and apartment mix updated	16.08.22	KM	MH
P12	Site plan updated.	12.07.22	KM	MH
P11	Site plan updated. Boundary treatments indicated	08.07.22	KM	MH
P10	No of units reduced following LPA comments	04.07.22	KM	MH
Issue	Description	Date	Drawn	Checked

Drawing Status

P - Planning | T - Tender | C - Construction | R - As Record

For Approval

tadw architects



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Client **Watson Construction Ltd**

Job **Levenshulme Road
Gorton**

Title **Proposed Site Plan**

Scale **1:250 @ A1**

Note - Prints from PDF files may not be to scale, check accuracy against scale



Job Number
221310

Drawing Number
02

Issue
P19

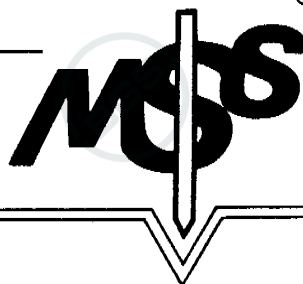
01 **Proposed Site Plan**
02 Scale 1:250 @ A1

Appendix D

Ground Investigation Data



SJ89NE
821



MINI • SOIL • SURVEYS

JOB NUMBER CAS0235

BOREHOLE No. 2 of 4

CREW A

SITE 17 Wayland Rd, South Gorton

DATE DRILLED 16/08/90

GROUND LVL (if recorded)

Description	Depth	Leg	Sample/Test
Tarmac overlying cinder and ash FILL, with occ., brick and gravel.	0.25		
350mm brown clay FILL, with occ., brick and gravel fragments, overlying brown fine to medium sand FILL.			
Slightly organic grey clay FILL, with occ., peat bands and gravel fragments. Some ash and cinder.	0.70		1.2 SPT N= 3
Soft to firm grey organic CLAY, with occ., peat bands.	1.60		
Very stiff, brown CLAY, with occ., fine gravel and black shale.	2.30		2.9 SV 140+Kn/m ² 3.0 SPT N= 33
End of hole.	3.30		3.4 SV 140+Kn/m ²

Comments: Hole dry.
SPT @ 1.2 1/0/1,1,1,0
SPT @ 3.0 6/7/7,8,9,9

SJ 89NE 820-85

MSS

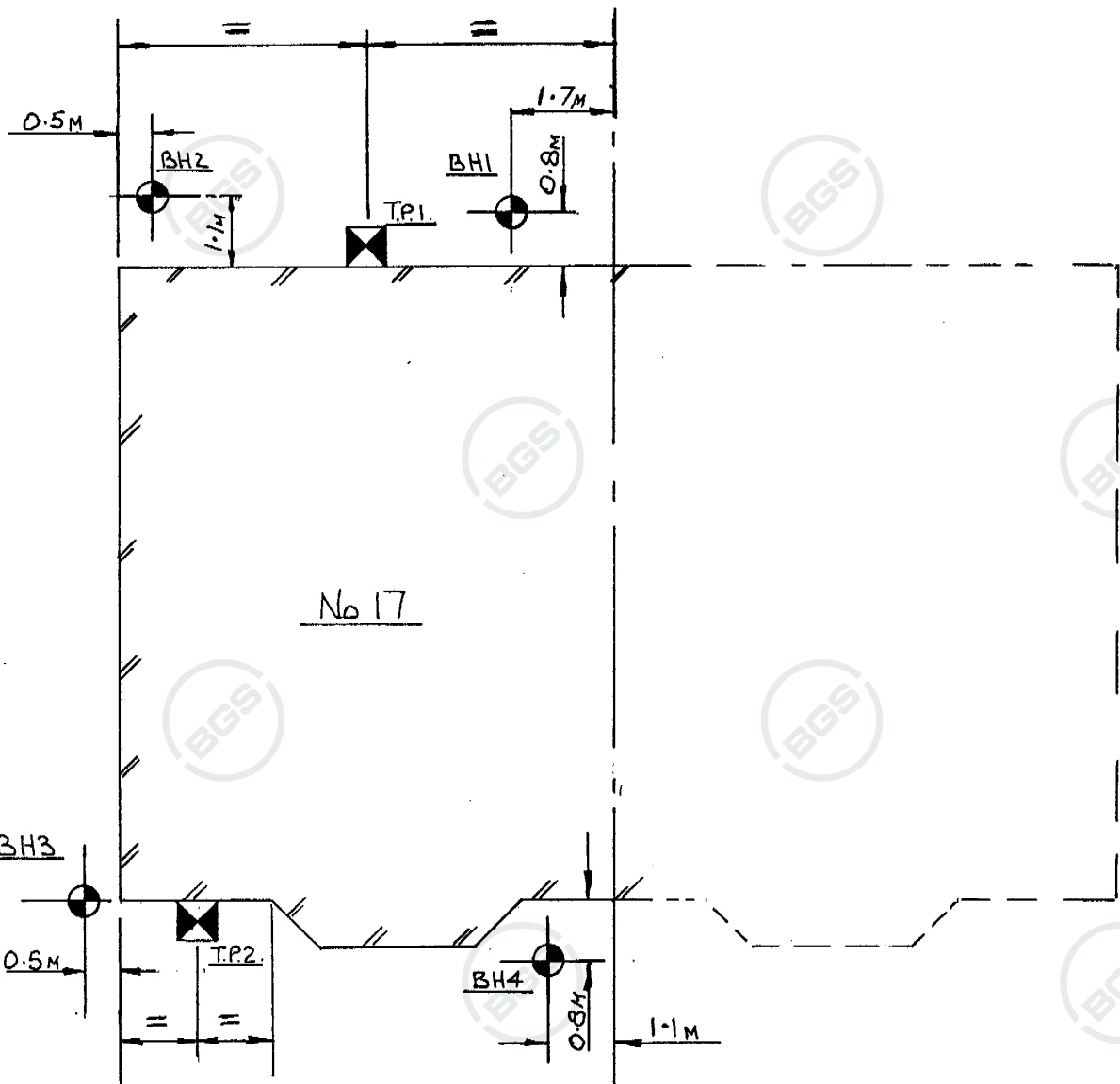
MINI • SOIL • SURVEYS

CAS0235

17 Wayland Road, South Gorton

Borehole and Trial Pit Layout

Not to scale





Borehole Log

Site 31, Sandown Crescent, Gorton, Manchester
Client Manchester City Council
Borehole No. 4
Grid Ref.
Ground Level Existing garden

Job No. S.I. 5217
Date Sep. 1991
Diameter 100 mm
Method Rotary
Scale 1:20

Description	Depth m	Legend	O.D. level m	Samples and in situ tests			Shear Strength kN/m ²		Groundwater
				Depth, m	Type	Test			
Soil - (with Fill)	0.400	} }							
FILL - Clay, ash, brick	1.100	/ /							
Clay - Stiff, mid brown sand lenses mottled grey	1.700			1.200		V	105		
				1.500		V	95		
Clay - Soft to Firm, plastic sand lenses	2.000			1.800		V	48		
Clay - Firm, dark brown	2.200			2.000		V	98		
Sand- Fairly compact silty damp	2.700								
Clay - Stiff glacial till (unable to bore further stone obstruction?)	2.850			2.800		V	152		
									No ground water
Remarks						Key: U – undisturbed B – bulk D – disturbed S – SPT: SC – Solid Cone C – Core W – Water V – Vane			

Northern Foundations

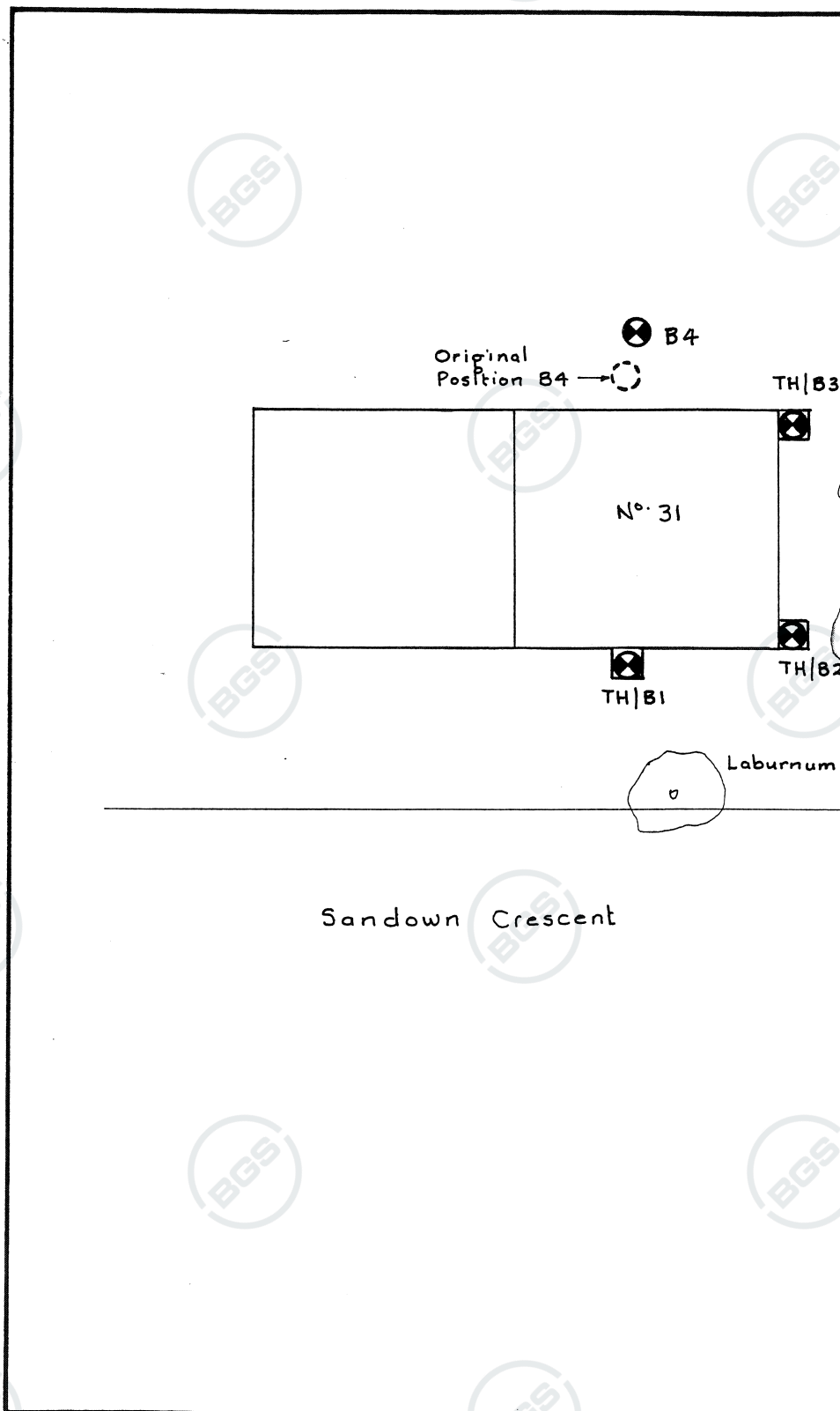


Site 31, Sandown Crescent, Gorton, Manchester

Job No. 5

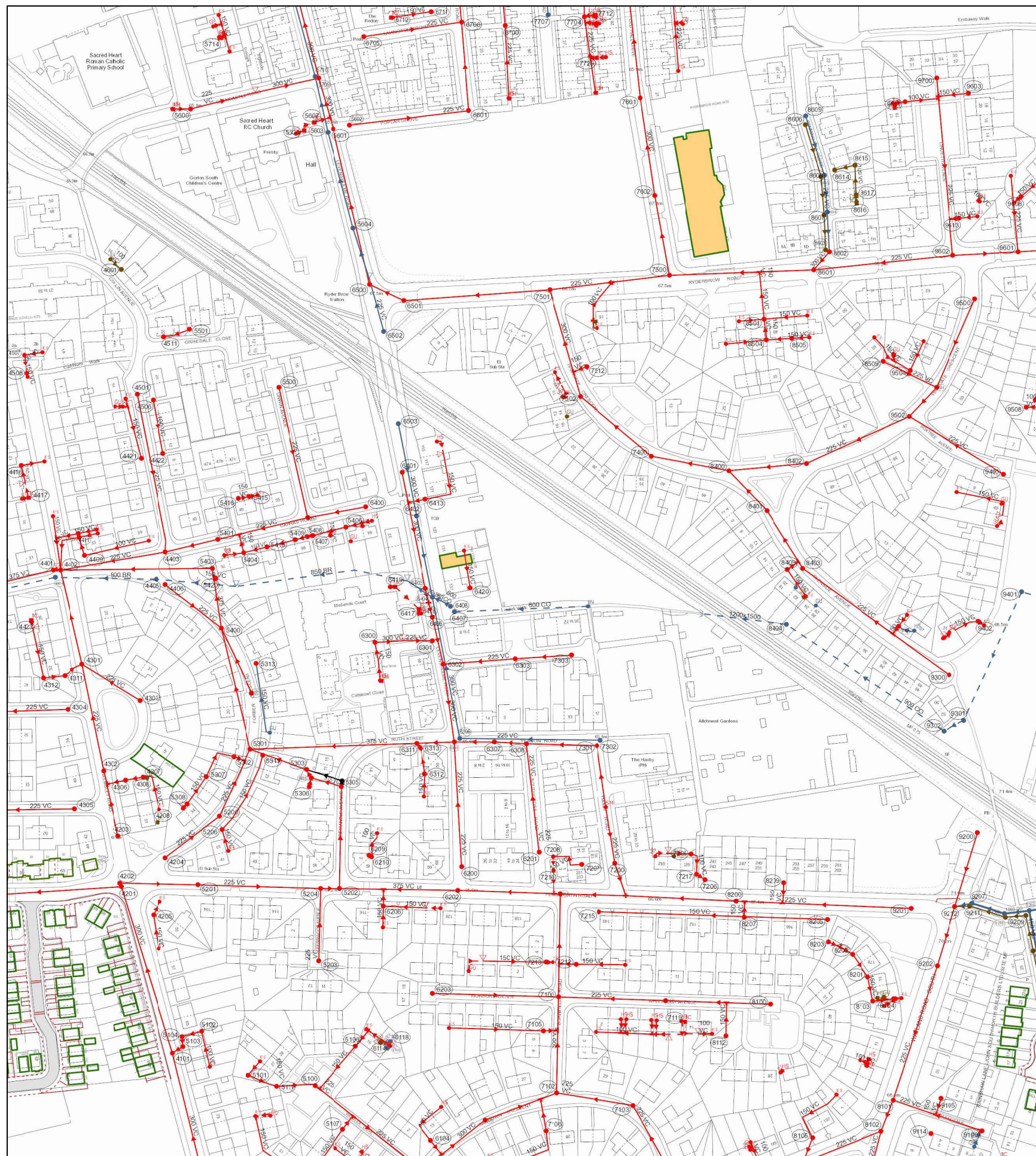
Client Manchester City Council

Date Se



NORTHERN FOUNDATIONS LIMITED

Appendix E
United Utilities Asset Plan



Reho	Cover	Func	Invert	Size x	Size y	Shape	Mat	Length	Grad
3304	64.04	CO	62.89	375			VC	5.252319	1 in 520
3210	70.5	FO	68.16	150			VC	20.76044	1 in 136
9209	70.59	FO	68.24	150			VC	11.27235	1 in 141
4411				150			VC	12.11822	
8413				150			VC	9.709964	
9105				150			VC	6.50074	
7207				150			VC	19.95103	
8406				150			VC	5.399991	
9603				150			VC	18.89787	
4205				150			VC	6.105422	
4312				150			VC	11.83539	
6312				150			VC	14.38271	
9207	70.72	CO	68.28	225			VC	5.291263	
8602	68.44	CO	65.99	300			VC	13.16045	1 in 165
5416				150			VC	6.475503	
6410				150			VC	13.54052	
8112				100			VC	18.37894	
7205				100			VC	13.90029	
8104				150			VC	6.846372	
8201				150			VC	13.78181	
5102				100			VC	11.19502	
5302				300			VC	105.116	
7500	67.45	CO	63.86	225			VC	66.89306	1 in 81
4201				150			VC	11.59026	
8202				150			VC	15.15534	
9205	70.66	SW	67.88	1050			VC	13.98654	1 in 457
6313				150			VC	3.353137	
8601	68.59	CO	65.91	225			VC	80.65623	1 in 65
4409				100			VC	10.33374	
8207				150			VC	6.629881	
5404				150			VC	10.56348	
5308	65.1	CO	62.77	375			VC	4.981405	1 in 42
8607	68.25	SW	66.18	225			VC	21.26852	1 in 116
9211	70.71	FO	68.01	150			VC	6.057603	1 in 12
5409				150			VC	16.44052	
7217				100			VC	5.498114	
9209	70.72	CO	67.9	150			VC	1.902885	
8103				150			VC	9.204525	1 in 63
8603	68.44	CO	66	150			VC	11.50734	
7213				150			VC	2.352103	1 in 225
7208				150			VC	7.875972	
8400	66.07	CO	63.87	225			VC	32.55764	1 in 56
9301				300			VC	3.945512	
9208				150			VC	12.52969	
7105	70.46	FO	68.39	150			VC	19.80875	1 in 133
8401				150			VC	8.20345	
8401		SW		800			VC	6.44336	
9608		CO		150			VC	77.87811	
9308		CO		150			VC	5.148954	
6208		CO		150			VC	16.31306	
5415				150			VC	6.339784	
5305	64.4	CO	60.83	375			VC	4.98772	1 in 125
6210				150			VC	17.56155	
5408				150			VC	126.854	
9206	70.53	SW	67.85	1050			VC	14.19108	1 in 403
5408				150			VC	18.40032	
8104				150			VC	18.29273	1 in 379
5407				150			VC	6.50907	
7210				150			VC	4.331229	
8402				150			VC	3.230001	
8604				150			VC	12.89989	
5104	68.25	CO	66.13	100			VC	3.799779	1 in 148
8509				225			VC	18.18102	
8504				150			VC	5.541949	
8102	66.16	CO	65.78	225			VC	32.79887	1 in 101
8102				225			VC	2.07654	
5200	64.17	CO	62.33	225			VC	63.18374	1 in 62
9311	65.5	FO	62.3	375			VC	14.86644	
5303	65.56	CO	60.68	375			VC	40.71855	1 in 110
5302				150			VC	92.57802	
5307				150			VC	33.26452	1 in 475
7100	66.26	CO	61.89	300			VC	5.443155	
7201	66.38	CO	61.7	375			VC	24.24461	
8609	67.7	SW	66.61	225			VC	57.03877	1 in 380
8615				100			VC	87.03556	1 in 256
8608	68.04	SW	66.34	225			VC	34.38674	1 in 127
8606	67.7	FO	66.46	225			VC	11.82391	
8502	67.67	SW	65.96	225			VC	20.44124	1 in 128
8503	68.84	CO	63.85	225			VC	21.29682	1 in 132
8406	63.2	CO	60.74	300			VC	29.96649	1 in 143
6703	65.92	CO	64.45	225			VC	30.20322	1 in 54
4406	63.42	CO	61.39	225			VC	70.28866	1 in 74
8401	67.45	CO	64.89	225			VC	26.68333	
6200	65.94	CO	63.93	225			VC	48.17308	1 in 16
8400	67.45	CO	64.36	300			VC	30.20459	1 in 101
6202	66.86	CO	61.71	225			VC	30.41381	1 in 109
5300	63.93	CO	61.71	225			VC	69.11584	1 in 95
5601	65.81	CO	61.71	225			VC	43.27865	1 in 125
9303	64.89	CO	61.71	225			VC	78.20005	1 in 62
9200	71.72	CO	68.1	225			VC	38.1209	1 in 67
9303	64.89	CO	61.71	225			VC	26.1044	1 in 285
9602	65.76	CO	64.39	225			VC	42.88745	1 in 107
4303	63.95	CO	61.84	225			VC	40.1234	1 in 111
5402	65.21	CO	63.05	225			VC	66.48306	1 in 201
6503	67.98	SW	66.17	300			VC	37.75962	1 in 57
8401	67.03	CO	65.15	300			VC	51.41964	1 in 58
8100	67.55	CO	65.53	225			VC	51.97115	1 in 33
9108	69.22	CO	62.08	300			VC	65.50967	1 in 30
8708	65.71	CO	62.72	225			VC	68.63713	1 in 75
9602	67.45	CO	64.89	225			VC	60.87693	1 in 184
7303	65.12	CO	63.25	225			VC	42.19004	1 in 63
6500	67.55	CO	62.89	300			VC	77.41447	1 in 1548
7101	67.27	CO	64.73	225			VC	31.06445	1 in 119
9300	68.11	CO	66.13	225			VC	88.2486	1 in 201
7302	66.06	CO	63.25	225			VC	69.03889	1 in 37
5103				100			VC	100.2096	1 in 99
5203	63.31	CO	61.68	225			VC	78.05441	
4410				150			VC	6.76047	
5404	66.87	SW	64.82	300			VC	40.0125	1 in 22
9602	68.91	CO	65.99	225			VC	26.23647	
9603	68.83	SW	64.74	300			VC	51.88196	1 in 198
6601	65.08	CO	64.02	225			VC	54.87786	1 in 51
5500	65.22	CO	63.79	225			VC	36.55551	1 in 451
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8402	67.84	CO	65.25	225			VC	49.16269	1 in 286
7102	66.18	CO	62.13	300			VC	73.75638	1 in 107
7103	68.44	CO	64.54	225			VC	65.41647	1 in 139
8101	68.25	CO	66.04	225			VC	43.85565	1 in 49
7501	66.63	CO	63.04	300			VC	53.00043	1 in 196
4501				150			VC	42.57934	1 in 89
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9305	65.87	CO	61.87	375			VC	81.22162	1 in 389
5202	65.35	CO	61	375			VC	68.85532	
7200	66.5	CO	64.89	225			VC	60.40966	1 in 78
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4302	63.75	CO	61.42	225			VC	16.03122	1 in 42
8408	63.3	SW	61.56	800			VC	18.02778	1 in 120
9212	70.82	CO	67.7	225			VC	61.67136	1 in 82
5403				375			VC	21.93171	1 in 35
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5501				100			VC	5.830652	1 in 58
6402	66.23	SW	64.6	300			VC	34.30268	1 in 54
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7601	66.07	CO	63.09	300			VC	61.07373	
7602	67.08	CO	63.54	300			VC	56.02863	1 in 85
7400	66.99	CO	63.88	300			VC	68.0204	1 in

Appendix F

Greenfield Run-Off Rates and Volume Calculations

Flo Consult UK Ltd		Page 1
4 Market Square	Levenshulme Road	
Old Amersham	Greenfield Run-Off	
Buckinghamshire, HP7 0DQ	Rate Calculations	
Date 04/05/2023	Designed by MDS	
File	Checked by MDS	
Innovyze	Source Control 2020.1.3	

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 1/s

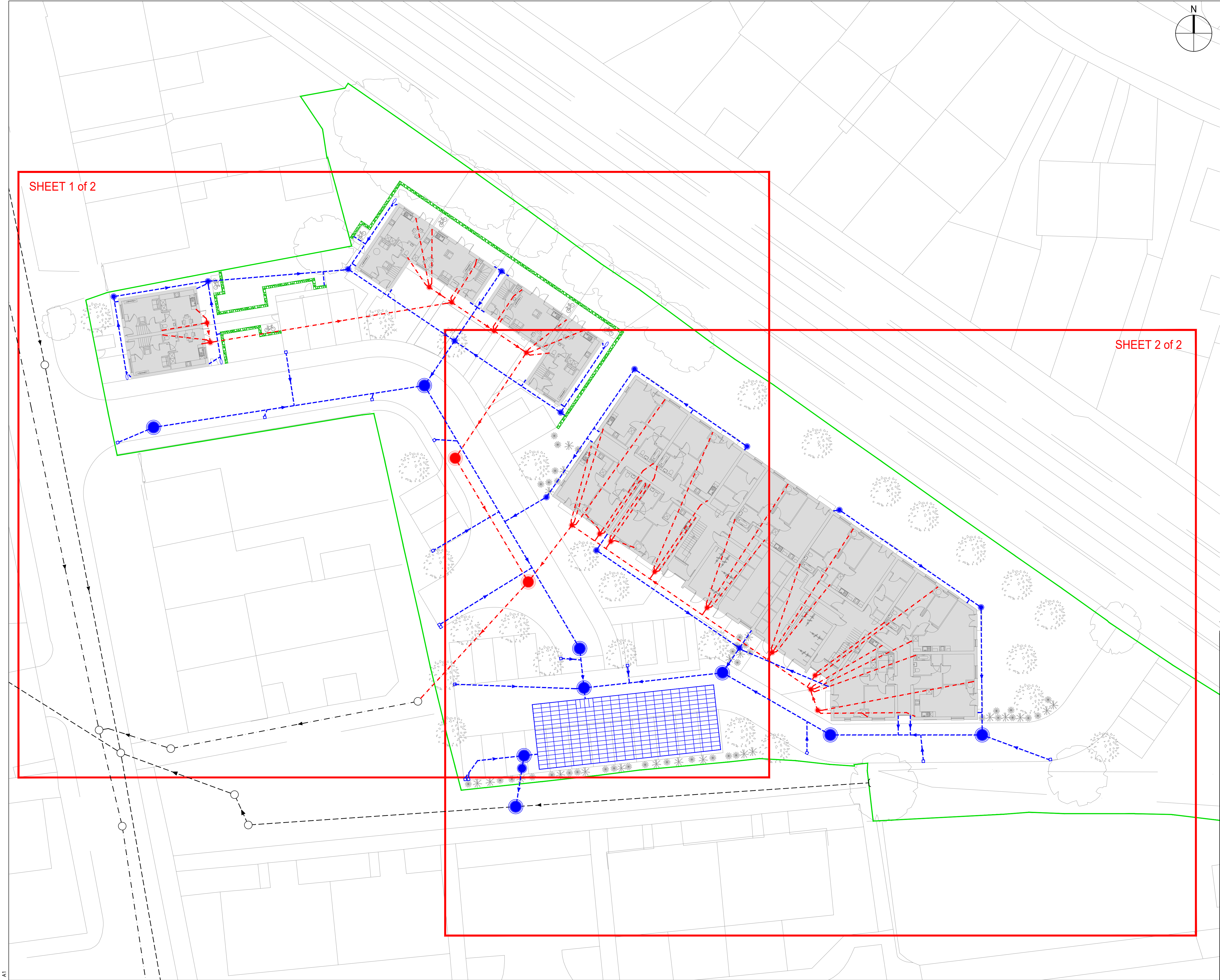
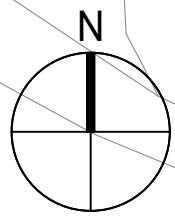
QBAR Rural	281.0
QBAR Urban	281.0
Q1 year	244.5
Q1 year	244.5
Q2 years	261.7
Q5 years	334.4
Q10 years	387.8
Q20 years	441.8
Q25 years	460.8
Q30 years	476.4
Q50 years	519.8
Q100 years	584.5
Q200 years	663.1
Q250 years	688.4
Q1000 years	854.2

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Flo Consult UK Ltd		Page 1																										
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Greenfield Run-Off Volume Calculations																											
Date 04/05/2023	Designed by MDS																											
File	Checked by MDS																											
Innovyze		Source Control 2020.1.3																										
<p style="text-align: center;"><u>Greenfield Runoff Volume</u></p> <p style="text-align: center;">FEH Data</p> <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 388687 395445 SJ 88687 95445</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>0.300</td> </tr> <tr> <td>SAAR (mm)</td> <td>891</td> </tr> <tr> <td>CWI</td> <td>121.752</td> </tr> <tr> <td>SPR Host</td> <td>47.000</td> </tr> <tr> <td>URBEXT (1990)</td> <td>0.0000</td> </tr> </table> <p style="text-align: center;">Results</p> <table> <tr> <td>Percentage Runoff (%)</td> <td>51.03</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>106.817</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	FEH Rainfall Version	2013	Site Location	GB 388687 395445 SJ 88687 95445	Data Type	Point	Areal Reduction Factor	1.00	Area (ha)	0.300	SAAR (mm)	891	CWI	121.752	SPR Host	47.000	URBEXT (1990)	0.0000	Percentage Runoff (%)	51.03	Greenfield Runoff Volume (m ³)	106.817
Return Period (years)	100																											
Storm Duration (mins)	360																											
FEH Rainfall Version	2013																											
Site Location	GB 388687 395445 SJ 88687 95445																											
Data Type	Point																											
Areal Reduction Factor	1.00																											
Area (ha)	0.300																											
SAAR (mm)	891																											
CWI	121.752																											
SPR Host	47.000																											
URBEXT (1990)	0.0000																											
Percentage Runoff (%)	51.03																											
Greenfield Runoff Volume (m ³)	106.817																											
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Appendix G

Below Ground Drainage Layout and Details



General Drainage Notes:

Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.

All existing drainage depths, size and conditions, to which the proposed drainage is to connect, are to be confirmed prior to the commencement of any drainage works.

All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent.

The proposed building outlines shown on this drawing are for information only. Refer to Architects plans for precise location setting out information and details.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.

At least one soil pipe at the head of each foul run shall be vented to the atmosphere.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

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P1	Preliminary Issue	MDS	04.05.23
rev	amendments	by	date



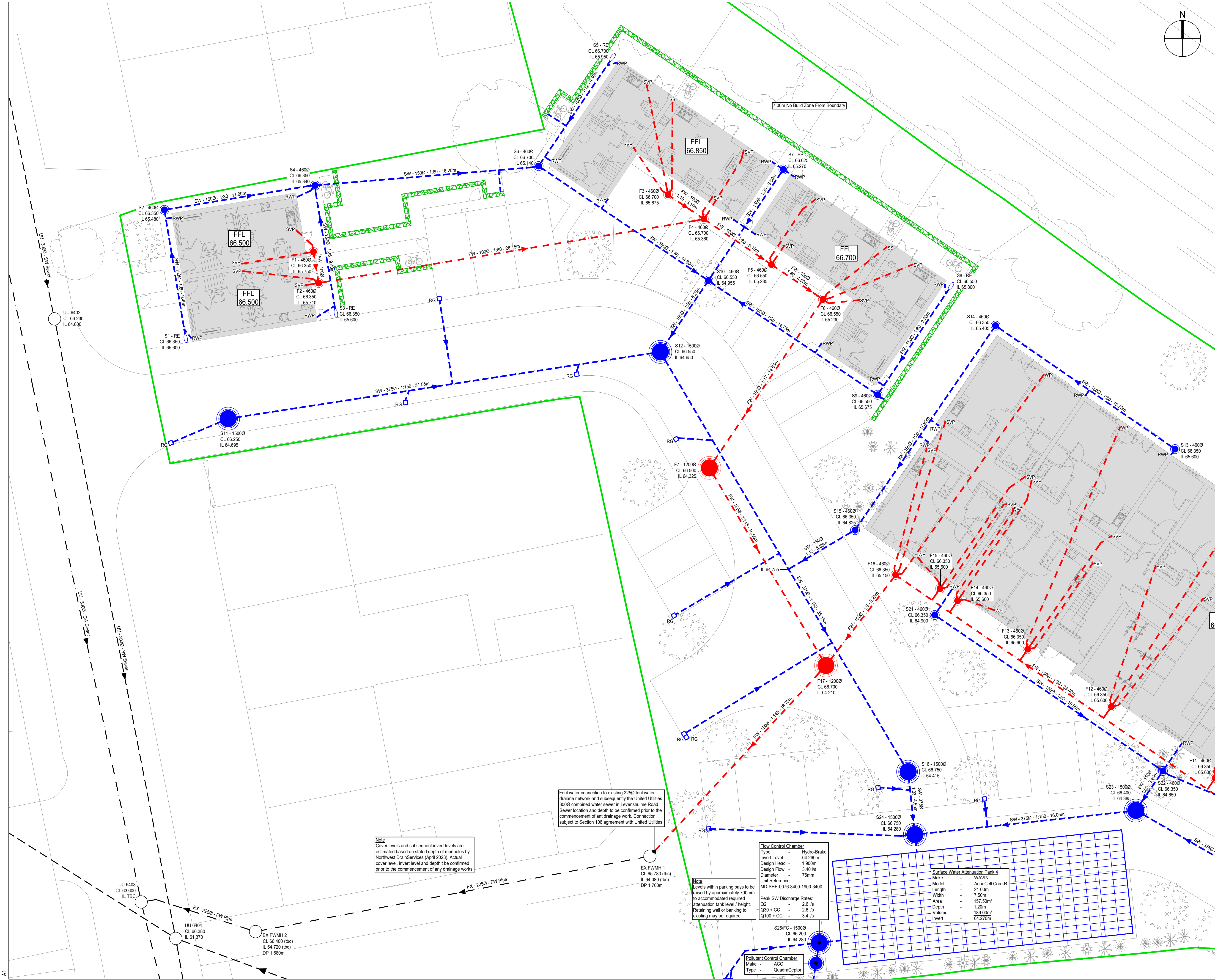
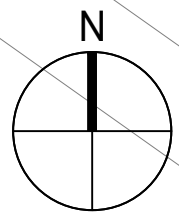
Client:
Watson Construction Ltd

Project:
**Levenshulme Road
Gorton**

Title:
**Below Ground Draiage Layout
Overall**

Drawing Status: Preliminary	Date Created: May '23	Drawing Scale: 1:200@A1
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22-2365 / A1 / 100		P2
Project Leader: LS	Drawn By: MS	Initial Review: LS



Site Specific Drainage Notes:

Rainwater pipe (RWP) and foul down pipe (SVP/SS) locations to be confirmed by Architect and M+E Engineer. Discrepancies to be brought to CCS Consulting's attention prior to the commencement of drainage works. Design subject to change

Finished floor and external levels to be confirmed by Architect prior to the commencement of drainage works. Manhole and inspection chamber cover levels subject to change one known.

Existing combined water sewer (to which the proposed FW is connecting) location and depth to be confirmed prior to the commencement of any drainage works.

Existing surface water sewer (to which the proposed SW is connecting) location and depth to be confirmed prior to the commencement of any drainage works.

All foul water pipes to be 100Ø, and all surface water pipes to be 150Ø unless shown otherwise.

Rainwater pipes to have rest bend invert of 600mm below finished floor level unless stated otherwise.

Foul water down pipes to have rest bend invert of 450mm below finished floor level unless stated otherwise.

Surface water drainage networks and attenuation design to prevent flooding up to and including 100-year + 45% climate change storm event.

Drainage networks within access road to be built to adoptable standards.

Drainage Key:	
---	Below Ground Surface Water Drainage
---	Below Ground Foul Water Drainage
●	RWP Rainwater Pipe to Below Ground
□	RG Surface Water Road Gully
●	SVP Soil Vent Pipe to Below Ground
●	SS Stub Stack to Below Ground
●	WP Waste Pipe to Below Ground
---	Filter Drain System (See Note)
---	Development Boundary

P2	Preliminary Issue	MDS	09.05.23
P1	Preliminary Issue	MDS	04.05.23
rev	amendments	by	date



Client:
Watson Construction Ltd

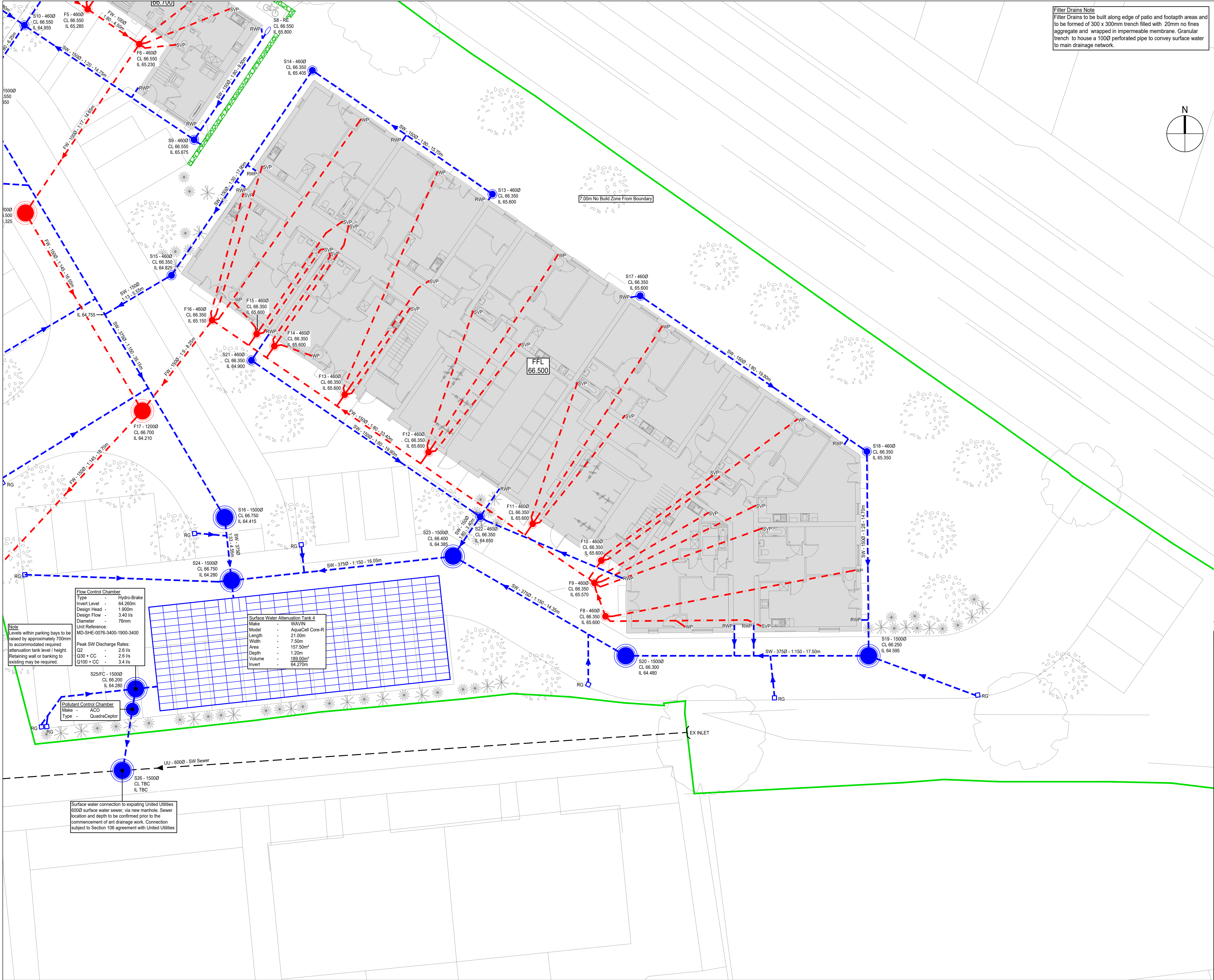
Project:
Levenshulme Road
Gorton

Title:
Below Ground Drainage Layout
Sheet 1 of 2

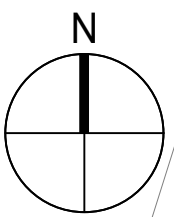
Drawing Status: Preliminary	Date Created: May '23	Drawing Scale: 1:125@A1
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22-2365 / A1 / 101 P2

Project Leader: LS	Drawn By: MS	Initial Review: LS
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Filter Drains Note
Filter Drains to be built along edge of patio and footpath areas and to be formed of 300 x 300mm trench filled with 20mm no fines aggregate and wrapped in impermeable membrane. Granular trench to house a 1000 perforated pipe to convey surface water to main drainage network.



Site Specific Drainage Notes:

Rainwater pipe (RWP) and foul down pipe (SVP/SS) locations to be confirmed by Architect and M+E Engineer. Discrepancies to be brought to CCS Consulting's attention prior to the commencement of drainage works. Design subject to change

Finished floor and external levels to be confirmed by Architect prior to the commencement of drainage works. Manhole and inspection chamber cover levels subject to change one known.

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Existing surface water sewer (to which the proposed SW is connecting) location and depth to be confirmed prior to the commencement of any drainage works.

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Foul water down pipes to have rest bend invert of 450mm below finished floor level unless stated otherwise.

Surface water drainage networks and attenuation design to prevent flooding up to and including 100-year + 45% climate change storm event.

Drainage networks within access road to be built to adoptable standards.

Drainage Key:

- Below Ground Surface Water Drainage
- Below Ground Foul Water Drainage
- RWP Rainwater Pipe to Below Ground
- RG Surface Water Road Gully
- SVP Soil Vent Pipe to Below Ground
- SS Stub Stack to Below Ground
- WP Waste Pipe to Below Ground
- Filter Drain System (See Note)
- Development Boundary

Flow Control Chamber
Type - Hydro-Brake
Invert Level - 64.280m
Design Head - 1.900m
Design Flow - 3.40 l/s
Diameter - 76mm
Unit Reference: MD-SHE-0076-3400-1900-3400
Peak SW Discharge Rates:
Q2 - 2.6 l/s
Q30 + CC - 2.6 l/s
Q100 + CC - 3.4 l/s

Surface Water Attenuation Tank 4
Make - WIAVIN
Model - AquaCell Core-R
Length - 21.00m
Width - 7.50m
Area - 157.50m²
Depth - 1.20m
Volume - 189.00m³
Invert - 64.270m

Pollutant Control Chamber
Make - ACO
Type - QuadraCeptor

Note
Levels within parking bays to be raised by approximately 700mm to accommodate required attenuation tank level / height. Retaining wall or banking to existing may be required.

Surface water connection to existing United Utilities 600Ø surface water sewer, via new manhole. Sewer location and depth to be confirmed prior to the commencement of ant drainage work. Connection subject to Section 106 agreement with United Utilities

P2	Preliminary Issue	MDS	09.05.23
P1	Preliminary Issue	MDS	04.05.23
rev	amendments	by	date

Client:
Watson Construction Ltd

Project:
**Levenshulme Road
Gorton**

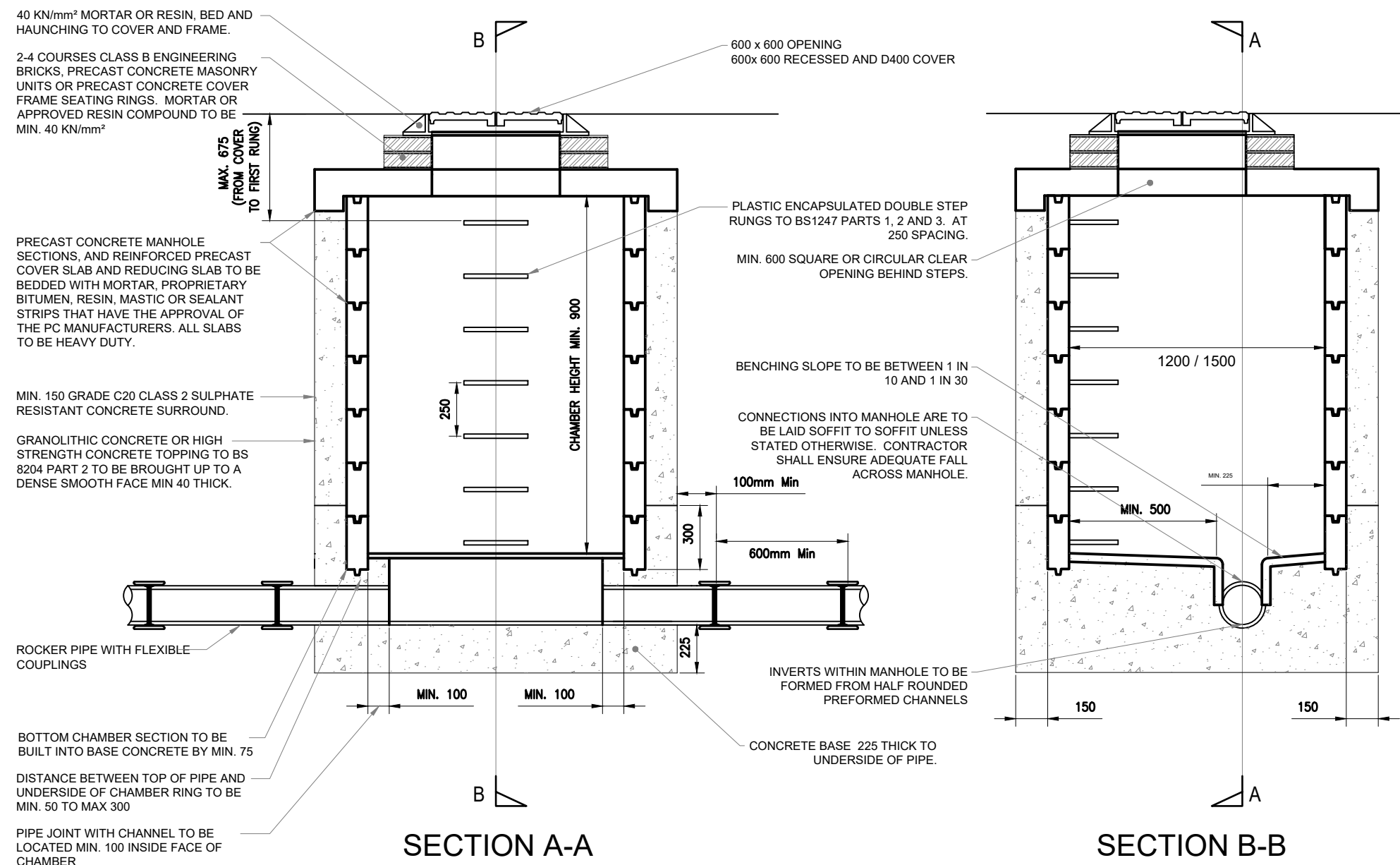
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Sheet 2 of 2**

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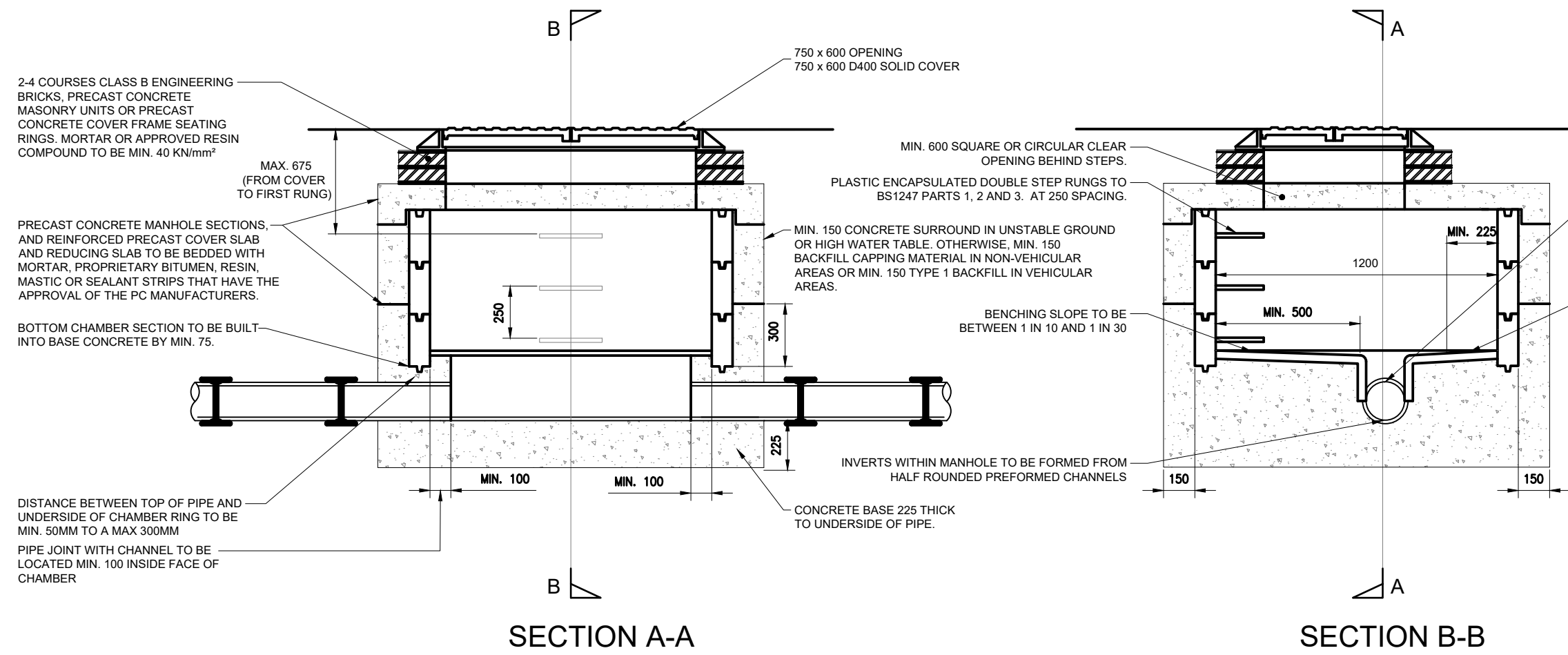
22-2365 / A1 / 102

P2

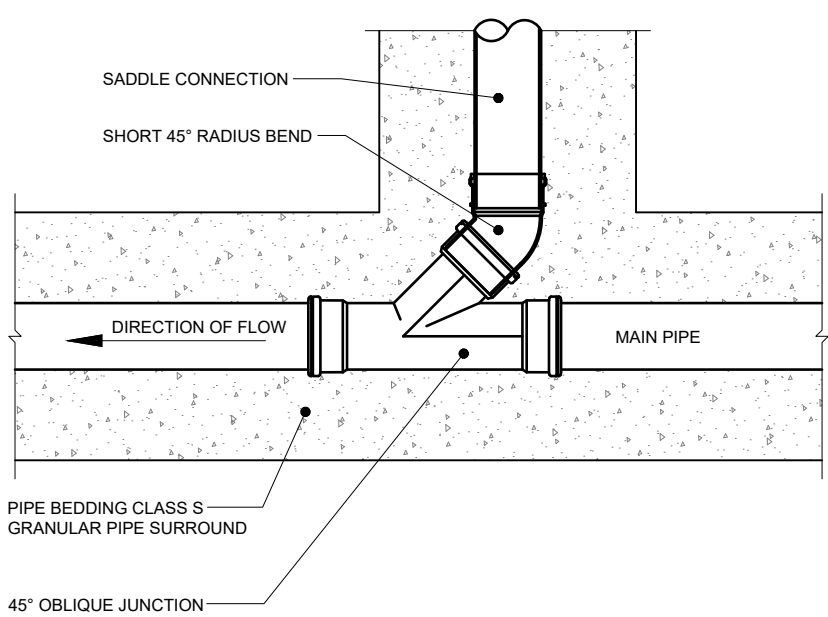
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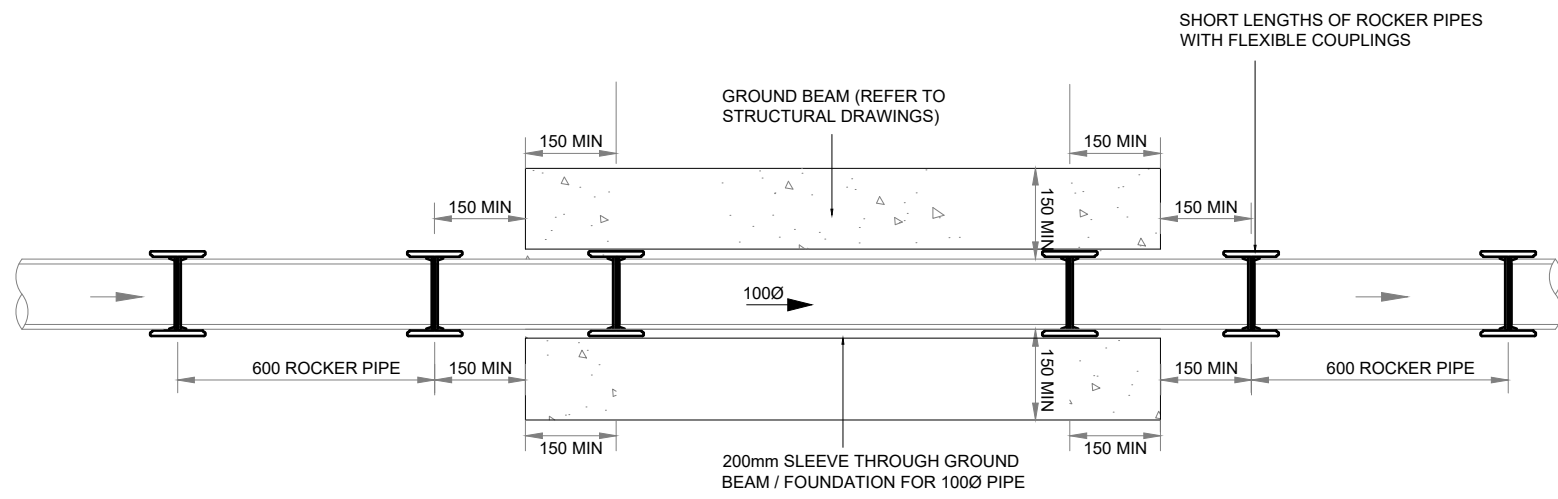
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(DEPTH MORE THAN 1.50m TO TOP OF PIPE)



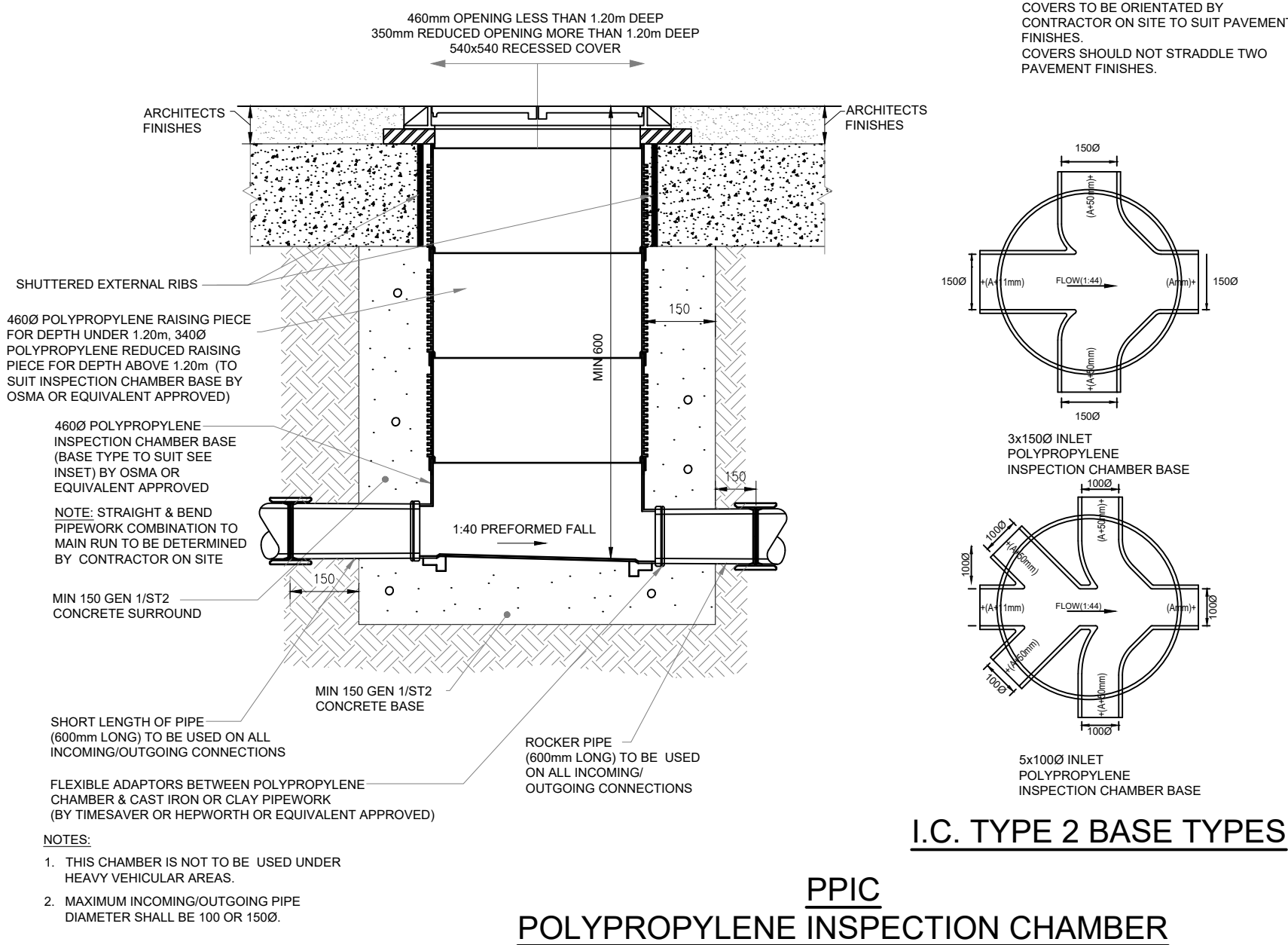
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(DEPTH LESS THAN 1.50m TO TOP OF PIPE)



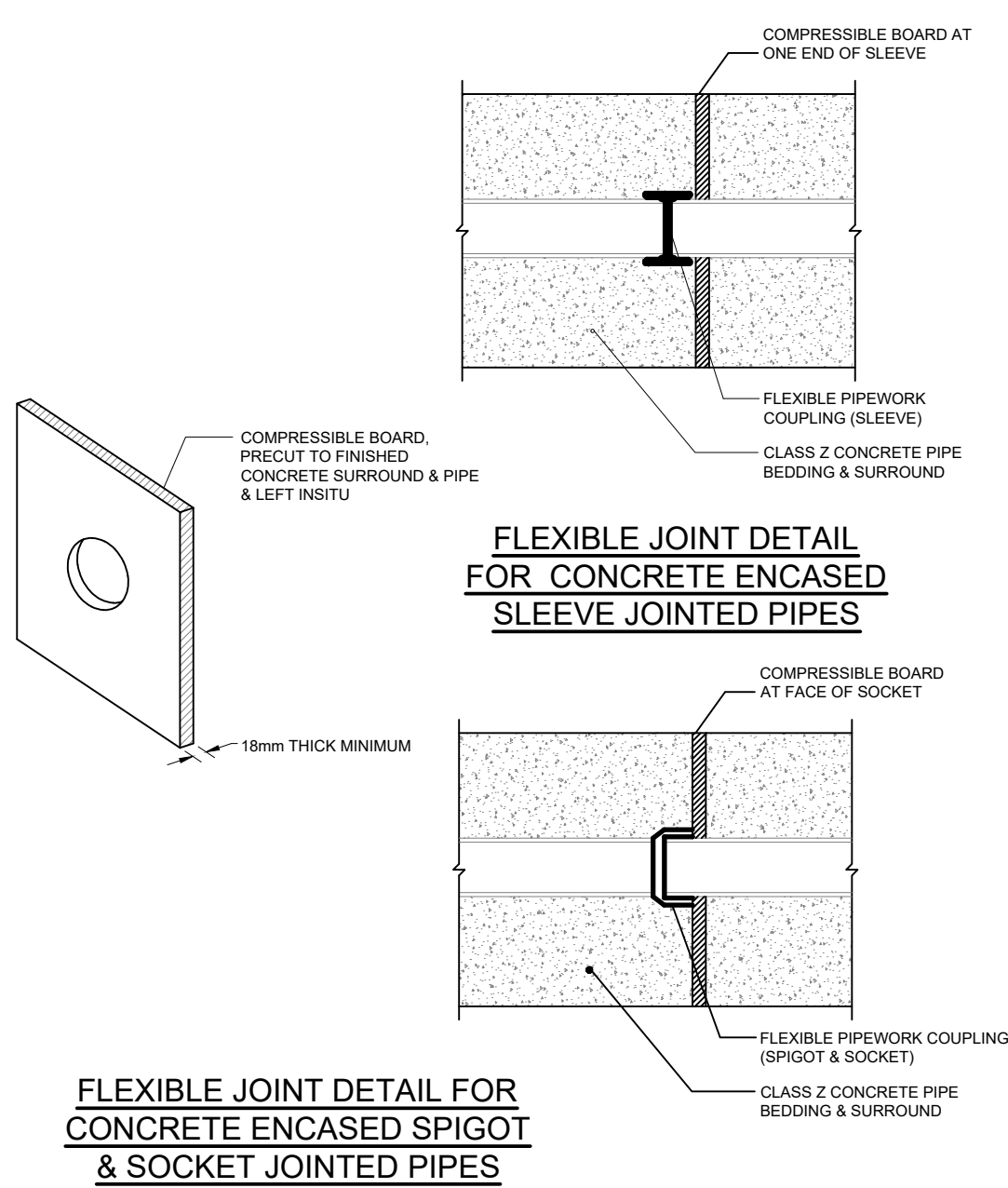
TYPICAL 45° PIPE JUNCTION
CONNECTION DETAIL



TYPICAL PIPE THROUGH GROUND BEAM /
FOUNDATION DETAIL



PPIC
POLYPROPYLENE INSPECTION CHAMBER



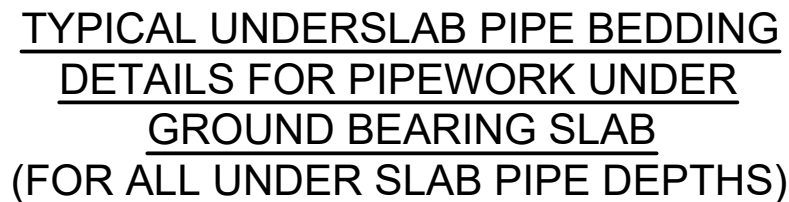
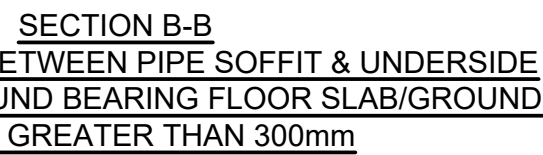
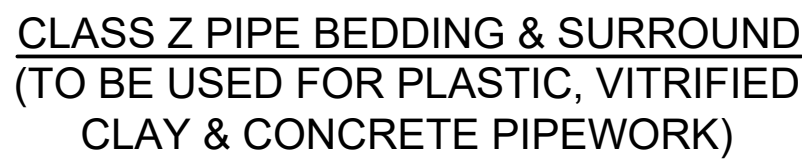
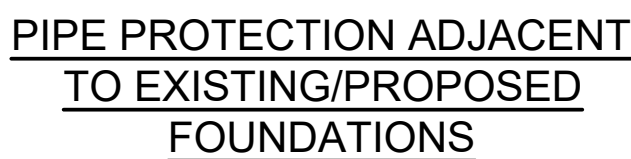
FLEXIBLE JOINT DETAIL FOR
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& SOCKET JOINTED PIPES

FLEXIBLE JOINT DETAIL FOR
CONCRETE ENCASED PIPES
(TO B.S. 1142)

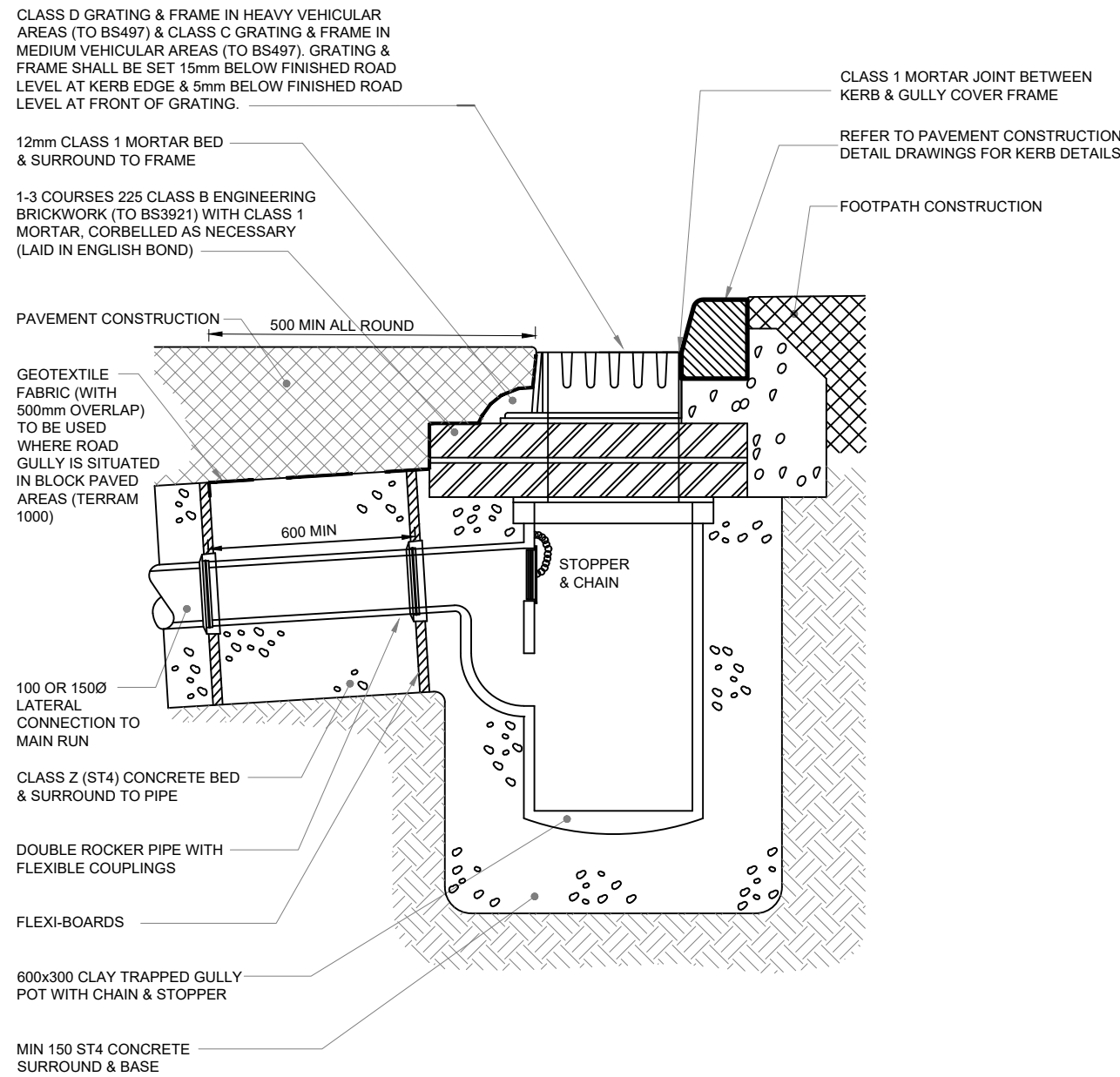
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rev	amendments	by	date
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Project: Levenshulme Road Gorton			
Title: Below Ground Drainage Details Sheet 1			
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22-2365 / A1 / 104			P1
Project Leader: LS	Drawn By: MS	Initial Review: LS	



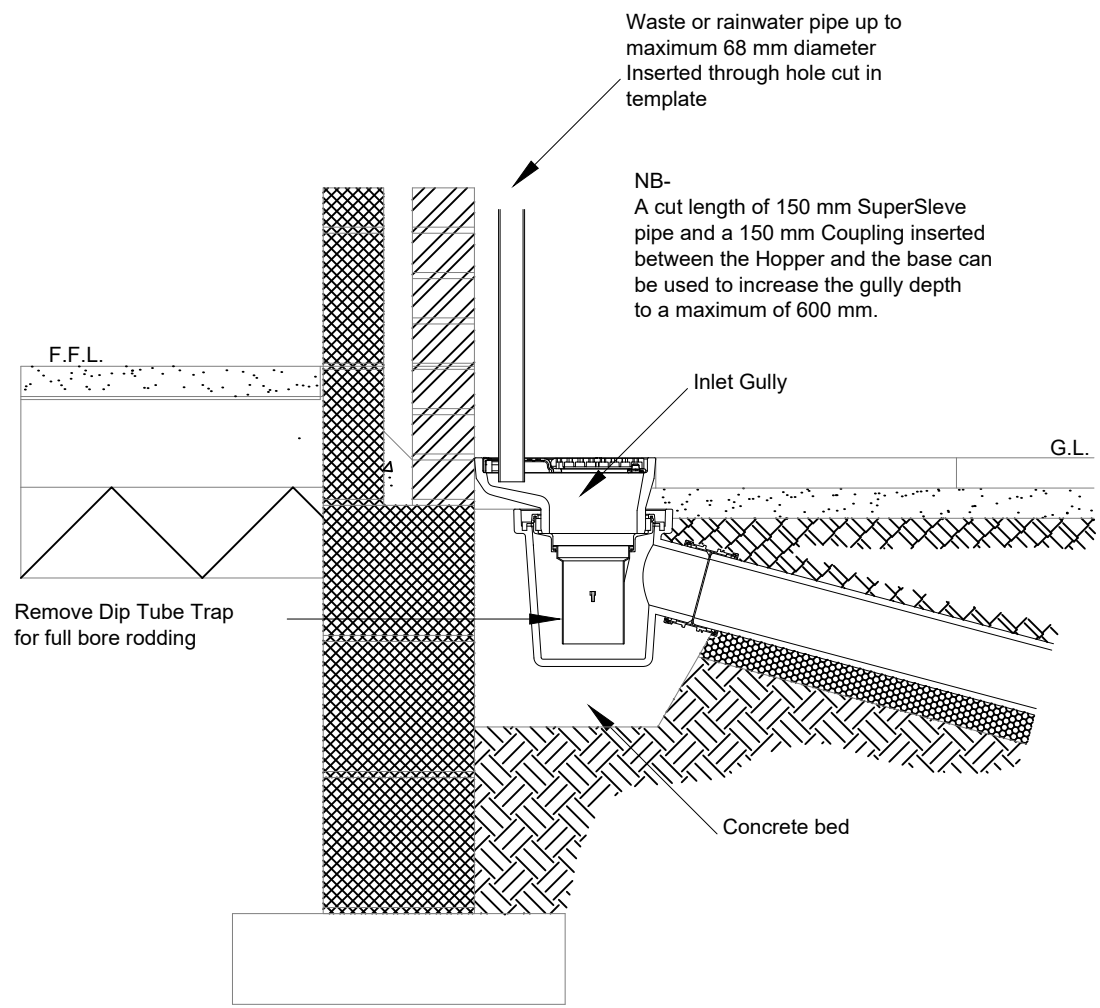
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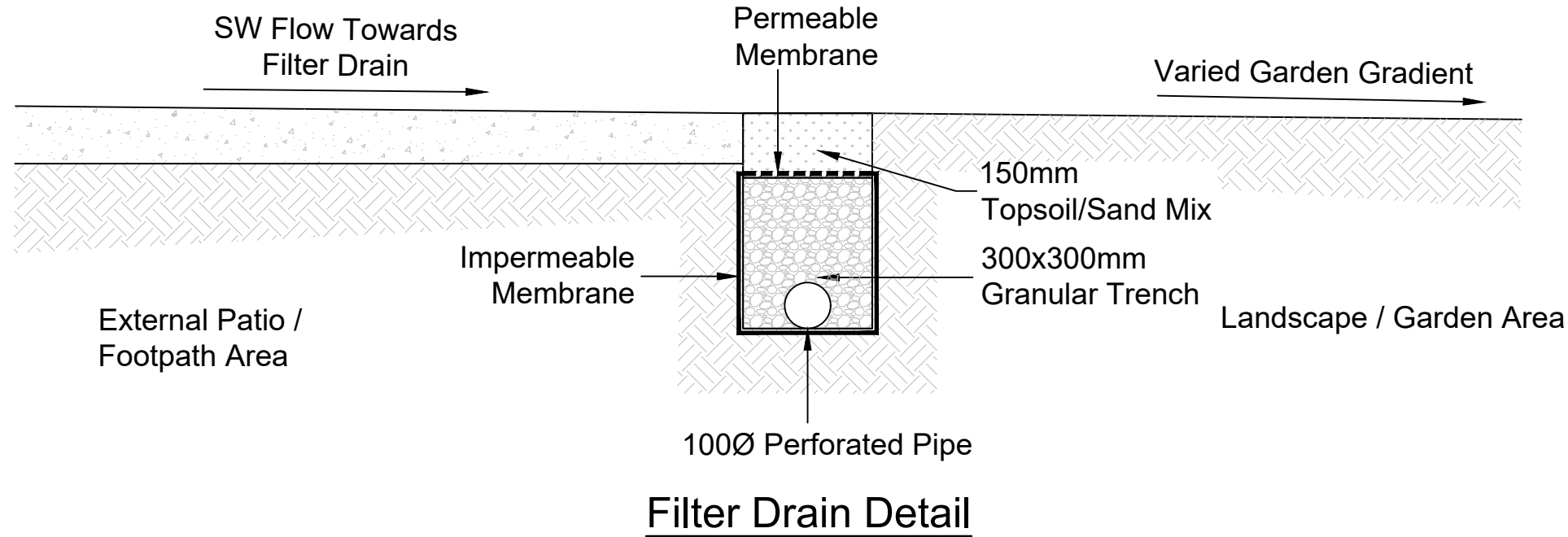
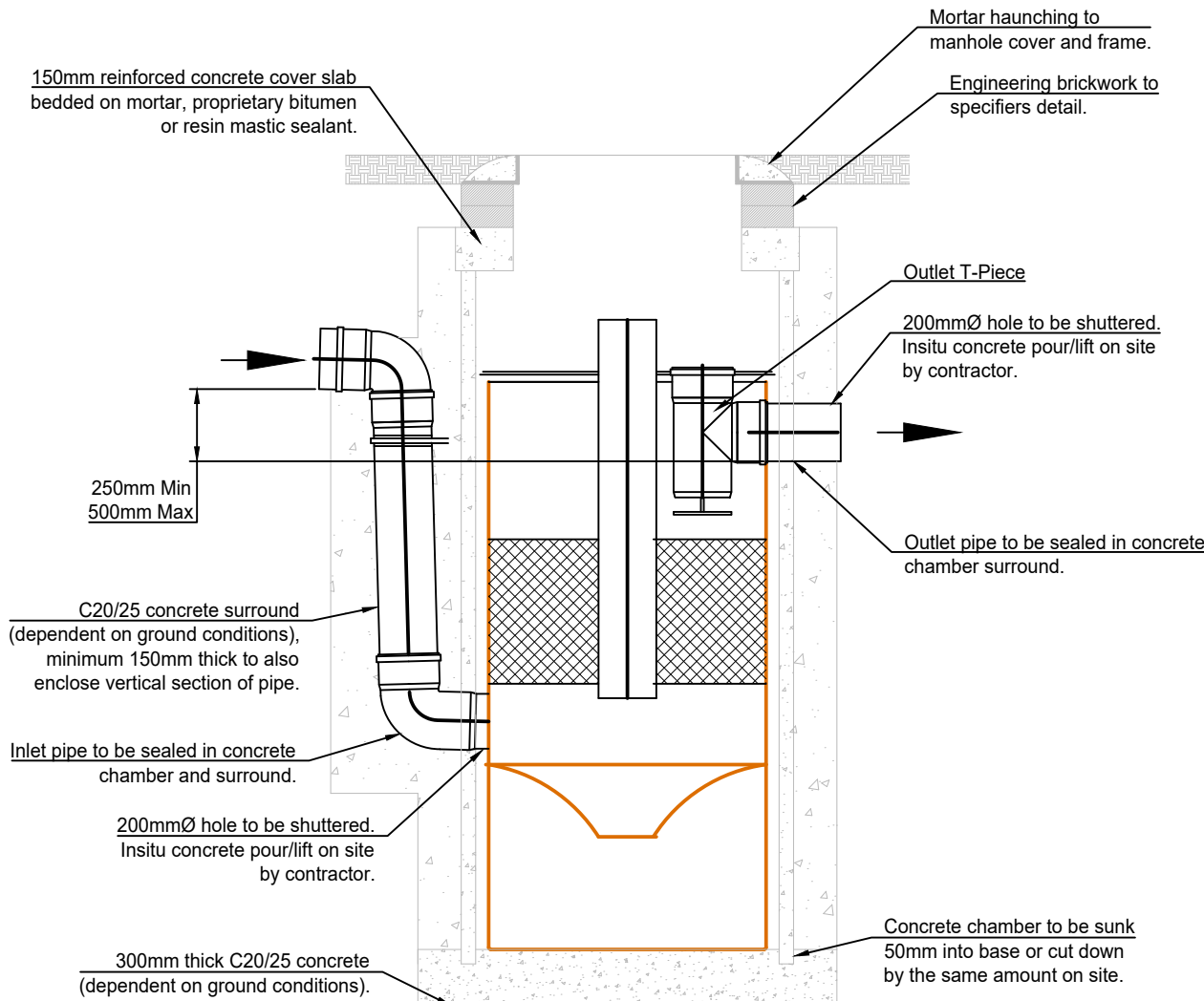
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IS	MS	IS



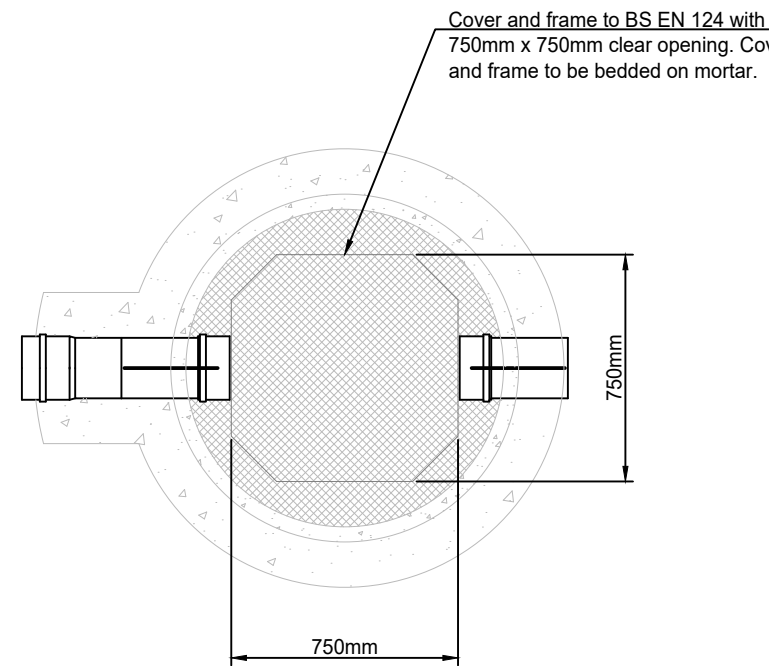
EXTERNAL GULLY DETAIL
(ROAD AREAS)



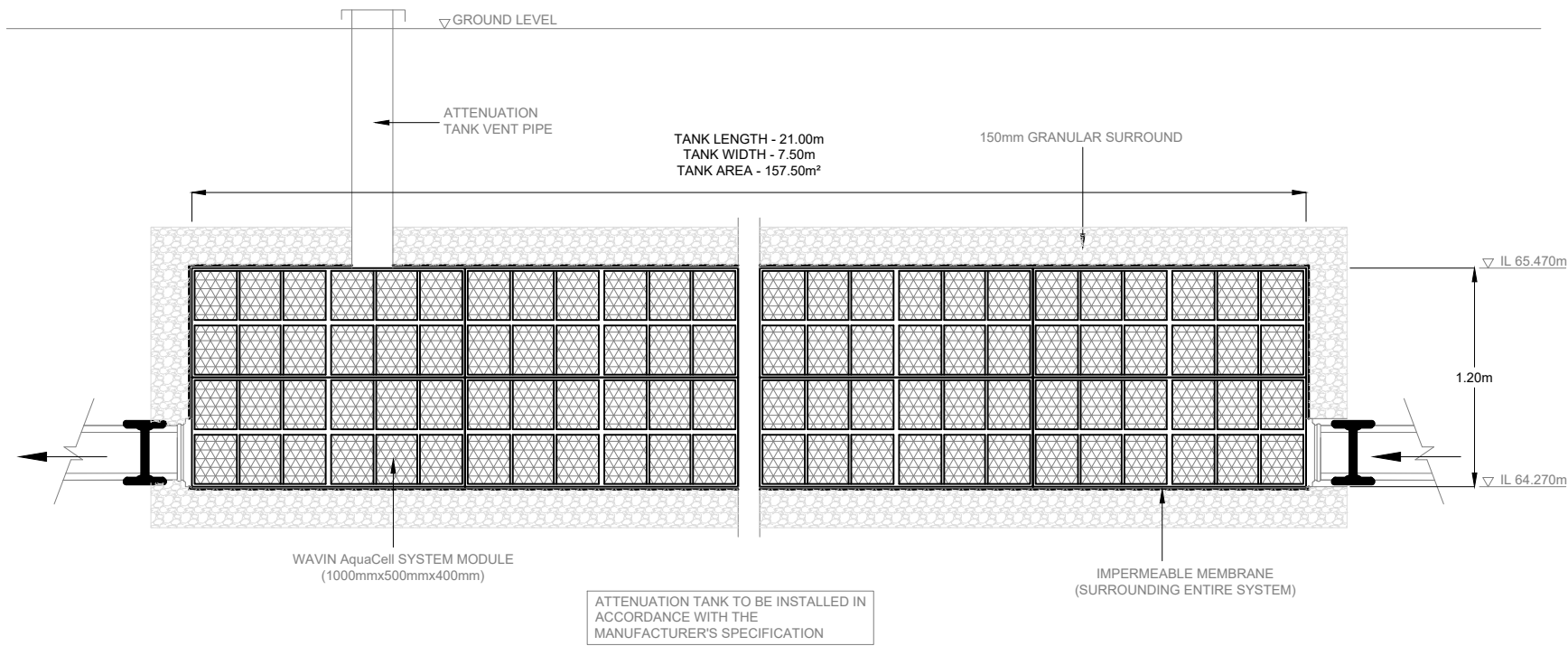
TYPICAL RAINWATER PIPE AND
BACK INLET GULLY DETAIL



ACO QUADRACEPTOR DETAIL



Plan View of Quadraceptor Chamber



TYPICAL CELLULAR UNIT / TANK DETAIL

P2	Preliminary Issue	MDS	09.05.23
P1	Preliminary Issue	MDS	04.05.23
rev	amendments	by	date



Client:
Watson Construction Ltd

Project:
Levenshulme Road
Gorton

Title:
Below Ground Drainage Details
Sheet 3

Drawing Status: Preliminary	Date Created: May '23	Drawing Scale: N.T.S
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22-2365 / A1 / 106

P2

Project Leader: LS	Drawn By: MS	Initial Review: LS
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Appendix H

Surface Water Network / Management Calculations

Flo Consult UK Ltd		Page 1
4 Market Square	Levenshulme Road	
Old Amersham	Surface Water	
Buckinghamshire, HP7 0DQ	Network Calculations	
Date 04/05/2023	Designed by MDS	
File SW Network Calculations.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location GB 388687 395445 SJ 88687 95445	
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 (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
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	0.239	4-8	0.061

Total Area Contributing (ha) = 0.300

Total Pipe Volume (m³) = 17.014

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
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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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Flo Consult UK Ltd		Page 6
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations	
Date 04/05/2023 File SW Network Calcualtions.MDX	Designed by MDS Checked by MDS	
Innovyze	Network 2020.1.3	

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., (mm)	L*W
6.000	o	375	S11	66.250	64.965	0.910	Open Manhole		1500
1.005	o	375	S12	66.550	64.650	1.525	Open Manhole		1500
1.006	o	375	S16	66.750	64.415	1.960	Open Manhole		1500
7.000	o	150	S17	66.350	65.600	0.600	Open Manhole		460
7.001	o	150	S18	66.350	65.350	0.850	Open Manhole		460
7.002	o	375	S19	66.250	64.595	1.280	Open Manhole		1500
7.003	o	375	S20	66.300	64.480	1.445	Open Manhole		1500
8.000	o	150	S21	66.350	64.900	1.300	Open Manhole		460
8.001	o	150	S22	66.350	64.650	1.550	Open Manhole		460
7.004	o	375	S23	66.400	64.385	1.640	Open Manhole		1500
1.007	o	375	S24	66.750	64.280	2.095	Open Manhole		1500
1.008	o	375	S24/FC	66.750	64.260	2.115	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., (mm)	L*W
6.000	31.550	100.2	S12	66.550	64.650	1.525	Open Manhole		1500
1.005	35.150	149.6	S16	66.750	64.415	1.960	Open Manhole		1500
1.006	4.550	33.7	S24	66.750	64.280	2.095	Open Manhole		1500
7.000	19.800	79.2	S18	66.350	65.350	0.850	Open Manhole		460
7.001	14.700	27.7	S19	66.250	64.820	1.280	Open Manhole		1500
7.002	17.500	152.2	S20	66.300	64.480	1.445	Open Manhole		1500
7.003	14.350	151.1	S23	66.400	64.385	1.640	Open Manhole		1500
8.000	19.900	79.6	S22	66.350	64.650	1.550	Open Manhole		460
8.001	3.400	85.0	S23	66.400	64.610	1.640	Open Manhole		1500
7.004	16.050	152.9	S24	66.750	64.280	2.095	Open Manhole		1500
1.007	3.000	150.0	S24/FC	66.750	64.260	2.115	Open Manhole		1500
1.008	5.000	100.0	S26	65.750	64.210	1.165	Open Manhole		1500

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Flo Consult UK Ltd		Page 7
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations	
Date 04/05/2023	Designed by MDS	
File SW Network Calcualtions.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall C. Level Name	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	S26	65.750	64.210	0.000 1500	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 388687 395445 SJ 88687 95445
Data Type	Point
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950
Storm Duration (mins)	15

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations																																																																									
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Innovyze	Network 2020.1.3																																																																									
<div>Online Controls for Storm</div>																																																																										
<div>Hydro-Brake® Optimum Manhole: S24/FC, DS/PN: 1.008, Volume (m³): 4.6</div>																																																																										
<div><div>Unit Reference MD-SHE-0076-3400-1900-3400</div><div><div>Design Head (m)</div><div>1.900</div></div><div><div>Design Flow (l/s)</div><div>3.4</div></div><div><div>Flush-Flo™</div><div>Calculated</div></div><div><div>Objective</div><div>Minimise upstream storage</div></div><div><div>Application</div><div>Surface</div></div><div><div>Sump Available</div><div>Yes</div></div><div><div>Diameter (mm)</div><div>76</div></div><div><div>Invert Level (m)</div><div>64.260</div></div><div><div>Minimum Outlet Pipe Diameter (mm)</div><div>100</div></div><div><div>Suggested Manhole Diameter (mm)</div><div>1200</div></div></div>																																																																										
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.900</td><td>3.4</td><td>Kick-Flo®</td><td>0.676</td><td>2.1</td></tr><tr><td>Flush-Flo™</td><td>0.330</td><td>2.6</td><td>Mean Flow over Head Range</td><td>-</td><td>2.6</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.900	3.4	Kick-Flo®	0.676	2.1	Flush-Flo™	0.330	2.6	Mean Flow over Head Range	-	2.6																																																						
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<div>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</div>																																																																										
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>2.1</td><td>1.200</td><td>2.7</td><td>3.000</td><td>4.2</td><td>7.000</td><td>6.2</td></tr><tr><td>0.200</td><td>2.5</td><td>1.400</td><td>2.9</td><td>3.500</td><td>4.5</td><td>7.500</td><td>6.4</td></tr><tr><td>0.300</td><td>2.6</td><td>1.600</td><td>3.1</td><td>4.000</td><td>4.8</td><td>8.000</td><td>6.6</td></tr><tr><td>0.400</td><td>2.6</td><td>1.800</td><td>3.3</td><td>4.500</td><td>5.1</td><td>8.500</td><td>6.8</td></tr><tr><td>0.500</td><td>2.5</td><td>2.000</td><td>3.5</td><td>5.000</td><td>5.3</td><td>9.000</td><td>7.0</td></tr><tr><td>0.600</td><td>2.4</td><td>2.200</td><td>3.6</td><td>5.500</td><td>5.6</td><td>9.500</td><td>7.2</td></tr><tr><td>0.800</td><td>2.3</td><td>2.400</td><td>3.8</td><td>6.000</td><td>5.8</td><td></td><td></td></tr><tr><td>1.000</td><td>2.5</td><td>2.600</td><td>3.9</td><td>6.500</td><td>6.0</td><td></td><td></td></tr></table>			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	2.7	3.000	4.2	7.000	6.2	0.200	2.5	1.400	2.9	3.500	4.5	7.500	6.4	0.300	2.6	1.600	3.1	4.000	4.8	8.000	6.6	0.400	2.6	1.800	3.3	4.500	5.1	8.500	6.8	0.500	2.5	2.000	3.5	5.000	5.3	9.000	7.0	0.600	2.4	2.200	3.6	5.500	5.6	9.500	7.2	0.800	2.3	2.400	3.8	6.000	5.8			1.000	2.5	2.600	3.9	6.500	6.0		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
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Flo Consult UK Ltd		Page 9																																																																																				
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<u>Storage Structures for Storm</u>																																																																																						
<u>Cellular Storage Manhole: S24/FC, DS/PN: 1.008</u>																																																																																						
Invert Level (m) 64.270 Safety Factor 2.0																																																																																						
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95																																																																																						
Infiltration Coefficient Side (m/hr) 0.00000																																																																																						
<table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>157.5</td><td>0.0</td><td>2.600</td><td>0.0</td><td>0.0</td></tr><tr><td>0.200</td><td>157.5</td><td>0.0</td><td>2.800</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>157.5</td><td>0.0</td><td>3.000</td><td>0.0</td><td>0.0</td></tr><tr><td>0.600</td><td>157.5</td><td>0.0</td><td>3.200</td><td>0.0</td><td>0.0</td></tr><tr><td>0.800</td><td>157.5</td><td>0.0</td><td>3.400</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>157.5</td><td>0.0</td><td>3.600</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>157.5</td><td>0.0</td><td>3.800</td><td>0.0</td><td>0.0</td></tr><tr><td>1.400</td><td>0.0</td><td>0.0</td><td>4.000</td><td>0.0</td><td>0.0</td></tr><tr><td>1.600</td><td>0.0</td><td>0.0</td><td>4.200</td><td>0.0</td><td>0.0</td></tr><tr><td>1.800</td><td>0.0</td><td>0.0</td><td>4.400</td><td>0.0</td><td>0.0</td></tr><tr><td>2.000</td><td>0.0</td><td>0.0</td><td>4.600</td><td>0.0</td><td>0.0</td></tr><tr><td>2.200</td><td>0.0</td><td>0.0</td><td>4.800</td><td>0.0</td><td>0.0</td></tr><tr><td>2.400</td><td>0.0</td><td>0.0</td><td>5.000</td><td>0.0</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	157.5	0.0	2.600	0.0	0.0	0.200	157.5	0.0	2.800	0.0	0.0	0.400	157.5	0.0	3.000	0.0	0.0	0.600	157.5	0.0	3.200	0.0	0.0	0.800	157.5	0.0	3.400	0.0	0.0	1.000	157.5	0.0	3.600	0.0	0.0	1.200	157.5	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
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																																																	
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Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations	
Date 04/05/2023	Designed by MDS	
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Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 388687 395445 SJ 88687 95445
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 (%)	40
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
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

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 388687 395445 SJ 88687 95445
Data Type	Point
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950

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Flo Consult UK Ltd		Page 2
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations	
Date 04/05/2023	Designed by MDS	
File SW Network Calcualtions.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	
<div>Synthetic Rainfall Details</div> <div>Storm Duration (mins) 15</div>		
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Micro
Drainage

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

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	65.608	-0.142	0.000	0.01		0.2	OK
1.001	S2	65.490	-0.140	0.000	0.01		0.3	OK
2.000	S3	65.605	-0.145	0.000	0.01		0.2	OK
1.002	S4	65.356	-0.134	0.000	0.02		0.5	OK
3.000	S5	65.953	-0.147	0.000	0.00		0.2	OK
1.003	S6	65.159	-0.131	0.000	0.04		0.7	OK
4.000	S7	65.804	-0.146	0.000	0.01		0.3	OK
5.000	S8	65.808	-0.142	0.000	0.01		0.2	OK
5.001	S9	65.681	-0.144	0.000	0.01		0.3	OK
1.004	S10	65.084	-0.021	0.000	0.09		1.5	OK
6.000	S11	65.083	-0.257	0.000	0.01		1.1	OK
1.005	S12	65.083	0.058	0.000	0.03		4.2	SURCHARGED
1.006	S16	65.082	0.292	0.000	0.03		4.0	SURCHARGED
7.000	S17	65.614	-0.136	0.000	0.02		0.4	OK
7.001	S18	65.366	-0.134	0.000	0.02		0.7	OK
7.002	S19	65.082	0.112	0.000	0.01		1.5	SURCHARGED
7.003	S20	65.082	0.227	0.000	0.01		1.5	SURCHARGED
8.000	S21	65.083	0.033	0.000	0.02		0.5	SURCHARGED
8.001	S22	65.083	0.283	0.000	0.07		0.9	SURCHARGED
7.004	S23	65.082	0.322	0.000	0.02		3.1	SURCHARGED
1.007	S24	65.082	0.427	0.000	0.09		7.4	SURCHARGED
1.008	S24/FC	65.081	0.446	0.000	0.02	816	2.6	SURCHARGED

Flo Consult UK Ltd		Page 1
4 Market Square	Levenshulme Road	
Old Amersham	Surface Water	
Buckinghamshire, HP7 0DQ	Network Calculations	
Date 04/05/2023	Designed by MDS	
File SW Network Calculations.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	

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 388687 395445 SJ 88687	95445
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)		0.000
Maximum Backdrop Height (m)		0.000
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

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	45.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 388687 395445 SJ 88687 95445
Data Type	Point
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.950

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations	
Date 04/05/2023	Designed by MDS	
File SW Network Calcualtions.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	
<div>Synthetic Rainfall Details</div> <div>Storm Duration (mins) 15</div>		
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Micro
Drainage

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	65.650	-0.100	0.000	0.24		4.3	OK
1.001	S2	65.537	-0.093	0.000	0.31		5.6	OK
2.000	S3	65.640	-0.110	0.000	0.16		4.3	OK
1.002	S4	65.462	-0.028	0.000	0.51		9.4	OK
3.000	S5	65.981	-0.119	0.000	0.09		4.3	OK
1.003	S6	65.410	0.120	0.000	0.84		15.3	SURCHARGED
4.000	S7	65.834	-0.116	0.000	0.12		5.5	OK
5.000	S8	65.849	-0.101	0.000	0.24		4.3	OK
5.001	S9	65.716	-0.109	0.000	0.17		6.2	OK
1.004	S10	65.283	0.178	0.000	1.81		30.7	SURCHARGED
6.000	S11	65.072	-0.268	0.000	0.13		23.4	OK
1.005	S12	65.071	0.046	0.000	0.57		83.9	SURCHARGED
1.006	S16	65.068	0.278	0.000	0.57		82.1	SURCHARGED
7.000	S17	65.668	-0.082	0.000	0.43		8.0	OK
7.001	S18	65.427	-0.073	0.000	0.51		16.1	OK
7.002	S19	65.070	0.100	0.000	0.25		33.4	SURCHARGED
7.003	S20	65.069	0.214	0.000	0.29		35.5	SURCHARGED
8.000	S21	65.073	0.023	0.000	0.51		9.6	SURCHARGED
8.001	S22	65.069	0.269	0.000	1.54		19.3	SURCHARGED
7.004	S23	65.068	0.308	0.000	0.57		72.6	SURCHARGED
1.007	S24	65.068	0.413	0.000	1.95		162.4	SURCHARGED
1.008	S24/FC	65.067	0.432	0.000	0.02		2.6	SURCHARGED

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Levenshulme Road Surface Water Network Calculations	
Date 04/05/2023	Designed by MDS	
File SW Network Calcualtions.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	

Summary of Results for 360 minute 100 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)	
1.000	S1	66.177	0.427	0.000	0.04			0.8	FLOOD RISK
1.001	S2	66.177	0.547	0.000	0.06			1.0	FLOOD RISK
2.000	S3	66.177	0.427	0.000	0.03			0.8	FLOOD RISK
1.002	S4	66.176	0.686	0.000	0.10			1.8	FLOOD RISK
3.000	S5	66.176	0.076	0.000	0.02			0.8	SURCHARGED
1.003	S6	66.176	0.886	0.000	0.16			2.9	SURCHARGED
4.000	S7	66.175	0.225	0.000	0.02			1.0	SURCHARGED
5.000	S8	66.175	0.225	0.000	0.04			0.8	SURCHARGED
5.001	S9	66.175	0.350	0.000	0.03			1.1	SURCHARGED
1.004	S10	66.174	1.069	0.000	0.34			5.8	SURCHARGED
6.000	S11	66.173	0.833	0.000	0.02			4.2	FLOOD RISK
1.005	S12	66.173	1.148	0.000	0.10			14.7	SURCHARGED
1.006	S16	66.172	1.382	0.000	0.10			14.7	SURCHARGED
7.000	S17	66.175	0.425	0.000	0.08			1.5	FLOOD RISK
7.001	S18	66.174	0.674	0.000	0.09			2.9	FLOOD RISK
7.002	S19	66.173	1.203	0.000	0.04			5.8	FLOOD RISK
7.003	S20	66.172	1.317	0.000	0.05			6.5	FLOOD RISK
8.000	S21	66.174	1.124	0.000	0.09			1.7	FLOOD RISK
8.001	S22	66.173	1.373	0.000	0.28			3.5	FLOOD RISK
7.004	S23	66.172	1.412	0.000	0.10			13.0	FLOOD RISK
1.007	S24	66.171	1.516	0.000	0.34			28.7	SURCHARGED
1.008	S24/FC	66.171	1.536	0.000	0.03			3.4	SURCHARGED



Micro
Drainage

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)	
1.000	S1	66.141	0.391	0.000	0.03			0.5	FLOOD RISK
1.001	S2	66.141	0.511	0.000	0.03			0.6	FLOOD RISK
2.000	S3	66.142	0.392	0.000	0.02			0.5	FLOOD RISK
1.002	S4	66.141	0.651	0.000	0.06			1.0	FLOOD RISK
3.000	S5	66.146	0.046	0.000	0.01			0.5	SURCHARGED
1.003	S6	66.145	0.855	0.000	0.09			1.7	SURCHARGED
4.000	S7	66.151	0.201	0.000	0.01			0.6	SURCHARGED
5.000	S8	66.148	0.198	0.000	0.03			0.5	SURCHARGED
5.001	S9	66.147	0.322	0.000	0.02			0.7	SURCHARGED
1.004	S10	66.150	1.045	0.000	0.20			3.4	SURCHARGED
6.000	S11	66.152	0.812	0.000	0.01			2.4	FLOOD RISK
1.005	S12	66.147	1.122	0.000	0.06			8.6	SURCHARGED
1.006	S16	66.147	1.357	0.000	0.06			8.6	SURCHARGED
7.000	S17	66.153	0.403	0.000	0.05			0.8	FLOOD RISK
7.001	S18	66.150	0.650	0.000	0.05			1.7	FLOOD RISK
7.002	S19	66.151	1.181	0.000	0.03			3.4	FLOOD RISK
7.003	S20	66.149	1.294	0.000	0.03			3.8	FLOOD RISK
8.000	S21	66.155	1.105	0.000	0.05			1.0	FLOOD RISK
8.001	S22	66.149	1.349	0.000	0.16			2.0	FLOOD RISK
7.004	S23	66.148	1.388	0.000	0.06			7.7	FLOOD RISK
1.007	S24	66.149	1.494	0.000	0.20			16.9	SURCHARGED
1.008	S24/FC	66.151	1.516	0.000	0.03			3.4	SURCHARGED

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ			Levenshulme Road Surface Water Network Calculations						
Date 04/05/2023			Designed by MDS						
File SW Network Calcualtions.MDX			Checked by MDS						
Innovyze			Network 2020.1.3						
<p><u>Summary of Results for 1440 minute 100 year Winter (Storm)</u></p> <p>Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON DVD Status OFF Inertia Status OFF</p>									
		Water	Surcharged	Flooded		Half Drain	Pipe		
	US/MH	Level	Depth	Volume	Flow /	Time	Flow		
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status
1.000	S1	65.611	-0.139	0.000	0.01			0.3	OK
1.001	S2	65.522	-0.108	0.000	0.02			0.3	OK
2.000	S3	65.607	-0.143	0.000	0.01			0.3	OK
1.002	S4	65.521	0.031	0.000	0.03			0.6	SURCHARGED
3.000	S5	65.954	-0.146	0.000	0.01			0.3	OK
1.003	S6	65.521	0.231	0.000	0.05			1.0	SURCHARGED
4.000	S7	65.805	-0.145	0.000	0.01			0.3	OK
5.000	S8	65.810	-0.140	0.000	0.01			0.3	OK
5.001	S9	65.682	-0.143	0.000	0.01			0.4	OK
1.004	S10	65.520	0.415	0.000	0.12			2.0	SURCHARGED
6.000	S11	65.518	0.178	0.000	0.01			1.4	SURCHARGED
1.005	S12	65.518	0.493	0.000	0.04			5.2	SURCHARGED
1.006	S16	65.517	0.727	0.000	0.04			5.1	SURCHARGED
7.000	S17	65.616	-0.134	0.000	0.03			0.5	OK
7.001	S18	65.519	0.019	0.000	0.03			1.0	SURCHARGED
7.002	S19	65.518	0.548	0.000	0.02			2.0	SURCHARGED
7.003	S20	65.518	0.663	0.000	0.02			2.2	SURCHARGED
8.000	S21	65.519	0.469	0.000	0.03			0.6	SURCHARGED
8.001	S22	65.518	0.718	0.000	0.09			1.2	SURCHARGED
7.004	S23	65.518	0.758	0.000	0.04			4.4	SURCHARGED
1.007	S24	65.517	0.862	0.000	0.12			9.9	SURCHARGED
1.008	S24/FC	65.516	0.881	0.000	0.03		1032	2.8	SURCHARGED
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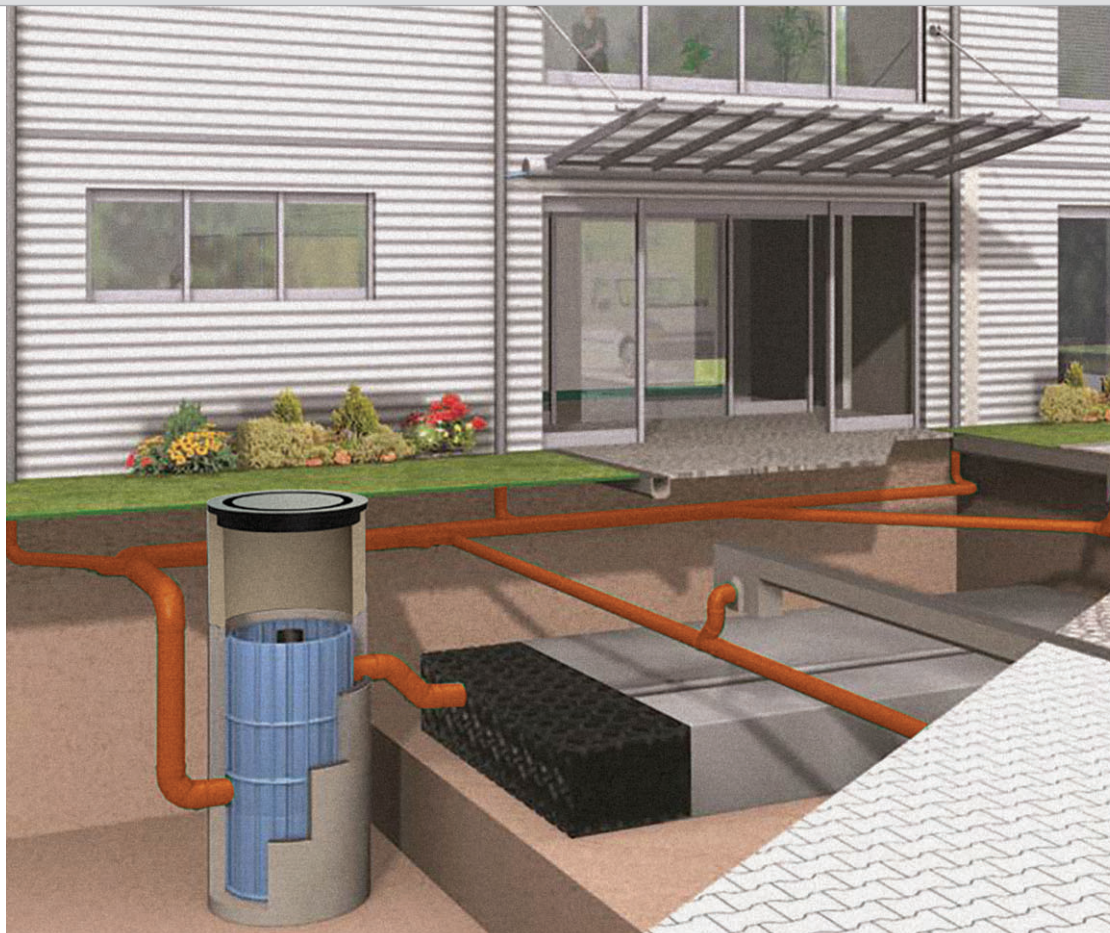
Appendix I

Pollutant Control Chamber

Uniclass L7315 + L2123	EPIC J3413
CI/SfB (52.5)	In6

ACO Water Management: Civils + Infrastructure

ACO QuadraCeptor



ACO QuadraCeptor

Four Stage Surface Water Treatment Unit



Introduction to ACO QuadraCeptor

ACO QuadraCeptor is a specialist rainwater and surface water runoff filtration system for the removal of sediment and harmful pollutants.

Surface Water Management

ACO QuadraCeptor is an efficient and reliable system for the treatment of surface water run-off from roofs, car parks and roads, even in heavily trafficked areas, before discharge in to ground (infiltration) or to a surface water feature.

The system has been designed to remove, in a four stage process, heavy particles, silt and nutrients and dissolved materials, such as heavy metals, from the surface water as part of an integrated Sustainable Drainage Solution. ACO QuadraCeptor will improve the water quality ensuring pollutants are not infiltrated into the soil.

Where infiltration is not feasible, the surface water discharged from site needs to be treated to an acceptable level.

Where this is to a watercourse, the Environment Agency (in England), the Scottish Environmental Protection Agency or Natural Resources Wales in line with legislation and guidelines such as the Water Framework Directive, will determine the levels of pollutants that can be discharged from site based on a number of factors such as the sensitivity of the receiving water, the dilution, etc.

Using the ACO QuadraCeptor at some point in the SuDS treatment train before discharge ensures clean surface water run-off is discharged from site meeting discharge consent limits on pollutants.

ACO's Water Management solutions team's technical expertise and knowledge of current best practice is your assurance of an affordable, long term sustainable solution.

Source control

Source Control: Changes in the Planning process for new developments from April 2015 will require all development, except the most minor, to have a SuDS solution for managing surface water runoff on-site. The first objective of any SuDS scheme is to manage surface water runoff at source and, where feasible, not to allow surface water runoff to discharge from the site.



What is ACO QuadraCeptor?

The ACO QuadraCeptor uses an upflow filtration process, resulting in minimal head loss between the inlet and the outlet. The rainwater is treated within the unit by the following 4 processes: sedimentation, filtration, adsorption and precipitation. The cleaned water is of an outstanding water quality.

The initial treatment steps take place in the hydrodynamic separator stage, where sedimentation of solid particles occurs within a radial flow regime.

To prevent remobilisation, settled material passes through a funnel trap into the silt chamber at the base of the unit.

Secondary treatment of raw water occurs via a suite of filters located above the separator unit. These filtration units cover the entire diameter of the unit's housing. As water flows upwards through the removable filter elements the filtration media is kept saturated. Such saturation maximises filter efficiency by minimising the rate at which filter units clog.

The filter elements can be cleaned when required and are easy to exchange when the media is exhausted.

ACO QuadraCeptor is supplied in a plastic housing and is safe and easy to fit on site. It is designed for installation within load bearing shafts and can be installed in standard concrete or plastic chambers.

Why choose ACO QuadraCeptor

An integrated approach to surface water quantity and quality

By using ACO QuadraCeptor in conjunction with attenuation and flow control devices from ACO's water management solutions, surface water run-off can be discharged from site at an agreed rate, at a permitted quality.

Low maintenance

There are no moving parts in the ACO QuadraCeptor, meaning the only maintenance required is occasional emptying of the silt chamber (an ACO silt level alarm can be fitted) and cleaning or replacing of the filters when required.

Easy to install

The ACO QuadraCeptor is supplied as a standalone unit, easily installed in a load bearing shaft, either standard concrete or plastic chambers.

How it works

Step 1

Surface water run-off from the catchment area drains into the lower section of the QuadraCeptor shaft. A deflector plate initiates radial flow.

Step 2

Sedimentation of particles, especially the larger and denser fractions, takes place in the hydrodynamic separator due to turbulent secondary flows within the radial flow regime.

Step 3

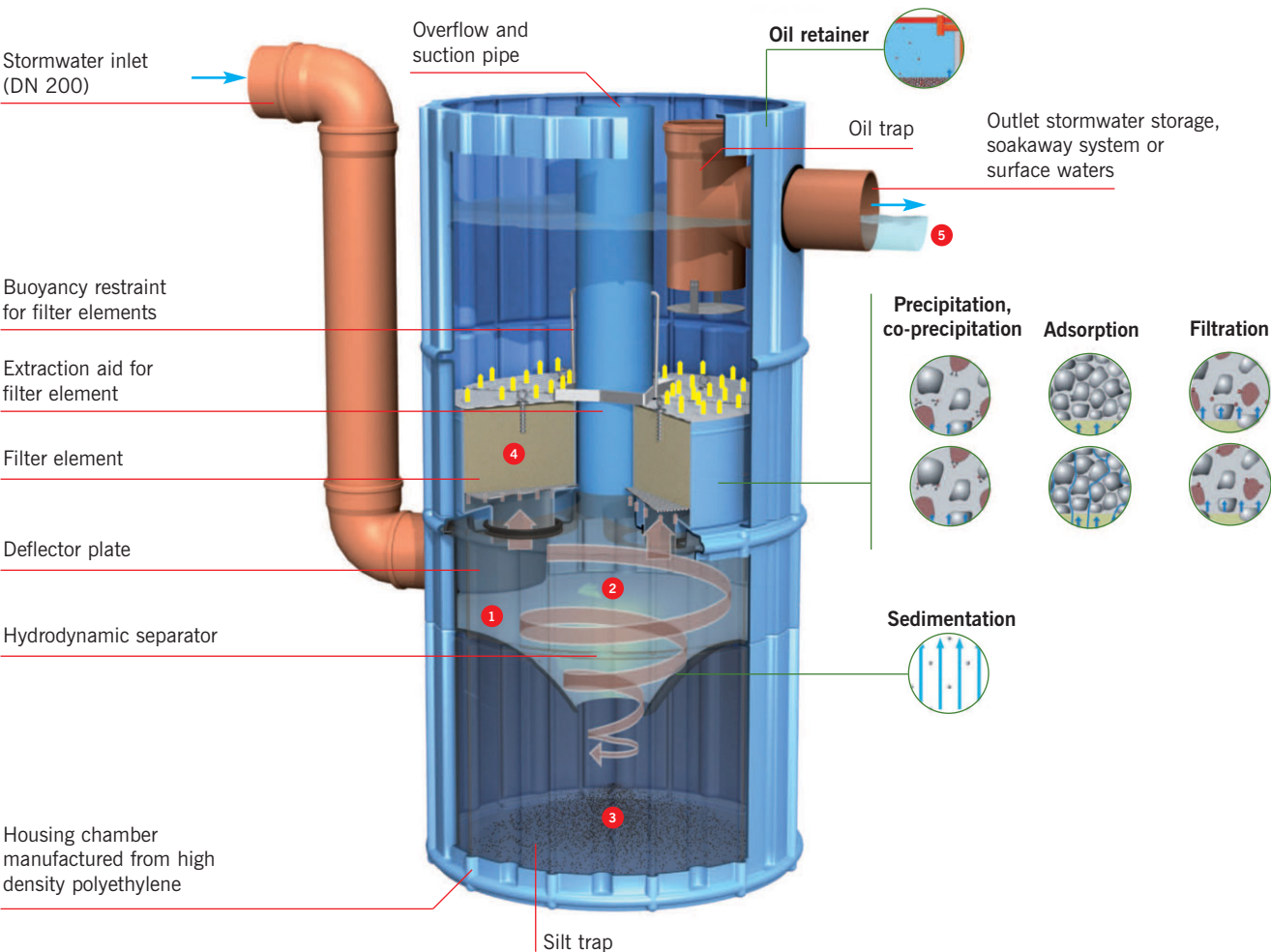
The settleable solids are retained in the silt trap chamber. This chamber should be emptied periodically, via the central by-pass tube.

Step 4

Four filter elements are located within the filter shaft. As water flows upwards fine particles are filtered out and dissolved pollutants are precipitated and adsorbed. Filter units can be backwashed simply and, if completely clogged or exhausted, can easily be replaced.

Step 5

Clean water above the filter elements passes to discharge to a soakaway or watercourse. Normal concentrations of dissolved oils are retained within the filter elements but any free floating oil that does pass through the filters is retained in an integrated oil trap.



ACO QuadraCeptor Range

The ACO QuadraCeptor is available with various filter types, depending on the usage of the connected area. The three options are:

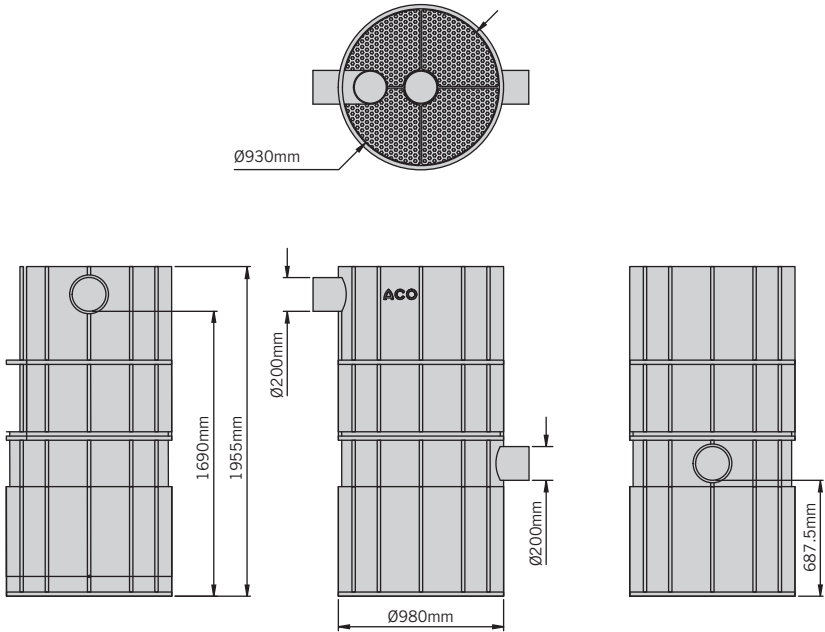
R1000 (Roof)	Application: Roof areas that do not have a significant proportion of uncoated metals* Material: Filter Substrate: Roof Weight of filter element: 34kg Total weight of ACO QuadraCeptor unit including polyethylene housing: 220kg
T750 (Traffic)	Application: Trafficked areas with normal levels of pollutants, such as staff car parks and side streets. Material: Filter Substrate: Traffic Weight of filter element: 34kg Total weight of ACO QuadraCeptor unit including polyethylene housing: 220kg
HT 500 (Heavy Traffic)	Application: Heavily traffic areas, such as main highways and supermarket car parks with high vehicle turnover. This option has DIBt approval. Material: Filter Substrate: Heavy Traffic Weight of filter element: 54kg Total weight of ACO QuadraCeptor unit including polyethylene housing: 300kg

*QuadraCeptor solutions are available for removal of high levels of copper or zinc: please contact technical@aco.co.uk or 01462 816666.

ACO QuadraCeptor

Product code	Description	Nature of the surface to be drained	Size of the surface to be drained (m²)	Replacement filter element (set of 4)
26650	R1000 (Roof)	Roofs without a significant proportion (<5%) of uncoated metals	1000	26654
26651	T750 (Traffic)	Trafficked areas with normal levels of pollutants, such as staff car parks and side streets	750	26654
26652	HT500 (Heavy traffic)	Heavily traffic areas, such as main highways and supermarket car parks with high vehicle turnover	500	26555

Dimensions



Water quality performance

Pollution Mitigation Indices		
Total Suspended Solids	Metals	Hydrocarbons
0.8	0.8	0.8

		Typical values from surface run off					Standards		
Parameter	Unit	Roofs			Traffic		Drinking Water ¹	Infiltration ²	ACO QuadraCeptor output ³
		Non metal	Copper	Zinc	Low vehicle turnover ⁴	High vehicle turnover ⁵			

Physico-chemical parameters

Conductivity	uS/cm	25 to 270	25 to 270	25 to 270	50 to 2500	110 to 2500	2500	-	< 1500
pH		4.7 - 6.8	4.7 - 6.8	4.7 - 6.8	6.4 to 8.0	6.4 to 8.0	6.5 - 9.5	-	7.0 – 9.5

Nutrients

Phosphorous, P	mg/L	0.06 to 0.5	0.06 to 0.5	0.06 to 0.5	0.09 to 0.3	0.23 to 0.35	no limit set		0.2
Ammonia/ammonium, NH ₄	mg/L	0.1 to 6.0	0.1 to 6.0	0.1 to 6.0	0 to 1.0	0.5 to 2.3	0.5	-	0.3
Nitrates, NO ₃	mg/L	0.1 to 5.0	0.1 to 5.0	0.1 to 5.0	0 to 16	0 to 16	50	-	*6

Heavy metals

Cadmium, Cd	µg/L	0.2 to 2.5	0.2 to 1.0	0.5 to 2	0.2 to 1.7	0.3 to 13	5	5	<1.0
Zinc, Zn	mg/L	24 to 4900	24 to 900	1700 - 44000	15 to 1500	120 to 2000	no limit set	500	<500 ^{*7}
Copper, Cu	mg/L	0.6 to 3.5	2000 to 8500	11 to 900	21 to 140	97 to 100	2	50	< 50 ^{*7}
Lead, Pb	µg/L	2 to 500	2 to 500	4 to 300	70 to 170	11 to 525	10	25	<25
Nickel, Ni	µg/L	2 to 7	2 to 7	2 to 7	4 to 70	4 to 70	20	50	<20
Chromium, Cr	µg/L	2 to 6	2 to 6	2 to 6	6 to 50	6 to 50	50	50	<50

Organic substances

Polycyclic aromatic hydrocarbons, PAH	µg/L	0.4 to 0.6	0.4 to 0.6	2 to 7	0.2 to 17	0.2 to 17	0.1	0.2	<0.2
Total petroleum hydrocarbons, TPH	µg/L	0.1 to 3.0	0.1 to 3.0	2 to 6	0.1 to 6.5	0.1 to 6.5	-	0.2	<0.2
Quadraceptor Model		R1000 (Roof)	Contact ACO ^{*8}	T750 (Traffic)	HT500 (Heavy Traffic)				

^{*1} Water Supply (Water Quality) Regulations 2000. Maximum values shown

^{*2} Control values for infiltration of surface water according to the German Federal Soil Protection Act (1999) and used as the basis for DIBt approval. Maximum values shown.

^{*3} Output values based on average annual loads.

^{*4} e.g. residential streets, office car parks.

^{*5} e.g. highways, supermarket car parks, distribution yards.

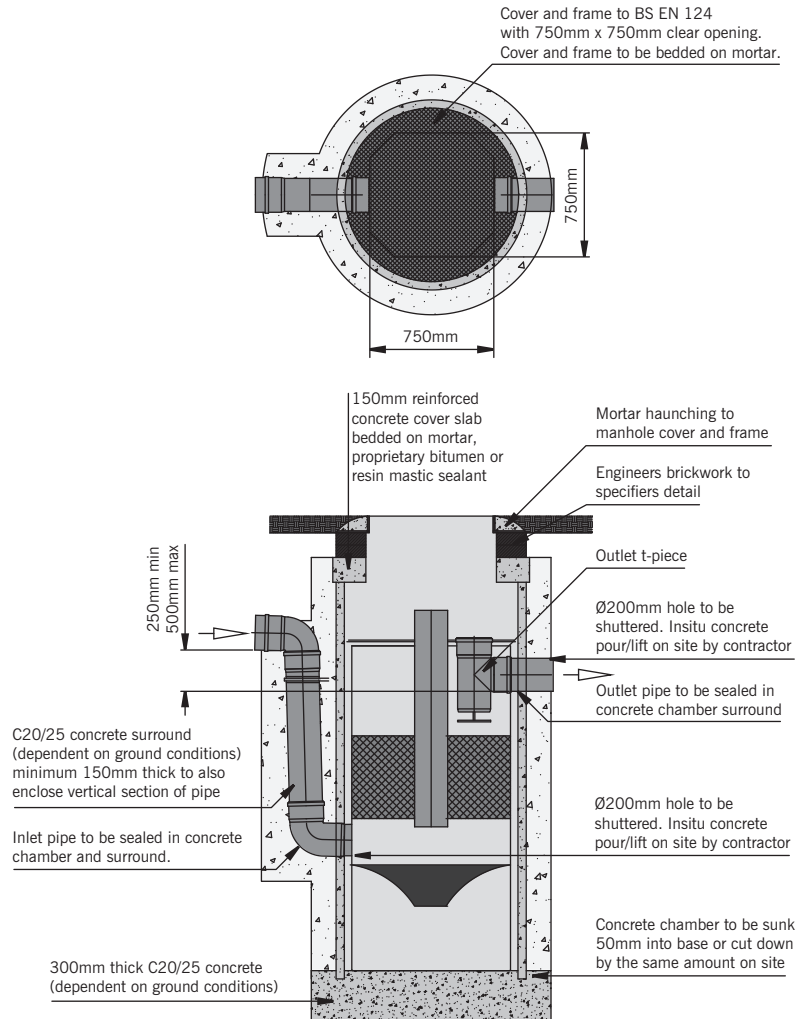
^{*6} Nitrate levels are not significantly reduced

^{*7} Values shown are not applicable to copper or zinc roofs where a second treatment stage is required

^{*8} QuadraCeptor solutions are available for removal of high levels of copper or zinc: please contact technical@aco.co.uk or 01462 816666.

Specifiers and Contractors are advised to obtain a copy of the full installation recommendations from www.aco.co.uk, or the ACO Design Services department at technical@aco.co.uk or telephone 01462 816666.

1. This outline guidance assumes that the ACO Quadraceptor unit will be installed with a concrete backfill. Engineering advice should be sought to ensure any site specific conditions are addressed.
2. Quadraceptor units should be stored on firm level ground. Do not drag, drop or roll the units.
3. Excavate a hole to receive the unit, allowing a minimum 300mm thickness of concrete below the unit and 150 mm around the sides, allowing sufficient space for concrete surround to encapsulate the vertical inlet pipework. Allow sufficient working space for the connection of all pipework. Any unstable ground should be removed and replaced. Engineering advice may be necessary. The excavation is to be kept free of water.
4. Prior to installation all filter elements should be removed or covered to prevent contamination or fouling during installation.
5. All concrete used in the installation process must be of minimum grade C20/25. Where necessary, a higher specification concrete mix may be required and engineering advice should be sought. Pour a minimum 300mm thickness of concrete onto the base of the excavation. Whilst the concrete is still wet carefully lower the Quadraceptor unit onto the concrete. Check that the unit is fully supported by the concrete, and that the unit is level, at the correct height and in the correct orientation. Allow the concrete to harden.



6. The vertical distance from the bottom of the incoming pipework to the bottom of the outlet pipework must be a minimum of 250 mm and a maximum of 500 mm (see outline installation drawing for guidance).
7. Prior to back-filling the excavation, using appropriate concrete mix, all pipework should be connected and sealed to prevent contamination of the system, and any additional shaft rings and top cover put in place.
8. After installation filter elements should be re-installed, or anti-fouling covers removed. The end cap maintenance cover and other buoyancy protective devices should be checked for correct insertion. The T-Piece on the outlet pipework should be connected from the inside of the drainage line (see outline installation drawing for guidance).
9. Prior to commissioning and operation the ACO Quadrceptor must be inspected for proper installation by a competent person.

Maintenance and servicing

To ensure the ACO Quadraceptor surface water runoff treatment system provides continuous and reliable environmental protection it needs appropriate maintenance and servicing. Where a system is correctly maintained in accordance with supplier recommendations the environmental performance will be maintained, otherwise environmental damage and increased liability are likely to be experienced. ACO service partners work closely with the relevant UK Environment Agencies and are able to offer ongoing maintenance and servicing programmes, waste disposal, inspection, testing and full installation and commissioning of water treatment systems and alarms. For further details please contact the ACO Water Management Design Services Team on 01462 816666.

Model specification clause

The water treatment system shall be an ACO Quadraceptor water treatment system, supplied by ACO Water Management. The unit shall be manufactured from High Density Polyethylene and incorporate a filtration system appropriate to the intended end use.

The ACO Quadraceptor surface water treatment system is to be designed and manufactured in conformity with German DIBT requirements and shall be installed in accordance with the manufacturer's recommendations.



NBS Specification

ACO Quadraceptor should be specified in section R12 327. Assistance in completing this clause can be found in ACO Technologies product entries in NBS Plus or a model specification can be downloaded from www.aco.co.uk. For further assistance, contact the ACO Water Management Design Services Team.

ACO Technologies plc

- ACO Water Management
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ACO Water Management: Civils + Infrastructure

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