

ISG Construction Ltd

Whitefield Fire Station

Surface Water Management Report

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Preliminary Note

This report has been produced by Mark Symonds who has over 19 years' experience in infrastructure engineering (in particular surface water management design), and has qualifications including: BSc (Hons) Civil Engineering (2003); HND Civil Engineering Studies (2002); and OND Construction Studies (2000).

1. Introduction

Bradshaw Gass & Hope LLP have prepared this surface water management report to support a detailed drainage design for Whitefield Fire Station, which is in the Bury Metropolitan Borough Council area.

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) ('Flood Risk and Coastal Change' section), released in March 2014 and updated in August 2022;
- National Standards for Sustainable Drainage Systems (SuDS) set out by the Department for Environment, Food & Rural Affairs (DEFRA) (2011);
- CIRIA (2010) Planning for SuDS – Making it Happen C687;
- CIRIA SuDS Manual C753 (2015);
- Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015);
- Bury Council Preliminary Flood Risk Assessment (May 2011);
- Bury, Rochdale and Oldham Strategic Flood Risk Assessment (November 2009);
- Greater Manchester Surface Water Management Plan (January 2012);
- Bury Council Local Plan (October 2018).

Bury Metropolitan Borough Council (acting as Lead Local Flood Authority - LLFA), and United Utilities (local water company and sewerage undertaker), 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;
- 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. Site Setting and Description

2.1. Site Location

The fire station site is in a residential area of Whitefield, is approximately 500m north of Whitefield station, and as shown on the site location plan in Appendix A, is bound by residential dwellings to the north; George Street to the east and south; and Bury New Road to the west.

The address of the site is Whitefield Fire Station, Bury New Road, Whitefield, Manchester, M45 7SY, with the co-ordinates for the centre of the site being E: 380485, N: 406475.

2.2. Existing Site and Topography

As detailed on the existing site / topographical survey plan in Appendix B, the site currently consists of a fire station building to the centre, with hard-standing training yard areas to the north and east, soft-landscaping areas to the south, and hard-standing access areas to the west.

In terms of topography the site has a general fall towards the north-east boundary, where the levels range from approximately 103.92m AOD along the south-west boundary to approximately 102.65m AOD along the north-east boundary.

2.3. Proposed Development

The proposed site plan is shown in Appendix C, with a full description being stated by the Architect. In brief, and in relation to this surface water management report, the proposal is to demolish the existing fire station building, and to build a new building in the centre of the site, with reformed parking and training yard areas to the north and east, and reformed soft-landscaping areas to the south.

2.4. Ground Conditions

A Soakaway Suitability Letter Report was issued by IGE Consulting in February 2023 (see Appendix D), which states that 4 boreholes were excavated at the site that found the ground to consist of made ground to a depth of 2.80m bgl, over Glaciofluvial Deposits (peat, clay, silt and clay).

Infiltration tests (via falling head tests) at depths of between 0.430m to 2.08m bgl, show the ground to have infiltration rates of between 4.48×10^{-5} m/s and 5.60×10^{-5} m/s.

The test shows that the ground is suitable for infiltration of surface water to ground. However, any potential soakaways will have to be in made ground, which is unfeasible due to potential contamination and stability issues.

2.5. Waterbody / Rivers / Canals / Reservoirs

There are no known waterbodies, rivers, canals, or reservoirs directly adjacent to the development site, with the nearest waterbody being the River Irwell approximately 1 km to the north-west

2.6. On-Site Drainage / Public Sewers

As detailed on the United Utilities pre-development response and asset plan in Appendix D, there is a 375mm diameter combined water sewer in Bury New Road (west of the site), with no surface water sewers near the site.

The Utilities plan in Appendix E, identifies existing 100mm diameter combined water drainage networks within the site that takes the surface water run-off from the existing building and external hard-standing areas.

2.7. Development Areas

The overall site boundary area is approximately 3,510m² / **0.351 ha**.

The existing fire station site consists of the building and hard-standing training yard areas, which equate to approximately 2,570m² / 0.257 ha, with the remaining grassed / soft-landscaping areas equating to approximately 940m² / 0.094 ha.

The surface water run-off from the developed areas discharges to the existing combined water drainage network, with the surface water run-off from the grassed areas discharging off the site at a natural / greenfield rate.

Therefore, in terms of the pre-development surface water run-off calculations, the area of **0.257 ha** is to be used, and in terms of greenfield run-off calculations, the site has an urban factor of **0.73** (0.257 ha / 0.351 ha).

The proposed fire station site will consist of the new building and reformed hard-standing parking and training areas which equate to approximately 1,890m² / 0.189 ha, with the reformed soft-landscaping areas equating to approximately 1,620m² / 0.162 ha.

The surface water run-off from the developed areas of the proposed fire station site is to discharge to a below ground drainage network, with the surface water run-off from the permeable (soft-landscaping) areas continuing to discharge off the site at a natural / greenfield rate.

Therefore, the post development surface water management area is based on an area of **0.189 ha**.

3. Surface Water Management Principles

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

3.1. 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.

3.2. 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).

3.3. 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.

3.4. Peak Surface Water Flow

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

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event'.

United Utilities have stated (see Appendix e) that the peak surface water flow from the development site is to be 5.0 l/s, if discharging to their 375mm diameter combined water sewer in Bury New Road.

As the site is previously developed, the aim will be to reduce the run-off rates to the equivalent greenfield rates, or to a peak flow rate of 5.0 l/s for all storm events.

3.5. Volume Control

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

S5 Where reasonably practicable, for developments which have been previously developed, 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 must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that 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 S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk'.

3.6. 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. Surface Water Run-Off Destination

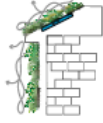
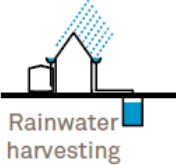
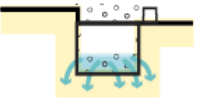
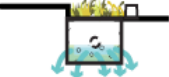
The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

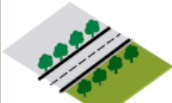
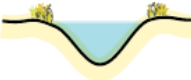
Run-Off Destination	Feasible	Description
Discharge to Ground	No	A Soakaway Suitability Letter Report was issued by IGE Consulting (February 2023), stated that 4 boreholes were excavated at the site that found the ground to consist of made ground to a depth of 2.80m bgl, over Glaciofluvial Deposits (peat, clay, silt and clay). Infiltration tests (via falling head tests) at depths of between 0.430m to 2.08m bgl, show the ground to have infiltration rates of between 4.48×10^{-5} m/s and 5.60×10^{-5} m/s. The test shows that the ground is suitable for infiltration of surface water to ground. However, any potential soakaways will have to be within the made ground, which is unfeasible due to potential contamination and stability issues. Therefore, due to the presence of made ground, discharge to ground is not feasible.
Discharge to Surface Water Body	No	There are no known waterbodies near the development site. Therefore, discharge to a surface waterbody is not feasible.
Discharge to Surface Water Sewer	No	There are no known surface water sewers near to the development site. Therefore, discharge to a surface water sewer is not feasible.
Discharge to Highway Drain or Other	No	There are no known highway or other drains near to the development site. Therefore, discharge to a highway or other drain is not feasible.
Discharge to Combined Water Sewer	Yes	As the ground is not suitable for soakaways, and there are no known waterbodies, surface water sewer, or highway drains near the site, the only alternative is a discharge to the 375mm combined water sewer in Bury New Road. The principle of discharging to the 375mm sewer has been agreed with United Utilities.

5. 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	Potential Use	Description
Green Roofs	Yes	There is potential to have biodiverse roofs over parts of the new fire station building. Full details to be confirmed, but the biodiverse roof will reduce surface water run-off rates, act as a pollutant control, and add biodiversity to the development.
Rainwater Harvesting	Yes	Rainwater harvesting tanks could be installed for use with firefighting practices. Full details of the harvesting method / size / volume to be confirmed.
Soakaway	No	A Soakaway Suitability Letter Report was issued by IGE Consulting (February 2023), stated that 4 boreholes were excavated at the site that found the ground to consist of made ground to a depth of 2.80m bgl, over Glaciofluvial Deposits (peat, clay, silt and clay). Infiltration tests (via falling head tests) at depths of between 0.430m to 2.08m bgl, show the ground to have

		infiltration rates of between 4.48×10^{-5} m/s and 5.60×10^{-5} m/s. The test shows that the ground is suitable for infiltration of surface water to ground. However, any potential soakaways will have to be within the made ground, which is unfeasible due to potential contamination and stability issues. Therefore, due to the presence of made ground, the use of soakaways is not suitable.
Filter Strips	No	There are limited areas within the site for filter drains, and therefore this is not a suitable SuDS method.
Permeable Paving	No	External parking and yard areas are used by heavy loads vehicles, where permeable paving will not have the structural integrity to withstand the loads. Therefore, it is deemed that this is not a suitable SuDS method.
Swale	No	There are limited areas within the site for swales (trees within soft-landscaping areas to the south), and therefore this is not a suitable SuDS method.
Pond / Basin	No	There are limited areas within the site for ponds/ basins (trees within soft-landscaping areas to the south), and therefore this is not a suitable SuDS method.
Underground Storage	Yes	The surface water run-off from the site will be restricted. Therefore, there will be a requirement to have underground storage for storm events up to 1 in 30-year; and to suitably sized so that the volume of water during the 1 in 100-year storm event is kept a minimum at surface level, where it can be contained on the site.

6. Development Greenfield Run-Off Rates

To minimise the surface water run-off from the new fire station site, it is preferred that the post development surface water run-off be restricted to the equivalent greenfield run-off rates and volume.

6.1. 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 of Ciria C753 Table 24.2 to generate Growth Factors. These are used to convert QBAR to different return periods for different regions in the UK.

The input variables to establish QBAR are:

Return Period (years) Results based on a range of return periods and the specified RP;

Area Catchment Area (ha) which is adjusted to km² for use in the equation;

SAAR Average annual rainfall in mm (1941-1970) from FSR figure II.3.1;

Soil Procedure Volume 3. Soil classes 1 to 5 have Soil Index values of 0.15, 0.3, 0.4, 0.45 and 0.5 respectively;

Urban Proportion of area urbanised expressed as a decimal;

Region Number Region number of the catchment based on FSR Figure I.2.4.

QBAR(l/s)

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

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

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 = 1056

Soil = 0.450

Urban Factor = 0.73

Region Number = 10

The calculations in Appendix G show the rate for 50.00ha is 824.1 l/s, but is to be reduced to reflect the surface water catchment area (0.189 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

$$\text{QBAR} = 3.11 \text{ l/s (16.48 l/s/ha)}$$

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	3.11 l/s	0.93	2.9 l/s
Q ₃₀	3.11 l/s	1.70	5.2 l/s
Q ₁₀₀	3.11 l/s	2.08	6.5 l/s

6.2. 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 G.

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

Site Location	=	GB 380483 406476 SD 80483 06476
Area	=	0.189 ha
SAAR	=	1057
CWI	=	123.493
SPR Host	=	47.000
URBTEXT	=	0.50 (actual 0.73, but 0.50 highest for calculation)

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

Q ₁₀₀ (6-Hour)	=	72.44m ³ (383.30m ³ /ha)
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7. Pre-Development Surface Water Run-Off Rates

The pre-development surface water run-off rates from the existing developed areas of the site are to be calculated, so that the post development rates are at least a betterment.

The calculations to determine the pre-development surface water run-off rates and volume are based on the pre-development surface water run-off area of 0.257 ha, the rainfall data given by the FEH 2013, and simulation / calculations in the MicroDrainage computer software (see Appendix H).

Based on the FEH 2013 data and computer software results, the pre-development surface water run-off rates are as follows:

$$Q_2 = 35.8 \text{ l/s}$$

$$Q_{30} = 83.2 \text{ l/s}$$

$$Q_{100} = 107.9 \text{ l/s}$$

Based on the above variables for the surface water run-off from the pre-development areas, it has been calculated that the pre-development surface water discharge volume (at 6-hour storm events) is as follows:

$$Q_{100} (6\text{-Hour}) = 145.32\text{m}^3 (360\text{-minute storm duration})$$

8. 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.

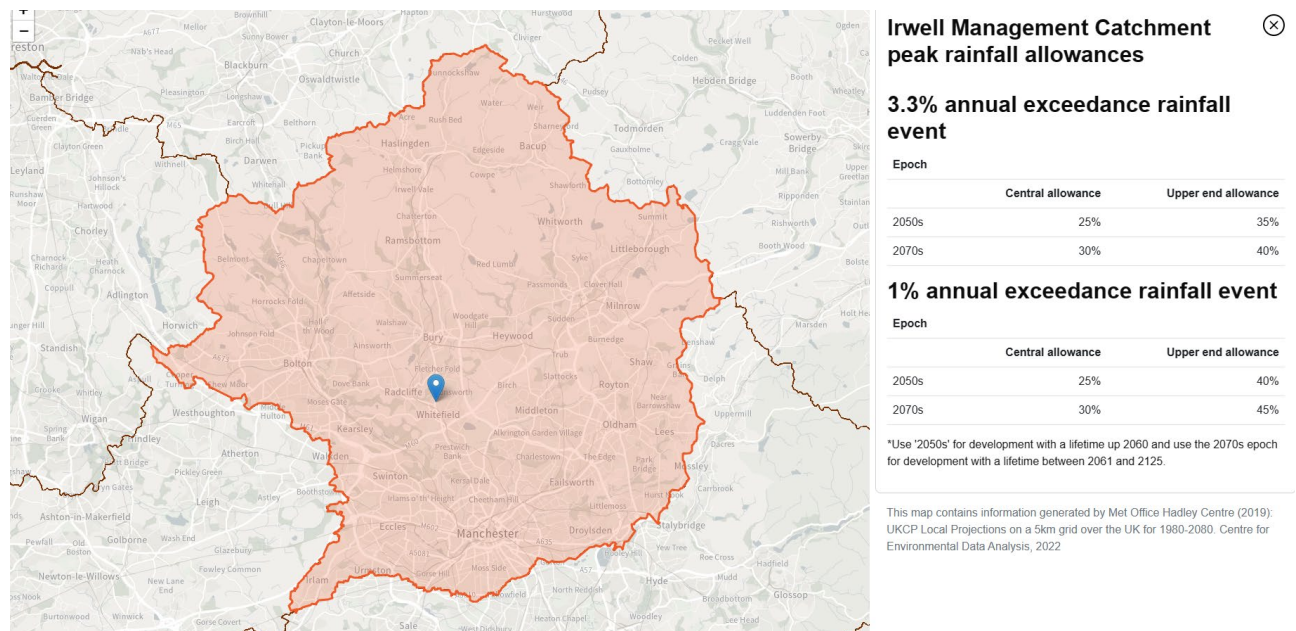


Figure 1 - Department for Environment Food & Rural Affairs – Climate Change Allowances

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.

9. Below Ground Drainage Networks and Surface Water Management Calculations

9.1. 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 0.189 ha, and the rainfall data given by the FEH 2013.

9.2. Surface Water Drainage Network and Management

As shown on the below ground drainage layout drawing in Appendix I, the proposed surface water network will consist of 150mm to 300mm diameter pipes; 460mm diameter inspection chambers, 1200mm to 1500mm diameter manholes; a petrol interceptor; a flow control chamber containing a hydro-brake; a below ground attenuation tank in the form of cellular units.

The surface water network will flow to the west of the site, where it will pass through the flow control chamber and petrol interceptor, prior to discharge to the 375mm diameter combined water sewer in Bury New Road.

The restricted water will back flow and fill the network and attenuation tank (in the form of cellular units), where the water will be stored during the storm event to prevent flooding.

9.3. Surface Water Run-Off Rate

For the surface water run-off from the entire development site to be at the greenfield run-off rate, the surface water run-off rate for post development site is to be restricted to 2.9 l/s for the 1 in 1-year storm event; 5.2 l/s for the 1 in 30-year storm event including 40% climate change., and 6.5 l/s for the 1 in 100-year storm event including 45% climate change.

For the surface water run-off from the development site to be a reduction of the pre-development run-off rates, the surface water run-off rate for post development site is to be restricted to at less 35.8 l/s for the 1 in 1-year storm event; 83.2 l/s for the 1 in 30-year storm event including 40% climate change., and 107.9l/s for the 1 in 100-year storm event including 45% climate change.

However, United Utilities have stated that the peak surface water run-off rate for each of the storm events (up to and including the 100-year + 45% climate change event) is to be 5.0 l/s.

Therefore, as shown in the output calculation from the MicroDrainage computer software in Appendix J, if the hydro-brake opening is set at 100mm, with a design head of 1.390 m, and a design flow of 5.0 l/s, the maximum surface water run-off rates for each storm event will be as follows:

Strom	-	Rate	-	Critical Storm Event
Q ₂	-	4.9 l/s	-	30-minute winter storm duration
Q _{30 + cc}	-	5.0 l/s	-	120-minute winter storm duration
Q _{100 + cc}	-	5.0 l/s	-	240-minute winter storm duration

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

Greenfield Rate to Post Development Rate

Strom	-	Greenfield	-	Post Dev	-	Difference
Q ₂	-	2.9 l/s	-	4.9 l/s	-	69% Increase
Q _{30+ 40%}	-	5.2 l/s	-	5.0 l/s	-	4% Reduction
Q _{100 + 45%}	-	6.5 l/s	-	5.0 l/s	-	23% Reduction

Pre-Development Rate to Post Development Rate

Strom	-	Pre-Dev	-	Post Dev	-	Difference
Q ₂	-	35.8 l/s	-	4.9 l/s	-	86% Reduction
Q _{30 + 40%}	-	83.2 l/s	-	5.0 l/s	-	94% Reduction
Q _{100 + 45%}	-	107.9 l/s	-	5.0 l/s	-	95% Reduction

The surface water run-off rates exceed the 1-year greenfield rate, but are between a 4% and 23% reduction of the 30-year and 100-year greenfield rates, respectively, and are between an 86% to 95% reduction of the pre-development rates. Therefore, the rates are deemed to be acceptable, as they meet the requirements of the Non-Statutory Technical Standards for Sustainable Drainage Systems S3 (see Section 3.4) and United Utilities.

9.4. Surface Water Run-Off Volume

The surface water run-off volumes for the post development site can be calculated for 1 in 100-Year the 6-hour duration (Inc. 45% CC), based on the peak discharge rate of 5.0 l/s, where:

$$Q_{100 \text{ (6-hour)}} - 5.0 \text{ l/s} \times (60 \times 60 \times 6) - 108,000 \text{ litres} - 108.00\text{m}^3$$

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

Greenfield Volume to Post Development Volume

Strom	-	Greenfield	-	Post Dev	-	Difference
Q ₁₀₀	-	72.44m ³	-	108.00m ³	-	49% Increase

Pre-Development Volume to Post Development Volume

Strom	-	Pre-Dev	-	Post Dev	-	Difference
Q ₁₀₀	-	145.32m ³	-	108.00m ³	-	26% Reduction

The surface water run-off volume for the 100-year, 6-hour storm event is a 49% increase of the greenfield volume, but a 59% reduction of the pre-development volume. Therefore, the volume is still deemed to be acceptable, as it still meets the requirements of the Non-Statutory Technical Standards for Sustainable Drainage Systems – S5-S6 (see Section 3.5).

9.5. 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'*.

And PPS25 Practice Guidance Paragraph 5.51 previously stated that: *'For events with a return-period in excess of 30 years, surface flooding of open spaces such as landscaped areas or car parks is acceptable for short periods, but the layout and landscaping of the site should aim to route water away from any vulnerable property, and avoid creating hazards to access and egress routes. No flooding of property should occur as a result of a one in 100-year storm event (including an appropriate allowance for climate change)'*.

Attenuation will be within the drainage network and below ground attenuation tank in the form of cellular units.

As detailed in the MicroDrainage calculations (Appendix J) and below ground drainage layout (Appendix I) the attenuation volumes and details for the SuDS method are as follows:

Attenuation Tank Length	-	36.00m
Attenuation Tank Width	-	3.00m
Attenuation Tank Area	-	108.000m ²
Attenuation Tank Depth	-	1.20m
Porosity	-	0.95
Attenuation Tank Volume	-	123.12m ³
<i>Overall Tank Volume</i>	-	<i>129.60m³</i>

The calculations show that no flooding occurs from the network for all storms up to and including the 100-year + 45% climate change event. All restricted surface water will therefore be contained on site, and is deemed acceptable.

10. Maintenance Requirements

The extent of the drainage network and SuDS features for the development site are shown on the below ground drainage layout drawings in Appendix I.

The management and maintenance of the surface water drainage networks and SuDS features will be by contractors appointed by Whitefield Fire Station, which will form part of the overall site management and maintenance schedule. Details of which are as follows:

10.1. Surface Water Drainage Network, Cellular Units and Flow Control Chamber

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

10.2. 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.

11. Conclusion / Summary

11.1. SuDS Principles and Discharge Destination

All feasible SuDS methods, and surface water discharge destination have been assessed, with the feasible SuDS methods being cellular units and a flow control chamber, and the surface water destination being to a combined water sewer.

11.2. Peak Flow Control

The surface water run-off rates exceed the 1-year greenfield rate, but are between a 4% and 23% reduction of the 30-year and 100-year greenfield rates, respectively, and are between an 86% to 95% reduction of the pre-development rates. Therefore, the rates are deemed to be acceptable, as they meet the requirements of the Non-Statutory Technical Standards for Sustainable Drainage Systems S3 (see Section 3.4) and United Utilities.

11.3. Volume Control

The surface water run-off volume for the 100-year, 6-hour storm event is a 49% increase of the greenfield volume, but a 59% reduction of the pre-development volume. Therefore, the volume is still deemed to be acceptable, as it still meets the requirements of the Non-Statutory Technical Standards for Sustainable Drainage Systems – S5-S6 (see Section 3.5).

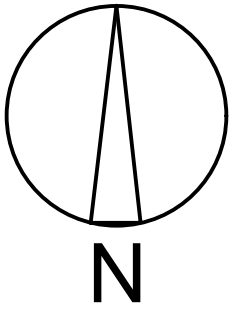
11.4. Flood Risk within the Development

The below ground cellular unit structure will be suitably sized so that no flooding occurs from the network for all storms up to and including the 100-year + 45% climate change event. All restricted surface water will therefore be contained on site, and is deemed acceptable.

11.5. Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be by contractors appointed by Whitefield Fire Station, which will form part of the overall site management and maintenance schedule.

Appendix A - Site Location Plan



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P1	FIRST ISSUE	ST	
ref	revision	by	date

client	GREATER MANCHESTER COMBINED AUTHORITY		
project	NEW FIRE STATIONS		
drawing	WHITEFIELD FS - LOCATION PLAN		
drawn by	ST	date	MAR 23
scale	1:1250		A4
dwg no	1978.35.4251	rev	P1
		status	PLANNING



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Bradshaw Gass & Hope LLP

Appendix B - Topographical Survey



status

PLANNING

This drawing is copyright Bradshaw Gass & Hope LLP and is not to be copied, reproduced or re-distributed either in whole or in part without the prior written permission of the originator.

The originator shall have no responsibility for any liability, loss, cost, damage or expense arising from or relating to any use of this document other than for its intended purpose on this project.

This drawing shall be read in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work.

All dimensions are to be checked on site by the contractor prior to proceeding with any work.

Hazard Identification

!

ref	hazard	date

N

P1	FIRST ISSUE	ST	
ref	revision	by	date

B
&
H

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Bradshaw Gass & Hope LLP

client

GREATER MANCHESTER
COMBINED AUTHORITY

project

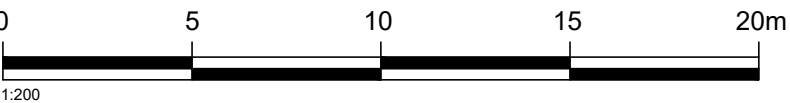
NEW FIRE STATIONS
FEASIBILITY STUDIES

drawing

WHITEFIELD FIRE STATION
EXISTING SITE PLAN

drawn by	ST	date	MAR 23
checked by		date	
scale	1:200		A1
dwg no	1978.35.4252	rev	P1

Appendix C - Proposed Site Plan



N

-
-  TREE TO BE RETAINED
 TREE TO BE REMOVED
 NEW TREE
 NEW SOFT LANDSCAPING
 WORKS WITHIN THE PUBLIC HIGHWAY

P3	HARDSTANDING AREA REDUCED / SOFT LANDSCAPING INCREASED	ST	23.06.23
P2	PLANT ENCLOSURE SHOWN AT GROUND LEVEL. BUILDING FOOTPRINT UPDATED. AMBULANCE BAY RELOCATED	ST	12.04.23
P1	FIRST ISSUE	ST	17.03.23
ref	revision	by	date


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Bradshaw Gass & Hope LLP

client			
GREATER MANCHESTER COMBINED AUTHORITY			
project			
NEW FIRE STATIONS FEASIBILITY STUDIES			
drawing			
WHITEFIRE FIRE STATION PROPOSED SITE PLAN			
drawn by		ST	date
checked by			MAR 23
		date	
scale		1:200	A1
dmg no		1978.35.4253	rev
			P3

Appendix D - Ground Investigation Data



3866/LM/03-a

24th February 2023

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WHITEFIELD FIRE STATION - SOAKAWAY SUITABILITY LETTER REPORT

Introduction

IGE Consulting were instructed in October 2022 to undertake Phase 1 and Phase 2 investigations at the above-named site. This site is c.0.35Ha and located to the east of Bury New Road, Whitefield at the approximate post code M45 7SY. The National Ordnance Survey Grid Reference for the centre of the site is 380477E, 406478N. The Phase 1 investigation report was produced in February 2023 (Ref: 3866a-01 Rev A) and the Phase 2 intrusive investigation work was completed between December 2022 and February 2023.

The investigation comprised the drilling of 4 No. dynamic sample boreholes and 3 No. cable percussive boreholes. The shallow ground conditions, though noted to vary across site, are generalised below:

- **Made Ground** comprising asphalt and concrete to between 0.34 and 0.40m bgl (no hardstanding encountered at DS04), underlain by:
- **Made Ground** comprising sub base of limestone and concrete to between 0.85 and 1.25m bgl
- **Made Ground** comprising sandy clay (locally organic) to depths of between 1.60 and 2.80m bgl (0.75m at DS04), underlain by:
- **Glaciofluvial Deposits** comprising peat, clay, silt and sand.

Infiltration Testing

Infiltration testing was carried out via falling head tests in combined gas and groundwater monitoring wells. The infiltration testing was completed in DS01, DS03 and DS04, with the monitoring wells for DS02 and BH03 having groundwater levels above that of the well response zone.



Location	Standing Groundwater Level (m bgl)	Response Zone (m bgl)	Test began at (m bgl)	Test ended at (m bgl)	Infiltration rate, k (m/s ²)
DS01	1.64	1 - 2	1.13	1.66	5.60x10 ⁻⁵
DS03	2.42	2 - 4	0.37	1.79	5.28x10 ⁻⁵
DS04	1.58	1 - 2	0.15	0.80	4.48x10 ⁻⁵

Soakaway Feasibility

Infiltration rates were recorded between 4.48 and 5.60x10⁻⁵ m/s², which would ordinarily indicate that the ground conditions were suitable for soakaway drainage. However, consideration must be given to a number of other factors.

Whilst no groundwater strikes were recorded during the formation of the dynamic sample boreholes, shallow groundwater has been recorded in all exploratory holes during each of the completed 4 No. monitoring visits. The depth of groundwater monitored ranged between 0.83 and 2.42m bgl; this is indicative of a shallow permanent groundwater body at the site. It is considered likely that this shallow groundwater body may preclude the use of soakaway drainage.

The Phase 1 investigation identified the possibility of firefighting foam having been used at the site historically. Firefighting foam is a source of PFAS compounds which can be persistent, bio-accumulative and toxic (PBT). If firefighting foam, or vehicles that carried firefighting foam were ever used on site, there is the potential for PFAS to be present on the surface hardstanding and within any shallow Made Ground at the site.

The influx of large amounts of water through soakaway drainage would give rise to the possibility of mobilising and transporting these contaminants both laterally and vertically. The Phase 1 report indicated the presence of a Secondary (A) Aquifer within the superficial deposits in the eastern site section, and a Principal Aquifer within the bedrock. Therefore, it is assessed that the historical contamination of the site with PFAS is likely to preclude the use of soakaway drainage.

Conclusion

Based upon the potential widespread presence of PFAS compounds and the existing shallow groundwater, the use of soakaways within the proposed commercial scheme is not considered feasible at this stage.

If additional information is needed, do not hesitate to ask.

Yours sincerely,

Liam McMahon MEng MSc FGS
Senior Geo-Environmental Engineer

Enc

Exploratory Hole Logs

Exploratory Hole Location Plan

Infiltration Testing Results

IGEconsulting Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log ver. 1.5		Dynamic Sample No. DS01					
Project Name: Whitefield Fire Station		Co-ords:	380490E - 406496N		Project No. 3866a				
Location: Whitefield, Greater Manchester		Level (m AOD):	102.95		Logged By LM				
Client: Greater Manchester Combined Authority		Date:	15/12/2022		Checked By				
Weather:		Freezing							
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description	
		Depth(m)	Type	Results					
					0.04	102.91		ASPHALT MADE GROUND	
					0.34	102.61		CONCRETE MADE GROUND	
								Light greyish brown clayey sandy angular to subangular fine to coarse GRAVEL of limestone and concrete. MADE GROUND	
		0.80	ES						
		0.80	PID	0.00ppm					
		1.00	SPT(C)	N=2 (2,0/1,0,0,1)					
					1.25	101.70		Soft dark brown mottled light grey sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of concrete, brick fragments, mudstone and sandstone. MADE GROUND	
		1.50	ES						
		1.50	PID	0.00ppm					
		2.00	D						
		2.00	SPT(C)	N=5 (4,2/1,1,1,2)					
		2.50	ES						
2.50	PID	0.00ppm							
			2.80	100.15		Very soft dark brown pseudofibrous PEAT GLACIOFLUVIAL SHEET DEPOSITS			
3.00	D								
3.00	SPT(C)	N=4 (2,1/1,1,1,1)							
			3.25	99.70		Soft to firm light grey silty CLAY GLACIOFLUVIAL SHEET DEPOSITS			
4.00	D								
4.00	SPT(C)	N=6 (1,1/1,1,2,2)							
			4.50	98.45		Firm light greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. GLACIOFLUVIAL SHEET DEPOSITS			
5.00	D								
5.00	SPT(C)	N=11 (3,3/2,3,3,3)							
			5.45	97.50		Dynamic Sample terminated at 5.45m.			
Remarks:		Water Strike		Casing Details		Sample Sleeve Runs			
Hardstanding cored. Dynamic sample progressed to target depth at 5.45m bgl.		Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)	
				4.00	115	0.00	1.00	87mm 100%	
						1.00	2.00	87mm 75%	
						2.00	3.00	77mm 60%	
						3.00	4.00	77mm 90%	
						4.00	5.00	67mm 70%	

IGEconsulting Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log ver. 1.5		Dynamic Sample No. DS02						
Project Name: Whitefield Fire Station		Co-ords:	380501E - 406463N		Project No. 3866a					
Location: Whitefield, Greater Manchester		Level (m AOD):	102.67		Logged By LM					
Client: Greater Manchester Combined Authority		Date:	15/12/2022		Checked By					
Weather:		Freezing								
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description		
		Depth(m)	Type	Results						
					0.05	102.62		ASPHALT MADE GROUND		
						0.35	102.32			CONCRETE MADE GROUND
		0.50	ES			0.85	101.82			Soft light grey sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of concrete, limestone, brick fragments and timber fragments. MADE GROUND
		0.50	PID	0.00ppm						
		1.00	D			1.35	101.32			Soft dark grey slightly sandy slightly gravelly organic CLAY. Gravel is subangular fine of mudstone and timber fragments. MADE GROUND
		1.00	ES							
		1.00	SPT(C)	N=2 (1,0/1,0,1,0)		1.90	100.77			Very soft dark brown pseudofibrous PEAT. MADE GROUND
		1.00	PID	0.00ppm						
		2.00	D			2.70	99.97			Soft locally very soft light grey mottled dark grey silty organic CLAY. GLACIOFLUVIAL SHEET DEPOSITS
		2.00	SPT(C)	N=0 (1,0/0,0,0,0)						
					2.90	99.77		Very soft dark brown pseudofibrous clayey PEAT GLACIOFLUVIAL SHEET DEPOSITS		
		3.00	D							
		3.00	SPT(C)	N=0 (1,0/0,0,0,0)		4.40	98.27			Soft becoming firm light grey slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of mudstone and sandstone. GLACIOFLUVIAL SHEET DEPOSITS
		4.00	D							
		4.00	SPT(C)	N=9 (2,2/2,2,2,3)						
		5.00	D							
		5.00	SPT(C)	N=29 (6,7/7,7,7,8)						
Remarks:		Water Strike		Casing Details		Sample Sleeve Runs				
Hardstanding cored. Dynamic sample progressed to target depth at 5.45m bgl.		Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)		
				3.00	115	0.00	1.00	87mm 100%		
						1.00	2.00	87mm 90%		
						2.00	3.00	77mm 100%		
						3.00	4.00	77mm 90%		
						4.00	5.00	67mm 100%		



ver. 1,5

Dynamic Sample No.

DS03

Sheet 1 of 1

Project Name: Whitefield Fire Station

Co-ords:	380521E - 406483N
----------	-------------------

Project No.
3866a

Location: Whitefield, Greater Manchester

Level (m AOD):	102.62
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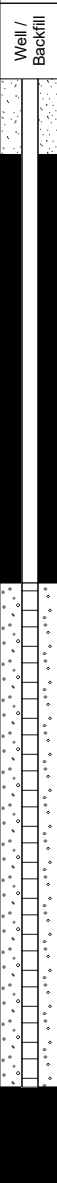
Logged By
LM

Client: Greater Manchester Combined Authority

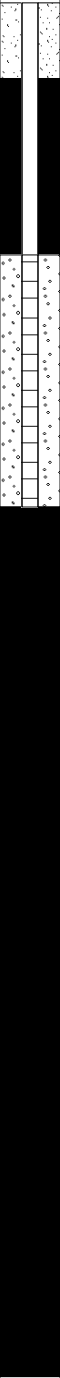
Date: 15/12/2022

Checked By

Weather:	Freezing
----------	----------

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description	
		Depth(m)	Type	Results					
					0.05	102.57		ASPHALT MADE GROUND CONCRETE MADE GROUND	1
					0.36	102.26			
		0.70 0.70	ES PID	0.00ppm	0.90	101.72			Soft locally very soft sandy organic CLAY. MADE GROUND
		1.00 1.20 1.20	SPT(C) ES PID	N=5 (1,1/1,1,2,1) 0.00ppm	1.60	101.02			Soft light greyish brown silty CLAY thickly interbedded with clayey SILT. GLACIOFLUVIAL SHEET DEPOSITS
		2.00 2.00 2.00 2.00	D ES SPT(C) PID	N=5 (2,1/2,2,1,0) 0.00ppm	2.50	100.12			Firm dark brownish grey mottled greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS
		3.00 3.00	D SPT(C)	N=11 (2,2/3,2,3,3)	3.70	98.92			Medium dense becoming very dense light brown mottled dark greyish brown gravelly silty fine to coarse SAND. Gravel is subrounded fine of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS
		4.00	SPT(C)	N=50 (2,3/4,8,18,20)	4.38	98.24			Dynamic Sample terminated at 4.38m.
									5
									6
Remarks:									
Hardstanding cored. Dynamic sample progressed to refusal at 4.39m bgl									

		Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log		Dynamic Sample No. DS04	
				ver. 1.5		Sheet 1 of 1	
Project Name: Whitefield Fire Station				Co-ords: 380455E - 406448N		Project No. 3866a	
Location: Whitefield, Greater Manchester				Level (m AOD):		Logged By LM	
Client: Greater Manchester Combined Authority				Date: 15/12/2022		Checked By	
				Weather: Freezing			

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)		Stratum Description	
		Depth(m)	Type	Results					
					0.15		Soft dark brown sandy CLAY with roots and rootlets. TOPSOIL	1	
							Soft dark brown sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse of brick fragments, clinker, concrete, ceramic and mudstone. MADE GROUND		
		0.50 0.50	ES PID	0.00ppm		0.75		Soft locally very soft dark brown organic CLAY. GLACIOFLUVIAL SHEET DEPOSITS	2
		1.00 1.00	D SPT(C)	N=0 (1,0/0,0,0,0)		1.40		Very soft locally soft light grey mottled dark brownish grey silty sandy CLAY. GLACIOFLUVIAL SHEET DEPOSITS	
		1.50 1.50	ES PID	0.00ppm		2.70		Firm dark brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	3
		2.00 2.00	D SPT(C)	N=0 (1,0/0,0,0,0)		3.50		Medium dense dark brown gravelly silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
		3.00 3.00	D SPT(C)	N=12 (1,0/2,3,3,4)		4.00		Becomes orangish brown	4
		4.00	SPT(C)	N=10 (1,0/2,3,2,3)		5.00			
		5.00	SPT(C)	N=29 (5,5/7,8,7,7)		5.45			5
							Dynamic Sample terminated at 5.45m.	6	

Remarks:	Water Strike		Casing Details		Sample Sleeve Runs		
	Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)
			3.00	115	0.00	1.00	87mm 90%
					1.00	2.00	87mm 100%
					2.00	3.00	77mm 85%
					3.00	4.00	77mm 90%
				4.00	5.00	67mm 85%	

IGEconsulting Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Hand Dug Pit Log ver. 1.0			Trial Pit No. HDP01 Sheet 1 of 1	
Project Name: Whitefield Fire Station				Level (mAOD): 103.21	Date: 26/02/2023	Project No. 3866a
Location: Whitefield, Greater Manchester				Weather: Overcast		Logged By JH
Client: Greater Manchester Combined Authority				Co-ords: 380456E - 406473N		Checked By
Water Strike	Samples & In Situ Testing			Depth (mbgl)	Level (mAOD)	Stratum Description
	Depth (m)	Type	Results			
	0.40	ES				Dark brown, gravelly, slightly clayey, silty, fine to coarse SAND with occasional rootlets. Gravel is angular to subrounded, fine to coarse of red brick, concrete, clinker, slate and mixed natural lithologies. MADE GROUND
				0.80	102.41	Suspected CONCRETE slab. MADE GROUND
				0.81	102.40	
Trial Pit terminated at 0.81m.						
1						
Water Strike						
Depth Strike (mbgl)		Remarks				
		No strike				
Stability: Stable						
Remarks: Hand dug pit terminated at 0.81m bgl on a suspected concrete slab.						

IGE

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Borehole Log

ver. 0.5

Borehole No.
BH02

Sheet 1 of 1

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380473E - 406498N

Level (mAOD):102.93

Dates:25/02/2023

Weather:Showers

Project No.:3866a

Rev.:1.0

Logged By:JH

Checked By:LM

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description		
		Depth (m)	Type	Results						
					0.23	102.70		CONCRETE. MADE GROUND		
					0.50	102.43		Light brown, fine to coarse SAND and angular to subangular, fine to coarse GRAVEL of sandstone. MADE GROUND		
		0.80	ES					Soft, dark brownish grey, slightly sandy, gravelly CLAY. Gravel is angular to subangular, fine to coarse of red brick, concrete, sandstone, slate and ceramic. MADE GROUND	1	
								Possible ceramic land drain at 0.60m bgl.		
		1.20	SPT	N=2 (1,1/0,1,0,1)						
		1.80	D			1.70	101.23		Firm, dark brown, pseudo-fibrous PEAT. GLACIOFLUVIAL SHEET DEPOSITS	
		2.00	SPT	N=8 (1,1/2,2,2,2)		1.90	101.03		Soft, light grey, slightly sandy, slightly gravelly CLAY. Gravel is subrounded to well rounded, fine to coarse of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	2
						2.00	100.93		Loose, brown, clayey, fine to coarse SAND. GLACIOFLUVIAL SHEET DEPOSITS	
		2.40	B							
		2.40	ES							
						2.80	100.13		Dark brown, plastic, pseudo-fibrous PEAT. GLACIOFLUVIAL SHEET DEPOSITS	3
		3.00	SPT	N=2 (1,0/0,0,1,1)		2.90	100.03		Very loose, light grey, gravelly, slightly clayey, fine to coarse SAND. Gravel is rounded to well rounded, fine to coarse of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
		3.20	B						Soft to firm, light grey, slightly gravelly, slightly sandy CLAY. Gravel is subrounded to well rounded, fine to coarse of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
		3.70	B			3.40	99.53			4
		4.00	SPT	N=23 (3,4/4,6,6,7)		4.00	98.93		Medium dense, light grey, sandy, slightly clayey, rounded to well rounded, fine to coarse GRAVEL of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
		4.50	B							
		5.00	SPT	N=10 (6,3/3,3,2,2)						5
						5.40	97.53		Soft to firm, greyish brown, slightly gravelly, slightly sandy CLAY. Gravel is rounded to well rounded, fine to coarse of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
5.80	B									
6.00	SPT	N=20 (6,7/5,5,5,5)		6.00	96.93		Medium dense, light greyish brown, gravelly, slightly silty, fine to coarse SAND. Gravel is rounded to well rounded, fine to coarse of mixed lithologies. GLACIOFLUVIAL SHEET DEPOSITS	6		
6.50	B									
7.00	SPT	N=18 (4,5/7,4,4,3)						7		
8.00	SPT	N=24 (6,7/7,5,6,6)						8		
8.50	B									
9.00	SPT	N=28 (7,6/6,7,7,8)		8.85	94.08		Firm, brown, slightly gravelly, slightly sandy CLAY. Gravel is rounded to well rounded, fine to coarse of mixed lithologies. GLACIAL TILL	9		
9.45	SPT	N=30 (6,7/7,7,8,8)								
				9.90	93.03		Borehole terminated at 9.90m.	10		

Remarks:
Hardstanding cored. Cable percussive borehole terminated at 9.90m bgl due to no recovery.

Casing Details

Depth Top (m)Depth Base (m)Diameter (mm)

GL6.00110

Water Strike

Depth Strike (m)Time Elapsed (min)Water Level (m)

3.807.90

Chiselling Details

Depth Top (m)Depth Base (m)Duration (hrs)

SPT Energy Ratio:

IGE

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Borehole Log

ver. 0.5

Borehole No.
BH03

Sheet 1 of 2

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380499E - 406486N

Level (mAOD):102.81

Dates:30/01/2023 - 31/01/2023

Weather:Overcast

Project No.:3866a

Rev.:1.0

Logged By:AS

Checked By:

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
					0.05	102.76		ASPHALT. MADE GROUND	
					0.40	102.41		CONCRETE. MADE GROUND	
								Brown, gravelly, slightly clayey, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of concrete (60%) and limestone (40%). MADE GROUND	
		1.20 - 1.65 1.20 - 1.65 1.20	B D SPT	N=8 (4,2/3,2,1,2)	1.20	101.61		Soft to firm, dark brown, mottled black, slightly gravelly, sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mudstone (50%) and quartzite (50%). MADE GROUND	
		2.00 - 2.45 2.00 - 2.50 2.00	D B SPT	N=7 (2,3/2,1,2,2)	2.00	100.81		Loose, grey, slightly gravelly, silty, fine to coarse SAND with frequent fragments of black, amorphous PEAT and wood fragments. Gravel is subangular to subrounded, fine to coarse of mudstone (60%) and timber (40%). GLACIOFLUVIAL SHEET DEPOSITS	
		3.00 - 3.45 3.00 - 3.50 3.00	D B SPT	N=1 (1,1/0,0,1,0)	3.00	99.81		Firm, grey, mottled black, slightly gravelly, sandy, silty CLAY with frequent organic fragments and occasional laminations of light brown, slightly clayey, fine to coarse sand. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
		4.00 - 4.45 4.00 - 4.50 4.00	D B SPT	N=9 (1,2/2,2,2,3)				No longer organic from 4.00m bgl.	
		5.00 - 5.45 5.00 - 5.50 5.00	D B SPT	N=9 (1,1/1,2,3,3)					
		6.00 - 6.45 6.00 - 6.50 6.00	D B SPT	N=27 (2,3/5,7,7,8)	6.00	96.81		Medium dense, brown, slightly gravelly, silty, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	
		7.50 - 7.95 7.50 - 8.00 7.50	D B SPT	N=22 (6,7/8,8,4,2)	7.50	95.31		Medium dense, brown, mottled dark brown, slightly clayey fine to coarse SAND and subangular to subrounded, fine to coarse GRAVEL of mixed natural lithologies. GLACIAL TILL	
9.00 - 9.45 9.00 - 9.50 9.00	D B SPT	N=18 (2,2/3,4,5,6)	9.00	93.81		Firm to stiff, brown, slightly gravelly, slightly sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIAL TILL			

Remarks:
Hardstanding cored. Cable percussive borehole terminated at 19.95m bgl at target depth.

Continued on next sheet

Casing Details			Chiselling Details		
Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
0.00	6.00	200			
0.00	15.00	150			
Water Strike					
Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
3.00	20	2.70			

SPT Energy Ratio:

IGE consulting		Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5				Borehole No. BH03 Sheet 2 of 2	
Project Name: Whitefield Fire Station				Co-ords: 380499E - 406486N		Project No.: 3866a			
Location: Whitefield, Greater Manchester				Level (mAOD): 102.81		Rev.: 1.0			
Client: Greater Manchester Combined Authority				Dates: 30/01/2023 - 31/01/2023		Logged By: AS			
				Weather: Overcast		Checked By:			
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
		10.50 - 10.95	U					Firm to stiff, brown, slightly gravelly, slightly sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIAL TILL	11
		12.00 - 12.45 12.00 - 12.50 12.00	D B SPT	N=40 (5,7/8,10,10,12)	12.00	90.81		Firm, brown, laminated, sandy, silty CLAY. GLACIAL TILL	12
		12.00 - 12.45 12.00 - 12.50 12.00			12.45	90.36		Firm to stiff, brown, slightly gravelly, sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIAL TILL	13
		13.50 - 13.95 13.50 - 14.00 13.50	D B SPT	N=31 (4,5/7,7,8,9)					14
		15.00 - 15.45 15.00 - 15.50 15.00	D B SPT	N=27 (3,4/6,6,7,8)			Becoming stiff from 15.00m bgl.		15
		16.50 - 16.95 16.50 - 17.00 16.50	D B SPT	N=29 (3,4/5,7,8,9)					16
		18.00 - 18.45	U						17
		19.50 - 19.95 19.50	D SPT	N=35 (3,5/7,8,9,11)				18	
					19.95	82.86			19
Borehole terminated at 19.95m.									20
Remarks: Hardstanding cored. Cable percussive borehole terminated at 19.95m bgl at target depth.				Casing Details			Chiselling Details		
				Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
				0.00	6.00	200			
				0.00	15.00	150			
				Water Strike					
Depth Strike (m)	Time Elapsed (min)	Water Level (m)							
3.00	20	2.70							
SPT Energy Ratio:									

IGE

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Borehole Log

ver. 0.5

Borehole No.
BH04

Sheet 1 of 2

Project Name:Whitefield Fire Station

Location:Whitefield, Greater Manchester

Client:Greater Manchester Combined Authority

Co-ords:380511E - 406469N

Level (mAOD):102.65

Dates:01/02/2023 - 02/02/2023

Weather:Rain

Project No.:3866a

Rev.:1.0

Logged By:AS

Checked By:

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
					0.05	102.60		ASPHALT. MADE GROUND	
					0.40	102.25		CONCRETE. MADE GROUND	
								Light brown, slightly sandy, subangular to subrounded, fine to coarse GRAVEL of concrete (70%) and limestone (30%). MADE GROUND	1
		1.20 - 1.65 1.20 - 1.65 1.20	B D SPT	N=5 (1,1/2,1,1,1)	1.20	101.45		Dark brown, mottled grey, slightly gravelly, clayey, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of concrete (40%), mudstone (30%) and limestone (30%). MADE GROUND	
		2.00 - 2.45 2.00 - 2.50 2.00	D B SPT	N=3 (1,0/0,1,1,1)	2.00	100.65		Soft to firm, greyish brown, slightly gravelly, sandy, silty CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	2
		3.00 - 3.45 3.00 - 3.50 3.00	D B SPT	N=11 (3,2/1,3,3,4)				Becoming firm from 3.00m bgl.	3
		4.00 - 4.45 4.00 - 4.50 4.00	D B SPT	N=12 (1,2/2,3,3,4)	3.80	98.85		Firm to stiff, brown, slightly gravelly, sandy CLAY. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	4
		5.00 - 5.45	U						5
		6.00 - 6.45 6.00 - 6.50 6.00	D B SPT	N=19 (2,2/3,4,5,7)	6.00	96.65		Medium dense, brown, slightly gravelly, silty, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	6
		7.50 - 7.95 7.50 - 8.00 7.50	D B SPT	N=8 (5,7/2,1,1,4)	7.50	95.15		Medium dense, brown, silty, fine to coarse SAND and subangular to well rounded, fine to coarse GRAVEL of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	8
9.00 - 9.50	B						9		
								10	

Remarks:

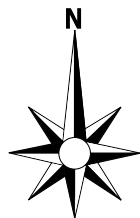
Hardstanding cored. Cable percussive borehole terminated at 16.45m bgl due to refusal.

SPT Energy Ratio:

Continued on next sheet

Casing Details			Chiselling Details		
Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
0.00	4.50	200			
0.00	12.00	150			
Water Strike					
Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
6.00	20	3.70			

IGEconsulting Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5			Borehole No. BH04 Sheet 2 of 2										
Project Name: Whitefield Fire Station				Co-ords: 380511E - 406469N		Project No.: 3866a									
Location: Whitefield, Greater Manchester				Level (mAOD): 102.65		Rev.: 1.0									
Client: Greater Manchester Combined Authority				Dates: 01/02/2023 - 02/02/2023		Logged By: AS									
				Weather: Rain		Checked By:									
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)	Stratum Description								
		Depth (m)	Type	Results											
		10.50	SPT	N=27 (3,4/6,6,7,8)		87.65	Medium dense, brown, silty, fine to coarse SAND and subangular to well rounded, fine to coarse GRAVEL of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	11							
		12.00 - 12.45 12.00 - 12.50 12.00	D B SPT	N=30 (3,5/7,7,8,8)					12						
		13.50 - 13.95 13.50 - 14.00 13.50	D B SPT	N=40 (4,6/9,9,10,12)						13					
		15.00 - 15.45 15.00 - 15.50 15.00	D B SPT	N=50 (6,8/50 for 295mm)							14				
		16.00 - 16.45 16.00	D SPT	N=50 (7,10/50 for 285mm)								15			
					16.45	86.20	Dense, brown, slightly gravelly, silty, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse of mixed natural lithologies. GLACIOFLUVIAL SHEET DEPOSITS	16							
							Borehole terminated at 16.45m.	17							
								18							
								19							
								20							
Remarks: Hardstanding cored. Cable percussive borehole terminated at 16.45m bgl due to refusal.				Casing Details			Chiselling Details								
				Depth Top (m)		Depth Base (m)		Diameter (mm)		Depth Top (m)		Depth Base (m)		Duration (hrs)	
				0.00		4.50		200							
				0.00		12.00		150							
				Water Strike											
				Depth Strike (m)		Time Elapsed (min)		Water Level (m)							
6.00		20		3.70											
SPT Energy Ratio:															



FOR GUIDANCE PURPOSES ONLY

- Approximate Site Boundary
- Proposed
- Cable Percussive Boreholes
- DCPs
- Dynamic Sample Boreholes
- Hand Dug pit



Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Whitefield Fire Station, Whitefield			
For: Greater Manchester Fire and Rescue Service			
Drawing Title: Exploratory Hole Location Plan			
IGEconsulting Office 16, Bartle House, Manchester, M2 3QW Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 914 9170			
Scale: 1:300 @A3		Date: Feb 2023	
Drawn: JH		Checked: AE	
Contract No. 3866a		Drawing No. SI-05	P1

Window Sample Hole Falling Head Test

DS01

FIELD MEASUREMENTS	Time (min)	Water Depth (m below top of casing)	Head (from water level) (m)	INPUT PARAMETERS	Borehole Depth	2.090	m
	0.00	1.130	0.960		Casing Depth	0.000	m
	0.50	1.170	0.920		Difference in Length between bottom of casing/boreholes, L	2.090	m
	1.00	1.250	0.840		Water Depth	1.640	m
	1.50	1.310	0.780		Casing Diameter, D	0.051	m
	2.00	1.420	0.670		Cross Sectional area of casing, A	0.002	m²
	2.50	1.480	0.610		Height of casing above ground level	0.000	m
	3.00	1.540	0.550		Approximate long term water table (or base of BH see rules)	2.090	m
	3.50	1.570	0.520		Borehole End Condition (important to get right)	d	
	4.00	1.600	0.490		a= Soil flush with bottom at impervious boundary	0.102	
	4.50	1.610	0.480		b= Soil flush with bottom in uniform soil	0.140	
	5.00	1.630	0.460		c= Well point or hole extended at impervious boundary	2.848	
	6.00	1.640	0.450		d= Well point or hole extended in uniform soil	0.325	
	7.00	1.650	0.440		e= Soil in casing with bottom at impervious boundary	0.001	
	8.00	1.650	0.440		f= Soil in casing with bottom in uniform soil	0.001	
	9.00	1.650	0.440		Intake factor, F (Select correct end condition)	0.325	
	10.00	1.650	0.440		Variable Head, H¹	0.960	m
	12.00	1.650	0.440		Time, T¹	0.000	min
	15.00	1.650	0.440		Variable Head, H²	0.430	m
	20.00	1.650	0.440		Time, T²	90.000	min
	40.00	1.660	0.430	K unsat (m/s)	5.60E-05		
	60.00	1.660	0.430				
	90.00	1.660	0.430	RULES	1. A borehole location MUST be entered to generate <i>k</i> . 2. Enter all values in shaded cells: A, F, L and k are calculated automatically in the spreadsheet. 3. Head is measured to the base of the BH, or use WL if higher. 4. End conditions referenced in BS 5930 see notes. Usually d. <u>Formula for uncased hole</u> . 5. If groundwater level is below test, k is not true permeability, but indicative only. 6. Usually T¹=0 and T²=60 or at H¹=25% and H²=75% of effective depth, input H at these times. 7. Where 25% and 75% of effective depth cannot be calculated, an extrapolated value can be produced.		

Window Sample Hole Falling Head Test

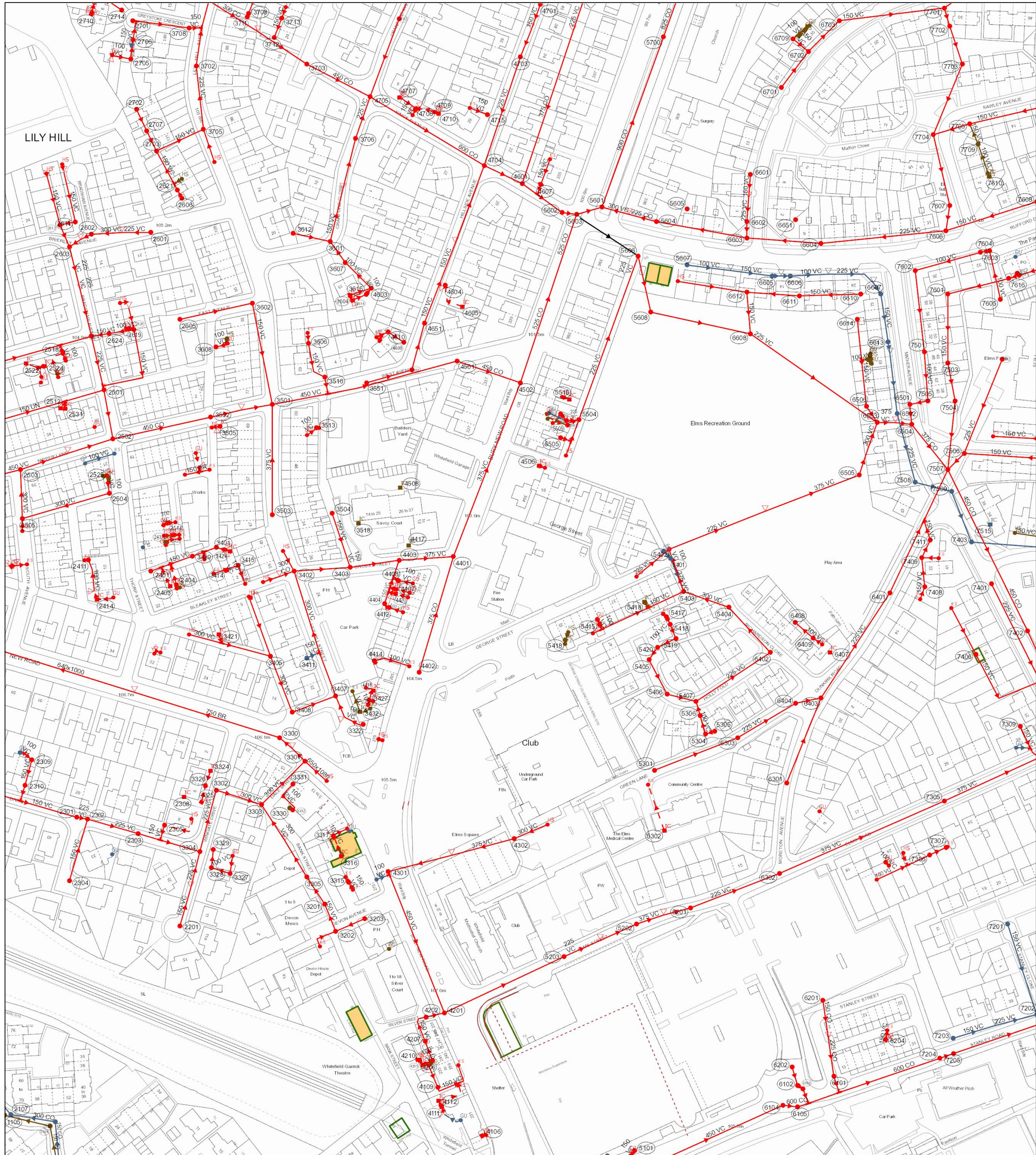
DS03

FIELD MEASUREMENTS	Time (min)	Water Depth (m below top of casing)	Head (from water level) (m)	INPUT PARAMETERS	Borehole Depth	3.870	m
	0.00	0.370	3.500		Casing Depth	0.000	m
	0.50	0.670	3.200		Difference in Length between bottom of casing/boreholes, L	3.870	m
	1.00	0.830	3.040		Water Depth	2.420	m
	1.50	0.960	2.910		Casing Diameter, D	0.051	m
	2.00	1.100	2.770		Cross Sectional area of casing, A	0.002	m²
	2.50	1.150	2.720		Height of casing above ground level	0.000	m
	3.00	1.190	2.680		Approximate long term water table (or base of BH see rules)	3.870	m
	3.50	1.250	2.620		Borehole End Condition (important to get right)	d	
	4.00	1.270	2.600		a= Soil flush with bottom at impervious boundary	0.102	
	4.50	1.290	2.580		b= Soil flush with bottom in uniform soil	0.140	
	5.00	1.310	2.560		c= Well point or hole extended at impervious boundary	4.653	
	6.00	1.350	2.520		d= Well point or hole extended in uniform soil	0.336	
	7.00	1.400	2.470		e= Soil in casing with bottom at impervious boundary	0.001	
	8.00	1.420	2.450		f= Soil in casing with bottom in uniform soil	0.001	
	9.00	1.440	2.430		Intake factor, F (Select correct end condition)	0.336	
	10.00	1.450	2.420		Variable Head, H¹	3.500	m
	12.00	1.480	2.390		Time, T¹	0.000	min
	15.00	1.530	2.340		Variable Head, H²	2.080	m
	20.00	1.600	2.270		Time, T²	60.000	min
	40.00	1.690	2.180	K unsat (m/s)	5.28E-05		
	60.00	1.790	2.080				
				RULES	1. A borehole location MUST be entered to generate <i>k</i> . 2. Enter all values in shaded cells: A, F, L and k are calculated automatically in the spreadsheet. 3. Head is measured to the base of the BH, or use WL if higher. 4. End conditions referenced in BS 5930 see notes. Usually d. <u>Formula for uncased hole.</u> 5. If groundwater level is below test, k is not true permeability, but indicative only. 6. Usually T¹=0 and T²=60 or at H¹=25% and H²=75% of effective depth, input H at these times. 7. Where 25% and 75% of effective depth cannot be calculated, an extrapolated value can be produced.		

Window Sample Hole Falling Head Test

DS04

FIELD MEASUREMENTS	Time (min)	Water Depth (m below top of casing)	Head (from water level) (m)	INPUT PARAMETERS	Borehole Depth	2.020	m
	0.00	0.150	1.870		Casing Depth	0.000	m
	0.50	0.210	1.810		Difference in Length between bottom of casing/boreholes, L	2.020	m
	1.00	0.250	1.770		Water Depth	1.580	m
	1.50	0.280	1.740		Casing Diameter, D	0.051	m
	2.00	0.330	1.690		Cross Sectional area of casing, A	0.002	m²
	2.50	0.360	1.660		Height of casing above ground level	0.000	m
	3.00	0.390	1.630		Approximate long term water table (or base of BH see rules)	2.020	m
	3.50	0.410	1.610		Borehole End Condition (important to get right)	d	
	4.00	0.440	1.580		a= Soil flush with bottom at impervious boundary	0.102	
	4.50	0.460	1.560		b= Soil flush with bottom in uniform soil	0.140	
	5.00	0.480	1.540		c= Well point or hole extended at impervious boundary	2.774	
	6.00	0.520	1.500		d= Well point or hole extended in uniform soil	0.325	
	7.00	0.540	1.480		e= Soil in casing with bottom at impervious boundary	0.001	
	8.00	0.570	1.450		f= Soil in casing with bottom in uniform soil	0.001	
	9.00	0.600	1.420		Intake factor, F (Select correct end condition)	0.325	
	10.00	0.620	1.400		Variable Head, H¹	1.870	m
	12.00	0.660	1.360		Time, T¹	0.000	min
	15.00	0.700	1.320		Variable Head, H²	1.220	m
	20.00	0.730	1.290		Time, T²	60.000	min
	40.00	0.780	1.240	K unsat (m/s)	4.48E-05		
	60.00	0.800	1.220				
				RULES	1. A borehole location MUST be entered to generate <i>k</i> .		
					2. Enter all values in shaded cells: A, F, L and k are calculated automatically in the spreadsheet.		
					3. Head is measured to the base of the BH, or use WL if higher.		
					4. End conditions referenced in BS 5930 see notes. Usually d. <u>Formula for uncased hole</u> .		
					5. If groundwater level is below test, k is not true permeability, but indicative only.		
					6. Usually T¹=0 and T²=60 or at H¹=25% and H²=75% of effective depth, input H at these times.		
					7. Where 25% and 75% of effective depth cannot be calculated, an extrapolated value can be produced.		



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

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LEGEND

Abandoned

Foul

Surface Water

Combined

Public Sewer

Private Sewer

Rising Main

Sludge Main

Overflow

Water Course

Highway Drain

All point assets follow the standard colour convention:

red - combined

blue - surface water

brown - foul

purple - overflow

MANHOLE FUNCTION

FO Foul

SW Surface Water

CO Combined

OV Overflow

SEWER SHAPE

CI Circular

TR Trapezoidal

EG Egg

AR Arch

OV Oval

BA Barrel

FT Flat Top

HO HorseShoe

RE Rectangular

UN Unspecified

SQ Square

SEWER MATERIAL

AC Asbestos Cement

BR Brick

PE Polyethylene

RP Reinforced Plastic Matrix

CO Concrete

CSB Concrete Segment Bolted

CCU Concrete Segment Unbolted

CS Concrete Box Culverted

PSC Plastic / Steel Composite

GRC Glass Reinforced Plastic

DI Ductile Iron

PVC Polyvinyl Chloride

CI Cast Iron

SI Spun Iron

ST Steel

VC Vitrified Clay

PP Polypropylene

PF Pitch Fibre

MAC Masonry, Coursed

MAR Masonry, Random

U Unspecified

Address or Site Reference:

GREATER MANCHESTER FIRE & RESCUE SERVICE
FIRE STATION BURY NEW ROAD,
WHITEFIELD,
MANCHESTER,
M45 7SY

Scale: 1:1250

Date: 30/11/2022

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities

Water for the North West

**wastewaterdeveloperservices@uuplc.co.uk** <wastewaterdeveloperservices@uuplc.co.uk>

Thu, Mar 2, 9:03 AM

to Brendan Howarth, Steve Thomas, Paul Airey ▼

You are viewing an attached message. Flo_ Mail can't verify the authenticity of attached messages.



Good morning Brendan,

Thank you for discounting each part of the Surface Water Hierarchy, I would not object to a surface water connection to the 375mm diameter public combined sewer within New Bury Road located West at a restricted discharge rate of 5 l/s, calculated using HR Wallingford IH124 edited to soil type 5.

This is subject to section 106 approval. I have linked below the connections application form and guidance.

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

If I can be of any further assistance please do get in touch.

Kind regards



cid:image001.png@01D6A0A4.98957260

Ashleigh Bellerby

Assistant Developer Engineer

Developer Services & Metering

Customer Services

T: 07826891650

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----- Original Message -----

From: Brendan Howarth [b.howarth@bghbolton.co.uk]

Sent: 24/02/2023 10:52

To: wastewaterdeveloperservices@uuplc.co.uk

Cc: s.thomas@bghbolton.co.uk; p.airey@bghbolton.co.uk

Subject: RE: Pre Development Enquiry for: Whitefield Fire Station, Bury New Road, Manchester, M45 7SY UU Reference Number : 02929688

EXTERNAL EMAIL This email originated outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good Morning

Thank you for your previous response.

In accordance with the SUDs hierarchy we have been carrying out geotechnical investigations of the ground below Whitefield fire station in order to assess its suitability for infiltration/soakaways.

Please find attached statement from our geotechnical consultant which indicates the ground is unsuitable due to the potential of mobilising PFAS contamination within the ground.

Could you please provide an indication of the allowable flow rate for surface water into the local drainage network.

Appendix F - Utilities Plan

[illegible]

Where chamber extents are significantly greater than the cover size, their approximate extents are shown thus:

[illegible][illegible]

Disclaimer

Only manholes that were accessible on site during survey
other manholes may be present but covered
all invert levels taken where possible at main channel
Man Entry to sewers has not been undertaken. Depths, Pipe sizes etc
are measured from the ground. All sewers and inverts to be checked
prior to any works commencing on site. The CAD Room Ltd are
not responsible for manholes, services, information not surveyed which
may have an impact on site development.
Boundaries shown are physical and may not represent legally conveyed



Client : MCA	7
Location: Identified Fire Station	

Comments:		
Drawing Number: 01-S-1072-GM Fire Stations		Revision: A
Date: 10.02.2022	Scale: 1:100 @ A0	
Drawn By: LK	Checked By: CG	

Appendix G - Greenfield SW Run-Off Rates and Volume Calculations

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Greenfield Run-Off Rate Calculations	
Date 25/04/2023	Designed by MDS	
File	Checked by MDS	
Innovyze	Source Control 2020.1.3	
IH 124 Mean Annual Flood Input Return Period (years)100Soil0.450 Area (ha)50.000Urban0.730 SAAR (mm)1056Region NumberRegion 10 Results1/s QBAR Rural355.4 QBAR Urban824.1 Q100 years1305.9 Q1 year717.0 Q2 years840.0 Q5 years1009.5 Q10 years1090.3 Q20 years1164.0 Q25 years1183.2 Q30 years1198.0 Q50 years1237.0 Q100 years1305.9 Q200 years1401.0 Q250 years1429.8 Q1000 years1610.9		
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Flo Consult UK Ltd		Page 1																										
4 Market Square	Whitefield FS																											
Old Amersham	Greenfield Run-Off																											
Buckinghamshire, HP7 0DQ	Rates Calculations																											
Date 28/06/2023	Designed by MDS																											
File	Checked by MDS																											
Innovyze	Source Control 2020.1.3																											
<u>Greenfield Runoff Volume</u> FEH Data <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 380483 406476 SD 80483 06476</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>0.189</td> </tr> <tr> <td>SAAR (mm)</td> <td>1024</td> </tr> <tr> <td>CWI</td> <td>123.419</td> </tr> <tr> <td>SPR Host</td> <td>47.000</td> </tr> <tr> <td>URBEXT (USER)</td> <td>0.5000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>56.95</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>72.443</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	FEH Rainfall Version	2013	Site Location	GB 380483 406476 SD 80483 06476	Data Type	Point	Areal Reduction Factor	1.00	Area (ha)	0.189	SAAR (mm)	1024	CWI	123.419	SPR Host	47.000	URBEXT (USER)	0.5000	Percentage Runoff (%)	56.95	Greenfield Runoff Volume (m³)	72.443
Return Period (years)	100																											
Storm Duration (mins)	360																											
FEH Rainfall Version	2013																											
Site Location	GB 380483 406476 SD 80483 06476																											
Data Type	Point																											
Areal Reduction Factor	1.00																											
Area (ha)	0.189																											
SAAR (mm)	1024																											
CWI	123.419																											
SPR Host	47.000																											
URBEXT (USER)	0.5000																											
Percentage Runoff (%)	56.95																											
Greenfield Runoff Volume (m³)	72.443																											
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Appendix H - Pre-Development SW Run-Off Rates and Volume Calculations

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Pre-Development SW Run-Off Calculations	
Date 25/04/2023	Designed by MDS	
File	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 380483 406476 SD 80483 06476
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)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	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 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 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 380483 406476 SD 80483 06476
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840

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Flo Consult UK Ltd		Page 2
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Pre-Development SW Run-Off Calculations	
Date 25/04/2023	Designed by MDS	
File	Checked by MDS	
Innovyze	Network 2020.1.3	
Synthetic Rainfall Details Storm Duration (mins) 30		
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Flo Consult UK Ltd		Page 3	
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Whitefield Fire Station Pre-Development SW Run-Off Calculations	
Date 25/04/2023		Designed by MDS	
File		Checked by MDS	
Innovyze		Network 2020.1.3	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 380483 406476 SD 80483 06476
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s) Summer and Winter

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

								Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act. Level (m)
1.000	1 15 Winter		2	+0%	30/15 Summer			101.619
1.001	2 15 Winter		2	+0%	30/15 Summer			101.559

Surcharged Flooded					Half Drain	Pipe		
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap. (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
1.000	1	-0.106	0.000	0.54		23.2	OK	
1.001	2	-0.066	0.000	0.83		35.8	OK	

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Flo Consult UK Ltd						Page 4	
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ				Whitefield Fire Station Pre-Development SW Run-Off Calculations			
Date 25/04/2023				Designed by MDS			
File				Checked by MDS			
Innovyze				Network 2020.1.3			
<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>							
<u>Simulation Criteria</u>							
Areal Reduction Factor		1.000		Additional Flow - % of Total Flow		0.000	
Hot Start (mins)		0		MADD Factor * 10m³/ha Storage		2.000	
Hot Start Level (mm)		0		Inlet Coefficient		0.800	
Manhole Headloss Coeff (Global)		0.500		Flow per Person per Day (l/per/day)		0.000	
Foul Sewage per hectare (l/s)		0.000					
Number of Input Hydrographs		0		Number of Offline Controls		0	
Number of Online Controls		0		Number of Storage Structures		0	
				Number of Time/Area Diagrams		0	
				Number of Real Time Controls		0	
<u>Synthetic Rainfall Details</u>							
Rainfall Model				FEH			
FEH Rainfall Version				2013			
Site Location				GB 380483 406476 SD 80483 06476			
Data Type				Point			
Cv (Summer)				0.750			
Cv (Winter)				0.840			
Margin for Flood Risk Warning (mm)				300.0		DVD Status OFF	
Analysis Timestep				Fine Inertia		Status OFF	
DTS Status				ON			
Profile(s)				Summer and Winter			
Duration(s) (mins)				15, 30, 60, 120, 240, 360, 480, 960, 1440			
Return Period(s) (years)				2, 30, 100			
Climate Change (%)				0, 0, 0			

Flo Consult UK Ltd		Page 5	
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Whitefield Fire Station Pre-Development SW Run-Off Calculations	
Date 25/04/2023		Designed by MDS	
File		Checked by MDS	
Innovyze		Network 2020.1.3	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 380483 406476 SD 80483 06476
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+0%	30/15 Summer				102.374
1.001	2	15 Winter	100	+0%	30/15 Summer				102.149

PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.649	0.000	1.54		66.5	SURCHARGED	
1.001	2	0.524	0.000	2.49		107.9	SURCHARGED	

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Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Pre-Development SW Run-Off Calculations	
Date 25/04/2023	Designed by MDS	
File	Checked by MDS	
Innovyze		Network 2020.1.3
<u>Simulation Criteria for Storm</u> Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (l/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FEH Return Period (years) 2 FEH Rainfall Version 2013 Site Location GB 380483 406476 SD 80483 06476 Data Type Point Summer Storms Yes Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30		
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Flo Consult UK Ltd		Page 2
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Pre-Development SW Run-Off Calculations	
Date 25/04/2023	Designed by MDS	
File	Checked by MDS	
Innovyze	Network 2020.1.3	

Summary Wizard of 360 minute 100 year Winter I+0% for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 380483 406476 SD 80483 06476
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

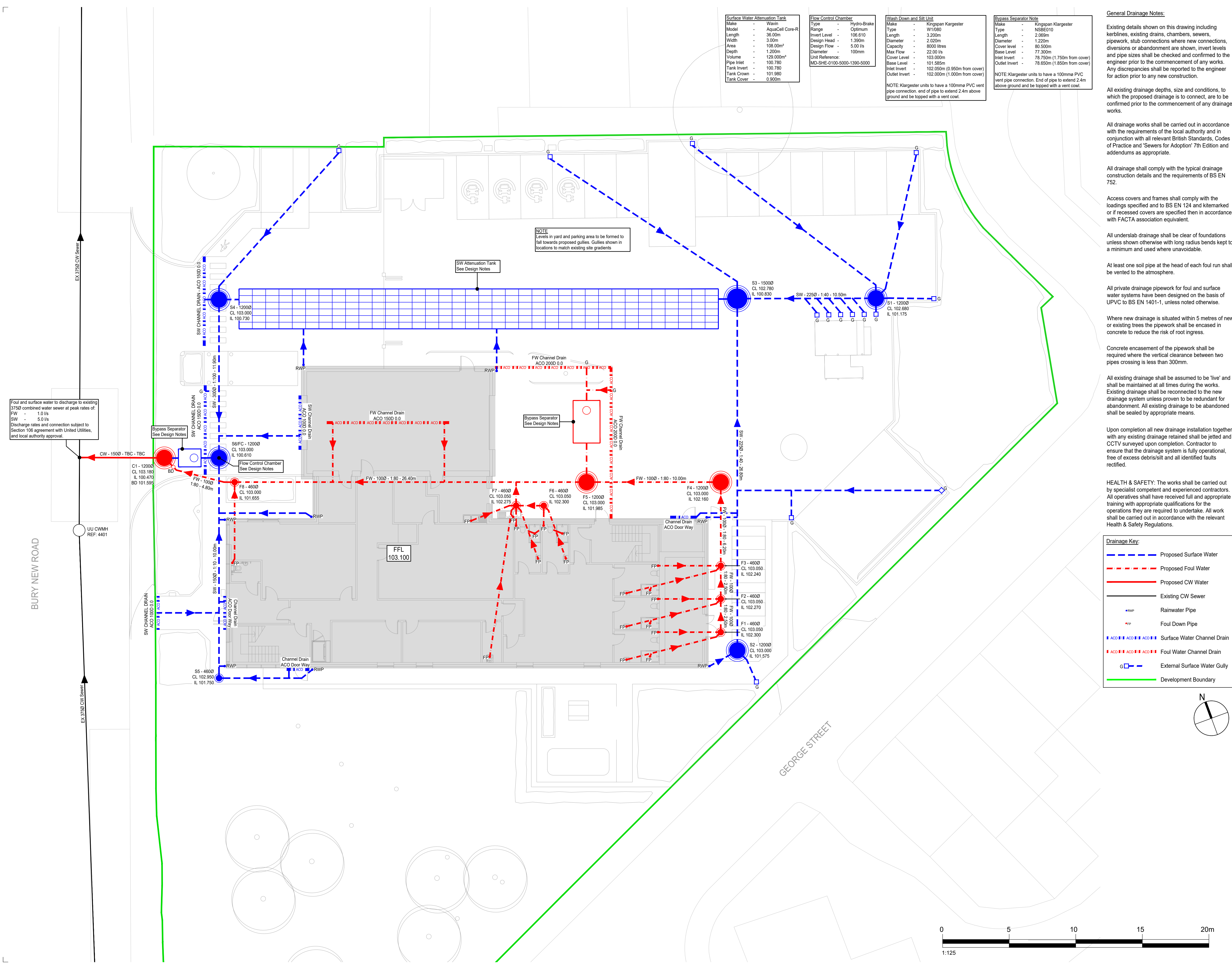
Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	1	360 minute 100 year Winter I+0%	103.000	101.574	-0.151	0.000	0.24
1.001	2	360 minute 100 year Winter I+0%	103.000	101.497	-0.128	0.000	0.39

PN	US/MH Name	Overflow (l/s)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	1		88.753	10.3	OK
1.001	2		145.324	16.9	OK

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Appendix I - Below Ground Drainage Layout and Details



Surface Water Attenuation Tank	
Make	- Wavin
Model	- AquaCell Core-R
Length	- 35.00m
Width	- 3.00m
Area	- 108.00m²
Depth	- 1.200m
Volume	- 123.000m³
Pipe Inlet	- 100.780
Tank Invert	- 100.780
Tank Crown	- 101.980
Tank Cover	- 0.900m

Flow Control Chamber	
Type	- Hydro-Brake
Range	- Optimum
Invert Level	- 106.510
Design Flow	- 1.390m
Capacity	- 8000 litres
Diameter	- 1000mm
Unit Reference	- MD-SHE-0100-5000-1390-5000

Wash Down and Silt Unit	
Make	- Kingspan Klargester
Type	- W1080
Length	- 3.200m
Diameter	- 2.020m
Capacity	- 8000 litres
Max Flow	- 22.00 l/s
Cover Level	- 103.000m
Base Level	- 101.585m
Inlet Invert	- 102.050m (0.950m from cover)
Outlet Invert	- 102.000m (1.000m from cover)

NOTE: Klargester units to have a 100mm PVC vent pipe connection. End of pipe to extend 2.4m above ground and be topped with a vent cowl.

Bypass Separator Note	
Make	- Kingspan Klargester
Type	- NSBE010
Length	- 2.069m
Diameter	- 1.220m
Cover level	- 80.500m
Base Level	- 77.300m
Inlet Invert	- 78.750m (1.750m from cover)
Outlet Invert	- 78.650m (1.850m from cover)

NOTE: Klargester units to have a 100mm PVC vent pipe connection. End of pipe to extend 2.4m above ground and be topped with a vent cowl.

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.

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.

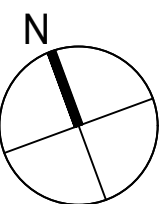
All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

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.

Drainage Key:

- Proposed Surface Water
- Proposed Foul Water
- Proposed CW Water
- Existing CW Sewer
- RWP
- FP
- Surface Water Channel Drain
- Foul Water Channel Drain
- External Surface Water Gully
- Development Boundary



status

PRELIMINARY

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This drawing shall be read in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work.

All dimensions are to be checked on site by the contractor prior to proceeding with any work.

Hazard Identification

ref

hazard

date

1

DEEP SOAKAWAY MANHOLE

20.04.23

Site Specific Drainage Notes:

Rainwater pipe and foul down pipe locations to be confirmed by Architect prior to the commencement of drainage works. Design subject to change once known.

Final external levels to be confirmed. Manhole and inspection cover levels subject to change once final external levels are known.

Existing combined network (to which the foul and surface water is connecting / discharging) location, size and depth to be confirmed prior to the commencement of any drainage works. Design subject to change once known.

Connection to 3750 sewer subject to Section 106 agreement with United Utilities. No connection unto approval issued.

All foul water pipes to be 1000, and all surface water pipes to be 1500 unless shown otherwise.

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

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

Surface and foul water discharge to sewer subject to Section 106 agreement with United Utilities. No drainage work to commence until approval has been received.

All existing drainage found on-site to remain live unless proven to be redundant. Survey of existing drainage to establish network to be carried out prior to the commencement of work on site.

Drainage Specifications

Foul water pipes to be Polypipe to BS EN 1401-1 or similar.

Surface water pipes to be Polypipe Rigidrain or similar.

Manholes to be Precast Concrete by FP McCann or similar

Inspection chambers to be Polypipe or similar.

Channel and Threshold Drains by ACO or similar.

Flow control to be Hydro-Brake by Hydro International or similar.

Attenuation tank to be WAVIN AquaCell Core-R or similar.

P2

LAYOUT AND TANK AMENDMENTS

MDS

28.06.23

P1

FIRST ISSUE

MDS

21.04.23

ref

revision

by

date

BGH

Architects
Consulting Engineers
Quantity Surveyors

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Bradshaw Gass & Hope LLP

client
GREATER MANCHESTER
COMBINED AUTHORITY

project
WHITEFIELD FIRE STATION

drawing
PROPOSED DRAINAGE LAYOUT

drawn by

MDS

date

20.04.23

checked by

BH

date

scale

1:125

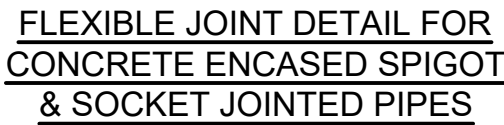
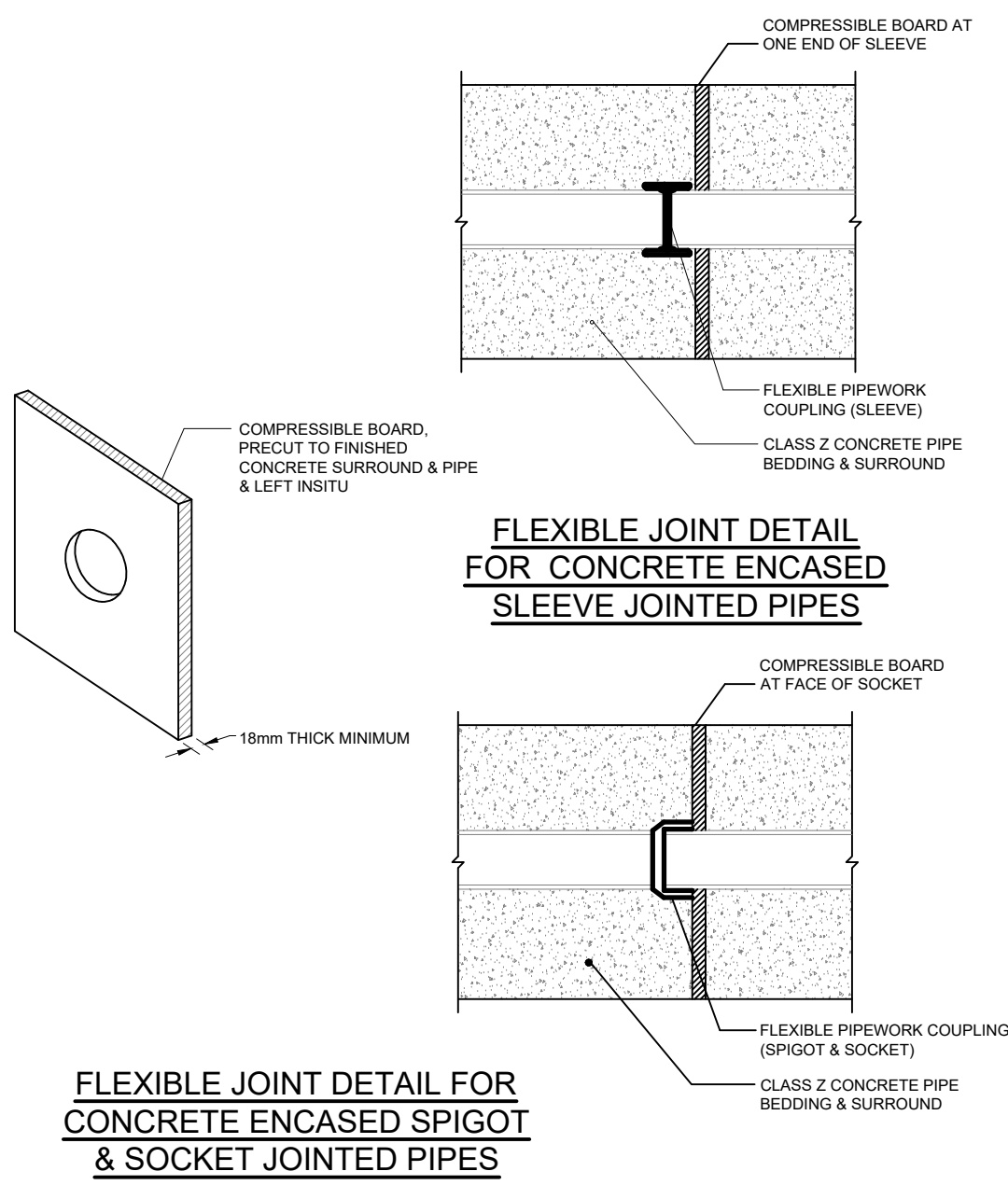
A1

dwg no

1978.35.400-WHITEF

rev

P2



status		PRELIMINARY	
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This drawing shall be read in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work.			
All dimensions are to be checked on site by the contractor prior to proceeding with any work.			
Hazard Identification			
ref	hazard		date
P2	TANK AND GULLY DETAIL AMENDED	MDS	28.06.23
P1	FIRST ISSUE	MDS	25.04.23
ref	revision	by	date
 Architects Consulting Engineers Quantity Surveyors		21 Silverwell Street Bolton BL1 1PR t: 01204 525321 email: bgh@bolton.co.uk www.bghbolton.co.uk	
Bradshaw Gass & Hope LLP			
client			
GREATER MANCHESTER COMBINED AUTHORITY			
project			
WHITEFIELD FIRE STATION			
drawing			
DRAINAGE DETAILS SHEET 2			
drawn by MDS		date 25.04.23	
checked by BH		date	
scale N.T.S		A1	
dwg no 1978.35.403.WHITEF		rev P2	

Appendix J - Surface Water Management Calculations

Flo Consult UK Ltd		Page 1
4 Market Square	Whitefield Fire Station	
Old Amersham	Surface Water	
Buckinghamshire, HP7 0DQ	Network Calculations	
Date 28/06/2023	Designed by MDS	
File WFS - SW Network Calcula...	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 380483 406476 SD 80483 06476	
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	45
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.154	4-8	0.035

Total Area Contributing (ha) = 0.189

Total Pipe Volume (m³) = 3.491

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 2		
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ						Whitefield Fire Station Surface Water Network Calculations						
Date 28/06/2023						Designed by MDS						
File WFS - SW Network Calcula...						Checked by MDS						
Innovyze						Network 2020.1.3						
<u>Network Design Table for Storm</u>												
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
1.000	10.500	0.270	38.9	0.057	5.00	0.0	0.600	o	225	Pipe/Conduit		
2.000	26.800	0.670	40.0	0.035	5.00	0.0	0.600	o	225	Pipe/Conduit		
1.001	10.000	0.100	100.0	0.065	0.00	0.0	0.600	o	300	Pipe/Conduit		
1.002	11.900	0.120	99.2	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit		
3.000	10.000	0.980	10.2	0.021	5.00	0.0	0.600	o	150	Pipe/Conduit		
1.003	4.000	0.150	26.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		
<u>Network Results Table</u>												
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)		
1.000	50.00	5.08	101.175	0.057	0.0	0.0	3.5	2.10	83.7	11.2		
2.000	50.00	5.22	101.575	0.035	0.0	0.0	2.1	2.07	82.5	6.9		
1.001	50.00	5.32	100.830	0.157	0.0	0.0	9.6	1.57	111.1	30.8		
1.002	50.00	5.45	100.730	0.168	0.0	0.0	10.2	1.58	111.6	33.0		
3.000	50.00	5.05	101.750	0.021	0.0	0.0	1.3	3.17	56.1	4.1		
1.003	50.00	5.47	100.610	0.189	0.0	0.0	11.5	3.06	216.1	37.1		
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Surface Water Network Calculations	
Date 28/06/2023	Designed by MDS	
File WFS - SW Network Calcula...	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., L*W (mm)
1.000	o	225	S1	102.680	101.175	1.280	Open Manhole	1200
2.000	o	225	S2	103.000	101.575	1.200	Open Manhole	1200
1.001	o	300	S3	103.000	100.830	1.870	Open Manhole	1500
1.002	o	300	S4	103.000	100.730	1.970	Open Manhole	1200
3.000	o	150	S5	102.950	101.750	1.050	Open Manhole	460
1.003	o	300	S6/FC	103.000	100.610	2.090	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	10.500	38.9	S3	103.000	100.905	1.870	Open Manhole	1500
2.000	26.800	40.0	S3	103.000	100.905	1.870	Open Manhole	1500
1.001	10.000	100.0	S4	103.000	100.730	1.970	Open Manhole	1200
1.002	11.900	99.2	S6/FC	103.000	100.610	2.090	Open Manhole	1200
3.000	10.000	10.2	S6/FC	103.000	100.770	2.080	Open Manhole	1200
1.003	4.000	26.7	C1	103.200	100.460	2.440	Open Manhole	1200

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	C1	103.200	100.460	0.000	1200	0

Flo Consult UK Ltd		Page 5
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Surface Water Network Calculations	
Date 28/06/2023	Designed by MDS	
File WFS - SW Network Calcula...	Checked by MDS	
Innovyze	Network 2020.1.3	
Simulation Criteria for Storm Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 45.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet 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 380483 406476 SD 80483 06476 Data Type Point Summer Storms Yes Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30		
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Surface Water Network Calculations																																																																																																																	
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Innovyze	Network 2020.1.3																																																																																																																	
<u>Online Controls for Storm</u> <u>Hydro-Brake® Optimum Manhole: S6/FC, DS/PN: 1.003, Volume (m³): 3.6</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0100-5000-1390-5000</td></tr><tr><td>Design Head (m)</td><td>1.390</td></tr><tr><td>Design Flow (l/s)</td><td>5.0</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>100</td></tr><tr><td>Invert Level (m)</td><td>100.610</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>150</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1200</td></tr></table> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.390</td><td>5.0</td><td>Kick-Flo®</td><td>0.855</td><td>4.0</td></tr><tr><td>Flush-Flo™</td><td>0.418</td><td>5.0</td><td>Mean Flow over Head Range</td><td>-</td><td>4.4</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>3.3</td><td>1.200</td><td>4.7</td><td>3.000</td><td>7.2</td><td>7.000</td><td>10.7</td></tr><tr><td>0.200</td><td>4.6</td><td>1.400</td><td>5.0</td><td>3.500</td><td>7.7</td><td>7.500</td><td>11.0</td></tr><tr><td>0.300</td><td>4.9</td><td>1.600</td><td>5.3</td><td>4.000</td><td>8.2</td><td>8.000</td><td>11.4</td></tr><tr><td>0.400</td><td>5.0</td><td>1.800</td><td>5.6</td><td>4.500</td><td>8.7</td><td>8.500</td><td>11.7</td></tr><tr><td>0.500</td><td>5.0</td><td>2.000</td><td>5.9</td><td>5.000</td><td>9.1</td><td>9.000</td><td>12.1</td></tr><tr><td>0.600</td><td>4.9</td><td>2.200</td><td>6.2</td><td>5.500</td><td>9.5</td><td>9.500</td><td>12.4</td></tr><tr><td>0.800</td><td>4.3</td><td>2.400</td><td>6.4</td><td>6.000</td><td>9.9</td><td></td><td></td></tr><tr><td>1.000</td><td>4.3</td><td>2.600</td><td>6.7</td><td>6.500</td><td>10.3</td><td></td><td></td></tr></table>			Unit Reference	MD-SHE-0100-5000-1390-5000	Design Head (m)	1.390	Design Flow (l/s)	5.0	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	100	Invert Level (m)	100.610	Minimum Outlet Pipe Diameter (mm)	150	Suggested Manhole Diameter (mm)	1200	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.390	5.0	Kick-Flo®	0.855	4.0	Flush-Flo™	0.418	5.0	Mean Flow over Head Range	-	4.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.3	1.200	4.7	3.000	7.2	7.000	10.7	0.200	4.6	1.400	5.0	3.500	7.7	7.500	11.0	0.300	4.9	1.600	5.3	4.000	8.2	8.000	11.4	0.400	5.0	1.800	5.6	4.500	8.7	8.500	11.7	0.500	5.0	2.000	5.9	5.000	9.1	9.000	12.1	0.600	4.9	2.200	6.2	5.500	9.5	9.500	12.4	0.800	4.3	2.400	6.4	6.000	9.9			1.000	4.3	2.600	6.7	6.500	10.3		
Unit Reference	MD-SHE-0100-5000-1390-5000																																																																																																																	
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Surface Water Network Calculations																																																																																					
Date 28/06/2023	Designed by MDS																																																																																					
File WFS - SW Network Calcula...	Checked by MDS																																																																																					
Innovyze	Network 2020.1.3																																																																																					
Storage Structures for Storm Cellular Storage Manhole: S4, DS/PN: 1.002 Invert Level (m) 100.780 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><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></thead><tbody><tr><td>0.000</td><td>108.0</td><td>0.0</td><td>2.600</td><td>0.0</td><td>0.0</td></tr><tr><td>0.200</td><td>108.0</td><td>0.0</td><td>2.800</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>108.0</td><td>0.0</td><td>3.000</td><td>0.0</td><td>0.0</td></tr><tr><td>0.600</td><td>108.0</td><td>0.0</td><td>3.200</td><td>0.0</td><td>0.0</td></tr><tr><td>0.800</td><td>108.0</td><td>0.0</td><td>3.400</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>108.0</td><td>0.0</td><td>3.600</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>108.0</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></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	108.0	0.0	2.600	0.0	0.0	0.200	108.0	0.0	2.800	0.0	0.0	0.400	108.0	0.0	3.000	0.0	0.0	0.600	108.0	0.0	3.200	0.0	0.0	0.800	108.0	0.0	3.400	0.0	0.0	1.000	108.0	0.0	3.600	0.0	0.0	1.200	108.0	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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2.400	0.0	0.0	5.000	0.0	0.0																																																																																	
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Whitefield Fire Station Surface Water Network Calculations	
Date 28/06/2023	Designed by MDS	
File WFS - SW Network Calcula...	Checked by MDS	
Innovyze	Network 2020.1.3	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S1	-0.162	0.000	0.17			12.3	OK	
2.000	S2	-0.178	0.000	0.10			7.5	OK	
1.001	S3	-0.167	0.000	0.40			31.4	OK	
1.002	S4	-0.098	0.000	0.07		42	5.9	OK	
3.000	S5	-0.120	0.000	0.09			4.5	OK	
1.003	S6/FC	0.026	0.000	0.05			4.9	SURCHARGED	

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ			Whitefield Fire Station Surface Water Network Calculations																																																																																															
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Innovyze			Network 2020.1.3																																																																																															
<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>																																																																																																		
<u>Simulation Criteria</u>																																																																																																		
Areal Reduction Factor		1.000	Additional Flow - % of Total Flow		45.000																																																																																													
Hot Start (mins)		0	MADD Factor * 10m³/ha Storage		2.000																																																																																													
Hot Start Level (mm)		0	Inlet Coefficient		0.800																																																																																													
Manhole Headloss Coeff (Global)		0.500	Flow per Person per Day (l/per/day)		0.000																																																																																													
Foul Sewage per hectare (l/s)		0.000																																																																																																
Number of Input Hydrographs		0	Number of Offline Controls		0	Number of Time/Area Diagrams	0																																																																																											
Number of Online Controls		1	Number of Storage Structures		1	Number of Real Time Controls	0																																																																																											
<u>Synthetic Rainfall Details</u>																																																																																																		
Rainfall Model			FEH																																																																																															
FEH Rainfall Version			2013																																																																																															
Site Location			GB 380483 406476 SD 80483 06476																																																																																															
Data Type			Point																																																																																															
Cv (Summer)			0.750																																																																																															
Cv (Winter)			0.840																																																																																															
Margin for Flood Risk Warning (mm)			300.0																																																																																															
Analysis Timestep			2.5 Second Increment (Extended)																																																																																															
DTS Status			ON																																																																																															
DVD Status			ON																																																																																															
Inertia Status			OFF																																																																																															
Profile(s)			Summer and Winter																																																																																															
Duration(s) (mins)			15, 30, 60, 120, 240, 360, 480, 960, 1440																																																																																															
Return Period(s) (years)			2, 30, 100																																																																																															
Climate Change (%)			0, 40, 45																																																																																															
WARNING: Half Drain Time has not been calculated as the structure is too full.																																																																																																		
<table><tr><th></th><th>US/MH</th><th></th><th>Return</th><th>Climate</th><th>First (X)</th><th>First (Y)</th><th>First (Z)</th><th>Overflow</th><th>Water</th></tr><tr><th>PN</th><th>Name</th><th>Storm</th><th>Period</th><th>Change</th><th>Surcharge</th><th>Flood</th><th>Overflow</th><th>Act.</th><th>Level</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>(m)</th></tr><tr><td>1.000</td><td>S1</td><td>120 Winter</td><td>30</td><td>+40%</td><td>30/30 Winter</td><td></td><td></td><td></td><td>101.616</td></tr><tr><td>2.000</td><td>S2</td><td>15 Winter</td><td>30</td><td>+40%</td><td>100/60 Winter</td><td></td><td></td><td></td><td>101.661</td></tr><tr><td>1.001</td><td>S3</td><td>120 Winter</td><td>30</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>101.614</td></tr><tr><td>1.002</td><td>S4</td><td>120 Winter</td><td>30</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>101.611</td></tr><tr><td>3.000</td><td>S5</td><td>15 Winter</td><td>30</td><td>+40%</td><td>100/60 Winter</td><td></td><td></td><td></td><td>101.805</td></tr><tr><td>1.003</td><td>S6/FC</td><td>120 Winter</td><td>30</td><td>+40%</td><td>2/30 Winter</td><td></td><td></td><td></td><td>101.626</td></tr></table>										US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water	PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level										(m)	1.000	S1	120 Winter	30	+40%	30/30 Winter				101.616	2.000	S2	15 Winter	30	+40%	100/60 Winter				101.661	1.001	S3	120 Winter	30	+40%	30/15 Summer				101.614	1.002	S4	120 Winter	30	+40%	30/15 Summer				101.611	3.000	S5	15 Winter	30	+40%	100/60 Winter				101.805	1.003	S6/FC	120 Winter	30	+40%	2/30 Winter				101.626
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Date 28/06/2023	Designed by MDS	
File WFS - SW Network Calcula...	Checked by MDS	
Innovyze	Network 2020.1.3	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
1.000	S1	0.216	0.000	0.18			12.3	SURCHARGED	
2.000	S2	-0.139	0.000	0.31			23.9	OK	
1.001	S3	0.484	0.000	0.42			33.5	SURCHARGED	
1.002	S4	0.581	0.000	0.06			4.8	SURCHARGED	
3.000	S5	-0.095	0.000	0.29			14.4	OK	
1.003	S6/FC	0.716	0.000	0.05			5.0	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Simulation Criteria Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 45.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FEH FEH Rainfall Version 2013 Site Location GB 380483 406476 SD 80483 06476 Data Type Point Cv (Summer) 0.750 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON DVD Status ON Inertia Status OFF Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440 Return Period(s) (years) 2, 30, 100 Climate Change (%) 0, 40, 45 WARNING: Half Drain Time has not been calculated as the structure is too full.																																																																																																	
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	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water																																																																																								
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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>								
		Surcharged	Flooded		Half Drain	Pipe		
	US/MH	Depth	Volume	Flow / Overflow	Time	Flow		Level
PN	Name	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status
1.000	S1	0.640	0.000	0.15			10.2	SURCHARGED
2.000	S2	0.240	0.000	0.09			6.6	SURCHARGED
1.001	S3	0.908	0.000	0.35			27.9	SURCHARGED
1.002	S4	1.005	0.000	0.06			5.3	SURCHARGED
3.000	S5	0.136	0.000	0.08			4.0	SURCHARGED
1.003	S6/FC	1.129	0.000	0.05			5.0	SURCHARGED
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