BURO HAPPOLD

Design Note

Project	Project North Stand Manchester
Subject	Site Improvement Works Drainage Strategy
Project no	053810
Date	25 April 2023

Revision	Description	Issued by	Date	Approved (signature)
P01	Issued For Planning	CM	25/04/2023	NH

Introduction

Buro Happold has been instructed by Manchester City Football Club to prepare a Surface Water Strategy Design Note in support of a Site Improvement Works (SIW) detailed planning application to Manchester City Council (MCC) for the proposed Project North Stand Manchester development at the Etihad Campus.

Works on the Project North Stand Manchester development are broken down into two phases, the SIW phase and the main phase. The SIW phase is preparatory enabling works to ready the site for the main phase of development. The SIW consists of drainage and services diversions and abandonments, grouting of below ground mining voids and other ground preparation activities. The SIW phase will involve hoarding off areas of the site to allow works to be undertaken safely. The SIW phase also therefore includes paving works required to maintain pedestrian routes for the stadium and other campus users. The main phase then encompasses all other construction associated with the Project North Stand Manchester development.

The drainage components of the SIW consists of :

The diversion and abandonment of existing private drainage infrastructure;

The Installation of elements of the main phase drainage strategy in advance of the main works, consisting of;

Proposed private drainage manholes and pipes required for connection of the future main phase works;

A proposed geocellular attenuation tank required as part of the sustainable drainage strategy for the main phase.

The drainage infrastructure constructed under item 2 above will not be made live until the main works are consented and construction commences.

The Project North Stand Manchester Drainage Strategy (document reference: 0053810-BHE-XX-XX-RP-X-0001) was prepared and submitted as part of the Project North Stand Manchester development planning application, reference: 136763/FO/2023. This strategy can be seen in **Appendix A**.

The purpose of this design note is twofold. Firstly to describe the diversions and abandonments that will occur during the SIW. Secondly it will present the aspects of the main phase drainage strategy that are to be constructed during the SIW phase (item 2 above) and provide the associated, catchment plans, discharge rate calculations, and hydraulic calculations.

The SIW red line boundary differs to the main works red line boundary as shown in Figure 0-1 below.

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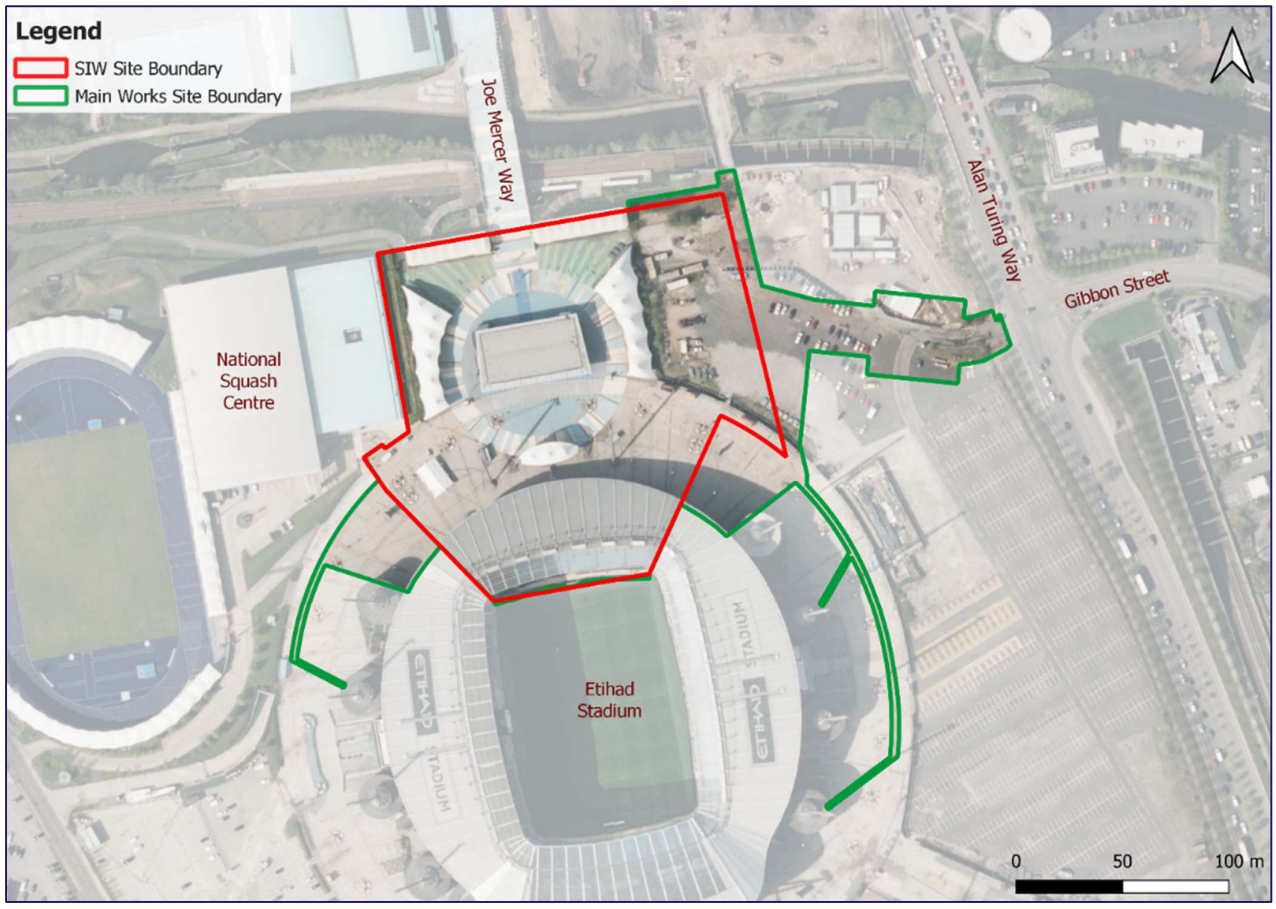

Figure 0-1 SIW and Main Phase Works Site Boundaries

Diversions and Abandonments

All diversions and abandonments are of privately owned drainage elements. No diversions of public sewers are proposed.

Surface Water

The abandonments and diversions of onsite surface water infrastructure are described and presented below. For further information see drawing NSE-BHE-ZX-XX-DR-C-003201 "SIW Below Ground Drainage Surface Water General Arrangement Overview" in **Appendix B**.

600mm diameter surface water drain that enters the site from the west. A new manhole will be constructed on the existing 600mm diameter pipe. A proposed 600mm diameter pipe run of 4.5m length will direct the pipe into the radial road that encompasses the stadium known as the raceway. A new manhole will be constructed in the raceway from where a proposed 600mm diameter pipe run 57m in length will connect the diversion back into the existing surface water drainage manhole. This diversion is being put in place to avoid foundations of a proposed main phase structure. A 600mm diameter pipe, 55m in length is being abandoned as part of this diversion. The diversion provides a simple like-for like replacement of the existing pipe, no changes to the catchment connecting to the pipe will be made hence flows will be unchanged.

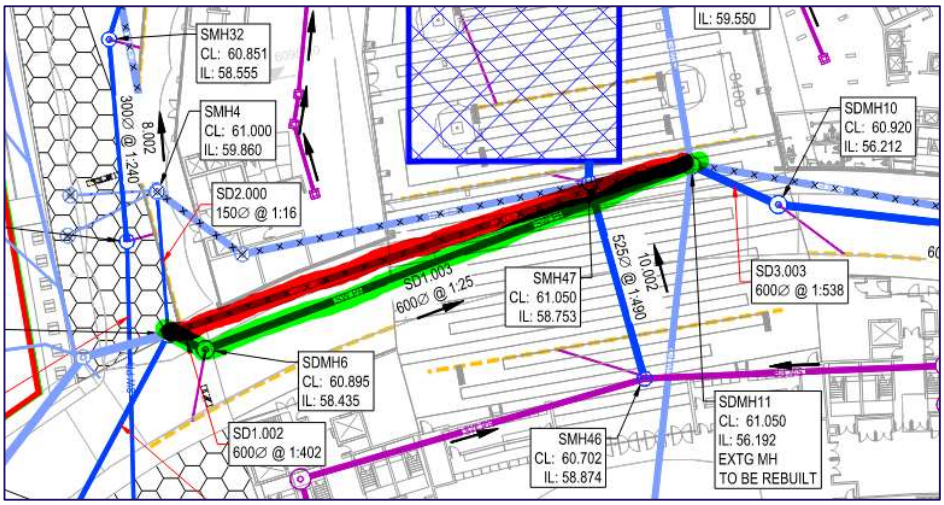

Figure 0-1 Surface Water Diversion 1 (Proposed Diversion = Green - Proposed Abandonment = Red)

600mm diameter surface water drain that runs anticlockwise round the raceway to the northeast of the Etihad Stadium. A new manhole is to be constructed on the existing 600mm diameter pipe. A proposed 600mm diameter pipe run of 39m length will run under the raceway with a new manhole being constructed in the raceway, from where a 600mm diameter pipe run 10m in length will connect the diversion back into the existing surface water drainage manhole. This diversion is being put in place to avoid foundations of a proposed main phase structure. A 600mm diameter pipe, 49m in length is being abandoned as part of this diversion. The diversion provides a simple like-for like replacement of the existing pipe, no changes to the catchment connecting to the pipe will be made hence flows will be unchanged.

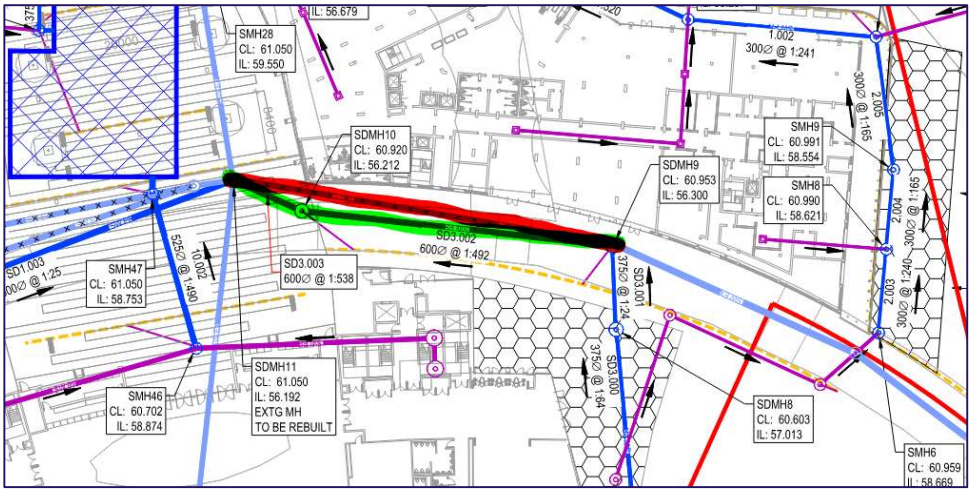

Figure 0-2 Surface Water Diversion 2 (Proposed Diversion = Green - Proposed Abandonment = Red)

150mm diameter surface water drain along the west side of the site. A proposed 150mm diameter pipe is to connect an existing manhole in the west of the site to the new manhole being constructed on the existing 600mm pipe (part of diversion 1). This diversion is being put in place to avoid foundations of a proposed main phase structure. A 150mm diameter pipe, 12m in length is being abandoned as part of this diversion. This diversion is being put in place to avoid foundations of a proposed main phase structure. The diversion provides a simple like-for like replacement of the existing pipe, no changes to the catchment connecting to the pipe will be made hence flows will be unchanged.

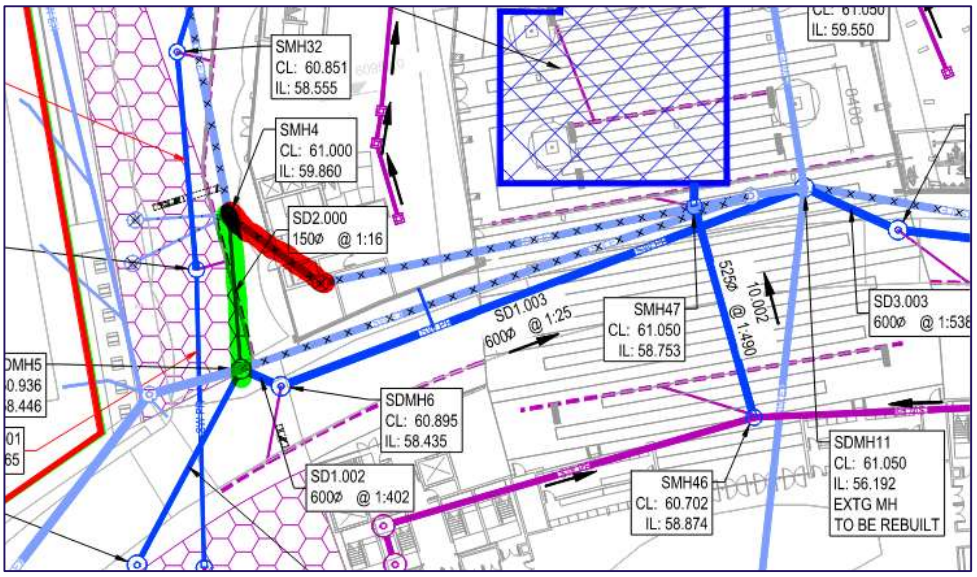

Figure 0-3 Surface Water Diversion 3 (Proposed Diversion = Green - Proposed Abandonment = Red)

A channel drain that runs along the north west edge of the raceway currently connects to an existing manhole and a 300mm diameter pipe, 45m in length is being abandoned as part of this diversion. This diversion is being put in place to avoid foundations of a proposed main phase structure. This channel is to be connected to the 600mm diameter pipe running within the raceway (part of diversion 1).

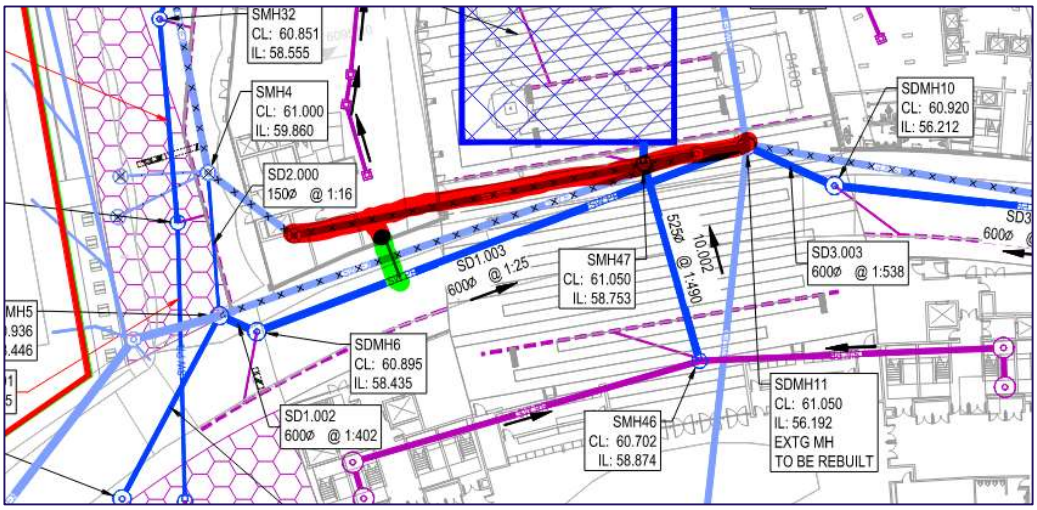

Figure 0-4 Surface Water Diversion 4 (Proposed Diversion = Green - Proposed Abandonment = Red)

Stormwater runoff from the existing stadium roof currently drains from the northern edge of the stadium roof into a well via a metal chute. It is conveyed via a 600mm sewer to a manhole just north of the raceway which is also the manhole that diversions 1 and 2 above both connect into. The drainage serving the existing roof is to be diverted to avoid the footprint of the expanded north stand. These diversions are summarised in diversion 5 and 6. The additional north stand roof is to be captured separately to allow it to be attenuated prior to discharge off site, the drainage for the extended roof is part of the man works planning application.

A proposed 375mm diameter pipe is proposed to collect stormwater from the proposed west drainage chute for the existing stadium roof. A proposed 375mm diameter pipe 34m in length will run north with a new manhole being constructed from where a 375mm diameter pipe run 22m in length will connect to the new manhole being constructed on the existing 600mm pipe (part of diversion 1).

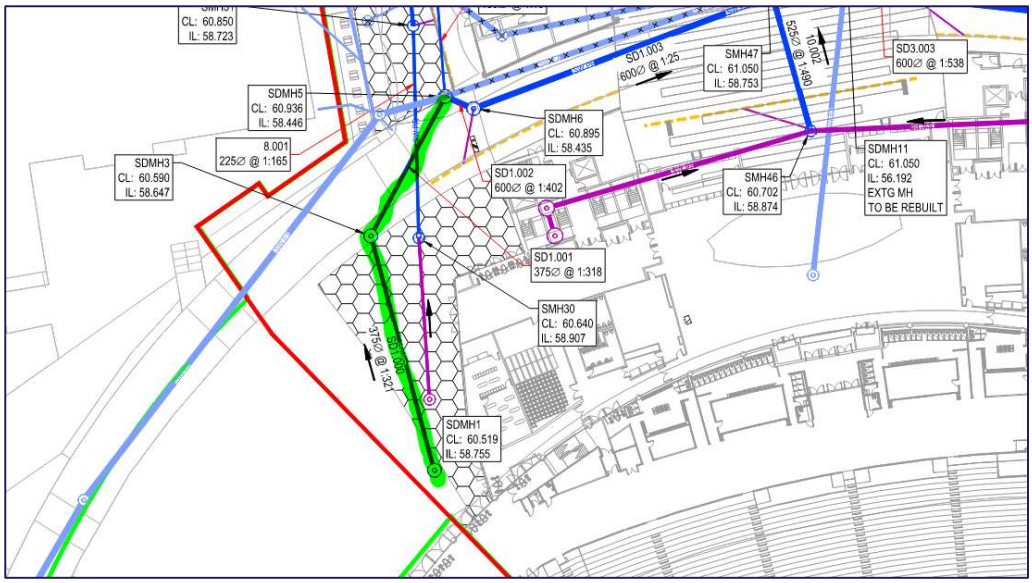

Figure 0-5 Surface Water Diversion 5 (Proposed Diversion = Green)

A proposed 375mm diameter pipe is proposed to collect stormwater from the proposed east drainage chute for the existing stadium roof. A proposed 375mm diameter pipe run 31m in length will run north with a new manhole being constructed from where a 375mm diameter pipe run 14m in length will connect to the new manhole being constructed on the existing 600mm pipe (part of diversion 2).

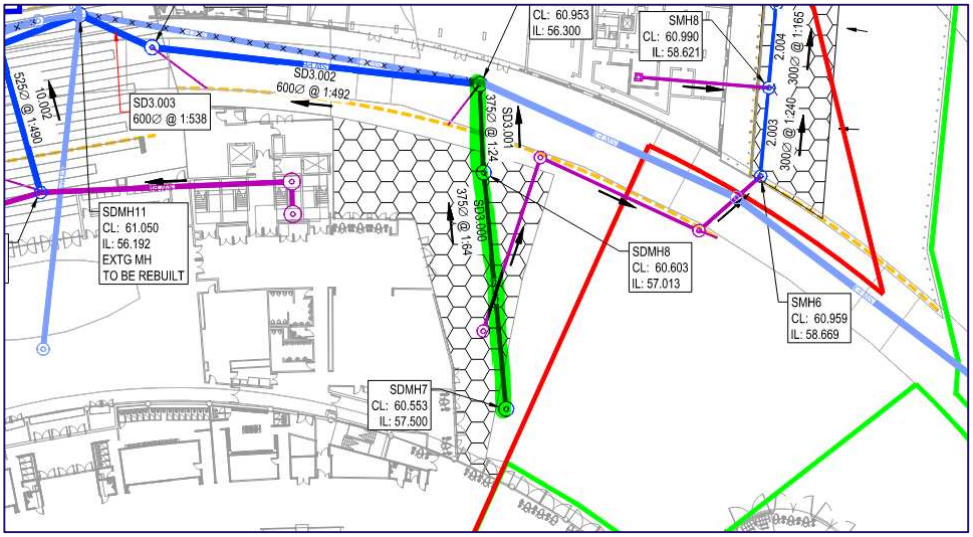

Figure 0-6 Surface Water Diversion 6 (Proposed Diversion = Green)

As the downstream pipe that diversion 1 and 2 flow into is 600mm in diameter and currently accommodates flows from the roof and surrounding hardstanding it is considered that the 600mm diameter pipes that diversions 5 and 6 connect into are sufficiently sized to accept the increased flow. This existing 600mm diameter pipe downstream of diversion 1 and 2 is highlighted in Figure 0-7 below. Hydraulic calculations for the diversion are located in **Appendix C.**

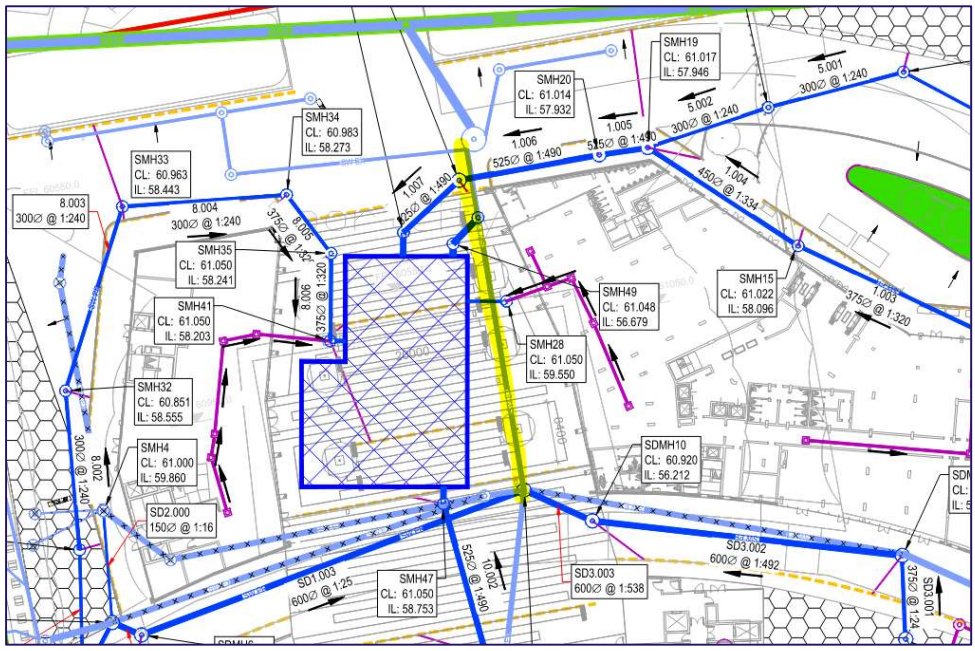

Figure 0-7 600mm diameter Pipe Downstream from Diversion 1 and 2

Foul Water

The abandonments and diversions of onsite foul water infrastructure are described and presented below. For further information see **Appendix D** for SIW Below Ground Drainage Foul Water General Arrangement Overview, NSE-BHE-ZX-XX-DR-C-003202

A proposed 225mm diameter pipe is to connect an existing manhole that receives foul flows from the existing north stand and runs north though the site before running west to connect to a proposed manhole to be constructed on an existing private foul water drain approximately 11.5m prior to its connection to the UU sewer network. 9 proposed manholes are to be constructed as part of this diversion to facilitate the routing of this drain around the footprint of the proposed main works development and to avoid existing constraints. As part of this diversion a 225mm diameter pipe transitioning into a 300mm diameter pipe that runs from the north edge of the Etihad Stadium to the northwest corner of the site approximately 11.5m prior to its connection to the UU sewer network is to be abandoned.

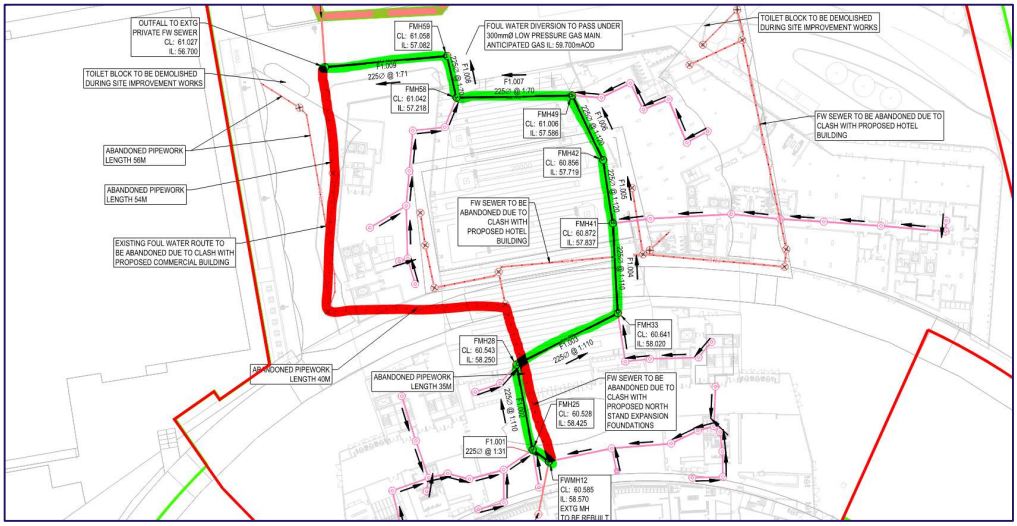

Figure 0-8 Foul Water Diversion 1 (Proposed Diversion = Green - Proposed Abandonment = Red)

An existing 150mm pipe that runs 40m from the toilet block in the north west of the site to a foul water manhole in the west of the site is abandoned as the toilet block is being demolished as part of the SIW.

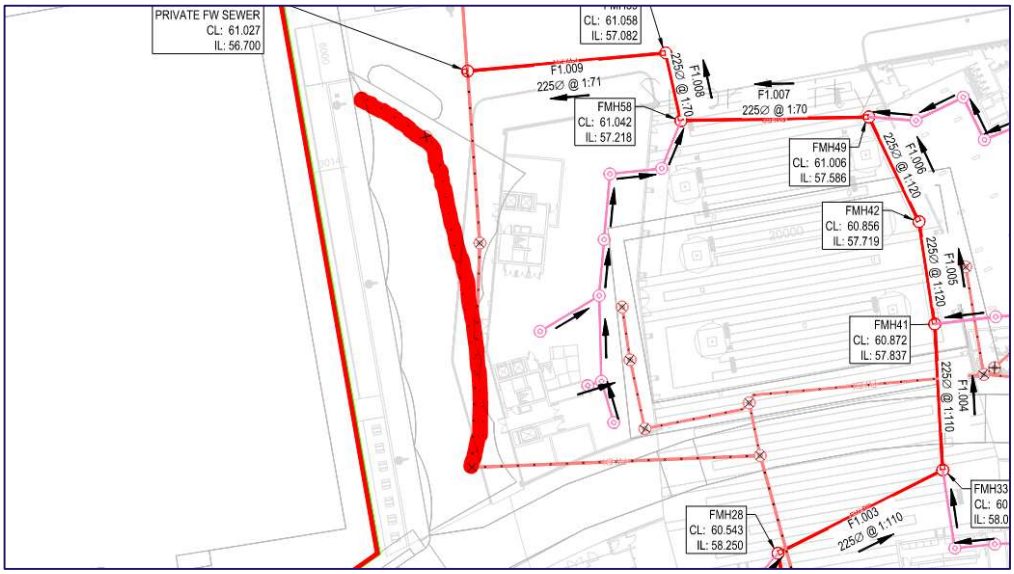

Figure 0-9 Foul Water Abandonment 1 (Proposed Abandonment = Red)

An existing 150mm pipe that runs 48m from the toilet block in the north east of the site to a foul water manhole in the east of the site and then runs 55m to the centre of the site is abandoned as the toilet block is being demolished as part of the SIW. A number of laterals associated with this sewer are also to be abandoned as part of the demolition of the club shop and Summerbee Bar.

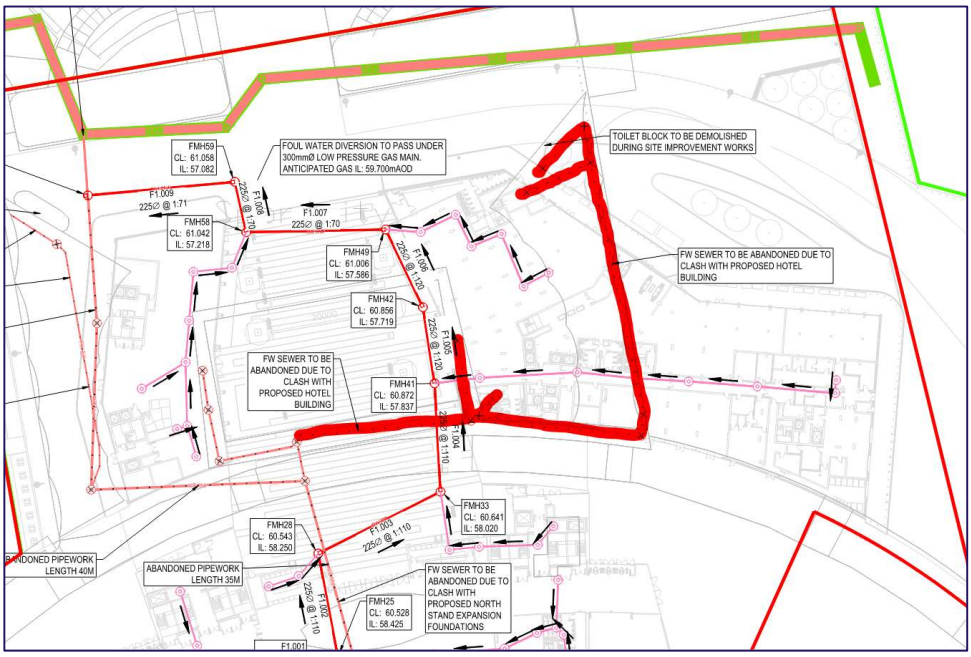

Figure 0-10 Foul Water Abandonment 2 (Proposed Abandonment = Red)

Proposed Drainage Strategy

All proposed drainage calculations within this note consider the impermeable area for the main phase of works, i.e. the completed development. Construction of drainage elements within the SIW phase will only occur within the SIW red line boundary. There will be no inflow connectivity of new stormwater catchments until the main phase of works is consented and underway (subject to a separate planning application, 136763/FO/2023).

Within the SIW phase the surface water elements to be constructed include a number of the main phase below ground external drainage pipe runs and the geocellular attenuation tank. This section will set out the drainage variables which are required to confirm the details of the pipework and attenuation tank to be constructed within the SIW phase. For further information see **Appendix B** for SIW Below Ground Drainage Surface Water General Arrangement Overview, NSE-BHE-ZX-XX-DR-C-003201.

The size of pipework and the volume of attenuation required for the main phase works but to be installed under the SIW have been established through design of the main works, and presented in the drainage strategy submitted for the main works under planning reference: 136763/FO/2023. The full strategy is presented in **Appendix A** and is summarised below.

Detailed hydraulic calculations have been undertaken to size the surface water pipework. For further information see hydraulic calculations located within **Appendix E**.

Allowable Discharge Rate

The main works site area measures 3.5ha. Approximately 2.46ha is positively drained existing hardstanding and buildings, of which 1.87ha is proposed to be modified by this project and 0.59ha is to remain unchanged. An additional 0.91ha is a gravel car park with no positive drainage system and therefore considered greenfield land from a hydraulic perspective. The remaining 0.11ha is soft landscaping, consisting of steep grass banks leading down to the National Squash Centre and the Metrolink tram stop platform, which are to remain unchanged. These areas are shown in Figure 0-1below.

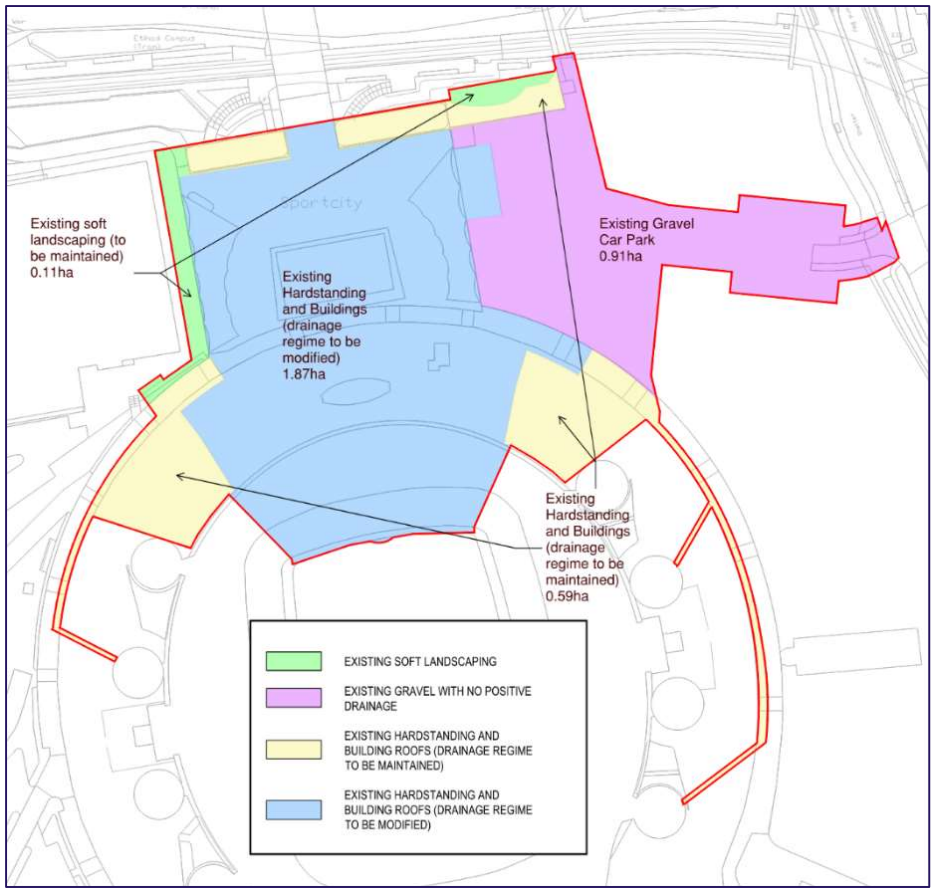

Figure 0-1 Existing Surface Water Catchment Areas

The existing brownfield discharge rate for the positively drained hardstanding has been calculated using the modified rational method, where;

$$Q_{peak} = 2.78CIA$$

Q_{peak} = Peak runoff
C = Co-efficient C = Cv*Cr
Cv = Volumetric Co-efficient = 0.84
Cr = Routing Co-efficient = 1.3
I = Rainfall Intensity = 11.376mm/hr (60 min 1 in 1 year event)
A = Area = 1.87ha

$$Q_{peak} = 2.78 * 0.84 * 1.3 * 11.376 * 1.87$$

$$Q_{peak} = 64.6l/s$$

The runoff rate for the non-positively drained gravel car park (Q_{bar}) has been calculated as 5.91l/s. This was calculated at greenfield rates via the HR Wallingford Greenfield Runoff Rate Estimation tool. Please refer to **Appendix F** for the results.

It is considered the existing total runoff rate from site is therefore;

$$Q_{Tpeak} = 64.6 + 5.9 = 70.5l/s$$

As per the Manchester, Salford and Trafford Strategic Flood Risk Assessment new developments are to reduce brownfield runoff rates by 50%.

Therefore, the total allowable discharge rate from the site = 50% of positively drained hardstanding + Non-positively Drained Car Park Greenfield Rate;

$$Allowable\ Discharge\ Rate = \left(\frac{64.6}{2}\right) + 5.9 = 38.2l/s$$

However, even though the modified rational method provides a reasonable method of calculating flow it does not consider limitations on flow due to constraints such as pipe capacities. The limitation on this flow is calculated based upon the theoretical pipe full capacity of existing incoming connections from the site into the UU Sewerage Network, as shown in Table 0-1 below. See Figure 0-2 below for the Pipe Catchment Plan.

Table 0-1 Full Bore Pipe Analysis

Catchment	Area (m2)	Cum. Area (m2)	Flow (l/s)	Pipe Diameter	Capacity	Flows to	Flow Restricted
1	4017.53	4017.53	13.9	600	306	5	NO
2	545.02	545.02	1.9	225	40.4	10	NO
3	1278.56	1278.56	4.4	150	17.8	4	NO
4	1084.69	2363.25	8.2	300	71.2	8	NO
5	2940.9	6958.43	24.0	300	71.2	8	NO
6	2664.57	2664.57	9.2	600	306	8	NO
7	988.63	988.63	3.4	3x150	53.4	10	NO
8	540.14	14077.26	48.6	600	306	13	NO
9	1550.87	1550.87	5.4	300	71.2	8	NO
10	1277.2	2810.85	9.7	300	71.2	13	NO
11	1159.86	1159.86	4.0	150	17.8	13	NO
12	418.44	418.44	1.4	450	160.7	13	NO
13	239.85	18706.26	64.6	600	306	offsite	NO

The theoretical pipe full capacity check has been undertaken based on individual runs within the site and checking against cumulative area as the run progresses through the site. This check has shown that the flow discharging offsite is limited to 306l/s.

As shown within Table 0-1 it is not considered that the existing pipe sizes restrict the flow offsite. It is therefore proposed that the allowable Surface Water discharge rate is 38.2l/s.

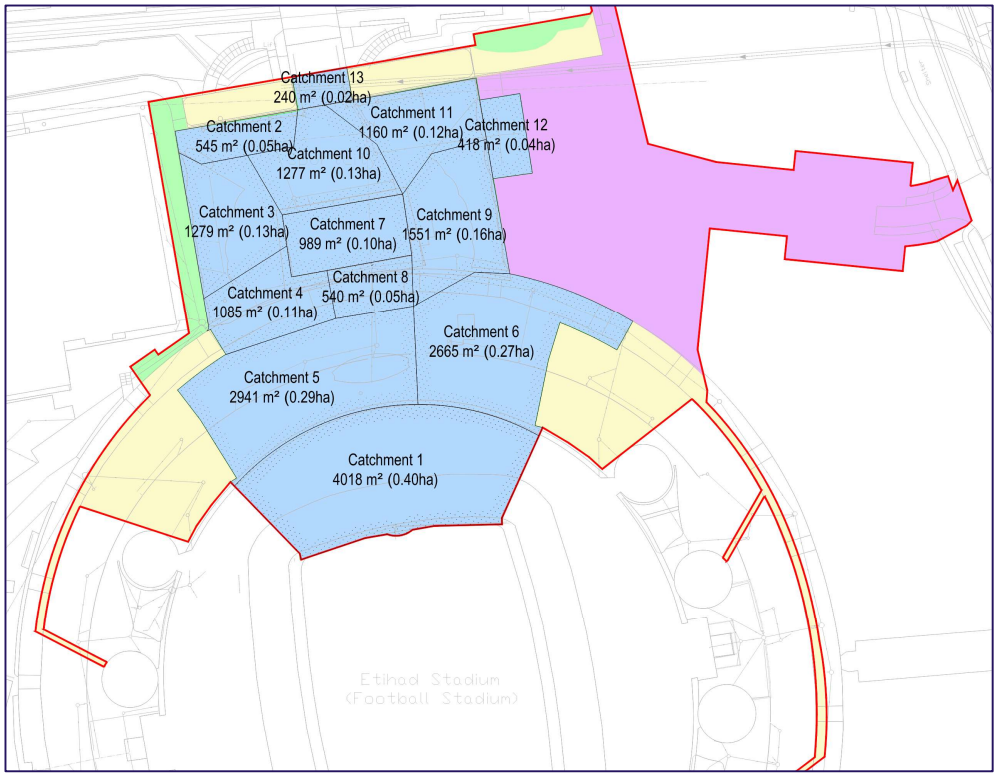

Figure 0-2 Existing Pipe Catchment Plan

Drainage Hierarchy

Planning guidance requires drainage strategies for new developments to discharge surface water in line with the following hierarchy:

Infiltration

Existing Watercourse

Existing sewer

Infiltration is not considered suitable at the site due to the ground conditions identified within the ground investigation. Boreholes, undertaken as part of the ground investigation, shows that the ground make up in the area of the attenuation tank consists of approximately 4.40m of made ground on top of clay. This strategy has been agreed with United Utilities.

There are no existing watercourses on site to receive flows from the development. It is therefore proposed to utilise the existing surface water connection to the public UU overflow sewer, running east-west through the north of the site, which discharges into the River Medlock.

Climate Change

The stormwater network will ensure no uncontrolled flooding in the 1 in 100 year rainfall event plus climate change. The site is modelled using FEH13 rainfall data.

In accordance with the Irwell Management Catchment peak rainfall allowance, for a 1% annual exceedance event, an uplift in rainfall intensity of 45% is proposed to account for the future effects of climate change across the lifespan of the development.

Surface Water Attenuation Tank

Hydraulic calculations for the main phase development have been undertaken based upon;

- Proposed catchment area of 2.48ha

- Discharge Rate 38.2l/s
- Discharge to a UU sewer via an existing private surface water drainage pipe.

The geocellular tank is sized based on 95% porosity and is designed to accommodate rainfall events up to and including the critical 1 in 100 year plus 45% allowance for climate change rainfall event (see Table 0-2 for required attenuation volumes). Hydraulic Calculations are available in **Appendix E**.

Table 0-2 Attenuation Volumes

Catchment	Catchment Area (ha)	Proposed Discharge Rate (l/s)	Approximate Total Volume (m^3)	Void Ratio
Etihad North Stand Development	2.480	38.2	1440	0.95

The surface water will discharge from the attenuation tank to an existing private manhole in the north of the site at a rate of 38.2l/s before being conveyed through the private network into a UU surface water sewer.

Exceedance Flows

There are no level changes, earthworks or above ground structures associated with the SIW and therefore exceedance flows will replicate the existing scenario.

Appendix A Project North Stand Manchester Drainage Strategy

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Project North Stand Manchester

Drainage Strategy

0053810-BHE-XX-XX-RP-X-0001

0053810

17 April 2023

Revision P01

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Revision	Description	Issued by	Date	Checked
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author	**Alex Mulroy**
date	**17/04/2023**
approved	**Chris Moore**
signature	
date	**17/04/2023**

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Glossary

Term	Definition
BH	Buro Happold
MCC	Manchester City Council
EA	Environmental Agency
UU	United Utilities
LLFA	Lead Local Flood Authority
BGS	British Geological Society
FRA	Flood Risk Assessment
SuDS	Sustainable Drainage Systems
DU	Discharge Unit
MH	Manhole
RWP	Rain Water Pipe

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1 Executive Summary

Buro Happold has been instructed by Manchester City Football Club to prepare a stormwater drainage strategy in support of a detailed planning application to Manchester City Council (MCC) for the proposed Project North Stand Manchester development at the Etihad Campus

The drainage strategy has been undertaken in accordance with local and national standards, best practice and the requirements of MCC and United Utilities.

The site area is currently occupied by the existing club shop and city square open space, an existing car park associated with the Etihad Campus and existing hardstanding areas. The immediate surrounding area comprises mainly of the Etihad Campus including Sports infrastructure, the Metrolink Tram Line and Ashton Canal. The majority of the existing site is drained via an existing private drainage network which discharges into a public sewer in the north of the site.

The proposed development comprises of an expanded North Stand, an expanded and covered 'City Square' fan zone adjacent to the North Stand with associated food and drink facilities workspace, a new club shop, club museum and a hotel. A new vehicular access route is proposed from Alan Turing Way, to provide a drop-offpoint as required for the operation of the hotel.

The surface water drainage strategy will comprise a traditional gravity drainage network sized to convey flows from hardstanding areas and buildings to a geocellular storage tank, located in the northern area of the City Square, prior to being discharged offsite at an agreed allowable discharge rate. SuDS are incorporated into the landscape plan and used for water quality, conveyance and attenuation where possible.

The foul water drainage strategy will comprise a traditional gravity drainage network sized to convey flows from connection points within the hotel building, commercial building and expanded North Stand to a private onsite sewer. This existing private foul water network has been diverted as part of the site improvement works undertaken onsite but maintains its connection to the UU sewer in the north of the site.

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2 Introduction

2.1 Appointment and Brief

Buro Happold has been instructed by Manchester City Football Club to prepare a stormwater drainage strategy in support of a detailed planning application to Manchester City Council (MCC) for the proposed Project North Stand Manchester development at the Etihad Campus, herein referred to as the site. This report is to be read in conjunction with the Buro Happold Flood Risk Assessment (FRA) and Structural and Ground Engineering Report also prepared in support of the planning application.

This report will review and document the following;

- Site constraints;
- Existing drainage regime; and
- Proposed surface and foul water drainage strategy.

The drainage strategy has been undertaken in accordance with local and national standards, best practice and the requirements of MCC and United Utilities.

2.2 Limitations

This report is based on the interpretation and assessment of data provided by third parties. It should be noted that the detailed design of the drainage and associated Sustainable Drainage Systems (SuDS) features for the site has not been finalised and the assumptions and information presented herein is subject to design development and outcomes from consultation with relative authorities. Operation and maintenance of all SuDS (including proprietary systems) will need to be considered once the proposed development has been finalised with all specific information being presented to those responsible for the maintenance of the facility. Buro Happold cannot be held responsible for the accuracy of third-party data or the conclusions that come from this information or as a result of changes arising from the developing design. The conclusions and findings of this report may change if the proposed development is amended or updated after the date of publishing.

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3 Existing Site

3.1 Site Location and Description

The site is located within the Etihad Campus in the east of Manchester. It is approximately 3.5ha and is bordered by the Etihad Stadium to the south, the National Squash Centre to the west, the Metrolink Tram Line to the north and Alan Turing Way to the east.

The site area is currently occupied by the existing club shop and city square open space, an existing car park associated with the Etihad Campus and existing hardstanding areas. The immediate surrounding area comprises mainly of the Etihad Campus including Sports infrastructure, the Metrolink Tram Line and Ashton Canal. The majority of the existing site is drained via an existing private drainage network which discharges into separate foul and surface water sewers in the north of the site.

Figure 3-1 shows the boundary of the site and its relative location.

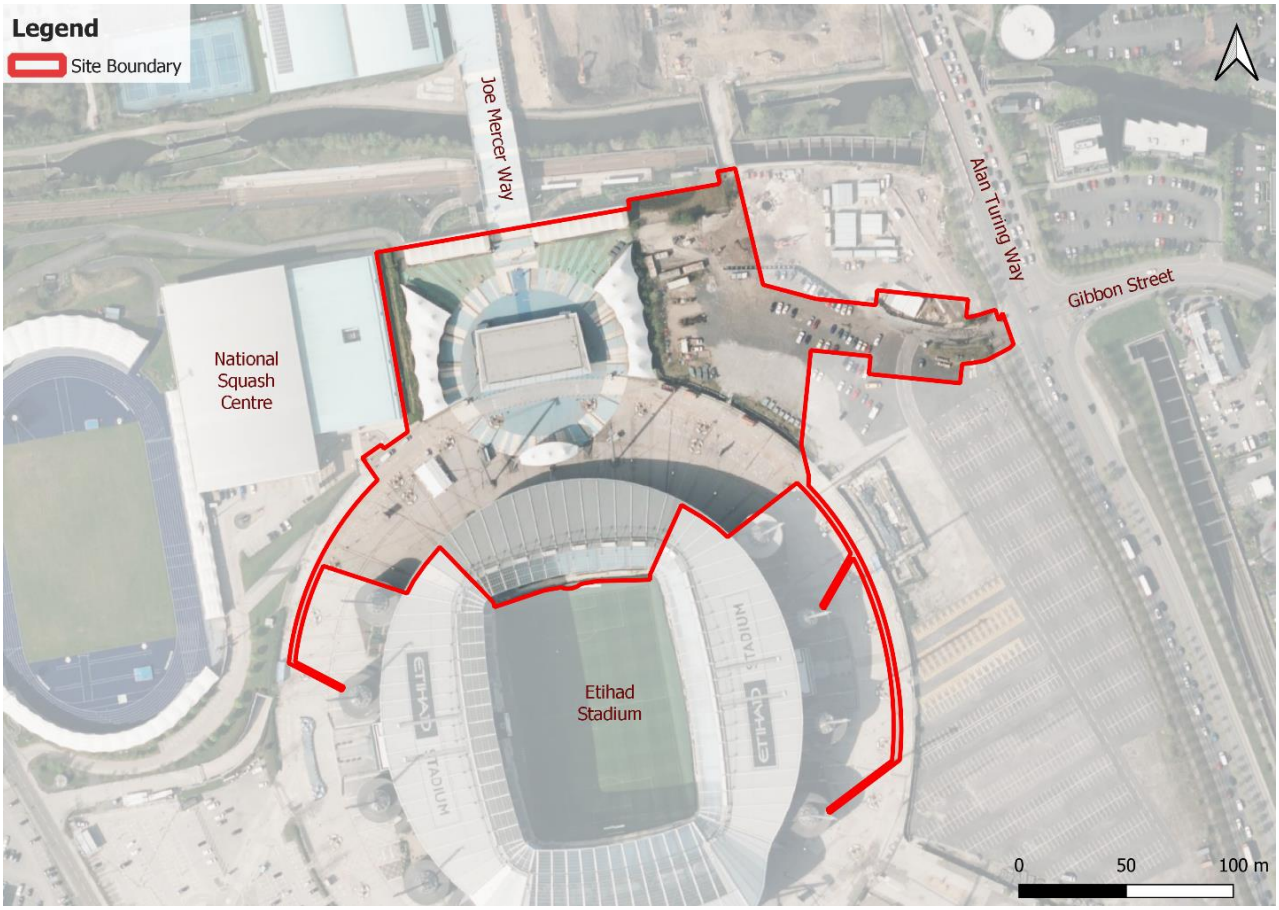

Figure 3-1 Site Location Plan

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3.2 Topography and Existing Levels

The site is relatively flat. The highest point of the site is located in the eastern side of the site within the existing gravel car park with an approximate level of +62.64mAOD. The site slopes down towards the southwest to a low point adjacent to the Etihad Stadium at a level of approximate +60.44m AOD. The site levels reduce approximately 2.20m over a distance of approximately 150m (east to west); giving an average gradient of 1:75. Refer to **Appendix A** for Topographical survey.

3.3 Geology

British Geological Survey (BGS) England and Wales (Sheet No. 085 - Manchester, 1:50 000, 2011) and the BGS online geology (1:50,000) indicate the site is underlain by Made Ground over till deposits and the Pennine Upper Coal Measures Formation (mudstone, siltstone and sandstone).

Boreholes, undertaken as part of the ground investigation, shows that the ground make up in the area the attenuation tank consists of approximately 4.40m of made ground on top of clay. See **Appendix B** for borehole logs.

3.4 Flood Risk

The site is located entirely within Flood Zone 1 as designated by the Environment Agency (EA) and shown in Figure 3-2. The site is considered to be at low risk of flooding from rivers and the sea.

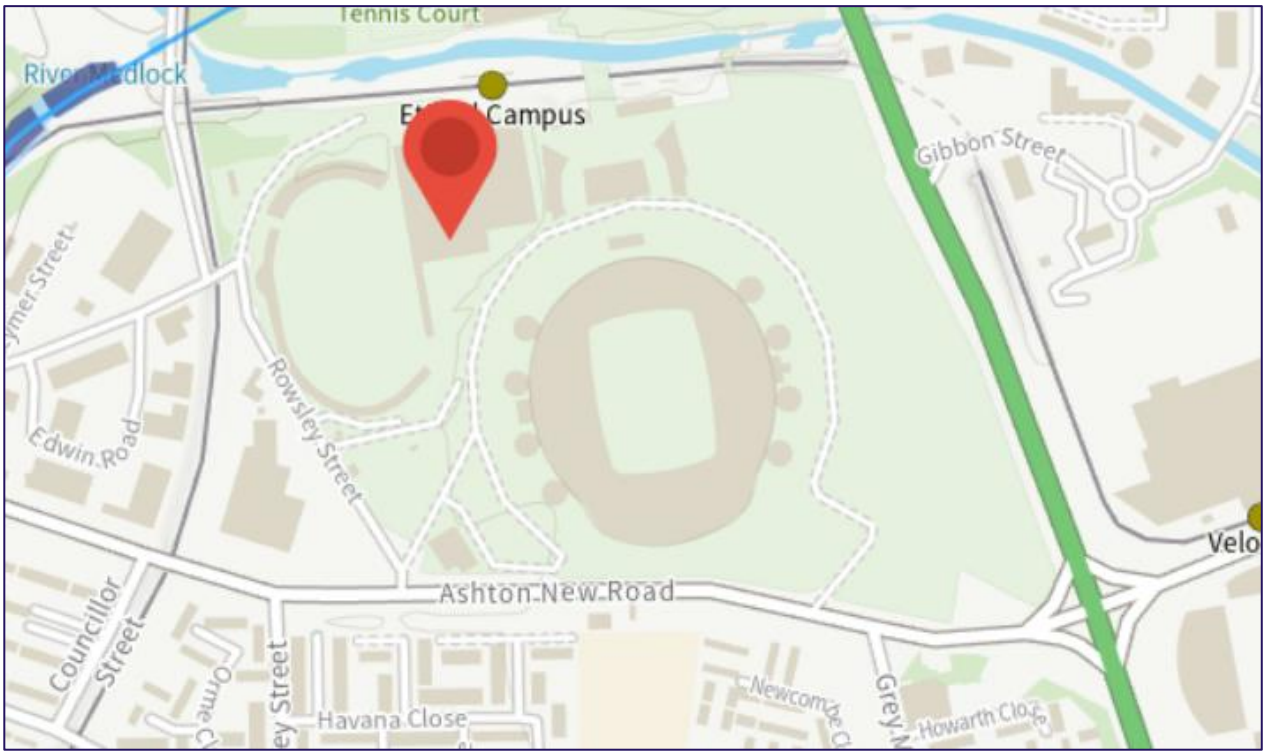

Figure 3-2 Flood Map for Planning extract

Multiple areas of the site are at risk from surface water flooding as per EA Flood Risk from Surface Water Mapping, as shown in Figure 3-3. These areas include the radial footway around the Etihad Stadium and the vehicular access to the

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proposed development at Gibbon Street / Alan Turing Way. However, the vast majority of the flooding extents are considered low risk with an annual chance of occurring between 1 in 100 and 1 in 1000 in any given year.

Figure 3-3 Flood Risk from Surface Water Mapping Extract

Further information can be found in the accompanying Flood Risk Assessment (FRA) (see Environmental Statement Appendix 8.1).

3.5 Existing Drainage Regime

Record information obtained from UU (see Figure 3-4) indicates the following drainage systems are present in the vicinity of the site:

- 850mm diameter surface water sewer running east to west through the north of the site;
- 900mm diameter combined sewer running from south to north on the east side of the site;
- 375mm diameter concrete sewer running from south to north on the west side of the site; and
- 375mm diameter vitrified clay sewer running along the northern boundary of the site, and;
- 550mm x 950mm running along the northern boundary of the site.

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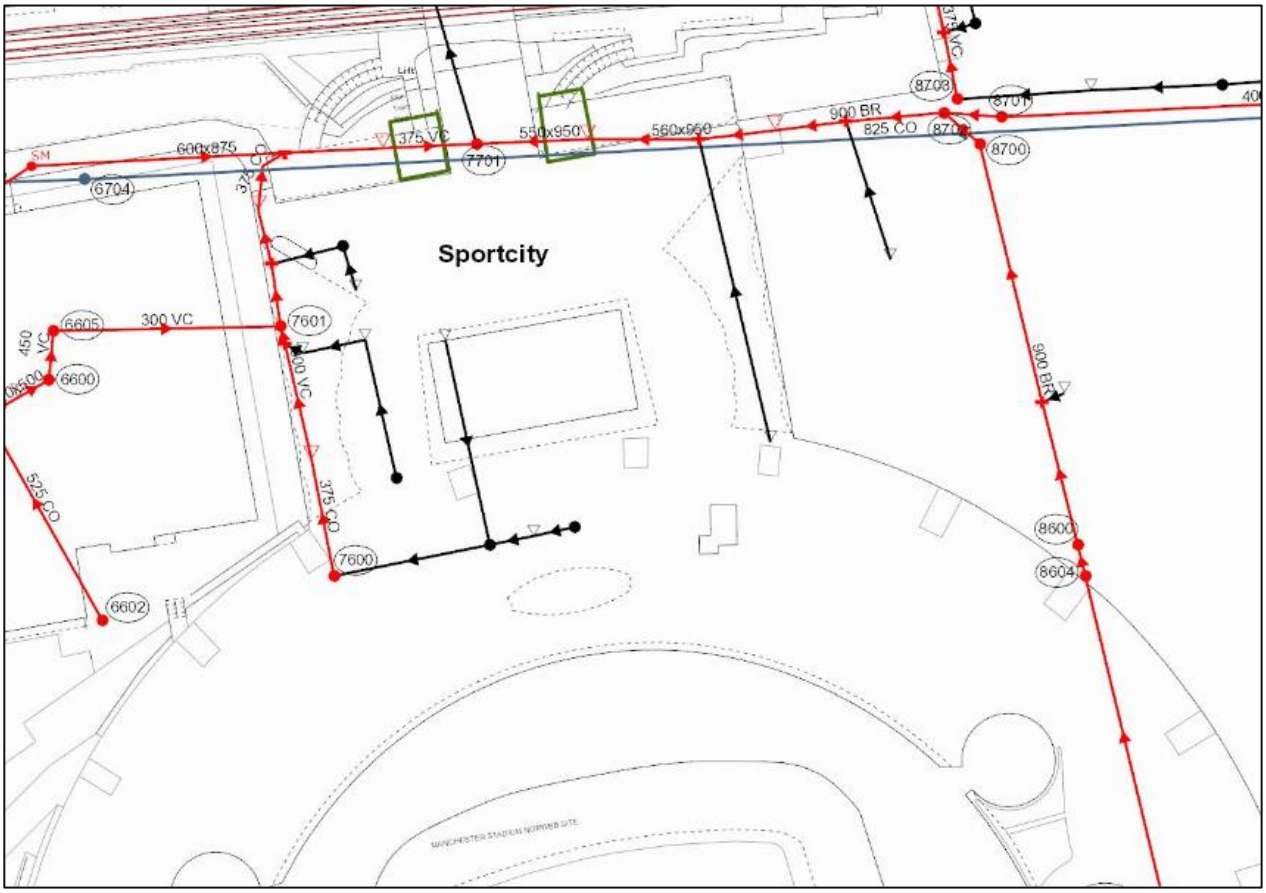

Figure 3-4 Local Existing Public Sewer Network

Alignments shown in UU asset records conflict with onsite CCTV surveys in places. Discussions with UU regarding conflicting record information are ongoing.

3.5.1 Existing Private Foul Water Drainage

Foul water flows from the existing stadium and associated infrastructure drain via private drains running north, discharging into a UU sewer.

CCTV surveys indicate the following private foul water sewers are present within the site boundary:

1. A 225mm foul sewer running from the existing North Stand to the existing UU sewer in the north west of the site;
2. A 150mm foul sewer running from the north east of the site into the existing 225mm foul sewer (1) in the centre of the site;
3. A 150mm foul sewer running from toilets in the north west of the site into the existing 225mm foul sewer (1) in the south west of the site;

3.5.2 Existing Private Surface Water Drainage

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Surface water flows from the existing stadium and associated infrastructure drain via private surface water drains running north, discharging into the UU Work 6 combined overflow sewer, ultimately discharging to the River Medlock west of the site.

CCTV surveys indicate the following private surface water sewers are present within the site boundary:

- 450mm and 600mm sewers convey flows from the stadium roof and adjacent hardstanding to a point outside the centre of the existing North Stand;
- A 600mm sewer conveys flows north to a 4m diameter manhole north east of the stadium shop, and onwards unrestricted to the United Utilities Works 6 overflow sewer.
- Other areas of hardstanding within the site boundary are drained to the 4m diameter manhole, and onwards unrestricted to the UU sewer, via private surface water sewers of varying diameters (150mm-750mm).

3.6 Watercourse

The nearest watercourses to the site are the Ashton Canal, approximately 35m to the north of the site and the River Medlock approximately 170m to the northwest which is designated as a Main River. The River Medlock is culverted below the car parks on the far side of Ashton canal to the north of the site.

3.7 Local stakeholders and approving authorities

With regard to development planning and permissions, and residual flood risk and drainage related matters, there are two principal stakeholders and/or approving authorities associated with the site. They are as follows:

Manchester City Council are the local governing planning authority and Lead Local Flood Authority (LLFA), having responsibility for:

- Leading the management of risk of flooding from ordinary watercourses, canals, ponds and reservoirs in its area; and
- Surface water flood risk in relation to planning applications, under The Flood and Water Management Act.

United Utilities (UU) are the statutory sewerage undertaker with powers under The Water Industry Act 1991.

Preliminary enquiries have been made to MCC and UU and are reported on herein. Consultation with the Environment Agency has not been deemed necessary as the site does not lie within a Groundwater Protection Zone and discharge is not to the ground or a main river. For further details, refer to the FRA submitted alongside this Drainage Strategy.

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4 Proposed Development

The proposed development comprises of an expanded North Stand, an expanded and covered 'City Square' fan zone adjacent to the North Stand with associated food and drink facilities workspace, a new club shop and club museum, and a hotel. A new vehicular access route is proposed from Alan Turing Way, to provide a drop-off point as required for the operation of the hotel. See Figure 4-1 below for a plan of the proposed development.

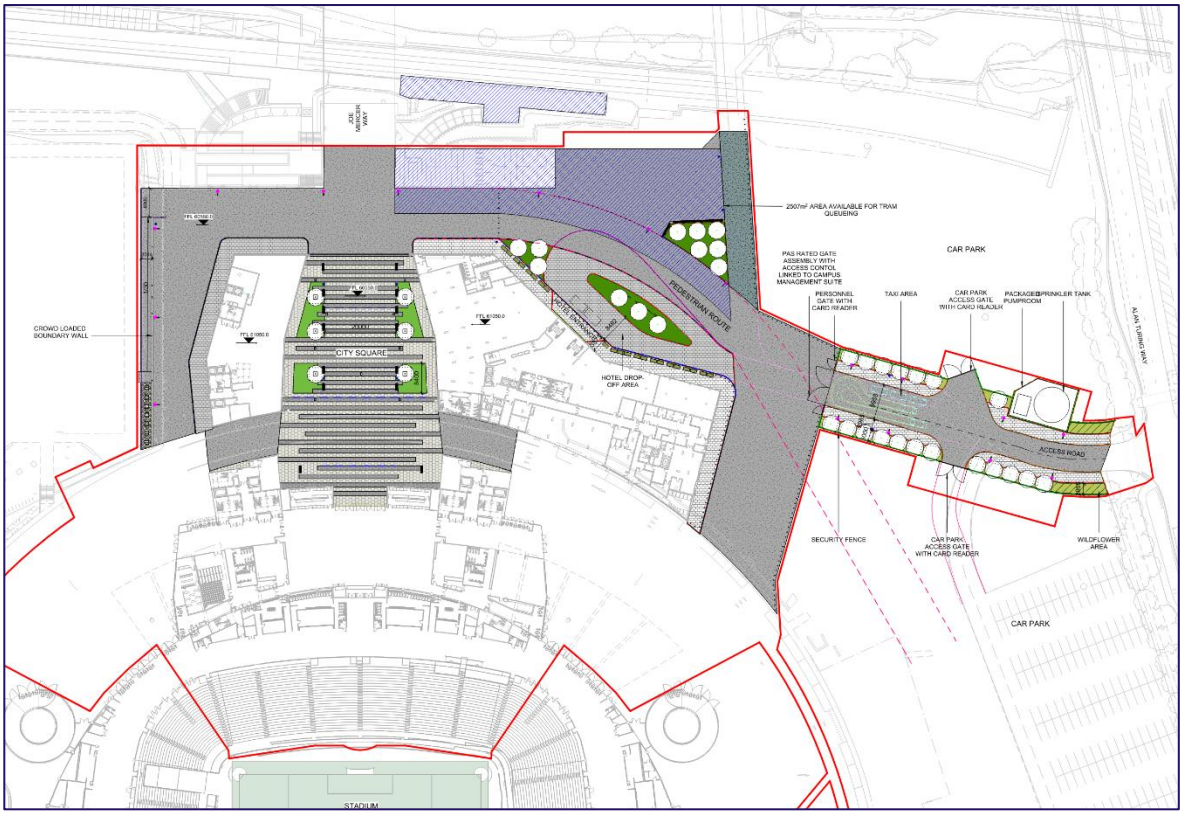

Figure 4-1 Proposed Development

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5 Proposed Surface Water Drainage Strategy

The proposed surface water strategy is presented within this section. It will set out the existing site catchments and the associated brownfield and greenfield runoff rates, the discharge methodology in line with the discharge hierarchy, the climate change allowances to be used within the drainage design, an explanation of the SuDS to be used onsite, where they will be located and how they will be utilised, a summary of the surface water strategy for the site, the water quality management design methods and calculations for the site and the exceedance flow strategy.

5.1 Existing Site

The existing site area measures 3.5ha. Approximately 2.46ha is positively drained hardstanding and buildings, of which 1.87ha is proposed to be modified by this project and 0.59ha is to remain unchanged.

An additional 0.91ha is a gravel car park with no positive drainage system and therefore considered greenfield land. The remaining 0.11ha is soft landscaping, consisting of steep grass banks leading down to the National Squash Centre and the Metrolink tram stop platform, and which likewise are to remain unchanged. These areas are shown in Figure 5-1 below.

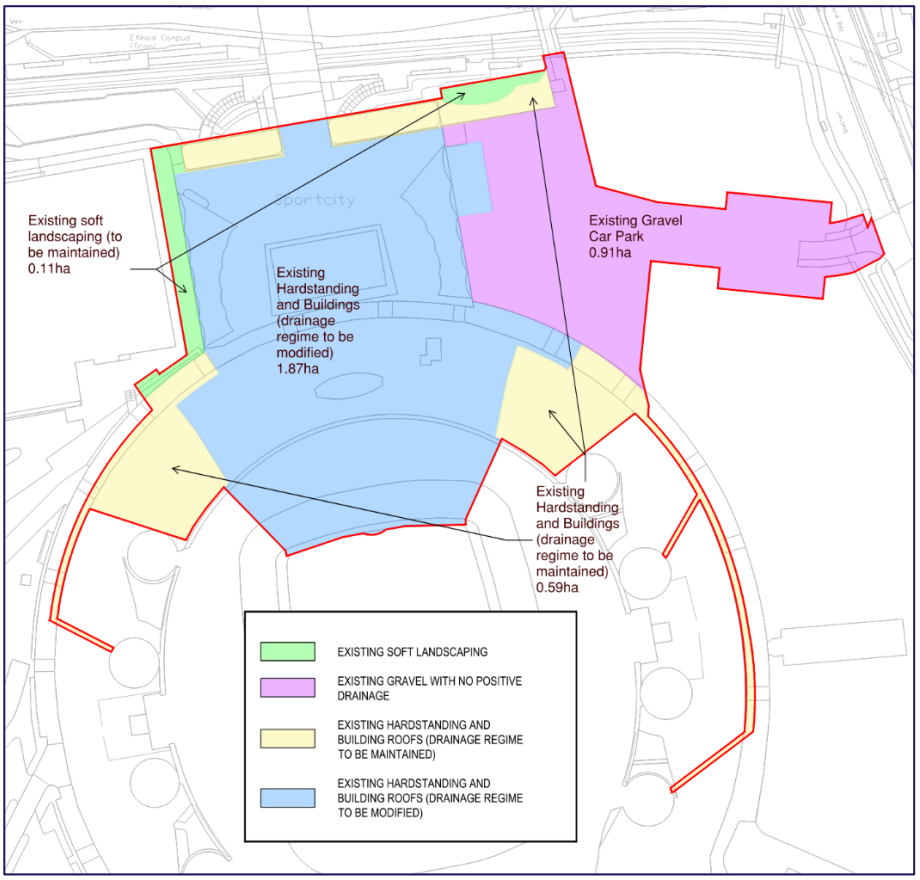

Figure 5-1- Existing Surface Water Catchment Areas

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The existing brownfield discharge rate for the positively drained hardstanding has been calculated using the modified rational method, where;

$$Q_{peak} = 2.78CIA$$

Q_{peak} = Peak runoff

C = Co-efficient C = Cv*Cr

Cv = Volumetric Co-efficient = 0.84

Cr = Routing Co-efficient = 1.3

I = Rainfall Intensity = 11.376mm/hr (60 min 1 in 1 year event)

A = Area = 1.87ha

$$Q_{peak} = 2.78 * 0.84 * 1.3 * 11.376 * 1.87$$

$$Q_{peak} = 64.6l/s$$

The runoff rate for the non-positively drained gravel car park (Q_{bar}) has been calculated as 5.91l/s. This was calculated at greenfield rates via the HR Wallingford Greenfield Runoff Rate Estimation tool. Please refer to **Appendix C** for the results.

It is considered the existing total runoff rate from site is therefore;

$$Q_{Tpeak} = 64.6 + 5.9 = 70.5l/s$$

As per the Manchester, Salford and Trafford Strategic Flood Risk Assessment new developments are to reduce brownfield runoff rates by 50%.

Therefore, the total allowable discharge rate from the site = 50% of positively drained hardstanding + Non-positively Drained Car Park Greenfield Rate;

$$Allowable\ Discharge\ Rate = \left(\frac{64.6}{2}\right) + 5.9 = 38.2l/s$$

However, even though the modified rational method provides a reasonable method of calculating flow it does not consider limitations on flow due to constraints such as pipe capacities. The limitation on this flow is calculated based upon the theoretical pipe full capacity of existing incoming connections from the site into the UU Sewerage Network, as shown in Table 5-1 below. See Figure 5-2 below for the Pipe Catchment Plan.

Table 5-1 Full Bore Pipe Analysis

Catchment	Area (m2)	Cum. Area (m2)	Flow (l/s)	Pipe Diameter	Capacity	Flows to	Flow Restricted
1	4017.53	4017.53	13.9	600	306	5	NO
2	545.02	545.02	1.9	225	40.4	10	NO
3	1278.56	1278.56	4.4	150	17.8	4	NO

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4	1084.69	2363.25	8.2	300	71.2	8	NO
5	2940.9	6958.43	24.0	300	71.2	8	NO
6	2664.57	2664.57	9.2	600	306	8	NO
7	988.63	988.63	3.4	3x150	53.4	10	NO
8	540.14	14077.26	48.6	600	306	13	NO
9	1550.87	1550.87	5.4	300	71.2	8	NO
10	1277.2	2810.85	9.7	300	71.2	13	NO
11	1159.86	1159.86	4.0	150	17.8	13	NO
12	418.44	418.44	1.4	450	160.7	13	NO
13	239.85	18706.26	64.6	600	306	offsite	NO

The theoretical pipe full capacity check has been undertaken based on individual runs within the site and checking against cumulative area as the run progresses through the site. This check has shown that the flow discharging offsite is limited to 306l/s.

As shown within Table 5-1 it is not considered that the existing pipe sizes restrict the flow offsite. It is therefore proposed that the allowable Surface Water discharge rate is 38.2l/s.

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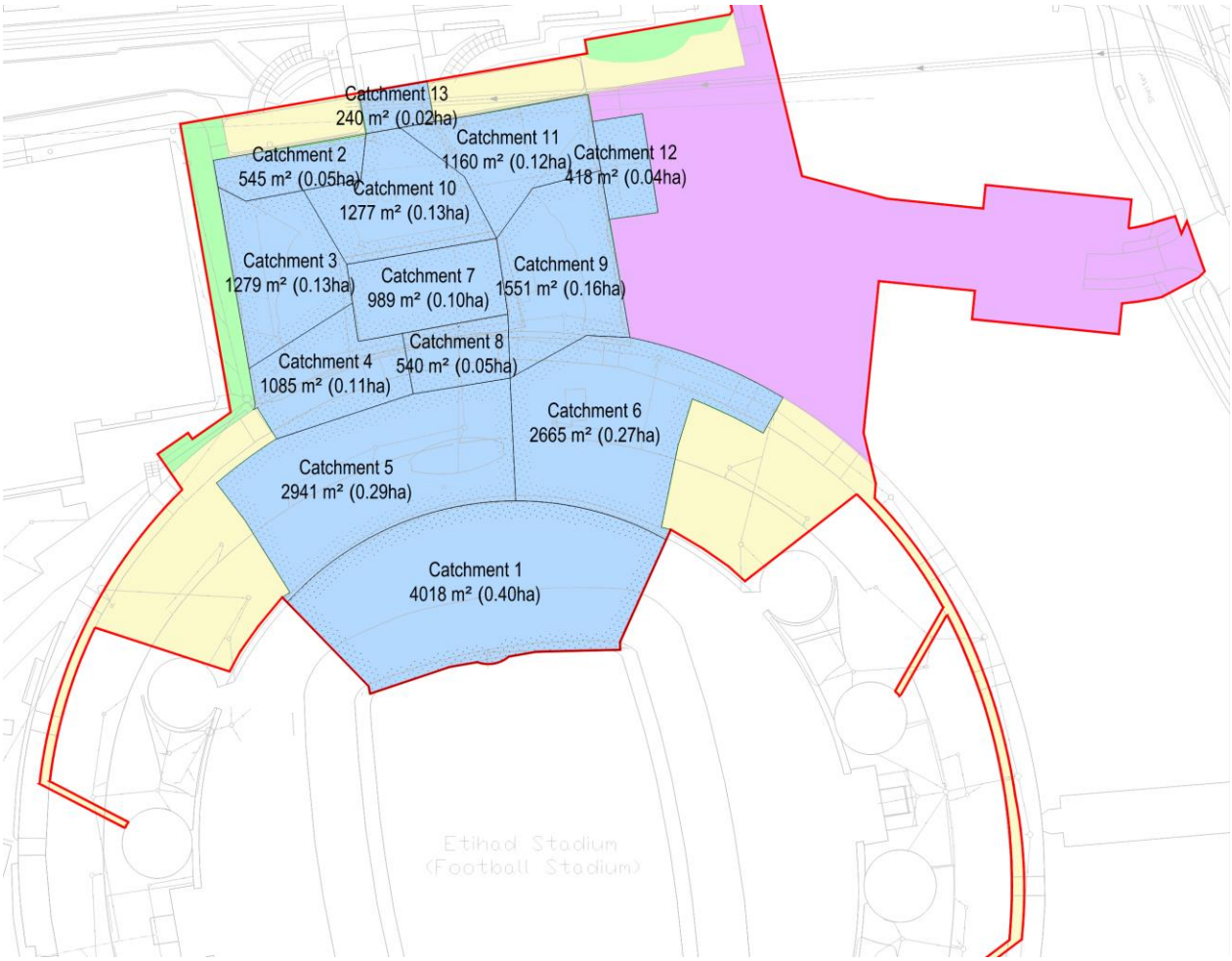

Figure 5-2 Pipe Catchment Plan

5.2 Drainage Hierarchy

Planning guidance requires drainage strategies for new developments to discharge surface water in line with the following hierarchy:

1. Infiltration
2. Existing Watercourse
3. Existing sewer

Infiltration is not considered suitable on site due to the ground conditions identified within the ground investigation. Boreholes, undertaken as part of the ground investigation, shows that the ground make up in the area of the attenuation tank consists of approximately 4.40m of made ground on top of clay. This strategy has been agreed with United Utilities. See **Appendix B** for borehole logs.

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There are no existing watercourses onsite to receive flows from the development. It is therefore proposed to utilise the existing surface water connection to the public UU overflow sewer, running east-west through the north of the site, which discharges into the River Medlock.

5.3 Climate Change

The stormwater network will ensure no flooding in the 1 in 100 year rainfall event. The site is modelled using FEH13 rainfall data.

In accordance with the Irwell Management Catchment peak rainfall allowance, for a 1% annual exceedance event, an uplift in rainfall intensity of 45% is proposed to account for the future effects of climate change across the lifespan of the development.

5.4 SuDS selection

The following Sustainable Drainage Systems (SuDS) are considered appropriate for the development.

Permeable Paving

Permeable paving provides a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainfall to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before being discharged downstream. As part of the Etihad North Stand development, permeable paving will be considered to provide conveyance, attenuation and water treatment within hardstanding areas across the development. Due to the relatively flat nature of the site the storage provided within the underlying structure can be used to reduce the required volume of the attenuation tank.

Bioretention Systems

Bioretention systems are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution though the use of engineered soils and vegetation. As part of the Etihad North Stand development, Bioretention systems will be considered as a collection and attenuation feature to provide water quality treatment for the car loop within the north east of the site.

Geocellular Storage System

Geocellular storage systems are modular plastic units with a high porosity (approx. 95%) that can be used to efficiently create a below ground structure for the temporary storage of surface water before controlled release. Due to the restricted external space and abundance of existing underground utilities within the site, geocellular storage structures will be the main form of attenuation.

SuDs Operation and Maintenance Manual

Regular maintenance of the sustainable drainage system is essential to maintain its performance. An Operation and Maintenance Manual will be prepared in accordance with the CIRIA guidance C753 section 32. This manual will be collated during the detailed design stage and will be included as part of the H&S File and Building Manual for the development. Maintenance will be in accordance with the specific requirements of each feature and the chosen attenuation supplier.

The Operation and Maintenance Manual will set out the location of all SuDS components on-site as well as a brief summary of their design intent, how the SuDS components work, their purpose and performance risks. It will also include

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a maintenance plan and record pro forma, an explanation of the objectives of the maintenance proposed and the potential implications of not meeting those objectives.

It is currently understood that all drainage, including SuDS features, will remain within the ownership of the developer.

5.5 Surface Water Drainage Network

As there will be an increase in positively drained impermeable area within the site, there will be an increase in the likelihood and magnitude of standing water and surface water runoff occurring. The surface water strategy below has been devised to mitigate this and provide betterment to the existing surface water flows discharging from the site. Refer to drawing NSE-BHE-ZX-XX-DR-C-003101 in **Appendix D** for more details.

SuDS will be implemented within this development scheme. The conceptual SuDS strategy for the proposed development has been derived using the principles outlined within the CIRIA C753 SuDS Manual along with BS 8582:2013 – Code of Practice for Surface Water Management for Development Sites.

The scheme will utilise the existing topography and natural drainage catchments. Minor re-profiling of the site is proposed to direct surface water runoff away from proposed structures, however, it is expected the resultant flood flow paths will replicate the existing and direct exceedance flows to the stadium raceway to the south around the stadium.

The anticipated impermeable area of the catchment is based upon all redeveloped areas being utilised as hardstanding. With limited possibility of further hardstanding being implemented no allowance has been made for urban creep.

The proposed piped drainage system should be designed such that there is no surcharging in the 1 in 2 year probability event, and no flooding in the 1 in 30 year probability event. The piped system should be designed to Building Regulations Part H standards.

The surface water drainage strategy will comprise a traditional gravity drainage network sized to convey flows from hardstanding areas and buildings to a geocellular storage tank, located in the northern area of the City Square, prior to being discharged offsite at an agreed allowable discharge rate. Pipe gradients are set to achieve the self-cleansing velocity of 1m/s.

Porous paving will be used within the south of the site adjacent to the proposed north stand to provide attenuation, delay and mitigate the peak flood flows from the site, and offer treatment to the runoff. The porous paving will be supplemented with linear drainage and/or gullies to ensure all runoff is captured within the site boundary. The hardstanding will slope towards the linear drains with gullies located at low points where required.

The commercial roof, hotel roof and expanded north stand roof will discharge via multiple rain water pipes (RWPs). These RWPs will connect into the proposed gravity drainage network and be conveyed to the attenuation tank.

The drainage of the existing stadium roof retains the status quo as it drains into the existing drainage infrastructure within the Etihad Campus. The development of the site will not impact the discharge of the existing roof.

The hotel drop off will drain into a bioretention system within the adjacent green areas. The stadium raceway will be drained via permeable paving where possible. Where it is not possible to drain the onsite highways via SuDS, gullies and channel drains will be used to convey water directly into the gravity drainage network. A petrol interceptor may be required if it is not possible to treat all relevant areas of the site via SuDS.

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The geocellular tank is sized based on 95% porosity and is designed to accommodate rainfall events up to and including the critical 1 in 100 year plus 45% allowance for climate change rainfall event (see Table 5-2 for required attenuation volumes). Hydraulic Calculations are available in **Appendix E**.

Table 5-2 Attenuation Volumes

Catchment	Catchment Area (ha)	Proposed Discharge Rate (l/s)	Approximate Total Volume (m^3)	Void Ratio
Etihad North Stand Development	2.480	38.2	1440	0.95

The surface water will discharge to an existing private manhole in the north of the site at a rate of 38.2l/s before being conveyed through the private network into a UU surface water sewer.

5.6 Pollution Control

The appropriateness of proposed SuDS for the proposed development has been evaluated based on the CIRIA SuDS Manual 2015 Simple Index Approach. The pollution hazard indices for different land uses within the proposed development have been taken from table 26.2 of the CIRIA SuDS Manual 2015 and pollution mitigation indices have been determined using table 26.3 of the CIRIA SuDS Manual 2015. The mitigation index must be equal to or exceed the pollution hazard index. Two components or more will be required if the mitigation index of an individual component is insufficient. As there will be reduced inflow concentrations for secondary or tertiary components a factor of 0.5 is used to account for this.

$$\underset{(for\ each\ contaminant\ type)}{Total\ SuDS\ mitigation\ index} \geq \underset{(for\ each\ contaminant\ type)}{pollution\ hazard\ index}$$

$$Total\ SuDS\ mitigation\ index = mitigation\ index_1 + 0.5(mitigation\ index_2)$$

Where;

$$mitigation\ index_{\ n} = mitigation\ index\ for\ component\ n$$

Table 5—3 Pollution Hazard Indices and Proposed Mitigation Methods

Land Use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs	Low	0.3	0.2	0.05
Individual property driveways	Low	0.5	0.4	0.4
Residential carparks	Low	0.5	0.4	0.4
Low traffic roads	Low	0.5	0.4	0.4
Commercial yard and delivery areas	Medium	0.7	0.6	0.7
Non-residential car parking with frequent change	Medium	0.7	0.6	0.7

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Table 5—4 Mitigation Indices of Proposed SuDS Components

Type of SuDS	**Mitigation Indices**		
	TSS	Metals	Hydrocarbons
Porous Pavement	0.7	0.6	0.7
Bioretention System	0.8	0.8	0.8

To provide sufficient levels of treatment prior to discharge offsite appropriate water quality management design has been undertaken to satisfy Section 26 of the Ciria C753 SuDS Manual.

It is considered that the onsite hotel drop off will average less than 300 traffic movements per day. Table 26.2 of the Ciria C753 SuDS notes that pollution hazard levels for low traffic roads are as follows:

- TSS = 0.5;
- Metals = 0.4;
- Hydrocarbons = 0.4.

Treatment will be provided via a bioretention system which provide the following mitigation indices

- TSS = 0.8;
- Metals = 0.8;
- Hydrocarbons = 0.8.

It is considered that the stadium raceway will average less than 300 traffic movements per day. Table 26.2 of the Ciria C753 SuDS notes that pollution hazard levels for low traffic roads are as follows:

- TSS is 0.5;
- Metals is 0.4;
- Hydrocarbons is 0.4

Treatment will be provided via porous paving which provide the following mitigation indices

- TSS = 0.7;
- Metals = 0.6;
- Hydrocarbons = 0.7.

It is considered that the goods drop off to the east of the hotel will average less than 300 traffic movements per day. Table 26.2 of the Ciria C753 SuDS notes that pollution hazard levels for low traffic roads are as follows:

- TSS is 0.5;
- Metals is 0.4;
- Hydrocarbons is 0.4

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Treatment will be provided via porous paving which provide the following mitigation indices

- TSS = 0.7;
- Metals = 0.6;
- Hydrocarbons = 0.7.

Each of the above is beyond the level of pollutants expected from the proposed usage therefore the use of the bioretention system and permeable paving will provide an adequate level of pre-treatment for the site where it can be applied. As stated in Section 5.5 it is envisaged a petrol interceptor may also be required if these SuDS cannot be implemented due to proposed levels or site constraints. A proprietary device, or devices, will be incorporated if appropriate based on the calculated mitigation indices.

The pollution hazard of the pedestrianised areas of the site and the stadium, commercial and hotel roofs have been considered. Due to the finish, treatment and design of the roofs and hardstanding it is not considered that metals or hydrocarbons will occur to a sufficient level to require treatment. It is considered that minor amounts of suspended solids will occur across the hardstanding and roofs, catchpit manholes are to be used across the site to capture and mitigate the occurrence of suspended solids.

5.7 Designing for Exceedance

The proposed site levels are designed to allow exceedance flow paths to safely convey overland surface water. Levels are designed to direct flows towards green areas or other areas where they will have no or limited impact. The scheme will utilize the existing topography and natural drainage catchments. Minor re-profiling of the site is proposed however the resultant flood flow paths will replicate the existing and direct flows flow paths onto the stadium raceway to the south.

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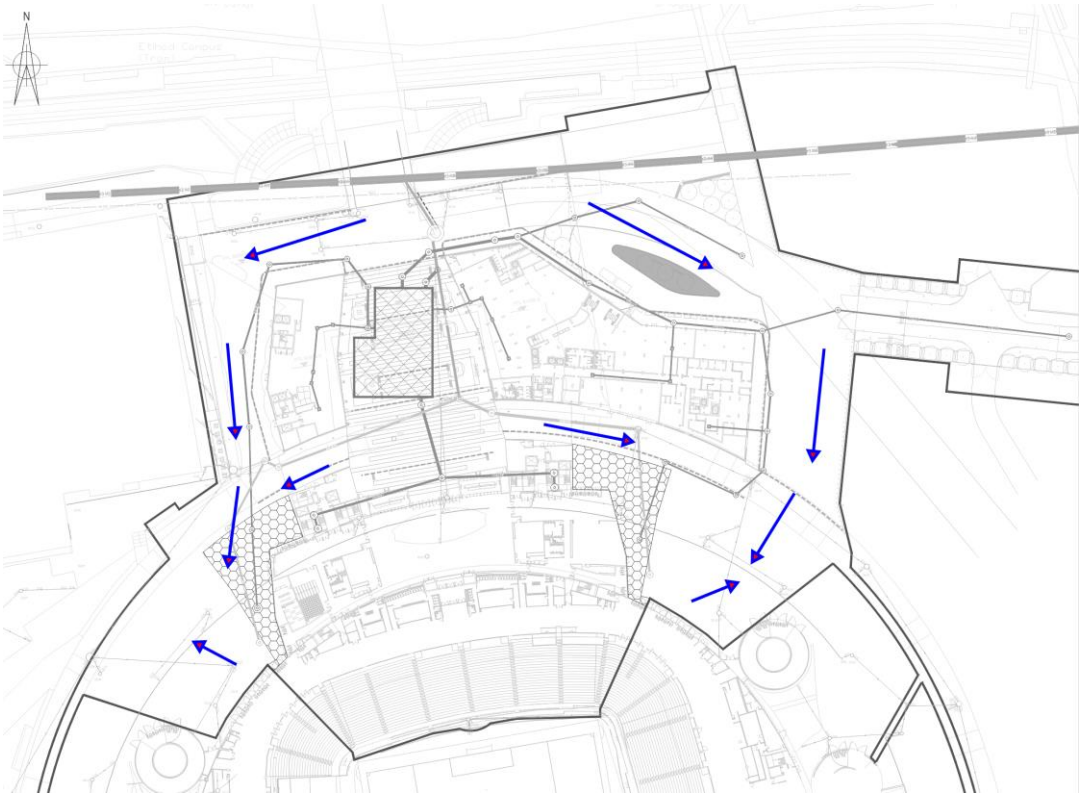

Figure 5—3 Exceedance Flow Routes

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6 Proposed Foul Water Drainage Strategy

A foul water strategy drawing, NSE-BHE-ZX-XX-DR-C-003102, has been prepared for the proposed development and can be found in **Appendix F.**

All internal and external areas of the site will be served by a private foul water network which will be designed in accordance with Part H of the Building Regulations.

The network will comprise a traditional gravity drainage network sized to convey flows from connection points within the hotel building, commercial building and expanded North Stand to a private onsite sewer. This existing private foul water network has been diverted as part of the site improvement works undertaken onsite but maintains its connection to the UU network in the north of the site.

Calculations have shown that the private network has the capacity to accept the additional flows. Please see foul water calculations in **Appendix E**.

Estimated Discharge Units (DUs) for these building have been provided by the public health engineer. These discharge units have been converted into a litre per second flow rate based on the expected frequency factor and have been used to inform communication with UU. Calculations are shown below:

$$Q_{peak} = K_{DU}\sqrt{DU}$$

Where:

- Q_{peak} = Peak Flow
- K_{DU} = Frequency Factor
    - 0.5 for Dwellings, Guest houses, offices (Intermittent use)
    - 0.7 for Hospitals, schools, restaurants, hotels (Frequent use)
    - 1 for Toilets open to the public (Congested Use)
    - 1.2 for Laboratory buildings (Special Use)
- DU = Discharge Units

A DU value of 109 was provided for the proposed commercial building. It is considered that there will be intermittent use of the public facilities in this building and therefore a frequency factor of 0.5 has been used.

$$Commercial\ Building\ Q_{peak} = K_{DU}\sqrt{DU}$$

$$Commercial\ Building\ Q_{peak} = 0.5\sqrt{109} = 5.22l/s$$

A DU value of 1071 was provided for the proposed hotel. It is considered that there will be frequent use of the public facilities in this building and therefore a frequency factor of 0.7 has been used.

$$Hotel\ Q_{peak} = K_{DU}\sqrt{DU}$$

$$Hotel\ Q_{peak} = 0.7\sqrt{1071} = \ 22.91l/s$$

A DU value of 287 was provided for the proposed North Stand. It is considered that there will be congested use of the public facilities in this building and therefore a frequency factor of 1.0 has been used.

$$North\ Stand\ Q_{peak} = K_{DU}\sqrt{DU}$$

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$$North\ Stand\ Q_{peak} = 1.0\sqrt{287} = \ 16.94l/s$$

Based on the above calculations the total site discharge for the site is:

$$Total\ Site\ Discharge = 5.22l/s + 22.91l/s + 16.94l/s = \ 45.07l/s$$

The above calculations are considered industry standard for calculating total site; however, for this development it can be reasonably assumed that the individual buildings will not be concurrently discharging at peak flow and therefore the calculated total site discharge is likely to be conservative.

UU have agreed to accept flows from the site at an unrestricted rate to their network – refer to **Appendix G** for correspondence.

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Appendix A Topographic Survey

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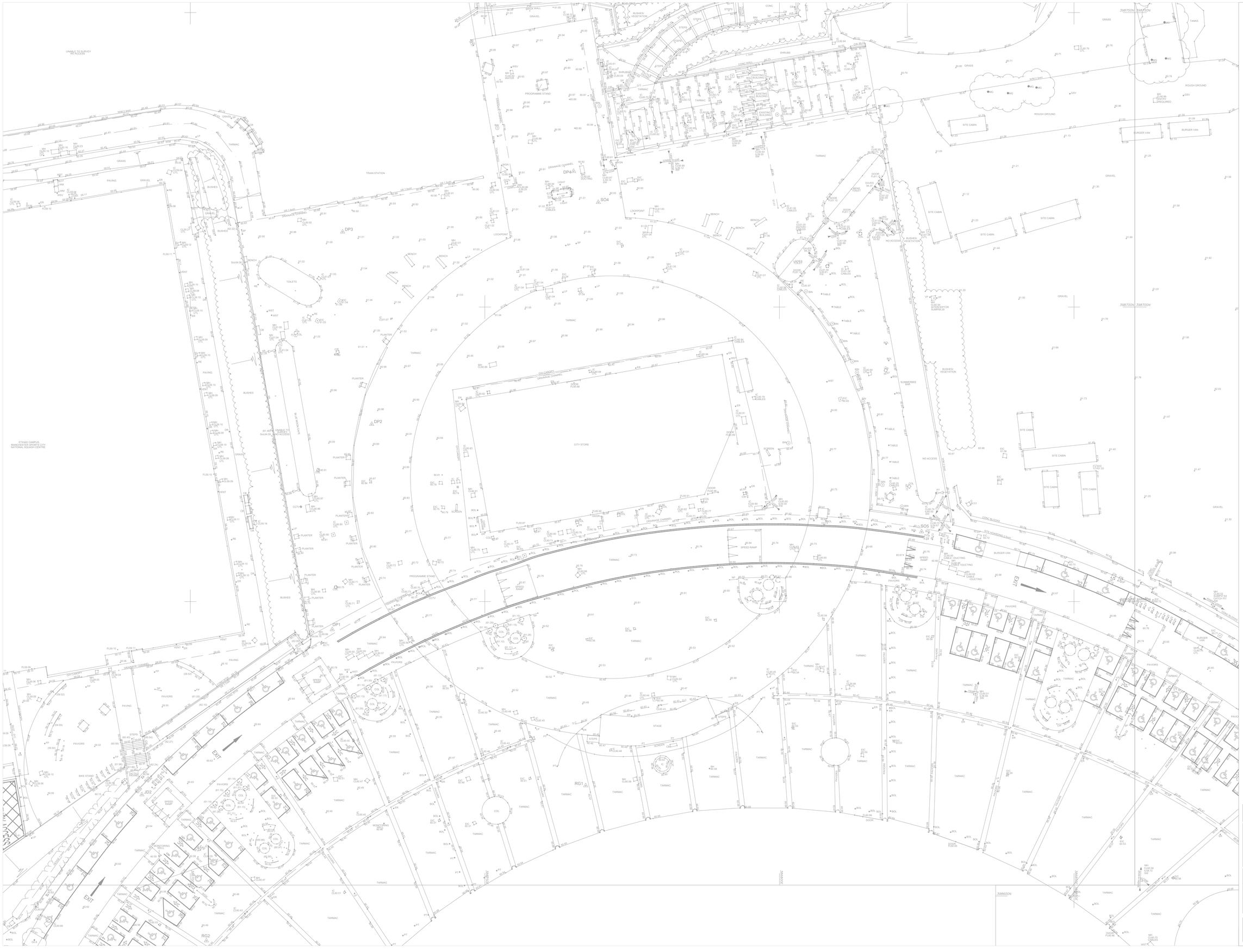

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N

Note:
Orientation to existing site grid.
All levels relate to existing site datum.
Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.
Drainage information must be verified with local authority records before use
Levels in parenthesis indicate top of walls.
A - 07/06/19 - Additional drainage infomation added.

SURVEY STATIONS

Name	Eastting	Northing	Height
SO1	386721.67	398820.01	57.14
SO2	386617.56	398918.87	57.02
SO3	386741.20	398815.98	61.42
SO4	386769.25	398717.79	60.96
SO5	386813.52	398697.57	60.62
SO6	386913.44	398610.20	60.65
SO7	386937.57	398522.46	60.62
SO8	386827.35	398447.36	60.62
SO9	387008.05	398411.30	61.97
SO10	387137.75	398352.69	63.16
SO11	387124.73	398459.14	61.97
SO12	387010.82	398552.83	61.01
SO13	387019.92	398602.57	62.01
SO14	386978.40	398798.85	63.81
SO15	386898.51	398956.39	56.75
SO16	386798.10	398952.83	56.10
TBM1	386721.76	399070.17	58.65
MF1	386761.83	398781.31	61.20
MF2	386761.83	398781.31	61.20
MF3	386802.60	398787.06	56.87
MF4	386831.82	398790.90	56.93
MF5	386869.50	398795.96	57.67
MF6	386891.26	398800.37	60.27
MF7	386835.55	398858.06	60.61
MF8	386934.83	398843.43	61.96
PA1	386864.49	398900.89	58.63
PA2	386864.49	398900.89	58.63
PA3	386806.40	398900.16	57.70
PA4	386771.87	398799.10	60.85
MF9	386832.46	399075.21	52.23
SO4	386449.28	398988.75	56.27
SO5	386546.44	398718.60	59.69

STANDARD REFERENCE & ABBREVIATIONS

(AS).....Assumed Route	I1.....Invert Level
AB.....Air Brick	IP.....Inset Pipe
AV.....Air Valve	KO.....Kerb Outlet
B/W.....Barbed Wire	LB.....Letter Box
BAR.....Barrier	LP.....Lamp Post
BB.....Bellaha Beacon	MG.....Multi Girth
BH.....Borehole	MH.....Manhole
BL.....Bed Level	MKR.....Marker
BOL.....Bollard	MP.....Mooring Point
BS.....Bus Stop	NP.....Street Name Plate
BT Box.....British Telecom Box	O/H.....Overhead
BT.....British Telecom St	O/P.....Open Paling
BWTW.....Brick Retaining Wall	OH.....Overhead Electric Wire
BW.....Brick Wall	OP.....Outfall Pipe
C/H.....Close Boarded	OSBM.....Ordnance Survey Bench Mark
C/I.....Corrugated Iron	OT.....Overhead Telecom Wire
C/P.....Chestnut Paling	P/C.....Post & Chain
CB.....Control Box	P/R.....Post & Rail
CBW.....Concrete Block Wall	P/W.....Post & Wire
CCTV.....Closed Circuit TV	PAV.....Paving
CO.....Cable Duct	PB.....Pillar Box
CR.....Cellar Light	PC.....Pedestrian Crossing
CWJ.....Chain Link	PP.....Petrol Pump
CHY.....Chimney	PT.....Post or Pillar
CL.....Cover Level	RD.....Rodding Eye
CM.....Cable Marker	RS.....Road Sign
COL.....Column	RTW.....Retaining Wall
CONC.....Concrete	RWP.....Rain Water Pipe
CP.....Catch Pit	SAP.....Sapling
CRTW.....Concrete Retaining Wall	SL.....Sump Level
CTV.....Cable Television	SoL.....Soffit Level
CUL.....Culvert	SP.....Sign Post
CW.....Concrete Block Wall	SPL.....Springing Level
DC.....Drainage Channel	SRTW.....Stone Retaining Wall
DPO.....Deep Proof Course	SV.....Stop Valve (unspecified)
DR.....Drain	SVP.....Soil Vent Pipe
DSW.....Dry Stone Wall	SW.....Stone Wall
ESP.....Electricity Cable Pit	TC.....Tactile Paving
ESS.....Electricity Inspection Cover	TB.....Traffic Bollard
EJ.....Expansion Joint	TBM.....Temporary Bench Mark
EJB.....Electricity Junction Box	TCB.....Telephone Call Box
EL SUB STN..Electricity Sub Station	TPR.....Taken From Records
EL.....Trans Level	TSC.....Anchor Point (Back/Pole)
ELB.....Electricity Box	TL.....Traffic Light
EP.....Electricity Pole	TLB.....Traffic Light Control Box
ER.....Earth Rod	TM.....Ticket Machine
ETL.....Electricity Transmission Line	TWC.....Tarmac
FB.....Flower Bed	TP.....Telecommunications Pole
FH.....Fire Hydrant	TPIT.....Trial Pit
FL.....Floor Level	TS.....Trash Screen
FP.....Flagpole	U/C.....Under Construction
GP.*.....Girth (# tree)	U/G.....Underground
H.....Holly	UTL.....Unable to Life (BM,St etc)
HWL.....Hedge	UTS.....Unable to Survey
GIP.....Gas Inlet Pipe	VIP.....Vehicle Detector Pad
GMKR.....Gas Marker	VP.....Vent Pipe
GOT.....Gas Stop Tap (Domestic)	W/W.....Wire Mesh
GPV.....Gas Stop Valve (Mains)	WL.....Water Level
HSE.....Housing	WM.....Water Meter
Ht.....Height	WO.....Wash Out
HV.....High Voltage	WP.....Waste Pipe
I/W.....Iron Railing	WST.....Water Stop Tap (domestic)
IC.....Inspection Cover	WSV.....Water Stop Valve (mains)

Client

Drawing Title
Topographical Survey of Land at:
Etihad Campus
Manchester

Scale(s) 1:200	Surveyor
Date June 19	Drawn
Job Number	Checked

Sheet Size & Drg Number & Revision

Appendix B Borehole Logs

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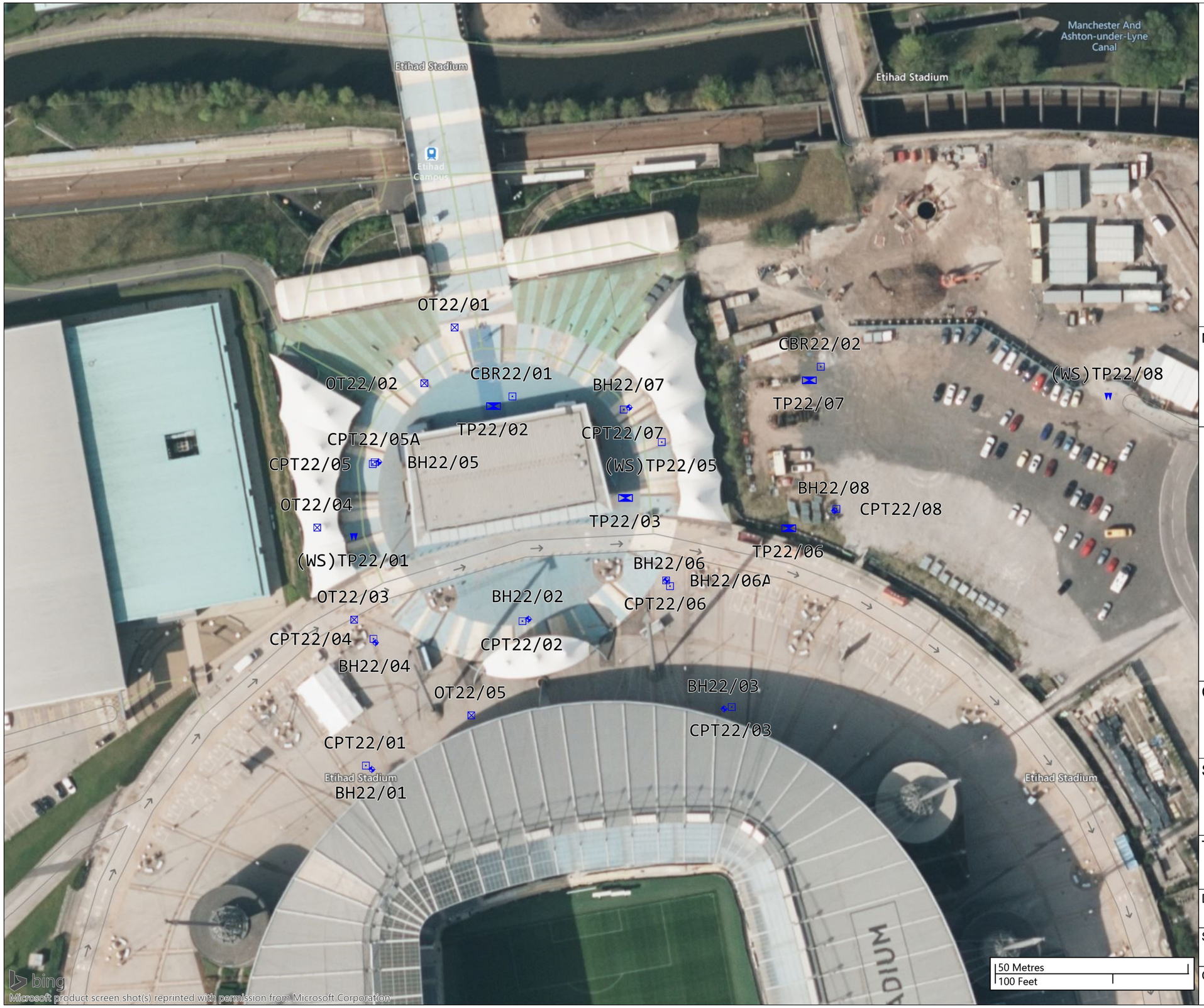

Key.

- Borehole
- Inspection Pit
- Observation Pit
- Trial Pit
- Window Sample

North

Notes:

Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

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Client: CITY FOOTBALL GROUP LIMITED

Site: ETIHAD GROUND INVESTIGATION

Title: EXPLORATORY HOLE LOCATION PLAN

Drawn By:	AC	Checked By:	TH	Paper Size:	A3
Scale:	1:1000			Date:	February 2023
Contract:	37349			Figure:	1

APPENDIX A

FIELDWORK DATA

Geotechnical Engineering Limited

KEY TO EXPLORATORY HOLE LOGS

Sample type

D	Small disturbed	U	Undisturbed	L	Dynamic	ES	Environmental - soil	CS	Core subsample (prepared)
B	Bulk disturbed	UT	Undisturbed thin wall	C	Core	EW	Environmental - water	LS	Dynamic subsample (prepared)
LB	Large bulk disturbed	P	Piston	W	Water				

Test type

S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value

C SPT - Solid cone followed by uncorrected SPT 'N' Value

(*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, ** - Denotes no effective penetration). Arrow length reflects test depth range.

H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re* denotes refusal. Where the limit of the equipment is reached during a test, the reported value is the minimum recorded shear strength of the material.

M Mackintosh probe - number of blows to achieve 100mm penetration

Mx Mexe cone - average reading of equivalent CBR value in %

PP Pocket penetrometer - calculated reading in kPa

Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with isobutylene, using a 10.6eV bulb)

TR In situ thermal resistivity by needle probe in mK/W

Sample/core range/I_f

Dynamic sample

Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

x = Total Core Recovery (TCR) as percentage of core run

y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter

z = Rock Quality Designation (RQD). The amount of solid core greater then 100mm expressed as percentage of core run

Where SPT has been carried out at the beginning of core run, disturbed section of core excluded from SCR and RQD assessment

I_f - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are also given. NI = non-intact core NA = not applicable NR = no recovery

Instrumentation

Porous tip

Perforated standpipe

Inclinometer

Extensometer

Backfill

Granular response zone

Bentonite seal

Cement/ bentonite grout

Soil backfill

Concrete

Cover

Raised cover

Stopcock cover

Stratum boundaries

Estimated boundary

Grading boundary

Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015+A1:2020

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identified when, within the natural make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

General comments

The process of drilling and sampling will inevitably lead to sample disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

Where provided, the stratigraphical names/geological rock units are for guidance only and may not be wholly accurate.

Geotechnical Engineering Limited

BOREHOLE LOG

BH22/02

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 1 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
C	0.00 - 0.10						Vo 10.8	Black TARMACADAM.	0.10	60.45	
1B	0.10 - 0.30							Light grey subangular and subrounded limestone COBBLES with some sandy fine to coarse gravel. Gravel is angular to subrounded fine to coarse limestone. (MADE GROUND)	0.30	60.25	
1ES	0.50 - 0.70						Vo 11.3				
2B	0.50 - 0.70										
3D	0.50 - 0.70										
2ES	0.90 - 1.10						Vo 10.7	Greyish brown slightly clayey sandy locally very sandy angular to subrounded fine to coarse limestone and brick GRAVEL with a low subangular brick cobble content. (MADE GROUND)	1.20	59.35	
4B	0.90 - 1.10										
5D	0.90 - 1.10										
6B	1.20 - 1.70										
3ES	1.50						Vo 1.5	Firm greyish brown slightly sandy slightly gravelly CLAY with a low angular brick and concrete cobble content. Gravel is angular to subrounded fine to coarse brick and concrete. (MADE GROUND)			
7D	2.00										
8B	2.00 - 2.50										
4ES	2.50	2.00					S 17				
9D	2.50 - 2.95						Vo 1.1	2.50m: Stiff.			
10B	2.50 - 2.95										
11D	3.00	3.00					S 13		3.00	57.55	
12D	3.00 - 3.45							Firm greyish brown locally mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine and medium sandstone and coal.			
13B	3.00 - 3.45										
14UT	3.50 - 3.95	3.00					Vo 0.6				
5ES	3.50										
16D	4.00 - 4.45	4.00					S 14				
17B	4.00 - 4.45										
18UT	4.50 - 4.95	4.00									
19D	5.00	5.00					S 13				
20D	5.00 - 5.45										
21B	5.00 - 5.45										
22D	6.00	6.00									
23UT	6.00 - 6.45										
24B	6.50 - 7.00										
25D	7.00	7.00					S 18	7.00m: Becoming stiff.			
26D	7.00 - 7.45										
27B	7.00 - 7.45										
28D	8.00										

Continued Next Page

HOLE CONSTRUCTION

TOP (m)	BASE (m)	TYPE	PLANT USED
0.00	0.10	Rotary Core	Geotechnical Pioneer Rig
0.10	1.20	Inspection Pit	Hand Tools
1.20	14.00	Cable Percussion	Cable Percussion Rig

WATER STRIKE Groundwater not encountered prior to use of flush

DEPTH (m)	CASING (m)	ROSE TO (m)	AFTER (min)	REMARKS

CASING DEPTH

DIAM (mm)	BASE (m)
200	13.50
168	24.00
140	60.00

BARREL DIAMETER

DIAM (mm)	BASE (m)
300	0.10
200	14.00
128	14.20
146	60.00

BACKFILL

TOP (m)	BASE (m)	MATERIAL
0.00	0.50	Concrete
0.50	0.60	Gravel
0.60	0.90	Bentonite
0.90	3.10	Gravel

INSTRUMENTATION

DEPTH (m)	TYPE
3.00	Standpipe (50mm)
40.00	Standpipe (35mm) with geosock

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
15-11-2022 07:00	0.00	Nil	
15-11-2022 17:00	0.10	Nil	Dry
17-11-2022 07:00	0.10	Nil	Dry
17-11-2022 17:00	1.20	Nil	1.15
22-11-2022 12:00	1.20	Nil	NR
22-11-2022 16:00	4.00	4.00	NR

REMARKS

Water flush used 14.20-15.00m. Polymer flush used 15.00-60.00m. Driller notes reduced flush returns (20%) 21.00-22.50m and 45.00-46.50m and (10%) 46.50-48.00m. Driller notes loss of flush returns 22.50-24.00m and 48.00-60.00m.

CONTRACT	CHECKED
37349	CT

Geotechnical Engineering Limited

BOREHOLE LOG

BH22/02

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 2 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
29UT	8.00 - 8.45	8.00									
30B	8.50 - 9.00										
31D	9.00	9.00					S 23				
32D	9.00 - 9.45										
33B	9.00 - 9.45										
34D	10.00	10.00						Stiff grey slightly gravelly slightly sandy locally sandy silty CLAY. Gravel is subangular and subrounded fine to coarse siltstone, mudstone and sandstone.	10.00	50.55	
UT	10.00 - 10.45										
35D	10.30										
36B	10.50 - 11.00										
37D	11.00										
38D	11.00 - 11.50										
39B	11.50 - 12.00										
40D	12.00	12.00					S 17				
41D	12.00 - 12.45										
42B	12.00 - 12.45										
43D	13.00	13.00						13.00 - 14.00m: Becoming very stiff. Rare thin and thick laminae of orangish brown fine and medium sand.			
44UT	13.00 - 13.45										
45B	13.50 - 14.00										
46D	14.00	13.50					S 42		14.00	46.55	
48L	14.00 - 14.20							Very stiff locally stiff brown slightly sandy locally sandy slightly gravelly CLAY. Gravel is angular to rounded fine and medium siltstone, mudstone, sandstone and rare limestone and quartzite.			
49C	14.20 - 15.00	14.20	100	NA							
50D	14.90 - 15.00							15.00 - 15.50m: Gravel is fine to coarse.			
51D	15.00 - 15.40	14.20	100				S *60				
52C	15.00 - 16.50	15.00	0					Extremely weak grey MUDSTONE with frequent thin laminae of grey siltstone. Frequently tending to very stiff fissured grey silty clay. Relict bedding fractures are subhorizontal to 10° extremely closely and very closely spaced planar rarely stepped smooth and 80° to subvertical planar smooth.			
53D	15.40 - 15.50		0	NI					15.50	45.05	

Continued Next Page

HOLE CONSTRUCTION

TOP (m)	BASE (m)	TYPE	PLANT USED
14.00	14.20	Windowless Sample	Geotechnical Pioneer Rig
14.20	60.00	Rotary Core	Geotechnical Pioneer Rig

WATER STRIKE Groundwater not encountered prior to use of flush

DEPTH (m)	CASING (m)	ROSE TO (m)	AFTER (min)	REMARKS

CASING DEPTH

DIAM (mm)	BASE (m)

BARREL DIAMETER

DIAM (mm)	BASE (m)

BACKFILL

TOP (m)	BASE (m)	MATERIAL
3.10	29.90	Bentonite
29.90	40.00	Gravel
40.00	60.00	Bentonite

INSTRUMENTATION

DEPTH (m)	TYPE

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
23-11-2022 07:00	4.00	4.00	NR
23-11-2022 12:00	9.00	9.00	NR
24-11-2022 07:00	9.00	9.00	NR
24-11-2022 14:30	14.00	13.50	NR
02-12-2022 10:30	14.00	13.50	Dry
02-12-2022 13:45	15.00	14.20	3.40

REMARKS

AGS

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BOREHOLE LOG

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SITE ETIHAD GROUND INVESTIGATION

Sheet 3 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from	to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
54D	16.40	16.50										
55C	16.50	18.00	16.50	100 0 0								
									17.40 - 17.45m: Moderately weak thin bed of grey siltstone.			
					NI 80				Extremely weak to weak grey MUDSTONE with frequent extremely closely and very closely spaced thin laminae of siltstone. Bedding fractures are 10-20° extremely closely to medium spaced planar smooth and 80° to subvertical undulating and stepped smooth.	17.70	42.85	
56D	18.00	18.13	18.00		220			S *273				
57C	18.00	19.50		100 63 37								
58D	18.60	18.70										
59D	18.80	18.90										
60C	19.50	21.00	19.50	100 53 26								
61CS	19.50	19.72										
62D	20.90	21.00										
63D	21.00	21.45	21.00	85 23 0				S 11	21.00 - 21.70m: Disintegrated to clayey sandy angular fine to coarse gravel.			
64C	21.00	22.50										
65D	21.85	21.95			NI				Extremely weak black pyritic COAL recovered as angular fine to coarse gravel.	21.75	38.80	
					NI				Extremely weak to very weak grey, dark grey and black MUDSTONE disintegrated to very stiff sandy gravelly clay with rare coal gravel. Relict fractures are subhorizontal very closely spaced planar smooth.	22.05	38.50	
66C	22.50	24.00	22.50	100 0 0								
67D	22.90	23.00										
									Very weak to moderately weak thinly laminated to thinly bedded grey MUDSTONE locally thinly interlaminated with siltstone. Bedding fractures are subhorizontal very closely to medium spaced planar and undulating smooth.			
68D	23.90	24.00								23.90	36.65	
69D	24.00	24.12	24.00					S *300				

Continued Next Page

HOLE CONSTRUCTION

TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush

DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH

DIAM (mm) BASE (m)

BARREL DIAMETER

DIAM (mm) BASE (m)

BACKFILL

TOP (m) BASE (m) MATERIAL

INSTRUMENTATION

DEPTH (m) TYPE

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
05-12-2022 10:40	15.00	14.20	3.60
05-12-2022 17:40	22.50	22.50	Dry
06-12-2022 08:00	22.50	22.50	Dry
06-12-2022 17:10	34.50	34.50	0.90
07-12-2022 08:00	34.50	34.50	0.90
07-12-2022 17:15	52.50	52.50	22.00

REMARKS

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BOREHOLE LOG

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CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 4 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
70C	24.00 - 25.50		100 82 75	NI 100 300							
71D	24.90 - 25.00							24.75 - 24.85m: Disintegrated to angular medium and coarse gravel. 25.05 - 25.35m: Dark grey carbonaceous mudstone locally tending to extremely weak black coal.			
72C	25.50 - 27.00	25.50	100 100 100	80 90 140 760				25.70 - 26.45m: Fractures are widely spaced.			
73CS	26.55 - 26.80			140 170 300							
74C 75CS	27.00 - 28.50 27.00 - 27.50	27.00	93 93 74	570							
				50 100 240							
76C	28.50 - 30.00	28.50	100 52 27	NI 40 150				Weak dark grey and black carbonaceous MUDSTONE with medium spaced moderately weak thinly interbedded grey mudstone and siltstone and closely to widely spaced very thinly and thinly bedded extremely weak black coal frequently disintegrated to angular fine to coarse gravel. Fractures are 10-30° very closely to medium spaced planar rarely undulating and stepped smooth and 80° to subvertical planar smooth. (CHARLOTTE LOWER LEAF COAL SEAM).	28.50	32.05	
77CS	29.20 - 29.40			250 300							
78D 79C	29.90 - 30.00 30.00 - 31.50	30.00	100 73 49	NI 40 100				28.90 - 29.20m: Non intact. Subvertical undulating smooth fracture.			
80CS	31.00 - 31.30			NI 250 530				Weak locally extremely weak fossiliferous grey MUDSTONE. Bedding fractures are subhorizontal to 20° closely and medium spaced planar smooth.	30.85	29.70	
81D 82C	31.40 - 31.50 31.50 - 33.00	31.50	100 97 66								

Continued Next Page

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
08-12-2022 08:15	52.50	52.50	19.70
08-12-2022 14:30	60.00	60.00	19.00

REMARKS

AGS

CONTRACT	CHECKED
37349	CT

Geotechnical Engineering Limited

BOREHOLE LOG

BH22/02

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 5 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
83CS	32.10 - 32.42										
84D	32.90 - 33.00			NI					32.90	27.65	
85C	33.00 - 34.50	33.00	100 97 78	150 300				Weak to moderately weak thinly laminated to thinly bedded grey SILTSTONE with very closely to medium spaced thinly and thickly laminated dark grey mudstone rarely thinly bedded light grey fine sandstone. Fractures are 10-45° very closely to medium spaced planar smooth.			
86CS	33.40 - 33.74										
87D	34.40 - 34.50										
88C	34.50 - 36.00	34.50	100 73 60					34.50 - 34.60m: Recovered non-intact as subangular coarse gravel. 34.65 - 34.80m: 70° planar rough fracture.			
89CS	35.57 - 35.72										
90D	35.90 - 36.00										
91C	36.00 - 37.50	36.00	100 79 57					36.50 - 36.55m: Conjugate intersecting fractures. Non intact.			
92CS	36.92 - 37.23										
93D	37.40 - 37.50										
94C	37.50 - 39.00	37.50	100 75 29					37.50 - 38.05m: Mudstone is thinly and thickly interlaminated with siltstone. 37.60m: Very weak.			
95CS	37.60 - 37.80										
				NI 30 115				Weak locally moderately weak grey MUDSTONE with medium spaced thinly laminated to thinly bedded medium strong light grey siltstone rarely tending to fine sandstone. Bedding fractures are subhorizontal to 30° extremely closely to closely spaced planar smooth.	38.05	22.50	
96D	38.90 - 39.00										
97C	39.00 - 40.50	39.00	100 84 9					38.40 - 38.50m: Two subhorizontal becoming 50° very closely spaced undulating rough fractures.			

Continued Next Page

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

AGS

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Geotechnical Engineering Limited

BOREHOLE LOG

BH22/02

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 6 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
								40.15 - 40.35m: 80° planar smooth fracture.			
98D	40.40 - 40.50										
99C	40.50 - 42.00	40.50	90 76 63					40.80 - 40.90m: Locally gravel sized brown limestone. 40.95 - 41.50m: Subvertical to 80° undulating rough fracture.	41.00	19.55	
				NI 250 360				Moderately weak thinly laminated to very thinly bedded grey SILTSTONE with extremely closely to closely spaced thinly and thickly interlaminated dark grey mudstone. Fractures are subhorizontal to 30° very closely to medium spaced planar rarely undulating smooth.			
100CS	41.45 - 41.65										
101D	41.90 - 42.00										
102C	42.00 - 43.50	42.00	93 83 73					42.00 - 42.40m: 50° undulating smooth fracture.			
103D	42.90 - 43.00										
104CS	43.23 - 43.50										
105C	43.50 - 45.00	43.50	100 91 84					43.50 - 44.15m: Mudstone is thinly laminated to medium bedded.			
106CS	43.60 - 43.95							43.95 - 44.05m: 60° planar smooth fracture.			
107CS	44.25 - 44.50			130 270 290				Moderately weak thickly laminated to thinly bedded grey fine SANDSTONE with extremely closely and very closely spaced thinly and thickly laminated grey siltstone and rare thinly laminated mudstone. Laminae are subhorizontal to 10° planar rarely undulating smooth. Fractures are subhorizontal to 20° medium and widely spaced rarely very closely spaced planar smooth.	44.15	16.40	
108C	45.00 - 46.50	45.00	100 100 99	560							
				20 920							
109CS	46.10 - 46.50										
110C	46.50 - 48.00	46.50	93 66 46	470				Medium strong grey frequently stained reddish brown fine and medium SANDSTONE with rare thinly laminated black coal and mudstone. Fractures are 10-30° very closely and medium spaced planar smooth.	47.00	13.55	
111CS	46.50 - 47.00			NI 110 350				47.00 - 47.10m: Extremely closely and very closely spaced thinly interlaminated coal. 47.00 - 47.25m: 70° planar smooth locally rough fracture. 47.20 - 47.40m: Subvertical undulating smooth incipient fracture. 47.55 - 48.30m: Fractures are very closely and closely spaced with 70° to subvertical intersecting planar smooth fractures.			
112C	48.00 - 49.50	48.00						Continued Next Page			

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

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Geotechnical Engineering Limited

BOREHOLE LOG

BH22/02

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 7 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
			100 85 70	70 270 390							
113CS	49.10 - 49.50										
114C	49.50 - 51.00	49.50	100 85 71	30 35 190 790				Moderately weak reddish brown fine and medium SANDSTONE with rare thinly laminated coal. Fractures are subhorizontal to 20° very closely to widely spaced planar smooth and 60-80° medium spaced planar smooth.	49.75	10.80	
115CS	50.20 - 50.55							50.80 - 51.10m: 80° to subvertical intersecting planar smooth fractures.			
116C	51.00 - 52.50	51.00	100 85 83	NI 120 160 770							
117CS	51.86 - 52.17							52.05 - 52.50m: Subvertical planar smooth incipient fracture.			
118C	52.50 - 54.00	52.50	100 99 89	NI 70 200 20 350 560				53.20 - 53.70m: Locally light grey.			
119CS	53.60 - 54.00							53.70 - 54.25m: Light grey.			
120C	54.00 - 55.50	54.00	100 79 25	NI 20 120				Very weak to weak thickly laminated to medium bedded dark grey MUDSTONE with thinly interlaminated to very thinly interbedded greyish brown siltstone. Fractures are 5-20° very closely and closely spaced planar smooth. Bedding fractures are 5-20° extremely closely and very closely spaced planar smooth.	54.25	6.30	
121CS	55.30 - 55.43										
122C 123D	55.50 - 57.00 55.50 - 55.60	55.50	90 46 32	NI 40 90				Very weak dark grey carbonaceous MUDSTONE. Fractures are randomly orientated very closely and closely spaced planar polished.	55.50	5.05	
								Continued Next Page			

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

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BOREHOLE LOG

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SITE ETIHAD GROUND INVESTIGATION

Sheet 8 of 8

Start Date 15 November 2022 Easting 386777 Scale 1:50

End Date 08 December 2022 Northing 398641 Ground Level 60.55mOD Depth 60.00 m

sample no & type	sample depth (m) from	to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
					90 100 390				Weak locally moderately weak grey locally dark grey MUDSTONE. Bedding fractures are subhorizontal to 20° closely and medium spaced undulating and planar smooth.	56.45	4.10	
124D 125C	56.90 - 57.00 57.00 - 58.50		57.00	100 91 59								
					NI 50 130				Very weak to weak dark grey carbonaceous MUDSTONE with thinly bedded coal locally disintegrated to angular fine to coarse gravel. Fractures are subhorizontal very closely spaced planar smooth.	58.05	2.50	
126D 127C	58.40 - 58.50 58.50 - 60.00		58.50	96 86 55	NI 80 190				Very weak to moderately weak thinly interlaminated to thinly interbedded grey MUDSTONE and light grey SILTSTONE. Bedding fractures are subhorizontal to 10° closely and medium spaced planar rarely undulating smooth.	58.65	1.90	
128CS	59.30 - 59.72				650				58.70 - 58.80m: Subhorizontal undulating smooth fracture infilled (up to 100mm) with firm grey sandy clay. 59.35 - 60.00m: Fractures are widely spaced.			
									Borehole Completed at 60.00m	60.00	0.55	

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

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BOREHOLE LOG

BH22/07

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 1 of 6

Start Date 15 November 2022 Easting 386804 Scale 1:50

End Date 19 December 2022 Northing 398696 Ground Level 61.00mOD Depth 45.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
C	0.00 - 0.10							Black TARMACADAM.	0.10	60.90	
1B	0.10 - 0.30							Light grey sandy angular to subrounded fine to coarse limestone and rare concrete GRAVEL. (MADE GROUND)	0.30	60.70	
2D	0.10 - 0.30						Vo 6.9				
1ES	0.30 - 0.50						Vo 7.2				
3B	0.30 - 0.50							Greyish brown slightly clayey locally clayey very sandy angular and subangular fine to coarse brick, siltstone, limestone, concrete and rare tarmacadam GRAVEL with a low angular and subangular brick and concrete cobble content. (MADE GROUND)	1.15	59.85	
4D	0.30 - 0.50										
2ES	0.90 - 1.10										
5B	0.90 - 1.10										
6D	0.90 - 1.10	Nil					C 17				
7B	1.20 - 1.65										
3ES	1.50						Vo 3.0	Firm to stiff dark grey and grey slightly sandy gravelly CLAY. Gravel is angular fine to coarse sandstone, brick and concrete. Strong hydrocarbon odour. (MADE GROUND)			
8D	2.00	2.00					C *200		2.00	59.00	
9B	2.00 - 2.50	Nil					Vo 1.0	Brown clayey sandy angular to subrounded fine to coarse brick, concrete, sandstone, quartzite, mudstone and limestone GRAVEL. Faint hydrocarbon odour. (MADE GROUND)			
10L	2.00 - 2.30										
4ES	2.10 - 2.20	2.30	100	NA			Vo 3.0		2.30	58.70	
11D	2.20 - 2.30	2.30		NA			S *67		2.40	58.60	
12C	2.30 - 2.50		100								
13D	2.40 - 2.50										
5ES	2.40			NA			Vo 0.0	Dark brownish grey locally dark grey and reddish brown slightly sandy angular to subrounded fine to coarse brick, limestone, quartzite and rare concrete GRAVEL. Faint hydrocarbon odour. (MADE GROUND)	2.80	58.20	
14D	2.50 - 2.88	3.00					S 34				
15C	2.50 - 3.00										
6ES	2.80 - 3.00										
16D	3.00 - 3.45										
17L	3.00 - 3.50	3.50					S 10	Very stiff dark brownish grey slightly sandy gravelly clayey SILT. Gravel is angular to subrounded fine to coarse brick, quartzite and clinker. (MADE GROUND)			
18D	3.50 - 3.95										
19L	3.50 - 4.00						Vo 0.0				
7ES	3.70 - 3.90										
20D	3.90 - 4.00	4.00					S 2	Stiff becoming firm brown slightly sandy gravelly silty CLAY locally tending to clayey very sandy gravel. Gravel is angular to subrounded fine to coarse brick and quartzite. (MADE GROUND)			
21D	4.00 - 4.45										
22L	4.00 - 4.50										
23UT	4.50 - 4.95	4.50						4.00 - 4.50m: Very soft slightly gravelly slightly sandy.	4.50	56.50	
24D	4.95 - 5.05							Stiff becoming very stiff brown locally tending to dark brown slightly gravelly slightly sandy locally sandy silty CLAY. Gravel is angular to subrounded fine and medium sandstone, siltstone, mudstone and rare coal.			
25D	5.05 - 5.10	4.50					S 27				
26D	5.10 - 5.55										
27L	5.10 - 6.00										
28D	5.20 - 5.30										
29D	5.90 - 6.00										
30D	6.00 - 6.45	4.50					S 32				
31L	6.00 - 6.60	6.00									
32D	6.60 - 7.05	6.00					S 24				
33C	6.60 - 7.50	6.60	100	NA							
34D	6.90 - 7.00										
35D	7.50 - 7.95	7.50					S 24				
36C	7.50 - 9.00		100								
37D	7.90 - 8.00										

Continued Next Page

HOLE CONSTRUCTION

TOP (m)	BASE (m)	TYPE	PLANT USED
0.00	0.10	Rotary Core	Geotechnical Pioneer Rig
0.10	1.20	Inspection Pit	Hand Tools
1.20	2.50	Cable Percussion	Cable Percussion Rig

WATER STRIKE Groundwater not encountered prior to use of flush

DEPTH (m)	CASING (m)	ROSE TO (m)	AFTER (min)	REMARKS

CASING DEPTH

DIAM (mm)	BASE (m)
200	3.00
168	14.00
140	45.00

BARREL DIAMETER

DIAM (mm)	BASE (m)
300	0.10
200	2.50
128	2.50
146	3.00

BACKFILL

TOP (m)	BASE (m)	MATERIAL
0.00	0.50	Concrete
0.50	0.60	Gravel
0.60	0.90	Bentonite
0.90	4.20	Gravel

INSTRUMENTATION

DEPTH (m)	TYPE
4.00	Standpipe (50mm)
40.00	Standpipe (35mm) with geosock

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
15-11-2022 09:00	0.00	Nil	
15-11-2022 09:10	0.10	Nil	Dry
17-11-2022 15:50	0.10	Nil	Dry
17-11-2022 17:55	1.20	Nil	Dry
29-11-2022 12:00	1.20	Nil	NR
29-11-2022 14:00	2.50	2.50	NR

REMARKS

Partial collapse of borehole 2.50-2.00m prior to commencing dynamic sampling. Water flush used 2.30-3.00m. Polymer flush used 6.60-45.00m. Driller notes reduced flush returns (40%) 31.50-33.00m. Driller notes loss of flush returns 33.00-45.00m.

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BOREHOLE LOG

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CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 2 of 6

Start Date 15 November 2022 Easting 386804 Scale 1:50

End Date 19 December 2022 Northing 398696 Ground Level 61.00mOD Depth 45.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
38D	8.90 - 9.00										
39D	9.00 - 9.45	9.00	100				S 26				
40C	9.00 - 10.50										
41D	9.90 - 10.00										
42D	10.50 - 10.95	10.50	100				S 34				
43C	10.50 - 12.00										
44D	10.90 - 11.00										
45D	11.90 - 12.00										
46D	12.00 - 12.45	12.00	100				S 33				
47C	12.00 - 13.50										
48D	12.90 - 13.00										
49D	13.50 - 13.95	13.50	100				S 44				
50C	13.50 - 15.00										
51D	14.50 - 14.60										
52D	15.00 - 15.45	15.00	100				S 48				
53C	15.00 - 16.50										
54D	16.00 - 16.10							15.80 - 15.90m: Dark grey.			
								Continued Next Page			

HOLE CONSTRUCTION

TOP (m)	BASE (m)	TYPE	PLANT USED
2.00	2.30	Windowless Sample	Geotechnical Pioneer Rig
2.30	3.00	Rotary Core	Geotechnical Pioneer Rig
3.00	6.60	Windowless Sample	Geotechnical Pioneer Rig

WATER STRIKE Groundwater not encountered prior to use of flush

DEPTH (m)	CASING (m)	ROSE TO (m)	AFTER (min)	REMARKS

CASING DEPTH

DIAM (mm)	BASE (m)

BARREL DIAMETER

DIAM (mm)	BASE (m)
128	6.60
146	45.00

BACKFILL

TOP (m)	BASE (m)	MATERIAL
4.20	29.90	Bentonite
29.90	40.00	Gravel
40.00	45.00	Bentonite

INSTRUMENTATION

DEPTH (m)	TYPE

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
12-12-2022 13:50	2.00	Nil	0.90
12-12-2022 17:20	3.00	3.00	0.20
13-12-2022 08:15	3.00	3.00	0.40
13-12-2022 17:15	13.50	13.50	1.10
14-12-2022 14:20	13.50	13.50	0.40
14-12-2022 17:45	19.50	19.50	0.70

REMARKS

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BOREHOLE LOG

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SITE ETIHAD GROUND INVESTIGATION

Sheet 3 of 6

Start Date 15 November 2022 Easting 386804 Scale 1:50

End Date 19 December 2022 Northing 398696 Ground Level 61.00mOD Depth 45.00 m

sample no & type	sample depth (m) from	to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
									Stiff becoming very stiff brown locally tending to dark brown slightly gravelly slightly sandy locally sandy silty CLAY. Gravel is angular to subrounded fine and medium sandstone, siltstone, mudstone and rare coal.			
55D	16.50	16.83	16.50	100	NI			S *136	5.90 - 16.40m: Light bluish grey mottled light brown.	16.40	44.60	
56C	16.50	18.00		86	840				Extremely weak thinly laminated light brownish grey MUDSTONE locally tending to very stiff slightly gravelly locally gravelly silty clay. Laminae are subhorizontal extremely closely spaced planar smooth. Bedding fractures are subhorizontal to 20° very closely and closely spaced planar smooth rarely stained brown.			
				86					16.70 - 17.55m: Fractures are widely spaced.	17.55	43.45	
					NI				17.15 - 17.25m: 30° planar smooth lamination.			
					250				17.40 - 17.55m: Two very closely spaced thin beds of very weak brown and light reddish brown siltstone.			
57D	17.90	18.00			320							
58C	18.00	19.50	18.00	100					Extremely weak to very weak thinly and thickly laminated grey locally dark grey MUDSTONE locally disintegrated to very stiff gravelly clay with medium spaced thin beds of light brown siltstone. Bedding fractures are subhorizontal to 20° closely and medium spaced planar smooth.			
				90								
				87								
59CS	19.02	19.27										
60C	19.50	21.00	19.50	100	NI				19.85 - 19.95m: Thin bed of weak grey mudstone.			
				60	80							
				50	100				20.40 - 21.00m: Fractures are widely spaced.			
					600							
61CS	20.80	21.00										
62D	20.90	21.00										
63D	21.00	21.11	21.00	100	NI			S *429	Extremely weak to weak thinly interlaminated to thinly interbedded grey and light grey MUDSTONE and SILTSTONE. Bedding fractures are subhorizontal to 20° very closely and closely spaced planar and undulating smooth.	21.05	39.95	
64C	21.00	22.50		98	60							
				90	150							
65CS	22.13	22.38										
66D	22.40	22.50										
67D	22.50	22.63	22.50	100				S *333				
68C	22.50	24.00		83	60				Very weak to weak locally moderately weak grey SILTSTONE with medium and widely spaced thin beds of thinly interlaminated mudstone. Fractures are subhorizontal to 20° very closely to medium spaced planar smooth.	22.60	38.40	
69CS	22.80	22.91		60	240				23.00 - 23.10m: Subvertical planar smooth fracture.			
					370				23.40 - 23.80m: Fractures are 30-40° locally intersecting planar smooth.			
70D	23.90	24.00										
71C	24.00	25.50	24.00									
									Continued Next Page			

HOLE CONSTRUCTION

TOP (m)	BASE (m)	TYPE	PLANT USED
6.60	45.00	Rotary Core	Geotechnical Pioneer Rig

WATER STRIKE Groundwater not encountered prior to use of flush

DEPTH (m)	CASING (m)	ROSE TO (m)	AFTER (min)	REMARKS

CASING DEPTH

DIAM (mm)	BASE (m)

BARREL DIAMETER

DIAM (mm)	BASE (m)

BACKFILL

TOP (m)	BASE (m)	MATERIAL

INSTRUMENTATION

DEPTH (m)	TYPE

HOLE PROGRESS

DATE TIME	DEPTH (m)	CASING (m)	WATER (m)
15-12-2022 08:00	19.50	19.50	0.60
15-12-2022 17:30	30.00	30.00	1.50
16-12-2022 08:15	30.00	30.00	18.90
16-12-2022 13:15	37.50	37.50	13.60
19-12-2022 10:00	37.50	37.50	20.65
19-12-2022 15:15	45.00	45.00	20.65

REMARKS

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BOREHOLE LOG

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CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 4 of 6

Start Date 15 November 2022 Easting 386804 Scale 1:50

End Date 19 December 2022 Northing 398696 Ground Level 61.00mOD Depth 45.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
			100 86 81					24.70 - 24.85m: Extremely weak. 60° undulating rough fracture.			
72CS	25.15 - 25.43			20 150 380				Weak to moderately weak thinly interlaminated to thinly interbedded light grey and grey fine SANDSTONE and SILTSTONE. Fractures are subhorizontal to 30° extremely closely to medium spaced planar smooth.	25.05	35.95	
73C 74CS	25.50 - 27.00 25.50 - 25.89	25.50	100 60 47								
				NI				26.10 - 26.30m: 70° planar smooth fracture. 26.20 - 26.70m: Disintegrated to fine sand.			
				NI 200 380				26.55 - 26.80m: 70° planar smooth fracture.			
75C	27.00 - 28.50	27.00	100 93 82								
				NI 150 200				27.40 - 28.15m: Stained brown and greyish brown. 27.45 - 28.05m: Fractures are 60-70° closely spaced planar smooth.			
76CS	28.26 - 28.50			55 250 410							
77C 78CS	28.50 - 30.00 28.60 - 29.08	28.50	100 90 67								
				NI 90 130				29.55 - 32.40m: Rare becoming frequent 60° planar smooth rarely incipient fractures frequently stained orangish brown.			
79C	30.00 - 31.50	30.00	100 61 59	NI 60 140							
80CS	30.81 - 31.03										
				NI 40 160				31.10 - 32.40m: Fractures are very closely spaced and intersecting.			
81C	31.50 - 33.00	31.50	100 40 29								
								Continued Next Page			

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

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SITE ETIHAD GROUND INVESTIGATION

Sheet 5 of 6

Start Date 15 November 2022 Easting 386804 Scale 1:50

End Date 19 December 2022 Northing 398696 Ground Level 61.00mOD Depth 45.00 m

sample no & type	sample depth (m) from	to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
82CS	32.40	32.80			440				32.40 - 33.80m: Sandstone is fine to coarse.			
					NI				32.80 - 33.00m: 60° planar smooth fracture stained orangish brown.			
83C	33.00	34.50	33.00	100	30				33.00 - 33.80m: Fractures are widely spaced.			
84CS	33.00	33.40		54	80							
				54	800				33.25m: Medium strong.			
					NI					33.80	27.20	
85C	34.50	36.00	34.50	100					Extremely weak to very weak thickly laminated grey and dark grey MUDSTONE. Bedding fractures are subhorizontal to 20° locally 50-70° extremely closely and very closely spaced planar smooth.			
				52								
				0								
					NI							
					60							
					NI					35.35	25.65	
					60				Extremely weak to weak dark grey MUDSTONE frequently disintegrated to angular and subangular fine to coarse gravel with very closely to widely spaced thinly interlaminated to very thinly interbedded brownish grey siltstone. Fractures are subhorizontal to 30° very closely and closely spaced planar smooth rarely 80° to subvertical planar smooth.			
					140							
86D	35.90	36.00										
87C	36.00	37.50	36.00	100								
				67								
				27					36.50 - 36.65m: Carbonaceous.			
					NI					36.70	24.30	
					60				Extremely weak to very weak grey becoming light grey MUDSTONE frequently disintegrated to angular fine to coarse gravel. Bedding fractures are subhorizontal to 30° extremely closely to closely spaced planar and undulating smooth.			
					100							
88D	37.40	37.50										
89C	37.50	39.00	37.50	100								
				41								
				21								
90D	38.00	38.10										
					NI					38.25	22.75	
					50				Very weak dark grey carbonaceous MUDSTONE. Fractures are subhorizontal to 20° very closely and closely spaced planar smooth.			
					110							
91CS	38.70	38.81										
					NI				Very weak to weak grey locally fossiliferous MUDSTONE with extremely closely and very closely spaced thinly interlaminated grey siltstone. Fractures are 10-40° closely and medium spaced planar rough.	38.85	22.15	
92C	39.00	40.50	39.00	100	180							
				70	250							
				59								
									39.00 - 39.20m: Disintegrated to subangular fine to coarse gravel.			
									39.30 - 39.80m: 50° becoming subvertical undulating rough fracture intersecting with subvertical planar smooth fracture.			
									Continued Next Page			

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

AGS

CONTRACT	CHECKED
37349	**CT**

Geotechnical Engineering Limited

BOREHOLE LOG

BH22/07

CLIENT CITY FOOTBALL GROUP LIMITED

SITE ETIHAD GROUND INVESTIGATION

Sheet 6 of 6

Start Date 15 November 2022 Easting 386804 Scale 1:50

End Date 19 December 2022 Northing 398696 Ground Level 61.00mOD Depth 45.00 m

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range	If	water record depth (m)	instru-ment	test type & value	description	depth (m)	reduced level (m)	legend
93CS	40.18 - 40.30										
94C	40.50 - 42.00	40.50	100 85 80					40.50 - 40.70m: 70° to subvertical undulating smooth fracture. 40.75 - 40.90m: 70° to subvertical planar rough fracture. Partially disintegrated to subangular fine to coarse gravel.			
				NI 260					41.00	20.00	
95CS	41.30 - 41.69			370				Weak thinly interlaminated to thinly interbedded dark grey and light grey MUDSTONE and SILTSTONE with widely spaced thin beds of light grey fine sandstone. Bedding fractures are subhorizontal to 20° very closely to medium spaced planar and undulating smooth. 41.20 - 42.00m: Locally fossiliferous.			
96C	42.00 - 43.50	42.00	100								
97CS	42.00 - 42.15		53 29	NI 80 140				42.30 - 42.50m: 80° to subvertical planar smooth fracture.			
98C	43.50 - 45.00	43.50	100	NI				43.30 - 43.35m: Disintegrated to subangular grey slightly sandy clayey fine to coarse gravel.			
99CS	43.50 - 43.75		75 53	120 230				43.70 - 43.80m: 40° planar smooth fracture. 43.90 - 44.00m: 40° planar smooth fracture locally disintegrated to angular and subangular fine and medium gravel. 44.10 - 45.00m: Very weak fossiliferous grey mudstone with closely spaced very thin beds of brownish grey siltstone. 44.40 - 44.75m: Disintegrated to angular medium and coarse gravel. 60° probably very closely spaced planar smooth fractures.			
								Borehole Completed at 45.00m	45.00	16.00	

HOLE CONSTRUCTION
TOP (m) BASE (m) TYPE PLANT USED

WATER STRIKE Groundwater not encountered prior to use of flush
DEPTH (m) CASING (m) ROSE TO (m) AFTER (min) REMARKS

CASING DEPTH
DIAM (mm) BASE (m)

BARREL DIAMETER
DIAM (mm) BASE (m)

BACKFILL
TOP (m) BASE (m) MATERIAL

INSTRUMENTATION
DEPTH (m) TYPE

HOLE PROGRESS
DATE TIME DEPTH (m) CASING (m) WATER (m)

REMARKS

AGS

CONTRACT	CHECKED
37349	CT

Appendix C Greenfield Runoff Calculations

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Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Alex Mulroy
Site name:	MCFC Etihad Stadium
Site location:	Manchester, UK

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.48447° N
Longitude:	2.20054° W
Reference:	2803643795
Date:	Apr 12 2023 17:11

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.91

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	902	902
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.91	5.91
1 in 1 year (l/s):	5.14	5.14
1 in 30 years (l/s):	10.05	10.05
1 in 100 year (l/s):	12.29	12.29
1 in 200 years (l/s):	14.01	14.01

Appendix D Surface Water Drainage Strategy

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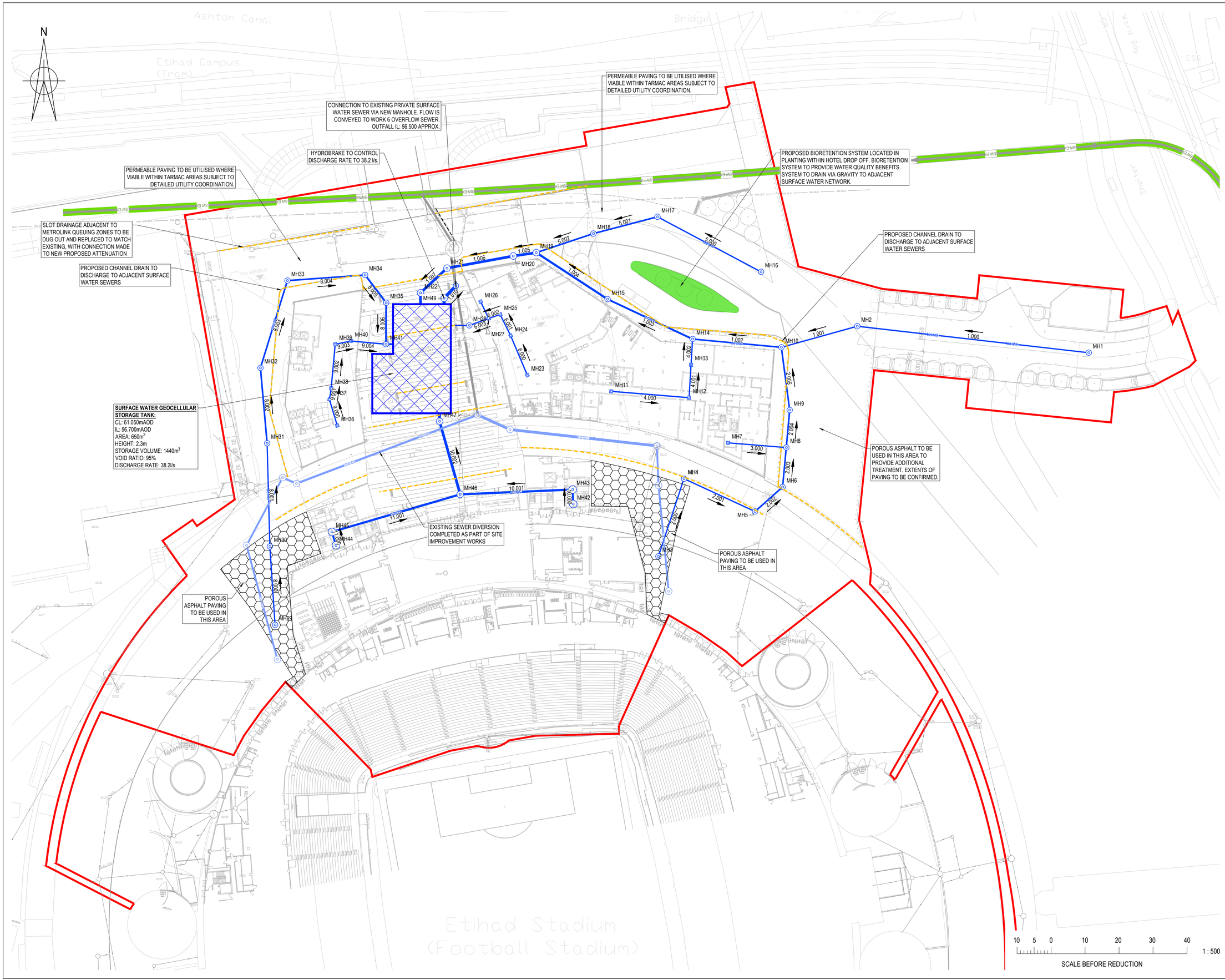

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DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

CONSTRUCTION ACTIVITIES IN CLOSE PROXIMITY TO LOW PRESSURE GAS MAIN

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. ALL EXISTING UTILITIES ARE TO BE CONFIRMED ON SITE AND SAFE WORKING PRACTICES TO BE USED PRIOR TO EXCAVATION.
4. UNIDENTIFIED UTILITIES WERE RECORDED DURING THE GPR SURVEY. THE PURPOSE OF THESE UTILITIES SHOULD BE CONFIRMED PRIOR TO DECOMMISSIONING.
5. THE DRAWING IS BASED ON:
   - LANDSCAPE ARCHITECT'S LAYOUT (NSE-POP-ZZ-ZZ-GA-A-00600) RECEIVED FROM POPULOUS ON 11/04/2023;
   - TOPOGRAPHICAL SURVEY (19D065) DATED JUNE 2 2019.
   - GPR SURVEY DATA (GR48864-UU-DR) RECEIVED FROM SUBSCAN ON 24/01/2023 AND SHOWN IN GREY.
6. SITE IMPROVEMENT WORKS CONSTRUCTED IN PREVIOUS PHASE OF WORK AND SUBJECT TO SEPARATE PLANNING APPLICATION

LEGEND:

- SITE BOUNDARY
- EXISTING
- SURFACE WATER SEWER (PRIVATE)
- WORK 6 OVERFLOW SEWER (UNITED UTILITIES)
- PROPOSED
- BELOW GROUND SURFACE WATER SEWER AND MANHOLES
- BELOW GROUND SURFACE WATER SEWER AND MANHOLES (CONSTRUCTED IN SITE IMPROVEMENT WORKS PHASE)
- LINEAR SURFACE DRAINAGE
- ATTENUATION TANK
- BIORETENTION SYSTEM
- PERMEABLE PAVING (APPROX EXTENTS)

Rev	Description	Date	Iss'd	Rev'd	App'd
P02	ISSUED FOR DETAILED PLANNING	17.04.2023	AM	CM	NH
P01	ISSUED FOR STAGE 3	28.02.2023	SG	CM	NH

PLANNING

Project Stage

PLANNING

Status of Drawing

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Web: www.burohappold.com

Client: MCFC
Architect: POPULOUS
Project: ETIHAD CAMPUS NS
Drg Title: BELOW GROUND DRAINAGE SURFACE WATER GENERAL ARRANGEMENT

Job No.	Scale@A1
NSE	1:500

Drawn/Designed By.	Checked By.	Approved By.
SG	CM	NH

Drawing No.: NSE-BHE-ZX-XX-DR-C-003101
Revision: P02

Ant Murray P:\00038919 MCFC North Stand\05 Cities - Infra\01 - Sheets\NSE-BHE-ZX-XX-DR-C-003101_Surface Water Drainage Strategy.dwg

Appendix E Hydraulic Calculations

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Water Permanent

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	60
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Water Permanent

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.870	4-8	0.926	8-12	0.293	12-16	0.293	16-20	0.098

Total Area Contributing (ha) = 2.481

Total Pipe Volume (m^3) = 83.267

Network Design Table for Surface Water Permanent

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

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

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Network Design Table for Surface Water Permanent

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
S1.000	68.557	0.415	165.0	0.152	15.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	23.171	0.140	165.0	0.059	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	17.217	0.455	37.8	0.013	15.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	24.049	0.146	164.7	0.022	15.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	23.013	0.139	165.0	0.072	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	10.847	0.045	240.0	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.003	11.661	0.049	240.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	11.072	0.067	165.2	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.002	18.611	0.113	165.0	0.093	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	26.242	0.109	240.7	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	22.979	0.139	165.3	0.050	15.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	9.692	0.059	165.0	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	7.586	0.546	13.9	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	27.625	0.086	321.2	0.037	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	16.13	60.121	0.152	0.0	0.0	0.0	1.02	40.4	20.6
S1.001	50.00	16.51	59.706	0.211	0.0	0.0	0.0	1.02	40.4	28.6
S2.000	50.00	15.13	60.200	0.013	0.0	0.0	0.0	2.13	84.8	1.7
S3.000	50.00	15.39	59.075	0.022	0.0	0.0	0.0	1.02	40.4	3.0
S3.001	50.00	15.77	58.929	0.094	0.0	0.0	0.0	1.02	40.4	12.7
S3.002	50.00	15.95	58.715	0.121	0.0	0.0	0.0	1.01	71.4	16.4
S3.003	50.00	16.14	58.669	0.121	0.0	0.0	0.0	1.01	71.4	16.4
S2.001	50.00	16.29	58.621	0.179	0.0	0.0	0.0	1.22	86.3	24.3
S2.002	50.00	16.55	58.554	0.272	0.0	0.0	0.0	1.22	86.3	36.8
S1.002	50.00	16.98	58.441	0.525	0.0	0.0	0.0	1.01	71.3	71.1
S4.000	50.00	15.38	60.200	0.050	0.0	0.0	0.0	1.01	40.3	6.8
S4.001	50.00	15.54	60.061	0.088	0.0	0.0	0.0	1.02	40.4	11.9
S4.002	50.00	15.57	60.002	0.117	0.0	0.0	0.0	3.53	140.3	15.8
S1.003	50.00	17.44	58.257	0.679	0.0	0.0	0.0	1.01	111.0	91.9

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Network Design Table for Surface Water Permanent

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
S1.004	25.048	0.075	334.0	0.062	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	34.509	0.209	165.1	0.053	15.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	19.485	0.081	240.0	0.102	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.002	17.723	0.074	240.0	0.063	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	6.844	0.014	490.0	0.052	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.006	19.835	0.040	490.0	0.029	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.007	10.640	0.022	490.0	0.057	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	15.654	0.010	1534.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.000	12.568	0.076	165.0	0.068	15.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	6.983	0.042	165.0	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.002	3.576	0.238	15.0	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	5.453	0.364	15.0	0.018	15.00	0.0	0.600	o	225	Pipe/Conduit	
S6.003	6.043	0.211	28.6	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.004	13.202	0.030	435.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	50.00	17.82	58.096	0.741	0.0	0.0	0.0	1.11	176.0	100.4
S5.000	50.00	15.57	59.658	0.053	0.0	0.0	0.0	1.01	40.3	7.2
S5.001	50.00	15.89	59.374	0.155	0.0	0.0	0.0	1.01	71.4	21.0
S5.002	50.00	16.18	59.293	0.218	0.0	0.0	0.0	1.01	71.4	29.5
S1.005	50.00	17.93	57.946	1.011	0.0	0.0	0.0	1.01	217.6	136.9
S1.006	50.00	18.26	57.932	1.040	0.0	0.0	0.0	1.01	217.6	140.8
S1.007	50.00	18.44	57.892	1.097	0.0	0.0	0.0	1.01	217.6	148.6
S1.008	50.00	18.86	57.795	1.097	0.0	0.0	0.0	0.61	173.3	148.6
S6.000	50.00	15.21	60.200	0.068	0.0	0.0	0.0	1.02	40.4	9.2
S6.001	50.00	15.32	60.124	0.112	0.0	0.0	0.0	1.02	40.4	15.2
S6.002	50.00	15.34	60.082	0.129	0.0	0.0	0.0	3.40	135.0	17.5
S7.000	50.00	15.03	60.200	0.018	0.0	0.0	0.0	3.40	135.0	2.5
S6.003	50.00	15.38	59.836	0.165	0.0	0.0	0.0	2.45	97.6	22.3
S6.004	50.00	15.73	59.625	0.165	0.0	0.0	0.0	0.62	24.7	22.3

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Network Design Table for Surface Water Permanent

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
S8.000	23.127	0.140	165.2	0.027	15.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	30.370	0.184	165.1	0.043	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	22.252	0.093	240.0	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.003	26.866	0.112	240.0	0.037	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.004	22.928	0.096	240.0	0.065	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.005	10.250	0.032	320.3	0.046	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.006	12.199	0.038	321.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.000	7.993	0.048	166.5	0.051	15.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	3.330	0.020	165.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	13.019	0.259	50.3	0.048	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.003	4.705	0.314	15.0	0.032	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.004	10.360	0.691	15.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.007	12.718	0.016	794.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.000	4.286	0.013	329.7	0.324	15.00	0.0	0.600	oo	400	Double Pipe	
S10.001	33.100	0.083	400.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S11.000	4.135	0.013	318.1	0.323	15.00	0.0	0.600	oo	400	Double Pipe	

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)
S8.000	50.00	15.38	59.047	0.027	0.0	0.0	0.0	1.01	40.3	3.6
S8.001	50.00	15.88	58.907	0.069	0.0	0.0	0.0	1.01	40.4	9.4
S8.002	50.00	16.25	58.648	0.092	0.0	0.0	0.0	1.01	71.4	12.4
S8.003	50.00	16.69	58.555	0.128	0.0	0.0	0.0	1.01	71.4	17.4
S8.004	50.00	17.07	58.443	0.193	0.0	0.0	0.0	1.01	71.4	26.2
S8.005	50.00	17.24	58.273	0.239	0.0	0.0	0.0	1.01	111.2	32.4
S8.006	50.00	17.44	58.241	0.239	0.0	0.0	0.0	1.01	111.1	32.4
S9.000	50.00	15.13	60.250	0.051	0.0	0.0	0.0	1.01	40.2	6.8
S9.001	50.00	15.19	60.202	0.066	0.0	0.0	0.0	1.02	40.4	8.9
S9.002	50.00	15.30	60.182	0.113	0.0	0.0	0.0	1.85	73.5	15.4
S9.003	50.00	15.33	59.923	0.146	0.0	0.0	0.0	3.40	135.0	19.8
S9.004	50.00	15.38	59.609	0.180	0.0	0.0	0.0	3.40	135.0	24.3
S8.007	50.00	17.77	58.203	0.419	0.0	0.0	0.0	0.63	70.1	56.7
S10.000	50.00	15.07	59.110	0.324	0.0	0.0	0.0	1.03	259.8	43.8
S10.001	50.00	15.62	59.047	0.324	0.0	0.0	0.0	1.01	160.7	43.8
S11.000	50.00	15.07	59.110	0.323	0.0	0.0	0.0	1.05	264.6	43.7

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Network Design Table for Surface Water Permanent

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
S11.001	39.344	0.098	400.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.002	22.316	0.046	490.0	0.053	0.00	0.0	0.600	o	525	Pipe/Conduit	
S10.003	22.556	0.010	2210.5	0.100	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.009	13.864	0.021	660.2	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
S1.010	5.584	0.023	240.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.001	50.00	15.71	59.047	0.323	0.0	0.0	0.0	1.01	160.7	43.7
S10.002	50.00	16.08	58.874	0.700	0.0	0.0	0.0	1.01	217.6	94.8
S10.003	50.00	16.82	58.753	0.800	0.0	0.0	0.0	0.51	143.8	108.4
S1.009	50.00	19.09	56.700	2.481	0.0	0.0	0.0	1.01	362.3	336.0
S1.010	50.00	19.15	56.679	2.481	0.0	0.0	0.0	1.69	603.8	336.0

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Manhole Schedules for Surface Water Permanent

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	61.546	1.425	Open Manhole	1200	S1.000	60.121	225				
S2	61.477	1.771	Open Manhole	1200	S1.001	59.706	225	S1.000	59.706	225	
S3	61.050	0.850	Open Manhole	1200 x 900	S2.000	60.200	225				
S4	60.640	1.565	Open Manhole	1200	S3.000	59.075	225				
S5	60.734	1.805	Open Manhole	1200	S3.001	58.929	225	S3.000	58.929	225	
S6	60.638	1.923	Open Manhole	1200	S3.002	58.715	300	S3.001	58.790	225	
S7	60.959	2.290	Open Manhole	1200	S3.003	58.669	300	S3.002	58.669	300	
S8	60.990	2.369	Open Manhole	1200	S2.001	58.621	300	S2.000	59.745	225	1049
								S3.003	58.621	300	
S9	60.991	2.437	Open Manhole	1200	S2.002	58.554	300	S2.001	58.554	300	
S10	61.009	2.568	Open Manhole	1200	S1.002	58.441	300	S1.001	59.565	225	1049
								S2.002	58.441	300	
S11	61.050	0.850	Open Manhole	1200 x 900	S4.000	60.200	225				
S12	61.050	0.989	Open Manhole	1200 x 900	S4.001	60.061	225	S4.000	60.061	225	
S13	61.050	1.048	Open Manhole	1200 x 900	S4.002	60.002	225	S4.001	60.002	225	
S14	61.026	2.769	Open Manhole	1500	S1.003	58.257	375	S1.002	58.332	300	
								S4.002	59.456	225	1049
S15	61.022	2.926	Open Manhole	1500	S1.004	58.096	450	S1.003	58.171	375	
S16	61.136	1.478	Open Manhole	1200	S5.000	59.658	225				
S17	60.874	1.500	Open Manhole	1200	S5.001	59.374	300	S5.000	59.449	225	
S18	60.900	1.607	Open Manhole	1200	S5.002	59.293	300	S5.001	59.293	300	
S19	61.017	3.071	Open Manhole	1500	S1.005	57.946	525	S1.004	58.021	450	
								S5.002	59.219	300	1048
S20	61.014	3.082	Open Manhole	1500	S1.006	57.932	525	S1.005	57.932	525	
S21	61.017	3.125	Open Manhole	1500	S1.007	57.892	525	S1.006	57.892	525	
S22	61.050	3.255	Open Manhole	1500	S1.008	57.795	600	S1.007	57.870	525	
S23	61.050	0.850	Open Manhole	1200 x 900	S6.000	60.200	225				
S24	61.050	0.926	Open Manhole	1200 x 900	S6.001	60.124	225	S6.000	60.124	225	
S25	61.050	0.968	Open Manhole	1200 x 900	S6.002	60.082	225	S6.001	60.082	225	
S26	61.050	0.850	Open Manhole	1200 x 900	S7.000	60.200	225				
S27	61.050	1.214	Open Manhole	1200 x 900	S6.003	59.836	225	S6.002	59.843	225	7
								S7.000	59.836	225	
S28	61.050	1.425	Open Manhole	1200	S6.004	59.625	225	S6.003	59.625	225	
S29	60.600	1.553	Open Manhole	1200	S8.000	59.047	225				

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Manhole Schedules for Surface Water Permanent

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S30	60.640	1.733	Open Manhole	1200	S8.001	58.907	225	S8.000	58.907	225	
S31	60.850	2.202	Open Manhole	1200	S8.002	58.648	300	S8.001	58.723	225	
S32	60.851	2.295	Open Manhole	1200	S8.003	58.555	300	S8.002	58.555	300	
S33	60.963	2.520	Open Manhole	1200	S8.004	58.443	300	S8.003	58.443	300	
S34	60.983	2.710	Open Manhole	1500	S8.005	58.273	375	S8.004	58.348	300	
S35	61.050	2.809	Open Manhole	1500	S8.006	58.241	375	S8.005	58.241	375	
S36	61.050	0.800	Open Manhole	1200 x 900	S9.000	60.250	225				
S37	61.050	0.848	Open Manhole	1200 x 900	S9.001	60.202	225	S9.000	60.202	225	
S38	61.050	0.868	Open Manhole	1200 x 900	S9.002	60.182	225	S9.001	60.182	225	
S39	61.050	1.127	Open Manhole	1200 x 900	S9.003	59.923	225	S9.002	59.923	225	
S40	61.050	1.441	Open Manhole	1200 x 900	S9.004	59.609	225	S9.003	59.609	225	
S41	61.050	2.847	Open Manhole	1500	S8.007	58.203	375	S8.006	58.203	375	
								S9.004	58.918	225	566
S42	60.800	1.690	Open Manhole	1800	S10.000	59.110	400				
S43	60.800	1.753	Open Manhole	1800	S10.001	59.047	450	S10.000	59.097	400	
S44	60.800	1.690	Open Manhole	1800	S11.000	59.110	400				
S45	60.800	1.753	Open Manhole	1800	S11.001	59.047	450	S11.000	59.097	400	
S46	60.702	1.828	Open Manhole	1500	S10.002	58.874	525	S10.001	58.964	450	16
								S11.001	58.949	450	
S47	61.050	2.297	Open Manhole	1500	S10.003	58.753	600	S10.002	58.828	525	
S48	61.050	4.350	Open Manhole	1500	S1.009	56.700	675	S1.008	57.785	600	1010
								S6.004	59.595	225	2445
								S8.007	58.187	375	1187
								S10.003	58.743	600	1968
S49	61.050	4.371	Open Manhole	1500	S1.010	56.679	675	S1.009	56.679	675	
S	61.050	4.394	Open Manhole	0		OUTFALL		S1.010	56.656	675	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	386964.618	398684.425	386964.618	398684.425	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S2	386896.506	398692.218	386896.506	398692.218	Required	
S3	386858.464	398657.933	386858.464	398657.933	Required	
S4	386837.995	398624.539	386837.995	398624.539	Required	
S5	386845.524	398647.379	386845.524	398647.379	Required	
S6	386866.419	398637.735	386866.419	398637.735	Required	
S7	386874.540	398644.926	386874.540	398644.926	Required	
S8	386875.624	398656.537	386875.624	398656.537	Required	
S9	386876.625	398667.563	386876.625	398667.563	Required	
S10	386874.182	398686.013	386874.182	398686.013	Required	
S11	386824.124	398673.075	386824.124	398673.075	Required	
S12	386847.026	398671.201	386847.026	398671.201	Required	
S13	386847.609	398680.875	386847.609	398680.875	Required	
S14	386848.053	398688.448	386848.053	398688.448	Required	
S15	386823.043	398700.179	386823.043	398700.179	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S16	386868.207	398708.214	386868.207	398708.214	Required	
S17	386837.731	398724.403	386837.731	398724.403	Required	
S18	386818.883	398719.464	386818.883	398719.464	Required	
S19	386802.066	398713.868	386802.066	398713.868	Required	
S20	386795.296	398712.866	386795.296	398712.866	Required	
S21	386775.784	398709.301	386775.784	398709.301	Required	
S22	386768.012	398702.034	386768.012	398702.034	Required	
S23	386799.435	398677.843	386799.435	398677.843	Required	
S24	386794.542	398689.419	386794.542	398689.419	Required	
S25	386791.440	398695.675	386791.440	398695.675	Required	
S26	386785.722	398699.426	386785.722	398699.426	Required	
S27	386788.062	398694.500	386788.062	398694.500	Required	
S28	386782.377	398692.452	386782.377	398692.452	Required	
S29	386725.217	398604.372	386725.217	398604.372	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S30	386723.686	398627.449	386723.686	398627.449	Required	
S31	386722.878	398657.808	386722.878	398657.808	Required	
S32	386720.911	398679.973	386720.911	398679.973	Required	
S33	386728.846	398705.640	386728.846	398705.640	Required	
S34	386751.715	398707.290	386751.715	398707.290	Required	
S35	386757.912	398699.125	386757.912	398699.125	Required	
S36	386743.493	398663.009	386743.493	398663.009	Required	
S37	386741.217	398670.670	386741.217	398670.670	Required	
S38	386741.726	398673.961	386741.726	398673.961	Required	
S39	386742.910	398686.926	386742.910	398686.926	Required	
S40	386747.519	398687.874	386747.519	398687.874	Required	
S41	386757.836	398686.926	386757.836	398686.926	Required	
S42	386812.917	398639.912	386812.917	398639.912	Required	
S43	386812.759	398644.195	386812.759	398644.195	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S44	386743.125	398627.770	386743.125	398627.770	Required	
S45	386741.926	398631.728	386741.926	398631.728	Required	
S46	386779.690	398642.767	386779.690	398642.767	Required	
S47	386773.612	398664.239	386773.612	398664.239	Required	
S48	386770.549	398686.586	386770.549	398686.586	Required	
S49	386774.973	398699.725	386774.973	398699.725	Required	
S	386778.417	398704.120			No Entry	

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S1.000	o	225	S1	61.546	60.121	1.200	Open Manhole	1200
S1.001	o	225	S2	61.477	59.706	1.546	Open Manhole	1200
S2.000	o	225	S3	61.050	60.200	0.625	Open Manhole	1200 x 900
S3.000	o	225	S4	60.640	59.075	1.340	Open Manhole	1200
S3.001	o	225	S5	60.734	58.929	1.580	Open Manhole	1200
S3.002	o	300	S6	60.638	58.715	1.623	Open Manhole	1200
S3.003	o	300	S7	60.959	58.669	1.990	Open Manhole	1200
S2.001	o	300	S8	60.990	58.621	2.069	Open Manhole	1200
S2.002	o	300	S9	60.991	58.554	2.137	Open Manhole	1200
S1.002	o	300	S10	61.009	58.441	2.268	Open Manhole	1200
S4.000	o	225	S11	61.050	60.200	0.625	Open Manhole	1200 x 900
S4.001	o	225	S12	61.050	60.061	0.764	Open Manhole	1200 x 900
S4.002	o	225	S13	61.050	60.002	0.823	Open Manhole	1200 x 900

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)
S1.000	68.557	165.0	S2	61.477	59.706	1.546	Open Manhole	1200
S1.001	23.171	165.0	S10	61.009	59.565	1.219	Open Manhole	1200
S2.000	17.217	37.8	S8	60.990	59.745	1.020	Open Manhole	1200
S3.000	24.049	164.7	S5	60.734	58.929	1.580	Open Manhole	1200
S3.001	23.013	165.0	S6	60.638	58.790	1.623	Open Manhole	1200
S3.002	10.847	240.0	S7	60.959	58.669	1.990	Open Manhole	1200
S3.003	11.661	240.0	S8	60.990	58.621	2.069	Open Manhole	1200
S2.001	11.072	165.2	S9	60.991	58.554	2.137	Open Manhole	1200
S2.002	18.611	165.0	S10	61.009	58.441	2.268	Open Manhole	1200
S1.002	26.242	240.7	S14	61.026	58.332	2.394	Open Manhole	1500
S4.000	22.979	165.3	S12	61.050	60.061	0.764	Open Manhole	1200 x 900
S4.001	9.692	165.0	S13	61.050	60.002	0.823	Open Manhole	1200 x 900
S4.002	7.586	13.9	S14	61.026	59.456	1.345	Open Manhole	1500

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S1.003	o	375	S14	61.026	58.257	2.394	Open Manhole	1500
S1.004	o	450	S15	61.022	58.096	2.476	Open Manhole	1500
S5.000	o	225	S16	61.136	59.658	1.253	Open Manhole	1200
S5.001	o	300	S17	60.874	59.374	1.200	Open Manhole	1200
S5.002	o	300	S18	60.900	59.293	1.307	Open Manhole	1200
S1.005	o	525	S19	61.017	57.946	2.546	Open Manhole	1500
S1.006	o	525	S20	61.014	57.932	2.557	Open Manhole	1500
S1.007	o	525	S21	61.017	57.892	2.600	Open Manhole	1500
S1.008	o	600	S22	61.050	57.795	2.655	Open Manhole	1500
S6.000	o	225	S23	61.050	60.200	0.625	Open Manhole	1200 x 900
S6.001	o	225	S24	61.050	60.124	0.701	Open Manhole	1200 x 900
S6.002	o	225	S25	61.050	60.082	0.743	Open Manhole	1200 x 900
S7.000	o	225	S26	61.050	60.200	0.625	Open Manhole	1200 x 900

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)
S1.003	27.625	321.2	S15	61.022	58.171	2.476	Open Manhole	1500
S1.004	25.048	334.0	S19	61.017	58.021	2.546	Open Manhole	1500
S5.000	34.509	165.1	S17	60.874	59.449	1.200	Open Manhole	1200
S5.001	19.485	240.0	S18	60.900	59.293	1.307	Open Manhole	1200
S5.002	17.723	240.0	S19	61.017	59.219	1.498	Open Manhole	1500
S1.005	6.844	490.0	S20	61.014	57.932	2.557	Open Manhole	1500
S1.006	19.835	490.0	S21	61.017	57.892	2.600	Open Manhole	1500
S1.007	10.640	490.0	S22	61.050	57.870	2.655	Open Manhole	1500
S1.008	15.654	1534.1	S48	61.050	57.785	2.665	Open Manhole	1500
S6.000	12.568	165.0	S24	61.050	60.124	0.701	Open Manhole	1200 x 900
S6.001	6.983	165.0	S25	61.050	60.082	0.743	Open Manhole	1200 x 900
S6.002	3.576	15.0	S27	61.050	59.843	0.982	Open Manhole	1200 x 900
S7.000	5.453	15.0	S27	61.050	59.836	0.989	Open Manhole	1200 x 900

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S6.003	o	225	S27	61.050	59.836	0.989	Open Manhole	1200 x 900
S6.004	o	225	S28	61.050	59.625	1.200	Open Manhole	1200
S8.000	o	225	S29	60.600	59.047	1.328	Open Manhole	1200
S8.001	o	225	S30	60.640	58.907	1.508	Open Manhole	1200
S8.002	o	300	S31	60.850	58.648	1.902	Open Manhole	1200
S8.003	o	300	S32	60.851	58.555	1.995	Open Manhole	1200
S8.004	o	300	S33	60.963	58.443	2.220	Open Manhole	1200
S8.005	o	375	S34	60.983	58.273	2.335	Open Manhole	1500
S8.006	o	375	S35	61.050	58.241	2.434	Open Manhole	1500
S9.000	o	225	S36	61.050	60.250	0.575	Open Manhole	1200 x 900
S9.001	o	225	S37	61.050	60.202	0.623	Open Manhole	1200 x 900
S9.002	o	225	S38	61.050	60.182	0.643	Open Manhole	1200 x 900
S9.003	o	225	S39	61.050	59.923	0.902	Open Manhole	1200 x 900
S9.004	o	225	S40	61.050	59.609	1.216	Open Manhole	1200 x 900

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)
S6.003	6.043	28.6	S28	61.050	59.625	1.200	Open Manhole	1200
S6.004	13.202	435.7	S48	61.050	59.595	1.230	Open Manhole	1500
S8.000	23.127	165.2	S30	60.640	58.907	1.508	Open Manhole	1200
S8.001	30.370	165.1	S31	60.850	58.723	1.902	Open Manhole	1200
S8.002	22.252	240.0	S32	60.851	58.555	1.995	Open Manhole	1200
S8.003	26.866	240.0	S33	60.963	58.443	2.220	Open Manhole	1200
S8.004	22.928	240.0	S34	60.983	58.348	2.335	Open Manhole	1500
S8.005	10.250	320.3	S35	61.050	58.241	2.434	Open Manhole	1500
S8.006	12.199	321.0	S41	61.050	58.203	2.472	Open Manhole	1500
S9.000	7.993	166.5	S37	61.050	60.202	0.623	Open Manhole	1200 x 900
S9.001	3.330	165.0	S38	61.050	60.182	0.643	Open Manhole	1200 x 900
S9.002	13.019	50.3	S39	61.050	59.923	0.902	Open Manhole	1200 x 900
S9.003	4.705	15.0	S40	61.050	59.609	1.216	Open Manhole	1200 x 900
S9.004	10.360	15.0	S41	61.050	58.918	1.907	Open Manhole	1500

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S8.007	o	375	S41	61.050	58.203	2.472	Open Manhole	1500
S10.000	oo	400	S42	60.800	59.110	1.290	Open Manhole	1800
S10.001	o	450	S43	60.800	59.047	1.303	Open Manhole	1800
S11.000	oo	400	S44	60.800	59.110	1.290	Open Manhole	1800
S11.001	o	450	S45	60.800	59.047	1.303	Open Manhole	1800
S10.002	o	525	S46	60.702	58.874	1.303	Open Manhole	1500
S10.003	o	600	S47	61.050	58.753	1.697	Open Manhole	1500
S1.009	o	675	S48	61.050	56.700	3.675	Open Manhole	1500
S1.010	o	675	S49	61.050	56.679	3.696	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.007	12.718	794.9	S48	61.050	58.187	2.488	Open Manhole	1500
S10.000	4.286	329.7	S43	60.800	59.097	1.303	Open Manhole	1800
S10.001	33.100	400.0	S46	60.702	58.964	1.288	Open Manhole	1500
S11.000	4.135	318.1	S45	60.800	59.097	1.303	Open Manhole	1800
S11.001	39.344	400.0	S46	60.702	58.949	1.303	Open Manhole	1500
S10.002	22.316	490.0	S47	61.050	58.828	1.697	Open Manhole	1500
S10.003	22.556	2210.5	S48	61.050	58.743	1.707	Open Manhole	1500
S1.009	13.864	660.2	S49	61.050	56.679	3.696	Open Manhole	1500
S1.010	5.584	240.0	S	61.050	56.656	3.719	Open Manhole	0

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Area Summary for Surface Water Permanent

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.132	0.132	0.132
	User	-	100	0.020	0.020	0.152
1.001	User	-	100	0.059	0.059	0.059
2.000	User	-	100	0.013	0.013	0.013
3.000	User	-	100	0.022	0.022	0.022
3.001	User	-	100	0.072	0.072	0.072
3.002	User	-	100	0.027	0.027	0.027
3.003	-	-	100	0.000	0.000	0.000
2.001	User	-	100	0.045	0.045	0.045
2.002	User	-	100	0.061	0.061	0.061
	User	-	100	0.032	0.032	0.093
1.002	User	-	100	0.042	0.042	0.042
4.000	User	-	100	0.026	0.026	0.026
	User	-	100	0.024	0.024	0.050
4.001	User	-	100	0.038	0.038	0.038
4.002	User	-	100	0.029	0.029	0.029
1.003	User	-	100	0.037	0.037	0.037
1.004	User	-	100	0.041	0.041	0.041
	User	-	100	0.021	0.021	0.062
5.000	User	-	100	0.040	0.040	0.040
	User	-	100	0.013	0.013	0.053
5.001	User	-	100	0.102	0.102	0.102
5.002	User	-	100	0.063	0.063	0.063
1.005	User	-	100	0.052	0.052	0.052
1.006	User	-	100	0.029	0.029	0.029
1.007	User	-	100	0.045	0.045	0.045
	User	-	100	0.013	0.013	0.057
1.008	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.037	0.037	0.037
	User	-	100	0.031	0.031	0.068
6.001	User	-	100	0.025	0.025	0.025
	User	-	100	0.020	0.020	0.045
6.002	User	-	100	0.017	0.017	0.017
7.000	User	-	100	0.018	0.018	0.018
6.003	User	-	100	0.017	0.017	0.017
6.004	-	-	100	0.000	0.000	0.000
8.000	User	-	100	0.027	0.027	0.027
8.001	User	-	100	0.043	0.043	0.043
8.002	User	-	100	0.022	0.022	0.022
8.003	User	-	100	0.037	0.037	0.037
8.004	User	-	100	0.065	0.065	0.065
8.005	User	-	100	0.046	0.046	0.046
8.006	-	-	100	0.000	0.000	0.000
9.000	User	-	100	0.024	0.024	0.024
	User	-	100	0.027	0.027	0.051
9.001	User	-	100	0.015	0.015	0.015

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Area Summary for Surface Water Permanent

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
9.002	User	-	100	0.024	0.024	0.024
	User	-	100	0.024	0.024	0.048
9.003	User	-	100	0.032	0.032	0.032
9.004	User	-	100	0.034	0.034	0.034
8.007	-	-	100	0.000	0.000	0.000
10.000	User	-	100	0.324	0.324	0.324
10.001	-	-	100	0.000	0.000	0.000
11.000	User	-	100	0.323	0.323	0.323
11.001	-	-	100	0.000	0.000	0.000
10.002	User	-	100	0.053	0.053	0.053
10.003	User	-	100	0.100	0.100	0.100
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.481	2.481	2.481

Free Flowing Outfall Details for Surface Water Permanent

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.010	S	61.050	56.656	0.000	0	0

Simulation Criteria for Surface Water Permanent

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 Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Summer Storms	Yes

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Synthetic Rainfall Details

Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Surface Water Permanent

Hydro-Brake® Optimum Manhole: S48, DS/PN: S1.009, Volume (m³): 19.4

Unit Reference	MD-SHE-0232-3820-3100-3820
Design Head (m)	3.100
Design Flow (l/s)	38.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	232
Invert Level (m)	56.700
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.100	38.1	Kick-Flo®	1.849	29.7
Flush-Flo™	0.889	37.8	Mean Flow over Head Range	-	33.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	37.2	3.000	37.5	7.000	56.4
0.200	23.3	1.400	36.1	3.500	40.4	7.500	58.4
0.300	31.4	1.600	34.2	4.000	43.1	8.000	60.2
0.400	34.0	1.800	30.9	4.500	45.6	8.500	62.0
0.500	35.7	2.000	30.9	5.000	48.0	9.000	63.8
0.600	36.8	2.200	32.3	5.500	50.2	9.500	65.5
0.800	37.8	2.400	33.7	6.000	52.4		
1.000	37.8	2.600	35.0	6.500	54.4		

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Storage Structures for Surface Water Permanent

Porous Car Park Manhole: S4, DS/PN: S3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	111.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	60.200	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: S29, DS/PN: S8.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	111.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	60.200	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: S48, DS/PN: S1.009

Invert Level (m)	56.700	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	650.0	0.0	2.301	0.0	0.0
2.300	650.0	0.0			

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	2	+0%	100/15 Summer				60.208
S1.001	S2	30 Winter	2	+0%	100/15 Summer				59.813
S2.000	S3	30 Winter	2	+0%	100/15 Summer				60.214
S3.000	S4	120 Winter	2	+0%	30/15 Summer				59.100
S3.001	S5	15 Winter	2	+0%	30/15 Summer				59.005
S3.002	S6	15 Winter	2	+0%	30/15 Summer	100/15 Summer			58.811
S3.003	S7	15 Winter	2	+0%	30/15 Summer				58.767
S2.001	S8	15 Winter	2	+0%	30/15 Summer				58.733
S2.002	S9	15 Winter	2	+0%	30/15 Summer				58.697
S1.002	S10	15 Winter	2	+0%	30/15 Summer				58.647
S4.000	S11	30 Winter	2	+0%					60.250

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.138	0.000	0.32			12.4	OK	
S1.001	S2	-0.117	0.000	0.46			17.2	OK	
S2.000	S3	-0.211	0.000	0.01			1.0	OK	
S3.000	S4	-0.200	0.000	0.03		18	1.0	OK	
S3.001	S5	-0.149	0.000	0.25			9.2	OK	
S3.002	S6	-0.203	0.000	0.23			12.8	OK	3
S3.003	S7	-0.202	0.000	0.22			12.8	OK	
S2.001	S8	-0.188	0.000	0.30			19.2	OK	
S2.002	S9	-0.157	0.000	0.41			30.4	OK	
S1.002	S10	-0.094	0.000	0.81			51.6	OK	
S4.000	S11	-0.175	0.000	0.11			4.1	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S12	15 Winter	2	+0%	100/15 Summer				60.136
S4.002	S13	15 Winter	2	+0%					60.052
S1.003	S14	15 Winter	2	+0%	30/15 Summer				58.487
S1.004	S15	15 Winter	2	+0%	30/15 Summer				58.365
S5.000	S16	30 Winter	2	+0%	100/15 Summer				59.708
S5.001	S17	15 Winter	2	+0%	100/15 Summer				59.481
S5.002	S18	15 Winter	2	+0%	100/15 Summer				59.424
S1.005	S19	15 Winter	2	+0%	30/15 Summer				58.325
S1.006	S20	15 Winter	2	+0%	30/15 Summer				58.312
S1.007	S21	15 Winter	2	+0%	30/15 Summer				58.277
S1.008	S22	15 Winter	2	+0%	30/15 Summer				58.232
S6.000	S23	30 Winter	2	+0%	100/15 Summer				60.260
S6.001	S24	15 Winter	2	+0%	100/15 Summer				60.215
S6.002	S25	15 Winter	2	+0%	100/15 Summer				60.146
S7.000	S26	30 Winter	2	+0%					60.219
S6.003	S27	15 Winter	2	+0%	100/15 Summer				59.912
S6.004	S28	15 Winter	2	+0%	30/15 Summer				59.790
S8.000	S29	60 Winter	2	+0%	100/15 Summer				59.077
S8.001	S30	15 Winter	2	+0%	100/15 Summer				58.964
S8.002	S31	15 Winter	2	+0%	30/15 Summer				58.720
S8.003	S32	15 Winter	2	+0%	30/15 Summer				58.646
S8.004	S33	15 Winter	2	+0%	30/15 Summer				58.570
S8.005	S34	15 Winter	2	+0%	30/15 Summer				58.530
S8.006	S35	15 Winter	2	+0%	30/15 Summer				58.515
S9.000	S36	30 Winter	2	+0%					60.304
S9.001	S37	30 Winter	2	+0%					60.271
S9.002	S38	15 Winter	2	+0%					60.246
S9.003	S39	15 Winter	2	+0%	100/15 Summer				59.990
S9.004	S40	15 Winter	2	+0%					59.672
S8.007	S41	15 Winter	2	+0%	30/15 Summer				58.495
S10.000	S42	30 Winter	2	+0%	100/15 Summer				59.212
S10.001	S43	30 Winter	2	+0%	100/15 Summer				59.188
S11.000	S44	30 Winter	2	+0%	100/15 Summer				59.212
S11.001	S45	30 Winter	2	+0%	100/15 Summer				59.188
S10.002	S46	30 Winter	2	+0%	100/15 Summer				59.115
S10.003	S47	30 Winter	2	+0%	100/15 Summer				59.071
S1.009	S48	240 Winter	2	+0%	30/30 Winter				57.147
S1.010	S49	240 Winter	2	+0%					56.826

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S12	-0.150	0.000	0.24			8.0	OK	
S4.002	S13	-0.175	0.000	0.11			11.7	OK	
S1.003	S14	-0.145	0.000	0.68			66.6	OK	
S1.004	S15	-0.180	0.000	0.48			70.6	OK	
S5.000	S16	-0.175	0.000	0.11			4.3	OK	
S5.001	S17	-0.193	0.000	0.26			16.4	OK	
S5.002	S18	-0.169	0.000	0.39			24.1	OK	
S1.005	S19	-0.146	0.000	0.66			95.2	OK	
S1.006	S20	-0.145	0.000	0.64			97.1	OK	
S1.007	S21	-0.139	0.000	0.89			101.5	OK	
S1.008	S22	-0.163	0.000	0.92			101.5	OK	
S6.000	S23	-0.165	0.000	0.16			5.5	OK	
S6.001	S24	-0.134	0.000	0.34			10.2	OK	
S6.002	S25	-0.161	0.000	0.18			12.3	OK	
S7.000	S26	-0.206	0.000	0.02			1.5	OK	
S6.003	S27	-0.150	0.000	0.24			15.6	OK	
S6.004	S28	-0.060	0.000	0.88			15.7	OK	
S8.000	S29	-0.195	0.000	0.04		12	1.5	OK	
S8.001	S30	-0.168	0.000	0.15			5.5	OK	
S8.002	S31	-0.228	0.000	0.13			8.3	OK	
S8.003	S32	-0.209	0.000	0.20			12.7	OK	
S8.004	S33	-0.174	0.000	0.31			19.8	OK	
S8.005	S34	-0.117	0.000	0.29			23.3	OK	
S8.006	S35	-0.100	0.000	0.28			23.5	OK	
S9.000	S36	-0.171	0.000	0.13			4.1	OK	
S9.001	S37	-0.156	0.000	0.21			5.4	OK	
S9.002	S38	-0.161	0.000	0.18			11.3	OK	
S9.003	S39	-0.158	0.000	0.20			15.4	OK	
S9.004	S40	-0.162	0.000	0.17			19.7	OK	
S8.007	S41	-0.083	0.000	0.97			40.4	OK	
S10.000	S42	-0.298	0.000	0.15			26.5	OK	
S10.001	S43	-0.309	0.000	0.19			26.4	OK	
S11.000	S44	-0.298	0.000	0.14			26.4	OK	
S11.001	S45	-0.309	0.000	0.18			26.3	OK	
S10.002	S46	-0.284	0.000	0.34			55.8	OK	
S10.003	S47	-0.282	0.000	0.55			61.4	OK	
S1.009	S48	-0.228	0.000	0.20		139	32.0	OK	
S1.010	S49	-0.528	0.000	0.11			32.0	OK	

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	30	+0%	100/15 Summer				60.264
S1.001	S2	15 Winter	30	+0%	100/15 Summer				59.921
S2.000	S3	30 Winter	30	+0%	100/15 Summer				60.226
S3.000	S4	15 Winter	30	+0%	30/15 Summer				59.430
S3.001	S5	15 Winter	30	+0%	30/15 Summer				59.431
S3.002	S6	15 Winter	30	+0%	30/15 Summer	100/15 Summer			59.396
S3.003	S7	15 Winter	30	+0%	30/15 Summer				59.374
S2.001	S8	15 Winter	30	+0%	30/15 Summer				59.351
S2.002	S9	15 Winter	30	+0%	30/15 Summer				59.261
S1.002	S10	15 Winter	30	+0%	30/15 Summer				59.163
S4.000	S11	30 Winter	30	+0%					60.277

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.082	0.000	0.72			28.2	OK	
S1.001	S2	-0.010	0.000	1.00			37.0	OK	
S2.000	S3	-0.199	0.000	0.03			2.3	OK	
S3.000	S4	0.130	0.000	0.10		3	3.8	SURCHARGED	
S3.001	S5	0.277	0.000	0.57			21.1	SURCHARGED	
S3.002	S6	0.381	0.000	0.40			22.8	SURCHARGED	3
S3.003	S7	0.405	0.000	0.40			22.9	SURCHARGED	
S2.001	S8	0.430	0.000	0.53			34.1	SURCHARGED	
S2.002	S9	0.408	0.000	0.76			56.3	SURCHARGED	
S1.002	S10	0.422	0.000	1.62			104.0	SURCHARGED	
S4.000	S11	-0.148	0.000	0.25			9.4	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S12	15 Winter	30	+0%	100/15 Summer				60.189
S4.002	S13	15 Winter	30	+0%					60.086
S1.003	S14	15 Winter	30	+0%	30/15 Summer				58.864
S1.004	S15	15 Winter	30	+0%	30/15 Summer				58.680
S5.000	S16	30 Winter	30	+0%	100/15 Summer				59.736
S5.001	S17	15 Winter	30	+0%	100/15 Summer				59.604
S5.002	S18	15 Winter	30	+0%	100/15 Summer				59.561
S1.005	S19	15 Winter	30	+0%	30/15 Summer				58.594
S1.006	S20	15 Winter	30	+0%	30/15 Summer				58.548
S1.007	S21	15 Winter	30	+0%	30/15 Summer				58.469
S1.008	S22	15 Winter	30	+0%	30/15 Summer				58.400
S6.000	S23	15 Winter	30	+0%	100/15 Summer				60.303
S6.001	S24	15 Winter	30	+0%	100/15 Summer				60.286
S6.002	S25	15 Winter	30	+0%	100/15 Summer				60.189
S7.000	S26	30 Winter	30	+0%					60.229
S6.003	S27	15 Winter	30	+0%	100/15 Summer				59.993
S6.004	S28	15 Winter	30	+0%	30/15 Summer				59.911
S8.000	S29	30 Winter	30	+0%	100/15 Summer				59.102
S8.001	S30	15 Winter	30	+0%	100/15 Summer				59.008
S8.002	S31	15 Winter	30	+0%	30/15 Summer				58.969
S8.003	S32	15 Winter	30	+0%	30/15 Summer				58.934
S8.004	S33	15 Summer	30	+0%	30/15 Summer				58.851
S8.005	S34	15 Winter	30	+0%	30/15 Summer				58.763
S8.006	S35	15 Winter	30	+0%	30/15 Summer				58.686
S9.000	S36	30 Winter	30	+0%					60.335
S9.001	S37	15 Winter	30	+0%					60.312
S9.002	S38	15 Winter	30	+0%					60.291
S9.003	S39	15 Winter	30	+0%	100/15 Summer				60.039
S9.004	S40	15 Winter	30	+0%					59.718
S8.007	S41	15 Winter	30	+0%	30/15 Summer				58.609
S10.000	S42	30 Winter	30	+0%	100/15 Summer				59.423
S10.001	S43	30 Winter	30	+0%	100/15 Summer				59.413
S11.000	S44	30 Winter	30	+0%	100/15 Summer				59.426
S11.001	S45	30 Winter	30	+0%	100/15 Summer				59.416
S10.002	S46	30 Winter	30	+0%	100/15 Summer				59.356
S10.003	S47	30 Winter	30	+0%	100/15 Summer				59.301
S1.009	S48	240 Winter	30	+0%	30/30 Winter				57.742
S1.010	S49	240 Winter	30	+0%					56.839

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S12	-0.097	0.000	0.60			19.9	OK	
S4.002	S13	-0.141	0.000	0.29			30.1	OK	
S1.003	S14	0.232	0.000	1.44			139.9	SURCHARGED	
S1.004	S15	0.134	0.000	1.05			154.7	SURCHARGED	
S5.000	S16	-0.147	0.000	0.26			9.9	OK	
S5.001	S17	-0.070	0.000	0.67			41.3	OK	
S5.002	S18	-0.032	0.000	1.00			61.3	OK	
S1.005	S19	0.123	0.000	1.58			227.6	SURCHARGED	
S1.006	S20	0.091	0.000	1.53			232.8	SURCHARGED	
S1.007	S21	0.053	0.000	2.14			245.3	SURCHARGED	
S1.008	S22	0.005	0.000	2.23			244.9	SURCHARGED	
S6.000	S23	-0.122	0.000	0.34			11.9	OK	
S6.001	S24	-0.063	0.000	0.84			25.1	OK	
S6.002	S25	-0.117	0.000	0.45			30.8	OK	
S7.000	S26	-0.196	0.000	0.04			3.4	OK	
S6.003	S27	-0.068	0.000	0.61			39.4	OK	
S6.004	S28	0.061	0.000	2.22			39.4	SURCHARGED	
S8.000	S29	-0.170	0.000	0.14		13	5.0	OK	
S8.001	S30	-0.124	0.000	0.41			15.3	OK	
S8.002	S31	0.021	0.000	0.32			19.9	SURCHARGED	
S8.003	S32	0.079	0.000	0.47			30.1	SURCHARGED	
S8.004	S33	0.108	0.000	0.68			42.9	SURCHARGED	
S8.005	S34	0.115	0.000	0.76			60.7	SURCHARGED	
S8.006	S35	0.070	0.000	0.74			61.4	SURCHARGED	
S9.000	S36	-0.140	0.000	0.31			9.4	OK	
S9.001	S37	-0.115	0.000	0.47			12.5	OK	
S9.002	S38	-0.116	0.000	0.46			29.4	OK	
S9.003	S39	-0.109	0.000	0.52			41.0	OK	
S9.004	S40	-0.116	0.000	0.47			53.0	OK	
S8.007	S41	0.031	0.000	2.54			106.4	SURCHARGED	
S10.000	S42	-0.087	0.000	0.32			58.4	OK	
S10.001	S43	-0.084	0.000	0.41			57.5	OK	
S11.000	S44	-0.084	0.000	0.32			58.2	OK	
S11.001	S45	-0.081	0.000	0.40			57.3	OK	
S10.002	S46	-0.042	0.000	0.71			116.9	OK	
S10.003	S47	-0.052	0.000	1.10			123.3	OK	
S1.009	S48	0.367	0.000	0.23		188	37.8	SURCHARGED	
S1.010	S49	-0.515	0.000	0.13			37.8	OK	

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	100	+45%	100/15 Summer				61.532
S1.001	S2	15 Winter	100	+45%	100/15 Summer				60.957
S2.000	S3	15 Winter	100	+45%	100/15 Summer				60.753
S3.000	S4	30 Winter	100	+45%	30/15 Summer				60.335
S3.001	S5	15 Winter	100	+45%	30/15 Summer				60.624
S3.002	S6	15 Winter	100	+45%	30/15 Summer	100/15 Summer			60.640
S3.003	S7	15 Winter	100	+45%	30/15 Summer				60.689
S2.001	S8	15 Winter	100	+45%	30/15 Summer				60.742

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.186	0.000	1.55			60.6	FLOOD RISK	
S1.001	S2	1.027	0.000	1.87			69.1	SURCHARGED	
S2.000	S3	0.328	0.000	0.13			9.7	FLOOD RISK	
S3.000	S4	1.035	0.000	1.38		8	51.2	SURCHARGED	
S3.001	S5	1.470	0.000	1.50			55.6	FLOOD RISK	
S3.002	S6	1.625	2.538	1.00			56.5	FLOOD	3
S3.003	S7	1.720	0.000	0.99			57.1	FLOOD RISK	
S2.001	S8	1.821	0.000	0.94			60.8	FLOOD RISK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S2.002	S9	15 Winter	100	+45%	30/15 Summer				60.741
S1.002	S10	15 Winter	100	+45%	30/15 Summer				60.650
S4.000	S11	15 Winter	100	+45%					60.338
S4.001	S12	15 Winter	100	+45%	100/15 Summer				60.307
S4.002	S13	15 Winter	100	+45%					60.183
S1.003	S14	15 Winter	100	+45%	30/15 Summer				60.058
S1.004	S15	360 Winter	100	+45%	30/15 Summer				59.688
S5.000	S16	15 Winter	100	+45%	100/15 Summer				60.016
S5.001	S17	15 Winter	100	+45%	100/15 Summer				59.979
S5.002	S18	15 Winter	100	+45%	100/15 Summer				59.825
S1.005	S19	360 Winter	100	+45%	30/15 Summer				59.683
S1.006	S20	360 Winter	100	+45%	30/15 Summer				59.681
S1.007	S21	360 Winter	100	+45%	30/15 Summer				59.677
S1.008	S22	360 Winter	100	+45%	30/15 Summer				59.674
S6.000	S23	15 Winter	100	+45%	100/15 Summer				60.675
S6.001	S24	15 Winter	100	+45%	100/15 Summer				60.625
S6.002	S25	15 Winter	100	+45%	100/15 Summer				60.521
S7.000	S26	15 Winter	100	+45%					60.357
S6.003	S27	15 Winter	100	+45%	100/15 Summer				60.354
S6.004	S28	15 Winter	100	+45%	30/15 Summer				60.116
S8.000	S29	360 Winter	100	+45%	100/15 Summer				59.687
S8.001	S30	360 Winter	100	+45%	100/15 Summer				59.686
S8.002	S31	360 Winter	100	+45%	30/15 Summer				59.684
S8.003	S32	360 Winter	100	+45%	30/15 Summer				59.682
S8.004	S33	360 Winter	100	+45%	30/15 Summer				59.680
S8.005	S34	360 Winter	100	+45%	30/15 Summer				59.677
S8.006	S35	360 Winter	100	+45%	30/15 Summer				59.675
S9.000	S36	15 Winter	100	+45%					60.396
S9.001	S37	15 Winter	100	+45%					60.382
S9.002	S38	15 Winter	100	+45%					60.367
S9.003	S39	15 Winter	100	+45%	100/15 Summer				60.154
S9.004	S40	15 Winter	100	+45%					59.779
S8.007	S41	360 Winter	100	+45%	30/15 Summer				59.674
S10.000	S42	360 Winter	100	+45%	100/15 Summer				59.679
S10.001	S43	360 Winter	100	+45%	100/15 Summer				59.679
S11.000	S44	360 Winter	100	+45%	100/15 Summer				59.679
S11.001	S45	360 Winter	100	+45%	100/15 Summer				59.679
S10.002	S46	360 Winter	100	+45%	100/15 Summer				59.676
S10.003	S47	360 Winter	100	+45%	100/15 Summer				59.673
S1.009	S48	360 Winter	100	+45%	30/30 Winter				59.671
S1.010	S49	1440 Summer	100	+45%					56.839

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2.002	S9	1.887	0.000	1.04			77.7	FLOOD RISK	
S1.002	S10	1.909	0.000	2.28			145.7	SURCHARGED	
S4.000	S11	-0.087	0.000	0.47			17.5	OK	
S4.001	S12	0.021	0.000	1.19			39.8	SURCHARGED	
S4.002	S13	-0.044	0.000	0.55			57.2	OK	
S1.003	S14	1.426	0.000	2.23			217.2	SURCHARGED	
S1.004	S15	1.142	0.000	0.50			74.2	SURCHARGED	
S5.000	S16	0.133	0.000	0.53			20.3	SURCHARGED	
S5.001	S17	0.305	0.000	1.33			82.4	SURCHARGED	
S5.002	S18	0.233	0.000	2.03			124.2	SURCHARGED	
S1.005	S19	1.212	0.000	0.70			101.1	SURCHARGED	
S1.006	S20	1.224	0.000	0.68			104.0	SURCHARGED	
S1.007	S21	1.260	0.000	0.96			109.7	SURCHARGED	
S1.008	S22	1.279	0.000	1.00			109.7	SURCHARGED	
S6.000	S23	0.250	0.000	0.80			27.6	SURCHARGED	
S6.001	S24	0.276	0.000	1.46			43.6	SURCHARGED	
S6.002	S25	0.214	0.000	0.77			53.3	SURCHARGED	
S7.000	S26	-0.068	0.000	0.09			7.7	OK	
S6.003	S27	0.292	0.000	1.04			67.5	SURCHARGED	
S6.004	S28	0.265	0.000	3.83			67.9	SURCHARGED	
S8.000	S29	0.415	0.000	0.07		28	2.7	SURCHARGED	
S8.001	S30	0.554	0.000	0.18			7.0	SURCHARGED	
S8.002	S31	0.736	0.000	0.15			9.2	SURCHARGED	
S8.003	S32	0.827	0.000	0.20			12.9	SURCHARGED	
S8.004	S33	0.937	0.000	0.31			19.4	SURCHARGED	
S8.005	S34	1.029	0.000	0.30			23.9	SURCHARGED	
S8.006	S35	1.060	0.000	0.29			23.9	SURCHARGED	
S9.000	S36	-0.079	0.000	0.58			17.8	OK	
S9.001	S37	-0.045	0.000	0.95			25.0	OK	
S9.002	S38	-0.040	0.000	0.91			57.9	OK	
S9.003	S39	0.006	0.000	1.01			79.5	SURCHARGED	
S9.004	S40	-0.055	0.000	0.91			103.2	OK	
S8.007	S41	1.096	0.000	1.00			41.9	SURCHARGED	
S10.000	S42	0.169	0.000	0.18			32.4	SURCHARGED	
S10.001	S43	0.182	0.000	0.23			32.4	SURCHARGED	
S11.000	S44	0.169	0.000	0.18			32.3	SURCHARGED	
S11.001	S45	0.182	0.000	0.23			32.3	SURCHARGED	
S10.002	S46	0.278	0.000	0.42			69.8	SURCHARGED	
S10.003	S47	0.320	0.000	0.71			79.7	SURCHARGED	
S1.009	S48	2.296	0.000	0.23			37.8	SURCHARGED	
S1.010	S49	-0.515	0.000	0.13			37.8	OK	

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FOUL SEWERAGE DESIGN

Design Criteria for Foul Water Network

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Calculation Method	EN 752	Maximum Backdrop Height (m)	0.000
Frequency Factor	1.00	Min Design Depth for Optimisation (m)	1.000
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	12.488	0.083	150.5	0.000	1.00	136.5	0.0	1.500	o	150	Pipe/Conduit	
F2.000	6.826	0.171	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.001	5.684	0.142	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.002	4.327	0.054	80.0	0.000	1.00	28.5	0.0	1.500	o	100	Pipe/Conduit	
F2.003	1.892	0.024	80.0	0.000	1.00	28.5	0.0	1.500	o	150	Pipe/Conduit	
F3.000	8.801	0.390	22.6	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.004	3.748	0.047	79.8	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F2.005	6.610	0.083	79.6	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	58.728	0.000	0.0	136.5	0.0	114	0.81	0.71	12.6	11.7
F2.000	59.400	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F2.001	59.229	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F2.002	59.087	0.000	0.0	28.5	0.0	75	0.85	0.74	5.8	5.3
F2.003	58.983	0.000	0.0	57.0	0.0	69	0.95	0.98	17.3	7.5
F3.000	59.400	0.000	0.0	0.0	0.0	0	0.00	1.41	11.0	0.0
F2.004	58.960	0.000	0.0	57.0	0.0	69	0.95	0.98	17.3	7.5
F2.005	58.913	0.000	0.0	57.0	0.0	69	0.95	0.98	17.4	7.5

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F2.006	13.265	0.088	150.7	0.000	1.00	7.2	0.0	1.500	o	150	Pipe/Conduit	
F4.000	5.210	0.309	16.9	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.007	14.311	0.096	149.1	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F1.001	4.460	0.145	30.8	0.000	1.00	30.0	0.0	1.500	o	225	Pipe/Conduit	
F5.000	12.827	0.321	40.0	0.000	1.00	10.0	0.0	1.500	o	100	Pipe/Conduit	
F5.001	8.588	0.215	39.9	0.000	1.00	10.0	0.0	1.500	o	100	Pipe/Conduit	
F6.000	3.067	0.136	22.5	0.000	1.00	2.0	0.0	1.500	o	100	Pipe/Conduit	
F7.000	10.490	0.262	40.0	0.000	1.00	2.3	0.0	1.500	o	100	Pipe/Conduit	
F7.001	8.651	0.274	31.6	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F5.002	4.290	0.054	79.5	0.000	1.00	24.8	0.0	1.500	o	150	Pipe/Conduit	
F5.003	5.021	0.063	79.7	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F5.004	7.910	0.099	79.9	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F2.006	58.830	0.000	0.0	64.2	0.0	87	0.75	0.71	12.6	8.0
F4.000	59.100	0.000	0.0	0.0	0.0	0	0.00	1.63	12.8	0.0
F2.007	58.741	0.000	0.0	64.2	0.0	87	0.76	0.72	12.7	8.0
F1.001	58.570	0.000	0.0	230.7	0.0	65	1.58	2.07	82.5	15.2
F5.000	59.400	0.000	0.0	10.0	0.0	43	0.98	1.05	8.3	3.2
F5.001	59.079	0.000	0.0	20.0	0.0	52	1.08	1.06	8.3	4.5
F6.000	59.000	0.000	0.0	2.0	0.0	24	0.96	1.41	11.0	1.4
F7.000	59.400	0.000	0.0	2.3	0.0	29	0.80	1.05	8.3	1.5
F7.001	59.138	0.000	0.0	2.3	0.0	27	0.87	1.19	9.3	1.5
F5.002	58.814	0.000	0.0	49.1	0.0	66	0.93	0.98	17.4	7.0
F5.003	58.760	0.000	0.0	49.1	0.0	66	0.93	0.98	17.3	7.0
F5.004	58.697	0.000	0.0	49.1	0.0	66	0.93	0.98	17.3	7.0

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F8.000	5.880	0.235	25.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F8.001	7.279	0.317	23.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F5.005	7.810	0.098	79.7	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F9.000	8.525	0.550	15.5	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.002	19.281	0.175	110.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F10.000	5.871	0.320	18.3	0.000	1.00	3.6	0.0	1.500	o	100	Pipe/Conduit	
F10.001	5.506	0.305	18.1	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.003	25.306	0.230	110.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F11.000	4.476	0.112	40.0	0.000	1.00	3.6	0.0	1.500	o	100	Pipe/Conduit	
F11.001	10.862	0.272	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F11.002	5.480	0.137	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F11.003	10.861	0.272	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.004	20.052	0.182	110.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F8.000	59.200	0.000	0.0	0.0	0.0	0	0.00	1.33	10.5	0.0
F8.001	58.965	0.000	0.0	0.0	0.0	0	0.00	1.39	10.9	0.0
F5.005	58.598	0.000	0.0	49.1	0.0	66	0.93	0.98	17.3	7.0
F9.000	59.100	0.000	0.0	0.0	0.0	0	0.00	1.70	13.3	0.0
F1.002	58.425	0.000	0.0	279.8	0.0	97	1.02	1.09	43.5	16.7
F10.000	59.000	0.000	0.0	3.6	0.0	27	1.12	1.56	12.2	1.9
F10.001	58.680	0.000	0.0	3.6	0.0	27	1.13	1.57	12.3	1.9
F1.003	58.250	0.000	0.0	283.4	0.0	97	1.03	1.09	43.5	16.8
F11.000	59.400	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F11.001	59.288	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F11.002	59.017	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F11.003	58.880	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F1.004	58.020	0.000	0.0	287.0	0.0	97	1.03	1.09	43.5	16.9

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F12.000	2.399	0.060	40.0	0.000	0.70	85.0	0.0	1.500	o	100	Pipe/Conduit	
F12.001	14.437	0.361	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F12.002	12.724	0.318	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F12.003	9.687	0.242	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F12.004	11.016	0.275	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F12.005	18.013	0.450	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F12.006	8.418	0.210	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	14.229	0.119	120.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	15.927	0.133	120.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F13.000	5.286	0.132	40.0	0.000	0.70	85.0	0.0	1.500	o	100	Pipe/Conduit	
F13.001	10.487	0.262	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F13.002	6.012	0.150	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F13.003	6.530	0.163	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F13.004	7.220	0.181	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F13.005	6.476	0.162	40.0	0.000	0.70	81.0	0.0	1.500	o	150	Pipe/Conduit	
F1.007	25.774	0.368	70.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F12.000	60.288	0.000	0.0	85.0	0.0	66	1.17	1.05	8.3	6.5
F12.001	60.178	0.000	0.0	170.0	0.0	63	1.28	1.39	24.5	9.1
F12.002	59.817	0.000	0.0	255.0	0.0	71	1.35	1.39	24.5	11.2
F12.003	59.499	0.000	0.0	335.0	0.0	77	1.40	1.39	24.5	12.8
F12.004	59.257	0.000	0.0	415.0	0.0	82	1.44	1.39	24.5	14.3
F12.005	58.981	0.000	0.0	495.0	0.0	87	1.47	1.39	24.5	15.6
F12.006	58.531	0.000	0.0	575.0	0.0	91	1.50	1.39	24.5	16.8
F1.005	57.837	0.000	0.0	862.0	0.0	122	1.08	1.05	41.6	23.8
F1.006	57.719	0.000	0.0	862.0	0.0	122	1.08	1.05	41.6	23.8
F13.000	59.793	0.000	0.0	85.0	0.0	66	1.17	1.05	8.3	6.5
F13.001	59.611	0.000	0.0	165.0	0.0	63	1.28	1.39	24.5	9.0
F13.002	59.349	0.000	0.0	250.0	0.0	71	1.35	1.39	24.5	11.1
F13.003	59.198	0.000	0.0	330.0	0.0	77	1.40	1.39	24.5	12.7
F13.004	59.035	0.000	0.0	415.0	0.0	82	1.44	1.39	24.5	14.3
F13.005	58.855	0.000	0.0	496.0	0.0	87	1.47	1.39	24.5	15.6
F1.007	57.586	0.000	0.0	1358.0	0.0	115	1.39	1.37	54.6	28.5

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F14.000	5.901	0.316	18.7	0.000	0.50	17.5	0.0	1.500	o	100	Pipe/Conduit	
F15.000	1.961	0.131	15.0	0.000	0.50	19.5	0.0	1.500	o	100	Pipe/Conduit	
F14.001	11.746	0.249	47.2	0.000	0.50	0.0	0.0	1.500	o	100	Pipe/Conduit	
F16.000	9.459	0.316	29.9	0.000	0.50	18.5	0.0	1.500	o	100	Pipe/Conduit	
F14.002	7.745	0.352	22.0	0.000	0.50	16.0	0.0	1.500	o	100	Pipe/Conduit	
F14.003	9.027	0.286	31.6	0.000	0.50	17.5	0.0	1.500	o	100	Pipe/Conduit	
F14.004	7.147	0.286	25.0	0.000	0.50	20.0	0.0	1.500	o	100	Pipe/Conduit	
F14.005	7.075	0.182	38.9	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.008	9.530	0.136	70.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	27.294	0.382	71.5	0.012	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F14.000	59.450	0.000	0.0	17.5	0.0	28	1.15	1.55	12.1	2.1
F15.000	59.265	0.000	0.0	19.5	0.0	27	1.26	1.73	13.6	2.2
F14.001	59.134	0.000	0.0	37.0	0.0	44	0.91	0.97	7.6	3.0
F16.000	59.164	0.000	0.0	18.5	0.0	32	0.98	1.22	9.6	2.2
F14.002	58.848	0.000	0.0	71.5	0.0	43	1.32	1.42	11.2	4.2
F14.003	58.496	0.000	0.0	89.0	0.0	50	1.19	1.19	9.3	4.7
F14.004	58.211	0.000	0.0	109.0	0.0	50	1.33	1.34	10.5	5.2
F14.005	57.925	0.000	0.0	109.0	0.0	57	1.13	1.07	8.4	5.2
F1.008	57.218	0.000	0.0	1467.0	0.0	117	1.39	1.37	54.6	29.0
F1.009	57.082	0.012	0.0	1467.0	0.0	117	1.38	1.36	54.0	29.0

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Manhole Schedules for Foul Water Network

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F1	60.650	1.922	Open Manhole	1200	F1.000	58.728	150				
F2	60.650	1.250	Open Manhole	1200	F2.000	59.400	100				
F3	60.650	1.421	Open Manhole	1200	F2.001	59.229	100	F2.000	59.229	100	
F4	60.650	1.563	Open Manhole	1200	F2.002	59.087	100	F2.001	59.087	100	
F5	60.650	1.667	Open Manhole	1200	F2.003	58.983	150	F2.002	59.033	100	
F6	60.650	1.250	Open Manhole	1200	F3.000	59.400	100				
F7	60.650	1.690	Open Manhole	1200	F2.004	58.960	150	F2.003	58.960	150	
								F3.000	59.010	100	
F8	60.650	1.737	Open Manhole	1200	F2.005	58.913	150	F2.004	58.913	150	
F9	60.650	1.820	Open Manhole	1200	F2.006	58.830	150	F2.005	58.830	150	
F10	60.650	1.550	Open Manhole	1200 x 900	F4.000	59.100	100				
F11	60.650	1.909	Open Manhole	1200	F2.007	58.741	150	F2.006	58.742	150	1
								F4.000	58.791	100	
F12	60.650	2.080	Open Manhole	1200	F1.001	58.570	225	F1.000	58.645	150	
								F2.007	58.645	150	
F13	60.650	1.250	Open Manhole	1200	F5.000	59.400	100				
F14	60.650	1.571	Open Manhole	1200	F5.001	59.079	100	F5.000	59.079	100	
F15	60.650	1.650	Open Manhole	1200	F6.000	59.000	100				
F16	60.800	1.400	Open Manhole	1200	F7.000	59.400	100				
F17	60.650	1.512	Open Manhole	1200	F7.001	59.138	100	F7.000	59.138	100	
F18	60.650	1.836	Open Manhole	1200	F5.002	58.814	150	F5.001	58.864	100	
								F6.000	58.864	100	
								F7.001	58.864	100	
F19	60.650	1.890	Open Manhole	1200	F5.003	58.760	150	F5.002	58.760	150	
F20	60.650	1.953	Open Manhole	1200	F5.004	58.697	150	F5.003	58.697	150	
F21	60.650	1.450	Open Manhole	1200	F8.000	59.200	100				
F22	60.650	1.685	Open Manhole	1200	F8.001	58.965	100	F8.000	58.965	100	
F23	60.650	2.052	Open Manhole	1200	F5.005	58.598	150	F5.004	58.598	150	
								F8.001	58.648	100	
F24	60.650	1.550	Open Manhole	1200	F9.000	59.100	100				
F25	60.650	2.225	Open Manhole	1200	F1.002	58.425	225	F1.001	58.425	225	
								F5.005	58.500	150	
								F9.000	58.550	100	
F26	60.650	1.650	Open Manhole	1200	F10.000	59.000	100				

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Manhole Schedules for Foul Water Network

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F27	60.656	1.976	Open Manhole	1200	F10.001	58.680	100	F10.000	58.680	100	
F28	60.712	2.462	Open Manhole	1200	F1.003	58.250	225	F1.002	58.250	225	
								F10.001	58.375	100	
F29	60.800	1.400	Open Manhole	1200	F11.000	59.400	100				
F30	60.800	1.512	Open Manhole	1200	F11.001	59.288	100	F11.000	59.288	100	
F31	60.682	1.665	Open Manhole	1200	F11.002	59.017	100	F11.001	59.017	100	
F32	60.653	1.773	Open Manhole	1200	F11.003	58.880	100	F11.002	58.880	100	
F33	60.796	2.777	Open Manhole	1200	F1.004	58.020	225	F1.003	58.020	225	
								F11.003	58.608	100	463
F34	61.050	0.762	Open Manhole	1200	F12.000	60.288	100				
F35	61.050	0.872	Open Manhole	1200	F12.001	60.178	150	F12.000	60.228	100	
F36	61.050	1.233	Open Manhole	1200	F12.002	59.817	150	F12.001	59.817	150	
F37	61.050	1.551	Open Manhole	1200	F12.003	59.499	150	F12.002	59.499	150	
F38	61.050	1.793	Open Manhole	1200	F12.004	59.257	150	F12.003	59.257	150	
F39	61.050	2.069	Open Manhole	1200	F12.005	58.981	150	F12.004	58.981	150	
F40	61.050	2.519	Open Manhole	1200	F12.006	58.531	150	F12.005	58.531	150	
F41	61.050	3.213	Open Manhole	1200	F1.005	57.837	225	F1.004	57.837	225	
								F12.006	58.321	150	408
F42	61.050	3.331	Open Manhole	1200	F1.006	57.719	225	F1.005	57.719	225	
F43	61.050	1.257	Open Manhole	1200	F13.000	59.793	100				
F44	61.050	1.439	Open Manhole	1200	F13.001	59.611	150	F13.000	59.661	100	
F45	61.050	1.701	Open Manhole	1200	F13.002	59.349	150	F13.001	59.349	150	
F46	61.050	1.852	Open Manhole	1200	F13.003	59.198	150	F13.002	59.198	150	
F47	61.050	2.015	Open Manhole	1200	F13.004	59.035	150	F13.003	59.035	150	
F48	61.050	2.195	Open Manhole	1200	F13.005	58.855	150	F13.004	58.855	150	
F49	61.050	3.464	Open Manhole	1200	F1.007	57.586	225	F1.006	57.586	225	
								F13.005	58.693	150	1032
F50	61.050	1.600	Open Manhole	1200	F14.000	59.450	100				
F51	61.050	1.785	Open Manhole	1200	F15.000	59.265	100				
F52	61.050	1.916	Open Manhole	1200	F14.001	59.134	100	F14.000	59.134	100	
								F15.000	59.134	100	
F53	61.050	1.886	Open Manhole	1200	F16.000	59.164	100				
F54	61.050	2.202	Open Manhole	1200	F14.002	58.848	100	F14.001	58.885	100	37
								F16.000	58.848	100	

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Manhole Schedules for Foul Water Network

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F55	61.050	2.554	Open Manhole	1200	F14.003	58.496	100	F14.002	58.496	100	
F56	61.050	2.839	Open Manhole	1200	F14.004	58.211	100	F14.003	58.211	100	
F57	61.050	3.125	Open Manhole	1200	F14.005	57.925	100	F14.004	57.925	100	
F58	61.050	3.832	Open Manhole	1200	F1.008	57.218	225	F1.007	57.218	225	
								F14.005	57.743	100	400
F59	60.954	3.872	Open Manhole	1200	F1.009	57.082	225	F1.008	57.082	225	
F	60.948	4.248	Open Manhole	0		OUTFALL		F1.009	56.700	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1	386772.783	398607.464	386772.783	398607.464	Required	
F2	386807.323	398616.092	386807.323	398616.092	Required	
F3	386814.147	398616.250	386814.147	398616.250	Required	
F4	386814.016	398621.932	386814.016	398621.932	Required	
F5	386813.510	398626.229	386813.510	398626.229	Required	
F6	386812.482	398636.342	386812.482	398636.342	Required	
F7	386812.152	398627.547	386812.152	398627.547	Required	
F8	386808.536	398626.559	386808.536	398626.559	Required	
F9	386802.594	398623.665	386802.594	398623.665	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F10	386790.502	398617.526	386790.502	398617.526	Required	
F11	386789.371	398622.611	386789.371	398622.611	Required	
F12	386775.363	398619.683	386775.363	398619.683	Required	
F13	386743.411	398600.679	386743.411	398600.679	Required	
F14	386740.549	398613.183	386740.549	398613.183	Required	
F15	386748.164	398613.034	386748.164	398613.034	Required	
F16	386742.633	398634.235	386742.633	398634.235	Required	
F17	386745.768	398624.225	386745.768	398624.225	Required	
F18	386748.639	398616.064	386748.639	398616.064	Required	
F19	386752.826	398617.000	386752.826	398617.000	Required	
F20	386757.695	398615.774	386757.695	398615.774	Required	
F21	386759.675	398609.030	386759.675	398609.030	Required	
F22	386765.347	398610.582	386765.347	398610.582	Required	
F23	386765.324	398617.861	386765.324	398617.861	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F24	386773.189	398613.896	386773.189	398613.896	Required	
F25	386771.751	398622.299	386771.751	398622.299	Required	
F26	386758.994	398635.158	386758.994	398635.158	Required	
F27	386764.540	398637.084	386764.540	398637.084	Required	
F28	386768.151	398641.242	386768.151	398641.242	Required	
F29	386811.583	398646.287	386811.583	398646.287	Required	
F30	386808.715	398642.850	386808.715	398642.850	Required	
F31	386797.860	398642.491	386797.860	398642.491	Required	
F32	386792.409	398641.924	386792.409	398641.924	Required	
F33	386790.736	398652.656	386790.736	398652.656	Required	
F34	386863.842	398673.253	386863.842	398673.253	Required	
F35	386863.681	398670.860	386863.681	398670.860	Required	
F36	386849.296	398672.090	386849.296	398672.090	Required	
F37	386836.606	398673.028	386836.606	398673.028	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F38	386826.938	398673.614	386826.938	398673.614	Required	
F39	386815.978	398674.722	386815.978	398674.722	Required	
F40	386797.994	398673.691	386797.994	398673.691	Required	
F41	386789.637	398672.677	386789.637	398672.677	Required	
F42	386787.473	398686.740	386787.473	398686.740	Required	
F43	386810.727	398693.142	386810.727	398693.142	Required	
F44	386806.083	398690.616	386806.083	398690.616	Required	
F45	386801.994	398700.272	386801.994	398700.272	Required	
F46	386796.441	398697.970	386796.441	398697.970	Required	
F47	386793.535	398703.817	386793.535	398703.817	Required	
F48	386787.061	398700.621	386787.061	398700.621	Required	
F49	386780.604	398701.110	386780.604	398701.110	Required	
F50	386745.619	398659.182	386745.619	398659.182	Required	
F51	386742.060	398664.248	386742.060	398664.248	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F52	386743.931	398664.836	386743.931	398664.836	Required	
F53	386735.519	398671.684	386735.519	398671.684	Required	
F54	386743.614	398676.578	386743.614	398676.578	Required	
F55	386744.293	398684.293	386744.293	398684.293	Required	
F56	386745.089	398693.285	386745.089	398693.285	Required	
F57	386752.196	398694.045	386752.196	398694.045	Required	
F58	386754.834	398700.610	386754.834	398700.610	Required	
F59	386752.736	398709.906	386752.736	398709.906	Required	
F	386725.557	398707.396			No Entry	

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PIPELINE SCHEDULES for Foul Water Network

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)
F1.000	o	150	F1	60.650	58.728	1.772	Open Manhole	1200
F2.000	o	100	F2	60.650	59.400	1.150	Open Manhole	1200
F2.001	o	100	F3	60.650	59.229	1.321	Open Manhole	1200
F2.002	o	100	F4	60.650	59.087	1.463	Open Manhole	1200
F2.003	o	150	F5	60.650	58.983	1.517	Open Manhole	1200
F3.000	o	100	F6	60.650	59.400	1.150	Open Manhole	1200
F2.004	o	150	F7	60.650	58.960	1.540	Open Manhole	1200
F2.005	o	150	F8	60.650	58.913	1.587	Open Manhole	1200
F2.006	o	150	F9	60.650	58.830	1.670	Open Manhole	1200
F4.000	o	100	F10	60.650	59.100	1.450	Open Manhole	1200 x 900
F2.007	o	150	F11	60.650	58.741	1.759	Open Manhole	1200
F1.001	o	225	F12	60.650	58.570	1.855	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)
F1.000	12.488	150.5	F12	60.650	58.645	1.855	Open Manhole	1200
F2.000	6.826	40.0	F3	60.650	59.229	1.321	Open Manhole	1200
F2.001	5.684	40.0	F4	60.650	59.087	1.463	Open Manhole	1200
F2.002	4.327	80.0	F5	60.650	59.033	1.517	Open Manhole	1200
F2.003	1.892	80.0	F7	60.650	58.960	1.540	Open Manhole	1200
F3.000	8.801	22.6	F7	60.650	59.010	1.540	Open Manhole	1200
F2.004	3.748	79.8	F8	60.650	58.913	1.587	Open Manhole	1200
F2.005	6.610	79.6	F9	60.650	58.830	1.670	Open Manhole	1200
F2.006	13.265	150.7	F11	60.650	58.742	1.758	Open Manhole	1200
F4.000	5.210	16.9	F11	60.650	58.791	1.759	Open Manhole	1200
F2.007	14.311	149.1	F12	60.650	58.645	1.855	Open Manhole	1200
F1.001	4.460	30.8	F25	60.650	58.425	2.000	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F5.000	o	100	F13	60.650	59.400	1.150	Open Manhole	1200
F5.001	o	100	F14	60.650	59.079	1.471	Open Manhole	1200
F6.000	o	100	F15	60.650	59.000	1.550	Open Manhole	1200
F7.000	o	100	F16	60.800	59.400	1.300	Open Manhole	1200
F7.001	o	100	F17	60.650	59.138	1.412	Open Manhole	1200
F5.002	o	150	F18	60.650	58.814	1.686	Open Manhole	1200
F5.003	o	150	F19	60.650	58.760	1.740	Open Manhole	1200
F5.004	o	150	F20	60.650	58.697	1.803	Open Manhole	1200
F8.000	o	100	F21	60.650	59.200	1.350	Open Manhole	1200
F8.001	o	100	F22	60.650	58.965	1.585	Open Manhole	1200
F5.005	o	150	F23	60.650	58.598	1.902	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)
F5.000	12.827	40.0	F14	60.650	59.079	1.471	Open Manhole	1200
F5.001	8.588	39.9	F18	60.650	58.864	1.686	Open Manhole	1200
F6.000	3.067	22.5	F18	60.650	58.864	1.686	Open Manhole	1200
F7.000	10.490	40.0	F17	60.650	59.138	1.412	Open Manhole	1200
F7.001	8.651	31.6	F18	60.650	58.864	1.686	Open Manhole	1200
F5.002	4.290	79.5	F19	60.650	58.760	1.740	Open Manhole	1200
F5.003	5.021	79.7	F20	60.650	58.697	1.803	Open Manhole	1200
F5.004	7.910	79.9	F23	60.650	58.598	1.902	Open Manhole	1200
F8.000	5.880	25.0	F22	60.650	58.965	1.585	Open Manhole	1200
F8.001	7.279	23.0	F23	60.650	58.648	1.902	Open Manhole	1200
F5.005	7.810	79.7	F25	60.650	58.500	2.000	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F9.000	o	100	F24	60.650	59.100	1.450	Open Manhole	1200
F1.002	o	225	F25	60.650	58.425	2.000	Open Manhole	1200
F10.000	o	100	F26	60.650	59.000	1.550	Open Manhole	1200
F10.001	o	100	F27	60.656	58.680	1.876	Open Manhole	1200
F1.003	o	225	F28	60.712	58.250	2.237	Open Manhole	1200
F11.000	o	100	F29	60.800	59.400	1.300	Open Manhole	1200
F11.001	o	100	F30	60.800	59.288	1.412	Open Manhole	1200
F11.002	o	100	F31	60.682	59.017	1.565	Open Manhole	1200
F11.003	o	100	F32	60.653	58.880	1.673	Open Manhole	1200
F1.004	o	225	F33	60.796	58.020	2.552	Open Manhole	1200
F12.000	o	100	F34	61.050	60.288	0.662	Open Manhole	1200
F12.001	o	150	F35	61.050	60.178	0.722	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)
F9.000	8.525	15.5	F25	60.650	58.550	2.000	Open Manhole	1200
F1.002	19.281	110.0	F28	60.712	58.250	2.237	Open Manhole	1200
F10.000	5.871	18.3	F27	60.656	58.680	1.876	Open Manhole	1200
F10.001	5.506	18.1	F28	60.712	58.375	2.237	Open Manhole	1200
F1.003	25.306	110.0	F33	60.796	58.020	2.552	Open Manhole	1200
F11.000	4.476	40.0	F30	60.800	59.288	1.412	Open Manhole	1200
F11.001	10.862	40.0	F31	60.682	59.017	1.565	Open Manhole	1200
F11.002	5.480	40.0	F32	60.653	58.880	1.673	Open Manhole	1200
F11.003	10.861	40.0	F33	60.796	58.608	2.088	Open Manhole	1200
F1.004	20.052	110.0	F41	61.050	57.837	2.988	Open Manhole	1200
F12.000	2.399	40.0	F35	61.050	60.228	0.722	Open Manhole	1200
F12.001	14.437	40.0	F36	61.050	59.817	1.083	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F12.002	o	150	F36	61.050	59.817	1.083	Open Manhole	1200
F12.003	o	150	F37	61.050	59.499	1.401	Open Manhole	1200
F12.004	o	150	F38	61.050	59.257	1.643	Open Manhole	1200
F12.005	o	150	F39	61.050	58.981	1.919	Open Manhole	1200
F12.006	o	150	F40	61.050	58.531	2.369	Open Manhole	1200
F1.005	o	225	F41	61.050	57.837	2.988	Open Manhole	1200
F1.006	o	225	F42	61.050	57.719	3.106	Open Manhole	1200
F13.000	o	100	F43	61.050	59.793	1.157	Open Manhole	1200
F13.001	o	150	F44	61.050	59.611	1.289	Open Manhole	1200
F13.002	o	150	F45	61.050	59.349	1.551	Open Manhole	1200
F13.003	o	150	F46	61.050	59.198	1.702	Open Manhole	1200
F13.004	o	150	F47	61.050	59.035	1.865	Open Manhole	1200
F13.005	o	150	F48	61.050	58.855	2.045	Open Manhole	1200
F1.007	o	225	F49	61.050	57.586	3.239	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)
F12.002	12.724	40.0	F37	61.050	59.499	1.401	Open Manhole	1200
F12.003	9.687	40.0	F38	61.050	59.257	1.643	Open Manhole	1200
F12.004	11.016	40.0	F39	61.050	58.981	1.919	Open Manhole	1200
F12.005	18.013	40.0	F40	61.050	58.531	2.369	Open Manhole	1200
F12.006	8.418	40.0	F41	61.050	58.321	2.579	Open Manhole	1200
F1.005	14.229	120.0	F42	61.050	57.719	3.106	Open Manhole	1200
F1.006	15.927	120.0	F49	61.050	57.586	3.239	Open Manhole	1200
F13.000	5.286	40.0	F44	61.050	59.661	1.289	Open Manhole	1200
F13.001	10.487	40.0	F45	61.050	59.349	1.551	Open Manhole	1200
F13.002	6.012	40.0	F46	61.050	59.198	1.702	Open Manhole	1200
F13.003	6.530	40.0	F47	61.050	59.035	1.865	Open Manhole	1200
F13.004	7.220	40.0	F48	61.050	58.855	2.045	Open Manhole	1200
F13.005	6.476	40.0	F49	61.050	58.693	2.207	Open Manhole	1200
F1.007	25.774	70.0	F58	61.050	57.218	3.607	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F14.000	o	100	F50	61.050	59.450	1.500	Open Manhole	1200
F15.000	o	100	F51	61.050	59.265	1.685	Open Manhole	1200
F14.001	o	100	F52	61.050	59.134	1.816	Open Manhole	1200
F16.000	o	100	F53	61.050	59.164	1.786	Open Manhole	1200
F14.002	o	100	F54	61.050	58.848	2.102	Open Manhole	1200
F14.003	o	100	F55	61.050	58.496	2.454	Open Manhole	1200
F14.004	o	100	F56	61.050	58.211	2.739	Open Manhole	1200
F14.005	o	100	F57	61.050	57.925	3.025	Open Manhole	1200
F1.008	o	225	F58	61.050	57.218	3.607	Open Manhole	1200
F1.009	o	225	F59	60.954	57.082	3.647	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)
F14.000	5.901	18.7	F52	61.050	59.134	1.816	Open Manhole	1200
F15.000	1.961	15.0	F52	61.050	59.134	1.816	Open Manhole	1200
F14.001	11.746	47.2	F54	61.050	58.885	2.065	Open Manhole	1200
F16.000	9.459	29.9	F54	61.050	58.848	2.102	Open Manhole	1200
F14.002	7.745	22.0	F55	61.050	58.496	2.454	Open Manhole	1200
F14.003	9.027	31.6	F56	61.050	58.211	2.739	Open Manhole	1200
F14.004	7.147	25.0	F57	61.050	57.925	3.025	Open Manhole	1200
F14.005	7.075	38.9	F58	61.050	57.743	3.207	Open Manhole	1200
F1.008	9.530	70.0	F59	60.954	57.082	3.647	Open Manhole	1200
F1.009	27.294	71.5	F	60.948	56.700	4.023	Open Manhole	0

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Area Summary for Foul Water Network

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
2.000	0.000	0.000
2.001	0.000	0.000
2.002	0.000	0.000
2.003	0.000	0.000
3.000	0.000	0.000
2.004	0.000	0.000
2.005	0.000	0.000
2.006	0.000	0.000
4.000	0.000	0.000
2.007	0.000	0.000
1.001	0.000	0.000
5.000	0.000	0.000
5.001	0.000	0.000
6.000	0.000	0.000
7.000	0.000	0.000
7.001	0.000	0.000
5.002	0.000	0.000
5.003	0.000	0.000
5.004	0.000	0.000
8.000	0.000	0.000
8.001	0.000	0.000
5.005	0.000	0.000
9.000	0.000	0.000
1.002	0.000	0.000
10.000	0.000	0.000
10.001	0.000	0.000
1.003	0.000	0.000
11.000	0.000	0.000
11.001	0.000	0.000
11.002	0.000	0.000
11.003	0.000	0.000
1.004	0.000	0.000
12.000	0.000	0.000
12.001	0.000	0.000
12.002	0.000	0.000
12.003	0.000	0.000
12.004	0.000	0.000
12.005	0.000	0.000
12.006	0.000	0.000
1.005	0.000	0.000
1.006	0.000	0.000
13.000	0.000	0.000
13.001	0.000	0.000
13.002	0.000	0.000
13.003	0.000	0.000

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Area Summary for Foul Water Network

Pipe Number	Gross Area (ha)	Pipe Total (ha)
13.004	0.000	0.000
13.005	0.000	0.000
1.007	0.000	0.000
14.000	0.000	0.000
15.000	0.000	0.000
14.001	0.000	0.000
16.000	0.000	0.000
14.002	0.000	0.000
14.003	0.000	0.000
14.004	0.000	0.000
14.005	0.000	0.000
1.008	0.000	0.000
1.009	0.012	0.012
	Total	Total
	0.012	0.012

Free Flowing Outfall Details for Foul Water Network

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.009	F	60.948	56.700	0.000	0	0

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Appendix F Foul Water Strategy

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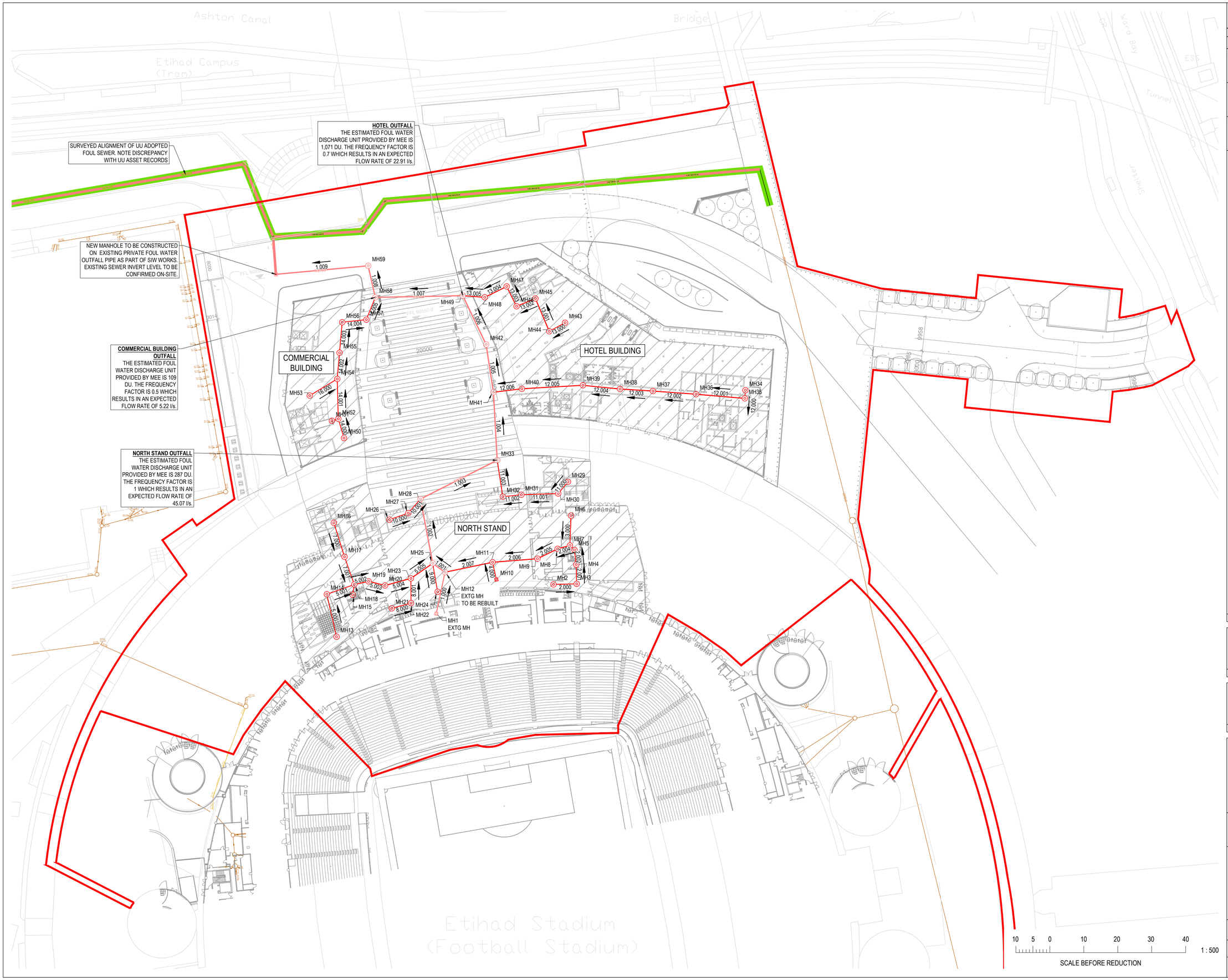

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DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

CONSTRUCTION ACTIVITIES IN CLOSE PROXIMITY TO LOW PRESSURE GAS MAIN

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. ALL EXISTING UTILITIES ARE TO BE CONFIRMED ON SITE AND SAFE WORKING PRACTICES TO BE USED PRIOR TO EXCAVATION.
4. UNIDENTIFIED UTILITIES WERE RECORDED DURING THE GPR SURVEY. THE PURPOSE OF THESE UTILITIES SHOULD BE CONFIRMED PRIOR TO DECOMMISSIONING.
5. THE DRAWING IS BASED ON:
   - LANDSCAPE ARCHITECT'S LAYOUT (NSE-POP-ZZ-ZZ-GA-A-00600) RECEIVED FROM POPULOUS ON 11/04/2023;
   - TOPOGRAPHICAL SURVEY (19D065) DATED JUNE 2 2019.
   - GPR SURVEY DATA (GR48864-UU-DR) RECEIVED FROM SUBSCAN ON 24/01/2023 AND SHOWN IN GREY.
6. SITE IMPROVEMENT WORKS CONSTRUCTED IN PREVIOUS PHASE OF WORK AND SUBJECT TO SEPARATE PLANNING APPLICATION

LEGEND:

SITE BOUNDARY

EXISTING

EXTG FOUL WATER SEWER (PRIVATE)

EXTG FOUL WATER SEWER (UNITED UTILITIES)

FOUL WATER SEWER (TO BE RETAINED AS EXISTING))

PROPOSED

FOUL WATER SEWER AND MANHOLES

FOUL WATER SEWER AND MANHOLES (CONSTRUCTED DURING SIW PHASE)

Rev	Description	Date	Iss'd	Rev'd	App'd
P02	ISSUED FOR DETAILED PLANNING	17.04.2023	AM	CM	NH
P01	ISSUED FOR STAGE 3	28.02.2023	SG	CM	NH

PLANNING

Project Stage

PLANNING

Status of Drawing

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Client: MCFC

Architect: POPULOUS

Project: ETIHAD CAMPUS NS

Drg Title: BELOW GROUND DRAINAGE FOUL WATER GENERAL ARRANGEMENT

Job No.	Scale@A1	
NSE	1:500	
Drawn/Designed By. SG	Checked By. CM	Approved By. NH
Drawing No. NSE-BHE-ZX-XX-DR-C-003102		Revision P02

Alex Murray P:\0053810 MCFC North Stand\08 Cities - Infra\01_Sheet\NSE-BHE-ZX-XX-DR-C-003102_Foul Water Drainage Strategy.dwg

Appendix G United Utilities Correspondence

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Christopher Moore

From: wastewaterdeveloperservices@uuplc.co.uk
Sent: 21 September 2022 14:21
To: Christopher Moore
Subject: RE: Project Manchester Pre-development Enquiry - UU Ref. 02777724

External Email. This email originated from outside Buro Happold.

Good afternoon Chris,

Pre Development Enquiry for: Project Manchester, Gibbon Street UU Reference Number : 02777724

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

https://www.unitedutilities.com/builders-developers/working-near-our-assets/

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 520*710 mm public combined sewer located to the West of your proposed development **(UUMH6700)** at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

If the applicant wishes to keep **UUMH7701** at the proposed point of connection. The applicant needs to provide further investigation (CCTV survey) to clarify the outfall point from the manhole as the current records show the outfall sewer to the north was abandoned. Meanwhile, I will ask our network team to investigate this issue more.

Please ensure all proposed manhole chambers cover levels and finished floor levels are higher than the receiving public sewer.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in

Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.
This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**
2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

According to the provided document ref: A3174-13 dated 02/2014 prepared by ESG, we are satisfied that infiltration is not feasible, we accept the provided sufficient evidence to discount infiltration.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the canal located 80m North of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as

outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 520*710 mm public combined sewer located West of the proposed site **(UUMH6700)** at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 33.1l/s.

Similar to what was stated in the foul water section, if the investigation identifies the final outfall from UUMH 7701, then UU will consider this option.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

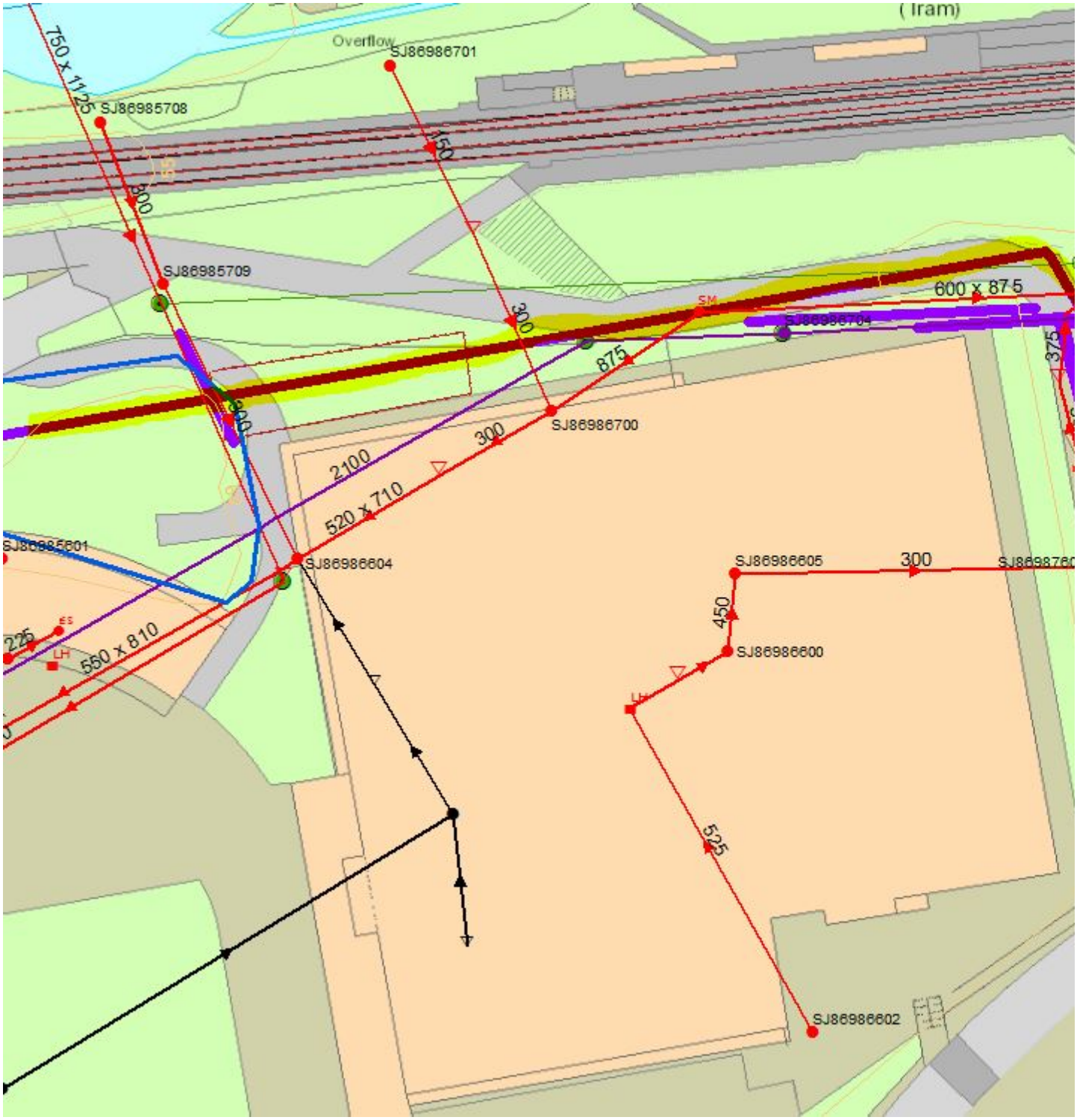
United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the pubic sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

Regarding the easement question for the below sewers:

-
- 850mm dia surface water sewer running east to west through the north of the site (upstream of MH6704). This is not a surface water sewer, it is an over flow sewer with a 6m legal easement.
- 900mm dia combined sewer running from south to north on the east side of the site (MH 8600 to MH 8700). sewer with a 6m easement.
- 375mm dia concrete sewer running from south to north on the west side of the site (MH7600 to MH7601 to junction with sewer running west to east). sewer with a 6m legal easement.
- 375mm dia VC sewer and 550mm x 950mm running along the northern boundary of the site (MH6700 to MH7701 to MH8702). sewer with a 6m legal easement.

There is another **10m** easement according to our records, it starts from UUMH7701 going to the west as highlighted in yellow below:



According to our public sewer records there are public sewers located within your site boundary. We will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of 6m which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If you cannot achieve this then you may wish to consider diverting and or abandoning the public sewer.

Please be aware that any proposed diversion may require modelling. This process may take up to 6 months in order to reach an acceptable design.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/

Please refer to the link below to obtain full details of the processes involved with sewer closure:

https://www.unitedutilities.com/builders-developers/wastewater-services/close-a-sewer/sewer-closures/

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

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

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

Sewer Adoptions

You have indicated on your application form that you intend to put the sewers forward for adoption (including any SuDS components that can come within the meaning of a sewer).

United Utilities assess adoption applications based on the current Design & Construction Guidance and local practices which have now replaced 'Sewers For Adoption 6th Edition'.

We recommend that you submit a pre design assessment to the sewer adoption mailbox (SewerAdoptions@uuplc.co.uk) stating pre design assessment in the title

Please refer to links below to obtain further guidance:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-adoptions/

Site drainage must be designed in accordance with Building Regulations, National Planning Policy, and local flood authority guidelines, we would recommend that you speak and make suitable agreements with the relevant statutory bodies.

If you intend to put forward your wastewater assets for adoption by United Utilities, the proposed detail design will be subject to a technical appraisal by an Adoption Engineer as we need to be sure that the proposals meets the

requirements set out in the Design & Construction Guidance. The proposed design should give consideration to long term operability and give United Utilities a safe and cost effective proposal for the lifetime of the assets. In these cases, we strongly recommend that no construction commences until the detailed drainage design, submitted as part of the Section 104 application, has been assessed and accepted in writing by United Utilities. Any work carried out prior to the technical assessment being approved is done entirely at the developer's own risk and could be subject to change.

SuDS

If your development proposal incorporates any SuDS component(s) which interact with a sewer network you plan on offering for adoption to United Utilities; contact should be made with our technical team at your earliest convenience, please complete the 'Section 104 pre-application form : ' and include as much relevant detail as you can. These discussions can help prevent delays later in the development process.

Section 104 Pre application form (1b)

As per the sewerage sector guidance, all SuDS should be designed in accordance with the standards within the Design & construction guidance & the CIRIA SuDS manual (C753)

Codes For Adoption

The new Codes for Adoption are outlined on the Water UK Website. The link below takes you to their webpage:

https://www.water.org.uk/technical-guidance/developers-services/codes-for-adoption/

A free copy of the new Design & Construction Guidance can be downloaded via the link below:

https://www.water.org.uk/sewerage-sector-guidance-approved-documents/

Many thanks and kind regards,

United Utilities
Water for the North West

Mohammed Aljafarawi (He/Him)
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$$North\ Stand\ Q_{peak} = 1.0\sqrt{287} = \ 16.94l/s$$

Based on the above calculations the total site discharge for the site is:

$$Total\ Site\ Discharge = 5.22l/s + 22.91l/s + 16.94l/s = \ 45.07l/s$$

The above calculations are considered industry standard for calculating total site; however, for this development it can be reasonably assumed that the individual buildings will not be concurrently discharging at peak flow and therefore the calculated total site discharge is likely to be conservative.

UU have agreed to accept flows from the site at an unrestricted rate to their network – refer to **Appendix G** for correspondence.

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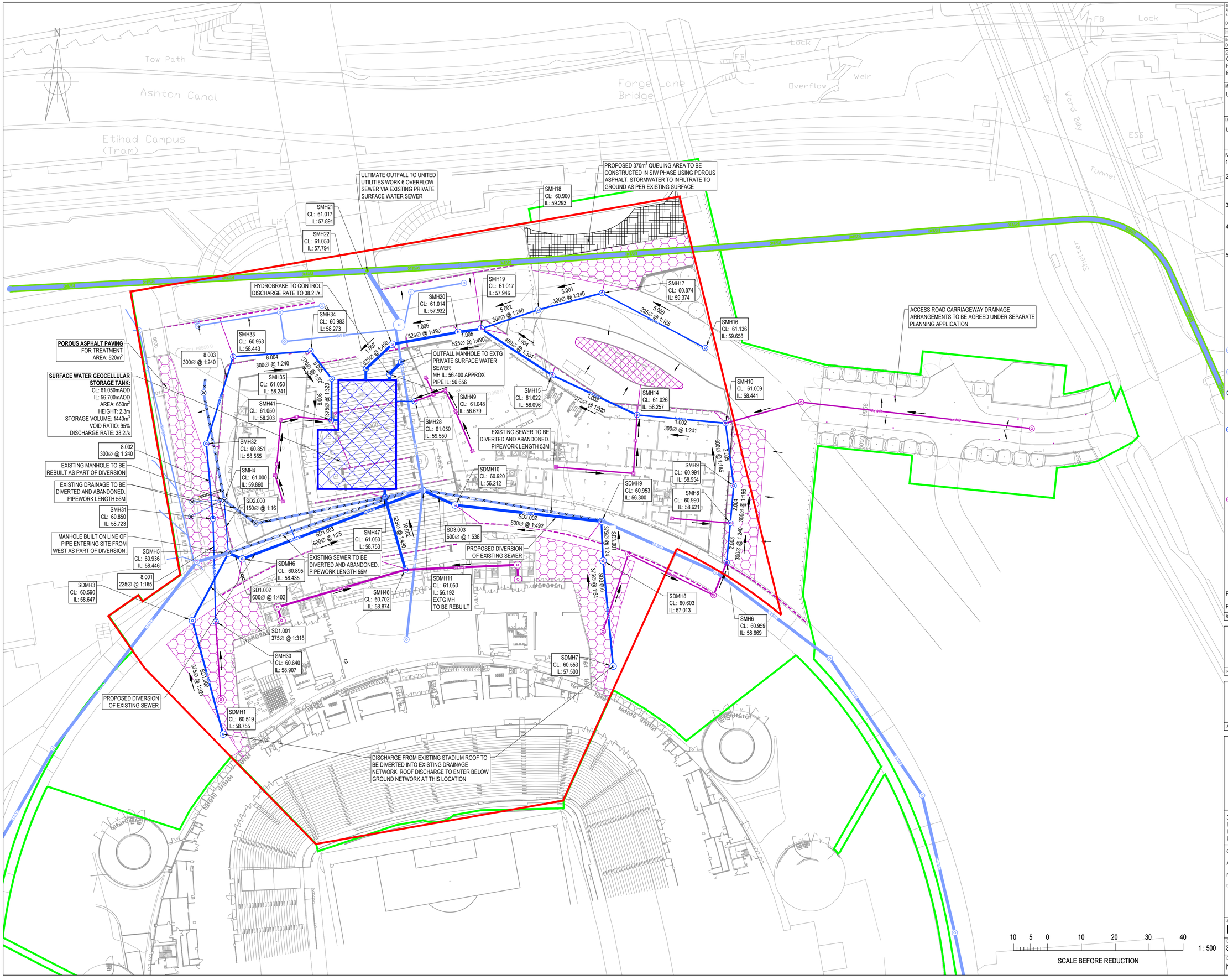
Appendix B Site Improvement Works Surface Water Drainage Strategy



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DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

CONSTRUCTION ACTIVITIES IN CLOSE PROXIMITY TO LOW PRESSURE GAS MAIN
EXCAVATION IN MADE GROUND

MAINTENANCE/CLEANING/OPERATION.

UNUSUALLY DEEP SEWERS

DECOMMISSIONING/DEMOLITION.

UNUSUALLY DEEP SEWERS

NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND PROJECT NORTH STAND SITE IMPROVEMENT WORKS DRAINAGE STRATEGY DESIGN NOTE
3. EXISTING COMBINED SERVICES DATA TAKEN FROM ECS-ARP-SW-DR-CU-0001 EXISTING COMBINED SERVICES.PDF RECEIVED FROM ARUP 15/07/2022.
4. GPR SURVEY DATA TAKEN FROM GR48864-UU-DR.dwg RECEIVED FROM SUBSCAN 24/01/2023 AND IS SHOWN IN GREY ON THE COMBINED EXISTING UTILITIES PLAN.
5. ALIGNMENT OF WORK 6 OVERFLOW SEWER TAKEN FROM 137954-25-11-2019-02-54-50.PDF RECEIVED FROM UNITED UTILITIES 26/11/2019

LEGEND:

- SITE BOUNDARY
- MAIN WORKS PLANNING APPLICATION BOUNDARY

EXISTING

- PRIVATE SURFACE WATER DRAIN TO BE RETAINED
- WORK 6 OVERFLOW SEWER (UNITED UTILITIES)
- PRIVATE SURFACE WATER DRAIN TO BE ABANDONED

PROPOSED

- BELOW GROUND SURFACE WATER DRAIN AND MANHOLES
- ATTENUATION TANK
- PERMEABLE PAVING

PROPOSED SUBJECT TO SEPARATE PLANNING APPLICATION

- INDICATIVE BELOW GROUND SURFACE WATER DRAIN AND MANHOLES
- INDICATIVE LINEAR SURFACE DRAINAGE
- INDICATIVE BIORETENTION SYSTEM
- INDICATIVE PERMEABLE PAVING

Rev	Description	Date	Iss'd	Rev'd	App'd
P02	REVISED TO ALIGN WITH MAIN WORKS	25.04.2023	AM	CM	NH
P01	ISSUED FOR SIW	01.02.2023	CM	CM	NH

SIW

Project Stage

PLANNING

Status of Drawing

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Web: www.burohappold.com

Client *MCFC*

Architect *POPULOUS*

Project **ETIHAD CAMPUS NS**

Drg Title SIW BELOW GROUND DRAINAGE SURFACE WATER GENERAL ARRANGEMENT OVERVIEW

Job No. NSE

Scale@A1 1:500

Drawn/Designed By. SG

Checked By. CM

Approved By. NH

Drawing No. NSE-BHE-ZX-XX-DR-C-003201

Revision P02

Alex Murray P:\003810 MCFC North Stand\08 Cities - Infra\01_Sheet\NSE-BHE-ZX-XX-DR-C-003201.dwg

Appendix C Site Improvement Works Surface Water Diversions Hydraulic Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Water Diversion

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 386500 398850 SJ 86500 98850
C (1km)	-0.027
D1 (1km)	0.341
D2 (1km)	0.400
D3 (1km)	0.306
E (1km)	0.303
F (1km)	2.456
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Water Diversion

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.417	4-8	0.343

Total Area Contributing (ha) = 0.760

Total Pipe Volume (m^3) = 45.703

Network Design Table for Surface Water Diversion

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

Network Results Table

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Network Design Table for Surface Water Diversion

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

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Network Design Table for Surface Water Diversion

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
SD1.000	34.719	0.108	320.0	0.380	5.00	0.0	0.600	o	375	Pipe/Conduit	
SD1.001	22.586	0.071	320.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SD2.000	15.626	0.964	16.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
SD1.002	4.427	0.011	400.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
SD1.003	57.019	2.243	25.4	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
SD3.000	31.230	0.487	64.1	0.380	5.00	0.0	0.600	o	375	Pipe/Conduit	
SD3.001	11.657	0.487	23.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
SD3.002	43.462	0.087	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
SD3.003	10.471	0.021	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
SD1.004	6.147	0.012	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SD1.000	50.00	5.57	58.850	0.380	0.0	0.0	0.0	1.01	111.3	51.5
SD1.001	50.00	5.95	58.742	0.380	0.0	0.0	0.0	1.01	111.3	51.5
SD2.000	50.00	5.10	59.860	0.000	0.0	0.0	0.0	2.51	44.4	0.0
SD1.002	50.00	6.01	58.446	0.380	0.0	0.0	0.0	1.21	342.5	51.5
SD1.003	50.00	6.21	58.435	0.380	0.0	0.0	0.0	4.84	1369.3	51.5
SD3.000	50.00	5.23	57.500	0.380	0.0	0.0	0.0	2.27	250.3	51.5
SD3.001	50.00	5.28	57.013	0.380	0.0	0.0	0.0	3.72	410.5	51.5
SD3.002	50.00	5.95	56.300	0.380	0.0	0.0	0.0	1.08	306.0	51.5
SD3.003	50.00	6.11	56.213	0.380	0.0	0.0	0.0	1.08	306.0	51.5
SD1.004	50.00	6.30	56.192	0.760	0.0	0.0	0.0	1.08	306.0	102.9

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Manhole Schedules for Surface Water Diversion

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	60.519	1.669	Open Manhole	1500	SD1.000	58.850	375				
S3	60.590	1.848	Open Manhole	1500	SD1.001	58.742	375	SD1.000	58.742	375	
S4	61.000	1.140	Open Manhole	1200	SD2.000	59.860	150				
S5	60.936	2.490	Open Manhole	1500	SD1.002	58.446	600	SD1.001	58.671	375	
								SD2.000	58.896	150	
S6	60.895	2.460	Open Manhole	1500	SD1.003	58.435	600	SD1.002	58.435	600	
S7	60.553	3.053	Open Manhole	1500	SD3.000	57.500	375				
S8	60.603	3.590	Open Manhole	1500	SD3.001	57.013	375	SD3.000	57.013	375	
S9	60.953	4.653	Open Manhole	1500	SD3.002	56.300	600	SD3.001	56.526	375	1
S10	60.920	4.707	Open Manhole	1500	SD3.003	56.213	600	SD3.002	56.213	600	
S11	61.050	4.858	Open Manhole	1500	SD1.004	56.192	600	SD1.003	56.192	600	
								SD3.003	56.192	600	
S	61.050	4.870	Open Manhole	0		OUTFALL		SD1.004	56.180	600	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	386725.897	398594.236	386725.897	398594.236	Required	
S3	386716.824	398627.748	386716.824	398627.748	Required	
S4	386726.177	398663.263	386726.177	398663.263	Required	
S5	386727.433	398647.687	386727.433	398647.687	Required	
S6	386731.504	398645.948	386731.504	398645.948	Required	
S7	386841.027	398614.293	386841.027	398614.293	Required	

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Manhole Schedules for Surface Water Diversion

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S8	386838.046	398645.380	386838.046	398645.380	Required	
S9	386837.559	398657.027	386837.559	398657.027	Required	
S10	386794.364	398661.842	386794.364	398661.842	Required	
S11	386784.822	398666.154	386784.822	398666.154	Required	
S	386784.045	398672.251			No Entry	

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PIPELINE SCHEDULES for Surface Water Diversion

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)
SD1.000	o	375	S1	60.519	58.850	1.294	Open Manhole	1500
SD1.001	o	375	S3	60.590	58.742	1.473	Open Manhole	1500
SD2.000	o	150	S4	61.000	59.860	0.990	Open Manhole	1200
SD1.002	o	600	S5	60.936	58.446	1.890	Open Manhole	1500
SD1.003	o	600	S6	60.895	58.435	1.860	Open Manhole	1500
SD3.000	o	375	S7	60.553	57.500	2.678	Open Manhole	1500
SD3.001	o	375	S8	60.603	57.013	3.215	Open Manhole	1500
SD3.002	o	600	S9	60.953	56.300	4.053	Open Manhole	1500
SD3.003	o	600	S10	60.920	56.213	4.107	Open Manhole	1500
SD1.004	o	600	S11	61.050	56.192	4.258	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SD1.000	34.719	320.0	S3	60.590	58.742	1.473	Open Manhole	1500
SD1.001	22.586	320.0	S5	60.936	58.671	1.890	Open Manhole	1500
SD2.000	15.626	16.2	S5	60.936	58.896	1.890	Open Manhole	1500
SD1.002	4.427	400.0	S6	60.895	58.435	1.860	Open Manhole	1500
SD1.003	57.019	25.4	S11	61.050	56.192	4.258	Open Manhole	1500
SD3.000	31.230	64.1	S8	60.603	57.013	3.215	Open Manhole	1500
SD3.001	11.657	23.9	S9	60.953	56.526	4.052	Open Manhole	1500
SD3.002	43.462	500.0	S10	60.920	56.213	4.107	Open Manhole	1500
SD3.003	10.471	500.0	S11	61.050	56.192	4.258	Open Manhole	1500
SD1.004	6.147	500.0	S	61.050	56.180	4.270	Open Manhole	0

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Area Summary for Surface Water Diversion

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.380	0.380	0.380
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.380	0.380	0.380
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
3.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.760	0.760	0.760

Free Flowing Outfall Details for Surface Water Diversion

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SD1.004	S	61.050	56.180	0.000	0	0

Simulation Criteria for Surface Water Diversion

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 Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840

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Synthetic Rainfall Details

Storm Duration (mins) 30

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 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 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
SD1.000	S1	15 Winter	2	+0%	30/15 Summer				59.057
SD1.001	S3	15 Winter	2	+0%	30/15 Summer				58.949
SD2.000	S4	15 Summer	2	+0%					59.860
SD1.002	S5	15 Winter	2	+0%					58.652
SD1.003	S6	15 Winter	2	+0%					58.517
SD3.000	S7	15 Winter	2	+0%	100/15 Summer				57.630
SD3.001	S8	15 Winter	2	+0%	100/15 Summer				57.130
SD3.002	S9	15 Winter	2	+0%	100/15 Summer				56.546
SD3.003	S10	15 Winter	2	+0%	100/15 Summer				56.513
SD1.004	S11	15 Winter	2	+0%	100/15 Summer				56.497

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
SD1.000	S1	-0.168	0.000	0.57			56.7	OK	
SD1.001	S3	-0.167	0.000	0.59			56.0	OK	
SD2.000	S4	-0.150	0.000	0.00			0.0	OK	
SD1.002	S5	-0.394	0.000	0.26			56.1	OK	
SD1.003	S6	-0.518	0.000	0.05			56.0	OK	
SD3.000	S7	-0.245	0.000	0.26			57.8	OK	
SD3.001	S8	-0.258	0.000	0.21			57.1	OK	
SD3.002	S9	-0.354	0.000	0.21			56.0	OK	
SD3.003	S10	-0.301	0.000	0.33			50.0	OK	
SD1.004	S11	-0.295	0.000	0.51			105.7	OK	

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 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 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
SD1.000	S1	15 Winter	30	+0%	30/15 Summer				59.312
SD1.001	S3	15 Winter	30	+0%	30/15 Summer				59.146
SD2.000	S4	15 Summer	30	+0%					59.860
SD1.002	S5	15 Winter	30	+0%					58.765
SD1.003	S6	15 Winter	30	+0%					58.561
SD3.000	S7	15 Winter	30	+0%	100/15 Summer				57.707
SD3.001	S8	15 Winter	30	+0%	100/15 Summer				57.196
SD3.002	S9	15 Winter	30	+0%	100/15 Summer				56.864
SD3.003	S10	15 Winter	30	+0%	100/15 Summer				56.774
SD1.004	S11	15 Winter	30	+0%	100/15 Summer				56.751

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
SD1.000	S1	0.087	0.000	1.23			123.1	SURCHARGED	
SD1.001	S3	0.029	0.000	1.28			121.8	SURCHARGED	
SD2.000	S4	-0.150	0.000	0.00			0.0	OK	
SD1.002	S5	-0.281	0.000	0.56			121.5	OK	
SD1.003	S6	-0.473	0.000	0.10			120.7	OK	
SD3.000	S7	-0.168	0.000	0.58			129.5	OK	
SD3.001	S8	-0.192	0.000	0.47			128.0	OK	
SD3.002	S9	-0.036	0.000	0.47			124.3	OK	
SD3.003	S10	-0.039	0.000	0.68			102.2	OK	
SD1.004	S11	-0.041	0.000	1.01			209.4	OK	

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 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 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
SD1.000	S1	15 Winter	100	+45%	30/15 Summer				60.125
SD1.001	S3	15 Winter	100	+45%	30/15 Summer				59.481
SD2.000	S4	15 Summer	100	+45%					59.860
SD1.002	S5	15 Winter	100	+45%					59.046
SD1.003	S6	15 Winter	100	+45%					58.613
SD3.000	S7	15 Winter	100	+45%	100/15 Summer				58.071
SD3.001	S8	15 Winter	100	+45%	100/15 Summer				57.457
SD3.002	S9	15 Winter	100	+45%	100/15 Summer				57.079
SD3.003	S10	15 Winter	100	+45%	100/15 Summer				57.014
SD1.004	S11	15 Winter	100	+45%	100/15 Summer				56.981

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
SD1.000	S1	0.900	0.000	2.39			238.4	SURCHARGED	
SD1.001	S3	0.365	0.000	2.50			237.7	SURCHARGED	
SD2.000	S4	-0.150	0.000	0.00			0.0	OK	
SD1.002	S5	0.000	0.000	1.05			229.8	OK	
SD1.003	S6	-0.422	0.000	0.19			230.7	OK	
SD3.000	S7	0.196	0.000	1.14			252.5	SURCHARGED	
SD3.001	S8	0.069	0.000	0.90			244.7	SURCHARGED	
SD3.002	S9	0.179	0.000	0.91			240.4	SURCHARGED	
SD3.003	S10	0.201	0.000	1.58			239.2	SURCHARGED	
SD1.004	S11	0.189	0.000	2.28			471.9	SURCHARGED	

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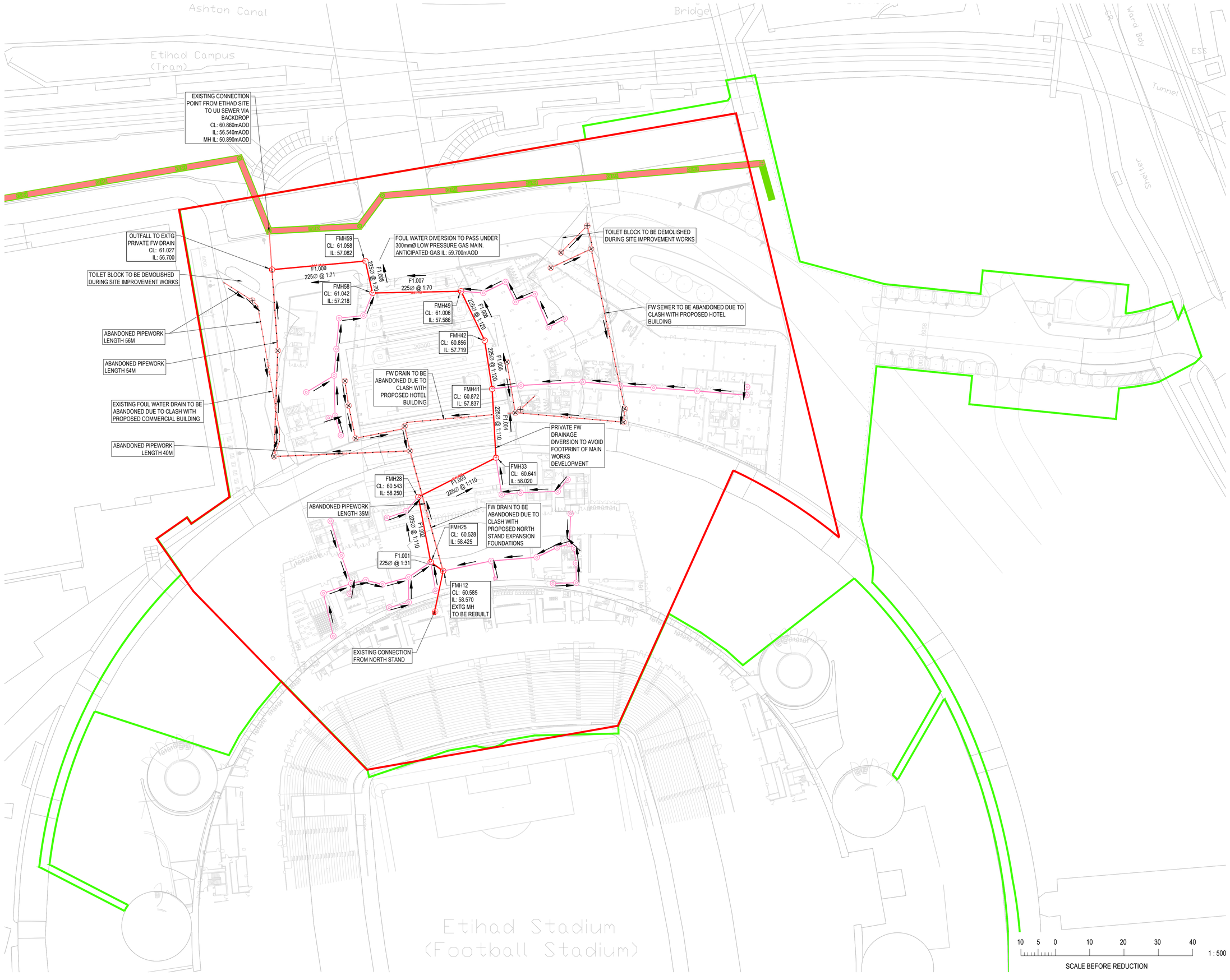
Appendix D Site Improvement Works Foul Water Drainage Strategy



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DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

CONSTRUCTION ACTIVITIES IN CLOSE PROXIMITY TO LOW PRESSURE GAS MAIN
EXCAVATION IN MADE GROUND

MAINTENANCE/CLEANING/OPERATION.

UNUSUALLY DEEP SEWERS

DECOMMISSIONING/DEMOLITION.

UNUSUALLY DEEP SEWERS

NOTES:
1. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND PROJECT NORTH STAND SITE IMPROVEMENT WORKS DRAINAGE STRATEGY DESIGN NOTE
3. EXISTING COMBINED SERVICES DATA TAKEN FROM ECS-ARP-SW-DR-CU-0001 EXISTING COMBINED SERVICES.PDF RECEIVED FROM ARUP 15/07/2022.
4. GPR SURVEY DATA TAKEN FROM GR48864-UU-DR.dwg RECEIVED FROM SUBSCAN 24/01/2023 AND IS SHOWN IN GREY ON THE COMBINED EXISTING UTILITIES PLAN.
5. ALIGNMENT OF UNITED UTILITIES ASSETS TAKEN FROM SURVEY RECORDS AND NOT FROM UNITED UTILITIES ASSET RECORDS. ASSET RECORDS BELIEVED TO BE INACCURATE IN THIS AREA.

LEGEND:

- SITE BOUNDARY
- MAIN WORKS PLANNING APPLICATION BOUNDARY

EXISTING

- PRIVATE FOUL WATER DRAIN TO BE RETAINED
- EXISTING PUBLIC SEWER (UNITED UTILITIES)
- PRIVATE FOUL WATER DRAIN TO BE ABANDONED

PROPOSED

- BELOW GROUND FOUL WATER DRAIN AND MANHOLES
- INDICATIVE BELOW GROUND FOUL WATER DRAIN AND MANHOLES (SUBJECT TO SEPARATE APPLICATION)

Rev	Description	Date	Iss'd	Rev'd	App'd
P02	REVISED TO ALIGN WITH MAIN WORKS	25.04.2023	AM	CM	NH
P01	ISSUED FOR SIW	01.02.2023	CM	CM	NH

SIW

Project Stage

PLANNING

Status of Drawing

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Client	MCFC
Architect	POPULOUS
Project	ETIHAD CAMPUS NS
Drg Title	SIW BELOW GROUND DRAINAGE FOUL WATER GENERAL ARRANGEMENT OVERVIEW

Job No.	Scale@A1
NSE	1:500

Drawn/Designed By.	Checked By.	Approved By.
SG	CM	NH

Drawing No.	Revision
NSE-BHE-ZX-XX-DR-C-003202	P02

Alan Murray P:\053810 MCFC North Stand\06 Ghost - Interp\01_Sheet\NSE-BHE-ZX-XX-DR-C-003202.dwg

Appendix E Project North Stand Manchester Hydraulic Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Water Permanent

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	60
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Water Permanent

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.870	4-8	0.926	8-12	0.293	12-16	0.293	16-20	0.098

Total Area Contributing (ha) = 2.481

Total Pipe Volume (m^3) = 83.267

Network Design Table for Surface Water Permanent

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

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

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Network Design Table for Surface Water Permanent

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
S1.000	68.557	0.415	165.0	0.152	15.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	23.171	0.140	165.0	0.059	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	17.217	0.455	37.8	0.013	15.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	24.049	0.146	164.7	0.022	15.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	23.013	0.139	165.0	0.072	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	10.847	0.045	240.0	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.003	11.661	0.049	240.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	11.072	0.067	165.2	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.002	18.611	0.113	165.0	0.093	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	26.242	0.109	240.7	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	22.979	0.139	165.3	0.050	15.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	9.692	0.059	165.0	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	7.586	0.546	13.9	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	27.625	0.086	321.2	0.037	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	16.13	60.121	0.152	0.0	0.0	0.0	1.02	40.4	20.6
S1.001	50.00	16.51	59.706	0.211	0.0	0.0	0.0	1.02	40.4	28.6
S2.000	50.00	15.13	60.200	0.013	0.0	0.0	0.0	2.13	84.8	1.7
S3.000	50.00	15.39	59.075	0.022	0.0	0.0	0.0	1.02	40.4	3.0
S3.001	50.00	15.77	58.929	0.094	0.0	0.0	0.0	1.02	40.4	12.7
S3.002	50.00	15.95	58.715	0.121	0.0	0.0	0.0	1.01	71.4	16.4
S3.003	50.00	16.14	58.669	0.121	0.0	0.0	0.0	1.01	71.4	16.4
S2.001	50.00	16.29	58.621	0.179	0.0	0.0	0.0	1.22	86.3	24.3
S2.002	50.00	16.55	58.554	0.272	0.0	0.0	0.0	1.22	86.3	36.8
S1.002	50.00	16.98	58.441	0.525	0.0	0.0	0.0	1.01	71.3	71.1
S4.000	50.00	15.38	60.200	0.050	0.0	0.0	0.0	1.01	40.3	6.8
S4.001	50.00	15.54	60.061	0.088	0.0	0.0	0.0	1.02	40.4	11.9
S4.002	50.00	15.57	60.002	0.117	0.0	0.0	0.0	3.53	140.3	15.8
S1.003	50.00	17.44	58.257	0.679	0.0	0.0	0.0	1.01	111.0	91.9

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Network Design Table for Surface Water Permanent

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
S1.004	25.048	0.075	334.0	0.062	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.000	34.509	0.209	165.1	0.053	15.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	19.485	0.081	240.0	0.102	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.002	17.723	0.074	240.0	0.063	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	6.844	0.014	490.0	0.052	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.006	19.835	0.040	490.0	0.029	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.007	10.640	0.022	490.0	0.057	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	15.654	0.010	1534.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.000	12.568	0.076	165.0	0.068	15.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	6.983	0.042	165.0	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.002	3.576	0.238	15.0	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	5.453	0.364	15.0	0.018	15.00	0.0	0.600	o	225	Pipe/Conduit	
S6.003	6.043	0.211	28.6	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.004	13.202	0.030	435.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	50.00	17.82	58.096	0.741	0.0	0.0	0.0	1.11	176.0	100.4
S5.000	50.00	15.57	59.658	0.053	0.0	0.0	0.0	1.01	40.3	7.2
S5.001	50.00	15.89	59.374	0.155	0.0	0.0	0.0	1.01	71.4	21.0
S5.002	50.00	16.18	59.293	0.218	0.0	0.0	0.0	1.01	71.4	29.5
S1.005	50.00	17.93	57.946	1.011	0.0	0.0	0.0	1.01	217.6	136.9
S1.006	50.00	18.26	57.932	1.040	0.0	0.0	0.0	1.01	217.6	140.8
S1.007	50.00	18.44	57.892	1.097	0.0	0.0	0.0	1.01	217.6	148.6
S1.008	50.00	18.86	57.795	1.097	0.0	0.0	0.0	0.61	173.3	148.6
S6.000	50.00	15.21	60.200	0.068	0.0	0.0	0.0	1.02	40.4	9.2
S6.001	50.00	15.32	60.124	0.112	0.0	0.0	0.0	1.02	40.4	15.2
S6.002	50.00	15.34	60.082	0.129	0.0	0.0	0.0	3.40	135.0	17.5
S7.000	50.00	15.03	60.200	0.018	0.0	0.0	0.0	3.40	135.0	2.5
S6.003	50.00	15.38	59.836	0.165	0.0	0.0	0.0	2.45	97.6	22.3
S6.004	50.00	15.73	59.625	0.165	0.0	0.0	0.0	0.62	24.7	22.3

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Network Design Table for Surface Water Permanent

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
S8.000	23.127	0.140	165.2	0.027	15.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	30.370	0.184	165.1	0.043	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	22.252	0.093	240.0	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.003	26.866	0.112	240.0	0.037	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.004	22.928	0.096	240.0	0.065	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.005	10.250	0.032	320.3	0.046	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.006	12.199	0.038	321.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.000	7.993	0.048	166.5	0.051	15.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	3.330	0.020	165.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	13.019	0.259	50.3	0.048	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.003	4.705	0.314	15.0	0.032	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.004	10.360	0.691	15.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.007	12.718	0.016	794.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.000	4.286	0.013	329.7	0.324	15.00	0.0	0.600	oo	400	Double Pipe	
S10.001	33.100	0.083	400.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S11.000	4.135	0.013	318.1	0.323	15.00	0.0	0.600	oo	400	Double Pipe	

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)
S8.000	50.00	15.38	59.047	0.027	0.0	0.0	0.0	1.01	40.3	3.6
S8.001	50.00	15.88	58.907	0.069	0.0	0.0	0.0	1.01	40.4	9.4
S8.002	50.00	16.25	58.648	0.092	0.0	0.0	0.0	1.01	71.4	12.4
S8.003	50.00	16.69	58.555	0.128	0.0	0.0	0.0	1.01	71.4	17.4
S8.004	50.00	17.07	58.443	0.193	0.0	0.0	0.0	1.01	71.4	26.2
S8.005	50.00	17.24	58.273	0.239	0.0	0.0	0.0	1.01	111.2	32.4
S8.006	50.00	17.44	58.241	0.239	0.0	0.0	0.0	1.01	111.1	32.4
S9.000	50.00	15.13	60.250	0.051	0.0	0.0	0.0	1.01	40.2	6.8
S9.001	50.00	15.19	60.202	0.066	0.0	0.0	0.0	1.02	40.4	8.9
S9.002	50.00	15.30	60.182	0.113	0.0	0.0	0.0	1.85	73.5	15.4
S9.003	50.00	15.33	59.923	0.146	0.0	0.0	0.0	3.40	135.0	19.8
S9.004	50.00	15.38	59.609	0.180	0.0	0.0	0.0	3.40	135.0	24.3
S8.007	50.00	17.77	58.203	0.419	0.0	0.0	0.0	0.63	70.1	56.7
S10.000	50.00	15.07	59.110	0.324	0.0	0.0	0.0	1.03	259.8	43.8
S10.001	50.00	15.62	59.047	0.324	0.0	0.0	0.0	1.01	160.7	43.8
S11.000	50.00	15.07	59.110	0.323	0.0	0.0	0.0	1.05	264.6	43.7

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Network Design Table for Surface Water Permanent

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
S11.001	39.344	0.098	400.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.002	22.316	0.046	490.0	0.053	0.00	0.0	0.600	o	525	Pipe/Conduit	
S10.003	22.556	0.010	2210.5	0.100	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.009	13.864	0.021	660.2	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
S1.010	5.584	0.023	240.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.001	50.00	15.71	59.047	0.323	0.0	0.0	0.0	1.01	160.7	43.7
S10.002	50.00	16.08	58.874	0.700	0.0	0.0	0.0	1.01	217.6	94.8
S10.003	50.00	16.82	58.753	0.800	0.0	0.0	0.0	0.51	143.8	108.4
S1.009	50.00	19.09	56.700	2.481	0.0	0.0	0.0	1.01	362.3	336.0
S1.010	50.00	19.15	56.679	2.481	0.0	0.0	0.0	1.69	603.8	336.0

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Manhole Schedules for Surface Water Permanent

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	61.546	1.425	Open Manhole	1200	S1.000	60.121	225				
S2	61.477	1.771	Open Manhole	1200	S1.001	59.706	225	S1.000	59.706	225	
S3	61.050	0.850	Open Manhole	1200 x 900	S2.000	60.200	225				
S4	60.640	1.565	Open Manhole	1200	S3.000	59.075	225				
S5	60.734	1.805	Open Manhole	1200	S3.001	58.929	225	S3.000	58.929	225	
S6	60.638	1.923	Open Manhole	1200	S3.002	58.715	300	S3.001	58.790	225	
S7	60.959	2.290	Open Manhole	1200	S3.003	58.669	300	S3.002	58.669	300	
S8	60.990	2.369	Open Manhole	1200	S2.001	58.621	300	S2.000	59.745	225	1049
								S3.003	58.621	300	
S9	60.991	2.437	Open Manhole	1200	S2.002	58.554	300	S2.001	58.554	300	
S10	61.009	2.568	Open Manhole	1200	S1.002	58.441	300	S1.001	59.565	225	1049
								S2.002	58.441	300	
S11	61.050	0.850	Open Manhole	1200 x 900	S4.000	60.200	225				
S12	61.050	0.989	Open Manhole	1200 x 900	S4.001	60.061	225	S4.000	60.061	225	
S13	61.050	1.048	Open Manhole	1200 x 900	S4.002	60.002	225	S4.001	60.002	225	
S14	61.026	2.769	Open Manhole	1500	S1.003	58.257	375	S1.002	58.332	300	
								S4.002	59.456	225	1049
S15	61.022	2.926	Open Manhole	1500	S1.004	58.096	450	S1.003	58.171	375	
S16	61.136	1.478	Open Manhole	1200	S5.000	59.658	225				
S17	60.874	1.500	Open Manhole	1200	S5.001	59.374	300	S5.000	59.449	225	
S18	60.900	1.607	Open Manhole	1200	S5.002	59.293	300	S5.001	59.293	300	
S19	61.017	3.071	Open Manhole	1500	S1.005	57.946	525	S1.004	58.021	450	
								S5.002	59.219	300	1048
S20	61.014	3.082	Open Manhole	1500	S1.006	57.932	525	S1.005	57.932	525	
S21	61.017	3.125	Open Manhole	1500	S1.007	57.892	525	S1.006	57.892	525	
S22	61.050	3.255	Open Manhole	1500	S1.008	57.795	600	S1.007	57.870	525	
S23	61.050	0.850	Open Manhole	1200 x 900	S6.000	60.200	225				
S24	61.050	0.926	Open Manhole	1200 x 900	S6.001	60.124	225	S6.000	60.124	225	
S25	61.050	0.968	Open Manhole	1200 x 900	S6.002	60.082	225	S6.001	60.082	225	
S26	61.050	0.850	Open Manhole	1200 x 900	S7.000	60.200	225				
S27	61.050	1.214	Open Manhole	1200 x 900	S6.003	59.836	225	S6.002	59.843	225	7
								S7.000	59.836	225	
S28	61.050	1.425	Open Manhole	1200	S6.004	59.625	225	S6.003	59.625	225	
S29	60.600	1.553	Open Manhole	1200	S8.000	59.047	225				

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Manhole Schedules for Surface Water Permanent

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S30	60.640	1.733	Open Manhole	1200	S8.001	58.907	225	S8.000	58.907	225	
S31	60.850	2.202	Open Manhole	1200	S8.002	58.648	300	S8.001	58.723	225	
S32	60.851	2.295	Open Manhole	1200	S8.003	58.555	300	S8.002	58.555	300	
S33	60.963	2.520	Open Manhole	1200	S8.004	58.443	300	S8.003	58.443	300	
S34	60.983	2.710	Open Manhole	1500	S8.005	58.273	375	S8.004	58.348	300	
S35	61.050	2.809	Open Manhole	1500	S8.006	58.241	375	S8.005	58.241	375	
S36	61.050	0.800	Open Manhole	1200 x 900	S9.000	60.250	225				
S37	61.050	0.848	Open Manhole	1200 x 900	S9.001	60.202	225	S9.000	60.202	225	
S38	61.050	0.868	Open Manhole	1200 x 900	S9.002	60.182	225	S9.001	60.182	225	
S39	61.050	1.127	Open Manhole	1200 x 900	S9.003	59.923	225	S9.002	59.923	225	
S40	61.050	1.441	Open Manhole	1200 x 900	S9.004	59.609	225	S9.003	59.609	225	
S41	61.050	2.847	Open Manhole	1500	S8.007	58.203	375	S8.006	58.203	375	
								S9.004	58.918	225	566
S42	60.800	1.690	Open Manhole	1800	S10.000	59.110	400				
S43	60.800	1.753	Open Manhole	1800	S10.001	59.047	450	S10.000	59.097	400	
S44	60.800	1.690	Open Manhole	1800	S11.000	59.110	400				
S45	60.800	1.753	Open Manhole	1800	S11.001	59.047	450	S11.000	59.097	400	
S46	60.702	1.828	Open Manhole	1500	S10.002	58.874	525	S10.001	58.964	450	16
								S11.001	58.949	450	
S47	61.050	2.297	Open Manhole	1500	S10.003	58.753	600	S10.002	58.828	525	
S48	61.050	4.350	Open Manhole	1500	S1.009	56.700	675	S1.008	57.785	600	1010
								S6.004	59.595	225	2445
								S8.007	58.187	375	1187
								S10.003	58.743	600	1968
S49	61.050	4.371	Open Manhole	1500	S1.010	56.679	675	S1.009	56.679	675	
S	61.050	4.394	Open Manhole	0		OUTFALL		S1.010	56.656	675	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	386964.618	398684.425	386964.618	398684.425	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S2	386896.506	398692.218	386896.506	398692.218	Required	
S3	386858.464	398657.933	386858.464	398657.933	Required	
S4	386837.995	398624.539	386837.995	398624.539	Required	
S5	386845.524	398647.379	386845.524	398647.379	Required	
S6	386866.419	398637.735	386866.419	398637.735	Required	
S7	386874.540	398644.926	386874.540	398644.926	Required	
S8	386875.624	398656.537	386875.624	398656.537	Required	
S9	386876.625	398667.563	386876.625	398667.563	Required	
S10	386874.182	398686.013	386874.182	398686.013	Required	
S11	386824.124	398673.075	386824.124	398673.075	Required	
S12	386847.026	398671.201	386847.026	398671.201	Required	
S13	386847.609	398680.875	386847.609	398680.875	Required	
S14	386848.053	398688.448	386848.053	398688.448	Required	
S15	386823.043	398700.179	386823.043	398700.179	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S16	386868.207	398708.214	386868.207	398708.214	Required	
S17	386837.731	398724.403	386837.731	398724.403	Required	
S18	386818.883	398719.464	386818.883	398719.464	Required	
S19	386802.066	398713.868	386802.066	398713.868	Required	
S20	386795.296	398712.866	386795.296	398712.866	Required	
S21	386775.784	398709.301	386775.784	398709.301	Required	
S22	386768.012	398702.034	386768.012	398702.034	Required	
S23	386799.435	398677.843	386799.435	398677.843	Required	
S24	386794.542	398689.419	386794.542	398689.419	Required	
S25	386791.440	398695.675	386791.440	398695.675	Required	
S26	386785.722	398699.426	386785.722	398699.426	Required	
S27	386788.062	398694.500	386788.062	398694.500	Required	
S28	386782.377	398692.452	386782.377	398692.452	Required	
S29	386725.217	398604.372	386725.217	398604.372	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S30	386723.686	398627.449	386723.686	398627.449	Required	
S31	386722.878	398657.808	386722.878	398657.808	Required	
S32	386720.911	398679.973	386720.911	398679.973	Required	
S33	386728.846	398705.640	386728.846	398705.640	Required	
S34	386751.715	398707.290	386751.715	398707.290	Required	
S35	386757.912	398699.125	386757.912	398699.125	Required	
S36	386743.493	398663.009	386743.493	398663.009	Required	
S37	386741.217	398670.670	386741.217	398670.670	Required	
S38	386741.726	398673.961	386741.726	398673.961	Required	
S39	386742.910	398686.926	386742.910	398686.926	Required	
S40	386747.519	398687.874	386747.519	398687.874	Required	
S41	386757.836	398686.926	386757.836	398686.926	Required	
S42	386812.917	398639.912	386812.917	398639.912	Required	
S43	386812.759	398644.195	386812.759	398644.195	Required	

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Manhole Schedules for Surface Water Permanent

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S44	386743.125	398627.770	386743.125	398627.770	Required	
S45	386741.926	398631.728	386741.926	398631.728	Required	
S46	386779.690	398642.767	386779.690	398642.767	Required	
S47	386773.612	398664.239	386773.612	398664.239	Required	
S48	386770.549	398686.586	386770.549	398686.586	Required	
S49	386774.973	398699.725	386774.973	398699.725	Required	
S	386778.417	398704.120			No Entry	

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S1.000	o	225	S1	61.546	60.121	1.200	Open Manhole	1200
S1.001	o	225	S2	61.477	59.706	1.546	Open Manhole	1200
S2.000	o	225	S3	61.050	60.200	0.625	Open Manhole	1200 x 900
S3.000	o	225	S4	60.640	59.075	1.340	Open Manhole	1200
S3.001	o	225	S5	60.734	58.929	1.580	Open Manhole	1200
S3.002	o	300	S6	60.638	58.715	1.623	Open Manhole	1200
S3.003	o	300	S7	60.959	58.669	1.990	Open Manhole	1200
S2.001	o	300	S8	60.990	58.621	2.069	Open Manhole	1200
S2.002	o	300	S9	60.991	58.554	2.137	Open Manhole	1200
S1.002	o	300	S10	61.009	58.441	2.268	Open Manhole	1200
S4.000	o	225	S11	61.050	60.200	0.625	Open Manhole	1200 x 900
S4.001	o	225	S12	61.050	60.061	0.764	Open Manhole	1200 x 900
S4.002	o	225	S13	61.050	60.002	0.823	Open Manhole	1200 x 900

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)
S1.000	68.557	165.0	S2	61.477	59.706	1.546	Open Manhole	1200
S1.001	23.171	165.0	S10	61.009	59.565	1.219	Open Manhole	1200
S2.000	17.217	37.8	S8	60.990	59.745	1.020	Open Manhole	1200
S3.000	24.049	164.7	S5	60.734	58.929	1.580	Open Manhole	1200
S3.001	23.013	165.0	S6	60.638	58.790	1.623	Open Manhole	1200
S3.002	10.847	240.0	S7	60.959	58.669	1.990	Open Manhole	1200
S3.003	11.661	240.0	S8	60.990	58.621	2.069	Open Manhole	1200
S2.001	11.072	165.2	S9	60.991	58.554	2.137	Open Manhole	1200
S2.002	18.611	165.0	S10	61.009	58.441	2.268	Open Manhole	1200
S1.002	26.242	240.7	S14	61.026	58.332	2.394	Open Manhole	1500
S4.000	22.979	165.3	S12	61.050	60.061	0.764	Open Manhole	1200 x 900
S4.001	9.692	165.0	S13	61.050	60.002	0.823	Open Manhole	1200 x 900
S4.002	7.586	13.9	S14	61.026	59.456	1.345	Open Manhole	1500

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S1.003	o	375	S14	61.026	58.257	2.394	Open Manhole	1500
S1.004	o	450	S15	61.022	58.096	2.476	Open Manhole	1500
S5.000	o	225	S16	61.136	59.658	1.253	Open Manhole	1200
S5.001	o	300	S17	60.874	59.374	1.200	Open Manhole	1200
S5.002	o	300	S18	60.900	59.293	1.307	Open Manhole	1200
S1.005	o	525	S19	61.017	57.946	2.546	Open Manhole	1500
S1.006	o	525	S20	61.014	57.932	2.557	Open Manhole	1500
S1.007	o	525	S21	61.017	57.892	2.600	Open Manhole	1500
S1.008	o	600	S22	61.050	57.795	2.655	Open Manhole	1500
S6.000	o	225	S23	61.050	60.200	0.625	Open Manhole	1200 x 900
S6.001	o	225	S24	61.050	60.124	0.701	Open Manhole	1200 x 900
S6.002	o	225	S25	61.050	60.082	0.743	Open Manhole	1200 x 900
S7.000	o	225	S26	61.050	60.200	0.625	Open Manhole	1200 x 900

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)
S1.003	27.625	321.2	S15	61.022	58.171	2.476	Open Manhole	1500
S1.004	25.048	334.0	S19	61.017	58.021	2.546	Open Manhole	1500
S5.000	34.509	165.1	S17	60.874	59.449	1.200	Open Manhole	1200
S5.001	19.485	240.0	S18	60.900	59.293	1.307	Open Manhole	1200
S5.002	17.723	240.0	S19	61.017	59.219	1.498	Open Manhole	1500
S1.005	6.844	490.0	S20	61.014	57.932	2.557	Open Manhole	1500
S1.006	19.835	490.0	S21	61.017	57.892	2.600	Open Manhole	1500
S1.007	10.640	490.0	S22	61.050	57.870	2.655	Open Manhole	1500
S1.008	15.654	1534.1	S48	61.050	57.785	2.665	Open Manhole	1500
S6.000	12.568	165.0	S24	61.050	60.124	0.701	Open Manhole	1200 x 900
S6.001	6.983	165.0	S25	61.050	60.082	0.743	Open Manhole	1200 x 900
S6.002	3.576	15.0	S27	61.050	59.843	0.982	Open Manhole	1200 x 900
S7.000	5.453	15.0	S27	61.050	59.836	0.989	Open Manhole	1200 x 900

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S6.003	o	225	S27	61.050	59.836	0.989	Open Manhole	1200 x 900
S6.004	o	225	S28	61.050	59.625	1.200	Open Manhole	1200
S8.000	o	225	S29	60.600	59.047	1.328	Open Manhole	1200
S8.001	o	225	S30	60.640	58.907	1.508	Open Manhole	1200
S8.002	o	300	S31	60.850	58.648	1.902	Open Manhole	1200
S8.003	o	300	S32	60.851	58.555	1.995	Open Manhole	1200
S8.004	o	300	S33	60.963	58.443	2.220	Open Manhole	1200
S8.005	o	375	S34	60.983	58.273	2.335	Open Manhole	1500
S8.006	o	375	S35	61.050	58.241	2.434	Open Manhole	1500
S9.000	o	225	S36	61.050	60.250	0.575	Open Manhole	1200 x 900
S9.001	o	225	S37	61.050	60.202	0.623	Open Manhole	1200 x 900
S9.002	o	225	S38	61.050	60.182	0.643	Open Manhole	1200 x 900
S9.003	o	225	S39	61.050	59.923	0.902	Open Manhole	1200 x 900
S9.004	o	225	S40	61.050	59.609	1.216	Open Manhole	1200 x 900

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)
S6.003	6.043	28.6	S28	61.050	59.625	1.200	Open Manhole	1200
S6.004	13.202	435.7	S48	61.050	59.595	1.230	Open Manhole	1500
S8.000	23.127	165.2	S30	60.640	58.907	1.508	Open Manhole	1200
S8.001	30.370	165.1	S31	60.850	58.723	1.902	Open Manhole	1200
S8.002	22.252	240.0	S32	60.851	58.555	1.995	Open Manhole	1200
S8.003	26.866	240.0	S33	60.963	58.443	2.220	Open Manhole	1200
S8.004	22.928	240.0	S34	60.983	58.348	2.335	Open Manhole	1500
S8.005	10.250	320.3	S35	61.050	58.241	2.434	Open Manhole	1500
S8.006	12.199	321.0	S41	61.050	58.203	2.472	Open Manhole	1500
S9.000	7.993	166.5	S37	61.050	60.202	0.623	Open Manhole	1200 x 900
S9.001	3.330	165.0	S38	61.050	60.182	0.643	Open Manhole	1200 x 900
S9.002	13.019	50.3	S39	61.050	59.923	0.902	Open Manhole	1200 x 900
S9.003	4.705	15.0	S40	61.050	59.609	1.216	Open Manhole	1200 x 900
S9.004	10.360	15.0	S41	61.050	58.918	1.907	Open Manhole	1500

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PIPELINE SCHEDULES for Surface Water Permanent

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)
S8.007	o	375	S41	61.050	58.203	2.472	Open Manhole	1500
S10.000	oo	400	S42	60.800	59.110	1.290	Open Manhole	1800
S10.001	o	450	S43	60.800	59.047	1.303	Open Manhole	1800
S11.000	oo	400	S44	60.800	59.110	1.290	Open Manhole	1800
S11.001	o	450	S45	60.800	59.047	1.303	Open Manhole	1800
S10.002	o	525	S46	60.702	58.874	1.303	Open Manhole	1500
S10.003	o	600	S47	61.050	58.753	1.697	Open Manhole	1500
S1.009	o	675	S48	61.050	56.700	3.675	Open Manhole	1500
S1.010	o	675	S49	61.050	56.679	3.696	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.007	12.718	794.9	S48	61.050	58.187	2.488	Open Manhole	1500
S10.000	4.286	329.7	S43	60.800	59.097	1.303	Open Manhole	1800
S10.001	33.100	400.0	S46	60.702	58.964	1.288	Open Manhole	1500
S11.000	4.135	318.1	S45	60.800	59.097	1.303	Open Manhole	1800
S11.001	39.344	400.0	S46	60.702	58.949	1.303	Open Manhole	1500
S10.002	22.316	490.0	S47	61.050	58.828	1.697	Open Manhole	1500
S10.003	22.556	2210.5	S48	61.050	58.743	1.707	Open Manhole	1500
S1.009	13.864	660.2	S49	61.050	56.679	3.696	Open Manhole	1500
S1.010	5.584	240.0	S	61.050	56.656	3.719	Open Manhole	0

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Area Summary for Surface Water Permanent

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.132	0.132	0.132
	User	-	100	0.020	0.020	0.152
1.001	User	-	100	0.059	0.059	0.059
2.000	User	-	100	0.013	0.013	0.013
3.000	User	-	100	0.022	0.022	0.022
3.001	User	-	100	0.072	0.072	0.072
3.002	User	-	100	0.027	0.027	0.027
3.003	-	-	100	0.000	0.000	0.000
2.001	User	-	100	0.045	0.045	0.045
2.002	User	-	100	0.061	0.061	0.061
	User	-	100	0.032	0.032	0.093
1.002	User	-	100	0.042	0.042	0.042
4.000	User	-	100	0.026	0.026	0.026
	User	-	100	0.024	0.024	0.050
4.001	User	-	100	0.038	0.038	0.038
4.002	User	-	100	0.029	0.029	0.029
1.003	User	-	100	0.037	0.037	0.037
1.004	User	-	100	0.041	0.041	0.041
	User	-	100	0.021	0.021	0.062
5.000	User	-	100	0.040	0.040	0.040
	User	-	100	0.013	0.013	0.053
5.001	User	-	100	0.102	0.102	0.102
5.002	User	-	100	0.063	0.063	0.063
1.005	User	-	100	0.052	0.052	0.052
1.006	User	-	100	0.029	0.029	0.029
1.007	User	-	100	0.045	0.045	0.045
	User	-	100	0.013	0.013	0.057
1.008	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.037	0.037	0.037
	User	-	100	0.031	0.031	0.068
6.001	User	-	100	0.025	0.025	0.025
	User	-	100	0.020	0.020	0.045
6.002	User	-	100	0.017	0.017	0.017
7.000	User	-	100	0.018	0.018	0.018
6.003	User	-	100	0.017	0.017	0.017
6.004	-	-	100	0.000	0.000	0.000
8.000	User	-	100	0.027	0.027	0.027
8.001	User	-	100	0.043	0.043	0.043
8.002	User	-	100	0.022	0.022	0.022
8.003	User	-	100	0.037	0.037	0.037
8.004	User	-	100	0.065	0.065	0.065
8.005	User	-	100	0.046	0.046	0.046
8.006	-	-	100	0.000	0.000	0.000
9.000	User	-	100	0.024	0.024	0.024
	User	-	100	0.027	0.027	0.051
9.001	User	-	100	0.015	0.015	0.015

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Area Summary for Surface Water Permanent

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
9.002	User	-	100	0.024	0.024	0.024
	User	-	100	0.024	0.024	0.048
9.003	User	-	100	0.032	0.032	0.032
9.004	User	-	100	0.034	0.034	0.034
8.007	-	-	100	0.000	0.000	0.000
10.000	User	-	100	0.324	0.324	0.324
10.001	-	-	100	0.000	0.000	0.000
11.000	User	-	100	0.323	0.323	0.323
11.001	-	-	100	0.000	0.000	0.000
10.002	User	-	100	0.053	0.053	0.053
10.003	User	-	100	0.100	0.100	0.100
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.481	2.481	2.481

Free Flowing Outfall Details for Surface Water Permanent

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.010	S	61.050	56.656	0.000	0	0

Simulation Criteria for Surface Water Permanent

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 Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Summer Storms	Yes

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Synthetic Rainfall Details

Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Surface Water Permanent

Hydro-Brake® Optimum Manhole: S48, DS/PN: S1.009, Volume (m³): 19.4

Unit Reference	MD-SHE-0232-3820-3100-3820
Design Head (m)	3.100
Design Flow (l/s)	38.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	232
Invert Level (m)	56.700
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.100	38.1	Kick-Flo®	1.849	29.7
Flush-Flo™	0.889	37.8	Mean Flow over Head Range	-	33.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	37.2	3.000	37.5	7.000	56.4
0.200	23.3	1.400	36.1	3.500	40.4	7.500	58.4
0.300	31.4	1.600	34.2	4.000	43.1	8.000	60.2
0.400	34.0	1.800	30.9	4.500	45.6	8.500	62.0
0.500	35.7	2.000	30.9	5.000	48.0	9.000	63.8
0.600	36.8	2.200	32.3	5.500	50.2	9.500	65.5
0.800	37.8	2.400	33.7	6.000	52.4		
1.000	37.8	2.600	35.0	6.500	54.4		

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Storage Structures for Surface Water Permanent

Porous Car Park Manhole: S4, DS/PN: S3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	111.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	60.200	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: S29, DS/PN: S8.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	111.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	60.200	Cap Volume Depth (m)	0.300

Cellular Storage Manhole: S48, DS/PN: S1.009

Invert Level (m)	56.700	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	650.0	0.0	2.301	0.0	0.0
2.300	650.0	0.0			

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	2	+0%	100/15 Summer				60.208
S1.001	S2	30 Winter	2	+0%	100/15 Summer				59.813
S2.000	S3	30 Winter	2	+0%	100/15 Summer				60.214
S3.000	S4	120 Winter	2	+0%	30/15 Summer				59.100
S3.001	S5	15 Winter	2	+0%	30/15 Summer				59.005
S3.002	S6	15 Winter	2	+0%	30/15 Summer	100/15 Summer			58.811
S3.003	S7	15 Winter	2	+0%	30/15 Summer				58.767
S2.001	S8	15 Winter	2	+0%	30/15 Summer				58.733
S2.002	S9	15 Winter	2	+0%	30/15 Summer				58.697
S1.002	S10	15 Winter	2	+0%	30/15 Summer				58.647
S4.000	S11	30 Winter	2	+0%					60.250

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.138	0.000	0.32			12.4	OK	
S1.001	S2	-0.117	0.000	0.46			17.2	OK	
S2.000	S3	-0.211	0.000	0.01			1.0	OK	
S3.000	S4	-0.200	0.000	0.03		18	1.0	OK	
S3.001	S5	-0.149	0.000	0.25			9.2	OK	
S3.002	S6	-0.203	0.000	0.23			12.8	OK	3
S3.003	S7	-0.202	0.000	0.22			12.8	OK	
S2.001	S8	-0.188	0.000	0.30			19.2	OK	
S2.002	S9	-0.157	0.000	0.41			30.4	OK	
S1.002	S10	-0.094	0.000	0.81			51.6	OK	
S4.000	S11	-0.175	0.000	0.11			4.1	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S12	15 Winter	2	+0%	100/15 Summer				60.136
S4.002	S13	15 Winter	2	+0%					60.052
S1.003	S14	15 Winter	2	+0%	30/15 Summer				58.487
S1.004	S15	15 Winter	2	+0%	30/15 Summer				58.365
S5.000	S16	30 Winter	2	+0%	100/15 Summer				59.708
S5.001	S17	15 Winter	2	+0%	100/15 Summer				59.481
S5.002	S18	15 Winter	2	+0%	100/15 Summer				59.424
S1.005	S19	15 Winter	2	+0%	30/15 Summer				58.325
S1.006	S20	15 Winter	2	+0%	30/15 Summer				58.312
S1.007	S21	15 Winter	2	+0%	30/15 Summer				58.277
S1.008	S22	15 Winter	2	+0%	30/15 Summer				58.232
S6.000	S23	30 Winter	2	+0%	100/15 Summer				60.260
S6.001	S24	15 Winter	2	+0%	100/15 Summer				60.215
S6.002	S25	15 Winter	2	+0%	100/15 Summer				60.146
S7.000	S26	30 Winter	2	+0%					60.219
S6.003	S27	15 Winter	2	+0%	100/15 Summer				59.912
S6.004	S28	15 Winter	2	+0%	30/15 Summer				59.790
S8.000	S29	60 Winter	2	+0%	100/15 Summer				59.077
S8.001	S30	15 Winter	2	+0%	100/15 Summer				58.964
S8.002	S31	15 Winter	2	+0%	30/15 Summer				58.720
S8.003	S32	15 Winter	2	+0%	30/15 Summer				58.646
S8.004	S33	15 Winter	2	+0%	30/15 Summer				58.570
S8.005	S34	15 Winter	2	+0%	30/15 Summer				58.530
S8.006	S35	15 Winter	2	+0%	30/15 Summer				58.515
S9.000	S36	30 Winter	2	+0%					60.304
S9.001	S37	30 Winter	2	+0%					60.271
S9.002	S38	15 Winter	2	+0%					60.246
S9.003	S39	15 Winter	2	+0%	100/15 Summer				59.990
S9.004	S40	15 Winter	2	+0%					59.672
S8.007	S41	15 Winter	2	+0%	30/15 Summer				58.495
S10.000	S42	30 Winter	2	+0%	100/15 Summer				59.212
S10.001	S43	30 Winter	2	+0%	100/15 Summer				59.188
S11.000	S44	30 Winter	2	+0%	100/15 Summer				59.212
S11.001	S45	30 Winter	2	+0%	100/15 Summer				59.188
S10.002	S46	30 Winter	2	+0%	100/15 Summer				59.115
S10.003	S47	30 Winter	2	+0%	100/15 Summer				59.071
S1.009	S48	240 Winter	2	+0%	30/30 Winter				57.147
S1.010	S49	240 Winter	2	+0%					56.826

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S12	-0.150	0.000	0.24			8.0	OK	
S4.002	S13	-0.175	0.000	0.11			11.7	OK	
S1.003	S14	-0.145	0.000	0.68			66.6	OK	
S1.004	S15	-0.180	0.000	0.48			70.6	OK	
S5.000	S16	-0.175	0.000	0.11			4.3	OK	
S5.001	S17	-0.193	0.000	0.26			16.4	OK	
S5.002	S18	-0.169	0.000	0.39			24.1	OK	
S1.005	S19	-0.146	0.000	0.66			95.2	OK	
S1.006	S20	-0.145	0.000	0.64			97.1	OK	
S1.007	S21	-0.139	0.000	0.89			101.5	OK	
S1.008	S22	-0.163	0.000	0.92			101.5	OK	
S6.000	S23	-0.165	0.000	0.16			5.5	OK	
S6.001	S24	-0.134	0.000	0.34			10.2	OK	
S6.002	S25	-0.161	0.000	0.18			12.3	OK	
S7.000	S26	-0.206	0.000	0.02			1.5	OK	
S6.003	S27	-0.150	0.000	0.24			15.6	OK	
S6.004	S28	-0.060	0.000	0.88			15.7	OK	
S8.000	S29	-0.195	0.000	0.04		12	1.5	OK	
S8.001	S30	-0.168	0.000	0.15			5.5	OK	
S8.002	S31	-0.228	0.000	0.13			8.3	OK	
S8.003	S32	-0.209	0.000	0.20			12.7	OK	
S8.004	S33	-0.174	0.000	0.31			19.8	OK	
S8.005	S34	-0.117	0.000	0.29			23.3	OK	
S8.006	S35	-0.100	0.000	0.28			23.5	OK	
S9.000	S36	-0.171	0.000	0.13			4.1	OK	
S9.001	S37	-0.156	0.000	0.21			5.4	OK	
S9.002	S38	-0.161	0.000	0.18			11.3	OK	
S9.003	S39	-0.158	0.000	0.20			15.4	OK	
S9.004	S40	-0.162	0.000	0.17			19.7	OK	
S8.007	S41	-0.083	0.000	0.97			40.4	OK	
S10.000	S42	-0.298	0.000	0.15			26.5	OK	
S10.001	S43	-0.309	0.000	0.19			26.4	OK	
S11.000	S44	-0.298	0.000	0.14			26.4	OK	
S11.001	S45	-0.309	0.000	0.18			26.3	OK	
S10.002	S46	-0.284	0.000	0.34			55.8	OK	
S10.003	S47	-0.282	0.000	0.55			61.4	OK	
S1.009	S48	-0.228	0.000	0.20		139	32.0	OK	
S1.010	S49	-0.528	0.000	0.11			32.0	OK	

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	30	+0%	100/15 Summer				60.264
S1.001	S2	15 Winter	30	+0%	100/15 Summer				59.921
S2.000	S3	30 Winter	30	+0%	100/15 Summer				60.226
S3.000	S4	15 Winter	30	+0%	30/15 Summer				59.430
S3.001	S5	15 Winter	30	+0%	30/15 Summer				59.431
S3.002	S6	15 Winter	30	+0%	30/15 Summer	100/15 Summer			59.396
S3.003	S7	15 Winter	30	+0%	30/15 Summer				59.374
S2.001	S8	15 Winter	30	+0%	30/15 Summer				59.351
S2.002	S9	15 Winter	30	+0%	30/15 Summer				59.261
S1.002	S10	15 Winter	30	+0%	30/15 Summer				59.163
S4.000	S11	30 Winter	30	+0%					60.277

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.082	0.000	0.72			28.2	OK	
S1.001	S2	-0.010	0.000	1.00			37.0	OK	
S2.000	S3	-0.199	0.000	0.03			2.3	OK	
S3.000	S4	0.130	0.000	0.10		3	3.8	SURCHARGED	
S3.001	S5	0.277	0.000	0.57			21.1	SURCHARGED	
S3.002	S6	0.381	0.000	0.40			22.8	SURCHARGED	3
S3.003	S7	0.405	0.000	0.40			22.9	SURCHARGED	
S2.001	S8	0.430	0.000	0.53			34.1	SURCHARGED	
S2.002	S9	0.408	0.000	0.76			56.3	SURCHARGED	
S1.002	S10	0.422	0.000	1.62			104.0	SURCHARGED	
S4.000	S11	-0.148	0.000	0.25			9.4	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.001	S12	15 Winter	30	+0%	100/15 Summer				60.189
S4.002	S13	15 Winter	30	+0%					60.086
S1.003	S14	15 Winter	30	+0%	30/15 Summer				58.864
S1.004	S15	15 Winter	30	+0%	30/15 Summer				58.680
S5.000	S16	30 Winter	30	+0%	100/15 Summer				59.736
S5.001	S17	15 Winter	30	+0%	100/15 Summer				59.604
S5.002	S18	15 Winter	30	+0%	100/15 Summer				59.561
S1.005	S19	15 Winter	30	+0%	30/15 Summer				58.594
S1.006	S20	15 Winter	30	+0%	30/15 Summer				58.548
S1.007	S21	15 Winter	30	+0%	30/15 Summer				58.469
S1.008	S22	15 Winter	30	+0%	30/15 Summer				58.400
S6.000	S23	15 Winter	30	+0%	100/15 Summer				60.303
S6.001	S24	15 Winter	30	+0%	100/15 Summer				60.286
S6.002	S25	15 Winter	30	+0%	100/15 Summer				60.189
S7.000	S26	30 Winter	30	+0%					60.229
S6.003	S27	15 Winter	30	+0%	100/15 Summer				59.993
S6.004	S28	15 Winter	30	+0%	30/15 Summer				59.911
S8.000	S29	30 Winter	30	+0%	100/15 Summer				59.102
S8.001	S30	15 Winter	30	+0%	100/15 Summer				59.008
S8.002	S31	15 Winter	30	+0%	30/15 Summer				58.969
S8.003	S32	15 Winter	30	+0%	30/15 Summer				58.934
S8.004	S33	15 Summer	30	+0%	30/15 Summer				58.851
S8.005	S34	15 Winter	30	+0%	30/15 Summer				58.763
S8.006	S35	15 Winter	30	+0%	30/15 Summer				58.686
S9.000	S36	30 Winter	30	+0%					60.335
S9.001	S37	15 Winter	30	+0%					60.312
S9.002	S38	15 Winter	30	+0%					60.291
S9.003	S39	15 Winter	30	+0%	100/15 Summer				60.039
S9.004	S40	15 Winter	30	+0%					59.718
S8.007	S41	15 Winter	30	+0%	30/15 Summer				58.609
S10.000	S42	30 Winter	30	+0%	100/15 Summer				59.423
S10.001	S43	30 Winter	30	+0%	100/15 Summer				59.413
S11.000	S44	30 Winter	30	+0%	100/15 Summer				59.426
S11.001	S45	30 Winter	30	+0%	100/15 Summer				59.416
S10.002	S46	30 Winter	30	+0%	100/15 Summer				59.356
S10.003	S47	30 Winter	30	+0%	100/15 Summer				59.301
S1.009	S48	240 Winter	30	+0%	30/30 Winter				57.742
S1.010	S49	240 Winter	30	+0%					56.839

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S4.001	S12	-0.097	0.000	0.60			19.9	OK	
S4.002	S13	-0.141	0.000	0.29			30.1	OK	
S1.003	S14	0.232	0.000	1.44			139.9	SURCHARGED	
S1.004	S15	0.134	0.000	1.05			154.7	SURCHARGED	
S5.000	S16	-0.147	0.000	0.26			9.9	OK	
S5.001	S17	-0.070	0.000	0.67			41.3	OK	
S5.002	S18	-0.032	0.000	1.00			61.3	OK	
S1.005	S19	0.123	0.000	1.58			227.6	SURCHARGED	
S1.006	S20	0.091	0.000	1.53			232.8	SURCHARGED	
S1.007	S21	0.053	0.000	2.14			245.3	SURCHARGED	
S1.008	S22	0.005	0.000	2.23			244.9	SURCHARGED	
S6.000	S23	-0.122	0.000	0.34			11.9	OK	
S6.001	S24	-0.063	0.000	0.84			25.1	OK	
S6.002	S25	-0.117	0.000	0.45			30.8	OK	
S7.000	S26	-0.196	0.000	0.04			3.4	OK	
S6.003	S27	-0.068	0.000	0.61			39.4	OK	
S6.004	S28	0.061	0.000	2.22			39.4	SURCHARGED	
S8.000	S29	-0.170	0.000	0.14		13	5.0	OK	
S8.001	S30	-0.124	0.000	0.41			15.3	OK	
S8.002	S31	0.021	0.000	0.32			19.9	SURCHARGED	
S8.003	S32	0.079	0.000	0.47			30.1	SURCHARGED	
S8.004	S33	0.108	0.000	0.68			42.9	SURCHARGED	
S8.005	S34	0.115	0.000	0.76			60.7	SURCHARGED	
S8.006	S35	0.070	0.000	0.74			61.4	SURCHARGED	
S9.000	S36	-0.140	0.000	0.31			9.4	OK	
S9.001	S37	-0.115	0.000	0.47			12.5	OK	
S9.002	S38	-0.116	0.000	0.46			29.4	OK	
S9.003	S39	-0.109	0.000	0.52			41.0	OK	
S9.004	S40	-0.116	0.000	0.47			53.0	OK	
S8.007	S41	0.031	0.000	2.54			106.4	SURCHARGED	
S10.000	S42	-0.087	0.000	0.32			58.4	OK	
S10.001	S43	-0.084	0.000	0.41			57.5	OK	
S11.000	S44	-0.084	0.000	0.32			58.2	OK	
S11.001	S45	-0.081	0.000	0.40			57.3	OK	
S10.002	S46	-0.042	0.000	0.71			116.9	OK	
S10.003	S47	-0.052	0.000	1.10			123.3	OK	
S1.009	S48	0.367	0.000	0.23		188	37.8	SURCHARGED	
S1.010	S49	-0.515	0.000	0.13			37.8	OK	

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

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 Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 386840 398863 SJ 86840 98863
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	100	+45%	100/15 Summer				61.532
S1.001	S2	15 Winter	100	+45%	100/15 Summer				60.957
S2.000	S3	15 Winter	100	+45%	100/15 Summer				60.753
S3.000	S4	30 Winter	100	+45%	30/15 Summer				60.335
S3.001	S5	15 Winter	100	+45%	30/15 Summer				60.624
S3.002	S6	15 Winter	100	+45%	30/15 Summer	100/15 Summer			60.640
S3.003	S7	15 Winter	100	+45%	30/15 Summer				60.689
S2.001	S8	15 Winter	100	+45%	30/15 Summer				60.742

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.186	0.000	1.55			60.6	FLOOD RISK	
S1.001	S2	1.027	0.000	1.87			69.1	SURCHARGED	
S2.000	S3	0.328	0.000	0.13			9.7	FLOOD RISK	
S3.000	S4	1.035	0.000	1.38		8	51.2	SURCHARGED	
S3.001	S5	1.470	0.000	1.50			55.6	FLOOD RISK	
S3.002	S6	1.625	2.538	1.00			56.5	FLOOD	3
S3.003	S7	1.720	0.000	0.99			57.1	FLOOD RISK	
S2.001	S8	1.821	0.000	0.94			60.8	FLOOD RISK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S2.002	S9	15 Winter	100	+45%	30/15 Summer				60.741
S1.002	S10	15 Winter	100	+45%	30/15 Summer				60.650
S4.000	S11	15 Winter	100	+45%					60.338
S4.001	S12	15 Winter	100	+45%	100/15 Summer				60.307
S4.002	S13	15 Winter	100	+45%					60.183
S1.003	S14	15 Winter	100	+45%	30/15 Summer				60.058
S1.004	S15	360 Winter	100	+45%	30/15 Summer				59.688
S5.000	S16	15 Winter	100	+45%	100/15 Summer				60.016
S5.001	S17	15 Winter	100	+45%	100/15 Summer				59.979
S5.002	S18	15 Winter	100	+45%	100/15 Summer				59.825
S1.005	S19	360 Winter	100	+45%	30/15 Summer				59.683
S1.006	S20	360 Winter	100	+45%	30/15 Summer				59.681
S1.007	S21	360 Winter	100	+45%	30/15 Summer				59.677
S1.008	S22	360 Winter	100	+45%	30/15 Summer				59.674
S6.000	S23	15 Winter	100	+45%	100/15 Summer				60.675
S6.001	S24	15 Winter	100	+45%	100/15 Summer				60.625
S6.002	S25	15 Winter	100	+45%	100/15 Summer				60.521
S7.000	S26	15 Winter	100	+45%					60.357
S6.003	S27	15 Winter	100	+45%	100/15 Summer				60.354
S6.004	S28	15 Winter	100	+45%	30/15 Summer				60.116
S8.000	S29	360 Winter	100	+45%	100/15 Summer				59.687
S8.001	S30	360 Winter	100	+45%	100/15 Summer				59.686
S8.002	S31	360 Winter	100	+45%	30/15 Summer				59.684
S8.003	S32	360 Winter	100	+45%	30/15 Summer				59.682
S8.004	S33	360 Winter	100	+45%	30/15 Summer				59.680
S8.005	S34	360 Winter	100	+45%	30/15 Summer				59.677
S8.006	S35	360 Winter	100	+45%	30/15 Summer				59.675
S9.000	S36	15 Winter	100	+45%					60.396
S9.001	S37	15 Winter	100	+45%					60.382
S9.002	S38	15 Winter	100	+45%					60.367
S9.003	S39	15 Winter	100	+45%	100/15 Summer				60.154
S9.004	S40	15 Winter	100	+45%					59.779
S8.007	S41	360 Winter	100	+45%	30/15 Summer				59.674
S10.000	S42	360 Winter	100	+45%	100/15 Summer				59.679
S10.001	S43	360 Winter	100	+45%	100/15 Summer				59.679
S11.000	S44	360 Winter	100	+45%	100/15 Summer				59.679
S11.001	S45	360 Winter	100	+45%	100/15 Summer				59.679
S10.002	S46	360 Winter	100	+45%	100/15 Summer				59.676
S10.003	S47	360 Winter	100	+45%	100/15 Summer				59.673
S1.009	S48	360 Winter	100	+45%	30/30 Winter				59.671
S1.010	S49	1440 Summer	100	+45%					56.839

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S2.002	S9	1.887	0.000	1.04			77.7	FLOOD RISK	
S1.002	S10	1.909	0.000	2.28			145.7	SURCHARGED	
S4.000	S11	-0.087	0.000	0.47			17.5	OK	
S4.001	S12	0.021	0.000	1.19			39.8	SURCHARGED	
S4.002	S13	-0.044	0.000	0.55			57.2	OK	
S1.003	S14	1.426	0.000	2.23			217.2	SURCHARGED	
S1.004	S15	1.142	0.000	0.50			74.2	SURCHARGED	
S5.000	S16	0.133	0.000	0.53			20.3	SURCHARGED	
S5.001	S17	0.305	0.000	1.33			82.4	SURCHARGED	
S5.002	S18	0.233	0.000	2.03			124.2	SURCHARGED	
S1.005	S19	1.212	0.000	0.70			101.1	SURCHARGED	
S1.006	S20	1.224	0.000	0.68			104.0	SURCHARGED	
S1.007	S21	1.260	0.000	0.96			109.7	SURCHARGED	
S1.008	S22	1.279	0.000	1.00			109.7	SURCHARGED	
S6.000	S23	0.250	0.000	0.80			27.6	SURCHARGED	
S6.001	S24	0.276	0.000	1.46			43.6	SURCHARGED	
S6.002	S25	0.214	0.000	0.77			53.3	SURCHARGED	
S7.000	S26	-0.068	0.000	0.09			7.7	OK	
S6.003	S27	0.292	0.000	1.04			67.5	SURCHARGED	
S6.004	S28	0.265	0.000	3.83			67.9	SURCHARGED	
S8.000	S29	0.415	0.000	0.07		28	2.7	SURCHARGED	
S8.001	S30	0.554	0.000	0.18			7.0	SURCHARGED	
S8.002	S31	0.736	0.000	0.15			9.2	SURCHARGED	
S8.003	S32	0.827	0.000	0.20			12.9	SURCHARGED	
S8.004	S33	0.937	0.000	0.31			19.4	SURCHARGED	
S8.005	S34	1.029	0.000	0.30			23.9	SURCHARGED	
S8.006	S35	1.060	0.000	0.29			23.9	SURCHARGED	
S9.000	S36	-0.079	0.000	0.58			17.8	OK	
S9.001	S37	-0.045	0.000	0.95			25.0	OK	
S9.002	S38	-0.040	0.000	0.91			57.9	OK	
S9.003	S39	0.006	0.000	1.01			79.5	SURCHARGED	
S9.004	S40	-0.055	0.000	0.91			103.2	OK	
S8.007	S41	1.096	0.000	1.00			41.9	SURCHARGED	
S10.000	S42	0.169	0.000	0.18			32.4	SURCHARGED	
S10.001	S43	0.182	0.000	0.23			32.4	SURCHARGED	
S11.000	S44	0.169	0.000	0.18			32.3	SURCHARGED	
S11.001	S45	0.182	0.000	0.23			32.3	SURCHARGED	
S10.002	S46	0.278	0.000	0.42			69.8	SURCHARGED	
S10.003	S47	0.320	0.000	0.71			79.7	SURCHARGED	
S1.009	S48	2.296	0.000	0.23			37.8	SURCHARGED	
S1.010	S49	-0.515	0.000	0.13			37.8	OK	

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FOUL SEWERAGE DESIGN

Design Criteria for Foul Water Network

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Calculation Method	EN 752	Maximum Backdrop Height (m)	0.000
Frequency Factor	1.00	Min Design Depth for Optimisation (m)	1.000
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	12.488	0.083	150.5	0.000	1.00	136.5	0.0	1.500	o	150	Pipe/Conduit	
F2.000	6.826	0.171	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.001	5.684	0.142	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.002	4.327	0.054	80.0	0.000	1.00	28.5	0.0	1.500	o	100	Pipe/Conduit	
F2.003	1.892	0.024	80.0	0.000	1.00	28.5	0.0	1.500	o	150	Pipe/Conduit	
F3.000	8.801	0.390	22.6	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.004	3.748	0.047	79.8	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F2.005	6.610	0.083	79.6	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	58.728	0.000	0.0	136.5	0.0	114	0.81	0.71	12.6	11.7
F2.000	59.400	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F2.001	59.229	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F2.002	59.087	0.000	0.0	28.5	0.0	75	0.85	0.74	5.8	5.3
F2.003	58.983	0.000	0.0	57.0	0.0	69	0.95	0.98	17.3	7.5
F3.000	59.400	0.000	0.0	0.0	0.0	0	0.00	1.41	11.0	0.0
F2.004	58.960	0.000	0.0	57.0	0.0	69	0.95	0.98	17.3	7.5
F2.005	58.913	0.000	0.0	57.0	0.0	69	0.95	0.98	17.4	7.5

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F2.006	13.265	0.088	150.7	0.000	1.00	7.2	0.0	1.500	o	150	Pipe/Conduit	
F4.000	5.210	0.309	16.9	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F2.007	14.311	0.096	149.1	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F1.001	4.460	0.145	30.8	0.000	1.00	30.0	0.0	1.500	o	225	Pipe/Conduit	
F5.000	12.827	0.321	40.0	0.000	1.00	10.0	0.0	1.500	o	100	Pipe/Conduit	
F5.001	8.588	0.215	39.9	0.000	1.00	10.0	0.0	1.500	o	100	Pipe/Conduit	
F6.000	3.067	0.136	22.5	0.000	1.00	2.0	0.0	1.500	o	100	Pipe/Conduit	
F7.000	10.490	0.262	40.0	0.000	1.00	2.3	0.0	1.500	o	100	Pipe/Conduit	
F7.001	8.651	0.274	31.6	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F5.002	4.290	0.054	79.5	0.000	1.00	24.8	0.0	1.500	o	150	Pipe/Conduit	
F5.003	5.021	0.063	79.7	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F5.004	7.910	0.099	79.9	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F2.006	58.830	0.000	0.0	64.2	0.0	87	0.75	0.71	12.6	8.0
F4.000	59.100	0.000	0.0	0.0	0.0	0	0.00	1.63	12.8	0.0
F2.007	58.741	0.000	0.0	64.2	0.0	87	0.76	0.72	12.7	8.0
F1.001	58.570	0.000	0.0	230.7	0.0	65	1.58	2.07	82.5	15.2
F5.000	59.400	0.000	0.0	10.0	0.0	43	0.98	1.05	8.3	3.2
F5.001	59.079	0.000	0.0	20.0	0.0	52	1.08	1.06	8.3	4.5
F6.000	59.000	0.000	0.0	2.0	0.0	24	0.96	1.41	11.0	1.4
F7.000	59.400	0.000	0.0	2.3	0.0	29	0.80	1.05	8.3	1.5
F7.001	59.138	0.000	0.0	2.3	0.0	27	0.87	1.19	9.3	1.5
F5.002	58.814	0.000	0.0	49.1	0.0	66	0.93	0.98	17.4	7.0
F5.003	58.760	0.000	0.0	49.1	0.0	66	0.93	0.98	17.3	7.0
F5.004	58.697	0.000	0.0	49.1	0.0	66	0.93	0.98	17.3	7.0

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F8.000	5.880	0.235	25.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F8.001	7.279	0.317	23.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F5.005	7.810	0.098	79.7	0.000	1.00	0.0	0.0	1.500	o	150	Pipe/Conduit	
F9.000	8.525	0.550	15.5	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.002	19.281	0.175	110.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F10.000	5.871	0.320	18.3	0.000	1.00	3.6	0.0	1.500	o	100	Pipe/Conduit	
F10.001	5.506	0.305	18.1	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.003	25.306	0.230	110.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F11.000	4.476	0.112	40.0	0.000	1.00	3.6	0.0	1.500	o	100	Pipe/Conduit	
F11.001	10.862	0.272	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F11.002	5.480	0.137	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F11.003	10.861	0.272	40.0	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.004	20.052	0.182	110.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F8.000	59.200	0.000	0.0	0.0	0.0	0	0.00	1.33	10.5	0.0
F8.001	58.965	0.000	0.0	0.0	0.0	0	0.00	1.39	10.9	0.0
F5.005	58.598	0.000	0.0	49.1	0.0	66	0.93	0.98	17.3	7.0
F9.000	59.100	0.000	0.0	0.0	0.0	0	0.00	1.70	13.3	0.0
F1.002	58.425	0.000	0.0	279.8	0.0	97	1.02	1.09	43.5	16.7
F10.000	59.000	0.000	0.0	3.6	0.0	27	1.12	1.56	12.2	1.9
F10.001	58.680	0.000	0.0	3.6	0.0	27	1.13	1.57	12.3	1.9
F1.003	58.250	0.000	0.0	283.4	0.0	97	1.03	1.09	43.5	16.8
F11.000	59.400	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F11.001	59.288	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F11.002	59.017	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F11.003	58.880	0.000	0.0	3.6	0.0	33	0.85	1.05	8.3	1.9
F1.004	58.020	0.000	0.0	287.0	0.0	97	1.03	1.09	43.5	16.9

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F12.000	2.399	0.060	40.0	0.000	0.70	85.0	0.0	1.500	o	100	Pipe/Conduit	
F12.001	14.437	0.361	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F12.002	12.724	0.318	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F12.003	9.687	0.242	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F12.004	11.016	0.275	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F12.005	18.013	0.450	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F12.006	8.418	0.210	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	14.229	0.119	120.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	15.927	0.133	120.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F13.000	5.286	0.132	40.0	0.000	0.70	85.0	0.0	1.500	o	100	Pipe/Conduit	
F13.001	10.487	0.262	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F13.002	6.012	0.150	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F13.003	6.530	0.163	40.0	0.000	0.70	80.0	0.0	1.500	o	150	Pipe/Conduit	
F13.004	7.220	0.181	40.0	0.000	0.70	85.0	0.0	1.500	o	150	Pipe/Conduit	
F13.005	6.476	0.162	40.0	0.000	0.70	81.0	0.0	1.500	o	150	Pipe/Conduit	
F1.007	25.774	0.368	70.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F12.000	60.288	0.000	0.0	85.0	0.0	66	1.17	1.05	8.3	6.5
F12.001	60.178	0.000	0.0	170.0	0.0	63	1.28	1.39	24.5	9.1
F12.002	59.817	0.000	0.0	255.0	0.0	71	1.35	1.39	24.5	11.2
F12.003	59.499	0.000	0.0	335.0	0.0	77	1.40	1.39	24.5	12.8
F12.004	59.257	0.000	0.0	415.0	0.0	82	1.44	1.39	24.5	14.3
F12.005	58.981	0.000	0.0	495.0	0.0	87	1.47	1.39	24.5	15.6
F12.006	58.531	0.000	0.0	575.0	0.0	91	1.50	1.39	24.5	16.8
F1.005	57.837	0.000	0.0	862.0	0.0	122	1.08	1.05	41.6	23.8
F1.006	57.719	0.000	0.0	862.0	0.0	122	1.08	1.05	41.6	23.8
F13.000	59.793	0.000	0.0	85.0	0.0	66	1.17	1.05	8.3	6.5
F13.001	59.611	0.000	0.0	165.0	0.0	63	1.28	1.39	24.5	9.0
F13.002	59.349	0.000	0.0	250.0	0.0	71	1.35	1.39	24.5	11.1
F13.003	59.198	0.000	0.0	330.0	0.0	77	1.40	1.39	24.5	12.7
F13.004	59.035	0.000	0.0	415.0	0.0	82	1.44	1.39	24.5	14.3
F13.005	58.855	0.000	0.0	496.0	0.0	87	1.47	1.39	24.5	15.6
F1.007	57.586	0.000	0.0	1358.0	0.0	115	1.39	1.37	54.6	28.5

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Network Design Table for Foul Water Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Freq Factor	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F14.000	5.901	0.316	18.7	0.000	0.50	17.5	0.0	1.500	o	100	Pipe/Conduit	
F15.000	1.961	0.131	15.0	0.000	0.50	19.5	0.0	1.500	o	100	Pipe/Conduit	
F14.001	11.746	0.249	47.2	0.000	0.50	0.0	0.0	1.500	o	100	Pipe/Conduit	
F16.000	9.459	0.316	29.9	0.000	0.50	18.5	0.0	1.500	o	100	Pipe/Conduit	
F14.002	7.745	0.352	22.0	0.000	0.50	16.0	0.0	1.500	o	100	Pipe/Conduit	
F14.003	9.027	0.286	31.6	0.000	0.50	17.5	0.0	1.500	o	100	Pipe/Conduit	
F14.004	7.147	0.286	25.0	0.000	0.50	20.0	0.0	1.500	o	100	Pipe/Conduit	
F14.005	7.075	0.182	38.9	0.000	1.00	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.008	9.530	0.136	70.0	0.000	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	27.294	0.382	71.5	0.012	1.00	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F14.000	59.450	0.000	0.0	17.5	0.0	28	1.15	1.55	12.1	2.1
F15.000	59.265	0.000	0.0	19.5	0.0	27	1.26	1.73	13.6	2.2
F14.001	59.134	0.000	0.0	37.0	0.0	44	0.91	0.97	7.6	3.0
F16.000	59.164	0.000	0.0	18.5	0.0	32	0.98	1.22	9.6	2.2
F14.002	58.848	0.000	0.0	71.5	0.0	43	1.32	1.42	11.2	4.2
F14.003	58.496	0.000	0.0	89.0	0.0	50	1.19	1.19	9.3	4.7
F14.004	58.211	0.000	0.0	109.0	0.0	50	1.33	1.34	10.5	5.2
F14.005	57.925	0.000	0.0	109.0	0.0	57	1.13	1.07	8.4	5.2
F1.008	57.218	0.000	0.0	1467.0	0.0	117	1.39	1.37	54.6	29.0
F1.009	57.082	0.012	0.0	1467.0	0.0	117	1.38	1.36	54.0	29.0

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Manhole Schedules for Foul Water Network

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F1	60.650	1.922	Open Manhole	1200	F1.000	58.728	150				
F2	60.650	1.250	Open Manhole	1200	F2.000	59.400	100				
F3	60.650	1.421	Open Manhole	1200	F2.001	59.229	100	F2.000	59.229	100	
F4	60.650	1.563	Open Manhole	1200	F2.002	59.087	100	F2.001	59.087	100	
F5	60.650	1.667	Open Manhole	1200	F2.003	58.983	150	F2.002	59.033	100	
F6	60.650	1.250	Open Manhole	1200	F3.000	59.400	100				
F7	60.650	1.690	Open Manhole	1200	F2.004	58.960	150	F2.003	58.960	150	
								F3.000	59.010	100	
F8	60.650	1.737	Open Manhole	1200	F2.005	58.913	150	F2.004	58.913	150	
F9	60.650	1.820	Open Manhole	1200	F2.006	58.830	150	F2.005	58.830	150	
F10	60.650	1.550	Open Manhole	1200 x 900	F4.000	59.100	100				
F11	60.650	1.909	Open Manhole	1200	F2.007	58.741	150	F2.006	58.742	150	1
								F4.000	58.791	100	
F12	60.650	2.080	Open Manhole	1200	F1.001	58.570	225	F1.000	58.645	150	
								F2.007	58.645	150	
F13	60.650	1.250	Open Manhole	1200	F5.000	59.400	100				
F14	60.650	1.571	Open Manhole	1200	F5.001	59.079	100	F5.000	59.079	100	
F15	60.650	1.650	Open Manhole	1200	F6.000	59.000	100				
F16	60.800	1.400	Open Manhole	1200	F7.000	59.400	100				
F17	60.650	1.512	Open Manhole	1200	F7.001	59.138	100	F7.000	59.138	100	
F18	60.650	1.836	Open Manhole	1200	F5.002	58.814	150	F5.001	58.864	100	
								F6.000	58.864	100	
								F7.001	58.864	100	
F19	60.650	1.890	Open Manhole	1200	F5.003	58.760	150	F5.002	58.760	150	
F20	60.650	1.953	Open Manhole	1200	F5.004	58.697	150	F5.003	58.697	150	
F21	60.650	1.450	Open Manhole	1200	F8.000	59.200	100				
F22	60.650	1.685	Open Manhole	1200	F8.001	58.965	100	F8.000	58.965	100	
F23	60.650	2.052	Open Manhole	1200	F5.005	58.598	150	F5.004	58.598	150	
								F8.001	58.648	100	
F24	60.650	1.550	Open Manhole	1200	F9.000	59.100	100				
F25	60.650	2.225	Open Manhole	1200	F1.002	58.425	225	F1.001	58.425	225	
								F5.005	58.500	150	
								F9.000	58.550	100	
F26	60.650	1.650	Open Manhole	1200	F10.000	59.000	100				

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Manhole Schedules for Foul Water Network

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F27	60.656	1.976	Open Manhole	1200	F10.001	58.680	100	F10.000	58.680	100	
F28	60.712	2.462	Open Manhole	1200	F1.003	58.250	225	F1.002	58.250	225	
								F10.001	58.375	100	
F29	60.800	1.400	Open Manhole	1200	F11.000	59.400	100				
F30	60.800	1.512	Open Manhole	1200	F11.001	59.288	100	F11.000	59.288	100	
F31	60.682	1.665	Open Manhole	1200	F11.002	59.017	100	F11.001	59.017	100	
F32	60.653	1.773	Open Manhole	1200	F11.003	58.880	100	F11.002	58.880	100	
F33	60.796	2.777	Open Manhole	1200	F1.004	58.020	225	F1.003	58.020	225	
								F11.003	58.608	100	463
F34	61.050	0.762	Open Manhole	1200	F12.000	60.288	100				
F35	61.050	0.872	Open Manhole	1200	F12.001	60.178	150	F12.000	60.228	100	
F36	61.050	1.233	Open Manhole	1200	F12.002	59.817	150	F12.001	59.817	150	
F37	61.050	1.551	Open Manhole	1200	F12.003	59.499	150	F12.002	59.499	150	
F38	61.050	1.793	Open Manhole	1200	F12.004	59.257	150	F12.003	59.257	150	
F39	61.050	2.069	Open Manhole	1200	F12.005	58.981	150	F12.004	58.981	150	
F40	61.050	2.519	Open Manhole	1200	F12.006	58.531	150	F12.005	58.531	150	
F41	61.050	3.213	Open Manhole	1200	F1.005	57.837	225	F1.004	57.837	225	
								F12.006	58.321	150	408
F42	61.050	3.331	Open Manhole	1200	F1.006	57.719	225	F1.005	57.719	225	
F43	61.050	1.257	Open Manhole	1200	F13.000	59.793	100				
F44	61.050	1.439	Open Manhole	1200	F13.001	59.611	150	F13.000	59.661	100	
F45	61.050	1.701	Open Manhole	1200	F13.002	59.349	150	F13.001	59.349	150	
F46	61.050	1.852	Open Manhole	1200	F13.003	59.198	150	F13.002	59.198	150	
F47	61.050	2.015	Open Manhole	1200	F13.004	59.035	150	F13.003	59.035	150	
F48	61.050	2.195	Open Manhole	1200	F13.005	58.855	150	F13.004	58.855	150	
F49	61.050	3.464	Open Manhole	1200	F1.007	57.586	225	F1.006	57.586	225	
								F13.005	58.693	150	1032
F50	61.050	1.600	Open Manhole	1200	F14.000	59.450	100				
F51	61.050	1.785	Open Manhole	1200	F15.000	59.265	100				
F52	61.050	1.916	Open Manhole	1200	F14.001	59.134	100	F14.000	59.134	100	
								F15.000	59.134	100	
F53	61.050	1.886	Open Manhole	1200	F16.000	59.164	100				
F54	61.050	2.202	Open Manhole	1200	F14.002	58.848	100	F14.001	58.885	100	37
								F16.000	58.848	100	

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Manhole Schedules for Foul Water Network

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F55	61.050	2.554	Open Manhole	1200	F14.003	58.496	100	F14.002	58.496	100	
F56	61.050	2.839	Open Manhole	1200	F14.004	58.211	100	F14.003	58.211	100	
F57	61.050	3.125	Open Manhole	1200	F14.005	57.925	100	F14.004	57.925	100	
F58	61.050	3.832	Open Manhole	1200	F1.008	57.218	225	F1.007	57.218	225	
								F14.005	57.743	100	400
F59	60.954	3.872	Open Manhole	1200	F1.009	57.082	225	F1.008	57.082	225	
F	60.948	4.248	Open Manhole	0		OUTFALL		F1.009	56.700	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1	386772.783	398607.464	386772.783	398607.464	Required	
F2	386807.323	398616.092	386807.323	398616.092	Required	
F3	386814.147	398616.250	386814.147	398616.250	Required	
F4	386814.016	398621.932	386814.016	398621.932	Required	
F5	386813.510	398626.229	386813.510	398626.229	Required	
F6	386812.482	398636.342	386812.482	398636.342	Required	
F7	386812.152	398627.547	386812.152	398627.547	Required	
F8	386808.536	398626.559	386808.536	398626.559	Required	
F9	386802.594	398623.665	386802.594	398623.665	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F10	386790.502	398617.526	386790.502	398617.526	Required	
F11	386789.371	398622.611	386789.371	398622.611	Required	
F12	386775.363	398619.683	386775.363	398619.683	Required	
F13	386743.411	398600.679	386743.411	398600.679	Required	
F14	386740.549	398613.183	386740.549	398613.183	Required	
F15	386748.164	398613.034	386748.164	398613.034	Required	
F16	386742.633	398634.235	386742.633	398634.235	Required	
F17	386745.768	398624.225	386745.768	398624.225	Required	
F18	386748.639	398616.064	386748.639	398616.064	Required	
F19	386752.826	398617.000	386752.826	398617.000	Required	
F20	386757.695	398615.774	386757.695	398615.774	Required	
F21	386759.675	398609.030	386759.675	398609.030	Required	
F22	386765.347	398610.582	386765.347	398610.582	Required	
F23	386765.324	398617.861	386765.324	398617.861	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F24	386773.189	398613.896	386773.189	398613.896	Required	
F25	386771.751	398622.299	386771.751	398622.299	Required	
F26	386758.994	398635.158	386758.994	398635.158	Required	
F27	386764.540	398637.084	386764.540	398637.084	Required	
F28	386768.151	398641.242	386768.151	398641.242	Required	
F29	386811.583	398646.287	386811.583	398646.287	Required	
F30	386808.715	398642.850	386808.715	398642.850	Required	
F31	386797.860	398642.491	386797.860	398642.491	Required	
F32	386792.409	398641.924	386792.409	398641.924	Required	
F33	386790.736	398652.656	386790.736	398652.656	Required	
F34	386863.842	398673.253	386863.842	398673.253	Required	
F35	386863.681	398670.860	386863.681	398670.860	Required	
F36	386849.296	398672.090	386849.296	398672.090	Required	
F37	386836.606	398673.028	386836.606	398673.028	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F38	386826.938	398673.614	386826.938	398673.614	Required	
F39	386815.978	398674.722	386815.978	398674.722	Required	
F40	386797.994	398673.691	386797.994	398673.691	Required	
F41	386789.637	398672.677	386789.637	398672.677	Required	
F42	386787.473	398686.740	386787.473	398686.740	Required	
F43	386810.727	398693.142	386810.727	398693.142	Required	
F44	386806.083	398690.616	386806.083	398690.616	Required	
F45	386801.994	398700.272	386801.994	398700.272	Required	
F46	386796.441	398697.970	386796.441	398697.970	Required	
F47	386793.535	398703.817	386793.535	398703.817	Required	
F48	386787.061	398700.621	386787.061	398700.621	Required	
F49	386780.604	398701.110	386780.604	398701.110	Required	
F50	386745.619	398659.182	386745.619	398659.182	Required	
F51	386742.060	398664.248	386742.060	398664.248	Required	

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Manhole Schedules for Foul Water Network

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F52	386743.931	398664.836	386743.931	398664.836	Required	
F53	386735.519	398671.684	386735.519	398671.684	Required	
F54	386743.614	398676.578	386743.614	398676.578	Required	
F55	386744.293	398684.293	386744.293	398684.293	Required	
F56	386745.089	398693.285	386745.089	398693.285	Required	
F57	386752.196	398694.045	386752.196	398694.045	Required	
F58	386754.834	398700.610	386754.834	398700.610	Required	
F59	386752.736	398709.906	386752.736	398709.906	Required	
F	386725.557	398707.396			No Entry	

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PIPELINE SCHEDULES for Foul Water Network

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)
F1.000	o	150	F1	60.650	58.728	1.772	Open Manhole	1200
F2.000	o	100	F2	60.650	59.400	1.150	Open Manhole	1200
F2.001	o	100	F3	60.650	59.229	1.321	Open Manhole	1200
F2.002	o	100	F4	60.650	59.087	1.463	Open Manhole	1200
F2.003	o	150	F5	60.650	58.983	1.517	Open Manhole	1200
F3.000	o	100	F6	60.650	59.400	1.150	Open Manhole	1200
F2.004	o	150	F7	60.650	58.960	1.540	Open Manhole	1200
F2.005	o	150	F8	60.650	58.913	1.587	Open Manhole	1200
F2.006	o	150	F9	60.650	58.830	1.670	Open Manhole	1200
F4.000	o	100	F10	60.650	59.100	1.450	Open Manhole	1200 x 900
F2.007	o	150	F11	60.650	58.741	1.759	Open Manhole	1200
F1.001	o	225	F12	60.650	58.570	1.855	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)
F1.000	12.488	150.5	F12	60.650	58.645	1.855	Open Manhole	1200
F2.000	6.826	40.0	F3	60.650	59.229	1.321	Open Manhole	1200
F2.001	5.684	40.0	F4	60.650	59.087	1.463	Open Manhole	1200
F2.002	4.327	80.0	F5	60.650	59.033	1.517	Open Manhole	1200
F2.003	1.892	80.0	F7	60.650	58.960	1.540	Open Manhole	1200
F3.000	8.801	22.6	F7	60.650	59.010	1.540	Open Manhole	1200
F2.004	3.748	79.8	F8	60.650	58.913	1.587	Open Manhole	1200
F2.005	6.610	79.6	F9	60.650	58.830	1.670	Open Manhole	1200
F2.006	13.265	150.7	F11	60.650	58.742	1.758	Open Manhole	1200
F4.000	5.210	16.9	F11	60.650	58.791	1.759	Open Manhole	1200
F2.007	14.311	149.1	F12	60.650	58.645	1.855	Open Manhole	1200
F1.001	4.460	30.8	F25	60.650	58.425	2.000	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F5.000	o	100	F13	60.650	59.400	1.150	Open Manhole	1200
F5.001	o	100	F14	60.650	59.079	1.471	Open Manhole	1200
F6.000	o	100	F15	60.650	59.000	1.550	Open Manhole	1200
F7.000	o	100	F16	60.800	59.400	1.300	Open Manhole	1200
F7.001	o	100	F17	60.650	59.138	1.412	Open Manhole	1200
F5.002	o	150	F18	60.650	58.814	1.686	Open Manhole	1200
F5.003	o	150	F19	60.650	58.760	1.740	Open Manhole	1200
F5.004	o	150	F20	60.650	58.697	1.803	Open Manhole	1200
F8.000	o	100	F21	60.650	59.200	1.350	Open Manhole	1200
F8.001	o	100	F22	60.650	58.965	1.585	Open Manhole	1200
F5.005	o	150	F23	60.650	58.598	1.902	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)
F5.000	12.827	40.0	F14	60.650	59.079	1.471	Open Manhole	1200
F5.001	8.588	39.9	F18	60.650	58.864	1.686	Open Manhole	1200
F6.000	3.067	22.5	F18	60.650	58.864	1.686	Open Manhole	1200
F7.000	10.490	40.0	F17	60.650	59.138	1.412	Open Manhole	1200
F7.001	8.651	31.6	F18	60.650	58.864	1.686	Open Manhole	1200
F5.002	4.290	79.5	F19	60.650	58.760	1.740	Open Manhole	1200
F5.003	5.021	79.7	F20	60.650	58.697	1.803	Open Manhole	1200
F5.004	7.910	79.9	F23	60.650	58.598	1.902	Open Manhole	1200
F8.000	5.880	25.0	F22	60.650	58.965	1.585	Open Manhole	1200
F8.001	7.279	23.0	F23	60.650	58.648	1.902	Open Manhole	1200
F5.005	7.810	79.7	F25	60.650	58.500	2.000	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F9.000	o	100	F24	60.650	59.100	1.450	Open Manhole	1200
F1.002	o	225	F25	60.650	58.425	2.000	Open Manhole	1200
F10.000	o	100	F26	60.650	59.000	1.550	Open Manhole	1200
F10.001	o	100	F27	60.656	58.680	1.876	Open Manhole	1200
F1.003	o	225	F28	60.712	58.250	2.237	Open Manhole	1200
F11.000	o	100	F29	60.800	59.400	1.300	Open Manhole	1200
F11.001	o	100	F30	60.800	59.288	1.412	Open Manhole	1200
F11.002	o	100	F31	60.682	59.017	1.565	Open Manhole	1200
F11.003	o	100	F32	60.653	58.880	1.673	Open Manhole	1200
F1.004	o	225	F33	60.796	58.020	2.552	Open Manhole	1200
F12.000	o	100	F34	61.050	60.288	0.662	Open Manhole	1200
F12.001	o	150	F35	61.050	60.178	0.722	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)
F9.000	8.525	15.5	F25	60.650	58.550	2.000	Open Manhole	1200
F1.002	19.281	110.0	F28	60.712	58.250	2.237	Open Manhole	1200
F10.000	5.871	18.3	F27	60.656	58.680	1.876	Open Manhole	1200
F10.001	5.506	18.1	F28	60.712	58.375	2.237	Open Manhole	1200
F1.003	25.306	110.0	F33	60.796	58.020	2.552	Open Manhole	1200
F11.000	4.476	40.0	F30	60.800	59.288	1.412	Open Manhole	1200
F11.001	10.862	40.0	F31	60.682	59.017	1.565	Open Manhole	1200
F11.002	5.480	40.0	F32	60.653	58.880	1.673	Open Manhole	1200
F11.003	10.861	40.0	F33	60.796	58.608	2.088	Open Manhole	1200
F1.004	20.052	110.0	F41	61.050	57.837	2.988	Open Manhole	1200
F12.000	2.399	40.0	F35	61.050	60.228	0.722	Open Manhole	1200
F12.001	14.437	40.0	F36	61.050	59.817	1.083	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F12.002	o	150	F36	61.050	59.817	1.083	Open Manhole	1200
F12.003	o	150	F37	61.050	59.499	1.401	Open Manhole	1200
F12.004	o	150	F38	61.050	59.257	1.643	Open Manhole	1200
F12.005	o	150	F39	61.050	58.981	1.919	Open Manhole	1200
F12.006	o	150	F40	61.050	58.531	2.369	Open Manhole	1200
F1.005	o	225	F41	61.050	57.837	2.988	Open Manhole	1200
F1.006	o	225	F42	61.050	57.719	3.106	Open Manhole	1200
F13.000	o	100	F43	61.050	59.793	1.157	Open Manhole	1200
F13.001	o	150	F44	61.050	59.611	1.289	Open Manhole	1200
F13.002	o	150	F45	61.050	59.349	1.551	Open Manhole	1200
F13.003	o	150	F46	61.050	59.198	1.702	Open Manhole	1200
F13.004	o	150	F47	61.050	59.035	1.865	Open Manhole	1200
F13.005	o	150	F48	61.050	58.855	2.045	Open Manhole	1200
F1.007	o	225	F49	61.050	57.586	3.239	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)
F12.002	12.724	40.0	F37	61.050	59.499	1.401	Open Manhole	1200
F12.003	9.687	40.0	F38	61.050	59.257	1.643	Open Manhole	1200
F12.004	11.016	40.0	F39	61.050	58.981	1.919	Open Manhole	1200
F12.005	18.013	40.0	F40	61.050	58.531	2.369	Open Manhole	1200
F12.006	8.418	40.0	F41	61.050	58.321	2.579	Open Manhole	1200
F1.005	14.229	120.0	F42	61.050	57.719	3.106	Open Manhole	1200
F1.006	15.927	120.0	F49	61.050	57.586	3.239	Open Manhole	1200
F13.000	5.286	40.0	F44	61.050	59.661	1.289	Open Manhole	1200
F13.001	10.487	40.0	F45	61.050	59.349	1.551	Open Manhole	1200
F13.002	6.012	40.0	F46	61.050	59.198	1.702	Open Manhole	1200
F13.003	6.530	40.0	F47	61.050	59.035	1.865	Open Manhole	1200
F13.004	7.220	40.0	F48	61.050	58.855	2.045	Open Manhole	1200
F13.005	6.476	40.0	F49	61.050	58.693	2.207	Open Manhole	1200
F1.007	25.774	70.0	F58	61.050	57.218	3.607	Open Manhole	1200

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PIPELINE SCHEDULES for Foul Water Network

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)
F14.000	o	100	F50	61.050	59.450	1.500	Open Manhole	1200
F15.000	o	100	F51	61.050	59.265	1.685	Open Manhole	1200
F14.001	o	100	F52	61.050	59.134	1.816	Open Manhole	1200
F16.000	o	100	F53	61.050	59.164	1.786	Open Manhole	1200
F14.002	o	100	F54	61.050	58.848	2.102	Open Manhole	1200
F14.003	o	100	F55	61.050	58.496	2.454	Open Manhole	1200
F14.004	o	100	F56	61.050	58.211	2.739	Open Manhole	1200
F14.005	o	100	F57	61.050	57.925	3.025	Open Manhole	1200
F1.008	o	225	F58	61.050	57.218	3.607	Open Manhole	1200
F1.009	o	225	F59	60.954	57.082	3.647	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)
F14.000	5.901	18.7	F52	61.050	59.134	1.816	Open Manhole	1200
F15.000	1.961	15.0	F52	61.050	59.134	1.816	Open Manhole	1200
F14.001	11.746	47.2	F54	61.050	58.885	2.065	Open Manhole	1200
F16.000	9.459	29.9	F54	61.050	58.848	2.102	Open Manhole	1200
F14.002	7.745	22.0	F55	61.050	58.496	2.454	Open Manhole	1200
F14.003	9.027	31.6	F56	61.050	58.211	2.739	Open Manhole	1200
F14.004	7.147	25.0	F57	61.050	57.925	3.025	Open Manhole	1200
F14.005	7.075	38.9	F58	61.050	57.743	3.207	Open Manhole	1200
F1.008	9.530	70.0	F59	60.954	57.082	3.647	Open Manhole	1200
F1.009	27.294	71.5	F	60.948	56.700	4.023	Open Manhole	0

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Area Summary for Foul Water Network

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
2.000	0.000	0.000
2.001	0.000	0.000
2.002	0.000	0.000
2.003	0.000	0.000
3.000	0.000	0.000
2.004	0.000	0.000
2.005	0.000	0.000
2.006	0.000	0.000
4.000	0.000	0.000
2.007	0.000	0.000
1.001	0.000	0.000
5.000	0.000	0.000
5.001	0.000	0.000
6.000	0.000	0.000
7.000	0.000	0.000
7.001	0.000	0.000
5.002	0.000	0.000
5.003	0.000	0.000
5.004	0.000	0.000
8.000	0.000	0.000
8.001	0.000	0.000
5.005	0.000	0.000
9.000	0.000	0.000
1.002	0.000	0.000
10.000	0.000	0.000
10.001	0.000	0.000
1.003	0.000	0.000
11.000	0.000	0.000
11.001	0.000	0.000
11.002	0.000	0.000
11.003	0.000	0.000
1.004	0.000	0.000
12.000	0.000	0.000
12.001	0.000	0.000
12.002	0.000	0.000
12.003	0.000	0.000
12.004	0.000	0.000
12.005	0.000	0.000
12.006	0.000	0.000
1.005	0.000	0.000
1.006	0.000	0.000
13.000	0.000	0.000
13.001	0.000	0.000
13.002	0.000	0.000
13.003	0.000	0.000

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Area Summary for Foul Water Network

Pipe Number	Gross Area (ha)	Pipe Total (ha)
13.004	0.000	0.000
13.005	0.000	0.000
1.007	0.000	0.000
14.000	0.000	0.000
15.000	0.000	0.000
14.001	0.000	0.000
16.000	0.000	0.000
14.002	0.000	0.000
14.003	0.000	0.000
14.004	0.000	0.000
14.005	0.000	0.000
1.008	0.000	0.000
1.009	0.012	0.012
	Total	Total
	0.012	0.012

Free Flowing Outfall Details for Foul Water Network

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.009	F	60.948	56.700	0.000	0	0

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Appendix F Greenfield Runoff Rate Calculations

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Alex Mulroy
Site name:	MCFC Etihad Stadium
Site location:	Manchester, UK

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.48447° N
Longitude:	2.20054° W
Reference:	2803643795
Date:	Apr 12 2023 17:11

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.91

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	902	902
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.91	5.91
1 in 1 year (l/s):	5.14	5.14
1 in 30 years (l/s):	10.05	10.05
1 in 100 year (l/s):	12.29	12.29
1 in 200 years (l/s):	14.01	14.01