Appendix 11.4

DRAINAGE STRATEGY

The People's Project

Drainage Strategy

BMD01-BHE-ZX-XX-RP-C-0300

0040026

18 December 2020

Revision P08

Revision	Description	Issued by	Date	Checked
P01	Draft Planning	MR	03/10/19	NJH
P02	Final Planning	MR	04/11/19	NJH
P03	Final Planning Update	MR	18/11/19	NJH
P04	Final Planning Update	MR	20/11/19	NJH
P05	Revised Planning	MR	10/06/20	MD
P06	Planning Update	MR	18/08/20	NJH
P07	Final Planning Update	MR	21/08/20	NJH
P08	Planning Update – Outfall to Nelson Dock & updated dock water levels.	MR	18/12/20	NJH

https://burohappold.sharepoint.com/sites/040026Everton/05_Discipline Specific/C - Civil Infrastructure/03 Reports/BMD01-BHE-ZX-XX-RP-C-0300 - Drainage Strategy/BMD01-BHE-ZX-XX-RP-C-0300 - Drainage Strategy P08.docx

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1 Introduction

This report has been prepared on behalf of Everton Stadium Development Ltd (hereafter 'Everton') to support a full planning application for a proposed new stadium with associated facilities and infrastructure at Bramley-Moore Dock, Liverpool. A planning application (LPA ref. 20F/0001) was submitted to Liverpool City Council ('LCC') in December 2019 and has been subject to formal statutory consultation. Following the consultation feedback a number of design-based changes have been made to the scheme as summarised below.

This report therefore describes the drainage strategy for the proposed new development in terms of dealing with foul flows and surface water flows generated.

1.1 2020 Environmental Statement Update

This Environmental Statement technical appendix relating to the drainage strategy, has been reviewed against the following aspects and for each it has been confirmed that there are no amendments required to the content of the appendix:

- Baseline data validity: there have been no relevant changes to the baseline data;
- Legislation/policy revisions: there have been no related updates to legislation/policy that have affected either the methodology or findings of this assessment;

There were limited statutory consultee comments received in relation to the information presented in this appendix that required a response. Where relevant, clarification responses have been agreed with the relevant consultees and details are provided in Table 11.2 within ES Volume II, Chapter 11. Formal consultee comments relating to drainage were received from United Utilities and the Environment Agency. Comments and queries were received from LCC as LLFA. All responses are discussed in section 1.3 below.

Due to the relevance and scale of the proposed development amendments limited technical assessment has been undertaken to the drainage strategy to confirm the validity of the previous conclusions. Specifically, the proposed development amendments impacting the assessment are:

- Removal of the multi-storey car park (MSCP) and consequent redesign of the western elevation (including a stepped terrace area with covered access to west stand turnstiles and hospitality entrances below)
- Removal of surface car park canopy (PV relocated to the stadium roof); and
- Relocation of Outside Broadcasting (OB) compound and sub-station to the northern extent of the west quay (surface car parking relocated to the south of these structures).

The relevant assessment information is discussed within this appendix and therefore this report has been revised to reflect these updates.

The sections that have been updated are detailed below:

- Section 1.3
- Section 3.4
- Section 3.5

- Section 4.6
- Section 4.8
- Section 4.10
- Section 4.11
- Section 4.12

1.2 Key Local Stakeholders

There are four key local stakeholders and/or approving authorities associated with drainage of the application site. They are as follows:

- The Environment Agency (EA) are responsible for management of 'Main Rivers' throughout England and advise on flood risk from fluvial and tidal sources.
- Liverpool City Council (LCC) are the Lead Local Flood Authority (LLFA). LLFA's hold a responsibility for managing local flood risk in their area and are a consultee for planning applications that impact on surface water, including approval of proposed drainage and Sustainable Drainage System (SuDS) strategies. LCC have powers to maintain and operate local watercourses, 'Ordinary Watercourses' and highways.
- United Utilities (UU) are the local sewerage undertaker and potable water supplier with powers under The Water Industry Act 1991. Consultation has been undertaken and will continue with UU with respect to existing sewerage infrastructure and disposal of foul water from the site.
- Peel Ports (and The Mersey Docks & Harbour Company) are the landowner of Bramley-Moore and the adjacent dock networks (Peel Land & Property submitted the outline Liverpool Waters planning application). The docks are hydraulically interconnected and provide the surface water drainage discharge route for the quayside areas. They have therefore been consulted on the proposed surface water discharge strategy for the site.

1.3 Agreements Reached with Stakeholders

1.3.1 Foul Water Drainage – United Utilities

The foul water drainage strategy has been discussed with UU at a meeting on 30th June 2017. They have no objection to the principle of the new stadium being connected into the existing foul water system to the north-east of the site. Further details of the existing infrastructure and proposed point of connection is included later in this report.

United Utilities were approached as a statutory consultee to the original planning application (LPA ref. 20F/0001) and provided to following formal response relating to drainage:

> *In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained on a separate system with foul water draining to the public sewer and surface water draining in the most sustainable way. Following our review of the submitted Drainage Strategy, we can confirm we have no in principle objection to the proposed approach and therefore should planning permission be granted we request the following condition is attached to any subsequent Decision Notice.*

<u>Recommended Drainage Condition</u>

Prior to the commencement of development, details of a sustainable surface water drainage scheme and a foul water drainage scheme shall be submitted to and approved in writing by the Local Planning Authority. The details of the drainage schemes shall be in accordance with the principles set out in the submitted Drainage Strategy of Appendix 11.4 of the Environmental Statement (Ref: BMD01-BHE-ZX-XX-RP-C-0300 - Drainage Strategy 0040026 Dated 18 November 2019 Revision P04). The drainage schemes must include:

(i) Levels of the proposed drainage systems including proposed ground and finished floor levels in AOD;

(ii) Foul and surface water shall drain on separate systems; and

(iii) A timetable for its implementation.

The approved schemes shall also be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards and no surface water shall discharge to the public sewer either directly or indirectly.

The development hereby permitted shall be carried out only in accordance with the approved drainage schemes and retained thereafter for the lifetime of the development.

Reason: To promote sustainable development, secure proper drainage and to manage the risk of flooding and pollution.

Please note, United Utilities are not responsible for determining an acceptable rate of discharge to the dock. This is a matter for discussion with the Lead Local Flood Authority, the Environment Agency and Peel.

Our understanding is that the applicant is not proposing to adopt the on-site drainage system. If the applicant intends to offer wastewater assets forward for adoption by United Utilities, the proposed detailed design will be subject to a technical appraisal by an Adoptions Engineer as we need to be sure that the proposal meets the requirements of Sewers for Adoption and United Utilities' Asset Standards. The detailed layout should be prepared with consideration of what is necessary to secure a development to an adoptable standard. This is important as drainage design can be a key determining factor of site levels and layout. The proposed design should give consideration to long term operability and give United Utilities a cost-effective proposal for the life of the assets. Therefore, should this application be approved, and the applicant wishes to progress a Section 104 agreement, we strongly recommend that no construction commences until the detailed drainage design, submitted as part of the Section 104 agreement, 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.

<u>Management and Maintenance of Sustainable Drainage Systems</u>

Without effective management and maintenance, sustainable drainage systems can fail or become ineffective. As a provider of wastewater services, we believe we have a duty to advise the Local Planning Authority of this potential risk to ensure the longevity of the surface water drainage system and the service it provides to people. We also wish to minimise the risk of a sustainable drainage system having a detrimental impact on the public sewer network should the two systems interact. We therefore recommend the Local Planning Authority include a condition in their Decision Notice regarding a management and maintenance regime for any sustainable drainage system that is included as part of the proposed development.

We recommend the Local Planning Authority consults with the Lead Local Flood Authority regarding the exact wording of any condition. You may find the below a useful example:

Recommended Management and Maintenance Condition

Prior to occupation of the development a sustainable drainage management and maintenance plan for the lifetime of the development shall be submitted to the local planning authority and agreed in writing. The sustainable drainage management and maintenance plan shall include as a minimum:

a. Arrangements for adoption by an appropriate public body or statutory undertaker, or, management and maintenance by a management company; and

b. Arrangements for inspection and ongoing maintenance of all elements of the sustainable drainage system to secure the operation of the surface water drainage scheme throughout its lifetime.

The development shall subsequently be completed, maintained and managed in accordance with the approved plan.

Reason: To ensure that management arrangements are in place for the drainage system in order to manage the risk of flooding and pollution during the lifetime of the development.

Please note United Utilities cannot provide comment on the management and maintenance of an asset that is owned by a third-party management and maintenance company. We would not be involved in the discharge of the management and maintenance condition in these circumstances.

1.3.2 Surface Water Drainage

1.3.2.1 Environment Agency

The EA have been consulted at a pre-application meeting on 19th February 2019 and confirmed agreement to the proposals described within this report; to discharge un-restricted flow into the water channel that is to be provided to the west of the stadium. This channel is to remain in hydraulic connectivity with the dock networks to the north and south, which are under the ownership and control of Peel. This connectivity ensures the water level in the channel matches the adjacent docks and is not affected by the tide level changes in the adjacent River Mersey.

The EA consultation response to the original planning application was:

No infiltration of surface water drainage into the ground where land contamination is known or suspected to be present is permitted other than with the express written consent of the local planning authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to controlled waters. The development shall be carried out in accordance with the approval details.

Reason

For the ongoing protection of the Water Environment from risks arising from land contamination.

No infiltration to the ground is proposed as part of the drainage strategy.

1.3.2.2 Lead Local Flood Authority (Liverpool City Council)

The LLFA were also consulted at the pre-application meeting on 19th February 2019 and confirmed agreement with the discharge proposals as described within this report. The LLFA also agreed to the principles of water quality management described within this report.

The LLFA provided comments and raised queries on the submitted drainage strategy, and a meeting was held on 7th May to discuss these. The queries raised and the agreed changes are summarised below:

- The pollution mitigation index for the Downstream Defender is less than the pollution hazard index for TTS and Metals. It should be equal to or greater than.

The pollution risk assessment and mitigation index for the Downstream Defender units were agreed to be correct as written in the submitted report. The text in section 4.6 below has been colour coded to clarify the different risk areas.

- The above ground storage of flooding at the south east corner of the stadium is considered excessive in relation to its location outside the entrance gates to the ground which could prevent their use. The drainage design should be amended to remove this ponding.

It was agreed that ponding during very extreme events is acceptable to the LLFA. Additional text has been added to section 4.10 within this report, and calculations provided in Appendix D to expand on the likelihood, frequency and duration of ponding.

- Require more detail regarding the frequency and maintenance of the drainage system. It would be normal practice for a detailed maintenance and operation. Plan to be produced as a separate document, which remove the requirement for any condition in a planning approval.

It was agreed with the LLFA that a maintenance strategy could be provided post-construction and be secured by an appropriate planning condition. This will allow the strategy to accurately reflect the chosen products used within the as-built system.

- Micro drainage calculations are required for a submerged outfalls situation

Submerged outfall scenario is now discussed in section 4.11 of this report and MicroDrainage results contained in Appendix B.

1.3.2.3 Peel Land & Property

The landowners Peel Land & Property have been consulted at a meeting on 16th May 2019 and have confirmed agreement to the proposed surface water discharge strategy for the site.

2 Site Context

2.1 Site Boundary and Area

The extent of the proposed development is important to the drainage design as it informs the extent of drainage catchment areas to be included in assessments of run-off rates and any temporary attenuation volumes, if required. The site extent used for drainage calculations is shown on Figure 4—5, within the drainage design section. The total site area within the red line boundary is 8.67ha.

The scheme includes the stadium, access roads, surface level car parking and large areas of public realm. Due to the current nature of the site and proposed use, there is minimal opportunities for soft landscaping or permeable surfacing. The landscape plan incorporates tree planting within the public realm to the north-east, east, and south of the site, and some grassed areas within the western quay area adjacent to the proposed sub-station building.

2.2 Geology

The geology of a site influences the selection of SuDS features that can be utilised on the site, in particular the viability of infiltration for drainage of surface water (in-line with the SuDS hierarchy). The site has been historically formed by land reclamation of the River Mersey, to provide the existing quayside areas. These are constructed as a series of stone retaining walls with fill placed between. The fill material is a mixture of made ground with variable geotechnical properties. It is assumed that infiltration cannot be relied upon as a means of surface water disposal due to uncertainty of this fill material and potential for historic contamination.

2.3 Existing Drainage Infrastructure

2.3.1 Private Foul Water Drainage

A Ground Penetration Radar (GPR) and drainage camera survey were completed on site in June 2019 to trace existing services and drainage within the site. Very little existing foul water drainage is present on site and pipework that was identified is no longer functioning and completely blocked. No connections off site were identified during the survey. Disused toilets within the Hydraulic Tower were noted to discharge directly into the dock waters via an outfall in the listed dock wall.

2.3.2 Public Foul Water Drainage

A UU Waste Water Treatment Works (WWTW) is located immediately north of the site at Wellington Dock. The works serve the majority of the city, including the existing Goodison Park stadium. Two existing combined public sewers run down Regent Road, adjacent to the site, and discharge to the WWTW:

- The Mersey Estuary Pollution Alleviation Scheme (MEPAS) tunnel. This was constructed in the 1990's to intercept combined outfalls to the Mersey and direct flows to the treatment works. It is c2.5m in diameter and approximately 10m below ground next to the site. The system is used for storage of effluent generated during heavy rainfall and flows are controlled by a series of gates along its run.
- A Combined sewer serving a more local catchment, c5m deep to invert and 675/920mm in dia.

UU have advised that a new connection to the MEPAS tunnel would not be permitted and the site should discharge to the local combined sewer. The preferred point of connection is UU chamber reference 6501, within Regent Road immediately east of the site as indicated on Figure 2—1. Consultation with UU on 30/06/2017 confirmed they had no immediate concern with the capacity of this sewer and therefore an unrestricted flow would be appropriate.

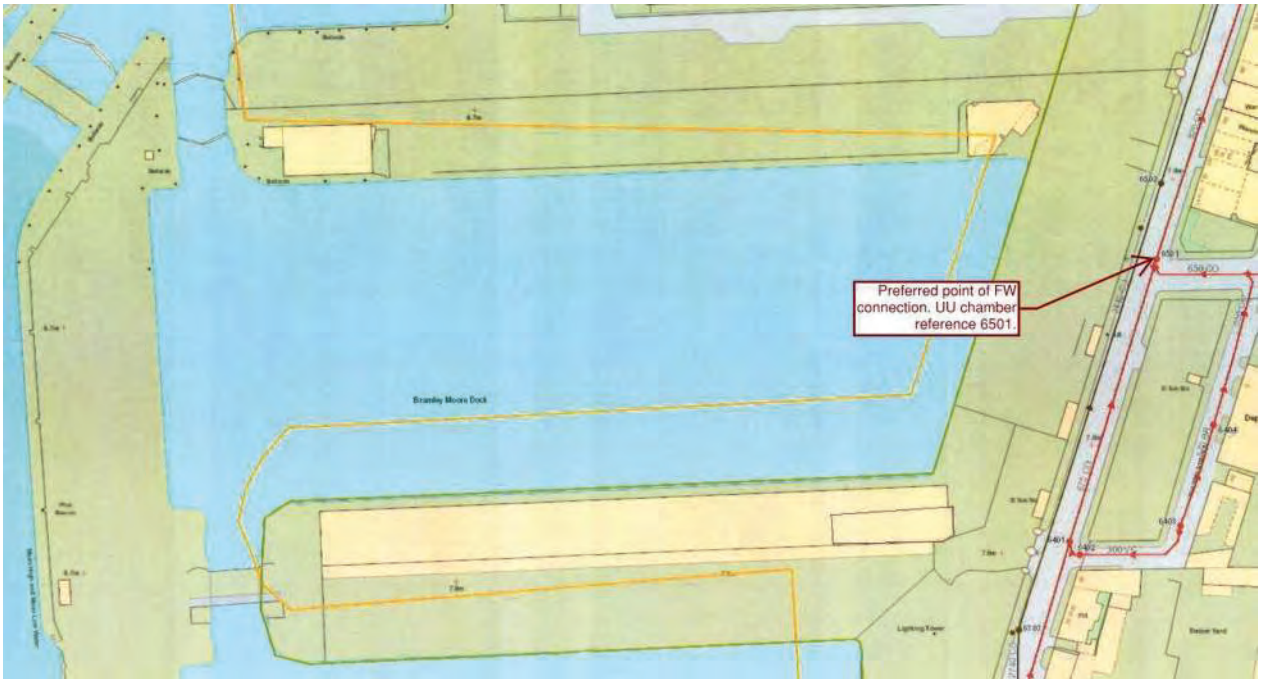


Figure 2—1 United Utilities Sewers Adjacent to Site

2.3.3 Private Surface Water Drainage

The June 2019 survey shows there to be very little in the way of formal surface water drainage infrastructure within the site. The majority of rainwater falling onto the site flows across the paved areas to drop directly over dock edge and into the dock waters.

A number of historic gullies have been observed and surveyed on the western boundary of the site alongside the River Mersey. These gullies provide drainage to the rear of the existing crown (sea) wall and connect back to Nelson Dock via a large culvert opening in the dock wall, identified during a dive survey of the wall. The line of this connection is defined by the line of historic gullies leading from the crown (sea) wall to the Nelson Dock.

It is understood from assessment of the site levels and the existing drainage infrastructure that all surface water either drains directly over edge into Bramley Moore Dock or Nelson Dock, or indirectly via the existing historic gullies noted above. All flows will ultimately connect through to the River Mersey via the wider dock water system under the control of Peel Land & Property / Peel Ports. All existing drainage is privately owned, with maintenance responsibility falling to the landowner.

Figure 2—2 Existing Historic Gullies on Western Side of Site

2.3.4 Public Surface Water Drainage

There is no dedicated public surface water network in proximity to the site. As discussed in the foul water section above, there is a large combined deep culvert (the MEPAS sewer) and a secondary combined large diameter sewer pipe in Regent Road that take combined flows.

3 Proposed Foul Water Drainage Strategy

3.1 Objectives

The proposed below ground foul water network will be designed to:

- Take the anticipated peak foul flows without surcharging or flooding,
- Collect and convey foul water away from the stadium in a safe and controlled manner,
- Provide measures to improve the quality of run-off, where contamination could occur, prior to discharge, such as the service/delivery area beneath the stands in the north-west corner of the site,
- Be sustainable and maintainable,
- Be appropriate for and compliment a developed, landmark urban space, and
- Ensure structural integrity over the duration of the development design life.

3.2 Basis of Design & Assumptions

- The on-site foul drainage infrastructure will be maintained by Everton as the landowner and operator, and have a design life of 60 years as a minimum.
- All covered areas of the site will drain to the foul water network, this includes the proposed service area and waste storage areas,
- The field of play will have a specialist drainage system. The system will have a discharge to the foul water network. This is due to the presence of fertilisers in the discharge making it unsuitable for discharge to the adjacent docks,
- The site will discharge into the existing foul water chamber located at the Regent Road / Blackstone Street junction, United Utilities chamber reference: 6501,
- There are no concerns with capacity of the receiving United Utilities sewer network, and
- Pumping stations will be designed to allow for 1-hour duration of emergency storage (during peak flows) in the event of failure.

3.3 Design Codes and Standards Applied

The foul water system network will be designed in accordance with the following Codes and Standards, as appropriate:

- BS EN 12056-2:2000, Gravity drainage systems inside buildings – Part 2: Sanitary pipework, layout and calculation,
- BS EN 752 (2017), Drains and Sewer Systems Outside of Buildings – Sewer system management,
- Building Regulations Part H (2010): Drainage and Waste Disposal (Approved Document H), and
- Sewers for Adoption (7th Edition) – A design and construction guide for developers.

3.4 Description of Foul Water Drainage

The intent for dealing with foul water flows from the stadium is to:

- Drain the area of stadium within the infilled dock area to the south by modifying existing penetrations in the existing southern dock wall.
- Drain the area of stadium to the north and south of the infilled dock area to the north and south respectively.

The approach outlined above seeks to reduce the depth of excavation adjacent to the existing hydraulic tower building. The existing dock walls are listed structures and therefore need to be preserved. The number of penetrations through the wall has been kept to a minimum. Two penetrations are proposed, both of which will re-use existing penetrations, with slight increases in the existing pipe diameter to provide sufficient capacity for the stadium foul water flows.

Once the flows have been conveyed from the stadium, the separate flows from the north and south are conveyed east and combined, prior to the proposed connection to UU manhole 6501 within Regent Road. The details of this manhole and downstream pipe are included below, based on information supplied by UU (via email received on 21/03/2019), along with the proposed connection level and size of the proposed new connection.

Table 3—1 UU FW Manhole Connection Details

UU Manhole Reference	Cover Level (mAOD)	Existing Invert Level (mAOD)	Existing Downstream Pipe Size (mm)	Proposed Invert Level (mAOD)	Proposed Pipe Size (mm)
6501	7.12	2.22	920	2.79	300

A separate, small packaged pumping station is proposed within the grow-light storage compound to take the flows from the welfare facilities for the Outdoor Broadcast compound. This will be a sub-surface chamber with duty and standby pump arrangement and will be sized to accommodate 1 hour of peak inflow in case of mechanical or electrical failure. The station should also be fitted with a high-level alarm, which could be linked back to the Building Management System (BMS). The rising main from this unit will run north and over the new isolation structure to connect into the northern foul network.

Rainwater falling onto the playing pitch of the stadium will be collected separately to other catchments. Fertiliser will be present in the water and therefore any discharge from this system will need to be directed to the foul water system.

3.5 Calculation of Foul Flow Rates

3.5.1 Sanitary Fittings

In the case of a football stadium, there will be extreme peaks in the foul flows, particularly at half time and straight after the match. At these times all toilet facilities can assumed to be in use simultaneously. Therefore, a calculation based on Discharge Units (DU's) is deemed appropriate to give a conservative peak discharge figure.

Based on the latest Architect layouts, the number of sanitary appliances has been calculated and associated DU values applied to them, as shown below. This includes for areas open to spectators and showers and sinks within team changing, physio areas and other back of house facilities.

An allowance for catering facilities has also been made based on GA plans provided by the architect, areas include: small kitchenettes, cold prep room, prep kitchen, main kitchen and a laundry facility. It should be noted that peak flows from these areas is unlikely to coincide with the peak flows from public facilities.

Total number of discharge units, εDU = **2684**

Therefore Qww = k√εDU = 1.0√2768 **= 51.8 l/s**

Where;

- Qww = Wastewater flow rate (l/s)
- k = Frequency factor taken as 1.0 (congested use e.g. toilets open to the public)
- εDU = Sum of discharge units

3.5.2 Pitch Drainage

It is proposed for flows from the pitch to be directed to the foul sewers. The pitch will generate run-off at periods of high rainfall, estimated in the table below. The pitch has an underground drainage system below the playing surface. Water will percolate through the pitch before entering the pipework, which then drains by gravity to a collection point in the south-east corner. This arrangement will behave in a similar manner to an intensive green roof.

Table 3—2 Pitch Runoff Estimates

Rainfall event	Peak flow
1 in 1yr (no climate change)	2.9 l/s
1 in 5yr (no climate change	8.1 l/s
1 in 100yr (30% climate change)	36.6 l/s

It is not considered practicable or economic to design the downstream foul water network to accommodate an unrestricted flow from the pitch, as this will require long lengths of large pipework to cater for potential large pitch flows coinciding with a peak foul water flow. It is therefore proposed to attenuate the peak pitch run-off within a culvert located between the pitch and the pitch plant room. This will allow pitch flows entering the downstream network to be controlled and prevent overloading of the system.

Limiting flows from the pitch to a maximum of 20l/sec would require 250m^3 of attenuation to be provided.

The total potential peak flow discharging off site is therefore 52.6 l/sec + 20 l/sec = **71.8 l/sec.** This is still considered to be a conservative figure. In reality the chance of a very large rainfall event coinciding with the peak foul water flow from the stadium is very low.

4 Proposed Surface Water Drainage Strategy

4.1 Objectives

The proposed surface water network will be designed to:

- Protect against flooding on the site for the following critical storms, in accordance with the 'Non-statutory technical standards for sustainable drainage systems' (DEFRA, 2015);
    - 1 in 30yr = no surface flooding of the system,
    - 1 in 100yr (+Climate Change) = temporary ponding in non-critical areas,
- Collect and convey surface water away from developed areas in a safe and controlled manner,
- Provide measures to improve the quality of run-off, where contamination could occur, prior to discharge,
- Be sustainable and maintainable,
- Be appropriate for and compliment a developed, landmark urban space, and
- Ensure structural integrity over the duration of the development design life.

4.2 Basis of Design & Assumptions

- Surface level drainage features will be adopted and maintained by Everton as landowner,
- Below ground surface water drainage systems (manholes, pipework, Outfalls and any proprietary treatment units) will be maintained by Everton, and have a design life of 60 years as a minimum.
- New penetrations of the listed dock wall should be avoided if possible. Where penetration cannot be avoided, the re-use of existing penetrations of the dock wall should be made if possible. Existing penetrations should be modified to suit pipe gradients and sizes and then new penetrations made if required as a last resort.
- Only areas of the site open the elements will drain to the surface water network, all entirely covered/enclosed areas of the site will drain to the foul water network, such as the service area,
- The field of play will have a specialist drainage system. The system will discharge to the foul water network. This is due to the presence of fertilisers making it unsuitable for discharge to the adjacent docks, and
- The River Mersey is tidal adjacent to the site and the local dock system overflows directly to the river. An uncontrolled discharge to the dock system therefore presents no risk of flooding, hence no attenuation is required within the application site.

4.3 Planning Policy, Design Codes and Standards Applied

The following national and local planning documents are relevant to the design of surface water drainage and SuDS:

- **Statutory Development Plan (Liverpool UDP, 2002)**

PROTECTION OF WATER RESOURCES EP12 1. Planning permission will not be granted for development which, in the opinion of the City Council following consultation with the Environment Agency, would adversely affect the quality or supply of surface water or groundwater as a result of:

i. the nature of the surface or wastewater discharge; or

ii. unsatisfactory arrangements for the disposal of foul sewage, trade effluent or surface water; or

iii. the disturbance of contaminated land; or

iv. the spillage or leakage of stored oil or chemicals.

2. Planning permission will not be granted for developments involving local abstraction of surface or ground water which in the opinion of the City Council following consultation with the Environment Agency would:

i . increase requirements for water, unless an adequate water supply already exists or would be provided in time to serve the development; or

ii. pose an unacceptable risk to the current supply of water users.

FLOOD PREVENTION EP13 1. Unless appropriate alleviation or mitigation measures are carried out, planning permission will not be granted for development which would:

i. be at direct unacceptable risk from flooding;

ii. be likely to increase the risk of flooding elsewhere;

iii. cause loss of access to watercourses for future maintenance;

iv. result in an adverse impact on the water environment due to additional surface water run off; or

iv. have adverse effects upon the integrity of tidal and fluvial defences.

2 . All works in, under, over or adjacent to water courses, waterbodies and the coast will need to be approved by the Environment Agency's Environmental Appraisal Procedure. Culverting and diversion will not be permitted except to enable reasonable access over a watercourse.

- **National Planning Policy Framework (NPPF, Feb 2019).** Paragraph 163 is relevant to drainage and details:

  When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment

  Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

  a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

  b) the development is appropriately flood resistant and resilient;

  c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

  d) any residual risk can be safely managed; and *e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan*

- **Liverpool Local Plan, Submission Draft (May 2018)** 'Policy R3 (Flood Risk and Water Management) states

  …development proposals should protect and enhance water quality, reduce flood risk and include water efficiency measures. All proposals for development must follow the sequential approach to determining the suitability of land for development, directing new development to areas at the lowest risk of flooding and where necessary apply the exception test, as outlined in national planning policy. Developers will be required to demonstrate, where necessary, through an appropriate Flood Risk Assessment (FRA) at the planning application stage, that development proposals will not increase flood risk on site or elsewhere and should seek to reduce the risk of flooding. New development will be required to include or contribute to flood mitigation, compensation and/or protection measures, where necessary, to manage flood risk associated with or caused by the development. Unless appropriate alleviation or mitigation measures are carried out, planning permission will not be granted for development which would:

  A. be at direct unacceptable risk from flooding from all sources, including flooding due to, or exacerbated by, rising groundwater;
  B. be likely to increase the risk of flooding;
  C. cause loss of access to watercourses for future maintenance;
  D. result in an adverse impact on the water environment due to additional surface water run-off; or
  E. have adverse effects upon the integrity of tidal and fluvial defences

  Development proposals should comply with the Water Framework Directive by contributing to the North West River Basin Management Plan and Mersey Estuary Management Plan objectives, by not adversely affecting water quality and should, where possible, seek to improve water quality unless it can be demonstrated that this would not be technically feasible.

  Where reasonably practicable development proposals should incorporate Sustainable Drainage Systems (SUDs) to manage surface water run-off. SUDs should be designed to provide effective drainage; to take account of the likely impacts of climate change and the likely changes in impermeable area; to ensure pollution is controlled; and to enhance water quality and existing habitats and create new habitats where practicable. Proposals for major developments should assess the incorporation of a sustainable drainage scheme into the development at the earliest site-planning stage.

  Proposals should demonstrate that there is adequate wastewater infrastructure and water supply capacity to serve the development. Where it is likely to create a specific shortfall or exacerbate existing deficiencies, developers will be required to adequately mitigate or compensate for those deficiencies, in line with Policies STP4 and STP5.'

- **Non-Statutory Technical Standards for Sustainable Drainage Systems (TSSuDS) (Department for Environment, Food and Rural Affairs, March 2015)** provides guidance for the hydraulic performance of Sustainable Drainage Systems (SuDS) systems to reduce flood risk and improve water quality of water discharging from a development site. The document provides guidance on best practice and is not a statutory requirement for approval.

- **Local Authority SuDS Officer Organisation (LASOO) Non-Statutory Technical Standards for Sustainable Drainage – Practice Guidance**

- **LCC Greenfield/ Brownfield sites surface water management guidance for planning applications: Version 3 – May 2018**

The storm water system network will be designed in accordance with the following Codes and Standards, as appropriate:

- BS EN 752 (2017), Drains and Sewer Systems Outside of Buildings – Sewer system management,
- Building Regulations Part H (2010): Drainage and Waste Disposal (Approved Document H),
- Sewers for Adoption (7th Edition) – A design and construction guide for developers,
- CIRIA C753 (2015), 'The SuDS Manual', and
- CIRIA C635 (2006), 'Designing for Exceedance in Urban Drainage – Good Practice'.

4.4 SuDS Philosophy

The incorporation of Sustainable Drainage Systems (SuDS) is a key requirement for all new developments and has therefore been carefully considered for this project and implemented where possible. The methodology behind SuDS is to mimic natural drainage processes and control the discharge of surface water run-off in a hierarchical manner (the SuDS Management train) starting at the source as indicated by Figure 4—1. Each site is different, and the selection of which SuDS measures may be suitable needs to be carefully considered.

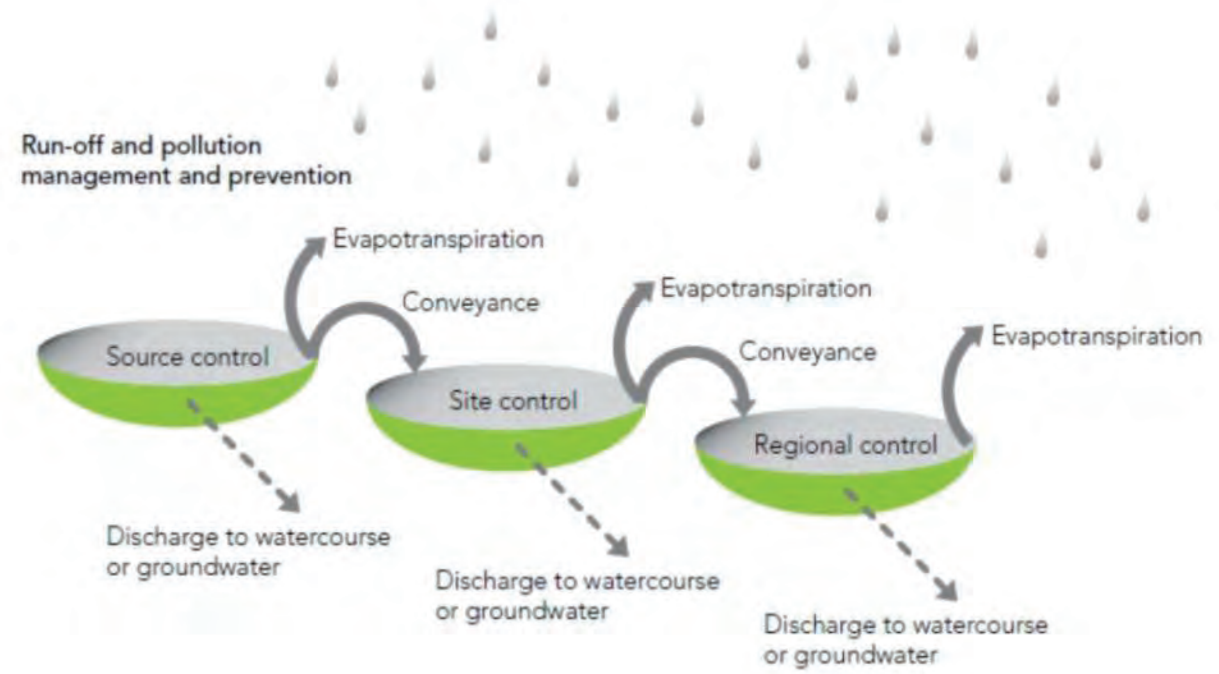


Figure 4—1 The SuDS Management Train (CIRIA)

4.5 Assessment of SuDS Viability

The detailed design for the proposed surface water drainage strategy for the application site will be designed with the CIRIA SuDS manual, particularly the hierarchy for surface water drainage discharge in mind. The hierarchy is as follows:

1. Discharge to the ground via infiltration
2. **Discharge to a watercourse or the sea**
3. Discharge to existing drainage infrastructure

4.5.1 Discharge via Infiltration

Due to the Historic nature of the application site and the need to retain the existing BMD dock walls, discharge via infiltration is not deemed feasible.

4.5.2 Discharge to a Watercourse or the Sea

Following discussion with the EA, it has been agreed that the surface water can be discharged, unrestricted, to the River Mersey via the wider dock network controlled by Peel Ports. This is common practice for developments adjacent to tidally influenced rivers, especially when located at the downstream end of the river catchment. Drainage through the wider dock network has been agreed with Peel during a meeting on 22nd October 2019.

As such this option for discharge can be utilised. Where water is clean, it can be discharged directly over the harbour wall edges (as per the existing situation), into the surrounding dock. Where treatment is required, water will pass through suitable cleansing systems (discussed in more detail later) prior to discharge to the new water channel.

4.5.3 Discharge to Existing Surface Water Infrastructure

As discussed above the nature and location of the application site allows for discharge to a watercourse to be utilised and only combined sewers are located within the vicinity of the site. For these reasons this option has been discounted.

Once the appropriate method of discharge has been selected the next step is to consider what SuDS features may be suitable for incorporation into the scheme.

The selection of SuDS features should be based on the SuDS Hierarchy and selection table shown below, although as discussed in this report the site conditions and constraints largely restrict the viability and choice of the solutions available.

Table 4—1 SuDS Assessment

SuDS Device	Suitable on Site	Comments
Permeable Pavement	No	Infiltration not considered viable. Pavement type not to be compatible with proposals to retain existing cobbles and desire to match new pavements to these. Unsuitable for use in HGV routes due to heavy loading.
Infiltration Trench	No	Infiltration not considered viable.

Infiltration Basin	No	Infiltration not considered viable.
Soakaway	No	Infiltration not considered viable.
Bio-retention/filter strips	No	Non-infiltrating arrangements may be suitable for use in any landscape buffers within the site, e.g. propriety SuDS tree pits. However, their potential for implementation will be limited and localised, hence have not been considered as a wider SuDS feature within the drainage design.
Filter Trench	No	Infiltration not considered viable.
Enhanced Dry Swale	No	No suitable landscape corridors identified
Enhanced Wet Swale	No	Insufficient green space available – retention (attenuation) of water not required.
Shallow Wetland	No	Insufficient green space available – retention (attenuation) of water not required.
Extended Detention Wetland	No	Insufficient green space available – retention (attenuation) of water not required.
Pond/wetland	No	Insufficient green space available – retention (attenuation) of water not required.
Pocket Wetland	No	Insufficient green space available – retention (attenuation) of water not required.
Submerged Gravel Wetland	No	Insufficient green space available – retention (attenuation) of water not required.
Wetland Channel	No	Insufficient green space available – retention (attenuation) of water not required.
Retention Pond	Yes	Water channel on site does serve as a retention pond and deliver a benefit to water quality by settling out silt and trapping floating debris before discharge to the wider dock network. No attenuation is needed so the feature has uncontrolled discharge to adjacent docks.
Conveyance Swale	No	No suitable landscape corridors identified
Detention Basin	No	Insufficient space – retention (attenuation) of water not required.
Sub-surface Storage	No	Retention (attenuation) of Surface Water discharge not required.
Rainwater Harvesting	Yes	Rainwater harvesting proposed.
Green/Brown Roof	No	Lightweight stadium roof construction not appropriate for green roof loads.

4.6 Water Quality Treatment Assessment

A water quality assessment has been carried out using the Simple Index Method as set out in the CIRIA SuDS Manual. This states that the index of the mitigation measure/s selected must match or exceed the index of the pollution hazard, based on land use, (for each contaminant type).

There are a couple of areas that are deemed a medium pollution hazard level as defined by the CIRIA SuDS Manual (extract below, highlighted in **red box**). These areas are proposed to be discharged to the **foul water system**.

- The pitch – This has its own pumped drainage system and will contain fertilisers in the run-off. As such this will be discharged to the foul water network, and
- Service/Delivery area – This zone will accommodate manoeuvring and parked HGVs for unloading. The area is covered and therefore run-off will be limited to wash-down, spillages and small volumes of wind driven rain. This increases the possibility of run-off becoming contaminated and therefore it is intended this zone is drained to the foul water network.

The rest of the areas of site are considered low risk on the pollution hazard index (highlighted with **blue boxes**), these include:

- Car Parking – surface car parking is provided on the west quay area. The car park provides a limited number of spaces and will be used infrequently, hence less than 300 traffic movements per day,
- Outside Broadcast Area – an area of the car parking noted above will be segregated for use by OB vehicle parking during a televised match. The area will be used infrequently for parking a small number of outside broadcast vehicles, it will therefore hence generate far less than the 300 traffic movements per day threshold noted in the pollution hazard ratings.
- Vehicle access routes (less than 300 traffic movements per day average), and public realm, and
- Stadium Roof.

Treatment to these areas is provided by a proprietary system (a Downstream Defender) installed immediately upstream of the outfalls. The SuDS Manual states that ‘These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1-year return period event, for inflow concentrations relevant to the contributing drainage area’. The pollution mitigation indices for this unit are highlighted in Figure 4—3.

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Passes through Downstream Defender

Discharges to Foul Water Network

Figure 4—2 Pollution Hazard Ratings (CIRIA)

Hydro Mitigation Indices			
Product	**TSS Index**	**Metals Index**	**Liquid HC Index**
UpFlo Filter	0.8	0.69	0.4
First Defence	0.5	0.4	0.8
Biofilter	0.8	0.8	0.8
Downstream Defender	0.5	0.4	0.8

Figure 4—3 Downstream Defender Pollution Removal Details

4.7 Climate Change Adaptation

The Environment Agency publish allowances for the potential impact of climate change on rainfall and surface water run-off. Climate change is a critical part of any assessment of flood risk and assessment of surface water design mitigation measures (from Government website https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances)

In accordance with Table 2 of this guidance (reproduced below), the following climate change allowance is included in the drainage design for the development, based on a building design life not exceeding 100 years:

- Surface Water Drainage: Additional peak rainfall intensity added 40%.

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Figure 4—4 Extract from .GOV Website Showing Climate Change Allowances

4.8 Description of Surface Water Drainage

The site catchments have been split to reflect the proposed layout of the site and minimise the number of penetrations through the historic harbour walls that are being retained (refer to Figure 4—5).

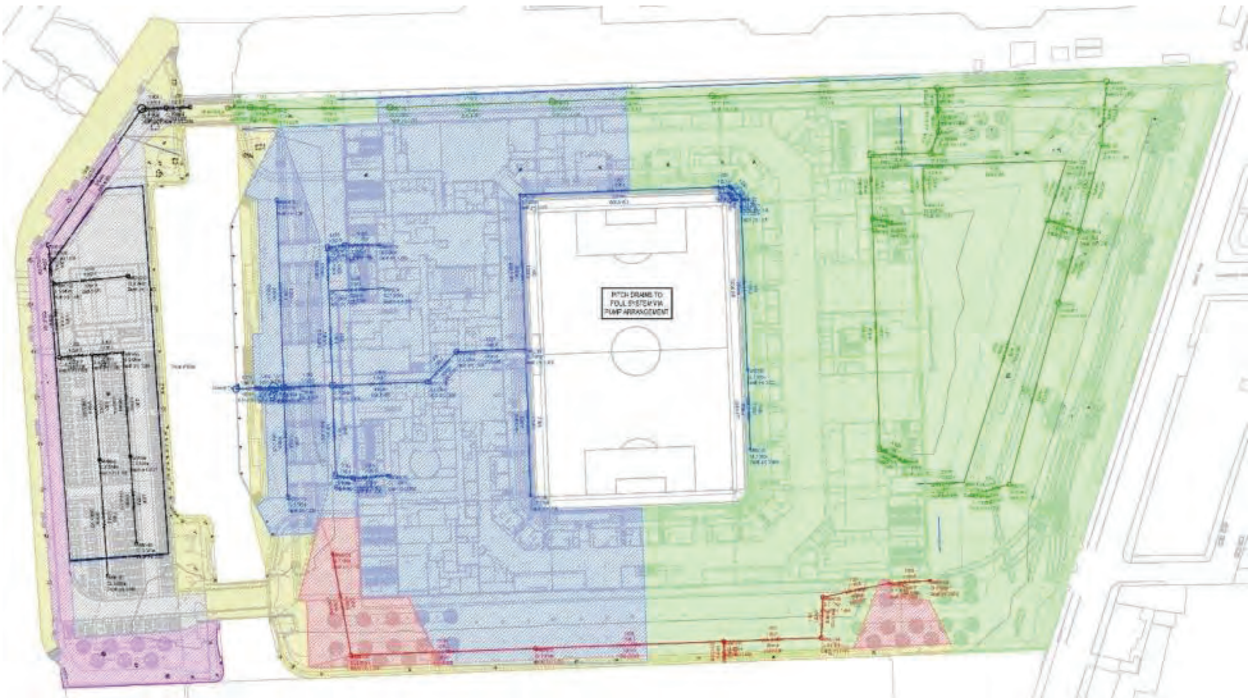


Figure 4—5 Drainage Catchment Plan

Legend

Catchment draining to North East (NE) Network (Green)

- Gross Area = 3.45 ha
- Impermeable Area = 3.018 ha

Catchment draining to Central (C) Network (Blue)

- Gross Area = 2.166 ha
- Impermeable Area = 1.926 ha

Catchment draining to western Car Park (CP) Network (Grey)

- Gross Area = 0.66 ha
- Impermeable Area = 0.56 ha

Catchment draining to South (S) Network (Red)

- Gross Area = 0.216 ha
- Impermeable Area = 0.184 ha

Area draining directly over edge (Beige)

- Gross Area = 0.586 ha

Area draining to existing gullies (Purple)

- Gross Area = 0.273 ha

The eastern half of the stadium roof and the eastern fan zone, along with the majority of the access road from the north-east corner of the Hydraulic Tower up to the new isolation structure to the north-west, form one catchment (shown green above). This catchment is collected by a network that runs around the north-east of the site, under the access road, heading west, before passing through a downstream defender unit. It then discharges, via a new outfall under the proposed northern isolation structure, into the proposed new water channel and thereafter into the dock system.

The second catchment takes the western roof area, the raised podium structure to the west of the stadium and ground level zone between the podium steps and the lower quayside steps (total area shown blue above). This catchment is collected by a network that runs under the west stand before passing through a downstream defender unit and discharging, via a new culverted outfall, through the new wall forming the water channel.

The third catchment is the area to the west of the site (shown grey above). This area comprises a surface car park, OB compound, DNO compound and a small welfare building housing toilets, OB cabinet and small sub-station. Grow light storage is provided to the north of the DNO compound. Flows from this area will be directed to new channel drains. Flows will then be collected in a below ground network and taken north to pass through a ‘Downstream defender’ unit prior to discharging via a new outfall under the proposed northern isolation structure, into the proposed new water channel and thereafter into the dock system.

The final catchment collects the small exposed areas to the south of the site (shown red above). and any wind-driven rain that is blown below the main cantilevered roof in this location. Flows are intercepted by a linear channel drain running parallel to the Nelson Dock wall, before flowing into Nelson dock via an existing outfall through the dock wall. It is proposed that the gravity roof downpipes serving the lower roof and southern balcony, below the main roof structure, are discharged directly to this network. There is minimal flow expected from these under-croft roofs as it will be protected by the main stadium roof above. Given the small catchment area is it proposed that interception of hydrocarbons and silt is achieved by using trapped channel drain outlets and a silt trap chamber immediately upstream of the outfall.

The lower quayside composite decking zone adjacent to the water channel to the west of the stadium will have a gentle slope towards the water channel to drain over edge, along with other minor areas of the site adjacent to the water edge (shown beige above).

The access road to the west of the car park/OB compound already slopes towards the River Mersey wall, where a number of large existing gullies (Figure 2—2) will collect the flows. These discharge into Nelson Dock (shown purple above).

Bramley Moore Dock is already connected to Nelson Dock to the south via the existing southern isolation structure. This structure is to remain in place to form the southern end of the new water channel. The structure has a number of pipes passing through, each has a penstock control. To the north a proposed new isolation structure will have large diameter pipes connecting through to Sandon Half-Tide Dock with no flow controls. This will allow free flow of water into Sandon Half-Tide Dock at all times and into Nelson Dock when required by Peel.

Microdrainage simulations for these networks are shown in Appendix B.

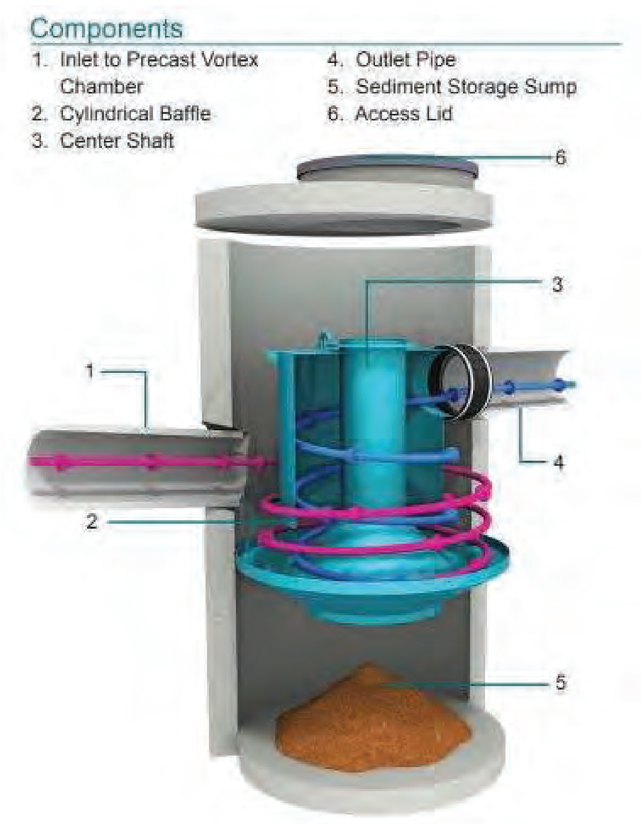


Figure 4—6 Downstream Defender

The proposed surface water drainage layout is presented on the drawings contained in Appendix C.

Some of the roof drainage is Siphonic and therefore special pressure break chambers will be required where these downpipes connect (such as the example shown in Figure 4—7 below). This allows the siphon to be broken turning the flow into normal gravity pipe flow.

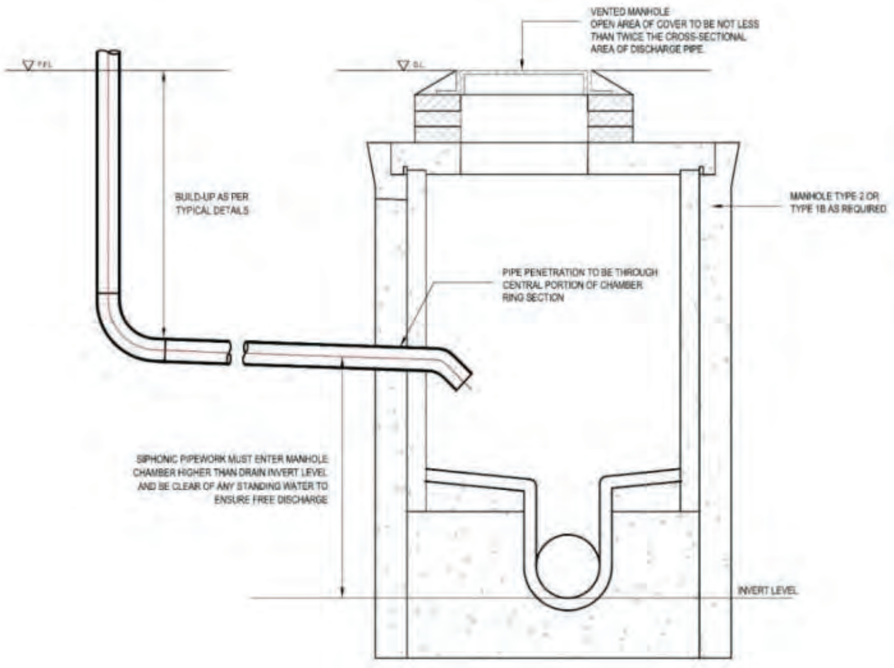


Figure 4—7 Typical SIphonic Break Chamber

4.9 Rainfall Data used for Simulation

The Flood Estimation Handbook (FEH) 2013 data set, purchased from the FEH web service, has been used to analyse rainfall at the site. This data set only allows simulation down to a 1 in 2yr rainfall return period and therefore this is the base level event pipework has been sized for.

As per national guidance (TSSuDS) and to protect against surface water flooding, three critical rainfall events have been considered to ensure the surface water design is appropriate. These are described below;

- 1 in 2yr: Used to initial size pipework and ensure self-cleansing velocities are achieved where possible.
- 1 in 30yr: To ensure no flooding to any part of the site. Surcharging of pipes and manholes acceptable.
- 1 in 100yr (+40% climate change): Any temporary flood water is directed away from buildings and stored on the site in non-critical areas. Depths should not exceed 300mm in vehicular areas to avoid the chance of flood waters moving vehicles.

Simulation of these key rainfall events has been run in microdrainage software to show that no flooding occurs during a 1 in 30yr event. Some temporary flooding does occur for the 100yr (+40%) event as discussed below.

4.10 Temporary Ponding During 1 in 100yr (+40% Climate Change) Event

The volumes of temporary ponding associated with each of the three networks and the pipe number where this flooding occurs is tabulated below and represented graphically in Figure 4—8 and Figure 4—9.

The graphical model represents the extent of flooding and gives a maximum temporary flood depth in that area. This shows that the volume of temporary flood can be accommodated in the low areas of the site without endangering the main stadium or flowing off site. A minimal depth of water is expected to enter the external stair wells and lift lobbies at the NE and SE corners of the east stand adjacent to the fan zone. Water will only ever enter these areas during a 30 min duration 1 in 100yr (+40% climate change) rainfall event. These areas are essentially open to the elements and will be subjected to wind driven rain. Gullies or slot drains will be provided in the stair wells to take any wash down, wind driven rain or flood flows, and sump pits will be provided within the base of lift pits to allow flood water to be pumped out.

The maximum depth of any temporary surface water ponding is 105mm. This occurs in the fan zone and reaches a maximum level of 6.655mAOD in the 100yr (+40% CC) event (top of existing historic wall), this is 645mm below the finished floor level of the main stadium, which is set at 7.30mAOD, and would not affect safe emergency access or egress. This depth of water is considered a low hazard risk based on guidance from 'Flood Risk Assessment Guidance for New Development' (FD2320 and FD2321).

Duration analysis has been carried out on the temporary flooding within the drainage simulation model. This shows the worst case flooding to occur for a maximum of 30 minutes, between minutes 19 and 49 of the storm event (refer to the Network Pipe Capacity Graphs in Appendix D). The likelihood of this coinciding with a match ingress/egress is very small. During this time the rainfall intensity peaks at 460mm/hour, so it's considered unlikely anyone will be venturing beyond the cover of the stadium during this time, even if an event were taking place the time.

4.10.1 Central Network

No flooding up to and including 1 in 100yr (+40% climate change) event.

4.10.2 North-Eastern Network

Pipe Number (from microdrainage model)	Volume of temporary flooding to store at surface (cu.m) 15min Storm	Volume of temporary flooding to store at surface (cu.m) 30min Storm	Volume of temporary flooding to store at surface (cu.m) 60min Storm	Total Flood Volume and Location
1.000	-	9.4	-	102 cu.m in Fan Zone during 30 minute storm.
2.000	1.9	11.4	6.1	
2.001	-	3.4	-	
3.001	11.5	29.1	19.5	
3.002	-	6.1	-	
2.002	6.5	27.8	11.3	
4.004	0.9	15.1	-	

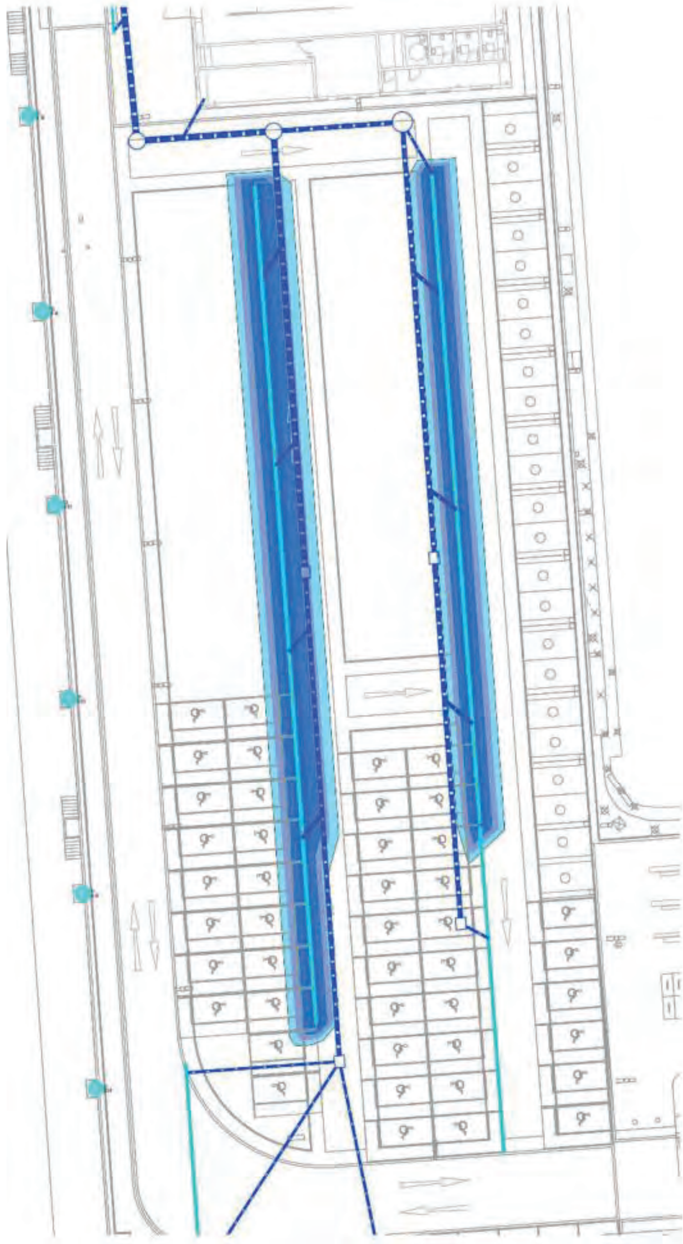
4.10.3 Car Park Network

Pipe Number (from microdrainage model)	Volume of temporary flooding to store at surface (cu.m) 15 min storm	Total Flood Volume and Location
1.000	6.5	18.9 cu.m in car park.
1.001	4.7	
2.000	4.5	
2.001	2.3	
1.002	0.9	

Temporary Ponding Depth

Number	Range From [m]	Range To [m]	Colour
1	0.000	0.020	
2	0.020	0.040	
3	0.040	0.060	
4	0.060	0.080	
5	0.080	0.106	

Figure 4—8 Plan showing temporary ponding and depths in fan zone during 15 min 1 in 100yr (+40% climate change) event



Number	Range From [m]	Range To [m]	Colour
1	0.000	0.010	
2	0.000	0.020	
3	0.020	0.030	
4	0.030	0.040	
5	0.040	0.050	
6	0.050	0.060	
7	0.060	0.070	
8	0.070	0.080	

Temporary Ponding Depth

Figure 4—9 Plan showing temporary ponding and depths in car park during 15 min 1 in 100yr (+40% climate change) event

4.11 Surcharged Outfall Analysis

According to the Nelson Dock isolation structure drawing (L24298/01) provided as an Appendix to the Liverpool Waters FRA (planning application ref:10O/2424 - now varied by ref. 19NM/1121), the water levels in Bramley Moore Dock are understood to be maintained within an operational range between 4.55 mAOD and 5.16 mAOD.

Monitoring of water levels in Bramley Moore Dock and Nelson Dock was undertaken for 2 months between September and November 2020, the results are shown in Figure 4—10. Bramley Moore Dock is shown to have a more usual operation range between 4.4mAOD and 5.2mAOD, however a couple of discreet peaks in water levels are noted in the data, where water reached a peak of 5.531mAOD. Nelson dock is separated from Bramley Moore by the southern isolation structure and is shown to have a less variable water level with less tidal influence.

Table 4—2 Water Levels from 2020 Survey

	Min (mAOD)	Mean (mAOD)	Max (mAOD)
Bramley Moore Dock	4.398	4.893	5.531
Nelson Dock	4.889	5.200	5.448

A highest figure of 5.53mAOD has been used to simulate the effects of surcharged outfalls to the surface water network design. It should be noted that this is an infrequent occurrence hence the probability of it occurring in combination with a 1 in 100 year rainfall event (+40% climate change) is small.

Three is no notable difference in the temporary flood volume when the outfalls are surcharged. The full Microdrainage simulation results are included in Appendix B.

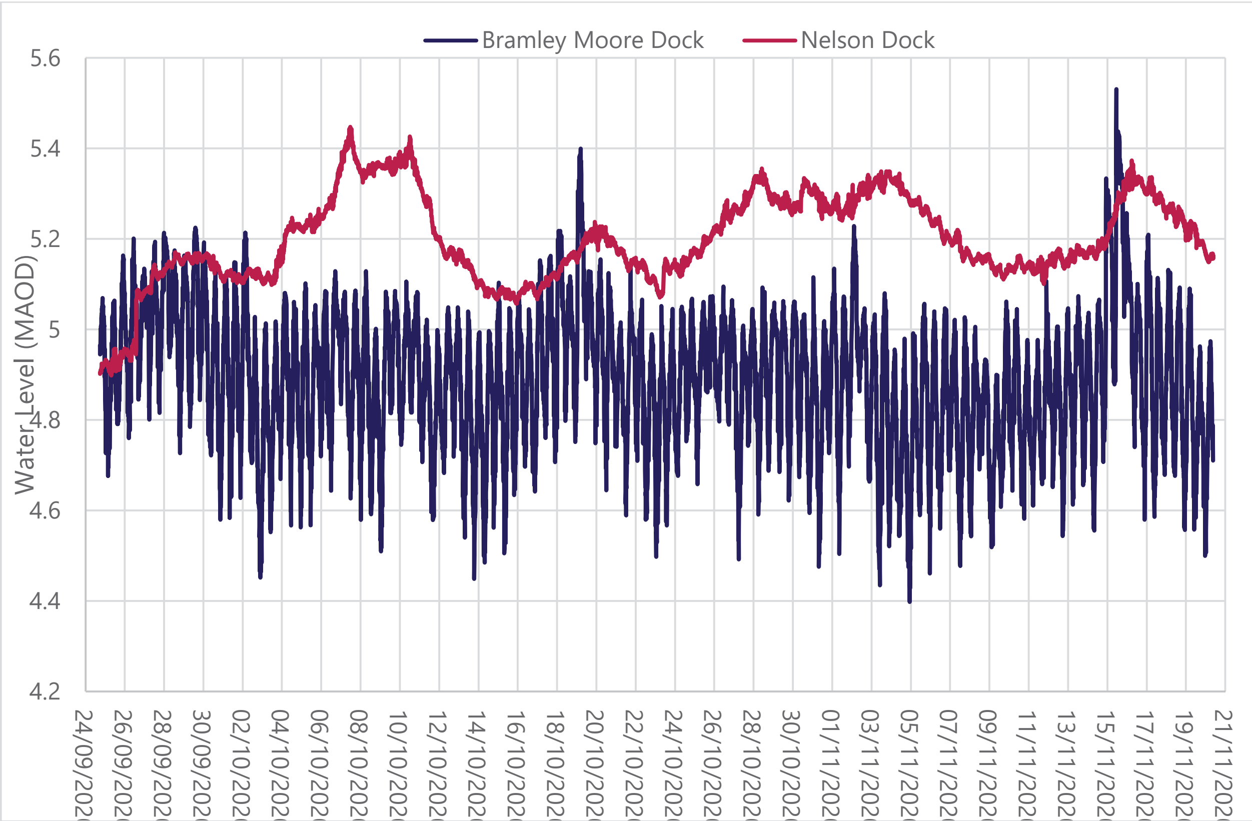


Figure 4—10 BMD and Nelson Dock Water Level Monitoring Results

4.12 Overland Flow Routes

An assessment of overland flow routes has been completed to establish the route of surface water flooding in the event of infrastructure failure or blockage, or from a rainfall event in exceedance of the design.

Overland flow routes are shown on the drawing in Appendix C, an extract is show in Figure 4—11. Water would pond temporarily in the low areas around channel drains and gullies before reaching a maximum depth of 250mm. Water would then flow over the harbour wall edges into the Nelson Dock and the water channel. A small upstand wall (150mm) along the northern boundary with United Utilities (UU) Waste Water Treatment Works (WWTW) site will ensure any temporary surface flooding in an exceedance event stays within the application site. The existing UU WWTW (Sandon) site slopes in a northerly direction away from the boundary of the application site ensuring surface water from this site cannot pond against the upstand and overflow to the application site.

External levels are designed to fall away from thresholds on the ground floor. The majority of the ground floor is raised to a flood protection level of 7.3mAOD, hence will not be prone to surface water flooding. However, the stair cores in the north-east are set a lower level for heritage reasons and are prone to shallow, short term ponding under very extreme events as described in section 4.10 above.

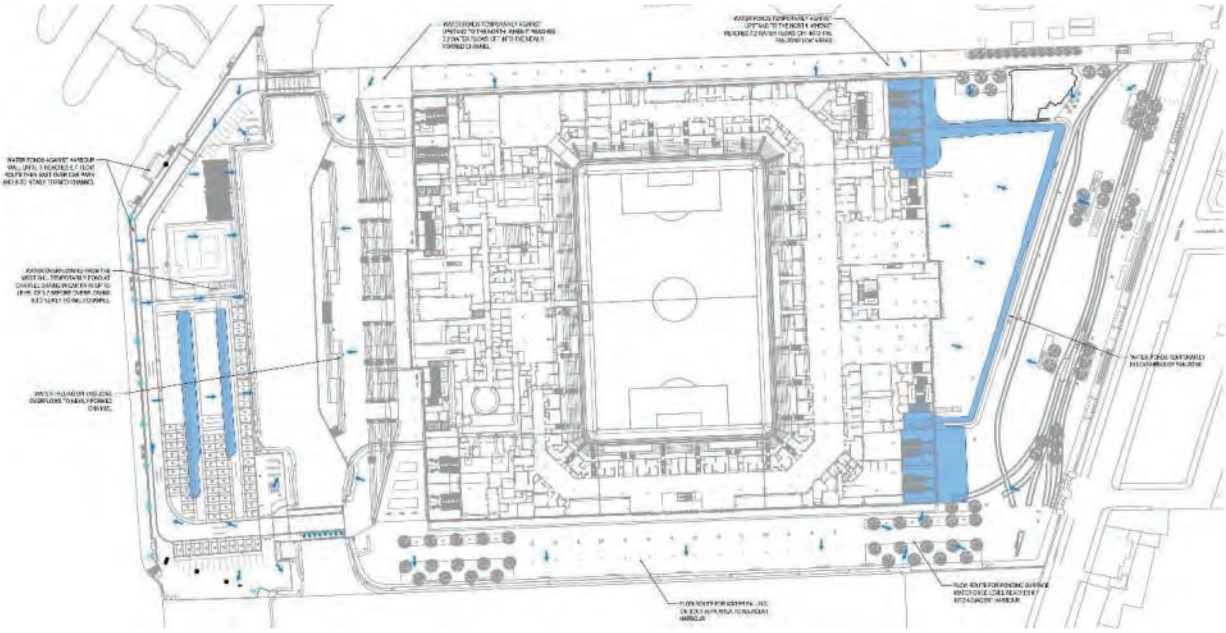


Figure 4—11 Exceedance Flows and Ponding Areas

4.13 Wave Over topping

In extreme events there is a possibility of wave overtopping occurring over the existing River Mersey wall to the west of the site, affecting a zone running parallel with the wall and extending 15m back from the Riverside face. This scenario is discussed in more detail within the Flood Risk Assessment, including proposed mitigation measures.

The total peak volume for the 1 in 200yr overtopping event (including climate change allowance) has been calculated within the FRA and estimated as 460cu.m, based on the length of exposed wall and volume per metre. As a safety check this volume has been analysed across the west quay area of the site, assuming an extreme worst-case scenario of all surface water drainage being blocked. The levels are designed such that water can only reach a maximum depth of 200mm within the car park, before overflowing to the new water channel. This ensures the risk to the public is low (based on a low hazard rating from 'Flood Risk Assessment Guidance for New Development' (FD2320 and FD2321) and is below the 300mm threshold level where vehicles can start to be moved by flood waters, as advised by Planning

Policy Statement 25 (PPS25) guidance. (It is noted that this planning guidance is now superseded, however this specific depth requirement is not addressed in the NPPF).

4.14 Operation and Maintenance

The surface water outlets should be visually inspected to check for any blockages and cleared when necessary, jetting access will be made possible from the upstream manholes. Any catch pits should be routinely inspected to check silt levels and cleared as and when necessary. Gullies, channel drains and outlet sumps to be periodically inspected and cleaned, with particular care taken for those near the low-level fan zone doors. Removable sediment buckets to be installed within gully and channel sump units for ease of maintenance.

The downstream defender should be inspected and maintained in-line with the supplier’s recommendations, the unit is designed to allow easy access for suction cleaning vehicles.

The foul packaged pumping station, associated with the OB toilets, will need to be regularly inspected and maintained as recommended by the supplier. The unit should be fitted with duty and standby pump arrangement and a high-level alarm in case of mechanical or electrical failure. As set out in the basis of design an emergency storage allowance of 1 hour of peak inflow will be designed for.

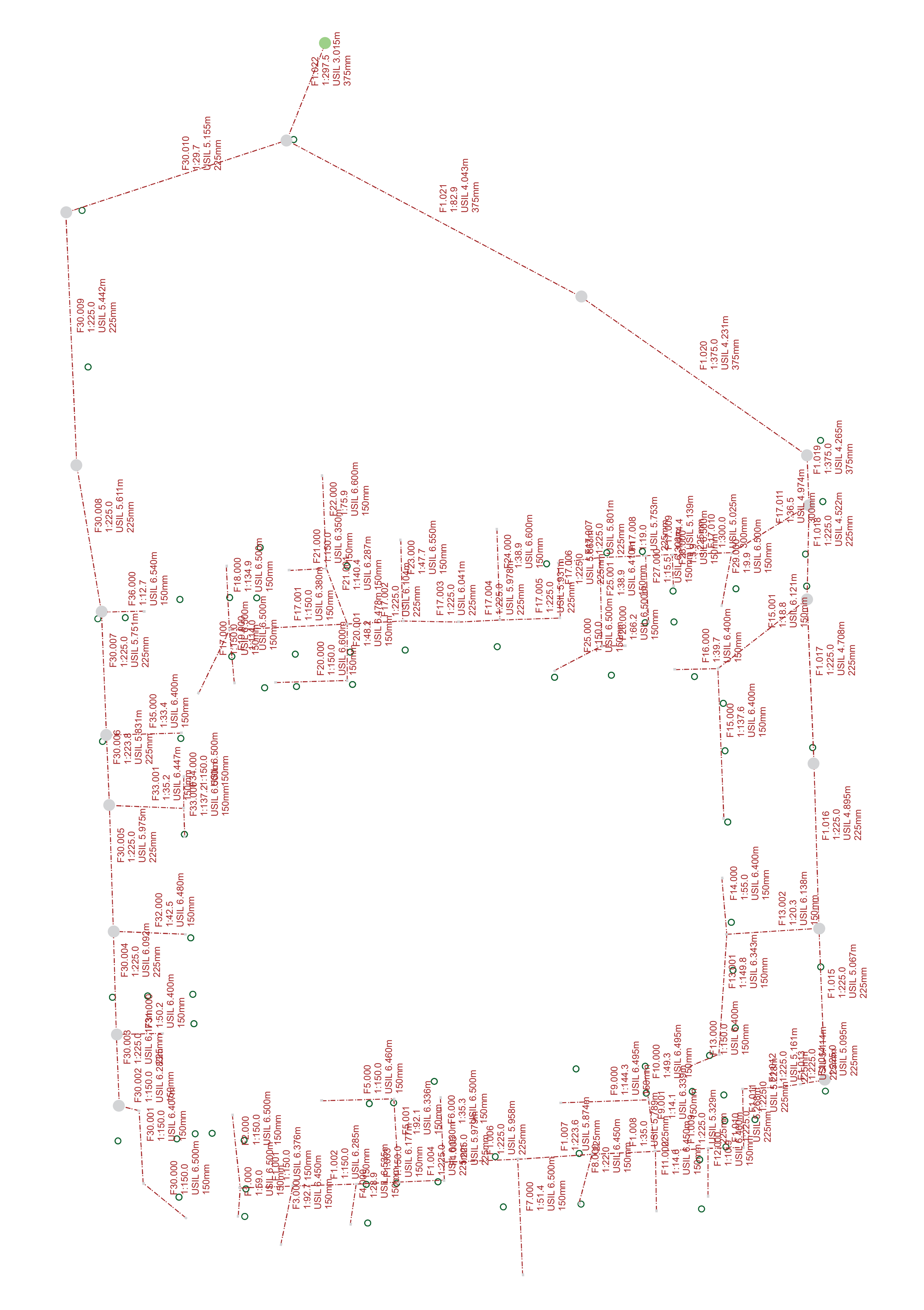
Any specific operation or maintenance information, such as for the packaged pump station, separator unit and downstream defender will be included within the Operation and Maintenance (O&M) manual produced at practical completion.

4.15 Conclusion

This document presents strategies for surface and foul water drainage that comply with the Liverpool UDP (as statutory development plan) and relevant material considerations including the NPPF (February 2019) and the Liverpool Local Plan (2018 Submission Version, May 2018):

- The proposed development does not increase the risk of flooding elsewhere.
- Discharge of surface water is to the tidal River Mersey via the wider dock network.
- The development does not result in an adverse impact on the water environment due to additional surface water run-off, nor adversely affect the quality or supply of surface water or groundwater.
- The delivery area is considered a medium risk for potential contamination. It is therefore enclosed and drains to the foul water network. All other areas of the site are lower risk and discharge through the surface water system via a 'Downstream Defender'. This is in accordance with the SuDS Manual.
- The drainage system is designed to accommodate climate change. A 40% allowance has been made for peak rainfall intensity in accordance with current government guidance (see Figure 4—4)

Appendix A Proposed FW Drainage Calculations



F1.022 1:297.5 USIL 3.015m 375mm
F30.010 1:29.7 USIL 5.155m 225mm
F1.021 1:82.9 USIL 4.043m 375mm
F30.009 1:225.0 USIL 5.442m 225mm
F1.020 1:375.0 USIL 4.231m 375mm
F1.019 1:375.0 USIL 4.265m 375mm
F30.008 1:225.0 USIL 5.611m 225mm
F1.018 1:225.0 USIL 4.522m 225mm
F22.000 1:75.9 USIL 6.600m 150mm
F23.000 1:47.7 USIL 6.550m 150mm
F24.000 1:38.9 USIL 6.600m 150mm
F36.000 1:12.7 USIL 6.540m 150mm
F18.000 1:134.9 USIL 6.500m 150mm
F17.001 1:150.0 USIL 6.380m 150mm
F17.003 1:225.0 USIL 6.041m 225mm
F17.005 1:225.0 USIL 5.931m 225mm
F30.007 1:225.0 USIL 5.751m 225mm
F20.000 1:150.0 USIL 6.600m 150mm
F16.000 1:39.7 USIL 6.400m 150mm
F15.001 1:18.8 USIL 6.121m 150mm
F1.017 1:225.0 USIL 4.708m 225mm
F35.000 1:33.4 USIL 6.400m 150mm
F15.000 1:137.6 USIL 6.400m 150mm
F1.016 1:225.0 USIL 4.895m 225mm
F30.005 1:225.0 USIL 5.975m 225mm
F32.000 1:42.5 USIL 6.480m 150mm
F14.000 1:55.0 USIL 6.400m 150mm
F13.002 1:20.3 USIL 6.138m 150mm
F30.004 1:225.0 USIL 6.092m 225mm
F13.001 1:149.8 USIL 6.343m 150mm
F1.015 1:225.0 USIL 5.067m 225mm
F5.000 1:150.0 USIL 6.460m 150mm
F9.000 1:144.3 USIL 6.495m
F10.000 1:49.3 USIL 6.495m 150mm
F2.000 1:150.0 USIL 6.500m 150mm
F6.000 1:35.3 USIL 6.500m 150mm
F1.006 1:225.0 USIL 5.958m 225mm
F1.007 1:223.6 USIL 5.874m 225mm
F3.000 1:92.7 USIL 6.450m 150mm
F30.000 1:150.0 USIL 6.500m 150mm
F7.000 1:51.4 USIL 6.500m 150mm

FOUL SEWERAGE DESIGN

Design Criteria for FW Network - Option B

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)	0.600
Calculation Method	EN 752	Maximum Backdrop Height (m)	20.000
Frequency Factor	1.00	Min Design Depth for Optimisation (m)	0.500
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)	300

Designed with Level Soffits

Network Design Table for FW Network - Option B

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	7.320	0.124	59.0	0.000	13.4	0.0	1.500	o	150	Pipe/Conduit	
F2.000	18.629	0.124	150.0	0.000	22.6	0.0	1.500	o	150	Pipe/Conduit	
F1.001	13.592	0.091	150.0	0.000	59.6	0.0	1.500	o	150	Pipe/Conduit	
F3.000	15.298	0.165	92.7	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F1.002	16.272	0.108	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F4.000	10.364	0.358	28.9	0.000	23.1	0.0	1.500	o	150	Pipe/Conduit	
F1.003	10.835	0.072	150.0	0.000	83.1	0.0	1.500	o	150	Pipe/Conduit	
F5.000	18.539	0.124	150.0	0.000	16.4	0.0	1.500	o	150	Pipe/Conduit	
F5.001	21.275	0.231	92.1	0.000	6.0	0.0	1.500	o	150	Pipe/Conduit	
F1.004	11.475	0.051	225.0	0.000	41.9	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)
F1.000	6.500	0.000	0.0	13.4	0.0	43	0.86	1.14	20.2	3.7
F2.000	6.500	0.000	0.0	22.6	0.0	64	0.66	0.71	12.6	4.8
F1.001	6.376	0.000	0.0	95.6	0.0	99	0.79	0.71	12.6	9.8
F3.000	6.450	0.000	0.0	0.0	0.0	0	0.00	0.91	16.1	0.0
F1.002	6.285	0.000	0.0	95.6	0.0	99	0.79	0.71	12.6	9.8
F4.000	6.535	0.000	0.0	23.1	0.0	41	1.20	1.63	28.8	4.8
F1.003	6.177	0.000	0.0	201.8	0.0	150	0.71	0.71	12.6«	14.2
F5.000	6.460	0.000	0.0	16.4	0.0	59	0.64	0.71	12.6	4.0
F5.001	6.336	0.000	0.0	22.4	0.0	56	0.79	0.91	16.1	4.7
F1.004	6.030	0.000	0.0	266.1	0.0	118	0.78	0.76	30.4	16.3

Network Design Table for FW Network - Option B

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.005	4.652	0.021	225.0	0.000	25.5	0.0	1.500	o	225	Pipe/Conduit	
F6.000	16.502	0.467	35.3	0.000	18.8	0.0	1.500	o	150	Pipe/Conduit	
F1.006	19.001	0.084	225.0	0.000	11.0	0.0	1.500	o	225	Pipe/Conduit	
F7.000	29.604	0.576	51.4	0.000	12.5	0.0	1.500	o	150	Pipe/Conduit	
F1.007	19.006	0.085	223.6	0.000	38.8	0.0	1.500	o	225	Pipe/Conduit	
F8.000	12.921	0.586	22.0	0.000	18.1	0.0	1.500	o	150	Pipe/Conduit	
F1.008	16.088	0.460	35.0	0.000	39.6	0.0	1.500	o	225	Pipe/Conduit	
F9.000	22.511	0.156	144.3	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F10.000	7.684	0.156	49.3	0.000	15.3	0.0	1.500	o	150	Pipe/Conduit	
F9.001	13.224	0.935	14.1	0.000	15.9	0.0	1.500	o	150	Pipe/Conduit	
F11.000	15.302	1.046	14.6	0.000	14.3	0.0	1.500	o	150	Pipe/Conduit	
F1.009	13.617	0.061	225.0	0.000	118.1	0.0	1.500	o	225	Pipe/Conduit	
F12.000	12.194	1.117	10.9	0.000	10.8	0.0	1.500	o	150	Pipe/Conduit	
F1.010	9.015	0.040	225.0	0.000	5.6	0.0	1.500	o	225	Pipe/Conduit	
F1.011	14.972	0.067	225.0	0.000	71.6	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)
F1.005	5.979	0.000	0.0	291.6	0.0	121	0.79	0.76	30.4	17.1
F6.000	6.500	0.000	0.0	18.8	0.0	41	1.09	1.48	26.1	4.3
F1.006	5.958	0.000	0.0	321.4	0.0	124	0.79	0.76	30.4	17.9
F7.000	6.500	0.000	0.0	12.5	0.0	41	0.90	1.22	21.6	3.5
F1.007	5.874	0.000	0.0	372.7	0.0	130	0.81	0.77	30.5	19.3
F8.000	6.450	0.000	0.0	18.1	0.0	36	1.28	1.87	33.1	4.3
F1.008	5.789	0.000	0.0	430.4	0.0	79	1.65	1.94	77.3	20.7
F9.000	6.495	0.000	0.0	0.0	0.0	0	0.00	0.73	12.9	0.0
F10.000	6.495	0.000	0.0	15.3	0.0	43	0.94	1.25	22.1	3.9
F9.001	6.339	0.000	0.0	31.2	0.0	37	1.63	2.34	41.3	5.6
F11.000	6.450	0.000	0.0	14.3	0.0	31	1.43	2.30	40.6	3.8
F1.009	5.329	0.000	0.0	594.0	0.0	153	0.85	0.76	30.4	24.4
F12.000	6.460	0.000	0.0	10.8	0.0	27	1.51	2.66	47.0	3.3
F1.010	5.268	0.000	0.0	610.4	0.0	154	0.85	0.76	30.4	24.7
F1.011	5.228	0.000	0.0	682.0	0.0	161	0.86	0.76	30.4	26.1

Network Design Table for FW Network - Option B

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.012	10.503	0.047	225.0	0.000	28.0	0.0	1.500	o	225	Pipe/Conduit	🔒
F1.013	4.312	0.019	225.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	🔒
F1.014	6.338	0.028	225.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	🔒
F1.015	38.622	0.172	225.0	0.000	55.6	0.0	1.500	o	225	Pipe/Conduit	🔒
F13.000	8.524	0.057	150.0	0.000	13.7	0.0	1.500	o	150	Pipe/Conduit	🔒
F13.001	30.712	0.205	149.8	0.000	8.1	0.0	1.500	o	150	Pipe/Conduit	🔒
F14.000	14.409	0.262	55.0	0.000	4.5	0.0	1.500	o	150	Pipe/Conduit	🔒
F13.002	23.725	1.168	20.3	0.000	47.6	0.0	1.500	o	150	Pipe/Conduit	🔒
F1.016	42.159	0.187	225.0	0.000	61.0	0.0	1.500	o	225	Pipe/Conduit	🔒
F1.017	41.944	0.186	225.0	0.000	53.2	0.0	1.500	o	225	Pipe/Conduit	🔒
F15.000	38.383	0.279	137.6	0.000	9.0	0.0	1.500	o	150	Pipe/Conduit	🔒
F16.000	11.081	0.279	39.7	0.000	14.5	0.0	1.500	o	150	Pipe/Conduit	🔒
F15.001	28.701	1.524	18.8	0.000	49.5	0.0	1.500	o	150	Pipe/Conduit	🔒
F1.018	24.037	0.107	225.0	0.000	78.5	0.0	1.500	o	225	Pipe/Conduit	🔒
F17.000	18.038	0.120	150.0	0.000	13.6	0.0	1.500	o	150	Pipe/Conduit	🔒
F18.000	16.189	0.120	134.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	🔒
F19.000	13.683	0.120	114.0	0.000	6.3	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)
F1.012	5.161	0.000	0.0	710.0	0.0	164	0.86	0.76	30.4	26.6
F1.013	5.114	0.000	0.0	710.0	0.0	164	0.86	0.76	30.4	26.6
F1.014	5.095	0.000	0.0	710.0	0.0	164	0.86	0.76	30.4	26.6
F1.015	5.067	0.000	0.0	765.6	0.0	169	0.86	0.76	30.4	27.7
F13.000	6.400	0.000	0.0	13.7	0.0	56	0.62	0.71	12.6	3.7
F13.001	6.343	0.000	0.0	21.8	0.0	63	0.66	0.71	12.6	4.7
F14.000	6.400	0.000	0.0	4.5	0.0	32	0.75	1.18	20.9	2.1
F13.002	6.138	0.000	0.0	73.9	0.0	51	1.62	1.95	34.5	8.6
F1.016	4.895	0.000	0.0	900.5	0.0	182	0.87	0.76	30.4	30.0
F1.017	4.708	0.000	0.0	953.7	0.0	225	0.76	0.76	30.4«	30.9
F15.000	6.400	0.000	0.0	9.0	0.0	49	0.60	0.75	13.2	3.0
F16.000	6.400	0.000	0.0	14.5	0.0	40	1.01	1.39	24.6	3.8
F15.001	6.121	0.000	0.0	73.0	0.0	50	1.66	2.03	35.8	8.5
F1.018	4.522	0.000	0.0	1105.2	0.0	225	0.76	0.76	30.4«	33.2
F17.000	6.500	0.000	0.0	13.6	0.0	56	0.62	0.71	12.6	3.7
F18.000	6.500	0.000	0.0	0.0	0.0	0	0.00	0.75	13.3	0.0
F19.000	6.500	0.000	0.0	6.3	0.0	42	0.61	0.82	14.5	2.5

Network Design Table for FW Network - Option B

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F17.001	30.174	0.201	150.0	0.000	128.4	0.0	1.500	o	150	Pipe/Conduit	
F20.000	18.244	0.122	150.0	0.000	7.3	0.0	1.500	o	150	Pipe/Conduit	
F20.001	14.423	0.299	48.2	0.000	28.6	0.0	1.500	o	150	Pipe/Conduit	
F21.000	9.431	0.063	150.0	0.000	61.8	0.0	1.500	o	150	Pipe/Conduit	
F22.000	23.767	0.313	75.9	0.000	36.2	0.0	1.500	o	150	Pipe/Conduit	
F21.001	15.161	0.108	140.4	0.000	72.7	0.0	1.500	o	150	Pipe/Conduit	
F17.002	14.270	0.063	225.0	0.000	139.9	0.0	1.500	o	225	Pipe/Conduit	
F23.000	20.681	0.434	47.7	0.000	46.7	0.0	1.500	o	150	Pipe/Conduit	
F17.003	14.128	0.063	225.0	0.000	21.2	0.0	1.500	o	225	Pipe/Conduit	
F17.004	10.554	0.047	225.0	0.000	19.1	0.0	1.500	o	225	Pipe/Conduit	
F24.000	23.108	0.594	38.9	0.000	33.2	0.0	1.500	o	150	Pipe/Conduit	
F17.005	15.357	0.068	225.0	0.000	31.5	0.0	1.500	o	225	Pipe/Conduit	
F17.006	13.990	0.062	225.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F17.007	10.754	0.048	225.0	0.000	27.8	0.0	1.500	o	225	Pipe/Conduit	
F25.000	13.526	0.090	150.0	0.000	5.4	0.0	1.500	o	150	Pipe/Conduit	
F26.000	5.962	0.090	66.2	0.000	1.0	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)
F17.001	6.380	0.000	0.0	148.3	0.0	118	0.81	0.71	12.6	12.2
F20.000	6.600	0.000	0.0	7.3	0.0	47	0.57	0.71	12.6	2.7
F20.001	6.478	0.000	0.0	35.9	0.0	53	1.07	1.26	22.3	6.0
F21.000	6.350	0.000	0.0	61.8	0.0	86	0.75	0.71	12.6	7.9
F22.000	6.600	0.000	0.0	36.2	0.0	60	0.91	1.01	17.8	6.0
F21.001	6.287	0.000	0.0	170.7	0.0	150	0.74	0.74	13.0«	13.1
F17.002	6.104	0.000	0.0	494.8	0.0	143	0.83	0.76	30.4	22.2
F23.000	6.550	0.000	0.0	46.7	0.0	57	1.11	1.27	22.5	6.8
F17.003	6.041	0.000	0.0	562.7	0.0	150	0.84	0.76	30.4	23.7
F17.004	5.978	0.000	0.0	581.8	0.0	152	0.85	0.76	30.4	24.1
F24.000	6.600	0.000	0.0	33.2	0.0	49	1.14	1.41	24.9	5.8
F17.005	5.931	0.000	0.0	646.5	0.0	158	0.85	0.76	30.4	25.4
F17.006	5.863	0.000	0.0	646.5	0.0	158	0.85	0.76	30.4	25.4
F17.007	5.801	0.000	0.0	674.3	0.0	160	0.86	0.76	30.4	26.0
F25.000	6.500	0.000	0.0	5.4	0.0	44	0.54	0.71	12.6	2.3
F26.000	6.500	0.000	0.0	1.0	0.0	24	0.56	1.08	19.0	1.0

Network Design Table for FW Network - Option B

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F25.001	22.642	0.582	38.9	0.000	31.3	0.0	1.500	o	150	Pipe/Conduit	
F17.008	11.653	0.614	19.0	0.000	141.8	0.0	1.500	o	225	Pipe/Conduit	
F27.000	16.841	1.086	15.5	0.000	46.4	0.0	1.500	o	150	Pipe/Conduit	
F17.009	6.802	0.039	174.4	0.000	9.4	20.0	1.500	o	225	Pipe/Conduit	
F28.000	7.880	1.325	5.9	0.000	14.5	0.0	1.500	o	150	Pipe/Conduit	
F17.010	15.164	0.051	300.0	0.000	55.6	0.0	1.500	o	300	Pipe/Conduit	
F29.000	13.670	1.376	9.9	0.000	21.0	0.0	1.500	o	150	Pipe/Conduit	
F17.011	23.145	0.634	36.5	0.000	20.9	0.0	1.500	o	300	Pipe/Conduit	
F1.019	12.769	0.034	375.0	0.000	0.0	0.0	1.500	o	375	Pipe/Conduit	
F1.020	70.435	0.188	375.0	0.000	0.0	0.0	1.500	o	375	Pipe/Conduit	
F1.021	85.210	1.028	82.9	0.000	0.0	0.0	1.500	o	375	Pipe/Conduit	
F30.000	13.884	0.093	150.0	0.000	20.5	0.0	1.500	o	150	Pipe/Conduit	
F30.001	18.613	0.124	150.0	0.000	123.9	0.0	1.500	o	150	Pipe/Conduit	
F30.002	5.247	0.035	150.0	0.000	36.0	0.0	1.500	o	150	Pipe/Conduit	
F30.003	18.199	0.081	225.0	0.000	0.0	5.0	1.500	o	225	Pipe/Conduit	
F31.000	11.692	0.233	50.2	0.000	2.0	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)
F25.001	6.410	0.000	0.0	37.7	0.0	51	1.16	1.41	24.9	6.1
F17.008	5.753	0.000	0.0	853.8	0.0	81	2.26	2.64	105.0	29.2
F27.000	6.300	0.000	0.0	46.4	0.0	42	1.67	2.23	39.4	6.8
F17.009	5.139	0.000	20.0	909.6	0.0	225	0.87	0.87	34.5«	50.2
F28.000	6.500	0.000	0.0	14.5	0.0	25	1.96	3.61	63.8	3.8
F17.010	5.025	0.000	20.0	979.7	0.0	225	0.90	0.80	56.4	51.3
F29.000	6.500	0.000	0.0	21.0	0.0	31	1.74	2.79	49.3	4.6
F17.011	4.974	0.000	20.0	1021.6	0.0	116	2.05	2.30	162.5	52.0
F1.019	4.265	0.000	20.0	2126.8	0.0	237	0.90	0.83	91.2	66.1
F1.020	4.231	0.000	20.0	2126.8	0.0	237	0.90	0.83	91.2	66.1
F1.021	4.043	0.000	20.0	2126.8	0.0	150	1.60	1.76	194.6	66.1
F30.000	6.500	0.000	0.0	20.5	0.0	62	0.66	0.71	12.6	4.5
F30.001	6.407	0.000	0.0	144.4	0.0	117	0.81	0.71	12.6	12.0
F30.002	6.283	0.000	0.0	180.4	0.0	150	0.71	0.71	12.6«	13.4
F30.003	6.173	0.000	5.0	180.4	0.0	127	0.80	0.76	30.4	18.4
F31.000	6.400	0.000	0.0	2.0	0.0	26	0.69	1.24	21.9	1.4

Network Design Table for FW Network - Option B

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F30.004	26.315	0.117	225.0	0.000	44.6	0.0	1.500	o	225	Pipe/Conduit	🔒
F32.000	18.286	0.430	42.5	0.000	10.3	0.0	1.500	o	150	Pipe/Conduit	🔒
F30.005	32.302	0.144	225.0	0.000	59.4	0.0	1.500	o	225	Pipe/Conduit	🔒
F33.000	7.270	0.053	137.2	0.000	7.3	0.0	1.500	o	150	Pipe/Conduit	🔒
F34.000	7.999	0.053	150.0	0.000	1.6	0.0	1.500	o	150	Pipe/Conduit	🔒
F33.001	19.019	0.541	35.2	0.000	22.4	0.0	1.500	o	150	Pipe/Conduit	🔒
F30.006	17.901	0.080	223.8	0.000	53.6	0.0	1.500	o	225	Pipe/Conduit	🔒
F35.000	19.198	0.574	33.4	0.000	8.6	0.0	1.500	o	150	Pipe/Conduit	🔒
F30.007	31.524	0.140	225.0	0.000	43.3	0.0	1.500	o	225	Pipe/Conduit	🔒
F36.000	10.816	0.854	12.7	0.000	4.6	0.0	1.500	o	150	Pipe/Conduit	🔒
F30.008	37.950	0.169	225.0	0.000	78.4	0.0	1.500	o	225	Pipe/Conduit	🔒
F30.009	64.622	0.287	225.0	0.000	40.9	0.0	1.500	o	225	Pipe/Conduit	🔒
F30.010	59.165	1.990	29.7	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	🔒
F1.022	26.774	0.090	297.5	0.000	0.0	0.0	1.500	o	375	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)
F30.004	6.092	0.000	5.0	227.0	0.0	134	0.82	0.76	30.4	20.1
F32.000	6.480	0.000	0.0	10.3	0.0	37	0.93	1.35	23.8	3.2
F30.005	5.975	0.000	5.0	296.7	0.0	143	0.83	0.76	30.4	22.2
F33.000	6.500	0.000	0.0	7.3	0.0	46	0.59	0.75	13.2	2.7
F34.000	6.500	0.000	0.0	1.6	0.0	32	0.45	0.71	12.6	1.3
F33.001	6.447	0.000	0.0	31.3	0.0	47	1.17	1.48	26.2	5.6
F30.006	5.831	0.000	5.0	381.6	0.0	153	0.85	0.77	30.4	24.5
F35.000	6.400	0.000	0.0	8.6	0.0	34	0.99	1.52	26.8	2.9
F30.007	5.751	0.000	5.0	433.5	0.0	159	0.86	0.76	30.4	25.8
F36.000	6.540	0.000	0.0	4.6	0.0	23	1.26	2.47	43.7	2.1
F30.008	5.611	0.000	5.0	516.5	0.0	169	0.86	0.76	30.4	27.7
F30.009	5.442	0.000	5.0	557.4	0.0	174	0.87	0.76	30.4	28.6
F30.010	5.155	0.000	5.0	557.4	0.0	91	1.91	2.11	83.9	28.6
F1.022	3.015	0.000	25.0	2684.2	0.0	243	1.02	0.93	102.5	76.8

Appendix B Proposed SW Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_C

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	29.313	0.158	185.5	0.000	5.00	0.0	0.600	o	250	Pipe/Conduit	
1.001	60.296	0.268	225.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	3.335	0.015	222.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	5.809	0.026	223.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	4.198	0.019	220.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	73.462	0.326	225.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	57.236	0.254	225.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	53.979	0.270	199.9	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	25.508	0.073	349.4	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
1.008	15.369	0.044	349.3	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
1.009	35.220	0.101	348.7	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
3.000	12.814	0.050	256.3	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.001	6.831	0.120	56.9	0.785	0.00	0.0	0.600	o	500	Pipe/Conduit	
3.002	33.361	0.480	69.5	0.054	0.00	0.0	0.600	o	500	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	82.12	5.48	6.635	0.000	0.0	0.0	0.0	1.02	50.3	0.0
1.001	76.32	6.44	6.477	0.000	0.0	0.0	0.0	1.04	73.8	0.0
1.002	76.03	6.49	6.209	0.000	0.0	0.0	0.0	1.05	74.2	0.0
1.003	75.53	6.58	6.194	0.000	0.0	0.0	0.0	1.05	74.1	0.0
1.004	75.17	6.65	6.168	0.000	0.0	0.0	0.0	1.05	74.5	0.0
1.005	69.45	7.83	6.149	0.000	0.0	0.0	0.0	1.04	73.7	0.0
1.006	65.64	8.74	5.823	0.000	0.0	0.0	0.0	1.04	73.7	0.0
2.000	78.99	5.98	6.600	0.000	0.0	0.0	0.0	0.92	36.6	0.0
1.007	64.04	9.16	5.468	0.000	0.0	0.0	0.0	1.00	126.2	0.0
1.008	63.12	9.42	5.395	0.000	0.0	0.0	0.0	1.00	126.2	0.0
1.009	61.11	10.00	5.351	0.000	0.0	0.0	0.0	1.00	126.3	0.0
3.000	83.86	5.22	6.450	0.000	0.0	0.0	0.0	0.98	69.1	0.0
3.001	83.59	5.26	5.800	0.785	0.0	0.0	0.0	2.88	566.2	177.7
3.002	82.16	5.47	5.680	0.839	0.0	0.0	0.0	2.61	512.2	186.6

Network Design Table for SW_C

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
4.000	12.588	0.100	125.9	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	6.657	0.030	221.9	0.723	0.00	0.0	0.600	o	500	Pipe/Conduit	
4.002	16.016	0.167	95.9	0.000	0.00	0.0	0.600	o	500	Pipe/Conduit	
5.000	20.431	0.586	34.9	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.003	34.848	0.361	96.5	0.101	0.00	0.0	0.600	o	500	Pipe/Conduit	
1.010	18.058	0.025	722.3	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
6.000	69.072	0.295	234.1	0.173	5.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	40.662	0.173	235.0	0.090	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.011	3.696	0.005	739.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.012	5.613	0.007	801.9	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.013	8.335	0.013	641.2	0.000	0.00	0.0	0.600	o	750	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)
4.000	84.34	5.15	6.100	0.000	0.0	0.0	0.0	1.40	99.0	0.0
4.001	83.81	5.23	5.800	0.723	0.0	0.0	0.0	1.45	285.5	164.1
4.002	82.99	5.35	5.770	0.723	0.0	0.0	0.0	2.22	435.6	164.1
5.000	84.32	5.15	6.422	0.000	0.0	0.0	0.0	2.22	88.4	0.0
4.003	81.27	5.61	5.603	0.824	0.0	0.0	0.0	2.21	434.2	181.3
1.010	60.17	10.29	4.950	1.662	0.0	0.0	0.0	1.03	456.6	270.8
6.000	78.11	6.13	5.670	0.173	0.0	0.0	0.0	1.02	72.3	36.7
7.000	80.92	5.66	5.548	0.090	0.0	0.0	0.0	1.02	72.2	19.8
1.011	59.97	10.35	4.925	1.926	0.0	0.0	0.0	1.02	451.3	312.8
1.012	59.67	10.45	4.920	1.926	0.0	0.0	0.0	0.98	433.1	312.8
1.013	59.28	10.58	4.913	1.926	0.0	0.0	0.0	1.10	484.9	312.8

Surcharged Outfall Details for SW_C

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013	Channel East 1	6.700	4.900	4.600	2100	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)
1440	4.893

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWIC101	120 Winter	2	+0%					6.635	-0.250
1.001	SWIC102	120 Winter	2	+0%					6.477	-0.300
1.002	SWIC103	120 Winter	2	+0%					6.209	-0.300
1.003	Bend	120 Winter	2	+0%					6.194	-0.300
1.004	Bend	120 Winter	2	+0%					6.168	-0.300
1.005	SWIC104	120 Winter	2	+0%					6.149	-0.300
1.006	SWIC105	120 Winter	2	+0%	100/15 Summer				5.823	-0.300
2.000	SWIC106	120 Winter	2	+0%					6.600	-0.225
1.007	SWIC107	120 Winter	2	+0%	100/15 Summer				5.468	-0.400
1.008	SWMH109	15 Winter	2	+0%	100/15 Summer				5.456	-0.339
1.009	SWMH109b	15 Winter	2	+0%	30/15 Winter				5.477	-0.274
3.000	SWMH110	120 Winter	2	+0%	100/15 Summer				6.450	-0.300
3.001	SWMH112	15 Winter	2	+0%	100/15 Summer				6.017	-0.283
3.002	SWMH113	15 Winter	2	+0%	100/15 Summer				5.842	-0.338
4.000	SWMH114	120 Winter	2	+0%	100/15 Summer				6.100	-0.300
4.001	SWMH115	15 Winter	2	+0%	100/15 Summer				6.054	-0.246
4.002	SWMH116	15 Winter	2	+0%	100/15 Summer				5.959	-0.311
5.000	SWRE01	120 Winter	2	+0%	100/15 Winter				6.422	-0.225
4.003	JNC	15 Winter	2	+0%					5.767	-0.336
1.010	SWMH117	15 Winter	2	+0%	30/15 Summer				5.480	-0.220
6.000	SWMH118	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.799	-0.171
7.000	SWMH119	15 Winter	2	+0%	100/15 Summer				5.640	-0.208
1.011	SWMH120	15 Winter	2	+0%	30/15 Summer				5.418	-0.257
1.012	SWMH121	15 Winter	2	+0%	30/15 Summer				5.408	-0.262
1.013	SWMH122	15 Winter	2	+0%	100/15 Summer				5.394	-0.269

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWIC101	0.000	0.00		0.0	OK	
1.001	SWIC102	0.000	0.00		0.0	OK	
1.002	SWIC103	0.000	0.00		0.0	OK	
1.003	Bend	0.000	0.00		0.0	OK*	
1.004	Bend	0.000	0.00		0.0	OK*	
1.005	SWIC104	0.000	0.00		0.0	OK	
1.006	SWIC105	0.000	0.00		0.0	OK	
2.000	SWIC106	0.000	0.00		0.0	OK	
1.007	SWIC107	0.000	0.00		0.0	OK	
1.008	SWMH109	0.000	0.01		1.2	OK	
1.009	SWMH109b	0.000	0.02		2.7	OK	
3.000	SWMH110	0.000	0.00		0.0	OK	
3.001	SWMH112	0.000	0.39		94.6	OK	
3.002	SWMH113	0.000	0.23		100.8	OK	
4.000	SWMH114	0.000	0.00		0.0	OK	
4.001	SWMH115	0.000	0.51		87.0	OK	
4.002	SWMH116	0.000	0.31		86.9	OK	
5.000	SWRE01	0.000	0.00		0.0	OK	
4.003	JNC	0.000	0.24		98.3	OK*	
1.010	SWMH117	0.000	0.87		193.1	OK	
6.000	SWMH118	0.000	0.38		26.1	OK	1
7.000	SWMH119	0.000	0.21		13.8	OK	
1.011	SWMH120	0.000	0.63		223.7	OK	
1.012	SWMH121	0.000	0.65		222.7	OK	
1.013	SWMH122	0.000	0.81		222.6	OK	

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWIC101	120 Winter	30	+0%					6.635	-0.250
1.001	SWIC102	120 Winter	30	+0%					6.477	-0.300
1.002	SWIC103	120 Winter	30	+0%					6.209	-0.300
1.003	Bend	120 Winter	30	+0%					6.194	-0.300
1.004	Bend	120 Winter	30	+0%					6.168	-0.300
1.005	SWIC104	120 Winter	30	+0%					6.149	-0.300
1.006	SWIC105	120 Winter	30	+0%	100/15 Summer				5.823	-0.300
2.000	SWIC106	120 Winter	30	+0%					6.600	-0.225
1.007	SWIC107	15 Winter	30	+0%	100/15 Summer				5.748	-0.120
1.008	SWMH109	15 Winter	30	+0%	100/15 Summer				5.748	-0.047
1.009	SWMH109b	15 Winter	30	+0%	30/15 Winter				5.760	0.009
3.000	SWMH110	120 Winter	30	+0%	100/15 Summer				6.450	-0.300
3.001	SWMH112	15 Winter	30	+0%	100/15 Summer				6.165	-0.135
3.002	SWMH113	15 Winter	30	+0%	100/15 Summer				5.938	-0.242
4.000	SWMH114	15 Winter	30	+0%	100/15 Summer				6.301	-0.099
4.001	SWMH115	15 Winter	30	+0%	100/15 Summer				6.300	0.000
4.002	SWMH116	15 Winter	30	+0%	100/15 Summer				6.068	-0.202
5.000	SWRE01	120 Winter	30	+0%	100/15 Winter				6.422	-0.225
4.003	JNC	15 Winter	30	+0%					5.872	-0.231
1.010	SWMH117	15 Winter	30	+0%	30/15 Summer				5.782	0.082
6.000	SWMH118	15 Winter	30	+0%	100/15 Summer	100/15 Winter			5.888	-0.082
7.000	SWMH119	15 Winter	30	+0%	100/15 Summer				5.786	-0.062
1.011	SWMH120	15 Winter	30	+0%	30/15 Summer				5.736	0.061
1.012	SWMH121	15 Winter	30	+0%	30/15 Summer				5.701	0.031
1.013	SWMH122	30 Winter	30	+0%	100/15 Summer				5.663	0.000

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWIC101	0.000	0.00		0.0	OK	
1.001	SWIC102	0.000	0.00		0.0	OK	
1.002	SWIC103	0.000	0.00		0.0	OK	
1.003	Bend	0.000	0.00		0.0	OK*	
1.004	Bend	0.000	0.00		0.0	OK*	
1.005	SWIC104	0.000	0.00		0.0	OK	
1.006	SWIC105	0.000	0.00		0.0	OK	
2.000	SWIC106	0.000	0.00		0.0	OK	
1.007	SWIC107	0.000	0.05		5.7	OK	
1.008	SWMH109	0.000	0.23		21.8	OK	
1.009	SWMH109b	0.000	0.28		31.5	SURCHARGED	
3.000	SWMH110	0.000	0.00		0.0	OK	
3.001	SWMH112	0.000	0.86		208.5	OK	
3.002	SWMH113	0.000	0.51		225.7	OK	
4.000	SWMH114	0.000	0.02		1.4	OK	
4.001	SWMH115	0.000	1.12		189.5	OK	
4.002	SWMH116	0.000	0.66		187.8	OK	
5.000	SWRE01	0.000	0.00		0.0	OK	
4.003	JNC	0.000	0.51		211.5	OK*	
1.010	SWMH117	0.000	1.80		400.9	SURCHARGED	
6.000	SWMH118	0.000	0.74		51.2	OK	1
7.000	SWMH119	0.000	0.40		26.9	OK	
1.011	SWMH120	0.000	1.33		473.7	SURCHARGED	
1.012	SWMH121	0.000	1.37		470.2	SURCHARGED	
1.013	SWMH122	0.000	1.48		408.5	OK	

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWIC101	120 Winter	100	+40%					6.635	-0.250
1.001	SWIC102	120 Winter	100	+40%					6.477	-0.300
1.002	SWIC103	15 Winter	100	+40%					6.316	-0.193
1.003	Bend	15 Winter	100	+40%					6.339	-0.155
1.004	Bend	15 Winter	100	+40%					6.347	-0.121
1.005	SWIC104	15 Winter	100	+40%					6.354	-0.095
1.006	SWIC105	15 Winter	100	+40%	100/15 Summer				6.382	0.259
2.000	SWIC106	120 Winter	100	+40%					6.600	-0.225
1.007	SWIC107	15 Winter	100	+40%	100/15 Summer				6.399	0.531
1.008	SWMH109	15 Winter	100	+40%	100/15 Summer				6.419	0.624
1.009	SWMH109b	15 Winter	100	+40%	30/15 Winter				6.451	0.700
3.000	SWMH110	15 Winter	100	+40%	100/15 Summer				7.031	0.281
3.001	SWMH112	15 Winter	100	+40%	100/15 Summer				7.032	0.732
3.002	SWMH113	15 Winter	100	+40%	100/15 Summer				6.805	0.625
4.000	SWMH114	15 Winter	100	+40%	100/15 Summer				7.118	0.718
4.001	SWMH115	15 Winter	100	+40%	100/15 Summer				7.119	0.819
4.002	SWMH116	15 Winter	100	+40%	100/15 Summer				6.927	0.657
5.000	SWRE01	15 Winter	100	+40%	100/15 Winter				6.737	0.090
4.003	JNC	30 Winter	100	+40%					6.103	0.000
1.010	SWMH117	15 Winter	100	+40%	30/15 Summer				6.499	0.799
6.000	SWMH118	15 Winter	100	+40%	100/15 Summer	100/15 Winter			6.727	0.757
7.000	SWMH119	15 Winter	100	+40%	100/15 Summer				6.414	0.566
1.011	SWMH120	15 Winter	100	+40%	30/15 Summer				6.326	0.651
1.012	SWMH121	15 Winter	100	+40%	30/15 Summer				6.086	0.416
1.013	SWMH122	15 Winter	100	+40%	100/15 Summer				5.848	0.185

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWIC101	0.000	0.00		0.0	OK	
1.001	SWIC102	0.000	0.00		0.0	OK	
1.002	SWIC103	0.000	0.04		2.0	OK	
1.003	Bend	0.000	0.06		3.7	OK*	
1.004	Bend	0.000	0.10		6.3	OK*	
1.005	SWIC104	0.000	0.06		4.0	OK	
1.006	SWIC105	0.000	0.34		23.7	SURCHARGED	
2.000	SWIC106	0.000	0.00		0.0	OK	
1.007	SWIC107	0.000	0.25		27.4	SURCHARGED	
1.008	SWMH109	0.000	0.50		46.8	SURCHARGED	
1.009	SWMH109b	0.000	0.44		49.1	SURCHARGED	
3.000	SWMH110	0.000	0.05		2.9	FLOOD RISK	
3.001	SWMH112	0.000	1.37		331.3	FLOOD RISK	
3.002	SWMH113	0.000	0.80		349.6	SURCHARGED	
4.000	SWMH114	0.000	0.04		3.2	FLOOD RISK	
4.001	SWMH115	0.000	1.80		306.1	FLOOD RISK	
4.002	SWMH116	0.000	1.06		301.6	SURCHARGED	
5.000	SWRE01	0.000	0.00		0.0	SURCHARGED*	
4.003	JNC	0.000	0.75		314.3	SURCHARGED*	
1.010	SWMH117	0.000	2.90		644.1	SURCHARGED	
6.000	SWMH118	0.044	1.17		81.1	FLOOD	1
7.000	SWMH119	0.000	0.64		42.7	SURCHARGED	
1.011	SWMH120	0.000	2.14		761.6	SURCHARGED	
1.012	SWMH121	0.000	2.23		762.8	SURCHARGED	
1.013	SWMH122	0.000	2.76		762.0	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_CP

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.700	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.900
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_CP

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	43.099	0.192	224.5	0.141	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
1.001	38.847	0.173	224.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
2.000	32.256	0.143	225.6	0.055	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
2.001	38.402	0.171	224.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
2.002	11.327	0.050	226.5	0.085	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
1.002	12.018	0.037	324.8	0.145	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
1.003	27.187	0.085	319.8	0.010	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
3.000	27.857	0.153	182.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
1.004	14.321	0.044	325.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
1.005	61.075	0.181	337.4	0.126	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
1.006	8.906	0.027	329.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
1.007	8.906	0.028	318.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	80.34	5.69	5.717	0.141	0.0	0.0	0.0	1.05	73.9	30.7
1.001	77.12	6.22	5.475	0.141	0.0	0.0	0.0	1.20	133.1	30.7
2.000	81.44	5.52	5.716	0.055	0.0	0.0	0.0	1.04	73.7	12.1
2.001	77.68	6.13	5.573	0.055	0.0	0.0	0.0	1.05	73.9	12.1
2.002	76.64	6.31	5.402	0.139	0.0	0.0	0.0	1.04	73.5	28.9
1.002	75.53	6.51	5.302	0.426	0.0	0.0	0.0	1.00	110.4	87.1
1.003	73.17	6.96	5.265	0.436	0.0	0.0	0.0	1.01	111.3	87.1
3.000	81.66	5.48	5.483	0.000	0.0	0.0	0.0	0.97	38.4	0.0
1.004	71.99	7.20	5.180	0.436	0.0	0.0	0.0	1.00	110.3	87.1
1.005	67.32	8.24	5.136	0.562	0.0	0.0	0.0	0.98	108.3	102.4
1.006	66.70	8.39	4.955	0.562	0.0	0.0	0.0	0.99	109.6	102.4
1.007	66.11	8.53	4.928	0.562	0.0	0.0	0.0	1.01	111.6	102.4

Surcharged Outfall Details for SW_CP

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	Channel West	7.580	4.900	0.000	1200	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)
1440	4.893

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

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   Data Type Catchment
FEH Rainfall Version 2013   Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800   Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH51	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.832	-0.185
1.001	SWMH52	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.588	-0.262
2.000	SWMH53	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.786	-0.230
2.001	SWMH54	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.642	-0.231
2.002	SWMH55	15 Winter	2	+0%	30/15 Summer				5.544	-0.158
1.002	SWMH56	15 Winter	2	+0%	30/15 Summer	100/15 Summer			5.527	-0.150
1.003	SWMH57	15 Winter	2	+0%	30/15 Summer				5.473	-0.167
3.000	SWDNO 01	120 Winter	2	+0%	100/15 Summer				5.483	-0.225
1.004	SWDNO 02	15 Winter	2	+0%	30/15 Summer				5.403	-0.152
1.005	SWMH58	15 Winter	2	+0%	30/15 Summer				5.358	-0.153
1.006	SWMH59	15 Winter	2	+0%	30/15 Summer				5.218	-0.112
1.007	SWMH60	15 Winter	2	+0%	30/15 Winter				5.183	-0.120

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH51	0.000	0.30		21.0	OK	4
1.001	SWMH52	0.000	0.17		20.4	OK	4
2.000	SWMH53	0.000	0.12		8.2	OK	4
2.001	SWMH54	0.000	0.12		8.0	OK	4
2.002	SWMH55	0.000	0.30		17.7	OK	
1.002	SWMH56	0.000	0.67		54.5	OK	2
1.003	SWMH57	0.000	0.57		55.0	OK	
3.000	SWDNO 01	0.000	0.00		0.0	OK	
1.004	SWDNO 02	0.000	0.65		54.4	OK	
1.005	SWMH58	0.000	0.63		64.1	OK	
1.006	SWMH59	0.000	0.83		62.3	OK	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	SWMH60	0.000	0.80		62.3	OK	

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

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	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333750 392800 SJ 33750 92800	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH51	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.894	-0.123
1.001	SWMH52	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.818	-0.032
2.000	SWMH53	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.845	-0.171
2.001	SWMH54	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.829	-0.044
2.002	SWMH55	15 Winter	30	+0%	30/15 Summer				5.820	0.118
1.002	SWMH56	15 Winter	30	+0%	30/15 Summer	100/15 Summer			5.751	0.074
1.003	SWMH57	15 Winter	30	+0%	30/15 Summer				5.713	0.073
3.000	SWDNO 01	15 Winter	30	+0%	100/15 Summer				5.627	-0.081
1.004	SWDNO 02	15 Winter	30	+0%	30/15 Summer				5.628	0.073
1.005	SWMH58	15 Winter	30	+0%	30/15 Summer				5.582	0.071
1.006	SWMH59	15 Winter	30	+0%	30/15 Summer				5.360	0.030
1.007	SWMH60	15 Winter	30	+0%	30/15 Winter				5.307	0.004

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH51	0.000	0.63		43.2	OK	4
1.001	SWMH52	0.000	0.30		35.8	OK	4
2.000	SWMH53	0.000	0.25		16.5	OK	4
2.001	SWMH54	0.000	0.19		12.8	OK	4
2.002	SWMH55	0.000	0.50		29.2	SURCHARGED	
1.002	SWMH56	0.000	1.22		99.7	SURCHARGED	2
1.003	SWMH57	0.000	0.98		95.1	SURCHARGED	
3.000	SWDNO 01	0.000	0.02		0.7	OK	
1.004	SWDNO 02	0.000	1.07		90.3	SURCHARGED	
1.005	SWMH58	0.000	1.08		109.8	SURCHARGED	
1.006	SWMH59	0.000	1.43		107.2	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	SWMH60	0.000	1.38		107.1	SURCHARGED	

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

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	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333750 392800 SJ 33750 92800	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH51	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.612	0.595
1.001	SWMH52	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.549	0.699
2.000	SWMH53	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.552	0.536
2.001	SWMH54	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.546	0.673
2.002	SWMH55	15 Winter	100	+40%	30/15 Summer				6.615	0.913
1.002	SWMH56	15 Winter	100	+40%	30/15 Summer	100/15 Summer			6.545	0.868
1.003	SWMH57	15 Winter	100	+40%	30/15 Summer				6.492	0.852
3.000	SWDNO 01	15 Winter	100	+40%	100/15 Summer				6.372	0.664
1.004	SWDNO 02	15 Winter	100	+40%	30/15 Summer				6.378	0.823
1.005	SWMH58	15 Winter	100	+40%	30/15 Summer				6.279	0.768
1.006	SWMH59	15 Winter	100	+40%	30/15 Summer				5.672	0.342
1.007	SWMH60	15 Winter	100	+40%	30/15 Winter				5.465	0.162

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH51	6.505	0.79		54.7	FLOOD	4
1.001	SWMH52	4.748	0.47		56.5	FLOOD	4
2.000	SWMH53	4.539	0.61		40.9	FLOOD	4
2.001	SWMH54	2.296	0.54		37.2	FLOOD	4
2.002	SWMH55	0.000	0.77		45.4	FLOOD RISK	
1.002	SWMH56	0.875	1.86		151.4	FLOOD	2
1.003	SWMH57	0.000	1.46		141.8	FLOOD RISK	
3.000	SWDNO 01	0.000	0.06		2.3	SURCHARGED	
1.004	SWDNO 02	0.000	1.58		132.9	FLOOD RISK	
1.005	SWMH58	0.000	1.76		179.1	SURCHARGED	
1.006	SWMH59	0.000	2.35		176.1	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	SWMH60	0.000	2.28		177.1	SURCHARGED	

Some temporary flooding for 1 in 100yr (+40%)
15 minute storm
19 cu.m of flooding at low points of car park.

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_NE

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_NE

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	14.220	0.050	284.4	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	69.482	0.183	379.7	0.341	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	27.875	0.063	442.5	0.131	0.00	0.0	0.600	o	500	Pipe/Conduit	
2.000	12.532	0.001	12532.0	0.000	5.00	0.0	0.600	Q70	-6	Pipe/Conduit	
2.001	101.664	0.011	9242.2	0.000	0.00	0.0	0.600	Q70	-6	Pipe/Conduit	
3.000	13.986	0.001	13986.0	0.000	5.00	0.0	0.600	Q70	-6	Pipe/Conduit	
3.001	53.042	0.005	10608.4	0.000	0.00	0.0	0.600	Q70	-6	Pipe/Conduit	
3.002	23.098	0.002	11549.0	0.000	0.00	0.0	0.600	Q70	-6	Pipe/Conduit	
2.002	12.528	0.060	208.8	0.753	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	32.766	0.066	496.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	23.389	0.047	497.6	0.158	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)
1.000	83.61	5.26	5.950	0.000	0.0	0.0	0.0	0.93	65.5	0.0
1.001	76.70	6.37	5.843	0.341	0.0	0.0	0.0	1.04	165.0	70.8
1.002	74.26	6.82	5.614	0.471	0.0	0.0	0.0	1.03	201.5	94.8
2.000	78.40	6.08	5.660	0.000	0.0	0.0	0.0	0.19	48.5	0.0
2.001	51.56	13.52	5.659	0.000	0.0	0.0	0.0	0.23	56.9	0.0
3.000	77.27	6.27	5.660	0.000	0.0	0.0	0.0	0.18	45.8	0.0
3.001	59.69	10.44	5.659	0.000	0.0	0.0	0.0	0.21	53.0	0.0
3.002	54.35	12.34	5.654	0.000	0.0	0.0	0.0	0.20	50.7	0.0
2.002	51.28	13.64	5.511	0.753	0.0	0.0	0.0	1.68	475.4	104.6
1.003	50.20	14.15	5.451	1.224	0.0	0.0	0.0	1.09	307.1	166.4
1.004	49.46	14.51	5.385	1.382	0.0	0.0	0.0	1.08	306.7	185.0

Network Design Table for SW_NE

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	62.559	0.083	753.7	0.061	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.000	9.295	0.015	619.7	0.785	5.00	0.0	0.600	o	500	Pipe/Conduit	
4.001	85.165	0.168	506.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	6.856	0.045	152.4	0.709	5.00	0.0	0.600	o	500	Pipe/Conduit	
4.002	23.516	0.025	940.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.003	22.080	0.052	424.6	0.000	0.00	0.0	0.600	oo	500	Double Pipe	
4.004	8.525	0.016	532.8	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.005	8.027	0.016	501.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.006	8.027	0.016	501.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.006	83.261	0.111	750.1	0.040	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.007	59.103	0.079	748.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.008	59.997	0.080	750.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.009	43.802	0.058	755.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.010	7.755	0.010	775.5	0.041	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.011	8.199	0.017	482.3	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	47.46	15.54	5.338	1.443	0.0	0.0	0.0	1.01	446.9	185.4
4.000	84.14	5.18	5.900	0.785	0.0	0.0	0.0	0.87	169.9«	178.9
4.001	75.99	6.50	5.785	0.785	0.0	0.0	0.0	1.07	303.9	178.9
5.000	84.94	5.07	5.800	0.709	0.0	0.0	0.0	1.76	345.1	163.0
4.002	73.70	6.93	5.511	1.494	0.0	0.0	0.0	0.90	399.4	298.2
4.003	71.96	7.28	5.455	1.494	0.0	0.0	0.0	1.05	411.5	298.2
4.004	71.39	7.40	5.403	1.494	0.0	0.0	0.0	1.21	532.5	298.2
4.005	70.89	7.51	5.271	1.494	0.0	0.0	0.0	1.24	548.9	298.2
4.006	70.39	7.62	5.271	1.494	0.0	0.0	0.0	1.24	548.9	298.2
1.006	45.09	16.91	5.255	2.977	0.0	0.0	0.0	1.01	447.9	363.4
1.007	43.56	17.88	5.144	2.977	0.0	0.0	0.0	1.02	448.5	363.4
1.008	42.13	18.86	5.065	2.977	0.0	0.0	0.0	1.01	448.0	363.4
1.009	41.14	19.58	4.985	2.977	0.0	0.0	0.0	1.01	446.4	363.4
1.010	40.97	19.71	4.927	3.018	0.0	0.0	0.0	1.00	440.5	363.4
1.011	40.83	19.82	4.917	3.018	0.0	0.0	0.0	1.27	560.0	363.4

Surcharged Outfall Details for SW_NE

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.011	Under Bridge	7.198	4.900	4.700	1500	0

Datum (m) 0.000 Offset (mins) 0

Surcharged Outfall Details for SW_NE

Time (mins)	Depth (m)
1440	4.893

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

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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH01	15 Winter	2	+0%	100/15 Summer	100/30 Winter			6.005	-0.245
1.001	SWMH02	15 Winter	2	+0%	100/15 Summer				6.006	-0.287
1.002	SWMH03	15 Winter	2	+0%	100/15 Summer				5.841	-0.273
2.000	QMAX IC01	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.810	-0.550
2.001	QMAX IC02	15 Winter	2	+0%	100/15 Summer	100/30 Winter			5.810	-0.549
3.000	QMAX IC03	15 Winter	2	+0%	100/15 Summer				5.805	-0.555
3.001	QMAX IC04	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.805	-0.554
3.002	QMAX IC05	15 Winter	2	+0%	100/15 Summer	100/30 Winter			5.805	-0.549
2.002	SWMH05	15 Winter	2	+0%	30/30 Winter	100/15 Winter			5.810	-0.301
1.003	SWMH04	15 Winter	2	+0%	100/15 Summer				5.796	-0.255
1.004	SWMH06	15 Winter	2	+0%	100/15 Summer				5.732	-0.253
1.005	SWMH07	30 Winter	2	+0%	100/15 Summer				5.691	-0.397
4.000	SWMH08	15 Winter	2	+0%	30/15 Summer				6.377	-0.023
4.001	SWMH09	15 Winter	2	+0%	30/15 Winter				6.113	-0.272
5.000	SWMH10	15 Winter	2	+0%	30/15 Summer	100/15 Winter			6.058	-0.242
4.002	SWMH11	15 Winter	2	+0%	30/15 Summer				6.045	-0.216
4.003	SWMH13	15 Winter	2	+0%	30/15 Summer				5.876	-0.079
4.004	SWMH14	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.829	-0.324
4.005	RWHT	30 Winter	2	+0%	100/15 Summer				5.670	-0.351
4.006	SWMH15	30 Winter	2	+0%	100/15 Summer				5.661	-0.360
1.006	SWMH16	30 Winter	2	+0%	100/15 Summer				5.652	-0.353
1.007	SWMH17	30 Winter	2	+0%	100/15 Summer				5.549	-0.345
1.008	SWMH18	30 Winter	2	+0%	100/15 Summer				5.470	-0.345
1.009	SWMH19	30 Winter	2	+0%	100/15 Summer				5.395	-0.340
1.010	SWMH20	30 Winter	2	+0%	100/15 Summer				5.327	-0.350
1.011	SWMH21	30 Winter	2	+0%	100/15 Winter				5.305	-0.362

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH01	0.000	0.00		0.2	OK	1
1.001	SWMH02	0.000	0.27		41.4	OK	
1.002	SWMH03	0.000	0.31		52.1	OK	
2.000	QMAX IC01	0.000	0.00		0.4	OK	4
2.001	QMAX IC02	0.000	0.00		0.9	OK	1
3.000	QMAX IC03	0.000	0.00		0.3	OK	
3.001	QMAX IC04	0.000	0.01		1.1	OK	5
3.002	QMAX IC05	0.000	0.03		4.2	OK	1
2.002	SWMH05	0.000	0.23		74.7	OK	5
1.003	SWMH04	0.000	0.49		123.5	OK	
1.004	SWMH06	0.000	0.58		134.8	OK	
1.005	SWMH07	0.000	0.31		122.5	OK	
4.000	SWMH08	0.000	1.09		113.0	OK	
4.001	SWMH09	0.000	0.37		104.9	OK	
5.000	SWMH10	0.000	0.51		106.0	OK	1
4.002	SWMH11	0.000	0.87		181.3	OK	
4.003	SWMH13	0.000	0.52		172.7	OK	
4.004	SWMH14	0.000	0.63		171.2	OK	3
4.005	RWHT	0.000	0.32		90.5	OK	
4.006	SWMH15	0.000	0.32		90.4	OK	
1.006	SWMH16	0.000	0.45		179.2	OK	
1.007	SWMH17	0.000	0.43		166.0	OK	
1.008	SWMH18	0.000	0.40		156.5	OK	
1.009	SWMH19	0.000	0.40		149.3	OK	
1.010	SWMH20	0.000	0.51		147.8	OK	
1.011	SWMH21	0.000	0.53		147.8	OK	

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

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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH01	60 Winter	30	+0%	100/15 Summer	100/30 Winter			6.171	-0.079
1.001	SWMH02	60 Winter	30	+0%	100/15 Summer				6.171	-0.122
1.002	SWMH03	60 Winter	30	+0%	100/15 Summer				6.114	0.000
2.000	QMAX IC01	60 Winter	30	+0%	100/15 Summer	100/15 Winter			6.112	-0.248
2.001	QMAX IC02	60 Winter	30	+0%	100/15 Summer	100/30 Winter			6.112	-0.247
3.000	QMAX IC03	60 Winter	30	+0%	100/15 Summer				6.111	-0.249
3.001	QMAX IC04	60 Winter	30	+0%	100/15 Summer	100/15 Winter			6.111	-0.248
3.002	QMAX IC05	60 Winter	30	+0%	100/15 Summer	100/30 Winter			6.111	-0.243
2.002	SWMH05	30 Winter	30	+0%	30/30 Winter	100/15 Winter			6.112	0.001
1.003	SWMH04	60 Winter	30	+0%	100/15 Summer				6.051	0.000
1.004	SWMH06	30 Winter	30	+0%	100/15 Summer				5.985	0.000
1.005	SWMH07	30 Winter	30	+0%	100/15 Summer				5.932	-0.156
4.000	SWMH08	15 Winter	30	+0%	30/15 Summer				6.516	0.116
4.001	SWMH09	15 Winter	30	+0%	30/15 Winter				6.390	0.005
5.000	SWMH10	15 Winter	30	+0%	30/15 Summer	100/15 Winter			6.361	0.061
4.002	SWMH11	15 Winter	30	+0%	30/15 Summer				6.281	0.020
4.003	SWMH13	15 Winter	30	+0%	30/15 Summer				6.230	0.275
4.004	SWMH14	15 Winter	30	+0%	100/15 Summer	100/15 Winter			6.153	0.000
4.005	RWHT	30 Winter	30	+0%	100/15 Summer				5.896	-0.125
4.006	SWMH15	30 Winter	30	+0%	100/15 Summer				5.882	-0.139
1.006	SWMH16	30 Winter	30	+0%	100/15 Summer				5.867	-0.138
1.007	SWMH17	30 Winter	30	+0%	100/15 Summer				5.771	-0.123
1.008	SWMH18	30 Winter	30	+0%	100/15 Summer				5.680	-0.135
1.009	SWMH19	30 Winter	30	+0%	100/15 Summer				5.587	-0.148
1.010	SWMH20	30 Winter	30	+0%	100/15 Summer				5.496	-0.181
1.011	SWMH21	30 Winter	30	+0%	100/15 Winter				5.472	-0.195

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH01	0.000	0.01		0.6	OK	1
1.001	SWMH02	0.000	0.36		55.8	OK	
1.002	SWMH03	0.000	0.42		70.1	OK	
2.000	QMAX IC01	0.000	0.00		0.7	OK	4
2.001	QMAX IC02	0.000	0.02		3.2	OK	1
3.000	QMAX IC03	0.000	0.00		0.6	OK	
3.001	QMAX IC04	0.000	0.02		3.2	OK	5
3.002	QMAX IC05	0.000	0.10		12.6	OK	1
2.002	SWMH05	0.000	0.37		118.5	SURCHARGED	5
1.003	SWMH04	0.000	0.63		159.9	OK	
1.004	SWMH06	0.000	1.00		231.4	OK	
1.005	SWMH07	0.000	0.59		230.3	OK	
4.000	SWMH08	0.000	2.32		241.0	SURCHARGED	
4.001	SWMH09	0.000	0.80		223.3	SURCHARGED	
5.000	SWMH10	0.000	1.02		211.7	SURCHARGED	1
4.002	SWMH11	0.000	1.97		410.1	SURCHARGED	
4.003	SWMH13	0.000	1.18		392.0	SURCHARGED	
4.004	SWMH14	0.000	1.44		393.0	OK	3
4.005	RWHT	0.000	0.78		221.5	OK	
4.006	SWMH15	0.000	0.78		220.8	OK	
1.006	SWMH16	0.000	0.91		366.2	OK	
1.007	SWMH17	0.000	0.85		329.5	OK	
1.008	SWMH18	0.000	0.79		307.0	OK	
1.009	SWMH19	0.000	0.80		295.2	OK	
1.010	SWMH20	0.000	1.02		294.1	OK	
1.011	SWMH21	0.000	1.05		294.2	OK	

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

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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH01	30 Winter	100	+40%	100/15 Summer	100/30 Winter			6.696	0.446
1.001	SWMH02	30 Winter	100	+40%	100/15 Summer				6.770	0.477
1.002	SWMH03	30 Summer	100	+40%	100/15 Summer				6.670	0.556
2.000	QMAX IC01	30 Winter	100	+40%	100/15 Summer	100/15 Winter			6.614	0.254
2.001	QMAX IC02	30 Winter	100	+40%	100/15 Summer	100/30 Winter			6.615	0.256
3.000	QMAX IC03	30 Winter	100	+40%	100/15 Summer				6.605	0.245
3.001	QMAX IC04	30 Winter	100	+40%	100/15 Summer	100/15 Winter			6.605	0.246
3.002	QMAX IC05	30 Winter	100	+40%	100/15 Summer	100/30 Winter			6.617	0.263
2.002	SWMH05	30 Winter	100	+40%	30/30 Winter	100/15 Winter			6.638	0.527
1.003	SWMH04	30 Summer	100	+40%	100/15 Summer				6.644	0.593
1.004	SWMH06	30 Summer	100	+40%	100/15 Summer				6.613	0.628
1.005	SWMH07	30 Winter	100	+40%	100/15 Summer				6.568	0.480
4.000	SWMH08	15 Winter	100	+40%	30/15 Summer				7.483	1.083
4.001	SWMH09	15 Winter	100	+40%	30/15 Winter				7.131	0.746
5.000	SWMH10	15 Winter	100	+40%	30/15 Summer	100/15 Winter			7.039	0.739
4.002	SWMH11	15 Winter	100	+40%	30/15 Summer				6.792	0.531
4.003	SWMH13	30 Winter	100	+40%	30/15 Summer				6.733	0.778
4.004	SWMH14	30 Winter	100	+40%	100/15 Summer	100/15 Winter			6.607	0.454
4.005	RWHT	30 Winter	100	+40%	100/15 Summer				6.586	0.565
4.006	SWMH15	30 Winter	100	+40%	100/15 Summer				6.568	0.547
1.006	SWMH16	30 Winter	100	+40%	100/15 Summer				6.539	0.534
1.007	SWMH17	30 Winter	100	+40%	100/15 Summer				6.349	0.455
1.008	SWMH18	30 Winter	100	+40%	100/15 Summer				6.220	0.405
1.009	SWMH19	30 Winter	100	+40%	100/15 Summer				6.059	0.324
1.010	SWMH20	30 Winter	100	+40%	100/15 Summer				5.913	0.236
1.011	SWMH21	30 Winter	100	+40%	100/15 Winter				5.763	0.096

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH01	9.395	0.82		44.5	FLOOD	1
1.001	SWMH02	0.000	0.90		138.5	FLOOD RISK	
1.002	SWMH03	0.000	1.22		204.9	FLOOD RISK	
2.000	QMAX IC01	11.386	0.29		46.0	FLOOD	4
2.001	QMAX IC02	3.432	0.22		39.7	FLOOD	1
3.000	QMAX IC03	0.000	0.03		4.8	FLOOD RISK*	
3.001	QMAX IC04	29.098	0.25		44.8	FLOOD	5
3.002	QMAX IC05	6.072	0.48		58.2	FLOOD	1
2.002	SWMH05	27.835	0.64		205.8	FLOOD	5
1.003	SWMH04	0.000	1.43		364.2	FLOOD RISK	
1.004	SWMH06	0.000	1.73		400.6	FLOOD RISK	
1.005	SWMH07	0.000	1.07		415.3	SURCHARGED	
4.000	SWMH08	0.000	3.90		406.2	FLOOD RISK	
4.001	SWMH09	0.000	1.36		381.8	FLOOD RISK	
5.000	SWMH10	0.389	1.73		358.1	FLOOD	1
4.002	SWMH11	0.000	3.49		723.7	SURCHARGED	
4.003	SWMH13	0.000	1.86		616.5	SURCHARGED	
4.004	SWMH14	15.053	2.25		613.8	FLOOD	3
4.005	RWHT	0.000	1.52		429.3	FLOOD RISK	
4.006	SWMH15	0.000	1.47		417.3	FLOOD RISK	
1.006	SWMH16	0.000	1.79		722.1	SURCHARGED	
1.007	SWMH17	0.000	1.74		673.5	SURCHARGED	
1.008	SWMH18	0.000	1.65		641.0	SURCHARGED	
1.009	SWMH19	0.000	1.68		619.8	SURCHARGED	
1.010	SWMH20	0.000	2.11		611.0	SURCHARGED	
1.011	SWMH21	0.000	2.17		606.8	SURCHARGED	

Some temporary flooding for 1 in 100yr (+40% climate change) event (up to 30 mins duration). Total temporary flood volume 112 cu.m.

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_S

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_S

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	15.093	0.101	150.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	25.312	0.169	149.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	14.988	0.075	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	36.077	0.120	300.0	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	38.176	0.191	200.0	0.048	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	68.115	0.227	300.0	0.091	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	69.615	0.232	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	7.725	0.026	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	83.26	5.31	5.941	0.000	0.0	0.0	0.0	0.82	14.5	0.0
1.001	79.93	5.82	5.840	0.000	0.0	0.0	0.0	0.82	14.5	0.0
1.002	78.57	6.05	5.521	0.000	0.0	0.0	0.0	1.11	78.3	0.0
1.003	74.84	6.71	5.446	0.045	0.0	0.0	0.0	0.90	63.8	9.1
2.000	80.75	5.69	6.051	0.048	0.0	0.0	0.0	0.92	36.6	10.4
2.001	73.62	6.95	5.785	0.139	0.0	0.0	0.0	0.90	63.8	27.7
2.002	67.69	8.23	5.558	0.139	0.0	0.0	0.0	0.90	63.8	27.7
1.004	67.09	8.38	5.326	0.184	0.0	0.0	0.0	0.90	63.8	33.4

Surcharged Outfall Details for SW_S

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004		6.600	5.300	0.000	0	0

Datum (m) 0.000 Offset (mins) 0

Surcharged Outfall Details for SW_S

Time (mins)	Depth (m)
1440	5.450

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

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	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333750 392800 SJ 33750 92800	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH126	120 Winter	2	+0%					5.941	-0.150
1.001	SWMH127	120 Winter	2	+0%					5.840	-0.150
1.002	SWMH128	120 Winter	2	+0%					5.521	-0.300
1.003	SWMH129	15 Winter	2	+0%					5.510	-0.237
2.000	SWMH123	15 Winter	2	+0%	100/15 Summer				6.121	-0.155
2.001	SWMH124	15 Winter	2	+0%	100/15 Summer				5.899	-0.186
2.002	SWMH125	15 Winter	2	+0%	100/15 Summer				5.668	-0.191
1.004	SWMH130	15 Winter	2	+0%	100/15 Summer				5.465	-0.161

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH126	0.000	0.00		0.0	OK	
1.001	SWMH127	0.000	0.00		0.0	OK	
1.002	SWMH128	0.000	0.00		0.0	OK	
1.003	SWMH129	0.000	0.10		5.7	OK	
2.000	SWMH123	0.000	0.20		7.1	OK	
2.001	SWMH124	0.000	0.29		17.7	OK	
2.002	SWMH125	0.000	0.27		16.7	OK	
1.004	SWMH130	0.000	0.44		20.7	OK	

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH126	120 Winter	30	+0%					5.941	-0.150
1.001	SWMH127	120 Winter	30	+0%					5.840	-0.150
1.002	SWMH128	15 Winter	30	+0%					5.562	-0.259
1.003	SWMH129	15 Winter	30	+0%					5.564	-0.183
2.000	SWMH123	15 Winter	30	+0%	100/15 Summer				6.155	-0.121
2.001	SWMH124	15 Winter	30	+0%	100/15 Summer				5.978	-0.107
2.002	SWMH125	15 Winter	30	+0%	100/15 Summer				5.737	-0.122
1.004	SWMH130	15 Winter	30	+0%	100/15 Summer				5.555	-0.071

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH126	0.000	0.00		0.0	OK	
1.001	SWMH127	0.000	0.00		0.0	OK	
1.002	SWMH128	0.000	0.00		0.2	OK	
1.003	SWMH129	0.000	0.24		14.2	OK	
2.000	SWMH123	0.000	0.42		14.6	OK	
2.001	SWMH124	0.000	0.67		40.9	OK	
2.002	SWMH125	0.000	0.62		37.7	OK	
1.004	SWMH130	0.000	0.94		44.2	OK	

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

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   Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH126	120 Winter	100	+40%					5.941	-0.150
1.001	SWMH127	120 Winter	100	+40%					5.840	-0.150
1.002	SWMH128	15 Winter	100	+40%					5.692	-0.129
1.003	SWMH129	15 Winter	100	+40%					5.693	-0.053
2.000	SWMH123	15 Winter	100	+40%	100/15 Summer				6.322	0.046
2.001	SWMH124	15 Winter	100	+40%	100/15 Summer				6.211	0.126
2.002	SWMH125	15 Winter	100	+40%	100/15 Summer				5.913	0.055
1.004	SWMH130	15 Winter	100	+40%	100/15 Summer				5.668	0.042

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH126	0.000	0.00		0.0	OK	
1.001	SWMH127	0.000	0.00		0.0	OK	
1.002	SWMH128	0.000	0.01		0.8	OK	
1.003	SWMH129	0.000	0.42		24.8	OK	
2.000	SWMH123	0.000	0.76		26.3	SURCHARGED	
2.001	SWMH124	0.000	1.18		71.9	SURCHARGED	
2.002	SWMH125	0.000	0.98		60.1	SURCHARGED	
1.004	SWMH130	0.000	1.52		71.9	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_C

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	29.313	0.158	185.5	0.000	5.00	0.0	0.600	o	250	Pipe/Conduit	
1.001	60.296	0.268	225.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	3.335	0.015	222.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	5.809	0.026	223.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	4.198	0.019	220.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	73.462	0.326	225.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	57.236	0.254	225.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	53.979	0.270	199.9	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	25.508	0.073	349.4	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
1.008	15.369	0.044	349.3	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
1.009	35.220	0.101	348.7	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
3.000	12.814	0.050	256.3	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.001	6.831	0.120	56.9	0.785	0.00	0.0	0.600	o	500	Pipe/Conduit	
3.002	33.361	0.480	69.5	0.054	0.00	0.0	0.600	o	500	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	82.12	5.48	6.635	0.000	0.0	0.0	0.0	1.02	50.3	0.0
1.001	76.32	6.44	6.477	0.000	0.0	0.0	0.0	1.04	73.8	0.0
1.002	76.03	6.49	6.209	0.000	0.0	0.0	0.0	1.05	74.2	0.0
1.003	75.53	6.58	6.194	0.000	0.0	0.0	0.0	1.05	74.1	0.0
1.004	75.17	6.65	6.168	0.000	0.0	0.0	0.0	1.05	74.5	0.0
1.005	69.45	7.83	6.149	0.000	0.0	0.0	0.0	1.04	73.7	0.0
1.006	65.64	8.74	5.823	0.000	0.0	0.0	0.0	1.04	73.7	0.0
2.000	78.99	5.98	6.600	0.000	0.0	0.0	0.0	0.92	36.6	0.0
1.007	64.04	9.16	5.468	0.000	0.0	0.0	0.0	1.00	126.2	0.0
1.008	63.12	9.42	5.395	0.000	0.0	0.0	0.0	1.00	126.2	0.0
1.009	61.11	10.00	5.351	0.000	0.0	0.0	0.0	1.00	126.3	0.0
3.000	83.86	5.22	6.450	0.000	0.0	0.0	0.0	0.98	69.1	0.0
3.001	83.59	5.26	5.800	0.785	0.0	0.0	0.0	2.88	566.2	177.7
3.002	82.16	5.47	5.680	0.839	0.0	0.0	0.0	2.61	512.2	186.6

Camden Mill
Lower Bristol Road
Bath

The Peoples Project
SW Calcs Surgharged Outfalls
Central (C) Network

Date 17/12/2020 17:03
File SW_Networks_201217.MDX

Designed by Matt Redfern
Checked by Nick Hall

Innovyze

Network 2019.1

Network Design Table for SW_C

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
4.000	12.588	0.100	125.9	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	6.657	0.030	221.9	0.723	0.00	0.0	0.600	o	500	Pipe/Conduit	
4.002	16.016	0.167	95.9	0.000	0.00	0.0	0.600	o	500	Pipe/Conduit	
5.000	20.431	0.586	34.9	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.003	34.848	0.361	96.5	0.101	0.00	0.0	0.600	o	500	Pipe/Conduit	
1.010	18.058	0.025	722.3	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
6.000	69.072	0.295	234.1	0.173	5.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	40.662	0.173	235.0	0.090	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.011	3.696	0.005	739.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.012	5.613	0.007	801.9	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.013	8.335	0.013	641.2	0.000	0.00	0.0	0.600	o	750	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)
4.000	84.34	5.15	6.100	0.000	0.0	0.0	0.0	1.40	99.0	0.0
4.001	83.81	5.23	5.800	0.723	0.0	0.0	0.0	1.45	285.5	164.1
4.002	82.99	5.35	5.770	0.723	0.0	0.0	0.0	2.22	435.6	164.1
5.000	84.32	5.15	6.422	0.000	0.0	0.0	0.0	2.22	88.4	0.0
4.003	81.27	5.61	5.603	0.824	0.0	0.0	0.0	2.21	434.2	181.3
1.010	60.17	10.29	4.950	1.662	0.0	0.0	0.0	1.03	456.6	270.8
6.000	78.11	6.13	5.670	0.173	0.0	0.0	0.0	1.02	72.3	36.7
7.000	80.92	5.66	5.548	0.090	0.0	0.0	0.0	1.02	72.2	19.8
1.011	59.97	10.35	4.925	1.926	0.0	0.0	0.0	1.02	451.3	312.8
1.012	59.67	10.45	4.920	1.926	0.0	0.0	0.0	0.98	433.1	312.8
1.013	59.28	10.58	4.913	1.926	0.0	0.0	0.0	1.10	484.9	312.8

Surcharged Outfall Details for SW_C

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013	Channel East 1	6.700	4.900	4.600	2100	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)
1440	5.530

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

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   Data Type Catchment
FEH Rainfall Version 2013   Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800   Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWIC101	120 Winter	2	+0%					6.635	-0.250
1.001	SWIC102	120 Winter	2	+0%					6.477	-0.300
1.002	SWIC103	120 Winter	2	+0%					6.209	-0.300
1.003	Bend	120 Winter	2	+0%					6.194	-0.300
1.004	Bend	120 Winter	2	+0%					6.168	-0.300
1.005	SWIC104	120 Winter	2	+0%					6.149	-0.300
1.006	SWIC105	120 Winter	2	+0%	100/15 Summer				5.823	-0.300
2.000	SWIC106	120 Winter	2	+0%					6.600	-0.225
1.007	SWIC107	120 Winter	2	+0%	100/15 Summer				5.468	-0.400
1.008	SWMH109	15 Winter	2	+0%	100/15 Summer				5.456	-0.339
1.009	SWMH109b	15 Winter	2	+0%	30/15 Winter				5.477	-0.274
3.000	SWMH110	120 Winter	2	+0%	100/15 Summer				6.450	-0.300
3.001	SWMH112	15 Winter	2	+0%	100/15 Summer				6.017	-0.283
3.002	SWMH113	15 Winter	2	+0%	100/15 Summer				5.842	-0.338
4.000	SWMH114	120 Winter	2	+0%	100/15 Summer				6.100	-0.300
4.001	SWMH115	15 Winter	2	+0%	100/15 Summer				6.054	-0.246
4.002	SWMH116	15 Winter	2	+0%	100/15 Summer				5.959	-0.311
5.000	SWRE01	120 Winter	2	+0%	100/15 Winter				6.422	-0.225
4.003	JNC	15 Winter	2	+0%					5.767	-0.336
1.010	SWMH117	15 Winter	2	+0%	30/15 Summer				5.480	-0.220
6.000	SWMH118	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.799	-0.171
7.000	SWMH119	15 Winter	2	+0%	100/15 Summer				5.640	-0.208
1.011	SWMH120	1440 Summer	2	+0%	30/15 Summer				5.444	-0.231
1.012	SWMH121	1440 Summer	2	+0%	30/15 Summer				5.444	-0.226
1.013	SWMH122	1440 Summer	2	+0%	100/15 Summer				5.444	-0.219

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWIC101	0.000	0.00		0.0	OK	
1.001	SWIC102	0.000	0.00		0.0	OK	
1.002	SWIC103	0.000	0.00		0.0	OK	
1.003	Bend	0.000	0.00		0.0	OK*	
1.004	Bend	0.000	0.00		0.0	OK*	
1.005	SWIC104	0.000	0.00		0.0	OK	
1.006	SWIC105	0.000	0.00		0.0	OK	
2.000	SWIC106	0.000	0.00		0.0	OK	
1.007	SWIC107	0.000	0.00		0.0	OK	
1.008	SWMH109	0.000	0.01		1.2	OK	
1.009	SWMH109b	0.000	0.02		2.7	OK	
3.000	SWMH110	0.000	0.00		0.0	OK	
3.001	SWMH112	0.000	0.39		94.6	OK	
3.002	SWMH113	0.000	0.23		100.8	OK	
4.000	SWMH114	0.000	0.00		0.0	OK	
4.001	SWMH115	0.000	0.51		87.0	OK	
4.002	SWMH116	0.000	0.31		86.9	OK	
5.000	SWRE01	0.000	0.00		0.0	OK	
4.003	JNC	0.000	0.24		98.3	OK*	
1.010	SWMH117	0.000	0.87		193.1	OK	
6.000	SWMH118	0.000	0.38		26.1	OK	1
7.000	SWMH119	0.000	0.21		13.8	OK	
1.011	SWMH120	0.000	0.21		75.9	OK	
1.012	SWMH121	0.000	0.24		80.7	OK	
1.013	SWMH122	0.000	0.30		82.2	OK	

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWIC101	120 Winter	30	+0%					6.635	-0.250
1.001	SWIC102	120 Winter	30	+0%					6.477	-0.300
1.002	SWIC103	120 Winter	30	+0%					6.209	-0.300
1.003	Bend	120 Winter	30	+0%					6.194	-0.300
1.004	Bend	120 Winter	30	+0%					6.168	-0.300
1.005	SWIC104	120 Winter	30	+0%					6.149	-0.300
1.006	SWIC105	120 Winter	30	+0%	100/15 Summer				5.823	-0.300
2.000	SWIC106	120 Winter	30	+0%					6.600	-0.225
1.007	SWIC107	15 Winter	30	+0%	100/15 Summer				5.748	-0.120
1.008	SWMH109	15 Winter	30	+0%	100/15 Summer				5.748	-0.047
1.009	SWMH109b	15 Winter	30	+0%	30/15 Winter				5.760	0.009
3.000	SWMH110	120 Winter	30	+0%	100/15 Summer				6.450	-0.300
3.001	SWMH112	15 Winter	30	+0%	100/15 Summer				6.165	-0.135
3.002	SWMH113	15 Winter	30	+0%	100/15 Summer				5.938	-0.242
4.000	SWMH114	15 Winter	30	+0%	100/15 Summer				6.301	-0.099
4.001	SWMH115	15 Winter	30	+0%	100/15 Summer				6.300	0.000
4.002	SWMH116	15 Winter	30	+0%	100/15 Summer				6.068	-0.202
5.000	SWRE01	120 Winter	30	+0%	100/15 Winter				6.422	-0.225
4.003	JNC	15 Winter	30	+0%					5.872	-0.231
1.010	SWMH117	15 Winter	30	+0%	30/15 Summer				5.782	0.082
6.000	SWMH118	15 Winter	30	+0%	100/15 Summer	100/15 Winter			5.888	-0.082
7.000	SWMH119	15 Winter	30	+0%	100/15 Summer				5.786	-0.062
1.011	SWMH120	15 Winter	30	+0%	30/15 Summer				5.736	0.061
1.012	SWMH121	15 Winter	30	+0%	30/15 Summer				5.701	0.031
1.013	SWMH122	30 Winter	30	+0%	100/15 Summer				5.663	0.000

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWIC101	0.000	0.00		0.0	OK	
1.001	SWIC102	0.000	0.00		0.0	OK	
1.002	SWIC103	0.000	0.00		0.0	OK	
1.003	Bend	0.000	0.00		0.0	OK*	
1.004	Bend	0.000	0.00		0.0	OK*	
1.005	SWIC104	0.000	0.00		0.0	OK	
1.006	SWIC105	0.000	0.00		0.0	OK	
2.000	SWIC106	0.000	0.00		0.0	OK	
1.007	SWIC107	0.000	0.05		5.7	OK	
1.008	SWMH109	0.000	0.23		21.8	OK	
1.009	SWMH109b	0.000	0.28		31.5	SURCHARGED	
3.000	SWMH110	0.000	0.00		0.0	OK	
3.001	SWMH112	0.000	0.86		208.5	OK	
3.002	SWMH113	0.000	0.51		225.7	OK	
4.000	SWMH114	0.000	0.02		1.4	OK	
4.001	SWMH115	0.000	1.12		189.5	OK	
4.002	SWMH116	0.000	0.66		187.8	OK	
5.000	SWRE01	0.000	0.00		0.0	OK	
4.003	JNC	0.000	0.51		211.5	OK*	
1.010	SWMH117	0.000	1.80		400.9	SURCHARGED	
6.000	SWMH118	0.000	0.74		51.2	OK	1
7.000	SWMH119	0.000	0.40		26.9	OK	
1.011	SWMH120	0.000	1.33		473.7	SURCHARGED	
1.012	SWMH121	0.000	1.37		470.2	SURCHARGED	
1.013	SWMH122	0.000	1.48		408.5	OK	

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

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	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333750 392800 SJ 33750 92800	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWIC101	120 Winter	100	+40%					6.635	-0.250
1.001	SWIC102	120 Winter	100	+40%					6.477	-0.300
1.002	SWIC103	15 Winter	100	+40%					6.316	-0.193
1.003	Bend	15 Winter	100	+40%					6.339	-0.155
1.004	Bend	15 Winter	100	+40%					6.347	-0.121
1.005	SWIC104	15 Winter	100	+40%					6.354	-0.095
1.006	SWIC105	15 Winter	100	+40%	100/15 Summer				6.382	0.259
2.000	SWIC106	120 Winter	100	+40%					6.600	-0.225
1.007	SWIC107	15 Winter	100	+40%	100/15 Summer				6.399	0.531
1.008	SWMH109	15 Winter	100	+40%	100/15 Summer				6.419	0.624
1.009	SWMH109b	15 Winter	100	+40%	30/15 Winter				6.451	0.700
3.000	SWMH110	15 Winter	100	+40%	100/15 Summer				7.031	0.281
3.001	SWMH112	15 Winter	100	+40%	100/15 Summer				7.032	0.732
3.002	SWMH113	15 Winter	100	+40%	100/15 Summer				6.805	0.625
4.000	SWMH114	15 Winter	100	+40%	100/15 Summer				7.118	0.718
4.001	SWMH115	15 Winter	100	+40%	100/15 Summer				7.119	0.819
4.002	SWMH116	15 Winter	100	+40%	100/15 Summer				6.927	0.657
5.000	SWRE01	15 Winter	100	+40%	100/15 Winter				6.737	0.090
4.003	JNC	30 Winter	100	+40%					6.103	0.000
1.010	SWMH117	15 Winter	100	+40%	30/15 Summer				6.499	0.799
6.000	SWMH118	15 Winter	100	+40%	100/15 Summer	100/15 Winter			6.727	0.757
7.000	SWMH119	15 Winter	100	+40%	100/15 Summer				6.414	0.566
1.011	SWMH120	15 Winter	100	+40%	30/15 Summer				6.326	0.651
1.012	SWMH121	15 Winter	100	+40%	30/15 Summer				6.086	0.416
1.013	SWMH122	15 Winter	100	+40%	100/15 Summer				5.848	0.185

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWIC101	0.000	0.00		0.0	OK	
1.001	SWIC102	0.000	0.00		0.0	OK	
1.002	SWIC103	0.000	0.04		2.0	OK	
1.003	Bend	0.000	0.06		3.7	OK*	
1.004	Bend	0.000	0.10		6.3	OK*	
1.005	SWIC104	0.000	0.06		4.0	OK	
1.006	SWIC105	0.000	0.34		23.7	SURCHARGED	
2.000	SWIC106	0.000	0.00		0.0	OK	
1.007	SWIC107	0.000	0.25		27.4	SURCHARGED	
1.008	SWMH109	0.000	0.50		46.8	SURCHARGED	
1.009	SWMH109b	0.000	0.44		49.1	SURCHARGED	
3.000	SWMH110	0.000	0.05		2.9	FLOOD RISK	
3.001	SWMH112	0.000	1.37		331.3	FLOOD RISK	
3.002	SWMH113	0.000	0.80		349.6	SURCHARGED	
4.000	SWMH114	0.000	0.04		3.2	FLOOD RISK	
4.001	SWMH115	0.000	1.80		306.1	FLOOD RISK	
4.002	SWMH116	0.000	1.06		301.6	SURCHARGED	
5.000	SWRE01	0.000	0.00		0.0	SURCHARGED*	
4.003	JNC	0.000	0.75		314.3	SURCHARGED*	
1.010	SWMH117	0.000	2.90		644.1	SURCHARGED	
6.000	SWMH118	0.044	1.17		81.1	FLOOD	1
7.000	SWMH119	0.000	0.64		42.7	SURCHARGED	
1.011	SWMH120	0.000	2.14		761.6	SURCHARGED	
1.012	SWMH121	0.000	2.23		762.8	SURCHARGED	
1.013	SWMH122	0.000	2.76		762.0	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_CP

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.700	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.900
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_CP

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	43.099	0.192	224.5	0.141	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	38.847	0.173	224.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	32.256	0.143	225.6	0.055	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	38.402	0.171	224.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	11.327	0.050	226.5	0.085	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	12.018	0.037	324.8	0.145	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	27.187	0.085	319.8	0.010	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	27.857	0.153	182.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	14.321	0.044	325.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	61.075	0.181	337.4	0.126	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	8.906	0.027	329.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	8.906	0.028	318.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	80.34	5.69	5.717	0.141	0.0	0.0	0.0	1.05	73.9	30.7
1.001	77.12	6.22	5.475	0.141	0.0	0.0	0.0	1.20	133.1	30.7
2.000	81.44	5.52	5.716	0.055	0.0	0.0	0.0	1.04	73.7	12.1
2.001	77.68	6.13	5.573	0.055	0.0	0.0	0.0	1.05	73.9	12.1
2.002	76.64	6.31	5.402	0.139	0.0	0.0	0.0	1.04	73.5	28.9
1.002	75.53	6.51	5.302	0.426	0.0	0.0	0.0	1.00	110.4	87.1
1.003	73.17	6.96	5.265	0.436	0.0	0.0	0.0	1.01	111.3	87.1
3.000	81.66	5.48	5.483	0.000	0.0	0.0	0.0	0.97	38.4	0.0
1.004	71.99	7.20	5.180	0.436	0.0	0.0	0.0	1.00	110.3	87.1
1.005	67.32	8.24	5.136	0.562	0.0	0.0	0.0	0.98	108.3	102.4
1.006	66.70	8.39	4.955	0.562	0.0	0.0	0.0	0.99	109.6	102.4
1.007	66.11	8.53	4.928	0.562	0.0	0.0	0.0	1.01	111.6	102.4

Surcharged Outfall Details for SW_CP

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	Channel West	7.580	4.900	0.000	1200	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)
1440	5.530

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH51	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.832	-0.185
1.001	SWMH52	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.588	-0.262
2.000	SWMH53	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.786	-0.230
2.001	SWMH54	15 Winter	2	+0%	100/15 Summer	100/15 Summer			5.642	-0.231
2.002	SWMH55	15 Winter	2	+0%	30/15 Summer				5.544	-0.158
1.002	SWMH56	15 Winter	2	+0%	30/15 Summer	100/15 Summer			5.527	-0.150
1.003	SWMH57	15 Winter	2	+0%	30/15 Summer				5.473	-0.167
3.000	SWDNO 01	120 Winter	2	+0%	100/15 Summer				5.483	-0.225
1.004	SWDNO 02	15 Winter	2	+0%	30/15 Summer				5.403	-0.152
1.005	SWMH58	15 Winter	2	+0%	30/15 Summer				5.358	-0.153
1.006	SWMH59	15 Winter	2	+0%	30/15 Summer				5.218	-0.112
1.007	SWMH60	1440 Summer	2	+0%	30/15 Winter				5.217	-0.086

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH51	0.000	0.30		21.0	OK	4
1.001	SWMH52	0.000	0.17		20.4	OK	4
2.000	SWMH53	0.000	0.12		8.2	OK	4
2.001	SWMH54	0.000	0.12		8.0	OK	4
2.002	SWMH55	0.000	0.30		17.7	OK	
1.002	SWMH56	0.000	0.67		54.5	OK	2
1.003	SWMH57	0.000	0.57		55.0	OK	
3.000	SWDNO 01	0.000	0.00		0.0	OK	
1.004	SWDNO 02	0.000	0.65		54.4	OK	
1.005	SWMH58	0.000	0.63		64.1	OK	
1.006	SWMH59	0.000	0.83		62.3	OK	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	SWMH60	0.000	0.40		30.8	OK	

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

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 Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH51	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.894	-0.123
1.001	SWMH52	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.818	-0.032
2.000	SWMH53	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.845	-0.171
2.001	SWMH54	15 Winter	30	+0%	100/15 Summer	100/15 Summer			5.829	-0.044
2.002	SWMH55	15 Winter	30	+0%	30/15 Summer				5.820	0.118
1.002	SWMH56	15 Winter	30	+0%	30/15 Summer	100/15 Summer			5.751	0.074
1.003	SWMH57	15 Winter	30	+0%	30/15 Summer				5.713	0.073
3.000	SWDNO 01	15 Winter	30	+0%	100/15 Summer				5.627	-0.081
1.004	SWDNO 02	15 Winter	30	+0%	30/15 Summer				5.628	0.073
1.005	SWMH58	15 Winter	30	+0%	30/15 Summer				5.582	0.071
1.006	SWMH59	15 Winter	30	+0%	30/15 Summer				5.360	0.030
1.007	SWMH60	15 Winter	30	+0%	30/15 Winter				5.307	0.004

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH51	0.000	0.63		43.2	OK	4
1.001	SWMH52	0.000	0.30		35.8	OK	4
2.000	SWMH53	0.000	0.25		16.5	OK	4
2.001	SWMH54	0.000	0.19		12.8	OK	4
2.002	SWMH55	0.000	0.50		29.2	SURCHARGED	
1.002	SWMH56	0.000	1.22		99.7	SURCHARGED	2
1.003	SWMH57	0.000	0.98		95.1	SURCHARGED	
3.000	SWDNO 01	0.000	0.02		0.7	OK	
1.004	SWDNO 02	0.000	1.07		90.3	SURCHARGED	
1.005	SWMH58	0.000	1.08		109.8	SURCHARGED	
1.006	SWMH59	0.000	1.43		107.2	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	SWMH60	0.000	1.38		107.1	SURCHARGED	

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

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	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333750 392800 SJ 33750 92800	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH51	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.612	0.595
1.001	SWMH52	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.549	0.699
2.000	SWMH53	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.552	0.536
2.001	SWMH54	15 Winter	100	+40%	100/15 Summer	100/15 Summer			6.546	0.673
2.002	SWMH55	15 Winter	100	+40%	30/15 Summer				6.615	0.913
1.002	SWMH56	15 Winter	100	+40%	30/15 Summer	100/15 Summer			6.545	0.868
1.003	SWMH57	15 Winter	100	+40%	30/15 Summer				6.492	0.852
3.000	SWDNO 01	15 Winter	100	+40%	100/15 Summer				6.372	0.664
1.004	SWDNO 02	15 Winter	100	+40%	30/15 Summer				6.378	0.823
1.005	SWMH58	15 Winter	100	+40%	30/15 Summer				6.279	0.768
1.006	SWMH59	15 Winter	100	+40%	30/15 Summer				5.672	0.342
1.007	SWMH60	15 Winter	100	+40%	30/15 Winter				5.465	0.162

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH51	6.505	0.79		54.7	FLOOD	4
1.001	SWMH52	4.748	0.47		56.5	FLOOD	4
2.000	SWMH53	4.539	0.61		40.9	FLOOD	4
2.001	SWMH54	2.296	0.54		37.2	FLOOD	4
2.002	SWMH55	0.000	0.77		45.4	FLOOD RISK	
1.002	SWMH56	0.875	1.86		151.4	FLOOD	2
1.003	SWMH57	0.000	1.46		141.8	FLOOD RISK	
3.000	SWDNO 01	0.000	0.06		2.3	SURCHARGED	
1.004	SWDNO 02	0.000	1.58		132.9	FLOOD RISK	
1.005	SWMH58	0.000	1.76		179.1	SURCHARGED	
1.006	SWMH59	0.000	2.35		176.1	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	SWMH60	0.000	2.28		177.1	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_NE

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW_NE

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	14.220	0.050	284.4	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	69.482	0.183	379.7	0.341	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	27.875	0.063	442.5	0.131	0.00	0.0	0.600	o	500	Pipe/Conduit	
2.000	12.532	0.001	12532.0	0.000	5.00	0.0	0.600	Q70	-6	Pipe/Conduit	
2.001	101.664	0.011	9242.2	0.000	0.00	0.0	0.600	Q70	-6	Pipe/Conduit	
3.000	13.986	0.001	13986.0	0.000	5.00	0.0	0.600	Q70	-6	Pipe/Conduit	
3.001	53.042	0.005	10608.4	0.000	0.00	0.0	0.600	Q70	-6	Pipe/Conduit	
3.002	23.098	0.002	11549.0	0.000	0.00	0.0	0.600	Q70	-6	Pipe/Conduit	
2.002	12.528	0.060	208.8	0.753	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	32.766	0.066	496.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	23.389	0.047	497.6	0.158	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)
1.000	83.61	5.26	5.950	0.000	0.0	0.0	0.0	0.93	65.5	0.0
1.001	76.70	6.37	5.843	0.341	0.0	0.0	0.0	1.04	165.0	70.8
1.002	74.26	6.82	5.614	0.471	0.0	0.0	0.0	1.03	201.5	94.8
2.000	78.40	6.08	5.660	0.000	0.0	0.0	0.0	0.19	48.5	0.0
2.001	51.56	13.52	5.659	0.000	0.0	0.0	0.0	0.23	56.9	0.0
3.000	77.27	6.27	5.660	0.000	0.0	0.0	0.0	0.18	45.8	0.0
3.001	59.69	10.44	5.659	0.000	0.0	0.0	0.0	0.21	53.0	0.0
3.002	54.35	12.34	5.654	0.000	0.0	0.0	0.0	0.20	50.7	0.0
2.002	51.28	13.64	5.511	0.753	0.0	0.0	0.0	1.68	475.4	104.6
1.003	50.20	14.15	5.451	1.224	0.0	0.0	0.0	1.09	307.1	166.4
1.004	49.46	14.51	5.385	1.382	0.0	0.0	0.0	1.08	306.7	185.0

Network Design Table for SW_NE

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	62.559	0.083	753.7	0.061	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.000	9.295	0.015	619.7	0.785	5.00	0.0	0.600	o	500	Pipe/Conduit	
4.001	85.165	0.168	506.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	6.856	0.045	152.4	0.709	5.00	0.0	0.600	o	500	Pipe/Conduit	
4.002	23.516	0.025	940.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.003	22.080	0.052	424.6	0.000	0.00	0.0	0.600	oo	500	Double Pipe	
4.004	8.525	0.016	532.8	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.005	8.027	0.016	501.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
4.006	8.027	0.016	501.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.006	83.261	0.111	750.1	0.040	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.007	59.103	0.079	748.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.008	59.997	0.080	750.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.009	43.802	0.058	755.2	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.010	7.755	0.010	775.5	0.041	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.011	8.199	0.017	482.3	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	47.46	15.54	5.338	1.443	0.0	0.0	0.0	1.01	446.9	185.4
4.000	84.14	5.18	5.900	0.785	0.0	0.0	0.0	0.87	169.9«	178.9
4.001	75.99	6.50	5.785	0.785	0.0	0.0	0.0	1.07	303.9	178.9
5.000	84.94	5.07	5.800	0.709	0.0	0.0	0.0	1.76	345.1	163.0
4.002	73.70	6.93	5.511	1.494	0.0	0.0	0.0	0.90	399.4	298.2
4.003	71.96	7.28	5.455	1.494	0.0	0.0	0.0	1.05	411.5	298.2
4.004	71.39	7.40	5.403	1.494	0.0	0.0	0.0	1.21	532.5	298.2
4.005	70.89	7.51	5.271	1.494	0.0	0.0	0.0	1.24	548.9	298.2
4.006	70.39	7.62	5.271	1.494	0.0	0.0	0.0	1.24	548.9	298.2
1.006	45.09	16.91	5.255	2.977	0.0	0.0	0.0	1.01	447.9	363.4
1.007	43.56	17.88	5.144	2.977	0.0	0.0	0.0	1.02	448.5	363.4
1.008	42.13	18.86	5.065	2.977	0.0	0.0	0.0	1.01	448.0	363.4
1.009	41.14	19.58	4.985	2.977	0.0	0.0	0.0	1.01	446.4	363.4
1.010	40.97	19.71	4.927	3.018	0.0	0.0	0.0	1.00	440.5	363.4
1.011	40.83	19.82	4.917	3.018	0.0	0.0	0.0	1.27	560.0	363.4

Surcharged Outfall Details for SW_NE

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.011	Under Bridge	7.198	4.900	4.700	1500	0

Datum (m) 0.000 Offset (mins) 0

Surcharged Outfall Details for SW_NE

Time (mins)	Depth (m)
1440	5.530

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

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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SWMH01	15 Winter	2	+0%	100/15 Summer	100/30 Winter			6.005
1.001	SWMH02	15 Winter	2	+0%	100/15 Summer				6.006
1.002	SWMH03	15 Winter	2	+0%	100/15 Summer				5.841
2.000	QMAX IC01	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.810
2.001	QMAX IC02	15 Winter	2	+0%	100/15 Summer	100/30 Winter			5.810
3.000	QMAX IC03	15 Winter	2	+0%	100/15 Summer				5.805
3.001	QMAX IC04	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.805
3.002	QMAX IC05	15 Winter	2	+0%	100/15 Summer	100/30 Winter			5.805
2.002	SWMH05	15 Winter	2	+0%	30/30 Winter	100/15 Winter			5.810
1.003	SWMH04	15 Winter	2	+0%	100/15 Summer				5.796
1.004	SWMH06	15 Winter	2	+0%	100/15 Summer				5.732
1.005	SWMH07	30 Winter	2	+0%	100/15 Summer				5.691
4.000	SWMH08	15 Winter	2	+0%	30/15 Summer				6.377
4.001	SWMH09	15 Winter	2	+0%	30/15 Winter				6.113
5.000	SWMH10	15 Winter	2	+0%	30/15 Summer	100/15 Winter			6.058
4.002	SWMH11	15 Winter	2	+0%	30/15 Summer				6.045
4.003	SWMH13	15 Winter	2	+0%	30/15 Summer				5.876
4.004	SWMH14	15 Winter	2	+0%	100/15 Summer	100/15 Winter			5.829
4.005	RWHT	30 Winter	2	+0%	100/15 Summer				5.670
4.006	SWMH15	30 Winter	2	+0%	100/15 Summer				5.661
1.006	SWMH16	30 Winter	2	+0%	100/15 Summer				5.652
1.007	SWMH17	30 Winter	2	+0%	100/15 Summer				5.549
1.008	SWMH18	30 Winter	2	+0%	100/15 Summer				5.470
1.009	SWMH19	30 Winter	2	+0%	100/15 Summer				5.395
1.010	SWMH20	30 Winter	2	+0%	100/15 Summer				5.327
1.011	SWMH21	1440 Winter	2	+0%	100/15 Winter				5.315

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH01	-0.245	0.000	0.00		0.2	OK	1
1.001	SWMH02	-0.287	0.000	0.27		41.4	OK	
1.002	SWMH03	-0.273	0.000	0.31		52.1	OK	
2.000	QMAX IC01	-0.550	0.000	0.00		0.4	OK	4
2.001	QMAX IC02	-0.549	0.000	0.00		0.9	OK	1
3.000	QMAX IC03	-0.555	0.000	0.00		0.3	OK	
3.001	QMAX IC04	-0.554	0.000	0.01		1.1	OK	5
3.002	QMAX IC05	-0.549	0.000	0.03		4.2	OK	1
2.002	SWMH05	-0.301	0.000	0.23		74.7	OK	5
1.003	SWMH04	-0.255	0.000	0.49		123.5	OK	
1.004	SWMH06	-0.253	0.000	0.58		134.8	OK	
1.005	SWMH07	-0.397	0.000	0.31		122.5	OK	
4.000	SWMH08	-0.023	0.000	1.09		113.0	OK	
4.001	SWMH09	-0.272	0.000	0.37		104.9	OK	
5.000	SWMH10	-0.242	0.000	0.51		106.0	OK	1
4.002	SWMH11	-0.216	0.000	0.87		181.3	OK	
4.003	SWMH13	-0.079	0.000	0.52		172.7	OK	
4.004	SWMH14	-0.324	0.000	0.63		171.2	OK	3
4.005	RWHT	-0.351	0.000	0.32		90.5	OK	
4.006	SWMH15	-0.360	0.000	0.32		90.4	OK	
1.006	SWMH16	-0.353	0.000	0.45		179.2	OK	
1.007	SWMH17	-0.345	0.000	0.43		166.0	OK	
1.008	SWMH18	-0.345	0.000	0.40		156.5	OK	
1.009	SWMH19	-0.340	0.000	0.40		149.3	OK	
1.010	SWMH20	-0.350	0.000	0.51		147.8	OK	
1.011	SWMH21	-0.352	0.000	0.25		68.5	OK	

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

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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH01	60 Winter	30	+0%	100/15 Summer	100/30 Winter			6.171	-0.079
1.001	SWMH02	60 Winter	30	+0%	100/15 Summer				6.171	-0.122
1.002	SWMH03	60 Winter	30	+0%	100/15 Summer				6.114	0.000
2.000	QMAX IC01	60 Winter	30	+0%	100/15 Summer	100/15 Winter			6.112	-0.248
2.001	QMAX IC02	60 Winter	30	+0%	100/15 Summer	100/30 Winter			6.112	-0.247
3.000	QMAX IC03	60 Winter	30	+0%	100/15 Summer				6.111	-0.249
3.001	QMAX IC04	60 Winter	30	+0%	100/15 Summer	100/15 Winter			6.111	-0.248
3.002	QMAX IC05	60 Winter	30	+0%	100/15 Summer	100/30 Winter			6.111	-0.243
2.002	SWMH05	30 Winter	30	+0%	30/30 Winter	100/15 Winter			6.112	0.001
1.003	SWMH04	60 Winter	30	+0%	100/15 Summer				6.051	0.000
1.004	SWMH06	30 Winter	30	+0%	100/15 Summer				5.985	0.000
1.005	SWMH07	30 Winter	30	+0%	100/15 Summer				5.932	-0.156
4.000	SWMH08	15 Winter	30	+0%	30/15 Summer				6.516	0.116
4.001	SWMH09	15 Winter	30	+0%	30/15 Winter				6.390	0.005
5.000	SWMH10	15 Winter	30	+0%	30/15 Summer	100/15 Winter			6.361	0.061
4.002	SWMH11	15 Winter	30	+0%	30/15 Summer				6.281	0.020
4.003	SWMH13	15 Winter	30	+0%	30/15 Summer				6.230	0.275
4.004	SWMH14	15 Winter	30	+0%	100/15 Summer	100/15 Winter			6.153	0.000
4.005	RWHT	30 Winter	30	+0%	100/15 Summer				5.896	-0.125
4.006	SWMH15	30 Winter	30	+0%	100/15 Summer				5.882	-0.139
1.006	SWMH16	30 Winter	30	+0%	100/15 Summer				5.867	-0.138
1.007	SWMH17	30 Winter	30	+0%	100/15 Summer				5.771	-0.123
1.008	SWMH18	30 Winter	30	+0%	100/15 Summer				5.680	-0.135
1.009	SWMH19	30 Winter	30	+0%	100/15 Summer				5.587	-0.148
1.010	SWMH20	30 Winter	30	+0%	100/15 Summer				5.496	-0.181
1.011	SWMH21	30 Winter	30	+0%	100/15 Winter				5.472	-0.195

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH01	0.000	0.01		0.6	OK	1
1.001	SWMH02	0.000	0.36		55.8	OK	
1.002	SWMH03	0.000	0.42		70.1	OK	
2.000	QMAX IC01	0.000	0.00		0.7	OK	4
2.001	QMAX IC02	0.000	0.02		3.2	OK	1
3.000	QMAX IC03	0.000	0.00		0.6	OK	
3.001	QMAX IC04	0.000	0.02		3.2	OK	5
3.002	QMAX IC05	0.000	0.10		12.6	OK	1
2.002	SWMH05	0.000	0.37		118.5	SURCHARGED	5
1.003	SWMH04	0.000	0.63		159.9	OK	
1.004	SWMH06	0.000	1.00		231.4	OK	
1.005	SWMH07	0.000	0.59		230.3	OK	
4.000	SWMH08	0.000	2.32		241.0	SURCHARGED	
4.001	SWMH09	0.000	0.80		223.3	SURCHARGED	
5.000	SWMH10	0.000	1.02		211.7	SURCHARGED	1
4.002	SWMH11	0.000	1.97		410.1	SURCHARGED	
4.003	SWMH13	0.000	1.18		392.0	SURCHARGED	
4.004	SWMH14	0.000	1.44		393.0	OK	3
4.005	RWHT	0.000	0.78		221.5	OK	
4.006	SWMH15	0.000	0.78		220.8	OK	
1.006	SWMH16	0.000	0.91		366.2	OK	
1.007	SWMH17	0.000	0.85		329.5	OK	
1.008	SWMH18	0.000	0.79		307.0	OK	
1.009	SWMH19	0.000	0.80		295.2	OK	
1.010	SWMH20	0.000	1.02		294.1	OK	
1.011	SWMH21	0.000	1.05		294.2	OK	

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

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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Catchment
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 333750 392800 SJ 33750 92800 Cv (Winter) 0.840

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

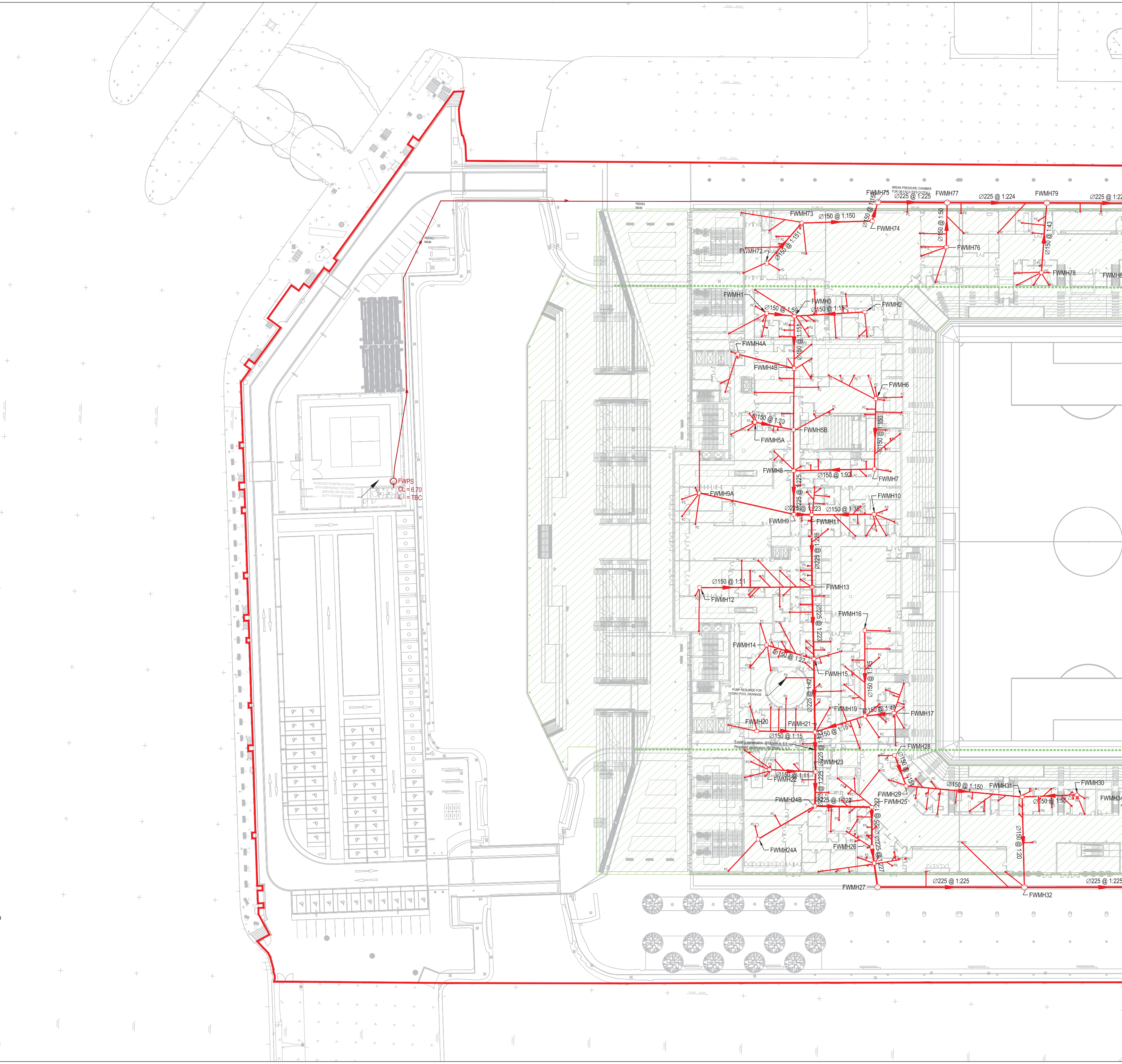
Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SWMH01	30 Winter	100	+40%	100/15 Summer	100/30 Winter			6.696	0.446
1.001	SWMH02	30 Winter	100	+40%	100/15 Summer				6.770	0.477
1.002	SWMH03	30 Summer	100	+40%	100/15 Summer				6.670	0.556
2.000	QMAX IC01	30 Winter	100	+40%	100/15 Summer	100/15 Winter			6.614	0.254
2.001	QMAX IC02	30 Winter	100	+40%	100/15 Summer	100/30 Winter			6.615	0.256
3.000	QMAX IC03	30 Winter	100	+40%	100/15 Summer				6.605	0.245
3.001	QMAX IC04	30 Winter	100	+40%	100/15 Summer	100/15 Winter			6.605	0.246
3.002	QMAX IC05	30 Winter	100	+40%	100/15 Summer	100/30 Winter			6.617	0.263
2.002	SWMH05	30 Winter	100	+40%	30/30 Winter	100/15 Winter			6.638	0.527
1.003	SWMH04	30 Summer	100	+40%	100/15 Summer				6.644	0.593
1.004	SWMH06	30 Summer	100	+40%	100/15 Summer				6.613	0.628
1.005	SWMH07	30 Winter	100	+40%	100/15 Summer				6.568	0.480
4.000	SWMH08	15 Winter	100	+40%	30/15 Summer				7.483	1.083
4.001	SWMH09	15 Winter	100	+40%	30/15 Winter				7.131	0.746
5.000	SWMH10	15 Winter	100	+40%	30/15 Summer	100/15 Winter			7.039	0.739
4.002	SWMH11	15 Winter	100	+40%	30/15 Summer				6.792	0.531
4.003	SWMH13	30 Winter	100	+40%	30/15 Summer				6.733	0.778
4.004	SWMH14	30 Winter	100	+40%	100/15 Summer	100/15 Winter			6.607	0.454
4.005	RWHT	30 Winter	100	+40%	100/15 Summer				6.586	0.565
4.006	SWMH15	30 Winter	100	+40%	100/15 Summer				6.568	0.547
1.006	SWMH16	30 Winter	100	+40%	100/15 Summer				6.539	0.534
1.007	SWMH17	30 Winter	100	+40%	100/15 Summer				6.349	0.455
1.008	SWMH18	30 Winter	100	+40%	100/15 Summer				6.220	0.405
1.009	SWMH19	30 Winter	100	+40%	100/15 Summer				6.059	0.324
1.010	SWMH20	30 Winter	100	+40%	100/15 Summer				5.913	0.236
1.011	SWMH21	30 Winter	100	+40%	100/15 Winter				5.763	0.096

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

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH01	9.395	0.82		44.5	FLOOD	1
1.001	SWMH02	0.000	0.90		138.5	FLOOD RISK	
1.002	SWMH03	0.000	1.22		204.9	FLOOD RISK	
2.000	QMAX IC01	11.386	0.29		46.0	FLOOD	4
2.001	QMAX IC02	3.432	0.22		39.7	FLOOD	1
3.000	QMAX IC03	0.000	0.03		4.8	FLOOD RISK*	
3.001	QMAX IC04	29.098	0.25		44.8	FLOOD	5
3.002	QMAX IC05	6.072	0.48		58.2	FLOOD	1
2.002	SWMH05	27.835	0.64		205.8	FLOOD	5
1.003	SWMH04	0.000	1.43		364.2	FLOOD RISK	
1.004	SWMH06	0.000	1.73		400.6	FLOOD RISK	
1.005	SWMH07	0.000	1.07		415.3	SURCHARGED	
4.000	SWMH08	0.000	3.90		406.2	FLOOD RISK	
4.001	SWMH09	0.000	1.36		381.8	FLOOD RISK	
5.000	SWMH10	0.389	1.73		358.1	FLOOD	1
4.002	SWMH11	0.000	3.49		723.7	SURCHARGED	
4.003	SWMH13	0.000	1.86		616.5	SURCHARGED	
4.004	SWMH14	15.053	2.25		613.8	FLOOD	3
4.005	RWHT	0.000	1.52		429.3	FLOOD RISK	
4.006	SWMH15	0.000	1.47		417.3	FLOOD RISK	
1.006	SWMH16	0.000	1.79		722.1	SURCHARGED	
1.007	SWMH17	0.000	1.74		673.5	SURCHARGED	
1.008	SWMH18	0.000	1.65		641.0	SURCHARGED	
1.009	SWMH19	0.000	1.68		619.8	SURCHARGED	
1.010	SWMH20	0.000	2.11		611.0	SURCHARGED	
1.011	SWMH21	0.000	2.17		606.8	SURCHARGED	

Appendix C Drawings



LEGEND: PROPOSED

∅XXX	FOUL WATER PIPEWORK WITH PIPE SIZE
CL= X.XXX IL = X.XXX	FOUL WATER MANHOLE WITH COVER LEVEL (CL) AND INVERT LEVEL (IL)
(BD)	EXTERNAL BACK DROP
FWPS CL = x.xx IL = x.xx	FOUL WATER PACKAGED PUMPING STATION WITH COVER LEVEL (CL) AND INVERT LEVEL (IL)
	FOUL WATER RISING MAIN
FWREX CL= X.XXX IL = X.XXX	SEALED RODDING EYE WITH COVER LEVEL (CL) AND INVERT LEVEL (IL)
FC	FOUL CONNECTION POINT (SEE NOTE BELOW)
	DRAINAGE WITHIN HATCHED AREA TO BE TIED INTO SLAB

NOTE: FINAL INTERNAL FOUL CONNECTION POSITIONS TO BE CONFIRMED ALONG WITH NUMBER OF

(FOR LOCAL AUTHORITY USE)

QR Code

N

0 50

1 : 250

STANDARD NOTES

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9. FINAL ACCESS AND SETTING OUT OF SERVICES SHALL BE AGREED BETWEEN THE ARCHITECT AND THE CONTRACTOR.
10. THE PROJECT NOTES ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT TECHNICAL SPECIFICATIONS.
11. WHERE MECHANICAL SERVICES PASS THROUGH FIRE COMPARTMENTATION CEILING VOIDS, FLOOR VOIDS AND STRUCTURAL WALLS THE CONTRACTOR SHALL SLEEVE/SEAL THE OPENING WITH AN ACOUSTIC AND FIRE SEALANT APPROVED BY THE ARCHITECT.
12. THE CONTRACTOR SHALL REFER TO THE ARCHITECT'S DRAWINGS FOR DETAILS OF FIRE COMPARTMENTATION.

No	Description

SAFETY, HEALTH AND ENVIRONMENT INFORMATION
Brief details on the identified hazard symbol referencing the unusual residual hazards / risks are listed above.

Rev	Description	Apvr	Chk'd	Date
P04	D3 - PLANNING	NJH	SBH	18.08.20
P03	D3 - PLANNING	SBH	NJH	10.06.20
P02	D3 - PLANNING	NJH	SBH	30.10.19
P01	D3 - PLANNING	NJH	SBH	07.10.19

Client

Everton

Project Manager: GT GARDINER &THEOBALD

Planning Consultant: CBRE

Main Contractor: LAING O'ROURKE

Design Consultant: PATTERN

Structural / MEP / Infrastructure: BURO HAPPOLD

Project Title
THE PEOPLE'S PROJECT

Drawing Title
FOUL WATER DRAINAGE
GENERAL ARRANGEMENT
SHEET 1

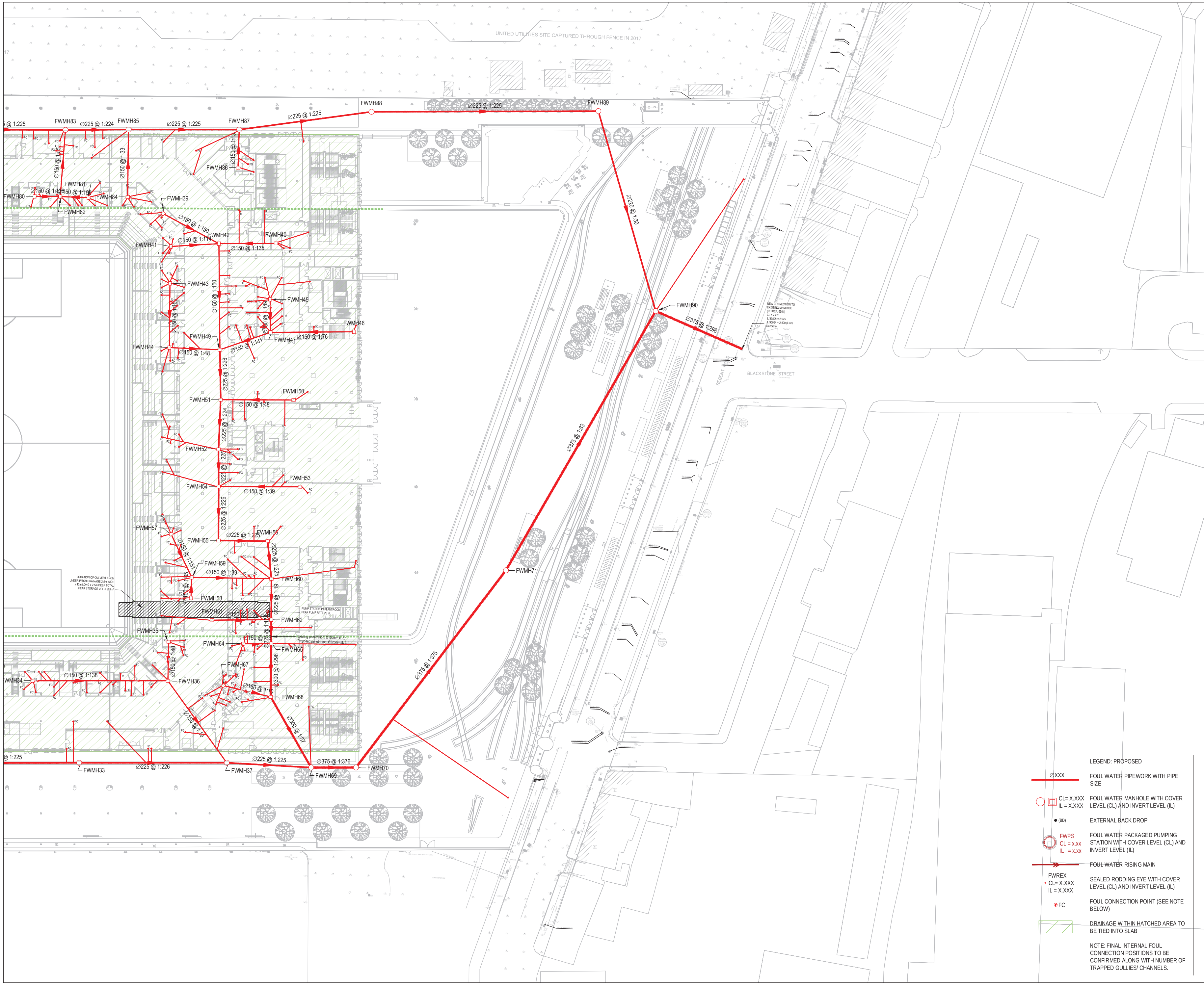
Checked	Drawn	Designed
NJH	SBH	MJR

Purpose of Issue
D3 - PLANNING

Model File Ref:

Drawing No
BMD01-BHE-C1-XX-DR-C-4000

Scale A1 (594x841)	Status	Revision No
1:500	D3	P04



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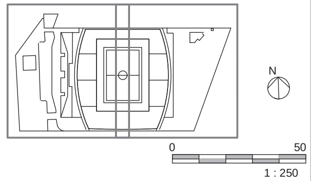
QR Code



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No	Description
	SAFETY, HEALTH AND ENVIRONMENT INFORMATION Brief details on the identified hazard symbol referencing the unusual residual hazards / risks are listed above.

Rev	Description	Apvr	Chk'd	Date
P04	D3 - PLANNING	NJH	SBH	18.08.20
P03	D3 - PLANNING	SBH	NJH	26.06.20
P02	D3 - PLANNING	NJH	SBH	30.10.19
P01	D3 - PLANNING	NJH	SBH	07.10.19

Client

Project Manager

Planning Consultant

Main Contractor

Design Consultant

Structural / MEP / Infrastructure

Project Title
THE PEOPLE'S PROJECT

Drawing Title
FOUL WATER DRAINAGE
GENERAL ARRANGEMENT
SHEET 2

Checked	Drawn	Designed
NJH	SBH	MJR

Purpose of Issue
D3 - PLANNING

Model File Ref:

Drawing No
BMD01-BHE-C1-XX-DR-C-4001

Scale A1 (594x841)	Status	Revision No
1:500	D3	P04