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Document Review
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OUR TOWN HALL, MANCHESTER

Below Ground Surface Water Drainage Strategy

Public Realm

Document ref: OTH-RAM-XX-XX-RPT-C-0017

Revision History

Revision	Date	Purpose / Status	Comments
P01	02/08/19	Planning Submission / S3	Draft for comment
P02	04/09/19	Planning Submission / S3	Final Issue
P03	19/12/19	Planning Submission / S3	Updated Appendix 5 to suit revised Planit landscape layout

Prepared By		Reviewed By		Approved By
				
Lisa Sawyer		**Gary Willis**		**Greig Kirker**
Director		Director Project Manager		Director Project Director

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1.0 INTRODUCTION

Ramboll UK Ltd have been appointed by Manchester City Council to produce a Drainage Strategy to support a planning application for the construction works for the public realm areas within the redline boundary external to Manchester Town Hall.

The Our Town Hall project is based upon eight core principles:

- To secure the long-term future of Manchester Town Hall, its civic role and its external setting
- To retain and enhance as a functioning and efficient Town Hall
- To restore and celebrate this significant heritage asset for Manchester
- To enhance the use of the building, as a visitor destination and increase access to Mancunians
- To transform users' and visitors' experiences
- To reduce carbon footprint and energy costs
- To maximise the commercial opportunities and offset costs to the public purse
- To deliver economic and social value for Manchester

One of the main objectives of the Our Town Hall Project is to refurbish the listed building back to its former glory and bring it back into functional civic uses. Submission of planning and listed building applications in relation to the early work package within the courtyard to the Town Hall building (which included in regard to drainage the Town Hall Building) was submitted in June 2019. Therefore a copy of the drainage strategy in regards to the Town Hall building has been included as an Appendix to this report for clarity.

The main application site, hereafter referred to as the "Application Site", is located at the centre of Albert Square, approximate central ordnance survey National Grid Reference SJ 83829 98119. The redline boundary covers highway areas where some work is being carried out to achieve access to the main site but where the drainage strategy will remain the same therefore in the main this document is written for the proposed drainage strategy within Albert Square.

Refer to Appendix 1 for the Application Site planning boundary.

2.0 SCOPE AND OBJECTIVES

This Below Ground Surface Water Drainage Strategy report has been prepared to support the planning application for the development of the Application Site and should be read in conjunction with the Flood Risk Statement, Drainage Strategy for the Town Hall building (OTH-RAM-XX-XX-RPT-C-0015) approved at part of the Early Works Package and all other planning documents which have been written for the wider project site.

The specific objectives of this assessment are to establish the following:

Existing drainage systems within the Application Site;

- Proposals for collection and discharge of surface water from the proposed Application Site;
- Review of sustainable drainage systems and why some are not possible within the Application Site, the wider project will be covered by a separate planning application.

3.0 LIMITATIONS

This report has been prepared for the planning application and shall not be relied upon by any third party unless that party has been granted a contractual right to rely on this report for the purpose for which it was prepared.

The findings and opinions in the report are based upon information derived from a variety of information sources. Ramboll believe these information sources to be reliable and, where possible, have tried to verify the information.

This report has been prepared on the basis of the proposed end use defined by the Client. If this proposed end use is altered or changed then it will be necessary to review the findings of this report.

It should be noted that some of the aspects considered in this study are subject to change with time. Therefore, if the development is delayed or postponed for a significant period, then it should be reviewed to confirm that no changes have taken place, either at the Application Site or within relevant legislation.

4.0 LEGISLATION

The following legislation has been reviewed and taken into account in preparation of the proposed drainage strategy.

4.1 Planning Policy - Managing Surface Water Runoff and Sustainable Drainage

The Government has strengthened planning policy on the provision of sustainable drainage systems (SuDS) for 'major' planning applications introduced from 6 April 2015 (Paragraph 103 of National Planning Policy Framework NPPF published February 2019 and Ministerial Statement on SuDS). As per the guidance issued by the Department of Communities and Local Government (DCLG), all 'major' planning applications being determined from 6 April 2015, must consider sustainable drainage systems.

On 18 December 2014 Government issued a written statement in relation to SuDs outlining the strengthening of existing planning policy to make it clear that the Governments expectations is that SuDs will be provided in new developments and redevelopments where possible. It is therefore expected that, where planning applications are for major developments, the local planning authority must ensure SuDs are put in place unless demonstrated to be inappropriate.

The Lead Local Flood Authority at Manchester City Council responded to this by producing a Sustainable Urban Drainage Requirements document.

This stated that developers submitting a planning application to Manchester City Council are advised to undertake the following to enable the submission to be approved in regard to Flood Risk and Surface Water Drainage.

Developers must:

- Assess the suitability of sustainable drainage systems in accordance with: paragraphs 051, 079 and 080 of the revised NPPF Planning Practice Guidance (PPG) for Flood Risk and Coastal Change.
- Design sustainable drainage systems in line with national Non-Statutory Technical Standards for SuDS and local policies DM1, EN08, EN14 and EN17 of the Core Strategy.

- Assess surface water attenuation requirements that offer a reduction in surface water runoff rate in line with the 'Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010' (Section 3.4.1 Critical Drainage Areas, page 31).
- Submit hydraulic calculations and drawings to support the design along with proposed standards of operation and maintenance in accordance with paragraph 081 of NPF (PPG).
- It will be essential that the type of sustainable drainage system for a site, along with details of its extent/position, is identified at the design stage. This information will be required for both outline and full applications, so it is clearly demonstrated that the SuDS can be accommodated within the development that is proposed. It will no longer be acceptable to leave the design of SuDS to a later stage to be dealt with by planning conditions.
- Surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management. SuDS seek to mimic natural drainage systems and retain water on or near to the site, when rain falls, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible. SuDS therefore offer significant advantages over conventional piped drainage systems.

In order to avoid objection, the following elements of evidence are required with submission of a planning application.

- Surface Water Management Statement for the site is submitted that is in line with requirement of NPPF PPG Paragraph 079.

- Evidence that drainage hierarchy has been applied in line with NPPF PPG Paragraph 080. The aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:
    - into the ground (infiltration);
    - to a surface water body;
    - to a surface water sewer, highway drain, or another drainage system;
    - to a combined sewer.

- Evidence that one viable solution for draining the site is secured.

- Evidence of consideration of green SuDS solution wherever practicable and viable in line with NPPF PPG Paragraph 051.

- For Brownfield site developments, for all sites located within Conurbation Core Critical Drainage Areas, details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e. at least a 50% reduction in runoff rate compared to the existing rates with an aim to reduce to Greenfield runoff rates wherever practicable;

- Where surface water runoff is to be disposed through infiltration, details of surface water attenuation that is adequate for infiltration capacity of the underlying soil is required. This capacity has to be assessed through site investigation carried out in line with Building Research Establishment Digest 365. Site investigations should be undertaken in locations and at proposed depths of the proposed infiltration devices. Half emptying time of proposed attenuation within 24 hours should be achieved.

- Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building; The NPPF suggests that 'for events with a return-period in excess of 30 years, surface flooding of open spaces such as landscaped areas or car parks is acceptable for short periods, but the layout and landscaping of the

site should aim to route water away from any vulnerable property, and avoid creating hazards to access and egress routes. No flooding of property should occur as a result of a one in 100-year storm event (including an appropriate allowance for climate change)'.

- Assessment of overland flow routes for extreme events that is diverted away from buildings providing long and cross sections for the proposed drainage system and finished floor levels;

- Evidence that runoff volume in the 1 in 100-year, 6 hours rainfall shall be constrained to a value as close as is reasonably practical to the Greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment;

- Hydraulic calculations of the proposed drainage system;

- Design construction drawings of proposed SuDS elements and flow controls;

- For sites where, proposed development would cause unusual pollution risk to surface water (large car park areas (>50 parking spaces) or industrial estates), evidence of pollution control measures (preferably through SuDS) is required.

- Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

5.0 CONSULTATIONS

Initial consultations have been undertaken with United Utilities and the Lead Local Flood Authority for Manchester City Council with regards to discharge of below ground drainage from the Application Site.

5.1 United Utilities (UU)

Initial consultation was made, via a pre-development enquiry, with United Utilities (UU) on 22 November 2017 regarding discharge of foul and surface from the development. UU confirmed that foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connections to the public sewer can be at a point convenient to the scheme.

UU also confirmed that surface water from the building and associated land can drain to the public sewer network at an unrestricted rate. The connections to the public sewer can be at a point convenient to the scheme.

UU are not obliged to accept runoff from highways to the public sewer network and therefore should drain any new sections of highway without recourse to the public sewer network.

Further consultation was made in response to the initial enquiry on 17/07/2019 (as the original correspondence was only valid for 12 months) to confirm that this advice still stands and to give an update of the scheme. UU replied in regards to the Building and Courtyard drainage on 26/07/2019. At the time of writing a response has not been received in regards to the public realm areas.

5.2 Lead Local Flood Authority Manchester City Council (LLFA)

Initial consultation was made with the Lead Local Flood Authority (LLFA) on 22 November 2017 regarding the proposed foul and surface water discharge strategy and the management of surface water within the Application Site and the wider project site.

The LLFA responded on 24 November 2017 stating that the drainage strategy should adhere to the national and local policies and in that respect would be looking for at least 50% reduction in flows. The design also needs to make sure that the proposed drainage system is future proved for impact of climate change and expected increase in rainfall intensities.

In addition to that, this being a Manchester City Council site, the LLFA would welcome opportunities to include green types of sustainable drainage system wherever possible as an exemplar for other developments.

An initial meeting was then held with the LLFA on 19 September 2018 to discuss the findings of the below ground drainage survey which established the existing discharge locations to the public sewer networks, capacities of the existing systems and connectivity, to discuss and gain comments on the proposed strategy for surface water discharge from the building, to discuss and gain comments on the proposed strategy for surface water discharge from Albert Square and surrounding road and gain an agreement in principle of the proposed discharge strategy in regard to areas to be attenuated.

The outcome of the meeting concluded that the LLFA would want evidence that the existing/new drainage systems proposed would accept the 1 in 100-year storm event plus a 40% allowance for climate change, and where this was not possible the impact this would have.

Where attenuation is required, evidence would need to be provided if blue/green sustainable attenuation systems were not possible and why.

Where possible 50% betterment should be provided (although it was accepted that this would not be possible within the systems for the Town Hall Building included as part of this planning application and submitted as part of the Early Works Package).

A further meeting was held with the LLFA on 19th March 2019 to go through the current proposals for surface water attenuation and go through the current limitations on the scheme.

6.0 EXISTING SITE

The Application Site consists of the existing Albert Square, Albert Square highway and pavements, Lloyd Street footway, part of Mount Street and Cooper Street. The redline boundary drawing in Appendix 1 gives the full extent of the works.

6.1 Existing Drainage Networks

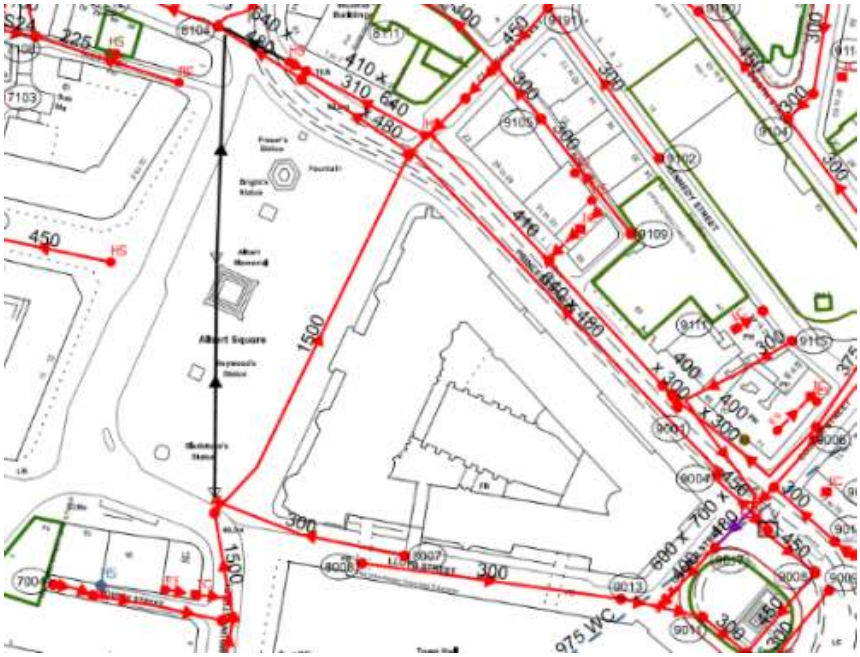
The following drainage network exist within the Application Site.

6.1.1 Public Sewers

The following is a summary of the public sewer infrastructure within the project boundary.

- 1500mm diameter combined public sewer within Albert Square parallel to the front elevation of the Town Hall flowing south to north
- 300m diameter combined public sewer starting in Lloyd Street at manhole 8007 and connecting into the 1500mm combined sewer in Albert Square
- 300mm combined sewer starting in Lloyd Street at manhole 8008 and connecting into a combined network in Cooper Street

- 640 x 480 egg vitrified clay public combined sewer in Princess Street flowing south east to north west and combining with the 1500mm to the north corner of the Town Hall
- There is also an abandoned main sewer indicated as crossing Albert Square



Extract of United Utilities Drawing showing Public Sewers

6.1.2 Albert Square Public Realm Drainage

A topographical and services survey has been undertaken by Powers & Tiltman which indicates a number of manholes within Albert Square. CCTV connectivity survey was undertaken which confirmed that the area of Albert Square north of the Albert Memorial is collected via linear drainage channels with cast ironing gratings into a network of 150/225mm vitrified clay pipework. The discharge from this is into United Utilities public sewer manhole EXPS8101 where the 640 x 480 combined public sewer in Princess Street and 1500mm diameter sewer in Albert Square converge.

South of the Albert Memorial the drainage collects into linear drainage channels with cast ironing gratings into a network of 150/225mm vitrified clay pipework. The discharge from this is into United Utilities public sewer manhole EXPS8001 via a 300mm connection. Existing drainage information can be found in Appendix 3.

6.1.3 Albert Square Public Highway

Albert Square road and Mount Street are served via road gullies. Highway drainage was found within the highway during the CCTV connectivity survey. Two systems were identified. One connecting into United Utilities public sewer in Brazennose Street at manhole EXPS7104 and one into the 1.5m diameter public sewer in Albert Square at manhole EXPS8001.

It is unclear where the highway drainage connecting into manhole 8001 commences as this could collect highway outside of our development from Lloyd Street West and/or Southmill Street.

Existing drainage information can be found in Appendix 3.

6.1.4 Lloyd Street and Cooper Street

Lloyd Street and Cooper Street are served via linear slot drainage which were installed as part of the St Peter's Square works around November 2014. Outfalls from this are believed to be directly via junction connections into both 300mm combined public sewers in Lloyd Street and combined public sewer crossing beneath the Cenotaph in St Peter's Square. This could not be confirmed during the CCTV survey works.

Existing drainage information can be found in Appendix 3.

6.1.5 Princess Street

Princess Street is currently drained via gullies. It is not clear whether these discharge into a highway drain or directly via junction connections to the public sewer.

6.1.6 Town Hall Building - Existing Storm Water Drainage

The existing above ground rainwater strategy for the Town Hall Building is covered by the Early Works Package. Document can be found in Appendix 7 of this report.

6.3 Existing Drainage Flows

Where possible a CCTV/connectivity survey has been undertaken of the existing drainage to identify where areas of the site drain and into which public survey they drain into.

The main public realm area of Albert Square currently drains to the 1500mm diameter combined public sewer within Albert Square parallel to the front elevation of the Town Hall flowing south to north. The area is split between two outlet locations, manhole EXPS8101 and EXPS8001.

The highway drainage (including pavement areas) discharge into the public sewer in Brazennose Street at the head of the system.

Using the Colebrook-White Formula the capacity of the existing outfalls have been calculated.

Outfall into EXPS8101 – 111l/s
Outfall into EXPS8001 – 111l/s
Outfall into EXPS7104 (Brazennose Street Sewer) – 52l/s

Existing calculations can be found in Appendix 4.

7.0 PROPOSED SITE

The proposed works include the removal of the Albert Square highway from the scheme and regrading and resurfacing of the entire Albert Square area to face of buildings. Remedial works are also to be undertaken to the footpath within Lloyd Street, Cooper Street due to a new access being constructed into the building and Mount Street due to change in levels and surfacing.

7.1 Proposed Surface Water Discharge

The following hierarchy has been reviewed in regard to discharge of surface water from the Application Site to confirm the discharge strategy taken forward.:

Infiltration

Soakaways which infiltrate directly into the ground as opposed to discharging to a watercourse or sewer are not possible on this part of the site. Made ground was present in all trial pit locations however the underlying stratum was found to be stiff clay. Additional trial pit locations are proposed in the tree pit locations at the next stage of the design and infiltration tests will be undertaken at this time to identify if infiltration is possible in these locations. For this strategy the use of infiltration has been assumed not possible.

Watercourse
The nearest known watercourse to the Application Site is the River Irwell and is approximately 1 mile away from the site. There is third party land located between the Application Site and the River therefore direct connection would not be feasible.

Sewer
As indicated in Section 6.1 there are public sewers within the Application Site into which the existing drainage from the Application Site discharges into. It is therefore proposed to reuse one of the existing connections to the public sewer systems for discharge from Albert Square for surface water, removing surface water from the sewer in Brazennose Street and reducing the surface water into the combined sewer crossing Albert Square.

In accordance with Building Regulations Part H, it is proposed that foul and surface water drainage systems within the Application Site will be kept separate up until the point of discharge. Foul drainage is only required in regards to manholes for connection to by an events that will utilise Albert Square going forward.

Initial consultation with the Lead Local Flood Authority has agreed the extent of works and the discharge restrictions which will be imposed within the Application Site.

50% betterment will be required on the existing discharge rates and surface water would need to be designed for storm events up to the 1 in 100-year plus 40% climate change. Attenuation will therefore need to be provided to achieve this design criteria.

The proposed general arrangement drawings can be found in Appendix 5 which indicate the proposed outfall locations.

7.2 Proposed Surface Water Flows

The capacity of the existing outfalls into the public sewer system are as follows.

Outfall into EXPS8101 – 111l/s
Outfall into EXPS8001 – 111l/s
Outfall into EXPS7104 (Brazennose Street Sewer) – 52l/s

It is proposed to provide a 50% betterment on the connections into the combined public sewer in Albert Square and remove the connection into the Brazennose Street Sewer.

Outfall into EXPS8101 – 0l/s
Outfall into EXPS8001 – 111l/s (remain as existing)
Outfall into EXPS7104 (Brazennose Street Sewer) – 0l/s

The proposed drainage calculations can be found in Appendix 6.

7.3 Proposed Sustainable Drainage Strategy

Due to the reduction in discharge into the public sewer systems and the need to design for the 1 in 100 storm event plus 40% climate change a review of potential sustainable drainage systems has been undertaken to identify the most suitable form of attenuation which can be included within the Application Site and if not possible why not.

Infiltration measures: Soakaways which infiltrate directly into the ground as opposed to discharging to a watercourse or sewer are not currently possible on this part of the site.

Made ground was present in all trial pit locations however the underlying stratum was found to be stiff clay. It is however proposed to undertake infiltration tests in all tree pit locations to identify if these can infiltrate and not connect back to the positive drainage system.

Permeable paving: Surfacing systems which allow water to infiltrate through the surface to an underlying gap-graded sub-base or into a sub-base geocellular system. The loading required on Albert Square, the maintenance requirements by MCC Highways, the presence of services and the proposal to introduce a new concrete base is such that the use of a permeable surface will not be possible on the site.

Detention Basins: Surface storage basins are normally dry and can provide attenuation of surface water run-off in peak storm conditions. The space requirements for detention basins or reduction in levels to allow areas of ponding are not suited to this site due to the requirement for this to be an event space with a relatively flat surface.

Below ground tank/cellular storage: A method involving storage tanks or geocellular crates installed below the lowest ground level has the advantage of having a 95% void ratio allowing it to attenuate large volumes. The use of a tank solution is possible below the main Albert Square area.

Tree pit attenuation: A tree root protection system is proposed to all trees which are not located within landscape beds. This root system has a 20% void ratio within the soil to allow storage of surface water for high storm events. The use of the tree pits within the attenuation system is possible on this site.

The location of the tree pit attenuation and below ground attenuation is indicated on the general arrangement drawings which can be found in Appendix 5.

7.4 Proposed Overall Surface Water Strategy

In accordance with Building Regulations Part H, it is proposed that foul and surface water drainage systems within the Application Site will be kept separate up until the point of discharge. Foul drainage is only required in regards to manholes for connection to by any events that will utilise Albert Square going forward therefore a single foul manhole has been provided either side of the site just upstream of the public sewer connection.

Initial consultation with the Lead Local Flood Authority has agreed the extent of works and the discharge restrictions noted in Section 7.2 which will be imposed within the Application Site.

A 50% betterment will be required on the existing discharge rates and surface water would need to be designed for storm events up to the 1 in 100-year plus 40% climate change.

Attenuation will therefore need to be provided to achieve this design criteria.

External hardstanding areas will be collected by linear drainage channels with gratings and slot drainage. Some new road gullies will be incorporated within amendments to public highways outside of the Albert Square area.

All drainage channels have been designed for the 1 in 100-year storm event with a check undertaken if maintenance is not undertaken as often as required to ensure that any ponding on the surface, due to the limitations on the openings does not stay on the surface for long lengths of time.

Oil separation has been included for within the scheme in the form of a Hydrobrake Downstream Defender which is a vortex system with minimal maintenance.

Anti-flood valves have also been included for within the scheme to prevent surcharge of the public sewers into the onsite systems.

The general arrangement drawings can be found in Appendix 5.

8.0 CODES OF PRACTICE

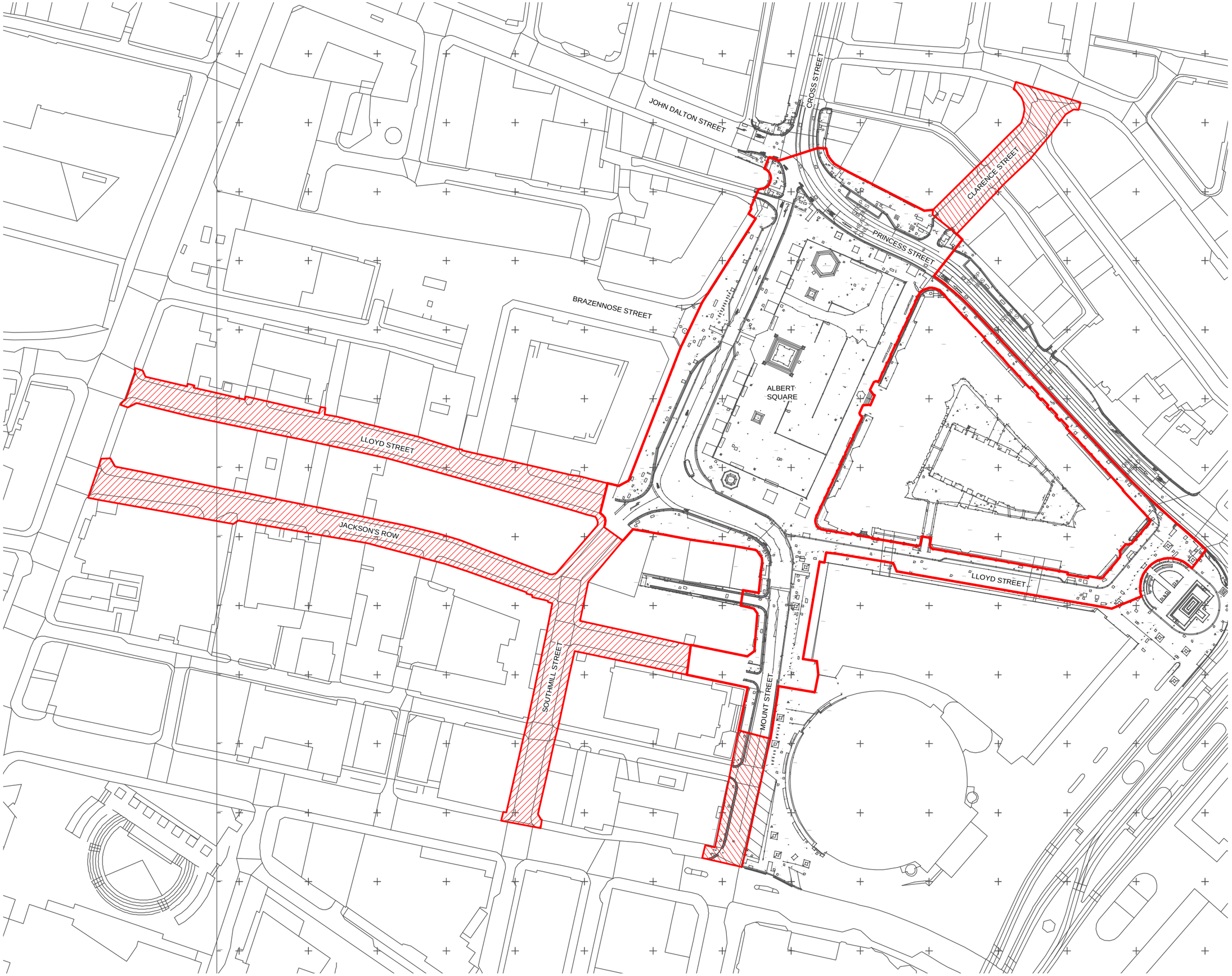
New below ground drainage has been designed in accordance with the following codes of practice:

BS EN 752:2008 Drain and Sewer Systems outside buildings
BS EN 124-1:2015 Gully tops and manhole tops for vehicular and pedestrian areas
BS EN 1610:2015 Construction and Testing of Drains and Sewers
CIRIA C680 Structural Design of Modular Geocellular Tanks
CIRIA C753 The SuDS Manual
British Water Flows and Loads – 4:2013
BRE DG 365:2016 Soakaway design

9.0 MAINTENANCE OF DRAINAGE SYSTEMS

Refer to document OTH-RAM-XX-XX-RPT-0018 for further details

APPENDIX 1
SITE APPLICATION BOUNDARY AND PROJECT BOUNDARY



C THIS DRAWING IS COPYRIGHT PROTECTED AND MAY NOT BE REPRODUCED IN WHOLE OR PART WITHOUT WRITTEN AUTHORITY FROM THE OWNER.

NOTES:
1. Do not scale from this drawing.
2. Always work to noted dimensions.
3. All dimensions are in millimetres unless otherwise stated.
4. All setting out, levels and dimensions to be agreed on site.
5. The dimensions of all materials must be checked on site before being laid out.
6. This drawing must be read with the relevant specification clauses and detail drawings.
7. Order of construction and setting out to be agreed on site.

Revision	Date	Description	Drawn	Apprvd.
01	16-08-19	Planning Issue	AD	MS

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Client Manchester City Council

Project Our Town Hall

Drg Title Red Line Boundary Plan

Created on	Created by	Approved by
16-08-19	AD	MS

Scale	Size	Workstage
1:1250	A3	Stage 4

Drg No.	Suitability	Revision
OTH-PLA-EE-XX-DWG-L-0010	S2	01

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APPENDIX 2
CONSULTATIONS

Lisa Sawyer

From: z.todorovic@manchester.gov.uk on behalf of floodriskmanagement@manchester.gov.uk
Sent: 24 November 2017 15:31
To: Lisa Sawyer
Cc: MCC Flood Risk Management (MCC) (floodriskmanagement@manchester.gov.uk)
Subject: Re: Manchester Town Hall and Albert Square Redevelopment
Attachments: SW Drainage Areas.pdf; Sewer Records - Groundwise Utility Report 20458JS (2).pdf

Lisa

Thank you for the email.

The drainage strategy should adhere to the national and local policies and in that respect we would be looking for at least 50% reduction in flows. We also need to make sure that the proposed drainage system is future proved for impact of climate change and expected increase in rainfall intensities.

In addition to that, this being a MCC site, we would welcome opportunities to include green types of sustainable drainage system wherever possible as an exemplar for other developments.

Kind regards

Zorica

Flood Risk Management
The Neighbourhoods Service
Growth and Neighbourhoods
Manchester City Council

Tel: 0161 219 6295
Email: floodriskmanagement@manchester.gov.uk
Web: http://www.manchester.gov.uk/

POSTAL ADDRESS: Manchester City Council, Public Realm, The Neighbourhood Service, PO Box 532, Town Hall, Manchester M60 2LA

Lisa Sawyer <Lisa.Sawyer@ramboll.co.uk> 22/11/2017 16:12	To	"MCC Flood Risk Management (MCC) (floodriskmanagement@manchester.gov.uk)" <floodriskmanagement@manchester.gov.uk>,
	cc	
	Subject	Manchester Town Hall and Albert Square Redevelopment

Ramboll have been appointed to begin work on the infrastructure design for the refurbishment of Manchester Town Hall and Albert Square and highway amendment works around Albert Square.



In regards to the existing surface water collection and discharge networks, the surface water falling onto the existing town hall roof is believed to be collected via 64 downpipes which discharge into the combined public sewers surrounding the site. It is believed that direct connections occur into the public sewers from the perimeter rainwater downpipes with the internal rainwater downpipes collected into two networks within the internal courtyards and discharged via one connection into Princess Street combined sewer and one connection into the Lloyd Street combined sewer. It is not proposed to change the above ground strategy for the Town Hall and therefore the impermeable roof area will remain the same within our works.

Albert Square is believed to collect into an existing private network which discharges into the combined sewer in Princess Street and possibly a highway drainage network within the adopted highway to the south. The private drainage within this area is proposed to be upgraded along with the surfacing and some kerb lines. Amendments to the highway could also be likely.

A below ground CCTV survey is due in January/February to provide us with the connectivity/capacity confirmation we require to move the design forward. However we are required to give some initial advice to our client and design team on your thoughts regarding discharge of surface water from the site before Christmas. We are aware that the current combined sewer networks in the vicinity of the site are at capacity so we have also made a predevelopment enquiry with United Utilities.

We assume that you will require us to provide a 50% betterment on the existing surface water discharge rates where possible. Looking at the existing areas within the approximate redline boundary it should be possible to provide attenuation for just over half of the roof area and the Albert Square pedestrianised area. This is indicated on the attached sketch. Please can you comment on this as a strategy and confirm your requirements for moving this project forward.

Yours sincerely
Lisa Sawyer

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Lisa Sawyer

From: O'Brien, Neil <Neil.O'Brien@uuplc.co.uk>
Sent: 26 July 2019 09:44
To: Lisa Sawyer; Wastewater Developer Services
Subject: RE: REPEAT 2: Manchester Town Hall and Albert Square Redevelopment - 4200019060

Dear Customer

Thank you for your email of 12/7/19 in relation to United Utilities' initial Pre Development Enquiry response.

United Utilities have no objection to you continuing to exercise your rights under the Water Industry Act and continue draining your existing building and associated court yard to the public sewer.

You only need to apply for a S106 Sewer Connection if the you are building a new premises (a part 1) or actually working on the public sewer itself (a part 2). As the work is to a private drain for an existing building there is no need for a s106 application

If you require any further guidance please follow http://www.unitedutilities.com/builders-developers.aspx

If you need a make further enquiry relating to this matter please send your enquiry to WastewaterDeveloperServices@uuplc.co.uk Please quote your reference number

Please Note:- enquiries sent to any other United Utilities e-mail address will be deleted

Please note, should you intend to enter into an adoption agreement with UU and although your proposal may comply with the principal strategy set out in the advice above, we do reserve the right to request changes to any future design proposals put forward for adoption, as we need to be sure that the proposals meet the requirements of Sewers for Adoption and UU Asset Standards. Any design proposals should take in to consideration long term operability whilst also offering cost effectiveness for the life of the assets. Where a developer would like to progress a Section 104 Agreement, it must be emphasised that any works commenced on site on the basis of the Pre-Development Enquiry Advice without an approved S104 technical assessment will be at the Designers/ Developers own risk and may be subject to change. Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, Planning Conditions and local flood authority guidelines, we would recommend that you laise and make suitable agreements with the relevant statutory bodies.

Regards,

Developer Services

From: Lisa Sawyer [mailto:Lisa.Sawyer@ramboll.co.uk]
Sent: 12 July 2019 17:55
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>; O'Brien, Neil <Neil.O'Brien@uuplc.co.uk>
Subject: FW: REPEAT 1: Manchester Town Hall and Albert Square Redevelopment - 4200019060

Neil
Conscious that the response below was over 6 months ago please can you confirm that your advice below still stands.

The project is now being split in regards to planning approval with an enabling works package to install the drainage beneath the courtyard of the Town Hall first. I have therefore attached the latest design information for the enabling works package (which is currently in for planning) indicating the existing outfall locations which we propose to utilise. Surface water is to discharge into the Princess Street sewer via the existing 150mm connection from the courtyard drainage and foul water into the Lloyd Street sewer. The LLFA are requiring from us your response in order to discharge the planning condition.

Can you please confirm if we are required to complete an S106 agreement for this. Assuming we get planning the works are hoping to start in the next few months.

Kind regards

Lisa Sawyer
Director, Team Leader Highways North

D +44 7896227086
lisa.sawyer@ramboll.co.uk

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Registered office: 240 Blackfriars Road, London SE1 8NW

From: O'Brien, Neil
Sent: 15 October 2018 10:51
To: Lisa Sawyer <Lisa.Sawyer@ramboll.co.uk>; Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: REPEAT 1: Manchester Town Hall and Albert Square Redevelopment - 4200019060

Dear Customer

Thank you for your email of 1/10/18 in relation to my initial Pre Development Enquiry response.

You will only need to enter into a build over agreement if the structure to be constructed is subject to part H4 of the Building Regulations.

UU would not object to the existing hardstanding areas and the existing building continuing to drain to the public sewer

If you require any further guidance please follow http://www.unitedutilities.com/builders-developers.aspx

If you need a make further enquiry relating to this matter please send your enquiry to WastewaterDeveloperServices@uuplc.co.uk Please quote your reference number

Please Note:- enquiries sent to any other United Utilities e-mail address will be deleted

Please note, should you intend to enter into an adoption agreement with UU and although your proposal may comply with the principal strategy set out in the advice above, we do reserve the right to request changes to any future design proposals put forward for adoption, as we need to be sure that the proposals meet the requirements of Sewers for Adoption and UU Asset Standards. Any design proposals should take in to consideration long term operability whilst also offering cost effectiveness for the life of the assets. Where a developer would like to progress a Section 104 Agreement, it must be emphasised that any works commenced on site on the basis of the Pre-Development Enquiry Advice without an approved S104 technical assessment will be at the Designers/ Developers own risk and may be subject to change. Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, Planning Conditions and local flood authority guidelines, we would recommend that you laise and make suitable agreements with the relevant statutory bodies.

Regards,

Developer Services

From: Lisa Sawyer [mailto:Lisa.Sawyer@ramboll.co.uk]
Sent: 01 October 2018 09:50
To: O'Brien, Neil ; Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: RE: Manchester Town Hall and Albert Square Redevelopment - 4200019060

Hi Neil

This scheme is developing and we are now at a position to confirm our likely discharge points to the public sewer network and design of the proposed scheme in Albert Square

As the programme of works is quite long and it may be some time before a S106 agreements are issued I wanted to ensure I kept United Utilities updated with our proposals in case you had any comments.

Attached are sketches which indicate the existing drainage systems for both the building, Albert Square and surrounding highways within the redline boundary. It is proposed to reuse the existing connections to the public sewer and the locations are indicated on these sketches. Some surface water attenuation will be provided but it is not possible to all areas within the redline boundary and this strategy has been agreed with the LLFA.

Please confirm if you have any queries at this time in regards to the strategy indicated on the attached.

I have also attached a part completed "Building over a public sewer" enquiry form to enable a discussion to be had on building over existing public sewers. It is not proposed to construct major structural works but there are new ramps, steps, anti-terrorism retractable bollards with potential large foundations and landscaping with large trees proposed on top of the public sewers or within the easement of the sewers therefore I need advice at this stage if the current scheme is acceptable to United Utilities or what would need to be amended to make the scheme work. There are also sketches attached to indicate the locations of these over the existing public sewers.

Your earliest response would be appreciated and if you require additional information please advise.

Kind regards
Lisa Sawyer
Associate, Infrastructure & Highways

D +44 7896227086
lisa.sawyer@ramboll.co.uk

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Registered office: 240 Blackfriars Road, London SE1 8NW

From: O'Brien, Neil
Sent: 07 December 2017 10:24
To: Lisa Sawyer <Lisa.Sawyer@ramboll.co.uk>; Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: RE: Manchester Town Hall and Albert Square Redevelopment - 4200019060

Dear Customer

We have carried out an assessment of your application which is based on the information provided; this pre development advice will be valid for 12 months

Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

Surface water from the building and associated land can drain to the public sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

United Utilities are not obliged to accept run-off from highways (highway drainage) to the public sewer network. Please drain any new sections of highway without recourse to the public sewer network.

If you require any further guidance please follow http://www.unitedutilities.com/builders-developers.aspx

If you need a make further enquiry relating to this matter please send your enquiry to WastewaterDeveloperServices@uuplc.co.uk Please quote your DEXXXX/42XXXXXXX?GEXXXX reference number

Please Note:- enquiries sent to any other United Utilities e-mail address will be deleted.

Connection Application

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

http://www.unitedutilities.com/connecting-public-sewer.aspx

Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, Planning Conditions and local flood authority guidelines, we would recommend that you laise and make suitable agreements with the relevant statutory bodies.

Regards

Neil O'Brien

Developer Engineer
Developer Services and Planning

From: Lisa Sawyer [mailto:Lisa.Sawyer@ramboll.co.uk]
Sent: 22 November 2017 15:00
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Manchester Town Hall and Albert Square Redevelopment

To whom it may concern

Please find attached a completed predevelopment enquiry which we have submitted to begin engagement on drainage discharge for the works being undertaken on the Manchester Town Hall refurbishment and works within Albert Square.

It is believed that the vast majority of the foul drainage and surface water roof drainage from Manchester Town Hall drains into the existing 640x480 combined sewer within Princess Street with a drainage connection also connecting into the combined sewer within Lloyd Street.

We believe that as part of the Metrolink Second City Crossing works two 375mm stubs were proposed to be provided and internal lining works undertaken to mitigate any future problems with the sewers located directly underneath tram tracks in preparation for the proposed works to the Town Hall and Albert Square. We are struggling however to obtain any information on this and we believe these works may not have been actually undertaken? I have a pdf copy (although it is unreadable) of a United Utilities drawing reference MISC/80030937/03/11/2300, see attached. Do you have any information on this to help inform a decision on proposed outfall locations?

It is not exactly clear yet what changes will be made within the Town Hall although it is expected that the majority of the building will be kept as offices (albeit it increased number of personnel) with increased kitchen and toilet facilities. The total proposed foul flow could be in the region of 20l/s.

It is unlikely that we will propose any new foul connections into the 1500mm diameter sewer in Albert Square due to the existing lightwells located between the Town Hall and the existing sewer. If possible the existing infrastructure will be utilised however the size of the connections (believed to be 150mm and 100mm) may not be adequate for the increased flows so either an upgrade of these will be required (tunnel bored under the tram line) or additional connection locations will be required.

In regards to surface water it is believed that this is also collected and discharged into the combined public sewers surrounding the site. It is believed that there are direct connections from the perimeter rainwater downpipes from the building and collection of the internal rainwater pipes which discharge into Princess Street. It is also believed the northern section of Albert Square discharges into the combined sewer in Princess Street but further connectivity surveys are required to identify where the remainder of the area ends up. Highway drainage is also assumed to discharge into the public sewer.

We will be in discussion with the Lead Local Flood Authority also who are likely to put restrictions on discharge of surface water from the site, however it would be useful to understand the sewers which are most vulnerable and where your preference would be on discharge for both Albert Square and the town hall building (foul and surface water). I have attached a sketch indicating the current thoughts on surface area split between that which can be attended and that which is likely to have to stay unattenuated.

A below ground CCTV survey is due in January/February to provide us with the connectivity/capacity confirmation we require to move the design forward. However we are required to give some initial advice to our client and design team on your thoughts regarding discharge and advise on the public sewer capacities within the vicinity of the site before Christmas if possible.

Yours sincerely
Lisa Sawyer

BEng (Hons) CEng MICE
Associate
Infrastructure & Highways

M +44 7896227086
Lisa.Sawyer@ramboll.co.uk

Connect with us

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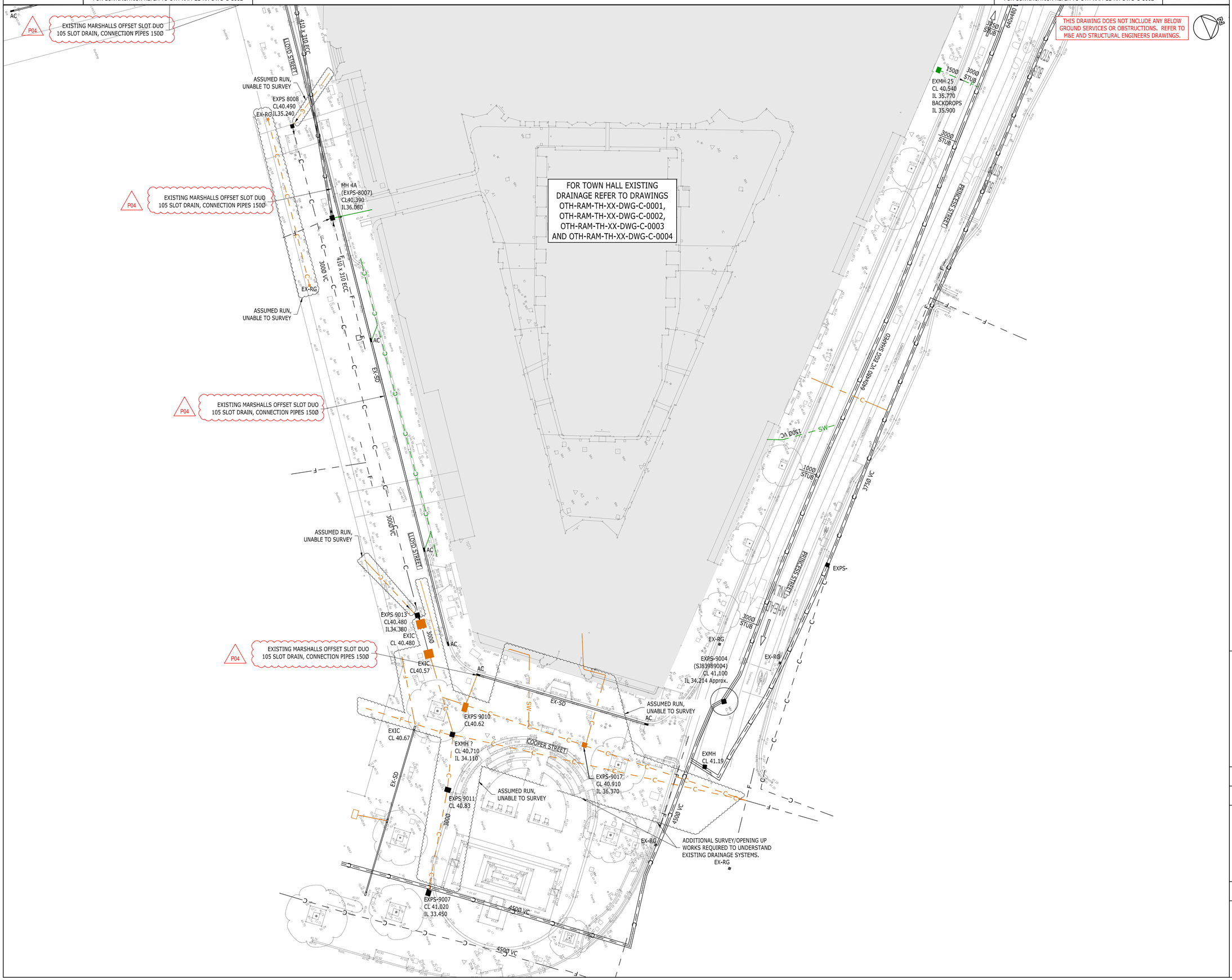
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APPENDIX 3
EXISTING DRAINAGE INFORMATION



Scale Bars to be used as guidance only - refer to sheet size below

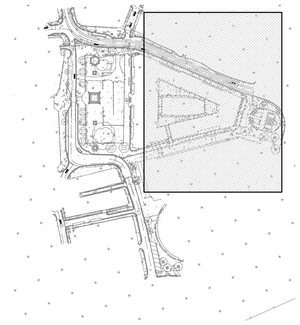
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1:200 mm 2000 4000 6000 8000
1:500 m 5 15 25 35
1:1250 m 10 30 50 70 90

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5. THIS DRAWING HAS BEEN CREATED USING THE FOLLOWING INFORMATION:

- UTILITIES SURVEY BY POWERS AND TILTMAN DATED FEBRUARY/MARCH 2018
- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18
- PUBLIC SEWER RECORDS

KEY

- EXISTING PUBLIC COMBINED DRAIN/ MANHOLE — C —
- EXISTING PUBLIC FOUL DRAIN/ MANHOLE — F —
- EXISTING PUBLIC SURFACE WATER DRAIN/MANHOLE — SW —
- EXISTING PRIVATE COMBINED DRAIN/ MANHOLE — C —
- EXISTING PRIVATE FOUL DRAIN/ MANHOLE — F —
- EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE — SW —
- EXISTING ASSUMED DRAIN/SEWER — C —
- EXISTING PRIVATE SURFACE WATER DRAIN IDENTIFIED BUT NOT SURVEYED — C —
- EXISTING DRAIN/SEWER IDENTIFIED BY CONNECTIVITY SURVEY BUT NO CONDITION SURVEY TAKEN — SW —
- EXISTING DRAINAGE CHANNEL AND COVER EX-DC AC
- EXISTING ROAD GULLY EX-RG
- EXISTING DRAINAGE ABANDONED



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P04	26/07/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS
P03	07/05/2019	LS	SG	STAGE 3+ ISSUE NO CHANGES SINCE PREVIOUS REVISION
P02	30/11/2018	LS	SG	STAGE 3 ISSUE ADDITIONAL NOTES

OUR TOWN HALL PROJECT

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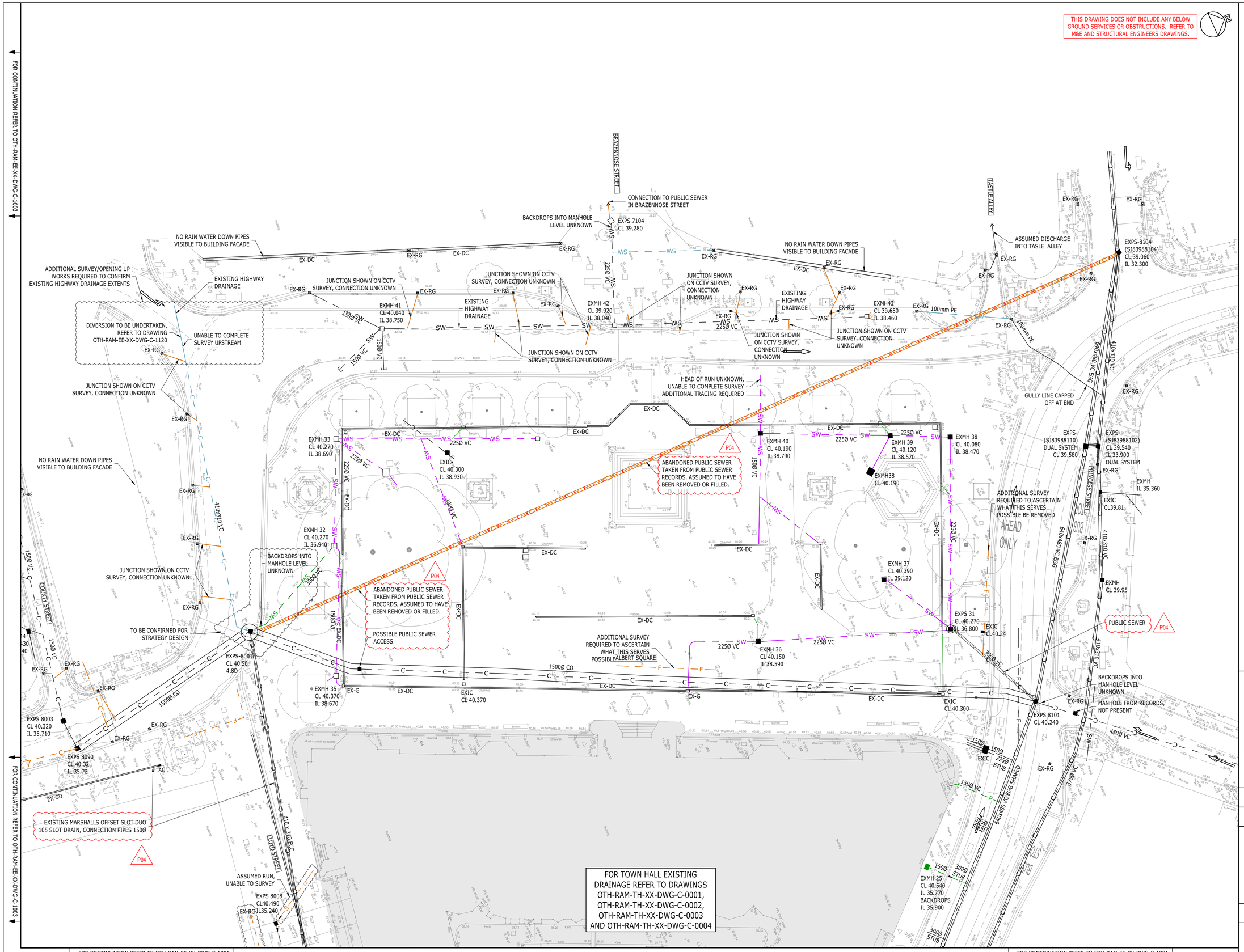
Arkwright House, Parsonage, Manchester, M3 2LF
+44 (0) 161 827 1890
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PROJECT STATUS	STAGE 4
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXTERNALS EXISTING DRAINAGE SHEET 1 OF 3
SIZE & SCALE	A1: 1:250
DRAWING STATUS	D2 - FOR TENDER
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-EE-XX-DWG-C-1001
REV	P04

26 July 2019 13:06:51

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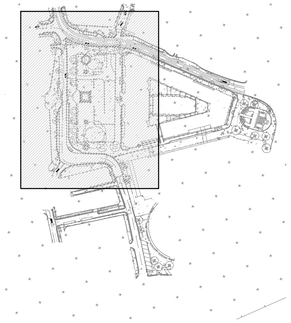
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- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18
- PUBLIC SEWER RECORDS

KEY

- EXISTING PUBLIC COMBINED DRAIN/ MANHOLE — C
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- EXISTING PRIVATE FOUL DRAIN/ MANHOLE — F
- EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE — SW
- EXISTING ASSUMED DRAIN/SEWER — C
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- EXISTING DRAIN/SEWER IDENTIFIED BY CONNECTIVITY SURVEY BUT NO CONDITION SURVEY TAKEN — SW
- EXISTING DRAINAGE CHANNEL AND COVER — EX-DC AC
- EXISTING ROAD GULLY — EX-RG
- EXISTING DRAINAGE ABANDONED



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P04	26/07/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS
P03	07/05/2019	LS	SG	STAGE 3+ ISSUE ADDITIONAL SURVEY INFO ADDED
P02	30/11/2018	LS	SG	STAGE 3 ISSUE ADDITIONAL NOTES

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CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXTERNALS EXISTING DRAINAGE SHEET 2 OF 3
SIZE & SCALE	A1: 1:250
DRAWING STATUS	D2 - FOR TENDER
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-EE-XX-DWG-C-1002
REV	P04

26 July 2019 13:07:16

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FOR CONTINUATION REFER TO OTH-RAM-EE-XX-DWG-C-1002

FOR CONTINUATION REFER TO OTH-RAM-EE-XX-DWG-C-1002

Scale Bars to be used as guidance only - refer to sheet size below

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1:200 mm 2000 4000 6000 8000 2000 4000 6000

1:500 m 5 15 25 35

1:250 m 10 30 50 70 90

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3. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM U.N.O
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- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18
- PUBLIC SEWER RECORDS

KEY

EXISTING PUBLIC COMBINED DRAIN/ MANHOLE — C —

EXISTING PUBLIC FOUL DRAIN/ MANHOLE — F —

EXISTING PUBLIC SURFACE WATER DRAIN/MANHOLE — SW —

EXISTING PRIVATE COMBINED DRAIN/ MANHOLE — C —

EXISTING PRIVATE FOUL DRAIN/ MANHOLE — F —

EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE — SW —

EXISTING ASSUMED DRAIN/SEWER — C —

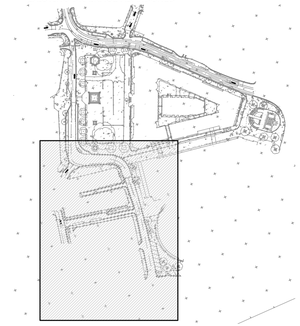
EXISTING PRIVATE SURFACE WATER DRAIN IDENTIFIED BUT NOT SURVEYED — C —

EXISTING DRAIN/SEWER IDENTIFIED BY CONNECTIVITY SURVEY BUT NO CONDITION SURVEY TAKEN — SW —

EXISTING DRAINAGE CHANNEL AND COVER EX-DC AC

EXISTING ROAD GULLY EX-RG

EXISTING DRAINAGE ABANDONED



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P04	26/07/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS
P03	07/05/2019	LS	SG	STAGE 3+ ISSUE ADDITIONAL SURVEY INFO ADDED
P02	30/11/2018	LS	SG	STAGE 3 ISSUE ADDITIONAL NOTES

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PROJECT STATUS	STAGE 4
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXTERNALS EXISTING DRAINAGE SHEET 3 OF 3
SIZE & SCALE	A1: 1:250
DRAWING STATUS	D2 - FOR TENDER
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-EE-XX-DWG-C-1003
REV	P04

26 July 2019 13:07:39

APPENDIX 4
EXISTING DRAINAGE CALCULATIONS

Albert Square Drainage

Existing outfall pipework from EXPS31 to manhole EXPS8101

Invert level of EXPS31 **was** identified during survey work by Powers & Tiltman/Lanes for Drains - 36.800
Invert level of EXPS8101 **was not** identified during survey work although backdrop indicated on report - invert levels of manhole up and downstream are also not indicated on public sewer records
Invert level identified on United Utilities sewer relining works drawing MISC/80030937/03/11/2300 Rev D is indicated as **33.302.**
Connections from bulding drainage into public sewer at upstream manholes were identied as below so appears the UU drawing could be correct.
EXMH21A - 34.010
EXMH21B - 34.930
EXMH25 - 35.770

Using an invert level of 33.302 the crown of the pipe would be at 33.942. This would make the incoming invert level 33.642 giving a 1 in 4 gradient from manhole EXPS31
Video evidence from the CCTV survey indicates that the connection is not into the crown of the pipe. The video indicates a fall on the pipe with the connection into the manhole below a landing level.
Assume 1 in 100 gradient at this stage

Colebrook-White Formula
All charts in AS2200-2006, have been developed using the formulae below:

g = Gravity	= 9.81 m/s^2			
ν = kinematic viscosity of water	= 1.010E-06 m^2/s			
k = Colebrook-White roughness coeff	= 0.600 mm	= 6.000E-04 m		
D = Inside diameter	= 300 mm	= 0.300 m		
S = Slope, in metres per metre	= 1 : 100	= 1.000%	= (Hydraulic Gradient)	
V = Velocity	= 1.57 m/s			
Discharge:				
Q = V x A	A = 0.071 m2			
	Q = 0.1111 m/s	= 111.128 L/s		

Existing outfall pipework from EXPS32 to manhole EXPS8001

Invert level of MH32 was identified during survey work as 36.940
Invert level of incoming pipe into EXPS8001 **was not** identified during survey work although backdrop noted on report.
Invert level was not identified on United Utilities sewer records
Manhole depth indicated as 4.8m on
Assume 1 in 100 gradient at this stage

Colebrook-White Formula
All charts in AS2200-2006, have been developed using the formulae below:

g = Gravity	= 9.81 m/s^2			
ν = kinematic viscosity of water	= 1.010E-06 m^2/s			
k = Colebrook-White roughness coeff	= 0.600 mm	= 6.000E-04 m		
D = Inside diameter	= 300 mm	= 0.300 m		
S = Slope, in metres per metre	= 1 : 100	= 1.000%	= (Hydraulic Gradient)	
V = Velocity	= 1.57 m/s			
Discharge:				
Q = V x A	A = 0.071 m2			
	Q = 0.1111 m/s	= 111.128 L/s		

Existing outfall pipework from EXPS42 to manhole EXPS7104

Invert level of MH42 was identified during survey work as 38.040 (this is believed to be an existing highway drain)
Invert level of MH7104 was not identified during the survey - this is the head of the public sewer and was unable to lift during Lincoln Square CCTV survey also
Invert level was not identified on United Utilities sewer records
Manhole downstream of 7104 in Brazennose Street has an invert level of 33.460. Public sewer is 450mm downstream of 7104.
Assume 1 in 100 gradient at this stage

Colebrook-White Formula
All charts in AS2200-2006, have been developed using the formulae below:

g = Gravity	= 9.81 m/s^2			
ν = kinematic viscosity of water	= 1.010E-06 m^2/s			
k = Colebrook-White roughness coeff	= 0.600 mm	= 6.000E-04 m		
D = Inside diameter	= 225 mm	= 0.225 m		
S = Slope, in metres per metre	= 1 : 100	= 1.000%	= (Hydraulic Gradient)	
V = Velocity	= 1.31 m/s			
Discharge:				
Q = V x A	A = 0.040 m2			
	Q = 0.0520 m/s	= 51.980 L/s		

APPENDIX 5
PROPOSED DRAINAGE DRAWINGS

FOR CONTINUATION REFER TO OTH-RAM-EE-XX-DWG-C-1101

FOR CONTINUATION REFER TO OTH-RAM-EE-XX-DWG-C-1101

FOR INTERNAL TOWN HALL PROPOSED DRAINAGE REFER TO DRAWINGS OTH-RAM-TH-XX-DWG-C-0100, OTH-RAM-TH-XX-DWG-C-0101, OTH-RAM-TH-XX-DWG-C-0102 AND OTH-RAM-TH-XX-DWG-C-0103
FOR COURT YARD TOWN HALL PROPOSED DRAINAGE REFER TO DRAWINGS OTH-RAM-TH-XX-DWG-5100 OTH-RAM-TH-XX-DWG-5101 OTH-RAM-TH-XX-DWG-5102 AND OTH-RAM-TH-XX-DWG-5103

LLOYD STREET

EXPS 8008
CL40.490
IL35.240
EX-RG

MH 4A
(EXPS-8007)
CL40.390
IL36.080

EX-RG

EXMH 25
CL 40.540
IL 35.770
BACKDROPS
IL 35.900

PRINCESS STREET

EXISTING MARSHALLS SLOT DRAIN, TO BE REMOVED ALONG THE LENGTH OF LLOYD STREET DURING PAVEMENT WORKS. NEW DUO SLOT TO BE PROVIDED ON TOP OF EXISTING INSITU CHANNEL

EXPS 9013
CL40.480
IL34.380

EXIC
CL 40.480

EXIC
CL40.57

ASSUMED EXISTING CONNECTION FROM SLOT DRAIN TO BE LOCATED ON SITE FOR RECONNECTION OF NEW SLOT DRAINAGE

EXPS 9010
CL40.62

COOPER STREET

EXIC
CL 40.67

EXMH ?
CL 40.710
IL 34.110

EXPS-9017
CL 40.910
IL 36.370

EXPS 9011
CL 40.83

EXISTING SLOT DRAIN TO BE REMOVED TO ALLOW FOR STEPS TO BE CONSTRUCTED. NEW MARSHALLS DUO SLOT DRAIN TO BE ALLOWED FOR AT BASE OF NEW STEPS WITH CONNECTION BACK INTO EXISTING BELOW GROUND DRAINAGE, REUSING EXISTING CONNECTIONS.

EXPS-9007
CL 41.020
IL 33.450

EXPS-9004
(SJ83989004)
CL 41.100
IL 34.214 Approx.

EXMH
CL 41.19

DRAINAGE CONNECTION FROM ACTIVE HVM BOLLARDS

ADDITIONAL SURVEY/OPENING UP WORKS REQUIRED TO UNDERSTAND EXISTING DRAINAGE SYSTEMS.

EX-RG

EX-RG

EX-RG

EX-RG

5. THIS DRAWING HAS BEEN CREATED USING THE FOLLOWING INFORMATION:

- UTILITIES SURVEY BY POWERS AND TILTMAN DATED FEBRUARY/MARCH 2018
- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18
- PROPOSED LANDSCAPE PLAN BY PLAN IT, DRAWING NUMBER OTH-PLA-EE-XX-CAD-L-1000
- P05 PROPOSED LEVELS DRAWING BY PLANIT, DRAWING NUMBER OTH-PLA-EE-ES-DWG-L-0001
- PROPOSED UTILITIES DIVERSION PLAN BY ARUP, OTH-ARU-EE-ES-DWG-U-20404/20405
- PROPOSED PUBLIC REALM SERVICING STRATEGY BY ARUP OTH-ARU-EE-ES-DWG-B-10401
- P05 DISTRICT HEATING AS BUILT DRAWING 50467-VE-SW-BG-DR-M-5601

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8. FOR DRAINAGE SCHEDULE REFER TO DRAWING OTH-RAM-EE-XX-DWG-C-1200

9. FOR DRAINAGE DETAILS REFER TO DRAWING SERIES OTH-RAM-EE-XX-DWG-C-1400 TO 1402

10. ALL DRAINAGE WORKS CARRIED OUT IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, DESIGN MANUAL FOR ROADS AND BRIDGES, RELEVANT WATER AUTHORITY STANDARDS, LOCAL COUNCIL STANDARDS AND HEALTH AND SAFETY POLICIES.

11. PIPES ARE NOT DESIGNED FOR CONSTRUCTION TRAFFIC, CONTRACTOR WILL TAKE NECESSARY PRECAUTIONS TO PROTECT PIPES DURING CONSTRUCTION. EXISTING DRAINAGE WHICH IS TO REMAIN IN THE PROPOSED WORKS TO BE PROTECTED AT ALL TIMES.

12. ALL SURFACE WATER PIPES (UP TO 600mm DIA) TO BE STRUCTURED WALL HDPE TO BS EN 13476-1 AND -3, KITEMARKED, AGREMENT CERTIFIED OR CE MARKED U.N.O.

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15. POLYPROPYLENE INSPECTION CHAMBER TO BE IN ACCORDANCE WITH B57158 OR BSEN13598-1 OR AGREEMENT CERTIFIED MINIMUM INTERNAL DIAMETER 450mm UNO.

16. ALL SURFACE WATER BRANCHES TO BE DN150 AT 1:80 MINIMUM GRADIENT U.N.O.

17. FOR PIPES WITH LESS THAN 1200mm COVER TO CROWN PIPE BEDDING TO BE CLASS Z SURROUND OR PROTECTIVE COVER SLAB.

18. ROOT PROTECTION BARRIERS REQUIRED TO ALL DRAINAGE TRENCHES WITHIN 5m OF EXISTING OR PROPOSED TREES SUBJECT TO CONFIRMATION BY LANDSCAPE ARCHITECT

19. CONNECTION TO EXISTING PUBLIC SEWER NETWORK IS SUBJECT TO AGREEMENT IN PRINCIPLE. A SECTION 106 AGREEMENT IS REQUIRED TO BE SUBMITTED FOR FORMAL CONNECTION.

20. SURFACE WATER DISCHARGE HAS BEEN RESTRICTED TO 110 L/S BY PIPE SIZE AND GRADIENT. FOUL WATER DISCHARGE IS UNRESTRICTED

21. THIS DRAWING IS THE COPYRIGHT OF RAMBOLL UK.

Scale Bars to be used as guidance only - refer to sheet size below

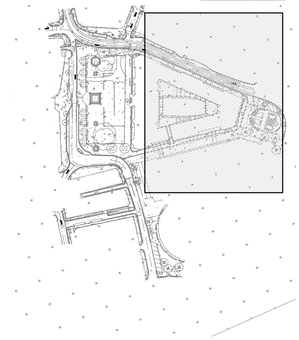
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3. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM U.N.O
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IF ANY INFORMATION WITHIN THESE DRAWINGS CHANGES THE BELOW GROUND DRAINAGE IS ALSO SUBJECT TO CHANGE

KEY

EXISTING PUBLIC COMBINED DRAIN/ MANHOLE — C —
EXISTING PUBLIC FOUL DRAIN/ MANHOLE — F —
EXISTING PUBLIC SURFACE WATER DRAIN/MANHOLE — SW —
EXISTING PRIVATE FOUL DRAIN/ MANHOLE — F —
EXISTING ROAD GULLY EX-RG
PROPOSED DRAW PIT LOCATION REF C AND D, REQUIRING DRAINAGE DP
PROPOSED FOUL WATER DRAIN/CONCRETE MANHOLE
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PROPOSED DRAINAGE CHANNEL / SLOT DRAIN WITH SUMP AND ACCESS UNIT DC / SD
PROPOSED ATTENUATION
PROPOSED TREE PIT



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P05	18/12/2019	LS	SG	PLANNING ISSUE SEE REVISION CLOUDS
P04	05/09/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS

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PROJECT STATUS	STAGE 4
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXTERNALS PROPOSED DRAINAGE SHEET 1 OF 3
SIZE & SCALE	A1: 1:250
DRAWING STATUS	D2 - FOR TENDER
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-EE-XX-DWG-C-1100
REV	P05

18 December 2019
14:59:36

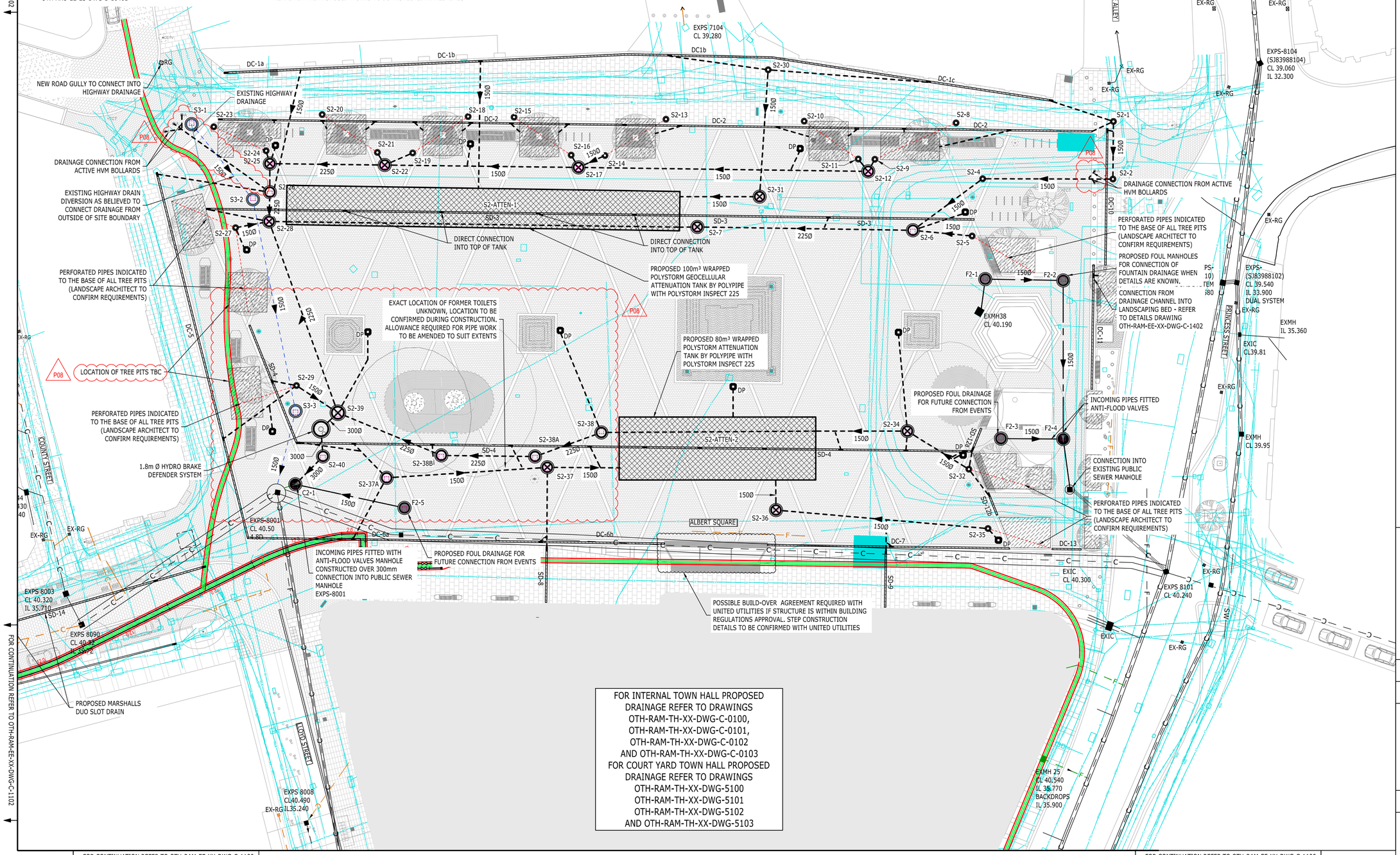
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- PROPOSED LEVELS DRAWING BY PLANIT, DRAWING NUMBER OTH-PLA-EE-ES-DWG-L-0001 P08
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- PROPOSED PUBLIC REALM SERVICING STRATEGY BY ARUP OTH-ARU-EE-ES-DWG-B-10401

- DISTRICT HEATING AS BUILT DRAWING 50467-VE-SW-BG-DR-M-5601 P08

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9. FOR DRAINAGE DETAILS REFER TO DRAWING SERIES OTH-RAM-EE-XX-DWG-C-1400 TO 1402
10. ALL DRAINAGE WORKS CARRIED OUT IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, DESIGN MANUAL FOR ROADS AND BRIDGES, RELEVANT WATER AUTHORITY STANDARDS, LOCAL COUNCIL STANDARDS AND HEALTH AND SAFETY POLICIES.
11. PIPES ARE NOT DESIGNED FOR CONSTRUCTION TRAFFIC, CONTRACTOR WILL TAKE NECESSARY PRECAUTIONS TO PROTECT PIPES DURING CONSTRUCTION. EXISTING DRAINAGE WHICH IS TO REMAIN IN THE PROPOSED WORKS TO BE PROTECTED AT ALL TIMES.
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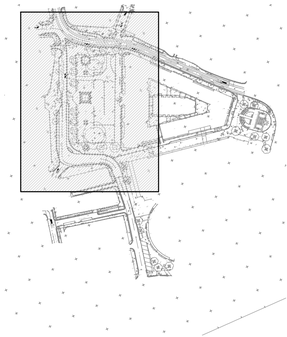
FOR INTERNAL TOWN HALL PROPOSED DRAINAGE REFER TO DRAWINGS OTH-RAM-TH-XX-DWG-C-0100, OTH-RAM-TH-XX-DWG-C-0101, OTH-RAM-TH-XX-DWG-C-0102 AND OTH-RAM-TH-XX-DWG-C-0103
FOR COURT YARD TOWN HALL PROPOSED DRAINAGE REFER TO DRAWINGS OTH-RAM-TH-XX-DWG-5100 OTH-RAM-TH-XX-DWG-5101 OTH-RAM-TH-XX-DWG-5102 AND OTH-RAM-TH-XX-DWG-5103

Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	4000	4000	4000	4000	4000
1:200	mm	8000	8000	8000	2000	8000
1:500	m	5	5	25		35
1:1250	m	10	30	50	70	90

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ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P08	18/12/2019	LS	SG	PLANNING ISSUE SEE REVISION CLOUDS
P07	11/10/2019	LS	SG	STAGE 4 ISSUE - VIC SOC CHANGES SEE REVISION CLOUDS
P06	05/09/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS
P05	26/07/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS

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PROJECT STATUS	STAGE 4
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXTERNALS PROPOSED DRAINAGE SHEET 2 OF 3
SIZE & SCALE	A1: 1:250
DRAWING STATUS	D2 - TENDER
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-EE-XX-DWG-C-1101
REV	P08

18 December 2019
14:57:45

1. DO NOT SCALE FROM THIS DRAWING

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- PROPOSED LEVELS PLAN BY PLANIT, DRAWING NUMBER OTH-PLA-EE-ES-CAD-L-0001 P06
- PROPOSED UTILITIES DIVERSION PLAN BY ARUP, OTH-ARU-EE-ES-DWG-U-20404/20405
- PROPOSED PUBLIC REALM SERVICING STRATEGY BY ARUP OTH-ARU-EE-ES-DWG-B-10401
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16. ALL FOUL BRANCH CONNECTIONS TO BE DN100 AT 1:40 MINIMUM GRADIENT U.N.O.

17. ALL SURFACE WATER BRANCHES FROM RAIN WATER DOWN PIPES , GULLIES AND CHANNELS TO BE DN150 AT 1:80 MINIMUM GRADIENT U.N.O.

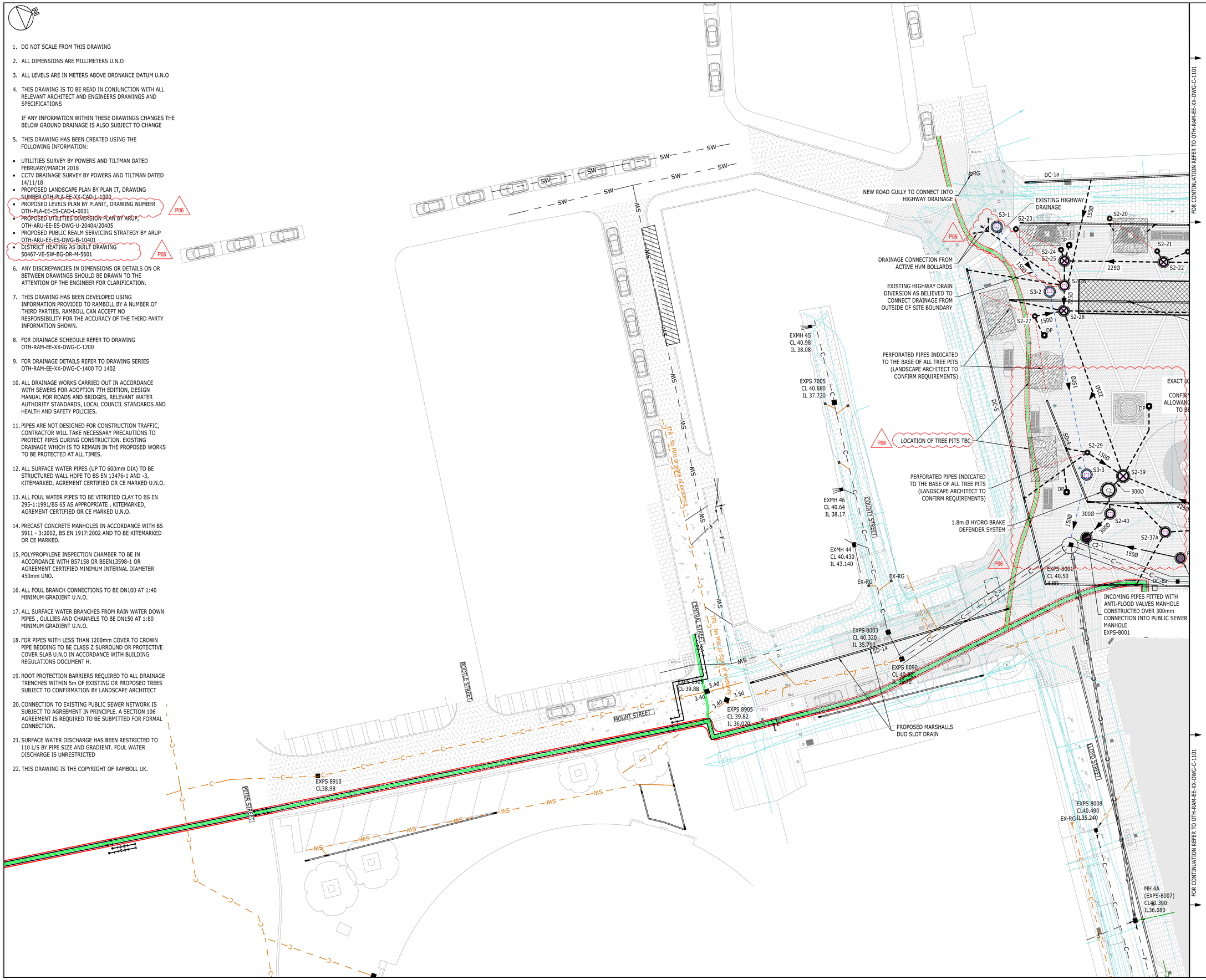
18. FOR PIPES WITH LESS THAN 1200mm COVER TO CROWN PIPE BEDDING TO BE CLASS Z SURROUND OR PROTECTIVE COVER SLAB U.N.O IN ACCORDANCE WITH BUILDING REGULATIONS DOCUMENT H.

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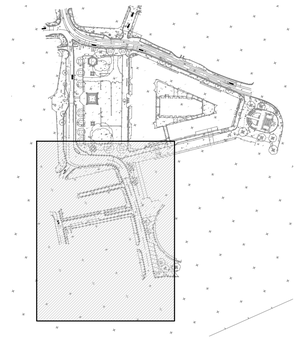


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1:200	mm	2000	4000	6000	8000	10000	14000
1:500	m	5	10	15	20	25	35
1:1250	m	10	20	30	40	50	70	90

KEY

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ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P06	18/12/2019	LS	SG	PLANNING ISSUE SEE REVISION CLOUDS
P05	11/10/2019	LS	SG	STAGE 4 ISSUE - VIC SOC CHANGES SEE REVISION CLOUDS
P04	05/09/2019	LS	SG	STAGE 4 ISSUE SEE REVISION CLOUDS

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PROJECT STATUS	STAGE 4
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXTERNALS PROPOSED DRAINAGE SHEET 3 OF 3
SIZE & SCALE	A1: 1:250
DRAWING STATUS	D2 - FOR TENDER
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-EE-XX-DWG-C-1102
REV	P06

18 December 2019
14:55:45

APPENDIX 6
PROPOSED DRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Albert Square Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	0.000
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	0.840	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.361	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	550	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.000		

Designed with Level Inverts

Network Design Table for Albert Square Storm

« - 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

Network Results Table

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

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	2.656	0.210	12.6	0.021	4.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	6.296	0.015	419.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	1.585	0.220	7.2	0.019	4.00	0.0	0.600	o	100	Pipe/Conduit	
S2.001	6.690	0.015	446.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	36.834	0.305	120.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	1.585	0.230	6.9	0.025	4.00	0.0	0.600	o	100	Pipe/Conduit	
S3.001	8.366	0.320	26.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	65.27	4.02	39.430	0.021	0.0	0.0	0.0	2.18	17.2	4.2
S1.001	64.01	4.24	38.220	0.021	0.0	0.0	0.0	0.48	8.6	4.2
S2.000	65.34	4.01	39.440	0.019	0.0	0.0	0.0	2.90	22.8	3.7
S2.001	63.95	4.25	38.220	0.019	0.0	0.0	0.0	0.47	8.3	3.7
S1.002	60.38	4.92	38.205	0.040	0.0	0.0	0.0	0.91	16.1	7.3
S3.000	65.34	4.01	39.450	0.025	0.0	0.0	0.0	2.96	23.3	4.9
S3.001	64.92	4.08	38.220	0.025	0.0	0.0	0.0	1.98	34.9	4.9

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.000	2.099	0.260	8.1	0.014	4.00	0.0	0.600	o	100	Pipe/Conduit	
S4.001	6.308	0.320	19.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	24.646	0.205	120.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S5.000	1.582	0.230	6.9	0.014	4.00	0.0	0.600	o	100	Pipe/Conduit	
S5.001	8.455	0.525	16.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.000	1.622	0.420	3.9	0.015	4.00	0.0	0.600	o	100	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)
S4.000	65.31	4.01	39.480	0.014	0.0	0.0	0.0	2.74	21.5	2.9
S4.001	65.04	4.06	38.220	0.014	0.0	0.0	0.0	2.28	40.3	2.9
S1.003	58.24	5.37	37.900	0.079	0.0	0.0	0.0	0.92	16.2	14.0
S5.000	65.34	4.01	39.450	0.014	0.0	0.0	0.0	2.97	23.3	2.9
S5.001	65.01	4.06	38.220	0.014	0.0	0.0	0.0	2.52	44.6	2.9
S6.000	65.35	4.01	39.640	0.015	0.0	0.0	0.0	3.96	31.1	3.0

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.001	6.528	0.525	12.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	14.602	0.075	194.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	2.442	0.460	5.3	0.015	4.00	0.0	0.600	o	100	Pipe/Conduit	
S7.001	4.694	0.600	7.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	3.632	0.020	181.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	3.723	0.130	28.6	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.001	65.12	4.04	38.220	0.015	0.0	0.0	0.0	2.87	50.8	3.0
S1.004	57.08	5.63	37.695	0.109	0.0	0.0	0.0	0.93	37.1	18.8
S7.000	65.32	4.01	39.680	0.015	0.0	0.0	0.0	3.38	26.5	3.0
S7.001	65.19	4.03	38.220	0.015	0.0	0.0	0.0	3.63	64.1	3.0
S1.005	56.81	5.69	37.620	0.124	0.0	0.0	0.0	0.97	38.4	21.3
S1.006	56.70	5.72	37.600	0.143	0.0	0.0	0.0	2.45	97.6	24.7

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.000	3.735	0.030	124.5	0.023	4.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	14.938	0.130	114.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	3.397	0.030	113.2	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
S8.002	11.069	0.090	123.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.003	27.407	0.405	67.7	0.050	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.004	2.263	0.040	56.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.005	24.997	0.075	333.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.000	64.98	4.07	38.250	0.023	0.0	0.0	0.0	0.90	15.9	4.6
S8.001	63.45	4.34	38.220	0.023	0.0	0.0	0.0	0.94	16.6	4.6
S9.000	65.03	4.06	38.120	0.000	0.0	0.0	0.0	0.94	16.7	0.0
S8.002	62.34	4.54	38.090	0.023	0.0	0.0	0.0	0.90	16.0	4.6
S8.003	60.41	4.91	38.000	0.073	0.0	0.0	0.0	1.22	21.6	13.4
S8.004	60.27	4.94	37.595	0.073	0.0	0.0	0.0	1.34	23.7	13.4
S8.005	57.53	5.53	37.555	0.073	0.0	0.0	0.0	0.71	28.3	13.4

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	16.162	0.135	120.0	0.049	4.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	10.125	0.085	119.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.002	25.296	0.150	168.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.006	27.193	0.010	2719.3	0.108	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	23.748	0.095	250.0	0.013	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	7.088	0.060	118.1	0.028	4.00	0.0	0.600	o	150	Pipe/Conduit	
S11.001	11.650	0.100	116.5	0.044	0.00	0.0	0.600	o	150	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)
S10.000	63.68	4.29	37.850	0.049	0.0	0.0	0.0	0.92	16.2	9.5
S10.001	62.67	4.48	37.715	0.049	0.0	0.0	0.0	0.92	16.3	9.5
S10.002	59.86	5.02	37.630	0.049	0.0	0.0	0.0	0.77	13.6	9.5
S8.006	50.42	7.40	37.480	0.230	0.0	0.0	0.0	0.24	9.6«	35.2
S1.007	49.17	7.80	37.470	0.386	0.0	0.0	0.0	0.99	70.0	57.6
S11.000	64.63	4.13	38.820	0.028	0.0	0.0	0.0	0.92	16.3	5.5
S11.001	63.44	4.34	38.760	0.072	0.0	0.0	0.0	0.93	16.4	13.8

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.002	12.500	0.150	83.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.000	27.055	0.225	120.0	0.029	4.00	0.0	0.600	o	150	Pipe/Conduit	
S12.001	12.426	0.095	130.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S13.000	23.251	0.245	94.9	0.045	4.00	0.0	0.600	o	150	Pipe/Conduit	
S11.003	14.768	0.010	1476.8	0.113	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.004	36.131	1.050	34.4	0.027	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S11.002	62.41	4.53	38.660	0.072	0.0	0.0	0.0	1.10	19.5	13.8
S12.000	62.59	4.49	38.980	0.029	0.0	0.0	0.0	0.92	16.2	5.5
S12.001	61.34	4.73	38.755	0.029	0.0	0.0	0.0	0.88	15.5	5.5
S13.000	63.23	4.38	38.905	0.045	0.0	0.0	0.0	1.03	18.2	8.6
S11.003	57.78	5.47	38.510	0.258	0.0	0.0	0.0	0.33	13.2«	45.3
S11.004	56.60	5.74	38.500	0.285	0.0	0.0	0.0	2.24	89.0	48.9

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Network Design Table for Albert Square Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S14.000	5.689	1.375	4.1	0.014	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	2.849	0.050	57.0	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	4.135	0.050	82.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	4.890	0.175	27.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.011	2.507	0.025	100.0	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)
S14.000	65.28	4.02	38.900	0.014	0.0	0.0	0.0	4.99	88.2	2.9
S1.008	49.10	7.82	37.375	0.736	0.0	0.0	0.0	2.09	147.5	109.6
S1.009	48.98	7.86	37.325	0.736	0.0	0.0	0.0	1.73	122.3	109.6
S1.010	48.89	7.89	37.275	0.736	0.0	0.0	0.0	2.99	211.1	109.6
S1.011	48.81	7.92	37.100	0.736	0.0	0.0	0.0	1.57	111.1	109.6

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Manhole Schedules for Albert Square Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S2-DC	39.880	0.450	Open Manhole	1200	S1.000	39.430	100				
S2-TP-1	39.880	1.660	Open Manhole	1200	S1.001	38.220	150	S1.000	39.220	100	950
S2-DC	39.890	0.450	Open Manhole	1200	S2.000	39.440	100				
S2-TP-2	39.890	1.670	Open Manhole	1200	S2.001	38.220	150	S2.000	39.220	100	950
S2-12	39.950	1.745	Open Manhole	1200	S1.002	38.205	150	S1.001	38.205	150	
								S2.001	38.205	150	
S2-DC	39.900	0.450	Open Manhole	1200	S3.000	39.450	100				
S2-TP-3	39.900	1.680	Open Manhole	1200	S3.001	38.220	150	S3.000	39.220	100	950
S2-DC	39.930	0.450	Open Manhole	1200	S4.000	39.480	100				
S2-TP-4	39.930	1.710	Open Manhole	1200	S4.001	38.220	150	S4.000	39.220	100	950
S2-17	39.985	2.085	Open Manhole	1200	S1.003	37.900	150	S1.002	37.900	150	
								S3.001	37.900	150	
								S4.001	37.900	150	
S2-DC	39.900	0.450	Open Manhole	1200	S5.000	39.450	100				
S2-TP-5	39.900	1.680	Open Manhole	1200	S5.001	38.220	150	S5.000	39.220	100	950
S2-DC	40.090	0.450	Open Manhole	1200	S6.000	39.640	100				
S2-TP-6	40.090	1.870	Open Manhole	1200	S6.001	38.220	150	S6.000	39.220	100	950
S2-22	40.055	2.360	Open Manhole	1200	S1.004	37.695	225	S1.003	37.695	150	
								S5.001	37.695	150	

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Manhole Schedules for Albert Square Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
								S6.001	37.695	150	
S2-DC	40.130	0.450	Open Manhole	1200	S7.000	39.680	100				
S2-TP-7	40.130	1.910	Open Manhole	1200	S7.001	38.220	150	S7.000	39.220	100	950
S2-25	40.170	2.550	Open Manhole	1200	S1.005	37.620	225	S1.004	37.620	225	
								S7.001	37.620	150	
S2-26	40.265	2.665	Open Manhole	1200	S1.006	37.600	225	S1.005	37.600	225	
S2-1	39.600	1.350	Open Manhole	1200	S8.000	38.250	150				
S2-2	39.735	1.515	Open Manhole	475	S8.001	38.220	150	S8.000	38.220	150	
S2-3	39.890	1.770	Open Manhole	475	S9.000	38.120	150				
S2-4	39.970	1.880	Open Manhole	475	S8.002	38.090	150	S8.001	38.090	150	
								S9.000	38.090	150	
S2-6	40.110	2.110	Open Manhole	1200	S8.003	38.000	150	S8.002	38.000	150	
S2-7	40.085	2.490	Open Manhole	1200	S8.004	37.595	150	S8.003	37.595	150	
S2-ATTEN1-N1	40.145	2.590	Junction		S8.005	37.555	225	S8.004	37.555	150	
S2-30	39.600	1.750	Open Manhole	1200	S10.000	37.850	150				
S2-31	40.075	2.360	Open Manhole	1200	S10.001	37.715	150	S10.000	37.715	150	
S2-ATTEN1-N2	40.145	2.515	Junction		S10.002	37.630	150	S10.001	37.630	150	
S2-ATTEN-1	40.145	2.665	Open Manhole	1200	S8.006	37.480	225	S8.005	37.480	225	
								S10.002	37.480	150	

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Manhole Schedules for Albert Square Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S2-28	40.265	2.795	Open Manhole	1200	S1.007	37.470	300	S1.006	37.470	225	
								S8.006	37.470	225	
S2-33	40.170	1.350	Open Manhole	1200	S11.000	38.820	150				
S2-34	40.170	1.410	Open Manhole	1200	S11.001	38.760	150	S11.000	38.760	150	
S2-ATTEN2-N1	40.200	1.540	Junction		S11.002	38.660	150	S11.001	38.660	150	
S2-35	40.330	1.350	Open Manhole	475	S12.000	38.980	150				
S2-36	40.360	1.605	Open Manhole	1200	S12.001	38.755	150	S12.000	38.755	150	
S2-37	40.255	1.350	Open Manhole	1200	S13.000	38.905	150				
S2-ATTEN-2	40.200	1.690	Open Manhole	1200	S11.003	38.510	225	S11.002	38.510	150	
								S12.001	38.660	150	75
								S13.000	38.660	150	75
S2-38	40.200	1.700	Open Manhole	1200	S11.004	38.500	225	S11.003	38.500	225	
S2-29	40.250	1.350	Open Manhole	1200	S14.000	38.900	150				
S2-39	40.225	2.850	Open Manhole	1200	S1.008	37.375	300	S1.007	37.375	300	
								S11.004	37.450	225	
								S14.000	37.525	150	
S2-OS	40.185	2.860	Open Manhole	1800	S1.009	37.325	300	S1.008	37.325	300	
S2-40	40.200	2.925	Open Manhole	1200	S1.010	37.275	300	S1.009	37.275	300	
S2-C2-1	40.260	3.160	Open Manhole	1200	S1.011	37.100	300	S1.010	37.100	300	

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Manhole Schedules for Albert Square Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S2-	40.500	3.425	Open Manhole	0	OUTFALL			S1.011	37.075	300	

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	100	S2-DC	39.880	39.430	0.350	Open Manhole	1200
S1.001	o	150	S2-TP-1	39.880	38.220	1.510	Open Manhole	1200
S2.000	o	100	S2-DC	39.890	39.440	0.350	Open Manhole	1200
S2.001	o	150	S2-TP-2	39.890	38.220	1.520	Open Manhole	1200
S1.002	o	150	S2-12	39.950	38.205	1.595	Open Manhole	1200
S3.000	o	100	S2-DC	39.900	39.450	0.350	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	2.656	12.6	S2-TP-1	39.880	39.220	0.560	Open Manhole	1200
S1.001	6.296	419.7	S2-12	39.950	38.205	1.595	Open Manhole	1200
S2.000	1.585	7.2	S2-TP-2	39.890	39.220	0.570	Open Manhole	1200
S2.001	6.690	446.0	S2-12	39.950	38.205	1.595	Open Manhole	1200
S1.002	36.834	120.8	S2-17	39.985	37.900	1.935	Open Manhole	1200
S3.000	1.585	6.9	S2-TP-3	39.900	39.220	0.580	Open Manhole	1200

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.001	o	150	S2-TP-3	39.900	38.220	1.530	Open Manhole	1200
S4.000	o	100	S2-DC	39.930	39.480	0.350	Open Manhole	1200
S4.001	o	150	S2-TP-4	39.930	38.220	1.560	Open Manhole	1200
S1.003	o	150	S2-17	39.985	37.900	1.935	Open Manhole	1200
S5.000	o	100	S2-DC	39.900	39.450	0.350	Open Manhole	1200
S5.001	o	150	S2-TP-5	39.900	38.220	1.530	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.001	8.366	26.1	S2-17	39.985	37.900	1.935	Open Manhole	1200
S4.000	2.099	8.1	S2-TP-4	39.930	39.220	0.610	Open Manhole	1200
S4.001	6.308	19.7	S2-17	39.985	37.900	1.935	Open Manhole	1200
S1.003	24.646	120.0	S2-22	40.055	37.695	2.210	Open Manhole	1200
S5.000	1.582	6.9	S2-TP-5	39.900	39.220	0.580	Open Manhole	1200
S5.001	8.455	16.1	S2-22	40.055	37.695	2.210	Open Manhole	1200

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.000	o	100	S2-DC	40.090	39.640	0.350	Open Manhole	1200
S6.001	o	150	S2-TP-6	40.090	38.220	1.720	Open Manhole	1200
S1.004	o	225	S2-22	40.055	37.695	2.135	Open Manhole	1200
S7.000	o	100	S2-DC	40.130	39.680	0.350	Open Manhole	1200
S7.001	o	150	S2-TP-7	40.130	38.220	1.760	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.000	1.622	3.9	S2-TP-6	40.090	39.220	0.770	Open Manhole	1200
S6.001	6.528	12.4	S2-22	40.055	37.695	2.210	Open Manhole	1200
S1.004	14.602	194.7	S2-25	40.170	37.620	2.325	Open Manhole	1200
S7.000	2.442	5.3	S2-TP-7	40.130	39.220	0.810	Open Manhole	1200
S7.001	4.694	7.8	S2-25	40.170	37.620	2.400	Open Manhole	1200

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.005	o	225	S2-25	40.170	37.620	2.325	Open Manhole	1200
S1.006	o	225	S2-26	40.265	37.600	2.440	Open Manhole	1200
S8.000	o	150	S2-1	39.600	38.250	1.200	Open Manhole	1200
S8.001	o	150	S2-2	39.735	38.220	1.365	Open Manhole	475
S9.000	o	150	S2-3	39.890	38.120	1.620	Open Manhole	475
S8.002	o	150	S2-4	39.970	38.090	1.730	Open Manhole	475

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.005	3.632	181.6	S2-26	40.265	37.600	2.440	Open Manhole	1200
S1.006	3.723	28.6	S2-28	40.265	37.470	2.570	Open Manhole	1200
S8.000	3.735	124.5	S2-2	39.735	38.220	1.365	Open Manhole	475
S8.001	14.938	114.9	S2-4	39.970	38.090	1.730	Open Manhole	475
S9.000	3.397	113.2	S2-4	39.970	38.090	1.730	Open Manhole	475
S8.002	11.069	123.0	S2-6	40.110	38.000	1.960	Open Manhole	1200

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.003	o	150	S2-6	40.110	38.000	1.960	Open Manhole	1200
S8.004	o	150	S2-7	40.085	37.595	2.340	Open Manhole	1200
S8.005	o	225	S2-ATTEN1-N1	40.145	37.555	2.365	Junction	
S10.000	o	150	S2-30	39.600	37.850	1.600	Open Manhole	1200
S10.001	o	150	S2-31	40.075	37.715	2.210	Open Manhole	1200
S10.002	o	150	S2-ATTEN1-N2	40.145	37.630	2.365	Junction	
S8.006	o	225	S2-ATTEN-1	40.145	37.480	2.440	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.003	27.407	67.7	S2-7	40.085	37.595	2.340	Open Manhole	1200
S8.004	2.263	56.6	S2-ATTEN1-N1	40.145	37.555	2.440	Junction	
S8.005	24.997	333.3	S2-ATTEN-1	40.145	37.480	2.440	Open Manhole	1200
S10.000	16.162	120.0	S2-31	40.075	37.715	2.210	Open Manhole	1200
S10.001	10.125	119.1	S2-ATTEN1-N2	40.145	37.630	2.365	Junction	
S10.002	25.296	168.6	S2-ATTEN-1	40.145	37.480	2.515	Open Manhole	1200
S8.006	27.193	2719.3	S2-28	40.265	37.470	2.570	Open Manhole	1200

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.007	o	300	S2-28	40.265	37.470	2.495	Open Manhole	1200
S11.000	o	150	S2-33	40.170	38.820	1.200	Open Manhole	1200
S11.001	o	150	S2-34	40.170	38.760	1.260	Open Manhole	1200
S11.002	o	150	S2-ATTEN2-N1	40.200	38.660	1.390	Junction	
S12.000	o	150	S2-35	40.330	38.980	1.200	Open Manhole	475
S12.001	o	150	S2-36	40.360	38.755	1.455	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.007	23.748	250.0	S2-39	40.225	37.375	2.550	Open Manhole	1200
S11.000	7.088	118.1	S2-34	40.170	38.760	1.260	Open Manhole	1200
S11.001	11.650	116.5	S2-ATTEN2-N1	40.200	38.660	1.390	Junction	
S11.002	12.500	83.3	S2-ATTEN-2	40.200	38.510	1.540	Open Manhole	1200
S12.000	27.055	120.0	S2-36	40.360	38.755	1.455	Open Manhole	1200
S12.001	12.426	130.8	S2-ATTEN-2	40.200	38.660	1.390	Open Manhole	1200

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S13.000	o	150	S2-37	40.255	38.905	1.200	Open Manhole	1200
S11.003	o	225	S2-ATTEN-2	40.200	38.510	1.465	Open Manhole	1200
S11.004	o	225	S2-38	40.200	38.500	1.475	Open Manhole	1200
S14.000	o	150	S2-29	40.250	38.900	1.200	Open Manhole	1200
S1.008	o	300	S2-39	40.225	37.375	2.550	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S13.000	23.251	94.9	S2-ATTEN-2	40.200	38.660	1.390	Open Manhole	1200
S11.003	14.768	1476.8	S2-38	40.200	38.500	1.475	Open Manhole	1200
S11.004	36.131	34.4	S2-39	40.225	37.450	2.550	Open Manhole	1200
S14.000	5.689	4.1	S2-39	40.225	37.525	2.550	Open Manhole	1200
S1.008	2.849	57.0	S2-OS	40.185	37.325	2.560	Open Manhole	1800

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PIPELINE SCHEDULES for Albert Square Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.009	o	300	S2-OS	40.185	37.325	2.560	Open Manhole	1800
S1.010	o	300	S2-40	40.200	37.275	2.625	Open Manhole	1200
S1.011	o	300	S2-C2-1	40.260	37.100	2.860	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.009	4.135	82.7	S2-40	40.200	37.275	2.625	Open Manhole	1200
S1.010	4.890	27.9	S2-C2-1	40.260	37.100	2.860	Open Manhole	1200
S1.011	2.507	100.0	S2-	40.500	37.075	3.125	Open Manhole	0

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Area Summary for Albert Square Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.014	0.014	0.014
	User	-	100	0.007	0.007	0.021
1.001	-	-	100	0.000	0.000	0.000
2.000	User	-	100	0.004	0.004	0.004
	User	-	100	0.015	0.015	0.019
2.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
3.000	User	-	100	0.016	0.016	0.016
	User	-	100	0.009	0.009	0.025
3.001	-	-	100	0.000	0.000	0.000
4.000	User	-	100	0.008	0.008	0.008
	User	-	100	0.006	0.006	0.014
4.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
5.000	User	-	100	0.008	0.008	0.008
	User	-	100	0.006	0.006	0.014
5.001	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.008	0.008	0.008
	User	-	100	0.007	0.007	0.015
6.001	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
7.000	User	-	100	0.004	0.004	0.004
	User	-	100	0.011	0.011	0.015
7.001	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	User	-	100	0.014	0.014	0.014
	User	-	100	0.006	0.006	0.020

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Area Summary for Albert Square Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
8.000	User	-	100	0.018	0.018	0.018
	User	-	100	0.005	0.005	0.023
8.001	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.000	0.000	0.000
8.002	-	-	100	0.000	0.000	0.000
8.003	User	-	100	0.031	0.031	0.031
	User	-	100	0.018	0.018	0.050
8.004	-	-	100	0.000	0.000	0.000
8.005	-	-	100	0.000	0.000	0.000
10.000	User	-	100	0.006	0.006	0.006
	User	-	100	0.023	0.023	0.029
	User	-	100	0.020	0.020	0.049
10.001	-	-	100	0.000	0.000	0.000
10.002	-	-	100	0.000	0.000	0.000
8.006	User	-	100	0.017	0.017	0.017
	User	-	100	0.018	0.018	0.035
	User	-	100	0.018	0.018	0.053
	User	-	100	0.018	0.018	0.071
	User	-	100	0.019	0.019	0.090
	User	-	100	0.018	0.018	0.108
1.007	User	-	100	0.013	0.013	0.013
11.000	User	-	100	0.028	0.028	0.028
11.001	User	-	100	0.022	0.022	0.022
	User	-	100	0.022	0.022	0.044
11.002	-	-	100	0.000	0.000	0.000
12.000	User	-	100	0.017	0.017	0.017
	User	-	100	0.012	0.012	0.029

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Area Summary for Albert Square Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
12.001	-	-	100	0.000	0.000	0.000
13.000	User	-	100	0.020	0.020	0.020
	User	-	100	0.013	0.013	0.033
	User	-	100	0.012	0.012	0.045
11.003	User	-	100	0.027	0.027	0.027
	User	-	100	0.026	0.026	0.053
	User	-	100	0.018	0.018	0.071
	User	-	100	0.021	0.021	0.092
	User	-	100	0.021	0.021	0.113
11.004	User	-	100	0.027	0.027	0.027
14.000	User	-	100	0.014	0.014	0.014
1.008	User	-	100	0.050	0.050	0.050
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.736	0.736	0.736

Free Flowing Outfall Details for Albert Square Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.011	S2-	40.500	37.075	0.000	0	0

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Simulation Criteria for Albert Square Storm

Volumetric Runoff Coeff	0.840	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	0	Number of Storage Structures	9	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000	Cv (Summer)	0.840
Return Period (years)	2	Ratio R	0.361	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer	Storm Duration (mins)	30

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Storage Structures for Albert Square Storm

Cellular Storage Manhole: S2-TP-1, DS/PN: S1.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

Cellular Storage Manhole: S2-TP-2, DS/PN: S2.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

Cellular Storage Manhole: S2-TP-3, DS/PN: S3.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

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Cellular Storage Manhole: S2-TP-4, DS/PN: S4.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

Cellular Storage Manhole: S2-TP-5, DS/PN: S5.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

Cellular Storage Manhole: S2-TP-6, DS/PN: S6.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

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Cellular Storage Manhole: S2-TP-7, DS/PN: S7.001

Invert Level (m) 38.220 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.20
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	0.0	1.000	25.0	0.0	1.001	0.0	0.0

Cellular Storage Manhole: S2-ATTEN-1, DS/PN: S8.006

Invert Level (m) 37.430 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	250.0	0.0	0.400	250.0	0.0	0.401	0.0	0.0

Cellular Storage Manhole: S2-ATTEN-2, DS/PN: S11.003

Invert Level (m) 38.460 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	200.0	0.0	0.400	200.0	0.0	0.401	0.0	0.0

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

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 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 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.358 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S2-DC	15 Summer	2	+0%					39.466	-0.064	0.000	0.28		3.6	OK
S1.001	S2-TP-1	15 Winter	2	+0%	100/15 Summer				38.287	-0.083	0.000	0.39		3.2	OK

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

PN	US/MH Name	Level Exceeded
S1.000	S2-DC	
S1.001	S2-TP-1	

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

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)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S2.000	S2-DC	15 Summer	2	+0%					39.473	-0.067	0.000	0.24		3.2
S2.001	S2-TP-2	15 Winter	2	+0%	100/15 Summer				38.286	-0.084	0.000	0.35		2.7
S1.002	S2-12	15 Winter	2	+0%	100/15 Summer				38.269	-0.086	0.000	0.37		5.7
S3.000	S2-DC	15 Summer	2	+0%	100/15 Summer				39.488	-0.062	0.000	0.31		4.1
S3.001	S2-TP-3	15 Summer	2	+0%	100/15 Summer				38.256	-0.114	0.000	0.13		4.0
S4.000	S2-DC	15 Summer	2	+0%					39.508	-0.072	0.000	0.17		2.4
S4.001	S2-TP-4	15 Winter	2	+0%	100/15 Summer				38.246	-0.124	0.000	0.07		2.4
S1.003	S2-17	15 Winter	2	+0%	30/15 Summer				37.998	-0.052	0.000	0.75		11.5
S5.000	S2-DC	15 Summer	2	+0%					39.479	-0.071	0.000	0.18		2.4
S5.001	S2-TP-5	15 Winter	2	+0%					38.244	-0.126	0.000	0.06		2.4
S6.000	S2-DC	15 Summer	2	+0%					39.665	-0.075	0.000	0.14		2.5
S6.001	S2-TP-6	15 Winter	2	+0%					38.243	-0.127	0.000	0.06		2.5
S1.004	S2-22	15 Winter	2	+0%	100/15 Summer				37.806	-0.114	0.000	0.49		15.9
S7.000	S2-DC	15 Summer	2	+0%					39.704	-0.076	0.000	0.13		2.5
S7.001	S2-TP-7	15 Summer	2	+0%					38.242	-0.128	0.000	0.05		2.5
S1.005	S2-25	15 Winter	2	+0%	30/15 Winter				37.757	-0.087	0.000	0.69		17.8
S1.006	S2-26	15 Winter	2	+0%	100/15 Summer				37.698	-0.126	0.000	0.39		20.0
S8.000	S2-1	15 Summer	2	+0%	100/15 Summer				38.312	-0.088	0.000	0.36		3.9
S8.001	S2-2	15 Summer	2	+0%	100/15 Summer				38.272	-0.098	0.000	0.26		3.9
S9.000	S2-3	15 Winter	2	+0%	100/15 Summer				38.143	-0.127	0.000	0.00		0.0
S8.002	S2-4	15 Winter	2	+0%	100/15 Summer				38.143	-0.097	0.000	0.27		3.9
S8.003	S2-6	15 Winter	2	+0%	30/15 Summer				38.076	-0.074	0.000	0.51		10.5
S8.004	S2-7	15 Winter	2	+0%	30/15 Summer				37.700	-0.045	0.000	0.83		10.5
S8.005	S2-ATTEN1-N1	15 Winter	2	+0%					37.650	-0.130	0.000	0.37		10.4
S10.000	S2-30	15 Winter	2	+0%	100/15 Summer				37.929	-0.071	0.000	0.55		8.2

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

PN	US/MH Name	Status	Level Exceeded
S2.000	S2-DC	OK	
S2.001	S2-TP-2	OK	
S1.002	S2-12	OK	
S3.000	S2-DC	OK	
S3.001	S2-TP-3	OK	
S4.000	S2-DC	OK	
S4.001	S2-TP-4	OK	
S1.003	S2-17	OK	
S5.000	S2-DC	OK	
S5.001	S2-TP-5	OK	
S6.000	S2-DC	OK	
S6.001	S2-TP-6	OK	
S1.004	S2-22	OK	
S7.000	S2-DC	OK	
S7.001	S2-TP-7	OK	
S1.005	S2-25	OK	
S1.006	S2-26	OK	
S8.000	S2-1	OK	
S8.001	S2-2	OK	
S9.000	S2-3	OK	
S8.002	S2-4	OK	
S8.003	S2-6	OK	
S8.004	S2-7	OK	
S8.005	S2-ATTEN1-N1	OK*	

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

PN	US/MH Name	Status	Level Exceeded
S10.000	S2-30	OK	

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

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)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S10.001	S2-31	15 Winter	2	+0%	100/15 Summer				37.796	-0.069	0.000	0.56		8.1
S10.002	S2-ATTEN1-N2	15 Winter	2	+0%					37.714	-0.066	0.000	0.60		8.2
S8.006	S2-ATTEN-1	360 Winter	2	+0%	100/30 Summer				37.565	-0.140	0.000	0.27		3.0
S1.007	S2-28	15 Winter	2	+0%	100/15 Summer				37.580	-0.189	0.000	0.29		18.0
S11.000	S2-33	15 Summer	2	+0%	30/15 Summer				38.880	-0.090	0.000	0.34		4.7
S11.001	S2-34	15 Winter	2	+0%	30/15 Summer				38.854	-0.056	0.000	0.71		10.5
S11.002	S2-ATTEN2-N1	15 Winter	2	+0%					38.739	-0.071	0.000	0.54		10.5
S12.000	S2-35	15 Winter	2	+0%	100/15 Summer				39.037	-0.093	0.000	0.31		4.8
S12.001	S2-36	15 Winter	2	+0%	100/15 Summer				38.815	-0.090	0.000	0.34		4.7
S13.000	S2-37	15 Winter	2	+0%	100/15 Summer				38.974	-0.081	0.000	0.43		7.5
S11.003	S2-ATTEN-2	180 Winter	2	+0%	100/15 Winter				38.612	-0.123	0.000	0.43		4.7
S11.004	S2-38	180 Winter	2	+0%					38.536	-0.189	0.000	0.06		5.2
S14.000	S2-29	15 Winter	2	+0%					38.918	-0.132	0.000	0.03		2.4
S1.008	S2-39	15 Winter	2	+0%	100/15 Summer				37.517	-0.157	0.000	0.45		27.9
S1.009	S2-OS	15 Winter	2	+0%	100/15 Summer				37.468	-0.157	0.000	0.46		28.0
S1.010	S2-40	15 Winter	2	+0%					37.380	-0.195	0.000	0.27		28.1
S1.011	S2-C2-1	15 Winter	2	+0%	100/15 Summer				37.245	-0.154	0.000	0.48		28.0

PN	US/MH Name	Status	Level Exceeded
S10.001	S2-31	OK	
S10.002	S2-ATTEN1-N2	OK*	

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

PN	US/MH Name	Status	Level Exceeded
S8.006	S2-ATTEN-1	OK	
S1.007	S2-28	OK	
S11.000	S2-33	OK	
S11.001	S2-34	OK	
S11.002	S2-ATTEN2-N1	OK*	
S12.000	S2-35	OK	
S12.001	S2-36	OK	
S13.000	S2-37	OK	
S11.003	S2-ATTEN-2	OK	
S11.004	S2-38	OK	
S14.000	S2-29	OK	
S1.008	S2-39	OK	
S1.009	S2-OS	OK	
S1.010	S2-40	OK	
S1.011	S2-C2-1	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 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 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.358 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S2-DC	15 Summer	30	+0%					39.482	-0.048	0.000	0.53		6.7	OK
S1.001	S2-TP-1	15 Winter	30	+0%	100/15 Summer				38.323	-0.047	0.000	0.73		5.9	OK

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

PN	US/MH Name	Level Exceeded
S1.000	S2-DC	
S1.001	S2-TP-1	

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

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S2.000	S2-DC	15 Summer	30	+0%					39.488	-0.052	0.000	0.46		6.0
S2.001	S2-TP-2	15 Winter	30	+0%	100/15 Summer				38.322	-0.048	0.000	0.67		5.2
S1.002	S2-12	15 Winter	30	+0%	100/15 Summer				38.311	-0.044	0.000	0.68		10.5
S3.000	S2-DC	15 Summer	30	+0%	100/15 Summer				39.505	-0.045	0.000	0.58		7.8
S3.001	S2-TP-3	15 Summer	30	+0%	100/15 Summer				38.271	-0.099	0.000	0.25		7.7
S4.000	S2-DC	15 Summer	30	+0%					39.519	-0.061	0.000	0.32		4.6
S4.001	S2-TP-4	15 Summer	30	+0%	100/15 Summer				38.257	-0.113	0.000	0.13		4.5
S1.003	S2-17	15 Winter	30	+0%	30/15 Summer				38.210	0.160	0.000	1.23		18.9
S5.000	S2-DC	15 Summer	30	+0%					39.490	-0.060	0.000	0.34		4.6
S5.001	S2-TP-5	15 Summer	30	+0%					38.254	-0.116	0.000	0.12		4.5
S6.000	S2-DC	15 Winter	30	+0%					39.675	-0.065	0.000	0.26		4.8
S6.001	S2-TP-6	15 Summer	30	+0%					38.253	-0.117	0.000	0.11		4.8
S1.004	S2-22	15 Winter	30	+0%	100/15 Summer				37.893	-0.026	0.000	0.80		26.0
S7.000	S2-DC	15 Winter	30	+0%					39.714	-0.066	0.000	0.25		4.7
S7.001	S2-TP-7	15 Winter	30	+0%					38.251	-0.119	0.000	0.10		4.7
S1.005	S2-25	15 Winter	30	+0%	30/15 Winter				37.845	0.000	0.000	1.15		29.7
S1.006	S2-26	15 Winter	30	+0%	100/15 Summer				37.736	-0.088	0.000	0.66		33.7
S8.000	S2-1	15 Summer	30	+0%	100/15 Summer				38.342	-0.058	0.000	0.69		7.4
S8.001	S2-2	15 Summer	30	+0%	100/15 Summer				38.294	-0.076	0.000	0.49		7.4
S9.000	S2-3	15 Winter	30	+0%	100/15 Summer				38.225	-0.045	0.000	0.01		0.1
S8.002	S2-4	15 Winter	30	+0%	100/15 Summer				38.226	-0.014	0.000	0.51		7.3
S8.003	S2-6	15 Winter	30	+0%	30/15 Summer				38.203	0.053	0.000	0.99		20.4
S8.004	S2-7	15 Winter	30	+0%	30/15 Summer				37.807	0.062	0.000	1.62		20.3
S8.005	S2-ATTEN1-N1	15 Winter	30	+0%					37.697	-0.083	0.000	0.72		20.3
S10.000	S2-30	15 Winter	30	+0%	100/15 Summer				38.000	0.000	0.000	1.00		15.0

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

PN	US/MH Name	Status	Level Exceeded
S2.000	S2-DC	OK	
S2.001	S2-TP-2	OK	
S1.002	S2-12	OK	
S3.000	S2-DC	OK	
S3.001	S2-TP-3	OK	
S4.000	S2-DC	OK	
S4.001	S2-TP-4	OK	
S1.003	S2-17	SURCHARGED	
S5.000	S2-DC	OK	
S5.001	S2-TP-5	OK	
S6.000	S2-DC	OK	
S6.001	S2-TP-6	OK	
S1.004	S2-22	OK	
S7.000	S2-DC	OK	
S7.001	S2-TP-7	OK	
S1.005	S2-25	SURCHARGED	
S1.006	S2-26	OK	
S8.000	S2-1	OK	
S8.001	S2-2	OK	
S9.000	S2-3	OK	
S8.002	S2-4	OK	
S8.003	S2-6	SURCHARGED	
S8.004	S2-7	SURCHARGED	
S8.005	S2-ATTEN1-N1	OK*	

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

PN	US/MH Name	Status	Level Exceeded
S10.000	S2-30	OK	

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

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)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S10.001	S2-31	15 Winter	30	+0%	100/15 Summer				37.863	-0.002	0.000	0.99		14.3
S10.002	S2-ATTEN1-N2	15 Winter	30	+0%					37.780	0.000	0.000	1.03		14.0
S8.006	S2-ATTEN-1	120 Winter	30	+0%	100/30 Summer				37.635	-0.070	0.000	0.81		9.1
S1.007	S2-28	15 Winter	30	+0%	100/15 Summer				37.636	-0.133	0.000	0.50		30.9
S11.000	S2-33	15 Winter	30	+0%	30/15 Summer				39.043	0.073	0.000	0.58		8.1
S11.001	S2-34	15 Winter	30	+0%	30/15 Summer				39.021	0.111	0.000	1.40		20.8
S11.002	S2-ATTEN2-N1	15 Winter	30	+0%					38.810	0.000	0.000	1.05		20.5
S12.000	S2-35	15 Winter	30	+0%	100/15 Summer				39.063	-0.067	0.000	0.59		9.1
S12.001	S2-36	15 Winter	30	+0%	100/15 Summer				38.843	-0.062	0.000	0.63		8.9
S13.000	S2-37	15 Winter	30	+0%	100/15 Summer				39.009	-0.046	0.000	0.82		14.2
S11.003	S2-ATTEN-2	120 Winter	30	+0%	100/15 Winter				38.702	-0.033	0.000	1.00		10.9
S11.004	S2-38	120 Winter	30	+0%					38.558	-0.167	0.000	0.15		12.7
S14.000	S2-29	15 Winter	30	+0%					38.924	-0.126	0.000	0.06		4.6
S1.008	S2-39	15 Winter	30	+0%	100/15 Summer				37.595	-0.080	0.000	0.87		53.7
S1.009	S2-OS	15 Winter	30	+0%	100/15 Summer				37.546	-0.079	0.000	0.89		53.8
S1.010	S2-40	15 Winter	30	+0%					37.428	-0.147	0.000	0.52		54.1
S1.011	S2-C2-1	15 Winter	30	+0%	100/15 Summer				37.325	-0.075	0.000	0.92		54.0

PN	US/MH Name	Status	Level Exceeded
S10.001	S2-31	OK	
S10.002	S2-ATTEN1-N2	SURCHARGED*	

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

PN	US/MH Name	Status	Level Exceeded
S8.006	S2-ATTEN-1	OK	
S1.007	S2-28	OK	
S11.000	S2-33	SURCHARGED	
S11.001	S2-34	SURCHARGED	
S11.002	S2-ATTEN2-N1	SURCHARGED*	
S12.000	S2-35	OK	
S12.001	S2-36	OK	
S13.000	S2-37	OK	
S11.003	S2-ATTEN-2	OK	
S11.004	S2-38	OK	
S14.000	S2-29	OK	
S1.008	S2-39	OK	
S1.009	S2-OS	OK	
S1.010	S2-40	OK	
S1.011	S2-C2-1	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 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 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.100 Cv (Summer) 0.750
Region England and Wales Ratio R 0.358 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S1.000	S2-DC 15	Summer	100	+40%					39.507	-0.023	0.000	0.95		12.2
S1.001	S2-TP-1 15	Winter	100	+40%	100/15 Summer				38.543	0.173	0.000	0.82		6.7

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

PN	US/MH Name	Status	Level Exceeded
S1.000	S2-DC	OK	
S1.001	S2-TP-1	SURCHARGED	

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

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)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S2.000	S2-DC	15 Summer	100	+40%					39.510	-0.030	0.000	0.83		10.8
S2.001	S2-TP-2	15 Winter	100	+40%	100/15 Summer				38.543	0.173	0.000	0.71		5.5
S1.002	S2-12	15 Winter	100	+40%	100/15 Summer				38.530	0.175	0.000	0.72		11.2
S3.000	S2-DC	15 Summer	100	+40%	100/15 Summer				39.559	0.009	0.000	1.01		13.5
S3.001	S2-TP-3	15 Winter	100	+40%	100/15 Summer				38.439	0.069	0.000	0.36		10.9
S4.000	S2-DC	15 Summer	100	+40%					39.535	-0.045	0.000	0.59		8.3
S4.001	S2-TP-4	15 Winter	100	+40%	100/15 Summer				38.425	0.055	0.000	0.18		6.0
S1.003	S2-17	15 Winter	100	+40%	30/15 Summer				38.414	0.364	0.000	1.48		22.7
S5.000	S2-DC	15 Summer	100	+40%					39.507	-0.043	0.000	0.62		8.3
S5.001	S2-TP-5	15 Summer	100	+40%					38.267	-0.103	0.000	0.21		8.3
S6.000	S2-DC	15 Winter	100	+40%					39.689	-0.051	0.000	0.48		8.6
S6.001	S2-TP-6	15 Summer	100	+40%					38.266	-0.104	0.000	0.20		8.6
S1.004	S2-22	15 Winter	100	+40%	100/15 Summer				38.099	0.180	0.000	1.04		33.8
S7.000	S2-DC	15 Winter	100	+40%					39.727	-0.053	0.000	0.45		8.6
S7.001	S2-TP-7	15 Summer	100	+40%					38.262	-0.108	0.000	0.18		8.6
S1.005	S2-25	15 Winter	100	+40%	30/15 Winter				38.021	0.177	0.000	1.62		41.9
S1.006	S2-26	15 Winter	100	+40%	100/15 Summer				37.940	0.115	0.000	0.99		50.5
S8.000	S2-1	15 Winter	100	+40%	100/15 Summer				38.964	0.564	0.000	0.90		9.7
S8.001	S2-2	15 Winter	100	+40%	100/15 Summer				38.946	0.576	0.000	0.67		10.2
S9.000	S2-3	15 Winter	100	+40%	100/15 Summer				38.898	0.628	0.000	0.05		0.5
S8.002	S2-4	15 Winter	100	+40%	100/15 Summer				38.899	0.659	0.000	0.77		11.0
S8.003	S2-6	15 Winter	100	+40%	30/15 Summer				38.866	0.716	0.000	1.46		30.2
S8.004	S2-7	15 Winter	100	+40%	30/15 Summer				37.998	0.253	0.000	2.32		29.0
S8.005	S2-ATTEN1-N1	60 Winter	100	+40%					37.780	0.000	0.000	0.70		19.7
S10.000	S2-30	15 Winter	100	+40%	100/15 Summer				38.527	0.527	0.000	1.56		23.4

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

PN	US/MH Name	Status	Level Exceeded
S2.000	S2-DC	OK	
S2.001	S2-TP-2	SURCHARGED	
S1.002	S2-12	SURCHARGED	
S3.000	S2-DC	SURCHARGED	
S3.001	S2-TP-3	SURCHARGED	
S4.000	S2-DC	OK	
S4.001	S2-TP-4	SURCHARGED	
S1.003	S2-17	SURCHARGED	
S5.000	S2-DC	OK	
S5.001	S2-TP-5	OK	
S6.000	S2-DC	OK	
S6.001	S2-TP-6	OK	
S1.004	S2-22	SURCHARGED	
S7.000	S2-DC	OK	
S7.001	S2-TP-7	OK	
S1.005	S2-25	SURCHARGED	
S1.006	S2-26	SURCHARGED	
S8.000	S2-1	SURCHARGED	
S8.001	S2-2	SURCHARGED	
S9.000	S2-3	SURCHARGED	
S8.002	S2-4	SURCHARGED	
S8.003	S2-6	SURCHARGED	
S8.004	S2-7	SURCHARGED	
S8.005	S2-ATTEN1-N1	SURCHARGED*	

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

PN	US/MH Name	Status	Level Exceeded
S10.000	S2-30	SURCHARGED	

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

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S10.001	S2-31	15 Winter	100	+40%	100/15 Summer				38.215	0.350	0.000	1.53		22.2
S10.002	S2-ATTEN1-N2	180 Winter	100	+40%					37.780	0.000	0.000	0.49		6.6
S8.006	S2-ATTEN-1	60 Winter	100	+40%	100/30 Summer				37.817	0.112	0.000	2.48		27.7
S1.007	S2-28	15 Winter	100	+40%	100/15 Summer				37.816	0.046	0.000	0.58		36.3
S11.000	S2-33	15 Winter	100	+40%	30/15 Summer				39.636	0.666	0.000	0.92		12.8
S11.001	S2-34	15 Winter	100	+40%	30/15 Summer				39.586	0.676	0.000	2.21		32.9
S11.002	S2-ATTEN2-N1	180 Winter	100	+40%					38.810	0.000	0.000	0.50		9.8
S12.000	S2-35	15 Winter	100	+40%	100/15 Summer				39.169	0.039	0.000	1.05		16.2
S12.001	S2-36	15 Winter	100	+40%	100/15 Summer				38.917	0.013	0.000	1.11		15.6
S13.000	S2-37	15 Winter	100	+40%	100/15 Summer				39.297	0.242	0.000	1.40		24.2
S11.003	S2-ATTEN-2	60 Winter	100	+40%	100/15 Winter				38.815	0.080	0.000	3.40		37.1
S11.004	S2-38	60 Winter	100	+40%					38.612	-0.113	0.000	0.49		40.9
S14.000	S2-29	15 Winter	100	+40%					38.933	-0.117	0.000	0.11		8.3
S1.008	S2-39	15 Winter	100	+40%	100/15 Summer				37.786	0.111	0.000	1.31		80.3
S1.009	S2-OS	15 Winter	100	+40%	100/15 Summer				37.677	0.052	0.000	1.33		80.9
S1.010	S2-40	15 Winter	100	+40%					37.565	-0.009	0.000	0.77		80.7
S1.011	S2-C2-1	15 Winter	100	+40%	100/15 Summer				37.463	0.063	0.000	1.36		80.0

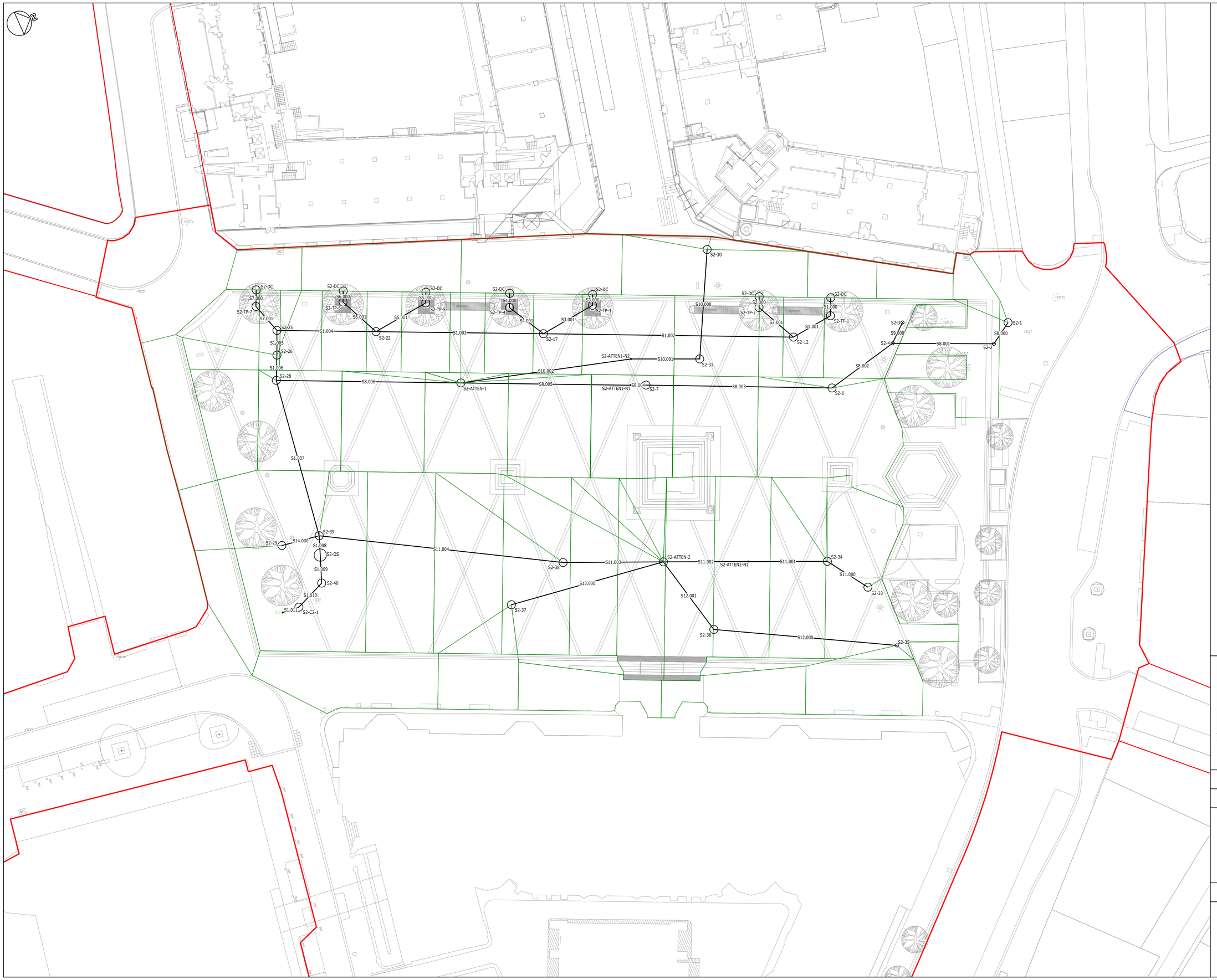
PN	US/MH Name	Status	Level Exceeded
S10.001	S2-31	SURCHARGED	
S10.002	S2-ATTEN1-N2	SURCHARGED*	

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

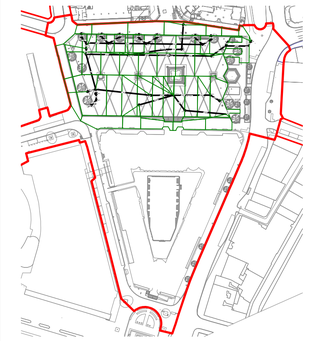
PN	US/MH Name	Status	Level Exceeded
S8.006	S2-ATTEN-1	SURCHARGED	
S1.007	S2-28	SURCHARGED	
S11.000	S2-33	SURCHARGED	
S11.001	S2-34	SURCHARGED	
S11.002	S2-ATTEN2-N1	SURCHARGED*	
S12.000	S2-35	SURCHARGED	
S12.001	S2-36	SURCHARGED	
S13.000	S2-37	SURCHARGED	
S11.003	S2-ATTEN-2	SURCHARGED	
S11.004	S2-38	OK	
S14.000	S2-29	OK	
S1.008	S2-39	SURCHARGED	
S1.009	S2-OS	SURCHARGED	
S1.010	S2-40	OK	
S1.011	S2-C2-1	SURCHARGED	

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Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	1000	2000	3000	4000	5000	
1:200	mm	2000	4000	6000	8000	10000	12000
1:500	M	5	10	15	20	25	30
1:250	M	10	20	30	40	50	60



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P01	22/08/2019	LS	CO	SKETCH

OUR TOWN HALL PROJECT

RAMBOLL

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PROJECT STATUS	SKETCH
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	ALBERT SQUARE MICRODRAINAGE MODEL AREAS
SIZE & SCALE	A1: 1:250
DRAWING STATUS	-
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-XX-XX-SKE-0046
REV	P01

22 August 2019 11:29:51

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NOTES:
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3. All dimensions are in millimetres unless otherwise stated.
4. All setting out, levels and dimensions to be agreed on site.
5. The dimensions of all materials must be checked on site before being set out.
6. This drawing is to be read in conjunction with all relevant Civil, Landscape and Structural drawings.
7. Order of construction and setting out to be agreed on site.

N

Design Parameters:

Rainfall Intensity: 1in100 yr + 40% (171.41 mm/hr)
Channel Used: ACO M150D
110dia Outlet to be used so maximum flow from outlet to be 14.1 l/s
Sump Depth: 735mm
110 Outlet Depth: 450mm
160 Outlet Depth: 710mm

Resilience Parameters:

Sedimentation Rate: Commercial (84.00 g/m²/yr)
Sedimentation Density: 1.40 g/cm³

DC-1a
Drained Area: 64m²
Channel Length: 9.5m
Channel: M150D 0.0
Flow: 3.05 l/s

DC-1b
Drained Area: 168m²
Channel Length: 23.5m
Channel: M150D 10.0
Flow: 8.01 l/s

DC-1c
Drained Area: 202m²
Channel Length: 23.5m
Channel: M150D 10.0
Flow: 9.63 l/s

DC-1d
Drained Area: 227m²
Channel Length: 27.5m
Channel: M150D 10.0
Flow: 10.82 l/s

DC-1e
Drained Area: 62m²
Channel Length: 10.25m
Channel: M150D 0.0
Flow: 2.95 l/s

DC-1f
Drained Area: 52m²
Channel Length: 11.25m
Channel: M150D 0.0
Flow: 2.48 l/s

DC-5a
Drained Area: 136m²
Channel Length: 21.5m
Channel: M150D 0.0
Flow: 6.48 l/s

DC-5b
Drained Area: 144m²
Channel Length: 26.5m
Channel: M150D 0.0
Flow: 6.86 l/s

DC-10
Drained Area: 183m²
Channel Length: 17.5m
Channel: M150D 10.0
Flow: 8.72 l/s

Sump Unit to collect directly into planter

End caps with fitted mesh at both ends of channel to connect into planter

End caps with fitted mesh at both ends of channel to connect into planter

DC-6a
Drained Area: 204m²
Channel Length: 26.5m
Channel: M150D 10.0
Flow: 9.72 l/s

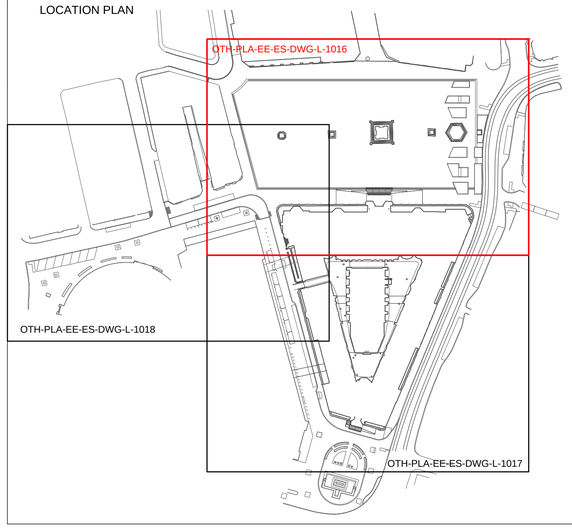
DC-6b
Drained Area: 126m²
Channel Length: 26.5m
Channel: M150D 0.0
Flow: 6.00 l/s

DC-8
Drained Area: 118m²
Channel Length: 7.0m
Channel: M150D 0.0
Flow: 5.62 l/s

DC-7
Drained Area: 170m²
Channel Length: 31.0m
Channel: M150D 10.0
Flow: 8.10 l/s

DC-9
Drained Area: 120m²
Channel Length: 7.0m
Channel: M150D 0.0
Flow: 5.72 l/s

LOCATION PLAN



KEY

BOUNDARIES
- Red Line Boundary — Subject to client approval
- Section 278 Works

LEVELS & DRAINAGE
- Proposed surface gradient
- Proposed spot level
- Existing spot level
- Proposed drainage channel / slot drain — Refer to Ramboll drawings for full details of proposed drainage: OTH-RAM-EE-XX-DWG-C-1100 - 1102
- Existing manholes & utility covers to be retained — NOTE: Assume all existing covers, manholes and in ground features to be replaced with new if retained unless noted. Any existing features proposed to be retained using increased / infill covers with paving to match adjacent new surfacing
- Existing manholes & utility covers to be removed
- Existing cover level
- Proposed cover level

RAMBOLL SKETCH
OTH-RAM-XX-XX-SKE-C-0042
23/07/2019

Revision Notes:

Revision	Date	Description	Drawn	Apprvd.
01	21/06/19	For information	SR	MS/KR

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Client	Manchester City Council
Project	Our Town Hall
Drg Title	Proposed Levels Detail Area 1 of 3 Albert Square

Created on	Created by	Approved by
19.06.19	SR	MS/KR

Scale	Size	Workstage
1:250	A1	Stage 4

Drg No.	Suitability	Revision
OTH-PLA-EE-ES-DWG-L-1016	S3	01

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Design Parameters:

Rainfall Intensity: 1in100 yr + 40% (171.41 mm/hr)
Channel Used: Marshalls Drexus

DC-3a
Drained Area: 126m²
Channel Length: 6m
Channel: 5/0 (M100D 10.0)
Flow: 6.01 l/s

DC-3c
Drained Area: 181m²
Channel Length: 12.25m
Channel: 15/0 (M100D 30.0)
Flow: 8.63 l/s

DC-3e
Drained Area: 186m²
Channel Length: 12.25m
Channel: 15/0 (M100D 30.0)
Flow: 8.82 l/s

DC-3g
Drained Area: 184m²
Channel Length: 12.45m
Channel: 15/0 (M100D 30.0)
Flow: 8.77 l/s

DC-3b
Drained Area: 181m²
Channel Length: 12.25m
Channel: 15/0 (M100D 30.0)
Flow: 8.63 l/s

DC-3d
Drained Area: 181m²
Channel Length: 12.25m
Channel: 15/0 (M100D 30.0)
Flow: 8.63 l/s

DC-3f
Drained Area: 183m²
Channel Length: 12.25m
Channel: 15/0 (M100D 30.0)
Flow: 8.72 l/s

DC-3h
Drained Area: 313m²
Channel Length: 18.25m
Channel: 20/0 (M150D 10.0)
Flow: 14.92 l/s

This area does not currently work with a single slot drain

LOCATION PLAN

OTH-PLA-EE-ES-DWG-L-1016

DC-4a
Drained Area: 501m²
Channel Length: 10m
Channel: 20/0 (M150D 10.0)
Flow: DOES NOT WORK.

DC-4c
Drained Area: 268m²
Channel Length: 10m
Channel: 20/0 (M150D 10.0)
Flow: 12.77 l/s

DC-4e
Drained Area: 182m²
Channel Length: 10m
Channel: 20/0 (M150D 10.0)
Flow: 8.67 l/s

DC-4g
Drained Area: 210m²
Channel Length: 7.2m
Channel: 20/0 (M150D 10.0)
Flow: 10.01 l/s

DC-4i
Drained Area: 219m²
Channel Length: 8.25m
Channel: 20/0 (M150D 10.0)
Flow: 10.44 l/s

DC-4b
Drained Area: 266m²
Channel Length: 10m
Channel: 20/0 (M150D 10.0)
Flow: 12.68 l/s

DC-4d
Drained Area: 260m²
Channel Length: 10m
Channel: 20/0 (M150D 10.0)
Flow: 12.39 l/s

DC-4f
Drained Area: 206m²
Channel Length: 7m
Channel: 20/0 (M150D 10.0)
Flow: 9.82 l/s

DC-4h
Drained Area: 219m²
Channel Length: 8.25m
Channel: 20/0 (M150D 10.0)
Flow: 10.44 l/s

DC-4j
Drained Area: 280m²
Channel Length: 7.90m
Channel: 20/0 (M150D 10.0)
Flow: 13.35 l/s

DC-14a
Drained Area: 236m²
Channel Length: 13m
Channel: 20/0 (M150D 10.0)
Flow: 11.25 l/s

DC-14c
Drained Area: 99m²
Channel Length: 5m
Channel: 15/0 (M100D 30.0)
Flow: 4.72 l/s

DC-14b
Drained Area: 247m²
Channel Length: 13m
Channel: 20/0 (M150D 10.0)
Flow: 11.77 l/s

DC-14d
Drained Area: 188m²
Channel Length: 10m
Channel: 15/0 (M100D 30.0)
Flow: 8.96 l/s

OTH-PLA-EE-ES-DWG-L-1018

OTH-PLA-EE-ES-DWG-L-1017

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3. All dimensions are in millimetres unless otherwise stated.
4. All setting out, levels and dimensions to be agreed on site.
5. The dimensions of all materials must be checked on site before being laid out.
6. This drawing is to be read in conjunction with all relevant Civils Clauses and detail drawings.
7. Order of construction and setting out to be agreed on site.

N

KEY

BOUNDARIES

- Red Line Boundary Subject to client approval
- Section 278 Works

LEVELS & DRAINAGE

- Proposed surface gradient
- Proposed spot level
- Existing spot level
- Proposed drainage channel / slot drain Refer to Ramboll drawings for full details of proposed drainage: OTH-RAM-EE-XX-DWG-C-1100 - 1102
- Existing manholes & utility covers to be retained NOTE: Assume all existing covers, manholes and in ground features to be replaced with new if retained as part of the Civils Contract. Any damaged to be relocated using standard C168 covers with paving to match adjacent new surfacing.
- Existing manholes & utility covers to be removed
- Existing cover level
- Proposed cover level

RAMBOLL SKETCH
OTH-RAM-XX-XX-SKE-C-0043
23/07/2019

Revision Notes:

Revision	Date	Description	Drawn	Apprvd.
01	21/06/19	For information	SR	MS/KR

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Client	Manchester City Council
Project	Our Town Hall
Drg Title	Proposed Levels Detail Area 1 of 3 Albert Square

Created on	Created by	Approved by
19.06.19	SR	MS/KR

Scale	Size	Workstage
1:250	A1	Stage 4

Drg No.	Suitability	Revision
OTH-PLA-EE-ES-DWG-L-1016	S3	01

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APPENDIX 7
DRAINAGE STRATEGY FOR EARLY WORKS PACKAGE

Intended for
Manchester City Council

Project no.
1620003165

Date
01 May 2019



OUR TOWN HALL, MANCHESTER

Below Ground Surface Water Drainage Strategy

Early Works Package

Document ref: OTH-RAM-XX-XX-RPT-C-0015

Revision History

Revision	Date	Purpose / Status	Comments
P01	15/04/19	Planning Submission / S3	Draft for comment
P02	01/05/19	Planning Submission / S3	Final

Prepared By		Reviewed By		Approved By
				
Lisa Sawyer		**Gary Willis**		**Greig Kirker**
Associate		Director Project Manager		Director Project Director

Table of Contents

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3.0	Limitations	2
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APPENDICES

Appendix 1	Application Site Boundary and Project Boundary
Appendix 2	Consultations
Appendix 3	Existing Drainage Information
Appendix 4	Existing Surface Water Discharge Calculations
Appendix 5	Proposed Drainage General Arrangement Drawings
Appendix 6	Proposed Drainage Calculations

1.0 INTRODUCTION

Ramboll UK Ltd have been appointed by Manchester City Council to produce a Drainage Strategy to support an early works planning application for the construction works within the Manchester Town Hall courtyard.

The Our Town Hall project is based upon eight core principles:

- To secure the long-term future of Manchester Town Hall, its civic role and its external setting
- To retain and enhance as a functioning and efficient Town Hall
- To restore and celebrate this significant heritage asset for Manchester
- To enhance the use of the building, as a visitor destination and increase access to Mancunians
- To transform users' and visitors' experiences
- To reduce carbon footprint and energy costs
- To maximise the commercial opportunities and offset costs to the public purse
- To deliver economic and social value for Manchester

One of the main objectives of the Our Town Hall Project is to refurbish the listed building back to its former glory and bring it back into functional civic uses.

Submission of planning and listed building applications in relation to the main development is currently scheduled for summer 2019.

In advance of the main applications, it has been identified that it would be beneficial to progress a number of early works to enable the appointed management contractor, Lend Lease, to be in the strongest position to commence the main works in line with the overall project programme in January 2020.

These early works are supported by a planning submission comprising applications for planning permission, listed building consent and advertisement consent.

The Site for the early works includes the Town Hall courtyard and elevations and partly extends into Albert Square to the west and Lloyd Street to the south and to allow for the erection of the hoarding and scaffolding along these elevations.

The Early Works site, hereafter referred to as the "Application Site", is located at approximate central ordnance survey National Grid Reference SJ 83896 98081.

Refer to Appendix 1 for the Application Site planning boundary and wider project boundary drawing.

2.0 SCOPE AND OBJECTIVES

This Below Ground Surface Water Drainage Strategy report has been prepared to support the planning application for the development of the Application Site and should be read in conjunction with the Flood Risk Statement and all other planning documents which have been written for the wider project site.

The specific objectives of this assessment are to establish the following:

- Existing drainage systems within the Application Site and the wider project boundary;
- Proposals for collection and discharge of surface water from the proposed Application Site, the wider project will be covered by a separate planning application;
- Review of sustainable drainage systems and why some are not possible within the Application Site, the wider project will be covered by a separate planning application.

3.0 LIMITATIONS

This report has been prepared for the planning application and shall not be relied upon by any third party unless that party has been granted a contractual right to rely on this report for the purpose for which it was prepared.

The findings and opinions in the report are based upon information derived from a variety of information sources. Ramboll believe these information sources to be reliable and, where possible, have tried to verify the information.

This report has been prepared on the basis of the proposed end land use defined by the Client. If this proposed end land use is altered or changed then it will be necessary to review the findings of this report.

It should be noted that some of the aspects considered in this study are subject to change with time. Therefore, if the development is delayed or postponed for a significant period, then it should be reviewed to confirm that no changes have taken place, either at the Application Site or within relevant legislation.

4.0 LEGISLATION

The following legislation has been reviewed and taken into account in preparation of the proposed drainage strategy.

4.1 Planning Policy - Managing Surface Water Runoff and Sustainable Drainage

The Government has strengthened planning policy on the provision of sustainable drainage systems (SuDS) for 'major' planning applications introduced from 6 April 2015 (Paragraph 103 of National Planning Policy Framework NPPF published February 2019 and Ministerial Statement on SuDS). As per the guidance issued by the Department of Communities and Local Government (DCLG), all 'major' planning applications being determined from 6 April 2015, must consider sustainable drainage systems.

On 18 December 2014 Government issued a written statement in relation to SuDs outlining the strengthening of existing planning policy to make it clear that the Governments expectations is that SuDs will be provided in new developments and redevelopments where possible. It is therefore expected that, where planning applications are for major developments, the local planning authority must ensure SuDs are put in place unless demonstrated to be inappropriate.

The Lead Local Flood Authority at Manchester City Council responded to this by producing a Sustainable Urban Drainage Requirements document.

This stated that developers submitting a planning application to Manchester City Council are advised to undertake the following to enable the submission to be approved in regard to Flood Risk and Surface Water Drainage.

Developers must:

- Assess the suitability of sustainable drainage systems in accordance with: paragraphs 051, 079 and 080 of the revised NPPF Planning Practice Guidance (PPG) for Flood Risk and Coastal Change.
- Design sustainable drainage systems in line with national Non-Statutory Technical Standards for SuDS and local policies DM1, EN08, EN14 and EN17 of the Core Strategy.
- Assess surface water attenuation requirements that offer a reduction in surface water runoff rate in line with the 'Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010' (Section 3.4.1 Critical Drainage Areas, page 31).
- Submit hydraulic calculations and drawings to support the design along with proposed standards of operation and maintenance in accordance with paragraph 081 of NPF (PPG).
- It will be essential that the type of sustainable drainage system for a site, along with details of its extent/position, is identified at the design stage. This information will be required for both outline and full applications, so it is clearly demonstrated that the SuDS can be accommodated within the development that is proposed. It will no longer be acceptable to leave the design of SuDS to a later stage to be dealt with by planning conditions.
- Surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management. SuDS seek to mimic natural drainage systems and retain water on or near to the site, when rain falls, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible. SuDS therefore offer significant advantages over conventional piped drainage systems.

In order to avoid objection, the following elements of evidence are required with submission of a planning application.

- Surface Water Management Statement for the site is submitted that is in line with requirement of NPPF PPG Paragraph 079.

  Evidence that drainage hierarchy has been applied in line with NPPF PPG Paragraph 080. The aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:
  - into the ground (infiltration);
  - to a surface water body;
  - to a surface water sewer, highway drain, or another drainage system;
  - to a combined sewer.

- Evidence that one viable solution for draining the site is secured.

- Evidence of consideration of green SuDS solution wherever practicable and viable in line with NPPF PPG Paragraph 051.

  For Brownfield site developments, for all sites located within Conurbation Core Critical Drainage Areas, details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e. at least a 50% reduction in runoff rate compared to the existing rates with an aim to reduce to Greenfield runoff rates wherever practicable;

Where surface water runoff is to be disposed through infiltration, details of surface water attenuation that is adequate for infiltration capacity of the underlying soil is required. This capacity has to be assessed through site investigation carried out in line with Building Research Establishment Digest 365. Site investigations should be undertaken in locations and at proposed depths of the proposed infiltration devices. Half emptying time of proposed attenuation within 24 hours should be achieved.

- Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building; The NPPF suggests that 'for events with a return-period in excess of 30 years, surface flooding of open spaces such as landscaped areas or car parks is acceptable for short periods, but the layout and landscaping of the site should aim to route water away from any vulnerable property, and avoid creating hazards to access and egress routes. No flooding of property should occur as a result of a one in 100-year storm event (including an appropriate allowance for climate change)'.

- Assessment of overland flow routes for extreme events that is diverted away from buildings providing long and cross sections for the proposed drainage system and finished floor levels;

- Evidence that runoff volume in the 1 in 100-year, 6 hours rainfall shall be constrained to a value as close as is reasonably practical to the Greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment;

- Hydraulic calculations of the proposed drainage system;

- Design construction drawings of proposed SuDS elements and flow controls;

- For sites where, proposed development would cause unusual pollution risk to surface water (large car park areas (>50 parking spaces) or industrial estates), evidence of pollution control measures (preferably through SuDS) is required.

- Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

5.0 CONSULTATIONS

Initial consultations have been undertaken with United Utilities and the Lead Local Flood Authority for Manchester City Council with regards to discharge of below ground drainage from the Application Site and the wider project site.

5.1 United Utilities (UU)

Initial consultation was made, via a pre-development enquiry, with United Utilities (UU) on 22 November 2017 regarding discharge of foul and surface from the development. UU confirmed that foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connections to the public sewer can be at a point convenient to the scheme.

UU also confirmed that surface water from the building and associated land can drain to the public sewer network at an unrestricted rate. The connections to the public sewer can be at a point convenient to the scheme.

UU are not obliged to accept runoff from highways to the public sewer network and therefore should drain any new sections of highway without recourse to the public sewer network.

Further consultation was made in response to the initial response on 29 March 2019 (as the original correspondence was only valid for 12 months) to confirm that this advice still stands and to give an update of the scheme. At the time of writing a response has not been received.

5.2 Lead Local Flood Authority Manchester City Council (LLFA)

Initial consultation was made with the Lead Local Flood Authority (LLFA) on 22 November 2017 regarding the proposed foul and surface water discharge strategy and the management of surface water within the Application Site and the wider project site.

The LLFA responded on 24 November 2017 stating that the drainage strategy should adhere to the national and local policies and in that respect would be looking for at least 50% reduction in flows. The design also needs to make sure that the proposed drainage system is future proved for impact of climate change and expected increase in rainfall intensities.

In addition to that, this being a Manchester City Council site, the LLFA would welcome opportunities to include green types of sustainable drainage system wherever possible as an exemplar for other developments.

An initial meeting was then held with the LLFA on 19 September 2018 to discuss the findings of the below ground drainage survey which established the existing discharge locations to the public sewer networks, capacities of the existing systems and connectivity, to discuss and gain comments on the proposed strategy for surface water discharge from the building, to discuss and gain comments on the proposed strategy for surface water discharge from Albert Square and surrounding road and gain an agreement in principle of the proposed discharge strategy in regard to areas to be attenuated.

The outcome of the meeting concluded that the LLFA would want evidence that the existing/new drainage systems proposed would accept the 1 in 100-year storm event plus a 40% allowance for climate change, and where this was not possible the impact this would have.

Where attenuation is required, evidence would need to be provided if blue/green sustainable attenuation systems were not possible and why.

Where possible, betterment should be provided (although it was accepted that this would not be possible within the systems for the Town Hall Building included as part of this planning application).

A further meeting was held with the LLFA on 19th March 2019 to go through the current proposals for surface water attenuation and go through the current limitations on the scheme.

6.0 EXISTING SITE DESCRIPTION

The Application Site consists of the existing internal courtyard area to the Town Hall building with ramp access to Lloyd Street and the moat along Albert Square elevation.

6.1 Topography

The existing Town Hall Building is bounded by Princess Street to the North and East, Lloyd Street to the South and Albert Square to the West with the topography falling from 41.1 in the Northeast to 40.4 in the West. The Courtyard levels range between 38.40 and 38.07 rising to 40.34 via the ramp to Lloyd Street.

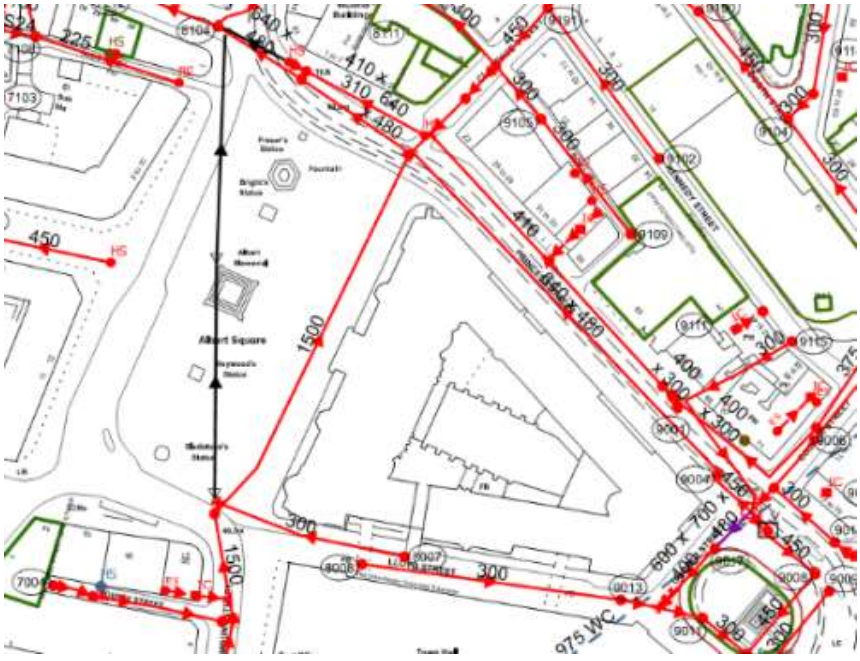
6.2 Existing Drainage Networks

The following drainage network exist within the Application Site and/or the wider project boundary.

6.2.1 Public Sewers

The following is a summary of the public sewer infrastructure within the project boundary.

- 1500mm diameter combined public sewer within Albert Square parallel to the front elevation of the Town Hall flowing south to north
- 300m diameter combined public sewer starting in Lloyd Street at manhole 8007 and connecting into the 1500mm combined sewer in Albert Square
- 300mm combined sewer starting in Lloyd Street at manhole 8008 and connecting into a combined network in Cooper Street
- 640 x 480 egg vitrified clay public combined sewer in Princess Street flowing south east to north west and combining with the 1500mm to the north corner of the Town Hall
- There is also an abandoned main sewer indicated as crossing Albert Square



Extract of United Utilities Drawing showing Public Sewers

6.2.2 Albert Square Public Realm Drainage

A topographical and services survey has been undertaken by Powers & Tiltman which indicates a number of manholes within Albert Square. CCTV connectivity survey was undertaken which confirmed that the area of Albert Square north of the Albert Memorial is collected via linear drainage channels with cast ironing gratings into a network of 150/225mm vitrified clay pipework. The discharge from this is into United Utilities public sewer manhole EXPS8101 where the 640 x 480 combined public sewer in Princess Street and 1500mm diameter sewer in Albert Square converge.

South of the Albert Memorial the drainage collects into linear drainage channels with cast ironing gratings into a network of 150/225mm vitrified clay pipework. The discharge from this is into United Utilities public sewer manhole EXPS8001 via a 300mm connection. Existing drainage information can be found in Appendix 3.

6.2.3 Albert Square Public Highway

Albert Square road and Mount Street are served via road gullies. Highway drainage was found within the highway during the CCTV connectivity survey. Two systems were identified. One connecting into United Utilities public sewer in Brazennose Street at manhole EXPS7104 and one into the 1.5m diameter public sewer in Albert Square at manhole EXPS8001.

It is unclear where the highway drainage connecting into manhole 8001 commences as this could collect highway outside of our development from Lloyd Street West and/or Southmill Street.

Existing drainage information can be found in Appendix 3.

6.2.4 Lloyd Street and Cooper Street

Lloyd Street and Cooper Street are served via linear slot drainage which were installed as part of the St Peter's Square works around November 2014. Outfalls from this are believed to be directly via junction connections into both 300mm combined public sewers in Lloyd Street and combined public sewer crossing beneath the Cenotaph in St Peter's Square. This could not be confirmed during the CCTV survey works.

Existing drainage information can be found in Appendix 3.

6.2.5 Princess Street

Princess Street is currently drained via gullies. It is not clear whether these discharge into a highway drain or directly via junction connections to the public sewer.

6.2.6 Town Hall Building - Existing Storm Water Drainage

The existing above ground rainwater strategy for the Town Hall Building is as follows and is indicated on the sketch indicated in Appendix 4.

- Rainwater downpipes on the Princess Street elevation connect into a below ground system either within the pavement or the moat and connect back into the Town Hall surface water systems
- The two rainwater downpipes on the Cooper Street elevation continue down the façade, stopping above ground and discharge into gullies within the moat. The gullies are believed to connect directly into the combined public sewer below the Cenotaph in Cooper Street. This could not be confirmed during the survey works
- Half of the rainwater downpipes on the Lloyd Street elevation of the Town Hall and one of the link bridge roofs connect into below ground systems within the moat or below the ramp and connect into the 150mm combined outfall into Lloyd Street public sewer. The other half of the rainwater pipes discharge into a below ground system in the moat which passes through the building and discharges into the surface water system in the courtyard which discharges into the public sewer in Princess Street
- The majority of the rainwater downpipes on the Albert Square elevation of the Town Hall continue down the façade, stopping above ground and discharge into gullies within the moat. The gullies discharge into a below ground drainage

system below the moat and discharge via a separate connection from the courtyard drainage into the public sewer in Princess Street

- The rainwater pipes within the courtyard discharge into two networks beneath the courtyard. The majority of the rainwater pipes are collected into an underground combined system beneath the courtyard which discharges via a 150mm connection into the public sewer in Princess Street. The remainder of the rainwater downpipes are collected into the combined underground system which discharges via a 150mm diameter connection into the combined public sewer in Lloyd Street
- There are believed to be no existing internal rainwater pipes within the building. Those that do run internally at higher level, become external at lower level, before discharging to the below ground drainage systems as noted above.

6.3 Existing Drainage Flows

The existing drainage systems serving the Application Site have been modelled in Microdrainage. The models have been run for storm events up to and including the 1 in 100-year event plus 40% allowance for climate change to assess where existing problems are occurring and where it is possible to retain existing drainage for future use.

The drainage from the Application Site, in the main, discharge via a 150mm pipe into the Lloyd Street combined sewer and 150mm pipe into the Princess Street combined sewer.

The capacity of these connections are as follows;

Lloyd Street Connection – 18.9l/s
Princess Street Connection – 20l/s

The outcome of this modelling exercise and existing calculations can be found in Appendix 4.

7.0 PROPOSED SITE

In advance of the main planning application, it has been identified that it would be beneficial to progress a number of early works to enable the appointed management contractor, Lend Lease, to be in the strongest position to commence the main works in line with the overall project programme in January 2020. These early works are supported by a planning submission comprising applications for planning permission, listed building consent and advertisement consent.

The Application Site for the early works includes the Town Hall courtyard and elevations and partly extends into Albert Square to the west and Lloyd Street to the south and to allow for the erection of the hoarding and scaffolding along these elevations.

The proposed early works relate to:

- The creation of a number of mock-up rooms to showcase the proposed design and materials of a selection of standard rooms within the Town Hall building
- Temporary protection works for items of high significance which are proposed to remain in situ during the works
- Soft strip of the building
- Mural security protection works to protect the murals within the Great Hall
- Scaffolding of the main Town Hall building on the Albert Square elevation and courtyard
- Installation of a hoarding line within Albert Square and along Princess Street

- Courtyard drainage works and drainage within the moats where scaffolding is to be erected
- Plant room alterations.

7.1 Proposed Surface Water Discharge

The following hierarchy has been reviewed in regard to discharge of surface water from the Application Site to confirm the discharge strategy taken forward.:

- Infiltration

  Soakaways which infiltrate directly into the ground as opposed to discharging to a watercourse or sewer are not possible on this part of the site. The location of soakaways, if they were possible, are limited in the Application Site due to the need to keep 5m away from any substructure. Made ground was present in all trial pit locations however the underlying stratum was found to be stiff clay. Ground water (perched water) was also identified at 1.2m below ground level in trial pits within the central core of the Town Hall building.

- Watercourse

  The nearest known watercourse to the Application Site is the River Irwell and is approximately 1 mile away from the site. There is third party land located between the Application Site and the River therefore direct connection would not be feasible.

- Sewer

  As indicated in Section 6.3 there are public sewers in the vicinity of the site into which the existing drainage from the Application Site discharges into. It is therefore proposed to reuse the existing connections to the public sewer systems for discharge from the Application Site.

In accordance with Building Regulations Part H, it is proposed that foul and surface water drainage systems within the Application Site, where possible, will be kept separate up until the point of discharge.

Initial consultation with the Lead Local Flood Authority has agreed the extent of works and discharge restrictions which will be imposed on each area within the Application Site.

No betterment will be required on the existing discharge rates, but surface water would need to be designed (where possible and evidence can be provided for where not) for the 1 in 100-year storm event plus 40% climate change. Attenuation will therefore need to be provided to achieve this design criteria.

To achieve where possible separate foul and surface water networks it is proposed to remove all surface water from the connection to the Lloyd Street sewer and retain existing drainage only for the foul drainage.

The proposed general arrangement drawings can be found in Appendix 5.

7.2 Proposed Surface Water Flows

Due to the requirements under building regulations for separate foul and surface water systems where possible it is proposed to collect all surface water which currently discharges into the courtyard into a new below ground system below the courtyard and discharge via the existing 150mm combined outfall into Princess Street. All existing networks to the external perimeter will remain as they currently drain, and a check has been undertaken to confirm the affects in a 1 in 100-year storm event plus 40% climate change.

Using the information provided from the CCTV survey and the Colebrook-White Formula the capacity of the existing outfall pipework into the Princess Street sewer from the courtyard drainage has been calculated. The maximum capacity of the connection into Princess Street has been calculated as 20l/s. Removing the allowance for foul discharge the surface water discharge will therefore be restricted to 15l/s.

The proposed drainage calculations can be found in Appendix 6.

8.0 SUSTAINABLE DRAINAGE SYSTEMS

Due to the discharge restriction imposed and the need to design for the 1 in 100 plus 40% climate change a review of potential sustainable drainage systems has been undertaken to identify the most suitable form of attenuation which can be included within the development and if not possible why not.

- Infiltration measures: Soakaways which infiltrate directly into the ground as opposed to discharging to a watercourse or sewer are not possible on this part of the site. The location of soakaways, if they were possible, are limited in the courtyard due to the need to keep 5m away from any substructure. Made ground was present in all trial pit locations however the underlying stratum was found to be stiff clay. Ground water (perched water) was also identified at 1.2m below ground level in trial pits within the central core of the Town Hall building.
- Permeable paving: Surfacing systems which allow water to infiltrate through the surface to an underlying gap-graded sub-base or into a sub-base geocellular system. As the existing setts in the courtyard are believed to be original Victorian, the proposals are to reinstate this material as faithfully as possible to the original and therefore given the heritage significance a permeable paving system would not be appropriate. The existing sub-base material is also believed to be original although not suitable for the current loading requirements. It is therefore proposed to introduce a new concrete base and rigid mortar system to the reinstated setts.
- Rainwater Harvesting: The use of rainwater harvesting for grey-water use within the building would decrease the volume and rate of surface water runoff from the building. This would reduce the roof runoff in low return period events, however it cannot be considered to reduce peak flows off site since the drainage strategy has to assume that the rainwater tank is full and therefore overflowing.

  The rainwater downpipes to the building are exposed on the external faces of the building therefore to try to incorporate rainwater harvesting options were reviewed to ascertain if it was a practical solution for this building.

  Option 1 – inclusion of an above ground rainwater harvesting tank

  This would require the rerouting of the external pipework back into the building in order to connect to a new tank. This would require a number of penetrations through historic walls which was deemed not acceptable by the design team. Horizontal pipework routes at most levels within the building is very challenging/impossible to incorporate due to historic ceilings. Horizontal pipework routes at level 00 are very challenging due to limited floor to ceiling height meaning that the roof areas that were able to be collected were minimal and didn't provide a great yield.

  Option 2 – inclusion of a below ground rainwater harvesting tank

  This option could be easier to introduce from a pipework perspective as there would be less intrusion with regards to historic walls. However as the attenuation tank which was being provided would need to become larger there was not enough space in the ground with other services for this to be possible.

Option 3 – inclusion of rainwater harvesting tank at higher levels

The roofs are at different levels and in most instances the rainwater cascades from one level to another therefore this was difficult to achieve within the building. Horizontal pipework routes at most levels are very challenging/impossible to incorporate due to historic ceilings.

- Green/Brown Roofs: These are planted roof areas which provide a degree of rainfall storage and attenuation for small return period storms. Well maintained green/brown roofs are able to decrease the volume of surface water runoff by up to 40% in low return period storms but during high storm events it has to be assumed that the green/brown roof is fully saturated.

  The majority of the existing roofs which are to be kept in the scheme are steeply pitched therefore incorporation of green/brown roofs are not possible.

- Blue roofs: A blue roof is a system which can provide attenuation within a tank solution at source on a roof area which stores water from that roof level. This can also be incorporated with a green roof above. The majority of the existing roofs which are to be kept in the scheme are steeply pitched therefore incorporation of a blue roof in these areas is not possible.

  However, three new flat roofs will be constructed as part of the alteration to the Town Hall. One in the north west corner adjacent to Princess Street tower; one replacing a lead flat roof behind Cooper Street tower and one on the east side of the Great Hall forming a new plant deck.

  The roof in the north-west corner is small and complex with numerous junctions to areas of pitched slate roof. The roof behind the Cooper Street tower will be used as a fire escape route and therefore levels cannot be altered on this area as level access from the corridors to onto the roof will be required. Due to these restrictions the provision of green or blue roofs in these areas would not be technically practical.

  The new flat roof on the west side of the Great Hall will be used for mounting large air handling plant, therefore it would not be practical to install a green roof in this area. It might be technically possible to install a blue roof, but the risks posed by deliberate water retention on the roof are considered too great for the following reasons:

  - Water ingress into the fabric of the building due to surcharged, blocked or leaking rainwater pipes and gutters has caused substantial damage to the internal and external fabric of the building. The primary focus of the rainwater drainage design is to ensure that there is adequate provision of rainwater pipes and means of access to maintain the pipes to ensure that discharge of water away from the building is as quick and efficient as possible. Deliberate storage of water by restricting the flow of rainwater off the roofs is contrary to this approach.
  - Although the area immediately below the new plant areas does not contain highly significant areas, the Great Hall on the east side of the new flat roof is one of the most significant areas of the building in heritage terms. The organ is located at the east end of the Great Hall immediately adjacent to the plant room roof, the ceiling is highly decorated, and the walls are painted with murals by the Pre-Raphaelite artist Ford Maddox Brown.
  - Any accidental water ingress into the Great Hall could have serious consequences for the contents, decoration and artwork in this area. Roof defects, rainwater pipe leaks or water overflows from the flat roof could be the source of water ingress into the Great Hall. The danger of water ingress would be exacerbated by a design that sought to retain water on the roof.

- Detention Basins: Surface storage basins are normally dry and can provide attenuation of surface water run-off in peak storm conditions. The space requirements for detention basins are not suited to this development. However proposed levels within the courtyard will be amended where possible to allow for some above ground storage of surface water in exceedance events. This is limited due to the building being located on all sides of the courtyard with existing access into the building on all sides.
- Below ground tank/cellular storage: A method involving storage tanks or geocellular crates installed below the lowest ground level has the advantage of having a 95% void ratio allowing it to attenuate large volumes. The use of a tank solution is possible below the courtyard area of this building.

Due to the reasons indicated above it is therefore proposed to include for below ground attenuation within the courtyard surface water drainage network. A geocellular system is proposed due to restrictions on construction space and ease of manual handling and adaption of shape during the works due to the historic nature of the project.

The location of the below ground attenuation is indicated on the general arrangement drawings which can be found in Appendix 5.

9.0 CODES OF PRACTICE

Whilst new drainage networks have been designed to current British Standards and Regulations, existing below ground drainage which is to be reused within the scheme is unlikely to comply with these.

Where existing drainage is to be reused, a design check for capacity and self-cleansing has been undertaken.

Building Control will need to be consulted at the next stage to ensure the proposed strategies for reusing drainage which is not fully compliant to current standards is accepted by them.

Where defects in the condition of any existing drainage to remain have been found, remedial works including localised replacement and/or pipe lining have been scheduled.

New below ground drainage, and where possible existing drainage, will be designed/checked in accordance with the following codes of practice:

- BS EN 752:2008 Drain and Sewer Systems outside buildings
- BS EN 12056-2:2000 Gravity drainage systems inside buildings
- BS EN 124-1:2015 Gully tops and manhole tops for vehicular and pedestrian areas
- BS EN 1610:2015 Construction and Testing of Drains and Sewers
- CIRIA C680 Structural Design of Modular Geocellular Tanks
- CIRIA C753 The SuDS Manual
- British Water Flows and Loads – 4:2013
- BRE DG 365:2016 Soakaway design
- Building Regulations Part H:2010 Drainage and waste disposal

10.0 MAINTENANCE OF DRAINAGE SYSTEMS

10.1 Performance Objectives

The operational maintenance need of the installed below ground drainage system is to provide a system that will continue to perform in accordance with the design and that the

operation of the system is safe, environmentally acceptable, economically efficient and provide the client with a functional and easily operated asset.

10.2 Maintenance Requirements

Effective maintenance includes a combination of planned and reactive tasks and looks to ensure that the system is kept in a condition that it can function as required.

The tasks may include:

- Removal of natural occurring sediments, abnormal obstructions etc. to restore hydraulic capacity
- Maintenance of mechanical plant
- Rodent and insect control
- Localised repair or replacement of damaged pipework or other structures (if required)

10.3 Maintenance Schedule

A strategy for the maintenance of the underground drainage elements will be developed incorporating normal regular maintenance requirements, any potential long term maintenance work and any monitoring required.

Any parties involved with the disposal of any waste materials from the underground drainage system should hold appropriate management licenses to undertake any such activities. Disposal of any site materials is required to be made in accordance with current legislation and guidance.

This initial maintenance schedule below has been prepared using guidance provided in 'CIRIA C625 – Model agreements for sustainable water management systems', CIRIA 626 – Rainwater and Greywater systems and manufacturers recommendation for specialist drainage elements. The detailed design drawings will incorporate the maintenance requirements for the project.

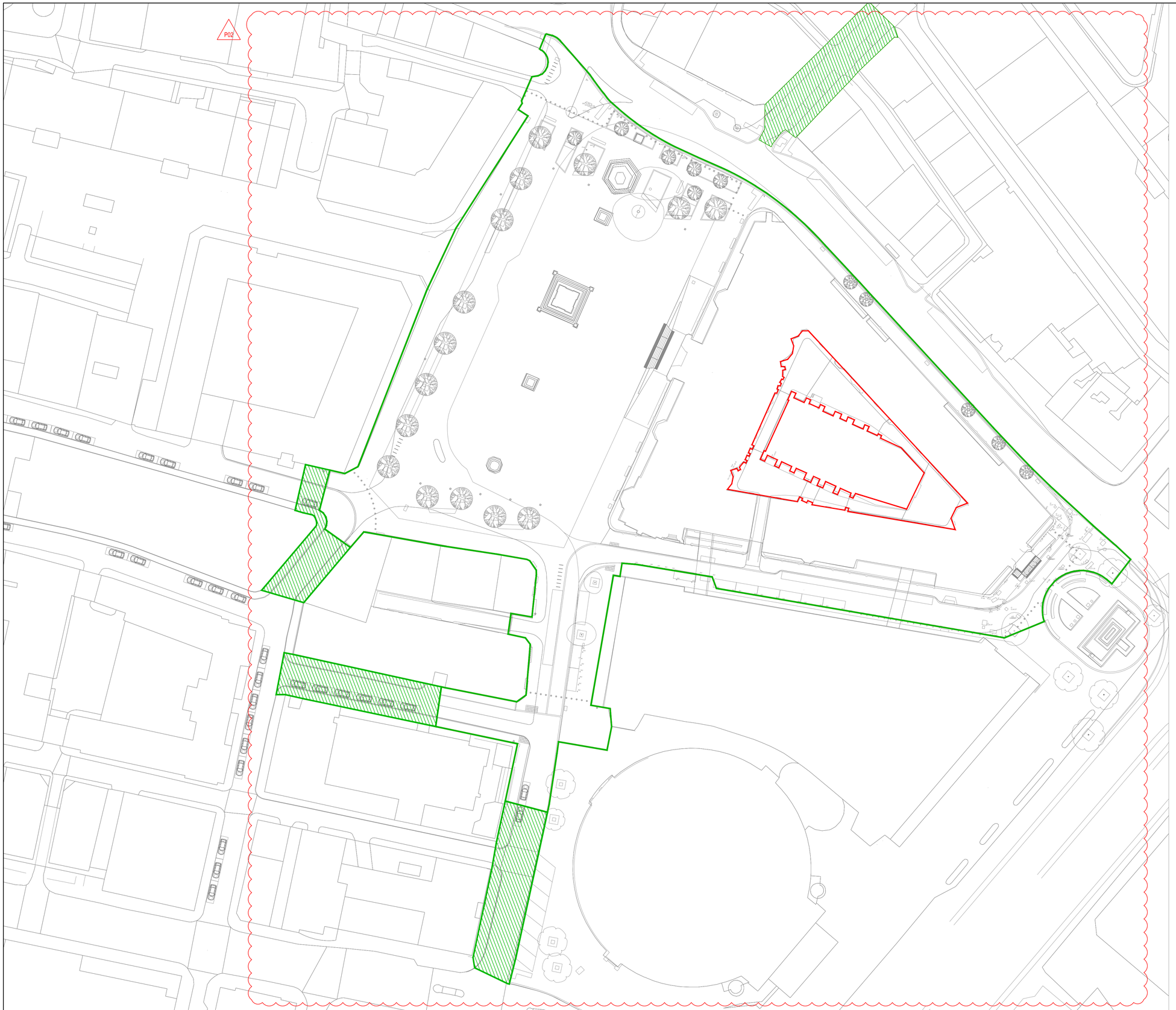
The following table notes the likely maintenance requirements for drainage within the Application Site and this is to be developed further at the next stage of the design.

Conventional Drainage Systems		
Foul and surface water gravity drainage pipework and manholes		
Silt accumulation, blockage, structural integrity		
Maintenance Schedule	Requirement	Recommended minimum frequency
Regular	Litter/Debris removal	Quarterly per annum (or as required and following a high storm event)
	Excess silts to silt traps to be removed	Quarterly per annum (or as required and following a high storm event)
Occasional	Pipe cleaning and inspection	As required
Monitoring	Inspection of manholes/chambers to identify evidence of sedimentation accumulation	Monthly to inform the above

Conventional Drainage Systems		
Storm Water Attenuation Tank and Flow Control		
Silt accumulation, blockage, structural integrity		
Maintenance Schedule	Requirement	Recommended minimum frequency
Regular	Removal of excess silts	Monthly (or as required)
Occasional	Removal and disposal of oil or petrol residues using safe standard practices	As required
Monitoring	Inspect upstream and downstream manholes and flow control devices for evidence of silt accumulation and integrity of system	Quarterly per annum

Conventional Drainage Systems		
Gullies at base of rainwater pipes		
Silt accumulation, blockage, structural integrity		
Maintenance Schedule	Requirement	Recommended minimum frequency
Regular	Litter/Debris removal	Quarterly per annum (or as required and following a high storm event)
	Excess silts to gully pots/silt buckets to be removed	Quarterly per annum (or as required and following a high storm event)
Occasional	Pipe cleaning and inspection	As required
Monitoring	Inspection of gully pots to identify evidence of sedimentation accumulation	Monthly to inform the above

APPENDIX 1
SITE APPLICATION BOUNDARY AND PROJECT BOUNDARY



KEY

PROJECT BOUNDARY

ENABLING WORKS APPLICATION BOUNDARY

Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	1000		3000		5000		7000
1:200	mm		2000		4000		6000	8000
1:500	m	5		15		25		35
1:1250	m	10		30	50		70	90

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS ARE MILLIMETERS U.N.O
3. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM U.N.O
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT AND ENGINEERS DRAWINGS AND SPECIFICATIONS

   IF ANY INFORMATION WITHIN THESE DRAWINGS CHANGES THE BELOW GROUND DRAINAGE IS ALSO SUBJECT TO CHANGE

ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	30/04/2019	LS	SG	PLANNING/LBC APPLICATION & STAGE 3+ ISSUE
P01	18/04/2019	LS	SG	DRAFT PLANNING/LBC APPLICATION

OUR TOWN HALL PROJECT

RAMBOLL

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PROJECT STATUS	STAGE 3
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	PLANNING/LBC APPLICATION PROJECT BOUNDARY AND APPLICATION SITE BOUNDARY
SIZE & SCALE	A1: 1:500
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-5000
REV	P02

30 April 2019 13:15:52

APPENDIX 2
CONSULTATIONS

Lisa Sawyer

From: z.todorovic@manchester.gov.uk on behalf of floodriskmanagement@manchester.gov.uk
Sent: 24 November 2017 15:31
To: Lisa Sawyer
Cc: MCC Flood Risk Management (MCC) (floodriskmanagement@manchester.gov.uk)
Subject: Re: Manchester Town Hall and Albert Square Redevelopment
Attachments: SW Drainage Areas.pdf; Sewer Records - Groundwise Utility Report 20458JS (2).pdf

Lisa

Thank you for the email.

The drainage strategy should adhere to the national and local policies and in that respect we would be looking for at least 50% reduction in flows. We also need to make sure that the proposed drainage system is future proved for impact of climate change and expected increase in rainfall intensities.

In addition to that, this being a MCC site, we would welcome opportunities to include green types of sustainable drainage system wherever possible as an exemplar for other developments.

Kind regards

Zorica

Flood Risk Management
The Neighbourhoods Service
Growth and Neighbourhoods
Manchester City Council

Tel: 0161 219 6295
Email: floodriskmanagement@manchester.gov.uk
Web: http://www.manchester.gov.uk/

POSTAL ADDRESS: Manchester City Council, Public Realm, The Neighbourhood Service, PO Box 532, Town Hall, Manchester M60 2LA

Lisa Sawyer <Lisa.Sawyer@ramboll.co.uk> 22/11/2017 16:12	To	"MCC Flood Risk Management (MCC) (floodriskmanagement@manchester.gov.uk)" <floodriskmanagement@manchester.gov.uk>,
	cc	
	Subject	Manchester Town Hall and Albert Square Redevelopment

Ramboll have been appointed to begin work on the infrastructure design for the refurbishment of Manchester Town Hall and Albert Square and highway amendment works around Albert Square.



In regards to the existing surface water collection and discharge networks, the surface water falling onto the existing town hall roof is believed to be collected via 64 downpipes which discharge into the combined public sewers surrounding the site. It is believed that direct connections occur into the public sewers from the perimeter rainwater downpipes with the internal rainwater downpipes collected into two networks within the internal courtyards and discharged via one connection into Princess Street combined sewer and one connection into the Lloyd Street combined sewer. It is not proposed to change the above ground strategy for the Town Hall and therefore the impermeable roof area will remain the same within our works.

Albert Square is believed to collect into an existing private network which discharges into the combined sewer in Princess Street and possibly a highway drainage network within the adopted highway to the south. The private drainage within this area is proposed to be upgraded along with the surfacing and some kerb lines. Amendments to the highway could also be likely.

A below ground CCTV survey is due in January/February to provide us with the connectivity/capacity confirmation we require to move the design forward. However we are required to give some initial advice to our client and design team on your thoughts regarding discharge of surface water from the site before Christmas. We are aware that the current combined sewer networks in the vicinity of the site are at capacity so we have also made a predevelopment enquiry with United Utilities.

We assume that you will require us to provide a 50% betterment on the existing surface water discharge rates where possible. Looking at the existing areas within the approximate redline boundary it should be possible to provide attenuation for just over half of the roof area and the Albert Square pedestrianised area. This is indicated on the attached sketch. Please can you comment on this as a strategy and confirm your requirements for moving this project forward.

Yours sincerely
Lisa Sawyer

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Associate
Infrastructure & Highways

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Lisa Sawyer

From: O'Brien, Neil <Neil.O'Brien@uuplc.co.uk>
Sent: 07 December 2017 10:24
To: Lisa Sawyer; Wastewater Developer Services
Subject: RE: Manchester Town Hall and Albert Square Redevelopment - 4200019060

Dear Customer

We have carried out an assessment of your application which is based on the information provided; this pre development advice will be valid for 12 months

Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

Surface water from the building and associated land can drain to the public sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

United Utilities are not obliged to accept run-off from highways (highway drainage) to the public sewer network. Please drain any new sections of highway without recourse to the public sewer network.

If you require any further guidance please follow http://www.unitedutilities.com/builders-developers.aspx

If you need a make further enquiry relating to this matter please send your enquiry to WastewaterDeveloperServices@uuplc.co.uk Please quote your DEXXXX/42XXXXXXX?GEXXXX reference number

Please Note:- enquiries sent to any other United Utilities e-mail address will be deleted.

Connection Application

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

http://www.unitedutilities.com/connecting-public-sewer.aspx

Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, Planning Conditions and local flood authority guidelines, we would recommend that you laise and make suitable agreements with the relevant statutory bodies.

Regards

Neil O'Brien

Developer Engineer
Developer Services and Planning

From: Lisa Sawyer [mailto:Lisa.Sawyer@ramboll.co.uk]
Sent: 22 November 2017 15:00
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Manchester Town Hall and Albert Square Redevelopment

To whom it may concern

Please find attached a completed predevelopment enquiry which we have submitted to begin engagement on drainage discharge for the works being undertaken on the Manchester Town Hall refurbishment and works within Albert Square.

It is believed that the vast majority of the foul drainage and surface water roof drainage from Manchester Town Hall drains into the existing 640x480 combined sewer within Princess Street with a drainage connection also connecting into the combined sewer within Lloyd Street.

We believe that as part of the Metrolink Second City Crossing works two 375mm stubs were proposed to be provided and internal lining works undertaken to mitigate any future problems with the sewers located directly underneath tram tracks in preparation for the proposed works to the Town Hall and Albert Square. We are struggling however to obtain any information on this and we believe these works may not have been actually undertaken? I have a pdf copy (although it is unreadable) of a United Utilities drawing reference MISC/80030937/03/11/2300, see attached. Do you have any information on this to help inform a decision on proposed outfall locations?

It is not exactly clear yet what changes will be made within the Town Hall although it is expected that the majority of the building will be kept as offices (albeit it increased number of personnel) with increased kitchen and toilet facilities. The total proposed foul flow could be in the region of 20l/s.

It is unlikely that we will propose any new foul connections into the 1500mm diameter sewer in Albert Square due to the existing lightwells located between the Town Hall and the existing sewer. If possible the existing infrastructure will be utilised however the size of the connections (believed to be 150mm and 100mm) may not be adequate for the increased flows so either an upgrade of these will be required (tunnel bored under the tram line) or additional connection locations will be required.

In regards to surface water it is believed that this is also collected and discharged into the combined public sewers surrounding the site. It is believed that there are direct connections from the perimeter rainwater downpipes from the building and collection of the internal rainwater pipes which discharge into Princess Street. It is also believed the northern section of Albert Square discharges into the combined sewer in Princess Street but further connectivity surveys are required to identify where the remainder of the area ends up. Highway drainage is also assumed to discharge into the public sewer.

We will be in discussion with the Lead Local Flood Authority also who are likely to put restrictions on discharge of surface water from the site, however it would be useful to understand the sewers which are most vulnerable and where your preference would be on discharge for both Albert Square and the town hall building (foul and surface water). I have attached a sketch indicating the current thoughts on surface area split between that which can be attended and that which is likely to have to stay unattenuated.

A below ground CCTV survey is due in January/February to provide us with the connectivity/capacity confirmation we require to move the design forward. However we are required to give some initial advice to our client and design team on your thoughts regarding discharge and advise on the public sewer capacities within the vicinity of the site before Christmas if possible.

Yours sincerely
Lisa Sawyer

BEng (Hons) CEng MICE
Associate
Infrastructure & Highways

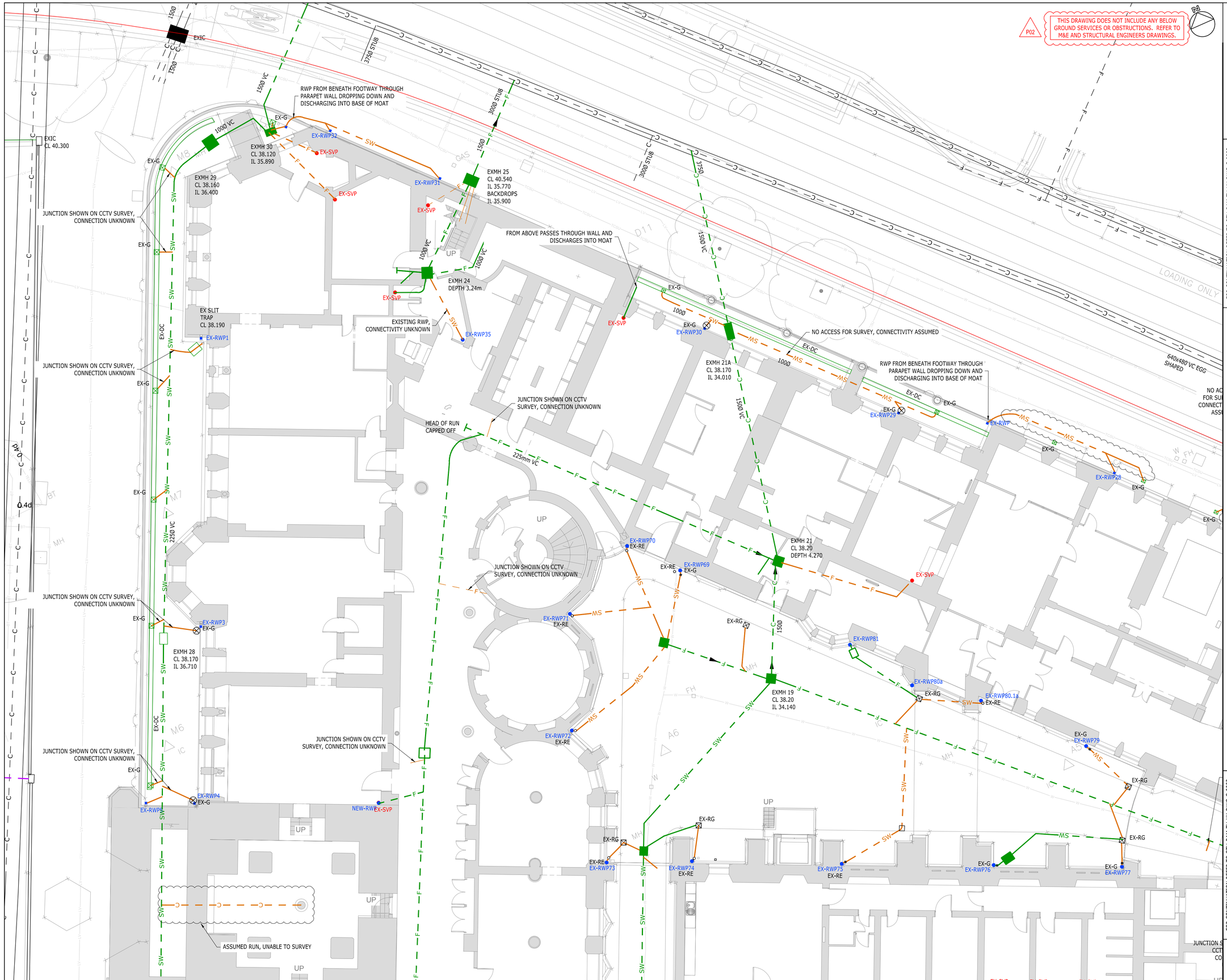
M +44 7896227086
Lisa.Sawyer@ramboll.co.uk

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St. John Street

APPENDIX 3
EXISTING DRAINAGE INFORMATION



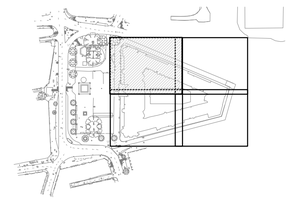
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- EXISTING BASEMENT PLAN BY PURCELL OTH-PUR-TH-B1-DWG-A-0120
- EXISTING GROUND FLOOR PLAN BY PURCELL OTH-PUR-TH-01-DWG-A-0121
- RAINWATER INDIVIDUAL CATCHMENTS BY ARUP, OTH-ARU-TH-XX-DWG-N-2XX26, DATED 06/11/18
- POP-UP DRAWING BY ARUP, WIP, OTH-ARU-TH-XX-DWG-N-2XX28
- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18

KEY

EXISTING PUBLIC COMBINED DRAIN/ MANHOLE	C
EXISTING PUBLIC FOUL DRAIN/ MANHOLE	F
EXISTING PUBLIC SURFACE WATER DRAIN/MANHOLE	SW
EXISTING PRIVATE COMBINED DRAIN/ MANHOLE	C
EXISTING PRIVATE FOUL DRAIN/ MANHOLE	F
EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE	SW
EXISTING ASSUMED DRAIN/SEWER	C
EXISTING DRAIN/SEWER IDENTIFIED BY CONNECTIVITY SURVEY BUT NO CONDITION SURVEY TAKEN	C
EXISTING DRAINAGE CHANNEL	EX-DC
EXISTING ROAD GULLY	EX-RG
EXISTING RWP GULLY	EX-G
EXISTING RODDING EYE	EX-RE
EXISTING SOIL PIPE	EX-SVP
EXISTING RWP	EX-RWP
EXISTING DRAINAGE ABANDONED	X—X—X—C—X



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	30/11/2018	LS	SG	STAGE 3 ISSUE ADDITIONAL NOTES
P01	14/11/2018	LS	SG	DRAFT STAGE 3 ISSUE

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DRAWING TITLE	TOWN HALL EXISTING DRAINAGE SHEET 1 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-0001
REV	P02

04 December 2018
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P02 THIS DRAWING DOES NOT INCLUDE ANY BELOW GROUND SERVICES OR OBSTRUCTIONS. REFER TO M&E AND STRUCTURAL ENGINEERS DRAWINGS.

N

FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-0001

FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-0001

LOADING ONLY

LOADING ONLY

640x480 VC EGG SHAPED

3750 VC

NO ACCESS FOR SURVEY, CONNECTIVITY ASSUMED

JUNCTION TO PUBLIC SEWER

EXPS-

EX-RWP28

EX-G

EX-RWP27

1500 VC

1000 STUB

EXMH 21B
CL 38.140
IL 34.930

EX-RWP26

EX-DC

1500 VC

EX-RWP25

EXMH 21C
DEPTH
UNKNOWN

EX-RWP24

3000 STUB

EXPS-9004
(SJ83989004)
CL 41.100
IL 34.214 Approx.

EXMH
CL 41.19

450Ø VC

EX-RG

EX-RWP79

JUNCTION SHOWN ON CCTV SURVEY, CONNECTION UNKNOWN

EX-RWP77

JUNCTION SHOWN ON CCTV SURVEY, CONNECTION UNKNOWN

EX-SVP

EX-RWP101

EX-RWP100

EX-RWP95

EX-RWP99

1500

EXMH 8

EXMH 6
CL 38.13
IL 37.230 A

EXMH 10
CL 38.07

EX-RWP23

RWP FROM BENEATH FOOTWAY THROUGH PARAPET WALL DROPPING DOWN AND DISCHARGING INTO BASE OF MOAT

ASSUMED RUN, UNABLE TO SURVEY

ASSUMED RUN, UNABLE TO SURVEY

FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-0003

FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-0003

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1:200 mm 0 2000 4000 6000 8000 2000 6000

1:500 m 0 5 15 25 35

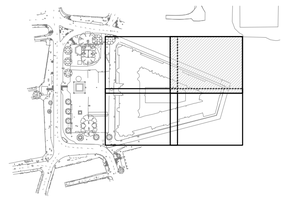
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- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18

KEY

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EXISTING PUBLIC FOUL DRAIN/ MANHOLE	F
EXISTING PUBLIC SURFACE WATER DRAIN/MANHOLE	SW
EXISTING PRIVATE COMBINED DRAIN/ MANHOLE	C
EXISTING PRIVATE FOUL DRAIN/ MANHOLE	F
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EXISTING ASSUMED DRAIN/SEWER	C
EXISTING DRAIN/SEWER IDENTIFIED BY CONNECTIVITY SURVEY BUT NO CONDITION SURVEY TAKEN	C
EXISTING DRAINAGE CHANNEL	EX-DC
EXISTING ROAD GULLY	EX-RG
EXISTING RWP GULLY	EX-G
EXISTING RODDING EYE	EX-RE
EXISTING SOIL PIPE	EX-SVP
EXISTING RWP	EX-RWP
EXISTING DRAINAGE ABANDONED	X X X C X



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P02	30/11/2018	LS	SG	STAGE 3 ISSUE ADDITIONAL NOTES
P01	14/11/2018	LS	SG	DRAFT STAGE 3 ISSUE

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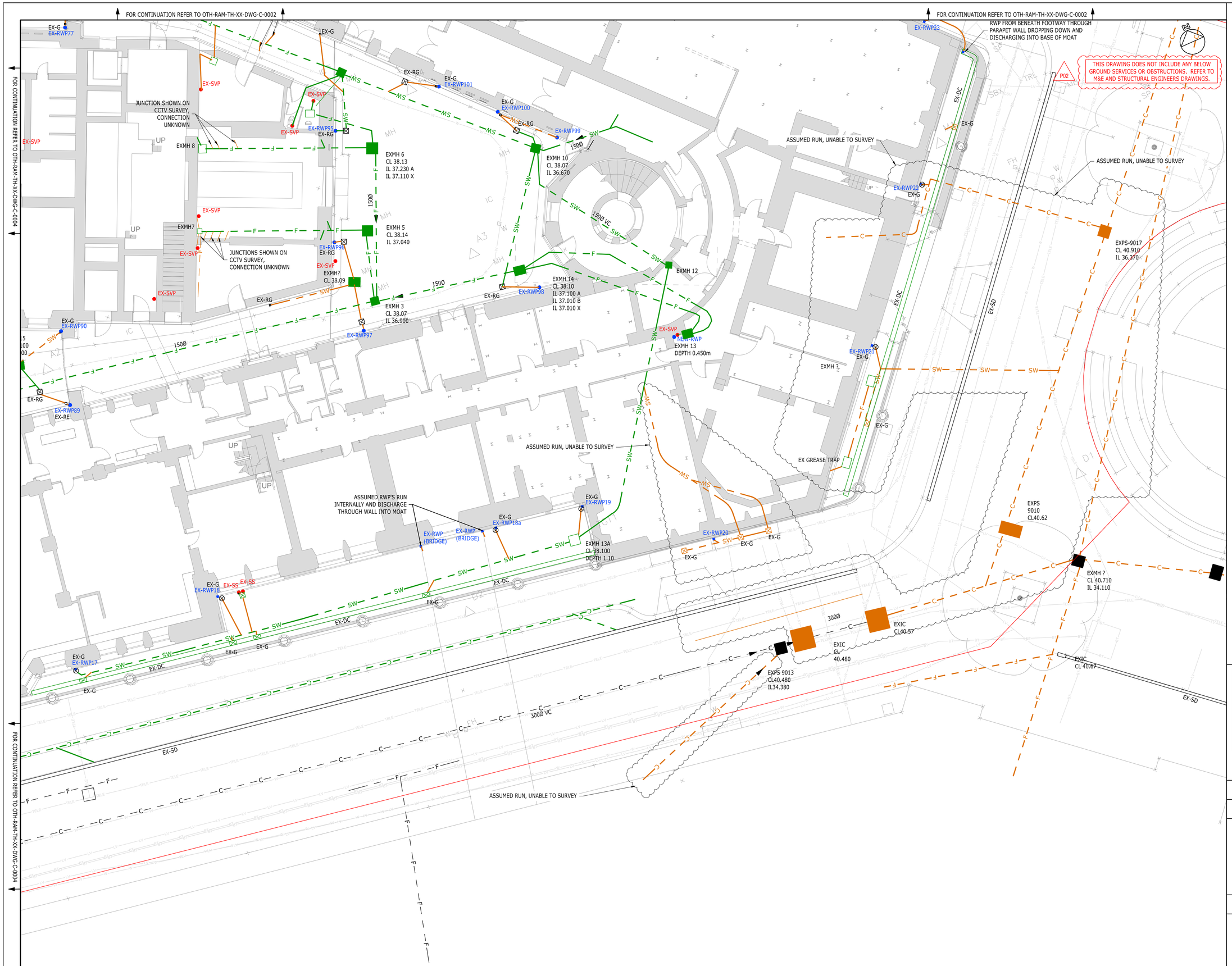
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PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	TOWN HALL EXISTING DRAINAGE SHEET 2 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-0002
REV	P02

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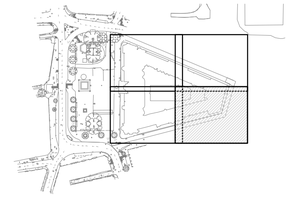
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KEY

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- EXISTING PUBLIC FOUL DRAIN/ MANHOLE — F —
- EXISTING PUBLIC SURFACE WATER DRAIN/MANHOLE — SW —
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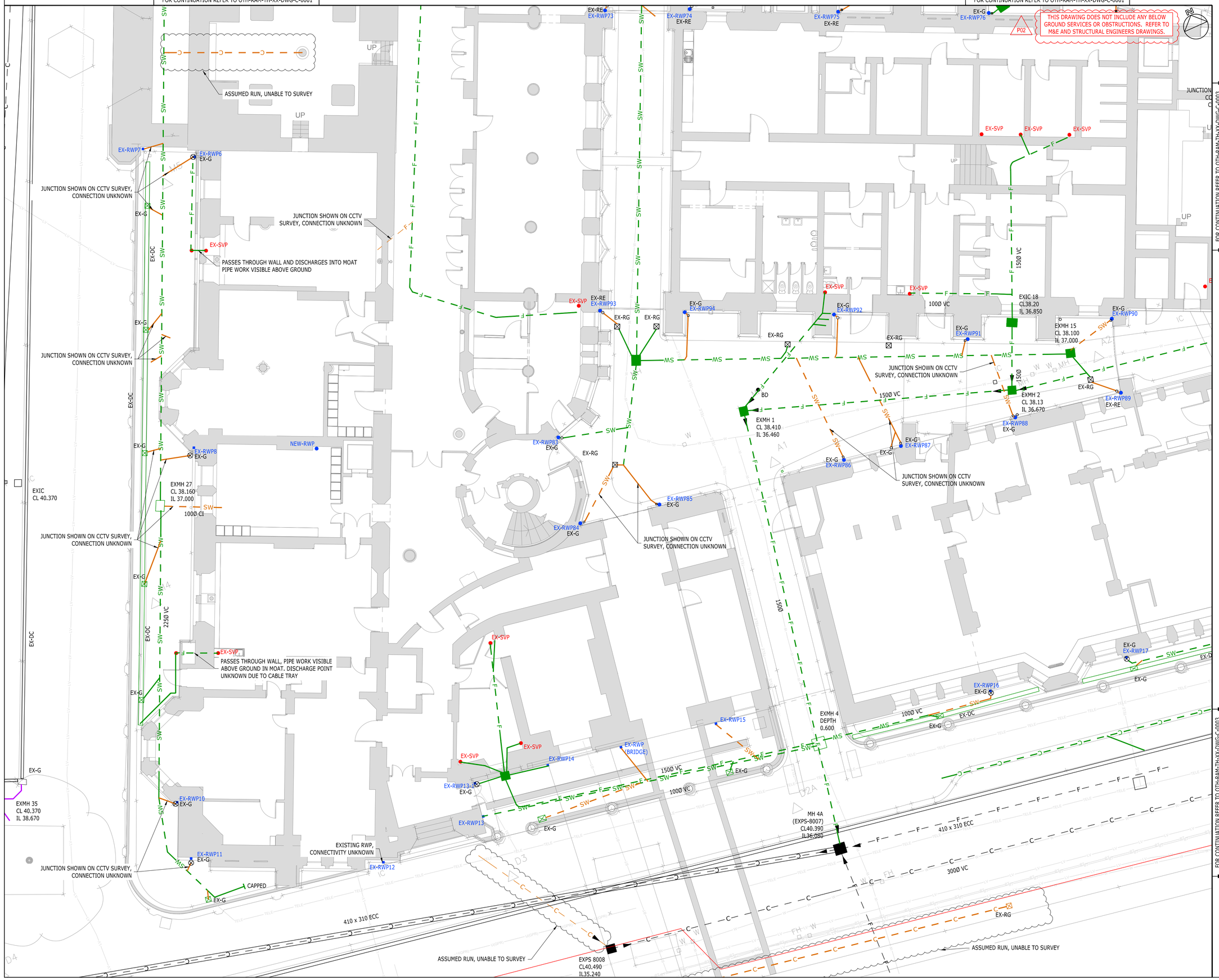
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DRAWING TITLE	TOWN HALL EXISTING DRAINAGE SHEET 3 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-0003
REV	P02

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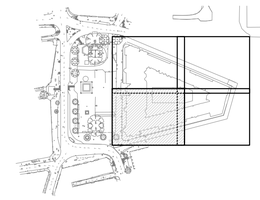
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EXISTING RWP	EX-RWP
EXISTING DRAINAGE ABANDONED	X C X



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SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-0004
REV	P02

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13:21:09

APPENDIX 4
EXISTING DRAINAGE CALCULATIONS

Town Hall Building

Existing outfall pipework Network 2 into Princess Street
Invert level of EXMH19 - 34.140
Invert level of EXMH21 - 34.020 (TBC)
Invert level of EXMH21A - 34.010
Invert level into public sewer unknown assume as 33.640
Invert level identified on United Utilities sewer relining works drawing MISC/80030937/03/11/2300 Rev D of downstream manhole is indicated as **33.302.**
Connections from bulding drainage into public sewer at upstream manholes were identied as below this so appears the UU drawing could be correct.

Gradient between 19 and 21 = (dist 6.5m) 1 in 54
Gradient between 21 and 21A = (dist 13.2m) TBC
Gradient between 21A and sewer = (dist 11m)
Total distance = 30.7m - gradient = 1 in 61.4

Assume 1 in 60 gradient at this stage for the worst case (to be modelled fully)

Colebrook-White Formula
All charts in AS2200-2006, have been developed using the formulae below:

g =	Gravity	= 9.81 m/s^2		
ν =	kinematic viscosity of water	= 1.010E-06 m^2/s		
k =	Colebrook-White roughness coeff	= 1.500 mm	= 1.500E-03 m	
D =	Inside diameter	= 150 mm	= 0.150 m	
S =	Slope, in metres per metre	= 1 : 60	= 1.667%	= (Hydraulic Gradient)
V =	Velocity	= 1.13 m/s		

Discharge:
Q = V x A A = 0.018 m2
Q = 0.0200 m/s = 20.008 L/s

Existing outfall pipework Network 1 into Lloyd Street
Invert level of EXMH1 - 36.460
Invert level of EXMH4 - unknown
Invert level of EXMH4A public sewer - 36.080

Gradient between 1 and 4 = (dist 19.5m)
Gradient between 4 and 4A = (6m)
Total distance = 25.5m = gradient (assuming even across MH4) = 1 in 67

Assume 1 in 67 gradient at this stage for the worst case (to be modelled fully)

Colebrook-White Formula
All charts in AS2200-2006, have been developed using the formulae below:

g =	Gravity	= 9.81 m/s^2		
ν =	kinematic viscosity of water	= 1.010E-06 m^2/s		
k =	Colebrook-White roughness coeff	= 1.500 mm	= 1.500E-03 m	
D =	Inside diameter	= 150 mm	= 0.150 m	
S =	Slope, in metres per metre	= 1 : 67	= 1.493%	= (Hydraulic Gradient)
V =	Velocity	= 1.07 m/s		

Discharge:
Q = V x A A = 0.018 m2
Q = 0.0189 m/s = 18.929 L/s

Stage 3 Existing Surface Water Flows - Building Only
OTH-RAM-XX-XX-CAL-C-0002 Rev B
06/11/2018
To be read in conjunction with Arup drawings;
OTH-ARU-TH-XX-DWG-N-2XX26 - Rainwater Catchment Calculations Schedule
Rainwater pipe numbering drawing no:N-2XX28

i1	i2	i30	i100	
48.22	79.32	111.19	139.19	mm/h*

* Values from brownfield calculation sheet

Princess Street - Outfall F5

RWP	Area [m^2]	Q1 [l/s]	Q5 [l/s]	Q30 [l/s]	Q100 [l/s]
25	66	0.96	1.59	2.23	2.79
26	48	0.70	1.15	1.62	2.03
27	65	0.95	1.56	2.19	2.74
28	67	0.98	1.61	2.26	2.83
Tot	**246**	**3.60**	**5.92**	**8.29**	**10.38**

Lloyd Street West - Outfall F4

RWP	Area [m^2]	Q1 [l/s]	Q5 [l/s]	Q30 [l/s]	Q100 [l/s]
16	76	1.11	1.83	2.56	3.21
12	59	0.86	1.42	1.99	2.49
13	42	0.61	1.01	1.42	1.77
14	21	0.31	0.51	0.71	0.89
15	53	0.77	1.27	1.79	2.24
Tot	**251**	**3.67**	**6.04**	**8.46**	**10.59**

Cooper Street

RWP	Area [m^2]	Q1 [l/s]	Q5 [l/s]	Q30 [l/s]	Q100 [l/s]
21	38	0.56	0.91	1.28	1.60
22	30	0.44	0.72	1.01	1.27
23	28	0.41	0.67	0.94	1.18
24	34	0.50	0.82	1.15	1.44
Tot	**130**	**1.90**	**3.13**	**4.38**	**5.49**

Outfall F2 into Princess Street

RWP	Area [m^2]	Q1 [l/s]	Q5 [l/s]	Q30 [l/s]	Q100 [l/s]
70	262	3.83	6.30	8.83	11.06
71	33	0.48	0.79	1.11	1.39
72	25	0.37	0.60	0.84	1.06
73	245	3.58	5.89	8.26	10.34
74	57	0.83	1.37	1.92	2.41
75	132	1.93	3.17	4.45	5.57
76	113	1.65	2.72	3.81	4.77
77	64	0.94	1.54	2.16	2.70
79	261	3.82	6.28	8.80	11.02
80	59	0.86	1.42	1.99	2.49
80.1	130	1.90	3.13	4.38	5.49
81	131	1.92	3.15	4.42	5.53
82	64	0.94	1.54	2.16	2.70
83	164	2.40	3.94	5.53	6.92
84	76	1.11	1.83	2.56	3.21
85	75	1.10	1.80	2.53	3.17
90	49	0.72	1.18	1.65	2.07
91	86	1.26	2.07	2.90	3.63
92	80	1.17	1.92	2.70	3.38
93	59	0.86	1.42	1.99	2.49
94	108	1.58	2.60	3.64	4.56
99	237	3.47	5.70	7.99	10.00
100	47	0.69	1.13	1.58	1.98
101	47	0.69	1.13	1.58	1.98
102	66	0.96	1.59	2.23	2.79
29	55	0.80	1.32	1.85	2.32
30	43	0.63	1.03	1.45	1.81
17	76	1.11	1.83	2.56	3.21
18	42	0.61	1.01	1.42	1.77
19	85	1.24	2.04	2.87	3.59
20	45	0.66	1.08	1.52	1.90
86	91	1.33	2.19	3.07	3.84
87	97	1.42	2.33	3.27	4.09
88	83	1.21	2.00	2.80	3.50
89	122	1.78	2.93	4.11	5.15
95	141	2.06	3.39	4.75	5.95
96	117	1.71	2.81	3.94	4.94
97	90	1.32	2.16	3.03	3.80
98	258	3.77	6.21	8.70	10.89
Tot	**4015**	**58.70**	**96.57**	**135.38**	**169.46**

Princess Street - Outfall F1

RWP	Area [m^2]	Q1 [l/s]	Q5 [l/s]	Q30 [l/s]	Q100 [l/s]	
2	145	2.12	3.49	4.89	6.12	
3	50	0.73	1.20	1.69	2.11	
4	191	2.79	4.59	6.44	8.06	
5	63	0.92	1.52	2.12	2.66	
6	90	1.32	2.16	3.03	3.80	
7	63	0.92	1.52	2.12	2.66	
8	447	6.54	10.75	15.07	18.87	
10	31	0.45	0.75	1.05	1.31	
11	21	0.31	0.51	0.71	0.89	
31	35	0.51	0.84	1.18	1.48	
32	55	0.80	1.32	1.85	2.32	
Tot	**1191**	**17.41**	**28.65**	**40.16**	**50.27**	
35	66	0.96	1.59	2.23	2.79	?
103	83	1.21	2.00	2.80	3.50	?

ASSUMED 1:100 GRADIENT FROM MH7 TO MH5; MH8 TO MH6; and MH9 TO MH6
BASED ON DOWNSTREAM MANHOLE INVERT LEVEL

MH26 TO MH04 ASSUMED CONSTANT GRADIENT INVERT-INVERT

ASSUMED CL = 42.20 BASED ON NEARBY FFL.
THEREFORE, IL = 41.34

ASSUMED 1:100 GRADIENT FROM N2(RWP) TO MH04
BASED ON ASSUMED INVERT LEVEL OF MH04

ASSUMED CL~40.0 BASED ON APPROXIMATE POSITION ON RAMP.
IL INTERPOLATED BETWEEN KNOWN LEVELS OF MH1 - PUBLIC SEWER

ASSUMED 1:100 GRADIENT FROM MH3a TO N1
BASED ON ASSUMED INVERT LEVEL OF N1
(N1 INVERT LEVEL INTERPOLATED BETWEEN MH2 - MH3)

ASSUMED 1:100 GRADIENT FROM MH13 TO MH14
BASED ON INVERT LEVEL AT MH14
COVER LEVELS ON BEND1 AND MH13 ASSUMED TO BE = MH14 (38.10)

Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	0	1000	3000	5000	7000		
1:200	mm	0	2000	6000	8000	2000	10000	
1:500	M	0	5	15	25	35		
1:250	M	10	30	50	70	90		

Notes:

Drawings are based on survey data and may not accurately represent what is physically present.
Do not scale from this drawing. All dimensions are to be verified on site before proceeding with the work.
All dimensions are in millimeters unless noted otherwise.
Purcell shall be notified in writing of any discrepancies.
All levels are in metres above ordnance datum U.N.O.
This drawing is to be read in conjunction with all relevant architects and engineers drawings and specifications.
The following information has been used in the design check:

- Powers & Tiltman CCTV Drainage Survey Plan; dwg no 7989/03 dated 06/08/18
- Arup drawing 256650-N-2XX28 dated 5th November 2018
- Roof Area Calculations from Arup drawing OTH-ARU-TH-XX-DWG-N-2XX26 dated 5th November 2018
- Existing foul discharge units calculated using Purcell General Arrangement Plans OTH-PUR-TH-01-DWG-A-0120 to 0128

Where no direct cover level has been provided, unless stated otherwise an assumption has been made based on the nearest topographical level as shown on the cctv drainage survey plan.
Where no invert level has been provided, unless stated otherwise a level has been assumed based on an assumed 1:100 pipe gradient from the upstream manhole.

ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	26/11/2018	LS	TM	INFORMATION
P01	05/09/2018	LS	TM	INFORMATION

OUR TOWN HALL PROJECT

RAMBOLL
www.ramboll.co.uk

Project Office, Room 308, Town Hall, MANCHESTER M60 2LL
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www.purcelluk.com

PROJECT STATUS	**PRELIMINARY**
CLIENT	**MANCHESTER CITY COUNCIL**
PROJECT	**OUR TOWN HALL PROJECT**
DRAWING TITLE	**EXISTING DRAINAGE NETWORK 1**
SIZE & SCALE	**A1: 1:200**
DRAWING STATUS	**For Information**
JOB NUMBER	**1620003165**
DRAWING NO.	**OTH-RAM-XX-XX-SKE-C-0008**
REV	**P02**

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26 November 2018
11:57:01

Time Area Diagram for Existing Foul - Converted Base Flow

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.053	4-8	0.025

Total Area Contributing (ha) = 0.078

Total Pipe Volume (m^3) = 2.734

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Existing Network Details for Existing Foul - Converted Base 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
E-1.000	7.496	0.075	100.0	0.000	5.00	0.8	0.600	oo	100	Double Pipe
E-1.001	5.621	0.056	100.4	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit
E-1.002	8.596	0.100	86.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-2.000	9.871	0.099	99.7	0.009	5.00	4.7	0.600	o	150	Pipe/Conduit
E-3.000	4.159	0.042	99.0	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit
E-2.001	8.889	0.200	44.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-4.000	9.749	0.097	100.5	0.006	5.00	4.8	0.600	o	150	Pipe/Conduit
E-4.001	4.155	0.140	29.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-1.003	0.962	0.009	106.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-5.000	1.354	0.014	96.7	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.004	23.789	0.221	107.6	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit
E-6.000	3.932	0.150	26.2	0.000	5.00	2.9	0.600	o	150	Pipe/Conduit
E-1.005	15.638	0.210	74.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E-1.000	37.131	0.000	0.8	0.77	12.1
E-1.001	37.056	0.000	0.8	0.77	6.0
E-1.002	37.000	0.000	0.8	1.08	19.2
E-2.000	37.199	0.009	4.7	1.01	17.8
E-3.000	37.142	0.014	0.0	1.01	17.8
E-2.001	37.100	0.023	4.7	1.51	26.7
E-4.000	37.137	0.006	4.8	1.00	17.7
E-4.001	37.040	0.006	4.8	1.85	32.8
E-1.003	36.900	0.029	10.3	0.97	17.2
E-5.000	36.905	0.012	0.0	1.02	18.1
E-1.004	36.891	0.050	10.3	0.97	17.1
E-6.000	36.820	0.000	2.9	1.97	34.9
E-1.005	36.670	0.050	13.2	1.17	20.6

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Existing Network Details for Existing Foul - Converted Base 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
E-1.006	19.732	0.343	57.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-7.000	19.823	0.198	100.1	0.011	5.00	0.0	0.600	o	100	Pipe/Conduit
E-8.000	1.997	0.530	3.8	0.004	5.00	2.7	0.600	o	150	Pipe/Conduit
E-8.001	17.691	4.693	3.8	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit
E-1.007	6.252	0.037	169.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E-1.006	36.460	0.050	13.2	1.33	23.5
E-7.000	36.315	0.011	0.0	0.77	6.0
E-8.000	41.340	0.004	2.7	5.23	92.4
E-8.001	40.810	0.012	2.7	5.23	92.4
E-1.007	36.117	0.078	15.9	0.77	13.6

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Manhole Schedules for Existing Foul - Converted Base Flow

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
MH13	38.100	0.969	Open Manhole	1200	E-1.000	37.131	100				
BEND1	38.100	1.044	Junction		E-1.001	37.056	100	E-1.000	37.056	100	
MH14	38.100	1.100	Open Manhole	1200	E-1.002	37.000	150	E-1.001	37.000	100	
MH8	38.130	0.931	Sealed Manhole	1200	E-2.000	37.199	150				
MH9	38.130	0.988	Sealed Manhole	1200	E-3.000	37.142	150				
MH6	38.130	1.030	Open Manhole	1200	E-2.001	37.100	150	E-2.000	37.100	150	
								E-3.000	37.100	150	
MH7	38.140	1.003	Sealed Manhole	1200	E-4.000	37.137	150				
MH5	38.140	1.100	Open Manhole	1200	E-4.001	37.040	150	E-4.000	37.040	150	
MH3	38.070	1.170	Open Manhole	1200	E-1.003	36.900	150	E-1.002	36.900	150	
								E-2.001	36.900	150	
								E-4.001	36.900	150	
MH3a	38.090	1.185	Open Manhole	1200	E-5.000	36.905	150				
N1	38.040	1.149	Junction		E-1.004	36.891	150	E-1.003	36.891	150	
								E-5.000	36.891	150	
MH18	38.200	1.380	Open Manhole	1200	E-6.000	36.820	150				
MH2	38.130	1.460	Open Manhole	1200	E-1.005	36.670	150	E-1.004	36.670	150	
								E-6.000	36.670	150	
MH1	38.410	1.950	Open Manhole	1200	E-1.006	36.460	150	E-1.005	36.460	150	
N2 (RWP)	40.510	4.195	Junction		E-7.000	36.315	100				
MH26	42.200	0.860	Open Manhole	1200	E-8.000	41.340	150				
BEND2	42.200	1.390	Junction		E-8.001	40.810	150	E-8.000	40.810	150	
MH04	40.000	3.883	Open Manhole	1200	E-1.007	36.117	150	E-1.006	36.117	150	
								E-7.000	36.117	100	
								E-8.001	36.117	150	
PUBLIC SEWER	40.390	4.310	Open Manhole	1200		OUTFALL		E-1.007	36.080	150	

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PIPELINE SCHEDULES for Existing Foul - Converted Base Flow

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	oo	100	MH13	38.100	37.131	0.869	Open Manhole	1200
E-1.001	o	100	BEND1	38.100	37.056	0.944	Junction	
E-1.002	o	150	MH14	38.100	37.000	0.950	Open Manhole	1200
E-2.000	o	150	MH8	38.130	37.199	0.781	Sealed Manhole	1200
E-3.000	o	150	MH9	38.130	37.142	0.838	Sealed Manhole	1200
E-2.001	o	150	MH6	38.130	37.100	0.880	Open Manhole	1200
E-4.000	o	150	MH7	38.140	37.137	0.853	Sealed Manhole	1200
E-4.001	o	150	MH5	38.140	37.040	0.950	Open Manhole	1200
E-1.003	o	150	MH3	38.070	36.900	1.020	Open Manhole	1200
E-5.000	o	150	MH3a	38.090	36.905	1.035	Open Manhole	1200
E-1.004	o	150	N1	38.040	36.891	0.999	Junction	
E-6.000	o	150	MH18	38.200	36.820	1.230	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	7.496	100.0	BEND1	38.100	37.056	0.944	Junction	
E-1.001	5.621	100.4	MH14	38.100	37.000	1.000	Open Manhole	1200
E-1.002	8.596	86.0	MH3	38.070	36.900	1.020	Open Manhole	1200
E-2.000	9.871	99.7	MH6	38.130	37.100	0.880	Open Manhole	1200
E-3.000	4.159	99.0	MH6	38.130	37.100	0.880	Open Manhole	1200
E-2.001	8.889	44.4	MH3	38.070	36.900	1.020	Open Manhole	1200
E-4.000	9.749	100.5	MH5	38.140	37.040	0.950	Open Manhole	1200
E-4.001	4.155	29.7	MH3	38.070	36.900	1.020	Open Manhole	1200
E-1.003	0.962	106.9	N1	38.040	36.891	0.999	Junction	
E-5.000	1.354	96.7	N1	38.040	36.891	0.999	Junction	
E-1.004	23.789	107.6	MH2	38.130	36.670	1.310	Open Manhole	1200
E-6.000	3.932	26.2	MH2	38.130	36.670	1.310	Open Manhole	1200

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PIPELINE SCHEDULES for Existing Foul - Converted Base Flow

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.005	o	150	MH2	38.130	36.670	1.310	Open Manhole	1200
E-1.006	o	150	MH1	38.410	36.460	1.800	Open Manhole	1200
E-7.000	o	100	N2 (RWP)	40.510	36.315	4.095	Junction	
E-8.000	o	150	MH26	42.200	41.340	0.710	Open Manhole	1200
E-8.001	o	150	BEND2	42.200	40.810	1.240	Junction	
E-1.007	o	150	MH04	40.000	36.117	3.733	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.005	15.638	74.5	MH1	38.410	36.460	1.800	Open Manhole	1200
E-1.006	19.732	57.5	MH04	40.000	36.117	3.733	Open Manhole	1200
E-7.000	19.823	100.1	MH04	40.000	36.117	3.783	Open Manhole	1200
E-8.000	1.997	3.8	BEND2	42.200	40.810	1.240	Junction	
E-8.001	17.691	3.8	MH04	40.000	36.117	3.733	Open Manhole	1200
E-1.007	6.252	169.0	PUBLIC SEWER	40.390	36.080	4.160	Open Manhole	1200

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Area Summary for Existing Foul - Converted Base Flow

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.009	0.009	0.009
3.000	-	-	100	0.014	0.014	0.014
2.001	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.006	0.006	0.006
4.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.012	0.012	0.012
1.004	-	-	100	0.009	0.009	0.009
6.000	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.011	0.011	0.011
8.000	-	-	100	0.004	0.004	0.004
8.001	-	-	100	0.008	0.008	0.008
1.007	-	-	100	0.005	0.005	0.005
				Total	Total	Total
				0.078	0.078	0.078

Free Flowing Outfall Details for Existing Foul - Converted Base Flow

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E-1.007	PUBLIC SEWER	40.390	36.080	0.000	1200	0

Simulation Criteria for Existing Foul - Converted Base Flow

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales Ratio R 0.360 Cv (Summer) 0.750 Storm Duration (mins) 30
Return Period (years) 2 M5-60 (mm) 18.000 Profile Type Summer Cv (Winter) 0.840

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.361 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH13	360 Winter	1	+0%	30/15 Winter				37.149	-0.082	0.000	0.07		0.8	OK	
E-1.001	BEND1	15 Winter	1	+0%					37.089	-0.067	0.000	0.14		0.8	OK*	
E-1.002	MH14	15 Winter	1	+0%	30/15 Summer				37.084	-0.066	0.000	0.06		0.9	OK	
E-2.000	MH8	15 Winter	1	+0%	100/15 Summer				37.262	-0.087	0.000	0.37		5.8	OK	
E-3.000	MH9	15 Winter	1	+0%	100/15 Summer				37.178	-0.114	0.000	0.13		1.7	OK	
E-2.001	MH6	15 Winter	1	+0%	30/15 Winter				37.158	-0.092	0.000	0.32		7.5	OK	
E-4.000	MH7	15 Winter	1	+0%	100/15 Summer				37.198	-0.089	0.000	0.35		5.5	OK	
E-4.001	MH5	15 Winter	1	+0%	30/15 Summer				37.092	-0.098	0.000	0.23		5.5	OK	
E-1.003	MH3	15 Winter	1	+0%	1/15 Summer				37.081	0.031	0.000	1.26		13.6	SURCHARGED	
E-5.000	MH3a	15 Winter	1	+0%	30/15 Summer				37.006	-0.049	0.000	0.13		1.4	OK	
E-1.004	N1	15 Winter	1	+0%					37.005	-0.036	0.000	0.92		15.8	OK*	
E-6.000	MH18	360 Winter	1	+0%	100/15 Summer				36.855	-0.115	0.000	0.12		2.9	OK	
E-1.005	MH2	15 Winter	1	+0%	2/15 Summer				36.800	-0.020	0.000	0.96		18.4	OK	
E-1.006	MH1	15 Winter	1	+0%	2/15 Summer				36.610	0.000	0.000	0.83		18.3	OK	
E-7.000	N2 (RWP)	15 Winter	1	+0%					36.387	-0.028	0.000	0.18		1.1	OK*	
E-8.000	MH26	15 Winter	1	+0%					41.366	-0.124	0.000	0.07		3.2	OK	
E-8.001	BEND2	15 Winter	1	+0%					40.830	-0.130	0.000	0.04		4.0	OK*	
E-1.007	MH04	15 Winter	1	+0%	1/15 Summer				36.376	0.109	0.000	2.03		23.2	SURCHARGED	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.361 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH13	360 Winter	2	+0%	30/15 Winter				37.149	-0.082	0.000	0.07		0.8	OK	
E-1.001	BEND1	15 Winter	2	+0%					37.097	-0.059	0.000	0.15		0.9	OK*	
E-1.002	MH14	15 Winter	2	+0%	30/15 Summer				37.092	-0.058	0.000	0.07		1.1	OK	
E-2.000	MH8	15 Winter	2	+0%	100/15 Summer				37.264	-0.085	0.000	0.39		6.1	OK	
E-3.000	MH9	15 Winter	2	+0%	100/15 Summer				37.184	-0.108	0.000	0.17		2.2	OK	
E-2.001	MH6	15 Winter	2	+0%	30/15 Winter				37.162	-0.088	0.000	0.35		8.3	OK	
E-4.000	MH7	15 Winter	2	+0%	100/15 Summer				37.200	-0.087	0.000	0.36		5.7	OK	
E-4.001	MH5	15 Winter	2	+0%	30/15 Summer				37.099	-0.091	0.000	0.24		5.7	OK	
E-1.003	MH3	15 Winter	2	+0%	1/15 Summer				37.090	0.040	0.000	1.34		14.5	SURCHARGED	
E-5.000	MH3a	15 Winter	2	+0%	30/15 Summer				37.042	-0.013	0.000	0.16		1.7	OK	
E-1.004	N1	15 Winter	2	+0%					37.041	0.000	0.000	0.98		16.8	OK*	
E-6.000	MH18	15 Winter	2	+0%	100/15 Summer				36.856	-0.114	0.000	0.12		3.0	OK	
E-1.005	MH2	15 Winter	2	+0%	2/15 Summer				36.846	0.026	0.000	0.99		18.9	SURCHARGED	
E-1.006	MH1	15 Winter	2	+0%	2/15 Summer				36.640	0.030	0.000	0.86		19.0	SURCHARGED	
E-7.000	N2 (RWP)	15 Winter	2	+0%					36.407	-0.008	0.000	0.24		1.5	OK*	
E-8.000	MH26	15 Winter	2	+0%					41.367	-0.123	0.000	0.07		3.3	OK	
E-8.001	BEND2	15 Winter	2	+0%					40.831	-0.129	0.000	0.05		4.4	OK*	
E-1.007	MH04	15 Winter	2	+0%	1/15 Summer				36.392	0.125	0.000	2.14		24.4	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.361 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH13	15 Winter	30	+0%	30/15 Winter				37.233	0.002	0.000	0.10		1.2	SURCHARGED	
E-1.001	BEND1	15 Winter	30	+0%					37.156	0.000	0.000	0.30		1.8	SURCHARGED*	
E-1.002	MH14	15 Winter	30	+0%	30/15 Summer				37.226	0.076	0.000	0.14		2.4	SURCHARGED	
E-2.000	MH8	15 Winter	30	+0%	100/15 Summer				37.272	-0.077	0.000	0.46		7.3	OK	
E-3.000	MH9	15 Winter	30	+0%	100/15 Summer				37.255	-0.037	0.000	0.29		3.7	OK	
E-2.001	MH6	15 Winter	30	+0%	30/15 Winter				37.251	0.001	0.000	0.44		10.3	SURCHARGED	
E-4.000	MH7	15 Winter	30	+0%	100/15 Summer				37.254	-0.033	0.000	0.41		6.5	OK	
E-4.001	MH5	15 Winter	30	+0%	30/15 Summer				37.234	0.044	0.000	0.26		6.0	SURCHARGED	
E-1.003	MH3	15 Winter	30	+0%	1/15 Summer				37.224	0.174	0.000	1.38		15.0	SURCHARGED	
E-5.000	MH3a	15 Winter	30	+0%	30/15 Summer				37.174	0.119	0.000	0.26		2.9	SURCHARGED	
E-1.004	N1	60 Winter	30	+0%					37.041	0.000	0.000	0.97		16.6	SURCHARGED*	
E-6.000	MH18	15 Winter	30	+0%	100/15 Summer				36.953	-0.017	0.000	0.13		3.2	OK	
E-1.005	MH2	15 Winter	30	+0%	2/15 Summer				36.948	0.128	0.000	1.06		20.2	SURCHARGED	
E-1.006	MH1	15 Winter	30	+0%	2/15 Summer				36.717	0.107	0.000	0.93		20.6	SURCHARGED	
E-7.000	N2 (RWP)	60 Winter	30	+0%					36.415	0.000	0.000	0.28		1.7	SURCHARGED*	
E-8.000	MH26	15 Winter	30	+0%					41.369	-0.121	0.000	0.09		3.9	OK	
E-8.001	BEND2	15 Winter	30	+0%					40.836	-0.124	0.000	0.07		6.4	OK*	
E-1.007	MH04	15 Winter	30	+0%	1/15 Summer				36.454	0.187	0.000	2.49		28.5	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.361 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH13	30 Winter	100	+40%	30/15 Winter				37.513	0.282	0.000	0.12		1.3	SURCHARGED	
E-1.001	BEND1	15 Winter	100	+40%					37.156	0.000	0.000	0.33		2.0	SURCHARGED*	
E-1.002	MH14	30 Winter	100	+40%	30/15 Summer				37.506	0.356	0.000	0.15		2.5	SURCHARGED	
E-2.000	MH8	30 Winter	100	+40%	100/15 Summer				37.557	0.208	0.000	0.49		7.8	SURCHARGED*	
E-3.000	MH9	30 Winter	100	+40%	100/15 Summer				37.540	0.248	0.000	0.36		4.6	SURCHARGED*	
E-2.001	MH6	30 Winter	100	+40%	30/15 Winter				37.534	0.284	0.000	0.46		10.8	SURCHARGED	
E-4.000	MH7	30 Winter	100	+40%	100/15 Summer				37.535	0.248	0.000	0.42		6.5	SURCHARGED*	
E-4.001	MH5	30 Winter	100	+40%	30/15 Summer				37.514	0.324	0.000	0.26		6.1	SURCHARGED	
E-1.003	MH3	30 Winter	100	+40%	1/15 Summer				37.504	0.454	0.000	1.51		16.4	SURCHARGED	
E-5.000	MH3a	30 Winter	100	+40%	30/15 Summer				37.444	0.389	0.000	0.36		3.9	SURCHARGED	
E-1.004	N1	180 Winter	100	+40%					37.041	0.000	0.000	0.96		16.5	SURCHARGED*	
E-6.000	MH18	30 Winter	100	+40%	100/15 Summer				37.160	0.190	0.000	0.14		3.3	SURCHARGED	
E-1.005	MH2	30 Winter	100	+40%	2/15 Summer				37.155	0.335	0.000	1.19		22.7	SURCHARGED	
E-1.006	MH1	15 Winter	100	+40%	2/15 Summer				36.871	0.261	0.000	1.04		23.0	SURCHARGED	
E-7.000	N2 (RWP)	180 Winter	100	+40%					36.415	0.000	0.000	0.25		1.5	SURCHARGED*	
E-8.000	MH26	15 Winter	100	+40%					41.373	-0.117	0.000	0.11		4.8	OK	
E-8.001	BEND2	15 Winter	100	+40%					40.842	-0.118	0.000	0.10		9.4	OK*	
E-1.007	MH04	15 Winter	100	+40%	1/15 Summer				36.569	0.302	0.000	3.04		34.7	SURCHARGED	

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ASSUMED CONSTANT GRADIENT FROM MH21 TO PUBLIC SEWER
WITH OUTFALL AT 33.905mAOD
NOTE THIS MEANS PUBLIC SEWER ASSUMED TO BE APPROX 6.5m DEEP!

PUBLIC SEWER

ASSUMED CONSTANT 1:100 GRADIENT
BETWEEN MH23-MH21 BASED ON DEPTH OF MH23 UPSTREAM.
NOTE: ASSUMED ENTERS MH21 WITH BACKDROP AT 36.664mAOD

MOAT 25m²

+RWP 66m²

269m²

69m²

ASSUMED COVER LEVEL
= SAME AS MH21
THEREFORE IL = 37.04

ASSUME PIPE LAID FLAT BETWEEN MH19 - MH21
THEREFORE MH21 DEPTH ADJUSTED = 4.20m

131m²

79m²

59m²

ASSUMED 1:100 GRADIENT BETWEEN MH17 TO MH19
BASED ON MH19 LEVELS

ASSUMED INVERT LEVEL BASED ON
INTERPOLATION BETWEEN MH11-MH19
COVER LEVEL = MH11

ASSUMED 1:100 GRADIENT
BASED ON N2
ASSUMED 150mm

151m²

118m²

COURTYARD 410m² (MH11 - MH19)

263m²

58m²

133m²

ASSUMED INVERT LEVEL BASED ON
INTERPOLATION BETWEEN MH11-MH19.
COVER LEVEL = MH11

ASSUMED 1:100 GRADIENT
BASED ON N1
ASSUMED 150mm

114m²

64m²

COURTYARD 80m² (MH16 - MH17)

142m²

58m²

115m²

13m²

83m²

ASSUMED 1:100 GRADIENT
BASED ON MH16

85m²

141m²

47m²

COURTYARD 93m² (MH10 - MH11)

47m²

227m²

119m²

79m²

104m²

75m²

90m²

COURTYARD 272m²

125m²

COURTYARD 71m²

ASSUMED 1:100 GRADIENT
BASED ON MH10

MH12 INVERT LEVEL ASSUMED BY ASSUMING
CONSTANT GRADIENT BETWEEN MH13A - MH10

272m²

42m²

40m²

85m²

76m²

ASSUMED 1:100 GRADIENT
BASED ON MH13A

AREA OF MOAT 75m²

Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	1000		3000		5000		7000
1:200	mm		2000		4000		6000	8000
1:500	M	5		15		25		35
1:1250	M	10		30		50		70	90

Notes:

Drawings are based on survey data and may not accurately represent what is physically present.
Do not scale from this drawing. All dimensions are to be verified on site before proceeding with the work.
All dimensions are in millimeters unless noted otherwise.
Purcell shall be notified in writing of any discrepancies.
All levels are in metres above ordnance datum U.N.O.
This drawing is to be read in conjunction with all relevant architects and engineers drawings and specifications.
The following information has been used in the design check:

- Powers & Tiltman CCTV Drainage Survey Plan; dwg no 7989/03 dated 06/08/18
- Arup drawing 256650-N-2XX28 dated 5th November 2018
- Roof Area Calculations from Arup drawing OTH-ARU-TH-XX-DWG-N-2XX26 dated 5th November 2018
- Existing foul discharge units calculated using Purcell General Arrangement Plans OTH-PUR-TH-01-DWG-A-0120 to 0128

Where no direct cover level has been provided, unless stated otherwise an assumption has been made based on the nearest topographical level as shown on the cctv drainage survey plan.
Where no invert level has been provided, unless stated otherwise a level has been assumed based on an assumed 1:100 pipe gradient from the upstream manhole.

ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	26/11/2018	LS	TM	INFORMATION
P01	05/09/2018	LS	TM	INFORMATION

OUR TOWN HALL PROJECT

RAMBOLL
www.ramboll.co.uk

Project Office, Room 308, Town Hall, MANCHESTER M60 2LI
+44 (0) 7970 097 432
www.purcelluk.com

PROJECT STATUS	**PRELIMINARY**
CLIENT	**MANCHESTER CITY COUNCIL**
PROJECT	**OUR TOWN HALL PROJECT**
DRAWING TITLE	**EXISTING DRAINAGE NETWORK 1**
SIZE & SCALE	**A1: 1:200**
DRAWING STATUS	**For Information**
JOB NUMBER	**1620003165**
DRAWING NO.	**OTH-RAM-XX-XX-SKE-C-0009**
REV	**P02**

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26 November 2018
12:06:54

Time Area Diagram for Existing Foul - Converted Base Flow

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.308	4-8	0.158

Total Area Contributing (ha) = 0.466

Total Pipe Volume (m^3) = 5.701

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Existing Network Details for Existing Foul - Converted Base 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
E-1.000	30.634	0.306	100.1	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.001	16.899	0.305	55.4	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit
E-1.002	10.283	0.185	55.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-2.000	8.276	0.083	99.7	0.034	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.003	12.101	2.050	5.9	0.041	0.00	0.0	0.600	o	150	Pipe/Conduit
E-3.000	3.391	0.034	99.7	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.004	17.863	0.148	120.7	0.000	0.00	1.4	0.600	o	150	Pipe/Conduit
E-4.000	2.132	0.021	101.5	0.011	5.00	1.8	0.600	o	150	Pipe/Conduit
E-4.001	4.988	0.050	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-4.002	2.165	0.022	98.4	0.007	0.00	0.0	0.600	o	150	Pipe/Conduit
E-1.005	12.518	0.103	121.5	0.067	0.00	0.0	0.600	o	150	Pipe/Conduit
E-5.000	5.776	0.058	99.6	0.013	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.006	8.296	0.069	120.2	0.031	0.00	0.8	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E-1.000	37.306	0.023	0.0	1.00	17.7
E-1.001	37.000	0.032	0.0	1.35	23.9
E-1.002	36.695	0.032	0.0	1.35	23.9
E-2.000	36.593	0.034	0.0	1.01	17.8
E-1.003	36.510	0.107	0.0	4.18	73.8
E-3.000	34.494	0.014	0.0	1.01	17.8
E-1.004	34.460	0.121	1.4	0.91	16.1
E-4.000	34.405	0.011	1.8	1.00	17.6
E-4.001	34.384	0.011	1.8	1.01	17.8
E-4.002	34.334	0.018	1.8	1.01	17.9
E-1.005	34.312	0.206	3.2	0.91	16.1
E-5.000	34.267	0.013	0.0	1.01	17.8
E-1.006	34.209	0.250	4.0	0.92	16.2

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Existing Network Details for Existing Foul - Converted Base 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
E-6.000	25.222	0.430	58.7	0.094	5.00	0.0	0.600	o	150	Pipe/Conduit
E-7.000	6.116	0.061	100.3	0.028	5.00	0.0	0.600	o	150	Pipe/Conduit
E-6.001	20.982	2.150	9.8	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit
E-6.002	1.597	0.034	47.0	0.021	0.00	0.0	0.600	o	150	Pipe/Conduit
E-6.003	11.066	0.246	45.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-8.000	6.502	0.065	100.0	0.048	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.007	6.772	0.000	0.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-9.000	18.699	0.187	100.0	0.000	5.00	2.7	0.600	o	225	Pipe/Conduit
E-9.001	18.936	0.189	100.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
E-1.008	13.488	0.130	103.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E-1.009	10.846	0.105	103.3	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E-6.000	37.000	0.094	0.0	1.32	23.3
E-7.000	36.631	0.028	0.0	1.00	17.7
E-6.001	36.570	0.144	0.0	3.24	57.3
E-6.002	34.420	0.165	0.0	1.47	26.0
E-6.003	34.386	0.165	0.0	1.50	26.6
E-8.000	34.205	0.048	0.0	1.00	17.8
E-1.007	34.140	0.463	4.0	0.00	0.0
E-9.000	37.040	0.000	2.7	1.31	52.0
E-9.001	36.853	0.000	2.7	1.31	51.9
E-1.008	34.140	0.463	6.8	0.99	17.4
E-1.009	34.010	0.466	6.8	0.99	17.5

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Manhole Schedules for Existing Foul - Converted Base Flow

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
EX-G1	38.100	0.794	Open Manhole	450	E-1.000	37.306	150				
MH13A	38.100	1.100	Open Manhole	1200	E-1.001	37.000	150	E-1.000	37.000	150	
MH12	38.070	1.375	Sealed Manhole	1200	E-1.002	36.695	150	E-1.001	36.695	150	
EX-RG1	38.060	1.467	Open Manhole	450	E-2.000	36.593	150				
MH10	38.070	1.560	Open Manhole	1200	E-1.003	36.510	150	E-1.002	36.510	150	
								E-2.000	36.510	150	
EX-RG2	38.080	3.586	Open Manhole	450	E-3.000	34.494	150				
MH11	38.120	3.660	Open Manhole	1200	E-1.004	34.460	150	E-1.003	34.460	150	
								E-3.000	34.460	150	
MH20	38.140	3.735	Open Manhole	1200	E-4.000	34.405	150				
BEND1	38.140	3.756	Junction		E-4.001	34.384	150	E-4.000	34.384	150	
EX-RG3	38.050	3.716	Open Manhole	450	E-4.002	34.334	150	E-4.001	34.334	150	
N1	38.120	3.808	Junction		E-1.005	34.312	150	E-1.004	34.312	150	
								E-4.002	34.312	150	
EX-RG4	38.050	3.783	Open Manhole	450	E-5.000	34.267	150				
N2	38.120	3.911	Junction		E-1.006	34.209	150	E-1.005	34.209	150	
								E-5.000	34.209	150	
MH15	38.100	1.100	Open Manhole	1200	E-6.000	37.000	150				
RG1	38.160	1.529	Open Manhole	450	E-7.000	36.631	150				
MH16	38.200	1.630	Open Manhole	1200	E-6.001	36.570	150	E-6.000	36.570	150	
								E-7.000	36.570	150	
MH17	38.160	3.740	Open Manhole	1200	E-6.002	34.420	150	E-6.001	34.420	150	
BEND2	38.160	3.774	Junction		E-6.003	34.386	150	E-6.002	34.386	150	
MH19a	38.140	3.935	Sealed Manhole	1200	E-8.000	34.205	150				
MH19	38.200	4.060	Open Manhole	1200	E-1.007	34.140	150	E-1.006	34.140	150	
								E-6.003	34.140	150	
								E-8.000	34.140	150	
MH23	38.340	1.300	Open Manhole	1200	E-9.000	37.040	225				
BEND3	38.340	1.487	Junction		E-9.001	36.853	225	E-9.000	36.853	225	
MH21	38.340	4.200	Open Manhole	1200	E-1.008	34.140	150	E-1.007	34.140	150	
								E-9.001	36.664	225	2599
MH21A	38.170	4.160	Open Manhole	1200	E-1.009	34.010	150	E-1.008	34.010	150	
PUBLIC SEWER	40.560	6.655	Open Manhole	0		OUTFALL		E-1.009	33.905	150	

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PIPELINE SCHEDULES for Existing Foul - Converted Base Flow

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	o	150	EX-G1	38.100	37.306	0.644	Open Manhole	450
E-1.001	o	150	MH13A	38.100	37.000	0.950	Open Manhole	1200
E-1.002	o	150	MH12	38.070	36.695	1.225	Sealed Manhole	1200
E-2.000	o	150	EX-RG1	38.060	36.593	1.317	Open Manhole	450
E-1.003	o	150	MH10	38.070	36.510	1.410	Open Manhole	1200
E-3.000	o	150	EX-RG2	38.080	34.494	3.436	Open Manhole	450
E-1.004	o	150	MH11	38.120	34.460	3.510	Open Manhole	1200
E-4.000	o	150	MH20	38.140	34.405	3.585	Open Manhole	1200
E-4.001	o	150	BEND1	38.140	34.384	3.606	Junction	
E-4.002	o	150	EX-RG3	38.050	34.334	3.566	Open Manhole	450
E-1.005	o	150	N1	38.120	34.312	3.658	Junction	
E-5.000	o	150	EX-RG4	38.050	34.267	3.633	Open Manhole	450
E-1.006	o	150	N2	38.120	34.209	3.761	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	30.634	100.1	MH13A	38.100	37.000	0.950	Open Manhole	1200
E-1.001	16.899	55.4	MH12	38.070	36.695	1.225	Sealed Manhole	1200
E-1.002	10.283	55.6	MH10	38.070	36.510	1.410	Open Manhole	1200
E-2.000	8.276	99.7	MH10	38.070	36.510	1.410	Open Manhole	1200
E-1.003	12.101	5.9	MH11	38.120	34.460	3.510	Open Manhole	1200
E-3.000	3.391	99.7	MH11	38.120	34.460	3.510	Open Manhole	1200
E-1.004	17.863	120.7	N1	38.120	34.312	3.658	Junction	
E-4.000	2.132	101.5	BEND1	38.140	34.384	3.606	Junction	
E-4.001	4.988	99.8	EX-RG3	38.050	34.334	3.566	Open Manhole	450
E-4.002	2.165	98.4	N1	38.120	34.312	3.658	Junction	
E-1.005	12.518	121.5	N2	38.120	34.209	3.761	Junction	
E-5.000	5.776	99.6	N2	38.120	34.209	3.761	Junction	
E-1.006	8.296	120.2	MH19	38.200	34.140	3.910	Open Manhole	1200

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PIPELINE SCHEDULES for Existing Foul - Converted Base Flow

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-6.000	o	150	MH15	38.100	37.000	0.950	Open Manhole	1200
E-7.000	o	150	RG1	38.160	36.631	1.379	Open Manhole	450
E-6.001	o	150	MH16	38.200	36.570	1.480	Open Manhole	1200
E-6.002	o	150	MH17	38.160	34.420	3.590	Open Manhole	1200
E-6.003	o	150	BEND2	38.160	34.386	3.624	Junction	
E-8.000	o	150	MH19a	38.140	34.205	3.785	Sealed Manhole	1200
E-1.007	o	150	MH19	38.200	34.140	3.910	Open Manhole	1200
E-9.000	o	225	MH23	38.340	37.040	1.075	Open Manhole	1200
E-9.001	o	225	BEND3	38.340	36.853	1.262	Junction	
E-1.008	o	150	MH21	38.340	34.140	4.050	Open Manhole	1200
E-1.009	o	150	MH21A	38.170	34.010	4.010	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-6.000	25.222	58.7	MH16	38.200	36.570	1.480	Open Manhole	1200
E-7.000	6.116	100.3	MH16	38.200	36.570	1.480	Open Manhole	1200
E-6.001	20.982	9.8	MH17	38.160	34.420	3.590	Open Manhole	1200
E-6.002	1.597	47.0	BEND2	38.160	34.386	3.624	Junction	
E-6.003	11.066	45.0	MH19	38.200	34.140	3.910	Open Manhole	1200
E-8.000	6.502	100.0	MH19	38.200	34.140	3.910	Open Manhole	1200
E-1.007	6.772	0.0	MH21	38.340	34.140	4.050	Open Manhole	1200
E-9.000	18.699	100.0	BEND3	38.340	36.853	1.262	Junction	
E-9.001	18.936	100.2	MH21	38.340	36.664	1.451	Open Manhole	1200
E-1.008	13.488	103.8	MH21A	38.170	34.010	4.010	Open Manhole	1200
E-1.009	10.846	103.3	PUBLIC SEWER	40.560	33.905	6.505	Open Manhole	0

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Area Summary for Existing Foul - Converted Base Flow

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.023	0.023	0.023
1.001	-	-	100	0.009	0.009	0.009
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.034	0.034	0.034
1.003	-	-	100	0.041	0.041	0.041
3.000	-	-	100	0.014	0.014	0.014
1.004	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.011	0.011	0.011
4.001	-	-	100	0.000	0.000	0.000
4.002	-	-	100	0.007	0.007	0.007
1.005	-	-	100	0.067	0.067	0.067
5.000	-	-	100	0.013	0.013	0.013
1.006	-	-	100	0.031	0.031	0.031
6.000	-	-	100	0.094	0.094	0.094
7.000	-	-	100	0.028	0.028	0.028
6.001	-	-	100	0.022	0.022	0.022
6.002	-	-	100	0.021	0.021	0.021
6.003	-	-	100	0.000	0.000	0.000
8.000	-	-	100	0.048	0.048	0.048
1.007	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.000	0.000	0.000
9.001	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.003	0.003	0.003
				Total	Total	Total
				0.466	0.466	0.466

Free Flowing Outfall Details for Existing Foul - Converted Base Flow

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E-1.009	PUBLIC SEWER	40.560	33.905	0.000	0	0

Simulation Criteria for Existing Foul - Converted Base Flow

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales Ratio R 0.360 Cv (Summer) 0.750 Storm Duration (mins) 30
Return Period (years) 2 M5-60 (mm) 18.000 Profile Type Summer Cv (Winter) 0.840

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.360 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	EX-G1	15 Winter	1	+0%	100/15 Summer	100/30 Winter			37.347	-0.109	0.000	0.16		2.7	OK	2
E-1.001	MH13A	15 Winter	1	+0%	30/15 Winter	100/15 Summer			37.041	-0.109	0.000	0.16		3.7	OK	7
E-1.002	MH12	15 Winter	1	+0%	30/15 Summer				36.736	-0.109	0.000	0.17		3.7	OK	9
E-2.000	EX-RG1	15 Winter	1	+0%	30/15 Summer	100/15 Summer			36.646	-0.097	0.000	0.26		4.1	OK	9
E-1.003	MH10	15 Winter	1	+0%	30/15 Summer	100/15 Summer			36.553	-0.107	0.000	0.18		11.8	OK	8
E-3.000	EX-RG2	15 Winter	1	+0%	1/15 Summer	100/15 Summer			35.347	0.703	0.000	0.08		1.0	SURCHARGED	6
E-1.004	MH11	15 Winter	1	+0%	1/15 Summer	100/15 Winter			35.346	0.736	0.000	0.73		11.0	SURCHARGED	2
E-4.000	MH20	15 Winter	1	+0%	1/15 Summer				35.316	0.761	0.000	0.32		3.5	SURCHARGED	
E-4.001	BEND1	180 Winter	1	+0%					34.534	0.000	0.000	0.18		2.5	SURCHARGED*	
E-4.002	EX-RG3	15 Winter	1	+0%	1/15 Summer	100/15 Summer			35.309	0.825	0.000	0.49		5.3	SURCHARGED	8
E-1.005	N1	180 Winter	1	+0%					34.462	0.000	0.000	0.58		9.3	SURCHARGED*	
E-5.000	EX-RG4	15 Winter	1	+0%	1/15 Summer	100/15 Winter			35.229	0.812	0.000	0.06		1.0	SURCHARGED	3
E-1.006	N2	240 Winter	1	+0%					34.359	0.000	0.000	0.64		10.4	SURCHARGED*	
E-6.000	MH15	15 Winter	1	+0%	30/15 Summer	100/15 Summer			37.077	-0.073	0.000	0.50		11.1	OK	8
E-7.000	RG1	15 Winter	1	+0%	30/15 Summer	100/15 Summer			36.680	-0.101	0.000	0.23		3.4	OK	4
E-6.001	MH16	15 Winter	1	+0%	30/15 Summer				36.628	-0.092	0.000	0.31		16.8	OK	
E-6.002	MH17	15 Winter	1	+0%	1/15 Summer				35.202	0.632	0.000	1.34		15.4	SURCHARGED	
E-6.003	BEND2	180 Winter	1	+0%					34.536	0.000	0.000	0.19		5.0	SURCHARGED*	
E-8.000	MH19a	15 Winter	1	+0%	1/15 Summer				35.160	0.805	0.000	0.16		2.4	SURCHARGED*	
E-1.007	MH19	15 Winter	1	+0%	1/15 Summer				35.156	0.866	0.000	3.67		28.1	SURCHARGED	
E-9.000	MH23	360 Winter	1	+0%					37.075	-0.190	0.000	0.06		2.7	OK	
E-9.001	BEND3	360 Winter	1	+0%					36.887	-0.191	0.000	0.05		2.7	OK*	
E-1.008	MH21	15 Winter	1	+0%	1/15 Summer				34.922	0.632	0.000	1.91		30.5	SURCHARGED	
E-1.009	MH21A	15 Winter	1	+0%	1/15 Summer				34.449	0.289	0.000	1.95		30.6	SURCHARGED	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.360 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	EX-G1	15 Winter	2	+0%	100/15 Summer	100/30 Winter			37.353	-0.103	0.000	0.21		3.5	OK	2
E-1.001	MH13A	15 Winter	2	+0%	30/15 Winter	100/15 Summer			37.047	-0.103	0.000	0.21		4.7	OK	7
E-1.002	MH12	15 Winter	2	+0%	30/15 Summer				36.743	-0.102	0.000	0.22		4.7	OK	9
E-2.000	EX-RG1	15 Winter	2	+0%	30/15 Summer	100/15 Summer			36.654	-0.089	0.000	0.34		5.3	OK	9
E-1.003	MH10	15 Winter	2	+0%	30/15 Summer	100/15 Summer			36.559	-0.101	0.000	0.23		15.3	OK	8
E-3.000	EX-RG2	30 Winter	2	+0%	1/15 Summer	100/15 Summer			35.787	1.143	0.000	0.09		1.0	SURCHARGED	6
E-1.004	MH11	30 Winter	2	+0%	1/15 Summer	100/15 Winter			35.786	1.176	0.000	0.79		11.9	SURCHARGED	2
E-4.000	MH20	30 Winter	2	+0%	1/15 Summer				35.740	1.185	0.000	0.33		3.6	SURCHARGED	
E-4.001	BEND1	180 Winter	2	+0%					34.534	0.000	0.000	0.19		2.7	SURCHARGED*	
E-4.002	EX-RG3	30 Winter	2	+0%	1/15 Summer	100/15 Summer			35.734	1.250	0.000	0.50		5.4	SURCHARGED	8
E-1.005	N1	240 Winter	2	+0%					34.462	0.000	0.000	0.59		9.6	SURCHARGED*	
E-5.000	EX-RG4	30 Winter	2	+0%	1/15 Summer	100/15 Winter			35.632	1.215	0.000	0.07		1.0	SURCHARGED	3
E-1.006	N2	480 Winter	2	+0%					34.359	0.000	0.000	0.56		9.0	SURCHARGED*	
E-6.000	MH15	15 Winter	2	+0%	30/15 Summer	100/15 Summer			37.090	-0.060	0.000	0.65		14.4	OK	8
E-7.000	RG1	15 Winter	2	+0%	30/15 Summer	100/15 Summer			36.687	-0.094	0.000	0.29		4.4	OK	4
E-6.001	MH16	15 Winter	2	+0%	30/15 Summer				36.637	-0.083	0.000	0.40		21.7	OK	
E-6.002	MH17	30 Winter	2	+0%	1/15 Summer				35.599	1.029	0.000	1.42		16.4	SURCHARGED	
E-6.003	BEND2	180 Winter	2	+0%					34.536	0.000	0.000	0.23		6.2	SURCHARGED*	
E-8.000	MH19a	30 Winter	2	+0%	1/15 Summer				35.539	1.184	0.000	0.17		2.6	SURCHARGED*	
E-1.007	MH19	30 Winter	2	+0%	1/15 Summer				35.532	1.242	0.000	4.28		32.7	SURCHARGED	
E-9.000	MH23	360 Winter	2	+0%					37.075	-0.190	0.000	0.06		2.7	OK	
E-9.001	BEND3	360 Winter	2	+0%					36.887	-0.191	0.000	0.05		2.7	OK*	
E-1.008	MH21	30 Winter	2	+0%	1/15 Summer				35.213	0.923	0.000	2.21		35.2	SURCHARGED	
E-1.009	MH21A	30 Winter	2	+0%	1/15 Summer				34.582	0.422	0.000	2.25		35.3	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.360 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	EX-G1	15 Winter	30	+0%	100/15 Summer	100/30 Winter			37.372	-0.084	0.000	0.39		6.6	OK	2
E-1.001	MH13A	30 Winter	30	+0%	30/15 Winter	100/15 Summer			37.319	0.169	0.000	0.33		7.5	SURCHARGED	7
E-1.002	MH12	30 Winter	30	+0%	30/15 Summer				37.308	0.463	0.000	0.33		7.1	SURCHARGED*	9
E-2.000	EX-RG1	30 Winter	30	+0%	30/15 Summer	100/15 Summer			37.307	0.564	0.000	0.50		7.8	SURCHARGED	9
E-1.003	MH10	30 Winter	30	+0%	30/15 Summer	100/15 Summer			37.298	0.638	0.000	0.34		22.9	SURCHARGED	8
E-3.000	EX-RG2	30 Winter	30	+0%	1/15 Summer	100/15 Summer			37.269	2.625	0.000	0.21		2.4	SURCHARGED	6
E-1.004	MH11	30 Winter	30	+0%	1/15 Summer	100/15 Winter			37.267	2.657	0.000	1.24		18.6	SURCHARGED	2
E-4.000	MH20	30 Winter	30	+0%	1/15 Summer				37.202	2.647	0.000	0.51		5.5	SURCHARGED	
E-4.001	BEND1	360 Winter	30	+0%					34.534	0.000	0.000	0.19		2.6	SURCHARGED*	
E-4.002	EX-RG3	30 Winter	30	+0%	1/15 Summer	100/15 Summer			37.195	2.711	0.000	0.84		9.1	SURCHARGED	8
E-1.005	N1	360 Winter	30	+0%					34.462	0.000	0.000	0.75		12.1	SURCHARGED*	
E-5.000	EX-RG4	30 Winter	30	+0%	1/15 Summer	100/15 Winter			37.054	2.637	0.000	0.14		2.0	SURCHARGED	3
E-1.006	N2	60 Winter	30	+0%					34.359	0.000	0.000	1.57		25.5	SURCHARGED*	
E-6.000	MH15	15 Winter	30	+0%	30/15 Summer	100/15 Summer			37.481	0.331	0.000	1.03		22.9	SURCHARGED	8
E-7.000	RG1	30 Winter	30	+0%	30/15 Summer	100/15 Summer			37.327	0.546	0.000	0.41		6.1	SURCHARGED	4
E-6.001	MH16	30 Winter	30	+0%	30/15 Summer				37.319	0.599	0.000	0.54		29.4	SURCHARGED	
E-6.002	MH17	30 Winter	30	+0%	1/15 Summer				37.115	2.545	0.000	2.23		25.8	SURCHARGED	
E-6.003	BEND2	480 Winter	30	+0%					34.536	0.000	0.000	0.22		5.9	SURCHARGED*	
E-8.000	MH19a	30 Winter	30	+0%	1/15 Summer				36.920	2.565	0.000	0.39		5.9	SURCHARGED*	
E-1.007	MH19	30 Winter	30	+0%	1/15 Summer				36.908	2.618	0.000	6.07		46.4	SURCHARGED	
E-9.000	MH23	360 Winter	30	+0%					37.075	-0.190	0.000	0.06		2.7	OK	
E-9.001	BEND3	360 Winter	30	+0%					36.887	-0.191	0.000	0.05		2.7	OK*	
E-1.008	MH21	30 Winter	30	+0%	1/15 Summer				36.271	1.981	0.000	3.05		48.6	SURCHARGED	
E-1.009	MH21A	30 Winter	30	+0%	1/15 Summer				35.064	0.904	0.000	3.11		48.8	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Existing Foul - Converted Base Flow

Simulation Criteria

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

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

Synthetic Rainfall Details

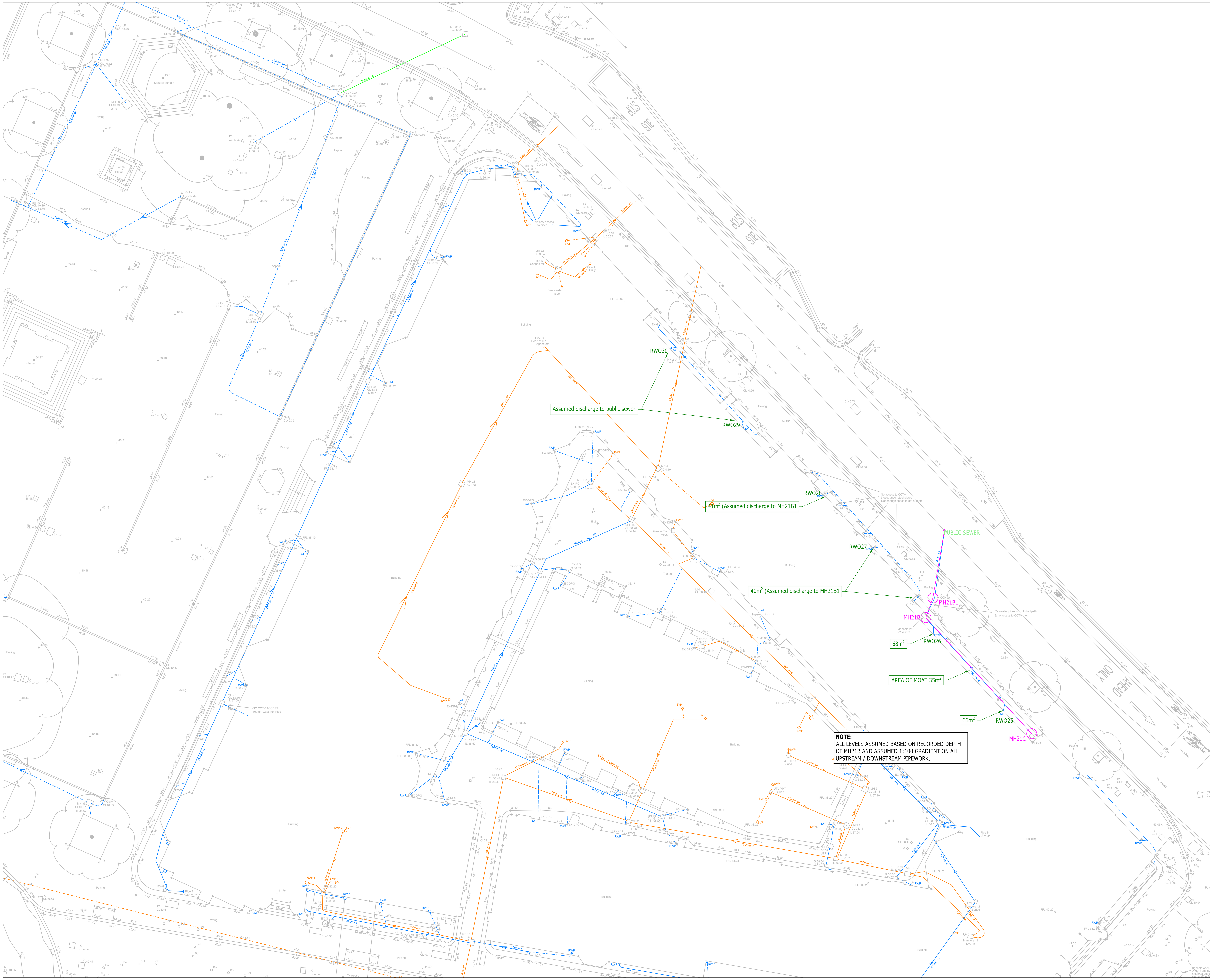
Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.360 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	EX-G1	60 Winter	100	+40%	100/15 Summer	100/30 Winter			38.101	0.645	0.958	0.37		6.4	FLOOD	2
E-1.001	MH13A	15 Winter	100	+40%	30/15 Winter	100/15 Summer			38.100	0.950	0.203	0.52		11.6	FLOOD	7
E-1.002	MH12	120 Winter	100	+40%	30/15 Summer				38.070	1.225	0.000	0.36		7.6	FLOOD RISK*	9
E-2.000	EX-RG1	60 Winter	100	+40%	30/15 Summer	100/15 Summer			38.069	1.326	9.086	1.24		19.2	FLOOD	9
E-1.003	MH10	60 Winter	100	+40%	30/15 Summer	100/15 Summer			38.077	1.417	6.982	0.31		21.0	FLOOD	8
E-3.000	EX-RG2	30 Winter	100	+40%	1/15 Summer	100/15 Summer			38.082	3.438	1.548	0.50		5.8	FLOOD	6
E-1.004	MH11	15 Winter	100	+40%	1/15 Summer	100/15 Winter			38.120	3.510	0.024	1.38		20.9	FLOOD	2
E-4.000	MH20	30 Winter	100	+40%	1/15 Summer				38.088	3.533	0.000	0.58		6.3	FLOOD RISK	
E-4.001	BEND1	30 Winter	100	+40%					34.534	0.000	0.000	0.63		8.8	SURCHARGED*	
E-4.002	EX-RG3	30 Winter	100	+40%	1/15 Summer	100/15 Summer			38.055	3.571	4.880	1.54		16.7	FLOOD	8
E-1.005	N1	30 Winter	100	+40%					34.462	0.000	0.000	1.69		27.1	SURCHARGED*	
E-5.000	EX-RG4	30 Winter	100	+40%	1/15 Summer	100/15 Winter			38.051	3.634	0.550	0.57		8.5	FLOOD	3
E-1.006	N2	15 Winter	100	+40%					34.359	0.000	0.000	2.08		33.6	SURCHARGED*	
E-6.000	MH15	30 Winter	100	+40%	30/15 Summer	100/15 Summer			38.114	0.964	14.305	0.97		21.5	FLOOD	8
E-7.000	RG1	30 Winter	100	+40%	30/15 Summer	100/15 Summer			38.161	1.380	0.692	0.73		10.8	FLOOD	4
E-6.001	MH16	30 Summer	100	+40%	30/15 Summer				38.155	1.435	0.000	0.56		30.0	FLOOD RISK	
E-6.002	MH17	30 Winter	100	+40%	1/15 Summer				38.097	3.527	0.000	2.28		26.4	FLOOD RISK	
E-6.003	BEND2	60 Winter	100	+40%					34.536	0.000	0.000	0.80		21.2	SURCHARGED*	
E-8.000	MH19a	30 Winter	100	+40%	1/15 Summer				38.003	3.648	0.000	1.14		17.2	FLOOD RISK*	
E-1.007	MH19	30 Winter	100	+40%	1/15 Summer				37.914	3.624	0.000	7.64		58.4	FLOOD RISK	
E-9.000	MH23	360 Winter	100	+40%					37.075	-0.190	0.000	0.06		2.7	OK	
E-9.001	BEND3	30 Winter	100	+40%					36.999	-0.079	0.000	0.08		4.0	OK*	
E-1.008	MH21	30 Winter	100	+40%	1/15 Summer				36.993	2.703	0.000	3.50		55.8	SURCHARGED	
E-1.009	MH21A	30 Winter	100	+40%	1/15 Summer				35.402	1.242	0.000	3.59		56.3	SURCHARGED	

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Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	1000	3000	5000	7000				
1:200	mm	5000	8000	12000	16000				
1:500	M	5	15	25	35				
1:1250	M	10	30	50	70	90			

Notes:

Drawings are based on survey data and may not accurately represent what is physically present.
Do not scale from this drawing. All dimensions are to be verified on site before proceeding with the work.
All dimensions are in millimeters unless noted otherwise.
Purcell shall be notified in writing of any discrepancies.
All levels are in metres above ordnance datum U.N.O.
This drawing is to be read in conjunction with all relevant architects and engineers drawings and specifications.
The following information has been used in the design check:

- Powers & Tiltman CCTV Drainage Survey Plan; dwg no 7989/03 dated 06/08/18
- Arup drawing 256650-N-2XX28 dated 5th November 2018
- Roof Area Calculations from Arup drawing OTH-ARU-TH-XX-DWG-N-2XX26 dated 5th November 2018
- Existing foul discharge units calculated using Purcell General Arrangement Plans OTH-PUR-TH-01-DWG-A-0120 to 0128

Where no direct cover level has been provided, unless stated otherwise an assumption has been made based on the nearest topographical level as shown on the cctv drainage survey plan.
Where no invert level has been provided, unless stated otherwise a level has been assumed based on an assumed 1:100 pipe gradient from the upstream manhole.

ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	26/11/2018	LS	TM	INFORMATION
P01	05/09/2018	LS	TM	INFORMATION

OUR TOWN HALL PROJECT

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PROJECT STATUS	PRELIMINARY
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	EXISTING DRAINAGE NETWORK 1
SIZE & SCALE	A1: 1:200
DRAWING STATUS	For Information
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-XX-XX-SKE-C-0010
REV	P02

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26 November 2018
12:10:06

Time Area Diagram for Existing

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.020	4-8	0.005

Total Area Contributing (ha) = 0.025

Total Pipe Volume (m^3) = 0.513

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Existing Network Details for Existing

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
E-1.000	18.483	0.190	97.3	0.017	5.00	0.0	0.600	o	150	Pipe/Conduit
E-1.001	2.463	0.025	98.5	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit
E-1.002	8.070	0.085	94.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E-1.000	37.900	0.017	0.0	1.02	18.0
E-1.001	37.710	0.025	0.0	1.01	17.9
E-1.002	37.685	0.025	0.0	1.03	18.2

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Manhole Schedules for Existing

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
MH21C	41.040	3.140	Open Manhole	1200	E-1.000	37.900	150				
MH21B	40.920	3.210	Open Manhole	1200	E-1.001	37.710	150	E-1.000	37.710	150	
MH21B1	40.880	3.195	Open Manhole	1200	E-1.002	37.685	150	E-1.001	37.685	150	
PUBLIC SEWER	40.830	3.230	Open Manhole	0		OUTFALL		E-1.002	37.600	150	

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PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	o	150	MH21C	41.040	37.900	2.990	Open Manhole	1200
E-1.001	o	150	MH21B	40.920	37.710	3.060	Open Manhole	1200
E-1.002	o	150	MH21B1	40.880	37.685	3.045	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	18.483	97.3	MH21B	40.920	37.710	3.060	Open Manhole	1200
E-1.001	2.463	98.5	MH21B1	40.880	37.685	3.045	Open Manhole	1200
E-1.002	8.070	94.9	PUBLIC SEWER	40.830	37.600	3.080	Open Manhole	0

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Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.017	0.017	0.017
1.001	-	-	100	0.008	0.008	0.008
1.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.025	0.025	0.025

Free Flowing Outfall Details for Existing

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E-1.002	PUBLIC SEWER	40.830	37.600	0.000	0	0

Simulation Criteria for Existing

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Region England and Wales		Ratio R	0.358	Cv (Summer)	0.750
Storm Duration (mins)	30	Return Period (years)	2	M5-60 (mm)	18.000	Profile Type	Summer Cv (Winter) 0.840

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.356 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH21C	15 Winter	2	+0%					37.940	-0.110	0.000	0.15		2.6	OK	
E-1.001	MH21B	15 Winter	2	+0%	100/15 Summer				37.771	-0.089	0.000	0.34		3.7	OK	
E-1.002	MH21B1	15 Winter	2	+0%					37.734	-0.101	0.000	0.23		3.7	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.356 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH21C	15 Winter	30	+0%					37.956	-0.094	0.000	0.29		4.9	OK	
E-1.001	MH21B	15 Winter	30	+0%	100/15 Summer				37.802	-0.058	0.000	0.67		7.3	OK	
E-1.002	MH21B1	15 Winter	30	+0%					37.757	-0.078	0.000	0.47		7.4	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

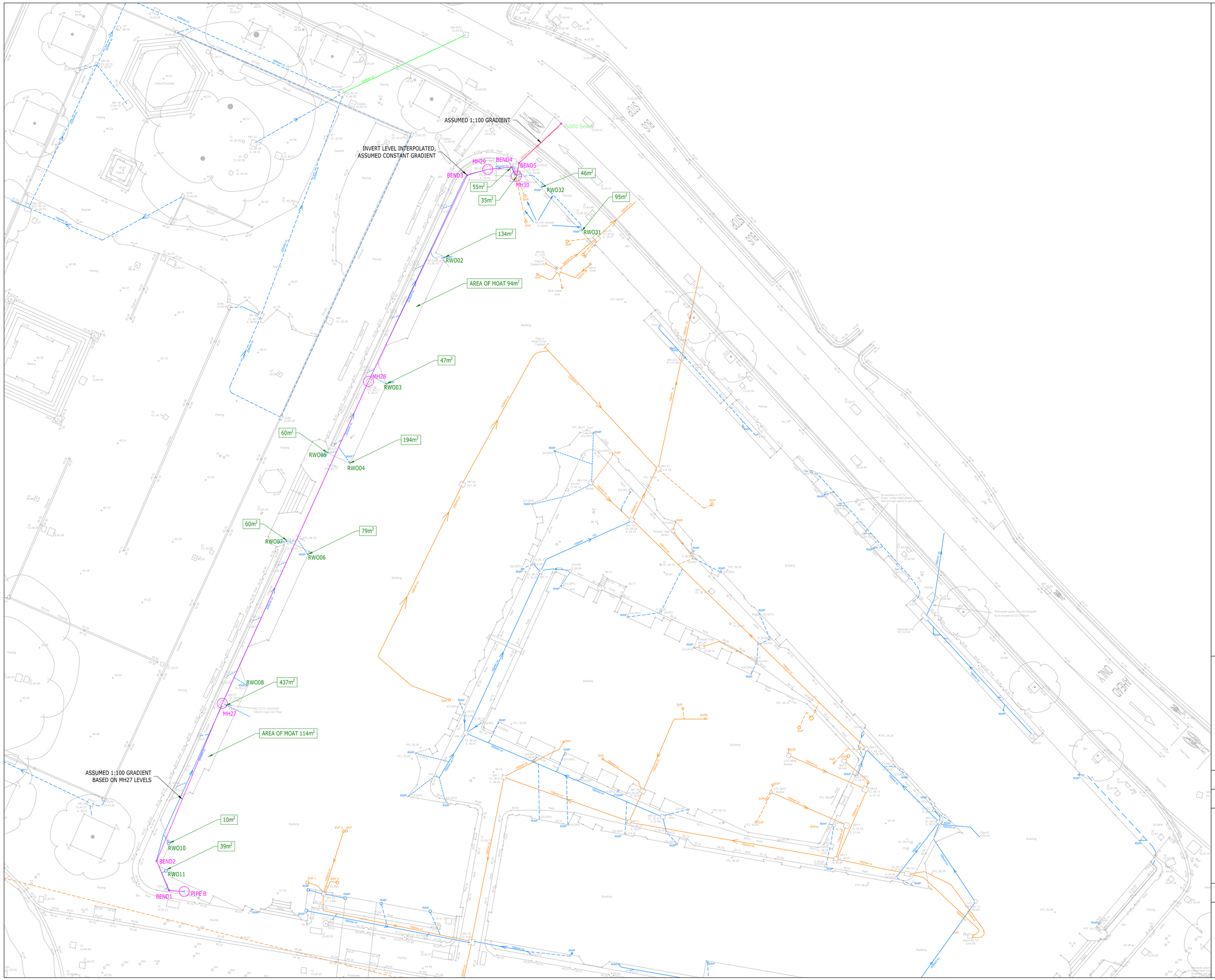
Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.356 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	MH21C	15 Winter	100	+40%					37.979	-0.071	0.000	0.53		8.9	OK	
E-1.001	MH21B	15 Winter	100	+40%	100/15 Summer				37.877	0.017	0.000	1.23		13.3	SURCHARGED	
E-1.002	MH21B1	15 Winter	100	+40%					37.793	-0.042	0.000	0.85		13.5	OK	

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Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	1000		3000		5000	7000
1:200	mm		2000		4000		6000
1:500	M	5		15	25		35
1:250	M	10	30	50	70	90	

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ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	26/11/2018	LS	TM	INFORMATION
P01	05/09/2018	LS	TM	INFORMATION

OUR TOWN HALL PROJECT

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Project Office, Room 308, Town Hall, MANCHESTER M60 2L1
+44 (0) 7970 097 432
www.purcelluk.com

PROJECT STATUS	PRELIMINARY
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	EXISTING DRAINAGE NETWORK 1
SIZE & SCALE	A1: 1:200
DRAWING STATUS	For Information
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-XX-XX-SKE-C-0011
REV	P02

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26 November 2018
12:12:45

Time Area Diagram for Existing

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.116	4-8	0.034

Total Area Contributing (ha) = 0.150

Total Pipe Volume (m³) = 4.026

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Existing Network Details for Existing

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	
E-1.000	1.784	0.018	99.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
E-1.001	3.770	0.038	99.2	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	
E-1.002	20.111	0.201	100.1	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
E-1.003	41.642	0.290	143.6	0.083	0.00	0.0	0.600	o	225	Pipe/Conduit	
E-1.004	26.927	0.283	95.1	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
E-1.005	2.511	0.025	100.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
E-1.006	2.835	0.358	7.9	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	← Pipe reduces in size
E-1.007	1.205	0.152	7.9	0.009	0.00	0.0	0.600	o	100	Pipe/Conduit	
E-1.008	1.581	0.016	98.8	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
E-1.009	6.772	0.068	99.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	← Outfall to public sewer

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E-1.000	37.257	0.000	0.0	1.31	52.2
E-1.001	37.239	0.004	0.0	1.31	52.2
E-1.002	37.201	0.016	0.0	1.31	52.0
E-1.003	37.000	0.099	0.0	1.09	43.3
E-1.004	36.710	0.127	0.0	1.34	53.3
E-1.005	36.425	0.127	0.0	1.30	51.9
E-1.006	36.400	0.127	0.0	2.76	21.7
E-1.007	36.042	0.136	0.0	2.76	21.7
E-1.008	35.890	0.150	0.0	1.01	17.9
E-1.009	35.874	0.150	0.0	1.01	17.8

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Manhole Schedules for Existing

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
PIPE B	38.100	0.843	Sealed Manhole	1200	E-1.000	37.257	225				
BEND1	38.160	0.921	Junction		E-1.001	37.239	225	E-1.000	37.239	225	
BEND2	38.160	0.959	Junction		E-1.002	37.201	225	E-1.001	37.201	225	
MH27	38.160	1.160	Open Manhole	1200	E-1.003	37.000	225	E-1.002	37.000	225	
MH28	38.170	1.460	Open Manhole	1200	E-1.004	36.710	225	E-1.003	36.710	225	
BEND3	38.160	1.735	Junction		E-1.005	36.425	225	E-1.004	36.427	225	2
MH29	38.160	1.760	Open Manhole	1200	E-1.006	36.400	100	E-1.005	36.400	225	
BEND4	38.120	2.078	Junction		E-1.007	36.042	100	E-1.006	36.042	100	
MH30	38.120	2.230	Open Manhole	1200	E-1.008	35.890	150	E-1.007	35.890	100	
BEND5	40.380	4.506	Junction		E-1.009	35.874	150	E-1.008	35.874	150	
Public Sewer	40.380	4.574	Open Manhole	0		OUTFALL		E-1.009	35.806	150	

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PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	o	225	PIPE B	38.100	37.257	0.618	Sealed Manhole	1200
E-1.001	o	225	BEND1	38.160	37.239	0.696	Junction	
E-1.002	o	225	BEND2	38.160	37.201	0.734	Junction	
E-1.003	o	225	MH27	38.160	37.000	0.935	Open Manhole	1200
E-1.004	o	225	MH28	38.170	36.710	1.235	Open Manhole	1200
E-1.005	o	225	BEND3	38.160	36.425	1.510	Junction	
E-1.006	o	100	MH29	38.160	36.400	1.660	Open Manhole	1200
E-1.007	o	100	BEND4	38.120	36.042	1.978	Junction	
E-1.008	o	150	MH30	38.120	35.890	2.080	Open Manhole	1200
E-1.009	o	150	BEND5	40.380	35.874	4.356	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E-1.000	1.784	99.1	BEND1	38.160	37.239	0.696	Junction	
E-1.001	3.770	99.2	BEND2	38.160	37.201	0.734	Junction	
E-1.002	20.111	100.1	MH27	38.160	37.000	0.935	Open Manhole	1200
E-1.003	41.642	143.6	MH28	38.170	36.710	1.235	Open Manhole	1200
E-1.004	26.927	95.1	BEND3	38.160	36.427	1.508	Junction	
E-1.005	2.511	100.4	MH29	38.160	36.400	1.535	Open Manhole	1200
E-1.006	2.835	7.9	BEND4	38.120	36.042	1.978	Junction	
E-1.007	1.205	7.9	MH30	38.120	35.890	2.130	Open Manhole	1200
E-1.008	1.581	98.8	BEND5	40.380	35.874	4.356	Junction	
E-1.009	6.772	99.6	Public Sewer	40.380	35.806	4.424	Open Manhole	0

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Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.004	0.004	0.004
1.002	-	-	100	0.012	0.012	0.012
1.003	-	-	100	0.083	0.083	0.083
1.004	-	-	100	0.028	0.028	0.028
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.009	0.009	0.009
1.008	-	-	100	0.014	0.014	0.014
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.150	0.150	0.150

Free Flowing Outfall Details for Existing

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E-1.009	Public Sewer	40.380	35.806	0.000	0	0

Simulation Criteria for Existing

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Region	England and Wales	Ratio R	0.358	Cv (Summer)	0.750
Storm Duration (mins)	30	Return Period (years)	2	M5-60 (mm)	18.000	Profile Type	Summer
Cv (Winter)	0.840						

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.359 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 30

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	PIPE B	360 Winter	1	+0%	100/15 Summer				37.257	-0.225	0.000	0.00		0.0	OK	
E-1.001	BEND1	15 Winter	1	+0%					37.253	-0.211	0.000	0.01		0.4	OK*	
E-1.002	BEND2	15 Winter	1	+0%					37.227	-0.199	0.000	0.03		1.6	OK*	
E-1.003	MH27	15 Winter	1	+0%	30/15 Winter				37.076	-0.149	0.000	0.24		9.9	OK	
E-1.004	MH28	15 Winter	1	+0%	30/15 Summer				36.787	-0.148	0.000	0.25		12.6	OK	
E-1.005	BEND3	15 Winter	1	+0%	30/15 Summer				36.527	-0.123	0.000	0.42		12.6	OK*	
E-1.006	MH29	15 Winter	1	+0%	2/15 Summer				36.484	-0.016	0.000	0.74		12.3	OK	
E-1.007	BEND4	15 Winter	1	+0%					36.142	0.000	0.000	1.20		13.0	SURCHARGED*	
E-1.008	MH30	15 Winter	1	+0%	1/15 Summer				36.069	0.029	0.000	1.31		14.2	SURCHARGED	
E-1.009	BEND5	15 Winter	1	+0%					35.982	-0.042	0.000	0.87		14.2	OK*	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.359 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	PIPE B	15 Winter	2	+0%	100/15 Summer				37.257	-0.225	0.000	0.00		0.0	OK	
E-1.001	BEND1	15 Winter	2	+0%					37.258	-0.206	0.000	0.02		0.5	OK*	
E-1.002	BEND2	15 Winter	2	+0%					37.230	-0.196	0.000	0.04		2.1	OK*	
E-1.003	MH27	15 Winter	2	+0%	30/15 Winter				37.087	-0.138	0.000	0.31		12.9	OK	
E-1.004	MH28	15 Winter	2	+0%	30/15 Summer				36.799	-0.136	0.000	0.33		16.3	OK	
E-1.005	BEND3	15 Winter	2	+0%	30/15 Summer				36.620	-0.030	0.000	0.48		14.4	OK*	
E-1.006	MH29	15 Winter	2	+0%	2/15 Summer				36.614	0.114	0.000	0.84		13.9	SURCHARGED	
E-1.007	BEND4	60 Winter	2	+0%					36.142	0.000	0.000	1.00		10.9	SURCHARGED*	
E-1.008	MH30	15 Winter	2	+0%	1/15 Summer				36.083	0.043	0.000	1.48		16.0	SURCHARGED	
E-1.009	BEND5	15 Winter	2	+0%					35.992	-0.032	0.000	0.98		16.0	OK*	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.359 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 30

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	PIPE B	15 Winter	30	+0%	100/15 Summer				37.269	-0.213	0.000	0.00		0.1	OK	
E-1.001	BEND1	15 Winter	30	+0%					37.283	-0.181	0.000	0.04		1.3	OK*	
E-1.002	BEND2	15 Winter	30	+0%					37.290	-0.136	0.000	0.10		5.0	OK*	
E-1.003	MH27	15 Winter	30	+0%	30/15 Winter				37.287	0.062	0.000	0.72		29.8	SURCHARGED	
E-1.004	MH28	15 Winter	30	+0%	30/15 Summer				37.245	0.310	0.000	0.60		29.4	SURCHARGED	
E-1.005	BEND3	60 Winter	30	+0%	30/15 Summer				36.652	0.002	0.000	0.55		16.4	SURCHARGED*	
E-1.006	MH29	15 Winter	30	+0%	2/15 Summer				37.172	0.672	0.000	1.14		18.9	SURCHARGED	
E-1.007	BEND4	180 Winter	30	+0%					36.142	0.000	0.000	0.94		10.2	SURCHARGED*	
E-1.008	MH30	15 Winter	30	+0%	1/15 Summer				36.198	0.158	0.000	2.02		21.9	SURCHARGED	
E-1.009	BEND5	60 Winter	30	+0%					36.024	0.000	0.000	1.17		19.1	SURCHARGED*	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.359 Cv (Summer) 0.750 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E-1.000	PIPE B	15 Winter	100	+30%	100/15 Summer				38.075	0.593	0.000	0.08		2.3	FLOOD RISK*	
E-1.001	BEND1	60 Winter	100	+30%					37.464	0.000	0.000	0.09		2.7	SURCHARGED*	
E-1.002	BEND2	60 Winter	100	+30%					37.426	0.000	0.000	0.10		5.4	SURCHARGED*	
E-1.003	MH27	15 Winter	100	+30%	30/15 Winter				38.075	0.850	0.000	0.81		33.3	FLOOD RISK	
E-1.004	MH28	15 Winter	100	+30%	30/15 Summer				38.017	1.082	0.000	0.66		32.8	FLOOD RISK	
E-1.005	BEND3	180 Winter	100	+30%	30/15 Summer				36.652	0.002	0.000	0.52		15.4	SURCHARGED*	
E-1.006	MH29	15 Winter	100	+30%	2/15 Summer				37.890	1.390	0.000	1.42		23.6	FLOOD RISK	
E-1.007	BEND4	240 Winter	100	+30%					36.142	0.000	0.000	1.28		13.9	SURCHARGED*	
E-1.008	MH30	15 Winter	100	+30%	1/15 Summer				36.371	0.331	0.000	2.63		28.5	SURCHARGED	
E-1.009	BEND5	180 Winter	100	+30%					36.024	0.000	0.000	1.11		18.1	SURCHARGED*	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.000 Ratio R 0.359 Cv (Summer) 0.750 Cv (Winter) 0.840

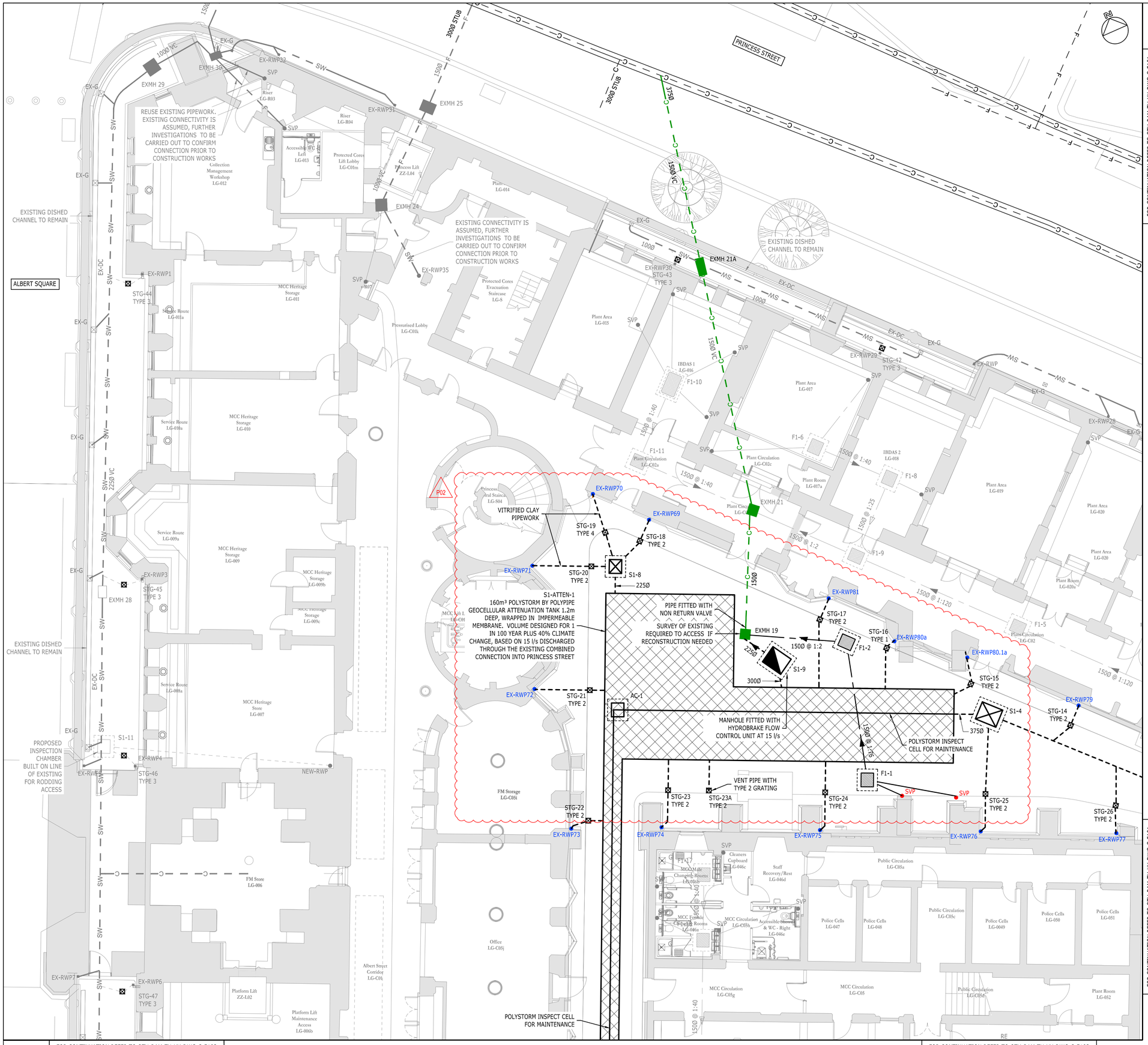
Margin for Flood Risk Warning (mm) 300.0 DTS Status OFF Inertia Status ON
Analysis Timestep 2.5 Second Increment (Extended) DVD Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	
E-1.000	PIPE B	15 Winter	100	+40%	100/15 Summer				38.100	0.618	0.000	0.08		2.4	FLOOD RISK*		
E-1.001	BEND1	60 Winter	100	+40%					37.464	0.000	0.000	0.10		3.0	SURCHARGED*		
E-1.002	BEND2	60 Winter	100	+40%					37.426	0.000	0.000	0.11		5.6	SURCHARGED*		
E-1.003	MH27	30 Winter	100	+40%	100/15 Summer	100/15 Winter			38.161	0.936	1.009	0.71		29.1	FLOOD	2	← 40% Climate Change check causes 1m³ of flooding into the moat
E-1.004	MH28	15 Winter	100	+40%	100/15 Summer				38.131	1.196	0.000	0.68		33.5	FLOOD RISK		
E-1.005	BEND3	180 Winter	100	+40%	100/15 Summer				36.652	0.002	0.000	0.54		16.2	SURCHARGED*		
E-1.006	MH29	30 Winter	100	+40%	100/15 Summer				38.008	1.508	0.000	1.47		24.5	FLOOD RISK		
E-1.007	BEND4	360 Winter	100	+40%					36.142	0.000	0.000	1.03		11.1	SURCHARGED*		
E-1.008	MH30	15 Winter	100	+40%	100/15 Summer				36.405	0.365	0.000	2.74		29.7	SURCHARGED		
E-1.009	BEND5	180 Winter	100	+40%					36.024	0.000	0.000	1.16		19.0	SURCHARGED*		

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APPENDIX 5
PROPOSED DRAINAGE DRAWINGS



5. THIS DRAWING HAS BEEN CREATED USING THE FOLLOWING INFORMATION:

- UTILITIES SURVEY BY POWERS AND TILTMAN DATED FEBRUARY/MARCH 2018
- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18
- PROPOSED EXTERNAL LEVELS PLAN BY PLAN IT, DRAWING NUMBER OTH-PLA-EE-XX-CAD-L-0008
- PROPOSED GROUND FLOOR PLAN BY PURCELL, DRAWING NUMBER 01-DWG-A-0121 EXPORTED 14.04.19
- PROPOSED SERVICES PLAN BY ARUP

6. ANY DISCREPANCIES IN DIMENSIONS OR DETAILS ON OR BETWEEN DRAWINGS SHOULD BE DRAWN TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION.

7. THIS DRAWING HAS BEEN DEVELOPED USING INFORMATION PROVIDED TO RAMBOLL BY A NUMBER OF THIRD PARTIES. RAMBOLL CAN ACCEPT NO RESPONSIBILITY FOR THE ACCURACY OF THE THIRD PARTY INFORMATION SHOWN.

8. FOR DRAINAGE SCHEDULE REFER TO DRAWING OTH-RAM-XX-XX-DWG-C-5200

9. FOR DRAINAGE DETAILS REFER TO DRAWING SERIES OTH-RAM-XX-XX-DWG-C-5400

10. ALL DRAINAGE WORKS CARRIED OUT IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, BS EN 752 (2008), BUILDING REGULATIONS PART H, RELEVANT WATER AUTHORITY STANDARDS, LOCAL COUNCIL STANDARDS AND HEALTH AND SAFETY POLICIES.

11. PIPES ARE NOT DESIGNED FOR CONSTRUCTION TRAFFIC, CONTRACTOR WILL TAKE NECESSARY PRECAUTIONS TO PROTECT PIPES DURING CONSTRUCTION. EXISTING DRAINAGE WHICH IS TO REMAIN IN THE PROPOSED WORKS TO BE PROTECTED AT ALL TIMES.

12. IT IS ASSUMED THAT ALL ABOVE GROUND DRAINAGE CONNECTIONS ARE RODDABLE AND VENTED FROM ABOVE GROUND. PUBLIC HEALTH ENGINEER TO CONFIRM ABOVE GROUND VENTING.

13. CONCRETE FOR GENERAL DRAINAGE WORKS DESIGNATED MIX GEN 3 TO BS 8500 - 1:2006, BS EN 206 - 1:2013 AND ENGINEERS SPECIFICATION.

14. ALL SURFACE WATER PIPES TO BE STRUCTURED WALL HDPE TO BS EN 13476-1 AND -3, KITEMARKED, AGREMENT CERTIFIED OR CE MARKED APART FROM RWP'S TO SILT TRAP

15. ALL FOUL WATER PIPES TO BE VITRIFIED CLAY TO BS EN 295-1:1991/BS 65 AS APPROPRIATE , KITEMARKED, AGREMENT CERTIFIED OR CE MARKED U.N.O.

16. ANY PIPEWORK WHICH IS CAST INTO FOUNDATIONS OR THROUGH GROUND BEAMS TO BE CAST IRON.

17. BRICK MANHOLES TO BE CONSTRUCTED USING CLASS B ENGINEERING BRICK IN ACCORDANCE WITH BS EN 771-1:2011, BS 5628-1:2005, AND PD 6697:2010.

18. POLYPROPYLENE INSPECTION CHAMBER TO BE IN ACCORDANCE WITH B57158 OR BSEN13598-1 OR AGREEMENT CERTIFIED MINIMUM INTERNAL DIAMETER 450mm UNO.

19. ALL FOUL BRANCH CONNECTIONS TO BE DN100 AT 1:40 MINIMUM GRADIENT U.N.O. HEAD OF BRANCH IL=37.450 U.N.O.

20. ALL SURFACE WATER BRANCHES FROM RAIN WATER DOWN PIPES , INTO SILT TRAP TO BE DN150 AT 1:60 MINIMUM GRADIENT. ALL OTHER SURFACE WATER BRANCHES TO BE DN150 AT 1:80 UNO.

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26. THIS DRAWING IS THE COPYRIGHT OF RAMBOLL.UK.

Scale Bars to be used as guidance only - refer to sheet size below

1:100	mm	1000	4000	5000	7000	
	m	10	40	50	70	100
1:200	mm	2000	4000	6000	10000	
	m	20	40	60	100	200
1:500	m	5	15	25	35	
1:1250	m	10	30	50	70	90

1. DO NOT SCALE FROM THIS DRAWING

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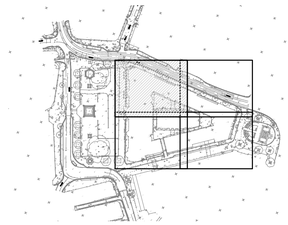
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KEY

EXISTING PUBLIC COMBINED DRAIN/ MANHOLE	— C —
EXISTING PUBLIC FOUL DRAIN/ MANHOLE	— F —
EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE	— SW —
EXISTING PRIVATE COMBINED DRAIN/ MANHOLE	— C —
EXISTING PRIVATE FOUL DRAIN/ MANHOLE	— F —
DRAINAGE UNDER BUILDING	— C —
EXISTING ROAD GULLY	EX-RG
EXISTING GULLY	EX-G
EXISTING RWP TO REMAIN	EX-RWP
PROPOSED NEW SOIL PIPE	SVP
PROPOSED NEW RWP	RWP
PROPOSED SILT TRAP GULLY (REFER TO DETAIL FOR 'TYPE')	STG-XX TYPE X
PROPOSED FOUL WATER MANHOLE	
PROPOSED FOUL WATER DRAIN	
PROPOSED SURFACE WATER MANHOLE	
PROPOSED SURFACE WATER DRAIN	
PROPOSED ATTENUATION	



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	30/04/2019	LS	SG	PLANNING/LBC APPLICATION & STAGE 3+ ISSUE
P01	18/04/2019	LS	SG	DRAFT PLANNING/LBC APPLICATION

OUR TOWN HALL PROJECT

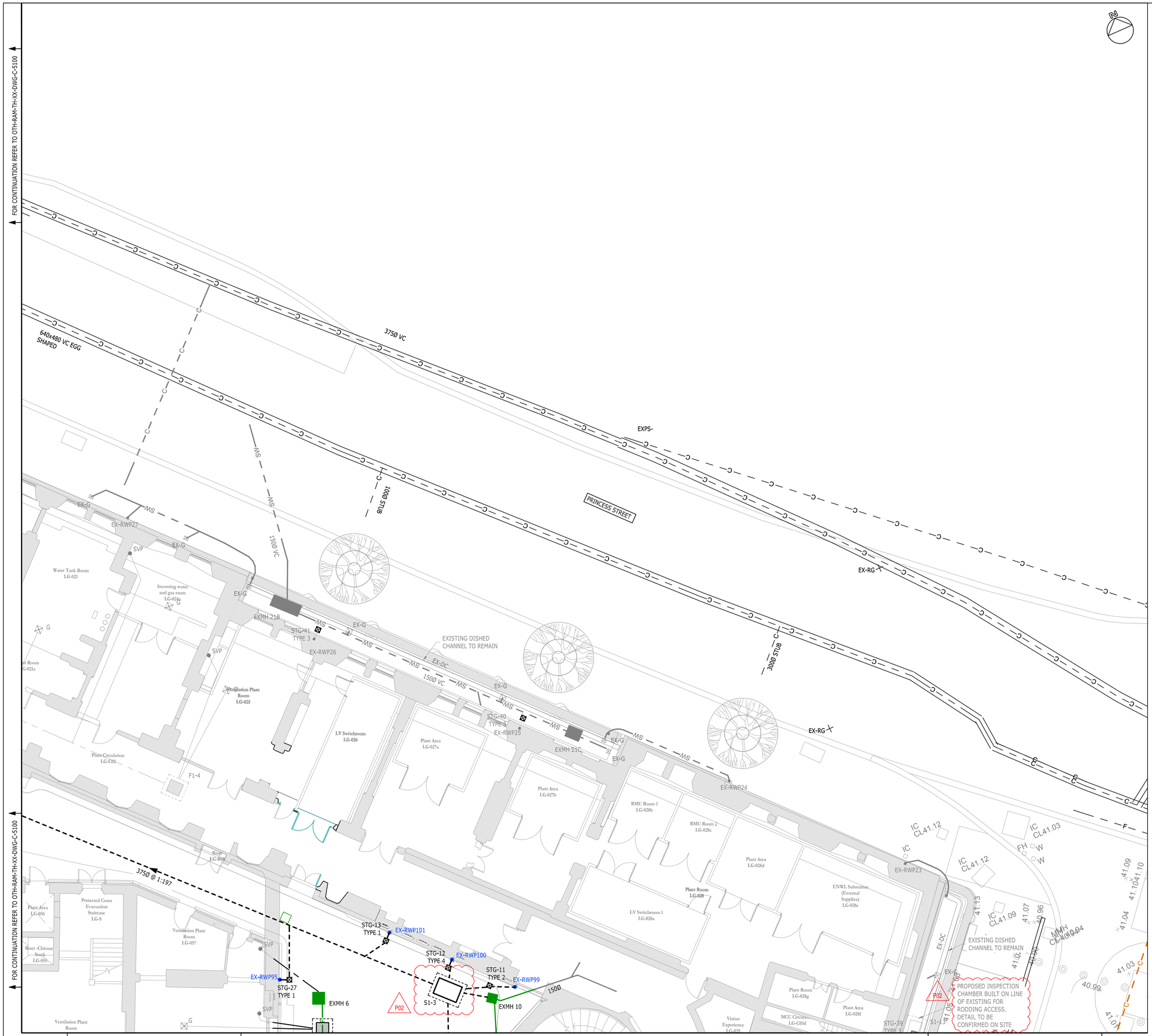
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PROJECT STATUS	STAGE 3
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	PLANNING/LBC APPLICATION ENABLING WORKS DRAINAGE SHEET 1 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-5100
REV	P02

30 April 2019 13:16:52



5. THIS DRAWING HAS BEEN CREATED USING THE FOLLOWING INFORMATION:

- UTILITIES SURVEY BY POWERS AND TILTMAN DATED FEBRUARY/MARCH 2018
- CCTV DRAINAGE SURVEY BY POWERS AND TILTMAN DATED 14/11/18
- PROPOSED EXTERNAL LEVELS PLAN BY PLAN IT, DRAWING NUMBER OTH-PLA-EE-XX-CAD-L-0008
- PROPOSED GROUND FLOOR PLAN BY PURCELL, DRAWING NUMBER 01-DWG-A-0121 EXPORTED 14.04.19
- PROPOSED SERVICES PLAN BY ARUP

6. ANY DISCREPANCIES IN DIMENSIONS OR DETAILS ON OR BETWEEN DRAWINGS SHOULD BE DRAWN TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION.

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8. FOR DRAINAGE SCHEDULE REFER TO DRAWING OTH-RAM-XX-XX-DWG-C-5200

9. FOR DRAINAGE DETAILS REFER TO DRAWING SERIES OTH-RAM-XX-XX-DWG-C-5400

10. ALL DRAINAGE WORKS CARRIED OUT IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, BS EN 752 (2008), BUILDING REGULATIONS PART H, RELEVANT WATER AUTHORITY STANDARDS, LOCAL COUNCIL STANDARDS AND HEALTH AND SAFETY POLICIES.

11. PIPES ARE NOT DESIGNED FOR CONSTRUCTION TRAFFIC, CONTRACTOR WILL TAKE NECESSARY PRECAUTIONS TO PROTECT PIPES DURING CONSTRUCTION. EXISTING DRAINAGE WHICH IS TO REMAIN IN THE PROPOSED WORKS TO BE PROTECTED AT ALL TIMES.

12. IT IS ASSUMED THAT ALL ABOVE GROUND DRAINAGE CONNECTIONS ARE RODDABLE AND VENTED FROM ABOVE GROUND. PUBLIC HEALTH ENGINEER TO CONFIRM ABOVE GROUND VENTING.

13. CONCRETE FOR GENERAL DRAINAGE WORKS DESIGNATED MIX GEN 3 TO BS 8500 - 1:2006, BS EN 206 - 1:2013 AND ENGINEERS SPECIFICATION.

14. ALL SURFACE WATER PIPES TO BE STRUCTURED WALL HDPE TO BS EN 13476-1 AND -3, KITEMARKED, AGREMENT CERTIFIED OR CE MARKED APART FROM RWP'S TO SILT TRAP

15. ALL FOUL WATER PIPES TO BE VITRIFIED CLAY TO BS EN 295-1:1991/BS 65 AS APPROPRIATE , KITEMARKED, AGREMENT CERTIFIED OR CE MARKED U.N.O.

16. ANY PIPEWORK WHICH IS CAST INTO FOUNDATIONS OR THROUGH GROUND BEAMS TO BE CAST IRON.

17. BRICK MANHOLES TO BE CONSTRUCTED USING CLASS B ENGINEERING BRICK IN ACCORDANCE WITH BS EN 771-1:2011, BS 5628-1:2005, AND PD 6697:2010.

18. POLYPROPYLENE INSPECTION CHAMBER TO BE IN ACCORDANCE WITH B57158 OR BSEN13598-1 OR AGREEMENT CERTIFIED MINIMUM INTERNAL DIAMETER 450mm UNO.

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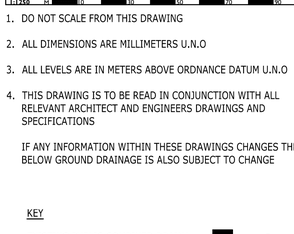
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1:500 m: 5 15 25 35
1:250 M: 10 30 50 70 90

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EXISTING PUBLIC COMBINED DRAIN/ MANHOLE	C
EXISTING PUBLIC FOUL DRAIN/ MANHOLE	F
EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE	SW
EXISTING PRIVATE COMBINED DRAIN/ MANHOLE	C
EXISTING PRIVATE FOUL DRAIN/ MANHOLE	F
DRAINAGE UNDER BUILDING	C
EXISTING ROAD GULLY	EX-RG
EXISTING GULLY	EX-G
EXISTING RWP TO REMAIN	EX-RWP
PROPOSED NEW SOIL PIPE	SVP
PROPOSED NEW RWP	RWP
PROPOSED SILT TRAP GULLY (REFER TO DETAIL FOR 'TYPE')	STG-XX TYPE X
PROPOSED FOUL WATER MANHOLE	
PROPOSED FOUL WATER DRAIN	
PROPOSED SURFACE WATER MANHOLE	
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PROPOSED ATTENUATION	



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	30/04/2019	LS	SG	PLANNING/LBC APPLICATION & STAGE 3+ ISSUE
P01	18/04/2019	LS	SG	DRAFT PLANNING/LBC APPLICATION

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PROJECT STATUS	STAGE 3
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	PLANNING/LBC APPLICATION ENABLING WORKS DRAINAGE SHEET 2 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-5101
REV	P02

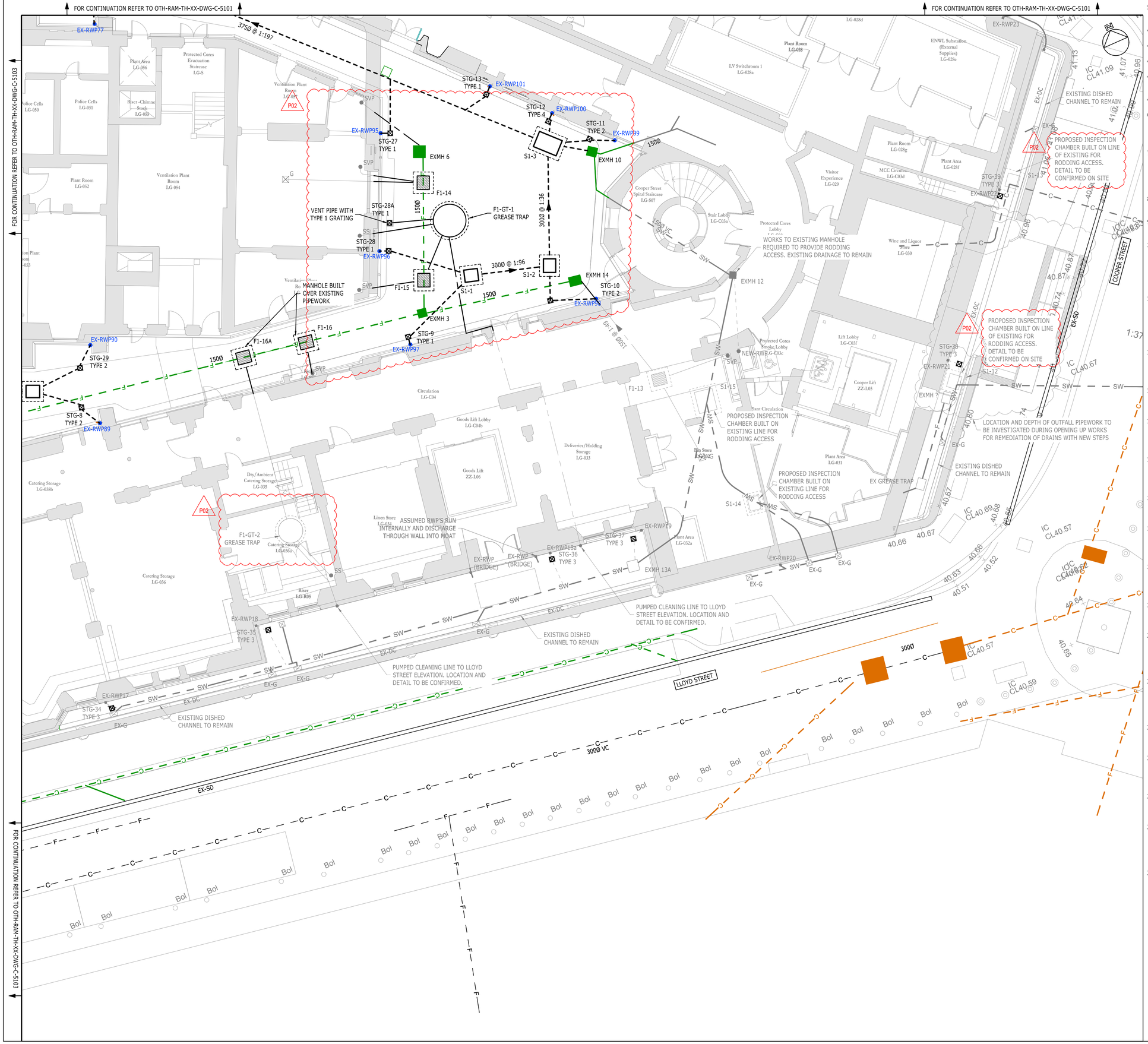
30 April 2019 13:17:58

FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-5101

FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-5103

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FOR CONTINUATION REFER TO OTH-RAM-TH-XX-DWG-C-5103



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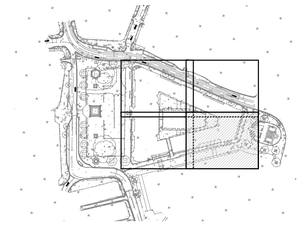
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- EXISTING PRIVATE FOUL DRAIN/ MANHOLE — F
- DRAINAGE UNDER BUILDING — C
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- EXISTING GULLY EX-G
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- PROPOSED ATTENUATION



ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	30/04/2019	LS	SG	PLANNING/LBC APPLICATION & STAGE 3+ ISSUE
P01	18/04/2019	LS	SG	DRAFT PLANNING/LBC APPLICATION

OUR TOWN HALL PROJECT

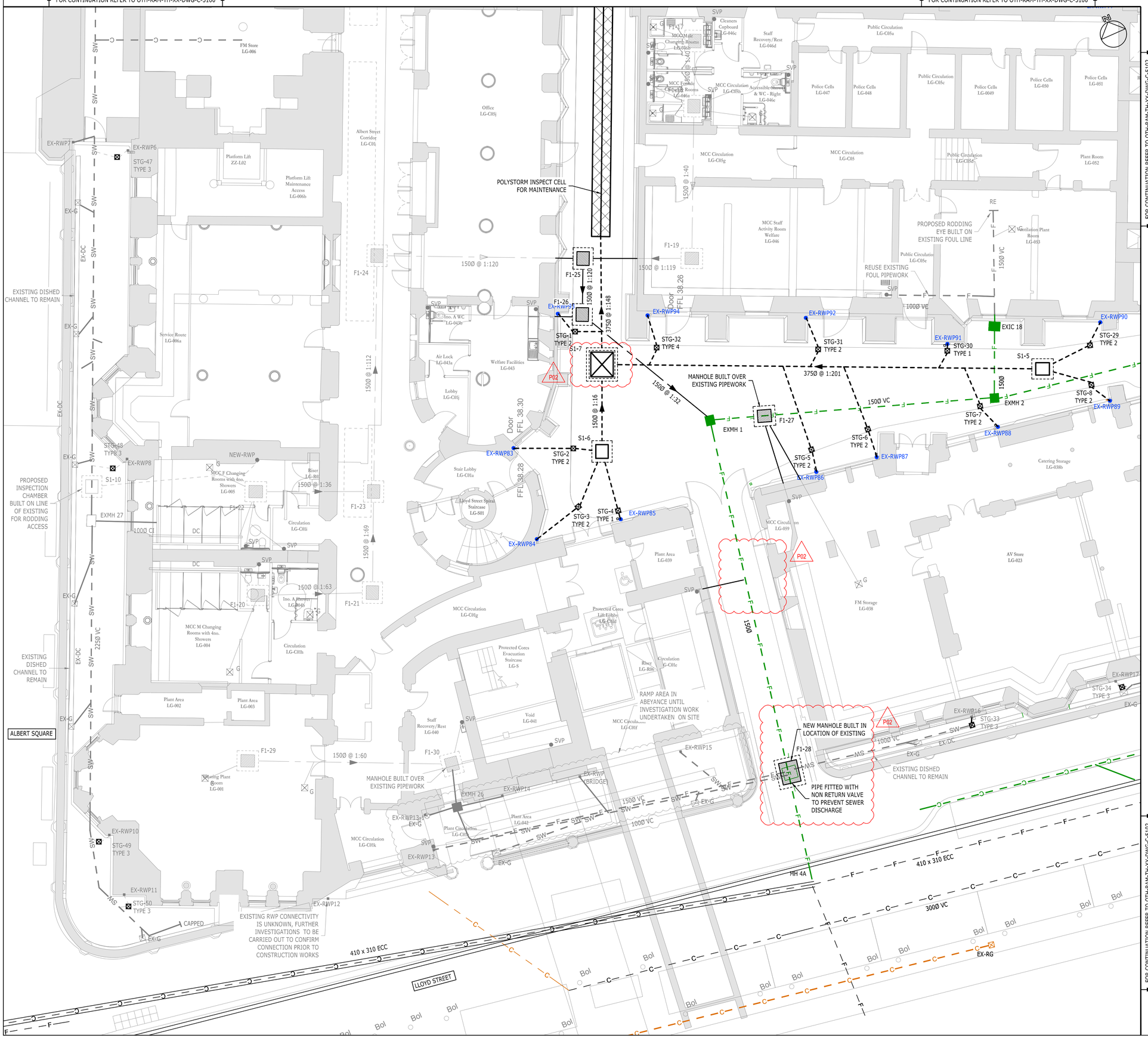
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PROJECT STATUS	STAGE 3
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	PLANNING/LBC APPLICATION ENABLING WORKS DRAINAGE SHEET 3 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D1 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-5102
REV	P02

30 April 2019 13:19:05



5. THIS DRAWING HAS BEEN CREATED USING THE FOLLOWING INFORMATION:
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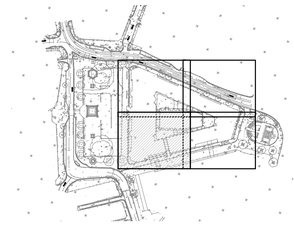
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- EXISTING PRIVATE SURFACE WATER DRAIN/MANHOLE — SW —
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ISSUE	DATE	APPROVED	DRAWN	DESCRIPTION
P02	30/04/2019	LS	SG	PLANNING/LBC APPLICATION & STAGE 3+ ISSUE
P01	18/04/2019	LS	SG	DRAFT PLANNING/LBC APPLICATION

OUR TOWN HALL PROJECT

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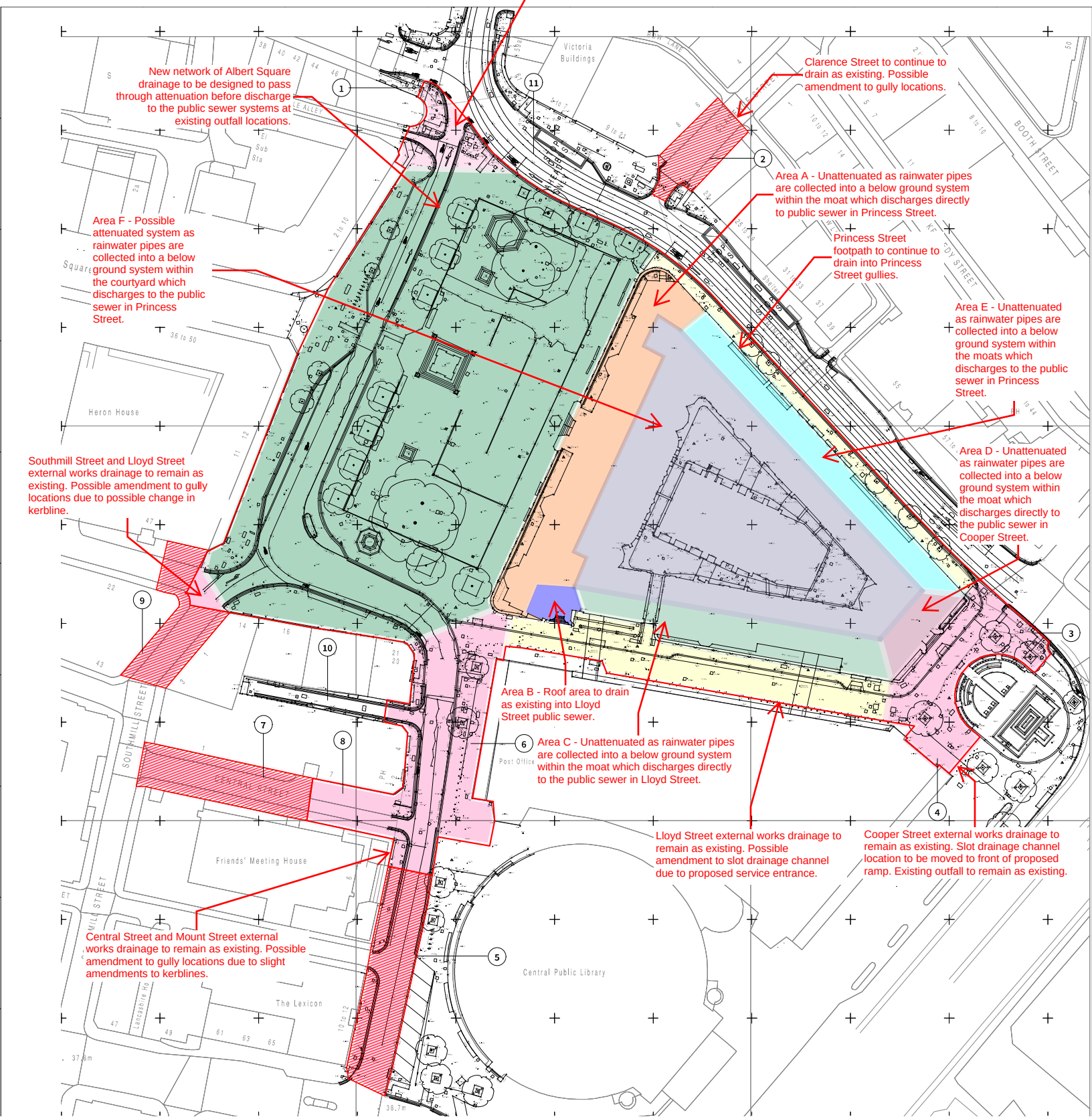
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PROJECT STATUS	STAGE 3
CLIENT	MANCHESTER CITY COUNCIL
PROJECT	OUR TOWN HALL PROJECT
DRAWING TITLE	PLANNING/LBC APPLICATION ENABLING WORKS DRAINAGE SHEET 4 OF 4
SIZE & SCALE	A1: 1:100
DRAWING STATUS	D4 - COSTING
JOB NUMBER	1620003165
DRAWING NO.	OTH-RAM-TH-XX-DWG-C-5103
REV	P02

30 April 2019 13:21:21

APPENDIX 6
PROPOSED DRAINAGE CALCULATIONS



Project: Our Town Hall
Drawing: Stage 3 Proposed Drainage Discharge Strategy
Drawing No: OTH-RAM-XX-XX-SKE-C-0007
Revision: -
Date: 28/08/2018

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	0.000
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	0.840	Min Design Depth for Optimisation (m)	0.000
Ratio R	0.357	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	550	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.000		

Designed with Level Inverts

Network Design Table for Storm

« - 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
S3.000	18.313	0.229	80.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S3.001	6.221	0.037	168.1	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.000	4.760	0.270	17.6	0.046	5.00	0.0	0.600	o	150	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)
S3.000	57.97	5.35	36.346	0.000	0.0	0.0	0.0	0.86	6.8	0.0
S3.001	57.37	5.49	36.117	0.022	0.0	0.0	0.0	0.77	13.6	3.8
S4.000	59.48	5.03	37.200	0.046	0.0	0.0	0.0	2.41	42.6	8.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.000	24.120	0.120	201.0	0.077	5.00	0.0	0.600	o	375	Pipe/Conduit	
S4.001	7.001	0.240	29.2	0.014	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.002	19.730	0.725	27.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	1.460	0.485	3.0	0.041	5.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	9.223	0.800	11.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	8.503	0.045	189.0	0.031	5.00	0.0	0.600	o	300	Pipe/Conduit	
S7.001	6.491	0.185	35.1	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.000	16.897	0.205	82.4	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	10.292	0.125	82.3	0.000	0.00	0.0	0.600	o	150	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)
S5.000	58.15	5.32	36.825	0.077	0.0	0.0	0.0	1.27	140.7	13.6
S4.001	57.99	5.35	36.705	0.137	0.0	0.0	0.0	3.37	371.7	24.1
S4.002	57.57	5.44	36.465	0.137	0.0	0.0	0.0	3.49	384.9	24.1
S6.000	59.62	5.00	37.025	0.041	0.0	0.0	0.0	7.60	302.1	7.4
S6.001	59.43	5.04	36.540	0.041	0.0	0.0	0.0	3.88	154.1	7.4
S7.000	59.04	5.12	36.880	0.031	0.0	0.0	0.0	1.14	80.6	5.6
S7.001	58.85	5.16	36.835	0.061	0.0	0.0	0.0	2.66	188.3	10.9
S8.000	58.43	5.25	37.000	0.024	0.0	0.0	0.0	1.11	19.6	4.3
S8.001	57.73	5.41	36.795	0.024	0.0	0.0	0.0	1.11	19.6	4.3

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.002	2.021	0.020	101.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S7.002	34.877	0.175	199.3	0.095	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.003	1.914	0.010	191.4	0.013	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.004	12.390	0.725	17.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.003	3.660	0.050	73.2	0.106	0.00	0.0	0.600	oo	300	Double Pipe	
S4.004	1.906	1.550	1.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.005	6.758	0.173	39.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.006	13.550	0.346	39.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.007	10.613	0.271	39.2	0.000	0.00	0.0	0.600	o	150	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)
S8.002	57.58	5.44	36.670	0.024	0.0	0.0	0.0	1.00	17.7	4.3
S7.002	55.63	5.90	36.650	0.180	0.0	0.0	0.0	1.28	141.4	30.4
S7.003	55.53	5.92	36.475	0.193	0.0	0.0	0.0	1.31	144.3	32.5
S7.004	55.34	5.97	36.465	0.193	0.0	0.0	0.0	4.40	486.1	32.5
S4.003	55.21	6.00	35.740	0.477	0.0	0.0	0.0	1.84	260.1	79.9
S4.004	55.20	6.00	35.690	0.477	0.0	0.0	0.0	14.28	1009.6	79.9
S4.005	54.92	6.07	34.140	0.477	0.0	0.0	0.0	1.62	28.5«	79.9
S4.006	54.37	6.21	33.967	0.477	0.0	0.0	0.0	1.61	28.5«	79.9
S4.007	53.95	6.32	33.621	0.477	0.0	0.0	0.0	1.61	28.5«	79.9

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S-ExMH 26	42.200	5.854	Open Manhole	1200	S3.000	36.346	100				
S-ExMH 4	40.000	3.883	Open Manhole	1200	S3.001	36.117	150	S3.000	36.117	100	
S-ExMH 4a	40.390	4.310	Open Manhole	0		OUTFALL		S3.001	36.080	150	
S1-6	38.250	1.050	Open Manhole	1200	S4.000	37.200	150				
S1-5	38.100	1.275	Open Manhole	1350	S5.000	36.825	375				
S1-7	38.200	1.495	Open Manhole	1350	S4.001	36.705	375	S4.000	36.930	150	
								S5.000	36.705	375	
S-Tank-ND4	38.150	1.685	Junction		S4.002	36.465	375	S4.001	36.465	375	
S1-8	38.150	1.125	Open Manhole	1200	S6.000	37.025	225				
S-Tank-ND3	38.150	1.610	Junction		S6.001	36.540	225	S6.000	36.540	225	
S1-1	38.080	1.200	Open Manhole	1200	S7.000	36.880	300				
S1-2	38.100	1.265	Open Manhole	1200	S7.001	36.835	300	S7.000	36.835	300	
S-ExMH 13a	38.100	1.100	Open Manhole	1200	S8.000	37.000	150				
S-ExMH 12	38.100	1.305	Open Manhole	1200	S8.001	36.795	150	S8.000	36.795	150	
S-ExMH 10	38.070	1.400	Open Manhole	1200	S8.002	36.670	150	S8.001	36.670	150	
S1-3	38.070	1.420	Open Manhole	1350	S7.002	36.650	375	S7.001	36.650	300	
								S8.002	36.650	150	
S1-4	38.110	1.635	Open Manhole	1350	S7.003	36.475	375	S7.002	36.475	375	
S-Tank-ND1	38.150	1.685	Junction		S7.004	36.465	375	S7.003	36.465	375	
S-Tank	38.150	2.410	Open Manhole	1500	S4.003	35.740	300	S4.002	35.740	375	
								S6.001	35.740	225	
								S7.004	35.740	375	
S1-9	38.200	2.510	Open Manhole	1500	S4.004	35.690	300	S4.003	35.690	300	
S-ExMH 19	38.200	4.060	Open Manhole	1200	S4.005	34.140	150	S4.004	34.140	300	
S-ExMH 21	38.200	4.233	Open Manhole	1200	S4.006	33.967	150	S4.005	33.967	150	

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S-ExMH 21a	38.200	4.579	Open Manhole	1200	S4.007	33.621	150	S4.006	33.621	150	
S-Ex Outfall	40.540	7.190	Open Manhole	0		OUTFALL		S4.007	33.350	150	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.000	o	100	S-ExMH 26	42.200	36.346	5.754	Open Manhole	1200
S3.001	o	150	S-ExMH 4	40.000	36.117	3.733	Open Manhole	1200
S4.000	o	150	S1-6	38.250	37.200	0.900	Open Manhole	1200
S5.000	o	375	S1-5	38.100	36.825	0.900	Open Manhole	1350
S4.001	o	375	S1-7	38.200	36.705	1.120	Open Manhole	1350
S4.002	o	375	S-Tank-ND4	38.150	36.465	1.310	Junction	
S6.000	o	225	S1-8	38.150	37.025	0.900	Open Manhole	1200
S6.001	o	225	S-Tank-ND3	38.150	36.540	1.385	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.000	18.313	80.0	S-ExMH 4	40.000	36.117	3.783	Open Manhole	1200
S3.001	6.221	168.1	S-ExMH 4a	40.390	36.080	4.160	Open Manhole	0
S4.000	4.760	17.6	S1-7	38.200	36.930	1.120	Open Manhole	1350
S5.000	24.120	201.0	S1-7	38.200	36.705	1.120	Open Manhole	1350
S4.001	7.001	29.2	S-Tank-ND4	38.150	36.465	1.310	Junction	
S4.002	19.730	27.2	S-Tank	38.150	35.740	2.035	Open Manhole	1500
S6.000	1.460	3.0	S-Tank-ND3	38.150	36.540	1.385	Junction	
S6.001	9.223	11.5	S-Tank	38.150	35.740	2.185	Open Manhole	1500

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.000	o	300	S1-1	38.080	36.880	0.900	Open Manhole	1200
S7.001	o	300	S1-2	38.100	36.835	0.965	Open Manhole	1200
S8.000	o	150	S-ExMH 13a	38.100	37.000	0.950	Open Manhole	1200
S8.001	o	150	S-ExMH 12	38.100	36.795	1.155	Open Manhole	1200
S8.002	o	150	S-ExMH 10	38.070	36.670	1.250	Open Manhole	1200
S7.002	o	375	S1-3	38.070	36.650	1.045	Open Manhole	1350
S7.003	o	375	S1-4	38.110	36.475	1.260	Open Manhole	1350
S7.004	o	375	S-Tank-ND1	38.150	36.465	1.310	Junction	
S4.003	oo	300	S-Tank	38.150	35.740	2.110	Open Manhole	1500
S4.004	o	300	S1-9	38.200	35.690	2.210	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.000	8.503	189.0	S1-2	38.100	36.835	0.965	Open Manhole	1200
S7.001	6.491	35.1	S1-3	38.070	36.650	1.120	Open Manhole	1350
S8.000	16.897	82.4	S-ExMH 12	38.100	36.795	1.155	Open Manhole	1200
S8.001	10.292	82.3	S-ExMH 10	38.070	36.670	1.250	Open Manhole	1200
S8.002	2.021	101.1	S1-3	38.070	36.650	1.270	Open Manhole	1350
S7.002	34.877	199.3	S1-4	38.110	36.475	1.260	Open Manhole	1350
S7.003	1.914	191.4	S-Tank-ND1	38.150	36.465	1.310	Junction	
S7.004	12.390	17.1	S-Tank	38.150	35.740	2.035	Open Manhole	1500
S4.003	3.660	73.2	S1-9	38.200	35.690	2.210	Open Manhole	1500
S4.004	1.906	1.2	S-ExMH 19	38.200	34.140	3.760	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.005	o	150	S-ExMH 19	38.200	34.140	3.910	Open Manhole	1200
S4.006	o	150	S-ExMH 21	38.200	33.967	4.083	Open Manhole	1200
S4.007	o	150	S-ExMH 21a	38.200	33.621	4.429	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.005	6.758	39.1	S-ExMH 21	38.200	33.967	4.083	Open Manhole	1200
S4.006	13.550	39.2	S-ExMH 21a	38.200	33.621	4.429	Open Manhole	1200
S4.007	10.613	39.2	S-Ex Outfall	40.540	33.350	7.040	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.022	0.022	0.022
4.000	-	-	100	0.046	0.046	0.046
5.000	-	-	100	0.077	0.077	0.077
4.001	-	-	100	0.014	0.014	0.014
4.002	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.041	0.041	0.041
6.001	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.031	0.031	0.031
7.001	-	-	100	0.030	0.030	0.030
8.000	-	-	100	0.024	0.024	0.024
8.001	-	-	100	0.000	0.000	0.000
8.002	-	-	100	0.000	0.000	0.000
7.002	-	-	100	0.095	0.095	0.095
7.003	User	-	100	0.013	0.013	0.013
7.004	-	-	100	0.000	0.000	0.000
4.003	-	-	100	0.106	0.106	0.106
4.004	-	-	100	0.000	0.000	0.000
4.005	-	-	100	0.000	0.000	0.000
4.006	-	-	100	0.000	0.000	0.000
4.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.499	0.499	0.499

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S3.001	S-ExMH 4a	40.390	36.080	0.000	0	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S4.007	S-Ex Outfall	40.540	33.350	0.000	0	0

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Online Controls for Storm

Non Return Valve Manhole: S-ExMH 10, DS/PN: S8.002, Volume (m³): 1.7

Hydro-Brake® Optimum Manhole: S1-9, DS/PN: S4.004, Volume (m³): 4.7

Unit Reference	MD-SHE-0160-1500-2000-1500	Sump Available	Yes
Design Head (m)	2.000	Diameter (mm)	160
Design Flow (l/s)	15.0	Invert Level (m)	35.690
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1500
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	15.0	Kick-Flo®	1.216	11.9
Flush-Flo™	0.582	15.0	Mean Flow over Head Range	-	13.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	0.600	15.0	1.600	13.5	2.600	17.0	5.000	23.2	7.500	28.2
0.200	12.5	0.800	14.7	1.800	14.3	3.000	18.2	5.500	24.3	8.000	29.1
0.300	13.9	1.000	13.9	2.000	15.0	3.500	19.6	6.000	25.3	8.500	30.0
0.400	14.6	1.200	12.1	2.200	15.7	4.000	20.9	6.500	26.3	9.000	30.8
0.500	14.9	1.400	12.7	2.400	16.4	4.500	22.1	7.000	27.3	9.500	31.6

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Storage Structures for Storm

Cellular Storage Manhole: S-Tank, DS/PN: S4.003

Invert Level (m) 35.690 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	160.0	0.0	1.200	160.0	0.0	1.201	0.0	0.0

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.361 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	S-ExMH 26	360 Winter	2	+0%					36.346	-0.100	0.000	0.00		0.0	OK	
S3.001	S-ExMH 4	15 Winter	2	+0%	100/15 Summer				36.169	-0.098	0.000	0.25		2.9	OK	
S4.000	S1-6	15 Winter	2	+0%					37.248	-0.102	0.000	0.22		7.2	OK	
S5.000	S1-5	15 Winter	2	+0%					36.904	-0.296	0.000	0.10		11.8	OK	
S4.001	S1-7	15 Winter	2	+0%					36.788	-0.292	0.000	0.11		20.8	OK	
S4.002	S-Tank-ND4	15 Winter	2	+0%					36.526	-0.314	0.000	0.06		21.0	OK*	
S6.000	S1-8	15 Winter	2	+0%					37.063	-0.187	0.000	0.07		6.4	OK	
S6.001	S-Tank-ND3	15 Winter	2	+0%					36.573	-0.192	0.000	0.05		6.3	OK*	
S7.000	S1-1	15 Winter	2	+0%					36.936	-0.244	0.000	0.08		4.8	OK	

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

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S1-2	15 Winter	2	+0%					36.893	-0.242	0.000	0.08		8.8	OK	
S8.000	S-ExMH 13a	15 Winter	2	+0%					37.046	-0.104	0.000	0.20		3.7	OK	
S8.001	S-ExMH 12	15 Winter	2	+0%	100/15 Summer				36.842	-0.103	0.000	0.21		3.7	OK	
S8.002	S-ExMH 10	15 Winter	2	+0%	30/15 Summer				36.767	-0.053	0.000	0.35		3.8	OK	
S7.002	S1-3	15 Winter	2	+0%					36.763	-0.262	0.000	0.20		24.7	OK	
S7.003	S1-4	15 Winter	2	+0%	100/15 Summer				36.615	-0.235	0.000	0.30		26.2	OK	
S7.004	S-Tank-ND1	15 Winter	2	+0%					36.535	-0.305	0.000	0.08		26.2	OK*	
S4.003	S-Tank	60 Winter	2	+0%	30/15 Winter				35.923	-0.117	0.000	0.11		13.6	OK	
S4.004	S1-9	60 Winter	2	+0%	30/15 Summer				35.925	-0.065	0.000	0.04		13.0	OK	
S4.005	S-ExMH 19	60 Winter	2	+0%					34.218	-0.072	0.000	0.54		13.0	OK	
S4.006	S-ExMH 21	60 Winter	2	+0%					34.042	-0.075	0.000	0.50		13.0	OK	
S4.007	S-ExMH 21a	60 Winter	2	+0%					33.697	-0.074	0.000	0.51		13.0	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.361 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	S-ExMH 26	360 Winter	30	+0%					36.346	-0.100	0.000	0.00		0.0	OK	
S3.001	S-ExMH 4	15 Summer	30	+0%	100/15 Summer				36.202	-0.065	0.000	0.61		7.0	OK	
S4.000	S1-6	15 Winter	30	+0%					37.268	-0.082	0.000	0.42		13.5	OK	
S5.000	S1-5	15 Winter	30	+0%					36.935	-0.265	0.000	0.18		22.3	OK	
S4.001	S1-7	15 Winter	30	+0%					36.822	-0.258	0.000	0.21		40.0	OK	
S4.002	S-Tank-ND4	15 Winter	30	+0%					36.552	-0.288	0.000	0.12		40.3	OK*	
S6.000	S1-8	15 Winter	30	+0%					37.078	-0.172	0.000	0.12		12.1	OK	
S6.001	S-Tank-ND3	15 Winter	30	+0%					36.587	-0.178	0.000	0.10		12.0	OK*	
S7.000	S1-1	15 Winter	30	+0%					36.958	-0.222	0.000	0.15		9.1	OK	

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

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)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S1-2	15 Winter	30	+0%					36.919	-0.216	0.000	0.17		18.5	OK	
S8.000	S-ExMH 13a	15 Winter	30	+0%					37.065	-0.085	0.000	0.38		7.0	OK	
S8.001	S-ExMH 12	15 Winter	30	+0%	100/15 Summer				36.862	-0.083	0.000	0.40		7.0	OK	
S8.002	S-ExMH 10	15 Winter	30	+0%	30/15 Summer				36.831	0.011	0.000	0.69		7.5	SURCHARGED	
S7.002	S1-3	15 Winter	30	+0%					36.823	-0.202	0.000	0.42		53.2	OK	
S7.003	S1-4	15 Winter	30	+0%	100/15 Summer				36.697	-0.153	0.000	0.65		57.2	OK	
S7.004	S-Tank-ND1	15 Winter	30	+0%					36.568	-0.272	0.000	0.17		57.0	OK*	
S4.003	S-Tank	60 Winter	30	+0%	30/15 Winter				36.178	0.138	0.000	0.14		17.0	SURCHARGED	
S4.004	S1-9	120 Winter	30	+0%	30/15 Summer				36.180	0.190	0.000	0.05		14.9	SURCHARGED	
S4.005	S-ExMH 19	60 Winter	30	+0%					34.225	-0.065	0.000	0.61		14.9	OK	
S4.006	S-ExMH 21	120 Winter	30	+0%					34.048	-0.069	0.000	0.57		14.9	OK	
S4.007	S-ExMH 21a	120 Winter	30	+0%					33.703	-0.068	0.000	0.58		14.9	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.361 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	S-ExMH 26	360 Winter	100	+40%					36.346	-0.100	0.000	0.00		0.0	OK	
S3.001	S-ExMH 4	15 Winter	100	+40%	100/15 Summer				36.269	0.002	0.000	1.09		12.5	SURCHARGED	
S4.000	S1-6	15 Winter	100	+40%					37.299	-0.051	0.000	0.75		24.5	OK	
S5.000	S1-5	15 Winter	100	+40%					36.976	-0.224	0.000	0.33		40.4	OK	
S4.001	S1-7	15 Winter	100	+40%					36.867	-0.213	0.000	0.38		72.3	OK	
S4.002	S-Tank-ND4	120 Winter	100	+40%					36.764	-0.076	0.000	0.08		25.2	OK*	
S6.000	S1-8	15 Winter	100	+40%					37.097	-0.153	0.000	0.22		21.9	OK	
S6.001	S-Tank-ND3	120 Winter	100	+40%					36.764	-0.001	0.000	0.06		7.5	OK*	
S7.000	S1-1	15 Winter	100	+40%					36.987	-0.193	0.000	0.27		16.5	OK	

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

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)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S1-2	15 Winter	100	+40%					36.962	-0.173	0.000	0.31		33.2	OK	
S8.000	S-ExMH 13a	15 Winter	100	+40%					37.114	-0.036	0.000	0.69		12.6	OK	
S8.001	S-ExMH 12	15 Winter	100	+40%	100/15 Summer				37.029	0.084	0.000	0.67		11.8	SURCHARGED	
S8.002	S-ExMH 10	15 Winter	100	+40%	30/15 Summer				36.979	0.159	0.000	1.21		13.1	SURCHARGED	
S7.002	S1-3	15 Winter	100	+40%					36.948	-0.077	0.000	0.73		93.2	OK	
S7.003	S1-4	15 Winter	100	+40%	100/15 Summer				36.867	0.017	0.000	1.05		91.9	SURCHARGED	
S7.004	S-Tank-ND1	120 Winter	100	+40%					36.765	-0.075	0.000	0.11		35.5	OK*	
S4.003	S-Tank	120 Winter	100	+40%	30/15 Winter				36.763	0.723	0.000	0.19		22.9	SURCHARGED	
S4.004	S1-9	120 Winter	100	+40%	30/15 Summer				36.766	0.776	0.000	0.05		15.0	SURCHARGED	
S4.005	S-ExMH 19	360 Summer	100	+40%					34.225	-0.065	0.000	0.62		15.0	OK	
S4.006	S-ExMH 21	120 Summer	100	+40%					34.049	-0.068	0.000	0.57		15.0	OK	
S4.007	S-ExMH 21a	600 Summer	100	+40%					33.704	-0.067	0.000	0.59		15.0	OK	

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