# CampbellReith consulting engineers

# 65-67 Holmes Road, London,

**NW5 3AN** 

# Basement Impact Assessment Audit

For

London Borough of Camden

Project Number: 12727-51 Revision: D1

Date April 2018

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## **Document History and Status**

Revision	Date	Purpose/Status	File Ref	Author	Check	Review
D1	April 2018	Comment	JBrm12727- 51-240418-65- 67 Holmes Road-D1.doc	J Brown	R Morley	R Morley

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#### **Document Details**

Last saved	24/04/2018 16:12
Path	JBrm12727-51-240418-65-67 Holmes Road-D1.doc
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Project Number	12727-51
Project Name	65-67 Holmes Road
Planning Reference	2017/6786/P

Structural • Civil • Environmental • Geotechnical • Transportation



# Contents

1.0	Non-technical summary	1
2.0	Introduction	3
3.0	Basement Impact Assessment Audit Check List	5
4.0	Discussion	8
5.0	Conclusions	10

# Appendix

Appen	dix	1:	Re	sid	ents'	Consu	ultation	Comments
-		-	-		-			

Appendix 2: Audit Query Tracker Appendix 3: Supplementary Supporting Documents



# 1.0 NON-TECHNICAL SUMMARY

- 1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 65-67 Holmes Road (planning reference 2017/6786/P). The basement is considered to fall within Category C as defined by the Terms of Reference.
- 1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.
- 1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.
- 1.4. The BIA has been prepared by engineering consultants holding suitable qualifications, with the exception of the ground water aspect of the assessment.
- 1.5. The LBC Instruction to proceed with the audit identified that the basement proposal neither involved a listed building or was adjacent to listed buildings.
- 1.6. The proposal consists of the demolition of the existing retail unit, with the construction of a double level basement with residential accommodation above ground level.
- 1.7. A similar planning proposal has already been granted, with much of the critical aspects of the basement construction has been undertaken, therefore impacts relating to wall construction have not been considered within the scope of this audit.
- 1.8. A borehole site investigation has been undertaken, during which ground water was not encountered.
- 1.9. The geology has been identified as a moderate to deep depth of made ground overlaying the London Clay, with the site geology potentially sloping or uneven. The proposed basement is to be founded within the London Clay.
- 1.10. The proposed basement structure is proposed of common basement construction methods.
- 1.11. A drainage strategy report indicates that surface water drainage from the site will be in accordance with the London Plan.
- It is accepted that the basement proposal is unlikely to impact on the ground water flows. However it is suggest that care be taken during excavation should unanticipated geology or ground water be encountered.

Date: April 2018



- 1.13. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.
- 1.14. It can be confirmed that the proposal adheres to the requirements of CPG4.



#### 2.0 **INTRODUCTION**

- CampbellReith was instructed by London Borough of Camden (LBC) on 7th February 2018 to 2.1. carry out a Category C Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 65-67 Holmes Road, London, NW5 3AN and Reference 2017/6786/P.
- 2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.
- 2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within
  - Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
  - Camden Planning Guidance (CPG) 4: Basements and Lightwells.
  - Camden Development Policy (DP) 27: Basements and Lightwells. \_
  - Camden Development Policy (DP) 23: Water.
  - Local Plan 2017, Policy A5 Basements. \_
- 2.4. The BIA should demonstrate that schemes:
  - a) maintain the structural stability of the building and neighbouring properties;
  - b) avoid adversely affecting drainage and run off or causing other damage to the water environment;
  - c) avoid cumulative impacts upon structural stability or the water environment in the local area, and;

evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as "Variation of condition 20 (approved plans) of 2013/7130/P as varied by 2015/5435/P and 2016/4664/P for a of a 3-7 storey building (with 2 basement levels) to provide 273 units of student accommodation with ancillary facilities and warehouse space; CHANGES ARE to lower the basement level by 950mm, internal changes and the reduction of warehouse and ancillary student space."



The Audit Instruction also confirmed 65-67 Holmes Road did not involve, or was neighbour to, listed buildings.

- 2.6. CampbellReith accessed LBC's Planning Portal on 20/03/2018 and gained access to the following relevant documents for audit purposes:
  - Basement Impact Assessment Report (BIA), Pringuer-James Consulting Engineers, February 2018, Revision A.
  - Structural Engineer's Assessment, Pringuer-James Consulting Engineers, October 2017, Revision -.
  - Planning Application Drawings consisting of

Proposed Elevations,

Proposed Floor Plans,

Proposed Sections A-G

Appendix D PJCE Planning Drawings

Temporary Propping to Sheet Piled Walls Step 1-7

- Design & Access Statement s73 update February 2018
- 2.7. The following was received via email on 24/04/18.
  - Drainage Strategy Report , 6<sup>th</sup> April 2018



# **3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST**

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	No	CGeol is not held
Is data required by Cl.233 of the GSD presented?	Yes	While a programme is not provided generally the requirement has been met
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	
Are suitable plan/maps included?	Yes	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	A justification statement is provided for all answers
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	A justification statement is provided for all answers
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	A justification statement is provided for all answers
Is a conceptual model presented?	No	Refer to section 4.5.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	A scoping statement is provided for all items identified as by screening

# 65-67 Holmes Road, NW5 3AN BIA – Audit



Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	N/A	No hydrogeological items have been carried forward from screening
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	N/A	No hydrological items have been carried forward from screening
Is factual ground investigation data provided?	Yes	Borehole logs are provided
Is monitoring data presented?	No	
Is the ground investigation informed by a desk study?	Yes	Some study of geological maps has been undertaken.
Has a site walkover been undertaken?	-	Assumed undertaken as part of the Ground Investigation.
Is the presence/absence of adjacent or nearby basements confirmed?	No	
Is a geotechnical interpretation presented?	No	
Does the geotechnical interpretation include information on retaining wall design?	No	
Are reports on other investigations required by screening and scoping presented?	N/A	
Are the baseline conditions described, based on the GSD?	Yes	
Do the base line conditions consider adjacent or nearby basements?	No	
Is an Impact Assessment provided?	Yes	
Are estimates of ground movement and structural impact presented?	No	A GMA has not been undertaken

# 65-67 Holmes Road, NW5 3AN BIA – Audit

Item	Yes/No/NA	Comment
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	No	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	No	
Has the need for monitoring during construction been considered?	No	
Have the residual (after mitigation) impacts been clearly identified?	No	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	However due to the advanced stage of construction this has not been considered within this audit
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	Flow to be attenuated in accordance with The London Plan
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	However due to the advanced stage of construction this has not been considered within this audit
Does report state that damage to surrounding buildings will be no worse than Burland Category 1?	No	However due to the advanced stage of construction this has not been considered within this audit
Are non-technical summaries provided?	Yes	

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# 4.0 DISCUSSION

- 4.1. The BIA has been prepared by engineering consultants Pringuer-James Consulting Engineers using individuals with a CEng and MICE qualification, although the authors did not provide evidence of their expertise. The BIA has not been authored by a Hydrogeologist with a CGeol qualification and this is a requirement of CPG4 July 2015 Section 3.6.
- 4.2. 65-67 Holmes Road was previously occupied by a Magnet warehouse building with hard standing on the western part of site. The site is located amongst residential and commercial properties with Holmes Road located directly adjacent to the site to the north. To the east 61-63 Holmes Road comprises a recently finished six storey residential building, and 55 to 57 Holmes road comprises a six storey residential building with a single storey basement. To the south is a three storey newly converted industrial building adjacent to a number of three storey flat on Azania Mews. To the west of the site is adjacent to Cathcart Street.
- 4.3. The LBC Instruction to proceed with the audit identified that the basement proposal neither involved a listed building or was adjacent to listed buildings.
- 4.4. The proposed basement consists of a two storey construction to 9.20mbgl formed by lowering an existing site level across the whole site. The basement will be mixed use comprising plant, warehouse, laundry and cycle storage alongside study areas at the lower level and a warehouse and accommodation at the upper level.
- 4.5. The borehole logs have identified that 5.00m of Made Ground in BH2 with up to 1m of soft brown slightly gravelly, sandy clay, likely attributed to tertiary deposits of Alluvium, potentially associated with the distributary of the River Fleet. Firm to Stiff London Clay is proven to a depth of 30.00mbgl. The conceptual site model has not identified these stratigraphic boundaries.
- 4.6. A previous planning application, 2016/4664/P, was approved in May 2017, which was for a similar proposal with a basement to the same extent on plan but to a depth approximately 1m shallower than is proposed for the planning application under consideration 2017/6786/P.
- 4.7. The Desk Study and Ground Investigation Report has not been provided with the application, however factual borehole data is provided. The BIA describes that groundwater was encountered during the ground investigation although this is not identified in any of the two exploratory boreholes included in the Appendix. No exploratory hole location plan is provided and no ground water monitoring is included with the BIA.
- 4.8. The BIA discusses a scheme comprising steel sheet piling across the full extent of the site with the clutches of the sheet piles welded up along the length of any upper permeable layers. The anticipated depth of the basement is approximately 9.20m bgl. Floor plates at ground floor, upper basement and lower basement levels will be designed as rigid diaphragms providing adequate restraint to the sheet piling in the permanent condition. Additional propping at the

mid span level of the lower basement will also be installed. The vertical loads will be transferred from the superstructure and basement floor plates onto a raft foundation extending below the entire footprint of the development via steel columns, thus the sheet piles be holding back the horizontal pressures and are hung from the basement floor plates. The BIA proposes to limit the impact to adjacent properties to the north and east, RC underpinned walls along the full length of the adjacent property to the north and raising the new basement slab over the existing property to the east is proposed. The walls will also provide support to the excavation in both the temporary and permanent condition. The lower basement floor will be designed as a reinforced concrete raft supporting steel columns.

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- 4.9. At the time of writing it is understood that construction has commenced with the basement walls having been constructed, with the majority of the excavation undertaken. It has been confirmed that the party wall process has been followed. Given that the worst case circumstance in terms of ground movements has already occurred, which would be during the construction case prior to the permanent structure being installed, the scope of this audit does not consider ground movement considerations, retaining wall stability or design, or temporary works proposals.
- 4.10. The BIA proposes that the raft planned will consider the upwards effects of base heave and groundwater. While details have not been provided of how this will be achieved, given the advanced status of the basement construction it is accepted that this is likely to have been considered in the detailed design.
- 4.11. The Drainage strategy report indicates that storm water attenuation is to be provided which is to attenuate flow to less than 50% of the existing site discharge rate, as is in accordance with the London Plan. This strategy is accepted.
- 4.12. Subterranean flow screening identifies a (dis)tributary of the River Fleet potentially located under or close to the site. A 'preliminary site investigation' undertaken on site has not identified evidence of a dried water channel on site and the BIA assumes this will not be encountered. It is accepted that any historic river tributary is likely to no longer be significantly active, however it is suggested that care be taken during excavation work should unanticipated geology or hydrogeology be encountered that may indicate a historic river channel, with consideration given to any design changes that may be necessary in order to facilitate any ongoing ground water flow.
- 4.13. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.

# 5.0 CONCLUSIONS

- 5.1. The BIA has been prepared by engineering consultants holding suitable qualifications, with the exception of the hydrogeological aspect of the assessment.
- 5.2. The LBC Instruction to proceed with the audit identified that the basement proposal neither involved a listed building or was adjacent to listed buildings.
- 5.3. The proposal consists of the demolition of the existing retail unit, with the construction of a double level basement to a depth of up to 9.2mbgl over the site with residential accommodation above ground level.
- 5.4. A similar planning proposal has already been granted, with much of the basement wall and slab construction has been undertaken, therefore ground movements and wall construction has not been considered within this audit.
- 5.5. A site specific SI has been undertaken with two boreholes carried out. Specific details of the SI have not been provided. Ground water was not encountered during the SI.
- 5.6. The geology has been identified as made ground overlaying the London Clay formation, with the top of the clay strata varying between 5mbgl and 2.2mbgl.
- 5.7. The proposed basement wall structure is proposed as sheet piling with a RC liner wall. RC floors are to permanent prop the walls at each level. A raft foundation is proposed to bear onto the London Clay.
- 5.8. Due to the advanced construction stage of the basement the scope of this audit does not consider ground movement considerations, retaining wall stability or design, or temporary works proposals.
- 5.9. SUDs are proposed which will reduce run off in accordance with The London Plan.
- 5.10. Due to the lack of ground water during the SI it is accepted that the proposal is unlikely to impact on ground water. However care should be taken during construction in order to identify any historic water courses with mitigation measures enacted as maintain drainage routes of any ground water that may exist.
- 5.11. It is accepted that there are no slope stability concerns regarding the proposed development and it is not in an area prone to flooding.
- 5.12. It can be confirmed that the proposal adheres to the requirements of CPG4.



# **Appendix 1: Residents' Consultation Comments**

None



# **Appendix 2: Audit Query Tracker**

None



# **Appendix 3: Supplementary Supporting Documents**



# 65-69 Holmes Road

# Residential Development in Kentish Town 65-69 Holmes Road, London, NW5 3AN

Drainage Strategy Report

For Hallmark Property Group

06<sup>th</sup> April 2018

1980\_RP\_D\_FRA\_01



Rev	Date	Purpose/Status	Document Ref.	QA
0	15/12/17	For comment		RC/JD
A	06/04/18	For Information	1980 –RP_D_FRA_01	RC/JD

#### Disclaimer

This report is for the use of the client only and is not for the use of any other parties without the express permission of the client. All calculations and related quantified assumptions are indicative for planning purpose only, and are based solely on the available design proposals and must be reassessed during detailed design with the appropriate compliance methodology.



# Table of Contents

Execu	tive Summary1
1.0	Existing Drainage2
2.0	Proposed Drainage Strategy2
2.1	Surface Water Drainage2
3.0	Surface Water Flows
3.1	Existing and proposed site run-off flows4
4.0	Stormwater Attenuation
5.0	Sustainable Urban Drainage Systems (SUDS)6
5.1	Infiltration Devices
5.2	Brown/Green Roofs7
5.3	Rainwater Harvesting
5.4	Porous Paving9
5.4	Below Ground Attenuation10
5.6	Wetlands10
5.7	Swales11
5.8	Ponds/Rain gardens11
6.0	Proposed SUDS Strategy11



# Executive Summary

Vortex Ltd has been appointed by Hallmark Property Group to design the surface water drainage aspects of the proposed development at 65-69, Holmes Road, London, NW5 3AN.

The report outlines the strategy for the surface water drainage for the redeveloped site.

It is advised that a combination of Sustainable Drainage Systems (SUDS) is used to increase the time of concentration of the water before it enters the Thames Water combined sewer in Cathcart Street and reduce the impact upon the receiving sewer.

This can be achieved by using Green roofs, Stormwater storage tanks and orifice plates to restrict discharge rates.

This combination of SUDS and retention currently designed will reduce surface runoff for the 1 in 100 year storm return period + 30% climate change allowance to a rate of 34.2 l/s, runoff for the 1 in 30 year storm return period to a rate of 23.8 l/s and runoff for the 1 in 1 year storm return period to a rate of 4.7l/s. This is in line with, and a slight betterment, to the Pringuer-James sustainable drainage systems strategy report, reference L1405, dated July 2016.

Attenuation has been designed to assume the Green roofs to be saturated during the worst case 1 in 100 year storm event with a climate change allowance of 30%. The volume of attenuation has been calculated to be approx.  $45.0 \text{ m}^3$ .



#### 1.0 Existing Drainage

The total existing site area is 0.245Ha of which approximately 0.245Ha (100%) is existing impermeable surfacing which includes car parking, buildings and hard landscaping.

A topographical survey has identified that surface water sewers exist within the site boundaries and that they discharge to the Thames Water combined public sewer in Cathcart Street.

A copy of the topographical survey is shown in Appendix A.

The surface water sewer currently discharges from the site at an unrestricted rate, without attenuation.

The Microdrainage calculations of the existing flow rates are shown in Appendix B.

#### 2.0 Proposed Drainage Strategy

Within the site it is proposed to collect surface water at high level and direct it to a Stormwater attenuation tank on the mezzanine floor via rainwater pipes.

The surface water network will include a complex flow control device, consisting of two 50mm and 100 mm diameter orifice plates. One at invert level to cater for the 1 in 1 year storm event and the other 0.9m above invert level to cater for the 1 in 30 and 1in 100 year storm events.

The Drainage Layout drawings are shown in Appendix C.

#### 2.1 Surface Water Drainage

In accordance with Ciria 753, SUDS Manual, flooding is permitted above ground during the 1 in 100 year storm event and all water must be stored below ground during the 1 in 30 year storm event. However, in this instance due to the topography of the site all attenuation will be below external ground level for the 1 in 100 year storm to ensure that no surface water leaves the site without going through the proposed control manhole.

In accordance with the current Local Water Authority technical guidance a climate change allowance of 30% has been allowed within the surface water calculations for the development

Proposed surface water calculations are shown in Appendix D.

SUDS techniques will be included where local ground conditions permit. In conjunction with the surface water management requirements, consideration of green roofs, infiltration devices, and rainwater harvesting techniques will be made. These methods are further detailed in Section 5.

The flows at the outfall will require attenuation to comply with discharge consent limits. This is still to be agreed with Thames Water Utilities Itd under a Section 106 Sewer connection agreement.



#### 2.1.1 Proposed Infrastructure

It is proposed that the surface water drainage system will take the form of a network of pipes transferring surface water within the building.

Surface water discharge will be restricted, and water will be attenuated within the Development Site boundaries.

#### 2.1.2 Standards

The performance of the surface water drainage system will be designed to Sewers for Adoption 6th Edition. This requires the pipes to be sized so they can run full during a simulated 1 in 1 year storm of all durations, but there will be no surcharging within manholes. Additionally, the drainage system has to be tested to ensure there is no flooding as a result of a simulated 1 in 30% year storm of any duration. For storms in excess of this, the standard requires consideration of the route flood water will take to avoid ingress into properties. The latter has been achieved by the use stormwater tanks to attenuate the worst case 1 in 100 year storm event to prevent flooding.

In accordance with the Local Water Authority guidance a climate change allowance of 30% is to be used within the proposed surface water calculations.

The materials specification for the scheme will be in accordance with the Highways Agency Specification for Highway Works. For the purposes of the indicative design, the following material types have been assumed:

- Drainage pipes up to 300mm diameter Vitrified clayware, plastic pipes will be permitted subject to ground conditions.
- Pipes within the building footprint are to be cast iron.
- Drainage pipes over 300mm diameter Concrete
- Manholes and chambers Precast concrete with concrete surround or PPIC
- Gullies precast concrete
- Chamber covers Class D400 infill type in higher quality paved areas.
- Class D400 standard type in all other road / park areas
- Class C250 standard type in all footpath areas
- Pipe bedding Imported granular
- Pipe Trench backfill Selected as dug or imported material
- Manholes should be located at every change of alignment or gradient; at the head of all sewers; at the every junction of a public sewer

The drainage shall be designed utilizing the following criteria:

- Minimum flow velocity 1.0m/s for self-cleansing
- Standard pipe roughness "Ks" of 0.6.



#### 3.0 Surface Water Flows

#### 3.1 Existing and proposed site run-off flows

An extract from the Pringuer-James report is shown in Appendix B and a summary of flow rates are shown in table 1 below.

The existing and proposed flow calculations do not include a reduction in time of concentration or of impermeable areas and are treated as worst case scenario when the Green roofs are in a saturated condition.

A summary of the existing and proposed peak flows are detailed in Table 1 below and include the 40% climate change allowance for the worst case 1 in 100 year storm event.

Return Period	Qbar I/s	50%Qbar I/s	Proposed I/s
1 in 1 year	24.71	12.36	4.7
1 in 30 years	61.7	30.85	23.8
1 in 100 years	48.65	39.33	34.2

#### Table 1: Summary of Existing and Proposed Surface Water Flows

The existing surface water calculations are shown in Appendix B and the proposed surface water calculations are shown in Appendix D.



# 4.0 Stormwater Attenuation

It is proposed that Sustainable Urban Drainage Systems (SUDS) will be the primary consideration for surface water management. There are a number of different methods that may be used to provide sufficient attenuation of the surface water described in Section 5 below.

Attenuation should be positioned as close to the outfall as possible and would control the surface water discharge from the site. Implementation of one or all of the SUDS methods outlined in Section 5 of this report is highly recommended to reduce the requirement for below ground storage.

Existing Surface Water volume calculations shown in Appendix E indicate that 126.5m<sup>3</sup> of surface water will be generated by the 6 hour 1 in 100 year storm event.

Surface Water calculations shown in Appendix F indicate that 164.4m3 of surface water will be generated by the 6 hour 1 in 100 year storm event including a 30% climate change allowance.

Return Period	Existing Volume Generated m <sup>3</sup>
1 in 1 year	44.1
1 in 30 years	97.5
1 in 100 years	126.5
1 in 100 years +30%	164.4

A summary of the existing volumes is detailed in Table 2 below.

#### Table 2: Summary of Existing and Proposed Surface Water Volumes

The Microdrainage calculations in Appendix D shows that no flooding occurs during the worst case 1 in 100 year storm event with a 30% climate change allowance.

Therefore the proposed attenuation system is suitable for supporting the proposed development.



# 5.0 Sustainable Urban Drainage Systems (SUDS)

The objective of SUDS is to minimise the impacts of the development on the quantity and quality of site runoff and maximise amenity and biodiversity opportunities. Surface water SUDS will be designed and installed in accordance with NPPF and associated technical guidance March 2012 and associated CIRIA documents.

The mix of SUDS to be used is determined by the conditions on site, in this case a development with areas of external space which can be utilised for SUDS. The methodology of surface water control is to slow the entry of the surface water into the system, by using roof level brown roofs and porous paving that increases the time of concentration (time for water to flow through the system). Then retain the runoff, by using above ground storage and porous paving, which will release it into the Watercourse at an agreed rate to limit the impact of the development on drainage infrastructure and therefore reduce the potential for flooding.

## 5.1 Infiltration Devices

Infiltration devices drain water directly into the ground. Infiltration trenches and soakaways are more practicable for urban sites with limited space available. Infiltration devices can be integrated into and form part of the landscaped areas.

Infiltration trenches are completely below ground, and water should not occur on the surface.



Figure 1 – Typical cross section through infiltration trench

**Advantages** – Reduces the volume of runoff, effective at pollutant removal, contributes to ground water recharge, simple and cost effective.

**Disadvantages** – Potentially high failure rates, comprehensive ground investigations required, offset from foundations (min. 5m away), risk of ground water pollution, reduced performance during prolonged wet periods.

**Suitable for use** – **No**, No Space for such devices and site subsoils are of clay content with poor infiltration properties.



## 5.2 Brown/Green Roofs

Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover/landscaping over a drainage layer. They are designed to intercept and retain precipitation, increasing the time of concentration and reducing the volume of runoff and attenuation peak flows. Green roofs can be anything from a thin growing layer of sedums and mosses to plants, shrubs and large trees.

These roofs vary in specification and can be designed to attract bird and invertebratespecies. Referring to CIRIA document C644, green and brown roofs also participate in<br/>attenuatingrainwater.Thiswouldreduce the requirement for below ground storage attenuation on the site.



# Figure 2 – Typical section through green roof build up

**Advantages** – Mimic greenfield state of building footprint, good removal of pollutants, ecological and amenity benefits, improve air quality, insulates building.

**Disadvantages** – Costs, increased structural loading, roof height, design, maintenance and exposure may preclude use.

Suitable for use – Yes, Green roofs are proposed.

1980- 65\_69 Holmes Road Drainage Strategy report



#### 5.3 Rainwater Harvesting

These tanks act as mini-storage chambers for surface water, reducing the extent of underground storage required. They provide a source of water for plant irrigation, washing machines and for flushing wc's

Harvested rainwater is stored below ground and pumped to provide a substitute for potable mains water reducing both the site discharge and water consumption.



Figure 4 – Rainwater Harvesting

Advantages – Provided source control of storm water runoff, reduces demand on mains water.

**Disadvantages** – Costs, Risk to public health, use dependant on demand requirements and seasonal rainfall characteristics, maintenance of pumps & control systems.

Suitable for use – No – not part of current proposal.



## 5.4 Porous Paving

Porous pavement is an alternative to conventional paving in which water permeates through the paved structure rather than draining off it. The surface water will be held in a reservoir structure (high void content sub-base) under the pavement for subsequent delayed discharge or infiltration into the sub-strata below.

The porous paving can be materials such as gravel, grasscrete, porous (no fines) concrete, concrete blocks or porous asphalt. Pollutant removal rates have been shown to be high, as the majority of the removal occurs as a result of the filtration of the water through the aggregate sub-base.



Figure 3 – Typical section through porous paving

Advantages – Effective in removing pollutants, lined systems can be used to avoid infiltration, reduces volume and rate of surface water runoff, suitable for high density developments. Mimics existing Greenfield conditions by filtering into the surrounding soft landscaped areas.

**Disadvantages** – Costs, used for low traffic volumes, low axel loads and speeds, risk of long term clogging due to poor maintenance.

**Suitable for use** – **No**. There is no space available for such construction due to the proposed basements.



# 5.5 Below Ground Attenuation

Attenuation involves the storing of surface water within pipework or underground tanks prior to controlled discharge into the public system. Attenuation tanks can also provide off line storage.



## Figure 5 – Typical section through below ground attenuation chamber (cellular storage)

**Advantages** – Effective storage of surface water, can be used below trafficked areas, can be used below public open areas, minimum maintenance.

Disadvantages - No water quality treatment.

Suitable for use –. No, there is no space available

#### 5.6 Wetlands

Wetlands provide both stormwater attenuation and treatment. They comprise shallowponds and marshy areas, covered in aquatic vegetation. Wetlands provide settlement of sediment and remove contaminants.

Advantages – Effective storage of surface water, good pollutant removal, ecological and amenity benefits.

**Disadvantages** – Requires large surface area. Health & Safety issues associated with large bodies of water.

Suitable for use – No, there is no space available.



#### 5.7 Swales

Swales are vegetated drainage structures up to 500mm deep and used to provide flow control through attenuation. They can be used for infiltration, where possible.

**Advantages** – Can be incorporated into landscaping, good removal of contaminants, reduces discharge rates. Low costs.

**Disadvantages** – Requires large surface area. Limits extent of trees used in landscaping. Health & Safety issues associated with large bodies of water following heavy rainfall.

Suitable for use – No, there is no space available.

#### 5.8 Ponds/Rain gardens

Ponds or rain gardens are irregular shaped vegetated drainage structures used to provide flow control through attenuation. They can be used for infiltration, where possible.

**Advantages** – Can be incorporated into landscaping, good removal of contaminants, reduces discharge rates. Low costs.

**Disadvantages** – Requires large surface area. Limits extent of trees used in landscaping. Health & Safety issues associated with large bodies of water following heavy rainfall.

Suitable for use – No, there is no space available.

## 6.0 Proposed SUDS Strategy

The proposed surface water drainage system for the development will incorporate 45m<sup>3</sup> Stormwater storage tanks for attenuation and flows will be restricted to a maximum of 34.2l/s for the worst case 1 in 100 year storm event +30% climate change allowance.

Green roofs are proposed and will be designed by a specialist company. They will be designed to capture the first 5mm of rainfall so that it can be retained for plant use as well as evaporation. Green roofs, by nature, provide primary treatment and improve biodiversity. Benefit to the community will be dependent upon the type of roof and planting proposed.



Appendix A

**Topographical Survey** 



# UTILITIES & UNDERGROUND INVESTIGATIONS

ABB	REVIATIONS & SYM	BOLS						
1D 5C	1 Duct 5 Cables	CPC	Circ Plastic Chamber	EOT	End Of Trace			
ø	Diameter	CrL	Crown Level	BD	Internal Backdrop			
AR	Assumed Route	DCr	Depth To Crown	IL	nvert Leve			
BL	Base Level	D	Depth To Invert	RBC	Rectangular Brick Chambe			
СВ	Concrete Benching	DS	Depth To Silt	RCC	Rectangular Conc Chambe			
CBC	Circular Brick Chamber	DTB	Depth To Base	SL	Silt Level			
CCC	Circular Conc Chamber	DTW	Depth To Water	TFR	Taken From Records			
CL	Cover Level	EBD	External Backdrop	UTC	Unable To CCTV			
	BT CA	BLE(S)		UTL	Unable To Lift			
	- 0/BT OVERI	HEAD BT	CABLE(S)	UTT	Unable To Trace			
			ONS CABLE(S)					
		RIC CAB	E(S)					
	- 0/E OVERI	HEAD EL	ECTRIC CABLE(S)					
	- FO - FIBRE	OPTIC C	ABLE(S)					
	GAS M							
	GAS S		ETRATING RADAR (GPE					
		ATER P	IPF					
	- LC LIGHTI	NG CIRC	CUIT					
	- SEC- SECUP	RITY CAE		48.93	UTILITIES COMMENT BOX			
	UNIDE	NTIFIED	TRACE					
	WATE	K MAIN		M 0.61	DEPTH TO SERVICE			
	COMB	NED SE	WER					
	FOUL	SEWER						
	RISING	6 MAIN						
		CE WAT	ER SEWER					
	UTILITIES INVESTIGATION EXTENTS							

# DRAWING NOTES

All below ground details shown have been identified from above ground without excavation. Survey Solution use electro-magnetic and/or ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not infallible and we recommend trial excavations are carried out to confirm any identifications, positions and depths.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no items have been identified during our investigations. All reasonable care and normal good practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access can not be achieved for tracing may not be shown and alternative locating methods should be used.

Survey Solutions has used all reasonable care to research available service records but the completeness or use of the service records supplied to or by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features annotated as 'taken from records' (TFR).

Depths obtained using electro-magnetic or GPR are effected by ground conditions and should be treated as indicative only. Electro-magnetic depths to utilities and services are generally taken to the centre of a feature, GPR depths to the top of a feature and drainage depth shown to inverts, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the camber and therefore should be treated as approximate. Pipe dimensions which have not been obtained visually will be taken from records when available.

All services, drainage and utilities routes are assumed straight between access points, unless otherwise stated. The numbers of cables in runs will not be shown unless specifically requested. All services are below ground unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of either the topographical survey or base mapping on this project.

All critical dimensions and measurements should be checked and verified with any errors or discrepancies notified to Survey Solutions immediately. The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

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AVAILABILITY OF UTILITY RECORD DRAWINGS							
UTILITY	AVAILABILITY	UTILITY	AVAILABILITY	UTILITY	AVAILABILITY		
SEWER WATER MAIN GAS MAIN	NO NO PUBLIC	BT CABLE TV ELECTRICITY	PUBLIC NO NO	OIL PIPES OTHERS	NO NO		

REV DESCRIPTION		DRAWN	APPR	DATE
		·	·	
Ipswich Coventry Y	SUR SOLUZ	V FI(	E ON m Brenty	Y IS wood

Tel No: 0845 0405 969 www.survey-solutions.co.uk

LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

Fax No: 0845 0405 970

enquiries@survey-solutions.co.uk

PROJECT TITLE 65-69 HOLMES ROAD LONDON, NW5 3AN							
DRAWING DETAIL UTILITIES AND CCTV DRAINAGE INVESTIGATION SHEET 1 OF 1							
CLIENT CONTEMP	CLIENT SCALE CONTEMPORARY DESIGN SOLUTIONS LLP 1:200						
SURVEYOR SURVEY DATE CHECKED BY APPROVED BY DWG STATUS   SRF/PI 13/07/2016 LMP RAG FINAL							
DRAWING NUMBER REVISION ISSUE DATE 18004UG-01 JULY 2016							



Appendix B

Pre-development surface water calculations



Calculated by:	Ray Clark
Site name:	65-69 Holmes Road
Site location:	65-69 Holmes Road

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

# Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

## Site coordinates

Latitude:	51.54942° N
Longitude:	0.14485° W
Reference:	6200902
Date:	2017-12-15T11:10:48

Methodology	IH124							
Site characteristics								
Total site area (ha)			0.245					
Methodology								
Qbar estimation metho	bc	Calculate fro	om SPR ar	nd SAAR				
SPR estimation metho	bd	Calculate fro	om SOIL type					
			Default	Edited				
SOIL type			4	4				
HOST class								
SPR/SPRHOST			0.47	0.47				
Hydrological charact	eristic	s	Default	Edited				
SAAR (mm)			641	641				
Hydrological region	6	6						
Growth curve factor: 1 year			0.85	0.85				
Growth curve factor: 30 year			2.3	2.3				
Growth curve factor: 1	00 ye	ar	3.19	3.19				

## Notes:

(1) Is Q<sub>BAR</sub> < 2.0 l/s/ha?

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

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements (3) Is SPR/SPRHOST  $\leq$  0.3?

Greenfield runoff rates	Default	Edited
Qbar (l/s)	1.07	1.07
1 in 1 year (l/s)	0.91	0.91
1 in 30 years (l/s)	2.45	2.45
1 in 100 years (l/s)	3.4	3.4

L

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

RCD	Page 1							
9 Birchtree Way	EXISTING FLOWS							
Maidstone	65-69 HOLMES ROAD							
Kent ME15 7RP	LONDON							
Date 15/12/2017 10:26	Designed by RAC							
File 1158-1003 EXISTING FLOW	Checked by Urainage							
Micro Drainage	Network 2016.1.1							
STORM SEWER DESIGN	by the Modified Rational Method							
Design Criteria for Storm								
Pipe Sizes STA	NDARD Manhole Sizes STANDARD							
FSR Rainfall	Model - England and Wales							
Return Period (years)	100 PIMP (%) 100							
MO-60 (mm) Ratio R	0.436 Minimum Backdrop Height (m) 0.200							
Maximum Rainfall (mm/hr)	50 Maximum Backdrop Height (m) 1.500							
Maximum Time of Concentration (mins)	30 Min Design Depth for Optimisation (m) 1.200							
Volumetric Runoff Coeff.	0.750 Min Slope for Optimisation (1:X) 500							
Designe	ed with Level Soffits							
<u>Time Are</u>	ea Diagram for Storm							
Time (mins)	Area Time Area (ha) (mins) (ha)							
0-4	0.189 4-8 0.056							
Total Area	Contributing (ha) = 0.245							
Total Pi	pe Volume $(m^3) = 5.655$							
<u>Network D</u>	esign Table for Storm							
PN Length Fall Slope I.Area T.H	E. Base k HYD DIA Section Type Auto							
(m) (m) (1:X) (ha) (mir	is) Flow (1/s) (mm) SECT (mm) Design							
1.000 20.000 0.100 200.0 0.065 5.	.00 0.0 0.600 o 300 Pipe/Conduit 🔒							
1.001 20.000 0.100 200.0 0.060 0.	.00 0.0 0.600 o 300 Pipe/Conduit							
$1.002 \ 20.000 \ 0.100 \ 200.0 \ 0.060 \ 0.$	.00 0.0 0.600 o 300 Pipe/Conduit 🚽							
	•							
Netwo	ork Results Table							
PN Rain T.C. US/IL $\Sigma$ I.A	rea $\Sigma$ Base Foul Add Flow Vel Cap Flow							
(nun/nr) (mins) (m) (ha	, fiow (1/S) (1/S) (1/S) (m/S) (1/S) (1/S)							
1.000 50.00 5.30 22.000 0.	065 0.0 0.0 0.0 1.11 78.3 8.8							
	125 0.0 0.0 0.0 1.11 78.3 16.9   185 0.0 0.0 1.11 78.3 25.1							
1.003 50.00 6.20 21.700 0.	245 0.0 0.0 0.0 1.11 78.3 33.2							

RCD		Page 2
9 Birchtree Way	EXISTING FLOWS	
Maidstone	65-69 HOLMES ROAD	<u> </u>
Kent ME15 7RP	LONDON	Micco
Date 15/12/2017 10:26	Designed by RAC	
File 1158-1003 EXISTING FLOW	Checked by	Diamaye
Micro Drainage	Network 2016.1.1	

#### Free Flowing Outfall Details for Storm

Outfall	Outfall	c.	Level	I.	Level		Min	D,L	W
Pipe Number	Name		(m)		(m)	Ι.	Level (m)	(mm)	(mm)

1.003 EX 23.000 21.600 21.600 1200 0

#### Simulation Criteria for Storm

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

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

#### Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type Summer						
Return Period (years)	100	Cv (Summer) 0.750						
Region Engl	and and Wales	Cv (Winter) 0.840						
M5-60 (mm)	20.600 Storn	m Duration (mins) 30						
Ratio R	0.436							
RCD					Page 3			
---	---	---	---	--	--	--	--	--
9 Birchtree Way		EXISTING	FLOWS		5			
Maidstone		65-69 HOL	MES ROAD					
Kent ME15 7RP		LONDON			Mirro			
Date 15/12/2017 10	:26	Designed	by RAC		Drainage			
File 1158-1003 EXI	'ile 1158-1003 EXISTING FLOW  Checked by							
Micro Drainage		Network 2	016.1.1					
<u>Summary of C</u>	Critical Resul	lts by Maxin	mum Level (Ra	ank 1) for	Storm			
Areal R H Hot S Manhole Headloss Foul Sewage pe Number	Seduction Factor tot Start (mins) tart Level (mm) Coeff (Global) r hectare (1/s) of Input Hydrog	imulation Cri 1.000 Addi 0 0.500 Flow p 0.000 graphs 0 Numbe	teria tional Flow - MADD Factor * Inle er Person per 2 er of Storage S	% of Total F 10m³/ha Stor et Coeffieci Day (l/per/d Structures 0	low 0.000 age 2.000 ent 0.800 ay) 0.000			
Numbe:	er of Online Con r of Offline Con	itrols 0 Numbe itrols 0 Numbe	er of Time/Area er of Real Time	Diagrams 0 Controls 0				
	Synth	netic Rainfall	<u>l Details</u>					
Ra	ainfall Model	I 	FSR Ratio F	0.436				
	M5-60 (mm)	20.	700 Cv (Winter)	0.840				
Nonzin fo	- Elecal Diele Mar	ening (mm)		4 E C				
Margin 10	Analysis	Timestep 2.	5 Second Increm	ent (Extende	ed)			
	Ι	DTS Status			ON			
	Inert	DVD Status		(	)FF )FF			
	1.010							
Durat	<pre>Profile(s) ion(s) (mins)</pre>	15, 30, 60, 720, 960,	s , 120, 180, 240 , 1440, 2160, 2 7	ummer and Wi , 360, 480, 880, 4320, 5 200, 8640, 1	nter 600, 5760, 0080			
Clima	od(s) (years) te Change (%)				0			
	Determe Olis				Water			
PN Name Stor	m Period Cha	nate First (X) nge Surcharge	) First (Y) Fi e Flood Ov	rst (2) Over erflow Ac	flow Level t. (m)			
1.000 1 15 Wir 1.001 2 15 Wir 1.002 3 15 Wir 1.003 4 15 Wir	nter 1 nter 1 nter 1 nter 1	+0% +0% +0%			22.075 22.002 21.924 21.843			
	Surcharged Flo	ooded	Pipe					
US/ME	I Depth Vo	lume Flow / (	Overflow Flow	Lev	7el			
PN Name	(m) (1	m <sup>3</sup> ) Cap.	(1/s) (1/s)	Status Exce	eded			
1.000 1	-0.225 0	0.000 0.14	9.5	OK				
1.001 2	2 -0.198 0 3 -0.176 0	0.000 0.25	17.0	OK				
1.003 4	4 -0.157 C	0.000 0.46	31.2	OK				
	©1982	2-2016 XP S	olutions					

RCD										Pa	ge 1
9 Birchtr	cee Way			EX	ISTING E	LOWS					
Maidstone	9			65	-69 HOLM	ES ROA	D			4	
Kent ME1	.5 7RP			LO	NDON						lice
Date 15/1	2/2017 1	0:59		De	signed k	y RAC					ILIU
File 1158	8-1003 EX	ISTI	NG FLOW	Ch	ecked by	-					rainage
Micro Dra	ainage			Ne	twork 20	16.1.1					
	STOR	M SE	WER DES	IGN by	the Mod	fied R	Ratior	nal I	Metho	<u>d</u>	
Design Criteria for Storm											
		P	ipe Sizes	5 STANDA	RD Manhol	e Sizes	STAND	ARD			
			FSR Rai	nfall Mo	del - Eng	Land and	Wales	3			
	Reti	ırn Pe	eriod (ye	ars)	100	المأم 7	Flore /	C1.	mata a	PIMP	(%) 100
			MD-60 Rat	io R 0.	. 436	Ada . Mii	rimum /	Backo	nate C drop H	nange eight	(m) 0.200
	Maximur	n Rair	ıfall (mm	/hr)	50	Ma	ximum	Backo	drop H	eight	(m) 1.500
Maximum I	ime of Cor	ncentr	ation (m	ins)	30 Min I	esign D	epth f	or Op	ptimis	ation	(m) 1.200 $(n)$
	FOU Volumet	ur Sew tric F	aye (1/s Runoff Co	/na) 0. eff. 0.	.000 Mi .750	n ver I Min Sloi	or Aut pe for	Opti	imisat	u⊥y (m/ ion (1:	x) 500
								. <u>1</u> . 0.		· - ·	
			De	signed v	with Level	Soffit	S				
			<u>Time</u>	e Area	Diagram	for St	orm				
			(	Time A mins) (i	rea   Time ha) (mins	Area ) (ha)					
			· ·			, , , , , , , , , , , , , , , , , , , ,					
				0-4 0.	.189  4-	8 0.056					
			Total 2	Area Con	tributing	(ha) =	0.245				
			Tota	al Pipe	Volume (m	<sup>3</sup> ) = 5.6	55				
						,					
			<u>Netwo</u>	rk Desi	.gn Table	e for S	<u>storm</u>				
PN Le:	ngth Fall	Slop	e I.Area	T.E.	Base	k	HYD	DIA	Secti	lon Typ	e Auto
	(m) (m)	(1:X	i) (ha)	(mins)	Flow (1/s	) (mm)	SECT	(mm)			Design
1.000 20	.000 0.100	200.	0 0.065	5.00	0.	0 0.600	0	300	Pipe/	'Condui	t 🔒
1.001 20	.000 0.100	200.	0 0.060	0.00	0.	0 0.600	0	300	Pipe/	(Condui	t 💣
1.002 20	.000 0.100	200.	0 0.060	0.00	0.	0 0.600	0	300	Pipe/	Condui	t 💣
1.005 20	.000 0.100	200.	0 0.000	0.00	0.	0 0.000	0	500	ттрел	CONGUL	C 🔟.
			N	letwork	Results	Table					
PN	Rain ( (mm/hr) (	T.C. mins)	US/IL X (m)	E I.Area (ha)	Σ Base Flow (1/	Foul s) (l/s)	Add (1/	Flow 's)	Vel (m/s)	Cap (1/s)	Flow (l/s)
1.000	50.00	5.30	22.000	0.065	0	.0 0.0	)	0.0	1.11	78.3	8.8
1.001	50.00	5.60	21.900	0.125	0	.0 0.0	)	0.0	1.11	78.3	16.9
1.002	50.00	5.90	21.800	0.185	0	.0 0.0	)	0.0	1.11	78.3	25.1
1.003	50.00	6.20	21./00	0.245	0	.0 0.0	J	0.0	1.11	/8.3	33.2
			©1	982-20	16 XP So	lution	S				
L											

RCD		Page 2
9 Birchtree Way	EXISTING FLOWS	
Maidstone	65-69 HOLMES ROAD	<u> </u>
Kent ME15 7RP	LONDON	Micco
Date 15/12/2017 10:59	Designed by RAC	
File 1158-1003 EXISTING FLOW	Checked by	Diamaye
Micro Drainage	Network 2016.1.1	

#### Free Flowing Outfall Details for Storm

Outfall	Outfall	c.	Level	I.	Level		Min	D,L	W
Pipe Number	Name		(m)		(m)	Ι.	Level (m)	(mm)	(mm)

1.003 EX 23.000 21.600 21.600 1200 0

#### Simulation Criteria for Storm

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

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

#### Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type Summer
Return Period (years)	100	Cv (Summer) 0.750
Region	England and Wales	Cv (Winter) 0.840
M5-60 (mm)	20.600 Stor	rm Duration (mins) 30
Ratio R	0.436	

RCD						Pag	e 3
9 Birchtree Way		EXISTI	NG FLOWS				
Maidstone		65-69	HOLMES R	OAD		2	~
Kent ME15 7RP		LONDON				Mi	
Date 15/12/2017 10:5	te 15/12/2017 10:59 Designed by RAC						
File 1158-1003 EXISTING FLOW Checked by							anaye
Micro Drainage		Networ	k 2016.1	.1			
<u>Summary of Cri</u>	tical Resu	ults by Ma	aximum Le	evel (	<u>(Rank 1) f</u>	<u>or Stor</u>	<u>m</u>
Areal Redu Hot Hot Star Manhole Headloss Co Foul Sewage per h Number of Number of	Action Factor Start (mins) The Level (mm) Deff (Global) Dectare (1/s) Input Hydro Dof Online Co f Offline Co	Simulation r 1.000 A 0 0 0 0.500 Flo 0 0.000 graphs 0 N ntrols 0 N ptrols 0 N	Criteria Additional MADD F ow per Per umber of S umber of J	Flow Tactor In Storage Storage Time/Ar	- % of Tota: * 10m³/ha St nlet Coeffic r Day (1/per * Structures rea Diagrams me Controls	l Flow 0. corage 2. ecient 0. c/day) 0. 0 0	000 000 800 000
Number 0	i offitine co	IICTOID 0 IN		illear ir	inc concrois	0	
Rain	<u>Synt</u> fall Model Region E M5-60 (mm)	hetic Rain	fall Deta: FSR Wales Cv 20.700 Cv	<u>ils</u> Ratic (Summe (Winte	e R 0.436 er) 0.750 er) 0.840		
Margin for F	lood Risk Wa Analysi Iner	rrning (mm) S Timestep DTS Status DVD Status tia Status	2.5 Secor	nd Incr	ement (Exte	450.0 nded) ON OFF OFF	
Duration	Profile(s) (s) (mins)	15, 30, 720,	60, 120, 960, 1440,	180, 2 , 2160,	Summer and 40, 360, 48 2880, 4320 7200, 8640	Winter 0, 600, , 5760, , 10080	
Climate	S) (years) Change (%)					0	
							Water
US/MH	Return Clima	ate First	(X) Fir	rst (Y)	First (Z)	Overflow	Level
1.000 1 15 Winter 1.001 2 15 Winter 1.002 3 15 Winter 1.003 4 15 Winter	30 - 30 - 30 - 30 -	+0% +0% +0% 30/15 ¥ +0% 30/15 \$	Vinter Summer				22.171 22.148 22.105 22.025
Sur	charged Floo	ded		Pipe			
US/MH D	epth Volu	ume Flow /	Overflow	Flow		Level	
PN Name	(m) (m <sup>2</sup>	3) Cap.	(1/s)	(l/s)	Status	Exceeded	L
1.000 1	-0.129 0.	000 0.33		22.4	OK		
1.001 2	-0.052 0.	000 0.61		41.4	OK		
1.002 3 1.003 4	0.005 0. 0.025 0.	000 0.88 000 1.16		60.4 79.3	SURCHARGED		
	େ1 ଦନ	2-2016 XI	Soluti	ons			
	@190	2 2010 AI		0110			

RCD												Pa	ge 1
9 Birch	tree 1	Way			EX	ISTIN	IG FL	OWS					
Maidsto	ne	-			65	5-69 H	IOLME	s roai	D			4	
Kent M	E15 71	RP			LC	NDON							- m
Date 15	/12/2	017 1	0:16		De	Designed by RAC							
File 11	58-10	03 EX	ISTI	NG FLOW	Ch	lecked	l by						rainage
Micro D	raina	ge			Ne	etwork	: 201	6.1.1					
		STOR	M SEI	WER DES	IGN by	the N	<u>lodif</u>	ied R	atio	nal N	Metho	<u>d</u>	
Design Criteria for Storm													
	Pipe Sizes STANDARD Manhole Sizes STANDARD												
				FSR Rain	nfall Mc	del -	Engla	nd and	Wale	5			
		Retu	rn Pe	riod (ye	ars)	100		- 1-1-X		014-	ate C	PIMP (	응) 100 %) ·
				rij-60 Rat	io R 0	.436		лий Р Mir	inimum	Backo	drop He	eight (	m) 0.200
	М	aximum	Rair	fall (mm	/hr)	50		Max	ximum	Backo	drop H	eight (	m) 1.500
Maximum	n Time	of Con	centr	ation (m	ins) /ha) O	30 M	in Des Mir	sign De	epth f	for Op	otimisa	ation (	m) 1.200
	V	olumet	ric F	unoff Co	eff. 0	.750	M	in Slop	e for	: Opti	lmisat:	ion (1:	X) 500
				_			7 -	- ec':		-			
				De	signed 1	with Le	evel S	offits	5				
				<u>Time</u>	e Area	Diagr	<u>am fo</u>	or Sto	orm				
				(1	Time A mins) (	rea     ha) (1	Time mins)	Area (ha)					
					0-4 0	.189	4-8	0.056					
					0 1 0		1 0	0.000					
				Total i	Area Con	itribut	ing (	ha) = (	0.245				
				Tota	al Pipe	Volume	e (m³)	= 5.6	55				
				<u>Netwo</u> :	rk Desi	ign Ta	able	for S	torm				
PN :	Length	Fall	Slop	e I.Area	T.E.	Ba	se	k	HYD	DIA	Secti	on Typ	e Auto
	(m)	(m)	(1:X	) (ha)	(mins)	Flow	(1/s)	(mm)	SECT	(mm)			Design
1.000	20.000	0.100	200.	0 0.065	5.00		0.0	0.600	0	300	Pipe/	Condui	t 🔒
1.001	20.000	0.100	200.	0 0.060	0.00		0.0	0.600	0	300	Pipe/	Condui	t 💣
1.002	20.000	0.100	200.	0 0.060	0.00		0.0	0.600	0	300	Pipe/ Pipe/	Condui Condui	t 🗗 t 🖌
1.000	20.000	0.100	2001	0.000	0.00		0.0		Ũ	000	1100	0011002	- <b>U</b>
				N	letwork	Resu	lts :	<u>[able</u>					
PN	Rai	in 1	.c.	US/IL X	I.Area	. ΣΒ	ase	Foul	Add	Flow	Vel	Cap	Flow
	(mm/	hr) (n	ins)	(m)	(ha)	Flow	(l/s)	(l/s)	(1,	s)	(m/s)	(l/s)	(1/s)
1.00	0 50	.00	5.30	22.000	0.065		0.0	0.0		0.0	1.11	78.3	8.8
1.00	1 50	.00	5.60	21.900	0.125		0.0	0.0		0.0	1.11	78.3	16.9
1.00	12 50 13 50	.00	5.90 6.20	∠⊥.800 21.700	0.185		0.0	0.0		0.0	1.11	78.3 78.3	∠5.⊥ 33.2
1.00	5 50		5.20	21.700	0.240		5.0	0.0		0.0	±•±±	,	JJ • 2
				©1	982-20	16 XP	Solı	utions	3				
L													

RCD		Page 2
9 Birchtree Way	EXISTING FLOWS	
Maidstone	65-69 HOLMES ROAD	<u> </u>
Kent ME15 7RP	LONDON	Micco
Date 15/12/2017 10:16	Designed by RAC	
File 1158-1003 EXISTING FLOW	Checked by	Diamaye
Micro Drainage	Network 2016.1.1	

### Free Flowing Outfall Details for Storm

Outfall	Outfall	c.	Level	I.	Level		Min	D,L	W
Pipe Number	Name		(m)		(m)	Ι.	Level (m)	(mm)	(mm)

1.003 EX 23.000 21.600 21.600 1200 0

#### Simulation Criteria for Storm

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

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

#### Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type Summer
Return Period (years)	100	Cv (Summer) 0.750
Region	England and Wales	Cv (Winter) 0.840
M5-60 (mm)	20.600 Stor	rm Duration (mins) 30
Ratio R	0.436	

RCD									Page	e 3
9 Birc	htree	Way			EXISTI	NG FLOW	S			
Maidst	one				65-69 1	HOLMES	ROAD		4	~
Kent	ME15 7	RP			LONDON				Mid	
Date 1	5/12/2	2017 10:1	L6		Designe	ed by R	AC			
File 1	158-10	03 EXIS	CING FL	OW	Checke	d by			DIC	maye
Micro	Draina	ige			Networ	k 2016.	1.1		·	
Ma	<u>Summa</u>	ry of Cr Areal Rec Hot Sta Headloss C ewage per Number o Number Number Rai:	itical luction F Start ( rt Level loeff (Gl hectare f Input S of Onli of Offlis nfall Mo Reg M5-60 (p	<u>Simu</u> Pactor 1 (mins) (mm) .obal) 0 (1/s) 0 Hydrogra ne Contr ne Contr ne Contr <u>Synthet</u> del ion Engl mm)	s by Ma alation 000 P 0 0 0 0 0 0 0 0 0 0 0 0 0	<u>Criteria</u> dditiona MADD bw per Pe umber of umber of <u>fall Det</u> FSR Wales C 20.700 C	Level ( al Flow - Factor - Factor - Factor - In erson pe: Storage Time/Ar Real Ti ails Real Ti ails Ratic v (Summe v (Winte	(Rank 1) f - % of Tota * 10m <sup>3</sup> /ha S hlet Coeffi r Day (1/pe e Structures me Controls 0 R 0.436 er) 0.750 r) 0.840	for Storr l Flow 0. torage 2. ecient 0. r/day) 0. s 0 s 0 s 0 s 0	n 000 000 800 000
	Ma Retu	Duratio Duratio urn Period Climate	Flood Ri An Profile n(s) (mi (s) (yea Change	sk Warni alysis T DTS DVD Inertia (s) ns) rs) (%)	ng (mm) imestep Status Status Status 15, 30, 720,	2.5 Sec 60, 120 960, 1440	ond Incr , 180, 2 0, 2160,	Summer and 40, 360, 48 2880, 4320 7200, 8640	450.0 ended) OFF OFF Winter 0, 600, 1, 5760, 100 0	
										Water
	US/MH		Return	Climate	First	(X) F	'irst (Y)	First (Z)	Overflow	Level
PN 1.000 1.001 1.002 1.003	Name 1 2 3 4	Storm 15 Winter 15 Winter 15 Winter 15 Winter	Period 100 100 100 100	Change +0% +0% +0%	Surch 100/15 100/15 100/15 100/15	<b>arge</b> Summer Summer Summer Summer	Flood	Overflow	Act.	(m) 22.348 22.318 22.256 22.120
		Su	rcharged	Flooded			Pipe			
		US/MH	Depth	Volume	Flow /	Overflo	w Flow		Level	
	PN	Name	(m)	(m³)	Cap.	(1/s)	(1/s)	Status	Exceeded	
	1.000	1	0.048	0.000	0.42		28.5	SURCHARGED		
	1.001	2	0.118	0.000	0.78		53.4	SURCHARGED		
	1.002	3 4	0.156 0.120	0.000 0.000	1.14		102.7	SURCHARGED SURCHARGED		
				©1982-1	2016 XI	2 Solut	ions			



Appendix C

Drainage Strategy Layout



Appendix D

Post Development surface water calculations

RCD											Pag	ge 1
9 Birc	htree	Way			65	-69 HOLME	S ROAI	D				
Maidst	one				LO	NDON					4	~
Kent	ME15 7	RP									M	irm
Date 0	5/04/2	018 1	4:52		De	signed by	RAC					
File 1	158-10	03 18	0504	.MDX	Ch	ecked by	JD					uniuge
Micro Drainage Network 2016.1.1												
	STORM SEWER DESIGN by the Modified Rational Method											
				Des	sign Cr:	<u>iteria fo</u> r	<u>s Stor</u>	<u>rm</u>				
			P	ipe Sizes	5 STANDAI	RD Manhole	Sizes	STAND	ARD			
	FSR Rainfall Model - England and Wales											
	Return Period (years) 1 PIMP (%) 100											
				Rati	LOR 0.4	438	Min.	imum :	Backd	rop He	ight (n	n) 0.000
	Ma	aximum	Rain	fall (mm/	/hr)	1	Max	imum	Backd	rop He	ight (n	n) 10.000
Maximu	m Time (	of Cond Foul	centra l Sewa	ation (mi age (1/s/	ins) (ha) 0.0	30 Min Des 000 Min	ign De Vel fo	pth f r Aut	or Op o Des	timisa ign on	tion (m lv (m/s	1.200
	V	olumeti	ric R	unoff Coe	eff. 0.	750 Mi	n Slop	e for	Opti	misati	on (1:)	X) 500
				De	signed w	ith Level 1	Inverts	5				
				<u>Time</u>	e Area l	Diagram fo	or Sto	orm				
				(:	Time An mins) (1	rea Time ha) (mins)	Area (ha)					
					0-4 0	162 4-8	0 083					
					0 1 0.	102   10	0.000					
				Total 2	Area Con	tributing (	ha) = (	0.245				
				Tota	al Pipe '	Volume (m³)	= 6.7	15				
				1000			0.7					
				<u>Netwo</u>	rk Desi	<u>gn Table</u>	for S	<u>torm</u>				
PN	Length (m)	Fall (m)	Slop (1:X	e I.Area ) (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Secti	on Type	e Auto Design
1.000	30.000	0.200	150.	0 0.080	5.00	0.0	0.600	0	300	Pipe/	Conduit	: 👌
2.000	30.000	0.200	150.	0 0.080	5.00	0.0	0.600	0	300	Pipe/	Conduit	: <del>1</del>
1.001	30.000	0.200	150.	0 0.085	0.00	0.0	0.600	0	300	Pipe/	Conduit	: <b>ď</b>
1.002	20.000	0.200	100.	0 0.000	0.00	0.0	0.600	0	150	Pipe/	Conduit	: 👌
				N	letwork	Results 1	<u>[able</u>					
P	N Ra: (mm/	in I 'hr) (m	.C. nins)	US/IL X (m)	E I.Area (ha)	Σ Base Flow (1/s)	Foul (1/s)	Add	Flow (s)	Vel (m/s)	Cap (1/s)	Flow (1/s)
1.0	000 1		5.39	31.700	0.080	0.0	0.0	(-)	0.0	1.28	90.6	0.2
2.0	000 1	.00	5.39	31.700	0.080	0.0	0.0		0.0	1.28	90.6	0.2
1.0	01 1	.00	5.78	31.500	0.245	0.0	0.0		0.0	1.28	90.6	0.7
1.0	02 1	.00	6.11	29.400	0.245	0.0	0.0		0.0	1.00	17.8	0.7
				©1	.982-202	16 XP Solu	utions	5				

RCD		Page 2
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	L.
Kent ME15 7RP		Micco
Date 05/04/2018 14:52	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Dialiage
Micro Drainage	Network 2016.1.1	

# 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)
1	32.300	0.600	Open Manhole	300	1.000	31.700	300				
2	32.300	0.600	Open Manhole	300	2.000	31.700	300				
3	32.300	0.800	Open Manhole	300	1.001	31.500	300	1.000	31.500	300	
								2.000	31.500	300	
4	32.300	2.900	Open Manhole	1500	1.002	29.400	150	1.001	31.300	300	2050
EXISTING	32.300	3.100	Open Manhole	300		OUTFALL		1.002	29.200	150	

									Page 3
9 Birchtree	Way				65-69	HOLMES	ROAD		
Maidstone					LONDON				
Kent ME15 7								Micco	
Date 05/04/2018 14:52					Design	ed by R	AC		
File 1158-10	03 1	80504	.MDX		Checke	d by JD			Diamay
Micro Draina	age				Networ	k 2016.	1.1		
			<u>P1</u>	PELINE	SCHEDU	LES for	Storm		
				qU	stream	Manhole	2		
PN	Hvd	Diam	МН	C.Level	I.Level	D.Depth	МН	MH DIAM.,	L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)	
1.000	) 0	300	1	32.300	31.700	0.300	Open Manhole		300
2.000	) 0	300	2	32.300	31.700	0.300	Open Manhole	2	300
1.001	. 0	300	3 4	32.300	31.500	0.500	Open Manhole	2	300
1.002	. 0	100	1	52.5000	23.100	2.700			1000
				DOW	nstream	Mannol	<u>.e</u>		
PN Le	ngth \$ (m)	Slope (1:X)	MH Nam	C.Le e (m	vel I.Le 1) (m	vel D.De ) (m	pth MH ) Connect	MH DI ion (	AM., L*W mm)
1.000 30	.000	150.0		3 32.	300 31.	500 0.	500 Open Mani	hole	300
2.000 30	.000	150.0		3 32.	<b>300</b> 31.	500 0.	500 Open Mani	hole	300
1.001 30 1.002 20	.000	150.0 100.0	EXIST	4 32. ING 32.	300 31. 300 29.	300 0. 200 2.	700 Open Mani 950 Open Mani	hole hole	1500 300
		Fr	ee Fl	lowing	Outfall	Detail	s for Stor	m	
	0	utfall		ıtfall (	Level	T Level	Min D	.T. W	
	Pip	e Numb	ber	Name	(m)	(m)	I. Level (m	m) (mm)	
							(m)		
		1.0	02 EX	ISTING	32.300	29.200	29.300 3	00 0	
			<u>Si</u>	mulatic	on Crite	eria fo	<u>r Storm</u>		
				~ ~ ~ ~ ~					
	Volume Areal	Reduc	Runorr ction	Factor 1	1.000	Additiona MADD	I Flow - % o Factor * 10m	I TOTAL FL 3/ha Stora	ow 0.000 ge 2.000
		Hot S	Start	(mins)	0		Inlet	Coeffiecie	nt 0.800
	Hot	Start	t Leve	l (mm)	0 Flc	ow per Pe	erson per Day	(l/per/da	y) 0.000
Manhole	nead⊥o ewage	per he	e⊥I (G ectare	(1/s) (	0.000		Kun Output Int	erval (min	s) 60 s) 1
Foul S		-					-		
Foul S	Numbe	er of	Inpu+	Hvdroar	aphs 0 N	umber of	Storage Stri	ictures 1	
Foul S	Numbe Nur Numb	er of mber o per of	Input f Onl	Hydrogr ine Cont ine Cont	aphs 0 N rols 1 N rols 0 N	umber of umber of umber of	Storage Stru Time/Area Di Real Time Co	actures 1 agrams 0	
Foul S	Numbe Nur Numł	er of mber o per of	Input of Onl: Offl:	Hydrogr ine Cont ine Cont	aphs 0 N rols 1 N rols 0 N	umber of umber of umber of	Storage Stru Time/Area Di Real Time Co	actures 1 agrams 0 ontrols 0	
Foul S	Numbe Nur Numł	er of nber o per of	Input of Onl: Offl:	Hydrogr ine Cont ine Cont Synthet	aphs 0 N rols 1 N rols 0 N <u>ic Rain</u>	umber of umber of umber of fall De	Storage Stru Time/Area Di Real Time Co tails	actures 1 agrams 0 ontrols 0	
Foul S	Numbe Num Numł Retu	er of nber o per of Ra: .rn Per	Input of Onl: Offl: <u>S</u> infall riod (	Hydrogr ine Cont ine Cont <u>Synthet</u> Model years)	aphs 0 N rols 1 N rols 0 N <u>ic Rain</u>	umber of umber of <u>fall De</u> FSF 1	Storage Stru Time/Area Di Real Time Co stails Ratio Profile Tvp	agrams 0 ontrols 0 R 0.438 e Summer	
Foul S	Numbe Nur Numb Retu	er of mber o per of Ra: rn Per	Input of Onl: Offl: <u>S</u> infall riod (	Hydrogr ine Cont Synthet Model years) Region H	aphs 0 N rols 1 N ic Rain England a	umber of umber of <u>fall De</u> FSF 1 und Wales 20 600	Storage Stru Time/Area Di Real Time Co stails Ratio Profile Typ Cv (Summer	R 0.438 e Summer ) 0.750	
Foul S	Numbe Num Numb Retu	er of nber o per of Ra: rn Pei	Input of Onl. Offl: infall riod ( M5-6	Hydrogr ine Cont Synthet Model years) Region H 0 (mm)	aphs 0 N rols 1 N ic Rain England a	umber of umber of fall De FSF 1 und Wales 20.600	Storage Stru Time/Area Di Real Time Co stails Ratio Profile Typ Cv (Summer Cv (Winter	actures 1 .agrams 0 ontrols 0 R 0.438 e Summer ) 0.750 ) 0.840	

RCD		Page 4
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 05/04/2018 14:52	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Dialitage
Micro Drainage	Network 2016.1.1	

# Synthetic Rainfall Details

Storm Duration (mins) 30

RCD		Page 5
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 05/04/2018 14:52	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Diginarie
Micro Drainage	Network 2016.1.1	

### Online Controls for Storm

# Complex Manhole: 4, DS/PN: 1.002, Volume (m<sup>3</sup>): 7.2

## <u>Orifice</u>

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 29.400

#### <u>Orifice</u>

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 30.400

RCD		Page 6
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	4 a
Kent ME15 7RP		Micco
Date 05/04/2018 14:52	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Digitigh
Micro Drainage	Network 2016.1.1	

#### Storage Structures for Storm

### Cellular Storage Manhole: 4, DS/PN: 1.002

Invert Level (m) 29.400 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000

### Depth (m) Area (m<sup>2</sup>) Inf. Area (m<sup>2</sup>) Depth (m) Area (m<sup>2</sup>) Inf. Area (m<sup>2</sup>)

0.000	20.0	20.0	2.501	0.0	64.7
2.500	20.0	64.7			

RCD									Page	e 7
9 Birc	htree	Way			65-69 H	HOLMES	ROAD		<b>_</b>	
Maidst	one	_			LONDON				2	~ ~
Kent	ME15 7	RP							— Mic	10
Date 0	5/04/2	2018 14:5	52 54 MDV		Designe	ed by R	AC		Dra	inage
File I	158-10	103 18050	J4.MDX		Checke	a by JD	1 1			
Micro	Draina	ige			Networl	K 2016.	1.1			
	<u>Summa</u>	<u>ry of Cr</u>	itical	Results	s by Ma	aximum 1	Level	( <u>Rank 1) f</u>	<u>or Storn</u>	<u>n</u>
Ma	anhole 1 Foul Se	Areal Rec Hot Hot Sta Headloss C ewage per	duction E Start ( art Level Coeff (G1 hectare	<u>Simu</u> Factor 1. (mins) (mm) (obal) 0. (1/s) 0.	<u>alation</u> .000 A 0 .500 Flc .000	<u>Criteria</u> additiona MADD ow per Pe	Factor Factor I: erson pe	- % of Tota * 10m³/ha S nlet Coeffi r Day (1/pe:	l Flow 0.0 torage 2.0 ecient 0.0 r/day) 0.0	000 000 300 000
		Number o Number Number	f Input of Onli: of Offli:	Hydrogra ne Contro ne Contro	phs 0 Ni ols 1 Ni ols 0 Ni	umber of umber of umber of	Storage Time/Ar Real Ti	e Structures ea Diagrams me Controls	: 1 : 0 : 0	
			<b>C 1 1 1 1</b>	Synthet	ic Rain:	fall Deta	ails	D 0 100		
		Rai	nfall Mo Req	del ion Engl	and and	FSR Wales C <sup>.</sup>	Ratic v (Summe	R 0.438 (r) 0.750		
			M5-60 (1	mm)	2	20.600 C <sup>.</sup>	v (Winte	r) 0.840		
	Ma	rgin for	Flood Ri	sk Warni	ng (mm)				450.0	
		2	An	alysis T	imestep	2.5 Sec	ond Incr	ement (Exte	ended)	
				DTS DVD	Status Status				ON ON	
				Inertia	Status				ON	
		Duratio	Profile n(s) (mi	e(s) ns)	15, 30, 720, 9	60, 120, 960, 1440	, 180, 2 0, 2160,	Summer and 40, 360, 48 2880, 4320 7200, 8640	Winter 0, 600, , 5760, , 10080	
	Reti	ırn Period Climate	(s) (yea Change	rs) (응)					100 30	
										Water
DN	US/MH Name	Storm	Return	Climate	First	(X) F	irst (Y)	First (Z) Overflow	Overflow	Level
	Italie	0 COIM	rerrou	change	Suren	arge	11000	overriow	Act.	(111)
1.000	1	15 Winter	100 100	+30% +30%	100/15	Summer				32.251 32.251
1.001	3	15 Winter	100	+30%	100/15	Summer				32.141
1.002	4	30 Winter	100	+30%	100/15	Summer				32.002
		Su	rcharged	Flooded			Pipe		_	
	DN	US/MH Namo	Depth (m)	Volume (m <sup>3</sup> )	Flow /	Overflo	w Flow	Status	Level	
	EN	Traille	()	()	Cap.	(1/3)	(1/3)	Jlalus	DACEEded	
	1.000	1	0.251	0.000	0.54		44.4	FLOOD RISK		
	1.001	3	0.341	0.000	1.62		133.6	FLOOD RISK		
	1.002	4	2.452	0.000	2.05		34.2	FLOOD RISK		
				©1982-2	2016 XE	Solut:	ions			
L										

RCD	Page 1										
9 Birchtree Way	65-69 HOLMES ROAD										
Maidstone	LONDON										
Kent ME15 7RP	Mirro										
Date 05/04/2018 14:53	Designed by RAC										
File 1158-1003 180504.MDX	Checked by JD										
Micro Drainage Network 2016.1.1											
STORM SEWER DESIGN by the Modified Rational Method											
Design	Criteria for Storm										
Pipe Sizes STA	ANDARD Manhole Sizes STANDARD										
FSR Rainfal	FSR Rainfall Model - England and Wales										
Return Period (years) 1 PIMP (%) 100											
Ratio R	0.438 Minimum Backdrop Height (m) 0.000										
Maximum Rainfall (mm/hr)	1 Maximum Backdrop Height (m) 10.000										
Maximum Time of Concentration (mins) Foul Sewage (1/s/ha)	30 Min Design Depth for Optimisation (m) 1.200 0.000 Min Vel for Auto Design only (m/s) 1.00										
Volumetric Runoff Coeff.	0.750 Min Slope for Optimisation (1:X) 500										
Design	ed with Level Inverts										
<u>Time Ar</u>	<u>ea Diagram for Storm</u>										
Time (mins	Area Time Area ) (ha) (mins) (ha)										
0-	4 0 162 4-8 0 083										
	10.102 100.003										
Total Area	Contributing (ha) = $0.245$										
Total P	ipe Volume $(m^3) = 6.715$										
Network I	Design Table for Storm										
PN Length Fall Slope I.Area T. (m) (m) (1:X) (ha) (mi	E. Base k HYD DIA Section Type Auto ns) Flow (l/s) (mm) SECT (mm) Design										
1.000 30.000 0.200 150.0 0.080 5	.00 0.0 0.600 o 300 Pipe/Conduit 🔒										
2.000 30.000 0.200 150.0 0.080 5	.00 0.0 0.600 o 300 Pipe/Conduit 🔒										
1.001 30.000 0.200 150.0 0.085 0	.00 0.0 0.600 o 300 Pipe/Conduit 💣										
1.002 20.000 0.200 100.0 0.000 0	.00 0.0 0.600 o 150 Pipe/Conduit 🔒										
Netw	ork Results Table										
PN Rain T.C. US/IL E I.A (mm/hr) (mins) (m) (ha	Area Σ Base Foul Add Flow Vel Cap Flow a) Flow (l/s) (l/s) (l/s) (m/s) (l/s) (l/s)										
1.000 1.00 5.39 31.700 0	.080 0.0 0.0 0.0 1.28 90.6 0.2										
2.000 1.00 5.39 <mark>31.700</mark> 0	.080 0.0 0.0 0.0 1.28 90.6 0.2										
1.001 1.00 5.78 31.500 0 1.002 1.00 6.11 29.400 0	.245       0.0       0.0       0.0       1.28       90.6       0.7         .245       0.0       0.0       0.0       1.00       17.8       0.7										
©1982	-2016 XP Solutions										

RCD		Page 2
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	L.
Kent ME15 7RP		Micco
Date 05/04/2018 14:53	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Digitight
Micro Drainage	Network 2016.1.1	

# Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	M Conne	fH ection	MH Diam.,L*W (mm)	PN	Pipe O Inver Level	ut t (m)	Diameter (mm)	PN	Pipes Inver Level	In t Dia (m) (	meter mm)	Backdrop (mm)
1	32.300	0.600	Open M	ianhole	300	1.000	31.7	700	300					
2	32.300	0.600	Open M	Ianhole	300	2.000	31.7	700	300					
3	32.300	0.800	Open M	ſanhole	300	1.001	31.5	500	300	1.000	31.5	500	300	
										2.000	31.5	500	300	
4	32.300	2.900	Open M	ſanhole	1500	1.002	29.4	400	150	1.001	31.3	300	300	2050
EXISTING	32.300	3.100	Open M	ianhole	300		OUTFA	ALL		1.002	29.2	200	150	

									Page 5
9 Birchtree	Way				65-69	HOLMES	ROAD		
Maidstone					LONDON				4
Kent ME15 7	RP								Micco
Date 05/04/2	2018	14:53			Design	ed by R	AC		
File 1158-10	03 1	80504	.MDX		Checke	d bv JD			Drainago
Micro Draina	are				Networ	k 2016.	1.1		
						. 2010.	±•±		
			<u>P1</u>	(PELINE	SCHEDU	LES for	Storm		
				Up	stream	Manhole	<u>.</u>		
PN	Hyd	Diam	MH	C.Level	I.Level	D.Depth	MH	MH DIA	M., L*W
1.000		300	1	32,300	31.700	0.300	Open Manho	le v	300
2.000	0	300	2	32,300	31.700	0.300	Open Manho	le	300
1 001	0	300	3	32 300	31 500	0 500	Open Manho		300
1.002	0	150	4	32.300	29.400	2.750	Open Manho	le	1500
				Dow	<u>instream</u>	Manhol	<u>.e</u>		
		11		G . T.			ath M		
PN Le	(m)	(1:X)	Name	е (п	n) (m	iver D.De i) (m	) Connec	tion	(mm)
1.000 30	.000 1	L50.0		3 32.	.300 31.	500 0.	500 Open Ma	nhole	300
2.000 30	.000 1	L50.0		3 32.	.300 31.	500 0.	500 Open Ma	nhole	300
1.001 30 1.002 20	.000 1	L50.0 L00.0	EXIST	4 32. ING 32.	.300 31. .300 29.	300       0.         200       2.	700 Open Ma 950 Open Ma	nhole nhole	1500 300
		Fr	ee Fl	Lowing	Outfall	Detail	s for Sto	rm	
	O,	utfall	1 01	utfall (	C Level	T Level	Min	D.T. W	
	Pip	e Numb	ber	Name	(m)	(m)	I. Level	(mm) (mm)	
							(m)		
		1.0	)02 EX	ISTING	32.300	29.200	29.300	300 0	)
			<u>si</u>	mulati	<u>on Crit</u> e	<u>eria fo</u>	<u>r Storm</u>		
	701,000	tria T							
	₄ ∩ ⊤ nīiie		マリック・ディ	: Cooff '	0 750 7	Addition	al Flow	of Total	Flow 0 000
Y	Areal	Reduc	Runoff ction	Coeff Factor	0.750 <i>2</i> 1.000	Additiona MADD	1 Flow - % Factor * 10	of Total m³/ha St	Flow 0.000 orage 2.000
,	Areal	Reduc Hot S	Runoff ction Start	Coeff Factor ( (mins)	0.750 <i>1</i> 1.000 0	Additiona MADD	1 Flow - % Factor * 10 Inlet	of Total m³/ha St Coeffie	Flow 0.000 orage 2.000 cient 0.800
,	Areal Hot	Reduc Hot Start	Runoff ction Start t Leve	Coeff Factor (mins)	0.750 2 1.000 0 Flc	Additiona MADD ow per Pe	I Flow - % Factor * 10 Inlet erson per Da	of Total m³/ha St Coeffie y (l/per	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000
Manhole J Foul Se	Areal Hot Headlo	Reduc Hot Start ss Coe per he	Runoff ction Start t Leve eff (G ectare	F Coeff Factor (mins) el (mm) Global) (1/s)	0.750 2 1.000 0 Flc 0.500 0.000	Additiona MADD ow per Pe	I Flow - % Factor * 10 Inlet erson per Da Ru Output Ir	of Total m³/ha St Coeffie y (l/per n Time ( terval (	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1
Manhole Manhole Se	Areal Hot Headlo wage Numbe	Reduc Hot Start Start ss Coe per he	Runoff ction Start t Leve eff (G ectare Input	F Coeff Factor (mins) (mm) (lobal) (lobal) (l/s) Hydrogr	0.750 2 1.000 0 Flc 0.500 0.000 Taphs 0 N	Additiona MADD ow per Pe Number of	Factor * 10 Factor * 10 Inlet erson per Da Ru Output Ir Storage St	of Total m³/ha St Coeffie y (l/per in Time ( iterval ( ructures	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1
Manhole Manhole Se	Areal Hot Headlo ewage Numbe Num Numk	Reduce Hot Start Start ss Coe per he er of mber of	Runoff ction Start t Leve eff (G ectare Input f Onl: Offl:	E Coeff Factor (mins) Pl (mm) Flobal) (1/s) Hydrogr ine Cont ine Cont	0.750 2 1.000 0 Flc 0.500 0.000 Caphs 0 N rols 1 N rols 0 N	Additiona MADD Dw per Pe Number of Number of	Factor + 10 Factor + 10 Inlet erson per Da Ru Output Ir Storage St Time/Area Real Time	of Total m³/ha St Coeffie y (l/per in Time ( iterval ( ructures Diagrams Controls	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1 0 0
Manhole J Foul Se	Areal Hot Headlo awage Numbe Numbe Numbe	Reduc Hot S Start ss Coe per he er of mber of	Runoff ction Start t Leve eff (G ectare Input f Onl: Offl: S	F Coeff Factor (mins) (l (mm) (lobal) (l/s) Hydrogr ine Cont ine Cont	0.750 2 1.000 0 Flc 0.500 0.000 caphs 0 N crols 1 N crols 0 N .ic Rain	Additiona MADD ow per Pe Number of Number of Stall De	Factor + 10 Factor + 10 Inlet erson per Da Output Ir Storage St Time/Area Real Time	of Total m³/ha St : Coeffie y (l/per in Time ( iterval ( ructures Diagrams Controls	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1 0 0
Manhole J Foul Se	Areal Hot Headlo ewage Numbe Num Numk	Reduc Hot S Start ss Coe per he er of mber o per of Ra:	Runoff ction Start t Leve eff (G ectare Input of Onl: <u>S</u> infall	Coeff Factor (mins) el (mm) flobal) (1/s) Hydrogr ine Cont ine Cont <u>Synthet</u> Model	0.750 2 1.000 0 Flc 0.500 0.000 aphs 0 N rols 1 N rols 0 N <u>ic Rain</u>	Additiona MADD Dw per Pe Number of Number of Infall De FSF	Al Flow - % Factor * 10 Inlet erson per Da Ru Output Ir Storage St Time/Area Real Time Etails Ratio	of Total m³/ha St Coeffie y (l/per in Time ( iterval ( ructures Diagrams Controls P R 0.43	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1 0 0
Manhole J Foul Se	Areal Hot Headlo awage Numbe Num Numk	Reduc Hot S Start ss Coe per he er of mber o poer of Ra: rn Pei	Runoff ction Start t Leve eff (G ectare Input f Onl: Offl: <u>S</u> infall riod (	Coeff Factor (mins) el (mm) ilobal) (1/s) Hydrogr ine Cont ine Cont <u>Synthet</u> Model years)	0.750 2 1.000 0 Flc 0.500 0.000 caphs 0 N crols 1 N crols 0 N <u>cic Rain</u>	Additiona MADD ow per Pe Jumber of Jumber of Additional Market Market SER	Al Flow - % Factor * 10 Inlet erson per Da Output Ir Storage St Time/Area Real Time etails C Ratio	of Total m³/ha St Coeffie y (l/per in Time ( iterval ( ructures Diagrams Controls o R 0.43 ppe Summe	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1 0 0
Manhole 1 Foul Se	Areal Hot Headlo ewage Numbe Num Numk	Reduc Hot S Start ss Coe per he er of mber of cer of Ra: rn Per	Runoff ction Start t Leve aff (G actare Input of Onl: Offl: <u>S</u> infall riod ( M5-6	Coeff Factor (mins) (mm) Flobal) (1/s) Hydrogr ine Cont ine Cont Synthet Model years) Region 1 0 (mm)	0.750 2 1.000 0 Flc 0.500 0.000 Taphs 0 N Trols 1 N Trols 0 N Trols 0 N Trols 0 N Trols 0 N Trols 1 A Trols 1	Additiona MADD ow per Pe Jumber of Jumber of Afall De FSF 1 and Wales 20.600	Al Flow - % Factor * 10 Inlet erson per Da Ru Output Ir Storage St Time/Area Real Time etails C Ratio Profile Ty Cv (Summe Cv (Winte	of Total m <sup>3</sup> /ha St c Coeffie y (1/per in Time ( iterval ( ructures Diagrams Controls P R 0.43 rpe Summe er) 0.75 er) 0.84	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1 0 0 8 r 0 0
Manhole i Foul Se	Areal Hot Headlo ewage Numbe Num Numk	Reduc Hot S Start ss Coe per he er of aber o per of Ra: rn Per	Runoff ction Start t Leve eff (G ectare Input of Onl: Offl: <u>S</u> infall riod ( M5-6	Coeff Factor (mins) el (mm) Global) (1/s) Hydrogr ine Cont ine Cont Synthet Model years) Region D (0 (mm)	0.750 2 1.000 0 Flc 0.500 0.000 caphs 0 N crols 1 N crols 0 N crols 0 N crols 2 N crols 2 N crols 3 N crols 4	Additiona MADD ow per Pe lumber of lumber of fall De FSF 1 and Wales 20.600	Al Flow - % Factor * 10 Inlet erson per Da Ru Output Ir Storage St Time/Area Real Time etails Real Time CV (Summe CV (Winte	of Total m <sup>3</sup> /ha St : Coeffie by (1/per in Time ( iterval ( ructures Diagrams Controls o R 0.43 rpe Summe er) 0.75 er) 0.84	Flow 0.000 orage 2.000 cient 0.800 /day) 0.000 mins) 60 mins) 1 1 0 0 8 r 0 0

RCD		Page 4
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	Y a
Kent ME15 7RP		Micco
Date 05/04/2018 14:53	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Digiliada
Micro Drainage	Network 2016.1.1	

# Synthetic Rainfall Details

Storm Duration (mins) 30

RCD		Page 5
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 05/04/2018 14:53	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Digitigh
Micro Drainage	Network 2016.1.1	

### Online Controls for Storm

# Complex Manhole: 4, DS/PN: 1.002, Volume (m<sup>3</sup>): 7.2

## <u>Orifice</u>

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 29.400

#### <u>Orifice</u>

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 30.400

RCD		Page 6
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	4 a
Kent ME15 7RP		Micco
Date 05/04/2018 14:53	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Digitigh
Micro Drainage	Network 2016.1.1	

#### Storage Structures for Storm

### Cellular Storage Manhole: 4, DS/PN: 1.002

Invert Level (m) 29.400 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000

#### Depth (m) Area (m<sup>2</sup>) Inf. Area (m<sup>2</sup>) Depth (m) Area (m<sup>2</sup>) Inf. Area (m<sup>2</sup>)

0.000	20.0	20.0	2.501	0.0	64.7
2.500	20.0	64.7			



Appendix E

Pre-development surface water volume calculations

RCD		Page 1
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 15/12/2017 10:55	Designed by RAC	
File 1158-1003 TOTAL VOLUME	Checked by	Diamarje
Micro Drainage	Source Control 2016.1.1	

# Summary of Results for 1 year Return Period

	Sto Eve	rm nt	Max Level (m)	Max Depth (m)	Max Volume (m³)	Status
360	min	Summer	23.203	0.303	39.3	O K
<mark>360</mark>	min	Winter	23.239	0.339	44.1	O K

	Sto	rm	Rain	Flooded	Time-Peak
	Eve	nt	(mm/hr)	Volume	(mins)
				(m³)	
360	min	Summer	3.569	0.0	368
360	min	Winter	3.569	0.0	368

RCD		Page 2
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	L.
Kent ME15 7RP		Micco
Date 15/12/2017 10:55	Designed by RAC	
File 1158-1003 TOTAL VOLUME	Checked by	Diginaria
Micro Drainage	Source Control 2016.1.1	
Ra	infall Details	
Rainfall Model	FSR Winter Storms Ye	es
Return Period (years)	1 Cv (Summer) 0.75	0
M5-60 (mm)	20.400 Shortest Storm (mins) 36	10 50
Ratio R	0.436 Longest Storm (mins) 36	50
Summer Storms	Yes Climate Change %	+ 0
Tin	ne Area Diagram	
Tota	al Area (ha) 0.245	
Time (mins)	Area Time (mins) Area	
From: To:	(ha) From: To: (ha)	
0 4	4 8 0.120	

RCD		Page 3				
9 Birchtree Way	65-69 HOLMES ROAD					
Maidstone	LONDON	L'				
Kent ME15 7RP		Micco				
Date 15/12/2017 10:55	Designed by RAC					
File 1158-1003 TOTAL VOLUME	Checked by	Diamaye				
Micro Drainage	Source Control 2016.1.1					
Madal Dataila						
<u>_</u>	<u>Nodel Delalis</u>					

Storage is Online Cover Level (m) 25.400

<u>Tank or Pond Structure</u>

Invert Level (m) 22.900

### Depth (m) Area (m<sup>2</sup>) Depth (m) Area (m<sup>2</sup>)

0.000 130.0 2.500 130.0

RCD		Page 1
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 15/12/2017 10:57	Designed by RAC	
File 1158-1003 TOTAL VOLUME	Checked by	Dialitaye
Micro Drainage	Source Control 2016.1.1	

# Summary of Results for 30 year Return Period

Storm Event		Max Level (m)	Max Depth (m)	Max Volume (m³)	Status	
360	min	Summer	23.569	0.669	87.0	O K
<mark>360</mark>	min	Winter	23.650	0.750	97.5	O K

Storm			Rain	Rain Flooded		
	Eve	nt	(mm/hr)	Volume (m³)	(mins)	
360	min	Summer	7.892	0.0	368	
360	min	Winter	7.892	0.0	368	

RCD		Page 2
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	Mr.
Kent ME15 7RP		Micro
Date 15/12/2017 10:57	Designed by RAC	Desipage
File 1158-1003 TOTAL VOLUME	Checked by	Diamaye
Micro Drainage	Source Control 2016.1.1	
Ra	<u>infall Details</u>	
Rainfall Model	FSR Winter Storms Ye	≥S
Region Engla	and and Wales Cv (Summer) 0.75	40
M5-60 (mm)	20.400 Shortest Storm (mins) 36	50
Ratio R	0.436 Longest Storm (mins) 36	50
Summer Storms	Yes Climate Change % -	-0
<u></u>	ne Area Diagram	
Tota	al Area (ha) 0.245	
Time (mins)	Area Time (mins) Area	
From: To:	(ha) From: To: (ha)	
0.4	0 125 4 8 0 120	

RCD		Page 3
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	L'
Kent ME15 7RP		Micco
Date 15/12/2017 10:57	Designed by RAC	
File 1158-1003 TOTAL VOLUME	Checked by	Diamaye
Micro Drainage	Source Control 2016.1.1	1
1	<u>Model Details</u>	

Storage is Online Cover Level (m) 25.400

<u>Tank or Pond Structure</u>

Invert Level (m) 22.900

### Depth (m) Area (m<sup>2</sup>) Depth (m) Area (m<sup>2</sup>)

0.000 130.0 2.500 130.0

RCD		Page 1
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 15/12/2017 10:56	Designed by RAC	
File 1158-1003 TOTAL VOLUME	Checked by	Digitigh
Micro Drainage	Source Control 2016.1.1	

# Summary of Results for 100 year Return Period

Storm Event		Max Level (m)	Max Max Level Depth (m) (m)		Status	
360	min	Summer	23.769	0.869	112.9	O K
<mark>360</mark>	<mark>min</mark>	Winter	23.873	0.973	126.5	O K

Storm			Rain	Flooded	Time-Peak	
Event		t (mm/hr) Vo		(mins)		
				(m³)		
360	min	Summer	10.244	0.0	368	
360	min	Winter	10.244	0.0	368	

RCD		Page 2
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	4
Kent ME15 7RP		- Com
Date 15/12/2017 10:56	Designed by RAC	
File 1158-1003 TOTAL VOLUME.	Checked by	Drainage
Micro Drainage	Source Control 2016 1 1	
Ra.	infall Details	
Rainfall Model Return Period (years) Region Engla M5-60 (mm) Ratio R Summer Storms	FSR Winter Storms Y 100 Cv (Summer) 0.7 and and Wales Cv (Winter) 0.8 20.400 Shortest Storm (mins) 3 0.436 Longest Storm (mins) 3 Yes Climate Change %	Yes 950 940 960 960 +0
Tim	ne Area Diagram	
Tota	al Area (ha) 0.245	
Time (mins) From: To:	Area Time (mins) Area (ha) From: To: (ha)	
0 4	0.125 4 8 0.120	

RCD		Page 3
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 15/12/2017 10:56	Designed by RAC	
File 1158-1003 TOTAL VOLUME	Checked by	Diamaye
Micro Drainage	Source Control 2016.1.1	1
4	Model Details	

Storage is Online Cover Level (m) 25.400

<u>Tank or Pond Structure</u>

Invert Level (m) 22.900

### Depth (m) Area (m<sup>2</sup>) Depth (m) Area (m<sup>2</sup>)

0.000 130.0 2.500 130.0



Appendix F

Post-development surface water volume calculations

RCD										Pag	je 7
9 Birch	ntree	Way			65-69 H	IOLME	S RO	AD			
Maidsto	one			1	LONDON					4	~
Kent N	ME15 7	7RP								M	
Date 05	5/04/2	2018 14:5	3	]	Designe	ed by	7 RAC				
File 11	158-10	03 18050	4.MDX	0	Checked	d by	JD			DI	amaye
Micro I	Draina	age		1	Networ}	c 201	6.1.	1			
Ма	Summa nhole : Foul S	ry of Cr: Areal Red Hot Sta Headloss C ewage per Number of Number of	uction F Start ( rt Level beff (Gl hectare f Input 1 of Onlin	<u>Simu</u> actor 1. (mins) (mm) (obal) 0. (1/s) 0. Hydrograp ne Contro	by Ma lation 000 A 0 500 Flo 000 ohs 0 Nu ohs 0 Nu ohs 0 Nu	<u>Crite</u> dditi MA w per umber umber umber	<u>m Le</u> nia onal DD Fa Pers of St of T: of Re	Flow ctor I on pe corage ime/Ar	(Rank 1) f - % of Tota * 10m³/ha S nlet Coeffi r Day (1/pe e Structures cea Diagrams me Controls	l Flow 0 torage 2 ecient 0 r/day) 0	cm .000 .000 .800 .000
	Ma	Rair argin for 1	afall Mov Reg M5-60 (n Flood Ri An	<u>Synthet</u> del ion Engl. mm) sk Warni alysis T DTS DVD Inertia	ic Raint and and 2 ng (mm) imestep Status Status Status Status	<u>Fall E</u> FSR Wales 20.600 2.5 S	Detail CV CV CV Second	ls Ratic (Summe (Winte d Incr	o R 0.438 er) 0.750 er) 0.840	450.0 nded) ON ON ON	
	Reti	Duration urn Period Climate	Profile n(s) (mi (s) (yea Change	(s) ns) rs) (%)	15, 30, 720, 9	60, 1 960, 1	120, 1 1440,	.80, 2 2160,	Summer and 40, 360, 48 2880, 4320 7200, 8640	Winter 0, 600, , 5760, , 10080 30 0	
											Water
DN	US/MH	0 to a mm	Return	Climate	First	(X)	Firs	t (Y)	First (Z)	Overflow	Level
1.000 2.000 1.001 1.002	1 2 3 4	15 Winter 15 Winter 15 Winter 30 Winter	30 30 30 30	+0% +0% +0% +0%	30/15 S	ummer	μŢ	.000	OverIlow	ACT.	(m) 31.825 31.825 31.769 31.115
		0	obsect					Dime			
		US/MH	Depth	Volume	Flow /	Overf	flow	Flow		Level	
	PN	Name	(m)	(m <sup>3</sup> )	Cap.	(1/	s)	(1/s)	Status	Exceede	d
	1 000	1	-0 175	0 000	0 35			28 /	∩r.		
	2.000	± 2	-0.175	0.000	0.35			28.4	OK		
	1.001	3	-0.031	0.000	1.00			82.3	OK		
	1.002	4	1.565	0.000	1.42			23.8	SURCHARGED		
				©1982-2	2016 XF	° Sol	utio	ns			

RCD											Pag	ge 1
9 Birc	htree	Way			65	-69 HOLME	S ROAI	D				
Maidst	one				LO	NDON					4	~
Kent	ME15 7	RP									M	irm
Date 0	5/04/2	018 1	4:54		De	signed by	RAC					
File 1158-1003 180504.MDX Checked by JD										uniuge		
Micro	Draina	ge			Ne	twork 201	6.1.1					
		STOR	M SEI	WER DES	IGN by	the Modif	ied R	atio	nal N	letho	<u>d</u>	
				Des	sign Cr:	<u>iteria fo</u> r	<u>s Stor</u>	<u>rm</u>				
			P	ipe Sizes	5 STANDAI	RD Manhole	Sizes	STAND	ARD			
				FSR Rain	nfall Mod	del - Engla	nd and	Wale	5			
		Retu	rn Pe	riod (yea	ars) (mm) 20 (	1	7.dd F	1.047 /	Clim	ato Ch	PIMP (%	s) 100
				Rati	LOR 0.4	438	Min.	imum 1	Backd	rop He	ight (n	n) 0.000
	Ma	aximum	Rain	fall (mm/	/hr)	1	Max	imum 1	Backd	rop He	ight (n	n) 10.000
Maximu	m Time (	ot Cond Four	centra L Sewa	ation (mi age (1/s/	LNS) (ha) 0 (	30 Min Des 000 Min	ign Dej Vel fo	pth for a state of the	or Op o Des	timisa ign on	tion (n lv (m/s	1.200
	Vo	olumeti	cic R	unoff Coe	eff. 0.	750 Mi	n Slop	e for	Opti	misati	on (1:)	X) 500
				De	esigned w	ith Level 1	Inverts	5				
				<u>Time</u>	e Area I	Diagram fo	or Sto	orm				
				(:	Time An mins) (1	rea Time ha) (mins)	Area (ha)					
					0-4 0	162 4-8	0 083					
					0 - 0.	102 1 1 0	0.000					
				Total 2	Area Con	tributing (	ha) = (	0.245				
				Tota	al Pipe '	Volume (m³)	= 6.7	15				
				1000	ar ripe		0.7					
				<u>Netwo</u> :	rk Desi	gn Table	for S	torm				
PN	Length (m)	Fall (m)	Slop (1:X	e I.Area ) (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Secti	on Type	e Auto Design
1.000	30.000	0.200	150.	0 0.080	5.00	0.0	0.600	0	300	Pipe/	Conduit	: 🔒
2.000	30.000	0.200	150.	0 0.080	5.00	0.0	0.600	0	300	Pipe/	Conduit	e 🔒
1.001	30.000	0.200	150.	0 0.085	0.00	0.0	0.600	0	300	Pipe/	Conduit	d d
1.002	20.000	0.200	100.	0 0.000	0.00	0.0	0.600	0	150	Pipe/	Conduit	- <del>0</del>
<u>Network Results Table</u>												
P	N Ra: (mm/	in I 'hr) (m	.C. nins)	US/IL X (m)	E I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add (1/	Flow (s)	Vel (m/s)	Cap (1/s)	Flow (l/s)
1.0	00 1	.00	5.39	31.700	0.080	0.0	0.0		0.0	1.28	90.6	0.2
2.0	00 1	.00	5.39	31.700	0.080	0.0	0.0		0.0	1.28	90.6	0.2
1.0	01 1 02 1	.00	5.78 6.11	31.500 29.400	0.245 0.245	0.0	0.0		0.0	1.28 1.00	90.6 17.8	0.7 0.7
				©1	.982-201	16 XP Solu	utions	3				

RCD		Page 2
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	L.
Kent ME15 7RP		Micco
Date 05/04/2018 14:54	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Digitight
Micro Drainage	Network 2016.1.1	

# Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	M Conne	fH ection	MH Diam.,L*W (mm)	PN	Pipe O Inver Level	ut t (m)	Diameter (mm)	PN	Pipes Inver Level	In t Dia (m) (	meter mm)	Backdrop (mm)
1	32.300	0.600	Open M	ianhole	300	1.000	31.7	700	300					
2	32.300	0.600	Open M	Ianhole	300	2.000	31.7	700	300					
3	32.300	0.800	Open M	ſanhole	300	1.001	31.5	500	300	1.000	31.5	500	300	
										2.000	31.5	500	300	
4	32.300	2.900	Open M	ſanhole	1500	1.002	29.4	400	150	1.001	31.3	300	300	2050
EXISTING	32.300	3.100	Open M	ianhole	300		OUTFA	ALL		1.002	29.2	200	150	
~														
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RCD		Page 4
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 05/04/2018 14:54	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Dialitage
Micro Drainage	Network 2016.1.1	

## Synthetic Rainfall Details

Storm Duration (mins) 30

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RCD		Page 5
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 05/04/2018 14:54	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Diamaye
Micro Drainage	Network 2016.1.1	

### Online Controls for Storm

### Complex Manhole: 4, DS/PN: 1.002, Volume (m<sup>3</sup>): 7.2

### <u>Orifice</u>

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 29.400

#### <u>Orifice</u>

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 30.400

RCD		Page 6
9 Birchtree Way	65-69 HOLMES ROAD	
Maidstone	LONDON	<u> </u>
Kent ME15 7RP		Micco
Date 05/04/2018 14:54	Designed by RAC	
File 1158-1003 180504.MDX	Checked by JD	Dialitage
Micro Drainage	Network 2016.1.1	

#### Storage Structures for Storm

### Cellular Storage Manhole: 4, DS/PN: 1.002

Invert Level (m) 29.400 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000

#### Depth (m) Area (m<sup>2</sup>) Inf. Area (m<sup>2</sup>) Depth (m) Area (m<sup>2</sup>) Inf. Area (m<sup>2</sup>)

0.000	20.0	20.0	2.501	0.0	64.7
2.500	20.0	64.7			

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9 Birchtree Way Maidstone Maidstone Kent Mal5 7RP Date 05/04/2018 14:54 Date 05/04/2018 14:54 Date 05/04/2018 14:54 Checked by RAC Checked by JD Micro Drainage Network 2016.1.1 Summary of Critical Results by Maximum Level (Rank 1) for Storm Simulation Criteria Areal Reduction Factor 1.000 Hot Start (mins) 0 MAD Factor 1.00*/Additional Flow - % of Total Flow 0.000 Bot Start (mins) 0 MAD Factor 1.00*/Additional Flow - % of Total Flow 0.000 Bot Start (Level (mn) 0 Inter Coefficient 0.800 Nanhole Headloss Coeff (Global) 0.500 Flow per Person per Day (L/per/day) 0.000 Foul Swage per hectare (L/S) 0.000 Number of Offine Controls 1 Number of Storage Structures 1 Number of Offine Controls 0 Number of Real Time Controls 0 Number of Offine Controls 0 Number of Real Time Controls 0 Number of Offine Controls 0 Number of Real Time 0.750 MS=60 (mn) 20.600 CV (Winter) 0.300 Margin for flood Kisk Warning (mn) 450.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status 0N DFO Sta	RCD										Pac	je 7
Maidstone LONDON Kent MEIS 7KP Lot 05/04/2018 14:54 File 1158-1003 180304.MDX Checked by JD Micro Drainage Network 2016.1.1 Micro Drainage Network 2016.1.1 Checked by JD	9 Birch	ntree	Way		E	65-69 H	HOLME	ES RO	DAD			
Kent WE15 7RP         Designed by RAC           Date 05/04/2018 14:54         Designed by RAC           Micro Drainage         Network 2016.1.1           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Elmulation Criteria           Areal Reduction Factor 1.000         Additional Flow - % of Total Flow 0.000 Mot Start (mins)           Network 2016.1.1           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Binubaction Criteria           Areal Reduction Factor 1.000         Additional Flow - % of Total Flow 0.000 Mot Start (mins)           Number of Critical Results by Maximum Level (Rank 1) for Storm           Number of Contine Controls 0 Number of Storage Structures 1 Number of Online Controls 0 Number of Thme/Area Diagtans 0 Number of Offile Controls 0 Number of Storage Structures 1 Number of Offile Controls 0 Number of Storage Structures 1 Number of Offile Controls 0 Number of Storage Structures 1 Number of Offile Controls 0 Number of Storage Structures 1 Number of Offile Controls 0 Number of Storage Structures 1 Number 0 for Starts 0 NS-60 (mn)         450.0 Nalysis Timestep 2.5 Second Increment (Extended) No No           Profile(s)         Summer and Winter         0N           Duration(s) (mins)         15, 30, 60, 120, 180, 240, 360, 460, 600, 720, 960, 440, 200, 300, 460, 600, 720, 960, 1400, 200, 300, 760, 720, 960, 1400, 200, 300, 760, 720, 960, 1400, 210, 300, 240, 300, 460, 10080           Return Period(s) (years)         0         31.776	Maidsto	one			I	LONDON					4	~
Date 05/04/2018 14:54 File 1158-1003 180504.MDX Checked by JD Micro Drainage Network 2016.1.1  Summary of Critical Results by Maximum Level (Rank 1) for Storm Simulation Arctar 10,000 Moto Drainage A real Reduction Factor 1.000 Moto Start Level (Main 0 Moto Start 1 Moto Moto Moto Moto Moto Moto Moto Main  Margin for Flood Risk Warning (mm) Moto Start  Moto Moto Main  Margin for Flood Risk Warning (mm) Moto Start  Moto Moto Moto Moto Moto Moto Moto Mo	Kent N	4E15 7	'RP						М	icro		
File 1158-1003 180504.MDX         Checked by JD         Definition Criteria           Micro Drainage         Network 2016.1.1           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Summary of Critical Results by Maximum Level (Rank 1) for Stores           Areal Reduction Pactor 1.000           Network 2016.1.1           Summary of Critical Results by Maximum Level (Rank 1) for Stores           Colspan="2">Colspan="2"           Summary of Critical Results by Maximum Level (Rank 1) for Stores Stores           Colspan="2">Colspan="2">Colspan="2" <colspan="2">Colspan="2"<colspan="2">Colspan="2"<colspan="2">Colspan="2"<colspan="2"<colspan="2">Colspan="2"<colspan="2"<colspan="2">Colspan="2"<colspan="2"<colspan="2"<colspan="2">Colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan=< td=""><td>Date 05</td><td>5/04/2</td><td>018 14:5</td><td>4</td><td colspan="6">Designed by RAC</td><td></td><td></td></colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan="2"<colspan=<></colspan="2"<colspan="2"<colspan="2"></colspan="2"<colspan="2"></colspan="2"<colspan="2"></colspan="2"></colspan="2"></colspan="2">	Date 05	5/04/2	018 14:5	4	Designed by RAC							
Micro Drainage Network 2016.1.1           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Summary of Critical Results by Maximum Level (Rank 1) for Storm           Reduction Factor 1.000         Additional Flow - % of Total Flow 0.000           Hot Start (mins)         0         MADD Factor * 10m <sup>1</sup> /ha Storage 2.000           Hot Start Level (mm)         0         Inlet Coefficient 0.800           Hanhols Headloss Coeff (Global) 0.5500 Flow per Person per Day (I/per/day) 0.000         Foul Sewage per hectare (I/s) 0.000           Number of Input Hydrographs 0 Number of Storage Structures 1         Number of Offline Controls 1 Number of Time/Area Diagrams 0           Number of Offline Controls 0 Number of Real Time Controls 0         Summer 0.0750           Minor Define Controls 0 Number of Storage Structures 1         Number of Offline Controls 0           Margin for Flood Risk Warning (mm)         450.0           Margin for Flood Risk Warning (mm)         450.0           Duration(s) (mins)         15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1400, 2160, 280, 430, 5760, 720, 960, 1400, 2160, 280, 430, 5760, 720, 960, 1400, 2160, 280, 430, 5760, 720, 960, 1400, 2160, 280, 430, 5760, 720, 960, 1400, 2160, 280, 430, 5760, 720, 960, 1400, 2160, 280, 430, 5760, 10080           Return Period(s) (pars)         1         0           Climate Change (%)         0         0           1.000         15 Ninter         1         108	File 11	158-10	03 18050	4.MDX	C	Checked	d by	JD			DI	alliaye
Summary of Critical Results by Maximum Level (Rank 1) for Storm         Summary of Critical Results by Maximum Level (Rank 1) for Storm         Summary of Critical Results by Maximum Level (Rank 1) for Storm         Summary of Critical Results by Maximum Level (Rank 1) for Storm         Summary of Critical Results by Maximum Level (Rank 1) for Storm         Sumber of Storm of Stormage Structures 1         Number of Input Hydrographs 0 Number of Storage Structures 1         Number of Critical Results Number of Real Time Controls 0         Number of Critical Results Number of Real Time Controls 0         Number of Input Hydrographs 0 Number of Real Time Controls 0         Number of Storage Structures 1         Number of Critical Results Number of Real Time Controls 0         Number of Storage Structures 1         Number of Input Hydrographs 0 Number of Real Time Controls 0         Number of Storage Structures 1         Number of Critical Results Naming (mp)         Number of Storage Structures 1         Number of Storage Structures 1 </td <td>Micro I</td> <td>Draina</td> <td>ige</td> <td></td> <td>1</td> <td>letworl</td> <td>k 201</td> <td>16.1</td> <td>.1</td> <td></td> <td></td> <td></td>	Micro I	Draina	ige		1	letworl	k 201	16.1	.1			
Synthetic Rainfall Details         Rainfall Model Nsiefo (mm)       Region England and Wales Cv (Summer) 0.750 Nsiefo (mm)         Margin for Flood Risk Warning (mm)       450.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status         DYD Status       ON DYD Status         DYD Status       ON DYD Status         Profile(s)       Summer and Winter Duration(s) (mins)         Dration(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         Climate Change (%)       O         VIS/MH       Return Climate       First (X) First (Y) First (2) Overflow         VIS/MH       Return Climate       First (X) First (Y) First (2) Overflow         Name       Storm       Period       Climate Tevel         N       Name       Storm       Period       Climate Tevel         N       Name       Storm       Period       Storm         N       Name       Storm       Pipe         US/MH       Depth       Volume Flow / Over	Mai	Summan nhole F Foul Se	ry of Cri Areal Redu Hot Stan Headloss Co ewage per P Number of Number o	tical action F Start ( rt Level beff (Gl bectare Input F of Onlin f Offlir	<u>Simu</u> actor 1. mins) (mm) obal) 0. (1/s) 0. Hydrograp ne Contro	by Ma lation 000 A 0 500 Flc 000 ohs 0 N ols 1 N ols 0 N	<u>Crite</u> dditi MZ ow per umber umber	eria Lonal ADD Fa of S of T of F	Flow actor I son pe Storage Sime/Ar Real Ti	(Rank 1) f - % of Tota * 10m³/ha S nlet Coeffi r Day (1/pe e Structures me Controls	l Flow 0 torage 2 ecient 0 r/day) 0 = 1 = 0 = 0	.000 .000 .800 .000
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         Climate Change (%)       0         VS/MH       Return Climate       First (X)       First (Y)       First (Z)       Overflow       Ketvel         PN       Name       Storm       Period       Change       Surcharge       Flood       Overflow       Act.       (m)         1,000       1       15       Winter       1       +0%       31.776         1.001       2       15       Winter       1       +0%       31.276         1.002       4       60       Winter       1       +0%       31.276         1.002       4       60       Winter       1       +0%       31.276         1.002       4       60       Winter       1       +0%       1/15       Summer         1.002       4       60       Winter       1       +0%       1/15       Status       Exceeded         1.000       1       -0.224       0.000       0.14       11.6       0K         2.000       2       -0.224		Ma	Rain rgin for F	fall Moc Regi M5-60 (r lood Ri: And	Synthet: del ion Engla nm) sk Warnir alysis T: DTS DVD Inertia	ic Rain: and and imestep Status Status Status	fall FSI Wale: 20.60 2.5	<u>Detai</u> R s Cv 0 Cv Secon	ls Ratic (Summe (Winte	e R 0.438 er) 0.750 er) 0.840	450.0 inded) ON ON ON	
US/MH PN         Storm         Return Period         Climate Change         First (X) Surcharge         First (Y) Flood         First (Z) Overflow         Overflow Act.         Mater Level (n)           1.000         1         15 Winter         1         +0%         31.776           2.000         2         15 Winter         1         +0%         31.776           1.001         3         15 Winter         1         +0%         31.633           1.002         4         60 Winter         1         +0%         1/15 Summer         Flow         Pipe           VS/MH         Depth         Volume         Flow / Overflow         Flow         Level         30.243           1.002         4         0 Winter         1         -0.224         0.000         0.14         11.6         OK           2.000         2         -0.224         0.000         0.14         11.6         OK           2.000         2         -0.224         0.000         0.14         11.6         OK           2.000         2         -0.693         0.000         0.28         4.7         SURCHARGED		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)         Climate Change (%)										
PN         Name         Storm         Period         Change         Surcharge         Flood         Overflow         Act.         (m)           1.000         1         15         Winter         1         +0%         31.776           2.000         2         15         Winter         1         +0%         31.776           1.001         3         15         Winter         1         +0%         31.633           1.002         4         60         Winter         1         +0%         1/15         Summer         30.243           Surcharged         Flooded         Pipe         Volume         Flow / Overflow         Flow         Level           PN         Name         (m)         (m³)         Cap.         (l/s)         (l/s)         Status         Exceeded           1.000         1         -0.224         0.000         0.14         11.6         OK           2.000         2         -0.224         0.000         0.41         33.5         OK           1.001         3         -0.167         0.000         0.28         4.7         SURCHARGED		US/MH		Return	Climate	First	(X)	Firs	st (Y)	First (Z) (	Overflow	Water Level
Surcharged Flooded       Pipe         US/MH       Depth       Volume Flow / Overflow       Flow       Level         PN       Name       (m)       (m³)       Cap.       (1/s)       (1/s)       Status       Exceeded         1.000       1       -0.224       0.000       0.14       11.6       OK         2.000       2       -0.224       0.000       0.41       33.5       OK         1.001       3       -0.167       0.000       0.41       33.5       OK         1.002       4       0.693       0.000       0.28       4.7       SURCHARGED	1.000 2.000 1.001	1 2 3	15 Winter 15 Winter 15 Winter	1 1 1	+0% +0% +0%	5urch	arde	F.7	1000	OVELITOM	ACT.	(m) 31.776 31.776 31.633 30.243
US/MH         Depth (m)         Volume (m³)         Flow Cap.         Overflow (l/s)         Flow Status         Level Exceeded           1.000         1         -0.224         0.000         0.14         11.6         OK           2.000         2         -0.224         0.000         0.14         11.6         OK           1.001         3         -0.167         0.000         0.41         33.5         OK           1.002         4         0.693         0.000         0.28         4.7         SURCHARGED	1.002	T	Sur	charged	Flooded	1/10 5	ununer		Pipe			50.245
PN         Name         (m)         (m³)         Cap.         (1/s)         (1/s)         Status         Exceeded           1.000         1         -0.224         0.000         0.14         11.6         OK           2.000         2         -0.224         0.000         0.14         11.6         OK           1.001         3         -0.167         0.000         0.41         33.5         OK           1.002         4         0.693         0.000         0.28         4.7         SURCHARGED			US/MH I	Pepth	Volume	Flow /	Over	flow	Flow		Level	
1.000 1 -0.224 0.000 0.14 11.6 OK 2.000 2 -0.224 0.000 0.14 11.6 OK 1.001 3 -0.167 0.000 0.41 33.5 OK 1.002 4 0.693 0.000 0.28 4.7 SURCHARGED ©1982-2016 XP Solutions		PN	Name	(m)	(m³)	Cap.	(1/	s)	(l/s)	Status	Exceede	d
2.000       2       -0.224       0.000       0.14       11.6       OK         1.001       3       -0.167       0.000       0.41       33.5       OK         1.002       4       0.693       0.000       0.28       4.7       SURCHARGED		1.000	1	-0.224	0.000	0.14			11.6	OK		
1.001     3     -0.167     0.000     0.41     33.5     OK       1.002     4     0.693     0.000     0.28     4.7     SURCHARGED         ©1982-2016 XP Solutions		2.000	2	-0.224	0.000	0.14			11.6	OK		
©1982-2016 XP Solutions		1.001	3	-0.167 0.693	0.000 0.000	0.41 0.28			33.5 4.7	OK SURCHARGED		
©1982-2016 XP Solutions												
					©1982-2	016 XE	? Sol	utic	ons			



Appendix G

**Thames Water Sewer Record** 



## Sewer Asset Map showing extents of proposed development

# London

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