Shehan

Re Kiln Place Development NW5

Thank you for your email. This is an important 1395mm diameter trunk sewer and we would not want it built over.

You must first consider your bulding layout keeping all buildings 3.00m in plan away from the sewer.

Failing this, diversion of the sewer may be possible depending on your building layout. You must propose a diversion route for the sewer in this case.

regards

Jim Boerio

Developer Services Engineer

Original Text

From: Shehan.Wijesundera@ramboll.co.uk
To: developer.services@thameswater.co.uk
CC: Glynn.Irvine@ramboll.co.uk
Sent: 22.10.13 16:55:36
Subject: Kiln Place development- Build over licence enquiry

F.A.O. Jim Boerio

Good Afternoon Jim,

We are currently undertaking the conceptual design for a residential development.

Previously, an Asset Location Search was requested, and sent to us by Thames Water. We have identified Combined Public Sewers that run in the vicinities of our site, indicated on the attached mark-ups.

We would like to know what the requirements are from Thames Water, with regard to a Build-Over licence being obtained? As indicated on our Mark-up, part of the Thames Water Sewer, runs through one of our development plots within the site boundary.

As this is a highly conceptual design, we will only be producing hand-drawn sketches to indicate our proposals. Any assistance you can provide in the matter will be greatly appreciated.

I look forward to your response. If you have any further queries, please do not hesitate to contact me.

Kind regards
Shehan Wijesundera

MEng (Hons)
Graduate Engineer
Environment - Infrastructure

T +44 (0)207 631 5291 (ext 5495)
shehan.wijesundera@ramboll.co.uk

_____

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W1T 3DA
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THAMES WATER UTILITIES LIMITED

DEVELOPER SERVICES
CUSTOMER LED TEAM

X2039/416
KILN PLACE, GOSPEL OAK, LONDON, NW5 4AP

PRELIMINARY INVESTIGATION REPORT

Company Confidential

July 2014

Date	Issue	Author	Checked	Approved
July 2014	1	Simon Gosling	Carl Battersby	Emma Cowan

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ITEM	DESCRIPTION
1.	**Introduction**
2.	**Development Proposals**
3.	**Thames Water Assets**
3.1	Clean Water
3.2	Waste/ Surface Water
4.	**Possible Impact of Development Upon Thames Water Assets**
4.1	Clean Water Network
4.2	Waste/ Surface Water Network
5.	**Conclusions and Recommendations**
5.1	Clean Water Assets
5.2	Waste/ Surface Water Assets
Appendix 'A'	**Proposed Cantilever Foundation Plan and Section**
Appendix 'B'	**Thames Water Culvert Route Through Site 2**

1. Introduction

The purpose of this preliminary investigation report is to provide an assessment of the effects associated with a proposed development at Kiln Place, Gospel Oak, London. A set of recommendations are provided which set out the preliminary concerns and mitigation measures to be considered as the scheme is developed from the design to the construction phase.

2. Development Proposals

Thames Water has been advised that London Borough of Camden (LBC) intend to develop a site at Kiln Place, London. EC Harris (ECH) is the consultant for the development acting on behalf of LBC and they have appointed Ramboll as structural designer. ECH has provided Thames Water with preliminary details outlining the current proposals.

The proposals include the re-development of the existing car parking spaces with a new building comprising of residential flats. Initial sketches indicate that the new building is to be 3 storeys high. The re-development site is bounded to the south-west by Kiln Place carriageway and to the north-east by an embankment. It is understood that it is intended to submit planning permission for the new development in August/ September 2014.

It is understood from the information supplied that the foundations will be 950mm and 650mm diameter piles and that the ground floor will cantilever 1m north-west from the 950mm diameter piles.

Sketches received from ECH showing the current proposals are attached in Appendix A.

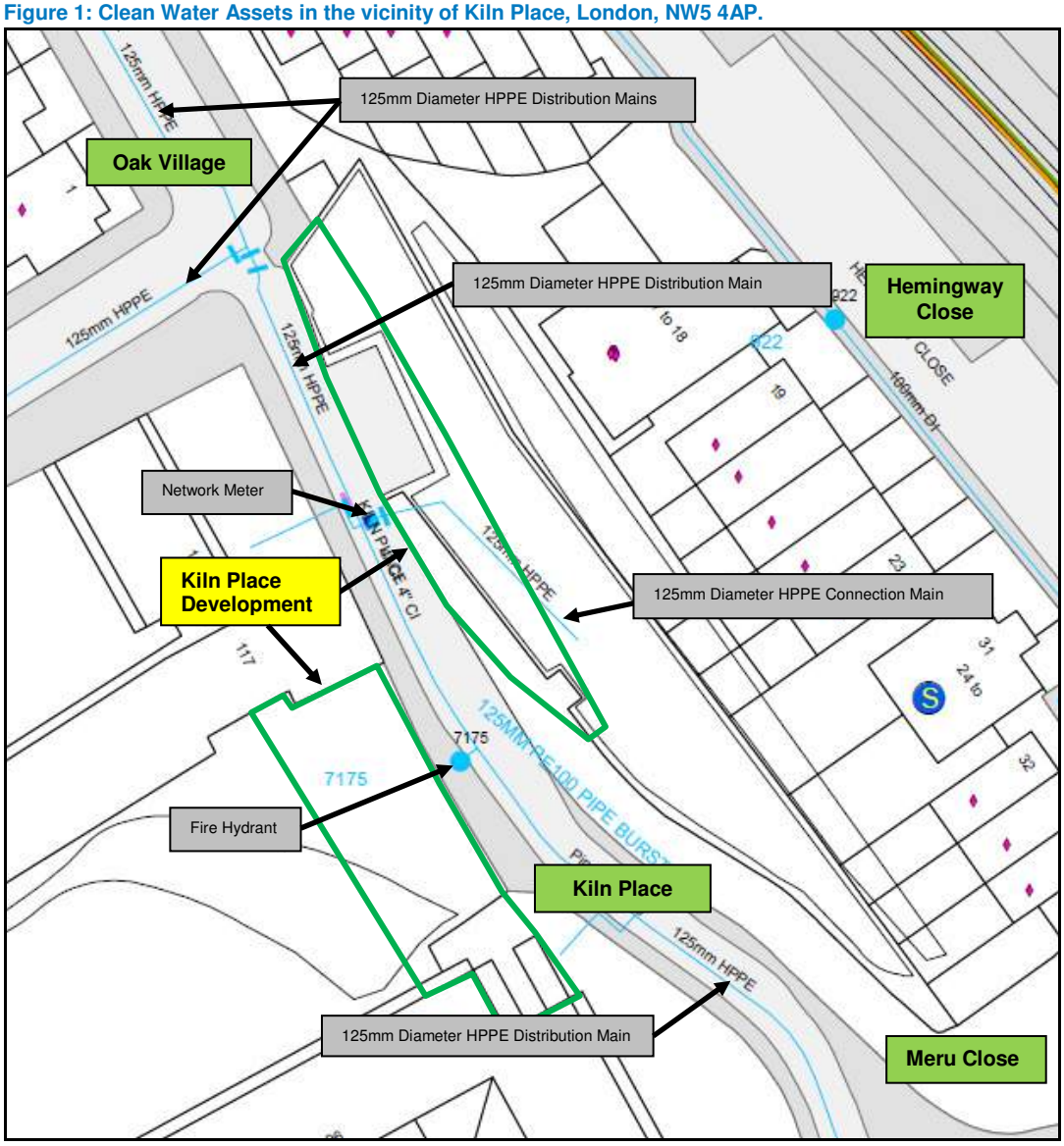
Some survey works, including CCTV and a line and level survey have been conducted on behalf of the developer and the results supplied to Thames Water. A drawing showing the surveyed sewerage in the vicinity of the proposed development is included in Appendix B.

3. Thames Water Assets

3.1 Clean Water

According to Thames Water's GIS there are a number of existing water mains and associated fittings within the streets surrounding the development area. These clean water assets are shown in Figure 1.

Figure 1: Clean Water Assets in the vicinity of Kiln Place, London, NW5 4AP.



Source: Thames Water GIS

According to the Thames Water GIS there is a 125mm diameter HPPE connection main that crosses beneath the proposed development site. The Thames Water GIS does not identify the property or properties being supplied by the 125mm diameter connection main.

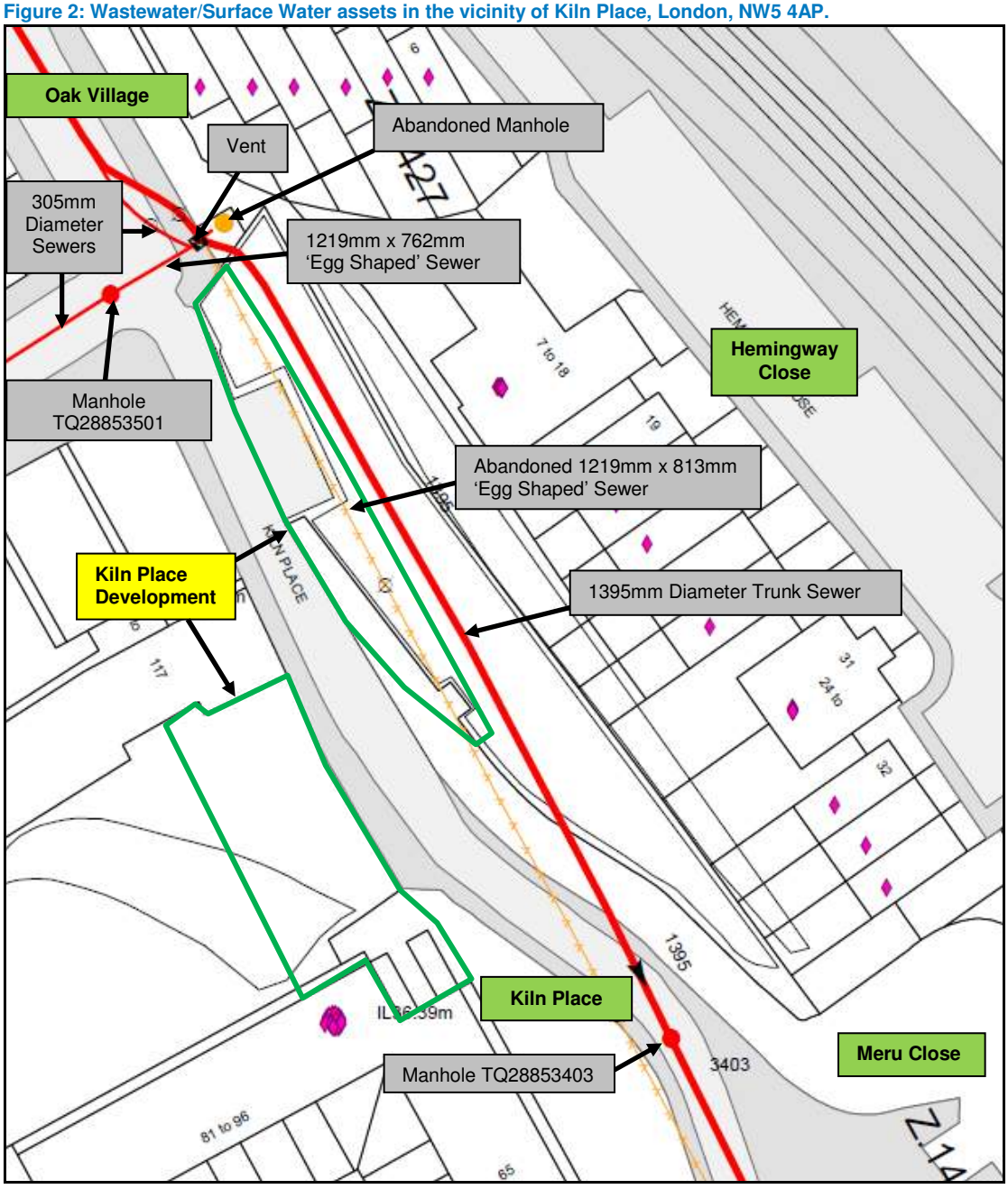
The Thames Water GIS also identifies the following clean water assets in proximity to the proposed development:

- A 125mm HPPE distribution main in Oak Village and Kiln Place;
- A 4" diameter CI distribution main in Kiln Place;
- A fire hydrant in Kiln Place;
- A network meter on the 125mm diameter connection main in Kiln Place.

3.2 Waste / Surface Water

According to the GIS, Thames Water owns and maintains a number of existing sewers conveying combined surface and wastewater flows from the area around the development site. The existing wastewater and surface water assets are shown in Figure 2.

Figure 2: Wastewater/Surface Water assets in the vicinity of Kiln Place, London, NW5 4AP.



Source: Thames Water GIS

The Thames Water GIS identifies a 1,395mm diameter trunk sewer adjacent to the proposed development and an abandoned 1,219mm x 813mm 'egg shaped' gravity sewer directly beneath the proposed development. The GIS does not provide confirmation of the material. The GIS also identifies the following wastewater assets in proximity to the proposed development:

- An abandoned side entry manhole at the junction of Oak Village and Kiln Place.
- A 305mm diameter sewer in Lamble Street, which conveys flows from Lamble Street to manhole TQ28853501;
- A 305mm diameter sewer in Oak Village, which conveys flows from Oak Village to the 1,395mm trunk sewer;
- An existing 1,219mm x 762mm brick 'egg shaped' gravity sewer at the junction of Kiln Place, Oak Village and Lamble Street, which conveys combined flows from manhole TQ28853501 in Lamble Street to the 1,395mm diameter trunk sewer in Kiln Place;

- A vent at chamber TQ28853511.

ECH have supplied a CCTV inspection report of the 1,395mm diameter trunk sewer. This identifies at least 4 nr connections entering the trunk sewer from the direction of the proposed development comprising 3 nr 225mm diameter connections and 1 nr 100mm diameter connection.

ECH have also supplied a drawing titled "Thames Water Culvert Route Through Site 2", which identifies an existing 150mm diameter private combined water drain and an existing 225mm diameter private surface water drain in the carriageway of Kiln Place and discharging in the direction of the proposed development. This drawing is included in Appendix B.

4. Possible Impact of Development upon Thames Water Assets

4.1 Clean Water Network

The proposed foundation work will potentially have a significant impact on the existing Thames Water connection main beneath the building. Drawings provided by ECH (refer to Appendix A) do not show the clean water assets in the area and options for mitigating the impact on the connection main have not been presented for consideration.

4.2 Waste/ Surface Water Network

The proposed foundation work will potentially have a significant impact on the existing Thames Water 1395mm diameter trunk main. Thames Water GIS shows the depth of the invert of the trunk sewer at manhole TQ28853403 to be 7.39m below ground level.

The proposed foundation work will also potentially have an impact on the abandoned 'egg shaped' sewer. The Thames Water GIS identifies the sewer as abandoned and filled but does not specify the material used to fill the sewer.

The drawings supplied by ECH show that piled foundations are being considered with the outside edge of the piles at a distance of 3m from the outside edge of the trunk sewer. The method of piling has not been provided at this stage. The drawings also show that it is proposed to construct a 1m cantilevered overhang of the ground floor, which will be 2m, horizontally, from the outside edge of the trunk sewer. It is also proposed that part of the embankment above the trunk sewer is cut away, with a retaining wall being constructed.

It is understood that no soil investigations have been conducted.

The CCTV inspection report and drawing supplied by ECH indicate that there may be at least 4 nr sewers crossing the proposed development and connection in to the 1,395mm diameter trunk sewer. The proposed foundation work will potentially have a significant impact on these sewers. The CCTV inspection report states that the depth to the invert level of the 1,395mm diameter trunk sewer at manhole TQ28853403 is 7.09m below ground level, i.e. 300mm shallower than the Thames Water GIS records. The line and level survey information provided indicates that the alignment of the 1,395mm diameter trunk sewer may be 1 – 2m further east than the alignment shown on the Thames Water GIS records. The accuracy of the information supplied by the developer is the responsibility of the developer.

5. Conclusions and Recommendations

5.1 Clean Water Assets

Thames Water's 125mm diameter HPPE connection main and network meter are within the proposed development site and will be directly affected by the proposed construction works. The current status of these assets has not been confirmed at this stage and should be established with the local Thames Water operations and maintenance team.

The developer must demonstrate an awareness of these assets and include an allowance for either their abandonment or protection. If the main and meter are live and supplying existing customers then (i) the customer's supply will require diversion around the proposed development, or (ii) the customer's supply will be required from a different source.

If the 125mm diameter HPPE connection main has been abandoned then it will be necessary to disconnect the meter and main and remove them from site.

5.2 Waste/Surface Water Assets

The 1,395mm diameter trunk sewer main represents a significant asset on Thames Water's sewerage network. The proposed foundation construction will have a significant impact on the 1,395mm diameter trunk sewer and a number of existing lateral connections. Any damage to the trunk sewer could potentially have catastrophic results, therefore any changes to loadings, increase in forces or vibration must be quantified and the magnitudes accurately determined. Piling in close proximity to the trunk sewer is a significant concern.

The Thames Water guidelines recommend that impact piles should not be installed any closer than 15m from the outside face of an existing pipe. Bored or augured piles should be at least 1.5m or 1.5 times the diameter of the pile (whichever is greater) from the outside face of the pipe. Piles adjacent to a pipe must be founded at a level not less than 1.5m below the underside of the pipe and any friction resistance of the pile above a line drawn upwards at 45 degrees from the underside of the pipe should be ignored when calculating the load carrying capacity of the pile. Thames Water's guidelines also recommend that construction activities should not induce vibrations in excess of 10mm/second (peak particle velocity) upon their assets, with lower values desirable. The information supplied by ECH advises that the piles will not have any load bearing capacity for the top 7m of their length.

The proposed development is not expected to result in any long term vibrations or displacement of the material surrounding sections of the pipework forming the 1,395mm diameter trunk sewer. However, changes in loads as a result of the re-development including ground heave have not been quantified. The magnitude of any additional forces imposed upon the trunk sewer must be calculated before the long term effects of the proposals can be fully assessed. Changes to the loading regime including ground heave in the vicinity of the trunk sewer should be calculated. Any forces acting upon the trunk sewer as a result of 'sequential off-loading' during the construction phase should also be calculated and submitted to Thames Water for review.

The developer must confirm the depth, layout and type of all the foundations and piles and the methods of installation prior to construction in order that Thames Water can make a more accurate assessment of the impact to their assets. Preferably piles should be bored or augured in order to minimise the resulting vibration and dynamic loads transmitted to Thames Water's nearby assets. It should be noted that the developer would be responsible for meeting costs to rectify any damage caused to Thames Water assets by the construction activities associated with the re-development of the site.

Significant loadings from construction plant and equipment may also impact the 1,395mm diameter trunk sewer. Prior to siting any large item of plant or equipment it will be necessary to provide Thames Water a complete impact assessment considering the ALARP (as low as reasonably practicable) risk approach.

CCTV inspection of the 1,395mm diameter trunk sewer has identified at least 4 nr sewers connecting from the direction of the proposed development. These connections will require further investigation by the developer and if they currently cross the site of the proposed development then the developer will be required to apply to Thames Water for these connections to be diverted.

The proposed development is within the Thames Water sewer easement of 3m from the outside of the 1,395mm diameter trunk sewer. The easement is required to enable Thames

Water to conduct repairs upon the sewer from ground level should they be required. The developer should review the proposal to avoid encroaching into the easement.

The abandoned 1,219mm x 813mm 'egg shaped' sewer is directly beneath the proposed development. Any disturbance of this abandoned asset may have an adverse effect on the 1,395mm diameter trunk sewer. The developer will need to provide details of how the foundation work for the proposed development will impact the abandoned sewer. The liability for the condition of this abandoned asset is currently with Thames Water. It is recommended therefore that the liability of the abandoned section of sewer beneath the proposed development be divested. On conclusion of this process the developer will be required to take on this liability.

In order to make any further assessment on the sewer, the developer should provide detailed drawings of the proposed below and above ground structure, formation levels and its position relative to the sewer.

On completion of all construction works a post condition survey of the 1,395mm diameter trunk sewer will be required to confirm that no construction related damage has occurred to the buried pipework.

Details of any ground investigations to be undertaken including borehole locations should also be provided to Thames Water for assessment.

APPENDIX: A

(Proposed Cantilever Foundation Plan and Section)

SITE 1 FOUNDATION PLAN

1:200

NOTE:

① SKETCH FOR THE PURPOSE OF IDENTIFYING STRUCTURAL PHILOSOPHY TO CULVERT EASEMENT ZONE.

② STRUCTURAL PHILOSOPHY ASSUMES ALL OTHER SERVICES TO BE DIVERTED BENEATH THE FOOTPRINT.

- 350mm ø pile
- 650mm ø pile
- 450mm x 600mm deep ground beams
- 450mm x 1000 mm deep ground beams
- 950mm x 1000mm deep ground beams
- 650mm x 1000m deep ground beams
- 225mm Beam and Block suspended ground floor slab

MABLE STREET

7-18 HEMINGWAY CLOSE

KILN PLACE

CULVERT EASEMENT ZONE

A

A

UNIT 2.1

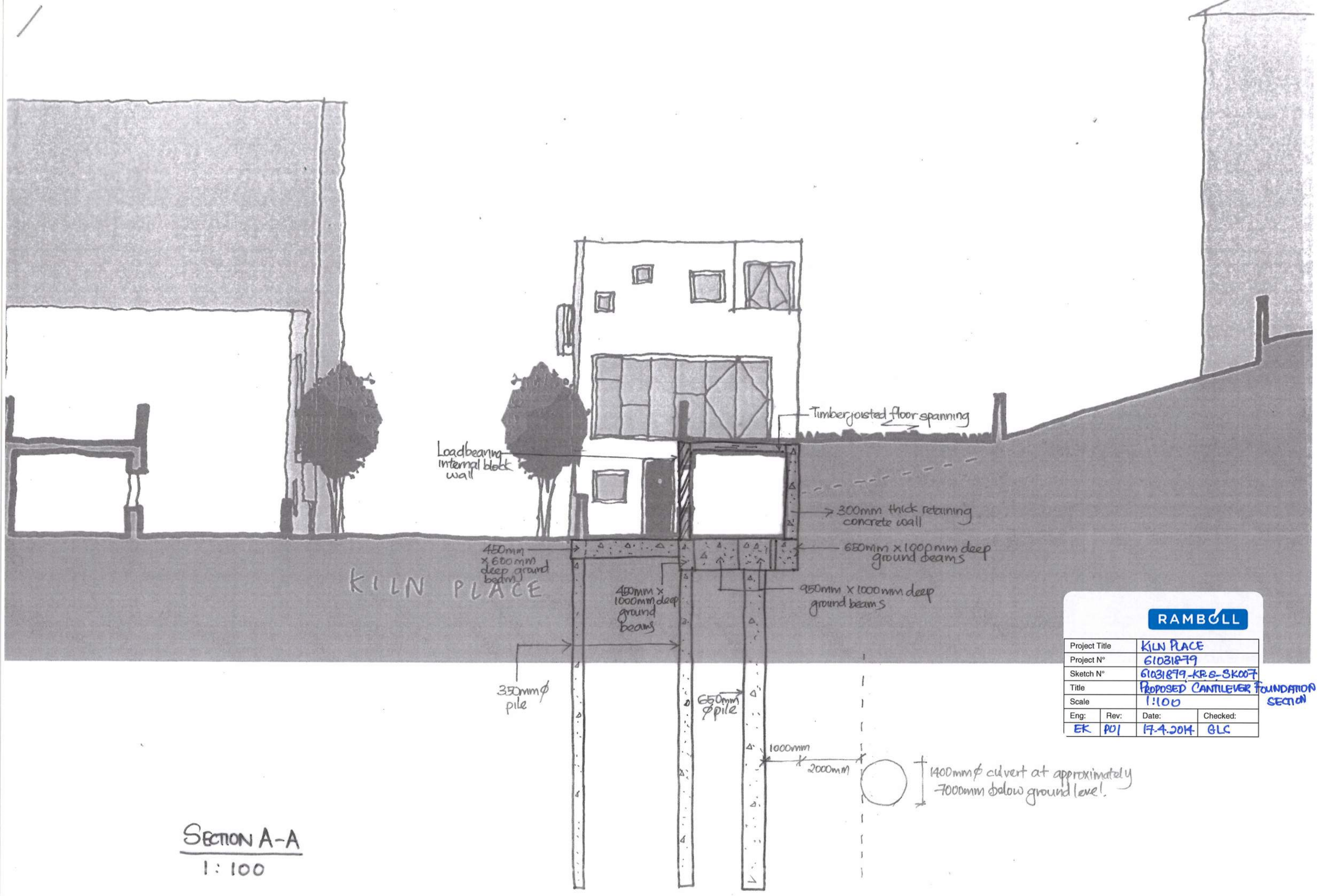
117-164

RAMBOLL

Project Title		KILN PLACE	
Project N°		61031879	
Sketch N°		61031879-KP-S-SK006	
Title		PROPOSED CANTILEVER FOUNDATION PLAN	
Scale		1:200	
Eng:	Rev:	Date:	Checked:
EK	P01	17.4.2014	GLC

PETER BARBER ARCHITECTS for EC Harris / LB Camden

Ground Floor Plan 1:200



SECTION A-A
1:100

RAMBOLL

Project Title		KILN PLACE	
Project N°		61031879	
Sketch N°		61031879-KR-S-SK007	
Title		PROPOSED CANTILEVER FOUNDATION SECTION	
Scale		1:100	
Eng:	Rev:	Date:	Checked:
EK	P01	17.4.2014	GLC

APPENDIX: B

(Thames Water Culvert Route Though Site 2)

OAK VILLAGE

LAMBLE STREET

THAMES WATER MANHOLE 3501 FROM ASSET RECORDS

305 mm DIA

EXTENT OF BUILD-OVER AGREEMENT

INCICATIVE SITE BOUNDARY FOR SITE 1

DIMENSIONS NOTED AS 1219x762 ON ASSET RECORDS

NOTE: INFILLED/ABANDONED 515x1220(ID) BRICK EGG COMBINED WATER SEWER ADDED FROM RECORDS. INVESTIGATIONS REVEAL NO EVIDENCE OF THIS STRUCTURE. THE ASSUMPTION IS THAT THE STRUCTURE REMAINS BUT HAS BEEN BACKFILLED. TYPICALLY AT THAT TIME USING FLY-ASH 'PFA' OR SIMILAR. FURTHER INVESTIGATION REQUIRED.

BUILDINGS OVERSAIL INTO BASEMENT ZONE BY 1m. REFER TO SECTION DRAWINGS FOR DETAILS

INVERT LEVEL OF ABANDONED SEWER 36.94m TAKEN FROM ASSET RECORDS

PROPOSED BUILDING LAYOUT FOR SITE 1

EXISTING 1395mmØ THAMES WATER CULVERT. SURVEYED BY INFOTEC ON 10/02/2014. REFER TO INF-3434A-D01 TO D04.

REFER TO 61031876-KP-S-SK007 FOR THE STRUCTURAL FOUNDATION SECTION. 1m OVERHANG INTO EASEMENT ZONE BETWEEN BUILDING LINE AND EDGE OF EXISTING THAMES WATER CULVERT.

EXISTING 150mm PIPE CONNECTION INTO PUBLIC SEWER IDENTIFIED THROUGH THE UTILITIES TRACE. IT IS ASSUMED THAT THIS CONNECTS TO THE THAMES WATER CULVERT.

225mm EXISTING CONNECTION TO PUBLIC SEWER IDENTIFIED THROUGH THE UTILITIES TRACE. IT IS ASSUMED THAT THIS CONNECTS TO THE THAMES WATER CULVERT.

KILN PLACE

EXTENT OF BUILD-OVER AGREEMENT

IL:37.687
IL:37.628
IL:37.581
IL:38.418
IL:38.406
IL:38.385
IL:36.304
IL:36.298
IL:36.249
IL:36.198
IL:36.164
IL:36.119
IL:36.083
IL:36.051
IL:36.020

515x1220(ID) BRICK EGG COMBINED WATER SEWER (CONFIRMED)
TFR (ABANDONED)
Ø1350(ID) CONCRETE COMBINED WATER SEWER CWMH2613X
515x1220(ID) BRICK EGG COMBINED WATER SEWER
TFR (ABANDONED)
Ø1350(ID) CONCRETE COMBINED WATER SEWER CWMH2615X
515x1220(ID) BRICK EGG COMBINED WATER SEWER
TFR (ABANDONED)

KEY:

- INDICATIVE SITE BOUNDARY
- EXISTING THAMES WATER COMBINED PUBLIC SEWER FROM UTILITIES TRACE
- EXISTING PRIVATE COMBINED WATER DRAIN
- EXISTING PRIVATE SURFACE WATER DRAIN
- EXISTING THAMES WATER CULVERT
- ABANDONED THAMES WATER SEWER
- EASEMENT FOR THAMES WATER CULVERT
- OVERHANG OF PROPOSED BUILDINGS INTO EASEMENT
- EXISTING BUILDINGS WITHIN SITE BOUNDARY
- EXISTING BUILDINGS WITHIN INDICATIVE BOUNDARY

RAMBOLL

Project Title: KILN PLACE
Project No: 61031879
Sketch No: KP/C /SK010
Title: THAMES WATER CULVERT ROUTE THROUGH SITE 2
Rev –
By: PMG
Checked: CL
Scale: 1:100
Date: 17/4/14

RECORD OF VERBAL COMMUNICATION

job title **Camden Development Sites – Kiln Place** job no. **61031879**

date **06.02.2014** file ref.

to **Rita Thorpe** by **A Tishler**

company **Kiln Place Tenants Association** circulation

tel no. **020 7482 3024**

Record of Communication	Action
AT contacted Rita Thorpe, the secretary of Kiln Place Tenants Association, to confirm whether flooding incidents have occurred at the estate previously and if there are any records of these. Rita Thorpe replied that records of flood incidents have been lost, however that flooding has occurred on a few occasions following heavy rainfall (approx. 3 times over the past 40 years) at the corner of Oak Village and Lamble Street, next to the entrance to the estate. She has associated the flooding with blocked drains.	Consider as evidence in the flood risk assessment

APPENDIX B GOSPEL OAK TOPOGRAPHICAL SURVEY

LAMBLE STREET

GRAFTON ROAD

HEMINGWAY CLOSE

N

7-18

19-23

24-31

32-35

117 - 164

81 - 96

65-80

105-116

97-104

1-64

"The Snack"

Portacabins

top 55.55

top 55.10

no access to survey

REVISIONS:

PETER BARBER
ARCHITECTS
173 Kings Cross Road LONDON WC1X 9BZ
T:020 7833 4499 F:020 7833 4999
e:architecture@peterbarberarchitects.com

DO NOT SCALE OFF THIS DRAWING
ALL DIMENSIONS MUST BE CHECKED ON SITE

INFORM THE ARCHITECT OF ANY
DISCREPANCIES PRIOR TO CONSTRUCTION

PLOT SIZE: A1

JOB: Kiln Place, Gospel Oak

CLIENT: London Borough of Camden / E C Harris

SCALE: 1/250 @ A1
1/500 @ A3

DATE: 10 13

DRAWN: FS

CHECKED: PB

STAGE D

TITLE: EXISTING SITE PLAN (FIGURE GROUND)

DRAWING NO: 116_P_01X

REV: A

APPENDIX C GOSPEL OAK EXISTING DRAINAGE LAYOUT

Camden

- Combined Manhole
- "Other" Manhole
- Gully Node
- Network Rail Catch Pit
- Track Drainage 1D-2D Connection Point
- Combined Sewer
- Foul Sewer
- Storm Sewer
- Track Drainage Link
- Roads modelled

Royal HaskoningDHV
Enhancing Society Together

raa
Richard Allitt Associates Ltd
Consulting Engineers

Richard Allitt Associates Ltd
Suite 3, The Forge Offices
Cuckfield Road, Staplefield
Haywards Heath,
West Sussex, RH17 6ET

Tel: 01444 401840

PLAN A

Sewer Network in Gospel Oak including gullies and roads modelled

DRAWN BY :	ASM	DATE :	28/02/2013
APPROVED BY :	JRF	DATE :	28/02/2013
SCALE :	NTS	REF :	Plan A

Plan Notes

Revisions

Revision	Date	Comments
A	27/02/2013	First Drawn
B	28/02/2013	Track Drainage Added

APPENDIX D WINDES CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Existing

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	Add Flow / Climate Change (%)	0
M5-60 (mm)	21.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.438	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Existing

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.005	4-8	0.014

Total Area Contributing (ha) = 0.019

Total Pipe Volume (m^3) = 3.425

Network Design Table for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
E1.000	64.795	0.432	150.0	0.019	5.00	0.0	0.600	o	150
E2.000	60.505	0.403	150.0	0.000	5.00	0.0	0.600	o	150
E1.001	68.509	0.457	150.0	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
E1.000	50.00	6.32	32.000	0.019	0.0	0.0	0.0	0.82	14.5	2.6
E2.000	50.00	6.23	31.000	0.000	0.0	0.0	0.0	0.82	14.5	0.0
E1.001	50.00	7.72	30.597	0.019	0.0	0.0	0.0	0.82	14.5	2.6

Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.019	0.019	0.019
2.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.019	0.019	0.019

Free Flowing Outfall Details for Existing

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E1.001	E	33.000	30.140	0.000	0	0

Simulation Criteria for Existing

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Storm Duration (mins)	30
Ratio R	0.438		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	1	0%					
E2.000	120 Winter	1	0%					
E1.001	15 Winter	1	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.046	-0.104	0.000	0.20	0.0	2.8	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.643	-0.104	0.000	0.19	0.0	2.8	OK

Input Hydrograph Manhole E2, DS/PN E1.001 (Existing)
15 minute 1 year Winter I+0%
Input Hydrograph Type: FSR Dynamic

Input Variables

Region	England and Wales	Area (Ha)	0.055
M5-60 (mm)	21.000	SAAR (mm)	600
Ratio R	0.438	CWI	87.000
Areal Reduction Factor	1.000	Urban	0.000
Main Stream Length (m)	11.250	SPR	47.000
H(85%) (m)	43.500	LAG (hrs)	0.000
H(10%) (m)	41.810	Base Flow (l/s)	(Calculated)

Output Variables

TP(0) (mins)	33	Q (l/s)	2.1	PR (%)	37.500
T (mins)	3	TB (mins)	88	S1085 (m/km)	200.296
TPt (mins)	35	Base Flow (l/s)	0.0		

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1	0.0	10	0.1	19	0.3	28	0.4	37	0.6	46	0.6	55	0.5
2	0.0	11	0.1	20	0.3	29	0.5	38	0.6	47	0.6	56	0.5
3	0.0	12	0.1	21	0.3	30	0.5	39	0.6	48	0.6	57	0.4
4	0.0	13	0.2	22	0.3	31	0.5	40	0.6	49	0.5	58	0.4
5	0.0	14	0.2	23	0.3	32	0.5	41	0.6	50	0.5	59	0.4
6	0.0	15	0.2	24	0.4	33	0.5	42	0.6	51	0.5	60	0.4
7	0.1	16	0.2	25	0.4	34	0.6	43	0.6	52	0.5		
8	0.1	17	0.2	26	0.4	35	0.6	44	0.6	53	0.5		
9	0.1	18	0.2	27	0.4	36	0.6	45	0.6	54	0.5		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	30	0%					
E2.000	120 Winter	30	0%					
E1.001	15 Winter	30	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.075	-0.075	0.000	0.49	0.0	6.9	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.673	-0.073	0.000	0.48	0.0	6.8	OK

Input Hydrograph Manhole E2, DS/PN E1.001 (Existing)
15 minute 30 year Winter I+0%
Input Hydrograph Type: FSR Dynamic

Input Variables

Region	England and Wales	Area (Ha)	0.055
M5-60 (mm)	21.000	SAAR (mm)	600
Ratio R	0.438	CWI	87.000
Areal Reduction Factor	1.000	Urban	0.000
Main Stream Length (m)	11.250	SPR	47.000
H(85%) (m)	43.500	LAG (hrs)	0.000
H(10%) (m)	41.810	Base Flow (l/s)	(Calculated)

Output Variables

TP(0) (mins)	33	Q (l/s)	2.1	PR (%)	37.500
T (mins)	3	TB (mins)	88	S1085 (m/km)	200.296
TPt (mins)	35	Base Flow (l/s)	0.0		

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1	0.0	10	0.2	19	0.7	28	1.1	37	1.5	46	1.4	55	1.2
2	0.0	11	0.3	20	0.7	29	1.1	38	1.5	47	1.4	56	1.1
3	0.0	12	0.3	21	0.7	30	1.2	39	1.5	48	1.4	57	1.1
4	0.0	13	0.4	22	0.8	31	1.2	40	1.5	49	1.3	58	1.1
5	0.1	14	0.4	23	0.8	32	1.3	41	1.5	50	1.3	59	1.0
6	0.1	15	0.5	24	0.9	33	1.3	42	1.5	51	1.3	60	1.0
7	0.1	16	0.5	25	0.9	34	1.3	43	1.5	52	1.2		
8	0.2	17	0.6	26	1.0	35	1.4	44	1.5	53	1.2		
9	0.2	18	0.6	27	1.0	36	1.4	45	1.5	54	1.2		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	100	0%					
E2.000	120 Winter	100	0%					
E1.001	15 Winter	100	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.089	-0.061	0.000	0.64	0.0	9.0	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.687	-0.060	0.000	0.62	0.0	8.9	OK

Input Hydrograph Manhole E2, DS/PN E1.001 (Existing)
15 minute 100 year Winter I+0%
Input Hydrograph Type: FSR Dynamic

Input Variables

Region	England and Wales	Area (Ha)	0.055
M5-60 (mm)	21.000	SAAR (mm)	600
Ratio R	0.438	CWI	87.000
Areal Reduction Factor	1.000	Urban	0.000
Main Stream Length (m)	11.250	SPR	47.000
H(85%) (m)	43.500	LAG (hrs)	0.000
H(10%) (m)	41.810	Base Flow (l/s)	(Calculated)

Output Variables

TP(0) (mins)	33	Q (l/s)	2.1	PR (%)	37.500
T (mins)	3	TB (mins)	88	S1085 (m/km)	200.296
TPt (mins)	35	Base Flow (l/s)	0.0		

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1	0.0	10	0.3	19	0.9	28	1.4	37	1.9	46	1.9	55	1.5
2	0.0	11	0.4	20	0.9	29	1.5	38	1.9	47	1.8	56	1.5
3	0.0	12	0.4	21	1.0	30	1.5	39	2.0	48	1.8	57	1.4
4	0.0	13	0.5	22	1.0	31	1.6	40	2.0	49	1.7	58	1.4
5	0.1	14	0.5	23	1.1	32	1.6	41	2.0	50	1.7	59	1.3
6	0.1	15	0.6	24	1.2	33	1.7	42	2.0	51	1.7	60	1.3
7	0.2	16	0.7	25	1.2	34	1.8	43	1.9	52	1.6		
8	0.2	17	0.7	26	1.3	35	1.8	44	1.9	53	1.6		
9	0.3	18	0.8	27	1.3	36	1.9	45	1.9	54	1.5		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Existing

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	Add Flow / Climate Change (%)	0
M5-60 (mm)	21.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.438	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Existing

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.004	4-8	0.012

Total Area Contributing (ha) = 0.016

Total Pipe Volume (m^3) = 3.425

Network Design Table for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
E1.000	64.795	0.432	150.0	0.016	5.00	0.0	0.600	o	150
E2.000	60.505	0.403	150.0	0.000	5.00	0.0	0.600	o	150
E1.001	68.509	0.457	150.0	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
E1.000	50.00	6.32	32.000	0.016	0.0	0.0	0.0	0.82	14.5	2.2
E2.000	50.00	6.23	31.000	0.000	0.0	0.0	0.0	0.82	14.5	0.0
E1.001	50.00	7.72	30.597	0.016	0.0	0.0	0.0	0.82	14.5	2.2

Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.016	0.016	0.016
2.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.016	0.016	0.016

Free Flowing Outfall Details for Existing

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E1.001	E	33.000	30.140	0.000	0	0

Simulation Criteria for Existing

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Storm Duration (mins)	30
Ratio R	0.438		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	1	0%					
E2.000	120 Winter	1	0%					
E1.001	15 Winter	1	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.042	-0.108	0.000	0.17	0.0	2.4	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.638	-0.109	0.000	0.16	0.0	2.2	OK

Input Hydrograph Manhole E2, DS/PN E1.001 (Existing)
15 minute 1 year Winter I+0%
Input Hydrograph Type: FSR Dynamic

Input Variables

Region	England and Wales	Area (Ha)	0.011
M5-60 (mm)	21.000	SAAR (mm)	630
Ratio R	0.438	CWI	92.400
Areal Reduction Factor	1.000	Urban	0.000
Main Stream Length (m)	9.260	SPR	47.000
H(85%) (m)	42.130	LAG (hrs)	0.000
H(10%) (m)	41.830	Base Flow (l/s)	(Calculated)

Output Variables

TP(0) (mins)	51	TPt (mins)	54	TB (mins)	136	PR (%)	38.850
T (mins)	5	Q (l/s)	0.3	Base Flow (l/s)	0.0	S1085 (m/km)	43.197

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1	0.0	10	0.0	19	0.0	28	0.0	37	0.1	46	0.1	55	0.1
2	0.0	11	0.0	20	0.0	29	0.0	38	0.1	47	0.1	56	0.1
3	0.0	12	0.0	21	0.0	30	0.0	39	0.1	48	0.1	57	0.1
4	0.0	13	0.0	22	0.0	31	0.0	40	0.1	49	0.1	58	0.1
5	0.0	14	0.0	23	0.0	32	0.0	41	0.1	50	0.1	59	0.1
6	0.0	15	0.0	24	0.0	33	0.0	42	0.1	51	0.1	60	0.1
7	0.0	16	0.0	25	0.0	34	0.1	43	0.1	52	0.1		
8	0.0	17	0.0	26	0.0	35	0.1	44	0.1	53	0.1		
9	0.0	18	0.0	27	0.0	36	0.1	45	0.1	54	0.1		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	30	0%					
E2.000	120 Winter	30	0%					
E1.001	15 Winter	30	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.068	-0.082	0.000	0.41	0.0	5.8	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.664	-0.082	0.000	0.39	0.0	5.5	OK

Input Hydrograph Manhole E2, DS/PN E1.001 (Existing)
15 minute 30 year Winter I+0%
Input Hydrograph Type: FSR Dynamic

Input Variables

Region	England and Wales	Area (Ha)	0.011
M5-60 (mm)	21.000	SAAR (mm)	630
Ratio R	0.438	CWI	92.400
Areal Reduction Factor	1.000	Urban	0.000
Main Stream Length (m)	9.260	SPR	47.000
H(85%) (m)	42.130	LAG (hrs)	0.000
H(10%) (m)	41.830	Base Flow (l/s)	(Calculated)

Output Variables

TP(0) (mins)	51	TPt (mins)	54	TB (mins)	136	PR (%)	38.850
T (mins)	5	Q (l/s)	0.3	Base Flow (l/s)	0.0	S1085 (m/km)	43.197

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1	0.0	10	0.0	19	0.1	28	0.1	37	0.1	46	0.2	55	0.2
2	0.0	11	0.0	20	0.1	29	0.1	38	0.1	47	0.2	56	0.2
3	0.0	12	0.0	21	0.1	30	0.1	39	0.1	48	0.2	57	0.2
4	0.0	13	0.0	22	0.1	31	0.1	40	0.1	49	0.2	58	0.2
5	0.0	14	0.0	23	0.1	32	0.1	41	0.2	50	0.2	59	0.2
6	0.0	15	0.0	24	0.1	33	0.1	42	0.2	51	0.2	60	0.2
7	0.0	16	0.1	25	0.1	34	0.1	43	0.2	52	0.2		
8	0.0	17	0.1	26	0.1	35	0.1	44	0.2	53	0.2		
9	0.0	18	0.1	27	0.1	36	0.1	45	0.2	54	0.2		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	100	0%					
E2.000	120 Winter	100	0%					
E1.001	15 Winter	100	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.080	-0.070	0.000	0.54	0.0	7.6	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.676	-0.071	0.000	0.51	0.0	7.2	OK

Input Hydrograph Manhole E2, DS/PN E1.001 (Existing)
15 minute 100 year Winter I+0%
Input Hydrograph Type: FSR Dynamic

Input Variables

Region	England and Wales	Area (Ha)	0.011
M5-60 (mm)	21.000	SAAR (mm)	630
Ratio R	0.438	CWI	92.400
Areal Reduction Factor	1.000	Urban	0.000
Main Stream Length (m)	9.260	SPR	47.000
H(85%) (m)	42.130	LAG (hrs)	0.000
H(10%) (m)	41.830	Base Flow (l/s)	(Calculated)

Output Variables

TP(0) (mins)	51	TPt (mins)	54	TB (mins)	136	PR (%)	38.850
T (mins)	5	Q (l/s)	0.3	Base Flow (l/s)	0.0	S1085 (m/km)	43.197

Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)	Time (mins)	Flow (l/s)
1	0.0	10	0.0	19	0.1	28	0.1	37	0.2	46	0.2	55	0.3
2	0.0	11	0.0	20	0.1	29	0.1	38	0.2	47	0.2	56	0.3
3	0.0	12	0.0	21	0.1	30	0.1	39	0.2	48	0.2	57	0.3
4	0.0	13	0.1	22	0.1	31	0.1	40	0.2	49	0.2	58	0.3
5	0.0	14	0.1	23	0.1	32	0.2	41	0.2	50	0.2	59	0.3
6	0.0	15	0.1	24	0.1	33	0.2	42	0.2	51	0.3	60	0.3
7	0.0	16	0.1	25	0.1	34	0.2	43	0.2	52	0.3		
8	0.0	17	0.1	26	0.1	35	0.2	44	0.2	53	0.3		
9	0.0	18	0.1	27	0.1	36	0.2	45	0.2	54	0.3		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Existing

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	Add Flow / Climate Change (%)	0
M5-60 (mm)	21.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.438	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
E1.000	64.795	0.432	150.0	0.006	5.00	0.0	0.600	o	150
E2.000	60.505	0.403	150.0	0.000	5.00	0.0	0.600	o	150
E1.001	68.509	0.457	150.0	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
E1.000	50.00	6.32	32.000	0.006	0.0	0.0	0.0	0.82	14.5	0.8
E2.000	50.00	6.23	31.000	0.000	0.0	0.0	0.0	0.82	14.5	0.0
E1.001	50.00	7.72	30.597	0.006	0.0	0.0	0.0	0.82	14.5	0.8

Manhole Schedules for Existing

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
E1	35.000	3.000	Open Manhole	1200	E1.000	32.000	150				
E2	34.000	3.000	Open Manhole	1200	E2.000	31.000	150				
E2	33.000	2.403	Open Manhole	1200	E1.001	30.597	150	E1.000	31.568	150	971
								E2.000	30.597	150	
E	33.000	2.860	Open Manhole	0		OUTFALL		E1.001	30.140	150	

PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.000	o	150	E1	35.000	32.000	2.850	Open Manhole	1200
E2.000	o	150	E2	34.000	31.000	2.850	Open Manhole	1200
E1.001	o	150	E2	33.000	30.597	2.253	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
E1.000	64.795	150.0	E2	33.000	31.568	1.282	Open Manhole	1200
E2.000	60.505	150.0	E2	33.000	30.597	2.253	Open Manhole	1200
E1.001	68.509	150.0	E	33.000	30.140	2.710	Open Manhole	0

Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.006	0.006	0.006
2.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.006	0.006	0.006

Free Flowing Outfall Details for Existing

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E1.001	E	33.000	30.140	0.000	0	0

Simulation Criteria for Existing

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)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Storm Duration (mins)	30
Ratio R	0.438		

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of 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	Ratio R 0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	1	0%					
E2.000	120 Winter	1	0%					
E1.001	15 Winter	1	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.025	-0.125	0.000	0.06	0.0	0.9	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.621	-0.126	0.000	0.06	0.0	0.8	OK

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of 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	Ratio R 0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	30	0%					
E2.000	120 Winter	30	0%					
E1.001	15 Winter	30	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.040	-0.110	0.000	0.15	0.0	2.2	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.636	-0.111	0.000	0.14	0.0	2.0	OK

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of 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	Ratio R 0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	21.000	Cv (Winter)	0.840

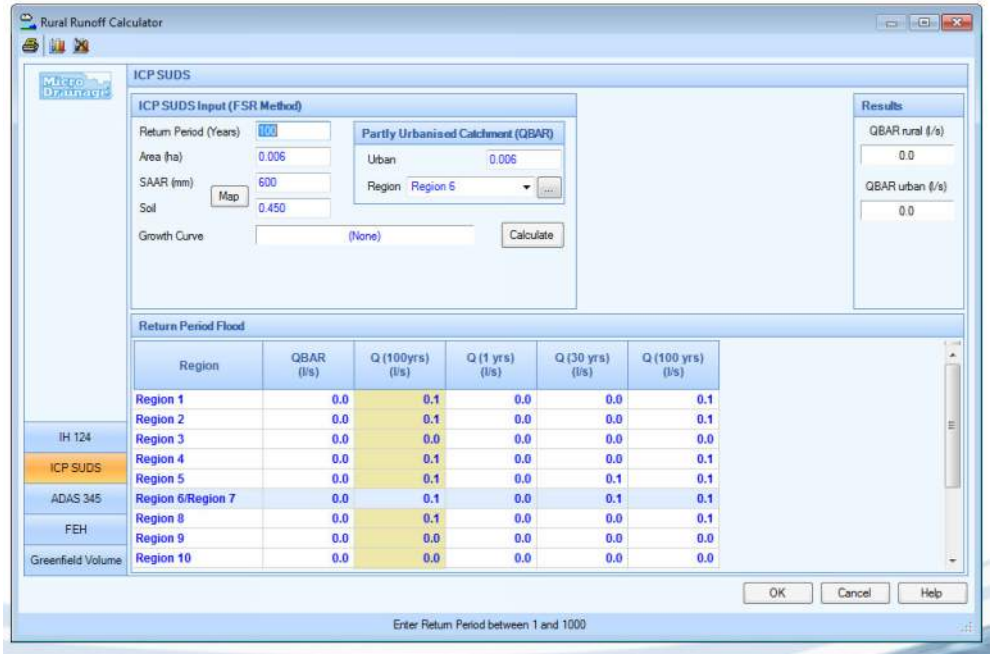
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

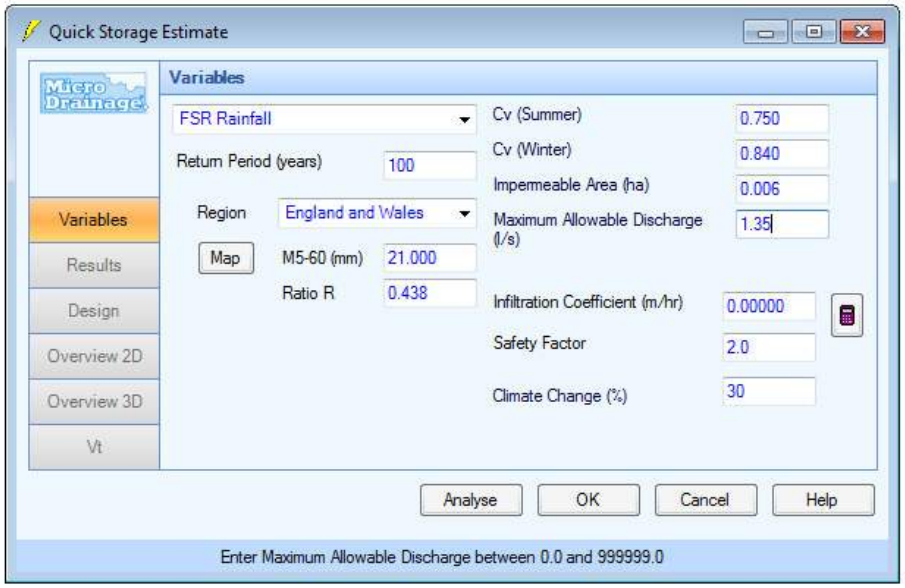
Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

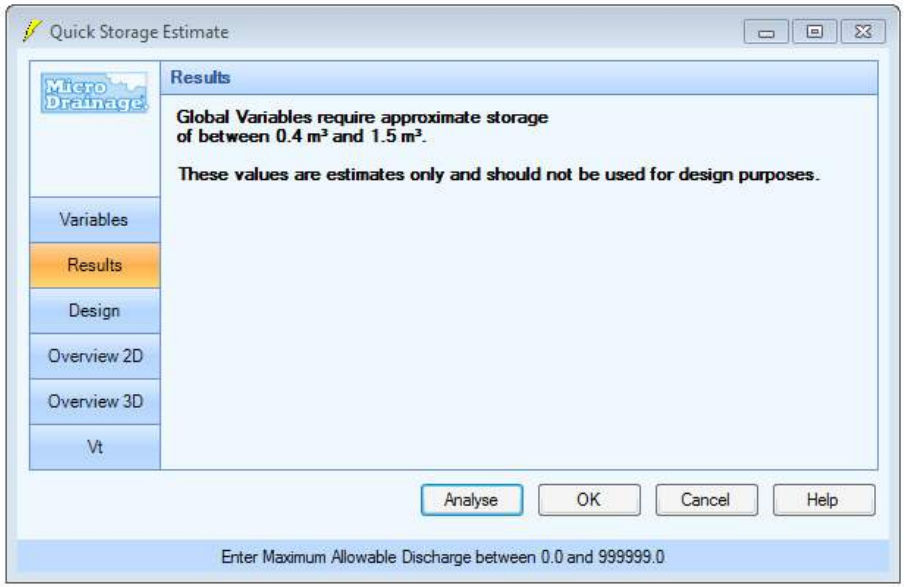
PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
E1.000	15 Winter	100	0%					
E2.000	120 Winter	100	0%					
E1.001	15 Winter	100	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
E1.000	E1	32.046	-0.104	0.000	0.20	0.0	2.8	OK
E2.000	E2	31.000	-0.150	0.000	0.00	0.0	0.0	OK
E1.001	E2	30.642	-0.104	0.000	0.19	0.0	2.7	OK

PLOT 3&4


Rural Runoff Calculator
ICP SUDS
ICP SUDS Input (FSR Method)
Return Period (Years) 100
Area (ha) 0.006
SAAR (mm) 600
Soil 0.450
Map
Growth Curve (None)
Calculate
Partly Urbanised Catchment (QBAR)
Urban 0.006
Region Region 6
Results
QBAR rural (l/s) 0.0
QBAR urban (l/s) 0.0
Return Period Flood
Region | QBAR (l/s) | Q (100yrs) (l/s) | Q (1 yrs) (l/s) | Q (30 yrs) (l/s) | Q (100 yrs) (l/s)
Region 1 0.0 0.1 0.0 0.0 0.1
Region 2 0.0 0.1 0.0 0.0 0.1
Region 3 0.0 0.0 0.0 0.0 0.0
Region 4 0.0 0.1 0.0 0.0 0.1
Region 5 0.0 0.1 0.0 0.1 0.1
Region 6/Region 7 0.0 0.1 0.0 0.1 0.1
Region 8 0.0 0.1 0.0 0.0 0.1
Region 9 0.0 0.0 0.0 0.0 0.0
Region 10 0.0 0.0 0.0 0.0 0.0
IH 124
ICP SUDS
ADAS 345
FEH
Greenfield Volume
OK
Cancel
Help
Enter Return Period between 1 and 1000


Quick Storage Estimate
Variables
FSR Rainfall
Return Period (years) 100
Region England and Wales
Map
M5-60 (mm) 21.000
Ratio R 0.438
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 0.006
Maximum Allowable Discharge (l/s) 1.35
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 30
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0


Quick Storage Estimate
Results
Global Variables require approximate storage of between 0.4 m³ and 1.5 m³.
These values are estimates only and should not be used for design purposes.
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Analyse
OK
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0