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# The Waterside Village – Opulwood
# FRA Addendum
# Date: 31.10.2024


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**Document History and Status**

| Revision | Date | Purpose/Statu | Author | File Ref | Check | Review |
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| 1 | 25.04.23 | Information | IC | 22006 | SF | SF |
| 2 | 19.07.23 | Information | IC | 22006 | SF | SF |
| 3 | 31.10.24 | Information | DW | 22006 | DW | DW |

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**Document Details**

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# 1.0 Introduction

Elluc Projects have been commissioned by Opulwood Developments to provide an addendum to the existing Flood Risk Assessment by BEK Enviro Ltd.report Ref: BEK-18439-1-Rev A dated December 2018.

Specifically, the planners for this development site have requested the drainage engineers to check if any updated flood data was used in the design calculations for the drainage design carried out by Elluc.

# 2.0 Proposed drainage design

The proposed drainage design shown in drawing ELL-22006-OP-L-120 within Appendix A shows a new private surface water and foul drainage system serving the development and combining to a combined drain just before connecting to the public combined sewer in Kay Street.

A hydrobrake flow control is proposed to limit surface water discharge to 5 l/s to 1 in 100 year plus climate change allowance.

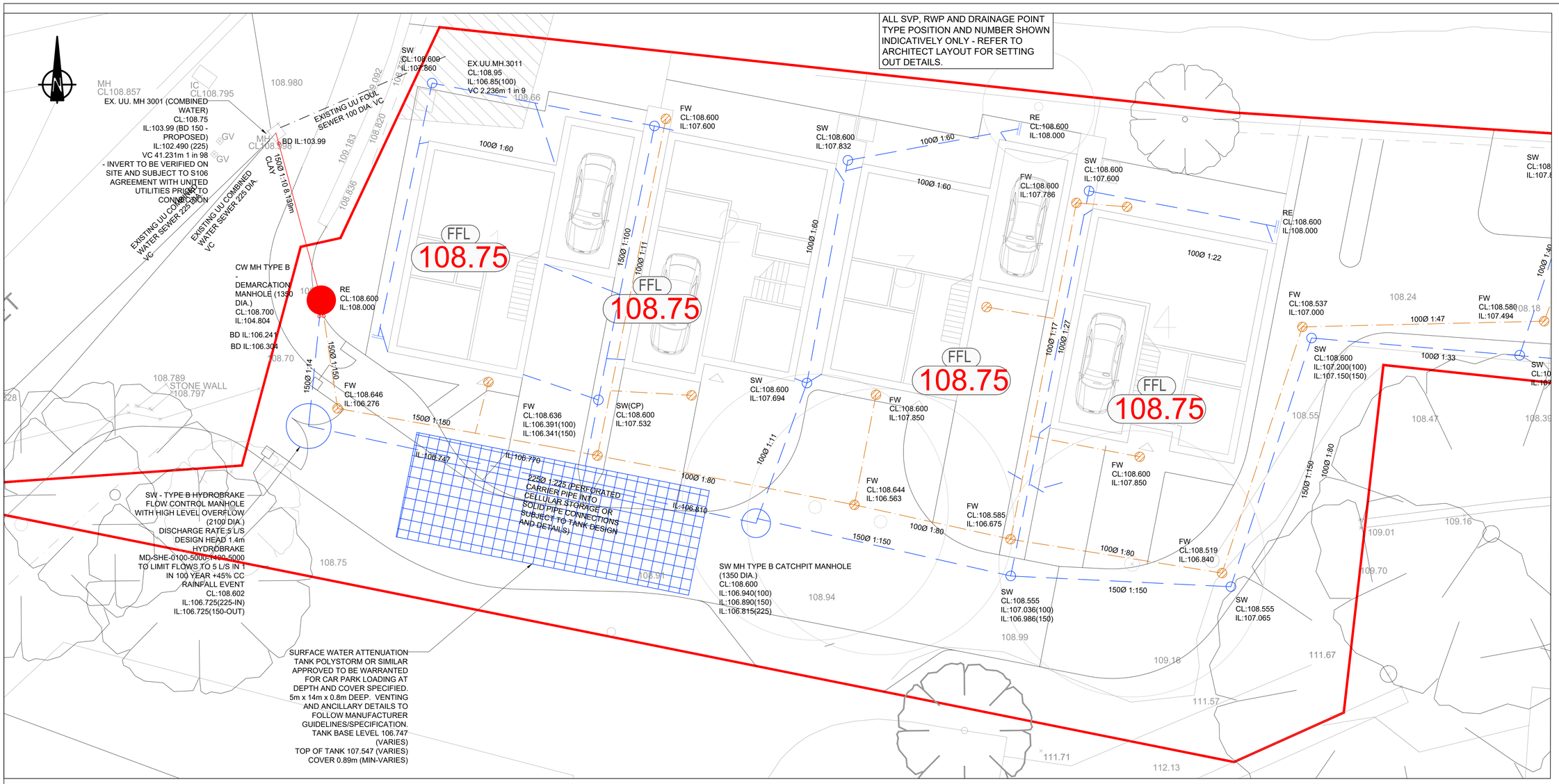
The proposed drainage design follows the hierarchy of surface water outfalls, due to the nature of the site and the practicalities of constructing a headwall outfall to the River Irwell a connection to the combined sewer is proposed. A public surface water sewer isn't available near to the site to connect to.

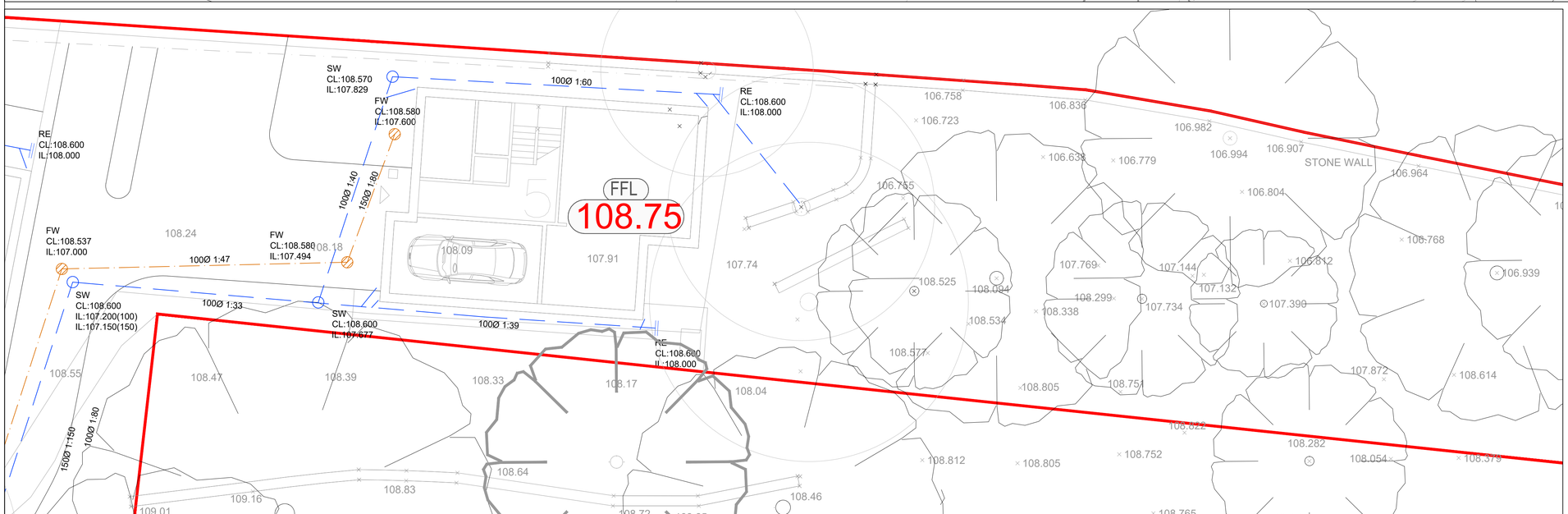
The public combined sewer is approximately 3.5m lower than the proposed surface and foul connections which backdrop into the combined demarcation manhole before leaving site. The risk of backing up of the sewers because of this and no direct connection to the river is considered low. The drainage calculations are provided in Appendix B.

# 3.0 Summary

The proposed drainage design shown in Appendix A and the calculations in Appendix B demonstrate the site can be drained safely, with regard to flood risk described in the BEK Enviro report. A majority of the flood risk is mitigated by the use of elevated external works and FFL's to the development set in line with the FRA report.

# APPENDIX A




## NOTES

1. ALL ADOPTABLE DRAINAGE WORKS HAVE BEEN DESIGNED AND ARE TO BE CONSTRUCTED IN ACCORDANCE WITH "DESIGN AND CONSTRUCTION GUIDANCE FOR FOUL AND SEWER ADOPTION - SEWER SECTOR GUIDANCE" AND WATER AUTHORITY SUPPLEMENT GUIDELINES AND STANDARD DETAILS.

2. ALL CLAY PIPE WORK SHALL BE EXTRA STRENGTH CLAYWARE TO B.S EN 295:1991 PART 1

3. ALL PRECAST CONCRETE PIPEWORK SHALL BE TO THE CLASS STATED ON THE DRAWINGS IN ACCORDANCE WITH B.S EN 1916:2002. ALSO, ALL MANHOLES AND CHAMBERS SHALL BE TO B.S EN 1917:2002

4. THE CONTRACTOR MAY ELECT TO USE REINFORCED PVC PIPES AS COVERED BY B.S 4660:2000 & B.S EN 1401-1. STRUCTURED WALL UPVC PIPES TO COMPLY WITH WIS 4-35-01 UPTO AND INCLUDING 300MM. (BY PRIOR AGREEMENT WITH ADOPTING AUTHORITY) MAX. PIPE LENGTH TO BE 3.0M

5. ALL LEVELS RELATE TO TOPOGRAPHICAL SURVEY DATUM

6. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS

7. PLOT DRAINAGE CONNECTIONS TO SEWERS MUST BE 150mm DIAMETER AND UNLESS OTHERWISE STATED LAID TO THE INVERT SHOWN.

8. LEVELS GIVEN ON DRAGOUT CHAMBERS ARE INCOMING PIPE LEVELS

9. PLOT DRAINAGE RUNS TO BE KEPT WITHIN THE CURTILAGE OF THE PLOT THEY SERVE WHEREVER POSSIBLE.

10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT ANY EXISTING INVERT LEVELS AND EXISTING SITE LEVELS (EXISTING BOUNDARY LEVELS) INDICATED ON DRAWINGS ARE CORRECT BEFORE WORKS COMMENCE.

11. ALL CONNECTIONS TO ADOPTABLE SEWERS SHALL BE MANUFACTURED JUNCTION PIPES. SADDLE CONNECTIONS WILL NOT BE PERMITTED, UNLESS SPECIFIED.

12. ALL SEWERS FOR ADOPTION WITH GREATER THAN 1.20M COVER IN ROADS OR 0.9M COVER IN FIELDS SHALL HAVE CLASS S GRANULAR BED AND SURROUND.

13. ANY SEWER FOR ADOPTION WITH LESS THAN 1.2M COVER IN ROADS OR 0.9m COVER IN FIELDS SHALL HAVE A MINIMUM OF 150mm ST4 CONCRETE SURROUND. FLEXIBILITY SHALL BE MAINTAINED BY THE PROVISION OF FLEXCELL OR SIMILAR APPROVED JOINT FILLER BREAKS IN THE CONCRETE SURROUND AT EACH PIPE JOINT

14. IT IS THE RESPONSIBILITY FOR THE CONTRACTOR TO CHECK ALL ONSITE EXISTING GROUND LEVELS PRIOR TO COMMENCING AND IF THERE ARE ANY DISCREPANCIES THE CONTRACTOR MUST REPORT TO THE ENGINEER IMMEDIATELY

15. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE DRAINAGE AUTHORITY OF THE COMMENCEMENT OF ANY DRAINAGE WORKS AND TO COMPLETE ANY REQUIRED SEWER CONNECTION FORMS INCLUSIVE OF PAYING ANY REQUIRED FEES. THE CONTRACTOR MUST ALLOW FOR THE SUPERVISION OF THE SEWER CONSTRUCTION WORKS BY THE LOCAL AUTHORITY AND NOTIFY THE SUPERVISING OFFICER, GIVING NOTICE WHICH IN ACCORDANCE WORTH THE L.A REQUIREMENTS.

16. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO APPLY FOR ANY REQUIRED ROAD OPENING PERMITS WITH THE LOCAL AUTHORITY INCLUDING THE PAYMENT OF ANY FEES

17. BEFORE COMMENCING ANY WORKS ON SITE, THE CONTRACTOR MUST CONTACT THE RELEVANT STATUTORY UNDERTAKER AND BE IN POSSESSION OF THE LATEST AVAILABLE DRAWINGS FROM THE STATUTORY UNDERTAKERS WHICH SHOWS DETAILS OF THEIR SERVICES/APPARATUS.
THE CONTRACTOR MUST CONFIRM EXACT LOCATION AND DEPTH OF ANY SERVICES/APPARATUS BY THE USE OF ELECTRO-LOCATION OR SIMILAR DEVICES AND BY HAND DUG TRIAL HOLES.
MECHANICAL EXCAVATOR, POWER TOOLS ETC. MUST NOT BE USED TO LOCATE EXISTING SERVICES/APPARATUS.

18. COUNCILS HIGHWAY SUPERVISION OFFICER REQUIRED ONSITE THROUGHOUT CONSTRUCTION. DESIGN SUBJECT TO CBR TESTING TO BE AGREED WITH HIGHWAYS OFFICER ONSITE.

19.SUBJECT TO HIGHWAYS APPROVAL

20. SUBJECT TO WATER AUTHORITY APPROVAL.

21. ALL PIPES TO BE 100mm DIAMETER UNLESS OTHERWISE STATED. ALL SURFACE WATER LATERAL CONNECTIONS TO BE 150mm DIAMETER.

| Rev: | Description: | Date: | By: | Chkd: |
|---|---|---|---|---|
| D | UPDATED TO SUIT NEW ARCHITECT LAYOUT / SCHEME. | 31.10.24 | DW | JC |
| C | UPDATED FLOW CONTROL DETAILS. | 14.11.23 | IC | IC |
| B | UPDATED TO SUIT NEW ARCHITECT LAYOUT / SCHEME. | 02.06.23 | IC | IC |
| A | UPDATED TO SUIT SEWER RECORDS / DRAINAGE SURVEY. | 25.04.23 | IC | IC |

Status: PRELIMINARY

Client: MAPLE CONSTRUCTION (NW) LTD

Project: THE WATERSIDE VILLAGE

Drg Title: PRIVATE DRAINAGE LAYOUT

## KEY:

- PROPOSED SURFACE WATER RUN
- PROPOSED SURFACE WATER CHAMBER
- PROPOSED SURFACE WATER RODDING EYE
- PROPOSED FOUL WATER RUN
- PROPOSED FOUL WATER CHAMBER
- PROPOSED SURFACE WATER MANHOLE AND SEWER
- PROPOSED SURFACE WATER ATTENUATION TANK
- FFL 109.250 — FINISHED FLOOR LEVEL
- PROPOSED PRIVATE ROAD GULLY (RODDABLE AND TRAPPED)
- DEVELOPMENT SITE BOUNDARY

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| Scale: | Size: | First Issue: | Drawn: | Checked: | Rev: |
|---|---|---|---|---|---|
| 1:100 | A1 | 07.03.22 | IC | MJS | D |

Drawing No: ELL-22006-OP-L-120

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File Location: c:\users\davewood\elluc projects\elluc projects group - drive\projects\2200_references\22006 - the waterside village - opulwood developments\e - drawings\b-working\civil\ell-22006-op-l-120 - private drainage layout.dwg

# APPENDIX B

## STORM SEWER DESIGN by the Modified Rational Method

### Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 14.278 | 0.096 | 148.7 | 0.037 | 5.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.001 | 1.121 | 0.171 | 6.6 | 0.098 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.002 | 14.000 | 0.063 | 222.2 | 0.000 | 0.00 | 0.0 | 0.600 | [] | -1 | Pipe/Conduit | |
| 1.003 | 5.043 | 0.022 | 229.2 | 0.000 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| 1.004 | 5.943 | 0.421 | 14.1 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.005 | 8.138 | 0.814 | 10.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 50.00 | 5.29 | 106.986 | 0.037 | 0.0 | 0.0 | 0.0 | 0.82 | 14.5 | 5.0 |
| 1.001 | 50.00 | 5.29 | 106.815 | 0.135 | 0.0 | 0.0 | 0.0 | 5.14 | 204.5 | 18.3 |
| 1.002 | 50.00 | 5.38 | 106.810 | 0.135 | 0.0 | 0.0 | 0.0 | 2.72 | 10326.3 | 18.3 |
| 1.003 | 50.00 | 5.48 | 106.747 | 0.135 | 0.0 | 0.0 | 0.0 | 0.86 | 34.2 | 18.3 |
| 1.004 | 50.00 | 5.51 | 106.725 | 0.135 | 0.0 | 0.0 | 0.0 | 2.70 | 47.6 | 18.3 |
| 1.005 | 50.00 | 5.56 | 104.804 | 0.135 | 0.0 | 0.0 | 0.0 | 3.21 | 56.6 | 18.3 |

### Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

| Section Number | Conduit Type | Major Dimn. (mm) | Minor Dimn. (mm) | Side Slope (Deg) | Corner Splay (mm) | 4*Hyd Radius (m) | XSect Area ($m^2$) |
|---|---|---|---|---|---|---|---|
| -1 | [] | 4750 | 800 | 90.0 | | 1.369 | 3.800 |

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## Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdro (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1 | 108.550 | 1.564 | Open Manhole | 450 | 1.000 | 106.986 | 150 | | | | |
| S2(CP) | 108.860 | 2.045 | Open Manhole | 1350 | 1.001 | 106.815 | 225 | 1.000 | 106.890 | 150 | |
| TANK IN | 108.600 | 1.956 | Open Manhole | 450 | 1.002 | 106.810 | -1 | 1.001 | 106.644 | 225 | |
| TANK OUT | 108.600 | 1.853 | Open Manhole | 450 | 1.003 | 106.747 | 225 | 1.002 | 106.747 | -1 | |
| FLOW CONTROL | 108.602 | 1.877 | Open Manhole | 2100 | 1.004 | 106.725 | 150 | 1.003 | 106.725 | 225 | |
| CW1 | 108.700 | 3.896 | Open Manhole | 1350 | 1.005 | 104.804 | 150 | 1.004 | 106.304 | 150 | 150 |
| | 108.750 | 4.760 | Open Manhole | 1500 | | OUTFALL | | 1.005 | 103.990 | 150 | |

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## PIPELINE SCHEDULES for Storm

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | o | 150 | S1 | 108.550 | 106.986 | 1.414 | Open Manhole | 450 |
| 1.001 | o | 225 | S2(CP) | 108.860 | 106.815 | 1.820 | Open Manhole | 1350 |
| 1.002 | [] | -1 | TANK IN | 108.600 | 106.810 | 0.990 | Open Manhole | 450 |
| 1.003 | o | 225 | TANK OUT | 108.600 | 106.747 | 1.628 | Open Manhole | 450 |
| 1.004 | o | 150 | FLOW CONTROL | 108.602 | 106.725 | 1.727 | Open Manhole | 2100 |
| 1.005 | o | 150 | CW1 | 108.700 | 104.804 | 3.746 | Open Manhole | 1350 |

### 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) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 14.278 | 148.7 | S2(CP) | 108.860 | 106.890 | 1.820 | Open Manhole | 1350 |
| 1.001 | 1.121 | 6.6 | TANK IN | 108.600 | 106.644 | 1.731 | Open Manhole | 450 |
| 1.002 | 14.000 | 222.2 | TANK OUT | 108.600 | 106.747 | 1.053 | Open Manhole | 450 |
| 1.003 | 5.043 | 229.2 | FLOW CONTROL | 108.602 | 106.725 | 1.652 | Open Manhole | 2100 |
| 1.004 | 5.943 | 14.1 | CW1 | 108.700 | 106.304 | 2.246 | Open Manhole | 1350 |
| 1.005 | 8.138 | 10.0 | | 108.750 | 103.990 | 4.610 | Open Manhole | 1500 |

### Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| 1.005 | | 108.750 | 103.990 | 0.000 | 1500 | 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 Offline Controls | 0 | Number of Time/Area Diagrams | 0 |
| Number of Online Controls | 1 | Number of Storage Structures | 0 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

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## 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) | 19.000 | Storm Duration (mins) | 30 |
| Ratio R | 0.254 | | |

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## Online Controls for Storm

### Hydro-Brake® Optimum Manhole: FLOW CONTROL, DS/PN: 1.004, Volume (m³): 6.7

| | |
|---|---|
| Unit Reference | MD-SHE-0100-5000-1400-5000 |
| Design Head (m) | 1.400 |
| Design Flow (l/s) | 5.0 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 100 |
| Invert Level (m) | 106.725 |
| Minimum Outlet Pipe Diameter (mm) | 150 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.400 | 5.0 | Kick-Flo® | 0.855 | 4.0 |
| Flush-Flo™ | 0.416 | 5.0 | Mean Flow over Head Range | - | 4.4 |

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

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.100 | 3.3 | 1.200 | 4.7 | 3.000 | 7.1 | 7.000 | 10.7 |
| 0.200 | 4.6 | 1.400 | 5.0 | 3.500 | 7.7 | 7.500 | 11.0 |
| 0.300 | 4.9 | 1.600 | 5.3 | 4.000 | 8.2 | 8.000 | 11.4 |
| 0.400 | 5.0 | 1.800 | 5.6 | 4.500 | 8.6 | 8.500 | 11.7 |
| 0.500 | 5.0 | 2.000 | 5.9 | 5.000 | 9.1 | 9.000 | 12.0 |
| 0.600 | 4.9 | 2.200 | 6.2 | 5.500 | 9.5 | 9.500 | 12.3 |
| 0.800 | 4.3 | 2.400 | 6.4 | 6.000 | 9.9 | | |
| 1.000 | 4.3 | 2.600 | 6.7 | 6.500 | 10.3 | | |

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

### Simulation Criteria

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

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

### Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.254
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

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

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. |
|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | 120 Winter | 100 | +45% | 100/15 Summer | | | |
| 1.001 | S2(CP) | 120 Winter | 100 | +45% | 100/15 Summer | | | |
| 1.002 | TANK IN | 120 Winter | 100 | +45% | 100/120 Winter | | | |
| 1.003 | TANK OUT | 120 Winter | 100 | +45% | 100/15 Summer | | | |
| 1.004 | FLOW CONTROL | 120 Winter | 100 | +45% | 100/15 Summer | | | |
| 1.005 | CW1 | 360 Summer | 100 | +45% | | | | |

| PN | US/MH Name | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | 107.622 | 0.486 | 0.000 | 0.57 | | 7.6 | SURCHARGED | |
| 1.001 | S2(CP) | 107.617 | 0.577 | 0.000 | 0.47 | | 27.6 | SURCHARGED | |
| 1.002 | TANK IN | 107.616 | 0.006 | 0.000 | 0.01 | | 27.5 | SURCHARGED | |

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

| PN | US/MH Name | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.003 | TANK OUT | 107.616 | 0.644 | 0.000 | 0.23 | | 5.7 | SURCHARGED | |
| 1.004 | FLOW CONTROL | 107.632 | 0.757 | 0.000 | 0.12 | | 4.9 | SURCHARGED | |
| 1.005 | CW1 | 104.835 | -0.119 | 0.000 | 0.10 | | 4.9 | OK | |

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