ASPINALL STREET, HEYWOOD, ROCHDALE



08/03/2019

DRAINAGE STRATEGY REPORT

The Alan Johnston Partnership LLP

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Prepared By

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Project Closure Report Version Control

Version	Date	Author	Change Description
P01	08.03.2019	Thomas Clark	Initial Issue
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Record of Approval

Originator	Approved	Date
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Thomas Clark	Jonathan Smith	11.03.2019
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1.0 INTRODUCTION

This Drainage Strategy Report (DRS) has been prepared for the development west of Aspinall Street to construct 4 no. dwellings on a site that is currently Greenfield in support of a planning application to Rochdale Council.

The purpose of this report is to present the surface water and foul water outline drainage strategies for the site which have been developed by the Alan Johnston Partnership. To demonstrate how the specific drainage planning requirements are to be met, the report should be read in conjunction with the relevant drawings and supporting information included within the appendices.

The drainage strategies outlined within this report, have been prepared in accordance with BS EN 752:2008 (Drain and sewer systems outside buildings), Sewers for Adoption, Building Regulations Approved Document H (Drainage and waste disposal) and the Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).

The site is located within Flood Zone 1, with a total site area under 1.0ha. Therefore, in accordance with DEFRA guidance, a Flood Risk Assessment is not required.

2.0 SITE DESCRIPTION

The proposed development site is located north of Townrow Street to the west of Aspinall Street and to the south of Dewhurst Street at National Grid Reference SJ 860108.

The proposed development site covers a total area of approximately 0.076ha and is currently a Greenfield site with the site currently public green space.

The site falls gently from north to south from a level of 114.080m AOD to a level of 113.530m AOD.

3.0 PROPOSED DEVELOPMENT

The proposed development consists of 4 new dwellings accessed off Aspinall Street. The total impermeable area from the proposed development is 0.038 Ha, encompassing the proposed roof area of the dwellings. A proposed site plan is attached in Appendix A.

4.0 ASSESSMENT OF FLOOD RISK

The site is located in Flood Zone 1 which states the development has no more than a 0.1% chance of flooding.

5.0 DEVELOPMENT AND DRAINAGE STRATEGY

5.1 Effect of Proposed Development

As previously outlined in Section 2.0, the existing site covers a total area of 0.076ha, and is a Greenfield site. The developed area of the site has an impermeable area of 0.038ha in total which is made up of the proposed roof areas for the dwellings only, with the paths and driveways infiltrating via permeable block paving.

Drainage Networks	Site Area (ha)	Existing Impermeable Area (ha)	Proposed Impermeable Area (ha)
SW Network 1	0.076	0.000	0.038

Therefore, the changes to the existing site will increase the volume of impermeable area and as such, the proposed development will lead to an increase in the;

- Volume of surface water ponding on the site
- Volume of surface water runoff leaving the site or discharging into surrounding areas
- Peak discharge rate from the site.

Accordingly, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design

and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

5.2 Existing Drainage Systems

As shown in the United Utilities map, attached in Appendix B, there is an existing 375mm diameter C.W sewer within Aspinall Street. Existing MH 0801 has an approximate invert level of 110.400m AOD, this ensures any proposed drainage can be connected into the existing drainage system without the requirement for a pumped system.

5.3 Proposed Drainage Strategy

As outlined above in section 5.1, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

5.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2002) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed site should infiltrate where possible.

Granular sands have been identified at circa 0.70 – 1.0m bgl beneath existing ground level with a thickness of approx. 300-500mm. Infiltration testing to BRE 365 hasn't been undertaken but some preliminary infiltration testing has. 2No. testing holes were dug to 1.8m x 0.8m X 1.5m with an effective depth of 1.0m both pits appear to be free from stone, both pits were filled and tested twice with an infiltration rate of 1.980×10^{-5} m/s calculated, based on the worst of these results.

Due to the space constraints onsite, infiltration via crate or precast concrete soakaway isn't viable as Building Regs H indicates soakaway systems must be at least 5m away from the nearest building. Surface water runoff from the proposed roof area will be attenuated in the proposed surface water plot drainage and restricted to 5.0l/s via a vortex flow control. Surface water falling onto the path and driveway areas around the development will infiltrate via a permeable block paving solution into the underlying sand strata.

While every effort to utilise any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Sewers for Adoption (6th Edition), the requirements for the design of a new surface water drainage system are as follows:

- Below ground piped drainage to be sized to accommodate the 1 in 2 year (50% AEP) design storm without surcharge.
- System to be designed not to flood any part of the site in a 1 in 30 year (3% AEP) design storm.
- For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site such as highways.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100 year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst case impacts of climate change. This is in accordance with Table 5 of the Technical Guidance to the National Planning Policy Framework.

A further consideration for the 1 in 100yr + CC event discharging to a surcharged outfall should be taken into account, to ensure it does not present a flood risk to any proposed or existing properties.

Should they be required, measures to prevent oil and other contaminants being passed forward to the existing surface water sewer should also be incorporated into the design of the surface water system, through the use of appropriate oil separators or other appropriate pre-treatment methods.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

With no correspondence from the Local Lead Flood Authority (LLFA) or United Utilities it has been assumed that the allowable surface water discharge rate from the proposed development will be restricted to Greenfield run off rates, due to maintenance the minimum allowable orifice plate diameter is 100mm thus restricting the proposed surface water runoff from the site to 5.0l/s.

The surface water drainage strategy and discharge rates are subject to approval from United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

5.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank
3. Cesspool.

The foul water system shall be designed in accordance with;

- BS EN 752:2008 (Drain and sewer systems outside buildings)
- Sewers for Adoption (7th Edition)
- Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).
- BS EN 12056-2:2000 (Drainage systems inside buildings)
- Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

As can be seen in the Outline Drainage Strategy Drawing, attached in Appendix C, it is anticipated that the foul water will be collected and conveyed to the Combined Sewer within Aspinall Street via new connection into MH 0801, discharge rates are yet to be confirmed with United Utilities.

The foul water drainage strategy and should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

5.4 Compliance with LASOO Non-Statutory Technical Standards for SUDS

In compliance with the runoff destinations guidance within the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Best Practice Guidance, infiltration is not feasible; therefore the surface water runoff is designed to discharge to the public sewer.

S1. Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control Standards (S2 and S3) and volume control Standards (S4 to S5) need not apply.

The site does not discharge to a surface water body that can accommodate uncontrolled surface water discharges and therefore Standards S2 – S5 shall apply.

5.4.1 Peak Flow Control

S2. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.

The site is considered Greenfield and the discharge rate for the 1 in 100 year return period has been restricted to the smallest practicable discharge rate of 5.0l/s for the development drainage network utilising a vortex flow control unit with an orifice size of 100mm in diameter.

S3. For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

The site is considered Greenfield therefore this standard does not apply.

5.4.2 Volume Control

S4. Where reasonably practicable, for Greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5. Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6. Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Due to the fact the site is Greenfield and is a small development area, there will be an increase in volume run off from the development site. The proposed surface water network has been designed to contain the 100 year + 40% climate change event with no flooding occurring during this return period.

5.5 Future Maintenance

The proposed surface water run-off is restricted using a vortex flow control device which will be maintained in accordance with manufacturer's requirements which will be provided within the O&M manual which will be issued as a compliance requirement to the maintenance contractor on completion of the works.

Proprietary systems (vortex flow control) should be cleaned out regularly, every 6 months or after a heavy storm period to prevent build-up of silts; this should be done by a suitably trained individual.

Maintenance of permeable paving involves removing sediment from the pavement surface using vacuum sweeping. It is recommended that the pavement be vacuum swept once a year and the collected sediments will require appropriate handling and disposal.

6.0 CONCLUSIONS

- The site is located within flood zone 1 and is less than 1ha in area; therefore no Flood Risk Assessment is required to support the planning application. All forms of flooding have been considered and the site is deemed to have a low risk of flooding.

- Granular sands have been identified at circa 0.70m – 1.0m bgl. Soakaway testing has been undertaken but not to BRE 365 giving an initial infiltration rate of 1.980 X 10^{-5} m/s. Due to space constraints, a crate or pre-cast concrete soakaway isn't viable for the roof areas.

- Due to the limited space available for a below ground attenuation tank, surface water falling onto pathways and driveways is to infiltrate via a permeable paving solution, as the proposed plot drainage wouldn't have capacity to attenuate the additional flows these hardstanding areas would create.

- The surface water discharge from the proposed site should discharge to the existing United Utilities 375mm C.W Sewer within Aspinall Street at a rate not exceeding 5.0/s.

- Foul water discharge from the proposed site should discharge, at unrestricted rate to be discussed with United Utilities to the existing United Utilities Combined Sewer in Aspinall Street.

7.0 RECOMMENDATIONS

- Surface water runoff from the proposed roof area is to be attenuated within the proposed plot drainage of the development.

- Additional trial pits to be dug outside of proposed building footprints to ensure underlying strata is suitable for infiltration (permeable paving).

- Surface water falling onto the paths and driveways within the development is to drain via a permeable block paving solution into the underlying sand strata.

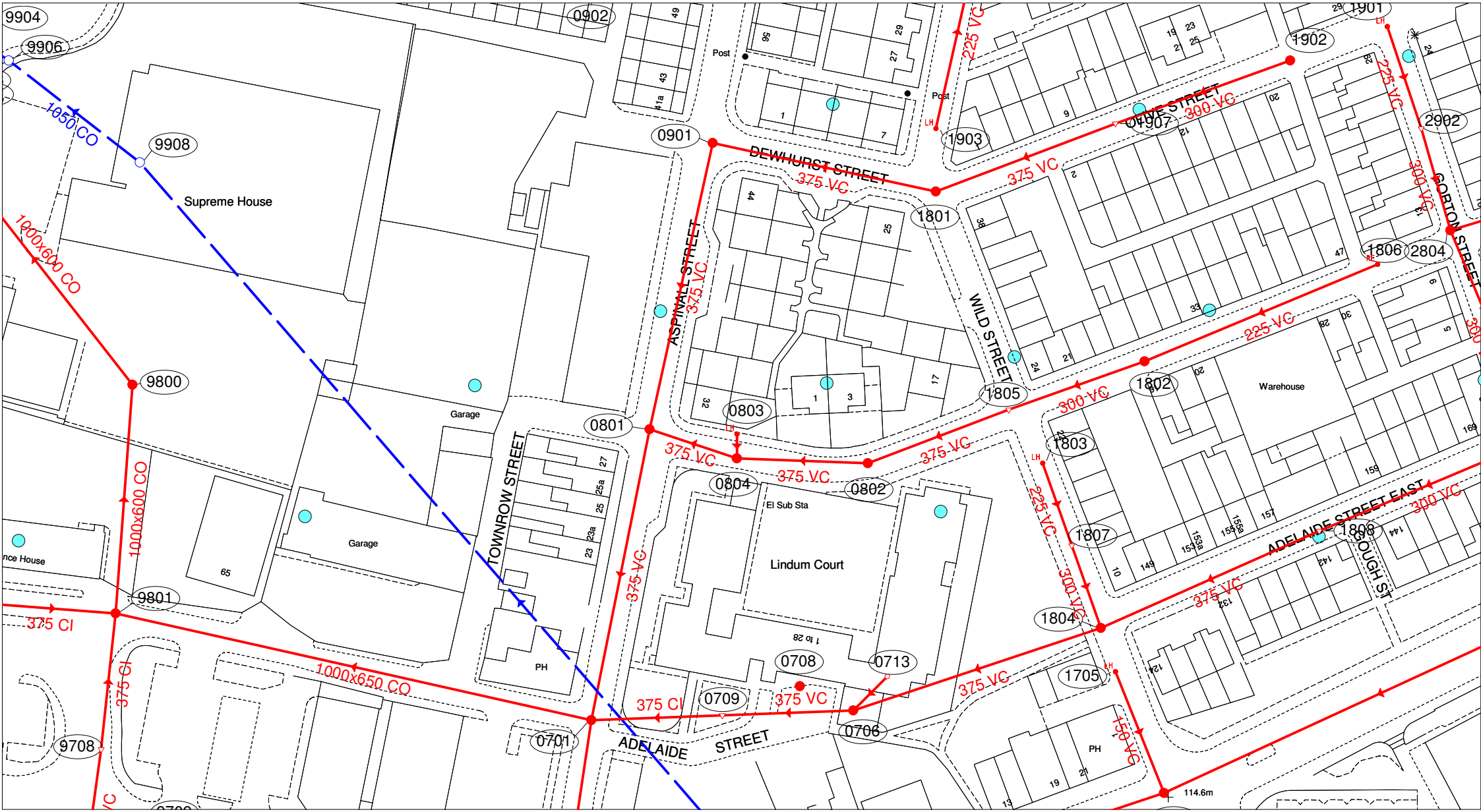
- Infiltration to BRE 365 needs to be undertaken to confirm/validate infiltration rates for the site.

Appendix A Proposed Site Plan



1 Level Ltd Proposed Bungalows Aspinall Street Heywood	Site Plan as Proposed work to figured dimensions © CJ Partnership owns the copyright of this design / drawing which must not be reproduced in whole or in part without the written permission of CJ Partnership	contract no 3516 drawn by Met Surveys	drawing no 08 date August 2018	revision B scale @ A3 1:200	**planning** Revisions: A. Bungalow layouts amended.PDC.October 2018 B. Bin stores and boundary details added. PDC. November 2018	Blue Pit Mill Queensway Castleton Rochdale OL11 2PG +44 (0)1706 631347 info@cjpartnership.com www.cjpartnership.com	CJPARTNERSHIP ENVIRONMENTAL ARCHITECTS

Appendix B United Utilities Map



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Garage
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Warehouse
Lindum Court
El Sub Sta
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Post
Post
DEWHURST STREET
ASPINALL STREET
WILD STREET
TOWNROW STREET
ADELAIDE STREET
ADELAIDE STREET EAST
GORTON STREET
GOUGH ST
1050 CO
1000x600 CO
1000x600 CO
1000x650 CO
375 CI
375 CI
375 VC
225 VC
300 VC
150 VC
114.6m

Appendix C Outline Drainage Layout and Calculations



DESIGN SUBJECT TO ADDITIONAL INFILTRATION TESTING TO BRE 365 TO ENSURE VALIDITY OF DESIGN.

CONTRACTOR TO ALLOW FOR ALL LOWERING/DIVERSION OF EXISTING SERVICES TO ACCOMMODATE NEW VEHICLE CROSSINGS, FOOTPATH WORKS(s278 WORKS) AND TO FACILITATE DEVELOPMENT OF SITE.

GENERAL NOTES

1. SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES SHOULD NOT BE SCALED FROM THIS DRAWING.
2. ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
3. THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150MM
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE RATES SHALL INCLUDE FOR HAND DIG AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
5. THE OUTSIDES OF ALL SEWERS SHALL BE A MINIMUM OF 1.0M FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 0.5M FROM KERB LINES
6. EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES 7. ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES
7. ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT (UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS
8. ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
9. WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND WIS GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
10. A CLASS S BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1M OF HIGHWAY SHALL, AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4. 12. SLAB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE
11. DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS APPROVED DOCUMENT H. 110MM U.P.V.C. PIPES LAID TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.

	FOUL	S.W.
HEAD RUN	1 IN 40	1 IN 60
ELSEWHERE	1 IN 80	1 IN 100

12. POLYPROPYLENE INSPECTION CHAMBERS TO BE PROVIDED TO ALL PRIVATE DRAINAGE LESS THAN 1.10m DEEP. WHERE PRIVATE DRAINAGE RUNS ARE DEEPER THAN 1.10m, REDUCED ACCESS CHAMBERS TO BE PROVIDED.

LEGEND

- PROPOSED SURFACE WATER DRAIN MANHOLE
- PROPOSED COMBINED WATER DRAIN MANHOLE
- EXISTING COMBINED WATER DRAIN MANHOLE
- EXISTING COMBINED WATER SEWER
- PROPOSED FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED COMBINED WATER SEWER
- PROPOSED SURFACE WATER INSPECTION CHAMBER
- PROPOSED FOUL WATER INSPECTION CHAMBER
- PROPOSED RWP WITH TRAPPED GULLY
- PROPOSED SOIL VENT PIPE

EXISTING DRAINAGE INVERT LEVELS ASSUMED ONLY, SURVEY TO DETERMINE TRUE INVERT LEVELS. FURTHER INVESTIGATION NEEDED TO DETERMINE CONDITION ETC.

TOPOGRAPHICAL SURVEY UNDERTAKEN BY MET GEO ENVIRONMENTAL DATED 24.08.18

SITE LAYOUT BASED ON DRG NO. 3516-08-B RECEIVED FROM CJ PARTNERSHIP.

DRAINAGE POP UPS BASED ON INTERNAL ARRANGEMENTS AND TO BE CONFIRMED BY ARCHITECT.

REV	DATE	DESCRIPTION	BY	CHK	APP
P01	08.03.19	PRELIMINARY ISSUE	TC	JCM	JCM

DRAWING STATUS: **PRELIMINARY**

CLIENT: HEYWOOD

ARCHITECT: CJ PARTNERSHIP

PROJECT: ASPINALL STREET, HEYWOOD ROCHDALE

TITLE: OUTLINE DRAINAGE PLAN

STATUS:	PROJECT NUMBER	DRAWING No:	REV:
S2	219-008	**ASP-AJP-ZZ-00-DR-C-1000**	**P01**

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:200	TC	TC	JCM	JCM	March 2019

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.150
Area (ha)	0.076	Urban	0.000
SAAR (mm)	1200	Region Number	Region 10

Results l/s

QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.1
Q1 year	0.1
Q30 years	0.1
Q100 years	0.1

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.276	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
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.028	4-8	0.010

Total Area Contributing (ha) = 0.038

Total Pipe Volume (m³) = 3.139

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	9.777	0.163	60.0	0.009	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	19.142	0.242	79.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	4.963	0.099	50.0	0.006	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	7.989	0.133	60.1	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	30.878	0.309	100.0	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	42.84	5.10	113.400	0.009	0.0	0.0	0.0	1.69	67.3	1.0
1.001	42.16	5.31	113.237	0.009	0.0	0.0	0.0	1.47	58.5	1.0
1.002	42.02	5.36	112.995	0.015	0.0	0.0	0.0	1.85	73.7	1.7
2.000	42.82	5.10	113.202	0.009	0.0	0.0	0.0	1.30	23.0	1.0
1.003	40.85	5.75	112.896	0.033	0.0	0.0	0.0	1.31	52.0	3.7

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	4.843	0.048	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	4.521	0.045	100.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	8.510	0.085	100.1	0.000	0.00	0.0	1.500	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)
1.004	40.67	5.81	112.587	0.033	0.0	0.0	0.0	1.31	52.0	3.7
1.005	40.46	5.89	112.539	0.038	0.0	0.0	0.0	1.00	17.8	4.2
1.006	40.01	6.05	112.244	0.038	0.0	0.0	0.0	0.88	15.5	4.2

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	114.150	0.750	Open Manhole	600	1.000	113.400	225				
2	114.150	0.913	Open Manhole	600	1.001	113.237	225	1.000	113.237	225	
3	114.150	1.155	Open Manhole	600	1.002	112.995	225	1.001	112.995	225	
4	114.150	0.948	Open Manhole	600	2.000	113.202	150				
4	114.150	1.254	Open Manhole	600	1.003	112.896	225	1.002	112.896	225	
								2.000	113.069	150	98
5	113.850	1.263	Open Manhole	600	1.004	112.587	225	1.003	112.587	225	
6	113.850	1.311	Open Manhole	1200	1.005	112.539	150	1.004	112.539	225	
7	113.750	1.506	Open Manhole	1200	1.006	112.244	150	1.005	112.493	150	249
	113.430	1.271	Open Manhole	0		OUTFALL		1.006	112.159	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	225	1	114.150	113.400	0.525	Open Manhole	600
1.001	o	225	2	114.150	113.237	0.688	Open Manhole	600
1.002	o	225	3	114.150	112.995	0.930	Open Manhole	600
2.000	o	150	4	114.150	113.202	0.798	Open Manhole	600
1.003	o	225	4	114.150	112.896	1.029	Open Manhole	600
1.004	o	225	5	113.850	112.587	1.038	Open Manhole	600
1.005	o	150	6	113.850	112.539	1.161	Open Manhole	1200
1.006	o	150	7	113.750	112.244	1.356	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)
1.000	9.777	60.0	2	114.150	113.237	0.688	Open Manhole	600
1.001	19.142	79.1	3	114.150	112.995	0.930	Open Manhole	600
1.002	4.963	50.0	4	114.150	112.896	1.029	Open Manhole	600
2.000	7.989	60.1	4	114.150	113.069	0.931	Open Manhole	600
1.003	30.878	100.0	5	113.850	112.587	1.038	Open Manhole	600
1.004	4.843	100.0	6	113.850	112.539	1.086	Open Manhole	1200
1.005	4.521	100.0	7	113.750	112.493	1.107	Open Manhole	1200
1.006	8.510	100.1		113.430	112.159	1.121	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.009	0.009	0.009
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.006	0.006	0.006
2.000	-	-	100	0.009	0.009	0.009
1.003	-	-	100	0.009	0.009	0.009
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.005	0.005	0.005
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.038	0.038	0.038

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)
1.006		113.430	112.159	110.400	0	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	1	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)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.276		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.005, Volume (m³): 1.6

Unit Reference	MD-SHE-0100-5000-1350-5000
Design Head (m)	1.350
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	112.539
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	5.0
Flush-Flo™	0.400	5.0
Kick-Flo®	0.829	4.0
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	7.3	7.000	10.9
0.200	4.6	1.400	5.1	3.500	7.8	7.500	11.2
0.300	4.9	1.600	5.4	4.000	8.3	8.000	11.6
0.400	5.0	1.800	5.7	4.500	8.8	8.500	11.9
0.500	5.0	2.000	6.0	5.000	9.2	9.000	12.2
0.600	4.8	2.200	6.3	5.500	9.7	9.500	12.6
0.800	4.2	2.400	6.5	6.000	10.1		
1.000	4.4	2.600	6.8	6.500	10.5		

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1 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 Storage Structures	0
Number of Online Controls	1	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 0.276
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	100/15 Winter				113.420
1.001	2	15 Winter	1	+0%	100/15 Summer				113.259
1.002	3	15 Winter	1	+0%	100/15 Summer				113.023
2.000	4	15 Winter	1	+0%	100/15 Summer				113.224
1.003	4	15 Winter	1	+0%	100/15 Summer				112.936
1.004	5	15 Winter	1	+0%	30/15 Summer				112.658
1.005	6	15 Winter	1	+0%	30/15 Summer				112.654
1.006	7	15 Winter	1	+0%					112.297

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.205	0.000	0.02		1.0	OK	
1.001	2	-0.203	0.000	0.02		1.0	OK	
1.002	3	-0.197	0.000	0.04		1.6	OK	
2.000	4	-0.128	0.000	0.05		1.0	OK	
1.003	4	-0.185	0.000	0.07		3.5	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	5	-0.154	0.000	0.11		3.4	OK	
1.005	6	-0.035	0.000	0.28		3.8	OK	
1.006	7	-0.097	0.000	0.27		3.8	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	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	1	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	0.276
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%	100/15 Winter				113.431
1.001	2	15 Winter	30	+0%	100/15 Summer				113.269
1.002	3	15 Winter	30	+0%	100/15 Summer				113.042
2.000	4	15 Winter	30	+0%	100/15 Summer				113.238
1.003	4	15 Winter	30	+0%	100/15 Summer				112.999
1.004	5	15 Winter	30	+0%	30/15 Summer				112.987
1.005	6	15 Winter	30	+0%	30/15 Summer				112.984
1.006	7	15 Summer	30	+0%					112.306

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.194	0.000	0.05		2.6	OK	
1.001	2	-0.193	0.000	0.05		2.5	OK	
1.002	3	-0.178	0.000	0.10		4.3	OK	
2.000	4	-0.114	0.000	0.13		2.6	OK	
1.003	4	-0.122	0.000	0.19		9.4	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	5	0.175	0.000	0.16		5.0	SURCHARGED	
1.005	6	0.295	0.000	0.38		5.0	SURCHARGED	
1.006	7	-0.088	0.000	0.36		5.0	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	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	1	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 0.276
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Winter	100	+40%	100/15 Winter				113.852
1.001	2	30 Winter	100	+40%	100/15 Summer				113.851
1.002	3	30 Winter	100	+40%	100/15 Summer				113.848
2.000	4	30 Winter	100	+40%	100/15 Summer				113.850
1.003	4	30 Winter	100	+40%	100/15 Summer				113.846
1.004	5	30 Winter	100	+40%	30/15 Summer				113.835
1.005	6	30 Winter	100	+40%	30/15 Summer				113.831
1.006	7	60 Summer	100	+40%					112.306

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.227	0.000	0.07		3.9	FLOOD RISK	
1.001	2	0.389	0.000	0.07		3.8	FLOOD RISK	
1.002	3	0.628	0.000	0.12		5.4	SURCHARGED	
2.000	4	0.498	0.000	0.19		3.8	FLOOD RISK	
1.003	4	0.725	0.000	0.23		11.2	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	5	1.023	0.000	0.18		5.7	FLOOD RISK	
1.005	6	1.143	0.000	0.38		5.0	FLOOD RISK	
1.006	7	-0.088	0.000	0.36		5.0	OK	

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