

13th May 2021
Email only

Hillingdon Planning Services
3N/04
Civic Centre
High Street
Uxbridge
Middlesex
UB8 1UW

Dear Sir/Madam,

I refer to our Drainage Strategy report, titled '210211 - Drainage Strategy and Sustainable Water Management - Rev B', as submitted in connection with Application Ref 74891/APP/2020/1614.

Further to recent design development, a new planning application is due to be submitted in connection with the scheme. This is mainly related to changes associated with combining the proposed two units into a single unit. The updated drawings for submission are listed in the schedule below.

This cover note is to confirm that we have reviewed the proposed changes to the consented scheme, and that our enclosed report submitted in connection with 74891/APP/2020/1614, is still valid and applicable to the proposed new scheme as detailed in the below drawings.

Updated Drawings referred to:

L001 Site Location Plan A
P001 Existing Site Plan B
P002 Existing Site Constraints Plan B
P003 Existing Ground floor Plan C
P004 Block Plan B
E001 Existing Elevations B
E002 Existing Elevations -
P101 Proposed Site Plan J
P102 Proposed Ground Floor Plan K
P103 Proposed Roof Plan D
P104 Proposed first Floor Plan -
P105 Site Constraints Plan C
P106 Site Survey with Proposed Overlay B
E101 Proposed Elevations J
E102 Proposed Elevations J
S101 Proposed Sections E

M101 Proposed Materials D

PH001 Existing Site Photos A

D&A Design and Access Statement B

Yours sincerely,



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Barton Buildings, Uxbridge Industrial Estate Drainage Strategy

Rev B – 26th February 2021

Prepared by: Paul White, HND Civil Engineering, Civil Engineer

Checked by: Paul Kay, Associate

B	Revised to suit comments. Issued for Planning	26.02.21	PK
A	Issued for Planning	12.02.21	PK
Revision	Purpose	Date	Checked

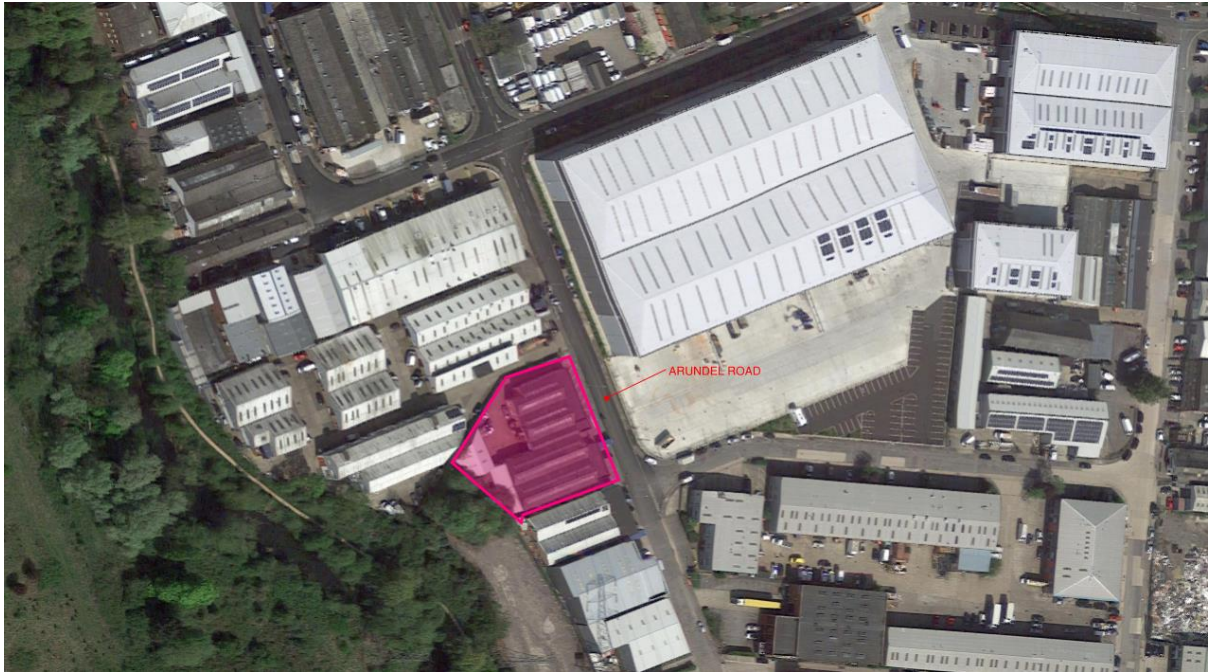
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Contents

1	Site Location and Setting	1
2	Proposed Development	2
3	Temporary Drainage During Construction	2
4	Hierarchy of Surface Water Disposal	2
4.1	Discharge to Ground (Infiltration)	2
4.2	Discharge to a Surface Water Body	2
4.3	Discharge to a Surface Water Sewer	2
4.4	Discharge to a Combined Sewer	3
5	Surface Water Runoff Rates	3
5.1	Greenfield Runoff Rate Calculation	3
5.2	Climate Change	3
6	Analysis of Sustainable Drainage Systems (SuDS)	4
7	Design of Drainage Infrastructure	5
7.1	Attenuation Volume	6
8	Surface Water Management Proposal	6
8.1	Maintenance for non-adoptable drainage elements	6
9	Foul Drainage	7
Appendix A	Microdrainage Calculations	8
Appendix B	Drainage General Arrangement	9

1 Site Location and Setting

The proposed development site is centred at approximate National Grid Reference TQ047830 (E 504707, N 183047). The site is irregular in shape and occupies an area of approximately 0.234ha.



The site is located at Unit C, Bartons Building Arundel Rd, Uxbridge UB8 2RR and is currently occupied by a number of small business in the units. The units form a U-shape around a small yard on the north of the site. An access road runs along the north edge of the site from Arundel road. The northwest boundary borders the adjacent access road to the Chiltern Business Village. The rear of the site is bounded by a chain link fence and vegetation. The boundary along Arundel road is undefined and the southern elevation of the building forms the southern boundary.

The site is not set within a Conservation Area and the Environment Agency show that the entire site is located in Flood Zone 1albeit that the adjacent Arundel Road is shown to be within Flood Zone 2.

The site is occupied approximately 64.0% by building footprint, 36.0% by hardstanding and 0.0% by soft landscaping.

The topographical site survey carried out by Laser Surveys November 2019 indicates the existing building on site sits at approximately 30.100m AOD. The existing car parking and service yard areas are graded to fall towards gullies and channels. The site as a whole is generally flat with levels around the building approximately 100mm lower than the slab. There is a slight fall from the front of the building to the curtilage with Arundel Road.

British Geological Survey (BGS) online mapping (1:50,000 scale) indicates the site to overlie a bedrock geology of London Clay with superficial deposits of Alluvium consisting of Silt, Sand And Gravel are listed overlying. An intrusive ground investigation was carried out in September 2020 by GO Contaminated Land Solutions. Their investigation undertook 4 boreholes across the site with the following findings:

Stratum	BH1	BH2	BH3	BH4
Tarmac/Concrete	FGL – 0.03m	FGL – 0.04m	FGL – 0.06m	FGL – 0.22m
Sand and Gravel Fill	0.03m – 0.25m	0.04m 0 0.30m	-	-
Clayey Made Ground	0.25m – 1.00m	0.30m – 1.30m	0.06m – 0.80m	0.22m – 1.30m
Silty Clayey Gravel	-	1.30m – 2.30m	0.80m – 2.20m	130m – 3.40m
Sandy Clayey Gravel	1.00m – 4.00m	2.30m – 4.000	2.20m – 4.00m	3.40m – 9.30m

The site is shown to be unproductive for Bedrock aquifers and within a secondary A designation for Superficial aquifers. The site is not shown to be located within a groundwater Source Protection Zone (SPZ).

2 Proposed Development

The project involves a demolition of the existing building and construction a large industrial building divided into two units along with associated parking and hard and soft landscaping. External areas are to be hard surfaced with a planting strip along the west and north boundary. Access to the rear will be gained via a dedicated access from Arundel Road. The existing sub station of site will be relocated.

3 Temporary Drainage During Construction

Temporary drainage methods will be coordinated with the contractor during the construction phasing and if required a Construction Surface Water Management Plan (CSWMP) will be completed.. Once demolition has taken place all existing hardstanding areas along with the majority of the private below ground drainage will have been removed. Surface and foul water connections to the public sewer will be maintained for temporary connections. Should any dewatering of the site be required, the contractor will apply for a temporary groundwater discharge licence.

4 Hierarchy of Surface Water Disposal

When developing or redeveloping a site, the control and dispersion of surface water falling on the site's catchment always must be considered. Wherever possible runoff from developments should be managed on the surface. This enables their performance to be more easily inspected and managed with pollution incidents and potential flood risk being visible. But due to the nature of some developments this is not always possible.

If surface water is to be discharged from the site Planning Practice Guidelines state "Generally, the aim should be to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration)
2. To a surface water body.
3. To a surface water sewer, highway drain or another drainage system.
4. To a combined sewer."

It is recommended to manage surface water as close to the source i.e., where the rain falls. The effective of control and management of surface water runoff will need to be addressed through the application of the above drainage hierarchy.

4.1 Discharge to Ground (Infiltration)

The underlying superficial strata shows that the ground is suitable for infiltration. A BRE365 soakage test was carried out (March 2020 by Fastrack) in the south western corner of the site with good infiltration rates shown within the sands and gravels of $17.63 \times 10^{-4} \text{m/s}$.

However, the intrusive survey carried out by Go Contaminated Land Solutions stuck groundwater in all four of their boreholes at variable depths between 2.2m and 5.2m below ground level. The proximity of the River Colne (50m to the south west of the site) is possible effecting the groundwater levels on the site.

The depth of the made ground shown across the site, the proximity of the river and the groundwater levels and the site layout in relation to adjacent buildings does not lend itself to allowing infiltration drainage.

4.2 Discharge to a Surface Water Body

Reference to OS Mapping indicates that the nearest surface water feature is the river Colne approximately 50m to the east of the site with the Grand Union Canal lying 250m away also to the east of the site. The distance from the site means that discharging to the to a surface water body will not be possible.

4.3 Discharge to a Surface Water Sewer

It is our intention to discharge the surface water from the site into a below ground gravity drainage (albeit with a restricted and attenuated discharge rate) and allow the flows to outfall to the existing public surface water sewer in Abbey Road. As set out in the Non-Statutory Technical Standards for Sustainable Drainage the flow rate should be as close as practically possible to matching the 1:1yr and 1:100yr greenfield runoff rate but not exceed the discharge from the previous development. Refer to section 6 for details.

In order to keep the volume of the attenuation down to a minimum a variable flow rate discharge unit (complex outfall) would be used. This means that the corresponding restriction can be applied to the 1:1yr, 1:30yr and 1:100yr rather than restricting the flow to only one of the return periods. Using only one return period could lead to potentially discharging too great a flow for the more frequent storms, or over designing the attenuation for the less frequent.

4.4 Discharge to a Combined Sewer

This option is not applicable as there are no combined sewers in the vicinity.

5 Surface Water Runoff Rates

The discharge from the site must not impact the flood risk of the surrounding developments both upstream and downstream of the site.

As the site has been previously developed it can be classed as a Brownfield Development. 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.

In addition to this, the runoff volume for 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. However, where it is not reasonably practicable to constrain the volume the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Hillingdon Councils Surface Water Management Plan does not show the site to be located in a Critical Drainage Area (CDA). Under Section 4.3.1 it states:

"It should be acknowledged that the CDAs only account for a small portion of the areas that could be affected by surface water flooding. The CDAs are the areas where the impact of surface water flooding is expected to be greatest, but it is recommended that the Council implement policies which will reduce the flood risk from surface water flooding throughout the borough and promote Best Management Practises to the implementations of SuDS and the reduction of runoff volumes."

Thames Water are the water authority that serve the site. They are known to require that only when it can be proven that soakage into the ground or a connection into an adjacent watercourse is not possible would they consider a restricted discharge into the public surface water sewer network.

They normally encourage techniques such as green roofs and/or permeable paving that restricts surface water discharge from the site.

The catchment areas for the existing site drainage layout have been taken from the topographical survey drawings and are broken down as follows:

		Area (m ²)	Runoff Coefficient	Factored Area (m ²)	Total (m ²)	Total Factored
Existing Development	Roof	1499	0.95	1424.05	2341	2139.75
	Green Roof	0	0.4	0		
	Hardstanding	842	0.85	715.7		
	Soft Landscaping	0	0.2	0		

5.1 Greenfield Runoff Rate Calculation

Using the ICP SUDS Rural Runoff Calculator within Microdrainage the following values have been calculated for the 0.234ha development site catchments. As the site is has previously been developed (brownfield) and approx. 100% impermeable an urban factor of 0.7 has been applied. The results of the calculation are shown below:

ICP SUDS Mean Annual Flood

Input					
Return Period (years)	30	SAAR (mm)	700	Urban	0.700
Area (ha)	0.234	Soil	0.325	Region Number	Region 6
Results l/s					
QBAR Rural	0.5				
QBAR Urban	1.5				
Q30 years	2.6				
Q1 year	1.3				
Q30 years	2.6				
Q100 years	3.1				

Qbar_{urban} for the site is shown to be 1.3l/s therefore a restriction of flows from the site will be set to match the Qbar_{urban} value of 1.5l/s for the 1yr storm, 2.6l/s for the Q30 and 3.1l/s for the 1:100yr flows from the proposed development site.

5.2 Climate Change

Referencing the gov.uk website we have used table 2 to set our climate change values.

**Table 2 peak rainfall intensity allowance in small and urban catchments
(use 1961 to 1990 baseline)**

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

The proposed development is for industrial units which is considered to have a lifetime of 50 years. The range of climate change allowances to be considered for the proposed development are 20% to 40%.

6 Analysis of Sustainable Drainage Systems (SuDS)

Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:

- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

To fall in line with the recommendations of The Flood and Water Management Act which requires that “*developers are to put SUDS in place in new developments wherever practicable.*”, we have reviewed the main SuDS components in line with the suitability for the proposed development.

SuDS components are a physical part of the drainage system and can be categorised as follows:.

SuDS Component	Description	Suitability for Development
Green Roof 	<i>A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.</i>	Due to the roof construction and use of PV units a green roof is not suitable. Unfeasible
Rainwater Harvesting 	<i>Rainwater is collected from the roof of a building or from other paved surfaces and stored in an over ground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.</i>	Due to site constraints, there is no room to include rainwater harvesting Unfeasible
Soakaway 	<i>A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.</i>	Due to the underlying geology groundwater levels, site layout and made ground infiltration is not suitable. Unfeasible

Filter Strip



Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.

Permeable Paving



Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.

Bioretention Area



A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.

Swales



Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.

Pond/Basin



Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.

Wetland



Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.

Underground Storage



Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.

Due to the size of the site and limited external landscaped space in the proposed scheme, the incorporation of filter strips are not feasible at the site.

Unfeasible

Due to the frequent slow moving and manoeuvring HGV traffic the use of open graded asphalt or porous block paving is not suitable.

Unfeasible

Due to the size of the site and limited external landscaped space in the proposed scheme, the incorporation of bio-retention area are not feasible at the site

Unfeasible

Due to the size of the site and limited external landscaped space in the proposed scheme, the incorporation of swales are not feasible at the site.

Unfeasible

Due to the size of the site and limited external landscaped space in the proposed scheme, the incorporation of attenuation basins are not feasible at the site.

Unfeasible

Due to the size of the site and limited external landscaped space in the proposed scheme, the incorporation of wetlands are not feasible at the site.

Unfeasible

Proposed for attenuation features

Feasible

7 Design of Drainage Infrastructure

The below ground drainage will be designed to ensure:

- No surcharging for the 1:1yr storm
- No flooding for all storms up to and including the critical 1:30yr storm.
- Any flooding experienced for all storms in excess of 1:30yr and up to and including the 1:100yr storm will need to be contained on site posing no risk to the building or affecting safe egress from site.
- The design will be checked for the impact of climate change on the 1:100yr storm.

The catchment areas for the proposed site drainage layout are broken down as follows:

		Area (m²)	Runoff Coefficient	Factored Area (m²)	Total (m²)	Total Factored
Proposed Development	Roof	1240	0.95	1178	2105	1856.05
	Green Roof	0	0.4	0		
	Hardstanding	777	0.85	660.45		
	Soft Landscaping	88	0.2	17.6		

Following redevelopment, the site will be occupied approximately 52.9% by building footprint, 33.1% by hardstanding and 14.0% by soft landscaping.

7.1 Attenuation Volume

In order to restrict the flows to match the existing greenfield runoff rate and ensure that no flooding occurs for the 1:100yr + 40% climate change event at 3.1/s, 119m³ of storage will be required. This will be stored below ground within attenuation crates.

Refer to Appendix A for MicroDrainage Calculations and Appendix B for the drainage layout.

8 Surface Water Management Proposal

Whilst the site will be privately owned it will be possible to offer some of the drainage system for adoption.

On the 25th of October 2019, the documentation submitted by Water UK concerning sewerage was approved by Ofwat. It is designed to guide water companies and developers when planning, designing, and constructing foul and surface water drainage systems which are intended for adoption, as per the Section 104 agreement under the Water Industry Act 1991. The documents provide updated guidance for all standards and specifications required when designing new water or drainage infrastructure and aim to accelerate the uptake of sustainable drainage (SuDS), by smoothing out the transfer of ownership, responsibility and ensure the assets are effectively managed and maintained. They will also allow English water and sewerage companies to adopt a wider range of drainage types, including those with sustainable elements.

Practically and in terms of SuDS, the basic criteria that need to be achieved for a surface water drainage system to be “adoptable” or “not adoptable”, will mainly require the following.

Adoptable	Non-Adoptable
It is constructed for the drainage of buildings and yards appurtenant to buildings	Watercourses as defined in law (these included rivers, streams and can include some ditches)
It has a channel (a depression between banks or ridges with a definite boundary)	Components built primarily for the drainage of surface water from streets or the drainage of land
It conveys and returns flows to a sewer or to a surface water body or to groundwater	Components built to manage groundwater
It has an effective point of discharge, which must have lawful authority to discharge into a watercourse or other water body or into land. As with conventional piped systems, this right to discharge must be secured by the developer and transferred to the sewerage company on adoption	Components which are part of the structure of a building or yard (e.g., green roof, pervious driveway or guttering and rainwater pipes attached to the building)
	Components which are an integral part of the structure of a street (e.g., a pervious street or channel formed by kerb of a conventional road or channel formed by a depression in the centre of a street)

Using the above criteria, it will not be possible to offer any part of the system for adoption.

On completion of the construction, an operation and maintenance manual will be written setting out the maintenance regime for the surface water and the foul water drainage system. The party responsible for undertaking the aforementioned maintenance will be determined by the detailed provisions of the lease, which are yet to be confirmed. The O&M manual will recommend the following:

8.1 Maintenance for non-adoptable drainage elements

The entire drainage system should be monitored monthly by lifting the covers to the manholes and chambers to monitor debris build-up. If required, these are to be cleaned at the earliest opportunity to prevent blockages.

Every six months, the drainage system should be inspected to identify areas that are not operating as required and any remedial works identified should be carried out at the earliest opportunity.

The system should be cleaned out at 12 monthly intervals and includes the removal of sediment from all structures that have capacity to accommodate sediment storage.

Debris removed from the catch pits should be removed by a suitably qualified and accredited contractor and an appropriate waste transfer or waste disposal certificate should be kept as record.

A full CCTV survey of the surface water drainage system should also be carried out at 10 yearly intervals to assess the condition of the drainage system.

9 Foul Drainage

The foul flow from the development will be collected in a below ground drainage system from the building and discharge to the existing public foul water sewer in Arundel Rd. Refer to Appendix B for drainage layout.

Appendix A Microdrainage Calculations

- Greenfield Runoff Rate
- 1:100yr + 40% Storage Sizing

Evolve		Page 1
20 Baltic Street London EC1Y 0UL		
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Innovyze Source Control 2019.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	30	SAAR (mm)	700	Urban	0.700
Area (ha)	0.234	Soil	0.325	Region Number	Region 6

Results l/s

QBAR Rural	0.5
QBAR Urban	1.5
Q30 years	2.6
Q1 year	1.3
Q30 years	2.6
Q100 years	3.1

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Evolve		Page 1
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%	
Date 11/02/2021 17:16 File 200803 SWS1.MDX	Designed by PW Checked by PW	
Innovyze	Network 2019.1	

Existing Network Details 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
1.000	30.419	0.310	98.1	0.044	5.00	0.0	0.600	o	150	Pipe/Conduit
2.000	6.130	0.060	102.2	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	7.100	0.060	118.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.002	34.205	0.000	0.0	0.037	0.00	0.0	0.600	[]	-15	Pipe/Conduit
3.000	5.183	0.050	103.7	0.050	5.00	0.0	0.600	o	150	Pipe/Conduit
4.000	30.419	0.305	99.7	0.044	5.00	0.0	0.600	o	150	Pipe/Conduit
1.003	2.969	0.025	118.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.004	3.845	0.030	128.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	29.500	0.044	0.0	1.01	17.9
2.000	29.250	0.024	0.0	0.99	17.6
1.001	29.210	0.068	0.0	1.20	47.7
1.002	28.700	0.105	0.0	0.00	0.0
3.000	28.750	0.050	0.0	0.99	17.4
4.000	29.500	0.044	0.0	1.01	17.8
1.003	28.700	0.199	0.0	0.92	16.3
1.004	28.675	0.199	0.0	0.89	15.7

Evolve	Page 2
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%
Date 11/02/2021 17:16 File 200803 SWS1.MDX	Designed by PW Checked by PW
Innovyze	Network 2019.1



Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
PICS1	30.150	0.650	Open Manhole	1050	1.000	29.500	150				
MHS1	30.000	0.750	Open Manhole	1050	2.000	29.250	150				
MHS2	30.150	0.960	Open Manhole	1200	1.001	29.210	225	1.000	29.190	150	
								2.000	29.190	150	
MHS3	30.150	1.450	Open Manhole	1200	1.002	28.700	-15	1.001	29.150	225	674
MHS4	30.000	1.250	Open Manhole	1050	3.000	28.750	150				
PICS4	30.150	0.650	Open Manhole	1050	4.000	29.500	150				
MHS5	30.000	1.300	Open Manhole	1500	1.003	28.700	150	1.002	28.700	-15	
								3.000	28.700	150	
								4.000	29.195	150	495
MHS6	30.000	1.325	Open Manhole	1050	1.004	28.675	150	1.003	28.675	150	
	30.000	1.355	Open Manhole	0		OUTFALL		1.004	28.645	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
PICS1	504694.269	183008.653	504694.269	183008.653	Required	
MHS1	504679.060	183029.073	504679.060	183029.073	Required	
MHS2	504679.404	183035.193	504679.404	183035.193	Required	
MHS3	504685.598	183038.663	504685.598	183038.663	Required	
MHS4	504712.908	183059.900	504712.908	183059.900	Required	
PICS4	504730.306	183028.838	504730.306	183028.838	Required	
MHS5	504715.441	183055.378	504715.441	183055.378	Required	
MHS6	504718.031	183056.829	504718.031	183056.829	Required	
	504721.386	183058.708			No Entry	

Evolve	Page 3
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%
Date 11/02/2021 17:16 File 200803 SWS1.MDX	Designed by PW Checked by PW
Innovyze	Network 2019.1



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	PICS1	30.150	29.500	0.500	Open Manhole	1050
2.000	o	150	MHS1	30.000	29.250	0.600	Open Manhole	1050
1.001	o	225	MHS2	30.150	29.210	0.715	Open Manhole	1200
1.002	[]	-15	MHS3	30.150	28.700	1.449	Open Manhole	1200
3.000	o	150	MHS4	30.000	28.750	1.100	Open Manhole	1050
4.000	o	150	PICS4	30.150	29.500	0.500	Open Manhole	1050
1.003	o	150	MHS5	30.000	28.700	1.150	Open Manhole	1500
1.004	o	150	MHS6	30.000	28.675	1.175	Open Manhole	1050

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	30.419	98.1	MHS2	30.150	29.190	0.810	Open Manhole	1200
2.000	6.130	102.2	MHS2	30.150	29.190	0.810	Open Manhole	1200
1.001	7.100	118.3	MHS3	30.150	29.150	0.775	Open Manhole	1200
1.002	34.205	0.0	MHS5	30.000	28.700	1.299	Open Manhole	1500
3.000	5.183	103.7	MHS5	30.000	28.700	1.150	Open Manhole	1500
4.000	30.419	99.7	MHS5	30.000	29.195	0.655	Open Manhole	1500
1.003	2.969	118.8	MHS6	30.000	28.675	1.175	Open Manhole	1050
1.004	3.845	128.2		30.000	28.645	1.205	Open Manhole	0

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)
1.004		30.000	28.645	28.645	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 * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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

Evolve		Page 4																				
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%																					
Date 11/02/2021 17:16 File 200803 SWS1.MDX	Designed by PW Checked by PW																					
Innovyze	Network 2019.1																					
Synthetic Rainfall Details <table><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>30</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>20.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.407</td><td></td><td></td></tr></table>			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)	20.000	Storm Duration (mins)	30	Ratio R	0.407		
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)	20.000	Storm Duration (mins)	30																			
Ratio R	0.407																					
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Evolve		Page 5
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%	
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Innovyze	Network 2019.1	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: MHS5, DS/PN: 1.003, Volume (m³): 131.0

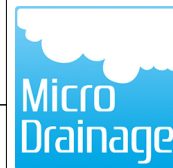
Unit Reference	MD-SHE-0088-3100-0686-3100
Design Head (m)	0.686
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	28.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.686	3.1	Kick-Flo®	0.458	2.6
Flush-Flo™	0.205	3.1	Mean Flow over Head Range	-	2.7

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	2.7	1.200	4.0	3.000	6.1	7.000	9.2
0.200	3.1	1.400	4.3	3.500	6.6	7.500	9.5
0.300	3.0	1.600	4.6	4.000	7.0	8.000	9.8
0.400	2.9	1.800	4.8	4.500	7.4	8.500	10.1
0.500	2.7	2.000	5.1	5.000	7.8	9.000	10.4
0.600	2.9	2.200	5.3	5.500	8.2	9.500	10.7
0.800	3.3	2.400	5.5	6.000	8.5		
1.000	3.7	2.600	5.7	6.500	8.9		

Evolve	Page 6
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%
Date 11/02/2021 17:16 File 200803 SWS1.MDX	Designed by PW Checked by PW
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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 Coefficient 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 M5-60 (mm) 20.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.404 Cv (Winter) 1.000

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

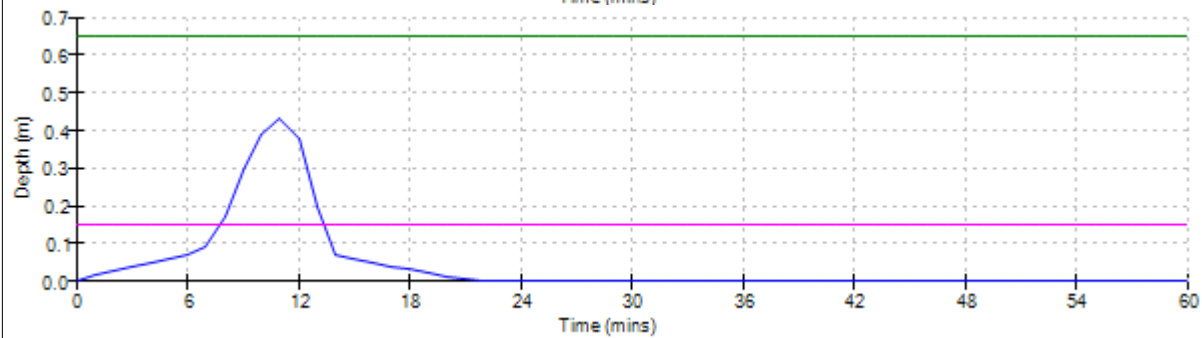
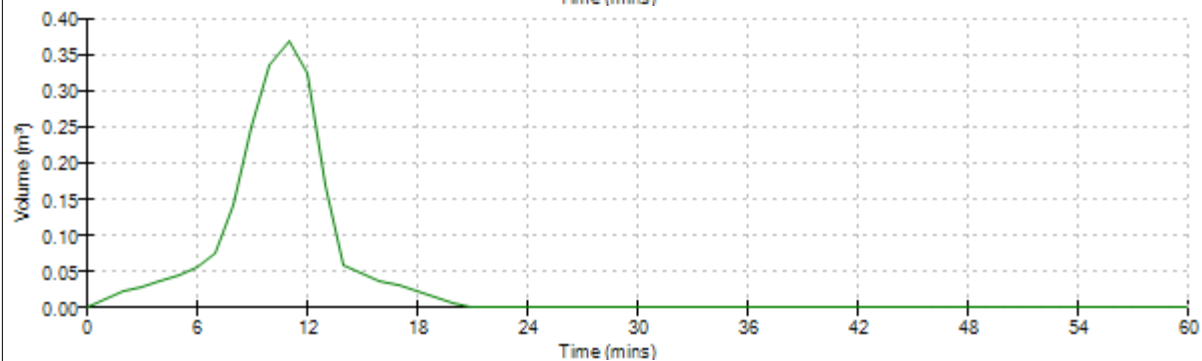
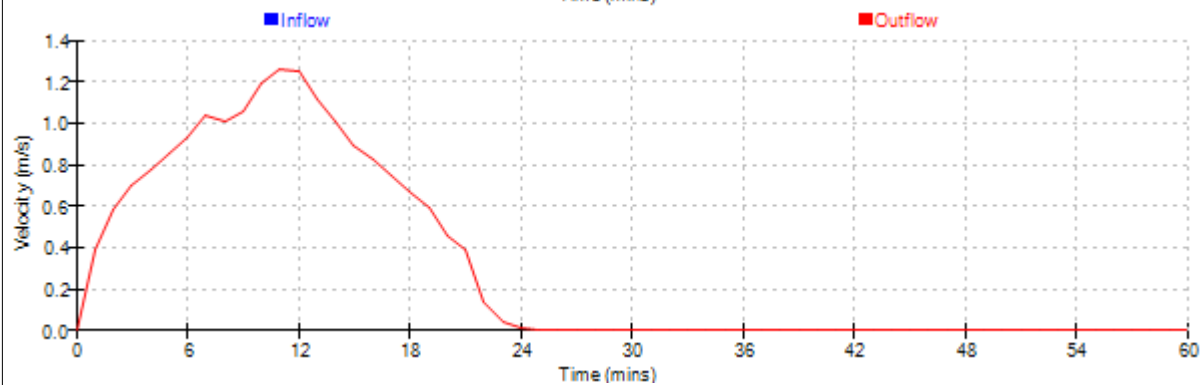
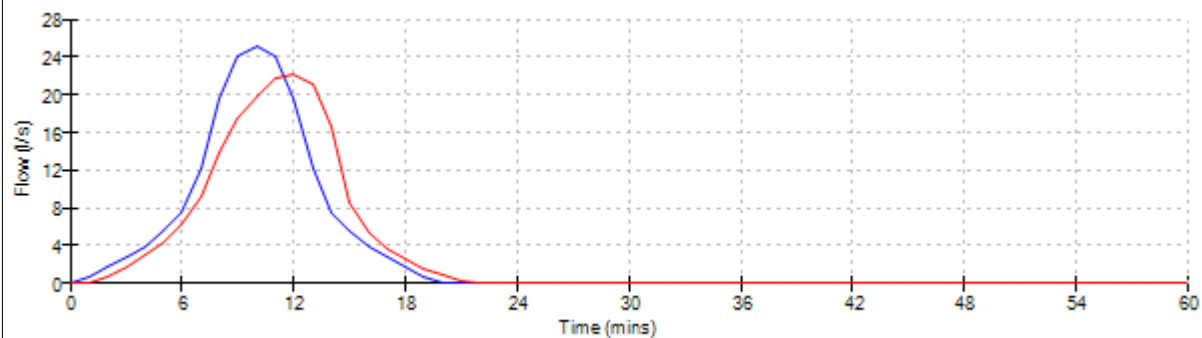
Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	PICS1	15 Summer	100	+0%	100/15 Summer				29.931	0.281
2.000	MHS1	15 Summer	100	+0%	100/15 Summer				29.442	0.042
1.001	MHS2	15 Summer	100	+0%					29.397	-0.038
1.002	MHS3	180 Winter	100	+0%					29.192	-0.194
3.000	MHS4	180 Winter	100	+0%	100/15 Summer				29.194	0.294
4.000	PICS4	15 Summer	100	+0%	100/15 Summer				29.893	0.243
1.003	MHS5	180 Winter	100	+0%	100/15 Summer				29.192	0.342
1.004	MHS6	360 Summer	100	+0%					28.729	-0.096

PN	US/MH Name	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	PICS1	0.000	1.29	22.2	FLOOD RISK	
2.000	MHS1	0.000	0.89	13.2	SURCHARGED	
1.001	MHS2	0.000	1.00	34.5	OK	
1.002	MHS3	0.000	0.00	12.9	OK	
3.000	MHS4	0.000	0.43	6.0	SURCHARGED	
4.000	PICS4	0.000	1.34	22.8	FLOOD RISK	
1.003	MHS5	0.000	0.29	3.1	SURCHARGED	
1.004	MHS6	0.000	0.29	3.1	OK	

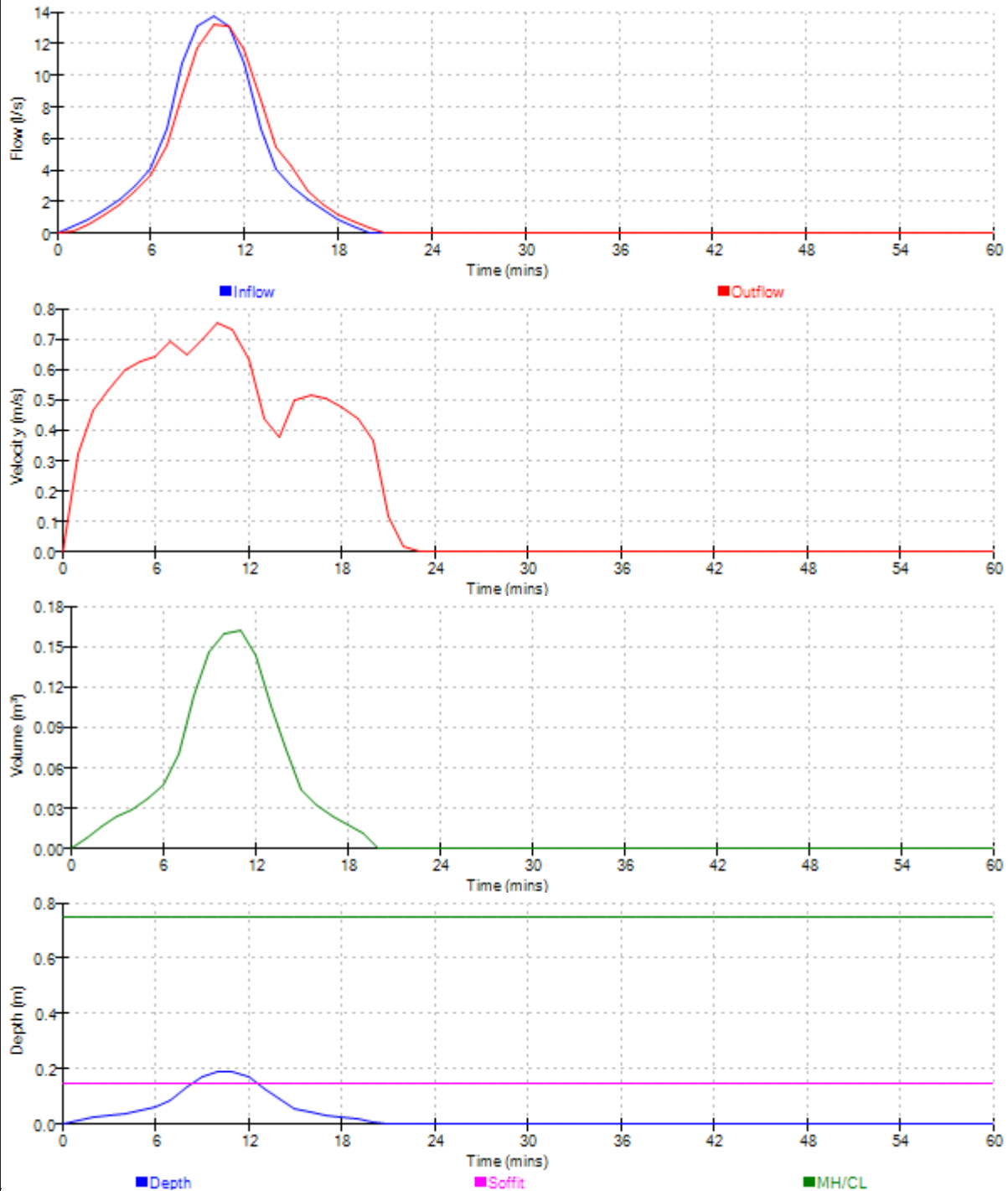
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Innovyze	Network 2019.1	

Graphs for Pipe 1.000 US/MH PICS1 (Storm)
15 minute 100 year Summer I+0%
Status: FLOOD RISK



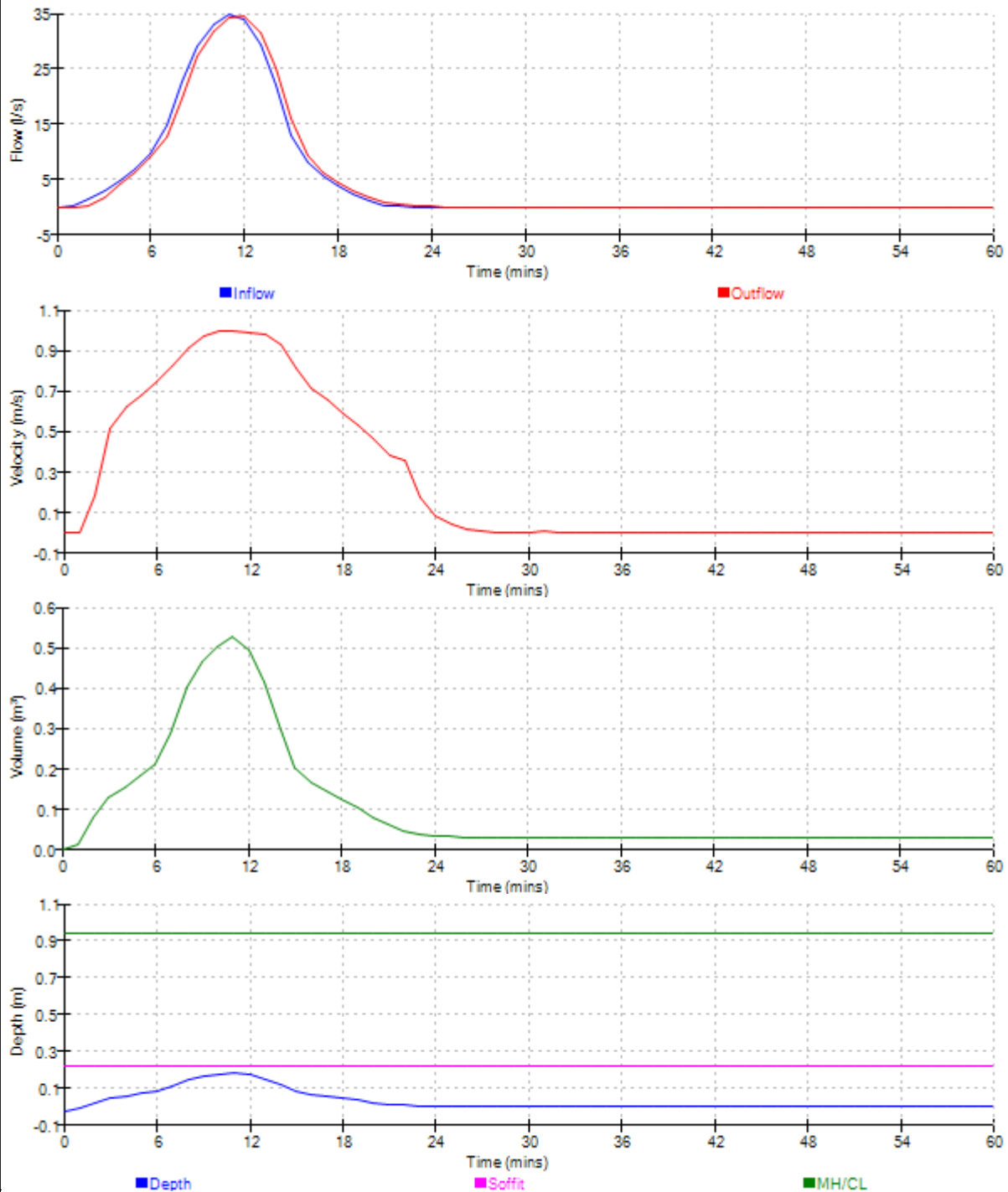
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Graphs for Pipe 2.000 US/MH MHS1 (Storm)
15 minute 100 year Summer I+0%
Status: SURCHARGED



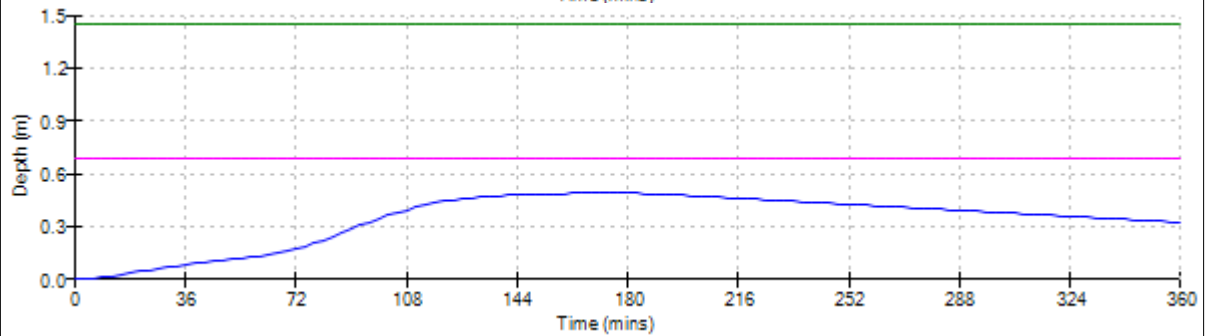
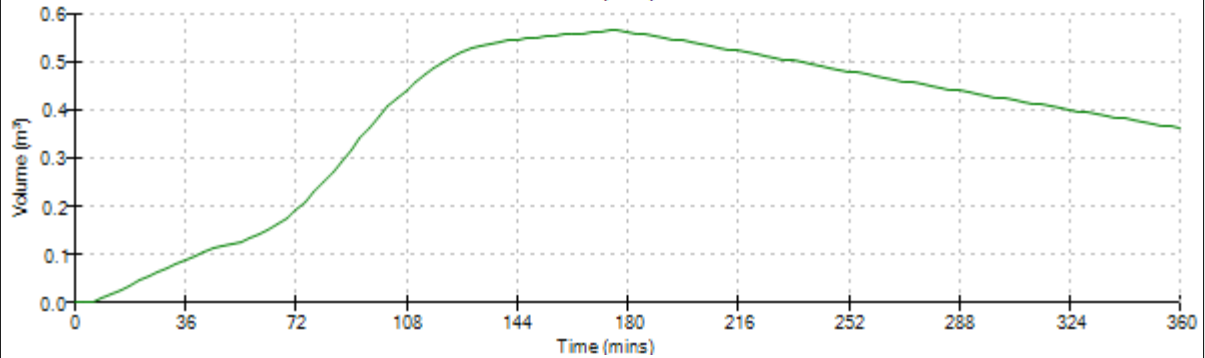
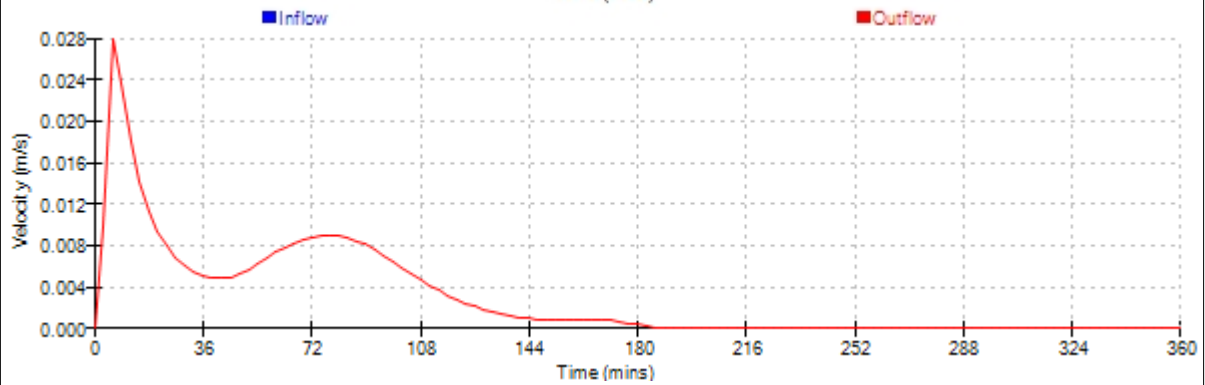
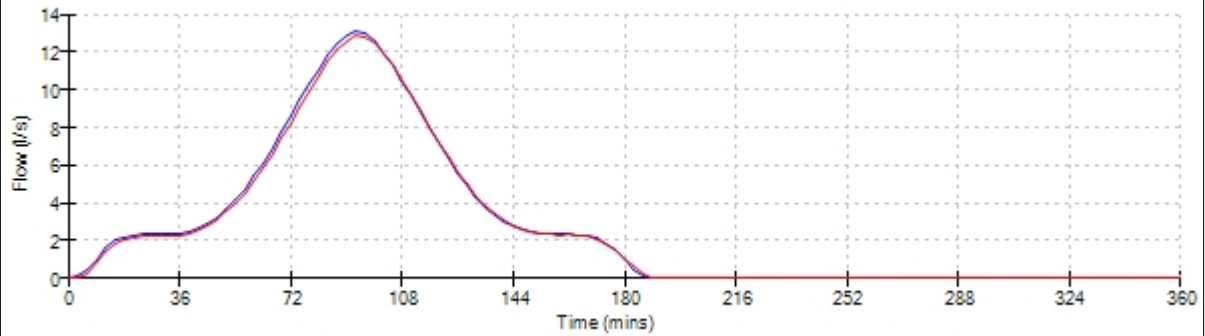
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Graphs for Pipe 1.001 US/MH MHS2 (Storm)
15 minute 100 year Summer I+0%
Status: OK



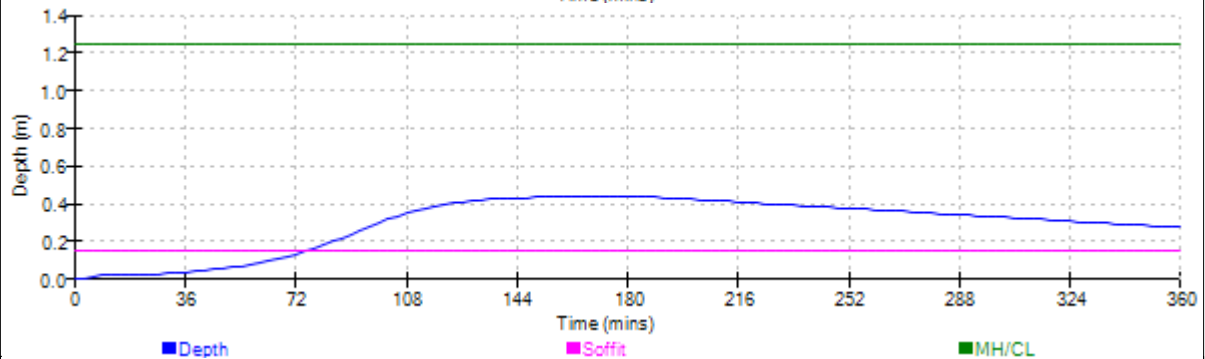
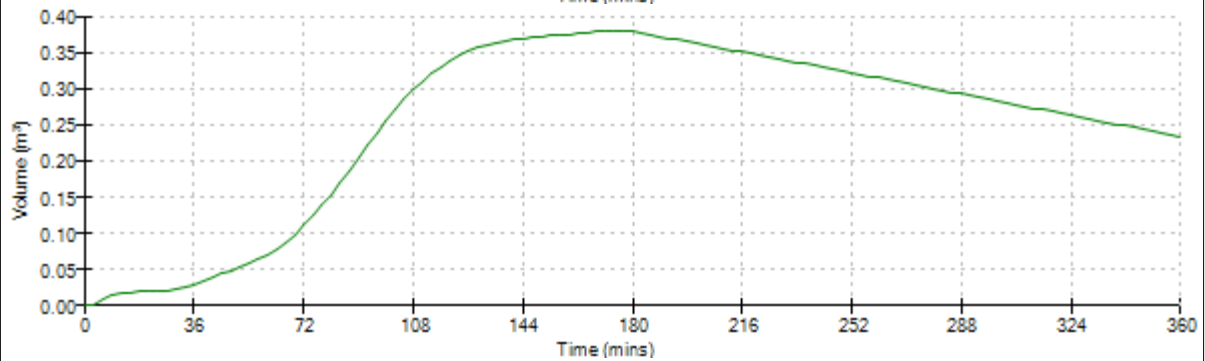
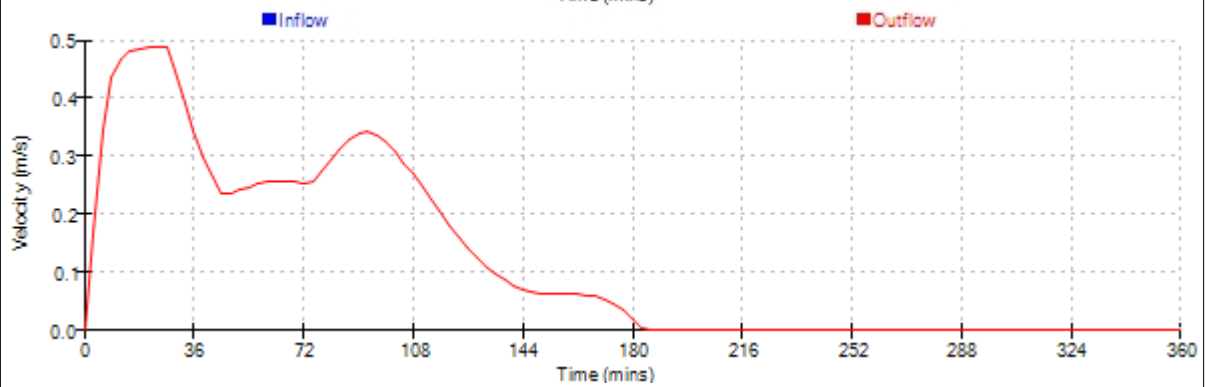
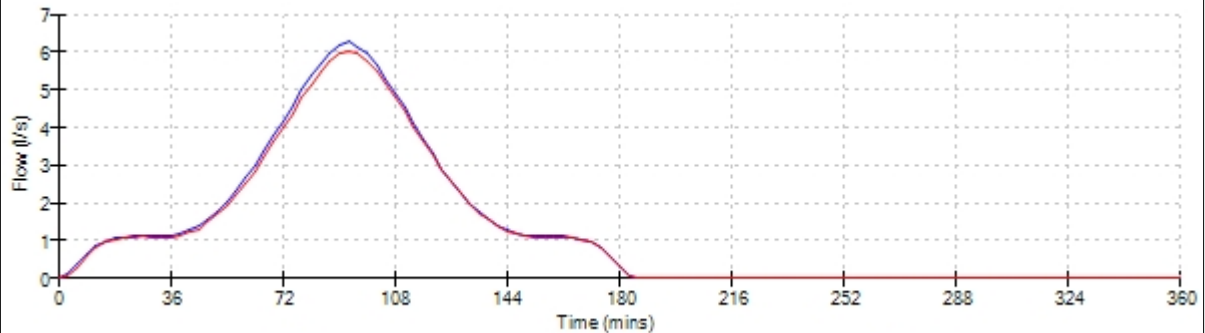
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Graphs for Pipe 1.002 US/MH MHS3 (Storm)
180 minute 100 year Winter I+0%
Status: OK



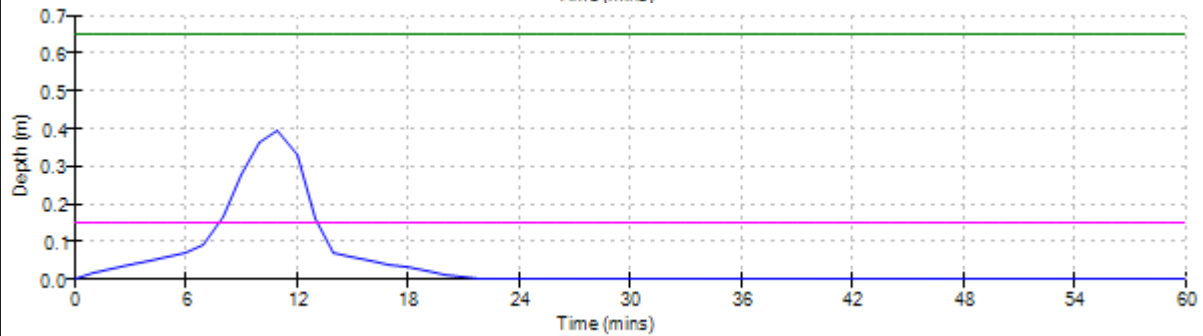
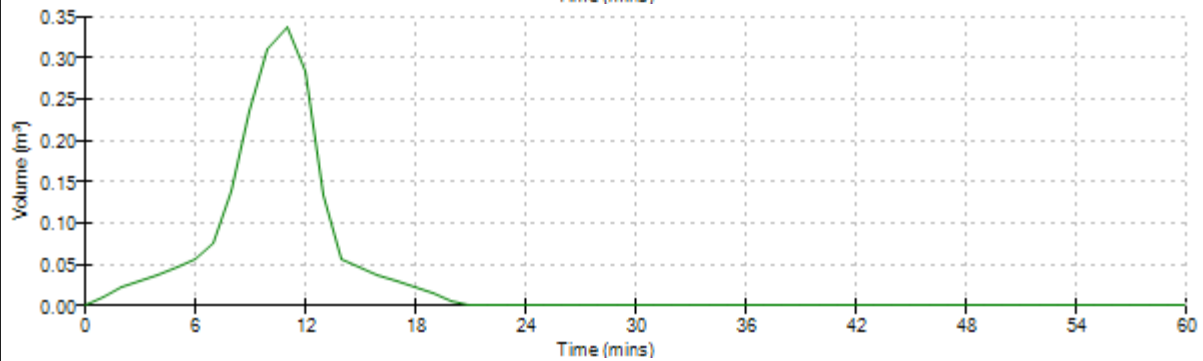
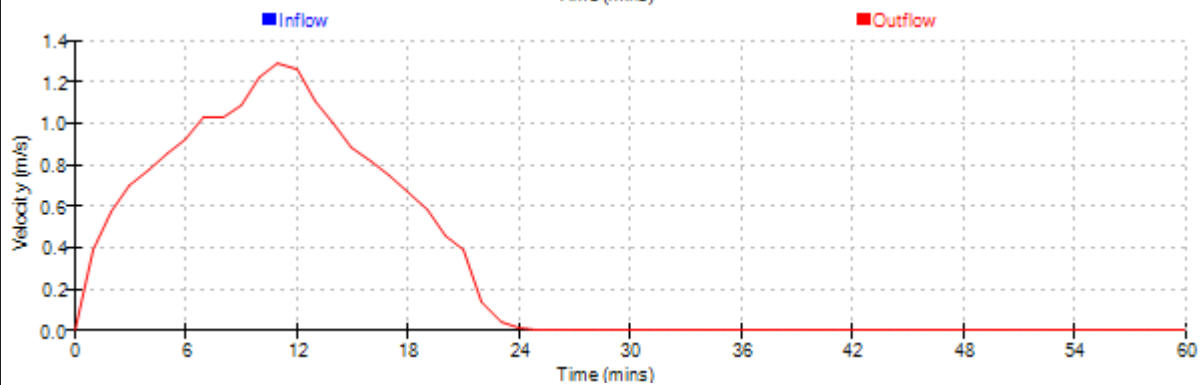
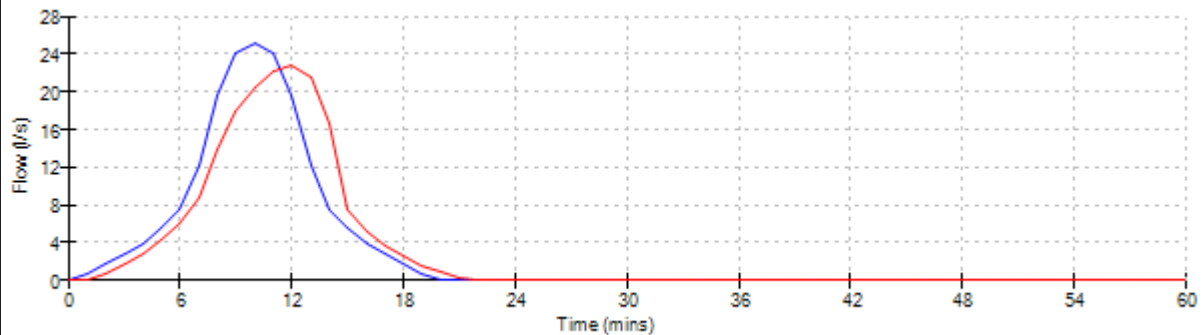
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Graphs for Pipe 3.000 US/MH MHS4 (Storm)
180 minute 100 year Winter I+0%
Status: SURCHARGED



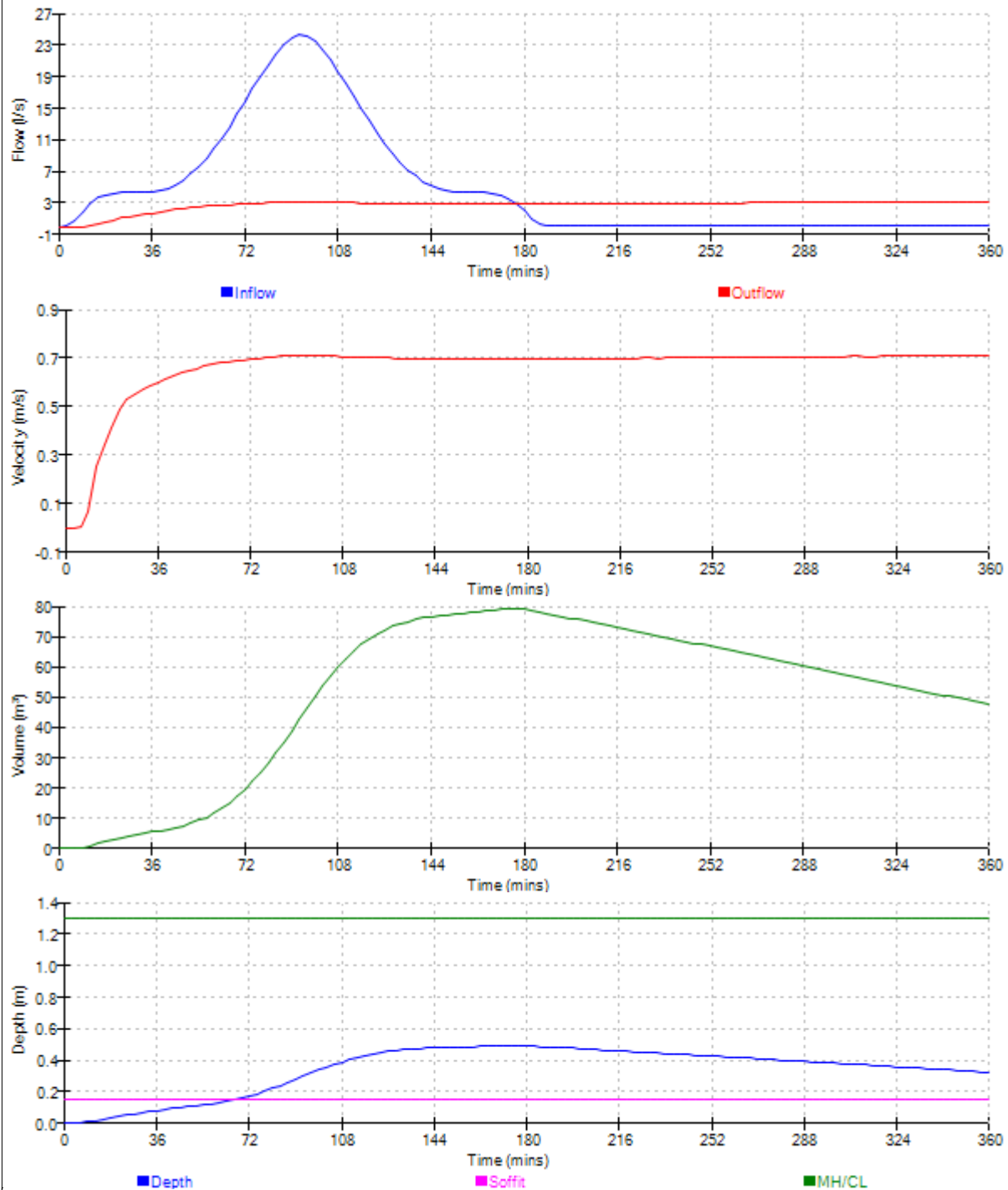
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Graphs for Pipe 4.000 US/MH PICS4 (Storm)
15 minute 100 year Summer I+0%
Status: FLOOD RISK



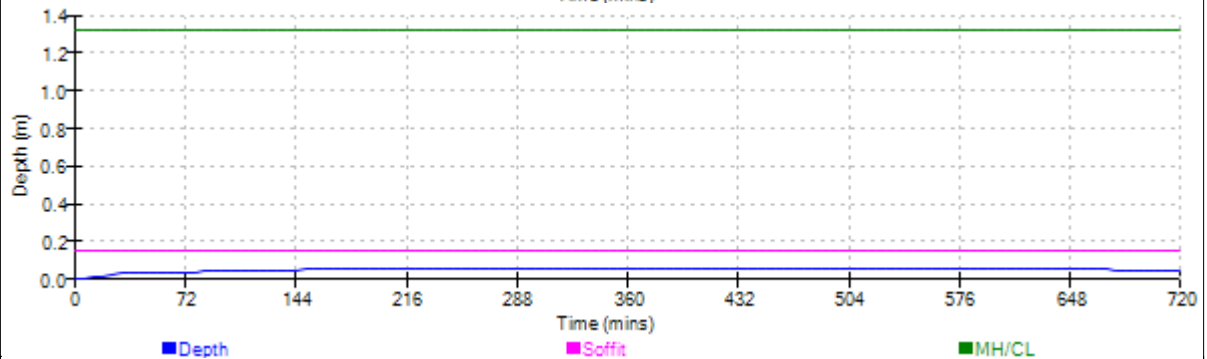
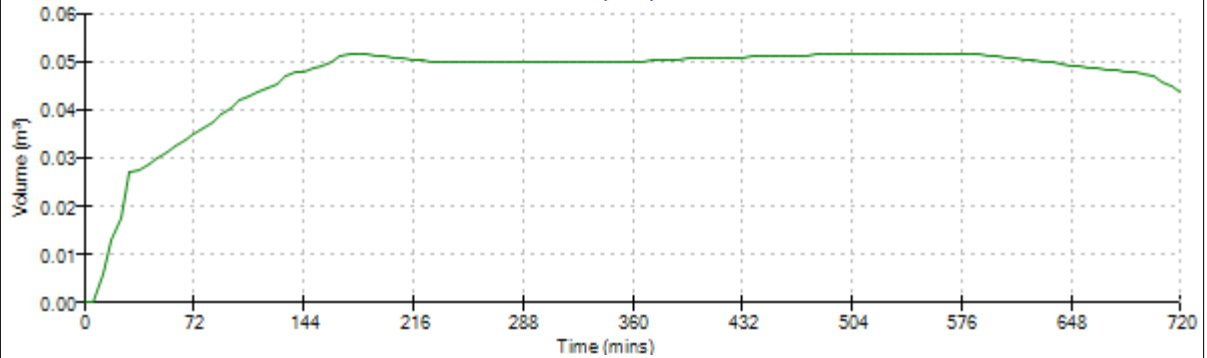
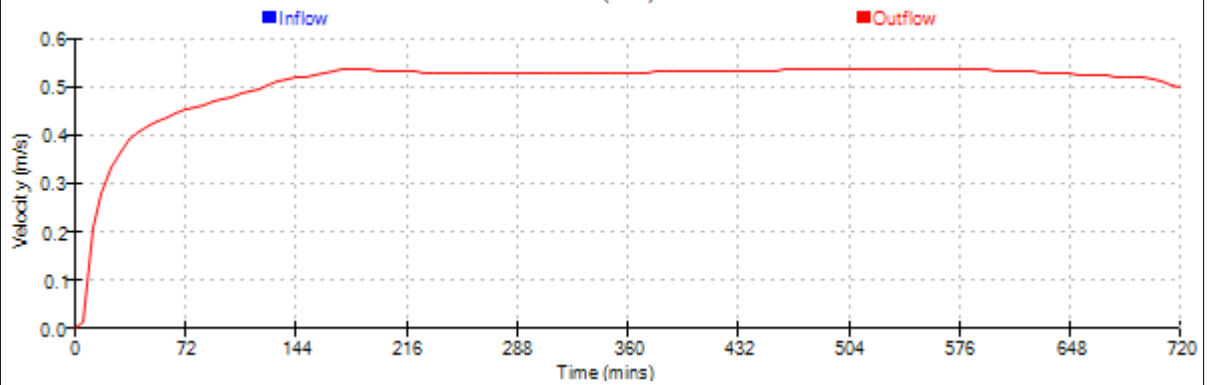
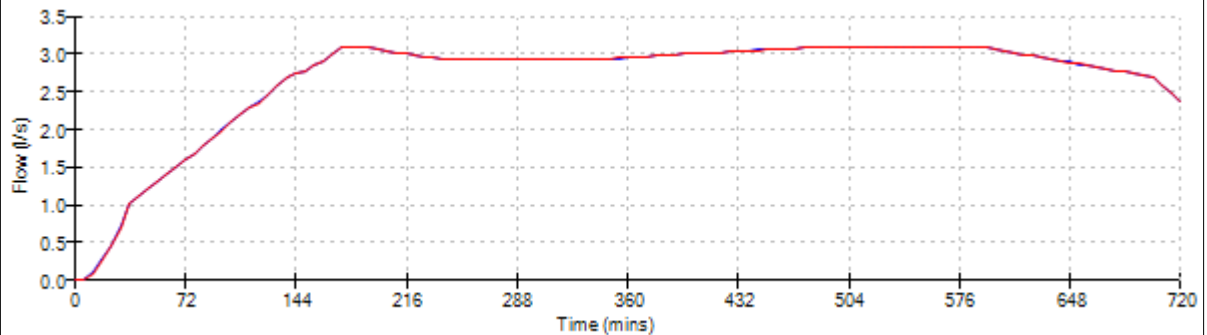
Evolve	Page 13	
20 Baltic Street London EC1Y 0UL	Barton Buildings Uxbridge SWS1 100yr + 40%	
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Graphs for Pipe 1.003 US/MH MHS5 (Storm)
180 minute 100 year Winter I+0%
Status: SURCHARGED

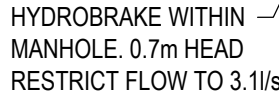


Evolve		Page 14
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London	Uxbridge	
EC1Y 0UL	SWS1 100yr + 40%	
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Graphs for Pipe 1.004 US/MH MHS6 (Storm)
360 minute 100 year Summer I+0%
Status: OK



Appendix B Drainage General Arrangement



GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE EVOLVE DESIGN STATEMENT.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SERVICES & SPECIALIST MANUFACTURERS DETAILS, DRAWINGS AND SPECIFICATIONS.

3. DO NOT SCALE THIS DRAWING. IF IN DOUBT ASK. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL DIMENSIONS TO EXISTING ELEMENTS ARE TO BE CHECKED AND CONFIRMED ON SITE BY CONTRACTOR.

NOTES

(I). THE CONTRACTOR SHALL COMPLY WITH THE FOLLOWING:-

(II). ALL OPERATIONS SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE GENERAL HEALTH AND SAFETY POLICY OF THE DEVELOPER AS REQUIRED BY SECTIONS 2 OF THE HEALTH AND SAFETY AT WORK ACT 1974 AND IN PARTICULAR THE CONSTRUCTION (GENERAL PROVISIONS) REGULATIONS.

(III). PRIOR TO CONSTRUCTION THE ACTUAL POSITIONS AND DEPTHS OF SERVICES LIKELY TO BE AFFECTED BY THE WORKS SHOULD BE ESTABLISHED BY MEANS OF HAND DIG IN CLOSE LIAISON WITH THE UTILITY COMPANIES. THE CONTRACTOR SHALL IMMEDIATELY ADVISE THE ENGINEER OF ANY SERVICES EXPOSED WHICH MAY AFFECT THE DESIGN

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT PIPES ARE ADEQUATELY PROTECTED FROM CONCENTRATED LOADING BY CONSTRUCTION TRAFFIC DURING THE CONSTRUCTION PERIOD. EVOLVE ARE RESPONSIBLE FOR PERMANENT WORKS ONLY. ANY TEMPORARY BUILD UPS ARE TO BE PROPOSED AND APPROVED BY THE CONTRACTOR PRIOR TO INSTALLATION.

THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT, AND TEMPORARY AND PERMANENT DIVERSION WORKS, AS NECESSARY TO ALL EXISTING SERVICES.

THE CONTRACTOR SHALL ALLOW FOR KEEPING TRENCHES AND EXCAVATIONS AS DRY AS PRACTICABLE BY PUMPING FROM TEMPORARY SUMPS AND DE-WATERING AS APPROPRIATE. THE POINT AND METHOD OF DISCHARGE TO BE AGREED WITH THE DRAINAGE AUTHORITY, LLFA AND ENVIRONMENT AGENCY.

IT IS ADVISED THAT DRAINAGE WORKS ARE TO BE CONSTRUCTED FROM THE OUTFALL TOWARDS THE HEAD OF RUN TO ENSURE THE OUTFALL CAN BE ACHIEVED.

ALL DRAINS TO BE CCTV SURVEYED ON COMPLETION OF THE WORKS.

A	07.08.20	ISSUED FOR TENDER	PW	PK
Rev.	Date	Revision	By	Chk

TENDER

Client

PJN PROPERTIES LTD

Project

BARTON BUILDINGS
UXBRIDGE INDUSTRIAL ESTATE

Drawing Title

PROPOSED DRAINAGE
GENERAL ARRANGEMENT

Drawn by	PW	Checked by	PK	Scale @ A1	1:200
Drawing No.	3121-500			Revision	A

evolve

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