ABLEY LETCHFORD PARTNERSHIP
Consulting Engineers

WEBBS COURT, LYNEHAM

DRAINAGE STATEMENT

GLEESON LAND LTD

17 OCTOBER 2023

Abley Letchford Partnership Limited
3 Tealgate
Charnham Park
Hungerford
RG17 0YT

T: 01488 684390
E: contact@alpce.co.uk
W: www.alpce.co.uk

Quality Management:

Prepared by:	Georgios Roinas
Authorised by:	Kris Willis
Date:	17 October 2023
Document Reference:	HD012-R001

COPYRIGHT © ABLEY LETCHFORD PARTNERSHIP LIMITED
The material presented in this report is confidential. This report has been prepared for the exclusive use of GLEESON LAND LTD within the terms of the contract and shall not be distributed or made available to any other company or person without the knowledge and written consent of Abley Letchford Partnership Limited. Any such party relies on the report at their own risk.

Contents

1.0 Introduction 3
2.0 Surface Water Drainage Strategy 5
3.0 Foul Water Drainage Strategy 8
4.0 Drainage and SuDS Maintenance 9

Appendices

Appendix 1 - Proposed Site Layout
Appendix 2 - Drainage Strategy Layout
Appendix 3 - Micdrodrainage Calculations

1.0 Introduction

Context

1.1. This Drainage Statement has been prepared by Abley Letchford Partnership Ltd (ALP) on behalf of Gleeson Land Ltd to summarize the drainage strategy proposals for the site and to inform the Reserved Matters Application in relation to outline application (PL/2021/11175). The site layout of the proposed development can be found in **Appendix A**.

1.2. Planning application PL/2021/11175 was supported by Flood Risk and Drainage Statement (FRA) dated 12th of November 2021 by FortRidge Consulting Limited. The drainage proposals were accepted by the LPA and the following planning condition(Condition 10) was set by the LPA with regards to the Surface Water Drainage:

No development shall commence on site until the following drainage details have been submitted to and approved by the Local Planning Authority:

Site-specific groundwater flood risk assessment that includes all available information and data from local sources such as historical records, parish councils, flood action groups and borehole records. In areas susceptible to groundwater flooding infiltration SuDS is not permitted unless it can be demonstrated to be appropriate. The groundwater assessment must include/consider the following:

- *Groundwater level monitoring (taking into account seasonal variations);*
- *The interaction between different sources of flooding;*
- *How groundwater will impact on the proposed drainage system.*
- *The interaction between groundwater, groundwater recharge and aquifers;*
- *Infiltration tests in accordance with British Research Establishment (BRE) Digest 365 – Soakaway Design, and undertake Groundwater level monitoring (taking into account seasonal variations) to confirm whether disposal of surface water via infiltration is feasible on the site. The Wiltshire Council's Surface Water Soakaway Guidance, which sets out the standards that must be met for planning approval and adoption. (It is accepted that through carrying out a more detailed assessment of groundwater flood risk/ groundwater levels on site, this may demonstrate that disposal of surface water via infiltration will not be feasible).*
- *A blockage assessment of the ordinary watercourse culvert, to establish the flood risk to the development posed. This should include assessment of variable levels of culvert blockage, and details of how any resultant overland flood flows will be managed in order to mitigate the risk to people and property.*
- *Detailed drainage calculations and drawings for the full surface water drainage system. These calculations shall demonstrate:*
    - *The 1 in 30 year rainfall event is contained within the drainage system without causing flooding to any part of the site.*

- *The 1 in 100 year plus 40% climate change rainfall event does not cause flooding to any building (including a basement) or utility plant.*
- *The site has been designed to ensure that flows in excess of the 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.*

The calculations should set the MADD factor / additional storage value to 0m3/ha to prevent an over-estimation of attenuation storage available on site. Calculations should include an allowance for increased surface water runoff, as a result of urban creep, in accordance with LASOO guidance. Due to the outfall to an ordinary watercourse, the calculations should also be simulated with a surcharged outfall, to ensure that this does not cause flooding on site. The applicant should provide detailed drainage drawings which use the same pipe / node numbers as the hydraulic modelling in order to link the designs.

- *Revised water quality calculations based on the detailed SuDS design, which factors the mitigation indices as per the guidance in the SuDS Manual.*

1.3. Gleeson has now reached the stage of submitting a Reserved Matters application to address the planning condition. This report provides a summary of the drainage proposals and highlights any design implications for the site since the FRA was produced in 2021.

1.4. This Report and drainage scheme takes cognisance of the approved Flood Risk Assessment and Drainage Strategy Report, dated 12th of November 2021 by FortRidge Consulting Limited and presents a drainage design to ensure that the guiding principles set out in the Report are adhered to. An initial review of the design principles set out in the report have been updated to suit current standards these are as follows.

- The MADD factor was set to 0 from 2.
- The proposed drainage network was simulated with a surcharged outfall.
- The climate change changed from 40% to 45% for the 1 in 100 storm event.
- The Cv values for winter and summer changed to 1 from default.
- Rainfall data used has been updated from FSR to FEH to suit most accurate design principles.

Report Aims and Formation

1.5. The aim of this Report is to detail/describe the drainage design on the development site, to demonstrate compliance with current design guidelines and building practice.

2.0 Surface Water Drainage Strategy

Introduction

2.1. This chapter describes the design principles behind the surface water drainage strategy.

Surface Water Drainage Strategy

2.2. The Approved Flood Risk and Drainage Statement, dated 12th of November 2021 by FortRidge Consulting Limited, provided the following key surface water drainage design parameters for the drainage strategy:

- A geotechnical investigation has been carried out by Card Geotechnics Limited and the investigation shows that the site is not suitable for infiltration to the ground. Based on the SI and the BGS information infiltration to the ground will not be possible across the site and therefore discharge to the nearby watercourse is the second and most preferred option.
- The surface water will be of conventional construction, drained by means of trapped road gullies connected to suitably sized pipework beneath the highway. The proposed surface water drainage strategy has been designed to cater for the 1 in 100 year storm event plus an allowance for a 45% increase in rainfall intensity to allow for climate change.
- The total impermeable area of the site is approximately 1.078ha, in which 0.317ha of this area is covered by the proposed dwellings. Therefore, the Urban Creep(10%) of the proposed development is 0.032ha. Hence, the total impermeable area that was considered in the drainage modelling is 1.110ha.
- Th proposed development is naturally split into two distinct catchments and the surface water will discharge via two outfalls to the nearby watercourses. The northern catchment covers and impermeable area of approximately 0.695ha and the southern catchment covers and impermeable area of approximately 0.415ha. The catchments and the outfalls of the proposed development can be seen in drawing HD012-RM-53 Catchment Plan and HD012–RM-51 Drainage Layout in **Appendix B**
- The greenfield discharge rate QBAR for this site is 4.9l/s/ha. Based on Wiltshire's guidance a 20% betterment on this greenfield runoff rate was applied. Hence, the reduced greenfield runoff rate QBAR is reduced to 3.9l/s/ha from 4.9l/s/ha. Therefore, the total discharge rate of the proposed development will be restricted to 4.3l/s with the use of a Hydrobrake or similar flow control system (the southern catchment has been limited to 2.0l/s as lower flows can cause issues due to blockages of the small size control required). The greenfield runoff rates can be found in **Appendix C**.
- The MADD factor was reduced from $2m^3$/ha to $0m^3$/ha to simulate all the storm events in the proposed drainage system. The drainage simulation was carried out using Site3D and this software has the MADD factor set to $0m^3$/ha by default. The proposed Site3D calculations and be found in **Appendix C**.

- The flows from the entire proposed development will be transferred, via a piped network, and will be attenuated into two basins. The basins have been designed to cater for the 1 in 100 year storm event plus 45% climate change and design principles set out in paragraph 1.4, without flooding.

2.3. Overall, the proposed surface water drainage provides a sustainable solution for all elements of the development and will not contribute to increased flood risk within or downstream of the site.

2.4. Site wide water quality improvements are provided through the provision of the two newly constructed strategic attenuation basins in line with the Approved Flood Risk Assessment. These features lie to the north and south-west of the residential development.

Design Principles, Scope and Objective

2.5. The parameters outlined in the Approved Flood Risk and Drainage Statement, dated 12th of November 2021 by FortRidge Consulting Limited have been fully carried through into the drainage design.

2.6. The design objective was to attenuate surface water run-off to the proposed basins, via a piped network and then to discharge with reduced greenfield runoff rates to the nearby watercourses. The resulting drainage design is shown in drawing HD012-RM–051, in **Appendix B**.

2.7. To achieve this objective, cognisance has been taken of known Guidance with regards to Sustainable Drainage Systems (SuDS) contained within DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, CIRIA C753 (The SuDS Manual) and Local Standards and or guidance documents from Wiltshire Council.

2.8. Attenuation features have been designed to accommodate the critical storm duration event without flooding. This includes the accepted +10% allowance (dwellings only) for future Urban Creep in accordance with CIRIA guidance documents.

2.9. Supporting Computational Calculations using Site3D for the proposed drainage strategy are included in **Appendix C**.

Existing Flood Risk and Exceedance Flows

2.10. As stipulated within the Approved Flood Risk Assessment, the Site is classified as being wholly within Flood Zone 1 and therefore is at very low flood risk from fluvial sources, ordinary watercourses as well overland surface water flows. Therefore, it is not a significant constraint to development.

2.11. An optimised drainage design has minimised flood water exceedance to 0m³ during the 1 in 100 year storm event plus 45% climate change. Meaning any exceedance flow route plan or overland flow route plan is not necessary. That said any potential exceedance routes above the 1 in 100 storm event plus 45% climate will be directed into the proposed basins as the entirety of the site slopes towards those basins. The drainage design is surrounded by no easily accessible water courses or open green spaces. The intended adoption and maintenance regime associated with the proposed SuDS is as follows:

- The main surface water pipe network will be offered for adoption to the water authority and the associated highway gullies will be offered for adoption to the Highway Authority.

- The proposed basins will be offered for adoption and management to a private Management Company.

3.0 Foul Water Drainage Strategy

Introduction

3.1. This chapter describes the design principles behind the foul water drainage design strategy.

Existing Drainage Conditions

3.2. As stated in the Approved Flood Risk and Drainage Statement, the proposed development will discharge to a pumping station and via a rising main will cross third party land and connect to the Wessex Water public sewer. Refer to ALP's drainage layout drawing in **Appendix B** for more information.

3.3. The foul capacity of these existing drainage sewers has been agreed under the Wessex Water.

Foul Water Drainage Strategy

3.4. The key design parameters for the foul network of the proposed development, include:

- "Under the Private Sewer transfer Regulations 2011; all new pipes which connect to the public sewer system and carry flow from more than one property will be adopted by a local Sewer Authority. Subsequently, they should be in publicly accessible area and accord with the following principles:
- Pipes to have a minimum cover of 1.2m in trafficked areas and 0.6m elsewhere.
- All pipes to achieve a self-cleansing velocity of 0.75m/s at one-third design flow where possible.
- The minimum pipe size to be 100mm diameter, or 150mm diameter, where presented for adoption.
- Roughness coefficient for all pipes (ks value) to be 1.5mm.
- Manholes to be placed at a maximum spacing of 150m centres.

3.5. The adoptable foul sewer that will be offered to Wessex Water for adoption under a Section 104 Agreement in accordance with the Water Authority "Codes for Adoption" document.

3.6. Foul water will discharge via an adoptable pumping station with connection to the existing Wessex Water network at Manhole 5003 to the east of the site.

3.7. The routing of the foul drainage can be seen in ALP's drawings HD012-RM–051 Drainage Layout, in **Appendix B**.

4.0 Drainage and SuDS Maintenance

4.1. This chapter provides information regarding the ownership, responsibility and maintenance of the proposed drainage systems including for SuDS features.

4.2. The main foul water drainage system will be adopted under a Section 104 Agreement of the Water Industry Act 1991 and will be maintained in perpetuity by Wessex Water Utilities in its role as sewerage undertaker.

4.3. The roads, footways, highway and surface water drainage (including gullies and connections) will be privately managed by a Management Company.

4.4. The proposed basins will be offered for adoption to Wessex Water and if not accepted to a private Management Company that will be set up by the Developer. Until such time as the required Management Company is in place the maintenance responsibilities wholly rest with the developer or their nominated contractor.

4.5. Guidance on the operation and maintenance requirements of sustainable drainage systems is contained in the SuDS Manual (CIRIA C753). There are three categories of maintenance: regular, occasional and remedial. The Management Company would be responsible for putting in place a suitable maintenance plan.

Maintenance Schedule Table – Detention Basins

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets, and overflows for blockages, and clear if required	Monthly
	Inspect bank sides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year) then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlets, and forebays	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years, or as required
	Remove sediment from inlets, outlets, forebays, and main basin when required.	Every five years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets, and overflows	As required
	Re-level uneven surfaces and reinstate design levels	As required
itoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/after large storms.
	Inspect bank sides, structures, pipework etc for evidence of physical damage.	Monthly/after large storms.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Check penstocks and other mechanical devices.	Half yearly.

Appendices

Appendix A – Proposed Site Layout



PRELIMINARY

Project:
LAND NORTH OF WEBBS COURT, LYNEHAM

Title:
PLANNING LAYOUT

Client:
gleeson

Scale @ A0:
0 5 10 15 20 25m
Scale 1:500
NORTH

Rev	Date	Drawn	Checked

Date: SEPTEMBER 2023

Drawn by : MC | Checked by : BB

Drg No: CB_14_345_001 | Rev:

COOPERBAILLIE

Please note these drawings are not for construction but for concept design and planning applications purposes only.
Cooper Baillie Limited - Connaught House, 24 Guildford Road, Bagshot, Surrey GU19 5JN - Telephone 01276 450039 - www.cooperbaillie.co.uk
This drawing and the works depicted are the copyright of Cooper Baillie Ltd. and may not be reproduced or amended except by written permission. No liability will be accepted for amendments made by other persons.

Appendix B – Drainage Strategy Layout

© ABLEY LETCHFORD PARTNERSHIP LTD.
This drawing should not be reproduced without consent.

DRAINAGE NOTES:

1. Do not scale.
2. Refer to all other Project Drawings and supporting notes.
3. All adoptable drainage works to be constructed as detailed in Design and Construction Guidance or as stipulated in the Water Authorities Addendum.
4. All public sewers are to be the subject of a Section 104 agreement of the Water Industry Act 1991.
5. Invert levels of existing manholes and sewers are to be checked on site before construction commences and results reported to engineers.
6. The Contractor is responsible for maintaining continuity of flow for all existing sewers within the site boundary and limit of works for the duration of the project.
7. All drainage ironworks to comply with BS EN124, and be stamped with BSI Kitemark. Covers to suit loading as below;
   - -Carriageways and Roads - D400
   - -Driveways and Verges - C250
   - -Footways and Pedestrian Areas - B125
   - -Gardens/Landscaping - A15
8. All sewer pipes, up to, and including 225mm are to be vitrified clay to BS EN295. All sewer pipes 300mm diameter and above to be concrete pipes to BS EN1916. Where agreed with adopting authority pipes up to and including 600mm diameter can be PVC-U to BS EN1404.
9. All drainage shall be installed and tested strictly in accordance with the Manufacturers' printed instructions, BS EN 752, BS EN 1601, Local Water Authority requirements and the Building Regulations.
10. All bedding shall be Class S unless noted otherwise.
11. All trenches under existing and proposed public highways are to be backfilled with thoroughly compacted Type 1 granular sub-base material.
12. Drainage laid beneath roads and areas of vehicular access (car parking etc) with less than 1200mm of cover shall be encased in concrete bed and surround with associated movement joints. Drainage laid beneath paths, footways and pedestrian areas with less than 900mm of cover shall be similarly treated.
13. Chambers with outgoing pipes greater than 600mm diameter shall be fitted with guard bars, safety chains or other approved safety devices.
14. The use of precast concrete products made with sulphate resisting cement is mandatory, unless a laboratory report proves such precautions are not necessary.
15. All gully connections to use a minimum diameter pipe of 150mm and to be surrounded by a minimum of 150mm of grade C8/C10 concrete over its full length (which should not exceed 15m) and its connection to the carrier system.
16. All sewers to be abandoned must be surveyed to identify any lateral connections that are still live with any found to be reported to the Engineer.
17. All laterals to be 150mm laid at 1:80 (surface) or 1:60 (foul) unless otherwise stated.
18. All private drains to be 100mm diameter unless otherwise stated.
19. All foul and storm water drains which are not to be adopted as public sewers shall be in accordance with Document H of the Building regulations, together with NHBC Standards Chapter 5.3 and BS8301.
20. Where pipes pass through footings, retaining or screen walls, lintels to be provided over drains.
21. Where inverts are less than 0.6m deep inspection chambers (min dia. 190mm) or access fittings (225 x 100mm) to be used, elsewhere proprietary plastic, brick or pcc is to be used and sized in accordance with Table 11 of Document H of the Building Regulations [<0.6m to invert min DN300, >0.6m to invert min DN475].
22. All gullies connected direct to drains to be roddable.
23. Rainwater downpipes to be easily removable for rodding or to be provided with rodding access at ground level.
24. Unless noted otherwise FW IC's and RE's to be 0.6m below DPC level, SW IC's and RE's to be 0.45m.
25. Adequate precautions in accordance with Approved Document H and manufacturers's recommendations to be taken to protect drains (particularly plastic) at shallow depths.
26. Catchpits to be as IC's but with 300mm sump below outgoing pipe invert level except where detailed elsewhere.
27. Trees and shrubs of a large size or heavy canopy with a moderate or high water demand must not be planted within any sewer easement.
28. Gullies within and adjacent to area of site works to be suction cleansed at commencement and completion of works.
29. Where required 1m deep root barrier of an approved type to be installed vertically along the back edging kerb of all areas of footway/ demarcation to protect from both proposed and future plantation.
30. Foul water IC's to be 750mm below FFL, unless noted otherwise.
31. Surface water IC's to be laid 600mm below external level, unless noted otherwise.
32. Rodding eye's to be laid 450mm below external level, unless noted otherwise.

ALL PIPE BEDDING TO BE CLASS 'S' GRANULAR SURROUND UNLESS NOTED OTHERWISE ON THE DRAWING

Manhole cover levels are derived from a 3D digital terrain model, final cover levels to suit finished surfaces onsite.

Manhole covers to be located wholly within one surface i.e grass or hard standing/road. Manhole covers are to be fully accessible to users.

0 5 10 15 20 25m
Scale 1:500

DRAINAGE KEY

FOUL STORM

- Existing Adopted Sewer
- Proposed adoptable sewer & MH
- Adoptable manholes Type 4
- Highway gully and 150mmØ connection
- Rising Main
- Headwall
- Storage Tank

Rev	Date	Description	Drawn	Checked
A	10/23	First Issue	LC	DS

ABLEY LETCHFORD PARTNERSHIP
Consulting Engineers
3 Tealgate, Charnham Park
Hungerford, Berkshire RG17 0YT
www.alpce.co.uk Tel: 01488 684390

Client
GLEESON LAND

Project
WEBBS COURT,
LYNEHAM

Title
RESERVED MATTERS
DRAINAGE LAYOUT

Status
FOR APPROVAL

Scale	Date	Drawn	Checked
1:500 @ A1	OCT 2023	LC	DS

Drawing No
HD012-RM-51

Revision
A

Appendix C – Computational Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	GEORGIOS ROINAS
Site name:	HD015 North East Old Sarum, Salisbury
Site location:	North East Old Sarum, Salisbury

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.51192° N
Longitude:	1.9684° W
Reference:	3397974954
Date:	Sep 06 2023 16:13

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	706	706
Hydrological region:	8	8
Growth curve factor 1 year:	0.78	0.78
Growth curve factor 30 years:	1.95	1.95
Growth curve factor 100 years:	2.43	2.43
Growth curve factor 200 years:	2.78	2.78

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	4.88	4.88
1 in 1 year (l/s):	3.8	3.8
1 in 30 years (l/s):	9.51	9.51
1 in 100 year (l/s):	11.85	11.85
1 in 200 years (l/s):	13.56	13.56

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

We use cookies on this site to enhance your user experience

By clicking the Accept button, you agree to us doing so.

OK, I AGREE MORE INFO

We use cookies on this site to enhance your user experience

By clicking the Accept button, you agree to us doing so.

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S30	0.047	1.350	Type C	124.950	123.600	1.200	402289.021	179390.388
S1	0.040	1.350	Type C	125.715	124.365	1.200	402274.209	179355.870
S2	0.017	1.200	Type B	125.463	123.299	1.940	402279.932	179369.659
S3	0.060	1.200	Type B	125.808	123.149	2.359	402291.187	179363.708
S4	0.000	1.200	Type B	126.117	123.111	2.706	402300.194	179362.297
S5	0.060	1.350	Type C	127.363	126.013	1.200	402365.866	179332.530
S6	0.048	1.350	Type C	127.193	125.843	1.200	402345.207	179311.061
S7	0.040	1.200	Type B	127.373	125.636	1.512	402354.095	179320.784
S8	0.055	1.350	Type C	126.599	125.174	1.200	402317.329	179325.198
S9	0.011	1.200	Type B	126.873	125.045	1.602	402330.239	179342.919
S10	0.121	1.500	Type A	126.519	122.794	3.201	402321.564	179356.565
S11	0.067	1.350	Type C	126.361	124.975	1.235	402370.996	179391.595
S12	0.013	1.500	Type B	126.072	122.687	2.860	402351.456	179400.379
S13	0.027	1.500	Type B	125.857	122.666	2.666	402347.048	179409.000
S14	0.036	1.350	Type C	124.261	123.197	0.914	402312.932	179425.843
S15	0.053	1.500	Type B	125.242	122.547	2.094	402331.072	179417.452
S16	0.000	0.000	Unknown	124.000	122.500	0.900	402343.441	179441.925
S17	0.000	1.500	Unknown	124.000	122.500	1.275	402334.212	179461.320
S18	0.000	1.350	Type C	121.505	121.410	-0.130	402315.044	179488.819

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Diameter (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S30	123.600	S2	123.374	0.150	22.634	100.0	0.600	1.200	1.940
2.000	S1	124.365	S2	123.374	0.150	14.929	15.1	0.600	1.200	1.940
1.001	S2	123.299	S3	123.224	0.225	12.732	170.0	0.600	1.940	2.359
1.002	S3	123.149	S4	123.111	0.300	9.117	240.0	0.600	2.359	2.706
1.003	S4	123.111	S10	123.019	0.300	22.125	240.0	0.600	2.706	3.201
3.000	S5	126.013	S7	125.711	0.150	16.628	55.1	0.600	1.200	1.512
4.000	S6	125.843	S7	125.711	0.150	13.173	100.0	0.600	1.200	1.512
3.001	S7	125.636	S9	125.045	0.225	32.544	55.1	0.600	1.512	1.602
5.000	S8	125.174	S9	125.045	0.225	21.926	170.0	0.600	1.200	1.602
3.002	S9	125.045	S10	123.094	0.225	16.169	8.3	0.600	1.602	3.201
1.004	S10	122.794	S12	122.687	0.525	53.040	495.9	0.600	3.201	2.860
6.000	S11	124.975	S12	123.062	0.150	21.424	11.2	0.600	1.235	2.860
1.005	S12	122.687	S13	122.666	0.525	9.682	472.9	0.600	2.860	2.666
1.006	S13	122.666	S15	122.622	0.525	18.074	411.8	0.600	2.666	2.094
7.000	S14	123.197	S15	122.997	0.150	19.987	100.0	0.600	0.914	2.094
1.007	S15	122.547	S16	122.500	0.600	27.422	580.0	0.600	2.094	0.900
1.008	S16	122.500	S17	122.500	0.600	21.478		0.600	0.900	0.900
1.009	S17	122.500	S18	121.410	0.225	33.521	30.8	0.600	1.275	-0.130

Outfall Details

Outfall Manhole S18 : Free Discharge

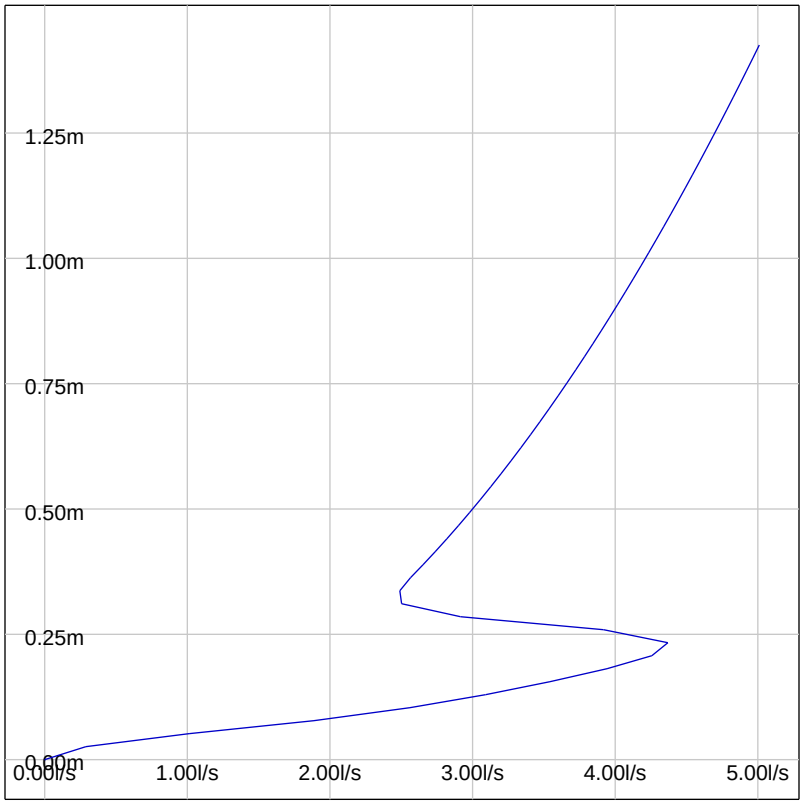
Flow Control Details

Controls within Manhole S17

Hydro-Brake® Optimum Control at Manhole S17

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CHE-0094-4600-1200-4600 ID:505705	1.200	4.600	0.000	0.230	4.373	0.325	2.477

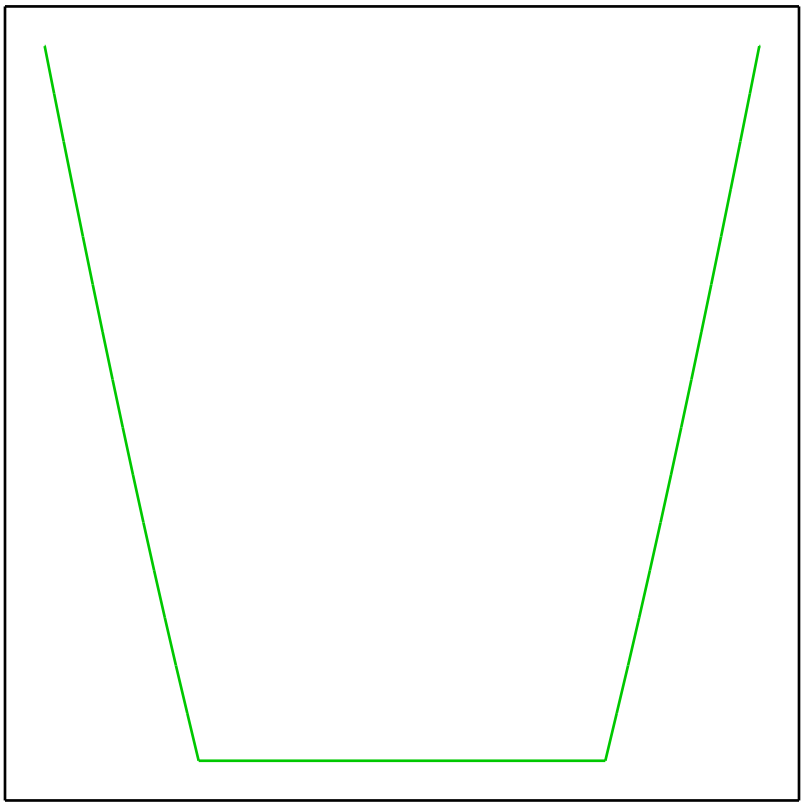
Hydro-Brake® Optimum Control at S17



Pond Structure at Manhole S17

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.500	1.500	905.086	123.700	0.300	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at S17



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_402347_179171_v5_0_1 (2).xml

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (1, +0%), (30, +40%), (100, +45%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Winter	14.307	0.00	-0.26	30Yr +40% 720Min Winter	6.911	0.00	8.40
1Yr 15Min Summer	14.307	0.00	-0.25	30Yr +40% 960Min Summer	5.556	0.00	7.13
1Yr 30Min Winter	9.026	0.00	-0.18	30Yr +40% 960Min Winter	5.556	0.00	7.63
1Yr 30Min Summer	9.026	0.00	-0.18	30Yr +40% 1440Min Summer	4.056	0.00	6.03
1Yr 60Min Winter	5.691	0.00	-0.14	30Yr +40% 1440Min Winter	4.056	0.00	6.98
1Yr 60Min Summer	5.691	0.00	-0.14	30Yr +40% 2160Min Summer	2.937	0.00	1.23
1Yr 120Min Winter	4.534	0.00	-0.08	30Yr +40% 2160Min Winter	2.937	0.00	4.25
1Yr 120Min Summer	4.534	0.00	-0.08	30Yr +40% 2880Min Summer	2.323	0.00	0.15
1Yr 180Min Summer	3.878	0.00	-0.05	30Yr +40% 2880Min Winter	2.323	0.00	1.10
1Yr 180Min Winter	3.878	0.00	-0.05	30Yr +40% 4320Min Summer	1.680	0.00	0.00
1Yr 240Min Summer	3.280	0.00	-0.05	30Yr +40% 4320Min Winter	1.680	0.00	0.00
1Yr 240Min Winter	3.280	0.00	-0.04	30Yr +40% 5760Min Summer	1.349	0.00	0.00
1Yr 360Min Summer	2.610	0.00	0.00	30Yr +40% 5760Min Winter	1.349	0.00	0.00
1Yr 360Min Winter	2.610	0.00	-0.03	30Yr +40% 7200Min Summer	1.153	0.00	0.00
1Yr 480Min Summer	2.196	0.00	-0.02	30Yr +40% 7200Min Winter	1.153	0.00	-0.00
1Yr 480Min Winter	2.196	0.00	-0.03	30Yr +40% 8640Min Summer	1.026	0.00	0.00
1Yr 600Min Summer	1.890	0.00	0.00	30Yr +40% 8640Min Winter	1.026	0.00	-0.01
1Yr 600Min Winter	1.890	0.00	-0.02	30Yr +40% 10080Min Summer	0.938	0.00	0.00
1Yr 720Min Summer	1.661	0.00	0.00	30Yr +40% 10080Min Winter	0.938	0.00	-0.01
1Yr 720Min Winter	1.661	0.00	0.00	100Yr +45% 15Min Summer	140.700	0.00	-0.37
1Yr 960Min Summer	1.358	0.00	0.00	100Yr +45% 15Min Winter	140.700	0.00	-0.57
1Yr 960Min Winter	1.358	0.00	0.00	100Yr +45% 30Min Summer	91.978	0.00	-0.25
1Yr 1440Min Winter	1.018	0.00	0.00	100Yr +45% 30Min Winter	91.978	0.00	-0.29
1Yr 1440Min Summer	1.018	0.00	0.00	100Yr +45% 60Min Summer	57.211	0.00	1.18
1Yr 2160Min Winter	0.761	0.00	0.00	100Yr +45% 60Min Winter	57.211	0.00	1.36
1Yr 2160Min Summer	0.761	0.00	0.00	100Yr +45% 120Min Summer	34.135	0.00	6.98
1Yr 2880Min Summer	0.621	0.00	0.00	100Yr +45% 120Min Winter	34.135	0.00	3.32
1Yr 2880Min Winter	0.621	0.00	-0.02	100Yr +45% 180Min Summer	25.314	0.00	2.60
1Yr 4320Min Summer	0.476	0.00	0.00	100Yr +45% 180Min Winter	25.314	0.00	2.60
1Yr 4320Min Winter	0.476	0.00	-0.02	100Yr +45% 240Min Summer	20.606	0.00	3.02
1Yr 5760Min Summer	0.401	0.00	0.00	100Yr +45% 240Min Winter	20.606	0.00	1.95
1Yr 5760Min Winter	0.401	0.00	-0.03	100Yr +45% 360Min Summer	15.409	0.00	3.21
1Yr 7200Min Summer	0.356	0.00	-0.01	100Yr +45% 360Min Winter	15.409	0.00	2.64
1Yr 7200Min Winter	0.356	0.00	-0.04	100Yr +45% 480Min Summer	12.533	0.00	2.90
1Yr 8640Min Summer	0.327	0.00	-0.01	100Yr +45% 480Min Winter	12.533	0.00	2.63
1Yr 8640Min Winter	0.327	0.00	-0.06	100Yr +45% 600Min Summer	10.660	0.00	3.34
1Yr 10080Min Winter	0.306	0.00	-0.07	100Yr +45% 600Min Winter	10.660	0.00	3.02
1Yr 10080Min Summer	0.306	0.00	-0.02	100Yr +45% 720Min Summer	9.320	0.00	3.66
30Yr +40% 15Min Summer	105.734	0.00	-0.36	100Yr +45% 720Min Winter	9.320	0.00	4.11
30Yr +40% 15Min Winter	105.734	0.00	-0.47	100Yr +45% 960Min Summer	7.510	0.00	8.49
30Yr +40% 30Min Summer	68.668	0.00	-0.26	100Yr +45% 960Min Winter	7.510	0.00	5.34
30Yr +40% 30Min Winter	68.668	0.00	-0.32	100Yr +45% 1440Min Summer	5.471	0.00	7.61
30Yr +40% 60Min Summer	42.453	0.00	0.08	100Yr +45% 1440Min Winter	5.471	0.00	7.88
30Yr +40% 60Min Winter	42.453	0.00	0.02	100Yr +45% 2160Min Summer	3.927	0.00	7.15
30Yr +40% 120Min Summer	25.674	0.00	0.00	100Yr +45% 2160Min Winter	3.927	0.00	6.86
30Yr +40% 120Min Winter	25.674	0.00	0.01	100Yr +45% 2880Min Summer	3.069	0.00	5.94
30Yr +40% 180Min Summer	19.116	0.00	0.00	100Yr +45% 2880Min Winter	3.069	0.00	6.33
30Yr +40% 180Min Winter	19.116	0.00	0.89	100Yr +45% 4320Min Summer	2.164	0.00	2.89
30Yr +40% 240Min Summer	15.516	0.00	2.14	100Yr +45% 4320Min Winter	2.164	0.00	4.36
30Yr +40% 240Min Winter	15.516	0.00	3.57	100Yr +45% 5760Min Summer	1.699	0.00	0.84
30Yr +40% 360Min Summer	11.544	0.00	5.72	100Yr +45% 5760Min Winter	1.699	0.00	0.65
30Yr +40% 360Min Winter	11.544	0.00	7.13	100Yr +45% 7200Min Summer	1.426	0.00	0.10
30Yr +40% 480Min Summer	9.351	0.00	7.61	100Yr +45% 7200Min Winter	1.426	0.00	0.00
30Yr +40% 480Min Winter	9.351	0.00	7.24	100Yr +45% 8640Min Summer	1.251	0.00	0.00
30Yr +40% 600Min Summer	7.926	0.00	7.05	100Yr +45% 8640Min Winter	1.251	0.00	-0.00

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr +40% 600Min Winter	7.926	0.00	7.51	100Yr +45% 10080Min Winter	1.133	0.00	-0.00
30Yr +40% 720Min Summer	6.911	0.00	7.65	100Yr +45% 10080Min Summer	1.133	0.00	0.00

Simulation Results

Return Period Yrs: 1.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S30	15 min Winter	8	123.646	0.046	3.731		OK
S1	15 min Winter	8	124.391	0.026	3.039		OK
S2	15 min Winter	9	123.366	0.067	7.728		OK
S3	15 min Winter	9	123.232	0.083	12.287		OK
S4	15 min Winter	9	123.194	0.084	12.364		OK
S5	15 min Winter	8	126.058	0.045	4.709		OK
S6	15 min Winter	8	125.889	0.046	3.766		OK
S7	15 min Winter	8	125.700	0.063	11.346		OK
S8	15 min Winter	8	125.223	0.049	4.169		OK
S9	15 min Winter	9	125.090	0.045	16.038		OK
S10	15 min Winter	9	122.938	0.145	37.506		OK
S11	15 min Winter	8	125.007	0.031	5.196		OK
S12	15 min Winter	9	122.836	0.149	43.700		OK
S13	15 min Winter	10	122.812	0.146	43.968		OK
S14	15 min Winter	8	123.236	0.039	2.738		OK
S15	15 min Winter	10	122.710	0.163	50.568		OK
S16	600 min Winter	430	122.673	0.173	3.343		Surcharged
S17	600 min Winter	430	122.672	0.172	3.343		OK
S18	600 min Winter	430	121.439	0.029	3.336		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S30	S2	0.046	0.791	3.591	0.203	OK
2.000	15 min Winter	8	S1	S2	0.026	1.474	2.997	0.065	OK
1.001	15 min Winter	9	S2	S3	0.067	0.791	7.847	0.198	OK
1.002	15 min Winter	9	S3	S4	0.083	0.772	12.364	0.173	OK
1.003	15 min Winter	9	S4	S10	0.084	0.775	12.457	0.175	OK
3.000	15 min Winter	8	S5	S7	0.044	1.053	4.615	0.193	OK
4.000	15 min Winter	8	S6	S7	0.046	0.797	3.678	0.207	OK
3.001	15 min Winter	8	S7	S9	0.054	1.521	11.189	0.159	OK
5.000	15 min Winter	8	S8	S9	0.047	0.684	4.085	0.103	OK
3.002	15 min Winter	9	S9	S10	0.045	2.855	16.206	0.089	OK
1.004	15 min Winter	9	S10	S12	0.147	0.762	37.765	0.175	OK
6.000	15 min Winter	8	S11	S12	0.031	1.918	5.130	0.096	OK
1.005	15 min Winter	9	S12	S13	0.147	0.856	42.624	0.193	OK
1.006	15 min Winter	10	S13	S15	0.142	0.949	44.904	0.189	OK
7.000	15 min Winter	8	S14	S15	0.039	0.724	2.632	0.148	OK
1.007	15 min Winter	10	S15	S16	0.156	0.873	51.249	0.181	OK
1.008	0 min Summer	0	S16	S17	0.000	0.000	0.000	-0.000	OK
1.009	600 min Winter	430	S17	S18	0.029	1.125	3.336	0.035	OK

Return Period Yrs: 30.0

Climate Change %: 40

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S30	15 min Winter	10	124.052	0.452	21.470		Surcharged
S1	15 min Winter	8	124.438	0.074	22.524		OK
S2	15 min Winter	9	123.662	0.363	53.397		Surcharged
S3	15 min Winter	9	123.551	0.403	81.888		Surcharged
S4	15 min Winter	9	123.506	0.396	79.165		Surcharged
S5	15 min Winter	9	126.448	0.435	32.803		Surcharged
S6	15 min Winter	9	126.201	0.358	26.230		Surcharged
S7	15 min Winter	10	125.947	0.311	71.889		Surcharged
S8	15 min Winter	8	125.320	0.146	30.891		OK
S9	15 min Winter	9	125.170	0.125	109.904		OK
S10	15 min Winter	9	123.400	0.607	251.308		Surcharged
S11	15 min Winter	8	125.069	0.094	38.500		OK
S12	960 min Winter	946	123.244	0.557	0.122		Surcharged
S13	720 min Winter	713	123.369	0.703	0.035		Surcharged
S14	15 min Winter	9	123.361	0.163	19.074		Surcharged
S15	960 min Winter	992	123.248	0.700	0.000		Surcharged
S16	720 min Winter	713	123.265	0.765	0.000		Surcharged
S17	960 min Winter	893	123.224	0.724	2.282		Surcharged
S18	7200 min Winter	3671	121.443	0.033	4.369		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	10	S30	S2	0.150	1.350	23.853	1.345	Surcharged
2.000	15 min Winter	8	S1	S2	0.112	1.587	22.412	0.486	OK
1.001	15 min Winter	9	S2	S3	0.225	1.235	49.118	1.237	OK
1.002	15 min Winter	9	S3	S4	0.300	1.120	79.165	1.110	Surcharged
1.003	15 min Winter	9	S4	S10	0.300	1.077	76.145	1.068	Surcharged
3.000	15 min Winter	9	S5	S7	0.150	1.766	31.205	1.302	Surcharged
4.000	15 min Winter	9	S6	S7	0.150	1.414	24.990	1.410	Surcharged
3.001	15 min Winter	10	S7	S9	0.173	2.271	74.684	1.064	OK
5.000	15 min Winter	8	S8	S9	0.135	1.226	30.473	0.768	OK
3.002	15 min Winter	9	S9	S10	0.175	3.312	109.894	0.604	OK
1.004	15 min Winter	9	S10	S12	0.525	1.154	249.799	1.157	OK
6.000	15 min Winter	8	S11	S12	0.122	2.492	38.309	0.716	OK
1.005	960 min Winter	946	S12	S13	0.458	0.000	0.028	0.000	OK
1.006	720 min Winter	713	S13	S15	0.513	0.000	0.028	0.000	OK
7.000	15 min Winter	9	S14	S15	0.141	1.143	19.720	1.112	OK
1.007	960 min Winter	992	S15	S16	0.600	0.004	1.154	0.004	Surcharged
1.008	10080 min Summer	-1	S16	S17	0.000	0.000	0.000	-0.000	OK
1.009	960 min Winter	893	S17	S18	0.030	1.143	3.524	0.037	OK

Return Period Yrs: 100.0

Climate Change %: 45

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S30	15 min Winter	10	124.688	1.088	28.715		Flood Risk
S1	15 min Winter	9	124.469	0.105	28.168		OK
S2	15 min Winter	10	124.064	0.765	63.702		Surcharged
S3	15 min Winter	10	123.864	0.715	101.957		Surcharged
S4	15 min Winter	10	123.785	0.674	105.129		Surcharged
S5	15 min Winter	10	127.105	1.092	36.246		Flood Risk
S6	15 min Winter	10	126.721	0.878	28.982		Surcharged
S7	15 min Winter	10	126.341	0.705	92.643		Surcharged
S8	15 min Winter	8	125.349	0.174	41.058		OK
S9	15 min Winter	9	125.190	0.145	138.071		OK
S10	15 min Winter	9	123.582	0.788	328.639		Surcharged
S11	15 min Winter	8	125.092	0.116	51.172		OK
S12	1440 min Winter	1557	123.679	0.992	23.573		Surcharged
S13	720 min Summer	726	123.781	1.115	39.689		Surcharged
S14	15 min Winter	9	123.582	0.385	25.372		Surcharged
S15	960 min Summer	1073	123.530	0.983	18.136		Surcharged
S16	720 min Winter	722	123.521	1.021	0.000		Surcharged
S17	960 min Winter	917	123.439	0.939	3.871		Surcharged
S18	8640 min Winter	4083	121.443	0.033	4.369		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	10	S30	S2	0.150	1.687	29.819	1.682	Surcharged
2.000	15 min Winter	9	S1	S2	0.127	1.757	28.092	0.610	OK
1.001	15 min Winter	10	S2	S3	0.225	1.654	65.748	1.656	OK
1.002	15 min Winter	10	S3	S4	0.300	1.487	105.129	1.474	Surcharged
1.003	15 min Winter	10	S4	S10	0.300	1.549	109.500	1.535	Surcharged
3.000	15 min Winter	10	S5	S7	0.150	2.182	38.562	1.609	Surcharged
4.000	15 min Winter	10	S6	S7	0.150	1.730	30.575	1.725	Surcharged
3.001	15 min Winter	10	S7	S9	0.183	2.685	93.201	1.328	OK
5.000	15 min Winter	8	S8	S9	0.158	1.360	40.503	1.020	OK
3.002	15 min Winter	9	S9	S10	0.185	3.942	137.911	0.758	OK
1.004	15 min Winter	9	S10	S12	0.525	1.445	312.768	1.448	OK
6.000	15 min Winter	8	S11	S12	0.133	3.069	50.888	0.951	OK
1.005	1440 min Winter	1557	S12	S13	0.310	0.366	48.665	0.220	OK
1.006	720 min Summer	726	S13	S15	0.525	-0.041	-8.905	-0.038	OK
7.000	15 min Winter	9	S14	S15	0.150	1.337	23.618	1.332	Surcharged
1.007	960 min Summer	1073	S15	S16	0.600	0.257	72.605	0.256	Surcharged
1.008	10080 min Winter	-1	S16	S17	0.000	0.000	0.000	-0.000	OK
1.009	960 min Winter	917	S17	S18	0.031	1.190	4.017	0.043	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S51	0.015	1.350	Type C	127.998	126.648	1.200	402338.958	179255.619
S52	0.059	1.350	Type C	128.687	127.337	1.200	402368.636	179221.788
S53	0.066	1.200	Type B	128.434	126.217	1.917	402357.106	179234.170
S54	0.045	1.350	Type C	127.915	126.206	1.484	402323.880	179216.127
S55	0.041	1.350	Type B	128.110	125.988	1.747	402331.502	179207.667
S56	0.004	1.350	Type B	128.010	125.959	1.676	402325.242	179200.946
S57	0.035	1.350	Type C	128.276	126.926	1.200	402343.306	179151.542
S58	0.012	1.200	Type B	128.448	126.745	1.553	402350.721	179168.049
S59	0.030	1.200	Type B	128.462	126.589	1.649	402350.743	179176.230
S60	0.072	1.350	Type B	127.957	125.924	1.658	402320.376	179190.753
S61	0.036	1.350	Type C	126.858	125.250	1.233	402299.810	179201.226
S62	0.000	0.000	Type C	126.700	125.200	1.350	402291.416	179190.147
S63	0.000	1.200	Type B	127.190	124.762	2.278	402257.649	179217.975
S64	0.000	1.350	Type C	125.751	124.636	0.965	402266.218	179230.447
S65	0.000	1.350	Type C	125.645	124.508	0.987	402256.523	179242.409
S66	0.000	1.350	Type B	126.960	124.343	2.467	402240.364	179230.904

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Diameter (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S51	126.648	S53	126.367	0.150	28.096	100.0	0.600	1.200	1.917
2.000	S52	127.337	S53	126.367	0.150	16.920	17.4	0.600	1.200	1.917
1.001	S53	126.217	S55	126.063	0.300	36.851	240.0	0.600	1.917	1.747
3.000	S54	126.206	S55	126.138	0.225	11.387	167.0	0.600	1.484	1.747
1.002	S55	125.988	S56	125.959	0.375	9.185	320.0	0.600	1.747	1.676
1.003	S56	125.959	S60	125.924	0.375	11.295	320.0	0.600	1.676	1.658
4.000	S57	126.926	S58	126.745	0.150	18.096	100.0	0.600	1.200	1.553
4.001	S58	126.745	S59	126.664	0.150	8.181	100.0	0.600	1.553	1.649
4.002	S59	126.589	S60	126.074	0.225	33.661	65.4	0.600	1.649	1.658
1.004	S60	125.924	S61	125.250	0.375	23.079	34.2	0.600	1.658	1.233
1.005	S61	125.250	S62	125.200	0.375	13.899	278.0	0.600	1.233	1.125
1.006	S62	125.200	S63	124.762	0.150	43.756	100.0	0.600	1.350	2.278
1.007	S63	124.762	S64	124.636	0.150	15.132	120.0	0.600	2.278	0.965
1.008	S64	124.636	S65	124.508	0.150	15.398	120.0	0.600	0.965	0.987
1.009	S65	124.508	S66	124.343	0.150	19.836	120.0	0.600	0.987	2.467

Outfall Details

Outfall Manhole S66 : Free Discharge

Flow Control Details

Tank Structure at Manhole S54

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
126.206	0.400	95.00	181.511	172.435	68.974	0.00000000	0.00000000	2.00

Controls within Manhole S55

Orifice Control

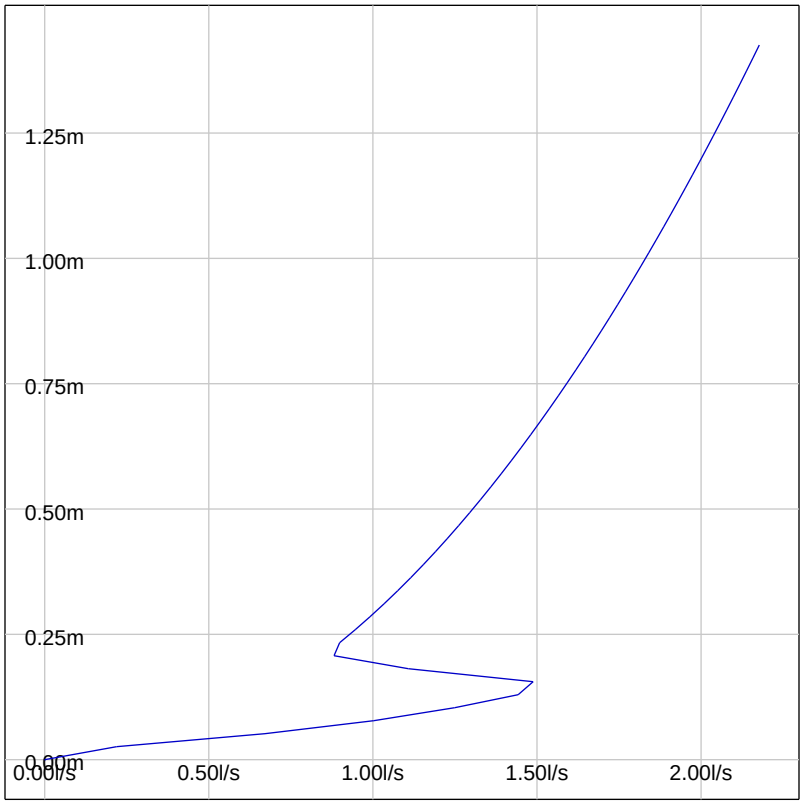
Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Controls within Manhole S62

Hydro-Brake® Optimum Control at Manhole S62

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
CHE-0062-2000-1200-2000 ID:505757	1.200	2.000	0.000	0.149	1.502	0.214	0.879

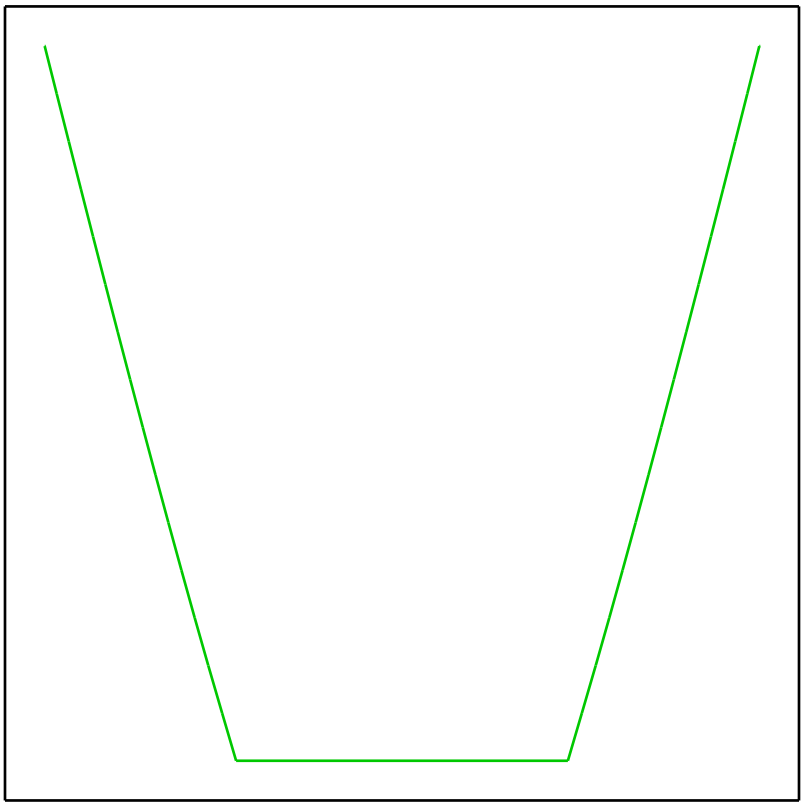
Hydro-Brake® Optimum Control at S62



Pond Structure at Manhole S62

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
125.200	1.500	310.731	126.400	0.300	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at S62



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_402347_179171_v5_0_1 (2).xml

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (1, +0%), (30, +40%), (100, +45%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Winter	14.307	0.00	0.00	30Yr +40% 720Min Winter	6.911	0.00	-38.19
1Yr 15Min Summer	14.307	0.00	0.00	30Yr +40% 960Min Summer	5.556	0.00	-52.75
1Yr 30Min Winter	9.026	0.00	0.00	30Yr +40% 960Min Winter	5.556	0.00	-50.93
1Yr 30Min Summer	9.026	0.00	0.00	30Yr +40% 1440Min Summer	4.056	0.00	0.33
1Yr 60Min Winter	5.691	0.00	0.00	30Yr +40% 1440Min Winter	4.056	0.00	0.41
1Yr 60Min Summer	5.691	0.00	0.00	30Yr +40% 2160Min Summer	2.937	0.00	-0.02
1Yr 120Min Winter	4.534	0.00	-0.13	30Yr +40% 2160Min Winter	2.937	0.00	0.08
1Yr 120Min Summer	4.534	0.00	-0.13	30Yr +40% 2880Min Summer	2.323	0.00	-0.01
1Yr 180Min Summer	3.878	0.00	-0.14	30Yr +40% 2880Min Winter	2.323	0.00	-0.01
1Yr 180Min Winter	3.878	0.00	-0.15	30Yr +40% 4320Min Summer	1.680	0.00	-0.01
1Yr 240Min Summer	3.280	0.00	-0.14	30Yr +40% 4320Min Winter	1.680	0.00	-0.01
1Yr 240Min Winter	3.280	0.00	-0.14	30Yr +40% 5760Min Summer	1.349	0.00	0.00
1Yr 360Min Summer	2.610	0.00	-0.12	30Yr +40% 5760Min Winter	1.349	0.00	-0.01
1Yr 360Min Winter	2.610	0.00	-0.12	30Yr +40% 7200Min Summer	1.153	0.00	0.00
1Yr 480Min Summer	2.196	0.00	-0.09	30Yr +40% 7200Min Winter	1.153	0.00	0.00
1Yr 480Min Winter	2.196	0.00	-0.10	30Yr +40% 8640Min Summer	1.026	0.00	0.00
1Yr 600Min Summer	1.890	0.00	-0.05	30Yr +40% 8640Min Winter	1.026	0.00	0.00
1Yr 600Min Winter	1.890	0.00	-0.06	30Yr +40% 10080Min Summer	0.938	0.00	0.00
1Yr 720Min Summer	1.661	0.00	0.00	30Yr +40% 10080Min Winter	0.938	0.00	0.00
1Yr 720Min Winter	1.661	0.00	0.00	100Yr +45% 15Min Summer	140.700	0.00	0.55
1Yr 960Min Summer	1.358	0.00	0.00	100Yr +45% 15Min Winter	140.700	0.00	-5.80
1Yr 960Min Winter	1.358	0.00	0.00	100Yr +45% 30Min Summer	91.978	0.00	6.37
1Yr 1440Min Winter	1.018	0.00	0.00	100Yr +45% 30Min Winter	91.978	0.00	8.15
1Yr 1440Min Summer	1.018	0.00	0.00	100Yr +45% 60Min Summer	57.211	0.00	13.54
1Yr 2160Min Winter	0.761	0.00	0.00	100Yr +45% 60Min Winter	57.211	0.00	14.95
1Yr 2160Min Summer	0.761	0.00	0.00	100Yr +45% 120Min Summer	34.135	0.00	11.18
1Yr 2880Min Summer	0.621	0.00	0.00	100Yr +45% 120Min Winter	34.135	0.00	12.61
1Yr 2880Min Winter	0.621	0.00	0.00	100Yr +45% 180Min Summer	25.314	0.00	7.47
1Yr 4320Min Summer	0.476	0.00	0.00	100Yr +45% 180Min Winter	25.314	0.00	9.10
1Yr 4320Min Winter	0.476	0.00	0.00	100Yr +45% 240Min Summer	20.606	0.00	4.39
1Yr 5760Min Summer	0.401	0.00	0.00	100Yr +45% 240Min Winter	20.606	0.00	6.24
1Yr 5760Min Winter	0.401	0.00	0.00	100Yr +45% 360Min Summer	15.409	0.00	-0.98
1Yr 7200Min Summer	0.356	0.00	0.00	100Yr +45% 360Min Winter	15.409	0.00	1.20
1Yr 7200Min Winter	0.356	0.00	0.00	100Yr +45% 480Min Summer	12.533	0.00	-5.48
1Yr 8640Min Summer	0.327	0.00	0.00	100Yr +45% 480Min Winter	12.533	0.00	-3.02
1Yr 8640Min Winter	0.327	0.00	0.00	100Yr +45% 600Min Summer	10.660	0.00	-10.05
1Yr 10080Min Winter	0.306	0.00	-0.01	100Yr +45% 600Min Winter	10.660	0.00	-8.81
1Yr 10080Min Summer	0.306	0.00	0.00	100Yr +45% 720Min Summer	9.320	0.00	-15.08
30Yr +40% 15Min Summer	105.734	0.00	0.30	100Yr +45% 720Min Winter	9.320	0.00	-8.59
30Yr +40% 15Min Winter	105.734	0.00	0.38	100Yr +45% 960Min Summer	7.510	0.00	-20.26
30Yr +40% 30Min Summer	68.668	0.00	0.63	100Yr +45% 960Min Winter	7.510	0.00	-16.67
30Yr +40% 30Min Winter	68.668	0.00	-7.44	100Yr +45% 1440Min Summer	5.471	0.00	-31.12
30Yr +40% 60Min Summer	42.453	0.00	-0.53	100Yr +45% 1440Min Winter	5.471	0.00	-27.46
30Yr +40% 60Min Winter	42.453	0.00	1.38	100Yr +45% 2160Min Summer	3.927	0.00	-49.60
30Yr +40% 120Min Summer	25.674	0.00	-2.81	100Yr +45% 2160Min Winter	3.927	0.00	-45.00
30Yr +40% 120Min Winter	25.674	0.00	-0.91	100Yr +45% 2880Min Summer	3.069	0.00	-67.32
30Yr +40% 180Min Summer	19.116	0.00	-7.46	100Yr +45% 2880Min Winter	3.069	0.00	-0.59
30Yr +40% 180Min Winter	19.116	0.00	-5.39	100Yr +45% 4320Min Summer	2.164	0.00	-12.92
30Yr +40% 240Min Summer	15.516	0.00	-12.56	100Yr +45% 4320Min Winter	2.164	0.00	-8.16
30Yr +40% 240Min Winter	15.516	0.00	-10.32	100Yr +45% 5760Min Summer	1.699	0.00	0.01
30Yr +40% 360Min Summer	11.544	0.00	-21.88	100Yr +45% 5760Min Winter	1.699	0.00	-1.14
30Yr +40% 360Min Winter	11.544	0.00	-19.10	100Yr +45% 7200Min Summer	1.426	0.00	0.00
30Yr +40% 480Min Summer	9.351	0.00	-29.36	100Yr +45% 7200Min Winter	1.426	0.00	0.00
30Yr +40% 480Min Winter	9.351	0.00	-26.23	100Yr +45% 8640Min Summer	1.251	0.00	0.00
30Yr +40% 600Min Summer	7.926	0.00	-35.93	100Yr +45% 8640Min Winter	1.251	0.00	0.00

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr +40% 600Min Winter	7.926	0.00	-32.51	100Yr +45% 10080Min Winter	1.133	0.00	-0.00
30Yr +40% 720Min Summer	6.911	0.00	-41.87	100Yr +45% 10080Min Summer	1.133	0.00	0.00

Simulation Results

Return Period Yrs: 1.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S51	15 min Winter	9	126.672	0.025	1.054		OK
S52	15 min Winter	8	127.370	0.033	4.637		OK
S53	15 min Winter	9	126.296	0.079	10.463		OK
S54	180 min Summer	116	126.262	0.055	0.477		OK
S55	15 min Winter	8	126.291	0.303	13.622		OK
S56	15 min Winter	9	126.001	0.042	3.013		OK
S57	15 min Winter	8	126.965	0.039	2.699		OK
S58	15 min Winter	9	126.790	0.045	3.463		OK
S59	15 min Winter	9	126.634	0.045	5.711		OK
S60	15 min Winter	9	125.975	0.051	14.186		OK
S61	720 min Winter	583	125.534	0.284	1.033		OK
S62	720 min Winter	583	125.534	0.334	1.033		Surcharged
S63	2160 min Winter	1148	124.793	0.031	1.488		OK
S64	2160 min Winter	1148	124.667	0.031	1.488		OK
S65	2160 min Winter	1149	124.539	0.031	1.487		OK
S66	2160 min Winter	1149	124.373	0.031	1.488		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	S51	S53	0.025	0.558	1.065	0.060	OK
2.000	15 min Winter	8	S52	S53	0.033	1.585	4.576	0.107	OK
1.001	15 min Winter	9	S53	S55	0.152	0.305	11.000	0.154	OK
3.000	180 min Summer	116	S54	S55	0.089	0.035	0.519	0.013	OK
1.002	15 min Winter	8	S55	S56	0.040	0.417	2.654	0.024	OK
1.003	15 min Winter	9	S56	S60	0.047	0.383	3.024	0.027	OK
4.000	15 min Winter	8	S57	S58	0.042	0.657	2.640	0.149	OK
4.001	15 min Winter	9	S58	S59	0.045	0.790	3.525	0.199	OK
4.002	15 min Winter	9	S59	S60	0.045	1.014	5.755	0.089	OK
1.004	15 min Winter	9	S60	S61	0.073	0.949	14.240	0.042	OK
1.005	720 min Winter	583	S61	S62	0.309	0.011	1.033	0.009	OK
1.006	720 min Winter	583	S62	S63	0.025	0.534	1.032	0.058	OK
1.007	2160 min Winter	1148	S63	S64	0.031	0.577	1.488	0.092	OK
1.008	2160 min Winter	1148	S64	S65	0.031	0.576	1.488	0.092	OK
1.009	2160 min Winter	1149	S65	S66	0.031	0.577	1.488	0.092	OK

Return Period Yrs: 30.0

Climate Change %: 40

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S51	15 min Winter	9	126.910	0.262	7.767		Surcharged
S52	15 min Winter	8	127.449	0.112	34.369		OK
S53	15 min Winter	9	126.862	0.646	76.207		Surcharged
S54	60 min Winter	40	126.607	0.400	32.602		Surcharged
S55	15 min Winter	9	126.698	0.710	97.888		Surcharged
S56	960 min Winter	1913	126.393	0.434	2.233		Surcharged
S57	15 min Winter	9	127.152	0.226	18.809		Surcharged
S58	15 min Winter	9	126.956	0.210	25.027		Surcharged
S59	15 min Winter	9	126.718	0.129	40.996		OK
S60	960 min Winter	1913	126.393	0.468	2.580		Surcharged
S61	960 min Winter	1902	126.391	1.141	1.150		Surcharged
S62	960 min Winter	1919	126.390	1.190	1.793		Surcharged
S63	960 min Winter	1919	124.797	0.035	1.965		OK
S64	960 min Winter	1919	124.671	0.035	1.965		OK
S65	960 min Winter	1919	124.543	0.035	1.965		OK
S66	960 min Winter	1919	124.378	0.035	1.965		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	S51	S53	0.150	0.404	7.140	0.403	Surcharged
2.000	15 min Winter	8	S52	S53	0.131	2.064	33.800	0.789	OK
1.001	15 min Winter	9	S53	S55	0.300	1.074	75.920	1.065	Surcharged
3.000	60 min Winter	40	S54	S55	0.225	-0.643	-25.555	-0.638	OK
1.002	15 min Winter	9	S55	S56	0.080	0.249	4.261	0.038	OK
1.003	960 min Winter	1913	S56	S60	0.375	0.023	2.580	0.023	Surcharged
4.000	15 min Winter	9	S57	S58	0.150	1.058	18.697	1.055	Surcharged
4.001	15 min Winter	9	S58	S59	0.144	1.426	24.890	1.404	OK
4.002	15 min Winter	9	S59	S60	0.129	1.739	41.111	0.639	OK
1.004	960 min Winter	1913	S60	S61	0.375	0.020	2.264	0.007	Surcharged
1.005	960 min Winter	1902	S61	S62	0.375	0.004	0.496	0.004	Surcharged
1.006	960 min Winter	1919	S62	S63	0.034	0.646	1.965	0.111	OK
1.007	960 min Winter	1919	S63	S64	0.035	0.625	1.965	0.122	OK
1.008	960 min Winter	1919	S64	S65	0.035	0.625	1.965	0.122	OK
1.009	960 min Winter	1919	S65	S66	0.035	0.625	1.965	0.122	OK

Return Period Yrs: 100.0

Climate Change %: 45

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S51	15 min Winter	10	127.213	0.565	8.622		Surcharged
S52	15 min Winter	9	127.965	0.627	42.997		Surcharged
S53	15 min Winter	10	127.153	0.936	87.899		Surcharged
S54	180 min Summer	92	126.607	0.400	52.793		Surcharged
S55	30 min Summer	18	126.952	0.964	103.765		Surcharged
S56	2880 min Summer	2984	126.484	0.524	0.814		Surcharged
S57	15 min Winter	9	127.402	0.476	25.022		Surcharged
S58	15 min Winter	9	127.074	0.329	32.563		Surcharged
S59	15 min Winter	9	126.743	0.155	53.418		OK
S60	2160 min Winter	2124	126.478	0.554	2.306		Surcharged
S61	2160 min Winter	2124	126.475	1.225	3.096		Surcharged
S62	2880 min Summer	2882	126.473	1.273	1.599		Flood Risk
S63	2880 min Summer	2883	124.798	0.036	2.033		OK
S64	2880 min Summer	2884	124.672	0.036	2.033		OK
S65	2880 min Summer	2886	124.544	0.036	2.033		OK
S66	2880 min Summer	2886	124.378	0.036	2.033		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	10	S51	S53	0.150	0.467	8.246	0.465	Surcharged
2.000	15 min Winter	9	S52	S53	0.150	2.268	40.075	0.936	Surcharged
1.001	15 min Winter	10	S53	S55	0.300	1.249	88.278	1.238	Surcharged
3.000	180 min Summer	92	S54	S55	0.225	-1.042	-41.444	-1.035	OK
1.002	30 min Summer	18	S55	S56	0.086	0.273	5.186	0.047	OK
1.003	2880 min Summer	2984	S56	S60	0.375	0.000	0.028	0.000	Surcharged
4.000	15 min Winter	9	S57	S58	0.150	1.366	24.142	1.362	Surcharged
4.001	15 min Winter	9	S58	S59	0.150	1.810	31.992	1.804	Surcharged
4.002	15 min Winter	9	S59	S60	0.154	1.834	53.382	0.830	OK
1.004	2160 min Winter	2124	S60	S61	0.375	0.028	3.054	0.009	Surcharged
1.005	2160 min Winter	2124	S61	S62	0.375	0.026	2.857	0.024	Surcharged
1.006	2880 min Summer	2882	S62	S63	0.035	0.652	2.033	0.115	OK
1.007	2880 min Summer	2883	S63	S64	0.036	0.632	2.033	0.126	OK
1.008	2880 min Summer	2884	S64	S65	0.036	0.631	2.033	0.126	OK
1.009	2880 min Summer	2886	S65	S66	0.036	0.632	2.033	0.126	OK



ABLEY LETCHFORD PARTNERSHIP LTD
3 Tealgate · Charnham Park · Hungerford · RG17 0YT
40 Caversham Road · Reading · RG1 7EB
T: 01488 684 390/ 0118 237 1736 E: contact@alpce.co.uk W: www.alpce.co.uk