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DRAINAGE STATEMENT

LAND OFF GYNN LANE HONLEY

FOR

VIVLY LIVING

Date: JUNE 2025

Ref: E24/8017/MH/L001

1. Introduction

Haigh Huddleston Associates have been requested by Homes by Honey to investigate and provide design information in relation to the proposed drainage for the development off Gynn Lane, Honley.

2. Site Description

The site is located on land to the south of Gynn Lane, Honley and lies around OS Grid Reference 414570E, 412090N. A site location plan is attached in Appendix A at the rear of the report. The overall site area is approximately 2.7ha.

The majority of the site is currently undeveloped and consists of a sloping grass field with wooded areas to the north west and south west. A single two storey stone detached house is located in the center north of the site, with a driveway connecting to Gynn Lane in the north east corner of the site. Adjacent the northern boundary, Ludhill Dike flows as an open watercourse from east to west. It enters site from the north east corner from an approximate 1.0x0.9m stone culvert that runs beneath the railway embankment, before passing beneath the driveway serving the house in the north of the site, and exiting the site in the north west corner.

The eastern boundary consists of a stone gabion wall retaining a railway embankment 1.7-1.9m above the site. This then slopes upwards to the railway line which runs south to north. The site is elevated above the residential properties to the west of the site, and above Marsh Platt Lane in the south western corner of the site.

The site generally falls steeply from a high point of 133m AOD in the south eastern corner to a low point of 110m AOD in the south western corner. The surrounding land generally falls from east to west.

3.0 PROPOSED DEVELOPMENT AND DRAINAGE CONSTRAINTS

It is understood that the proposed development is for a series of detached, semi-detached, terraced town houses (totalling approx 50 units) with associated car parking and access roads. A preliminary site layout is attached in the appendices.

There are existing public sewers adjacent to the site :-

i. A 225mm dia combined sewer running east to west beneath Gynn Lane to the north of the site.
ii. A 225mm dia surface water sewer running beneath Gynn Lane and discharging to Ludhill Dike in the north east of the site.
iii. A combined sewer running east to west beneath Marsh Platt Lane to the south west of the site.
v. The primarily open watercourse Lundhill Dike passes under the existing site entrance in the north east corner of the site.

There are no public sewers crossing the main body of the site. Yorkshire Water have confirmed that there is no capacity within adjacent adopted surface water systems to service the site. They have recommended that surface water is discharged to Ludhill Dyke adjacent the northern boundary of the site. This will require a right of discharge in perpetuity to the existing watercourse which will need to be agreed with the current landowner. Foul drainage can be accommodated in the 225mm dia sewer in Gynn Lane to the north of the site. A copy of the Yorkshire Water records and recent pre-planning enquiry for the site are in the appendices at the rear of the report.

As the majority of the site is currently undeveloped, there are no existing drainage systems serving the site. However there are two former mine adits at considerable depth below the site which have been proved to contain mine water. In addition there is a small pond situated off site which could be fed by existing land drainage on site (as yet to be proved).

4. The Proposed Drainage Arrangement

It is understood that the proposed development will comprise of approximately 50 number residential properties with associated adoptable roads and private drives/parking areas.

Please find attached a copy of drawing No. E23/8017/001E indicating the proposed drainage for the above development. Our current drainage scheme proposals may be summarised as follows:-

i. Foul Water Drainage

There are no existing foul sewers serving the site. There are a number of existing combined public sewers located in Gynn Lane.

The Yorkshire Water Pre-Planning enquiry states the development may discharge to the existing 225mm Diameter combined public sewer in Penistone Road. However, the current drainage design is based on a connection to the existing public sewer in Rowley Lane, which will be subject to Yorkshire Water approval.

Due to the steep nature of the site, at present it is anticipated that a gravity connection to the existing sewer network will be achievable. However due to having to lay the foul sewer connection below the new proposed culvert of Lundhill Dyke, the offsite foul will need to extend along Gynn Lane to achieve a gravity connection offsite.

ii. Surface Water Drainage

There are no adopted surface water sewers serving the site. There are a number of existing public surface sewers located in Gynn Lane offsite.

In accordance with the SUDS hierarchy, soakaways should be the initial preference for surface water from the development site.

A site investigation has been undertaken on site previously by Lithos and is detailed in their report no 4749/2 dated September 2024. The following information has been reviewed in order to establish the existing geology and the possibility of soakaways being suitable for the site.

i. The online soil mapping data indicated the site to be underlain by slowly permeable soils.
ii. The investigation has generally proved 300mm of topsoil overlying 0.5-5.0m of sandy gravelly clays and slightly angular to sub-angular coarse gravel. Mudstone or sandstone bedrock was generally encountered at depths of 1.5-3.7m below existing ground levels.
iii. Section 13.8.1 of the site investigation report states that soakaways are not considered an effective method of surface water drainage due to the steeply sloping nature of the site.

Further to the above we would not envisage that soakways/infiltration would be suitable for the development due to the slop of the site and the underlying strata.

With soakaways proved unsuitable for the development site, preference for surface water discharge should be to Lundhill Dyke to the north.

It is proposed to develop a sustainable drainage solution for the surface water design. A greenfield restricted surface water discharge from the site has been agreed with Kirklees Land Drainage and stipulated as 10.5l/s for the site.

The development has been designed to cater for rainfall events up to 1 in 100 years plus 45% climate change. Calculations for the surface water drainage are contained within the Appendix of this report.

Attenuation for the development is to be provided in an underground storage tank. Whilst detention basins or ponds would be a preferred solution, existing ground levels has meant that an underground storage tank is the only viable option for surface water attenuation.

There are no significant existing buildings or paved areas on site. In conjunction with infiltration systems not being suitable an overall discharge rate of 10.5 l/s greenfield discharge rate has been agreed for the development by the LLFA. Confirmation of this is included in the appendices to the rear of the report. The overall discharge has been split into an 8.5 l/s restricted discharge from the site, with an allowance of 2 l/s for the proposed adoptable highway downstream of the culvert, making for a total of 10.5 l/s. Negotiations would be required with the authorities and current landowners to secure permission to discharge in perpetuity together with easements.

The on site attenuation will provide up to 605m^3 of surface water storage onsite with both the tank and surface water system combined. Note the final detailed design will be undertaken through the S104 technical stage with agreement with the LLFA.

The proposed storage tank will operate as an offline feature that will allow control of the surface water discharge from the above development with excess surface water flows retained on-site during peak storm events. The stored volume of water will be released from the storage tank in a controlled manner over a prolonged time period.

The construction of the underground tank should take place at an early stage of the on-site construction. Timings will need to be carefully agreed with the developer to ensure that a satisfactory drainage solution is achieved and that the initial construction has an approved outfall.

iii. Land Drainage

As part of the proposed development any incoming existing land drains should be picked up and diverted through the site. The land drainage should be constructed as a separate system to the adoptable surface water network.

Given the steep nature of the site, the proposed development will include numerous retaining walls across the site which will also require land drainage.
Further consultation will be required with Kirklees Land Drainage to establish a suitable outfall for the on-site land drainage. In any case the land drainage run-off rate should be managed on site to ensure the existing downstream infrastructure is not negatively impacted.

iv. Flood Routing

Flood routing has been considered throughout the development scheme to ensure that any exceedance flows can be safely managed on site without entering properties.

The flood routing for exceedance events will mimic the natural flow path of the existing site which falls from East to West towards Gynn Lane and the natural fall of the site. A small catchment area on the western boundary falls towards the west this will continue within the final designs, however the contributing area has been minimised through proposed on site gradients. Additional kerbing and gullies can be introduced to reduce the risk further.

5. Measures to prevent Pollution of the existing Groundwater and Watercourses

i. During Construction

Following commencement of site works we would recommend that any topsoil strips are contained to the discrete build areas and phased release of units. In addition, measures to prevent overland flows from high intensity rainfall events carrying excessive silts into the adjacent drains should be established as an initial priority. These could entail the construction of a cut off bund with terram sheeting to enable the settlement of silts prior to the gradual release of rainwater into the surface water network. Any systems established on site will require effective maintenance to ensure their long-term suitability.

All contractors' diesel storage areas on-site should be effectively bunded and protected to prevent any leakages or spillages from entering the groundwater.

ii. Pollution Prevention within Proposed Development

Any commercial hardstanding areas or vehicular parking areas serving more than 12 cars should be constructed with suitably sized petrol interceptor arrangements.

All adopted highways and private drainage areas to be constructed with trapped and sealed gullies.

6.0 The Management and Maintenance of the Future Development

It is proposed that there will be a number of interested parties in the future management and maintenance of the drainage infrastructure for the proposed development.

i. During construction and prior to final adoption the developer will be responsible for maintaining the drainage system including the underground storage tank.
ii. All surface and foul drainage on-site will be put forward for adoption under a Section 104 Agreement with either Yorkshire Water or a NAV. This will include the underground storage tank.
iii. Road gullies and any highway drainage will be put forward for adoption by Kirklees Highways as part of the Section 38 Agreement.
iv. It is envisaged that a separate management company will be approached in relation to the maintenance and management of the land drains and open areas site. Land drainage within private curtilage will be the responsibility of the homeowner.

6.1 The maintenance of the attenuation tank and flow control manhole should be in line with the SUDS manual (CIRIA C753, 2015) as detailed in table 21.3 below.

Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where itmay cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replacesurface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflowsto ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up andremove if necessary	Every 5 years or as required

I trust that the above is sufficient for your present requirements. However, should you have any further queries please do not hesitate to contact me direct.

Yours sincerely,

MARTIN HUDDLESTON MEng
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APPENDICES

APPENDIX A

DRAWINGS AND PLANS

NOTES

This drawing has been prepared specifically for the purpose of obtaining Planning and or Building Regulations Approval. Its suitability for other purposes without additional supplementary details and specifications cannot be guaranteed.

All dimensions are to be checked on site, any discrepancies are to be reported to the designer before work commences. Use only figured dimensions.

All structural components shown are indicative only. Details / calculations of structural members are to be provided by the Structural Engineer.

This drawing is not to be copied or divulged to a third party without written permission.

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Key:

- Existing Tree Canopy
- Tree Root Protection Area
- Developable Area
- Indicative Retaining Walls
- Removed Features
- Mineshaft and no build zone
- Proposed boundary fences
- Attenuation Tank
- Attenuation Easement
- Proposed Walls
- Soft landscaping
- Bin Storage / Collection
- Bin Storage
- Bin Collection

Gynn House

GYNN LANE

ACCESS ROAD

PRIVATE DRIVE

PRIVATE DRIVE

MARSH PLATT LANE

OPEN SPACE WOODLAND

Path (um)

Scale 1:500

0 10 20 50

vivly living

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Revisions

R07	Garage amendments	11.12.24
R08	Client amendments	19.12.24
R09	Client amendments to Z4	27.01.25
R10	Client design amends	06.02.25
R11	Paths added	07.03.25

Project:

Residential Development

at Gynn Lane
Honley
Holmfirth

for Vivly Living

Site Layout

Purpose of issue: PLANNING

Drawn DRH

Date August 2024

Scales 1:500 @ A1

Drawing No. 2479 - 0301 - R11

Rev E Updated to suit planning layout 2479-0301-R05 received 19.110.24. Attenuation tank & SWS outfall moved east. Sub Station amended to suit. 10.12.24 HH

Rev D Attenuation tank amended to suit tree stand-off distance. Plot 1 amended back to original position. 14.11.24 HH

Rev C Updated to suit planning layout 2479-0301-R04 received 05.11.24. Attenuation tank amended to suit clients instruction, Plot 1 moved to suit. 13.11.24 HH

Rev B Updated to suit planning layout 2436-9901-P06C received 15.07.24. Attenuation tank amended. 18.07.24 HH

Rev A Updated to suit planning layout 2436-9910-P06C. FFL's amended to clients instructions. 11.06.24 HH

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Client
YORKSHIRE COUNTRY PROPERTIES

Project
GYNN LANE, HONLEY

Detail
PRELIMINARY FEASIBILITY PLAN

Dwn	Chkd	Date	Scale	Dwg No.
HH		MAY-24	1:500@A1	E24/8017/001E

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Client
YORKSHIRE COUNTRY PROPERTIES

Project
GYNN LANE, HONLEY

Detail
FLOOD ROUTING PLAN

Dwn	Chkd	Date	Scale	Dwg No.
HN		DEC-24	1:500@A1	E24/8017/019

APPENDIX B

CORRESPONDANCE

Consultation Response from KC Lead Local Flood Authority		
2019/91388 Land at Gynn Lane, Honley, Holmfirth,		
Outline application for the erection of up to 50 no. dwellings, all matters reserved except access		
Date Responded: 30th March 2020	**Responding Officer: Paul Farndale**	**Responding Ref:**

Kirklees COUNCIL

Further to our comments of 16th May 2019, 6th August 2019 and 15th January 2020. All previous comments are still relevant.

An updated Technical Note on Drainage by Curtains dated 7th February 2020 has been issued along with several drawings showing a new culverted section of Ludhill Dike under the proposed access.

Kirklees Flood Management & Drainage OBJECTS to this application due to disparities between the technical note and the proposed culverting of Ludhill Dike.

In addition to a trash screen design promoted in the Technical Report being omitted from plans, a meeting on site is required to discuss Land Drainage consent with regard to culvert size and dimensions in relation to the current channel. Opportunities should be taken to remove sharp bends that will result in a loss of energy, flow turbulence, an increase risk of blockage, sediment dropout.

The connection point from site via manhole access, as shown in the Technical Report has been omitted.

A flood routing plan to prevent any blockage scenarios flowing down Gynn Lane has not been explored and therefore not prevented.

Given the recent events along a 700m stretch of Gynn Lane, a section 19 investigation (Flood and Water Management Act 2010) is to be carried out. This has been delayed due to the current Covid 19 crisis and partial lockdown of movement. All opportunities need to be taken wherever possible to reduce flood risk within the locality through this development in accordance with good practice.

A report of potential works will need to be issued in due course to be considered by the LPA for section 106 contributions that benefits the common good for existing and new residents.

This is in addition to that already earmarked within the site locality and noted in the Technical Report.

The current culvert design proposals would appear to increase risk from potential overland flow routes, for blockage and exceedance scenarios, down Gynn Lane where existing properties already suffer internal flooding.

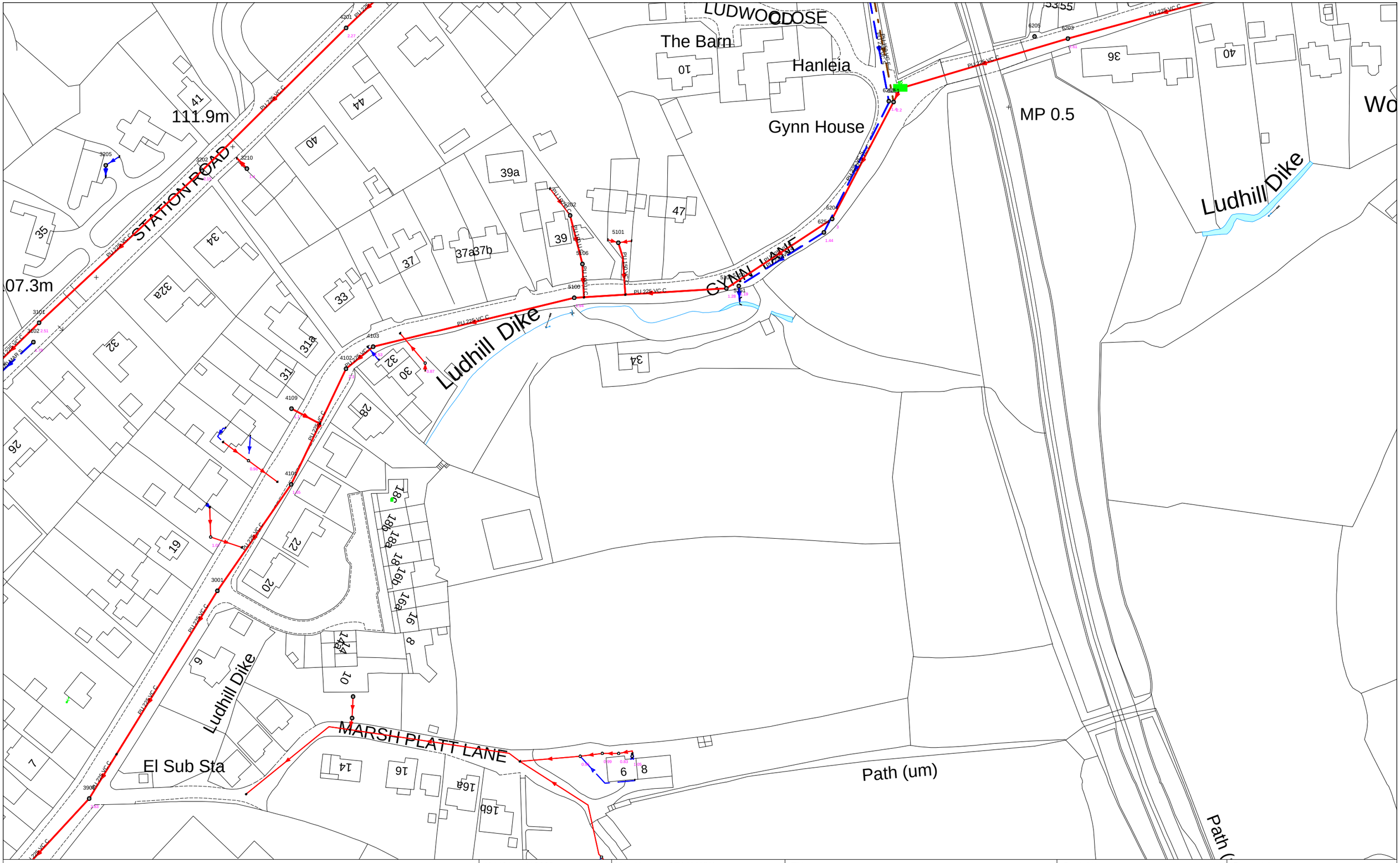
The LLFA supports the restriction of flow to 10.5l/s to help reduce the peak discharge rates to combat flood risk for flows in Ludhill Dike.

However, although the rate of flow has been combatted, given the known and potential risk already associated with this area, the inevitable increase in volume must be considered and mitigated downstream through both off site investment and ensuring that any flood route can get back into Ludhill Dike preferably using hard engineered solutions involving road levels. Overflows from manholes and the use of several new strategically place storm gullies needs to be considered.

To achieve this, the LLFA, Highways DC, Section 38 and the LPA should meet to discuss potential solutions with the developer before any solution is recommended.

APPENDIX C

YORKSHIRE WATER RECORDS



414461 : 412069	Map Name : SE1411NW	Title	Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
			Date Req : 21/05/2024, 15:40:41 Source : Sewer Network Enquiry
			Date Gen : 21/05/2024, 15:41:58

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

APPENDIX D

SURFACE WATER DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.350	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	x
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.090	4.00	128.769	1200	414646.149	412091.996	1.617
2	0.056	4.00	126.216	1200	414637.043	412131.133	1.466
3	0.037	4.00	126.434	1200	414637.843	412121.165	1.884
4	0.055	4.00	122.709	1200	414585.210	412126.975	1.459
5	0.045	4.00	122.959	1500	414586.009	412117.007	1.984
6	0.140	4.00	123.311	1500	414590.607	412059.691	3.055
7	0.083	4.00	122.809	1500	414587.219	412053.906	2.637
8	0.080	4.00	120.356	1500	414548.606	412046.570	3.459
9	0.144	4.00	119.904	1500	414535.189	412056.037	4.554
10	0.147	4.00	119.001	1500	414530.619	412116.865	4.058
11	0.063	4.00	118.070	1500	414540.097	412130.695	3.239
12	0.017	4.00	115.040	1500	414570.343	412149.658	3.353
13	0.000		115.000	2400	414569.186	412156.799	4.086
14			111.849		414566.971	412170.464	1.349

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	3	30.329	0.600	127.152	124.625	2.527	12.0	225	4.13	52.5
2.000	2	3	10.000	0.600	124.750	124.625	0.125	80.0	225	4.11	52.6
1.001	3	5	52.001	0.600	124.550	121.050	3.500	14.9	300	4.34	51.5
3.000	4	5	10.000	0.600	121.250	121.125	0.125	80.0	225	4.11	52.6
1.002	5	6	57.500	0.600	120.975	120.256	0.719	80.0	375	4.82	49.4
1.003	6	7	6.704	0.600	120.256	120.172	0.084	80.0	375	4.87	49.2
1.004	7	8	39.304	0.600	120.172	116.897	3.275	12.0	375	5.00	48.7
1.005	8	9	16.421	0.600	116.897	115.425	1.472	11.2	375	5.05	48.5
1.006	9	10	60.999	0.600	115.350	114.943	0.407	150.0	450	5.66	46.1

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.798	151.0	12.8	1.392	1.584	0.090	0.0	44	2.348
2.000	1.463	58.2	8.0	1.241	1.584	0.056	0.0	56	1.030
1.001	4.099	289.7	25.5	1.584	1.609	0.183	0.0	59	2.553
3.000	1.463	58.2	7.8	1.234	1.609	0.055	0.0	56	1.030
1.002	2.027	223.9	37.9	1.609	2.680	0.283	0.0	104	1.523
1.003	2.027	223.9	56.4	2.680	2.262	0.423	0.0	128	1.699
1.004	5.254	580.3	66.7	2.262	3.084	0.506	0.0	85	3.552
1.005	5.450	601.9	77.0	3.084	4.104	0.586	0.0	90	3.789
1.006	1.657	263.6	91.3	4.104	3.608	0.730	0.0	182	1.512

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	10	11	16.766	0.600	114.943	114.831	0.112	150.0	450	5.83	45.5
1.008	11	12	35.699	0.600	114.831	111.687	3.144	11.4	450	5.93	45.2
1.009	12	13	7.234	0.600	111.687	110.964	0.723	10.0	450	5.95	45.1
1.010	13	14	13.843	0.600	110.914	110.500	0.414	33.4	225	6.05	44.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.007	1.657	263.6	108.3	3.608	2.789	0.877	0.0	201	1.580
1.008	6.058	963.5	115.2	2.789	2.903	0.940	0.0	104	4.143
1.009	6.456	1026.8	117.1	2.903	3.586	0.957	0.0	102	4.353
1.010	2.270	90.3	116.2	3.861	1.124	0.957	0.0	225	2.312

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	30.329	12.0	225	Circular_Default Sewer Type	128.769	127.152	1.392	126.434	124.625	1.584
2.000	10.000	80.0	225	Circular_Default Sewer Type	126.216	124.750	1.241	126.434	124.625	1.584
1.001	52.001	14.9	300	Circular_Default Sewer Type	126.434	124.550	1.584	122.959	121.050	1.609
3.000	10.000	80.0	225	Circular_Default Sewer Type	122.709	121.250	1.234	122.959	121.125	1.609
1.002	57.500	80.0	375	Circular_Default Sewer Type	122.959	120.975	1.609	123.311	120.256	2.680
1.003	6.704	80.0	375	Circular_Default Sewer Type	123.311	120.256	2.680	122.809	120.172	2.262
1.004	39.304	12.0	375	Circular_Default Sewer Type	122.809	120.172	2.262	120.356	116.897	3.084
1.005	16.421	11.2	375	Circular_Default Sewer Type	120.356	116.897	3.084	119.904	115.425	4.104
1.006	60.999	150.0	450	Circular_Default Sewer Type	119.904	115.350	4.104	119.001	114.943	3.608
1.007	16.766	150.0	450	Circular_Default Sewer Type	119.001	114.943	3.608	118.070	114.831	2.789
1.008	35.699	11.4	450	Circular_Default Sewer Type	118.070	114.831	2.789	115.040	111.687	2.903
1.009	7.234	10.0	450	Circular_Default Sewer Type	115.040	111.687	2.903	115.000	110.964	3.586
1.010	13.843	33.4	225	Circular_Default Sewer Type	115.000	110.914	3.861	111.849	110.500	1.124

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
2.000	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.001	3	1200	Manhole	Adoptable	5	1500	Manhole	Adoptable
3.000	4	1200	Manhole	Adoptable	5	1500	Manhole	Adoptable
1.002	5	1500	Manhole	Adoptable	6	1500	Manhole	Adoptable
1.003	6	1500	Manhole	Adoptable	7	1500	Manhole	Adoptable
1.004	7	1500	Manhole	Adoptable	8	1500	Manhole	Adoptable
1.005	8	1500	Manhole	Adoptable	9	1500	Manhole	Adoptable
1.006	9	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable
1.007	10	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
1.008	11	1500	Manhole	Adoptable	12	1500	Manhole	Adoptable
1.009	12	1500	Manhole	Adoptable	13	2400	Manhole	Adoptable
1.010	13	2400	Manhole	Adoptable	14		Junction	

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
Rainfall Events	Singular	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	19.000	Starting Level (m)	
Ratio-R	0.350	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Normal		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 13 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	110.914	Product Number	CTL-SHE-0115-8500-2400-8500
Design Depth (m)	2.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.5	Min Node Diameter (mm)	1200

Node 13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	111.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	182.0	0.0	3.000	182.0	0.0	3.050	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	127.196	0.044	12.2	0.0984	0.0000	OK
15 minute summer	2	10	124.808	0.058	7.6	0.1094	0.0000	OK
15 minute winter	3	10	124.610	0.060	24.8	0.0911	0.0000	OK
15 minute summer	4	10	121.307	0.057	7.4	0.1073	0.0000	OK
15 minute winter	5	10	121.078	0.103	38.2	0.2291	0.0000	OK
15 minute winter	6	10	120.403	0.146	56.9	0.3931	0.0000	OK
15 minute winter	7	10	120.258	0.086	67.2	0.2071	0.0000	OK
15 minute winter	8	10	116.989	0.092	77.7	0.2042	0.0000	OK
15 minute winter	9	10	115.542	0.192	96.8	0.4601	0.0000	OK
15 minute winter	10	11	115.163	0.220	115.1	0.5485	0.0000	OK
15 minute winter	11	11	114.940	0.109	121.6	0.2356	0.0000	OK
15 minute summer	12	10	111.806	0.119	122.8	0.2231	0.0000	OK
180 minute winter	13	144	111.437	0.522	32.8	81.8945	0.0000	SURCHARGED
15 minute summer	14	1	110.500	0.000	6.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	12.2	2.274	0.081	0.1627	
15 minute summer	2	2.000	3	7.6	0.983	0.131	0.0773	
15 minute winter	3	1.001	5	24.7	2.515	0.085	0.5117	
15 minute summer	4	3.000	5	7.4	0.976	0.127	0.0758	
15 minute winter	5	1.002	6	38.0	1.185	0.170	1.8522	
15 minute winter	6	1.003	7	56.0	1.926	0.250	0.1977	
15 minute winter	7	1.004	8	66.9	3.352	0.115	0.7846	
15 minute winter	8	1.005	9	77.3	3.180	0.128	0.4104	
15 minute winter	9	1.006	10	95.2	1.359	0.361	4.2968	
15 minute winter	10	1.007	11	114.3	2.178	0.434	0.8944	
15 minute winter	11	1.008	12	122.0	3.929	0.127	1.1109	
15 minute summer	12	1.009	13	124.3	3.681	0.121	0.3678	
180 minute winter	13	Hydro-Brake®	14	7.2				141.8

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	127.222	0.069	29.8	0.1559	0.0000	OK
15 minute winter	2	10	124.845	0.095	18.6	0.1798	0.0000	OK
15 minute winter	3	10	124.645	0.095	60.7	0.1446	0.0000	OK
15 minute winter	4	10	121.344	0.094	18.2	0.1766	0.0000	OK
15 minute winter	5	10	121.142	0.167	93.8	0.3700	0.0000	OK
15 minute winter	6	10	120.506	0.250	140.1	0.6701	0.0000	OK
15 minute winter	7	10	120.314	0.142	166.9	0.3393	0.0000	OK
15 minute winter	8	10	117.041	0.144	193.1	0.3212	0.0000	OK
15 minute winter	9	10	115.712	0.362	240.5	0.8683	0.0000	OK
15 minute winter	10	10	115.332	0.389	286.5	0.9693	0.0000	OK
15 minute winter	11	10	115.007	0.176	302.7	0.3803	0.0000	OK
240 minute winter	12	236	112.381	0.694	78.3	1.2966	0.0000	SURCHARGED
240 minute winter	13	236	112.381	1.467	63.0	258.0161	0.0000	SURCHARGED
15 minute summer	14	1	110.500	0.000	7.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	29.8	2.922	0.197	0.3093	
15 minute winter	2	2.000	3	18.6	1.240	0.320	0.1501	
15 minute winter	3	1.001	5	60.7	3.235	0.209	0.9758	
15 minute winter	4	3.000	5	18.2	1.233	0.313	0.1476	
15 minute winter	5	1.002	6	93.7	1.492	0.418	3.5987	
15 minute winter	6	1.003	7	139.4	2.400	0.623	0.3887	
15 minute winter	7	1.004	8	166.6	4.330	0.287	1.5129	
15 minute winter	8	1.005	9	192.8	3.149	0.320	1.0624	
15 minute winter	9	1.006	10	237.8	1.687	0.902	8.6072	
15 minute winter	10	1.007	11	281.8	2.715	1.069	1.7036	
15 minute winter	11	1.008	12	301.2	4.672	0.313	2.3027	
240 minute winter	12	1.009	13	63.0	1.480	0.061	1.1462	
240 minute winter	13	Hydro-Brake®	14	7.2				175.6

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	127.232	0.080	38.6	0.1792	0.0000	OK
15 minute summer	2	10	124.861	0.111	24.0	0.2094	0.0000	OK
15 minute winter	3	10	124.656	0.106	78.5	0.1613	0.0000	OK
15 minute summer	4	10	121.359	0.109	23.6	0.2062	0.0000	OK
15 minute summer	5	10	121.171	0.196	121.3	0.4355	0.0000	OK
15 minute winter	6	10	120.553	0.297	181.9	0.7976	0.0000	OK
15 minute summer	7	10	120.333	0.161	216.4	0.3861	0.0000	OK
15 minute winter	8	10	117.084	0.187	251.1	0.4170	0.0000	OK
15 minute winter	9	10	116.137	0.787	308.6	1.8880	0.0000	SURCHARGED
15 minute winter	10	11	115.500	0.557	361.0	1.3880	0.0000	SURCHARGED
15 minute winter	11	10	115.032	0.201	382.6	0.4333	0.0000	OK
360 minute winter	12	352	112.908	1.221	59.1	2.2816	0.0000	SURCHARGED
360 minute winter	13	352	112.908	1.994	116.8	356.3108	0.0000	SURCHARGED
15 minute summer	14	1	110.500	0.000	7.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	3	38.6	3.133	0.256	0.3738	
15 minute summer	2	2.000	3	24.0	1.319	0.413	0.1820	
15 minute winter	3	1.001	5	78.5	3.264	0.271	1.2692	
15 minute summer	4	3.000	5	23.6	1.313	0.406	0.1797	
15 minute summer	5	1.002	6	122.0	1.588	0.545	4.3682	
15 minute winter	6	1.003	7	181.0	2.569	0.809	0.4652	
15 minute summer	7	1.004	8	216.8	4.435	0.374	1.9528	
15 minute winter	8	1.005	9	247.0	3.170	0.410	1.3562	
15 minute winter	9	1.006	10	301.5	1.903	1.144	9.6649	
15 minute winter	10	1.007	11	359.7	2.748	1.364	1.9023	
15 minute winter	11	1.008	12	385.4	4.802	0.400	2.9500	
360 minute winter	12	1.009	13	116.8	1.492	0.114	1.1462	
360 minute winter	13	Hydro-Brake®	14	7.8				244.2

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.32%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	127.250	0.098	55.9	0.2208	0.0000	OK
15 minute winter	2	10	124.890	0.140	34.8	0.2660	0.0000	OK
15 minute winter	3	10	124.679	0.129	113.7	0.1972	0.0000	OK
15 minute winter	4	10	121.389	0.139	34.2	0.2614	0.0000	OK
15 minute summer	5	10	121.225	0.250	175.9	0.5546	0.0000	OK
15 minute summer	6	10	120.709	0.453	261.6	1.2158	0.0000	SURCHARGED
15 minute summer	7	10	120.365	0.193	312.5	0.4626	0.0000	OK
15 minute winter	8	11	117.876	0.979	361.7	2.1823	0.0000	SURCHARGED
15 minute winter	9	11	117.137	1.787	419.2	4.2894	0.0000	SURCHARGED
15 minute winter	10	11	115.904	0.961	499.6	2.3944	0.0000	SURCHARGED
15 minute summer	11	10	115.071	0.240	527.7	0.5165	0.0000	OK
480 minute winter	12	464	113.990	2.303	68.7	4.3041	0.0000	SURCHARGED
480 minute winter	13	464	113.990	3.076	140.8	558.1497	0.0000	SURCHARGED
15 minute summer	14	1	110.500	0.000	7.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	3	55.9	3.447	0.370	0.4919	
15 minute winter	2	2.000	3	34.8	1.434	0.598	0.2426	
15 minute winter	3	1.001	5	113.7	3.265	0.392	1.8621	
15 minute winter	4	3.000	5	34.2	1.429	0.588	0.2393	
15 minute summer	5	1.002	6	174.7	1.695	0.780	5.4117	
15 minute summer	6	1.003	7	260.9	2.735	1.165	0.5612	
15 minute summer	7	1.004	8	312.3	4.404	0.538	3.2901	
15 minute winter	8	1.005	9	342.8	3.158	0.569	1.8112	
15 minute winter	9	1.006	10	421.6	2.661	1.599	9.6649	
15 minute winter	10	1.007	11	501.1	3.637	1.901	2.0463	
15 minute summer	11	1.008	12	529.5	4.899	0.550	4.1715	
480 minute winter	12	1.009	13	140.8	1.471	0.137	1.1462	
480 minute winter	13	Hydro-Brake®	14	9.6				344.7