Fiona Willis

Proposed Residential Development
Off Leak Hall Lane
Denby Dale

Drainage Assessment
Prepared by EWE Associates Ltd
Draft Rev0 June 2024

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CLIENT DETAILS

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CONTRACT

This report describes work commissioned by Fiona Willis following instruction 15th May 2024. Fiona Willis representative was Nick Willock. Lea Favill of EWE Associates Ltd carried out the work.

Date: 29th June 2024

Prepared by: …… …… Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 29th June 2024
- 1No copy issued to Mr Nick Willock

CONTENTS

APPENDICES:

1. INTRODUCTION

Terms of Reference

This report was commissioned by Fiona Willis to consider the surface water drainage for the proposed residential development site off Leak Hall Lane within Denby Dale.

The proposal involves the construction of a residential development including access road and parking spaces. The drainage issues are being considered as part of the current planning application.

Approach to the Assessment

For the purposes of this study, the following have been considered: -

- Site level information and proposed finished levels of the building and external works.
- Existing infiltration characteristics of subsoils.
- Onsite constriction.
- Options available to developer.
- NPPF guidelines with regards to the control of runoff.
- PPG3 pollution prevention guidelines.
- Future adoption and management of drainage system.
- Flood risk to adjacent land users.
- Discharge rate into existing pond/watercourse.

Design Constraints

For the purposes of this study, the following constraints have been applied: -

- The design is based on the proposed layout provided by the client's representative. At this stage no modifications to the layout are proposed.
- SUDs features are to be recommended where practically possible.
- A site visit was undertaken during June 2024. The existing drainage close to the site was inspected.
- No site investigation is available at this stage. However, the site is steep and therefore soakaways in the upper part of the site would need to be very deep to stop horizontal seepage. There are also spring lines at the south west corner of the site which suggests the lower part of the site is impermeable.
- There is a Yorkshire Water combined sewer within Leak Hall Crescent. The sewer is shown on the YW records to commence approximately 100m down stream of the site. However, there are manholes and sewers within

the upper part of this road close to the site which are assumed to connect into the YW combined sewer.

- Additional development in the form of 4 extra dwellings and a hammer head have recently been added to Leak Hall Crescent. It is believed that the YW sewer has been extend to these dwellings.
- It is assumed that the minimum design standard is 1 in 100 years plus climate change (40%).
- For the purpose of this assessment it is assumed that no flooding will be acceptable up to and including 1 in 100 years plus climate change (40%) storm.

2. SUDs Features Considered

The Environment Agency and LLFA requires that adequate pollution control is incorporated into the proposed drainage system in order to prevent deterioration of the quality of the water environment. However, this is only applicable for surface water originating from access roads and communal parking areas, which needs to be passed through a petrol/oil interceptor or equivalent system prior to discharge into the existing surface water sewer or infiltration system. It is noted however, that this will not apply to surface water originating from roof drainage.

To reduce the impact of surface water runoff from the development in accordance with the requirements of the Environment Agency and Local Authority, the employment of SUDS techniques to limit runoff volumes and rates from the site are recommended. SUDS techniques can also be used to provide an appropriate level of treatment to the runoff.

It is normal practice to ensure that the 1 in 30 year event is maintained within the drainage system and the 1 in 100 year is permitted to flood the surface as long as there is no flooding to buildings and the flood volume is contained within the site boundary in specific areas proposed for this purpose.

The following section will provide some possible SUDS techniques which could be employed on the site to balance flows in excess of the 1 in 30 year event. SUDS techniques will also provide treatment to the runoff to remove a proportion of the pollution and protect the quality of the downstream watercourses. Following guidance from CIRIA Report C522 the following levels of treatment will be provided:

- Roofs – 1 level
- Driveways – 1 level
- Roads and communal parking areas – 2 levels.

The level of treatment indicates the number of SUDS techniques that will be used to treat pollution. For example if two levels are required the runoff may enter a filter drain that leads to a basin or pond before outfall. It is recommended that source control techniques are used. In practice there will be little outflow from these techniques for a 1 in 2 year storm as most of the rainfall will be held within the system and will disperse via evapotranspiration.

Initial data suggests that the site is underlain by an impermeable layer which is unlikely to allow any infiltration at a reasonable rate. The impermeable area within the site will be increased following development. There will therefore be an increase in surface water runoff from the site when it is developed. It is considered that the site currently drains via infiltration and evaporation and overland flow to the sewers within Leak Hall Crescent.

The development site is considered to be of a small size with no space set aside, in which to incorporate SUDs techniques such as ponds and wet lands. The following SUDS techniques shown overleaf within Table 1-1. The precise combination of methods used will be dependent upon the site constraints identified at the final design stage.

Table 1-1: SUDS Techniques and Suitability of Use

Method	Description	Potential for use at site
Filter drains	Drainage trench filled with gravel and provided with a pipe	Could be used to intercept overland flows.
Swales	Shallow grass ditch	Could be used to intercept overland flows.
Permeable surfaces	Pavement surfaces that allow water to pass through into underlying storage in sub base e.g. permeable concrete block paving or porous asphalt.	Proposed as treatment under private drive areas.
Ponds and basins	Open areas that are used to store and treat rainwater. Ponds are permanent bodies of water and basins are generally dry and occasionally store water.	Not incorporated into design.
Green roofs	Roof system that is vegetated with plants (note sedum plants rather than grass so no mowing is required)	Not incorporated into design.
Infiltration devices	Methods that allow rainwater to soak into the ground, e.g. soakaways.	Ground conditions not suitable.
Storage tanks	Underground tanks that temporarily store water in the drainage system.	Oversized sewer within adoptable highway recommended.

3. DESIGN OF PROPOSED SURFACE WATER DRAINAGE SYSTEM

Catchment Area

The individual catchment areas for the proposed residential dwellings, driveways and access road were calculated from proposed layout drawing provide by the client. A total roofed and paved area of 0.203 hectares has been estimated.

Drainage Strategy

The proposed drainage strategy is as follows and is illustrated on the drainage layout drawing provided at Appendix C of this report.

- Dwellings and Access roads. Soakaways are not a practical solution due to limited infiltration. As such, the area below the access roads will be constructed with oversized twin pipes for attenuation. The runoff has been estimated at 100%.
- Private driveways will be constructed using under drained permeable paving to provide treatment.

Adoption & Maintenance

It is considered that the plot drainage will be maintained by the individual owners of the dwellings. The access road and drainage within the road area will be adopted.

Existing Runoff from Site

The existing site is unused vegetated area with no formalised drainage. The site covers an area of 0.4 hectares and using the H R Wallingford Greenfield runoff calculation method the peak Q bar runoff for the area has been estimated at 2.48l/s. The calculation sheet is provided at Appendix A.

Yorkshire Water consider that restricting to less than 75mm orifice/control is impractical. This equates to approximately 3.5l/s. As such, the site has been restricted to 3.5l/s for this assessment.

Discharge to combined sewer

At this stage it is assumed that the YW combined sewer has been extend to the hammerhead to serve the additional 4 dwellings close to the site. If this is not the case the developer will need to construct a 150mm diameter sewer approximately 100 in length within Leak Hall Crescent to connect with the YW combined sewer.

A restricted discharge rate of 3.5/s will be provided by a hydrobrake. The proposal includes an overall proposed impermeable area of 0.203 hectares. As such, the attenuation within the site has been calculated with the total impermeable area of 0.203 hectares discharging to the local watercourse at a peak rate of 3.5 l/s.

Using WinDes Source Control software developed by Microdrainage the required permeable paving depths have been calculated for the 1 in 100 year plus climate change (40%) event. Reference should be made to Appendix D where the calculation sheets are provided. The attenuation size has been tabulated below. The drainage strategy drawing provided at Appendix C shows the location of the drainage systems. The total storage volume required during the design storm has been estimated at 133.2m³.

Table 3-1: Attenuation sizes for 1 in 100 year plus (40%) climate change event

Storage Area	Approx Volume Provided (m³)
107m of twin 900mm diameter pipes	133.2m³
Total Volume provided	133.2m³

Permeable Paving Maintenance

Following construction regular inspection is recommended. The main concern is the clogging of the joints which limits the volume of water being passed through into the voided stone. The frequency of cleaning and maintenance is related to the potential design life of the paving system. The maintenance plan has been tabulated below and will be the responsibility of the appointed management company.

Maintenance Schedule	Required action	Frequency
Monitoring	Inspect paving for clogging, litter, weeds and water ponding.	Prior to hand over
	Inspect paving for clogging, litter, weeds and water ponding.	6 monthly
	Inspect paving for deformation	6 monthly
Regular Maintenance	Vacuum sweep litter and weed removal	12 Monthly
Remedial actions	Repair deformation of blocks once settlement stopped	As required
	Reconstruction	15 to 25 years

Appendix A: - Runoff Calculations

hrwallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	lea favill
Site name:	Leak Hill Lane
Site location:	Denby Dale

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:	53.57557° N
Longitude:	1.65561° W
Reference:	321267987
Date:	Jun 19 2024 10:52

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.4

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):	866	866
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

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

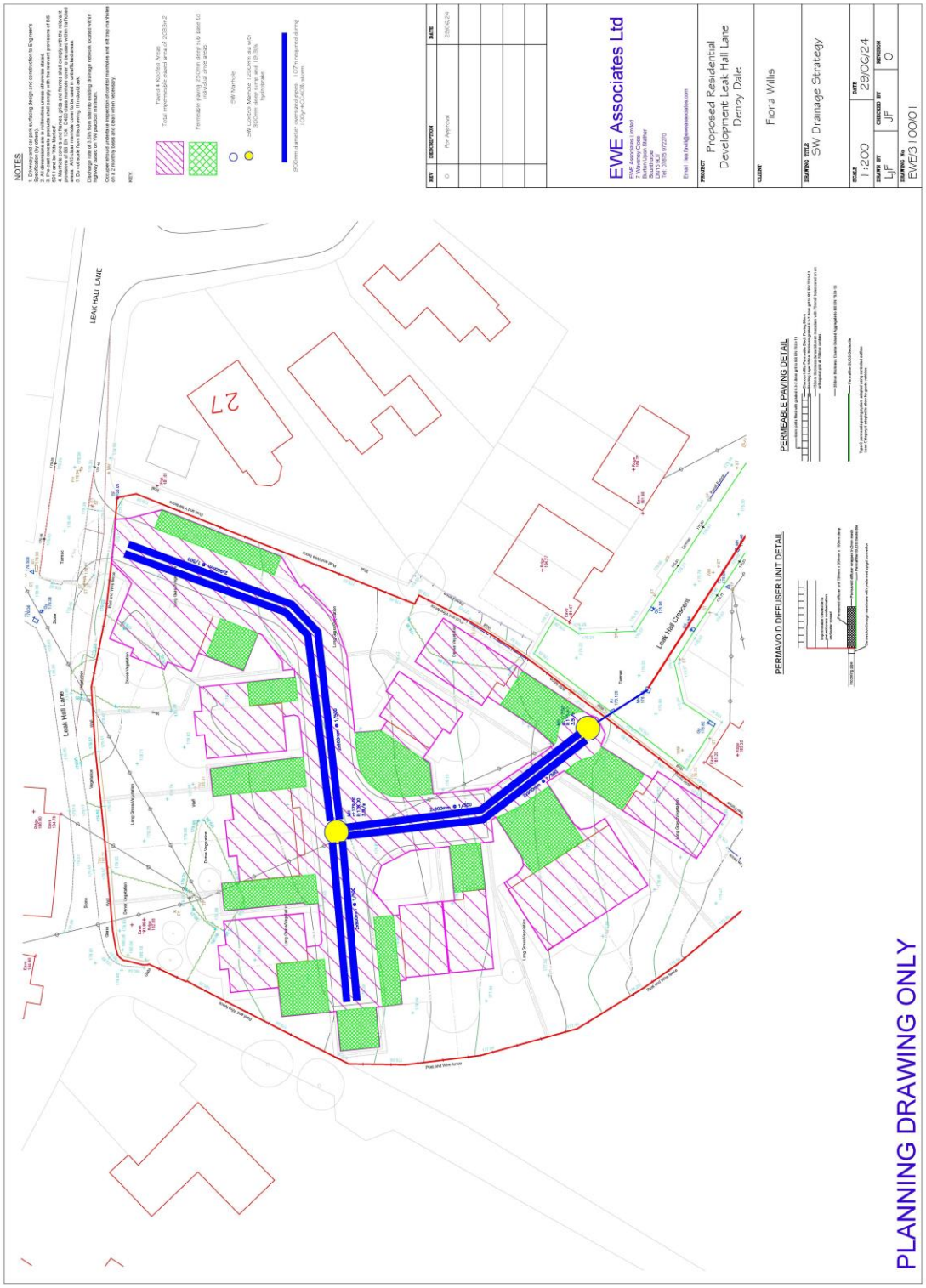
Default Edited

Q_{BAR} (l/s):	2.48	2.48
1 in 1 year (l/s):	2.13	2.13
1 in 30 years (l/s):	4.33	4.33
1 in 100 year (l/s):	5.15	5.15
1 in 200 years (l/s):	5.87	5.87

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.

Appendix B: - Sewer Plan

Appendix C: - Drainage Strategy Plan



Appendix D: - WINDES Storage Calculations

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/06/2024 19:36	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 478 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	175.813	0.413	0.0	1.9	1.9	62.8	O K
30 min Summer	175.891	0.491	0.0	2.0	2.0	74.7	O K
60 min Summer	175.977	0.577	0.0	2.2	2.2	87.8	O K
120 min Summer	176.064	0.664	0.0	2.4	2.4	100.9	O K
180 min Summer	176.107	0.707	0.0	2.4	2.4	107.5	O K
240 min Summer	176.131	0.731	0.0	2.5	2.5	111.1	O K
360 min Summer	176.149	0.749	0.0	2.5	2.5	113.9	O K
480 min Summer	176.156	0.756	0.0	2.5	2.5	114.9	O K
600 min Summer	176.157	0.757	0.0	2.5	2.5	115.1	O K
720 min Summer	176.156	0.756	0.0	2.5	2.5	114.9	O K
960 min Summer	176.171	0.771	0.0	2.5	2.5	117.3	O K
1440 min Summer	176.178	0.778	0.0	2.6	2.6	118.2	O K
2160 min Summer	176.163	0.763	0.0	2.5	2.5	116.0	O K
2880 min Summer	176.137	0.737	0.0	2.5	2.5	112.0	O K
4320 min Summer	175.994	0.594	0.0	2.2	2.2	90.3	O K
5760 min Summer	175.883	0.483	0.0	2.0	2.0	73.4	O K
7200 min Summer	175.793	0.393	0.0	1.8	1.8	59.8	O K
8640 min Summer	175.717	0.317	0.0	1.8	1.8	48.2	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	167.664	19
30 min Summer	101.113	33
60 min Summer	60.978	62
120 min Summer	36.774	122
180 min Summer	27.357	182
240 min Summer	22.177	240
360 min Summer	16.498	336
480 min Summer	13.374	392
600 min Summer	11.365	454
720 min Summer	9.949	520
960 min Summer	8.292	658
1440 min Summer	6.413	938
2160 min Summer	4.960	1360
2880 min Summer	4.134	1760
4320 min Summer	2.936	2552
5760 min Summer	2.303	3336
7200 min Summer	1.908	4104
8640 min Summer	1.636	4848

EWE Associates Ltd		Page 2
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/06/2024 19:36	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	175.639	0.239	0.0	1.8	1.8	36.3	O K
15 min Winter	175.863	0.463	0.0	2.0	2.0	70.4	O K
30 min Winter	175.952	0.552	0.0	2.2	2.2	83.9	O K
60 min Winter	176.050	0.650	0.0	2.3	2.3	98.8	O K
120 min Winter	176.150	0.750	0.0	2.5	2.5	114.0	O K
180 min Winter	176.203	0.803	0.0	2.6	2.6	122.0	O K
240 min Winter	176.237	0.837	0.0	2.7	2.7	126.7	O K
360 min Winter	176.275	0.875	0.0	2.7	2.7	130.9	O K
480 min Winter	176.283	0.883	0.0	2.7	2.7	131.6	O K
600 min Winter	176.284	0.884	0.0	2.7	2.7	131.7	O K
720 min Winter	176.279	0.879	0.0	2.7	2.7	131.3	O K
960 min Winter	176.303	0.903	0.0	2.8	2.8	133.2	O K
1440 min Winter	176.289	0.889	0.0	2.7	2.7	132.1	O K
2160 min Winter	176.230	0.830	0.0	2.6	2.6	125.8	O K
2880 min Winter	176.175	0.775	0.0	2.6	2.6	117.8	O K
4320 min Winter	175.982	0.582	0.0	2.2	2.2	88.4	O K
5760 min Winter	175.837	0.437	0.0	1.9	1.9	66.4	O K
7200 min Winter	175.713	0.313	0.0	1.8	1.8	47.6	O K
8640 min Winter	175.534	0.134	0.0	1.8	1.8	20.4	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	1.437	5640
15 min Winter	167.664	19
30 min Winter	101.113	33
60 min Winter	60.978	62
120 min Winter	36.774	120
180 min Winter	27.357	178
240 min Winter	22.177	234
360 min Winter	16.498	344
480 min Winter	13.374	442
600 min Winter	11.365	476
720 min Winter	9.949	550
960 min Winter	8.292	706
1440 min Winter	6.413	1012
2160 min Winter	4.960	1452
2880 min Winter	4.134	1876
4320 min Winter	2.936	2684
5760 min Winter	2.303	3512
7200 min Winter	1.908	4328
8640 min Winter	1.636	4672

EWE Associates Ltd		Page 3
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 29/06/2024 19:36	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	175.503	0.103	0.0	1.7	1.7	15.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	1.437	5224

EWE Associates Ltd		Page 4
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 29/06/2024 19:36	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	423050 408550 SE 23050 08550
C (1km)	-0.026
D1 (1km)	0.390
D2 (1km)	0.486
D3 (1km)	0.276
E (1km)	0.305
F (1km)	2.371
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time / Area Diagram

Total Area (ha) 0.204

Time (mins)	Area (ha)
0-4	0.204

EWE Associates Ltd		Page 5
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/06/2024 19:36	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Model Details

Storage is Online Cover Level (m) 177.000

Cellular Storage Structure

Invert Level (m) 175.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	160.0	160.0	2.600	0.0	205.5
0.200	160.0	170.1	2.800	0.0	205.5
0.400	160.0	180.2	3.000	0.0	205.5
0.600	160.0	190.4	3.200	0.0	205.5
0.800	160.0	200.5	3.400	0.0	205.5
1.000	0.0	205.5	3.600	0.0	205.5
1.200	0.0	205.5	3.800	0.0	205.5
1.400	0.0	205.5	4.000	0.0	205.5
1.600	0.0	205.5	4.200	0.0	205.5
1.800	0.0	205.5	4.400	0.0	205.5
2.000	0.0	205.5	4.600	0.0	205.5
2.200	0.0	205.5	4.800	0.0	205.5
2.400	0.0	205.5	5.000	0.0	205.5

Hydro-Brake® Outflow Control

Design Head (m) 1.500 Hydro-Brake® Type Md4 Invert Level (m) 175.400
Design Flow (l/s) 3.5 Diameter (mm) 61

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.7	1.200	3.2	3.000	5.0	7.000	7.7
0.200	1.5	1.400	3.4	3.500	5.4	7.500	7.9
0.300	1.6	1.600	3.7	4.000	5.8	8.000	8.2
0.400	1.8	1.800	3.9	4.500	6.2	8.500	8.5
0.500	2.1	2.000	4.1	5.000	6.5	9.000	8.7
0.600	2.2	2.200	4.3	5.500	6.8	9.500	8.9
0.800	2.6	2.400	4.5	6.000	7.1		
1.000	2.9	2.600	4.7	6.500	7.4		