5th Floor
Waterfront House
Station Street
Nottingham
NG2 3DQ

Arun District Council
Civic Centre
Maltravers Rd
Littlehampton
BN17 5LF

Our Ref: PD/243912
Date: 7th July 2025
BWB Contact: Tim Jones
Mobile: [redacted]
Email:

Dear Sir/Madam

PLANNING REF BE/150/22/OUT – NEWLANDS ROAD, BOGNOR REGIS – SURFACE WATER DRAINAGE

This letter has been produced in response to the recent LLFA/Arun District Council Drainage Engineer comments. The purpose of the below is to provide the necessary information for discharging the following surface water drainage related conditions:

Condition 22 – Surface Water Drainage

Condition 23 – Discharge to a Watercourse

Condition 24 – Maintenance

The exact wording of Condition 22 is as follows:

Development shall not commence, other than works of site survey and investigation, until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority. The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, and the recommendations of the SuDS Manual produced by CIRIA. Design considerations must take full account of the 'Supplementary Requirements for Surface Water Drainage Proposals' produced by Arun District Council, and are an overriding factor in terms of requirements. Winter groundwater monitoring to establish highest annual ground water levels and winter percolation testing to BRE 365, or similar approved, will be required to support the design of any infiltration drainage. No building / No part of the extended building shall be occupied until the complete surface water drainage system serving the property has been implemented in accordance with the agreed details and the details so agreed shall be maintained in good working order in perpetuity.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies W SP1, W DM1, W DM2 and W DM3 of the Arun Local Plan. This is required to be a precommencement condition because it is necessary to implement the surface water drainage system prior to commencing any building works.

The following information was provided in relation to discharging condition 24:

- Drainage Layout Dwg. No. 243912-BWB-EXT-XX-D-C-0500 S3 Rev. P01;
- Drainage Catchment Plan Dwg. No. 243912-BWB-EXT-XX-D-C-0530;
- Drainage Specification Ref. 243912-BWB-EXT-XX-SP-C-0002;
- Hydraulic Flow Report dated 3rd December 2024

In line with Building Regulations Part H the drainage hierarchy for surface water runoff (e.g. discharge to ground, then watercourse, then SW sewer) has been followed.

As outlined in the remediation strategy (NBR-BWB-EGT-XX-RP-LE-0003_RS - Rev P1 dated Nov 2024) the ground water table is relatively high with resting groundwater recorded between 1.09m & 3.25m below ground level (Section 2.15). The base of a soakaway should be located at least 1m above the highest seasonal ground water level to ensure the ground water is protected and the surface water will adequately drain away. This is not possible for the majority of the development and therefore the use of soakaways is limited. From the drainage layout you will see we have encouraged infiltration where possible by the introduction of higher filter drains for example around some of the footways & car parking areas.

The winter groundwater for the site has previously been monitored along with the infiltration testing and is appended to the end of this document (**Appendix A**) which supports the conclusion above that soakaways are limited due to a relatively high seasonal ground water level.

Following the hierarchy the next option is to discharge to a watercourse. The plot does not benefit from a watercourse within its demise so this option has been discounted.

The final available option is to connect to a surface water sewer. The plot is part of a wider development and the infrastructure has been built with a surface water spur/connection specifically for this plot. The surface water discharge rate has been restricted back to the previously approved greenfield runoff rate of 12.5 l/s (as set out in the FRA) to ensure the development does not increase flood risk. The site wide drainage system outfalls in a north easterly direction via an existing sewer in Newlands Road where it ultimately discharges to the nearest watercourse.

The proposed plot drainage has been hydraulically modelled showing no flooding in the 30yr event with minor controlled flooding in the worst case 100yr + 45% climate change event where flood water would be temporarily held in low risk external areas (e.g. lower dock leveller areas/back of service yard). The proposed drainage has been designed such that it does not put the proposed buildings at risk or increase flood risk to the surrounding areas.

The hydraulic modelling submitted previously uses the same principles as set out in the original surface water strategy in the approved Flood Risk & Drainage Statement e.g. based on FSR rainfall and standard Cv values of 0.75 summer & 0.86 winter.

We note that the Arun checklist refers to FEH rainfall a Cv value of 1 and a surcharged outfall. We have therefore re-run the hydraulic calculations which results in an increased volume of flooding. Having reviewed the levels this water can be adequately stored in the lower dock area and to the back of Unit 1 service yard. The updated results are included in **Appendix B**. The updated catchment plan showing the storage areas is included in **Appendix C**.

From a water quality perspective unfortunately due to the approved quantum of development in the outline planning permission (ADS ref BE/150/22/OUT), the need for an acoustic/screening bund to the south east and existing services to the west & south the use of open SuDS on this site are very limited. To ensure water quality is not compromised permeable car parking bays have been proposed. In the higher risk HGV yards full retention oil separators are proposed with silt traps & alarms to adequately treat runoff ensuring oil is reduced to no greater than 5mg/l whilst also allowing for silt/heavy metal removal.

The above addresses the ADC comments (Ref ADC/SB dated 5/6/25) and design checklist including winter groundwater information, hierarchy and hydraulic calculations etc.

The exact wording of Condition 23 is as follows:

The development shall not proceed until details have been submitted to and approved in writing by the Local Planning Authority for any proposals: to discharge flows to watercourses; or for the culverting, diversion, infilling or obstruction of any watercourse on or adjacent to the site. Any discharge to a watercourse must be at a rate no greater than the pre-development run-off values and in accordance with current policies. No construction is permitted, which will restrict current and future landowners from undertaking their riparian maintenance responsibilities in respect to any watercourse or culvert on or adjacent to the site.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies W DM1, W DM2 and W DM3 of the Arun Local Plan. And to ensure that the duties and responsibilities, as required under the Land Drainage Act 1991, and amended by the Flood and Water Management Act 2010, can be fulfilled without additional impediment following the development completion. It is considered necessary for this to be a pre-commencement condition to protect existing watercourses prior to the construction commencing.

As outlined above/as part of condition 22 the site does follow the hierarchy of discharge and connects to a site wide drainage infrastructure system. The flow from the plot in question is restricted back to greenfield runoff rates and treated through the use of permeable parking bays, filter trenches and oil separators with silt traps/alarms as highlighted on the drainage drawing.

The wording of Condition 24 is as follows:

Development shall not commence until full details of the maintenance and management of the surface water drainage system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include details of financial management and arrangements for the replacement of major components at the end of the manufacturer's recommended design life. Upon completed construction of the surface water drainage system, the owner or management company shall strictly adhere to and implement the recommendations contained within the manual.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with polices W DM1, W DM2 and W DM3 of the Arun Local Plan. It is considered necessary for this to be a pre-commencement condition to ensure that the future maintenance and funding arrangements for the surface water disposal scheme are agreed before construction commences.

It is anticipated that the drainage in the shared access road will be maintained by a site wide management company. The individual plots would be maintained by the occupier, potentially using the same/separate management company funded through service charge arrangements. A site specific maintenance guidance document has been produced and is enclosed as **Appendix D**.

Yours faithfully

[redacted]

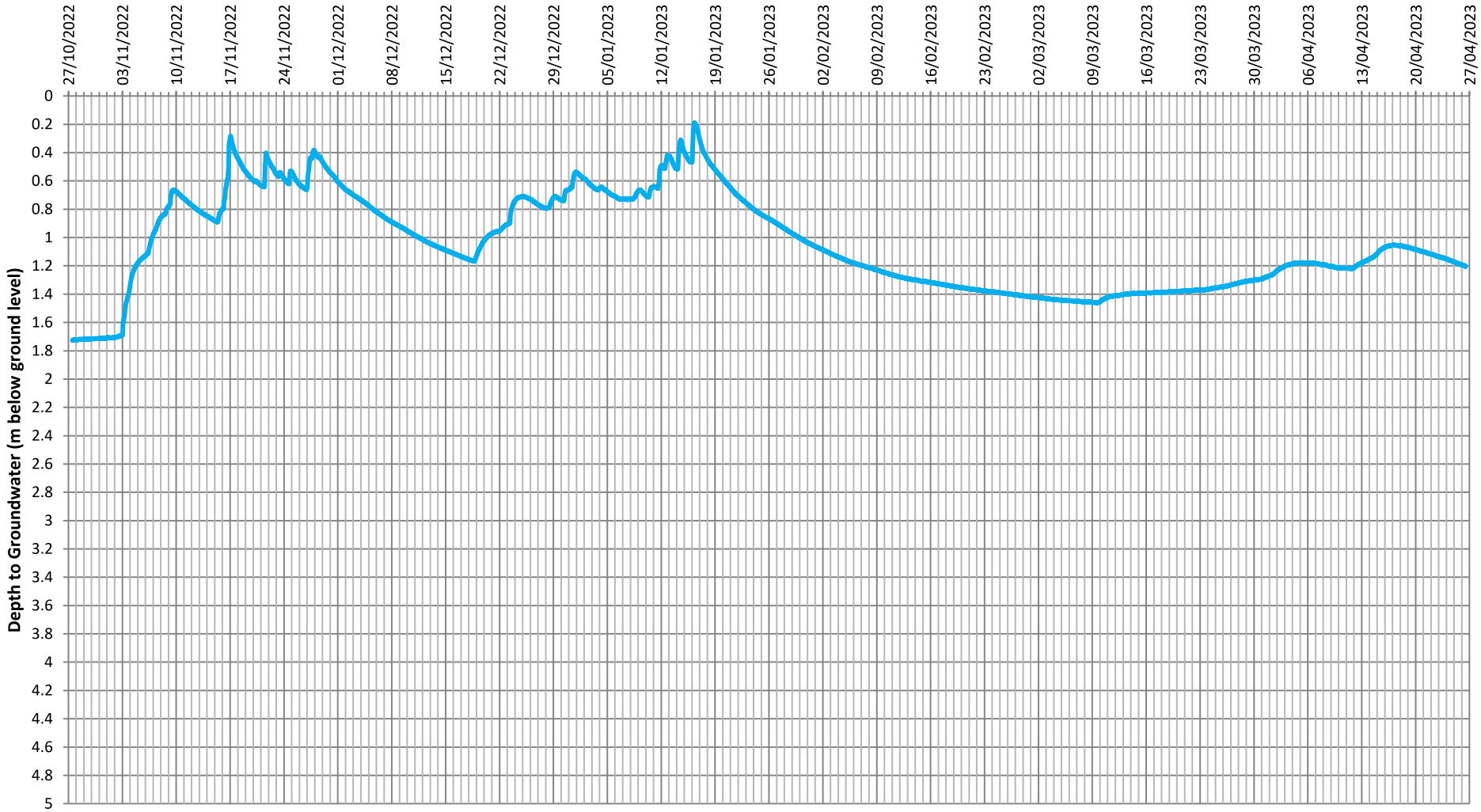
Tim Jones BEng (hons) IEng MICE
Associate Director

APPENDIX A – Winter Groundwater Information

Ashdown Site Investigation Limited

Site: Oldands Phase 3	Project No. P15857

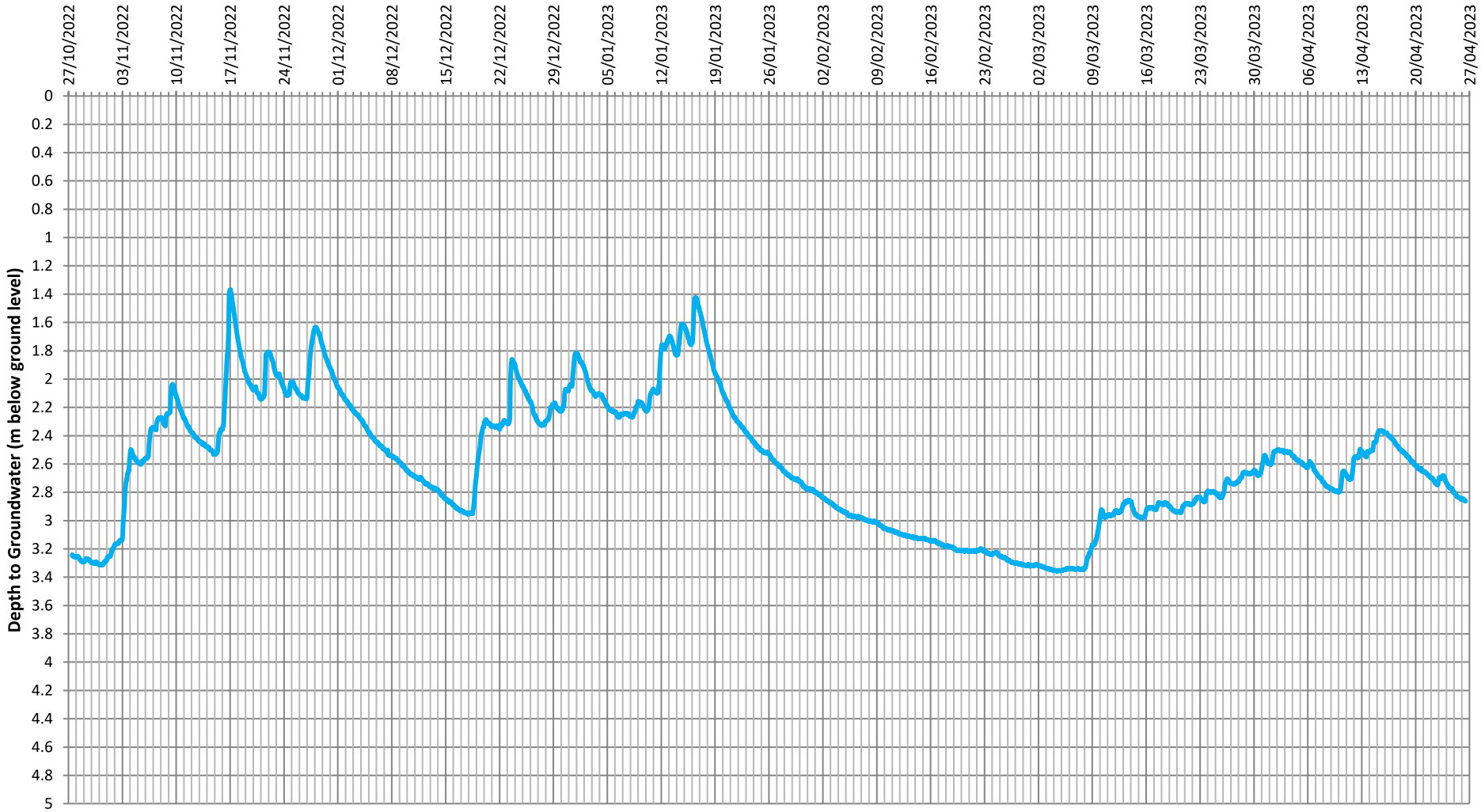
Groundwater Monitoring Results - BH301



Ashdown Site Investigation Limited

Site: Oldands Phase 3	Project No. P15857

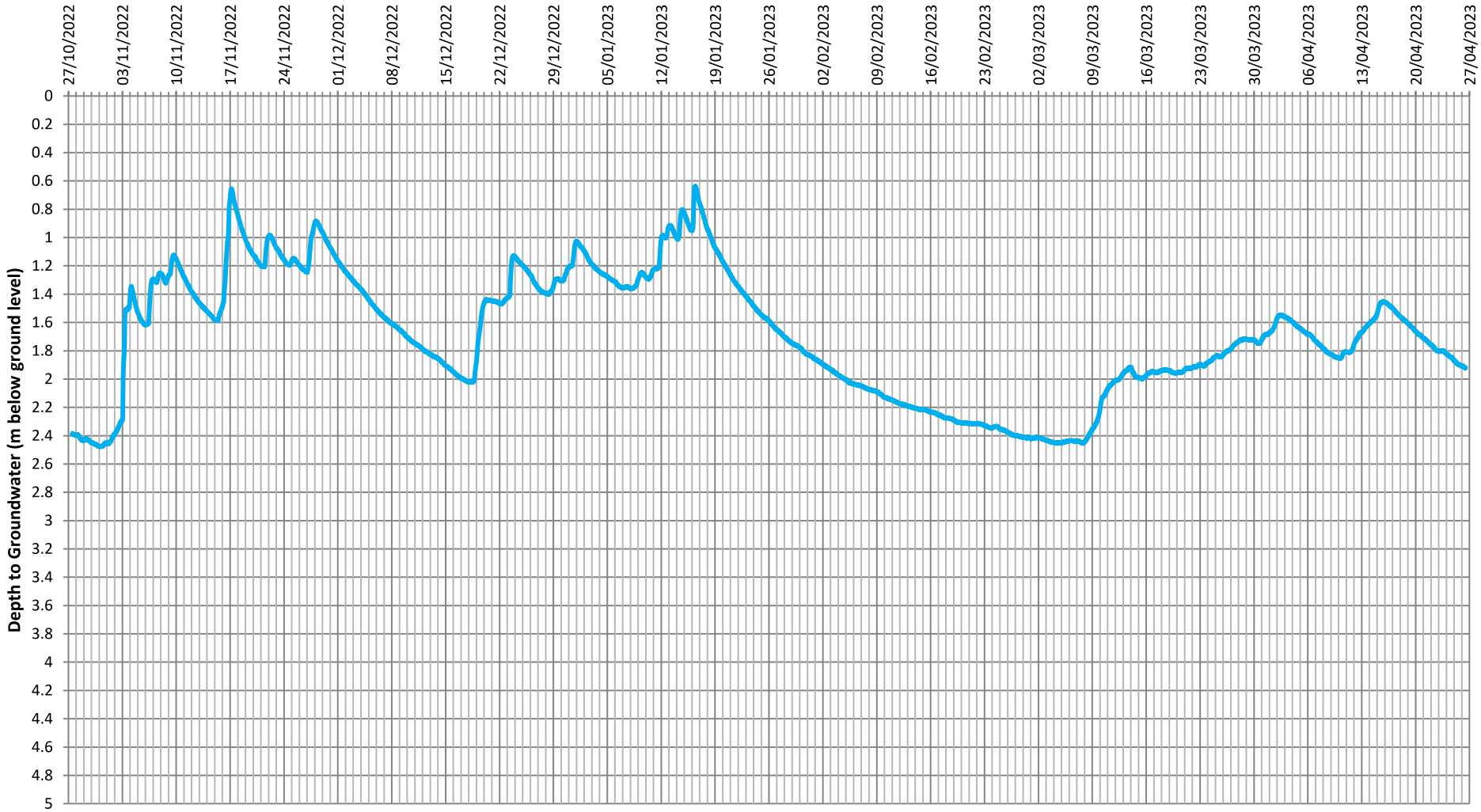
Groundwater Monitoring Results - BH302

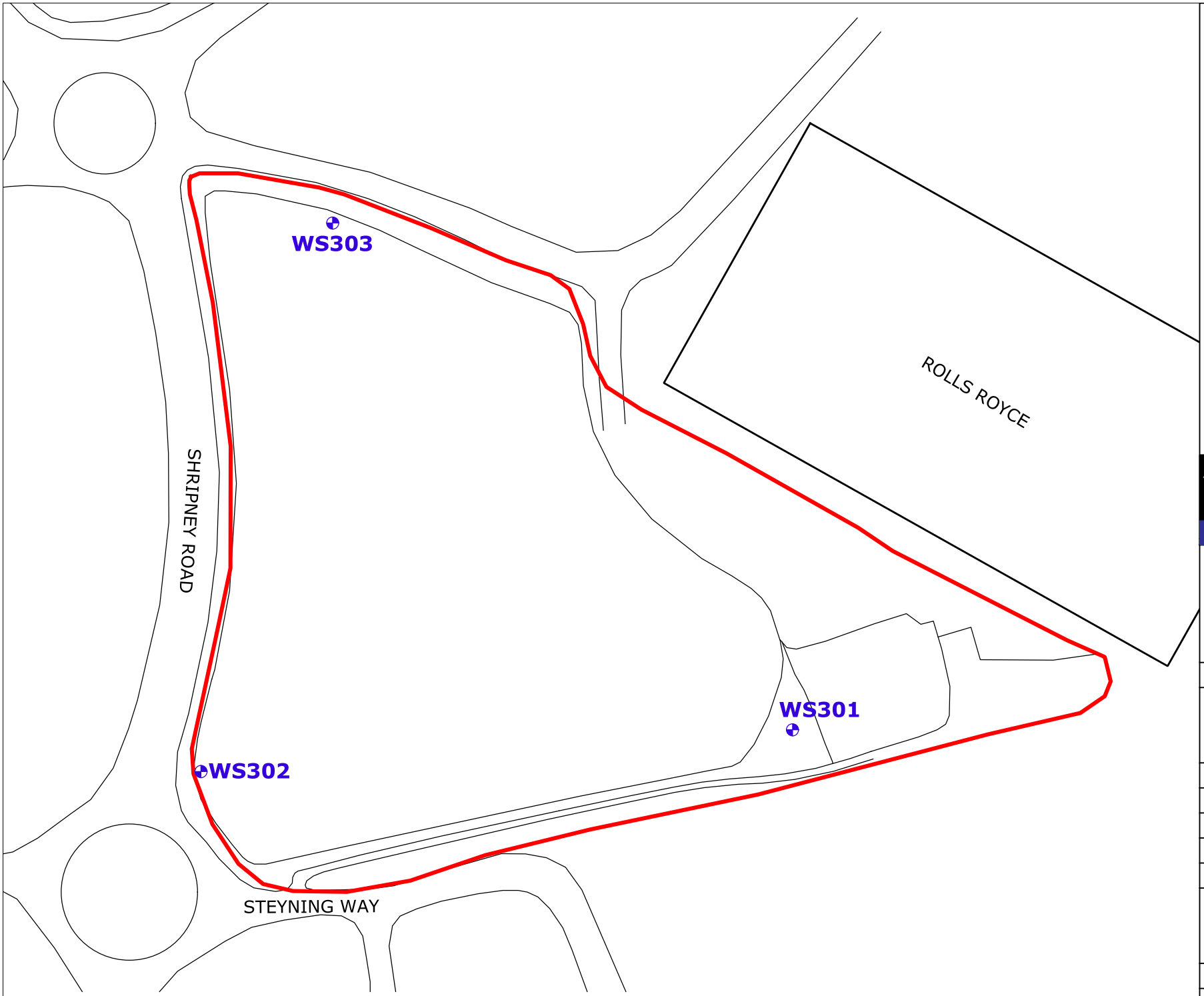


Ashdown Site Investigation Limited

Site: Oldands Phase 3	Project No. P15857

Groundwater Monitoring Results - BH303





N

ASHDOWN SITE INVESTIGATION LIMITED

Unit 3
The Old Grain Store
Ditchling Common Business Park
Ditchling
East Sussex
BN6 8SG
01273 483119
contact@ashdownsi.co.uk

Site:

Oldlands Phase 3
Bognor Regis
West Sussex

Project Ref:

P15533

Figure No.

1

Drawing Title

Sketch Plan Showing Approximate Borehole Locations

Scale

NTS

FURTHER GROUND INVESTIGATION

(SOAKAGE TESTING AND TOPSOIL ASSESSMENT)

AT

OLDLANDS FARM PHASE 3, BOGNOR REGIS

FOR

HANBURY PROPERTIES

G6575

25 January 2024

Ground Management Ltd

Civil and Geotechnical Engineering Services

DOCUMENT CONTROL

Report Title:	Further Ground Investigation – Soakage Tests and Topsoil Assessment Oldlands Farm Phase 3, Bognor Regis		
Report No./ Issue:	G6575-01/1		
Report Status:	Issued for Client Comment		
Distribution:	Hanbury Properties	PDF copy	25 January 2024
	BP Civils		

Prepared by: Alistair Tyler BSc MSc DIC CEng MICE

Signed:

Ground Management Ltd Robin Hill Farm Clay Lane Fishbourne Chichester West Sussex PO18 8AB

[redacted]

CONTENTS

1.0 INTRODUCTION

1.1 Ground Management Ltd have undertaken ground investigation at Oldlands Farm, Bognor Regis to collect information on ground conditions relating to proposals for development.

1.2 The work comprised a series of soakage tests and sampling of topsoil for assessment of suitability for soft landscaping. The locations of sampling and testing were defined by the Client.

1.3 This report provides a record of the investigation and its findings together with discussion and recommendations to assist design.

1.4 Recommendations are based on the conditions revealed by the investigation. Should the proposed development change or ground conditions be found to vary from those previously revealed they should be reported to a geotechnical engineer to consider the significance.

1.5 A contamination assessment has not been requested or carried out.

1.6 The work was carried out on behalf of Hanbury Properties and nothing in this report confers or purports to confer on any third party, any benefit or any right to enforce any term of this report pursuant to the Contract (Rights of Third Parties) Act 1999.

2.0 PROPOSED DEVELOPMENT

2.1 The proposed development comprises Phase 3 of the Oldlands Farm commercial development. Further details have not been received by Ground Management Ltd

3.0 GENERAL DESCRIPTION OF SITE AND SURROUNDING AREA

3.1 The site is located on the northern side of Bognor Regis between North Bersted and Shripney as indicated on Figure 1. The National Grid Reference for the site is SU 94196 01441 approximately and the postcode is PO22 9TR.

3.2 Shripney Road bounds the site to the west with commercial development off Newlands Road to the north and west and a small access track with Steyning Way beyond to the south.

3.3 The site comprises an open field in agricultural production and cultivated during the previous season. The existing site layout is presented on the topographic survey by Siteline Geospacial, dated November 2023, an extract of which is included as Figure 2.

3.4 At the time of the investigation the field was predominantly bare soil with stubble from the previous maize crop. It was noted that following a period of rainfall there were areas of standing water along the compacted vehicle tracks (tramlines).

3.5 By reference to the levels recorded on the topographic survey the site is noted to have slight undulations with higher areas (3.69m and 4.0m AOD) in the centre and south western corner and lower levels (2.86 and 2.18m AOD) in the north west and south east corners. Around the perimeter of the site the ground levels generally slope up across grassed margins outside the cropped area towards the surrounding roads.

3.6 There are some discontinuous sections of hedge around the southern and eastern sides of the site

4.0 GEOLOGY

4.1 The 1:50,000 British Geological Survey of England and Wales Sheet 317/332 "Chichester and Bognor" dated 1996 indicates the site to be underlain by Aeolian Deposits (Brickearth) typically silty clays, over the Upper Chalk.

4.2 By interpretation of the mapping it is anticipated that Raised Beach Deposits comprising sands and gravels may intervene the mapped strata.

4.3 The solid geology is indicated to have a slight southerly dip away from the Littlehampton Anticline that runs east to west approximately 2km north of the site.

5.0 DETAILS OF THE GROUND INVESTIGATION

5.1 The ground investigation fieldwork comprised the exploratory holes as indicated on Figure 2 and described below. The locations and depths of trial pits for soakage testing and topsoil sampling were defined by the Client based on the recommendations of the designer B P Civils.

5.2 The work commenced on 13 December 2023 with the excavation of pits TP1 to TP6.

5.3 Trial pits TP1 to TP4 were each excavated by hand to a depth of 0.5m for the purpose of soakage testing that was conducted in accordance with BRE 365. Testing included 3 fills of each pit and results are appended.

5.4 The exploratory holes were logged in general accordance with BS5930:1999 Code of Practice for Site Investigation. The sampling referencing and the results of in-situ hand shear vane tests are presented on the appended logs.

5.5 Topsoil samples were taken from all six pit locations for laboratory testing to BS3882. Results of the tests are appended.

5.6 Soakage tests were concluded on 15 December and pits were backfilled and the site cleared on 19 December 2023.

6.0 GROUND AND GROUNDWATER CONDITIONS

6.1 Descriptions of the soils encountered are presented on the attached exploratory hole logs. The findings can be summarised as follows:

Strata	Thickness (m)	Depth to base of strata (m bgl)
TOPSOIL. Brown /orange brown slightly friable slightly sandy (fine) slightly clayey silt with occasional coarse medium and fine flint gravel. Locally clayey. Rare flint cobbles.	0.3 – 0.35	0.3 – 035 (see note)
Firm silty CLAY with occasional flint gravel	> 0.2	> 0.5

Note: The depth of topsoil was typically recorded as 0.3m to 0.35m however there was some mixing with the underlying materials resulting in variability and irregularity in the interface and the transition between the strata was observed between 0.3m and 0.4m below ground level.

6.2 Groundwater was not encountered during excavation of the trial pits. As noted previously, following a period of rainfall there were areas of standing water along the compacted vehicle tracks (tramlines).

6.3 Samples taken from the topsoil at each trial pit locations TP1 to TP6 were sent for laboratory testing for the BS3882 Topsoil Suite. Copies of the laboratory test results are appended.

6.4 The soakage test results for TP1 to TP4 are appended and a summary is presented in the table below.

Trial Pit	Pit Dimensions LxWxD (metres)	Test No.	Water Level at start of test (mm below ground level)	Duration of test (mins)	Fall of water level during test (mm)	Infiltration Coefficient (m/s) (see note)
TP1	0.40 x 1.0 x 0.51	1	25	164	465	1.81×10^{-5}
		2	25	289	475	1.56×10^{-5}
		3	15	179	495	1.59×10^{-5}
TP2	0.375 x 0.9 x 0.54	1	30	124	500	4.01×10^{-5}
		2	45	163	495	2.08×10^{-5}
		3	20	170	510	1.75×10^{-5}
TP3	0.4 x 0.9 x 0.54	1	80	246	405	1.32×10^{-5}
		2	20	270	495	1.17×10^{-5}
		3	40	207	500	1.81×10^{-5}
TP4	0.35 x 1.0 x 0.54	1	55	169	445	2.44×10^{-5}
		2	15	256	485	1.35×10^{-5}
		3	10	198	400	1.02×10^{-5}

7.0 DISCUSSION AND RECOMMENDATIONS

7.1 Ground and groundwater conditions

7.1.1 Ground conditions revealed by this investigation confirm the anticipated geology of topsoil above Aeolian Deposits (Brickearth), comprising silty clay. The exploratory holes were of insufficient depth to encounter the underlying Upper Chalk and possible intervening Raised Beach Deposits.

7.1.2 Groundwater was not encountered during the investigation. It is understood that groundwater monitoring within standpipes installed across the site is ongoing.

7.2 Drainage

7.2.1 Based on the results of the infiltration testing preliminary design of shallow infiltration drainage may be based on a minimum infiltration coefficient of 1.0×10^{-5} m/s.

7.2.2 It is noted that based on local experience the infiltration rates were higher than anticipated. This is possibly due to favourable underdrainage or the structure of the soils at shallow depth being more open due to the activity of vegetation and invertebrates. It is recommended that this is given some consideration within the design and further testing should be carried out where the soil structure could have been altered by compaction.

7.2.3 Winter groundwater level monitoring would further inform drainage design and an appropriate maximum depth for soakaways.

7.3 Topsoil Assessment

7.3.1 Assessment of the topsoil suitability has been carried out by AG Geo-consultants Ltd and is presented within the appended document.

7.3.2 It is confirmed that the testing demonstrates that some samples comply with the BS3882 “multipurpose” limits whilst some require the addition of a little organic matter and or potassium in order to comply with the BS3882 limits.

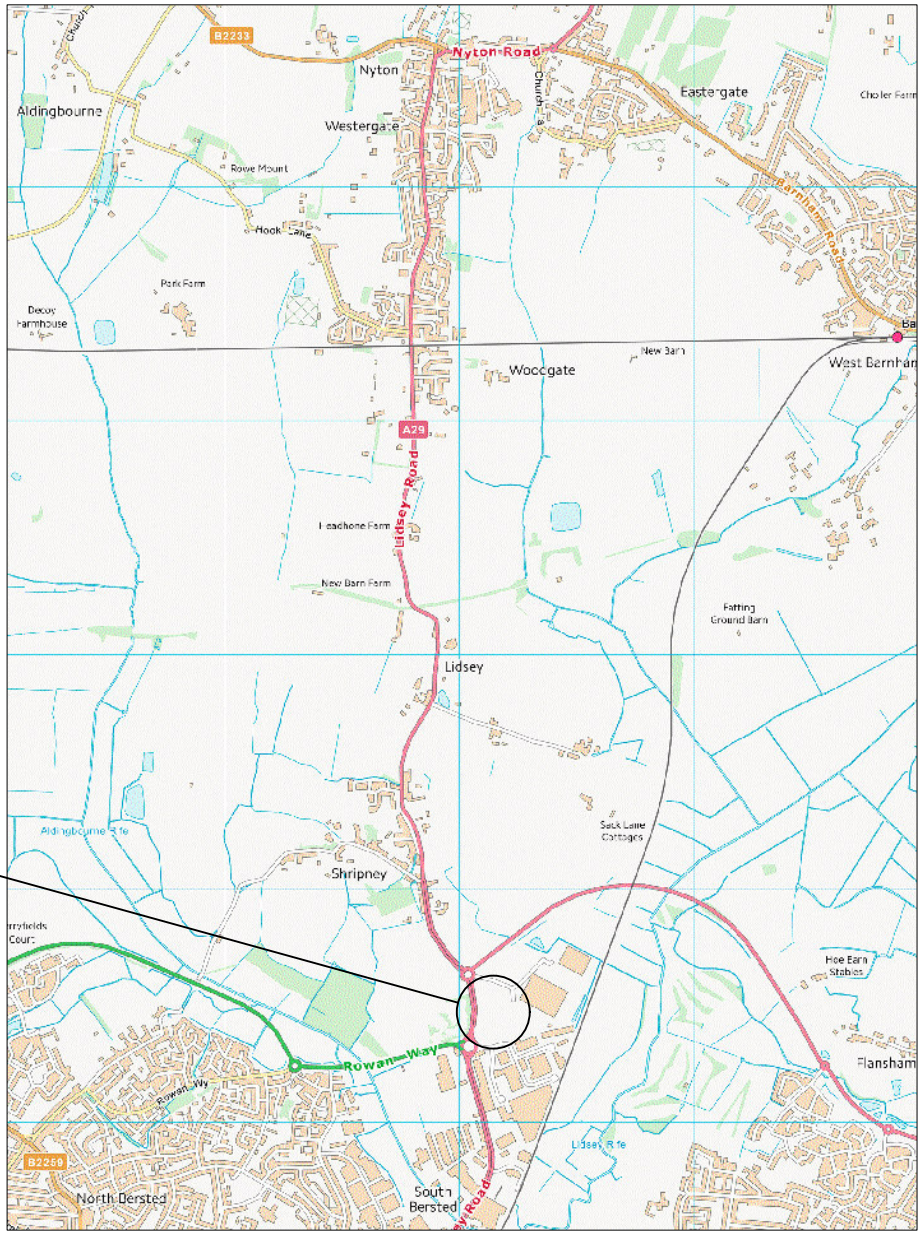
7.3.3 It is further noted that the topsoil includes a low percentage content of coarse flint gravel and cobbles that would be exceed the BS3882 limit of zero for stone content greater than 50mm. This is not reflected by the testing due to the volume of material that would be required to obtain a representative sample. To comply the coarse stone content would require removal.

7.4 The depth of topsoil was typically recorded at the sample locations as 0.3m to 0.35m however there was some mixing with the underlying materials resulting in variability and irregularity in the interface and the transition between the strata was observed between 0.3m and 0.4m below ground level.

7.4.1 We were advised by the Client that they have had contamination investigation carried out so did not require contamination testing and assessment of the topsoil or underlying soils.

Ground Management Ltd Civil and Geotechnical Engineering Services	Robin Hill Farm Clay Lane Fishbourne CHICHESTER West Sussex PO18 8AB [redacted]	PROJECT NO:	G6575
		FIGURE REF:	Figure 1
PROJECT:	Oldlands Farm, Bognor, Phase 3	PREPARED:	AJHT
SECTION:	Further Ground Investigation	CHECKED:	AJHT
TITLE:	Site Location Plan	DATE:	Jan 2024

North
(Not to scale)

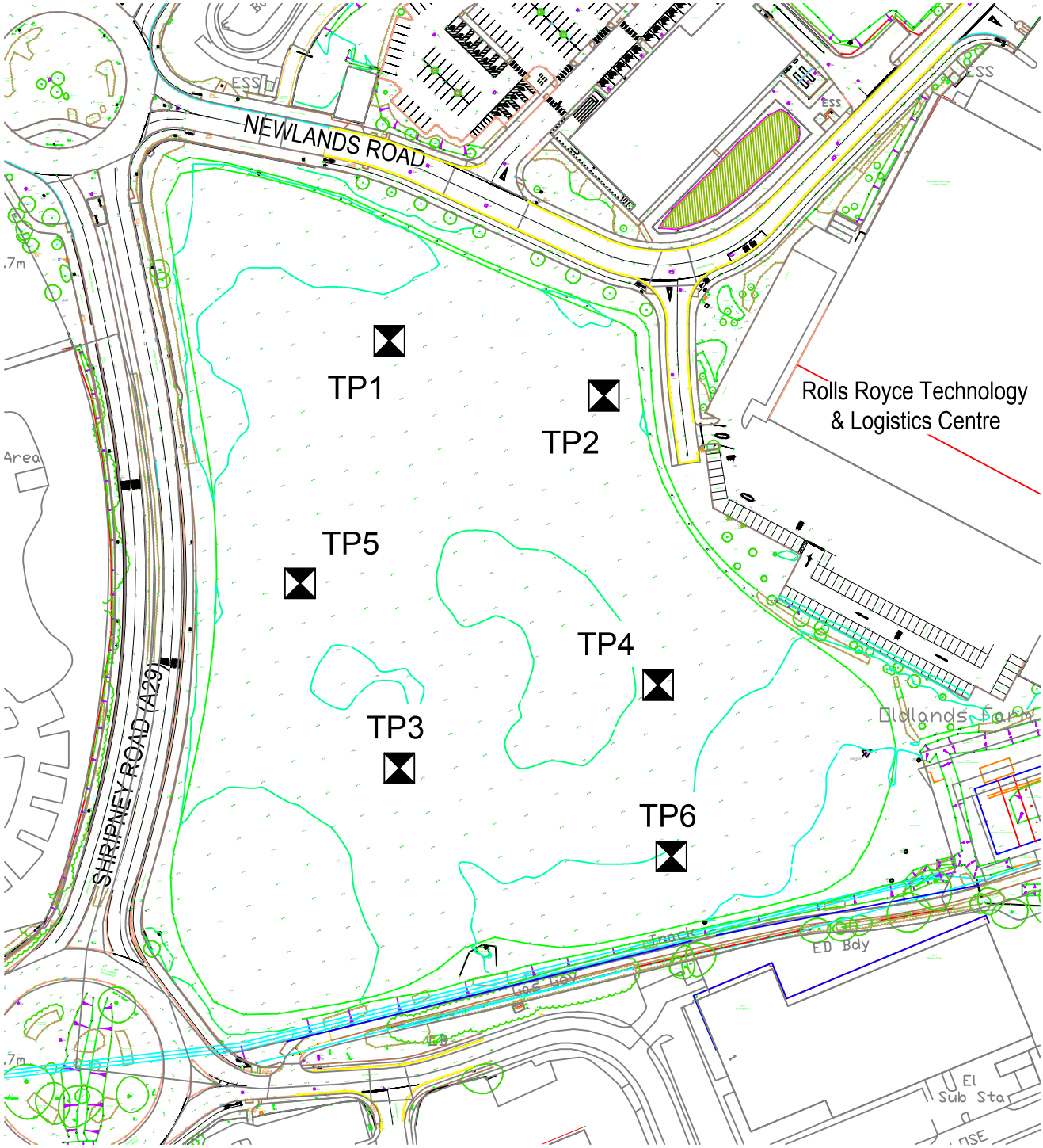


Site Location

Ground Management Ltd Civil and Geotechnical Engineering Services	Robin Hill Farm Clay Lane Fishbourne CHICHESTER West Sussex PO18 8AB [redacted]	PROJECT NO:	G6575
		FIGURE REF:	Figure 2
PROJECT:	Oldlands Farm, Bognor, Phase 3	PREPARED:	AJHT
SECTION:	Further Ground Investigation	CHECKED:	AJHT
TITLE:	Existing Site Layout and Exploratory Hole Location Plan	DATE:	Jan 2024

HOLE LOCATIONS ARE INDICATIVE ONLY UNLESS DIMENSIONED

North
(Approx)



Based on survey by Siteline Geospatialdated November 2023

Ground Management Ltd

Civil and Geotechnical Engineering Services

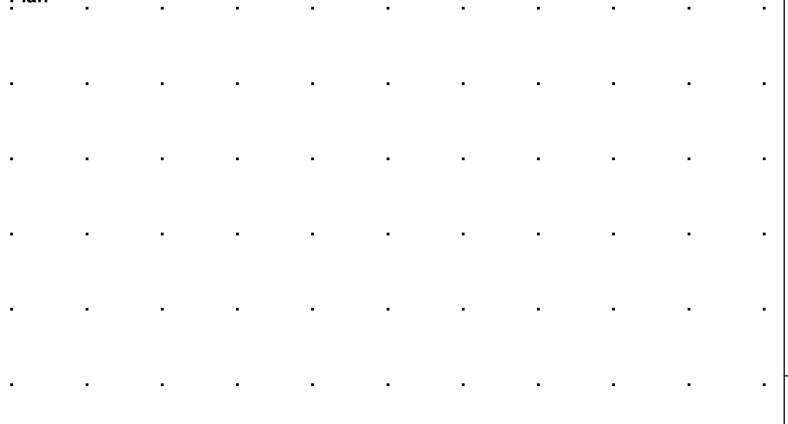
Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
[redacted]

Site	Trial Pit Number
Oldlands Farm Phase 3, Bognor Regis	TP1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand dug	0.4m x 1.0m	3.30	Hanbury Properties	G6575
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	13/12/2023	BP Civils	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30	D1				(0.35)	Moist brown / orange brown slightly friable slightly sandy (fine) slightly clayey silt TOPSOIL with occasional coarse medium and fine subangular to subrounded flint gravel. Below 0.3m becoming		
				2.95	0.35	Firm orange brown silty CLAY		
0.50	V 56.67kPa		60,55,55/Av. 56.67	2.80	(0.15) 0.50	Complete at 0.50m		

Plan



Remarks

Pit sides stable and vertical during excavation
Groundwater was not encountered
Ground level estimated by reference to Site Line Geospatial's topographic survey dated November 2023
There was some mixing of the topsoil with the underlying materials resulting in variability and irregularity in the interface between the strata. A transition zone was generally observed between 0.3m and 0.4m below ground level.

Scale (approx)	Logged By	Figure No.
1:10	AT	G6575.TP1

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
[redacted]

Site	Trial Pit Number
Oldlands Farm Phase 3, Bognor Regis	TP2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand dug	0.375m x 0.9m	3.15	Hanbury Properties	G6575
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	13/12/2023	BP Civils	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.20	D1				(0.30)	Moist brown slightly friable slightly sandy (fine) slightly clayey silt TOPSOIL with occasional coarse medium and fine angular to subrounded flint gravel.		
				2.85	0.30	Firm orange brown silty CLAY		
0.50	V 63.33kPa		60,65,65/Av. 63.33	2.65	(0.20) 0.50	Complete at 0.50m		

Plan

Remarks

There was some mixing of the topsoil with the underlying materials resulting in variability and irregularity in the interface between the strata. A transition zone was generally observed between 0.3m and 0.4m below ground level.
Pit sides stable and vertical during excavation
Groundwater was not encountered
Ground level estimated by reference to Site Line Geospatial's topographic survey dated November 2023

Scale (approx)	Logged By	Figure No.
1:10	AT	G6575.TP2

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
Phone/Fax: 01243 575073
mail@groundmanagement.com

Site	Trial Pit Number
Oldlands Farm Phase 3, Bognor Regis	TP3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand dug	0.4m x 0.9m	3.10	Hanbury Properties	G6575
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	13/12/2023	BP Civils	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						Moist brown slightly friable slightly sandy (fine) slightly clayey silt TOPSOIL with occasional coarse medium and fine angular to subrounded flint gravel and flint cobble		
0.15-0.25	D1				(0.30)	... locally clayey		
				2.80	0.30	Firm orange brown silty CLAY		
					(0.20)	... with a little coarse flint gravel and flint cobble above 0.4m		
0.50	V 50kPa		50,50,50/Av. 50.00	2.60	0.50	Complete at 0.50m		

Plan

Remarks

Pit sides stable and vertical during excavation
Groundwater was not encountered
Ground level estimated by reference to Site Line Geospatial's topographic survey dated November 2023
There was some mixing of the topsoil with the underlying materials resulting in variability and irregularity in the interface between the strata. A transition zone was generally observed between 0.3m and 0.4m below ground level.

Scale (approx)	Logged By	Figure No.
1:10	AT	G6575.TP3

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
[redacted]

Site	Trial Pit Number
Oldlands Farm Phase 3, Bognor Regis	TP4

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand dug	0.35m x 1.0m	3.40	Hanbury Properties	G6575
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	13/12/2023	BP Civils	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.20	D1				(0.35)	Moist brown / orange brown slightly friable slightly sandy (fine) slightly clayey silt TOPSOIL with occasional coarse medium and fine sub angular to rounded flint gravel Below 0.3m becoming ...		
				3.05	0.35 (0.15)	Firm moist brown becoming orange brown silty CLAY		
0.50	V 58.33kPa		55,60,60/Av. 58.33	2.90	0.50	Complete at 0.50m		

Plan

Remarks

Pit sides stable and vertical during excavation
Groundwater was not encountered
Ground level estimated by reference to Site Line Geospatial's topographic survey dated November 2023
There was some mixing of the topsoil with the underlying materials resulting in variability and irregularity in the interface between the strata. A transition zone was generally observed between 0.3m and 0.4m below ground level.

Scale (approx)	Logged By	Figure No.
1:10	AT	G6575.TP4

Ground Management Ltd

Civil and Geotechnical Engineering Services

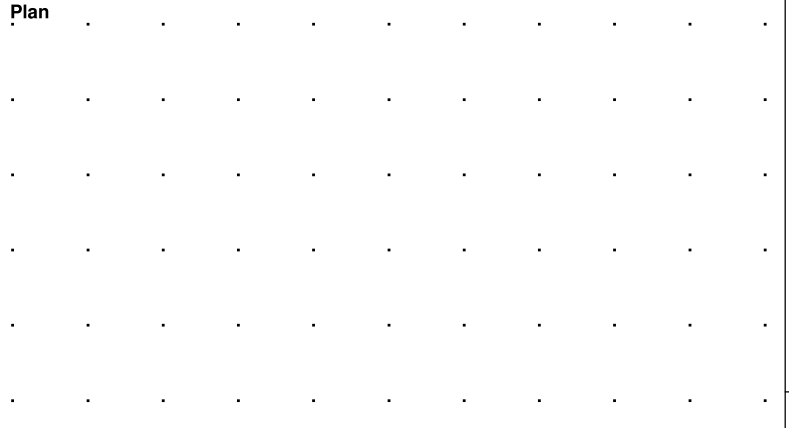
Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
[redacted]

Site	Trial Pit Number
Oldlands Farm Phase 3, Bognor Regis	TP5

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand dug	0.3m x 0.3m	3.15	Hanbury Properties	G6575
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	13/12/2023	BP Civils	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.20	D1				(0.35)	Moist brown slightly friable slightly sandy (fine) slightly clayey silt TOPSOIL with occasional coarse medium and fine angular to subangular flint gravel		
						Below 0.3m becoming orange brown silty clay		
				2.80	0.35			
						Complete at 0.50m		

Plan



Remarks

Pit sides stable and vertical during excavation
Groundwater was not encountered
Ground level estimated by reference to Site Line Geospatial's topographic survey dated November 2023
There was some mixing of the topsoil with the underlying materials resulting in variability and irregularity in the interface between the strata. A transition zone was generally observed between 0.3m and 0.4m below ground level.

Scale (approx)	Logged By	Figure No.
1:10	AT	G6575.TP5

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
[redacted]

Site	Trial Pit Number
Oldlands Farm Phase 3, Bognor Regis	TP6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Hand dug	0.3m x 0.3m	2.95	Hanbury Properties	G6575
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	13/12/2023	BP Civils	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.20	D1				(0.35)	Moist brown / orange brown slightly friable slightly sandy (fine) slightly clayey silt TOPSOIL with occasional coarse medium and fine sub angular to rounded flint gravel		
						Below 0.3m becoming orange brown silty clay		
				2.60	0.35			
						Complete at 0.50m		

Plan

Remarks

Pit sides stable and vertical during excavation
Groundwater was not encountered
Ground level estimated by reference to Site Line Geospatial's topographic survey dated November 2023
There was some mixing of the topsoil with the underlying materials resulting in variability and irregularity in the interface between the strata. A transition zone was generally observed between 0.3m and 0.4m below ground level.

Scale (approx)	Logged By	Figure No.
1:10	AT	G6575.TP6

G6575 Oldlands Farm Phase 3
Soakage Test

TP1 Test 1

Test Start Date: 13-Dec-23

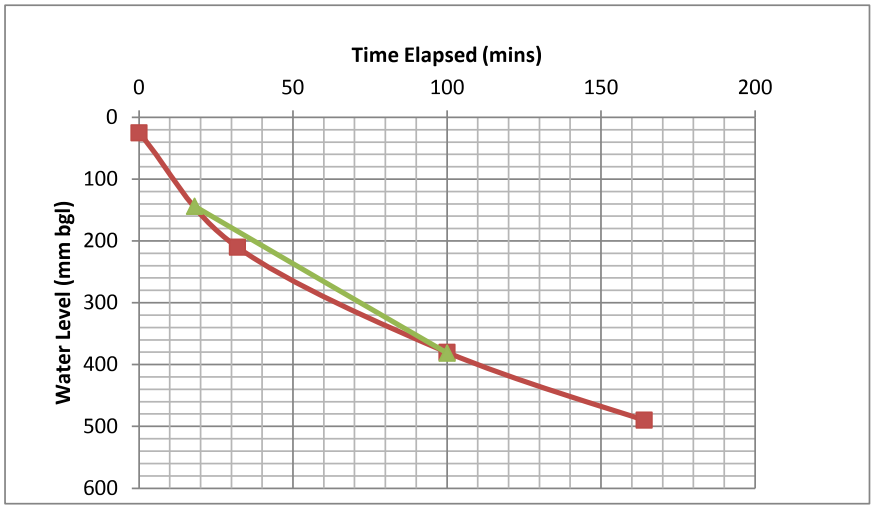
Dimensions (m): width = 0.40 length = 1.00 depth = 0.50

Date	Time	Date and time	Elapsed	Dip
13/12/2023	16:15	13/12/2023 16:15	start	dry
13/12/2023	16:20	13/12/2023 16:20	0	25
13/12/2023	16:52	13/12/2023 16:52	32	210
13/12/2023	18:00	13/12/2023 18:00	100	380
13/12/2023	19:04	13/12/2023 19:04	164	490

End Fit

Weather

Dry following period of wet



0

0 Projected

	Time (mins)	
t0	25	
t25	143.75	18
t50	262.5	
t75	381.25	100
t100	500	
fall		0.475
t25 - t75		0.2375
Area t50		1.065

Infiltration Coefficient = 1.81E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP2 Test 1

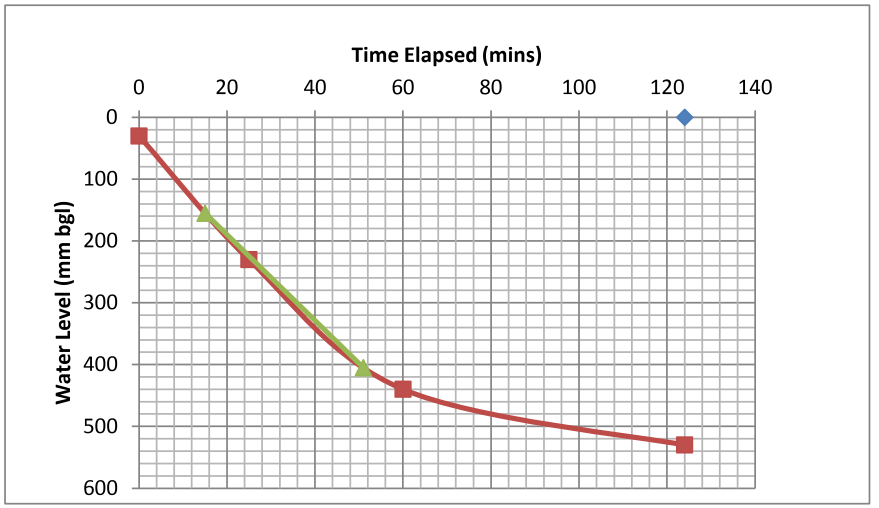
Test Start Date: 13-Dec-23

Dimensions (m): width = 0.375 length = 0.90 depth = 0.53

Date	Time	Date and time	Elapsed	Dip	End Fit
13/12/2023	15:45	13/12/2023 15:45	start	dry	
13/12/2023	15:50	13/12/2023 15:50	0	30	
13/12/2023	16:15	13/12/2023 16:15	25	230	
13/12/2023	16:50	13/12/2023 16:50	60	440	
13/12/2023	17:54	13/12/2023 17:54	124	530	dry

Weather

Dry following period of wet



0

0 Projected

	Time (mins)	
t0	30	
t25	155	15
t50	280	
t75	405	51
t100	530	
fall		0.5
t25 - t75		0.25
Area t50		0.975

Infiltration Coefficient = 4.01E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP3 Test 1

Test Start Date: 13-Dec-23

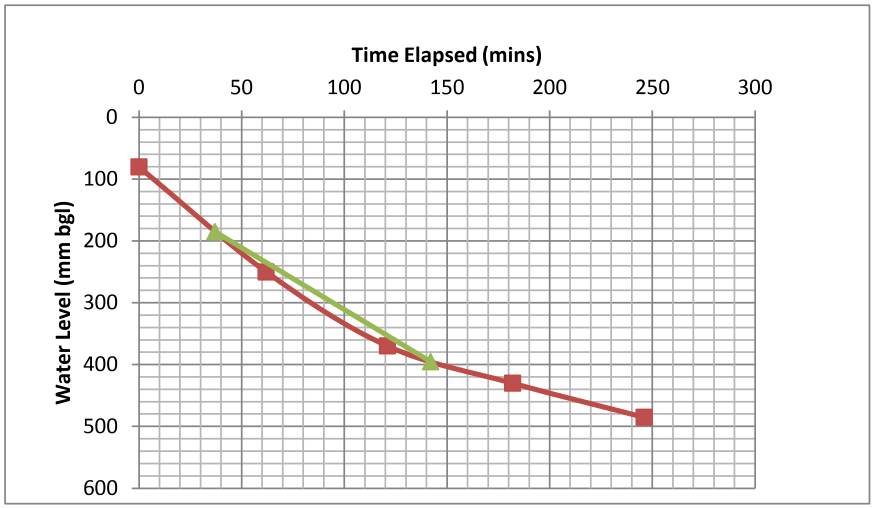
Dimensions (m): width = 0.400 length = 0.90 depth = 0.50

Date	Time	Date and time	Elapsed	Dip
13/12/2023	14:55	13/12/2023 14:55	start	dry
13/12/2023	15:00	13/12/2023 15:00	0	80
13/12/2023	16:02	13/12/2023 16:02	62	250
13/12/2023	17:01	13/12/2023 17:01	121	370
13/12/2023	18:02	13/12/2023 18:02	182	430
13/12/2023	19:06	13/12/2023 19:06	246	485

End Fit

Weather

Dry following period of wet weather



0

0 Projected

	Time (mins)	
t0	80	
t25	185	37
t50	290	
t75	395	142
t100	500	
fall		0.42
t25 - t75		0.21
Area t50		0.906

Infiltration Coefficient = 1.32E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP4 Test 1

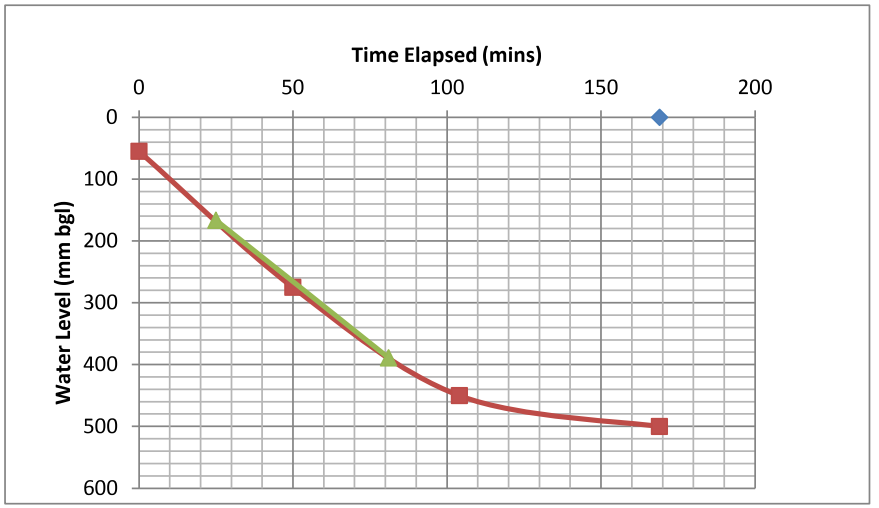
Test Start Date: 13-Dec-23

Dimensions (m): width = 0.350 length = 1.00 depth = 0.50

Date	Time	Date and time	Elapsed	Dip	End Fit
13/12/2023	15:10	13/12/2023 15:10	start	dry	
13/12/2023	15:15	13/12/2023 15:15	0	55	
13/12/2023	16:05	13/12/2023 16:05	50	275	
13/12/2023	16:59	13/12/2023 16:59	104	450	
13/12/2023	18:04	13/12/2023 18:04	169	500	dry

Weather

Dry following period of wet



0

0 Projected

	Time (mins)	
t0	55	
t25	166.25	25
t50	277.5	
t75	388.75	81
t100	500	
fall		0.445
t25 - t75		0.2225
Area t50		0.95075

Infiltration Coefficient = 2.44E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP1 Test 2

Test Start Date: 14-Dec-23

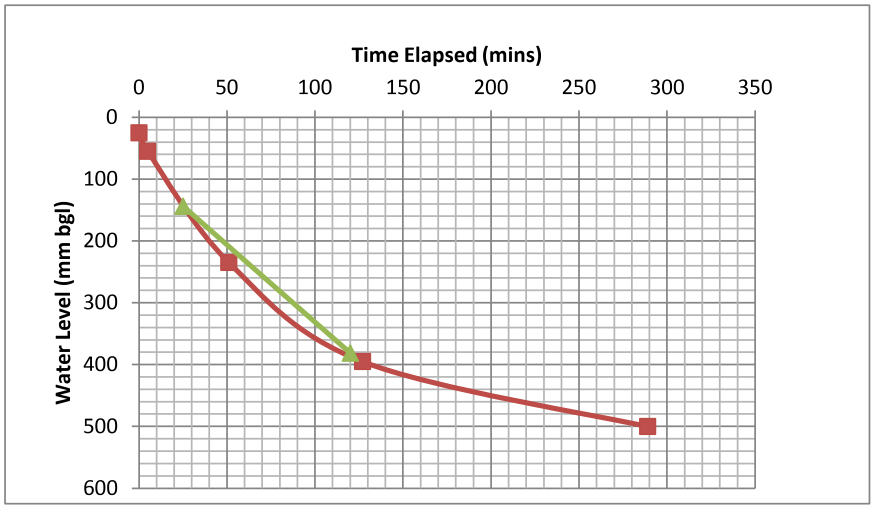
Dimensions (m): width = 0.40 length = 1.00 depth = 0.50

Date	Time	Date and time	Elapsed	Dip
14/12/2023	10:34	14/12/2023 10:34	start	dry
14/12/2023	10:39	14/12/2023 10:39	0	25
14/12/2023	10:44	14/12/2023 10:44	5	55
14/12/2023	11:30	14/12/2023 11:30	51	235
14/12/2023	12:46	14/12/2023 12:46	127	395
14/12/2023	15:28	14/12/2023 15:28	289	500

End Fit

Weather

Some rain



0

0 Projected

	Time (mins)	
t0	25	
t25	143.75	25
t50	262.5	
t75	381.25	120
t100	500	
fall		0.475
t25 - t75		0.2375
Area t50		1.065

Infiltration Coefficient = 1.56E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP2 Test 2

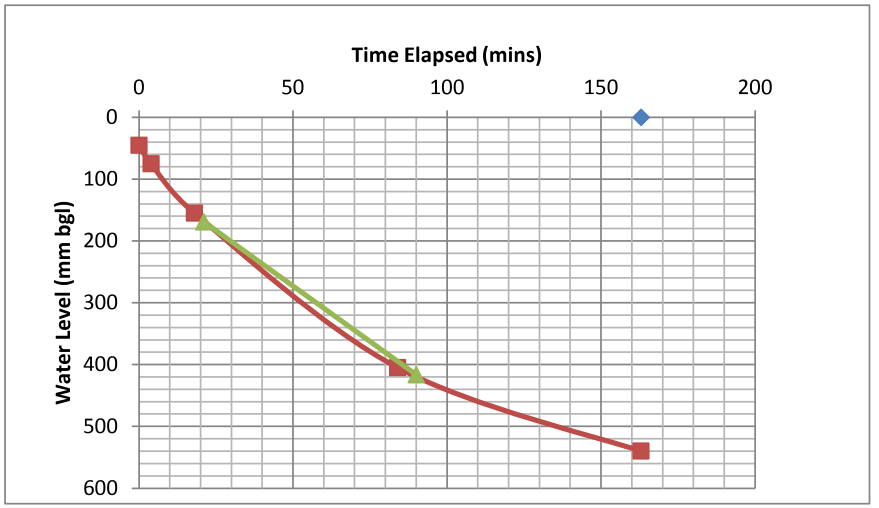
Test Start Date: 14-Dec-23

Dimensions (m): width = 0.375 length = 0.90 depth = 0.54

Date	Time	Date and time	Elapsed	Dip	End Fit
14/12/2023	10:03	14/12/2023 10:03	start	dry	
14/12/2023	10:08	14/12/2023 10:08	0	45	
14/12/2023	10:12	14/12/2023 10:12	4	75	
14/12/2023	10:26	14/12/2023 10:26	18	155	
14/12/2023	11:32	14/12/2023 11:32	84	405	
14/12/2023	12:51	14/12/2023 12:51	163	540	dry

Weather

Some rain



0

0 Projected

	Time (mins)	
t0	45	
t25	168.75	21
t50	292.5	
t75	416.25	90
t100	540	
fall		0.495
t25 - t75		0.2475
Area t50		0.968625

Infiltration Coefficient = 2.08E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP3 Test 2

Test Start Date: 14-Dec-23

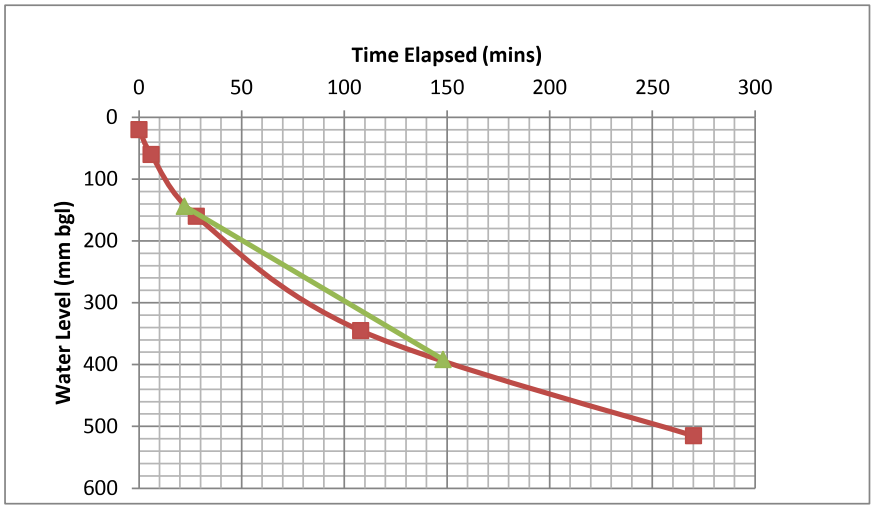
Dimensions (m): width = 0.400 length = 0.90 depth = 0.515

Date	Time	Date and time	Elapsed	Dip
14/12/2023	10:55	14/12/2023 10:55	start	dry
14/12/2023	11:00	14/12/2023 11:00	0	20
14/12/2023	11:06	14/12/2023 11:06	6	60
14/12/2023	11:28	14/12/2023 11:28	28	160
14/12/2023	12:48	14/12/2023 12:48	108	345
14/12/2023	15:30	14/12/2023 15:30	270	515

End Fit

Weather

Some rain



0

0 Projected

	Time (mins)	
t0	20	
t25	143.75	22
t50	267.5	
t75	391.25	148
t100	515	
fall		0.495
t25 - t75		0.2475
Area t50		1.0035

Infiltration Coefficient = 1.17E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

Test Start Date: 14-Dec-23

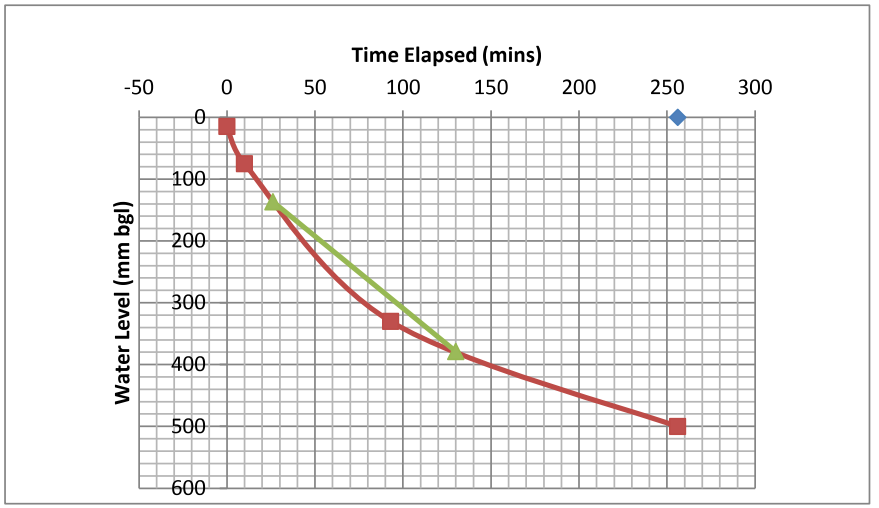
TP4 Test 2

Dimensions (m): width = 0.350 length = 1.00 depth = 0.50

Date	Time	Date and time	Elapsed	Dip	End Fit
14/12/2023	11:11	14/12/2023 11:11	start	dry	
14/12/2023	11:16	14/12/2023 11:16	0	15	
14/12/2023	11:26	14/12/2023 11:26	10	75	
14/12/2023	12:49	14/12/2023 12:49	93	330	
14/12/2023	15:32	14/12/2023 15:32	256	500	dry

Weather

Some rain



0

0 Projected

	Time (mins)	
t0	15	
t25	136.25	26
t50	257.5	
t75	378.75	130
t100	500	
fall		0.485
t25 - t75		0.2425
Area t50		1.00475

Infiltration Coefficient = 1.35E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP1 Test 3

Test Start Date: 15-Dec-23

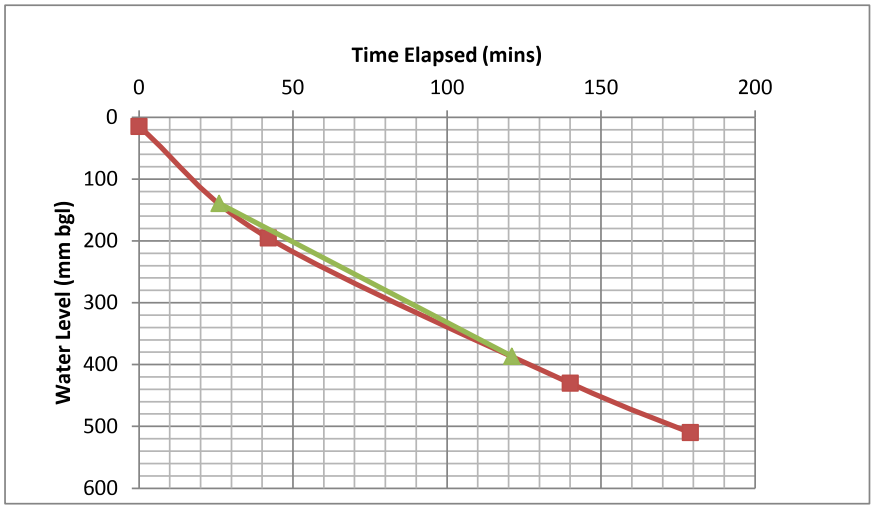
Dimensions (m): width = 0.40 length = 1.00 depth = 0.51

Date	Time	Date and time	Elapsed	Dip
15/12/2023	10:32	15/12/2023 10:32	start	dry
15/12/2023	10:37	15/12/2023 10:37	0	15
15/12/2023	11:19	15/12/2023 11:19	42	195
15/12/2023	12:57	15/12/2023 12:57	140	430
15/12/2023	13:36	15/12/2023 13:36	179	510

End Fit

Weather

Mostly dry



0

0 Projected

	Time (mins)	
t0	15	
t25	138.75	26
t50	262.5	
t75	386.25	121
t100	510	
fall		0.495
t25 - t75		0.2475
Area t50		1.093

Infiltration Coefficient = 1.59E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP2 Test 3

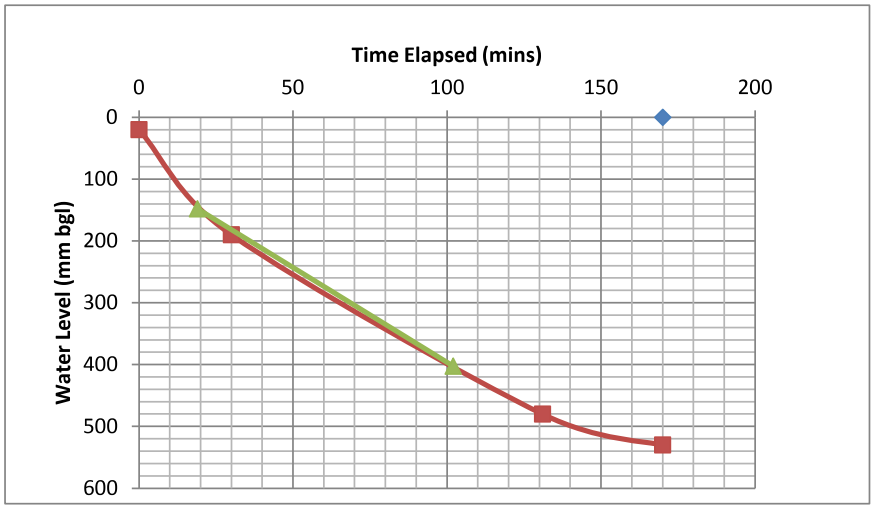
Test Start Date: 15-Dec-23

Dimensions (m): width = 0.375 length = 0.90 depth = 0.53

Date	Time	Date and time	Elapsed	Dip	End Fit
15/12/2023	10:43	15/12/2023 10:43	start	dry	
15/12/2023	10:48	15/12/2023 10:48	0	20	
15/12/2023	11:18	15/12/2023 11:18	30	190	
15/12/2023	12:59	15/12/2023 12:59	131	480	
15/12/2023	13:38	15/12/2023 13:38	170	530	dry

Weather

Mostly dry



0

0 Projected

	Time (mins)	
t0	20	
t25	147.5	19
t50	275	
t75	402.5	102
t100	530	
fall		0.51
t25 - t75		0.255
Area t50		0.98775

Infiltration Coefficient = 1.75E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP3 Test 3

Test Start Date: 15-Dec-23

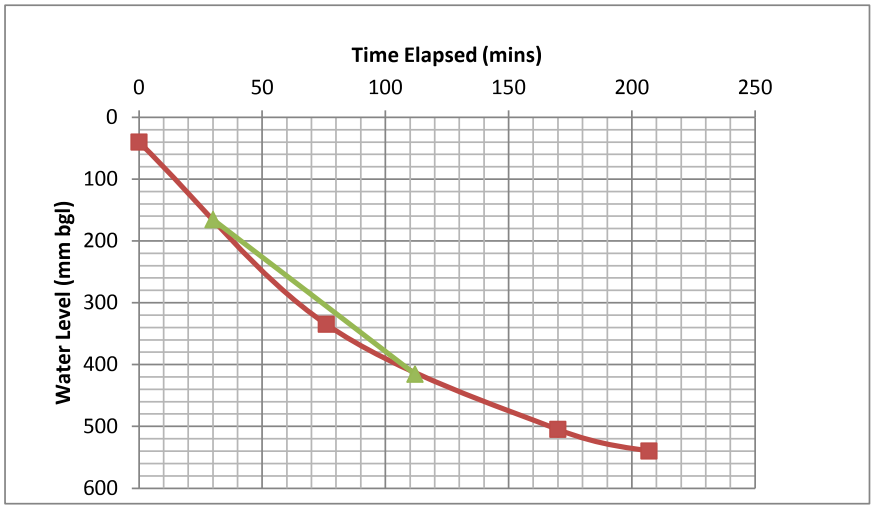
Dimensions (m): width = 0.400 length = 0.90 depth = 0.54

Date	Time	Date and time	Elapsed	Dip
15/12/2023	10:01	15/12/2023 10:01	start	dry
15/12/2023	10:06	15/12/2023 10:06	0	40
15/12/2023	11:22	15/12/2023 11:22	76	335
15/12/2023	12:56	15/12/2023 12:56	170	505
15/12/2023	13:33	15/12/2023 13:33	207	540

End Fit

Weather

Mostly dry



0

0 Projected

	Time (mins)	
t0	40	
t25	165	30
t50	290	
t75	415	112
t100	540	
fall		0.5
t25 - t75		0.25
Area t50		1.01

Infiltration Coefficient = 1.81E-05 m/s

G6575 Oldlands Farm Phase 3
Soakage Test

TP4 Test 3

Test Start Date: 15-Dec-23

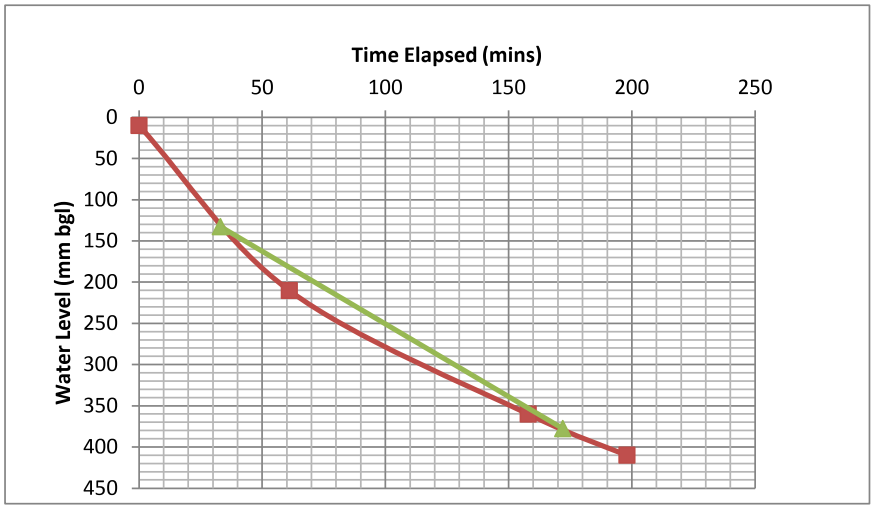
Dimensions (m): width = 0.350 length = 1.00 depth = 0.50

Date	Time	Date and time	Elapsed	Dip
15/12/2023	10:18	15/12/2023 10:18	start	dry
15/12/2023	10:23	15/12/2023 10:23	0	10
15/12/2023	11:24	15/12/2023 11:24	61	210
15/12/2023	13:01	15/12/2023 13:01	158	360
15/12/2023	13:41	15/12/2023 13:41	198	410

End Fit

Weather

Mostly dry



0

0 Projected

	Time (mins)	
t0	10	
t25	132.5	33
t50	255	
t75	377.5	172
t100	500	
fall		0.49
t25 - t75		0.245
Area t50		1.0115

Infiltration Coefficient = 1.02E-05 m/s

AG Geo-Consultants Ltd

Topsoil Assessment
Oldlands Phase 3, Oldlands Farm, Bognor Regis, PO22 9TR
Presented to: Ground Management Ltd

Issued: 17/01/24 (version 2) Status: Final Contract No./Report Type: 23-081/TopsoilLet

Contact	Position	Signature	Mobile	Email
André Gilleard	Director SiLC QP CSci CEnv BEng(Hons)	[redacted]		

Specialist In Land Condition (SiLC) No.A1201 Qualified Person (QP), No.086 (*Definition of Waste, Industry Code of Practice*, DoWCoP

1 Context and Purpose

AG Geo-Consultants Ltd (AGGC) has been requested by *Ground Management Ltd* (GML) on behalf of *Hanbury Properties (*their Client), to assess the topsoil at the site, as described below.

Proposed Development	Commercial units with landscaping and parking. Approx' postcode= PO22 9TR
Client Brief	*Clarification of topsoil depth across the site and an assessment of the suitability of topsoil for reuse in soft landscaping. Minimum of 6 locations*
Our proposals	So topsoil "suitability" falls into assessment of: 1. Chemical concentrations and 2. Composition of the soil e.g. is it too clayey etc, which is where *BS3882 topsoil testing* comes in. Scope of work is therefore: 1. We were advised that there has been a contamination investigation, by Ashdown we think, and so chemical concentration tests and assessment were not required. *2.* BS3882 test results are assessed against *Multipurpose topsoil* guideline values.

This report is provided for the benefit only of the party to whom it is addressed and we do not accept responsibility to any third party for the whole or any part of the contents and we exercise no duty of care in relation to this report to any third party.

Where intrusive investigations have been completed, information, comments and opinions given in this report are based on the ground conditions encountered during the site work and on the results of laboratory and field tests performed during the investigation. However, subsoils are inherently variable and hidden from view such that no investigation can be exhaustive to the extent that all soil conditions are revealed. Conditions may therefore be present beneath the site that were not apparent in the data reviewed as part of this assessment. In particular, it should be noted that groundwater levels vary due to seasonal and other effects, and may at times differ to those measured during the investigation.

Unless specifically noted to the contrary, it should be assumed that this report has not been submitted to any regulatory authorities for approval.

2 Site Investigation

During soakaway testing at the site on 13th December 2023 (trial pits TP1-TP6), GML obtained 6no. samples of topsoil, one from each location. See pit location plan in GML soakaway testing report.

3 Laboratory Testing

6no. soil samples were sent for testing for *BS3882 Topsoil suite.*

4 Topsoil Assessment

The topsoil layer is logged (See GML soakaway testing report) as:

- brown / orange brown slightly friable slightly sandy (fine) slightly clayey SILT, with occasional coarse, medium, and fine subangular to subrounded flint gravel.
- Locally clayey.
- Rare content of flint cobbles.

The thicknesses of topsoil is a consistent 0.3m, but some mixing occurs with the underlying soil layer, down to ~0.4m depth. Below the topsoil is firm silty CLAY.

The results are attached and summarised overleaf where they are compared to the required values in BS3882.

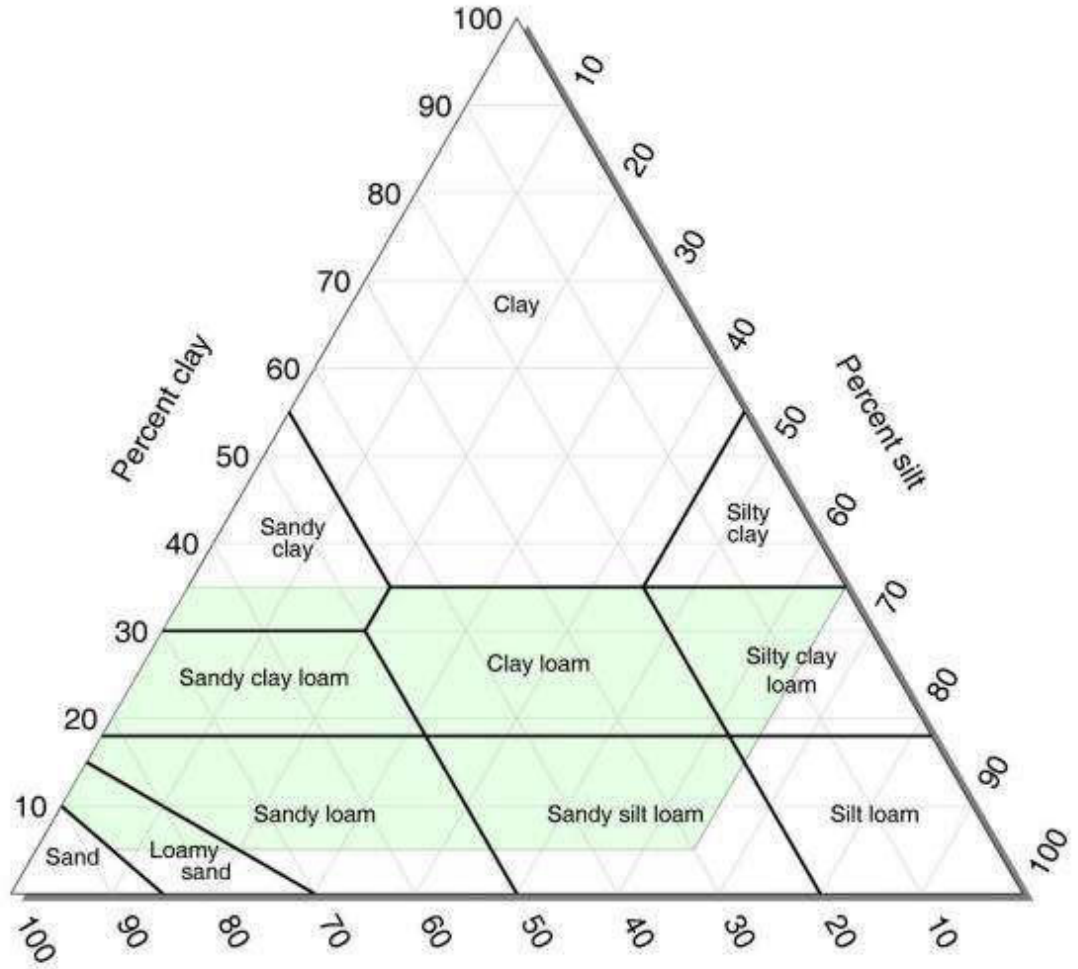
Lab Test Results

- Some of the soil samples comply with BS3882 “multipurpose” limits,
- whilst some require the **addition of a little organic matter and/or a little potassium** in order to comply with BS3882 limits.

Parameter	Units	Multipurpose Range			Results	Compliant with Multipurpose Range? (Y/N)
Texture						
Clay content	%				23-27%	-
Silt content	%				42-48%	-
Sand content	%				25-35%	-
Soil texture class		See BS3882 Chart			Clay Loam	YES
Mass Loss on Ignition						
Clay 5-20%		3.0-20			3.72-5.16	4 of 6 samples are 3.72-4.64%
Clay 20-35%		5.0-20				
Stone Content	**% m/m**					
>2mm		0-30			<1%	YES
>20mm		0-10			<1%	YES
>50mm		0			<1%	YES
Soil pH value		5.5-8.5			6.1-6.6	YES
Carbonate (Calcareous only)	%	-			2.4-3.8%	
Electrical Conductivity	µS/cm	If >3300 do ESP			1830-1900	YES
Available Nutrient Content						
Nitrogen %		>0.15			0.17-0.23	YES
Extractable phosphorus	mg/l	16-140			41-114	YES
Extractable potassium	mg/l	121-1500			93-173	3 of 6 samples are 93-106mg/l
Extractable magnesium	mg/l	51-600			78-94	YES
Carbon : Nitrogen Ratio		<20:1			12.84-14.73	YES
Exchangeable sodium	**%**	<15			-	
Available Calcium	mg/l	-			-	
Available Sodium	mg/l	-			-	
Phytotoxic Contaminants (by soil pH)		**< 6.0**	**6.0-7.0**	**> 7.0**		
Zinc (Nitric Acid extract)	mg/kg	<200	<200	<300	43.4-70.1	YES
Copper (Nitric Acid extract)	mg/kg	<100	<135	<200	15.5-20.7	YES
Nickel (Nitric Acid extract)	mg/kg	<60	<75	<110	11.9-14.8	YES
Visible Contaminants	**% mm**					
>2mm		<0.5			<0.01	YES
….. of which plastics		<0.25			<0.01	YES
….. man-made sharps		zero in 1kg			0.000	YES

Technical Information

Fig. 1. Textural Class:



Key

Area within which texture of topsoil is required to fall.

We refer the reader to the informative British Standard BS3882:2015 for more details on Topsoil and its use, handling and storage. The standard can be purchased from the British Standards Institute, 309 Chiswick High Road, London W4 4AL.

[redacted]

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TN38 9BY
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UKAS TESTING 2683

mCERTS

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	23-51616
Issue:	1
Date of Issue:	08/01/2024
Contact:	Andre Gilleard
Customer Details:	AG Geo-Consultants Ltd 58 Church Road Horfield Bristol BS7 8SE
Quotation No:	Q23-04188
Order No:	23-081
Customer Reference:	Not Supplied
Date Received:	18/12/2023
Date Approved:	08/01/2024
Details:	Oldlands
Approved by:	[redacted]

Ben Rees, Customer Services Assistant

Sample Summary

Report No.: 23-51616, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
348643	TP1 0.10 - 0.30	13/12/2023	18/12/2023	Silty loam	
348644	TP2 0.10 - 0.20	13/12/2023	18/12/2023	Silty loam	
348645	TP3 0.15 - 0.25	13/12/2023	18/12/2023	Silty loam	
348646	TP4 0.10 - 0.20	13/12/2023	18/12/2023	Silty loam	
348647	TP5 0.10 - 0.20	13/12/2023	18/12/2023	Silty loam	
348648	TP6 0.10 - 0.20	13/12/2023	18/12/2023	Silty loam	

Results Summary

Report No.: 23-51616, issue number 1

ELAB Reference				348643	348644	348645	348646	348647	348648
Customer Reference									
Sample ID									
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				TP1	TP2	TP3	TP4	TP5	TP6
Sample Depth (m)				0.10 - 0.30	0.10 - 0.20	0.15 - 0.25	0.10 - 0.20	0.10 - 0.20	0.10 - 0.20
Sampling Date				13/12/2023	13/12/2023	13/12/2023	13/12/2023	13/12/2023	13/12/2023
Determinand	**Codes**	**Units**	**LOD**						
Soil sample preparation parameters									
Moisture Content	N	%	0.1	18.5	20.1	20.4	21.1	21.0	18.9
Material removed	N	%	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Description of Inert material removed	N		0	None	None	None	None	None	None
Metals									
Copper	M	mg/kg	4	16.1	20.6	20.7	15.5	17.8	16.9
Nickel	M	mg/kg	1	11.9	14.2	14.8	14.1	11.9	13.7
Zinc	M	mg/kg	4.5	43.4	52.9	70.1	49.7	55.8	53.5
Inorganics									
Carbonate	N	%	0.1	2.9	2.9	3.1	3.4	3.8	2.4
Miscellaneous									
Electrical Conductivity (CaSO4 extract)	N	uS/cm	50	1830	1840	1900	1880	1850	1840
Carbon Nitrogen Ratio	N	ratio	0.1	12.8458	12.7745	13.7148	12.2465	14.7330	13.2542
Loss on Ignition	M	%	0.01	3.72	5.09	4.47	4.58	5.16	4.64
pH	M	pH units	0.1	6.4	6.4	6.5	6.6	6.5	6.1
Density	N	g/ml	0	1.11	1.02	1.03	1.02	0.99	1.03
Total Carbon	N	%	0.01	2.2	3.0	2.6	2.7	3.0	2.7
Total Nitrogen	N	%	0.01	0.17	0.23	0.19	0.22	0.20	0.20
Extractable Potassium	N	mg/l	20	93	152	122	173	99	106
Extractable Magnesium	N	mg/l	20	84	85	90	78	82	94
Extractable Phosphate	N	mg/l	1	41	55	68	56	114	72
Sand content	NS	%	1	35	25	33	26	30	30
Silt content	NS	%	1	42	48	44	48	46	45
Clay content	NS	%	1	23	27	23	25	24	25
Stones > 2mm	NS	%	1	< 1	< 1	< 1	< 1	< 1	< 1
Stones > 20mm	NS	%	1	< 1	< 1	< 1	< 1	< 1	< 1
Stones > 50mm	NS	%	1	< 1	< 1	< 1	< 1	< 1	< 1
Total Visible Contaminants	N	%	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Plastics	N	%	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sharps	N	n/kg	0	0	0	0	0	0	0

Method Summary

Report No.: 23-51616, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Acid neutralisation capacity	N	Air dried sample	20/12/2023		
Extractable cations - BS3882	N	Air dried sample	03/01/2024		ICPMS
Visible Contaminants	N		19/12/2023		
pH	M	Air dried sample	20/12/2023	113	Electromeric
Electrical conductivity of soil	N	Air dried sample.	03/01/2024	114	Electromeric
Loss on ignition at 450 deg C	M	Air dried sample	19/12/2023	129	Gravimetry
Extr. Phos	N	Air dried sample	03/01/2024	140	ICPMS
Aqua regia extractable metals	M	Air dried sample	19/12/2023	300	ICPMS

Tests marked N are not UKAS accredited

Report Information

Report No.: 23-51616, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"
LOD	LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.
	Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.
	ELAB are unable to provide an interpretation or opinion on the content of this report.
	The results relate only to the sample received.
	PCB congener results may include any coeluting PCBs
	Uncertainty of measurement for the determinands tested are available upon request
	Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

TPH Classification - HWOL Acronym System

HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
2D	GC-GC - Double coil gas chromatography
#1	EH_Total but with humics mathematically subtracted
#2	EH_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry

APPENDIX B – Hydraulic Calculations (Cv 1, FEH & Surcharge)

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	1	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
12		5.00	3.620	1200	494098.649	101499.328	0.620
13	0.026	5.00	3.650	1200	494099.603	101435.147	1.075
14			3.675	900	494100.533	101370.907	1.525
15	0.261	5.00	3.706	1200	494103.680	101363.570	1.761
16	0.487	5.00	3.704	1500	494124.534	101363.795	1.999
17		5.00	3.418	1200	494158.962	101354.803	2.113
18	0.254	5.00	3.700	1200	494178.252	101376.460	1.700
19			3.514	1500	494182.332	101363.615	2.259
20			3.579	1500	494220.134	101375.607	2.404
25	0.149	5.00	3.492	1200	494154.037	101349.088	1.734
26	0.059	5.00	3.519	900	494192.894	101378.147	1.069
27	0.019	5.00	3.340	1200	494197.388	101359.599	1.925
28	0.081	5.00	3.256	1200	494220.559	101365.203	1.946
29			3.235	1200	494226.507	101366.646	1.995
22	0.496	5.00	2.391	1500	494204.085	101432.443	1.041
23			3.126	1500	494204.244	101420.970	1.856
24			3.678	1500	494204.380	101394.589	2.478
30	0.009	5.00	3.623	1500	494225.866	101383.980	2.503
31			3.451	1800	494233.398	101386.902	2.391
1	0.051	5.00	3.376	900	494258.572	101373.022	1.176
2			3.862	900	494302.395	101383.250	1.962
3			3.050	900	494335.481	101390.919	1.380
4	0.203	5.00	2.720	900	494334.972	101429.136	1.240
5			2.975	1200	494323.972	101429.136	1.545
6			3.100	1500	494306.862	101439.388	1.840
7	0.082	5.00	3.250	1500	494292.142	101448.208	2.030
8	0.201	5.00	3.479	1350	494266.340	101447.867	2.319
9	0.107	5.00	3.290	1200	494258.481	101455.349	1.490
10			3.338	1500	494251.543	101455.258	2.138
11			3.593	1800	494239.341	101447.464	2.493
32	0.101	5.00	3.456	1800	494232.839	101447.511	2.526
33	0.062	5.00	3.456	1800	494232.393	101477.837	2.596
34	0.020	5.00	3.230	1800	494230.095	101517.661	2.450
35	0.013	5.00	3.634	900	494097.702	101564.737	1.064
36	0.140	5.00	3.699	1200	494100.770	101572.123	1.264
37	0.392	5.00	3.699	1500	494140.283	101572.672	1.724
38			3.707	1500	494173.595	101573.140	1.817
39		5.00	3.502	1500	494167.317	101582.554	2.612
40			3.499	1500	494175.985	101576.646	2.629
41			3.415	1500	494204.285	101557.358	2.615
45	0.133	5.00	3.600	900	494156.519	101590.413	1.710
46			3.450	900	494175.983	101582.619	2.078

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
47	0.057	5.00	3.371	1200	494200.191	101564.150	2.181
48			3.370	1200	494204.850	101560.596	2.250
43	0.225	5.00	2.391	1200	494201.716	101521.011	0.921
44			3.150	1200	494201.549	101531.374	1.760
49	0.020	5.00	3.348	1800	494213.587	101555.791	2.568
50	0.067	5.00	3.200	1800	494226.874	101555.916	2.500
Existing Outfall			2.840	1350	494226.798	101573.518	2.200

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)
S3.000	12	13	64.188	0.600	3.000	2.575	0.425	151.0	150	6.31	50.0
S3.001	13	14	64.247	0.600	2.575	2.150	0.425	151.2	150	7.63	50.0
S3.002	14	15	7.983	0.600	2.150	2.095	0.055	145.1	150	7.79	50.0
S3.003	15	16	20.855	0.600	1.945	1.855	0.090	231.7	300	8.12	50.0
S3.004	16	19	57.798	0.600	1.705	1.405	0.300	192.7	450	8.78	50.0
S4.000	17	19	24.976	0.600	1.305	1.255	0.050	499.5	600	5.38	50.0
S5.000	18	19	13.477	0.600	2.000	1.630	0.370	36.4	225	5.10	50.0
S3.005	19	20	39.659	0.600	1.255	1.175	0.080	495.7	600	9.39	50.0
S3.006	20	30	10.147	0.600	1.175	1.120	0.055	184.5	600	9.49	50.0
S6.000	25	27	44.607	0.600	1.758	1.490	0.268	166.4	225	5.74	50.0
S7.000	26	27	19.085	0.600	2.450	1.565	0.885	21.6	150	5.15	50.0
S6.001	27	28	23.839	0.600	1.415	1.310	0.105	227.0	300	6.12	50.0
S6.002	28	29	6.121	0.600	1.310	1.240	0.070	87.4	300	6.18	50.0
S6.003	29	30	17.346	0.600	1.240	1.120	0.120	144.6	300	6.40	50.0
S8.000	22	23	11.400	0.600	1.350	1.270	0.080	142.5	450	5.11	50.0
S8.001	23	24	26.307	0.600	1.270	1.200	0.070	375.8	450	5.53	50.0
S8.002	24	30	23.995	0.600	1.200	1.120	0.080	299.9	450	5.87	50.0
S3.007	30	31	8.079	0.600	1.120	1.060	0.060	134.7	225	9.61	50.0

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)
S3.000	0.815	14.4	0.0	0.470	0.925	0.000	0.0	0	0.000
S3.001	0.815	14.4	4.7	0.925	1.375	0.026	0.0	59	0.729
S3.002	0.832	14.7	4.7	1.375	1.461	0.026	0.0	58	0.741
S3.003	1.028	72.7	51.8	1.461	1.549	0.287	0.0	188	1.114
S3.004	1.461	232.4	139.8	1.549	1.659	0.774	0.0	252	1.525
S4.000	1.082	306.1	0.0	1.513	1.659	0.000	0.0	0	0.000
S5.000	2.174	86.4	46.0	1.475	1.659	0.254	0.0	116	2.205
S3.005	1.087	307.2	185.8	1.659	1.804	1.028	0.0	337	1.136
S3.006	1.789	505.9	185.8	1.804	1.903	1.028	0.0	251	1.658
S6.000	1.010	40.2	26.8	1.509	1.625	0.149	0.0	135	1.081
S7.000	2.178	38.5	10.7	0.919	1.625	0.059	0.0	54	1.862
S6.001	1.039	73.4	41.0	1.625	1.646	0.227	0.0	160	1.067
S6.002	1.682	118.9	55.7	1.646	1.695	0.308	0.0	144	1.656
S6.003	1.305	92.3	55.7	1.695	2.203	0.308	0.0	168	1.365
S8.000	1.701	270.5	89.6	0.591	1.406	0.496	0.0	178	1.534
S8.001	1.042	165.8	89.6	1.406	2.028	0.496	0.0	236	1.062
S8.002	1.168	185.8	89.6	2.028	2.053	0.496	0.0	220	1.158
S3.007	1.125	44.7	332.6	2.278	2.166	1.841	0.0	225	1.146

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)
S3.008	31	32	60.612	0.600	1.060	0.930	0.130	466.2	750	10.39	50.0
S1.000	1	2	45.001	0.600	2.200	1.900	0.300	150.0	150	5.92	50.0
S1.001	2	3	33.963	0.600	1.900	1.670	0.230	147.7	150	6.60	50.0
S1.002	3	4	38.220	0.600	1.670	1.480	0.190	201.2	225	7.30	50.0
S1.003	4	5	11.000	0.600	1.480	1.430	0.050	220.0	300	7.47	50.0
S1.004	5	6	19.946	0.600	1.430	1.260	0.170	117.3	300	7.70	50.0
S1.005	6	7	17.160	0.600	1.260	1.220	0.040	429.0	600	7.94	50.0
S1.006	7	8	25.804	0.600	1.220	1.160	0.060	430.1	600	8.31	50.0
S1.007	8	11	27.002	0.600	1.160	1.100	0.060	450.0	600	8.71	50.0
S2.000	9	10	6.939	0.600	1.800	1.425	0.375	18.5	225	5.04	50.0
S2.001	10	11	14.479	0.600	1.200	1.100	0.100	144.8	450	5.18	50.0
S1.008	11	32	6.502	0.600	1.100	1.080	0.020	325.1	600	8.79	50.0
S1.009	32	33	30.329	0.600	0.930	0.860	0.070	433.3	750	10.77	50.0
S1.010	33	34	39.890	0.600	0.860	0.780	0.080	498.6	750	11.30	50.0
S1.011	34	50	38.390	0.600	0.780	0.700	0.080	479.9	750	11.81	50.0
S9.000	12	35	65.364	0.600	3.000	2.570	0.430	152.0	150	6.34	50.0
S9.001	35	36	8.046	0.600	2.570	2.510	0.060	134.1	150	6.50	50.0
S9.002	36	37	39.517	0.600	2.435	2.200	0.235	168.2	225	7.15	50.0
S9.003	37	38	33.315	0.600	1.975	1.890	0.085	391.9	450	7.69	50.0
S9.004	38	40	4.243	0.600	1.890	1.020	0.870	4.9	450	7.70	50.0
S10.000	39	40	10.490	0.600	0.890	0.870	0.020	524.5	600	5.17	50.0
S9.005	40	41	34.248	0.600	0.870	0.800	0.070	489.3	600	8.22	50.0
S9.006	41	49	9.433	0.600	0.800	0.780	0.020	471.7	600	8.37	50.0
S12.000	45	46	20.966	0.600	1.890	1.372	0.518	40.5	225	5.17	50.0

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)
S3.008	1.289	569.5	332.6	1.641	1.776	1.841	0.0	413	1.337
S1.000	0.818	14.5	9.3	1.026	1.812	0.051	0.0	88	0.868
S1.001	0.825	14.6	9.3	1.812	1.230	0.051	0.0	87	0.873
S1.002	0.918	36.5	9.3	1.155	1.015	0.051	0.0	77	0.768
S1.003	1.056	74.6	46.0	0.940	1.245	0.254	0.0	170	1.108
S1.004	1.450	102.5	46.0	1.245	1.540	0.254	0.0	141	1.413
S1.005	1.169	330.5	46.0	1.240	1.430	0.254	0.0	150	0.833
S1.006	1.168	330.1	60.8	1.430	1.719	0.336	0.0	173	0.900
S1.007	1.141	322.6	97.1	1.719	1.893	0.537	0.0	225	1.003
S2.000	3.056	121.5	19.4	1.265	1.688	0.107	0.0	60	2.247
S2.001	1.687	268.3	19.4	1.688	2.043	0.107	0.0	81	0.999
S1.008	1.345	380.2	116.5	1.893	1.776	0.645	0.0	227	1.189
S1.009	1.338	591.0	467.4	1.776	1.846	2.586	0.0	506	1.475
S1.010	1.246	550.5	478.6	1.846	1.700	2.648	0.0	544	1.394
S1.011	1.270	561.3	482.2	1.700	1.750	2.668	0.0	539	1.419
S9.000	0.812	14.4	0.0	0.470	0.914	0.000	0.0	0	0.000
S9.001	0.866	15.3	2.4	0.914	1.039	0.013	0.0	40	0.632
S9.002	1.005	40.0	27.6	1.039	1.274	0.153	0.0	138	1.082
S9.003	1.021	162.3	98.4	1.274	1.367	0.545	0.0	254	1.068
S9.004	9.251	1471.3	98.4	1.367	2.029	0.545	0.0	78	5.358
S10.000	1.056	298.6	0.0	2.012	2.029	0.000	0.0	0	0.000
S9.005	1.094	309.3	98.4	2.029	2.015	0.545	0.0	232	0.976
S9.006	1.114	315.1	98.4	2.015	1.968	0.545	0.0	229	0.990
S12.000	2.062	82.0	24.0	1.485	1.853	0.133	0.0	83	1.795

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)
S12.001	46	47	30.449	0.600	1.372	1.190	0.182	167.3	225	5.67	50.0
S12.002	47	48	5.860	0.600	1.190	1.120	0.070	83.7	225	5.74	50.0
S12.003	48	49	9.971	0.600	1.120	1.060	0.060	166.2	300	5.88	50.0
S11.000	43	44	10.364	0.600	1.470	1.390	0.080	129.6	225	5.15	50.0
S11.001	44	49	27.223	0.600	1.390	0.780	0.610	44.6	225	5.38	50.0
S9.007	49	50	13.288	0.600	0.780	0.700	0.080	166.1	225	8.58	50.0
S1.012	50	Existing Outfall	17.602	0.600	0.700	0.640	0.060	293.4	450	12.05	50.0

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)
S12.001	1.008	40.1	24.0	1.853	1.956	0.133	0.0	125	1.051
S12.002	1.430	56.9	34.4	1.956	2.025	0.190	0.0	126	1.494
S12.003	1.217	86.0	34.4	1.950	1.988	0.190	0.0	132	1.150
S11.000	1.147	45.6	40.7	0.696	1.535	0.225	0.0	167	1.292
S11.001	1.963	78.1	40.7	1.535	2.343	0.225	0.0	116	1.985
S9.007	1.011	40.2	177.1	2.343	2.275	0.980	0.0	225	1.030
S1.012	1.182	187.9	671.4	2.050	1.750	3.715	0.0	450	1.197

Pipeline Schedule

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)
64.188	151.0	150	Pipe	3.620	3.000	0.470	3.650	2.575	0.925
64.247	151.2	150	Pipe	3.650	2.575	0.925	3.675	2.150	1.375
7.983	145.1	150	Pipe	3.675	2.150	1.375	3.706	2.095	1.461
20.855	231.7	300	Pipe	3.706	1.945	1.461	3.704	1.855	1.549
57.798	192.7	450	Pipe	3.704	1.705	1.549	3.514	1.405	1.659
24.976	499.5	600	Pipe	3.418	1.305	1.513	3.514	1.255	1.659
13.477	36.4	225	Pipe	3.700	2.000	1.475	3.514	1.630	1.659
39.659	495.7	600	Pipe	3.514	1.255	1.659	3.579	1.175	1.804
10.147	184.5	600	Pipe	3.579	1.175	1.804	3.623	1.120	1.903
44.607	166.4	225	Pipe	3.492	1.758	1.509	3.340	1.490	1.625
19.085	21.6	150	Pipe	3.519	2.450	0.919	3.340	1.565	1.625
23.839	227.0	300	Pipe	3.340	1.415	1.625	3.256	1.310	1.646
6.121	87.4	300	Pipe	3.256	1.310	1.646	3.235	1.240	1.695

US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
13	1200	Manhole	Adoptable	14	900	Manhole	Adoptable
14	900	Manhole	Adoptable	15	1200	Manhole	Adoptable
15	1200	Manhole	Adoptable	16	1500	Manhole	Adoptable
16	1500	Manhole	Adoptable	19	1500	Manhole	Adoptable
17	1200	Manhole	Adoptable	19	1500	Manhole	Adoptable
18	1200	Manhole	Adoptable	19	1500	Manhole	Adoptable
19	1500	Manhole	Adoptable	20	1500	Manhole	Adoptable
20	1500	Manhole	Adoptable	30	1500	Manhole	Adoptable
25	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
26	900	Manhole	Adoptable	27	1200	Manhole	Adoptable
27	1200	Manhole	Adoptable	28	1200	Manhole	Adoptable
28	1200	Manhole	Adoptable	29	1200	Manhole	Adoptable

Pipeline Schedule

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)
17.346	144.6	300	Pipe	3.235	1.240	1.695	3.623	1.120	2.203
11.400	142.5	450	Pipe	2.391	1.350	0.591	3.126	1.270	1.406
26.307	375.8	450	Pipe	3.126	1.270	1.406	3.678	1.200	2.028
23.995	299.9	450	Pipe	3.678	1.200	2.028	3.623	1.120	2.053
8.079	134.7	225	Pipe	3.623	1.120	2.278	3.451	1.060	2.166
60.612	466.2	750	Pipe	3.451	1.060	1.641	3.456	0.930	1.776
45.001	150.0	150	Pipe	3.376	2.200	1.026	3.862	1.900	1.812
33.963	147.7	150	Pipe	3.862	1.900	1.812	3.050	1.670	1.230
38.220	201.2	225	Pipe	3.050	1.670	1.155	2.720	1.480	1.015
11.000	220.0	300	Pipe	2.720	1.480	0.940	2.975	1.430	1.245
19.946	117.3	300	Pipe	2.975	1.430	1.245	3.100	1.260	1.540
17.160	429.0	600	Pipe	3.100	1.260	1.240	3.250	1.220	1.430
25.804	430.1	600	Pipe	3.250	1.220	1.430	3.479	1.160	1.719
27.002	450.0	600	Pipe	3.479	1.160	1.719	3.593	1.100	1.893
6.939	18.5	225	Pipe	3.290	1.800	1.265	3.338	1.425	1.688
14.479	144.8	450	Pipe	3.338	1.200	1.688	3.593	1.100	2.043
6.502	325.1	600	Pipe	3.593	1.100	1.893	3.456	1.080	1.776
30.329	433.3	750	Pipe	3.456	0.930	1.776	3.456	0.860	1.846
39.890	498.6	750	Pipe	3.456	0.860	1.846	3.230	0.780	1.700
38.390	479.9	750	Pipe	3.230	0.780	1.700	3.200	0.700	1.750
65.364	152.0	150	Pipe	3.620	3.000	0.470	3.634	2.570	0.914
8.046	134.1	150	Pipe	3.634	2.570	0.914	3.699	2.510	1.039
39.517	168.2	225	Pipe	3.699	2.435	1.039	3.699	2.200	1.274
33.315	391.9	450	Pipe	3.699	1.975	1.274	3.707	1.890	1.367
4.243	4.9	450	Pipe	3.707	1.890	1.367	3.499	1.020	2.029

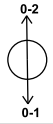
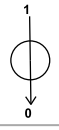
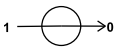
US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
29	1200	Manhole	Adoptable	30	1500	Manhole	Adoptable
22	1500	Manhole	Adoptable	23	1500	Manhole	Adoptable
23	1500	Manhole	Adoptable	24	1500	Manhole	Adoptable
24	1500	Manhole	Adoptable	30	1500	Manhole	Adoptable
30	1500	Manhole	Adoptable	31	1800	Manhole	Adoptable
31	1800	Manhole	Adoptable	32	1800	Manhole	Adoptable
1	900	Manhole	Adoptable	2	900	Manhole	Adoptable
2	900	Manhole	Adoptable	3	900	Manhole	Adoptable
3	900	Manhole	Adoptable	4	900	Manhole	Adoptable
4	900	Manhole	Adoptable	5	1200	Manhole	Adoptable
5	1200	Manhole	Adoptable	6	1500	Manhole	Adoptable
6	1500	Manhole	Adoptable	7	1500	Manhole	Adoptable
7	1500	Manhole	Adoptable	8	1350	Manhole	Adoptable
8	1350	Manhole	Adoptable	11	1800	Manhole	Adoptable
9	1200	Manhole	Adoptable	10	1500	Manhole	Adoptable
10	1500	Manhole	Adoptable	11	1800	Manhole	Adoptable
11	1800	Manhole	Adoptable	32	1800	Manhole	Adoptable
32	1800	Manhole	Adoptable	33	1800	Manhole	Adoptable
33	1800	Manhole	Adoptable	34	1800	Manhole	Adoptable
34	1800	Manhole	Adoptable	50	1800	Manhole	Adoptable
12	1200	Manhole	Adoptable	35	900	Manhole	Adoptable
35	900	Manhole	Adoptable	36	1200	Manhole	Adoptable
36	1200	Manhole	Adoptable	37	1500	Manhole	Adoptable
37	1500	Manhole	Adoptable	38	1500	Manhole	Adoptable
38	1500	Manhole	Adoptable	40	1500	Manhole	Adoptable

Pipeline Schedule

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)
10.490	524.5	600	Pipe	3.502	0.890	2.012	3.499	0.870	2.029
34.248	489.3	600	Pipe	3.499	0.870	2.029	3.415	0.800	2.015
9.433	471.7	600	Pipe	3.415	0.800	2.015	3.348	0.780	1.968
20.966	40.5	225	Pipe	3.600	1.890	1.485	3.450	1.372	1.853
30.449	167.3	225	Pipe	3.450	1.372	1.853	3.371	1.190	1.956
5.860	83.7	225	Pipe	3.371	1.190	1.956	3.370	1.120	2.025
9.971	166.2	300	Pipe	3.370	1.120	1.950	3.348	1.060	1.988
10.364	129.6	225	Pipe	2.391	1.470	0.696	3.150	1.390	1.535
27.223	44.6	225	Pipe	3.150	1.390	1.535	3.348	0.780	2.343
13.288	166.1	225	Pipe	3.348	0.780	2.343	3.200	0.700	2.275
17.602	293.4	450	Pipe	3.200	0.700	2.050	2.840	0.640	1.750

US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
39	1500	Manhole	Adoptable	40	1500	Manhole	Adoptable
40	1500	Manhole	Adoptable	41	1500	Manhole	Adoptable
41	1500	Manhole	Adoptable	49	1800	Manhole	Adoptable
45	900	Manhole	Adoptable	46	900	Manhole	Adoptable
46	900	Manhole	Adoptable	47	1200	Manhole	Adoptable
47	1200	Manhole	Adoptable	48	1200	Manhole	Adoptable
48	1200	Manhole	Adoptable	49	1800	Manhole	Adoptable
43	1200	Manhole	Adoptable	44	1200	Manhole	Adoptable
44	1200	Manhole	Adoptable	49	1800	Manhole	Adoptable
49	1800	Manhole	Adoptable	50	1800	Manhole	Adoptable
50	1800	Manhole	Adoptable	Existing Outfall	1350	Manhole	Adoptable

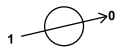
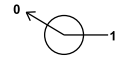
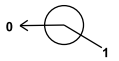
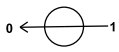
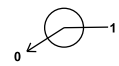
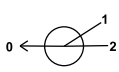
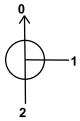
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
12	494098.649	101499.328	3.620	0.620	1200				
						0-1	S3.000	3.000	150
						0-2	S9.000	3.000	150
13	494099.603	101435.147	3.650	1.075	1200				
						1	S3.000	2.575	150
						0	S3.001	2.575	150
14	494100.533	101370.907	3.675	1.525	900				
						1	S3.001	2.150	150
						0	S3.002	2.150	150
15	494103.680	101363.570	3.706	1.761	1200				
						1	S3.002	2.095	150
						0	S3.003	1.945	300
16	494124.534	101363.795	3.704	1.999	1500				
						1	S3.003	1.855	300
						0	S3.004	1.705	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
17	494158.962	101354.803	3.418	2.113	1200	0	S4.000	1.305	600
18	494178.252	101376.460	3.700	1.700	1200	0	S5.000	2.000	225
19	494182.332	101363.615	3.514	2.259	1500	1	S5.000	1.630	225
						2	S4.000	1.255	600
						3	S3.004	1.405	450
						0	S3.005	1.255	600
20	494220.134	101375.607	3.579	2.404	1500	1	S3.005	1.175	600
						0	S3.006	1.175	600
25	494154.037	101349.088	3.492	1.734	1200	0	S6.000	1.758	225
26	494192.894	101378.147	3.519	1.069	900	0	S7.000	2.450	150
27	494197.388	101359.599	3.340	1.925	1200	1	S7.000	1.565	150
						2	S6.000	1.490	225
						0	S6.001	1.415	300
28	494220.559	101365.203	3.256	1.946	1200	1	S6.001	1.310	300
						0	S6.002	1.310	300
29	494226.507	101366.646	3.235	1.995	1200	1	S6.002	1.240	300
						0	S6.003	1.240	300
22	494204.085	101432.443	2.391	1.041	1500	0	S8.000	1.350	450
23	494204.244	101420.970	3.126	1.856	1500	1	S8.000	1.270	450
						0	S8.001	1.270	450
24	494204.380	101394.589	3.678	2.478	1500	1	S8.001	1.200	450
						0	S8.002	1.200	450
30	494225.866	101383.980	3.623	2.503	1500	1	S8.002	1.120	450
						2	S6.003	1.120	300
						3	S3.006	1.120	600
						0	S3.007	1.120	225

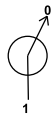
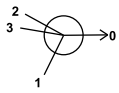
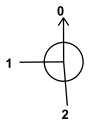
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
31	494233.398	101386.902	3.451	2.391	1800	 1	S3.007	1.060	225
						0	S3.008	1.060	750
1	494258.572	101373.022	3.376	1.176	900				
						0	S1.000	2.200	150
2	494302.395	101383.250	3.862	1.962	900	1	S1.000	1.900	150
									
						0	S1.001	1.900	150
3	494335.481	101390.919	3.050	1.380	900	 1	S1.001	1.670	150
						0	S1.002	1.670	225
4	494334.972	101429.136	2.720	1.240	900	1	S1.002	1.480	225
									
						0	S1.003	1.480	300
5	494323.972	101429.136	2.975	1.545	1200	 1	S1.003	1.430	300
						0	S1.004	1.430	300
6	494306.862	101439.388	3.100	1.840	1500	1	S1.004	1.260	300
									
						0	S1.005	1.260	600
7	494292.142	101448.208	3.250	2.030	1500	1	S1.005	1.220	600
									
						0	S1.006	1.220	600
8	494266.340	101447.867	3.479	2.319	1350	1	S1.006	1.160	600
									
						0	S1.007	1.160	600
9	494258.481	101455.349	3.290	1.490	1200				
						0	S2.000	1.800	225
10	494251.543	101455.258	3.338	2.138	1500	1	S2.000	1.425	225
									
						0	S2.001	1.200	450
11	494239.341	101447.464	3.593	2.493	1800	1	S2.001	1.100	450
						2	S1.007	1.100	600
									
						0	S1.008	1.100	600
32	494232.839	101447.511	3.456	2.526	1800	1	S1.008	1.080	600
						2	S3.008	0.930	750
									
						0	S1.009	0.930	750

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
33	494232.393	101477.837	3.456	2.596	1800	1	S1.009	0.860	750
						0	S1.010	0.860	750
34	494230.095	101517.661	3.230	2.450	1800	1	S1.010	0.780	750
						0	S1.011	0.780	750
35	494097.702	101564.737	3.634	1.064	900	1	S9.000	2.570	150
						0	S9.001	2.570	150
36	494100.770	101572.123	3.699	1.264	1200	1	S9.001	2.510	150
						0	S9.002	2.435	225
37	494140.283	101572.672	3.699	1.724	1500	1	S9.002	2.200	225
						0	S9.003	1.975	450
38	494173.595	101573.140	3.707	1.817	1500	1	S9.003	1.890	450
						0	S9.004	1.890	450
39	494167.317	101582.554	3.502	2.612	1500	0	S10.000	0.890	600
40	494175.985	101576.646	3.499	2.629	1500	1	S10.000	0.870	600
						2	S9.004	1.020	450
						0	S9.005	0.870	600
41	494204.285	101557.358	3.415	2.615	1500	1	S9.005	0.800	600
						0	S9.006	0.800	600
45	494156.519	101590.413	3.600	1.710	900	0	S12.000	1.890	225
46	494175.983	101582.619	3.450	2.078	900	1	S12.000	1.372	225
						0	S12.001	1.372	225
47	494200.191	101564.150	3.371	2.181	1200	1	S12.001	1.190	225
						0	S12.002	1.190	225
48	494204.850	101560.596	3.370	2.250	1200	1	S12.002	1.120	225
						0	S12.003	1.120	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
43	494201.716	101521.011	2.391	0.921	1200				
						0	S11.000	1.470	225
44	494201.549	101531.374	3.150	1.760	1200		1	S11.000	1.390	225
							0	S11.001	1.390	225
49	494213.587	101555.791	3.348	2.568	1800		1	S11.001	0.780	225
							2	S12.003	1.060	300
							3	S9.006	0.780	600
							0	S9.007	0.780	225
50	494226.874	101555.916	3.200	2.500	1800		1	S9.007	0.700	225
							2	S1.011	0.700	750
							0	S1.012	0.700	450
Existing Outfall	494226.798	101573.518	2.840	2.200	1350		1	S1.012	0.640	450

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
30	40	0	0
100	25	0	0
100	45	0	0

Node Existing Outfall Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.500	75	0.500	150	0.500	225	0.500	300	0.500	375	0.500
15	0.500	90	0.500	165	0.500	240	0.500	315	0.500	390	0.500
30	0.500	105	0.500	180	0.500	255	0.500	330	0.500	405	0.500
45	0.500	120	0.500	195	0.500	270	0.500	345	0.500	420	0.500
60	0.500	135	0.500	210	0.500	285	0.500	360	0.500	435	0.500

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
450	0.500	630	0.500	810	0.500	990	0.500	1170	0.500	1350	0.500
465	0.500	645	0.500	825	0.500	1005	0.500	1185	0.500	1365	0.500
480	0.500	660	0.500	840	0.500	1020	0.500	1200	0.500	1380	0.500
495	0.500	675	0.500	855	0.500	1035	0.500	1215	0.500	1395	0.500
510	0.500	690	0.500	870	0.500	1050	0.500	1230	0.500	1410	0.500
525	0.500	705	0.500	885	0.500	1065	0.500	1245	0.500	1425	0.500
540	0.500	720	0.500	900	0.500	1080	0.500	1260	0.500	1440	0.500
555	0.500	735	0.500	915	0.500	1095	0.500	1275	0.500		
570	0.500	750	0.500	930	0.500	1110	0.500	1290	0.500		
585	0.500	765	0.500	945	0.500	1125	0.500	1305	0.500		
600	0.500	780	0.500	960	0.500	1140	0.500	1320	0.500		
615	0.500	795	0.500	975	0.500	1155	0.500	1335	0.500		

Node 30 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.120	Product Number	CTL-SHE-0128-1000-2230-1000
Design Depth (m)	2.230	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	10.0	Min Node Diameter (mm)	1500

Node 11 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.100	Product Number	CTL-SHE-0087-5000-2470-5000
Design Depth (m)	2.470	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 49 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	0.780	Product Number	CTL-SHE-0086-5000-2570-5000
Design Depth (m)	2.570	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 50 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	0.700	Product Number	CTL-SHE-0146-1250-2000-1250
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	12.5	Min Node Diameter (mm)	1500

Node 6 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	150.0	0.0	0.800	150.0	0.0	0.801	0.0	0.0

Node 10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.220
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	375.0	0.0	0.800	375.0	0.0	0.801	0.0	0.0

Node 23 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.270
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	500.0	0.0	0.800	500.0	0.0	0.801	0.0	0.0

Node 24 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	350.0	0.0	1.200	350.0	0.0	1.201	0.0	0.0

Node 17 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.320
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	770.0	0.0	0.800	770.0	0.0	0.801	0.0	0.0

Node 39 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	0.920
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	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	780.0	0.0	1.200	780.0	0.0	1.201	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	76.334	21.600	1 year 120 minute winter	16.636	6.617
1 year 15 minute winter	53.568	21.600	1 year 180 minute summer	20.597	5.300
1 year 30 minute summer	49.841	14.103	1 year 180 minute winter	13.388	5.300
1 year 30 minute winter	34.976	14.103	1 year 240 minute summer	16.839	4.450
1 year 60 minute summer	33.678	8.900	1 year 240 minute winter	11.187	4.450
1 year 60 minute winter	22.375	8.900	1 year 360 minute summer	13.212	3.400
1 year 120 minute summer	25.040	6.617	1 year 360 minute winter	8.588	3.400

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 480 minute summer	10.483	2.770	30 year +40% CC 480 minute summer	37.621	9.942
1 year 480 minute winter	6.965	2.770	30 year +40% CC 480 minute winter	24.994	9.942
1 year 600 minute summer	8.601	2.353	30 year +40% CC 600 minute summer	30.258	8.276
1 year 600 minute winter	5.877	2.353	30 year +40% CC 600 minute winter	20.674	8.276
1 year 720 minute summer	7.665	2.054	30 year +40% CC 720 minute summer	26.550	7.116
1 year 720 minute winter	5.151	2.054	30 year +40% CC 720 minute winter	17.844	7.116
1 year 960 minute summer	6.288	1.656	30 year +40% CC 960 minute summer	21.256	5.597
1 year 960 minute winter	4.165	1.656	30 year +40% CC 960 minute winter	14.081	5.597
1 year 1440 minute summer	4.571	1.225	30 year +40% CC 1440 minute summer	14.910	3.996
1 year 1440 minute winter	3.072	1.225	30 year +40% CC 1440 minute winter	10.021	3.996
1 year 2160 minute summer	3.323	0.918	30 year +40% CC 2160 minute summer	10.399	2.874
1 year 2160 minute winter	2.290	0.918	30 year +40% CC 2160 minute winter	7.165	2.874
30 year 15 minute summer	288.602	81.664	100 year +25% CC 15 minute summer	452.410	128.016
30 year 15 minute winter	202.527	81.664	100 year +25% CC 15 minute winter	317.481	128.016
30 year 30 minute summer	190.913	54.022	100 year +25% CC 30 minute summer	302.031	85.464
30 year 30 minute winter	133.974	54.022	100 year +25% CC 30 minute winter	211.951	85.464
30 year 60 minute summer	129.360	34.186	100 year +25% CC 60 minute summer	206.308	54.521
30 year 60 minute winter	85.943	34.186	100 year +25% CC 60 minute winter	137.066	54.521
30 year 120 minute summer	78.849	20.838	100 year +25% CC 120 minute summer	123.411	32.614
30 year 120 minute winter	52.386	20.838	100 year +25% CC 120 minute winter	81.992	32.614
30 year 180 minute summer	59.815	15.393	100 year +25% CC 180 minute summer	93.198	23.983
30 year 180 minute winter	38.881	15.393	100 year +25% CC 180 minute winter	60.581	23.983
30 year 240 minute summer	46.709	12.344	100 year +25% CC 240 minute summer	72.703	19.213
30 year 240 minute winter	31.033	12.344	100 year +25% CC 240 minute winter	48.302	19.213
30 year 360 minute summer	34.845	8.967	100 year +25% CC 360 minute summer	54.283	13.969
30 year 360 minute winter	22.650	8.967	100 year +25% CC 360 minute winter	35.286	13.969
30 year 480 minute summer	26.872	7.102	100 year +25% CC 480 minute summer	41.943	11.084
30 year 480 minute winter	17.853	7.102	100 year +25% CC 480 minute winter	27.866	11.084
30 year 600 minute summer	21.613	5.912	100 year +25% CC 600 minute summer	33.791	9.243
30 year 600 minute winter	14.767	5.912	100 year +25% CC 600 minute winter	23.088	9.243
30 year 720 minute summer	18.965	5.083	100 year +25% CC 720 minute summer	29.689	7.957
30 year 720 minute winter	12.745	5.083	100 year +25% CC 720 minute winter	19.953	7.957
30 year 960 minute summer	15.183	3.998	100 year +25% CC 960 minute summer	23.810	6.270
30 year 960 minute winter	10.058	3.998	100 year +25% CC 960 minute winter	15.772	6.270
30 year 1440 minute summer	10.650	2.854	100 year +25% CC 1440 minute summer	16.691	4.473
30 year 1440 minute winter	7.158	2.854	100 year +25% CC 1440 minute winter	11.217	4.473
30 year 2160 minute summer	7.428	2.053	100 year +25% CC 2160 minute summer	11.576	3.199
30 year 2160 minute winter	5.118	2.053	100 year +25% CC 2160 minute winter	7.977	3.199
30 year +40% CC 15 minute summer	404.042	114.330	100 year +45% CC 15 minute summer	524.796	148.499
30 year +40% CC 15 minute winter	283.538	114.330	100 year +45% CC 15 minute winter	368.278	148.499
30 year +40% CC 30 minute summer	267.279	75.631	100 year +45% CC 30 minute summer	350.356	99.139
30 year +40% CC 30 minute winter	187.564	75.631	100 year +45% CC 30 minute winter	245.864	99.139
30 year +40% CC 60 minute summer	181.103	47.860	100 year +45% CC 60 minute summer	239.317	63.244
30 year +40% CC 60 minute winter	120.321	47.860	100 year +45% CC 60 minute winter	158.996	63.244
30 year +40% CC 120 minute summer	110.389	29.173	100 year +45% CC 120 minute summer	143.157	37.832
30 year +40% CC 120 minute winter	73.340	29.173	100 year +45% CC 120 minute winter	95.110	37.832
30 year +40% CC 180 minute summer	83.741	21.550	100 year +45% CC 180 minute summer	108.110	27.820
30 year +40% CC 180 minute winter	54.434	21.550	100 year +45% CC 180 minute winter	70.274	27.820
30 year +40% CC 240 minute summer	65.393	17.281	100 year +45% CC 240 minute summer	84.335	22.287
30 year +40% CC 240 minute winter	43.446	17.281	100 year +45% CC 240 minute winter	56.030	22.287
30 year +40% CC 360 minute summer	48.783	12.554	100 year +45% CC 360 minute summer	62.969	16.204
30 year +40% CC 360 minute winter	31.710	12.554	100 year +45% CC 360 minute winter	40.931	16.204

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 480 minute summer	48.654	12.858	100 year +45% CC 960 minute summer	27.619	7.273
100 year +45% CC 480 minute winter	32.325	12.858	100 year +45% CC 960 minute winter	18.296	7.273
100 year +45% CC 600 minute summer	39.198	10.721	100 year +45% CC 1440 minute summer	19.362	5.189
100 year +45% CC 600 minute winter	26.782	10.721	100 year +45% CC 1440 minute winter	13.012	5.189
100 year +45% CC 720 minute summer	34.440	9.230	100 year +45% CC 2160 minute summer	13.429	3.711
100 year +45% CC 720 minute winter	23.146	9.230	100 year +45% CC 2160 minute winter	9.253	3.711

Results for 1 year Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	12	1	3.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	13	11	2.622	0.047	3.2	0.0535	0.0000	OK
15 minute summer	14	12	2.197	0.047	3.0	0.0299	0.0000	OK
15 minute summer	15	10	2.097	0.152	34.4	0.1724	0.0000	OK
15 minute summer	16	11	1.908	0.203	94.4	0.3586	0.0000	OK
720 minute summer	17	525	1.442	0.137	18.1	90.1147	0.0000	OK
15 minute summer	18	10	2.102	0.102	31.7	0.1151	0.0000	OK
15 minute summer	19	11	1.636	0.381	124.0	0.6724	0.0000	OK
15 minute summer	20	11	1.633	0.458	49.1	0.8096	0.0000	OK
15 minute summer	25	10	1.866	0.108	18.5	0.1221	0.0000	OK
15 minute summer	26	10	2.496	0.046	7.4	0.0290	0.0000	OK
15 minute summer	27	12	1.684	0.269	27.7	0.3047	0.0000	OK
15 minute summer	28	11	1.667	0.357	35.6	0.4043	0.0000	SURCHARGED
15 minute summer	29	11	1.656	0.416	35.9	0.4710	0.0000	SURCHARGED
15 minute summer	22	8	1.785	0.435	61.8	0.7680	0.0000	OK
720 minute summer	23	525	1.442	0.172	13.8	82.2077	0.0000	OK
720 minute summer	24	525	1.442	0.242	11.0	81.0254	0.0000	OK
15 minute summer	30	12	1.628	0.508	101.8	0.8984	0.0000	SURCHARGED
2160 minute summer	31	1380	1.314	0.254	5.6	0.6453	0.0000	OK
15 minute summer	1	10	2.270	0.070	6.4	0.0448	0.0000	OK
15 minute summer	2	11	1.971	0.071	6.3	0.0451	0.0000	OK
15 minute summer	3	12	1.732	0.062	6.2	0.0392	0.0000	OK
15 minute summer	4	11	1.619	0.139	29.9	0.0884	0.0000	OK
15 minute summer	5	11	1.550	0.120	30.0	0.1355	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	12	S3.000	13	0.0	0.000	0.000	0.1525	
15 minute summer	12	S9.000	35	0.0	0.000	0.000	0.0967	
15 minute summer	13	S3.001	14	3.0	0.668	0.209	0.2979	
15 minute summer	14	S3.002	15	2.9	0.629	0.195	0.0364	
15 minute summer	15	S3.003	16	33.9	0.992	0.467	0.7145	
15 minute summer	16	S3.004	19	93.6	1.360	0.403	4.3652	
720 minute summer	17	S4.000	19	-18.1	-0.440	-0.059	1.5448	
15 minute summer	18	S5.000	19	31.5	1.910	0.364	0.2223	
15 minute summer	19	S3.005	20	49.1	0.706	0.160	8.3158	
15 minute summer	20	S3.006	30	63.9	0.509	0.126	2.4561	
15 minute summer	25	S6.000	27	18.0	0.925	0.449	1.1777	
15 minute summer	26	S7.000	27	7.3	1.651	0.190	0.1793	
15 minute summer	27	S6.001	28	28.1	0.749	0.382	1.6342	
15 minute summer	28	S6.002	29	35.9	0.961	0.302	0.4310	
15 minute summer	29	S6.003	30	39.6	0.589	0.429	1.2215	
15 minute summer	22	S8.000	23	75.8	2.101	0.280	0.8986	
720 minute summer	23	S8.001	24	5.8	0.394	0.035	1.8795	
720 minute summer	24	S8.002	30	-11.0	-0.170	-0.059	2.5019	
15 minute summer	30	Hydro-Brake®	31	9.2				
2160 minute summer	31	S3.008	32	5.6	0.221	0.010	10.8283	
15 minute summer	1	S1.000	2	6.3	0.790	0.434	0.3634	
15 minute summer	2	S1.001	3	6.2	0.847	0.428	0.2502	
15 minute summer	3	S1.002	4	6.1	0.418	0.167	0.6528	
15 minute summer	4	S1.003	5	30.0	1.033	0.402	0.3198	
15 minute summer	5	S1.004	6	30.2	1.600	0.294	0.4170	

Results for 1 year Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	6	510	1.403	0.143	5.4	15.0685	0.0000	OK
720 minute summer	7	510	1.403	0.183	4.4	0.3242	0.0000	OK
720 minute summer	8	510	1.403	0.243	7.9	0.3484	0.0000	OK
15 minute summer	9	10	1.854	0.054	13.4	0.0614	0.0000	OK
720 minute summer	10	510	1.403	0.203	8.0	65.8882	0.0000	OK
720 minute summer	11	510	1.403	0.303	7.6	0.7723	0.0000	OK
2160 minute summer	32	1380	1.313	0.383	8.4	0.9760	0.0000	OK
2160 minute summer	33	1380	1.313	0.453	8.6	1.1540	0.0000	OK
2160 minute summer	34	1380	1.313	0.533	8.7	1.3575	0.0000	OK
15 minute summer	35	11	2.604	0.034	1.7	0.0215	0.0000	OK
15 minute summer	36	11	2.545	0.110	18.9	0.1242	0.0000	OK
15 minute summer	37	10	2.173	0.198	66.9	0.3493	0.0000	OK
15 minute summer	38	9	1.955	0.065	65.9	0.1149	0.0000	OK
2160 minute winter	39	1560	1.379	0.489	6.1	341.1492	0.0000	OK
2160 minute winter	40	1560	1.379	0.509	6.2	0.8989	0.0000	OK
2160 minute winter	41	1560	1.379	0.579	3.9	1.0226	0.0000	OK
15 minute summer	45	10	1.958	0.068	16.5	0.0432	0.0000	OK
15 minute summer	46	10	1.473	0.101	16.4	0.0644	0.0000	OK
2160 minute winter	47	1560	1.379	0.189	1.2	0.2134	0.0000	OK
2160 minute winter	48	1560	1.379	0.259	2.3	0.2926	0.0000	OK
15 minute summer	43	10	1.605	0.135	28.1	0.1528	0.0000	OK
15 minute summer	44	10	1.482	0.092	28.0	0.1042	0.0000	OK
2160 minute winter	49	1560	1.379	0.599	4.2	1.5237	0.0000	SURCHARGED
2160 minute summer	50	1380	1.313	0.613	10.0	1.5611	0.0000	SURCHARGED
15 minute summer	Existing Outfall	1	1.140	0.500	2.8	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)
720 minute summer	6	S1.005	7	3.2	0.310	0.010	1.0681	
720 minute summer	7	S1.006	8	4.3	0.214	0.013	2.3238	
720 minute summer	8	S1.007	11	7.6	0.146	0.024	3.3772	
15 minute summer	9	S2.000	10	13.3	1.914	0.110	0.0484	
720 minute summer	10	S2.001	11	-5.7	-0.137	-0.021	1.3269	
720 minute summer	11	Hydro-Brake®	32	2.7				
2160 minute summer	32	S1.009	33	8.3	0.171	0.014	7.6545	
2160 minute summer	33	S1.010	34	8.6	0.042	0.016	12.2323	
2160 minute summer	34	S1.011	50	8.6	0.024	0.015	13.8297	
15 minute summer	35	S9.001	36	1.6	0.543	0.105	0.0244	
15 minute summer	36	S9.002	37	18.5	0.982	0.463	0.7458	
15 minute summer	37	S9.003	38	65.9	1.737	0.406	1.3446	
15 minute summer	38	S9.004	40	65.9	3.748	0.045	0.1553	
2160 minute winter	39	S10.000	40	-6.1	-0.207	-0.020	2.6254	
2160 minute winter	40	S9.005	41	-3.8	-0.067	-0.012	9.1333	
2160 minute winter	41	S9.006	49	-3.9	-0.043	-0.012	2.6415	
15 minute summer	45	S12.000	46	16.4	1.207	0.200	0.2875	
15 minute summer	46	S12.001	47	16.2	0.849	0.404	0.5840	
2160 minute winter	47	S12.002	48	2.3	0.454	0.040	0.2208	
2160 minute winter	48	S12.003	49	2.6	0.343	0.030	0.6732	
15 minute summer	43	S11.000	44	28.0	1.392	0.613	0.2081	
15 minute summer	44	S11.001	49	27.8	0.950	0.356	0.7495	
2160 minute winter	49	Hydro-Brake®	50	2.0				
2160 minute summer	50	Hydro-Brake®	Existing Outfall	10.0				751.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	12	13	3.055	0.055	6.2	0.0623	0.0000	OK
15 minute summer	13	11	3.193	0.618	22.1	0.6986	0.0000	SURCHARGED
15 minute summer	14	10	3.112	0.962	26.8	0.6121	0.0000	SURCHARGED
15 minute summer	15	10	3.148	1.203	122.9	1.3601	0.0000	SURCHARGED
15 minute summer	16	10	2.853	1.148	344.3	2.0281	0.0000	SURCHARGED
720 minute winter	17	705	1.819	0.514	29.5	366.0276	0.0000	OK
15 minute summer	18	10	3.059	1.059	119.9	1.1978	0.0000	SURCHARGED
15 minute summer	19	9	2.175	0.920	470.4	1.6264	0.0000	SURCHARGED
15 minute summer	20	9	2.179	1.004	129.1	1.7739	0.0000	SURCHARGED
15 minute summer	25	10	3.492	1.734	70.0	1.9612	0.7857	FLOOD
15 minute summer	26	11	3.290	0.840	27.8	0.5339	0.0000	FLOOD RISK
15 minute summer	27	10	2.815	1.400	100.7	1.5835	0.0000	SURCHARGED
15 minute summer	28	10	2.584	1.274	139.5	1.4406	0.0000	SURCHARGED
15 minute summer	29	10	2.396	1.156	142.2	1.3075	0.0000	SURCHARGED
15 minute winter	22	5	2.100	0.750	219.2	1.3251	0.0000	FLOOD RISK
720 minute winter	23	705	1.819	0.549	17.4	261.7860	0.0000	SURCHARGED
720 minute winter	24	705	1.819	0.619	12.1	206.9357	0.0000	SURCHARGED
15 minute summer	30	9	2.169	1.049	280.2	1.8541	0.0000	SURCHARGED
120 minute summer	31	76	1.732	0.672	11.0	1.7112	0.0000	OK
15 minute summer	1	12	3.113	0.913	24.1	0.5809	0.0000	FLOOD RISK
15 minute summer	2	12	2.465	0.565	20.3	0.3594	0.0000	SURCHARGED
15 minute summer	3	11	1.988	0.318	20.6	0.2020	0.0000	SURCHARGED
15 minute summer	4	11	1.930	0.450	110.9	0.2860	0.0000	SURCHARGED
480 minute winter	5	472	1.784	0.354	12.6	0.4004	0.0000	SURCHARGED

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	12	S3.000	13	-5.4	-0.398	-0.378	0.7533	
15 minute summer	12	S9.000	35	4.2	0.303	0.293	0.7671	
15 minute summer	13	S3.001	14	15.3	0.870	1.064	1.1311	
15 minute summer	14	S3.002	15	-23.7	-1.349	-1.615	0.1405	
15 minute summer	15	S3.003	16	125.3	1.780	1.724	1.4686	
15 minute summer	16	S3.004	19	350.3	2.211	1.508	9.1577	
720 minute winter	17	S4.000	19	-29.5	-0.464	-0.096	6.6430	
15 minute summer	18	S5.000	19	121.4	3.053	1.404	0.5360	
15 minute summer	19	S3.005	20	129.1	0.850	0.420	11.1710	
15 minute summer	20	S3.006	30	139.6	0.532	0.276	2.8582	
15 minute summer	25	S6.000	27	63.8	1.605	1.589	1.7741	
15 minute summer	26	S7.000	27	28.1	1.680	0.729	0.3360	
15 minute summer	27	S6.001	28	103.1	1.464	1.404	1.6787	
15 minute summer	28	S6.002	29	142.2	2.020	1.196	0.4310	
15 minute summer	29	S6.003	30	144.8	2.056	1.569	1.2215	
15 minute winter	22	S8.000	23	219.7	2.858	0.812	0.9156	
720 minute winter	23	S8.001	24	4.0	0.241	0.024	4.1682	
720 minute winter	24	S8.002	30	-11.9	-0.229	-0.064	3.8019	
15 minute summer	30	Hydro-Brake®	31	9.2				
120 minute summer	31	S3.008	32	-8.9	0.407	-0.016	25.9523	
15 minute summer	1	S1.000	2	20.3	1.155	1.406	0.7922	
15 minute summer	2	S1.001	3	20.6	1.173	1.417	0.5979	
15 minute summer	3	S1.002	4	25.8	0.683	0.707	1.5201	
15 minute summer	4	S1.003	5	109.7	1.558	1.470	0.7746	
480 minute winter	5	S1.004	6	12.3	0.684	0.120	1.4046	

Results for 30 year Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	6	472	1.784	0.524	12.3	69.9756	0.0000	OK
480 minute winter	7	472	1.784	0.564	8.4	0.9967	0.0000	OK
480 minute winter	8	472	1.784	0.624	17.6	0.8930	0.0000	SURCHARGED
15 minute summer	9	10	1.919	0.119	50.6	0.1347	0.0000	OK
480 minute winter	10	472	1.784	0.584	19.2	202.1659	0.0000	SURCHARGED
480 minute winter	11	472	1.784	0.684	16.8	1.7410	0.0000	SURCHARGED
120 minute summer	32	76	1.732	0.802	22.9	2.0418	0.0000	SURCHARGED
120 minute summer	33	76	1.732	0.872	18.5	2.2203	0.0000	SURCHARGED
120 minute summer	34	76	1.734	0.954	15.6	2.4271	0.0000	SURCHARGED
15 minute summer	35	11	3.036	0.466	11.2	0.2962	0.0000	SURCHARGED
15 minute summer	36	11	3.032	0.597	65.9	0.6754	0.0000	SURCHARGED
15 minute summer	37	10	2.394	0.419	243.1	0.7407	0.0000	OK
15 minute summer	38	10	2.043	0.153	240.6	0.2698	0.0000	OK
1440 minute winter	39	1380	1.772	0.882	18.6	632.9356	0.0000	SURCHARGED
1440 minute winter	40	1380	1.772	0.902	18.8	1.5931	0.0000	SURCHARGED
1440 minute winter	41	1380	1.772	0.972	11.1	1.7167	0.0000	SURCHARGED
15 minute summer	45	11	2.718	0.828	62.5	0.5265	0.0000	SURCHARGED
15 minute summer	46	11	2.366	0.994	60.2	0.6319	0.0000	SURCHARGED
15 minute summer	47	10	1.876	0.686	86.4	0.7757	0.0000	SURCHARGED
1440 minute winter	48	1380	1.772	0.652	3.5	0.7369	0.0000	SURCHARGED
15 minute summer	43	9	2.391	0.921	106.2	1.0417	6.4501	FLOOD
15 minute summer	44	9	2.123	0.733	73.6	0.8287	0.0000	SURCHARGED
1440 minute winter	49	1380	1.772	0.992	11.8	2.5235	0.0000	SURCHARGED
120 minute summer	50	76	1.731	1.031	19.9	2.6250	0.0000	SURCHARGED
15 minute summer	Existing Outfall	1	1.140	0.500	11.0	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)
480 minute winter	6	S1.005	7	4.4	0.317	0.013	4.5988	
480 minute winter	7	S1.006	8	7.6	0.260	0.023	7.1810	
480 minute winter	8	S1.007	11	16.8	0.209	0.052	7.6058	
15 minute summer	9	S2.000	10	50.4	2.623	0.415	0.1335	
480 minute winter	10	S2.001	11	-13.9	-0.129	-0.052	2.2941	
480 minute winter	11	Hydro-Brake®	32	3.1				
120 minute summer	32	S1.009	33	13.8	0.536	0.023	13.3484	
120 minute summer	33	S1.010	34	14.4	0.467	0.026	17.5564	
120 minute summer	34	S1.011	50	14.7	0.078	0.026	16.8962	
15 minute summer	35	S9.001	36	15.5	0.878	1.010	0.1416	
15 minute summer	36	S9.002	37	63.3	1.593	1.584	1.5323	
15 minute summer	37	S9.003	38	240.6	2.307	1.483	3.3505	
15 minute summer	38	S9.004	40	241.4	3.885	0.164	0.4364	
1440 minute winter	39	S10.000	40	-18.6	-0.339	-0.062	2.9548	
1440 minute winter	40	S9.005	41	-7.9	-0.103	-0.026	9.6469	
1440 minute winter	41	S9.006	49	-11.1	-0.068	-0.035	2.6571	
15 minute summer	45	S12.000	46	60.2	1.513	0.734	0.8338	
15 minute summer	46	S12.001	47	60.6	1.524	1.513	1.2110	
15 minute summer	47	S12.002	48	87.2	2.193	1.534	0.2331	
1440 minute winter	48	S12.003	49	7.5	0.408	0.087	0.7022	
15 minute summer	43	S11.000	44	73.6	1.850	1.613	0.4122	
15 minute summer	44	S11.001	49	73.9	1.859	0.947	1.0827	
1440 minute winter	49	Hydro-Brake®	50	3.0				
120 minute summer	50	Hydro-Brake®	Existing Outfall	12.5				224.1

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	12	11	3.620	0.620	22.3	0.7012	1.0222	FLOOD
15 minute summer	13	11	3.650	1.075	32.5	1.2158	1.3484	FLOOD
15 minute summer	14	11	3.675	1.525	41.6	0.9699	0.3107	FLOOD
15 minute summer	15	9	3.706	1.761	172.1	1.9917	5.7667	FLOOD
15 minute summer	16	9	3.471	1.766	446.4	3.1201	0.0000	FLOOD RISK
480 minute summer	17	480	2.092	0.787	94.9	565.9346	0.0000	SURCHARGED
15 minute summer	18	9	3.700	1.700	167.8	1.9227	1.9103	FLOOD
15 minute summer	19	9	2.318	1.063	611.0	1.8785	0.0000	SURCHARGED
15 minute summer	20	9	2.293	1.118	159.3	1.9753	0.0000	SURCHARGED
15 minute summer	25	9	3.492	1.734	98.0	1.9612	8.4388	FLOOD
15 minute summer	26	9	3.519	1.069	38.9	0.6799	1.8088	FLOOD
15 minute summer	27	9	3.038	1.623	103.8	1.8360	0.0000	SURCHARGED
15 minute summer	28	9	2.847	1.537	152.4	1.7388	0.0000	SURCHARGED
15 minute summer	29	9	2.654	1.414	154.4	1.5990	0.0000	SURCHARGED
15 minute winter	22	5	2.239	0.889	306.9	1.5710	0.0000	FLOOD RISK
480 minute summer	23	480	2.192	0.922	59.6	381.8660	0.0000	SURCHARGED
2160 minute winter	24	2040	2.092	0.892	6.7	298.0777	0.0000	SURCHARGED
15 minute summer	30	9	2.279	1.159	324.0	2.0488	0.0000	SURCHARGED
120 minute summer	31	76	3.201	2.141	23.0	5.4498	0.0000	FLOOD RISK
15 minute summer	1	10	3.376	1.176	33.8	0.7479	2.0817	FLOOD
15 minute summer	2	11	2.811	0.911	21.0	0.5794	0.0000	SURCHARGED
600 minute summer	3	570	2.721	1.051	4.3	0.6682	0.0000	SURCHARGED
600 minute winter	4	555	2.720	1.240	14.6	0.7886	6.8548	FLOOD
480 minute winter	5	456	2.721	1.291	17.2	1.4607	0.0000	FLOOD RISK

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	12	S3.000	13	-10.6	-0.721	-0.735	1.1300	
15 minute summer	12	S9.000	35	-11.7	-0.796	-0.814	1.1507	
15 minute summer	13	S3.001	14	17.0	0.964	1.178	1.1311	
15 minute summer	14	S3.002	15	-34.8	-1.975	-2.365	0.1405	
15 minute summer	15	S3.003	16	153.5	2.180	2.111	1.4686	
15 minute summer	16	S3.004	19	449.5	2.837	1.935	9.1577	
480 minute summer	17	S4.000	19	-94.9	-0.608	-0.310	7.0352	
15 minute summer	18	S5.000	19	161.5	4.061	1.868	0.5360	
15 minute summer	19	S3.005	20	159.3	0.875	0.519	11.1710	
15 minute summer	20	S3.006	30	162.0	0.597	0.320	2.8582	
15 minute summer	25	S6.000	27	61.7	1.553	1.537	1.7741	
15 minute summer	26	S7.000	27	31.9	1.814	0.830	0.3360	
15 minute summer	27	S6.001	28	105.6	1.500	1.438	1.6787	
15 minute summer	28	S6.002	29	154.4	2.192	1.298	0.4310	
15 minute summer	29	S6.003	30	156.4	2.221	1.695	1.2215	
15 minute winter	22	S8.000	23	307.0	2.957	1.135	1.1787	
480 minute summer	23	S8.001	24	44.5	0.281	0.268	4.1682	
2160 minute winter	24	S8.002	30	-6.3	-0.141	-0.034	3.8019	
15 minute summer	30	Hydro-Brake®	31	9.2				
120 minute summer	31	S3.008	32	-22.3	0.402	-0.039	26.6766	
15 minute summer	1	S1.000	2	21.0	1.192	1.452	0.7922	
15 minute summer	2	S1.001	3	22.3	1.268	1.532	0.5979	
600 minute summer	3	S1.002	4	4.3	0.288	0.118	1.5201	
600 minute winter	4	S1.003	5	14.2	0.839	0.191	0.7746	
480 minute winter	5	S1.004	6	16.9	0.650	0.164	1.4046	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	6	448	2.724	1.464	16.9	116.7300	0.0000	SURCHARGED
480 minute winter	7	448	2.725	1.505	10.7	2.6591	0.0000	SURCHARGED
480 minute winter	8	448	2.726	1.566	23.6	2.2403	0.0000	SURCHARGED
480 minute winter	9	448	2.726	0.926	7.5	1.0472	0.0000	SURCHARGED
480 minute winter	10	448	2.726	1.526	28.7	288.0526	0.0000	SURCHARGED
480 minute winter	11	448	2.726	1.626	22.5	4.1379	0.0000	SURCHARGED
120 minute summer	32	74	3.204	2.274	48.1	5.7880	0.0000	FLOOD RISK
120 minute summer	33	74	3.205	2.345	21.4	5.9688	0.0000	FLOOD RISK
120 minute summer	34	74	3.204	2.424	16.8	6.1692	0.0000	FLOOD RISK
15 minute summer	35	11	3.634	1.064	26.2	0.6767	0.9271	FLOOD
15 minute summer	36	11	3.683	1.248	92.2	1.4117	0.0000	FLOOD RISK
15 minute summer	37	10	2.688	0.713	330.2	1.2594	0.0000	SURCHARGED
1440 minute winter	38	1410	2.112	0.222	15.2	0.3919	0.0000	OK
1440 minute winter	39	1410	2.109	1.219	26.4	883.2595	0.0000	SURCHARGED
1440 minute winter	40	1410	2.110	1.240	26.5	2.1912	0.0000	SURCHARGED
1440 minute winter	41	1380	2.108	1.308	11.6	2.3111	0.0000	SURCHARGED
15 minute summer	45	10	3.600	1.710	87.5	1.0876	0.9830	FLOOD
15 minute summer	46	11	3.025	1.653	77.8	1.0511	0.0000	SURCHARGED
15 minute summer	47	10	2.251	1.061	113.3	1.2006	0.0000	SURCHARGED
1440 minute winter	48	1350	2.110	0.990	11.0	1.1200	0.0000	SURCHARGED
15 minute summer	43	8	2.391	0.921	148.7	1.0417	19.3633	FLOOD
15 minute summer	44	9	2.144	0.754	73.3	0.8530	0.0000	SURCHARGED
1440 minute winter	49	1350	2.108	1.328	11.9	3.3793	0.0000	SURCHARGED
120 minute summer	50	74	3.200	2.500	24.7	6.3625	0.9695	FLOOD
15 minute summer	Existing Outfall	1	1.140	0.500	12.3	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)
480 minute winter	6	S1.005	7	5.1	0.341	0.016	4.8336	
480 minute winter	7	S1.006	8	9.6	0.251	0.029	7.2684	
480 minute winter	8	S1.007	11	22.5	0.220	0.070	7.6058	
480 minute winter	9	S2.000	10	7.5	1.483	0.062	0.2760	
480 minute winter	10	S2.001	11	-21.4	-0.160	-0.080	2.2941	
480 minute winter	11	Hydro-Brake®	32	3.7				
120 minute summer	32	S1.009	33	-18.5	0.545	-0.031	13.3484	
120 minute summer	33	S1.010	34	14.3	0.482	0.026	17.5564	
120 minute summer	34	S1.011	50	15.1	0.118	0.027	16.8962	
15 minute summer	35	S9.001	36	18.7	1.064	1.224	0.1416	
15 minute summer	36	S9.002	37	78.5	1.975	1.965	1.5716	
15 minute summer	37	S9.003	38	326.1	2.509	2.009	3.7507	
1440 minute winter	38	S9.004	40	15.2	1.801	0.010	0.5012	
1440 minute winter	39	S10.000	40	-26.4	-0.363	-0.088	2.9548	
1440 minute winter	40	S9.005	41	-11.3	-0.107	-0.036	9.6469	
1440 minute winter	41	S9.006	49	-11.6	-0.071	-0.037	2.6571	
15 minute summer	45	S12.000	46	77.8	1.956	0.949	0.8338	
15 minute summer	46	S12.001	47	78.2	1.968	1.953	1.2110	
15 minute summer	47	S12.002	48	114.4	2.876	2.012	0.2331	
1440 minute winter	48	S12.003	49	5.9	0.420	0.069	0.7022	
15 minute summer	43	S11.000	44	73.3	1.844	1.608	0.4122	
15 minute summer	44	S11.001	49	73.8	1.856	0.945	1.0827	
1440 minute winter	49	Hydro-Brake®	50	3.3				
120 minute summer	50	Hydro-Brake®	Existing Outfall	12.7				235.0

Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	12	18	3.620	0.620	18.2	0.7012	1.5319	FLOOD
30 minute summer	13	18	3.650	1.075	30.0	1.2158	2.0424	FLOOD
30 minute summer	14	18	3.675	1.525	22.2	0.9699	0.6324	FLOOD
15 minute summer	15	9	3.706	1.761	192.7	1.9917	12.9340	FLOOD
15 minute summer	16	9	3.543	1.838	464.8	3.2483	0.0000	FLOOD RISK
600 minute winter	17	555	2.396	1.091	54.4	587.1655	0.0000	SURCHARGED
15 minute summer	18	9	3.700	1.700	187.9	1.9227	5.1648	FLOOD
600 minute winter	19	555	2.396	1.141	65.9	2.0162	0.0000	SURCHARGED
600 minute winter	20	555	2.396	1.221	22.5	2.1572	0.0000	SURCHARGED
15 minute summer	25	8	3.492	1.734	109.8	1.9612	13.0469	FLOOD
15 minute summer	26	9	3.519	1.069	43.6	0.6799	2.9614	FLOOD
15 minute summer	27	9	3.088	1.673	102.5	1.8923	0.0000	FLOOD RISK
15 minute summer	28	9	2.903	1.593	157.3	1.8012	0.0000	SURCHARGED
15 minute summer	29	9	2.688	1.448	159.0	1.6378	0.0000	SURCHARGED
960 minute summer	22	735	2.391	1.041	32.8	1.8394	142.1443	FLOOD
600 minute winter	23	555	2.392	1.122	61.1	382.2205	0.0000	SURCHARGED
600 minute winter	24	555	2.395	1.195	45.4	399.4664	0.0000	SURCHARGED
600 minute winter	30	555	2.396	1.276	30.9	2.2542	0.0000	SURCHARGED
60 minute summer	31	37	3.255	2.195	51.0	5.5850	0.0000	FLOOD RISK
15 minute summer	1	9	3.376	1.176	37.9	0.7479	3.8665	FLOOD
15 minute summer	2	11	2.915	1.015	22.7	0.6458	0.0000	SURCHARGED
180 minute summer	3	180	2.726	1.056	12.6	0.6714	0.0000	SURCHARGED
720 minute winter	4	480	2.720	1.240	18.3	0.7886	78.2274	FLOOD
960 minute summer	5	600	2.723	1.293	16.3	1.4624	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	12	S3.000	13	-7.4	-0.543	-0.513	1.1300	
30 minute summer	12	S9.000	35	-10.8	-0.791	-0.751	1.1507	
30 minute summer	13	S3.001	14	16.6	0.942	1.152	1.1311	
30 minute summer	14	S3.002	15	23.3	1.324	1.586	0.1405	
15 minute summer	15	S3.003	16	152.8	2.170	2.102	1.4686	
15 minute summer	16	S3.004	19	467.6	2.951	2.012	9.1577	
600 minute winter	17	S4.000	19	-54.4	-0.501	-0.178	7.0352	
15 minute summer	18	S5.000	19	161.7	4.065	1.870	0.5360	
600 minute winter	19	S3.005	20	22.5	0.437	0.073	11.1710	
600 minute winter	20	S3.006	30	23.9	0.254	0.047	2.8582	
15 minute summer	25	S6.000	27	63.7	1.601	1.585	1.7741	
15 minute summer	26	S7.000	27	31.2	1.772	0.810	0.3360	
15 minute summer	27	S6.001	28	106.2	1.508	1.446	1.6787	
15 minute summer	28	S6.002	29	159.0	2.258	1.337	0.4310	
15 minute summer	29	S6.003	30	160.7	2.283	1.742	1.2215	
960 minute summer	22	S8.000	23	32.6	0.945	0.121	1.8063	
600 minute winter	23	S8.001	24	-27.7	0.212	-0.167	4.1682	
600 minute winter	24	S8.002	30	-27.1	-0.315	-0.146	3.8019	
600 minute winter	30	Hydro-Brake®	31	8.3				
60 minute summer	31	S3.008	32	-51.0	0.382	-0.090	26.6766	
15 minute summer	1	S1.000	2	22.7	1.287	1.568	0.7922	
15 minute summer	2	S1.001	3	22.5	1.277	1.543	0.5979	
180 minute summer	3	S1.002	4	11.5	0.394	0.316	1.5201	
720 minute winter	4	S1.003	5	13.7	0.820	0.184	0.7746	
960 minute summer	5	S1.004	6	16.0	0.523	0.156	1.4046	

Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	6	172	2.727	1.467	40.3	116.7346	0.0000	SURCHARGED
180 minute winter	7	172	2.728	1.508	24.2	2.6650	0.0000	SURCHARGED
180 minute summer	8	180	2.731	1.571	80.3	2.2479	0.0000	SURCHARGED
180 minute winter	9	172	2.730	0.930	17.8	1.0518	0.0000	SURCHARGED
180 minute winter	10	172	2.731	1.531	72.3	288.0617	0.0000	SURCHARGED
180 minute winter	11	172	2.730	1.630	56.0	4.1489	0.0000	SURCHARGED
60 minute winter	32	41	3.239	2.309	59.2	5.8760	0.0000	FLOOD RISK
60 minute summer	33	41	3.225	2.365	57.6	6.0179	0.0000	FLOOD RISK
60 minute summer	34	40	3.216	2.436	54.0	6.1993	0.0000	FLOOD RISK
15 minute summer	35	10	3.634	1.064	31.2	0.6767	2.3088	FLOOD
15 minute summer	36	10	3.699	1.264	103.2	1.4296	1.6754	FLOOD
15 minute summer	37	10	2.804	0.829	362.3	1.4645	0.0000	SURCHARGED
600 minute winter	38	555	2.418	0.528	34.9	0.9335	0.0000	SURCHARGED
960 minute summer	39	705	2.408	1.518	66.0	892.6227	0.0000	SURCHARGED
600 minute winter	40	555	2.414	1.544	64.8	2.7282	0.0000	SURCHARGED
600 minute winter	41	555	2.410	1.610	30.0	2.8450	0.0000	SURCHARGED
15 minute summer	45	10	3.600	1.710	98.0	1.0876	2.5674	FLOOD
15 minute summer	46	10	3.074	1.702	78.7	1.0825	0.0000	SURCHARGED
600 minute winter	47	555	2.408	1.218	12.0	1.3778	0.0000	SURCHARGED
600 minute winter	48	555	2.410	1.290	11.9	1.4591	0.0000	SURCHARGED
960 minute summer	43	705	2.391	0.921	14.9	1.0417	78.4711	FLOOD
600 minute winter	44	555	2.397	1.007	14.5	1.1384	0.0000	SURCHARGED
600 minute winter	49	555	2.409	1.629	30.2	4.1456	0.0000	SURCHARGED
120 minute summer	50	68	3.200	2.500	68.6	6.3625	13.4614	FLOOD
15 minute summer	Existing Outfall	1	1.140	0.500	12.5	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)
180 minute winter	6	S1.005	7	-17.1	0.393	-0.052	4.8336	
180 minute winter	7	S1.006	8	21.6	0.324	0.066	7.2684	
180 minute summer	8	S1.007	11	76.6	0.351	0.237	7.6058	
180 minute winter	9	S2.000	10	17.8	1.916	0.147	0.2760	
180 minute winter	10	S2.001	11	-54.5	-0.344	-0.203	2.2941	
180 minute winter	11	Hydro-Brake®	32	3.7				
60 minute winter	32	S1.009	33	41.8	0.573	0.071	13.3484	
60 minute summer	33	S1.010	34	47.5	0.513	0.086	17.5564	
60 minute summer	34	S1.011	50	52.3	0.122	0.093	16.8962	
15 minute summer	35	S9.001	36	-21.9	-1.242	-1.429	0.1416	
15 minute summer	36	S9.002	37	76.7	1.930	1.920	1.5716	
15 minute summer	37	S9.003	38	358.6	2.665	2.209	3.9085	
600 minute winter	38	S9.004	40	34.9	2.338	0.024	0.6723	
960 minute summer	39	S10.000	40	-66.0	-0.435	-0.221	2.9548	
600 minute winter	40	S9.005	41	-29.9	-0.134	-0.097	9.6469	
600 minute winter	41	S9.006	49	-30.0	-0.107	-0.095	2.6571	
15 minute summer	45	S12.000	46	78.7	1.980	0.960	0.8338	
15 minute summer	46	S12.001	47	78.5	1.973	1.959	1.2110	
600 minute winter	47	S12.002	48	11.9	0.836	0.210	0.2331	
600 minute winter	48	S12.003	49	11.8	0.611	0.137	0.7022	
960 minute summer	43	S11.000	44	14.8	1.052	0.324	0.4122	
600 minute winter	44	S11.001	49	14.2	0.448	0.181	1.0827	
600 minute winter	49	Hydro-Brake®	50	3.1				
120 minute summer	50	Hydro-Brake®	Existing Outfall	12.7				236.9

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	12	10	3.620	0.620	16.5	0.7012	1.9594	FLOOD
15 minute summer	13	10	3.650	1.075	33.7	1.2158	3.3933	FLOOD
15 minute winter	14	10	3.675	1.525	38.4	0.9699	1.0282	FLOOD
15 minute summer	15	8	3.706	1.761	223.5	1.9917	28.6438	FLOOD
15 minute summer	16	9	3.639	1.934	488.2	3.4166	0.0000	FLOOD RISK
360 minute winter	17	248	2.438	1.133	103.2	587.2133	0.0000	SURCHARGED
15 minute summer	18	8	3.700	1.700	218.0	1.9227	12.4810	FLOOD
360 minute winter	19	248	2.437	1.182	116.8	2.0883	0.0000	SURCHARGED
240 minute winter	20	180	2.449	1.274	58.5	2.2505	0.0000	SURCHARGED
15 minute summer	25	8	3.492	1.734	127.3	1.9612	18.6964	FLOOD
15 minute summer	26	9	3.519	1.069	50.6	0.6799	4.7712	FLOOD
15 minute summer	27	9	3.114	1.699	102.4	1.9212	0.0000	FLOOD RISK
15 minute summer	28	9	2.927	1.617	164.3	1.8284	0.0000	SURCHARGED
15 minute winter	29	8	2.696	1.456	162.7	1.6464	0.0000	SURCHARGED
1440 minute winter	22	900	2.391	1.041	49.8	1.8394	550.4211	FLOOD
360 minute winter	23	248	2.400	1.130	67.9	382.2346	0.0000	SURCHARGED
240 minute winter	24	180	2.471	1.271	130.4	401.4128	0.0000	SURCHARGED
240 minute winter	30	180	2.459	1.339	96.6	2.3668	0.0000	SURCHARGED
120 minute summer	31	66	3.278	2.218	25.9	5.6451	0.0000	FLOOD RISK
30 minute summer	1	16	3.376	1.176	40.2	0.7479	6.1019	FLOOD
15 minute summer	2	11	3.025	1.125	20.5	0.7152	0.0000	SURCHARGED
15 minute summer	3	10	2.767	1.097	22.4	0.6976	0.0000	FLOOD RISK
600 minute summer	4	345	2.720	1.240	52.5	0.7886	182.9435	FLOOD
600 minute summer	5	345	2.743	1.313	30.5	1.4846	0.0000	FLOOD RISK

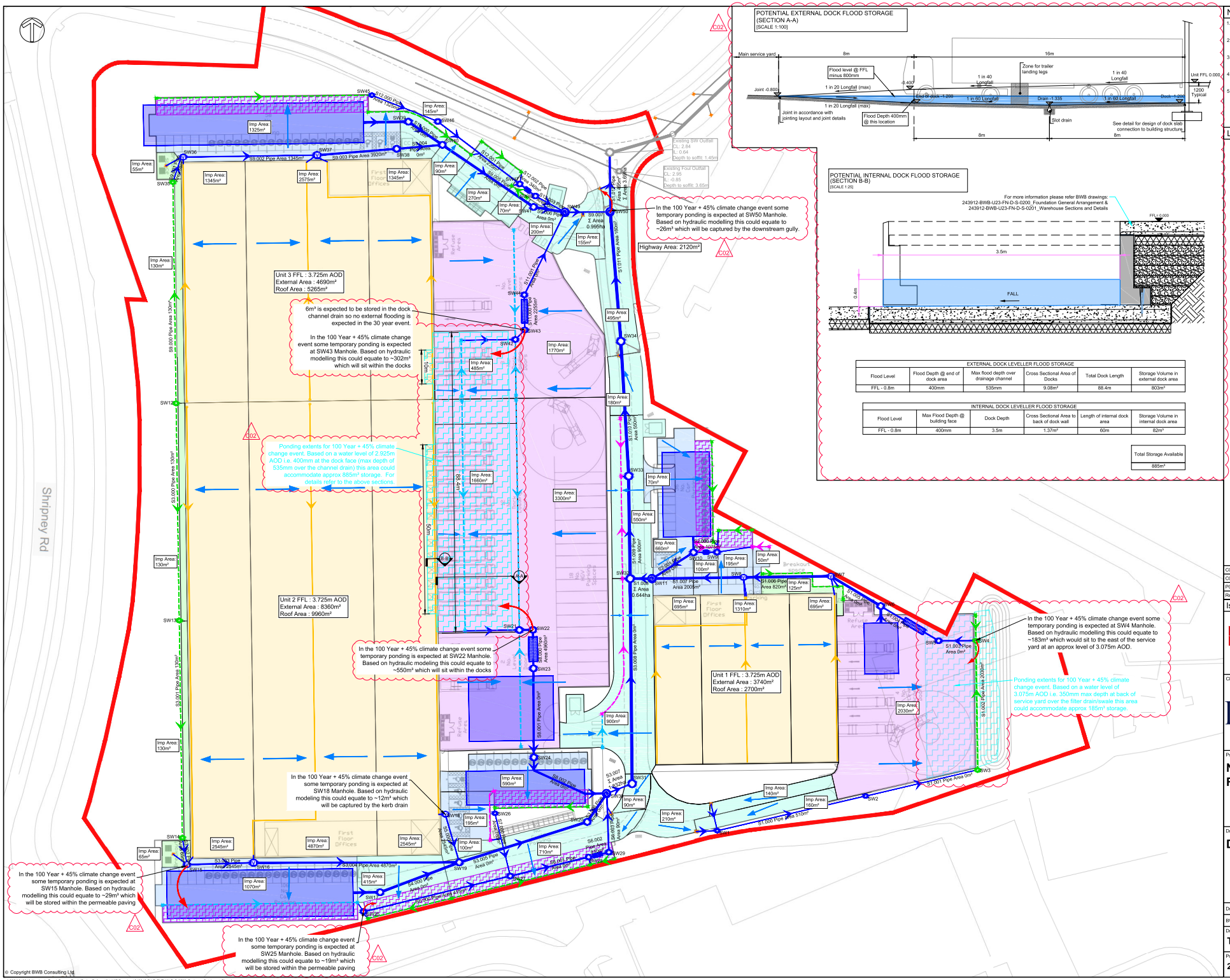
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	12	S3.000	13	-8.1	-0.521	-0.564	1.1300	
15 minute summer	12	S9.000	35	-9.9	-0.793	-0.691	1.1507	
15 minute summer	13	S3.001	14	16.9	0.962	1.177	1.1311	
15 minute winter	14	S3.002	15	-31.2	-1.770	-2.120	0.1405	
15 minute summer	15	S3.003	16	149.9	2.129	2.062	1.4686	
15 minute summer	16	S3.004	19	490.5	3.096	2.111	9.1577	
360 minute winter	17	S4.000	19	-103.2	-0.698	-0.337	7.0352	
15 minute summer	18	S5.000	19	164.0	4.125	1.897	0.5360	
360 minute winter	19	S3.005	20	74.2	0.493	0.242	11.1710	
240 minute winter	20	S3.006	30	55.0	0.427	0.109	2.8582	
15 minute summer	25	S6.000	27	63.2	1.590	1.573	1.7741	
15 minute summer	26	S7.000	27	31.1	1.817	0.809	0.3360	
15 minute summer	27	S6.001	28	106.2	1.508	1.446	1.6787	
15 minute summer	28	S6.002	29	165.7	2.354	1.394	0.4310	
15 minute winter	29	S6.003	30	164.0	2.329	1.777	1.2215	
1440 minute winter	22	S8.000	23	52.9	0.846	0.196	1.8063	
360 minute winter	23	S8.001	24	-67.9	-0.429	-0.410	4.1682	
240 minute winter	24	S8.002	30	-98.6	-0.622	-0.531	3.8019	
240 minute winter	30	Hydro-Brake®	31	8.5				
120 minute summer	31	S3.008	32	-25.9	0.394	-0.045	26.6766	
30 minute summer	1	S1.000	2	21.6	1.230	1.498	0.7922	
15 minute summer	2	S1.001	3	22.4	1.273	1.538	0.5979	
15 minute summer	3	S1.002	4	27.0	0.680	0.741	1.5201	
600 minute summer	4	S1.003	5	-33.3	0.888	-0.446	0.7746	
600 minute summer	5	S1.004	6	-30.5	0.622	-0.297	1.4046	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 85.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	6	152	2.809	1.549	68.0	116.8791	0.0000	FLOOD RISK
600 minute summer	7	345	2.783	1.563	30.4	2.7624	0.0000	SURCHARGED
240 minute summer	8	152	2.806	1.646	74.8	2.3548	0.0000	SURCHARGED
240 minute summer	9	152	2.817	1.017	25.2	1.1502	0.0000	SURCHARGED
240 minute summer	10	152	2.816	1.616	101.1	288.2120	0.0000	SURCHARGED
240 minute summer	11	152	2.819	1.719	78.2	4.3745	0.0000	SURCHARGED
60 minute winter	32	36	3.269	2.339	79.6	5.9524	0.0000	FLOOD RISK
60 minute summer	33	36	3.276	2.416	88.6	6.1484	0.0000	FLOOD RISK
60 minute summer	34	35	3.230	2.450	120.8	6.2353	1.8821	FLOOD
30 minute summer	35	17	3.634	1.064	30.7	0.6767	3.6934	FLOOD
15 minute summer	36	9	3.699	1.264	119.8	1.4296	5.9861	FLOOD
15 minute summer	37	10	2.949	0.974	402.5	1.7214	0.0000	SURCHARGED
720 minute winter	38	480	2.491	0.601	35.1	1.0619	0.0000	SURCHARGED
720 minute winter	39	480	2.495	1.605	64.9	892.7771	0.0000	SURCHARGED
720 minute winter	40	480	2.492	1.622	65.1	2.8660	0.0000	SURCHARGED
720 minute winter	41	480	2.491	1.691	30.1	2.9880	0.0000	SURCHARGED
15 minute summer	45	9	3.600	1.710	113.7	1.0876	7.6240	FLOOD
15 minute summer	46	10	3.114	1.742	75.7	1.1082	0.0000	SURCHARGED
720 minute winter	47	480	2.492	1.302	12.0	1.4724	0.0000	SURCHARGED
720 minute winter	48	480	2.490	1.370	11.9	1.5496	0.0000	SURCHARGED
2160 minute summer	43	1260	2.391	0.921	20.5	1.0417	302.5467	FLOOD
720 minute winter	44	480	2.422	1.032	23.7	1.1677	0.0000	SURCHARGED
720 minute winter	49	480	2.492	1.712	30.4	4.3568	0.0000	SURCHARGED
120 minute summer	50	66	3.200	2.500	92.4	6.3625	25.8908	FLOOD
15 minute summer	Existing Outfall	1	1.140	0.500	12.5	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)
240 minute summer	6	S1.005	7	-44.3	0.394	-0.134	4.8336	
600 minute summer	7	S1.006	8	-24.7	0.249	-0.075	7.2684	
240 minute summer	8	S1.007	11	74.4	0.348	0.231	7.6058	
240 minute summer	9	S2.000	10	25.2	1.805	0.207	0.2760	
240 minute summer	10	S2.001	11	-77.6	-0.490	-0.289	2.2941	
240 minute summer	11	Hydro-Brake®	32	3.7				
60 minute winter	32	S1.009	33	-36.9	0.575	-0.062	13.3484	
60 minute summer	33	S1.010	34	110.7	0.515	0.201	17.5564	
60 minute summer	34	S1.011	50	111.5	0.253	0.199	16.8962	
30 minute summer	35	S9.001	36	-21.2	-1.207	-1.389	0.1416	
15 minute summer	36	S9.002	37	78.2	1.967	1.957	1.5716	
15 minute summer	37	S9.003	38	398.2	2.879	2.453	4.0889	
720 minute winter	38	S9.004	40	35.1	2.276	0.024	0.6723	
720 minute winter	39	S10.000	40	-64.9	-0.538	-0.217	2.9548	
720 minute winter	40	S9.005	41	-30.0	0.148	-0.097	9.6469	
720 minute winter	41	S9.006	49	-30.1	-0.107	-0.096	2.6571	
15 minute summer	45	S12.000	46	75.7	1.904	0.923	0.8338	
15 minute summer	46	S12.001	47	77.3	1.943	1.928	1.2110	
720 minute winter	47	S12.002	48	11.9	0.782	0.210	0.2331	
720 minute winter	48	S12.003	49	12.0	0.558	0.140	0.7022	
2160 minute summer	43	S11.000	44	-15.4	0.808	-0.338	0.4122	
720 minute winter	44	S11.001	49	-23.7	-0.596	-0.304	1.0827	
720 minute winter	49	Hydro-Brake®	50	3.1				
120 minute summer	50	Hydro-Brake®	Existing Outfall	12.7				236.4

APPENDIX C – Updated Catchment Plan/Flood Routing



EXTERNAL DOCK LEVELLER FLOOD STORAGE

Flood Level	Flood Depth @ end of dock area	Max flood depth over drainage channel	Cross Sectional Area of Docks	Total Dock Length	Storage Volume in external dock area
FFL - 0.8m	400mm	535mm	9.08m²	88.4m	803m³

INTERNAL DOCK LEVELLER FLOOD STORAGE

Flood Level	Max Flood Depth @ building face	Dock Depth	Cross Sectional Area to back of dock wall	Length of internal dock area	Storage Volume in internal dock area
FFL - 0.8m	400mm	3.5m	1.37m²	60m	82m³

Total Storage Available
885m³

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. To read in conjunction with the latest BWB drawings / reports:
   243912-BWB-EXT-XX-D-C-0500_Drainage Layout,
   243912-BWB-EXT-XX-D-C-0001_Civil Engineering Notes,
   243912-BWB-EXT-XX-T-C-0500_Drainage Hydraulic Report

Legend

- Service Yard Drainage Catchment (0.92ha)
- Car Park Drainage Catchment (0.43ha)
- Highway Drainage Catchment (0.49ha)
- Building Roof Drainage Catchment (1.79ha)
- Footway Drainage Catchment (0.06ha)

Total Impermeable Catchment Area ~ 3.69ha

- SW Drainage
- FW Drainage
- Channel Drain
- Filter Drain
- Kerb Drain

Rev	Date	Details of issue / revision	Drw	Rev
C02	27.06.25	Updated to suit latest hydraulic model results	DH	TAJ
C01	20.12.24	Issued for tender	DH	TAJ
P01	29.11.24	Issued for comment	JJA	TAJ

Issues & Revisions

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Client

PANATTONI

Project Title

Newlands Road, Bognor Regis

Drawing Title

Drainage Catchment Plan

Drawn:	J.Arnold		Reviewed:	T.Jones
BWB Ref:	243912	Date:	29.11.24	Scale@A1: 1:500

Drawing Status

TENDER

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
243912-BWB-EXT-XX-D-C-0530	**A4**	**C02**

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APPENDIX D – Drainage O&M Guidance

Project	**Newlands Road, Bognor Regis**		
Document Number	243912-BWB-ZZ-XX-RP-C-0001	**BWB Ref**	243912
Author	T. Jones	**Status**	S2
Checked	D. Gray	**Revision**	P01
Approved	T. Jones	**Date**	03.07.25

1.0 Introduction

1.1. This technical note aims to provide the necessary information to discharge condition 24 (ADS ref BE/150/22/OUT) relating to the maintenance & management of the surface water drainage system.

1.2. The proposed drainage system for Newlands Road, Bognor Regis incorporates a series of drainage features to collect and convey storm water discharge. It is important that the site owner maintains the drainage to ensure that the drainage system elements operate effectively for their lifetime.

1.3. The site drainage strategy shown on drawing ref 243912-BWB-EXT-XX-D-C-0500 will be incorporated within the Operation and Maintenance (O&M) manual for the site and be accessible to those who undertake maintenance. This document should be read in conjunction with the drainage system drawings.

2.0 Overview of Maintenance

2.1. All drainage systems, both piped & SuDS systems require regular maintenance. The maintenance of the drainage system at Newlands Road, Bognor Regis should be included alongside other regular maintenance tasks. The table below gives an overview of typical maintenance tasks and the frequency with which they need to be undertaken.

Activity	Indicative Frequency	Typical Tasks
Routine / regular maintenance	Monthly to annually (for normal care of SuDS)	Litter picking Inspections
Occasional maintenance	Annually (dependent on the design)	Sediment removal Vegetation management
Remedial maintenance	As required (tasks to repair problems due to damage or vandalism)	Inlet/outlet repair Erosion repairs Reinstatement works Reinstatement following pollution Removal of silt build up
Unplanned incidents	As required as reactive measures for unforeseen accidents/spillages	

2.2. The below table lists the drainage features present on the Newlands Road, Bognor Regis site and provides a description of their function and design criteria.

Component	Function
Channel Drains	Channel drains are located at low points on the hardstanding external to collect surface water run-off and connect into the underground drainage system. A silt trap is located at the outfall of the channel drain to collect silt and debris prior to entering the underground surface water drainage system.
Gullies (including kerb drain outfalls)	Gullies are located at low points on the hardstanding external to collect surface water run-off and connect into the underground drainage system. A silt trap is located the base of the gully to collect silt and debris prior to entering the underground surface water drainage system.
Filter Drains	A stone filled trench with a perforated pipe at the bottom which collects, cleans, and stores runoff before conveying the water to the downstream drainage system.
Permeable Paving	A pervious block paved structure which allows surface water to soak through the structural paving. The stone sub-base cleanses and attenuates runoff before conveying the water to the downstream drainage system.
Controls Chambers	A manhole containing a self-activating device that regulates the flow of water through the device depending on the height of the water above the opening (hydraulic head) by creating a swirling vortex flow which restricts discharge rates from the site.
Below ground attenuation system	Modular system for below ground storage of storm water.
Oil Separators	A device that treats surface water run-offs to remove hydrocarbons, trash, and silt.

2.3. The required maintenance for each of the drainage components that make up the drainage system is scheduled below.

3.0 Maintenance Responsibility

3.1. During the development period and thereafter a maintenance and management regime will be adopted. The establishment and future success of the site is largely dependent on the standard and frequency of the subsequent maintenance and management it receives.

3.2. Maintenance responsibility should always be placed with an appropriate, long-term, accountable organisation. This often takes the form of a local or county council, sewerage undertaker or Management Companies. In this case, the intention is to utilise Management Companies, one will be responsible for the shared infrastructure and communal areas and the other responsible for each individual plot demise. Similar to many commercial estates the management companies will be funded through service charges.

4.0 Maintenance Guidance

4.1. The following maintenance guidance for the drainage system at Newlands Road, Bognor Regis is based on CIRIA C753 – The SuDS Manual. These O&M requirements are to be continually monitored by the body responsible for the operation and maintenance of below ground drainage and SuDS features and modified as necessary to suit requirements of the site once operational.

4.2. All inspections should comply with all relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) including the development of risk assessments for working close to or in water.

4.3. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. In the majority of cases, it will be acceptable to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

5.0 Channel Drains

5.1. Maintenance requirements for Channel drains are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Litter and debris removal	Monthly
	Check channel grating is secure and undamaged	Monthly
	Strim vegetation 1m min. Surround to channel drains and keep areas free from silt and debris	Monthly (during growing season)
	Undertake inspection of channel drains after leaf fall in autumn	As required
Occasional maintenance	Repair physical damage if necessary	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal, frequencies.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

6.0 Gullies

6.1. Maintenance requirements for gullies/kerb drain outlets are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Litter and debris removal	Monthly
	Strim vegetation 1m min. Surround to gullies and keep areas free from silt and debris	Monthly (during growing season)
	Undertake inspection of gullies after leaf fall in autumn	As required
Occasional maintenance	Repair physical damage if necessary	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal, frequencies.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

7.0 Filter Drains

7.1. Maintenance requirements for filter drains are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Remove weeds on trench surface	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
	Removal and washing of exposed stones on the trench surface	Bi-annually or when silts is evident on surface
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required

	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required
Remedial maintenance	Clear perforated pipework blockages.	As Required
	Rehabilitate infiltration and filtration surfaces.	As Required
	Replace	As Required
	Replace geotextiles and clean and replace filter media, if clogging occurs.	As Required
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies	Half Yearly
Incident remediation	Remove surface geotextile and replace, and wash or replace overlying filter medium	After spillage event
	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

8.0 Permeable Paving

8.1. Maintenance requirements for permeable paving are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface). Particular attention to be paid to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment	Once a year, after autumn leaf fall, or as per manufacturer's recommendations
Occasional maintenance	Stabilise and mow contributing and adjacent landscaped areas	As required
	Removal of weeds or management using	As required
Remedial maintenance	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving or adjacent footway paving level	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface paving and upper substructure bedding layer by remedial sweeping	Every 10 to 15 years or as required if infiltration performance is reduced due to significant clogging

Monitoring	Initial inspection	Monthly for 3 months after installation
	Inspect for evidence of poor operation and or weed growth, if required, take remedial action	Every 3 month, 48hrs after large storm events in first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

9.0 Control Chambers

9.1. Maintenance requirements for control chambers are given in the below Table.

Maintenance Activity	Action Required	Frequency
Regular Maintenance	Inspect surface structures removing obstructions and silt as necessary. Check there is no physical damage	Annually, after major storm event, or as required
	Remove control manhole cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt	Annually, after major storm event, or as required
	Undertake inspection of control chamber after leaf fall in autumn	As required
Occasional maintenance	Repair physical damage if necessary	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect structures for evidence of poor operation.	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal, frequencies.	Half yearly
	Check flow control device is functioning and that the emergency drain down mechanism is working.	Half yearly
Incident remediation	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event
	Flush up and downstream drainage system, remove contaminated water with tanker	After spillage event

10.0 Proprietary Products

10.1. The following proprietary products from part of the drainage strategy at this site:

- full retention separator.
- Below ground attenuation system.

10.2. Maintenance and inspection of all proprietary systems should follow the advice provided by the manufacturer or supplier and should be included on the maintenance schedule for the site.

10.3. All proprietary systems should be checked during the first year of operation to make sure they are appropriate for the operation of the site.

11.0 Flood Routes

11.1. Flood routes (exceedance routes), as illustrated on drawing 243912-BWB-EXT-XX-D-C-0530, allow water volumes that exceed the capacity of the drainage system to pass through or round the site without causing damage to property. These routes must be clear of obstructions.

11.2. Maintenance requirements for flood routes are given in the below table.

Maintenance Activity	Action Required	Frequency
Regular maintenance	Make visual inspection. Check route is not blocked by new fences, walls, soil or other rubbish. Remove as necessary	Monthly/after large storms

12.0 Spillage - Emergency Action

12.1. Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency with residual spillage allowed to bio-remediate in the drainage system.

12.2. In the event of a serious spillage, either by volume or of unknown or toxic compounds, the spillage should be isolated above ground if possible, for example with soil, sand or turf.

12.3. During a major spillage the Environment Agency should be contacted immediately.