
SURFACE & FOUL WATER DRAINAGE STRATEGY

**PROPOSED RESIDENTIAL DEVELOPMENT OFF
WIGNALS GATE, HOLBEACH, Lincs.
PHASE 3**

For D Brown Builders

Document Reference 36916-REP-01A

January 2021

Revision A

Revisions:

A – 19.02.21 – Drawings updated.

Introduction

The following drainage strategy has been prepared on behalf of D. Brown Building Contractors Ltd. to support a full planning application for Phase 3 of the proposed residential development, at Land off Wignals Gate, Holbeach.

This strategy is based upon Andrew M Wright Ltd. Site Layout drawing 071605-PD102-D2.

The object of this report is to clarify the design philosophy followed when preparing the proposed surface & foul water drainage arrangement and to outline the proposed solution in sufficient detail for all relevant parties to be able to comment. This assessment also demonstrates that the proposals are within the guidance contained within the National Planning Policy Framework (NPPF).

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Location & Site Description

The site is located to the south of Wignals Gate and has typical low-lying flat Fenland topography.

Ground investigations to determine soil infiltration rates took place on site, the location and results are attached ref 36916/SK02. These results demonstrate that the soil infiltration rate is relatively poor and although they would be acceptable for the individual private plot drainage, it would be inadequate to provide infiltration as a disposal method for the Highway surface water.

The Phase 3 part of the development is an extension to the South of the previously approved Phase 1 & 2. It is proposed that an additional 27 dwellings are to be provided. These will be accessed via either the previously approved Highway or an additional section of Highway to be adopted by Lincolnshire County Council. The following report will address how this section of additional Highway will be drained.

Discussion

It is proposed to use the same design philosophy for Phase 3 as the previously approved Phases 1 & 2. The drainage strategies supporting these previous phases are included at the end of the report.

Surface Water Design Proposal

As before, it is intended to discharge surface water from the road only into the existing Holbeach New River to the East of the site. This is a South Holland Internal Drainage Board maintained watercourse and the designed outfall will enter the watercourse at a relatively high level, approximately at the 1:100 year design water level within the existing watercourse.

The design proposals are shown on SRC drawing 36916 / 500A & 501A. The existing Phase 1 & 2 Highway areas are shown green and purple respectively and the proposed Phase 3 is shown orange.

The extent of proposed impermeable Highway is 1,070m², this is to be collected via a series of trapped road gullies and underground pipe network located beneath the carriageway.

The flow to The South Holland IDB system will be restricted to a maximum of 5.0 litres / second, therefore an attenuation basin is to be incorporated to store runoff above this value.

The site layout local to Phase 3 lends itself to the attenuation basin being located online whereas the previous phases had their basins located offline. Locating the basin online has two advantages, efficiency, and water quality improvement. All the run-off from the highway will flow through the basin therefore it is proposed that vegetation is to be planted within the basin to provide pollutant removal for up to the 1:1 year event, in accordance with CIRIA SuDS Manual 2015 guidance.

Should the system fail due to blockage cause by poor maintenance the overland flood flow routes will direct water to the existing watercourse. It is proposed that site levels are to be increased on the West of the site therefore the proposed topography will direct surface water Eastwards via the public open space to the existing watercourse. This will prevent any flooding to proposed or existing dwellings.

The system has been modelled utilising MicroDrainage and the calculation inputs and outputs are included within the calculation package 36916-MD-01A.

The system including the attenuation basin is proposed to be adopted by Lincolnshire County Council as part of the Section 38 agreement.

It is proposed that the surface water runoff from the dwelling roofs and private drives will be dealt with in the same manner as the previous phases. Roof water will be collected in a traditional manner and piped to suitably sized soakaways located in the dwellings rear garden. The driveway construction will be permeable paving and have a suitably designed open graded sub-base depth to temporarily store the runoff prior to infiltration.

Foul Water Design Proposal

Drawing 36916 / 501A demonstrates that the Anglian Water foul sewer which is to be constructed during the Phase 1 & 2 works, is at an adequate depth to allow the proposed Phase 3 to drain via gravity.

It is necessary that site levels are to be raised to a certain extent to suit the Flood Risk Assessment and to allow the Highway drainage to outfall to the existing watercourse. This allows adequate cover to be provided over the proposed foul sewer in the South West corner of the site.

The proposed foul water sewer extension is be offered for adoption by Anglian Water as part of a further Section 104 agreement.

List of Appendices:

1. Phase 1 & 2 Surface Water Drainage Strategy
2. Architectural Site Layout
3. SRC Design Drawings 36916 / 500A & 501A
4. Surface Water Calculations 36916-MD-01A
5. Ground Investigations

SURFACE WATER DRAINAGE STRATEGY

**PROPOSED RESIDENTIAL DEVELOPMENT OFF
WIGNALS GATE, HOLBEACH, Lincs.**

For D Brown Builders

Issue 3 – February 2019

Introduction

- 1) New Planning Requirements make it necessary to consider Sustainable Drainage Systems (SuDS) with respect to planning applications of the size and number of dwellings in this instance.
- 2) It is recognised that the type and scale of this development is what the local planning department is supporting. This being relatively dense use of available land.
- 3) The site is located to the south of Wignals Gate, and has typical low-lying flat Fenland topography. The proposed development site area is 5.1 hectares.

Discussion

With respect to SuDS, the introduction of a swale/filter drain along the road/pavement was considered. Due to the limited amount of available land and the relatively short length of road, these were considered to be impractical and unreasonable and therefore discounted. Furthermore, the high ground water table and flat topography experienced in the Fenland areas make these features unfeasible. These challenges are highlighted in 'Lincolnshire Development Roads and Sustainable Drainage Design Approach, November 2017 Edition'.

Further thought/discussion was given to providing a permeable road surface throughout and an open stone road base with an impermeable membrane to direct water to the drainage system.

This was considered unworkable since there would be many penetrations in the membrane for the foul sewer and all services.

Furthermore, Lincolnshire County Council would not adopt a permeable road surface in this area due to the high ground water table.

Although an Internal Drainage Board open drain is present to the Eastern side of the site, there is a requirement to minimise rainfall discharge into their system. Consequently the available space for soakaways to accept roof water also needs to be considered.

Ground investigation to determine soil infiltration rates took place on site, the location and results are attached ref 36916/SK02. It can be seen that the soil infiltration rate is poor and although this is acceptable for a 1:10 year event for roof water, soakaways would not be suitable for Lincolnshire County Council 1:30 year event requirement.

With respect to the local plan, it is necessary to provide affordable housing. Consequently, on small sites, it is necessary to have a relatively dense development, giving limited available space for swales, lagoons etc.

Having considered the "Development Road and Sustainable Drainage Specification and Construction". May 2018 Edition, issued by Lincolnshire County Council Highway and Flood Authority, it is clear that the introduction of swales or filter drains, would not comply with the design requirements of the document.

Reference being made to Figure 5/8 Element 12 and Figure 5/12 element 9, where in the Fenland Area the maximum ground water level cannot be achieved, please refer to ground investigation information attached.

Design Proposal

It is intended to discharge surface water from the road only into the existing South Holland Internal Drainage Board system to the east of the site via two separate outfalls.

Both outfalls will have a restricted discharge to 5.0 litres per second via the use of a HydroBrake located in an upstream chamber to the edge of the IDB easement strip. The excess flows over this discharge rate will be stored in the new upstream pipe network, underground storage pipes and open attenuation areas within the public open space.

Surface water from the roofs will be placed in suitable designed soakaways.

Please refer to attached drawing No.d 36916/15C for drainage design and layout of both surface and foul water. This drawing has been prepared in conjunction with MicroDrainage design calculations, also attached.

All drawings to be worked on site to final Contractor details to suit of site and materials of work to be submitted within 10 days and shall be final and not subject to change.

Report any discrepancies to the Contract Administrator at once.

This drawing is to be used with all relevant Architects and Engineers drawings and other relevant information.

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LEGEND: DO NOT SCALE

- Affordable dwellings
(shared ownership or rent)
- 13 no. bungalows (2 bed)
- 2 no. bungalows (2 bed)
- 4 no. 2 storey houses (1 bed)
- 28 no. bungalows (3 bed)
(with single or double garage)
- 4 no. 2 storey houses (2 bed)
- 8 no. 2 storey houses (2 bed)
- 14 no. 2 storey houses (4 bed)
(with double garage)
- 1 no. 2 storey house (4 bed)
- 26 no. 2 storey houses (3 bed)
(with single or double garage)
- 4 no. 2 storey houses (3 bed)
- Public open space
- Refuse collection point

Total no. of dwellings = 104



20	35.11.20	Scale 1:500	2007 - 2008
20	35.11.20	Scale 1:500	2007 - 2008
20	35.11.20	Scale 1:500	2007 - 2008
20	35.11.20	Scale 1:500	2007 - 2008

ANDREW M WRIGHT LTD
CHARTERED ARCHITECT



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Telephone: 01805 540373 Mobile: 07960 914778

Project:
Residential Development
Wigwags Gate
Holbeach
Lincs

Drawing Title:
Proposed Site Layout

Client:
Loosegate Developments Ltd

Drawn	Checked	Date	Scale	Project Name
AMW	AMW	03.11.20	1:1000	A1
07/1605	PD/02	Planning		D2



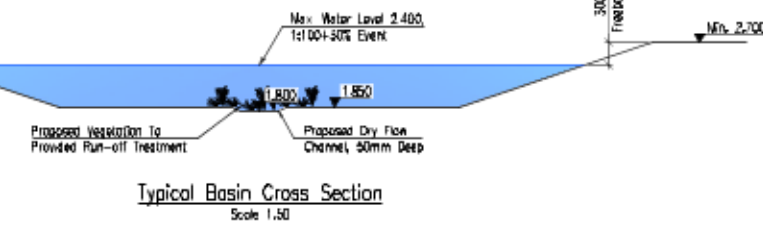
Key:

1.87	Existing Site Level
1.330	Proposed Site Level
④	Proposed High Point
②	Proposed Low Point
—	Proposed Drapped Here
—	Proposed Formed Surface



A	19.02.21	Minor Amendments.	
Rev	Date	Remarks	
Status	FOR PLANNING		
 SIDEBOTTOM RICHARDSON CHENG LTD 15 High Street, Spalding, Lincs. PE11 1HE Tel: 01775 712880 Fax: 01775 712885 Email: info@src.co.uk CONSULTING STRUCTURAL AND CIVIL ENGINEERS			
Project	Proposed Residential Development off Wignals Gate Holbeach, Lincs. For D Brown Builders		
Title	<u>Phase 3</u> Proposed Site Layout		
Date	Jan. '21	Scale	1:500
Drawn	MP	Checked	SRC
Design	SRC	File Name	36916-500
DRG No. 36916/500			Rev A

PHASE BASIN 2:
Drainage Attenuation Basin For Storage Of Purple Road Area
(Basin Extended To Allow Storage Of Additional Road Area,
Agreements To Be Amended With LCC Highways &
South Holland IDB)



PHASE BASIN 3:
Drainage Attenuation Basin For Storage Of Orange Road Area
(Agreements To Be Made With LCC Highways &
South Holland IDB At Detailed Design Stage)



Rev	19.02.21	Minor Amendments	Remarks
Status	FOR PLANNING		
Project	 SIDEBOTTOM RICHARDSON CHENG LTD CONSULTING STRUCTURAL AND CIVIL ENGINEERS 15 High Street, Spalding, Lincolnshire PE11 1HE Tel: 01775 712880 Fax: 01775 712881 Email: info@src.co.uk		
File	Proposed Residential Development off Wignals Gate, Holbeach, Lincs. For D Brown Builders Phase 3 Proposed Drainage Layout		
Date	Jan. 21	Scale	1:500 @A1
Drawn	MP	Checked	SRC
Design	SRC	File Name	36916-501
DRG No. 36916/501			Rev A

Project: Proposed Residential Development off Wignals Gate, Holbeach

Title: Phase 3 Road Drainage Calculations

Project: Proposed Residential Development

Location: Wignals Gate, Holbeach, Lincs.

Client: D Brown Builders

Project Ref: 36916

Prepared By: M.Pett

Date: January 2021

Doc Ref: 36916-MD-01

Revision: A

Revisions:
A – Basin Size Amended

Project: Proposed Residential Development off Wignals Gate, Holbeach

Calculation Summary:

The following calculations demonstrate the design of the surface water drainage system serving the adoptable Highway and footpath The design proposals are shown on SRC drawing 36916/501.

The system has been designed for storms up to and including the 1:100yr +30% climate change event.

The Highway drainage is collected via road gullies discharge to a pipe network beneath the road.

An online attenuation basin has been modelled on PN9.003, please refer to page 13 for details.

A proposed flow control has been incorporated within H104 to limit discharge to a maximum of 5 litres / second.

The system outfalls Holbeach New River which is maintained by South Holland IDB. A surcharged outfall has been modelled to suit the 1:100 year plus climate change level of 1.63 ODN.

The purpose of these calculation is to support the planning application and therefore they should not be used solely, for the detailed design/construction.

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Date 19/02/2021 12:34 File 36916-MD-01A.MDX	Designed by MP Checked by SRC	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
9.000	63.250	0.380	166.4	0.069	5.00	0.0	0.600	o	225	Pipe/Conduit	0
10.000	22.000	0.150	146.7	0.013	5.00	0.0	0.600	o	150	Pipe/Conduit	0
9.001	61.980	0.375	165.3	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit	0
9.002	16.478	0.100	164.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	0
9.003	11.232	0.075	149.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	0
9.004	19.000	0.125	152.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	0

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
9.000	75.00	6.04	2.655	0.069	0.0	0.0	0.0	1.01	40.2	14.1
10.000	75.00	5.44	2.500	0.013	0.0	0.0	0.0	0.83	14.6	2.7
9.001	75.00	7.06	2.275	0.107	0.0	0.0	0.0	1.01	40.3	21.7
9.002	75.00	7.33	1.900	0.107	0.0	0.0	0.0	1.02	40.4	21.7
9.003	75.00	7.51	1.800	0.107	0.0	0.0	0.0	1.07	42.4	21.7
9.004	75.00	7.90	1.725	0.107	0.0	0.0	0.0	0.81	14.4«	21.7

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XP Solutions	Network 2019.1	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
H100	3.530	0.875	Open Manhole	1200	9.000	2.655	225				
H101	3.250	0.750	Open Manhole	1200	10.000	2.500	150				
H102	3.115	0.840	Open Manhole	1200	9.001	2.275	225	9.000	2.275	225	
								10.000	2.350	150	
H103	2.800	0.900	Open Manhole	1200	9.002	1.900	225	9.001	1.900	225	
Basin	2.700	0.900	Open Manhole	1200	9.003	1.800	225	9.002	1.800	225	
H104	2.700	0.975	Open Manhole	1200	9.004	1.725	150	9.003	1.725	225	
	2.600	1.000	Open Manhole	0		OUTFALL		9.004	1.600	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
H100	534460399.180	324390293.140	534460399.180	324390293.140	Required	
H101	534460465.097	324390308.387	534460465.097	324390308.387	Required	
H102	534460462.090	324390286.594	534460462.090	324390286.594	Required	
H103	534460455.675	324390224.946	534460455.675	324390224.946	Required	
Basin	534460472.060	324390223.194	534460472.060	324390223.194	Required	
H104	534460483.237	324390222.078	534460483.237	324390222.078	Required	
	534460502.137	324390220.136			No Entry	

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XP Solutions	Network 2019.1



PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.000	o	225	H100	3.530	2.655	0.650	Open Manhole	1200
10.000	o	150	H101	3.250	2.500	0.600	Open Manhole	1200
9.001	o	225	H102	3.115	2.275	0.615	Open Manhole	1200
9.002	o	225	H103	2.800	1.900	0.675	Open Manhole	1200
9.003	o	225	Basin	2.700	1.800	0.675	Open Manhole	1200
9.004	o	150	H104	2.700	1.725	0.825	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
9.000	63.250	166.4	H102	3.115	2.275	0.615	Open Manhole	1200
10.000	22.000	146.7	H102	3.115	2.350	0.615	Open Manhole	1200
9.001	61.980	165.3	H103	2.800	1.900	0.675	Open Manhole	1200
9.002	16.478	164.8	Basin	2.700	1.800	0.675	Open Manhole	1200
9.003	11.232	149.8	H104	2.700	1.725	0.750	Open Manhole	1200
9.004	19.000	152.0		2.600	1.600	0.850	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
9.000	User	-	100	0.069	0.069	0.069
10.000	User	-	100	0.013	0.013	0.013
9.001	User	-	100	0.024	0.024	0.024
9.002	-	-	100	0.000	0.000	0.000
9.003	-	-	100	0.000	0.000	0.000
9.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.107	0.107	0.107

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

9.004 2.600 1.600 0.000 0 0

Datum (m) 1.600 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	0.030	28	0.030	55	0.030	82	0.030	109	0.030	136	0.030
2	0.030	29	0.030	56	0.030	83	0.030	110	0.030	137	0.030
3	0.030	30	0.030	57	0.030	84	0.030	111	0.030	138	0.030
4	0.030	31	0.030	58	0.030	85	0.030	112	0.030	139	0.030
5	0.030	32	0.030	59	0.030	86	0.030	113	0.030	140	0.030
6	0.030	33	0.030	60	0.030	87	0.030	114	0.030	141	0.030
7	0.030	34	0.030	61	0.030	88	0.030	115	0.030	142	0.030
8	0.030	35	0.030	62	0.030	89	0.030	116	0.030	143	0.030
9	0.030	36	0.030	63	0.030	90	0.030	117	0.030	144	0.030
10	0.030	37	0.030	64	0.030	91	0.030	118	0.030	145	0.030
11	0.030	38	0.030	65	0.030	92	0.030	119	0.030	146	0.030
12	0.030	39	0.030	66	0.030	93	0.030	120	0.030	147	0.030
13	0.030	40	0.030	67	0.030	94	0.030	121	0.030	148	0.030
14	0.030	41	0.030	68	0.030	95	0.030	122	0.030	149	0.030
15	0.030	42	0.030	69	0.030	96	0.030	123	0.030	150	0.030
16	0.030	43	0.030	70	0.030	97	0.030	124	0.030	151	0.030
17	0.030	44	0.030	71	0.030	98	0.030	125	0.030	152	0.030
18	0.030	45	0.030	72	0.030	99	0.030	126	0.030	153	0.030
19	0.030	46	0.030	73	0.030	100	0.030	127	0.030	154	0.030
20	0.030	47	0.030	74	0.030	101	0.030	128	0.030	155	0.030
21	0.030	48	0.030	75	0.030	102	0.030	129	0.030	156	0.030
22	0.030	49	0.030	76	0.030	103	0.030	130	0.030	157	0.030
23	0.030	50	0.030	77	0.030	104	0.030	131	0.030	158	0.030
24	0.030	51	0.030	78	0.030	105	0.030	132	0.030	159	0.030
25	0.030	52	0.030	79	0.030	106	0.030	133	0.030	160	0.030
26	0.030	53	0.030	80	0.030	107	0.030	134	0.030	161	0.030
27	0.030	54	0.030	81	0.030	108	0.030	135	0.030	162	0.030

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
163	0.030	213	0.030	263	0.030	313	0.030	363	0.030	413	0.030
164	0.030	214	0.030	264	0.030	314	0.030	364	0.030	414	0.030
165	0.030	215	0.030	265	0.030	315	0.030	365	0.030	415	0.030
166	0.030	216	0.030	266	0.030	316	0.030	366	0.030	416	0.030
167	0.030	217	0.030	267	0.030	317	0.030	367	0.030	417	0.030
168	0.030	218	0.030	268	0.030	318	0.030	368	0.030	418	0.030
169	0.030	219	0.030	269	0.030	319	0.030	369	0.030	419	0.030
170	0.030	220	0.030	270	0.030	320	0.030	370	0.030	420	0.030
171	0.030	221	0.030	271	0.030	321	0.030	371	0.030	421	0.030
172	0.030	222	0.030	272	0.030	322	0.030	372	0.030	422	0.030
173	0.030	223	0.030	273	0.030	323	0.030	373	0.030	423	0.030
174	0.030	224	0.030	274	0.030	324	0.030	374	0.030	424	0.030
175	0.030	225	0.030	275	0.030	325	0.030	375	0.030	425	0.030
176	0.030	226	0.030	276	0.030	326	0.030	376	0.030	426	0.030
177	0.030	227	0.030	277	0.030	327	0.030	377	0.030	427	0.030
178	0.030	228	0.030	278	0.030	328	0.030	378	0.030	428	0.030
179	0.030	229	0.030	279	0.030	329	0.030	379	0.030	429	0.030
180	0.030	230	0.030	280	0.030	330	0.030	380	0.030	430	0.030
181	0.030	231	0.030	281	0.030	331	0.030	381	0.030	431	0.030
182	0.030	232	0.030	282	0.030	332	0.030	382	0.030	432	0.030
183	0.030	233	0.030	283	0.030	333	0.030	383	0.030	433	0.030
184	0.030	234	0.030	284	0.030	334	0.030	384	0.030	434	0.030
185	0.030	235	0.030	285	0.030	335	0.030	385	0.030	435	0.030
186	0.030	236	0.030	286	0.030	336	0.030	386	0.030	436	0.030
187	0.030	237	0.030	287	0.030	337	0.030	387	0.030	437	0.030
188	0.030	238	0.030	288	0.030	338	0.030	388	0.030	438	0.030
189	0.030	239	0.030	289	0.030	339	0.030	389	0.030	439	0.030
190	0.030	240	0.030	290	0.030	340	0.030	390	0.030	440	0.030
191	0.030	241	0.030	291	0.030	341	0.030	391	0.030	441	0.030
192	0.030	242	0.030	292	0.030	342	0.030	392	0.030	442	0.030
193	0.030	243	0.030	293	0.030	343	0.030	393	0.030	443	0.030
194	0.030	244	0.030	294	0.030	344	0.030	394	0.030	444	0.030
195	0.030	245	0.030	295	0.030	345	0.030	395	0.030	445	0.030
196	0.030	246	0.030	296	0.030	346	0.030	396	0.030	446	0.030
197	0.030	247	0.030	297	0.030	347	0.030	397	0.030	447	0.030
198	0.030	248	0.030	298	0.030	348	0.030	398	0.030	448	0.030
199	0.030	249	0.030	299	0.030	349	0.030	399	0.030	449	0.030
200	0.030	250	0.030	300	0.030	350	0.030	400	0.030	450	0.030
201	0.030	251	0.030	301	0.030	351	0.030	401	0.030	451	0.030
202	0.030	252	0.030	302	0.030	352	0.030	402	0.030	452	0.030
203	0.030	253	0.030	303	0.030	353	0.030	403	0.030	453	0.030
204	0.030	254	0.030	304	0.030	354	0.030	404	0.030	454	0.030
205	0.030	255	0.030	305	0.030	355	0.030	405	0.030	455	0.030
206	0.030	256	0.030	306	0.030	356	0.030	406	0.030	456	0.030
207	0.030	257	0.030	307	0.030	357	0.030	407	0.030	457	0.030
208	0.030	258	0.030	308	0.030	358	0.030	408	0.030	458	0.030
209	0.030	259	0.030	309	0.030	359	0.030	409	0.030	459	0.030
210	0.030	260	0.030	310	0.030	360	0.030	410	0.030	460	0.030
211	0.030	261	0.030	311	0.030	361	0.030	411	0.030	461	0.030
212	0.030	262	0.030	312	0.030	362	0.030	412	0.030	462	0.030

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Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
463	0.030	513	0.030	563	0.030	613	0.030	663	0.030	713	0.030
464	0.030	514	0.030	564	0.030	614	0.030	664	0.030	714	0.030
465	0.030	515	0.030	565	0.030	615	0.030	665	0.030	715	0.030
466	0.030	516	0.030	566	0.030	616	0.030	666	0.030	716	0.030
467	0.030	517	0.030	567	0.030	617	0.030	667	0.030	717	0.030
468	0.030	518	0.030	568	0.030	618	0.030	668	0.030	718	0.030
469	0.030	519	0.030	569	0.030	619	0.030	669	0.030	719	0.030
470	0.030	520	0.030	570	0.030	620	0.030	670	0.030	720	0.030
471	0.030	521	0.030	571	0.030	621	0.030	671	0.030	721	0.030
472	0.030	522	0.030	572	0.030	622	0.030	672	0.030	722	0.030
473	0.030	523	0.030	573	0.030	623	0.030	673	0.030	723	0.030
474	0.030	524	0.030	574	0.030	624	0.030	674	0.030	724	0.030
475	0.030	525	0.030	575	0.030	625	0.030	675	0.030	725	0.030
476	0.030	526	0.030	576	0.030	626	0.030	676	0.030	726	0.030
477	0.030	527	0.030	577	0.030	627	0.030	677	0.030	727	0.030
478	0.030	528	0.030	578	0.030	628	0.030	678	0.030	728	0.030
479	0.030	529	0.030	579	0.030	629	0.030	679	0.030	729	0.030
480	0.030	530	0.030	580	0.030	630	0.030	680	0.030	730	0.030
481	0.030	531	0.030	581	0.030	631	0.030	681	0.030	731	0.030
482	0.030	532	0.030	582	0.030	632	0.030	682	0.030	732	0.030
483	0.030	533	0.030	583	0.030	633	0.030	683	0.030	733	0.030
484	0.030	534	0.030	584	0.030	634	0.030	684	0.030	734	0.030
485	0.030	535	0.030	585	0.030	635	0.030	685	0.030	735	0.030
486	0.030	536	0.030	586	0.030	636	0.030	686	0.030	736	0.030
487	0.030	537	0.030	587	0.030	637	0.030	687	0.030	737	0.030
488	0.030	538	0.030	588	0.030	638	0.030	688	0.030	738	0.030
489	0.030	539	0.030	589	0.030	639	0.030	689	0.030	739	0.030
490	0.030	540	0.030	590	0.030	640	0.030	690	0.030	740	0.030
491	0.030	541	0.030	591	0.030	641	0.030	691	0.030	741	0.030
492	0.030	542	0.030	592	0.030	642	0.030	692	0.030	742	0.030
493	0.030	543	0.030	593	0.030	643	0.030	693	0.030	743	0.030
494	0.030	544	0.030	594	0.030	644	0.030	694	0.030	744	0.030
495	0.030	545	0.030	595	0.030	645	0.030	695	0.030	745	0.030
496	0.030	546	0.030	596	0.030	646	0.030	696	0.030	746	0.030
497	0.030	547	0.030	597	0.030	647	0.030	697	0.030	747	0.030
498	0.030	548	0.030	598	0.030	648	0.030	698	0.030	748	0.030
499	0.030	549	0.030	599	0.030	649	0.030	699	0.030	749	0.030
500	0.030	550	0.030	600	0.030	650	0.030	700	0.030	750	0.030
501	0.030	551	0.030	601	0.030	651	0.030	701	0.030	751	0.030
502	0.030	552	0.030	602	0.030	652	0.030	702	0.030	752	0.030
503	0.030	553	0.030	603	0.030	653	0.030	703	0.030	753	0.030
504	0.030	554	0.030	604	0.030	654	0.030	704	0.030	754	0.030
505	0.030	555	0.030	605	0.030	655	0.030	705	0.030	755	0.030
506	0.030	556	0.030	606	0.030	656	0.030	706	0.030	756	0.030
507	0.030	557	0.030	607	0.030	657	0.030	707	0.030	757	0.030
508	0.030	558	0.030	608	0.030	658	0.030	708	0.030	758	0.030
509	0.030	559	0.030	609	0.030	659	0.030	709	0.030	759	0.030
510	0.030	560	0.030	610	0.030	660	0.030	710	0.030	760	0.030
511	0.030	561	0.030	611	0.030	661	0.030	711	0.030	761	0.030
512	0.030	562	0.030	612	0.030	662	0.030	712	0.030	762	0.030

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Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
763	0.030	813	0.030	863	0.030	913	0.030	963	0.030	1013	0.030
764	0.030	814	0.030	864	0.030	914	0.030	964	0.030	1014	0.030
765	0.030	815	0.030	865	0.030	915	0.030	965	0.030	1015	0.030
766	0.030	816	0.030	866	0.030	916	0.030	966	0.030	1016	0.030
767	0.030	817	0.030	867	0.030	917	0.030	967	0.030	1017	0.030
768	0.030	818	0.030	868	0.030	918	0.030	968	0.030	1018	0.030
769	0.030	819	0.030	869	0.030	919	0.030	969	0.030	1019	0.030
770	0.030	820	0.030	870	0.030	920	0.030	970	0.030	1020	0.030
771	0.030	821	0.030	871	0.030	921	0.030	971	0.030	1021	0.030
772	0.030	822	0.030	872	0.030	922	0.030	972	0.030	1022	0.030
773	0.030	823	0.030	873	0.030	923	0.030	973	0.030	1023	0.030
774	0.030	824	0.030	874	0.030	924	0.030	974	0.030	1024	0.030
775	0.030	825	0.030	875	0.030	925	0.030	975	0.030	1025	0.030
776	0.030	826	0.030	876	0.030	926	0.030	976	0.030	1026	0.030
777	0.030	827	0.030	877	0.030	927	0.030	977	0.030	1027	0.030
778	0.030	828	0.030	878	0.030	928	0.030	978	0.030	1028	0.030
779	0.030	829	0.030	879	0.030	929	0.030	979	0.030	1029	0.030
780	0.030	830	0.030	880	0.030	930	0.030	980	0.030	1030	0.030
781	0.030	831	0.030	881	0.030	931	0.030	981	0.030	1031	0.030
782	0.030	832	0.030	882	0.030	932	0.030	982	0.030	1032	0.030
783	0.030	833	0.030	883	0.030	933	0.030	983	0.030	1033	0.030
784	0.030	834	0.030	884	0.030	934	0.030	984	0.030	1034	0.030
785	0.030	835	0.030	885	0.030	935	0.030	985	0.030	1035	0.030
786	0.030	836	0.030	886	0.030	936	0.030	986	0.030	1036	0.030
787	0.030	837	0.030	887	0.030	937	0.030	987	0.030	1037	0.030
788	0.030	838	0.030	888	0.030	938	0.030	988	0.030	1038	0.030
789	0.030	839	0.030	889	0.030	939	0.030	989	0.030	1039	0.030
790	0.030	840	0.030	890	0.030	940	0.030	990	0.030	1040	0.030
791	0.030	841	0.030	891	0.030	941	0.030	991	0.030	1041	0.030
792	0.030	842	0.030	892	0.030	942	0.030	992	0.030	1042	0.030
793	0.030	843	0.030	893	0.030	943	0.030	993	0.030	1043	0.030
794	0.030	844	0.030	894	0.030	944	0.030	994	0.030	1044	0.030
795	0.030	845	0.030	895	0.030	945	0.030	995	0.030	1045	0.030
796	0.030	846	0.030	896	0.030	946	0.030	996	0.030	1046	0.030
797	0.030	847	0.030	897	0.030	947	0.030	997	0.030	1047	0.030
798	0.030	848	0.030	898	0.030	948	0.030	998	0.030	1048	0.030
799	0.030	849	0.030	899	0.030	949	0.030	999	0.030	1049	0.030
800	0.030	850	0.030	900	0.030	950	0.030	1000	0.030	1050	0.030
801	0.030	851	0.030	901	0.030	951	0.030	1001	0.030	1051	0.030
802	0.030	852	0.030	902	0.030	952	0.030	1002	0.030	1052	0.030
803	0.030	853	0.030	903	0.030	953	0.030	1003	0.030	1053	0.030
804	0.030	854	0.030	904	0.030	954	0.030	1004	0.030	1054	0.030
805	0.030	855	0.030	905	0.030	955	0.030	1005	0.030	1055	0.030
806	0.030	856	0.030	906	0.030	956	0.030	1006	0.030	1056	0.030
807	0.030	857	0.030	907	0.030	957	0.030	1007	0.030	1057	0.030
808	0.030	858	0.030	908	0.030	958	0.030	1008	0.030	1058	0.030
809	0.030	859	0.030	909	0.030	959	0.030	1009	0.030	1059	0.030
810	0.030	860	0.030	910	0.030	960	0.030	1010	0.030	1060	0.030
811	0.030	861	0.030	911	0.030	961	0.030	1011	0.030	1061	0.030
812	0.030	862	0.030	912	0.030	962	0.030	1012	0.030	1062	0.030

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Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1063	0.030	1113	0.030	1163	0.030	1213	0.030	1263	0.030	1313	0.030
1064	0.030	1114	0.030	1164	0.030	1214	0.030	1264	0.030	1314	0.030
1065	0.030	1115	0.030	1165	0.030	1215	0.030	1265	0.030	1315	0.030
1066	0.030	1116	0.030	1166	0.030	1216	0.030	1266	0.030	1316	0.030
1067	0.030	1117	0.030	1167	0.030	1217	0.030	1267	0.030	1317	0.030
1068	0.030	1118	0.030	1168	0.030	1218	0.030	1268	0.030	1318	0.030
1069	0.030	1119	0.030	1169	0.030	1219	0.030	1269	0.030	1319	0.030
1070	0.030	1120	0.030	1170	0.030	1220	0.030	1270	0.030	1320	0.030
1071	0.030	1121	0.030	1171	0.030	1221	0.030	1271	0.030	1321	0.030
1072	0.030	1122	0.030	1172	0.030	1222	0.030	1272	0.030	1322	0.030
1073	0.030	1123	0.030	1173	0.030	1223	0.030	1273	0.030	1323	0.030
1074	0.030	1124	0.030	1174	0.030	1224	0.030	1274	0.030	1324	0.030
1075	0.030	1125	0.030	1175	0.030	1225	0.030	1275	0.030	1325	0.030
1076	0.030	1126	0.030	1176	0.030	1226	0.030	1276	0.030	1326	0.030
1077	0.030	1127	0.030	1177	0.030	1227	0.030	1277	0.030	1327	0.030
1078	0.030	1128	0.030	1178	0.030	1228	0.030	1278	0.030	1328	0.030
1079	0.030	1129	0.030	1179	0.030	1229	0.030	1279	0.030	1329	0.030
1080	0.030	1130	0.030	1180	0.030	1230	0.030	1280	0.030	1330	0.030
1081	0.030	1131	0.030	1181	0.030	1231	0.030	1281	0.030	1331	0.030
1082	0.030	1132	0.030	1182	0.030	1232	0.030	1282	0.030	1332	0.030
1083	0.030	1133	0.030	1183	0.030	1233	0.030	1283	0.030	1333	0.030
1084	0.030	1134	0.030	1184	0.030	1234	0.030	1284	0.030	1334	0.030
1085	0.030	1135	0.030	1185	0.030	1235	0.030	1285	0.030	1335	0.030
1086	0.030	1136	0.030	1186	0.030	1236	0.030	1286	0.030	1336	0.030
1087	0.030	1137	0.030	1187	0.030	1237	0.030	1287	0.030	1337	0.030
1088	0.030	1138	0.030	1188	0.030	1238	0.030	1288	0.030	1338	0.030
1089	0.030	1139	0.030	1189	0.030	1239	0.030	1289	0.030	1339	0.030
1090	0.030	1140	0.030	1190	0.030	1240	0.030	1290	0.030	1340	0.030
1091	0.030	1141	0.030	1191	0.030	1241	0.030	1291	0.030	1341	0.030
1092	0.030	1142	0.030	1192	0.030	1242	0.030	1292	0.030	1342	0.030
1093	0.030	1143	0.030	1193	0.030	1243	0.030	1293	0.030	1343	0.030
1094	0.030	1144	0.030	1194	0.030	1244	0.030	1294	0.030	1344	0.030
1095	0.030	1145	0.030	1195	0.030	1245	0.030	1295	0.030	1345	0.030
1096	0.030	1146	0.030	1196	0.030	1246	0.030	1296	0.030	1346	0.030
1097	0.030	1147	0.030	1197	0.030	1247	0.030	1297	0.030	1347	0.030
1098	0.030	1148	0.030	1198	0.030	1248	0.030	1298	0.030	1348	0.030
1099	0.030	1149	0.030	1199	0.030	1249	0.030	1299	0.030	1349	0.030
1100	0.030	1150	0.030	1200	0.030	1250	0.030	1300	0.030	1350	0.030
1101	0.030	1151	0.030	1201	0.030	1251	0.030	1301	0.030	1351	0.030
1102	0.030	1152	0.030	1202	0.030	1252	0.030	1302	0.030	1352	0.030
1103	0.030	1153	0.030	1203	0.030	1253	0.030	1303	0.030	1353	0.030
1104	0.030	1154	0.030	1204	0.030	1254	0.030	1304	0.030	1354	0.030
1105	0.030	1155	0.030	1205	0.030	1255	0.030	1305	0.030	1355	0.030
1106	0.030	1156	0.030	1206	0.030	1256	0.030	1306	0.030	1356	0.030
1107	0.030	1157	0.030	1207	0.030	1257	0.030	1307	0.030	1357	0.030
1108	0.030	1158	0.030	1208	0.030	1258	0.030	1308	0.030	1358	0.030
1109	0.030	1159	0.030	1209	0.030	1259	0.030	1309	0.030	1359	0.030
1110	0.030	1160	0.030	1210	0.030	1260	0.030	1310	0.030	1360	0.030
1111	0.030	1161	0.030	1211	0.030	1261	0.030	1311	0.030	1361	0.030
1112	0.030	1162	0.030	1212	0.030	1262	0.030	1312	0.030	1362	0.030

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1363	0.030	1376	0.030	1389	0.030	1402	0.030	1415	0.030	1428	0.030
1364	0.030	1377	0.030	1390	0.030	1403	0.030	1416	0.030	1429	0.030
1365	0.030	1378	0.030	1391	0.030	1404	0.030	1417	0.030	1430	0.030
1366	0.030	1379	0.030	1392	0.030	1405	0.030	1418	0.030	1431	0.030
1367	0.030	1380	0.030	1393	0.030	1406	0.030	1419	0.030	1432	0.030
1368	0.030	1381	0.030	1394	0.030	1407	0.030	1420	0.030	1433	0.030
1369	0.030	1382	0.030	1395	0.030	1408	0.030	1421	0.030	1434	0.030
1370	0.030	1383	0.030	1396	0.030	1409	0.030	1422	0.030	1435	0.030
1371	0.030	1384	0.030	1397	0.030	1410	0.030	1423	0.030	1436	0.030
1372	0.030	1385	0.030	1398	0.030	1411	0.030	1424	0.030	1437	0.030
1373	0.030	1386	0.030	1399	0.030	1412	0.030	1425	0.030	1438	0.030
1374	0.030	1387	0.030	1400	0.030	1413	0.030	1426	0.030	1439	0.030
1375	0.030	1388	0.030	1401	0.030	1414	0.030	1427	0.030	1440	0.030

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15 High Street Spalding, Lincs PE11 1TW	Residential Development off Wignals Gate, Holbeach, Lincs. For D Brown Builders	
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: H104, DS/PN: 9.004, Volume (m³): 1.5

Unit Reference	MD-SHE-0109-5000-0775-5000
Design Head (m)	0.775
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	109
Invert Level (m)	1.725
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.775	5.0
Flush-Flo™	0.235	5.0
Kick-Flo®	0.523	4.2
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	6.1	3.000	9.4	7.000	14.1
0.200	5.0	1.400	6.6	3.500	10.1	7.500	14.6
0.300	4.9	1.600	7.0	4.000	10.8	8.000	15.0
0.400	4.8	1.800	7.4	4.500	11.4	8.500	15.5
0.500	4.4	2.000	7.8	5.000	12.0	9.000	15.9
0.600	4.4	2.200	8.1	5.500	12.6	9.500	16.3
0.800	5.1	2.400	8.5	6.000	13.1		
1.000	5.6	2.600	8.8	6.500	13.6		

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Storage Structures for Storm

Tank or Pond Manhole: Basin, DS/PN: 9.003

Invert Level (m) 1.850

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	49.0	0.850	144.0

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
 Number of Online Controls 5 Number of Time/Area Diagrams 0
 Number of Offline Controls 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 FEH Rainfall Version 2013
 Site Location GB 534616 324343 TF 34616 24343
 Data Type Point
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 30

									Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
9.000	H100	15 Winter	2	+0%	100/15 Summer				2.739
10.000	H101	15 Winter	2	+0%	100/15 Summer				2.540
9.001	H102	15 Winter	2	+0%	100/15 Summer				2.377
9.002	H103	15 Winter	2	+0%	30/15 Winter				2.004
9.003	Basin	15 Winter	2	+0%	30/15 Summer				1.920
9.004	H104	15 Winter	2	+0%	2/15 Summer				1.913

Surcharged Flooded					Pipe			
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
9.000	H100	-0.141	0.000	0.28		10.9	OK	
10.000	H101	-0.110	0.000	0.16		2.2	OK	
9.001	H102	-0.123	0.000	0.40		15.8	OK	
9.002	H103	-0.121	0.000	0.43		15.5	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged		Flooded		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		
9.003	Basin	-0.105	0.000	0.16		5.8		OK
9.004	H104	0.038	0.000	0.37		4.9	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
 Number of Online Controls 5 Number of Time/Area Diagrams 0
 Number of Offline Controls 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 FEH Rainfall Version 2013
 Site Location GB 534616 324343 TF 34616 24343
 Data Type Point
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 30

										Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)
9.000	H100	15 Winter	30	+0%	100/15 Summer					2.799
10.000	H101	15 Winter	30	+0%	100/15 Summer					2.565
9.001	H102	15 Winter	30	+0%	100/15 Summer					2.489
9.002	H103	15 Winter	30	+0%	30/15 Winter					2.125
9.003	Basin	30 Winter	30	+0%	30/15 Summer					2.112
9.004	H104	30 Winter	30	+0%	2/15 Summer					2.105

		Surcharged		Flooded			Pipe		
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	
9.000	H100	-0.081	0.000	0.69		27.0	OK		
10.000	H101	-0.085	0.000	0.38		5.3	OK		
9.001	H102	-0.011	0.000	0.98		38.2	OK		
9.002	H103	0.000	0.000	1.01		36.1	SURCHARGED		

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XP Solutions	Network 2019.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged		Flooded		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		
9.003	Basin	0.087	0.000	0.17		6.0	SURCHARGED	
9.004	H104	0.230	0.000	0.37		5.0	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
 Number of Online Controls 5 Number of Time/Area Diagrams 0
 Number of Offline Controls 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 FEH Rainfall Version 2013
 Site Location GB 534616 324343 TF 34616 24343
 Data Type Point
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 30

								Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Level (m)
9.000	H100	15 Winter	100	+30%	100/15 Summer			3.525
10.000	H101	15 Winter	100	+30%	100/15 Summer			3.144
9.001	H102	15 Winter	100	+30%	100/15 Summer			3.107
9.002	H103	120 Winter	100	+30%	30/15 Winter			2.408
9.003	Basin	120 Winter	100	+30%	30/15 Summer			2.399
9.004	H104	120 Winter	100	+30%	2/15 Summer			2.392

Surcharged Flooded				Pipe		Level	
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status
9.000	H100	0.645	0.000	1.10		42.7	FLOOD RISK
10.000	H101	0.494	0.000	0.53		7.4	FLOOD RISK
9.001	H102	0.607	0.000	1.47		57.5	FLOOD RISK
9.002	H103	0.283	0.000	0.69		24.8	FLOOD RISK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for Storm

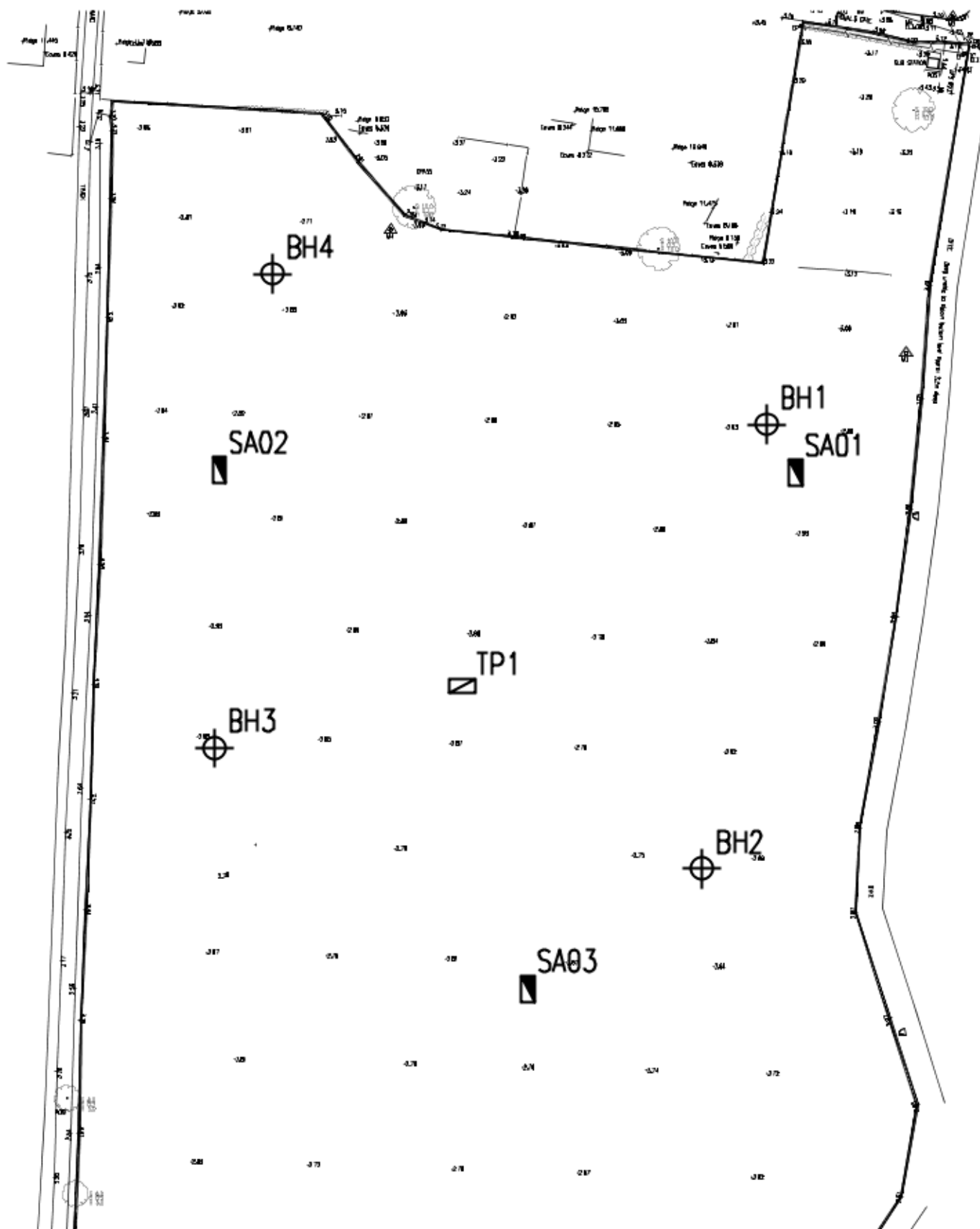
PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
9.003	Basin	0.374	0.000	0.15		5.6	FLOOD RISK		
9.004	H104	0.517	0.000	0.37		5.0	FLOOD RISK		

Project

**Proposed Residential
Development off Wignals Gate,
Holbeach, Lincs.**

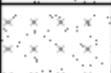
Title

**Plan Showing Ground Investigation
Trial Locations**



Location Proposed Residential Development off Wignals Gate, Holbeach, Lincs.	Carried Out For D Brown Builders	Date Undertaken 22/03/18
		Logged By MP

Equipment & Methods 100mmØ HandAuger Mackintosh Probe	Site Coordinates:	Borehole No. 1
	Ground Level:	

Description	Reduced Level	Legend	Depth (Thick)	Samples			Test Required	M.P.I. Blow Count (Depth)
				Depth	Sample Reference	Sample Type No.		
Topsoil.			450mm					
Mid Brown Moist Fine Sandy Silt.			1200mm (750mm)					0.6m Below G.L. 92 Blows For 300mm Movement
Orangey Brown Moist Silty Sand, Becoming Coarser With Depth.			1700mm (500mm)					1.55m Below G.L. 100 Blows For 230mm Movement
Brown Wet Silty Sand.			1900mm (200mm)					

Remarks

Standing Water @ 1.6m.
Borehole Terminated @ 1.9m Due To Collapse/Strata Washing Out.

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Location Proposed Residential Development off Wignals Gate, Holbeach, Lincs.	Carried Out For D Brown Builders	Date Undertaken 22/03/18
		Logged By MP

Equipment & Methods 100mmØ HandAuger Mackintosh Probe	Site Coordinates:	Borehole No. 2
	Ground Level:	

Description	Reduced Level	Legend	Depth (Thick)	Samples			Test Required	M.P.I. Blow Count (Depth)
				Depth	Sample Reference	Sample Type No.		
Topsoil.			450mm					
Orangey Brown Moist Sandy Silt.			1100mm (650mm)					0.6m Below G.L. 103 Blows For 300mm Movement 0.9m Below G.L. 97 Blows For 300mm Movement
Mid Brown Moist Silty Fine Sand, Becoming Sandier With Depth.			2100mm (1000mm)					1.2m Below G.L. 96 Blows For 300mm Movement 1.5m Below G.L. 96 Blows For 300mm Movement
Very Moist.			2300mm (200mm)					
Brown/Grey Wet Silt/Coarse Sand.								

Remarks Standing Water @ 1.6m After 1 Hour. Borehole Terminated @ 2.3m Due To Collapse/Strata Washing Out.

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File Name

36916-BH03

Location

**Proposed Residential
Development off Wignals Gate,
Holbeach, Lincs.**

Carried Out For

D Brown Builders

Date Undertaken

22/03/18

Logged By

MP

Equipment & Methods

100mmØ HandAuger
Mackintosh Probe

Site Coordinates:

Ground Level:

Borehole No.

3

Description	Reduced Level	Legend	Depth (Thick)	Samples			Test Required	M.P.I. Blow Count (Depth)
				Depth	Sample Reference	Sample Type No.		
Topsoil.			500mm					
Orangey Brown Moist Sandy Silt.			1200mm (700mm)					0.6m Below G.L. 123 Blows For 300mm Movement 0.9m Below G.L. 62 Blows For 300mm Movement 1.2m Below G.L.
Orangey Brown Very Moist Silty Sand, Becoming Wetter & Coarser With Depth. @ 1700mm Black Inclusions With Tiny Shells.			2100mm (900mm)					45 Blows For 300mm Movement
Dark Brown Very Wet Silty Sand.			2300mm (200mm)					

Remarks

Standing Water @ 1.4m After 1 Hour.
Borehole Terminated @ 2.3m Due To Collapse/Strata Washing Out.

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Location Proposed Residential Development off Wignals Gate, Holbeach, Lincs.	Carried Out For D Brown Builders	Date Undertaken 22/03/18
		Logged By MP

Equipment & Methods 100mmØ HandAuger Mackintosh Probe	Site Coordinates:	Borehole No. 4
	Ground Level:	

Description	Reduced Level	Legend	Depth (Thick)	Samples			Test Required	M.P.I. Blow Count (Depth)
				Depth	Sample Reference	Sample Type No.		
Topsoil.			500mm					
Orangey Moist Sand / Silt.			900mm (400mm)					0.6m Below G.L. 104 Blows For 300mm Movement
Orangey Moist Silty Sand.			1200mm (300mm)					0.9m Below G.L. 70 Blows For 300mm Movement
Brown Very Moist Fine Sandy Silt.			1600mm (400mm)					1.2m Below G.L. 34 Blows For 300mm Movement
Brown Wet Sandy Silt.			1800mm (200mm)					

Remarks

Standing Water @ 1.3m After 1 Hour.
Borehole Terminated @ 1.8m Due To Collapse/Strata Washing Out.

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Location

**Proposed Residential
Development off Wignals Gate,
Holbeach, Lincs.**

Carried Out For

D Brown Builders

Date Undertaken

22/03/18

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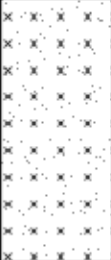
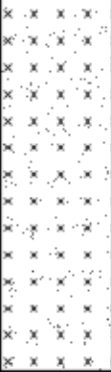
Equipment & Methods

Site Coordinates:

Trial Pit No.

Ground Level:

1

<u>Description</u>	<u>Reduced Level</u>	<u>Legend</u>	<u>Depth (Thick)</u>
Topsoil.			500mm
Mid Brown Moist Fine Sandy Silt.			1200mm (700mm)
Orangey Brown Moist Silty Sand.			2200mm (1000mm)
Very Moist Firm Grey Clayey Silt. Becoming Clayier With Depth.			2900mm (700mm)

Remarks

Trial Pit Terminated @ 2.9m.

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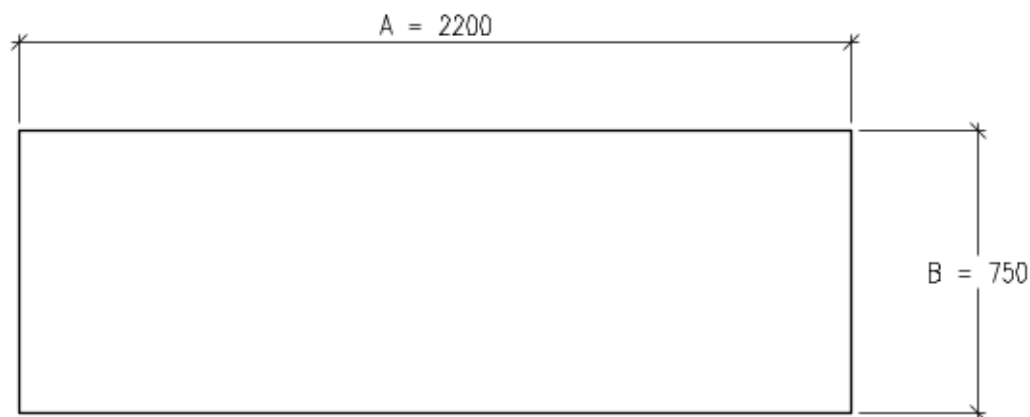
36916-SA01

Project

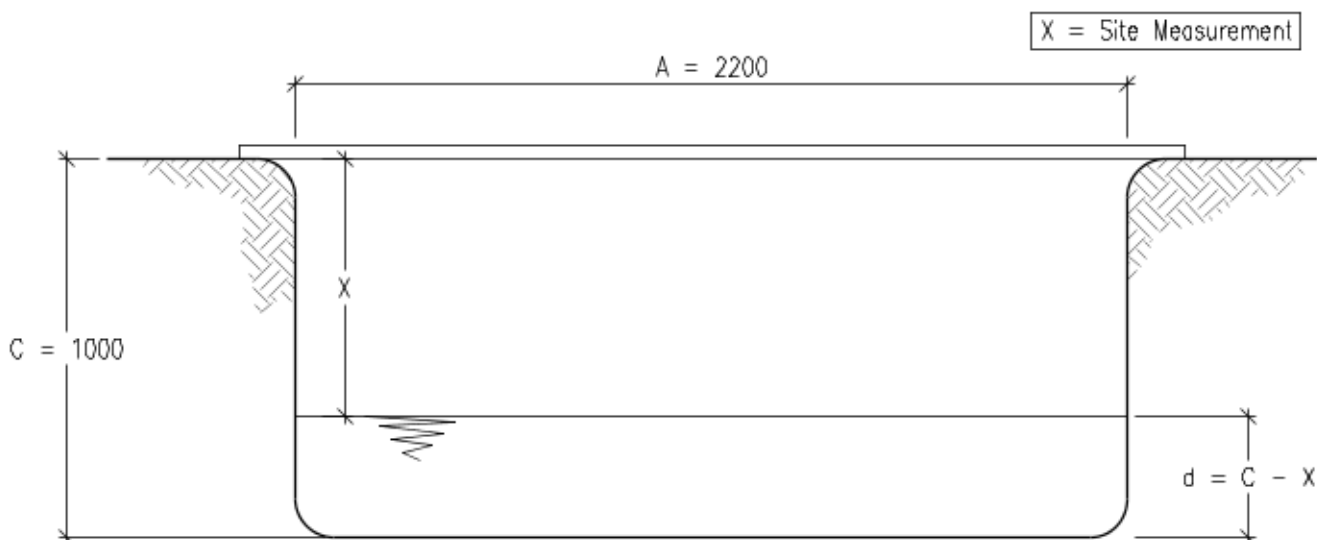
**Proposed Residential
Development off Wignals Gate,
Holbeach, Lincs.**

Title

Infiltration Soak Away Sketch



Plan On SA01



Section Through SA01

Soak-Away Test SA01

Job Reference Proposed Residential Development off
Wignals Gate, Holbeach, Lincs.

SA01	
TIME (Mins)	DEPTH mm (d)
0	320
10	310
40	305
70	290
110	290
145	280
180	270
215	260
275	255
320	240

Job No. 36916

Date 22/03/2018

Trial Dimensions

A = 2.2 m
B = 0.75 m
C = 1 m

C.S.Area of
SA01 = 1.65 m²

Total Volume = 0.132 m³
75% Volume = 0.099 m³
25% Volume = 0.033 m³

Time Taken From 75% Volume to 25% Volume

172 Mins

Effective Depth From 75% Volume to 25% Volume

0.04 m

50% Effective Internal Surface Area Including Base area

1.886 m²

Soil Infiltration rate, f

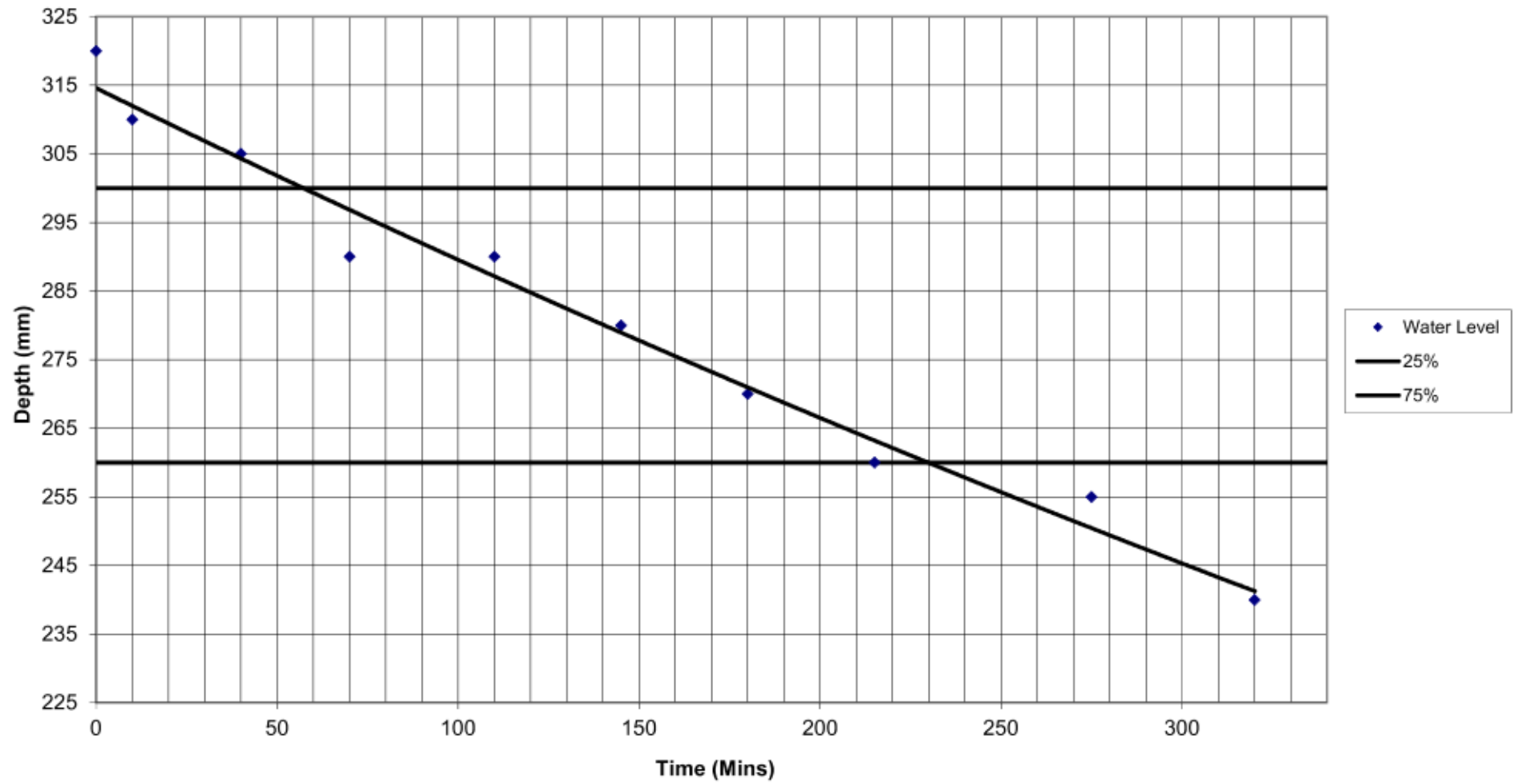
3.39096E-06 m/s

3.39 x 10⁻³ mm/s

Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Job No. 36916 22/03/18

Plot showing water level against time for SA01





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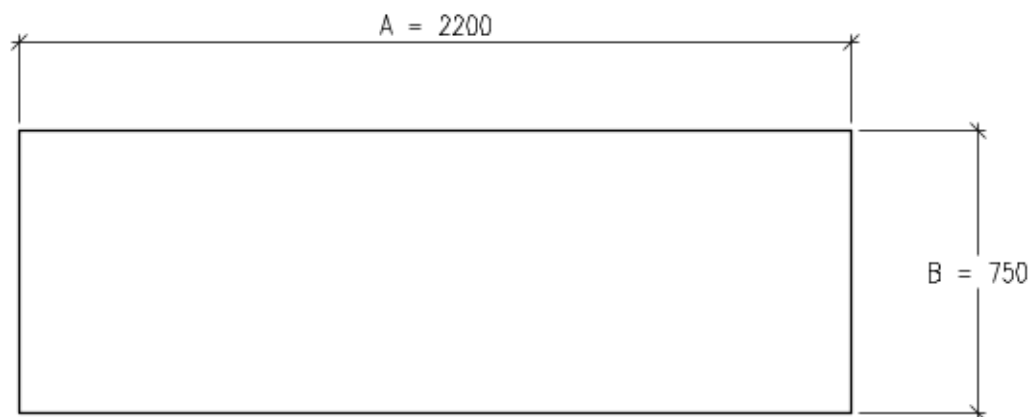
36916-SA02

Project

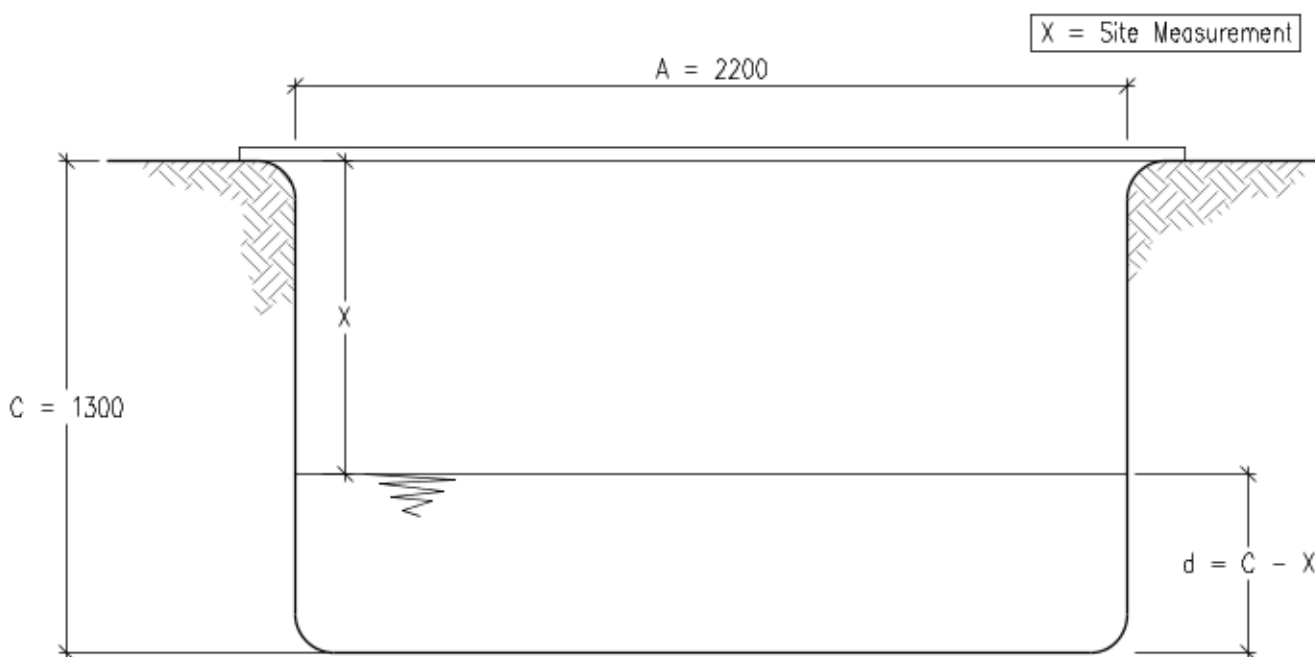
**Proposed Residential
Development off Wignals Gate,
Holbeach, Lincs.**

Title

Infiltration Soak Away Sketch



Plan On SA02



Section Through SA02

Soak-Away Test SA02

Job Reference Proposed Residential Development off
Wignals Gate, Holbeach, Lincs.

SA01	
TIME (Mins)	DEPTH mm (d)
0	475
15	430
35	410
80	400
110	385
145	375
180	350
205	340
235	330
275	325

Job No. 36916

Date 22/03/2018

Trial Dimensions

A = 2.2 m
B = 0.75 m
C = 1.3 m

C.S.Area of
SA01 = 1.65 m²

Total Volume = 0.248 m³
75% Volume = 0.186 m³
25% Volume = 0.062 m³

Time Taken From 75% Volume to 25% Volume

150 Mins

Effective Depth From 75% Volume to 25% Volume

0.075 m

50% Effective Internal Surface Area Including Base area

2.0925 m²

Soil Infiltration rate, f

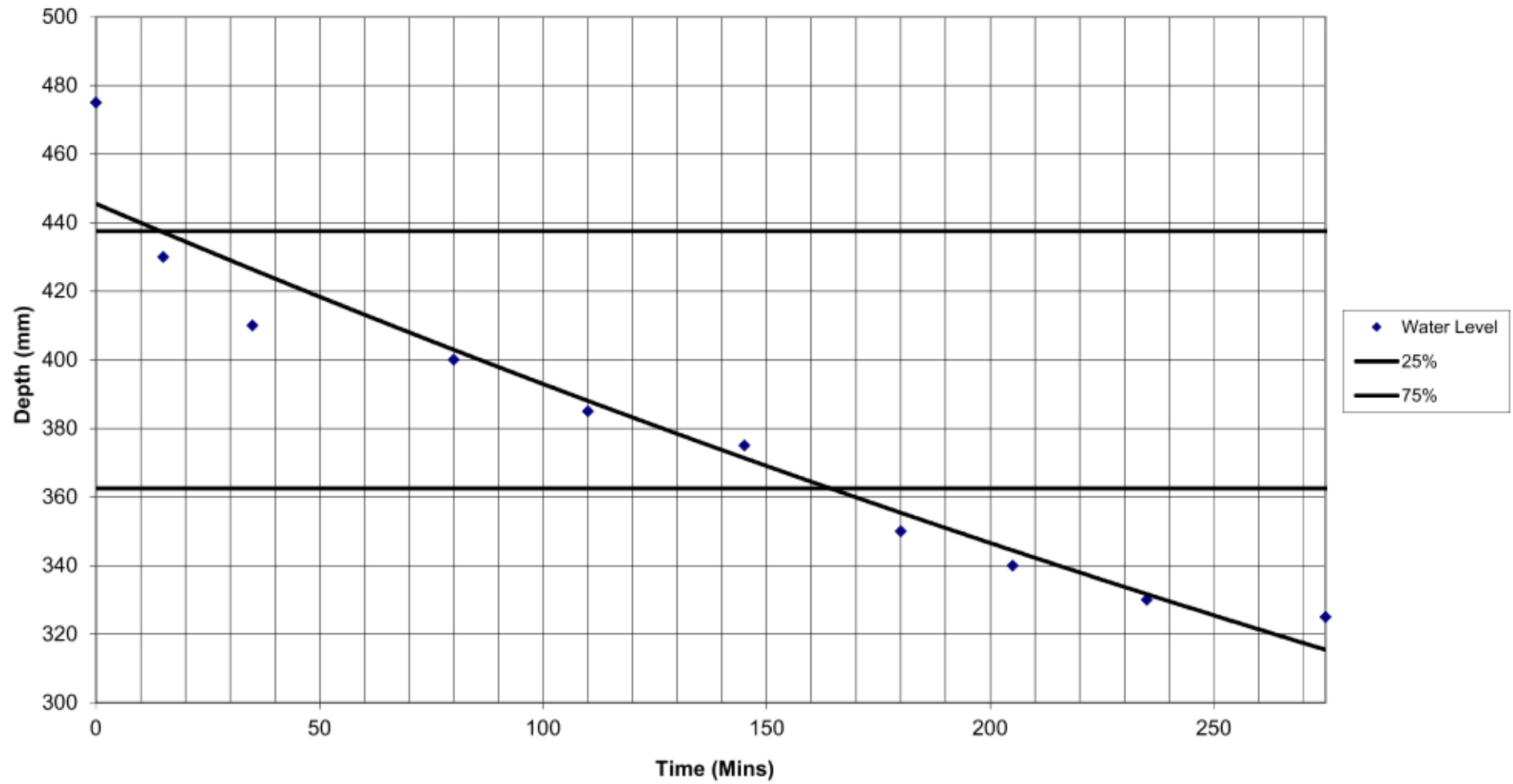
6.57109E-06 m/s

6.57 x 10⁻³ mm/s

Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Job No. 36916 22/03/18

Plot showing water level against time for SA02





**SIDEBOTTOM
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Sheet No.

36916/SA03

Rev

-

Status

FOR INFORMATION

Date

Mar. '18

Drawn

MP

Checked

SRC

Scale

1:20

Design

-

File Name

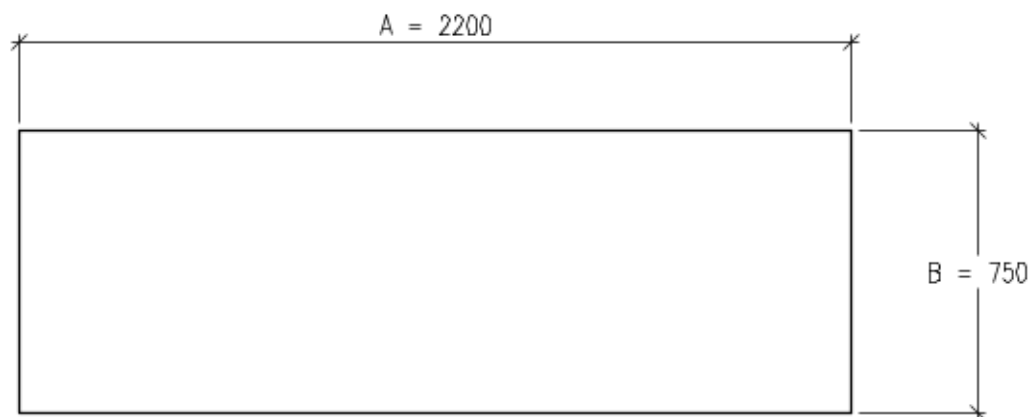
36916-SA03

Project

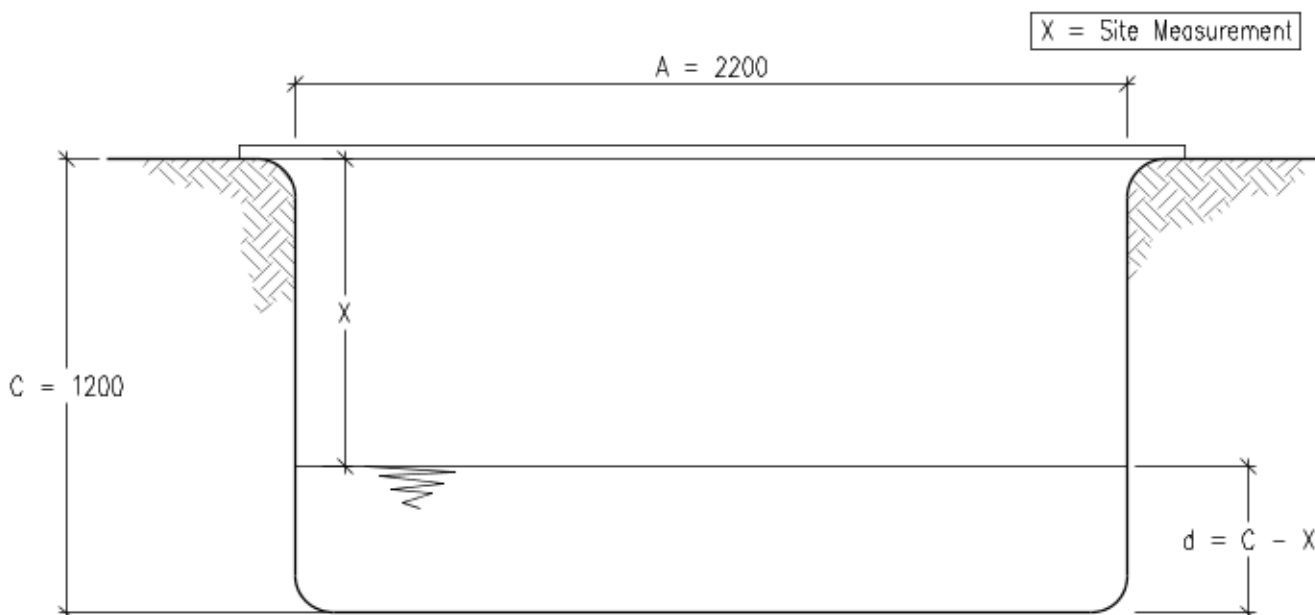
**Proposed Residential
Development off Wignals Gate,
Holbeach, Lincs.**

Title

Infiltration Soak Away Sketch



Plan On SA03



Section Through SA03

Soak-Away Test SA03

Job Reference Proposed Residential Development off
Wignals Gate, Holbeach, Lincs.

SA01	
TIME (Mins)	DEPTH mm (d)
0	390
25	385
60	380
90	375
130	370
185	365
230	360

Job No. 36916

Date 22/03/2018

Trial Dimensions

A = 2.2 m
B = 0.75 m
C = 1.2 m

C.S.Area of
SA01 = 1.65 m²

Total Volume = 0.050 m³
75% Volume = 0.037 m³
25% Volume = 0.012 m³

Time Taken From 75% Volume to 25% Volume

117 Mins

Effective Depth From 75% Volume to 25% Volume

0.015 m

50% Effective Internal Surface Area Including Base area

1.7385 m²

Soil Infiltration rate, f

2.02798E-06 m/s

2.03 x 10⁻³ mm/s

Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Job No. 36916 22/03/18

Plot showing water level against time for SA03

