McAdam
ENHANCING LOCAL COMMUNITIES

Client : Errigal Contracts Ltd

Project : E2333 – Norbeck Road, Blackpool, FY5 1RP

Proposed Drainage Strategy

PREPARED BY	CHECKED BY	APPROVED BY	ISSUE	DATE
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D Williams	P Alcorn	P Alcorn	2	13/12/2021

Contents

1 Introduction

1.1 Report Brief

This Drainage Strategy has been commissioned by Errigal Contracts Ltd, in relation to the development of lands at the former 'Mariners' pub, 8 Norbreck Road, Blackpool, FY5 1RP.

The development includes an apartment building, bin store, car parking, access and associated site works and landscaping.

This Drainage Strategy will review the following;

- Review of Environmental Agency flood records.
- Estimation of storm run-off under pre and post development scenarios, including allowance for climate change;
- Limitation of flows with mitigation measures and attenuation volumes if required;

1.2 Site Location

The proposed development site covers an area of approximately 2100m2, off Norbreck Road, Blackpool.

The Norbreck Road and Norbreak Castle Hotel are to the North and predominately residential areas are to the South, East and West of the site.

The assessment site is located at grid reference 331095 (Easting) 440595 (Northing).

A Site Location Map is presented below as Figure 1.2.1 below.

Figure 1.2.1: Site Location Map, 8 Norbreck Road, Blackpool

2 Existing Site Description and Proposed Site Development

2.1 Existing Site Description

The proposed development is situated on a 'Brownfield' site with all remanence of the former buildings removed. The site is an irregular polygonal shape with maximum length of width of circa 70m x 40m and falls approx. 0.5m from north to south.

The existing site is split into two areas. Area one to the North West of area two was previously occupied by a block of residential flats. The redevelopment within this area will include the proposed building along with the vehicular entrance, landscaping and associated drainage proposals.

Area two South East of area one is currently a tarmacadam / stone parking area with some road gullies. Area two is currently split from area one by a right of way access road. The existing surfacing illustrates signs of disrepair. This area is to be refurbished with a new parking area with landscaping and associated drainage proposals.

2.2 Proposed Site Development Plans

The development plans for the site include;

- New apartment building.
- New access off Norbreck Road.
- Car Parking.
- Landscaping including, resident's garden, kitchen garden and patio area.
- Bin Store.

A Proposed Site Layout Plan has been presented as Appendix A.

3 Existing Drainage / Environment Agency information

3.1 Existing Sewers

An historic topographical survey of the proposed site has been completed. This survey indicates no existing storm sewers, foul sewer or water courses within or in close proximity of the site. Three existing combined sewers are located within or just on the boundary of the site. The survey includes some gullies within the existing car park and access road. The existing drainage to the demolished buildings are also present. The location of the existing combined sewers / existing drainage / topographical layout are illustrated in Appendix B. This is based on a historic topo survey within the site. Additional topographical surveys are being commissioned on the site to confirm current levels / site constraints.

3.2 Environment Agency Flood Map

In order to assess Flood Risk, a review of the Environment Agency Flood Maps Website has been completed. The information provided on the website advises that the development site is in 'Flood Zone 1', this is an area of low probability of flooding. A copy of the Environment Agency site search map is provided in Appendix C.

3.2.1 Surface Water and Reservoir Inundation

The Environment Agency Flood Map show that the site is not at risk of surface water or reservoir inundation in the event of a reservoir failure.

As the site is in Flood Zone 1, is less than 1 hectare and not affected by other sources of flooding, the Environment Agency advise a Flood Risk Assessment is not required.

4 Detailed Assessment of proposed drainage

4.1 Development and Surface Water (Pluvial) Flood Risk

4.1.1 Introduction

In order to assess the potential impact of the development an assessment of the Pre and Post development runoff is required including allowance for climate change.

4.1.2 Pre-Development Runoff

The site can be classified as a 'Brownfield' Site which defines a site that has previously been developed. Whilst the existing site did include a building and car park storm drainage; in line with Sustainable Urban Design Guidelines it is a requirement to substantially reduce the storm discharge run-off rates from the site to as close to 'Greenfield' Runoff Rates as possible.

As mentioned within Section 2.1 the existing site is split into two separate areas / drainage networks. The first area to the North West adjacent to the Norbreck Road and the second to the South East of the site. For illustration within this report the area to the North West will be classified as Network 1 and the area to the South East will be classified as Network 2.

In order to determine existing flow rates for the site the existing storm sewer network has been modelled and discharge figures for the critical 1 in 2, 1 in 30 and 1 in 100 year Return Periods are summarised in Table 4.1.2.1 below. A copy of the calculations are provided in Appendix D.

Return Period	Network 1 Existing Discharge Q (l/s)	Network 2 Existing Discharge Q (l/s)
1 in 2	19.3	10.8
1 in 30	37.4	20.7
1 in 100	48.3	24.8

Table 4.1.2.1: Existing discharge – Un-Restricted

Furthermore to assess the required reduction in flow rates & to compare to existing flow rates as illustrated within Table 4.1.2.1, calculations have been completed to determine the Greenfield / QBar Runoff rates for each of the two site areas / existing Drainage Networks. The results of these calculations are illustrated within Appendix E and summarised in Table 4.1.2.2 below.

Return Period	Network 1 Existing Greenfield/QBar Discharge Q (l/s)	Network 2 Existing Greenfield/QBar Discharge Q (l/s)
1 in 2	0.9	0.5
1 in 30	1.3	0.7
1 in 100	1.4	0.8

Table 4.1.2.2: Existing discharge – Greenfield / QBar Discharge

To achieve these low rates of discharge would be impractical and cause maintenance issues with preventing blockages and subsequent flooding.

Taking this into account in accordance with Sustainable Urban Design Guidance it is proposed to limit the storm discharge for the site to 5.0l/s for both networks. This figure has been used to ensure sufficient flow to allow for self-cleansing of the proposed storm drainage therefore limiting any post development maintenance issues.

4.1.3 Post-Development Runoff

The proposed development will consist of a new apartment building, new access, car parking, landscaping and bin store.

Table 6-3 of the Urban Storm Drainage Critical Manual (Volume 1 January 2016) presents the percentage imperviousness from different land uses or surface characteristics for the purpose of calculating runoff rates. For the Hardstanding areas the runoff coefficients range from 100% for paved areas to 90% for Building roofs. For the Landscape areas the closest category within the table would be Parks / Cemeteries which illustrate the runoff coefficient as 10%. However, to be conservative, the drainage calculations detailed within this report have assumed a 20% runoff coefficient for all Landscaping areas.

It has been decided that two separate storm networks have been developed, one for the building, access road and landscaping within area one (Network 1) and the other for the car parking and landscaping within area two (Network 2), each connecting to different existing combined sewers. A copy of the proposed drainage drawing is provided in Appendix F.

Both networks have been modelled for the 1 in 2, 1 in 30 and 1 in 100 year Return Periods including 30% allowance for climate change for the 1 in 30 and 1 in 100 year Return Periods with the results summarised in Table 4.1.3.1 below. A copy of the calculations are provided in Appendix G.

Return Period	Network 1 Redevelopment Discharge Q (l/s) (Unrestricted)	Network 2 Redevelopment Discharge Q (l/s) (unrestricted)
1 in 2	16.1	9.4
1 in 30 +30%	32.7	20.9
1 in 100 +30%	39.0	25.4

Table 4.1.3.1: Proposed Development discharge – Unrestricted

4.1.4 Proposed Site Storm Drainage and discharge

As noted within Section 4.1.2 it is proposed to reduce the pre-existing storm discharge to 5.0 l/s for each separate proposed storm networks. Both networks have been modelled to include flow controls and attenuation required to restrict the site runoff to the discharge rates proposed.

The proposed storm networks have been developed and modelled resulting in an attenuation volume of 24 cubic metres and 9 cubic metres for network 1 and 2 respectively, with associated flow control restricting the discharge to 5.0 l/s.

Both networks have been modelled for the 1 in 2, 1 in 30 and 1 in 100 year Return Periods including 30% allowance for climate change for the 1 in 30 and 1 in 100 year Return Periods with the results summarised in Table 4.1.4.1 below. A copy of the calculations are provided in Appendix H.

Return Period	Network 1 Redevelopment Discharge Q (l/s) (Restricted)	Network 2 Redevelopment Discharge Q (l/s) (Restricted)
1 in 2	4.8	4.4
1 in 30 +30%	5.0	5.0
1 in 100 +30%	5.0	5.0

Table 4.1.4.1: Proposed Development discharge - Restricted

As part of the drainage design strategy consideration was given to the potential for infiltration within the existing soils. However following review of previous supplied Site Investigation data it was determined infiltration potential is very poor therefore infiltration techniques would not be suitable for use within the site proposals. A copy of the previously supplied Site Investigation data can be seen within Appendix I.

4.1.5 Surface Water (Pluvial) Flood Risk

The proposed storm drainage design inclusive of new storm sewer networks, restricted runoff rates and attenuation has been designed ensuring no out of sewer flooding. As such flood risk will not be increased within or beyond the immediate site boundary.

5 Proposed Foul Drainage

It is proposed that existing foul drainage infrastructure that served the demolished buildings will be removed with new connections made to the existing combined sewers.

As the proposed storm drainage discharge will be reduced by the proposed development the net discharge to the existing combined sewers form the site will be significantly reduced.

A copy of the proposed drainage layout can be found in Appendix F.

6 Drainage Maintenance

Stormwater runoff is collected at the source by a series of gullies, and conveyed through manholes / catchpit manholes and closed drain pipe networks to discharge all flows through a Geocellular/ modular attenuation tank to the proposed discharge location / sewer.

Attenuation is provided to restrict outfall runoff to the runoff rates as illustrated within this report by utilization of a Hydrobrake chamber. Maintenance and cleaning of catchpit manholes and the various SUDs components will ensure the operation of the system for the lifetime of the development.

6.1 General Maintenance

All Stormwater management structures to be inspected and records obtained at a minimum two times a year, with cleaning typically in April and October and possible more often, as site conditions warrant. Further inspection of the drainage systems will be required when the forecast for the area is for heavy rainfall. Concurrent with inspection and cleaning, all litter shall be picked up and removed from the site. This document provides details of specific infrastructure cleaning requirements.

Catchpit chambers/ manholes / Gullies / Channel Drains to be inspected with debris removal monthly. Sediment in chambers sumps, bottom of manholes and Gully / channel drain sumps to be removed bi-annually using conventional sump vacuum cleaner and properly disposed by a licenced cleaning company. If during monthly inspections the depth of sediment in the sumps exceeds 50% capacity, sediment must be removed.

Drainage pipe networks to be inspected for blockages as with catchpit chambers/ manholes. All drains and chambers must be inspected from the upstream network end to the outfall. Observe the flow of water and any indication of ponding in the chambers/ manholes indicate a blockage. All blockages must be assessed and any obstructions removed. Please note rodding or flushing may be necessary. This regime will also be required before each rainy season and after the first heavy storm event. To avoid flooding, water flushed into the drainage system should be pumped or vacuumed to a tank and properly disposed of. All infrastructure such as attenuation tanks/ hydrobrakes/ Gullies / drainage channels should be maintained as per manufacturer's guidelines.

During winter months ensure the drainage structures are not blocked by ice, snow, debris or trash.

6.2 Geocellular/ Modular Attenuation Tank

A Geocellular/ Modular Attenuation Tank System is required to provide the storage requirements for the stormwater runoff prior to discharging into the adjacent sewer. The storage volume is provided by the provision of a number of interlocking 'Honeycomb' structures, wrapped in a permeable geomembrane to promote infiltration. Under storm conditions rainwater is forced out of the pipework, into the storage structures. The Geocellular/ Modular Attenuation Tank System has been designed to provide the necessary storage volume and to withstand and provide the essential support to the loads that will be exerted on it by pedestrian and/or vehicular traffic.

6.2.1 Maintenance

Regular inspection and maintenance is required to ensure the effective long-term operation of the below ground modular systems. The system should be inspected regularly, preferably during and after heavy rainfall to check effective operation.

It is important that maintenance plans and schedules should be prepared during the design phase. Specific maintenance needs of the system should be monitored and maintenance schedules adjusted to suit requirements. Please refer to attenuation tank manufacturers guidelines for

specific maintenance requirements but as a minimum the proposed maintenance schedule is as follows:

Maintenance schedule	Required action	Recommended Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet , overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

7 Conclusion

The calculations presented indicate that the proposed development will reduce the existing storm discharge from the proposed development with the inclusion of appropriately sized storm water attenuation and associated flow control.

Due to this reduction in flow the proposed development will not contribute to surface water flooding within or beyond the site. The proposed connections at the reduced flow will also reduce any pressures on the existing combined sewers.

Appendices

Appendix A – Proposed Site / Surfacing Plan

Notes:

1. *All dimensions are in millimeters unless stated otherwise. All levels are in meters referenced to AOD.*
2. *The mapping illustrated on this drawing is the proposed site layout which will be subject to change following design development.*
3. *This drawing should be read in conjunction with all relevant drawings (Architectural and Engineering).*
4. *This drawing is provided to illustrate the surfacing materials for the site. All other features illustrated are indicative only and the respective drawing should be consulted if discrepancies occur.*
5. *For further details of the proposed surfacing please see landscape specifications / drawings. If any discrepancies occur between these the engineer must be informed.*
6. *This drawing must be read in conjunction with Construction Details Drawings which illustrates construction build-ups for the proposed pavements.*

LEGEND

- Proposed Building
- Landscaped / Planted Areas
- Stone Mastic Asphalt
- Ashpalt Concrete

Rev	Issue Date	Description	App
P2	13/12/21	Updated Layout	PA

Status: FOR INFORMATION

Client: Errigal Contracts

Project: Blackpool Norbreck Road

Drawing: Proposed Layout - Surfacing

Scale: 1:200 @ A1

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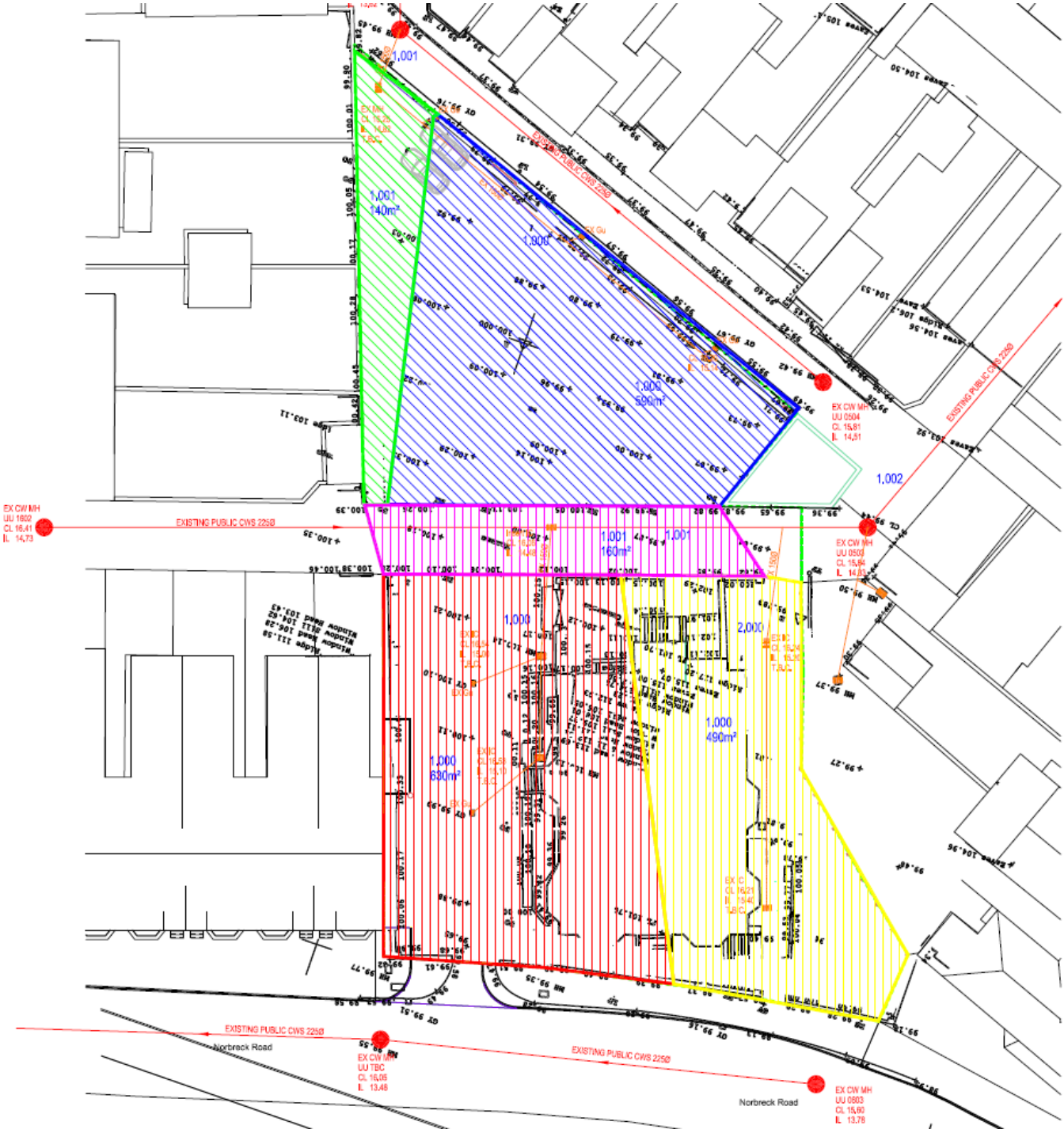
Drawn	Checked	Approved
ER	JS	PA
Date 16/09/2021	Date 16/09/2021	Date 16/09/2021

Project Number	Drawing Number	Revision
E2333	C-1300	S4-P2

Appendix B – Existing Topographical Survey / Drainage Layout



EX CW MH
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CL 15.86
IL 13.62

EXISTING PUBLIC C

1.001

EX MH
CL 16.25
IL 14.82
T.B.C.

EX 150Ø

EXISTING PUBLIC CWS 225Ø

EX Gu

EX CW MH
UU 0504
CL 15.81
IL 14.51

EXISTING PUBLIC CWS 225Ø

EXISTING PUBLIC CWS 225Ø

insert
CL 16.06
IL 14.48

EX CW MH
UU 0503
CL 15.84
IL 14.33

EX IC
CL 16.54
IL 15.00
T.B.C.

EX Gu

EX IC
CL 16.53
IL 15.10
T.B.C.

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EX IC
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T.B.C.

EX IC
CL 16.21
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T.B.C.

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EX CW MH
UU TBC
CL 16.05
IL 13.48

EXISTING PUBLIC CWS 225Ø

EX CW MH
UU 0603
CL 15.60

Appendix C – Environment Agency Flood Map

Flood map for planning

Your reference	Location (easting/northing)	Created
8 Norbreck Ro	**331099/440588**	**9 Sep 2021 19:42**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Environment Agency

Flood map for planning

Your reference
8 Norbreck Ro

Location (easting/northing)
331099/440588

Scale
1:2500

Created
9 Sep 2021 19:42

- Selected area
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Appendix D – Existing Drainage Calculations – Un-Restricted

Network 1 & Network 2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.036

Total Area Contributing (ha) = 0.128

Total Pipe Volume (m³) = 2.176

Network Design Table for Storm

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
1.000	10.150	0.440	23.1	0.063	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	24.850	0.150	165.7	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	12.070	0.700	17.2	0.049	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	20.000	0.444	45.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.08	15.000	0.063	0.0	0.0	0.0	2.11	37.2	8.5
1.001	50.00	5.49	14.485	0.079	0.0	0.0	0.0	1.01	40.3	10.7
2.000	50.00	5.08	15.200	0.049	0.0	0.0	0.0	2.44	43.1	6.6
1.002	50.00	5.66	14.335	0.128	0.0	0.0	0.0	1.95	77.7	17.3

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

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	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%					15.056
1.001	2	15 Winter	2	+0%					14.573
2.000	3	15 Winter	2	+0%					15.245
1.002	4	15 Winter	2	+0%					14.415

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.094	0.000	0.29		9.7	OK	
1.001	2	-0.137	0.000	0.32		11.8	OK	
2.000	3	-0.105	0.000	0.19		7.5	OK	
1.002	4	-0.145	0.000	0.27		19.3	OK	

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	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%					15.080
1.001	2	15 Winter	30	+0%					14.616
2.000	3	15 Winter	30	+0%					15.263
1.002	4	15 Winter	30	+0%					14.453

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.070	0.000	0.55		18.3	OK	
1.001	2	-0.094	0.000	0.62		22.9	OK	
2.000	3	-0.087	0.000	0.37		14.3	OK	
1.002	4	-0.107	0.000	0.53		37.4	OK	

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	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+0%					15.095
1.001	2	15 Winter	100	+0%					14.641
2.000	3	15 Winter	100	+0%					15.273
1.002	4	15 Winter	100	+0%					14.473

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.055	0.000	0.71		23.7	OK	
1.001	2	-0.069	0.000	0.80		29.6	OK	
2.000	3	-0.077	0.000	0.47		18.4	OK	
1.002	4	-0.087	0.000	0.69		48.3	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.054	4-8	0.019

Total Area Contributing (ha) = 0.073

Total Pipe Volume (m³) = 0.661

Network Design Table for Storm

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
1.000	32.600	0.320	101.9	0.059	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	4.820	1.000	4.8	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.55	15.140	0.059	0.0	0.0	0.0	1.00	17.6	8.0
1.001	50.00	5.56	14.820	0.073	0.0	0.0	0.0	4.62	81.7	9.9

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

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	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%	100/15 Summer				15.219
1.001	2	15 Winter	2	+0%					14.862

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.071	0.000	0.53		9.0	OK	
1.001	2	-0.108	0.000	0.17		10.8	OK	

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	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%	100/15 Summer				15.270
1.001	2	15 Winter	30	+0%					14.880

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.020	0.000	0.99		16.8	OK	
1.001	2	-0.090	0.000	0.33		20.7	OK	

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	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+0%	100/15 Summer				15.439
1.001	2	15 Winter	100	+0%					14.886

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.149	0.000	1.20		20.3	SURCHARGED	
1.001	2	-0.084	0.000	0.40		24.8	OK	

Appendix E – Existing Drainage Calculations – Greenfield Runoff / QBar

Network 1 & Network 2

ICP SUDS Mean Annual Flood

Input

Return Period (years)	2	Soil	0.300
Area (ha)	0.128	Urban	0.750
SAAR (mm)	892	Region Number	Region 10

Results l/s

QBAR Rural	0.3
QBAR Urban	0.9
Q2 years	0.9
Q1 year	0.8
Q30 years	1.3
Q100 years	1.4

ICP SUDS Mean Annual Flood

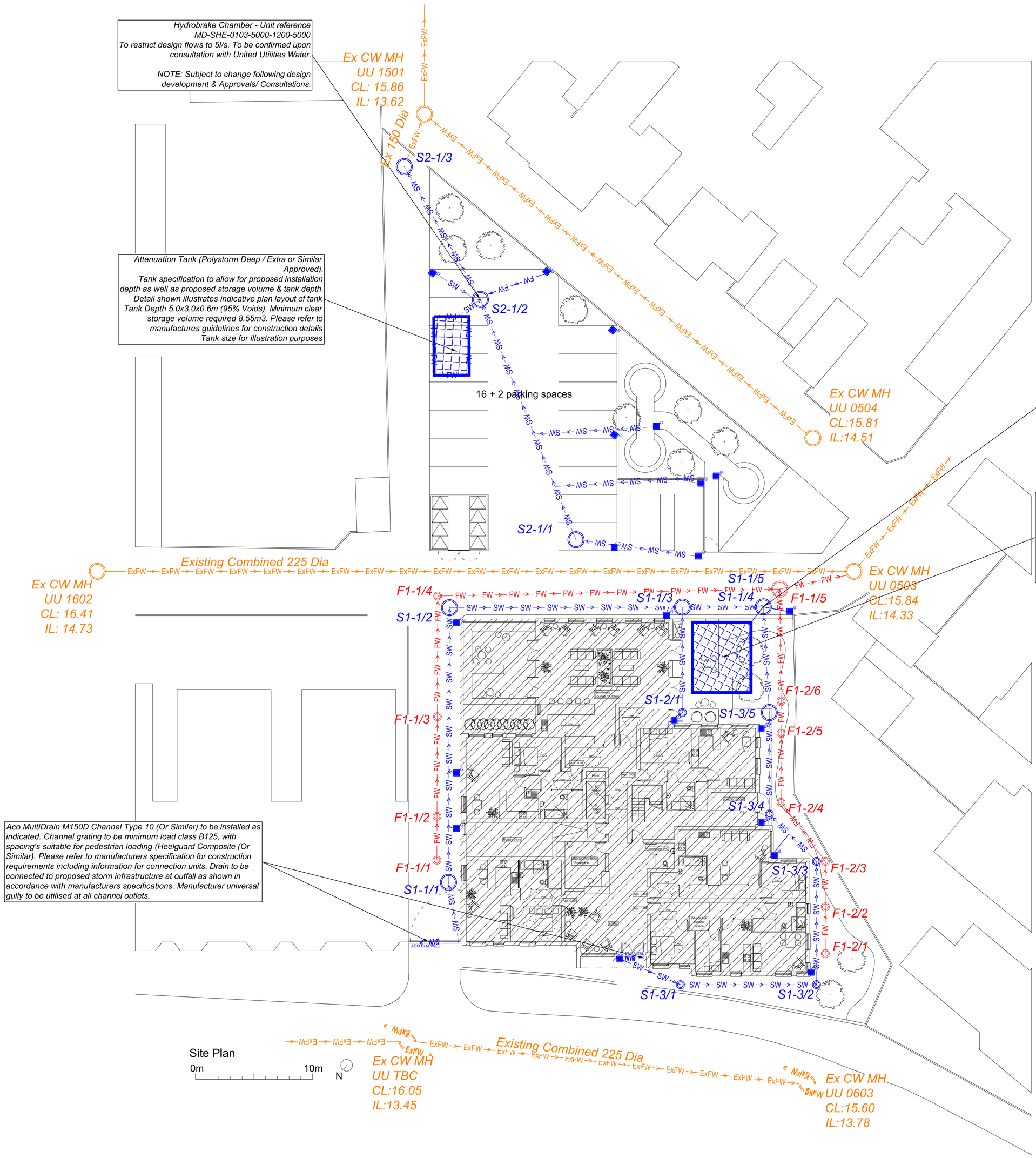
Input

Return Period (years)	2	Soil	0.300
Area (ha)	0.073	Urban	0.750
SAAR (mm)	892	Region Number	Region 10

Results l/s

QBAR Rural	0.2
QBAR Urban	0.5
Q2 years	0.5
Q1 year	0.4
Q30 years	0.7
Q100 years	0.8

Appendix F – Proposed Drainage Layout



ACO CHANNEL DRAINS TO INTERCEPT FLOWS AT ALL EXTERNAL ENTRANCES TO BUILDING AS INDICATED. ALL CHANNELS TO BE ACO BRICKSLOT [OR SIMILAR]. TO MANUFACTURERS SPECIFICATIONS AND CONSTRUCTION GUIDELINES. UNIVERSAL GULLY SITED AT CHANNEL OUTLET.

ALL FILTER / LAND DRAINS SHOWN TO BE FULLY PERFORATED 100Ø DRAINS TO INTERCEPT RUNOFF FROM EARTHWORK BANK. PIPE LAID WITHIN MINIMUM 0.3m WIDE TRENCH AT 600mm COVER AND AT MINIMUM GRADIENT 1 IN 100 TO THE OUTFALLS SHOWN. PIPE BEDDING AS PER HCD F SERIES DRG F2, TYPE K BEDDING [SHW CLAUSE 503.3 OR CLAUSE 505] / SUITABLE FILTER MATERIAL (TYPE B FILTER MATERIAL / PEA GRAVEL / 4-40MM AGGREGATE TO BS 7533-13)

ALL BELOW GROUND RAINWATER PIPES TO BE 150MM DIAMETER @ MIN GRADIENT 1 IN 40 UNLESS OTHERWISE INDICATED

WHERE STORM DRAINAGE PASSES THROUGH CONCRETE FOUNDATIONS ROCKER PIPES TO BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION DETAIL DRAWINGS

FLOOR PLANS SHOWN FOR ILLUSTRATION PURPOSES ONLY. REFER TO ARCHITECTURAL GA PLANS FOR ACCURATE LAYOUTS

ALL INTERNAL FOUL CONNECTION LINES MUST BE ACCESSIBLE FROM A CHAMBER OR RODDING EYE. WHERE SOURCE E.G. SINK CONNECTS DIRECTLY TO UNDERGROUND FOUL DRAIN WITHOUT A CHAMBER A RODDING EYE MUST BE PROVIDED.

LOCATION OF SOIL VENT PIPES TO BE CO-ORDINATED WITH ARCHITECTURE + M&E

CHANNEL DRAIN / INTERNAL GULLIES CONNECTED TO FOUL DRAINAGE SYSTEM. SEE M&E/ARCHITECTURAL FOR INTERNAL CHANNEL/GULLY DETAIL

INTERNAL DRAINAGE TO BE GRADED TO CONNECT TO MANHOLE / CHAMBER BASES WHERE SHOWN. WHERE CONNECTING TO BACK INLET GULLIES @ EDGE GROUND BEAMS PIPE TO HAVE MINIMUM GRADIENT 1 IN 40

LEGEND

- PROPOSED STORM SEWER
- PROPOSED FOUL SEWER
- PROPOSED CHANNEL DRAINAGE
- Fxxx PROPOSED FOUL MANHOLE
- Sxxx PROPOSED STORM MANHOLE
- PROPOSED TRAPPED GULLY
- EXISTING FOUL SEWER EXTENTS INDICATIVE ONLY SEE TOPO SURVEY

Notes:

1. *This drawing should be read in relation to the subject of the title. All other details illustrated on the drawing (e.g. The proposed layout/ building) are indicative only and are subject to change. For updated details of the proposed layout and finished levels see Proposed Layout & Levels drawings.*
2. *The mapping illustrated on this drawing is taken from the proposed site plan received with the tender documentation.*
3. *All storm & foul drainage designed in accordance with BS EN 752: 2008 drain and sewer systems outside buildings & The Building Regulations 2010, HM Government, Approved Document H (latest version).*
4. *Drainage works to carried out in accordance with Civil Engineering Specification for the Water Industry 6th Edition; published by WRC plc 2004.*
5. *Manholes to be constructed from precast concrete rings (unless otherwise stated / approved) to BS EN 1917:2002 & BS 5911-3:2002 with a D400 heavy duty cover for driveway/carpark and B125 for remaining surface (in accordance with BS EN 124:1994).*
6. *Pipes to be uPVC to BS EN 1401-1:1998 for sizes Ø100 & Ø150mm. Pipes to be uPVC to WIS 4-35-01, for sizes Ø225 & Ø300mm.*
7. *Pipes for storm drainage to be Polypipe Rigidrain (or similar approved).*
8. *All levels and dimensions are in meters unless stated otherwise.*
9. *For indicative location for all sewers and services please see Existing Site Services drawings. It shall be the contractor's responsibility to verify position and level prior to commencing construction. The contractor shall also be responsible for the arrangement of all necessary permits as required prior to commencement.*
10. *Min cover to Clay / Concrete drainage Pipes to be 1200mm under roads/footpaths and 600mm under landscaping. Min cover to Thermoplastic drainage Pipes to be 900mm under roads/footpaths and 600mm under landscaping. Where adequate cover cannot be provided pipes are to be protected with a lean mix concrete surround.*
11. *Changes in invert levels at a manhole (not requiring a drop manhole) shall be graded evenly through the manhole in order to avoid an abrupt change in invert level.*
12. *Where concrete surround is specified for pipes the pipes shall be first wrapped with an approved plastic membrane. Flexibility at joints shall be maintained by insertion of 25mm 'flexcell' (or similar approved) at each joint to break the continuity of the concrete surround. However the plastic membrane shall be continuous at these locations to protect rubber jointing rings from ingress of grout. The minimum thickness of the concrete surround should be 150mm or the diameter of the pipe whichever is the greater.*
13. *Compressible boards to be laid between crossing pipes where cover between pipes limited.*
14. *All in-curtilage pipes to be minimum ø100mm unless otherwise indicated.*
15. *A drain which is at a level lower than the foundations of a building should either (a) where the trench is within 1m of the foundations, be filled with concrete up to the level of the underside of the foundations,*
    (b) where the trench is more than 1m from the foundations, be filled with concrete up to a level, below the level of the underside of the foundations, equal to the distance from the foundations less 150mm,
16. *Existing sewers to be maintained and kept in service at all times.*
17. *This drawing should be read in conjunction with proposed drainage schedule drawings, construction details drawings and all other relevant drawings.*
18. *All internal pipework extending outside the building must be constructed with rocker pipes through the foundations/ trench fill as per construction details.*
19. *To allow connection to the invert levels of the proposed drainage network a change in pipe gradient may be required. To allow this all internal infrastructure (sinks, dishwasher's, floor gullies etc, including rainwater downpipes) to be connected to a back inlet bottle gully prior to connection to the proposed drainage as per construction details with the exception of WCs.*
20. *To achieve invert levels of the foul drainage network all WC internal infrastructure must be connected via backdrop manhole (if required) as per construction details drawings, or similar approved.*
21. *All back inlet bottle gullies for foul drainage to be capped with closed lid with same strength class as adjacent manholes. Perforated lids will not be suitable.*
22. *Back inlet bottle gullies to be constructed directly adjacent to building provided construction achievable above foundations.*
23. *All drainage channels and outfalls to be constructed in accordance with manufactures specifications.*
24. *All details/ dimensions to be checked by the contractor. Any discrepancies to be reported to the engineer immediately.*
25. *Invert levels of catchpit chambers shown denote approximate invert levels of the lowest pipe and do not include for catchpit sump depth.*

Rev	Issue Date	Description	App
P2	13/12/2021	Amended Layout	PA

Status: FOR INFORMATION

Client: Errigal Contracts

Project: Blackpool Norbreck Road

Drawing: Proposed Drainage Layout

Scale: 1:200 @ A1

McAdam ENHANCING LOCAL COMMUNITIES

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Drawn	Checked	Approved
ER	JS	PA
Date 16/09/2021	Date 16/09/2021	Date 16/09/2021

Project Number	Drawing Number	Revision
E2333	C-2000	S4-P2

Appendix G – Proposed Drainage Discharge – Un-Restricted

Network 1 & Network 2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network

Pipe Sizes Circular Manhole Sizes Adoptable

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	1000

Designed with Level Soffits

Time Area Diagram for Storm Network

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.085	4-8	0.029

Total Area Contributing (ha) = 0.114

Total Pipe Volume (m³) = 1.888

Network Design Table for Storm Network

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
1.000	23.441	0.293	80.0	0.051	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	19.886	0.249	79.9	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	9.003	0.117	76.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	6.910	0.086	80.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.35	15.450	0.051	0.0	0.0	0.0	1.12	19.9	6.9
1.001	50.00	5.64	15.157	0.066	0.0	0.0	0.0	1.13	19.9	8.9
2.000	50.00	5.13	15.100	0.010	0.0	0.0	0.0	1.15	20.3	1.4
1.002	50.00	5.74	14.908	0.076	0.0	0.0	0.0	1.12	19.8	10.3

Network Design Table for Storm Network

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
3.000	11.615	0.145	80.1	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	10.531	0.132	79.8	0.002	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	5.699	0.071	80.3	0.002	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	8.663	0.108	80.2	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.004	9.037	0.113	80.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	2.069	0.021	98.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	50.00	5.17	15.450	0.015	0.0	0.0	0.0	1.12	19.9	2.0
3.001	50.00	5.33	15.305	0.017	0.0	0.0	0.0	1.13	19.9	2.3
3.002	50.00	5.41	15.173	0.019	0.0	0.0	0.0	1.12	19.8	2.6
3.003	50.00	5.54	15.102	0.033	0.0	0.0	0.0	1.12	19.9	4.5
3.004	50.00	5.67	14.994	0.038	0.0	0.0	0.0	1.13	19.9	5.1
1.003	50.00	5.78	14.822	0.114	0.0	0.0	0.0	1.01	17.9	15.4

Simulation Criteria for Storm Network

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Storm Duration (mins)	30
Ratio R	0.400		

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1-1/1	15 Winter	2	+0%	30/15 Summer				15.517
1.001	1-1/2	15 Winter	2	+0%	30/15 Summer				15.234
2.000	1-2/1	15 Winter	2	+0%	30/15 Summer				15.129
1.002	1-1/3	15 Winter	2	+0%	30/15 Summer				15.046
3.000	1-3/1	15 Winter	2	+0%					15.485
3.001	1-3/2	15 Winter	2	+0%	100/15 Summer				15.343
3.002	1-3/3	15 Winter	2	+0%	100/15 Summer				15.215
3.003	1-3/4	15 Winter	2	+0%	30/15 Summer				15.155
3.004	1-3/5	15 Winter	2	+0%	30/15 Summer				15.051
1.003	1-1/4	15 Winter	2	+0%	2/15 Summer				15.010

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1-1/1	-0.083	0.000	0.40		7.7	OK	
1.001	1-1/2	-0.073	0.000	0.52		9.8	OK	
2.000	1-2/1	-0.121	0.000	0.08		1.5	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	1-1/3	-0.012	0.000	0.64		10.8	OK	
3.000	1-3/1	-0.115	0.000	0.12		2.3	OK	
3.001	1-3/2	-0.112	0.000	0.14		2.5	OK	
3.002	1-3/3	-0.108	0.000	0.17		2.8	OK	
3.003	1-3/4	-0.097	0.000	0.27		4.7	OK	
3.004	1-3/5	-0.093	0.000	0.30		5.3	OK	
1.003	1-1/4	0.038	0.000	1.48		16.1	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1-1/1	15 Winter	30	+30%	30/15 Summer				15.780
1.001	1-1/2	15 Winter	30	+30%	30/15 Summer				15.605
2.000	1-2/1	15 Winter	30	+30%	30/15 Summer				15.368
1.002	1-1/3	15 Winter	30	+30%	30/15 Summer				15.359
3.000	1-3/1	15 Winter	30	+30%					15.507
3.001	1-3/2	15 Winter	30	+30%	100/15 Summer				15.368
3.002	1-3/3	15 Winter	30	+30%	100/15 Summer				15.322
3.003	1-3/4	15 Winter	30	+30%	30/15 Summer				15.308
3.004	1-3/5	15 Winter	30	+30%	30/15 Summer				15.267
1.003	1-1/4	15 Winter	30	+30%	2/15 Summer				15.219

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1-1/1	0.180	0.000	0.80		15.6	SURCHARGED	
1.001	1-1/2	0.298	0.000	0.99		18.5	SURCHARGED	
2.000	1-2/1	0.118	0.000	0.17		3.3	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	1-1/3	0.301	0.000	1.27		21.4	SURCHARGED	
3.000	1-3/1	-0.093	0.000	0.30		5.7	OK	
3.001	1-3/2	-0.087	0.000	0.36		6.4	OK	
3.002	1-3/3	-0.001	0.000	0.40		6.5	OK	
3.003	1-3/4	0.056	0.000	0.65		11.3	SURCHARGED	
3.004	1-3/5	0.123	0.000	0.69		12.1	SURCHARGED	
1.003	1-1/4	0.247	0.000	3.01		32.7	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1-1/1	15 Winter	100	+30%	30/15 Summer				16.137
1.001	1-1/2	15 Winter	100	+30%	30/15 Summer				15.882
2.000	1-2/1	15 Winter	100	+30%	30/15 Summer				15.544
1.002	1-1/3	15 Winter	100	+30%	30/15 Summer				15.532
3.000	1-3/1	15 Winter	100	+30%					15.527
3.001	1-3/2	15 Winter	100	+30%	100/15 Summer				15.504
3.002	1-3/3	15 Winter	100	+30%	100/15 Summer				15.480
3.003	1-3/4	15 Winter	100	+30%	30/15 Summer				15.464
3.004	1-3/5	15 Winter	100	+30%	30/15 Summer				15.404
1.003	1-1/4	15 Winter	100	+30%	2/15 Summer				15.335

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1-1/1	0.537	0.000	0.93		17.9	FLOOD RISK	
1.001	1-1/2	0.575	0.000	1.18		22.0	SURCHARGED	
2.000	1-2/1	0.294	0.000	0.22		4.2	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	1-1/3	0.474	0.000	1.51		25.5	SURCHARGED	
3.000	1-3/1	-0.073	0.000	0.39		7.4	OK	
3.001	1-3/2	0.049	0.000	0.42		7.5	SURCHARGED	
3.002	1-3/3	0.157	0.000	0.47		7.6	SURCHARGED	
3.003	1-3/4	0.212	0.000	0.77		13.4	SURCHARGED	
3.004	1-3/5	0.260	0.000	0.83		14.6	SURCHARGED	
1.003	1-1/4	0.363	0.000	3.60		39.0	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network

Pipe Sizes Circular Manhole Sizes Adoptable

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.900
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	1000

Designed with Level Soffits

Time Area Diagram for Storm Network

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.042	4-8	0.019

Total Area Contributing (ha) = 0.061

Total Pipe Volume (m³) = 0.621

Network Design Table for Storm Network

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
1.000	22.069	0.350	63.1	0.061	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	13.071	0.087	150.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.29	15.200	0.061	0.0	0.0	0.0	1.27	22.4	8.3
1.001	50.00	5.56	14.850	0.061	0.0	0.0	0.0	0.82	14.4	8.3

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	2-1/1	15 Winter	2	+0%	30/15 Summer				15.269
1.001	2-1/2	15 Winter	2	+0%	30/15 Summer				14.944

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2-1/1	-0.081	0.000	0.43		9.3	OK	
1.001	2-1/2	-0.056	0.000	0.71		9.4	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	2-1/1	15 Winter	30	+30%	30/15 Summer				15.461
1.001	2-1/2	15 Winter	30	+30%	30/15 Summer				15.125

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2-1/1	0.111	0.000	0.97		21.2	SURCHARGED	
1.001	2-1/2	0.125	0.000	1.59		20.9	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	2-1/1	15 Winter	100	+30%	30/15 Summer				15.740
1.001	2-1/2	15 Winter	100	+30%	30/15 Summer				15.233

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2-1/1	0.390	0.000	1.19		26.0	SURCHARGED	
1.001	2-1/2	0.233	0.000	1.93		25.4	SURCHARGED	

Appendix H – Proposed Drainage Discharge – Restricted

Network 1 & Network 2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network

Pipe Sizes Circular Manhole Sizes Adoptable

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	1000

Designed with Level Soffits

Time Area Diagram for Storm Network

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.085	4-8	0.029

Total Area Contributing (ha) = 0.114

Total Pipe Volume (m³) = 1.888

Network Design Table for Storm Network

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
1.000	23.441	0.293	80.0	0.051	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	19.886	0.249	79.9	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	9.003	0.117	76.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	6.910	0.086	80.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.35	15.450	0.051	0.0	0.0	0.0	1.12	19.9	6.9
1.001	50.00	5.64	15.157	0.066	0.0	0.0	0.0	1.13	19.9	8.9
2.000	50.00	5.13	15.100	0.010	0.0	0.0	0.0	1.15	20.3	1.4
1.002	50.00	5.74	14.908	0.076	0.0	0.0	0.0	1.12	19.8	10.3

Network Design Table for Storm Network

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
3.000	11.615	0.145	80.1	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	10.531	0.132	79.8	0.002	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	5.699	0.071	80.3	0.002	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	8.663	0.108	80.2	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.004	9.037	0.113	80.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	2.069	0.021	98.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	50.00	5.17	15.450	0.015	0.0	0.0	0.0	1.12	19.9	2.0
3.001	50.00	5.33	15.305	0.017	0.0	0.0	0.0	1.13	19.9	2.3
3.002	50.00	5.41	15.173	0.019	0.0	0.0	0.0	1.12	19.8	2.6
3.003	50.00	5.54	15.102	0.033	0.0	0.0	0.0	1.12	19.9	4.5
3.004	50.00	5.67	14.994	0.038	0.0	0.0	0.0	1.13	19.9	5.1
1.003	50.00	5.78	14.822	0.114	0.0	0.0	0.0	1.01	17.9	15.4

Simulation Criteria for Storm Network

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm Network

Hydro-Brake® Optimum Manhole: 1-1/4, DS/PN: 1.003, Volume (m³): 1.8

Unit Reference	MD-SHE-0104-5000-1100-5000
Design Head (m)	1.100
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	104
Invert Level (m)	14.822
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	5.0
Flush-Flo™	0.323	5.0
Kick-Flo®	0.690	4.0
Mean Flow over Head Range	-	4.4

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	3.5	1.200	5.2	3.000	8.0	7.000	12.0
0.200	4.8	1.400	5.6	3.500	8.6	7.500	12.4
0.300	5.0	1.600	6.0	4.000	9.2	8.000	12.7
0.400	5.0	1.800	6.3	4.500	9.7	8.500	13.1
0.500	4.8	2.000	6.6	5.000	10.2	9.000	13.5
0.600	4.6	2.200	6.9	5.500	10.7	9.500	13.8
0.800	4.3	2.400	7.2	6.000	11.1		
1.000	4.8	2.600	7.5	6.500	11.5		

Storage Structures for Storm Network

Cellular Storage Manhole: 1-1/4, DS/PN: 1.003

Invert Level (m) 14.822 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	30.0	0.0	0.801	0.0	0.0
0.800	30.0	0.0			

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1-1/1	15 Winter	2	+0%	30/15 Summer				15.517
1.001	1-1/2	15 Winter	2	+0%	30/15 Summer				15.234
2.000	1-2/1	15 Winter	2	+0%	30/15 Summer				15.129
1.002	1-1/3	30 Winter	2	+0%	30/15 Summer				15.033
3.000	1-3/1	15 Winter	2	+0%	100/30 Winter				15.485
3.001	1-3/2	15 Winter	2	+0%	30/60 Winter				15.343
3.002	1-3/3	15 Winter	2	+0%	30/30 Summer				15.215
3.003	1-3/4	15 Winter	2	+0%	30/15 Summer				15.155
3.004	1-3/5	15 Winter	2	+0%	30/15 Summer				15.051
1.003	1-1/4	30 Winter	2	+0%	2/15 Summer				15.025

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1-1/1	-0.083	0.000	0.40		7.7	OK	
1.001	1-1/2	-0.073	0.000	0.52		9.8	OK	
2.000	1-2/1	-0.121	0.000	0.08		1.5	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	1-1/3	-0.025	0.000	0.53		9.0	OK	
3.000	1-3/1	-0.115	0.000	0.12		2.3	OK	
3.001	1-3/2	-0.112	0.000	0.14		2.5	OK	
3.002	1-3/3	-0.108	0.000	0.17		2.8	OK	
3.003	1-3/4	-0.097	0.000	0.27		4.7	OK	
3.004	1-3/5	-0.093	0.000	0.30		5.3	OK	
1.003	1-1/4	0.053	0.000	0.44		4.8	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1-1/1	15 Winter	30	+30%	30/15 Summer				15.700
1.001	1-1/2	15 Winter	30	+30%	30/15 Summer				15.524
2.000	1-2/1	60 Winter	30	+30%	30/15 Summer				15.454
1.002	1-1/3	60 Winter	30	+30%	30/15 Summer				15.453
3.000	1-3/1	15 Winter	30	+30%	100/30 Winter				15.507
3.001	1-3/2	60 Winter	30	+30%	30/60 Winter				15.458
3.002	1-3/3	60 Winter	30	+30%	30/30 Summer				15.456
3.003	1-3/4	60 Winter	30	+30%	30/15 Summer				15.454
3.004	1-3/5	60 Winter	30	+30%	30/15 Summer				15.450
1.003	1-1/4	60 Winter	30	+30%	2/15 Summer				15.445

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1-1/1	0.100	0.000	0.85		16.4	SURCHARGED	
1.001	1-1/2	0.217	0.000	1.03		19.2	SURCHARGED	
2.000	1-2/1	0.204	0.000	0.10		1.8	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	1-1/3	0.395	0.000	0.77		13.0	SURCHARGED	
3.000	1-3/1	-0.093	0.000	0.30		5.7	OK	
3.001	1-3/2	0.003	0.000	0.19		3.4	SURCHARGED	
3.002	1-3/3	0.133	0.000	0.23		3.8	SURCHARGED	
3.003	1-3/4	0.202	0.000	0.37		6.4	SURCHARGED	
3.004	1-3/5	0.306	0.000	0.37		6.4	SURCHARGED	
1.003	1-1/4	0.473	0.000	0.46		5.0	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1-1/1	15 Winter	100	+30%	30/15 Summer				16.029
1.001	1-1/2	60 Winter	100	+30%	30/15 Summer				15.917
2.000	1-2/1	60 Winter	100	+30%	30/15 Summer				15.905
1.002	1-1/3	60 Winter	100	+30%	30/15 Summer				15.904
3.000	1-3/1	60 Winter	100	+30%	100/30 Winter				15.912
3.001	1-3/2	60 Winter	100	+30%	30/60 Winter				15.909
3.002	1-3/3	60 Winter	100	+30%	30/30 Summer				15.907
3.003	1-3/4	60 Winter	100	+30%	30/15 Summer				15.905
3.004	1-3/5	60 Winter	100	+30%	30/15 Summer				15.900
1.003	1-1/4	60 Winter	100	+30%	2/15 Summer				15.895

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1-1/1	0.429	0.000	0.95		18.4	FLOOD RISK	
1.001	1-1/2	0.610	0.000	0.77		14.4	FLOOD RISK	
2.000	1-2/1	0.655	0.000	0.13		2.4	FLOOD RISK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.002	1-1/3	0.846	0.000	0.95		16.0	FLOOD RISK	
3.000	1-3/1	0.312	0.000	0.21		4.0	FLOOD RISK	
3.001	1-3/2	0.454	0.000	0.25		4.5	FLOOD RISK	
3.002	1-3/3	0.584	0.000	0.27		4.5	FLOOD RISK	
3.003	1-3/4	0.653	0.000	0.43		7.5	FLOOD RISK	
3.004	1-3/5	0.756	0.000	0.46		8.0	FLOOD RISK	
1.003	1-1/4	0.923	0.000	0.46		5.0	SURCHARGED	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network

Pipe Sizes Circular Manhole Sizes Adoptable

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.900
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	1000

Designed with Level Soffits

Time Area Diagram for Storm Network

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.042	4-8	0.019

Total Area Contributing (ha) = 0.061

Total Pipe Volume (m³) = 0.621

Network Design Table for Storm Network

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
1.000	22.069	0.350	63.1	0.061	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	13.071	0.087	150.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.29	15.200	0.061	0.0	0.0	0.0	1.27	22.4	8.3
1.001	50.00	5.56	14.850	0.061	0.0	0.0	0.0	0.82	14.4	8.3

Simulation Criteria for Storm Network

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm Network

Hydro-Brake® Optimum Manhole: 2-1/2, DS/PN: 1.001, Volume (m³): 1.9

Unit Reference	MD-SHE-0103-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	14.850
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.0
Flush-Flo™	0.354	5.0
Kick-Flo®	0.745	4.0
Mean Flow over Head Range	-	4.4

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	3.4	1.200	5.0	3.000	7.7	7.000	11.5
0.200	4.7	1.400	5.4	3.500	8.3	7.500	11.8
0.300	5.0	1.600	5.7	4.000	8.8	8.000	12.2
0.400	5.0	1.800	6.0	4.500	9.3	8.500	12.6
0.500	4.9	2.000	6.3	5.000	9.8	9.000	12.9
0.600	4.7	2.200	6.6	5.500	10.2	9.500	13.3
0.800	4.1	2.400	6.9	6.000	10.7		
1.000	4.6	2.600	7.2	6.500	11.1		

Storage Structures for Storm Network

Cellular Storage Manhole: 2-1/2, DS/PN: 1.001

Invert Level (m) 14.850 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	0.0	0.601	0.0	0.0
0.600	15.0	0.0			

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	2-1/1	15 Winter	2	+0%	30/15 Summer				15.269
1.001	2-1/2	30 Winter	2	+0%	30/15 Summer				15.000

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2-1/1	-0.081	0.000	0.43		9.3	OK	
1.001	2-1/2	0.000	0.000	0.34		4.4	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	2-1/1	15 Winter	30	+30%	30/15 Summer				15.467
1.001	2-1/2	30 Winter	30	+30%	30/15 Summer				15.353

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2-1/1	0.117	0.000	0.94		20.6	SURCHARGED	
1.001	2-1/2	0.353	0.000	0.38		5.0	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	2-1/1	60 Winter	100	+30%	30/15 Summer				16.091
1.001	2-1/2	60 Winter	100	+30%	30/15 Summer				16.066

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	2-1/1	0.741	0.000	0.68		14.8	SURCHARGED	
1.001	2-1/2	1.066	0.000	0.38		5.0	FLOOD RISK	

Appendix I – Existing Historic Site investigation Data / Infiltration testing

SUB SURFACE

SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Site	Trial Pit Number
8 NORBRECK ROAD, BLACKPOOL, LANCASHIRE.	TP1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
MECHANICAL EXCAVATOR	2.40m x 0.60m x 3.00m		FABRIK PROPERTY GROUP	6752
	Location	**Dates**	**Engineer**	**Sheet**
	AS PLAN	17/05/2019	CARTER-ZUB BUILDING CONSULTANCY LIMITED	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: bituminous macadam surfacing.		
0.20-0.30	B				0.15 (0.15) 0.30	MADE GROUND: cream slightly gravelly fine to medium sand with some roots and rootlets. Gravel sized fragments are fine to medium stone and concrete.		
0.40-0.60	B				(0.45)	MADE GROUND: brown slightly gravelly slightly sandy silt. Gravel sized fragments are fine to coarse stone, brick and concrete.		
					0.75	Brown slightly sandy clayey SILT with some pockets of clay.		
0.80-1.00	B					Firm orangish brown slightly gravelly slightly sandy silty CLAY with some pockets of fine sand. Gravel is subangular to subrounded fine to medium sandstone, siltstone and quartz.		
1.80-2.00	B				(2.25)			
2.80-3.00	B		17/05/2019:DRY		3.00	Complete at 3.00m		

Plan

Remarks

No groundwater entries recorded.
Pit sides remained vertical and stable.
Orientation of long axis of pit is East to West.
On completion soakaway test carried out, then backfilled with arisings.

Scale (approx)	Logged By	Figure No.
1:25	MSB/MJE	6752.TP1

SUB SURFACE

SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

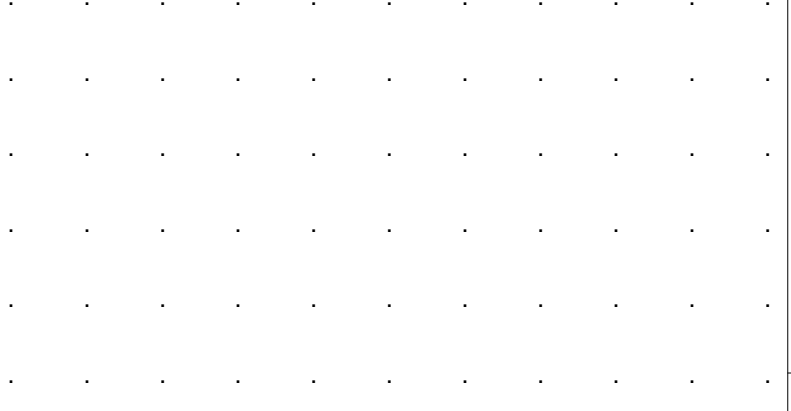
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Site	Trial Pit Number
8 NORBRECK ROAD, BLACKPOOL, LANCASHIRE.	TP2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
MECHANICAL EXCAVATOR	2.100m x 0.65m x 1.75m		FABRIK PROPERTY GROUP	6752
	Location AS PLAN	**Dates** 17/05/2019	**Engineer** CARTER-ZUB BUILDING CONSULTANCY LIMITED	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	MADE GROUND: bituminous macadam surfacing.		
					(0.10) 0.20	MADE GROUND: cream and grey sandy fine to coarse gravel sized fragments of stone.		
0.25-0.35	B				(0.25) 0.45	MADE GROUND: dark grey slightly gravelly slightly sandy clayey silt with occasion pockets of clay. Gravel sized fragments are fine to medium stone and brick.		
0.50-0.70	B				(0.65) 1.10	Brown slightly gravelly slightly sandy clayey SILT with occasional pockets of clay. Gravel is subangular to subrounded fine to medium sandstone and quartz.		
1.20-1.40	B				(0.65) 1.75	Firm orangish brown slightly gravelly slightly sandy silty CLAY with occasional pockets of fine sand. Gravel is subangular to subrounded fine to medium sandstone, siltstone and quartz.		
			17/05/2019:DRY			Complete at 1.75m		

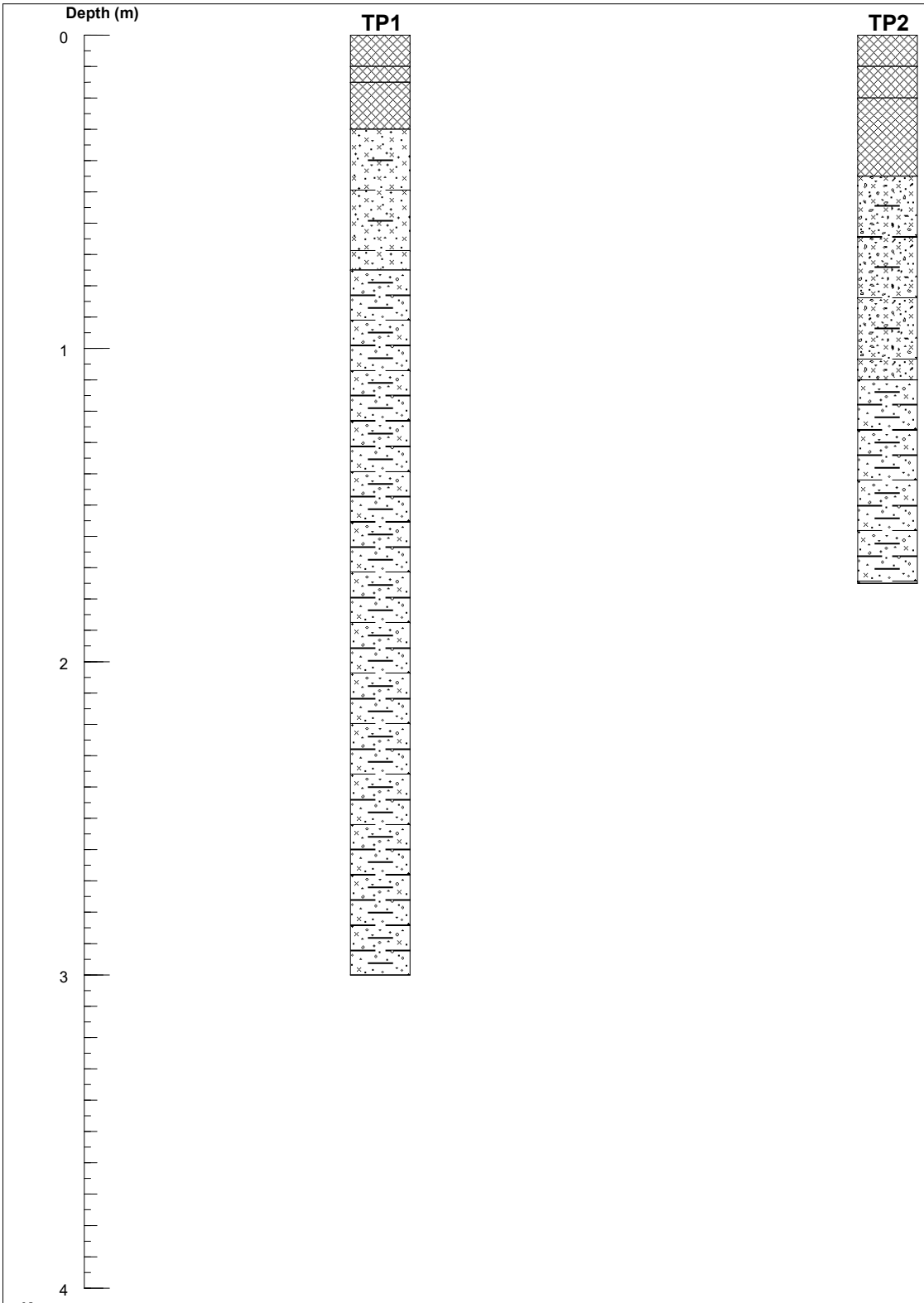
Plan



Remarks

No groundwater entries recorded.
Pit sides remained vertical and stable.
Orientation of long axis of pit is East to West.
On completion soakaway test carried out, then backfilled with arisings.

Scale (approx)	Logged By	Figure No.
1:25	MSB/MJE	6752.TP2



Key

- Groundwater Strike
- Strike Rise Level
- MADE GROUND
- Silty sandy gravelly CLAY
- Clayey sandy SILT
- Clayey sandy gravelly SILT

SUB SURFACE
SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Nominal Section

Site	Date Drawn	Date Checked	Sheet	Job Number
8 NORBRECK ROAD, BLACKPOOL, LANCASHIRE.	20/05/2019		1/1	6752
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
FABRIK PROPERTY GROUP			1:20[V]	M3338.1

SUB SURFACE
SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Insitu Test Results

Site: 8 NORBRECK ROAD, BLACKPOOL, LANCASHIRE

Client: FABRIK PROPERTY GROUP

Engineer: CARTER-ZUB BUILDING CONSULTANCY LIMITED

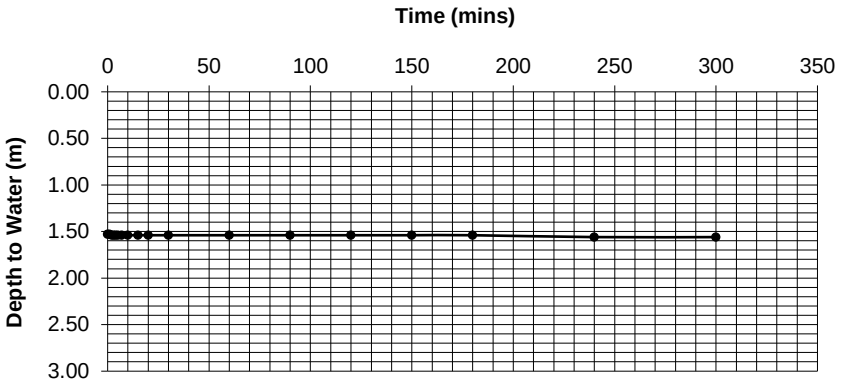
Job Number: 6752

Sheet: 1 / 2

Soakaway Test

Hole No: TP01

TEST NO: 1
DATE: 17/05/19



Time (min)	Depth (m)
0	1.53
1	1.53
2	1.54
3	1.54
4	1.54
5	1.54
7	1.54
10	1.54
15	1.54
20	1.54
30	1.54
60	1.54
90	1.54
120	1.54
150	1.54
180	1.54
240	1.56
300	1.56

Length of pit:	L =	2.40	m
Width of pit:	W =	0.60	m
Depth of pit	D =	3.00	m
Base area of pit:	A =	1.44	m^2
100% effective depth	D100 =	1.53	m
75% effective depth	D75 =	1.90	m
50% effective depth	D50 =	2.27	m
25% effective depth	D25 =	2.63	m
time to D75	T75 =	-	sec
time to D25	T25 =	-	sec
time from D75 to D25 (T25 - T75)	t_{p75-25} =	-	sec
volume between D75 & D25 (A x (D25 - D75))	V_{p75-25} =	1.06	m^3
surface area to D50 inc. base ((2x(D-D50)x(W+L)) + A)	a_{p50} =	5.85	m^2

SOIL INFILTRATION RATE **f =** $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f = - m/sec

Test Strata: Firm orangish brown slightly gravelly slightly sandy silty CLAY with some pockets of fine sand. Gravel is subangular to subrounded fine to medium sandstone, siltstone and quartz.

Remarks: Unable to calculate soil infiltration rate due to low permeability of strata

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Insitu Test Results

Site: 8 NORBRECK ROAD, BLACKPOOL, LANCASHIRE

Client: FABRIK PROPERTY GROUP

Engineer: CARTER-ZUB BUILDING CONSULTANCY LIMITED

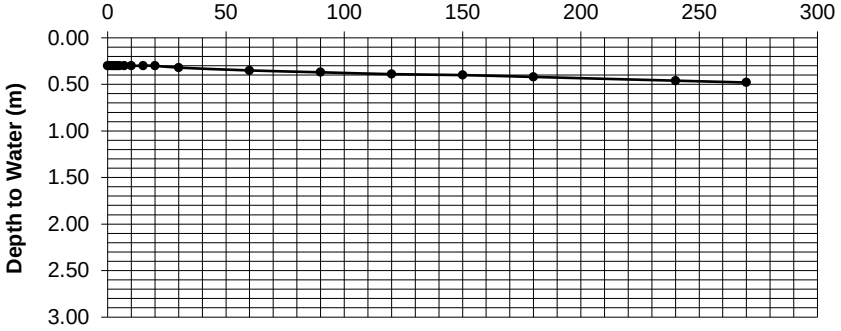
Job Number: 6752

Sheet: 2 / 2

Soakaway Test

Hole No: TP02

TEST NO: 1
DATE: 17/05/19



Time (min)	Depth (m)
0	0.30
1	0.30
2	0.30
3	0.30
4	0.30
5	0.30
7	0.30
10	0.30
15	0.30
20	0.30
30	0.32
60	0.35
90	0.37
120	0.39
150	0.40
180	0.42
240	0.46
270	0.48

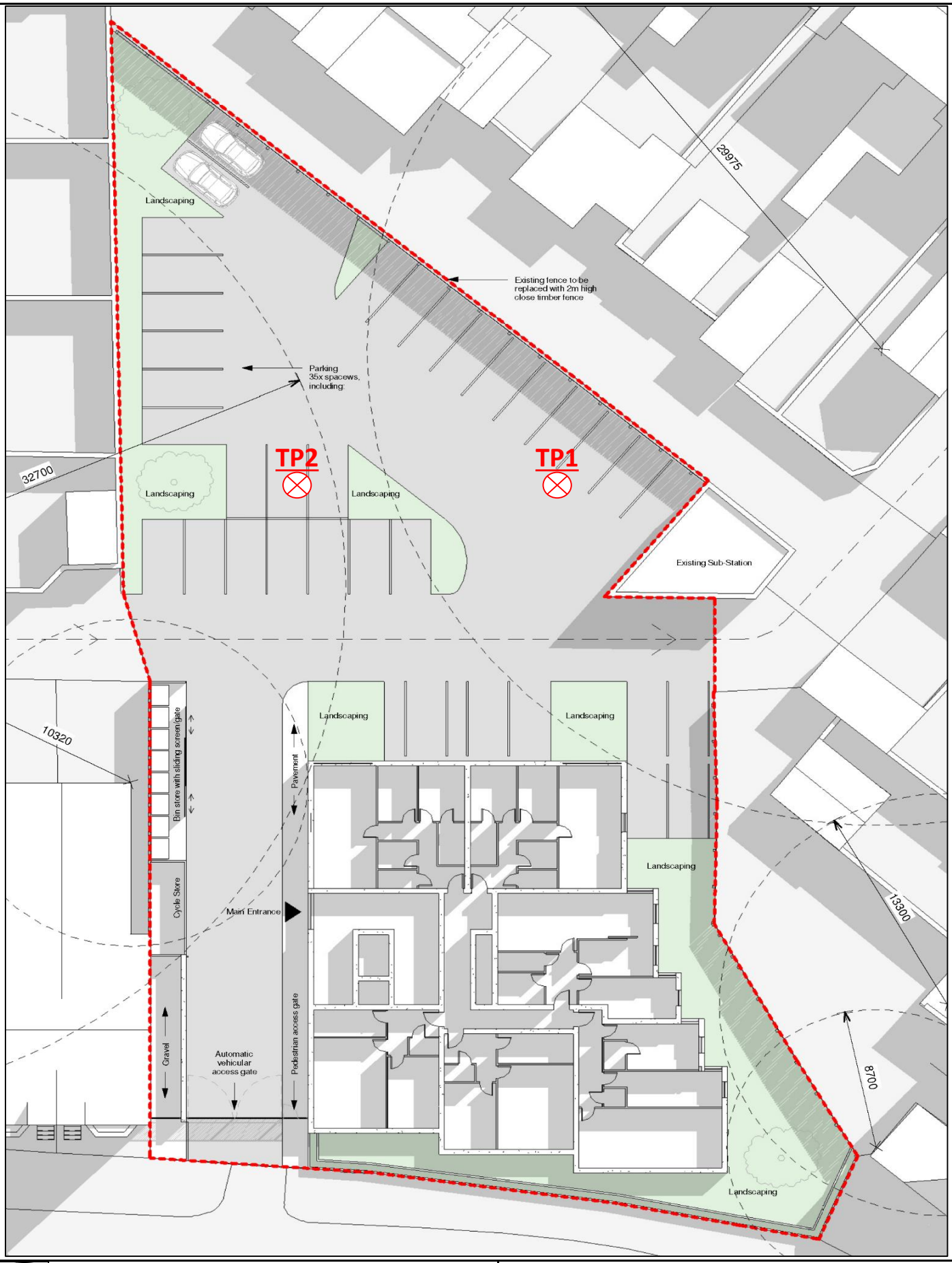
Length of pit:	L =	2.10	m
Width of pit:	W =	0.65	m
Depth of pit	D =	1.75	m
Base area of pit:	A =	1.37	m^2
100% effective depth	D100 =	0.30	m
75% effective depth	D75 =	0.66	m
50% effective depth	D50 =	1.03	m
25% effective depth	D25 =	1.39	m
time to D75	T75 =	-	sec
time to D25	T25 =	-	sec
time from D75 to D25 (T25 - T75)	t_{p75-25} =	-	sec
volume between D75 & D25 (A x (D25 - D75))	V_{p75-25} =	0.99	m^3
surface area to D50 inc. base ((2x(D-D50)x(W+L)) + A)	a_{p50} =	5.35	m^2

SOIL INFILTRATION RATE **f =** $\frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

f = - m/sec

Test Strata:
0.20m
MADE GROUND: dark grey slightly gravelly slightly sandy clayey silt with occasional pockets of clay.
0.45m
Brown slightly gravelly slightly sandy clayey SILT with occasional pockets of clay.
1.10m
Firm orangish brown slightly gravelly slightly sandy silty CLAY with occasional pockets of fine sand.
1.75m

Remarks: Unable to calculate soil infiltration rate due to low permeability of strata



SUB SURFACE SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907	Trial Pit & Soakaway Test Location Plan			
Site 8 NORBRECK ROAD, BLACKPOOL, LANCASHIRE	Date Drawn 20-May-19	Date Checked	Orientation N	Job No. 6752
Client FABRIK PROPERTY GROUP	Drawn By MSB	Checked By	Scale -	Figure No. 1

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