



79 SILVER STREET, READING, RG1 2SU



CHAMBERWELL INVESTMENT SERVICES LIMITED, COVENTRY

DRAINAGE STRATEGY

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Contents

1	Introduction	4
1.1	Site Description.....	4
1.2	Proposed Future Use.....	4
1.3	Site Levels	4
1.4	Underlying Ground.....	4
2	Managing Surface Water	5
2.1	Climate Change	5
2.2	Critical Drainage Area.....	5
2.3	Sustainable Drainage Systems (SUDS)	5
3	Drainage Strategy	7
3.1	Existing Site Drainage and Connections to the Public Sewer	7
3.2	Existing Flows from Site.....	7
3.3	Surface Water Drainage Strategy	7
3.4	Foul Flows	8
3.5	Access and Egress	8
4	Conclusions	9

Appendices

Appendix 1	Drawing WL_950_001_P1_Drainage Strategy
Appendix 2	Microdrainage Calculations – Existing Brown Field Run off
Appendix 3	Proposed Development Peak Foul Flow Rate Calculations

1 Introduction

Westlakes Consulting, as a division of Westlakes Engineering Ltd., has been commissioned by Chamberwell Investment Services Limited to prepare a Drainage Strategy report for a development site at 79 Silver Street, Reading, RG1 2SU.

Planning Permission will be sought to redevelop the site for student accommodation use.

1.1 Site Description

A site visit has not been undertaken however a topographic survey has been reviewed along with aerial and street images which suggest that the development site consists of a three-storey commercial development with a paved area to the front and a concrete access down the side of the property leading to a tarmac yard at the rear of the property, and a small garden which lies behind No 1 Mount Pleasant Terrace. With the exception of the garden area the site is made up of impermeable roof or impermeable paving. The total area of the site is 0.106ha of which 90% is impermeable

The site is accessed from Silver Street, which is adjacent to the western boundary of the site.

The site is located within a mix of commercial and residential property in an area lying south east of the centre of Reading.

The nearest surface water feature is the River Kennet which is located approximately 520m west of the site.

1.2 Proposed Future Use

The site is intended to be developed with a multi-storey building for 69 beds of student accommodation use.

Post-development there will be a sunken garden giving access to studio units, and leisure facilities in the basement (-1 level) There is also a proposed area of soft landscaping at the back of the development. The proposed drainage strategy is discussed in detail within Section 3 of this report.

1.3 Site Levels

It is assumed that post-development external site surface levels will be similar to those pre-development, however the internal levels in the sunken garden will reflect basement levels.

1.4 Underlying Ground

British Geological Survey (BGS) maps at 1:50,000 scale have been reviewed. The maps suggest that sand and gravel superficial drift deposits underlie the site. However, it is also possible that superficial deposits may not be present because the site is located close to an area where there are no superficial deposits recorded and the boundaries between the different strata are inferred on the maps. The site is shown to be underlain by solid geology of the Lambeth Group; comprising clay, silt and sand.

Historic borehole logs suggest that chalk bedrock may also be found at depth.

Ground conditions and infiltration rates will need to be confirmed via intrusive site investigation in order to accurately design soakaway drainage.

The depth to the underlying groundwater table is not currently known.

2 Managing Surface Water

In accordance with the National Planning Policy Framework (NPPF) (Achieving sustainable development – Section 10, Meeting the challenge of climate change), the Environment Agency Report ref SC030219 – Rainfall runoff management for Developments, and the local Strategic Flood Risk Assessment (SFRA), consideration should be given to natural water flows at the site. The development should not adversely affect flow or increase flood risk elsewhere, including increasing run-off rates. The disposal of surface water should be dealt with in a sustainable way and climate change should also be accounted for. The site drainage strategy is discussed in Section 3.

2.1 Climate Change

There is evidence to suggest that the climate is changing with sea levels predicted to continue to rise along with more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall. The NPPF recommends that the effects of climate change be accounted for in FRA, with consideration of the EA flood maps and local authority SFRA.

Increased rainfall or higher intensity short-duration rainfall may increase as a result of climate change. Technical guidance published in March 2012 by the NPPF (Para 13 Table 5) recommends that for developments with a design life beyond 2085, a 30% increase in peak rainfall intensity should be accommodated. A 30% increase is therefore being allowed for within the new surface water drainage design to take account of climate change as discussed in Section 2. Climate change may also lead to variations in groundwater level which will also be considered during the drainage design.

2.2 Critical Drainage Area

Critical Drainage Areas have been delineated within the SFRA, using a combination of natural catchments, areas with historical sewer flooding and areas susceptible to surface water flooding greater than 0.3 m (as defined by the 1 in 200 chance of occurring in a year Flood Map for Surface Water (FMfSW) map). Specific drainage requirements are recommended in these areas to help reduce local flood risk.

The site is located within Character area 3 Reading south, close to the boundary with Reading Central. The site lies in an area which is identified as Flood Zone 1, having a less than a 1:1000 annual probability of flooding from watercourses or the sea. The SFRA states that special considerations will be given to the proposed Green Park Village development which lies in zone 2, 3A and 3B flood zones. The report describes development in areas close to Reading central as being “heavily constrained by the availability of brown field and the availability of green field sites”. Because of the limited potential for development, the site does not appear to be within a Critical Drainage area. The site is a brownfield site and the SFRA states:

- *Development should aim for a minimum reduction in surface water runoff rates of 30% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year (1% AEP) storm event, considering climate change.*
- *Development should be designed so that there is no flooding to the development in a 1 in 30 year (3.33% AEP) event and so that there is no property flooding in a 1 in 100 year (1% AEP) plus climate change event.*
- *Wherever possible, reductions in surface water should be achieved through the implementation of SUDS with source control considered firstly. There may be opportunities to deliver SUDS through integrated solutions for collections of strategic sites”.*

2.3 Sustainable Drainage Systems (SUDS)

SUDS are a desirable way to manage surface water disposal within new developments and SUDS methods for surface water drainage management are discussed further within the SUDS Manual. When designing

surface water drainage strategies priority should be given to disposal of surface water via infiltration drainage systems over first watercourses and then sewers.

No current site permeability data exist, however geology maps suggest that sand and gravel superficial drift deposits may underlie the site. It is also possible that superficial deposits may not be present because the site is located close to an area where there are no superficial deposits recorded and the boundaries between the different strata are inferred on the maps. The site is shown to be underlain by solid geology of the Lambeth Group; comprising clay, silt and sand.

The natural ground may therefore be relatively permeable and may support infiltration drainage systems, such as soakaways, however ground conditions should be intrusively investigated and soakaway feasibility considered further. An infiltration rate would need to be determined for soakaway design.

There would need to be sufficient space on site to allow safe soakaway construction e.g. BRE365 guidelines recommends that soakaways are positioned at least 5m from building foundations and site boundaries. From the layout drawing WL_950_001_P1 in Appendix 1 it can be seen that there would be insufficient space on site to comply with this recommendation.

3 Drainage Strategy

Westlakes are undertaking the new site drainage design and have obtained details of Thames Water sewer assets in the area local to the site. The proposed strategy is set out below and is also shown on Drawing WL-950-001 included as Appendix 1 along with supporting MicroDrainage calculations (Appendix 2).

3.1 Existing Site Drainage and Connections to the Public Sewer

The proposed development site consists of a single building which is assumed to have an individual connection to the existing combined sewer connecting Mount Pleasant Terrace to the existing 300mm diameter combined sewer in Silver Street.

3.2 Existing Flows from Site

The site is approximately 0.106 ha in area and is considered to be 90% impermeable in its pre-development state.

The combined existing brownfield flow has been estimated using Microdrainage modelling software and these calculations are included in Appendix 2. The calculations are based on a site impermeable area of 0.096 ha and a 2 pipe system was created for the existing site which produces brownfield flow rates at discharge of:

- 1 in 30 year – 25.6 l/s
- 1 in 100 year + 30% climate change – 37.6 l/s

3.3 Surface Water Drainage Strategy

The use of soakaways has been discounted for this site because there is insufficient space to provide the recommended clearance prescribed in BRE365. There are no nearby watercourses to which surface waters could be discharged. It is therefore proposed that site surface water is discharged to the public sewer network.

It is noted in Section 2.2, that brownfield sites should aim for a minimum reduction in surface water runoff rates of 30%. In order to provide a conservative response, this figure has been applied to the existing impermeable site area (0.096ha) and in this scenario the total allowable discharge rates from site would be:

- 1 in 30 year – 17.9 l/s
- 1 in 100 year + Climate Change – 26.3 l/s

It is proposed that surface water from the site is allowed to discharge into the 300mm diameter surface water sewer in Silver Street at the reduced brownfield rates above. It is proposed to connect surface water flows via the existing combined sewer connection from manhole “S1”, shown on the drainage strategy drawing WL_950_001_P1.

The rate of discharge will however need to be confirmed by the local drainage authority and Thames Water who will take into account the capacity of the sewer and check their records for history of surcharging or flooding in the network.

In order to reduce the amount of surface run off the developer will investigate the use of porous paving and soft landscaping. If successful, this will reduce the run off area to 0.0648ha from the roofs and the bins store with the remaining site areas comprising permeable paved surfaces and landscaping thereby reducing the impermeable surfaces by circa 32.5% post-development. It is noted that the suitability of porous paving will be influenced by the permeability of the underlying ground and whether contamination is present, which will be considered as the design processes.

The site surface water drainage will be designed in accordance with current best practice to provide adequate capacity not to flood for a 1 in 30 year storm event and flood water generated from a 1 in 100 year

plus climate change storm event (+30%) shall be constrained within the site boundary so not to cause off-site flooding. The risk of flooding elsewhere should not be increased as a result of the development proposals.

All redundant drains, sewers and manholes within the site will be removed or filled.

Discussions should be held with Thames Water and the local drainage authority regarding the discharge of surface waters. Discharge restrictions and connection charges may apply.

3.4 Foul Flows

It is proposed to connect foul flows via the existing combined sewer connection from manhole "A", shown on the drainage strategy drawing WL_950_001_P1.

The peak flow calculated using the discharge unit method is 6.1 l/s (see appendix 3).

3.5 Access and Egress

The site has pedestrian access from Silver Street which is located in EA Flood zone one 1 and is therefore at low risk of flooding from rivers and the sea. There may be localised areas of surface water flooding of gullies during heavy rainfall although this is not considered likely to represent a threat to accessibility for vehicles or pedestrians.

Safe access and egress should therefore be maintained.

4 Conclusions

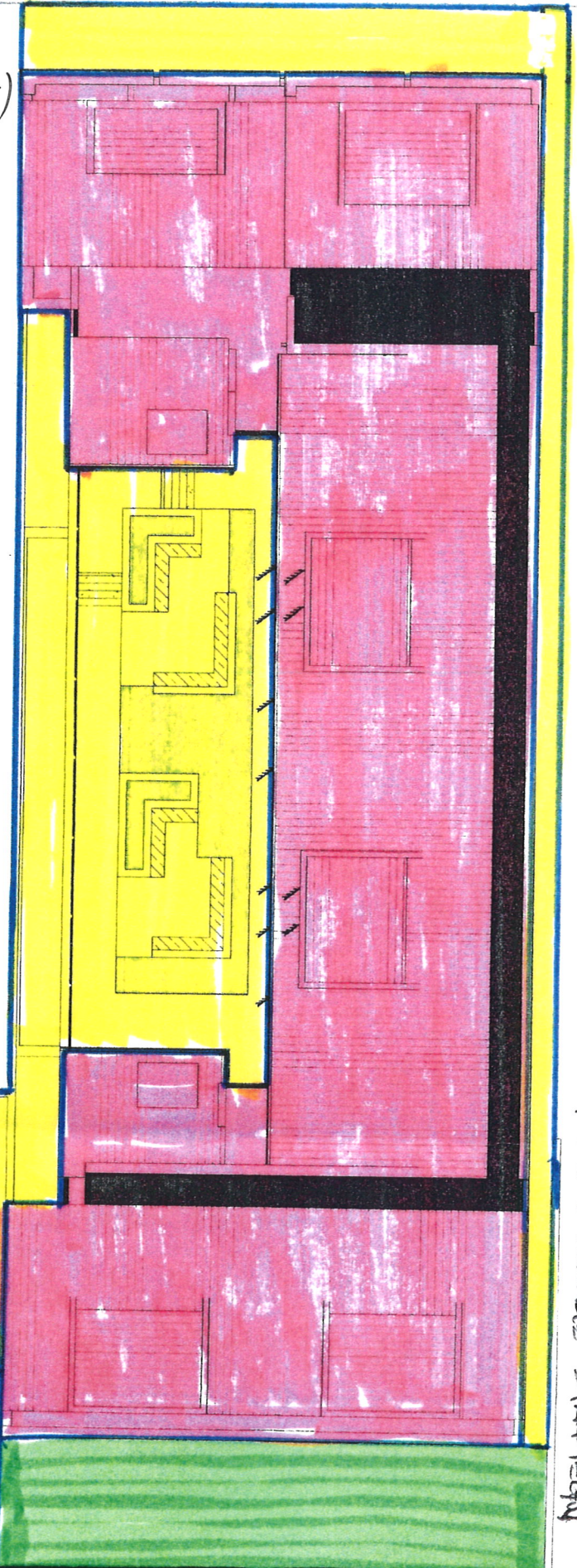
The site is in EA Flood Zone 1 and is not known to flood historically. The following conclusions are drawn:

- The site is thought to be at low risk from all forms of flooding.
- The site is expected to be underlain by that sand and gravel superficial drift deposits which may be relatively permeable and would therefore support use of soakaways. However, there is insufficient space within the proposed development to allow safe soakaway construction and consequently use of soakaways is not recommended. There are no nearby watercourses. Permeable paving is planned to be included as part of the development proposals.
- It is proposed to discharge surface water into the surface water sewer in Silver Street at attenuated discharge rates of 17.9 l/s for a 1 in 30 year event and 26.3 l/s for a 1 in 100 year plus climate change event.
- The new site drainage will be designed with adequate capacity not to flood during a 1 in 30 year storm event and flood water generated from a 1 in 100 year plus climate change storm event (+30%) shall be constrained within the areas on site. The risk of off-site flooding would not increase as a result of the development and safe access and egress is to be maintained.
- Discharge restrictions and charges may apply for connections to the public drainage network.
- It is proposed to discharge foul flows to the combined sewer in Silver Street via the existing combined sewer connection from manhole "A" as shown on drawing WL_950_001_P1. The peak flow calculated using the discharge unit method is 6.1 l/s.

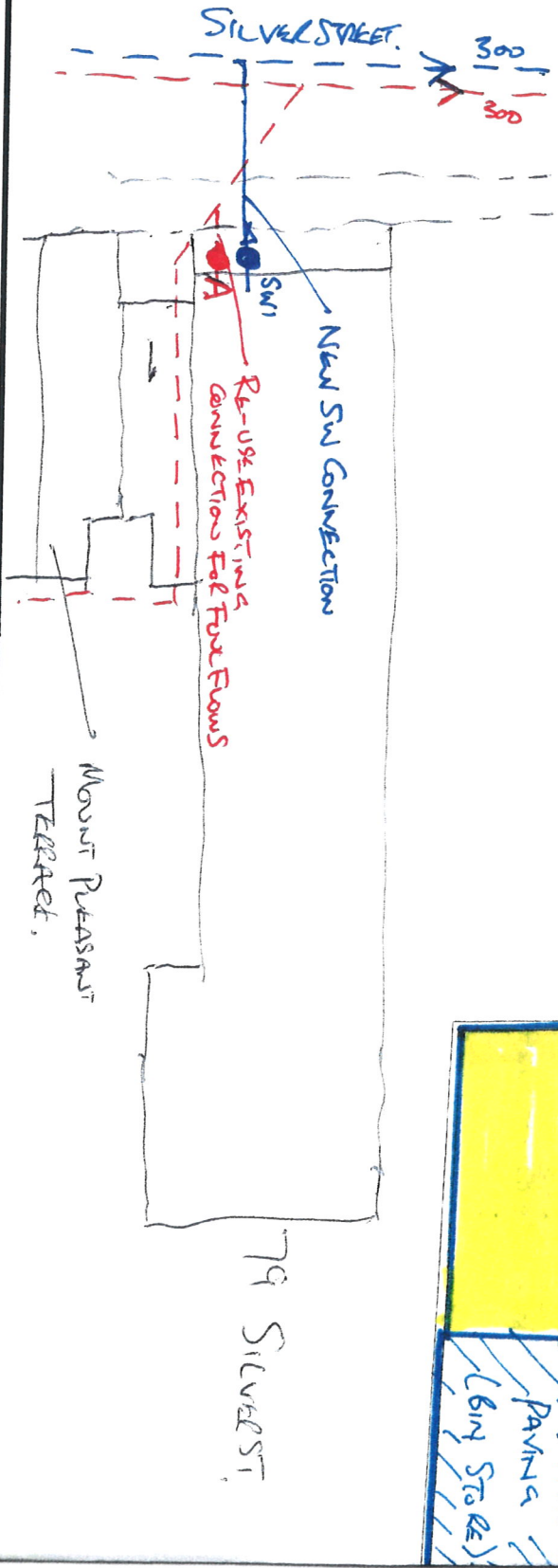


Appendix 1 Drawing WL_950_001_P1_Drainage Strategy

DRAWING WL-950-001-P1 - DRAINAGE STRATEGY



- Roof Level**
- SOFT LANDSCAPING (100m²)
 - PERMEABLE PAVEMENT + LANDSCAPING (342m²)
 - ROOF AREA (604m²)
 - IMPERMEABLE BIN STORE (44m²)





Appendix 2 Microdrainage Calculations – Existing Brown Field Run off

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20 Dale Street Manchester M1 1EZ		
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Micro Drainage		Network 2013.1.1

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	20.000	0.400	50.0	0.096	5.00	0.0	0.600	o	150
1.001	20.000	0.333	60.1	0.000	0.00	0.0	0.600	o	150

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	5.23	20.000	0.096	0.0	0.0	0.0	1.43	25.2	13.0
1.001	49.15	5.49	19.600	0.096	0.0	0.0	0.0	1.30	23.0	13.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001	outfall	21.000	19.267	19.267	1200	0

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.700	Storm Duration (mins)	30
Ratio R	0.400		

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Westlakes Engineering Ltd		Page 2
20 Dale Street Manchester M1 1EZ		
Date 17/08/2016 17:37	Designed by hammp	
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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 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 Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	0	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.100	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
Return Period(s) (years)	1, 30
Climate Change (%)	0, 0

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30	0%	30/15 Summer				
1.001	15 Winter	30	0%	30/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Flow (l/s)	
1.000	1	20.374	0.224	0.000	1.11	0.0	26.3	SURCHARGED
1.001	2	19.879	0.129	0.000	1.18	0.0	25.6	SURCHARGED

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20 Dale Street Manchester M1 1EZ		
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1.000	20.000	0.400	50.0	0.096	5.00	0.0	0.600	o	150
1.001	20.000	0.333	60.1	0.000	0.00	0.0	0.600	o	150

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	5.23	20.000	0.096	0.0	0.0	0.0	1.43	25.2	13.0
1.001	49.15	5.49	19.600	0.096	0.0	0.0	0.0	1.30	23.0	13.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
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Ratio R	0.400		

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Micro Drainage		Network 2013.1.1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.100	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
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	30/15 Summer				
1.001	15 Winter	100	+30%	30/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
1.000	1	21.458	1.308	0.000	1.62	0.0	38.5	SURCHARGED
1.001	2	20.424	0.674	0.000	1.74	0.0	37.6	SURCHARGED

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Appendix 3 Proposed Development Peak Foul Flow Rate Calculations

**Foul Drainage Calculations For
950 - 79 Silver Street, Reading**

Discharge Unit Method

Student Residential Units

Appliance	Number	DU	Total
	Appliances		
Student Accommodation			
WC	69	1.2	82.8
Wash Basin	69	0.3	20.7
Shower	69	0.45	31.05

Ground Floor and Basement (Reception, Plant, Leisure facilities)

WC	4	1.2	4.8
Wash Basin	4	0.3	1.2
Shower	1	0.45	0.45
Floor Gully	6	1.3	7.8

148.8

0.5

Total DU

6.1 **l/s**

KDU (Frequency)