

St. Edward Homes

Green Park Village

Drainage Strategy

Project Ref: 11321/2008

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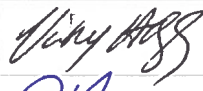
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Contents

1	Introduction	1
2	Site Location and Plan	1
3	Surface Water Drainage	2
3.1	Greenfield Runoff Calculations	2
3.2	Consented Surface Water Drainage Strategy	2
3.3	Proposed Surface Water Drainage Strategy	3
3.4	Risk Analysis.....	7
4	Proposed Foul Drainage Strategy.....	7
5	Summary	8

Appendices

Appendix 1 – Site Location Plan and Proposed Site Layout
Appendix 2 – Greenfield Run-off Calculations
Appendix 3 – Proposed Surface Water Drainage Layout
Appendix 4 – MicroDrainage Calculations North Network
Appendix 5 – MicroDrainage Calculations East Network
Appendix 6 – MicroDrainage Calculations Phase 1
Appendix 7 – MicroDrainage Calculations School
Appendix 8 – MicroDrainage Calculations Lake View Villas & CCRC Extra Care
Appendix 9 – MicroDrainage Calculations West Lakeside Development
Appendix 10 – MicroDrainage Calculations Surcharged Outfalls
Appendix 11 – Proposed Foul Drainage Layout

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1 Introduction

Peter Brett Associates LLP has been appointed by St. Edward Homes to prepare the surface water drainage strategy for Green Park Village.

This report describes the proposed scheme and any amendments to the previous consented strategy submitted for the site. This report encompasses two levels of detail; the main outline application for the site and the Phase 1 detailed application. Phase 1 is located in the east residential area of Green Park Village and is indicated on the proposed site layout (Appendix 1)

The surface water drainage scheme has been prepared in consultation with the Environment Agency (EA). The EA issued a response (reference dr10/00587/SCO dated 25th May 2010) in relation to the submitted Environmental Impact Assessment scoping report. This letter confirms that assuming no major changes are necessary a proposed drainage strategy would be based on the previous Flood Risk Assessment and Surface Water drainage concept, would be acceptable in terms of the application of Sustainable Drainage Systems (SuDS) techniques.

2 Site Location and Plan

The Green Park Village site is 24 hectares, and is located immediately to the west of Longwater Avenue in Green Park, Reading. The southern boundary is formed by Smallmead Road and the willows and stream which flows under Kybes Lane. The western boundary of the site is the Reading-Basingstoke railway line, and will be the location of the Green Park Reading Railway Station. The site is bounded to the north by the Northern ditch (formally Hall's ditch).

4 hectares of the site, about 17%, is a lake which will be largely retained in its current configuration and will form the focal point for a waterside park at the heart of Green Park Village, and also forms part of the Green Park Flood Alleviation Scheme that connects to Green Park.

About 4.75 hectares of the site, 20%, has either recently been or is in light industrial or waste recycling use, and effectively brownfield. These uses, including any contamination arising from them, will be removed to make way for the new railway station and the Green Park Village.

The remainder of the site is currently used for top soil storage, and has existing permissions that would raise the land out of the flood plain.

Appendix 1 includes the location plan and proposed site layout.

3 Surface Water Drainage

3.1 Greenfield Runoff Calculations

Due to a lack of information regarding the existing surface water drainage regime for the brownfield elements of the site, it has been decided that for the purpose of this surface water strategy that the site will be taken as 100% greenfield. The Consented Surface Water Drainage Strategy that accompanied the Green Park Village, Station and Interchange application calculated partial brownfield rates for the site. Therefore, the proposed strategy will provide a betterment in terms of the discharge rate at which surface water run-off from the development will enter the Lake and ditch network.

The Greenfield runoff rate for the site has been calculated using 'Preliminary Rainfall Runoff Management for Developments – Technical Report W5-074A/TR/1, Revision D, September 2005' (DEFRA) as recommended by the EA. The Greenfield runoff rate was calculated for a site area of 1ha, a pro-rota rate according to the individual site area (defined by the proposed topography of the site) was then calculated for the individual networks. This can be found in Appendix 2.

Table 3.1: Calculated Greenfield Run-off Rates

Rainfall Event	Greenfield Run-off Rate
1 in 1 year	3.16 l/s/ha
1 in 30 year	8.32 l/s/ha
1 in 100 year	11.85 l/s/ha

3.2 Consented Surface Water Drainage Strategy

A previous planning application was submitted for the site in July 2007. The principles of the drainage strategy, which formed an appendix of the Green Park Village, Station and Interchange Flood Risk Assessment (project ref. 11321/134, July 2007), have formed the basis for the proposed Green Park Village surface water drainage strategy, described in this report. Broadly these are as described in the following parts of this chapter taken from the original FRA.

Commercial Plots

- Clean roof run-off to be attenuated via underground cellular storage or dry ponds and discharge to Lake / ditches.
- Run-off from decked car parks to be discharge to ground via infiltration trench / filter drain or discharge to Lake /ditches via lined infiltration trench / filter drain.
- Run-off from surface car parks and plot access roads to be discharged via lined permeable paving or filter drains to lined cellular storage before discharging into the Lake / ditches.

School Plot

- Clean roof run-off discharged to Longwater Ditch via attenuation in underground cellular storage.
- Run-off from hard standing play area to be discharged to ground via infiltration or to Longwater Ditch via underground cellular storage.
- Run-off for the school car park to be discharged via infiltrating permeable paving.

Main residential Area to the East of the Lake

- Clean run-off from the front of houses to be discharged into the Lake / ditch network via attenuation in oversized pipes.
- Clean roof run-off from the rear of houses to be discharged to ground via infiltration devices located in car parking areas to the rear of properties.
- Clean roof runoff from houses that are located on the boundary of the development is discharged via infiltration trenches within the properties gardens.
- Run-off from private parking areas will discharge to ground via infiltrating permeable pavements. An emergency overflow will be connected to the proposed surface water drainage network which ultimately discharges into the Lake.
- The run-off from residential streets will be discharged to ground via infiltrating permeable paving located in the parking areas which front the properties. A high void sub-base in the parking bays and under the carriageway acts as storage during larger rainfall events.

Residential Development to the North West of the Lake Including Square

- Clean roof run-off to discharge to the Lake via attenuation in oversized pipes.
- Run-off from decked car parking to be discharged either to ground by infiltration or into the Lake.
- Run-off from residential streets to be discharged to ground via permeable paving and / or filter drains.
- Run-off from the public square is to be discharged to ground via permeable paving.

3.3 Proposed Surface Water Drainage Strategy

The proposed drainage strategy seeks to follow the drainage principles of the previous consented scheme (Section 3.2) and replicate the existing greenfield runoff situation by returning a significant proportion of rainfall runoff to ground via infiltration devices. It also acknowledges the risk to groundwater and maintains the EA's requirement for a 1m minimum unsaturated zone to groundwater level, which has been determined by site monitoring to be 37.800m AOD. Therefore, all of the proposed infiltration devices will maintain this clearance by setting their minimum invert level at 38.800m AOD.

All infiltration devices have been designed in accordance with BRE 365 to store a 1 in 10 year rainfall event below the invert level of the incoming pipe, and half drain in 24 hours. An infiltration rate of 1×10^{-5} m/s was used, which will be the specified property of the imported fill. Where infiltration techniques are not considered suitable due to potential contamination SuDS systems are to be lined, with the attenuated discharge piped into the lake or surrounding ditch network.

The strategy proposes that surface water runoff from areas classed as having a higher contamination risk, such as the proposed highways and parking areas, will pass through permeable paving which provides a water quality benefit by removing hydrocarbons before discharging to ground via infiltration or to the Lake via a filter drain. Where this is prohibited by the proposed layout of the development, run-off generated by the highway network will be discharged via trapped gullies into the proposed surface water drainage networks. These networks will ultimately discharge into the Lake or surrounding ditch network via oil separators.

Drawings showing the proposed surface water drainage strategy are contained in Appendix 3. The drawings have been broken down for clarity showing infiltrating drainage and positive drainage networks on separate sheets.

3.3.1 Main Residential Area to the East of the Lake

As per the consented surface water drainage strategy, roof run-off from the rear of residential properties will be discharged to ground via infiltration devices. Roof run-off from the front of properties will be discharged into the Lake / ditch network via one of the three proposed on-site surface water drainage networks. Where spatial constraints allow, the whole of the roof will be discharged to ground and in a few isolated cases the whole of the roof will discharge via the proposed networks.

All private car parks and private driveways will discharge run-off to ground via direct infiltration permeable pavements (permeable pavements which do not accept any additional run-off from neighbouring parts of the development).

Where possible, run-off from residential highways will pass through permeable paving located in the parking bays adjacent to the carriageway. The permeable paving in these bays is divided into infiltrating permeable paving (permeable pavements which act as soakaways) and lined (tanked) permeable paving, with the lined permeable paving utilised for storage and its water quality benefits. The boundary for the infiltrating permeable paving is 5m from any structures in accordance with current building Regulations. As previously discussed where this method of discharge is prohibited by the proposed development layout, the run-off generated by the highway will be discharged via trapped gullies and oil separators, in accordance with Pollution Prevention Guideline 3: Use and Design of Oil Separators in Surface Water Drainage (PPG3), into the Lake / ditch network.

The three proposed surface water drainage networks have been designed to attenuate the surface water discharge into the surrounding watercourses up to and including the 1 in 100 year + 30% climate change rainfall event below ground. The North and East Networks discharge into the Northern ditch via cellular storage devices located below equipped public open space, while the Phase 1 Network discharges into the Lake via cellular storage located under a car park.

All three networks have flow control devices located at the 1st manhole upstream of the outfall and flap valves (non-return valves) installed on the outfall itself to prevent water backing up the network in times of fluvial flood. This is discussed further in Section 3.4. However, the location of the controls ensures that should blockage of the device occur then the flood waters will be routed to the surrounding ditch network or Lake and away from highways and properties

Details of the proposed drainage strategy are shown on drawings 11321/2008/001 & 002 in Appendix 3.

Outline Design – Discharge rates

As previously discussed in Section 3.1, greenfield run-off rates for the site have been calculated and are contained in Appendix 2. In accordance with Planning Policy Statement 25: Development and Flood Risk (PPS25) an allowance for climate change of 30% has been added to the 1 in 100 year rainfall event.

For the North and East networks, comparison against the calculated greenfield 1 in 30 year and 1 in 100 year run-off rates has been undertaken. Comparison to the 1 in 1 year discharge rate will be made during the detail design stage. As can be seen in Tables 3.2 and 3.3 below a betterment has been achieved for each of the rainfall events. MicroDrainage Calculations for the North and East Networks are contained in Appendix 4 and 5 respectively.

Table 3.2: East Network – Existing and Proposed Discharge Rates

Rainfall event	Existing Discharge Rate	Proposed Discharge Rate
1 in 30 year	8.56 l/s	6.4 l/s
1 in 100 year	12.19 l/s	7.5 l/s
1 in 100 year + 30%	-	8.8 l/s

Table 3.3: North Network – Existing and Proposed Discharge Rates

Rainfall event	Existing Discharge Rate	Proposed Discharge Rate
1 in 30 year	8.55 l/s	7.7 l/s
1 in 100 year	12.18 l/s	8.9 l/s
1 in 100 year + 30%	-	10.4 l/s

Detail Design – Discharge Rates

For the Phase 1 network, comparison against the calculated greenfield 1 in 30 year and 1 in 100 year run-off rates has been undertaken. Assessment against the 1 in 1 year greenfield discharge rate has also been undertaken to ensure that the requirements of Code for Sustainable Homes (May 2010, Department for Communities and Local government) mandatory category 4 (SUR 1) are achieved by the development. As can be seen in Tables 3.4 below a betterment has been achieved for each of the rainfall events. MicroDrainage Calculations for the Phase 1 Network are contained in Appendix 6.

Table 3.4: Phase 1 – Existing and Proposed Discharge rates

Rainfall event	Existing Discharge Rate	Proposed Discharge Rate
1 in 1 year	3.11 l/s	3.0 l/s
1 in 30 year	8.19 l/s	5.8 l/s
1 in 100 year	11.66 l/s	7.2 l/s
1 in 100 year + 30%	-	9.0 l/s

Detail Design – Volume of Discharge

Also required under the Code for Sustainable Homes (May 2010, Department for Communities and Local government) mandatory category 4 (SUR 1) is the requirement to compare pre and post development discharge volumes. The Code requires that assessment of the 1 in 100year, 6 hour duration plus a 30% allowance for climate change is made and that any additional volume is managed on-site and made available for re-use or discharged at a reduced rate. It has been determined that the density of the proposed development will preclude the effective use of rainwater harvesting for the re-use of water. However, due to the level of infiltration proposed on the Green Park Village development, assessment for the Phase 1 Network has shown a reduction in discharge volumes. Refer to Table 3.5 below.

Table 3.5: Pre and Post Development Discharge Volumes.

Pre Development Volume	Post Development Volume	
	Summer	Winter
830.067m ³	262.535m ³	287.410m ³

3.3.2 School

All surface water runoff generated by the school buildings and areas of hard standing discharges to ground via infiltrating cellular storage. Parking areas are drained by direct infiltration permeable paving. The proposed strategy is shown on drawing 11321/2008/002, Appendix 3. MicroDrainage calculations for the school site are contained in Appendix 7.

3.3.3 Lake View Villas & Continuing Care Retirement Community (CCRC) Extra Care

The runoff generated by the Lake View Villa roofs is drained independently and discharged to ground via infiltrating cellular storage, which is located within the adjacent car park area. The car park itself is drained by direct infiltration permeable paving.

Similarly, the CCRC Extra Care Unit roof runoff is drained independently from other areas and all runoff discharges to ground via infiltrating cellular storage, which is located in the central courtyard area. Parking areas are drained by direct infiltration permeable paving.

The proposed strategy is shown on the drawing 11321/2008/2002 located in Appendix 2 and the MicroDrainage calculations are contained in Appendix 8.

3.3.4 Development to the West of the Lake

An area of potential contamination lies within part of this area of the development. Hence, we have not considered that infiltration techniques are suitable. However, SuDS have been used to provide a water quality benefit and outside this area infiltration devices have been utilised to discharge water to ground and reduce the discharge to the Lake. The boundary of the possible contamination and the proposed drainage strategy are shown on drawings 11321/2008/003 & 004 in Appendix 3.

Where possible clean roof run-off discharges to ground via infiltrating cellular devices located below car parks located outside the area of potential contamination. This is not always possible due to the recorded groundwater level and required 1m unsaturated zone. In this case the run-off is discharged into the Lake via a surface water drainage network including lined filter drains. In addition, two areas of green roof are also proposed which have the benefit of mimicking *'the predevelopment state of the building footprint'* and *'can reduce the volume and rate of run-off of rainfall'* (SuDS Manual CIRIA 697, 2007).

In areas outside the contamination boundary enclosed parking areas will discharge all run-off to ground via direct infiltration permeable paving. Parking areas within the contamination boundary will discharge into the Lake via lined permeable paving. This allows pollutants to be removed within the sub-base.

The run-off generated by the proposed highway will shed towards lined permeable paving in parking bays or parking areas. A surface water network then connects this storage to infiltrating cellular storage devices or discharge to the Lake. As such the run-off will benefit from treatment through the sub-base.

Discharge Rates

As previously discussed in Section 3.1 greenfield run-off rates for the site have been calculated and are contained in Appendix 2. In accordance with Planning Policy Statement 25: Development and Flood Risk (PPS25) an allowance for climate change of 30% has been added to the 1 in 100 year rainfall event.

As per the other outline design networks, East and North Networks, comparison against the calculated greenfield 1 in 30 year and 1 in 100 year run-off rates has been undertaken. Comparison to the 1 in 1 year discharge rate will be made during the detail design stage. As can be seen in Table 3.6 below a betterment has been achieved for each of the rainfall events. MicroDrainage Calculations for the West Lakeside Development Network are contained in Appendix 9.

Table 3.6: West Lakeside Network – Existing and Proposed Discharge Rates

Rainfall event	Existing Discharge Rate	Proposed Discharge Rate
1 in 30 year	3.33 l/s	3.1 l/s
1 in 100 year	4.74 l/s	3.6 l/s
1 in 100 year + 30%	-	4.4 l/s

3.4 Risk Analysis

As per the consented surface water drainage strategy, an assessment of the interaction between fluvial events of the Lake / ditch network and pluvial (rainfall) events has been undertaken on a risk basis.

All the proposed networks which ultimately discharge into the Lake have a minimum outfall level of 38.200m AOD as per the consented strategy, and flap valves to prevent water backing up the network during larger fluvial events.

In order to demonstrate that the precautionary principle that PPS25 advocates will be achieved by the proposed surface water drainage strategy, all networks which discharge to the Lake/ watercourse have been modelled with their outfalls surcharged to the 1 in 20 year level fluvial flood event (38.709m AOD). All of these networks have been shown to provide attenuation up to and including the 1 in 100 year + 30% increase for climate change rainfall event combined with a 1 in 20 year fluvial event below ground. MicroDrainage calculations for this assessment are contained in Appendix 10.

For details of the hydraulic modelling of the Lake and ditch network refer to the Green Park Flood Risk Assessment (11321/2008/R001/Rev 0, July 2010).

4 Proposed Foul Drainage Strategy

Effluent generated by the Green Park Village development will be discharged via two existing spurs into the private sewer which runs from west to east in Longwater Avenue. This in turn discharges into the adopted Thames Water Utilities sewer located in the A33 at its junction with Longwater Avenue. A pumping station is required to convey effluent generated from the development located to west of the Lake. A plan showing the proposed on-site foul drainage networks, 11321/2008/007, is contained in Appendix 11.

5 Summary

Table 5 below summaries this report and the proposed drainage strategy for the development.

Table 5: Summary

Location	Proposed drainage strategy
Main Residential Area to the East of the Lake	
Runoff from rear of houses	Soakaways in rear of garden or discharge to Lake/ ditch network if infiltration not available
Runoff from front of houses	Positive drainage network
Private car parks	Direct Infiltration permeable paving
Flats over Garages (FOGs)	Infiltrating cellular storage
Residential streets	Lined/ Infiltrating permeable paving in parking spaces adjacent to carriageway. Where none present, runoff is discharged to positive drainage network.
School and Lakeside Residential	
All drainage	Infiltrating cellular storage
West side	
Outside potential contamination zone	
Building roof runoff	Infiltrating cellular storage units within car parks
Car parks	Permeable paving connected to infiltrating cellular storage units.
Streets	Fall to adjacent permeable paving connected to infiltrating cellular storage units.
Within potential contamination zone	
Building roof runoff	Positive drainage networks discharging to lake via filter drain and cellular storage attenuation.
Car parks	Lined permeable paving connecting to positive drainage networks discharging to lake via filter drain and cellular storage attenuation
Streets	Fall to adjacent lined permeable paving connected to positive drainage networks discharging to lake via filter drain and cellular storage attenuation.

Appendix 1 – Site Location Plan and Illustrative Masterplan

- Site Location Plan, Figure 1
- Illustrative Masterplan drawing No. PL-MPL-005

Green Park Village
Drainage Strategy

Appendix 2 – Greenfield Run-off Calculations

Green Park Village
Drainage Strategy

Appendix 3 – Proposed Surface Water Drainage Layout

- Eastern Residential Development, Proposed Positive Drainage Network Discharging to the Lake and Watercourses, drawing No. 11321/2008/001
- Eastern Residential Development, Proposed Infiltrating Drainage Layout, 11321/2008/002
- West Lakeside Development, Proposed Positive Drainage Network Discharging to the Lake, drawing No. 11321/2008/003
- West Lakeside Development, Proposed infiltrating Drainage Layout, drawing No. 11321/2008/004
- Permeable Paving Details, drawing No. 11321/2008/005
- Soakaway Details, drawing No. 11321/2008/006

Green Park Village
Drainage Strategy

Appendix 4 – MicroDrainage Calculations North Network

- Surface Water Drainage Network - 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Cellular Soakaway
- Soakaways

Green Park Village
Drainage Strategy

Appendix 5 – MicroDrainage Calculations East Network

- Surface Water Drainage Network - 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Cellular Soakaway
- Soakaways

Green Park Village
Drainage Strategy

Appendix 6 – MicroDrainage Calculations Phase 1

- Surface Water Drainage Network – 1 in 1 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Soakaways
- Permeable Paving depths

Green Park Village
Drainage Strategy

Appendix 7 – MicroDrainage Calculations School

- Western Soakaway - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Eastern Soakaway - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change

Green Park Village
Drainage Strategy

Appendix 8 – MicroDrainage Calculations Lake View Villas & CCRC Extra Care

- Lake View Villas Soakaway - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- CCRC Extra Care Soakaway - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change

Green Park Village
Drainage Strategy

Appendix 9 – MicroDrainage Calculations West Lakeside Development

- Surface Water Drainage Network - 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Soakaway 1 - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Soakaway 2 - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Soakaway 3 - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Soakaway 4 - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change
- Soakaway 5 - 1 in 10 year, 1 in 30 year, 1 in 100 year, 1 in 100 year + 30% climate change

Green Park Village
Drainage Strategy

Appendix 10 – MicroDrainage Calculations Surcharged Outfalls

- Phase 1 Network - 1 in 100 year + 30% climate change
- Northern Network - 1 in 100 year + 30% climate change
- Eastern Network - 1 in 100 year + 30% climate change
- West Lakeside Network - 1 in 100 year + 30% climate change

Green Park Village
Drainage Strategy

Appendix 11 – Proposed Foul Drainage Layout

- Proposed Foul Drainage Layout, drawing No. 11321/2008/007

Green Park Village
Drainage Strategy