

CD07/066

REPORT ON FLOOD RISK & DRAINAGE STRATEGY AT THE ROYAL BATH AND WEST SHOWGROUND

April 2010

Revision #

**REPORT ON FLOOD RISK & DRAINAGE STRATEGY
AT THE ROYAL BATH
AND WEST SHOWGROUND**

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1.00 INTRODUCTION

- 1.01** This chapter assesses the flood risk and drainage issues in relation to the improvement of the Royal Bath and West Showground. It has been prepared to inform the Planning Framework for the site's enhancement.

- 1.02** The Environment Agency (EA) normally requires that a Flood Risk Assessment (FRA) is produced if a proposed development site has an operational development greater than 1ha. Accordingly, a FRA has been prepared by EWE Associates Ltd. This report summarises the main findings of this investigation and uses it to inform surface and foul water drainage strategies, which demonstrates how the site could accommodate development without unacceptable flood risk impact.

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2.00 ASSESSMENT APPROACH

2.01 The methodology for this assessment involves the initial review of the baseline conditions relating to the surface water environment. Several sources of information were obtained to complete this section.

- Topographical Site Survey.
- British Hydrological Society Chronology of British Hydrological Events website etc.
- On-site walkover survey (29 March 2010).
- Details of structures which may influence hydraulics of the watercourse and consideration of the effect of blockage of structures.
- Estimates of design levels, equivalent to a 200 year (coastal/tidal) and a 100 year (fluvial) return period flood event.
- Wessex Water sewer records.
- SUDS policies - PPS25.
- The SUDS Manual C697 (2007).
- Available information on historical flooding in the area.
- Foul Water Unit Discharge Method (BS-EN 752:2008 and BS-EN 12506-2:2000).

2.02 In order to assess the flood risk and drainage impacts, a Flood Risk Assessment (FRA) has been carried out by EWE Associates Ltd in accordance with Planning Policy Statement 25: Development and Flood Risk. The FRA is submitted with the Planning Framework.

2.03 This report identifies surface and foul water drainage strategies for the site to ameliorate any potential adverse flooding impacts of additional development at the Showground and, in addition, seek to enhance the environment wherever possible.

3.00 BASELINE CONDITIONS

3.01 The site covers an area of approximately 91 hectares and presently consists largely of grassed areas used for parking and ancillary uses to the South, North and West bounded by a mixture of fence lines, established trees, shrubs and hedgerows, surrounding the central core Showground area which comprises a network of internal roads with some extensive areas of hardstanding and a range of existing buildings of mixed size and condition. A local watercourse enters the site approximately midway along the Eastern boundary and runs in a Westerly direction toward the centre of the site. Here it turns to run toward the South, before leaving the site along the Southern part of the East boundary.

3.02 The site lies wholly within Zone 1 of the EA Flood Map (version 2.8.2), being the zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding. As such the general flood risk in this area is considered to be of a low probability. However, as the proposed improvements at the Showground are expected to accommodate a range of ancillary uses which may include hotels, (which for FRA purposes are considered to be residential), the site is considered to be 'More Vulnerable', as shown in the shaded area of Table 3.1.

Table 3.1: Flood Risk Vulnerability and Flood Zone 'Compatibility':

Flood Vulnerability classification		Risk	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1		✓	✓	✓	✓	✓
	Zone 2		✓	✓	Exception Test required	✓	✓
	Zone 3a		Exception Test required	✓	x	Exception Test required	✓
	Zone 3b		Exception Test required	✓	x	x	x

✓ Development is appropriate x Development should not be permitted

3.03 A search on the British Hydrological Society Chronology of British Hydrological Events website found no records indicating flooding close to the development site. Undertaking an internet based search for flooding in the area provided no further reference to flooding close to the site.

4.00 ASSESMENT OF POTENTIAL IMPACTS

4.01 Possible flooding Mechanisms are listed in Table 4.1 below:

Table 4.1: Possible Flooding Mechanisms

Source/Pathway	Significant?	Comment/Reason
Fluvial	Yes	Local watercourse
Tidal/Coastal	No	
Pluvial (urban drainage)	Yes	Existing site has some positive drainage.
Groundwater	No	
Overland flow	No	The Northern part of the site is significantly higher than the South.
Blockage	Yes	The local watercourse has several access bridge crossings and parts are culverted.
Infrastructure failure	No	
Rainfall Ponding	No	No higher ground adjacent to the development which could promote overland flow.

- 4.02** As part of the Showground improvement, there are proposals being prepared for new/and or intensified areas of development on the site. Following development, the impermeable area for the site will increase.
- 4.03** There are 2 sources of flood risk within the vicinity of the development site. These comprise the local watercourse and surface water runoff. The flood risk impact on the site and the neighbouring land from each source will be appraised as low, medium or high flood risk (the definition for low, medium and high risk/probability is described in Table D1 of PPS25 which is provided at Appendix A).
- 4.04** The watercourse is located within the South East corner of the site and is the responsibility of the local authority and the riparian owners. There are no flood defences such as embankments or walls, as such only overtopping needs consideration. There are several access bridges and culverts within the site which need to be considered in terms of blockage failure.
- 4.05** The proposed development will increase the impermeable area and hence surface water runoff from the site will also be increased. Therefore, consideration will need to be given to the existing drainage routes and the drainage characteristics in order to evaluate the impact surface water runoff from the site will have on the site and elsewhere.

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- 4.06** Due to the local topography the development site slopes from the North to the South, with the majority of the site draining towards the local watercourse. There are no depressed areas within the site which could encourage ponding, therefore flooding resulting from ponding has not been considered further.
- 4.07** The Northern part of the site is significantly higher than the Southern, with the natural ground water flow from the North towards the local watercourse which runs through the site. As such any development to the North of the local watercourse could sever an existing drainage route. Furthermore, the area of land to the South East of the watercourse is located within an area which could be flooded from the Local watercourse as it is lower than the left bank of the watercourse. This mechanism has been considered further in relation to the local watercourse
- 4.08** Information on groundwater flooding is limited within the Mendip District, in part due to the underlying substrate. It is noted that the Strategic Flood Risk Assessment does not identify groundwater as being a significant source of flooding within the study area. In addition, reference to the Groundwater Vulnerability Map and Source Protection Zones produced by the Environment Agency indicate that Shepton Mallet is predominantly underlain by low permeability aquifers and are therefore unlikely to be a source of significant flood risk.
- 4.09** Wessex Water is the statutory undertaker responsible for the Public sewer systems within the Mendip District. Wessex Water maintains a register of historical sewer flooding events (DG5 Register) within the Sedgemoor District. Information on the location of sewer flooding incidents has been provided on flood incidence maps. These maps identify general areas where sewer flooding is considered to pose a potential risk to property. There are no reported incidents close to the site.
- 4.10** The local watercourse is a tributary of the River Alham and upstream of the proposed development site has a small catchment area estimated at less than 3km². The local watercourse rises to the North East of Prestleigh and is generally open channel in profile upstream of the site.
- 4.11** As the watercourse flows through the site it passes beneath numerous bridges and culverts, and is generally narrow and shallow in profile. There is also a large pond within the site which has a large weir at the downstream end. Upstream of the pond the watercourse passes through a man made section of drains which artificially raise water levels with two small weirs. It is considered that the pond and man made section of the watercourse provide some attenuation.
- 4.12** Flood level data for the local watercourse is not available therefore a hydrological assessment of the catchment and river modelling has been carried out to establish the flow in the existing watercourse for a series of flood events as part of the FRA.

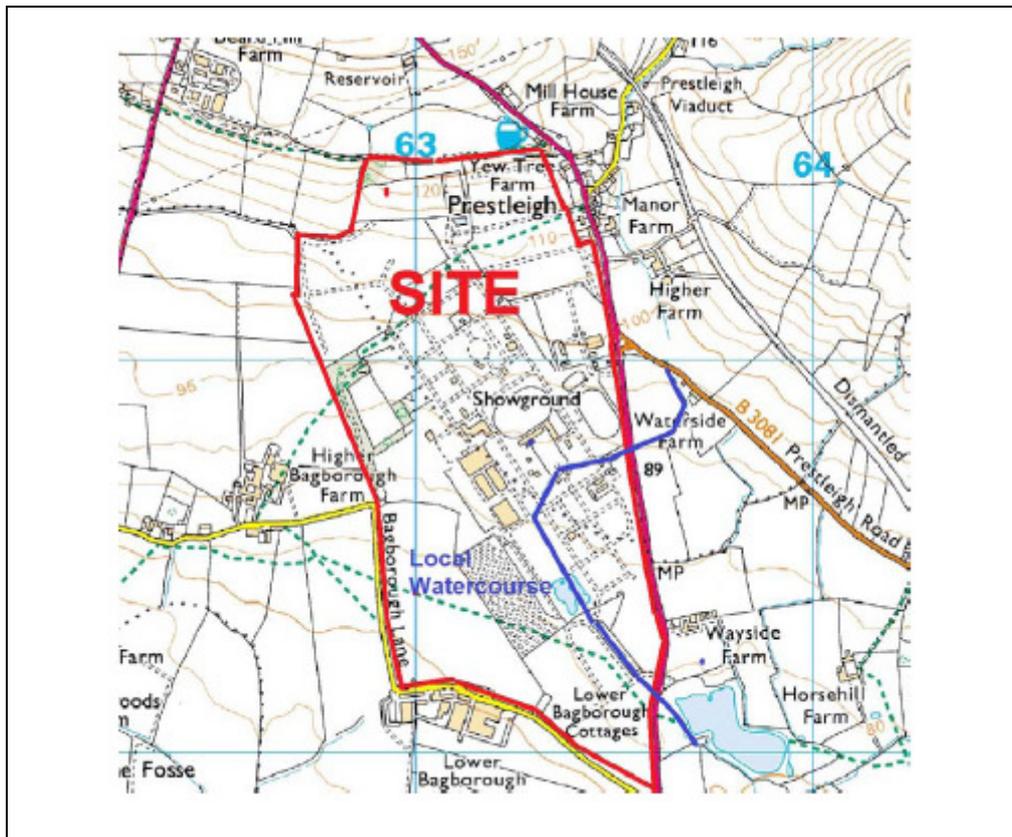
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- 4.13** It was found that during the 1 in 100 year plus climate change flood event, out of bank flooding regularly occurred especially within the upper reaches of the site and directly upstream of the numerous bridge and culverts located within the site. The out of bank flooding is clearly illustrated within the FRA flood envelope plan provided at Appendix B.
- 4.14** Consideration has also been given to two culverts within the site becoming blocked. Using hydraulic models it has been demonstrated that during the 1 in 100 year plus climate change flood event, a maximum increase in water level of 0.03m upstream of the culverts would occur. Due to the steepness of the watercourse, the increase in flood level is only experienced over a short distance upstream of the blockage.
- 4.15** Figure 4.1: Location Plan of Development Site illustrating Existing Local watercourse.



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5.00 MITIGATION MEASURES

- 5.01** The mitigation measures listed below have been considered to determine whether measures are necessary to ensure the site can accommodate the development proposals without unacceptable flood risk impact.

Raising Floor Levels/Land Raising

- 5.02** The local watercourse flows within the South East corner of the site, and modelling undertaken has highlighted several areas where out of bank flooding could impact upon the proposed development during extreme flood events. There are also areas which due to the local topography within the site could be flooded by overland flows from the local watercourse. It is considered that two areas within the proposed development could be affected by the flooding from the local watercourse.
- 5.03** The first is the South East corner of the site. It is considered that this area could be flooded from the local watercourse via a combination of out of bank flooding and overland flow. It is recommended that any buildings located within the blue area as shown on the flood envelope plan at Appendix B of this report will need to be elevated at least 300mm above the adjacent 1 in 100 year plus climate change flood level (which varies between 86.32mOD and 91.34mOD). Any buildings outside of this area could be affected by overland flow and as such internal ground floor levels of any buildings outside of the blue envelope should be elevated at least 150mm above the adjacent finished external ground level to ensure overland flows will not enter the building.
- 5.04** The second is land to the north west of the main entrance. It is considered that this area could be flooded from the local watercourse via out of bank flooding only. It is recommended that any buildings located within the blue area as shown on the flood envelope plan at Appendix B of this report will need to be elevated at least 300mm above the adjacent 1 in 100 year plus climate change flood level (which varies between 86.32mOD and 91.34mOD). Any buildings outside of this area should have internal ground floor levels elevated at least 150mm above the adjacent finished external ground level to ensure any localised flooding will not enter the building.
- 5.05** Where practically possible, buildings should be located outside of the blue area shown on the flood envelope plan. Constructing buildings within this area could result in a reduction of flood storage volume cross sectional area for flood conveyance. There are already buildings within this area which can be offset against any proposed development. Increasing the built area will require compensation outside of the flood envelope.

Emergency Access and Egress

- 5.06** It is considered that dry access and egress from the development site will be desirable during extreme flood events. It is considered that the majority of the development site is located outside of the flood area and dry access and egress will be available within the site. The proposed new accesses would be constructed above any modelled flood levels, and as such it is considered that dry access and egress from the development site will be available at all times.

Surface Water Drainage – Control of Runoff / Surface Water Attenuation

- 5.06** The impermeable area within the site is likely to be increased following the improvement development. There might therefore be an increase in surface water runoff from the site.
- 5.07** The EA recommends that soakaways should be used wherever possible. Geological mapping data suggests that the site is generally underlain by Mudstone and Limestone. There may therefore be potential for some areas of the site to drain to some form of surface water infiltration system, and it is recommended that on-site testing be carried out as the master plan and drainage strategy proposals develop to determine permeability rates and the feasibility for such a solution.
- 5.08** At the time of writing this report, it had not been established whether the permeability of the underlying strata on any parts of the site would be conducive to the use of surface water infiltration drainage, and therefore the use of soakaways has not been considered in the preliminary surface water drainage strategy for this site.
- 5.09** To reduce the impact of surface water runoff from the development in accordance with the requirements of the EA and Local Authority, the employment of Sustainable Drainage (SUDS) techniques to limit runoff volumes and rates from the site is required. SUDS is a method of dealing with runoff from development that mimics natural drainage and uses landscape features to manage rainfall rather than conventional gully or channel collection and pipe conveyance characteristic of conventional drainage.
- 5.10** In order to mimic natural conditions it is proposed to restrict runoff from the development site to 'green-field' runoff rate of 5 l/sec/ha (for storm events up to and including the 100 year return period with an agreed allowance for climate change of 20%) for existing 'green-field areas', discharging to the local watercourse which passes through the site. An additional discharge rate allowance will be made for areas of the site which are already developed. The proposed rate of discharge should be agreed with the Environment Agency as the masterplan and drainage strategy proposals are developed.

- 5.11** In preparing the drainage strategy it is proposed that the site will be sub-divided into a number of sub-catchments with their own drainage characteristics as recommended in the SUDS Manual CIRIA C697 2007. Wherever possible the whole rainfall volume for each sub-catchment will be managed within the SUDS features in the locality.
- 5.12** All rainfall falling on or through the proposed hard surfaces should pass through one, two or three 'treatment stages' before it reaches the receiving watercourse in accordance with the recommendations of the SUDS Manual CIRIA C697 2007. These hard surface areas comprise :
- Building Roofs – 1 treatment stages
 - Driveways – 2 stages
 - Site Road Network / Communal Parking – 2 treatment stages
- 5.13** Guided by the SUDS Manual CIRIA C697 2007, surface water attenuation for each sub-catchment of the site will cater for the 1 in 100 year storm plus 20% storm event. In some locations this will be accommodated within surface water retention ponds. In other sub-catchments, below ground attention facilities may be required. Whichever option is most appropriate to that section of the site, the detailed drainage attenuation calculations will be based on a detailed assessment of drainage implications and the requirements for that sub-catchment.
- 5.14** It is considered that a suitable drainage scheme can be designed to accommodate beyond the levels of development which are likely to be considered on the site. Detailed drainage information in relation to the specific improvement proposals for the site will be provided in the Drainage Strategy Addendum to be included as an appendix to the Masterplan Section of the Planning Framework, once improvement proposals have been developed, having due regard to the opportunities and constraints.

Foul Water Drainage

- 5.15** There is currently provision for the disposal of existing foul water flows from the site via a network of on-site foul drainage which ultimately discharges to a Public foul water pumping station which is situated to the South of the existing pond.
- 5.16** The foul water service company for this site is Wessex Water, who has provided sewer records that confirm the location of the existing Public foul water pumping station and associated rising main within the site. A copy of the sewer records are contained within Appendix C of this report.

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- 5.17** It is anticipated that the rising main will have an easement 3.0m either side of the centre line of the pipe, and the Public Foul Pumping Station will have a 15m cordon sanitaire (measured from the compound boundary line) in which no habitable buildings should be sited. These should both be taken into account when developing the master plan for the site.
- 5.18** The proposed foul water drainage strategy for site is to discharge the proposed foul water flows via a gravity sewer system into the existing Public foul water pumping station located toward the South of the site.
- 5.19** It is anticipated that the improvement proposals will lead to increased activity on site resulting in additional foul flows being generated, and it is likely to necessitate upgrading works to the existing on-site private drainage network, Public foul pumping station and associated rising main.
- 5.20** Foul Water Unit Discharge Method calculations of foul water sewerage flows (BS-EN 752:2008 and BS-EN 12506-2:2000) should be carried out following development of the master plan and drainage strategy proposals to confirm whether the diameter of the connection into the existing Public foul water pumping station needs to be increased to accommodate the total peak foul water flows.
- 5.21** Once the masterplan and drainage strategy proposals have been developed sufficiently, discussions should be held with Wessex Water to determine whether any improvement works will be required to the existing Public foul water pumping station and associated rising main to allow for the increased foul flows from the redeveloped site.

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6.00 RESIDUAL EFFECTS

- 6.01** There are a limited number of residual effects which could occur at the site. There are no flood embankments or walls which could be breached and the impact of the extreme flood event on the site has been assessed and mitigation measures proposed.
- 6.02** The SUDS strategy will be considered with long term maintenance as a major design criterion. The main activities required to keep the SUDS systems in good condition and fit for purpose is a straightforward landscape maintenance programme. Maintenance of SUDS is now known to be cost effective when compared to conventional drainage with the main requirements being litter collection, grass cutting and checking of inlets and outlets. Permeable pavement management is becoming more understood with regular brush and suction action necessary to keep the surface in good condition. In the event of accidental blockage then the surface can be reinstated effectively as most siltation is restricted to the joints. All components selected will have a long design life and control structures which are simple and easily maintained.
- 6.03** Any storm water storage ponds, underground storage facilities, swales and associated flow control units should be constructed at an early stage to ensure the surface water discharge from buildings and roads on the site is restricted to the existing green-field run off during the construction phase.
- 6.04** Implementation of the above measures would help reduce the level of flood risk to the proposed development site to an acceptable level and would ensure that the flood risk to other land does not increase. The risk of flooding to the development site area from groundwater, overland flow and surcharged sewer systems is considered to be low and is therefore considered to be of no significance.

7.00 SUMMARY

- 7.01** This chapter summarises the flood risk impacts and storm and foul water drainage strategies in relation to the development of the Royal Bath and West Showground.

Assessment Approach

- 7.02** In order to assess the flood risk and drainage impacts, a Flood Risk Assessment (FRA) has been carried out by EWE Associates Ltd in accordance with Planning Policy Statement 25: Development and Flood Risk.

- 7.03** Mitigation measures have then been identified to ameliorate any potential adverse impacts and, in addition, seek to enhance the environment wherever possible. This includes surface and foul water drainage strategies which have been completed by Rodgers Leak Limited.

Baseline Conditions

- 7.04** The site lies wholly within Zone 1 of the EA Flood Map (version 2.8.2), being the zone with zone with risk of 1 in 1,000 year (0.1% AEP) or less for river flooding. No records of past flooding within the area of the proposed development site were found and undertaking an internet based search for flooding in the area provided no further information.

- 7.05** The existing development area is drained by a local watercourse which enters the site approximately midway along the Eastern boundary and runs in a Westerly direction toward the centre of the site. Here it turns to run toward the South, before leaving the site along the Southern part of the East boundary. There are several positively drained roofs, internal roads and hard standing areas within the site.

Assessment of Potential Impacts

- 7.06** As part of the Showground improvement, there are proposals being prepared for new/and or intensified areas of development on the site. Following development, the impermeable area for the site will increase.

- 7.07** There are 2 sources of flood risk within the vicinity of the development site. These comprise the local watercourse and surface water runoff.

Mitigation Measures

- 7.08** To ensure the site can accommodate the development proposals, the following mitigation measures are proposed to be incorporated within the site.

Raising Floor Levels/Land Raising

- 7.09** In the area of the site to the South East, it is recommended that any buildings located within the blue area as shown on the flood envelope plan (Appendix B) will need to be elevated at least 300mm above the adjacent 1 in 100 year plus climate change flood level (which varies between 86.32mOD and 91.34mOD). Any buildings outside of this area could be affected by overland flow and as such internal ground floor levels of any buildings outside of the blue envelope but close by should be elevated at least 300mm above the adjacent finished external ground level to ensure overland flows will not enter the building.

- 7.10** To the north and west of the main entrance, it is also recommended that any buildings located within the blue area as shown on the flood envelope plan (Appendix B) will need to be elevated at least 300mm above the adjacent 1 in 100 year plus climate change flood level (which varies between 86.32mOD and 91.34mOD). Any buildings within the vicinity but outside of this area should have internal ground floor levels elevated at least 150mm 300mm above the adjacent finished external ground level to ensure any localised flooding will not enter the building.

- 7.11** Where practically possible, buildings should be located outside of the blue area shown on the flood envelope plan. Constructing buildings within this area could result in a reduction of flood storage volume cross sectional area for flood conveyance. There are already buildings within this area which can be offset against any proposed development. Increasing the built area will require compensation outside of the flood envelope.

Surface Water Drainage – Control of Runoff / Surface Water Attenuation

- 7.12** To reduce the impact of surface water runoff from the development in accordance with the requirements of the EA and Local Authority, the employment of Sustainable Drainage (SUDS) techniques to limit runoff volumes and rates from the site is required. SUDS is a method of dealing with runoff from development that mimics natural drainage and uses landscape features to manage rainfall rather than conventional gully or channel collection and pipe conveyance characteristic of conventional drainage.

- 7.13** In order to mimic natural conditions it is proposed to restrict runoff from the development site to 'green-field' runoff rate of 5 l/sec/ha (for storm events up to and including the 100 year return period with an agreed allowance for climate change of 20%), discharging to the local watercourse which passes through the site. The proposed rate of discharge should be agreed with the Environment Agency as the master plan and drainage strategy proposals are developed.
- 7.14** The proposed site will be sub-divided into a number of sub-catchments with their own drainage characteristics as recommended in the SUDS Manual CIRIA C697 2007. Wherever possible the whole rainfall volume for each sub-catchment will be managed within the SUDS features in the locality. The Drainage Strategy Addendum to be submitted with the Planning Framework will identify the sub-catchments for the site based on the Masterplan and the volume and method of surface water storage proposed for each part of the site.
- 7.15** All rainfall falling on or through the proposed hard surfaces should pass through one, two or three 'treatment stages' before it reaches the receiving watercourse in accordance with the recommendations of the SUDS Manual CIRIA C697 2007. These hard surface areas comprise :
- Building Roofs – 1 treatment stages
 - Driveways – 2 treatment stages
 - Site Road Network / Communal Parking – 2 treatment stages
- 7.16** The SUDS strategy will deliver a controlled flow of clean water to the local watercourse. As such the potential impact of grit, suspended solids and hydrocarbons contaminating the receiving watercourses areas are treated within the suds system and are therefore considered to be not significant.
- 7.17** The implementation of these SUDS mitigation measures will ensure that any risk of flooding at the proposed Royal Bath and West Showground development site is reduced to an acceptable level with a low risk of fluvial flooding and is therefore considered as being not significant.

Foul Water Drainage

- 7.18** The proposed foul water drainage strategy for site is to discharge the proposed foul water flows via a gravity sewer system into the existing Public foul water pumping station located toward the South of the site.

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Residual Effects

- 7.19** There are a limited number of residual effects which could occur at the site. There are no flood embankments or walls which could be breached and the impact of the extreme flood event on the site has been assessed and mitigation measures proposed.
- 7.20** The SUDS strategy will be considered with long term maintenance as a major design criterion. The main activities required to keep the SUDS systems in good condition and fit for purpose will be a straightforward landscape maintenance programme. Maintenance of SUDS is now known to be cost effective when compared to conventional drainage with the main requirements being litter collection, grass cutting and checking of inlets and outlets. Permeable pavement management is becoming more understood with regular brush and suction action necessary to keep the surface in good condition. In the event of accidental blockage then the surface can be reinstated effectively as most siltation is restricted to the joints. All components selected have a long design life and the control structures are simple and easily maintained.
- 7.21** Any storm water storage ponds, underground storage facilities, swales and associated flow control units should be constructed at an early stage to ensure the surface water discharge from buildings and roads on the site is restricted to the existing green-field run off during the construction phase.

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8.00 CONCLUSION

8.01 Implementation of the above measures will reduce the future level of flood risk to the site to an acceptable level and will ensure that the flood risk to other land does not increase. The risk of flooding to the development site area from groundwater, overland flow and surcharged sewer systems is considered to be low and therefore not significant.

Signed on behalf of Rodgers Leask Limited:

Date:

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APPENDIX A

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Flood Envelope Plan

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APPENDIX C

Wessex Water Sewer Records