Isle of Wight
Strategic Flood Risk Assessment MK2

Appendix W
Supporting SuDS Infornation

June 2010

ISLE of WIGHT COUNCIL

W1 - Infiltration Potential and Groundwater Contamination Potential

W 1.2 - Infiltration Potential

Infiltration techniques generally requiring an infiltration rate of above 10mm/hr for the upper soil layers (Parrett, 2005) and are thus partially controlled by soil characteristics. The combination of the soil and geological characteristics enable the potential use of infiltration techniques on the site to be assessed. The most useful dataset made available for use in the SFRA to determine the infiltration potential was the Groundwater Vulnerability mapping (scale 1:100,000) see Figure 8 in Appendix A. This dataset subdivides soils into those with a high, medium and low leaching potential. Leaching potential is proportional to infiltration potential. In that high infiltration potential equates to high infiltration potential and *vice versa*.

Figure 9 in Appendix A, presents the assimilation of this assessment and can be consulted for regional overview of the applicability of infiltration SuDS techniques. For all sites in the Sites Database, an infiltration potential has been assigned. Figure 9 (in Appendix A) will potentially be of use when processing windfall sites.

Aquifer assessment

The Groundwater Vulnerability map of the Island also provides details on the aquifer type. It provides an indication of the ability of the underlying rocks strata to absorb water which infiltrates from the overlying soil layer. Without knowledge of site specific soil types and depths, it is not possible to fully assess the infiltration potential. As such, the underlying aquifer type (and its permeability) is may limit the infiltration potential and thus the applicability of infiltration SuDS. Three aquifer types exist as defined by the Groundwater Vulnerability map (NRF, 1995):

- Principal Aquifers (Highly Permeable);
- Secondary Aquifers (Variably Permeable); and
- Unproductive Stratas (Negligibly Permeable).

A matrix relating soil infiltration (leaching) potential and aquifer type (permeability) to infiltration potential is presented in Table W.1.1

Table W1.1 Infiltration Potential Derived from Aquifer Vulnerability Classification

Aquifer Vulnerability Classification	Description	Infiltration Potential
Minor_L	Variably permeable groundwater with low leaching potential	Low
Minor_I	Variably permeable groundwater with intermediate leaching potential	Low
Minor_H	Variably permeable groundwater high leaching potential	Medium
Major_L	Highly permeable groundwater with low leaching potential	Low
Major_I	Highly permeable groundwater with intermediate leaching potential	Medium
Major_H	Highly permeable groundwater with high leaching potential	High
Non_Aquifer	Regarded as containing insignificant quantities of groundwater. No soils data.	Low

It should be noted that those parts of the Island are classified as '*Non_Aquifer*' by the Groundwater Vulnerability map and have no soils information on which to assess infiltration potential. These areas have been considered for the purposes of this SFRA to have a low Infiltration potential. Site Specific FRAs should assess this generalisation at the site specific level.

Mass Movement Consideration

Mass movement was also considered during the assignment of assessment of the suitability of infiltration SuDS. The process by which mass movement occurs on the Island is through slippage as defined by the BGS map for the Island (Figure 7 – in Appendix1). Thus additional water in areas defined as being prone to slippage may further lubricate the rock strata, thereby potentially inducing a slippage event. Three rock types are associated with areas of slippage on the Island. These are:

- Clay (undifferentiated);
- Sandstone (undifferentiated) and Mudstone; and
- Rock (Undifferentiated).

Mass movement is an important factor in the areas where infiltration SuDS are otherwise suitable, since the addition of water into the soil profile or underlying rock strata has the potential to trigger a mass movement event. It has been considered inappropriate to implement infiltration SuDS techniques in these areas. The Sites Database accounts for this by assigning a low suitability to sites which overlay any of these geologies.

S1.2 - Groundwater Contamination Potential

The use of SuDS, although a preferred method of managing surface water, has the adverse potential to contaminate groundwater with surface pollutants. Groundwater is known to be vulnerable to contamination from diffuse and

point source pollutants through indirect discharges into or onto land. Aquifer remediation is difficult, prolonged and expensive and thus the prevention of pollution is important. The map of Groundwater Vulnerability provides a useful indication of those areas where the implementation of infiltration SuDS techniques has the potential to contaminate the aquifer below through the transfer of pollutants from the surface. It is not a map of contaminated land, rather it is an indication of where there is the potential for groundwater to be polluted.

Source Protection Zones (SPZ's) are defined by the Environment Agency and delineate the risk of groundwater contamination. Figure 7 in Appendix A shows the location of SPZ's on the Island. Generally, the risk is greatest nearest to the abstraction point. The dataset is made up of three main zones, which are the inner, outer and total catchment. A forth zone is sometimes included, and applies to a groundwater source of special interest. The Environment Agency website (Environment Agency, 2007), provides the following definition for each of the SPZ's:

- ***Zone 1 (Inner protection zone)*** – Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1. This applies at and below the water table. This zone also has a minimum 50 metre protection radius around the borehole. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.

- ***Zone 2 (Outer protection zone***) – The outer zone covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the biggest. This travel time is the minimum amount of time that the Environment Agency believe pollutants need to be diluted, reduced in strength or delayed by the time they reach the borehole.

- ***Zone 3 (Total catchment)*** – The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

- ***Zone of special interest*** – This is usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area.

The Assessment of Groundwater Contamination Potential

The potential for groundwater contamination was assessed by combining the infiltration potential classifications made in Section S1.1 and the Source Protection Zones. It was considered important to compile a dataset which utilised the most useful available information to provide broad classifications to give an Island wide appreciation of the potential to contaminate groundwater resources.

Unproductive Strata were assigned a low contamination potential, unless they were over a Zone 1 or 2 SPZ, in which case it was given a rating of 'high' or 'medium' respectively. Areas of high infiltration potential were all assigned high contamination risk values as were areas of medium infiltration potential were they were in SPZ zones 1 and 2. The remaining areas of medium infiltration potential were assigned medium contamination potential values. Three classifications, high, medium and low were created. The resultant contamination potential map can be seen in Figure 10 (Appendix A). Table W1.2 presents the results of the classification process. Please note, that the impact of mass movement on the infiltration potential has been omitted from this classification process.

Table W1.2 Classification of Groundwater Contamination Potential

		Contamination Potential			
		SPZ 1	**SPZ 2**	**SPZ 3**	**No SPZ**
Infiltration Potential	**High**	High	High	High	High
	Medium	High	High	Medium	Medium
	Low	Medium	Medium	Low	Low

The information presented in this section is intended to highlight areas were the simplest of SuDS techniques (i.e. infiltration SuDS) are and are not considered suitable

In line with PPS23 development should be appropriate and should not lead to pollution. As such, it is not appropriate to install infiltration systems in land affected by contamination as this could lead to pollution of underlying groundwater. Please refer to the Environment Agency's 'Groundwater Protection: Policy and Practice (GP3)' document, which is available at www.environment-agency.gov.uk

Supporting SuDS Information

Table W.2 SuDS - Suitability According to Subdivisions of Water Quality, Quantity and Environmental Benefits

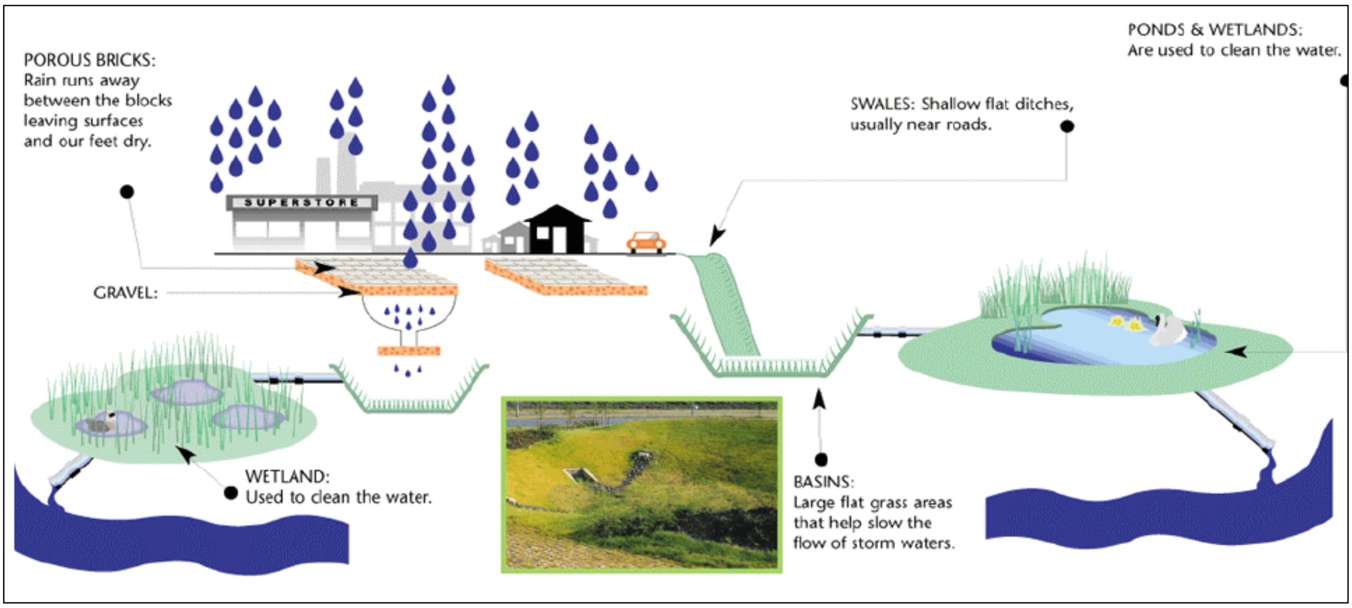
Technique	Description	Water quantity				Water quality								Enviro. benefits		
		Conveyance	Detention	Infiltration	Water harvesting	Sedimentation	Filtration	Adsorption	Biodegradation	Volatilisation	Precipitation	Phytoremediation	Nutrification	Aesthetics	Amenity	Ecology
Water butts, site layout	Good house keeping and design practices	=	=	#	=	=	=	=	=	=	=	=	=	=	=	=
Pervious pavements	Allow inflow of rainwater into underlying construction/soil		#	#	=	#	#	#	#	#				=	=	=
Filter drain	Linear drains/trenches filled with permeable material, often with a perforated pipe in the base of the trench	#	#				#	#	#	#						
Filter strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and other particulates	=	=	=		#	#	#	#					=	=	=
Swales	Shallow vegetated channels that conduct and/or retain water (and can permit infiltration when un-lined). The vegetation filters particulates	#	#	=		#	#	#	#			=		=	=	=
Ponds	Depressions used for storing and treating water. They have a permanent pool and bankside emergent and aquatic vegetation		#	=	#	#	#	#	#	#	#	#	#	#	#	#
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds	=	#	=	#	#	#	#	#	#	#	#	#	#	#	#
Detention basin	Dry depressions designed to store water for a specified retention time		#			#	=	=	#			=		=	=	=
Soakaways	Sub-surface structures that store and dispose of water via infiltration			#			#	#	#							
Infiltration trenches	As filter drains, but allowing infiltration through trench base and sides	=	#	#			#	#	#	#						
Infiltration basins	Depressions that store and dispose of water via infiltration		#	#			#	#	#	#				=	=	=
Green roofs	Vegetated roofs that reduce runoff volume and rate		#				#	#	#	#	#	#	#	#	=	#
Bioretention areas	Vegetated areas for collecting and treating water before discharge downstream, or to the ground via infiltration.		#	#		#	#	#	#	#	#	#	#	#	#	#
Sand filters	Treatment devices using sand beds as filter media		#	=			#	#	#	#	#					
Silt removal devices	Manhole and/or proprietary devices to remove silt					#										
Pipes, subsurface storage	Conduits and their accessories as conveyance measures and/or storage. Water quality can be targeted using sedimentation and filter media.	#	#			=	=									

High/primary process = Some opportunities, subject to design

Information in table modified after CIRIA (2007)

The information presented in Table E1 is based on the assumption that only a single SuDS technique is implemented on a site and is independent of connected SuDS.

Figure W.1 Likely Implementation of SuDS Management Train



Source of this Graphic = GDSDS (2005)

Table W.3 Influential site characteristics on the applicability of SuDS (Modified after CIRIA 2007)

SuDS Group	Technique	Soils		Area draining to a single SuDS component		Minimum depth to water table		Site slope		Available head	
		Impermeable	Permeable	0 – 2 ha	> 2 ha	0 – 1 m	> 1 m	0 – 5%	> 5 %	0-1 m	1 – 2 m
Retention	**Retention pond**	Y	Y[1]	Y	Y[5]	Y[2]	Y[2]	Y	Y	Y	Y
	Subsurface storage	Y	Y	Y	Y[5]	Y[2]	Y[2]	Y	Y	Y	Y
Wetland	**Shallow wetland**	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Extended detention wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Pond/wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Pocket wetland	Y[2]	Y[4]	Y[4]	N	Y[2]	Y[2]	Y	N	Y	Y
	Submerged gravel wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Wetland channel	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
Infiltration	**Infiltration trench**	N	Y	Y	N	N	Y	Y	Y	Y	N
	Infiltration basin	N	Y	Y	Y[5]	N	Y	Y	Y	Y	N
	Soakaway	N	Y	Y	N	N	Y	Y	Y	Y	N
Filtration	**Surface sand filter**	Y	Y	Y	Y[5]	N	Y	Y	N	N	Y
	Sub-surface sand filter	Y	Y	Y	N	N	Y	Y	N	N	Y
	Perimeter sand filter	Y	Y	Y	N	N	Y	Y	N	Y	Y
	Bioretention/filter strips	Y	Y	Y	N	N	Y	Y	N	Y	Y
	Filter trench	Y	Y[1]	Y	N	N	Y	Y	N	Y	Y
Detention	**Detention basin**	Y	Y[1]	Y	Y[5]	N	Y	Y	Y	N	Y
Open channels	**Conveyance swale**	Y	Y	Y	N	N	Y	Y	N[3]	Y	N
	Enhanced dry swale	Y	Y	Y	N	N	Y	Y	N[3]	Y	N
	Enhanced wet swale	Y[2]	Y[4]	Y	N	Y	Y	Y	N[3]	Y	N
Source control	**Green roof**	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
	Rainwater harvesting	Y	Y	Y	N	Y	Y	Y	Y	Y	
	Permeable pavement	Y	Y	Y	Y	N	Y	Y	N	Y	Y

Y = Yes

N = No

Y1 = with liner

Y2 = with surface baseflow

Y3 = Unless follows contours

Y4 = With liner and constant surface baseflow, or high ground water table

Y5 = possible, but not recommended (appropriate management train not in place)

Y6 = Where high flows are diverted around SuDS component

Additional policy and general guidance on SuDS and drainage include the following:

- PPS25 Practice Guide, 2007
- Water Framework Directive (200/60/EC);
- Highways Act, 1980;
- Town and Country Planning Act, 1990;
- Town and Country Planning Act, 1990 (amended) NB covers S106 Agreements;
- Town and Country Planning Act, 1991;
- Construction, Design and Management Regulations, 1994;
- Building Regulations Part C Approved Document H – Drainage and Waste Disposal of the Building Regulations 2002 Amendment;
- ODPM 2004. Planning Policy Statement 1: *Delivering Sustainable Development*;
- Communities and Local Government, 2006. Planning Policy Statement 25: *Development and Flood Risk*;
- Communities and Local Government, 2007. *Development and Flood Risk: A practice guide companion to PPS25* ;
- BRE Digest 365 Soakaway Design BSE EN 752-4: 1998 Drain and Sewer Systems outside buildings, part 4;
- CIRIA. Sustainable Drainage Systems – Hydraulic, Structural and water quality advice (CIRIA 609);
- CIRIA. The SUDS Manual (CIRIA C697);
- CIRIA. *Source control using constructed previous surfaces. Hydraulic, structural and water quality performance issues* (CIRIA 582);
- CIRIA. *Infiltration Drainage – manual of good practice* (CIRIA R156);
- CIRIA. *Review of the design and management of constructed wetlands* (CIRIA R180);
- CIRIA. *Control of pollution from highway drainage discharge* (CIRIA R142);
- CIRIA. *Design of flood storage reservoirs* (CIRIA Book 14);
- CIRIA. *Designing for exceedance in urban drainage systems – good practice* (CIRIA C635);
- CIRIA. *Rainwater and grey-water use in buildings* (CIRIA C539);

- Defra, 2004. *Making Space for Water – Developing a new Government strategy for flood and coastal erosion risk management in England: A Consultation Exercise;*
- Defra, 2005. *Making Space for Water – Taking forward a new Government strategy for flood and coastal erosion risk management in England: First Government response to the Autumn 2004;*
- Defra, 2006. *Urban Flood Risk and Integrated Drainage*. Scoping report and pilot studies;
- Environment Agency, 2003. Harvesting rainwater for domestic uses: an information guide;
- Groundwater Protection: Policy and Practice, Part 4 Legislation and Policies
- HR Wallingford. Use of SUDS in high density development;
- National SUDS Working Group, 2006. Interim Code of Practice for SUDS
- Planning Policy Statement 23
- WRc. Sewers for Adoption 6th Edition (SfA6) (published by Water UK).