6. Sustainable Drainage

This section examines sustainable drainage in the study area and four main towns of Braintree, Witham, Halstead and Haverhill with respect to surface water management and drainage.

New developments have the potential to increase surface water runoff through the introduction of impermeable surfaces such as roofs, roads and parking that replace undeveloped surfaces. The rate and volume of rainfall runoff from these areas can increase and exacerbate flooding by reaching river systems quicker than in a natural environment, and through exceeding the capacity of conventional piped drainage systems. In many areas, drains are designed for both surface water and foul water, and should these reach capacity ahead of heavy rainstorms, the risk of sewage flooding can be high.

Regional planning statements and the Environment Agency promote the use of Sustainable Drainage Systems (SuDS). The aim of SuDS is to mimic the natural drainage as far as possible by:

- controlling runoff at source;
- improving water quality by treating runoff and removing pollutants prior to discharge off site;
- enhancing the amenity value of a development;
- encouraging groundwater recharge; and
- integrating with the environmental surroundings.

This section provides an overview of the benefit of using SuDS, the planning context for sustainable drainage and high level guidance on the suitable techniques in relation to the study area and hydrological characteristics.

6.1 The Benefit of Sustainable Drainage Systems

SuDS are designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges by using more natural processes to convey surface water away from development. They do this by:

- Dealing with runoff close to where the rain falls;
- Managing potential pollution at its source now and in the future; and

- Protecting water resources from point pollution (such as accidental spills) and diffuse sources[4].

SuDS are often described in a "management train", a series of progressively larger scale practices to manage runoff and control water quality. The management train is:

- **Prevention**, Application at individual sites, e.g. use of rainwater harvesting, management to prevent accumulation of pollutants.
- **Source Control**, Control of runoff at or very near to its source e.g. through permeable pavements, green roofs etc.
- **Site Control**, Management of water in a local area or site e.g. by routing water from building roofs and car parks to large soakaways or infiltration/detention basins.
- **Regional Control**, Management of runoff from a site or number of sites, typically in a balancing pond or wetland.

6.2 Planning Context

Information on the Planning Policy Statement 25 (PPS25), relevant to flooding and drainage, and PPS1, delivering sustainable development, is within Section 3.1.1 on National Policy. This section examines how the national policies are relevant to this study and presents the potential constraints and solutions to development in the area.

The type of land on which development is to be located dictates the amount of runoff that is permitted from development, and how it must be managed. Developments on brownfield, or developed sites, that have conventional drainage infrastructure, are permitted to discharge to the existing drainage system provided flows do not increase. It is likely that development will increase runoff and therefore the additional runoff would need to be managed on site before being discharged into existing drains. However, the surface water runoff rate after development on Greenfield, or undeveloped sites, must not be greater than the runoff rate from the undeveloped site.

6.3 Braintree Local Plan Review (2005)

Braintree District Council already requires developers to adopt sustainable drainage systems in developments. Policy RLP69 within the Review of the Local Plan that was adopted in 2005 states that:

'Where appropriate, the District Council will require developers to use Sustainable Drainage techniques such as grass swales, detention/retention ponds and porous paving surfaces, as methods of flood protection, pollution control and aquifer recharge.'

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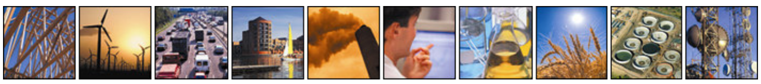
[4] CIRIA C69; *The SUDS Manual*; CIRIA 2007



6.4 Flood Risk

Flood risk within the study area is considered low as a result of the moderately low rainfall and small river systems. The fluvial flood zones are limited and generally confined close to the river channels, according to the Environment Agency's online Flood Map. A Strategic Flood Risk Assessment for Braintree District is being prepared and will provide more detailed information on fluvial flood risk in the district. Historical flooding records show that the main areas at risk are Braintree, Witham, Halstead, Great Yeldham, Kelvedon, Bures Hamlet and Lamarsh. For further information on flooding, reference to the Strategic Flood Risk Assessment should be made.

Urban flooding during heavy rainfall events can result from limited drainage capacity. Rainfall is generally low but runoff can still be high due to the impermeable soil structure. Urban flooding may occur if development does not include plans to manage the discharge of surface water. Unplanned and unmanaged surface water discharges entering combined sewer systems can lead to sewer flooding, particularly where the systems are designed for foul flows only, or if run-off rates exceed the capacity of the drains

In order to minimise flooding resulting from heavy rainfall and drainage constraints, development plans must consider the potential runoff and discharge rates from potential development sites.

PPS25 states that developments less than 1 hectare in Flood Zone 1 do not have to prepare a Flood Risk Assessment. These developments would therefore be allowed unrestricted surface water discharge (in terms of quantity). All developments in Flood Zones 2 and 3 must consider runoff and attenuation. However, some SFRA documents have adopted tighter controls to ensure developments greater than 0.5 hectares consider runoff and attenuate to existing rates. Clearly where flood risk is of concern, due to historic flooding incidents for example, a similar approach could be adopted.

6.5 Current Drainage Infrastructure

In the UK most drainage systems are conventional pipe networks, either combined (foul and surface water) or surface water only. Figure 3.1 illustrates the urban water cycle and shows that combined sewers are at risk of overflowing into streams and into urban areas during periods of heavy rainfall.

This study investigates the sustainable drainage systems that would be required in new developments to maintain current rates of runoff, and hence to ensure that development can be accommodated by existing drainage infrastructure.

This assessment does not include an analysis of the hydraulic capacity of the existing surface water management infrastructure. It is not feasible to develop detailed knowledge of the existing systems or complete specialist hydraulic assessments in the timescale and constraints of this study. However a more detailed assessment focused on the key areas identified for development should form part of the detailed Phase 2 study.

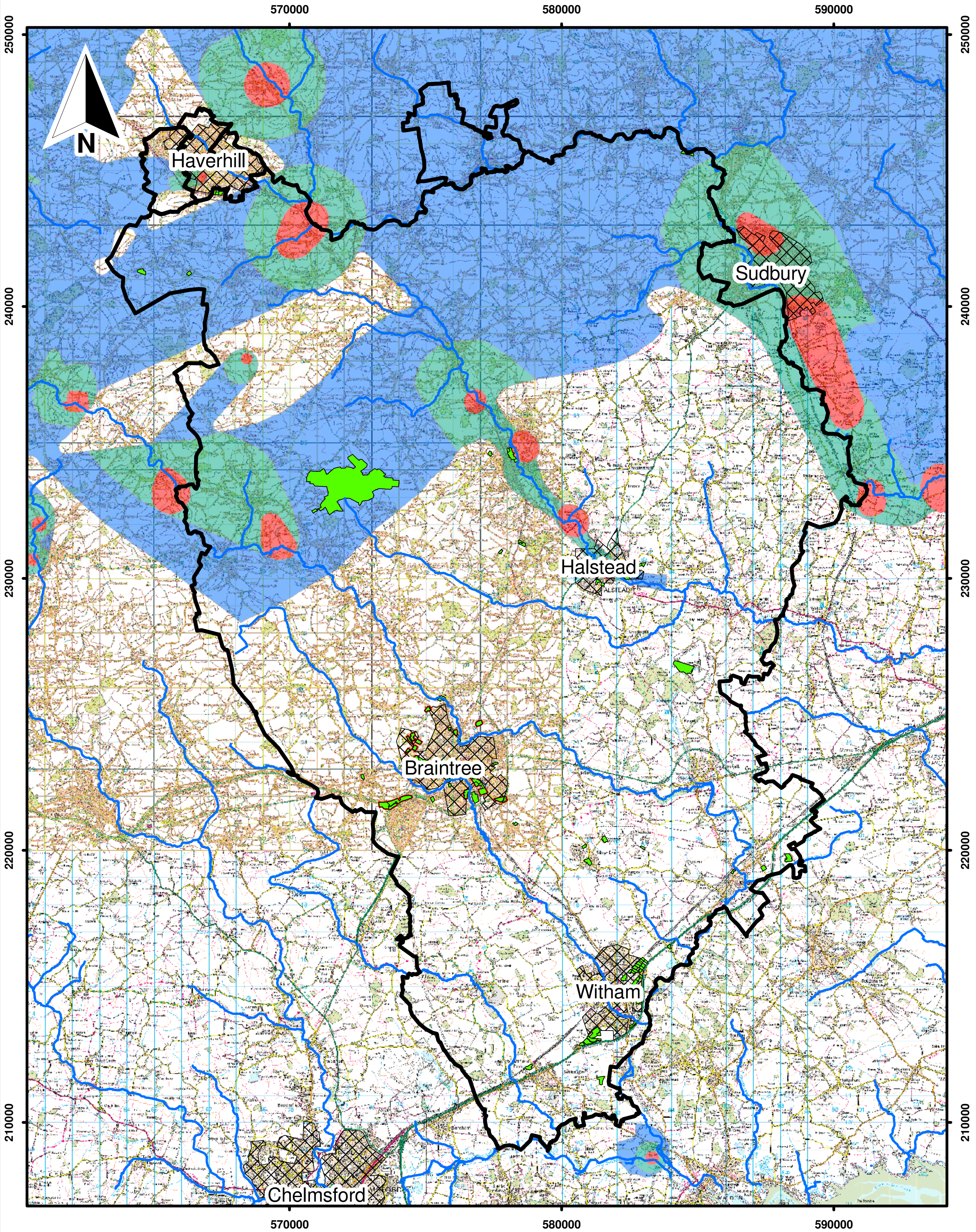
6.6 Infiltration and Groundwater Vulnerability

Many SuDS techniques are based on infiltration of surface water into the ground. In most cases any pollutant particles are absorbed and dissipated by vegetation. However, where infiltration is into an aquifer the risk of contamination must be minimised further, particularly where the groundwater is a source of public water supply. Additional measures, such as oil interceptors, may be required. Source Protection Zones (SPZs) are used to protect groundwater resources from pollutants. In areas designated as SPZs, the location and type of discharges into the water environment are closely controlled. The level of control is most stringent close to the point of abstraction. Table 6.1 defines the level of source protection based on distance (travel time) from the aquifer or point of abstraction.

Table 6.1 Definition of source protection zones

SPZ	Definition
Zone I (inner zone)	The area defined by a minimum of 50 m radius, or the distance corresponding to a 50 day travel time from any point below the water table, to the point of abstraction
Zone II (outer zone)	Similar to the inner zone (I), with a 400 day travel time and or a minimum of 25% of the source recharge area, whichever is the larger.
Zone III (total catchment)	Includes the whole catchment area for the source.

Figure 6.1 shows the location of the SPZs relevant to Braintree District area (see over).



Key:

[Study Area symbol]	Study Area	[Development Sites symbol]	Development Sites > 1ha
		Source Protection Zone	
[River symbol]	River	[Inner Zone symbol]	Inner Zone (Zone I)
[Main Urban Area symbol]	Main Urban Area	[Outer Zone symbol]	Outer Zone (Zone II)
		[Total Catchment symbol]	Total Catchment (Zone III)

Kilometers
2 0 2
Scale: 1:200,000 @ A4

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Braintree District Council
Water Cycle Study

Figure 6.1
Source Protection Zones

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The three sub-zones within a SPZ each has different requirements for the quality of the water that can be discharged to it and consequently the types of development from which runoff may infiltrate. Table 6.2 shows the development types that are permissible in each zone and the techniques required to control pollution before it is discharged.

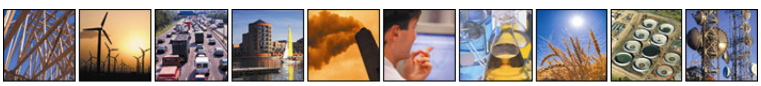
Table 6.2 Acceptability for discharges into source protection zones

Impermeable Area	Zone I	Zone II	Zone III
Roof Drainage	No objection (provided for sole use of roof drainage)	No objection	No objection
Public/Amenity	Not acceptable	Acceptable	Acceptable
Large Car Parks	Not acceptable	Acceptable (with interceptor)	Acceptable (with interceptor)
Lorry Parks	Not acceptable	Presumption Against	Acceptable (with interceptor)
Garage Forecourts	Not acceptable	Presumption Against	Acceptable (with interceptor)
Major Roads	Not acceptable	Presumption Against. Acceptable only in exceptional circumstances	Acceptable only if investigation favourable and with adequate precautions
Industrial Sites	No objection	Presumption Against	Acceptable only if investigation favourable and with adequate precautions

CIRIA R156 Infiltration Techniques

Table 6.1 shows that within the Study Area the SPZs are concentrated in areas to the north and west of Halstead. The SPZs around the Chalk groundwater in this area constrains sustainable drainage and therefore could add to pressure on the existing traditional surface water drainage systems. Clare is within zone III which means that discharges to the surface water drains from most impermeable land use types are acceptable as long as adequate interceptors and other precautions are implemented. This would be critical for Clare if the drainage system is combined as the existing WwTW is already close to capacity (see section 6.6). Haverhill itself is outside of the SPZs that surround it. Sustainable drainage systems would be appropriate on a site within the existing Haverhill boundary. However, any additional development in this area is likely to fall within an SPZ, to level III at least. Growth to the South East of the existing site would fall within the outer and inner zones (zones II and I) where the highest levels of source protection are required. Within the inner zone there would be no objection to small scale sustainable drainage such as roof drainage, but infiltration discharge from public amenities, large car parks, major roads etc would be unacceptable.

Outside of the SPZs any infiltration would discharge to the chalk aquifer, whilst this may not be in a water supply catchment the aquifer still has protected status and discharges are still restricted. Figure 6.1 shows that very little of the chalk aquifer is unprotected. More information on Source Protection Zones and the constraints on the type of discharges that can be released via sustainable drainage are available in Appendix I.



6.7 Attenuation Techniques

SuDS are not limited to infiltration. Green roofs, rainwater harvesting, wetlands and detention basins are examples of non-infiltration techniques, although the scope and impact of these are far more limited without infiltration. Often referred to as attenuation techniques, these examples reduce the rate of surface water runoff by holding back peak flows, following the management train hierarchy of Prevention, Source Control and Site Control drainage techniques.

Attenuation SuDS may be more appropriate in the proposed developments on low permeability ground, around Braintree, Halstead and Witham. Techniques such as detention basins/storage ponds, pervious paving, green roofs and rainwater harvesting will slow down the transit of water through the urban water cycle despite the impermeable nature of the clay bedrock. Offsite attenuation schemes can also be adopted where insufficient land is available or to serve a cluster of proposed developments that could benefit from one drainage system serving all of them.

The techniques listed in Table 6.3 have been identified as appropriate attenuation techniques, based on a high level assessment of ground conditions. It is important to note that a location specific assessment of the suitable SuDS techniques should be undertaken in the next phase of this study. The land take, surrounding land use, site gradients, ecology, economic viability, safety issues and maintenance must be considered during the design phase of a new development.

Table 6.3 Suitable attenuation SuDS techniques

Suitable SuDS techniques	Description
Detention Basins	A vegetated depression that is normally dry but designed to store water temporarily after heavy rainfall events.
Storage Ponds	Ponds designed to attenuate flows during heavy rainfall events. The pond is permanently wet and will discharge at a controlled rate, reducing the peak flows on the downstream system. Ponds can also be designed to allow settlement of suspended solids and biological removal of pollutants.
Storage Tanks	Engineered tanks for storing runoff volumes on site to reduce peak flow
Wetlands	A pond containing a high proportion of emergent vegetation in relation to open water.
Pervious Paving	Surfaces that allows inflow of water into the underlying construction or soils.
Rainwater Harvesting	Water is collected at the location where rain falls, rather than allowing runoff to occur, for example within the boundaries of a property, from roofs and surrounding surfaces. These systems can be beneficial for industrial or commercial developments over the roof space of large buildings/warehouses.
Green Roofs	A roof with vegetation growing which absorbs rainfall. The plants provide biodiversity value, whilst attenuating and treating rainwater and encouraging evaporation.

6.8 Interim Conclusion

Q. Is drainage a constraint to growth in the Study Area?

Drainage plans must be integrated to specific developments. Infiltration techniques are unlikely to be suitable in the central and southern parts of the study area due to the underlying clay. However, attenuation techniques should be incorporated into development plans to slow the movement of surface water through the urban water cycle. Infiltration techniques could be implemented with care around Haverhill and Clare to ensure that groundwater water supply sources are protected from contamination.

Water efficiency savings from existing and new housing would ease the pressure on the drainage network and increase the capacity of the existing infrastructure to cope with additional runoff from newly developed land and/or from increased rainfall that may occur as a symptom of climate change.

Unlike water resources which is a regional issue, and waste water treatment which is managed on a sewage treatment catchment scale, drainage is much more localised and site specific. This Phase 1 Water Cycle Study has examined the general feasibility of infiltration and attenuation drainage techniques relative to the underlying geology of the area. It is not appropriate at this stage to examine drainage in more detail as this requires detailed information and analysis of site specific surface permeability, rainfall runoff, and hydraulic capacity. It is recommended that such analyses are applied to specific potential development locations in a Phase 2 study. Site specific conclusions and developer recommendations would be of more use at that stage.

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