Site Drainage Evaluation

Site name: 294-295 High Holborn
Site location: London

Report Reference: 1596040211899
Date: 29/7/2020

1. INTRODUCTION

This is a bespoke report providing initial guidance on potential implementation of SuDS for the development site in line with current best practice.

The use of this tool should be supplemented by more detailed guidance on SuDS best practice provided in a number of sources, principally the CIRIA SUDS Manual (2007), other CIRIA documents; the Use of SUDS in High Density Developments, HR Wallingford, (2005) and other HR Wallingford documents.

The objective is to provide some early guidance on the numbers and types of components that might be suitable for consideration within the site design. This may facilitate pre-application discussions with planners and other relevant authorities.

This guidance has been provided prior to the completion of the SUDS standards and the supporting guidance. However the principles of this tool are unlikely to be very different to the aims of the SUDS standards. HR Wallingford is not liable for the use of any output from the use of this tool and the performance of the drainage system. It is recommended that detailed design using appropriately experienced engineers professionals and tools is undertaken before finalising any drainage scheme arrangement for a site.

THE CONTENT OF THE REPORT

This report is split into 8 sections as follows:

2. Generic SuDS Best Practice Principles
3. Runoff Destination
4. Hydraulic Design Criteria
5. Water Quality Design Criteria
6. Site-Specific Drainage Design Considerations
7. SuDS Construction
8. SuDS Components Performance
9. Guidance on The Use of Individual Components

2. GENERIC SuDS BEST PRACTICE PRINCIPLES

To comply with current best practice, the drainage system should:

(i) manage runoff at or close to its source;
(ii) manage runoff at the surface;
(iii) be integrated with public open space areas and contribute towards meeting the objectives of the urban plan;
(iv) be cost-effective to operate and maintain.

The drainage system should endeavour to ensure that, for any particular site:

(i) natural hydrological processes are protected through maintaining Interception of an initial depth of rainfall and prioritising infiltration, where appropriate;
(ii) flood risk is managed through the control of runoff peak flow rates and volumes discharged from the site;
(iii) stormwater runoff is treated to prevent detrimental impacts to the receiving water body as a result of urban contaminants.

In addition, it is desirable to maximise the amenity and ecological benefits associated with the drainage system where there are appropriate opportunities. SuDS are green infrastructure components and can provide health benefits, and reduce the vulnerability of developments to the impacts of climate change.

3. RUNOFF DESTINATION

Introduction

Infiltration should be prioritised as the method of controlling surface water runoff from the development site, unless it can be demonstrated that the use of infiltration would have a detrimental environmental impact.

Groundwater (via Infiltration)
Infiltration may not be appropriate for managing runoff from this site. Robust studies are reqired to confirm the significance of the following constraints to infiltration:

(1) The subsurface geology is primarily impermeable and the use of infiltration is unlikely to be suitable. Where infiltration rates are confirmed via testing to be < 1 x 10-7 m/s, infiltration will be very limited. Where infiltration rates are between 1 x 10-7 and 1 x 10-5 m/s, then soils can still provide Interception and partial infiltration. If rates are confirmed to be > 1 x 10-5 m/s, full infiltration can be considered in the design.

The groundwater beneath the site is designated as , and this designation will define the treatment requirement for any infiltrated water (See Water Quality Design Criteria).

Surface water body
It has been determined that surface water runoff from the site (that cannot be discharged to groundwater via infiltration) cannot practicably be discharged to a surface water body. The results of robust studies to confirm the significance of the following constraints should be presented as evidence:

(1) The distance from the point of discharge from the site to the surface water body is significantly greater than to the proposed alternative receiving waterbody, and this constraint outweighs any negative impacts resulting from discharging to the alternative location.

(2) Access over 3rd party land between the site and the receiving surface water body cannot be secured.

(3) The health and safety risks associated with constructing, operating or maintaining the conveyance route from the site to the surface water body are unacceptable and cannot be sufficiently mitigated.

(4) There is insufficient access for construction for the route from the site to the surface water body.

Surface water sewer /local highway drain
All surface water runoff that cannot be discharged to groundwater via infiltration will be managed on site and discharged to a surface water sewer or local highway drain.

The surface sewer reference is: *Thames water* and the asset owner is: *high holborn.*

4. HYDRAULIC DESIGN CRITERIA

Introduction
Best practice criteria for hydraulic control require Interception, runoff and volume control.

Interception
To fulfill the requirements for Interception, there should normally be no runoff from the site for an initial depth of rainfall - usually 5mm. This is achieved through the use of infiltration, evapotranspiration, or rainwater harvesting.

Flow and Volume Control
The site has been previously developed. It is likely that there will be a requirement for the runoff to be constrained to levels as close to the equivalent greenfield rates and volumes as possible. Discharges that exceed equivalent pre-development rates and volumes will not, generally, be acceptable.

Rainwater harvesting, or the use of Long Term Storage provide the means to achieve runoff volume control. Where volume control is not practicable, flows discharged from the site will need to be constrained to 2 l/s/ha.

5. WATER QUALITY DESIGN CRITERIA

Introduction
Current best practice takes a risk-based approach to managing discharges of surface runoff to the receiving environment. The following text provides guidance on the extent of water quality management likely to be appropriate for the site.

Hazard Classification
Runoff from clean roof surfaces (ie not metal roofs, roofs close to polluted atmospheric discharges, or roofs close to populations of flocking birds) is classified as Low in terms of hazard status.

Runoff from roads, parking and other areas of residential, commercial and industrial sites (that are not contaminated

with waste, high levels of hydrocarbons, or other chemicals) is classified as Medium in terms of hazard status.

Treatment requirements for disposal to surface water systems
Roof runoff will not require treatment prior to discharge.

Runoff from other parts of this site such as roads, parking and other areas will require at least 2 treatment stages prior to discharge.

6. SITE-SPECIFIC DRAINAGE DESIGN CONSIDERATIONS

The design of SuDS with access to temporary or permanent water should consider public health and safety as well as issues associated with construction and operational management of the structures. Health and safety issues and risk mitigation features are presented in the CIRIA SuDS Manual.

Individual SuDS components should not be treated in isolation, but should be seen together as providing a suite of drainage features which are appropriate in different combinations for varying scales. It is always desirable to have a mix of SuDS components across the site as different components have different capacities for treatment of individual pollutants.

7. SuDS CONSTRUCTION

SuDS are a combination of civil engineering structures and landscaping practice. Due to the limited experience of building SuDS in the water industry, there are a number of key issues which need to be particularly considered as their construction requires a change in approach to some standard construction practices.

• SuDS components should be constructed in line with either the manufacturer's guidelines or best practice methods.
• The construction of SuDS usually only requires the use of fairly standard civil engineering construction and landscaping operations, such as excavation, filling, grading, top-soiling, seeding, planting etc. These operations are specified in various standard construction documents, such as the Civil Engineering Specification for the Water Industry (CESWI).
• Construction of soakaways is regulated by the Buildings Regulations part H (Drainage and waste disposal) which sets out the requirements for drainage of rainwater from the roofs of buildings.
• During construction, any surfaces which are intended to enable infiltration must be protected from compaction. This includes protecting from heavy traffic or storage of materials.
• Water contaminated with silt must not be allowed to enter a watercourse or drain as it can cause pollution. All parts of the drainage system must be protected from construction runoff to prevent silt clogging the system and causing pollution downstream. Measures to prevent this include soil stabilisation, early construction of sediment management basins, channelling run-off away from watercourses and surface water drains, and erosion prevention measures.
• After the end of the construction period and prior to handover to the site owner/operator:
- Subsoil that has been compacted during construction activities should be broken up prior to the re-application of topsoil to garden areas and other areas of public open space to reinstate the natural infiltration performance of the ground;
- Any areas of the SuDs that have been compacted during construction but are intended to permit infiltration must be completely refurbished;
- Checks must be made for blockages or partial blockages of orifices or pipe systems;
- Any silt deposited during the construction must be completely removed;
- Soils must be stabilised and protected from erosion whilst planting becomes established.

Detailed guidance on the construction related issues for SuDS is available in the SuDS Manual and the associated Construction Site handbook (CIRIA, 2007).

8. SuDS COMPONENTS PERFORMANCE

	Interception	Peak flow control: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydrocarbons/ PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Swales	Y	Y	S	Y(*)	N	Y	Y(+)	Y	Y	Y(-)
Trenches	Y	Y	S	Y(*)	N	N	N	Y	Y	Y(-)
Detention Basins	Y	Y	Y	N	Y	Y	Y(+)	Y	Y	Var
Ponds	N	Y	Y	N	Y	N(~)	Y	Limited	Y	Var
Wetlands	N	Y	S	N	Y	N(~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bioretention Systems	Y	Y	S	Y(*)	N	N(~)	Y	Y	Y	Y
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y(!)	Y(!)	Y(!)

Subsurface Storage	N	Y	Y	N	Y	N(~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N(~)	N	N	N	N

Notes:
S: Not normally with standard designs, but possible where space is available and designs mitigate impact of high flow rates.
Y(*): Where infiltration is facilitated by the design.
N(~): Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
Y(+): Where designs minimise the risk of fine sediment mobilisation during larger events.
Y(!): Where designs specifically promote the trapping and breakdown of oils and PAH based constitutents.
Y("): Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
Var: The nutrient removal performance is variable, and can be negative in some situations.
Y(-): Good nutrient removal performance where subsurface biofiltration systems with a permanently saturated zone included within the design.

9. GUIDANCE ON THE USE OF INDIVIDUAL COMPONENTS

Rainwater Harvesting

• *Roofs*
Rainwater harvesting systems can be used to effectively drain roofs and provide both water supply and stormwater management benefits.

Swales

• *Roofs*
Swales can be used to convey roof water to other parts of the site.

Trenches

• *Roofs*
Trenches can be used to convey roof water to other parts of the site.

Detention Basins

• *Roofs*
Detention basins can be used to attenuate and treat runoff.

Ponds

• *Roofs*
Ponds can be used to attenuate and treat roof runoff.

• *Other*
Ponds built in permeable soils will require lining to maintain the water level of the permanent pool. The lining may be finished 100 or 200 mm lower than the outlet invert to encourage some infiltration to take place to contribute to interception.

Wetlands

• *Roofs*
Wetlands can be used to attenuate and treat roof runoff.

Green Roofs

• *Roofs*
Green roofs can be designed to provide interception, management and treatment of rainfall up to specified rainfall depths.

Bioretention Systems

• *Roofs*
Bioretention systems can be used to attenuate and treat roof runoff.

Proprietary Treatment Systems

Subsurface Storage

• *Roofs*
Subsurface storage can be used to attenuate roof runoff.

Subsurface Conveyance Pipes

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