

Residential Development, Manor Farm, Bedhampton

Note on Sustainable Drainage and Water Quality

1 Introduction

- 1.1 The development proposals are for 50 new residential dwellings to be constructed on greenfield land to the south of Lower Road, Bedhampton.
- 1.2 The site is undeveloped and currently has no positive surface water drainage infrastructure. There are no watercourses or ditches within the site or at the boundaries. Rainfall on the site currently discharges to ground with field runoff flowing towards the southwest following the topography.
- 1.3 The land falls to the southwest at approximately 1:100 gradient. There is a railway line to the south of the site in a shallow cutting and farmland to the west beyond which is a wooded area acting as a buffer adjacent to the A27.
- 1.4 The site is located 500 metres from the Chalkdock Lake tidal flats to the south and a tidal main river 200 metres to the east of the site which discharges to Brockhampton Mill Lake to the south and which is at a higher level than the site until it passes the railway lines and therefore not a potential point of surface water discharge.
- 1.5 There is a surface water sewer to the north of the site which would require surface water pumping and offsite sewer requisition upgrade.
- 1.6 Explorative ground investigation demonstrates the shallow subsoil cannot support conventional infiltration solutions.
- 1.7 Following the drainage hierarchy and to avoid surface water pumping this note investigates the potential for discharge to ground by shallow basin and overflow to borehole soakaway.

2 Hydrogeology

- 2.1 The site is located between the South Downs chalk hills and the South Coast. Groundwater flows do not cause springs in this location.
- 2.2 Ground investigation confirms that the site is underlain by firm sandy gravelly clay over structureless chalk and weak chalk substrata.

- 2.3 The clay layer ranges between 1.3m and 3m in thickness and is at its thinnest at the southwest corner and lowest point of the site. Groundwater monitoring shows depths below ground level of 4.4m to 6.7m below ground level in November 2018. Previous winter groundwater monitoring between October 2017 and March 2018 recorded groundwater levels between 3m and 5m below ground level which indicates saturated chalk in winter.
- 2.4 Borehole records available from the British Geological Survey also show groundwater in the wider area reaching approximately 2.4m below ground level.
- 2.5 Soakage tests undertaken in the shallow clay layers confirm insufficient permeability to support a conventional infiltration solution. Additional soakage testing in the chalk stratum just below the clay layer similarly shows very low infiltration. Falling head tests in boreholes in the chalk stratum at c.14-15m below ground level showed higher soakage rates of 1.4 to 1.6×10^{-4} m/s.
- 2.6 The DEFRA "Magic Map" confirms that the site is located on a major aquifer classified as intermediate vulnerability and that the site is not within a Source Protection Zone but is located approximately 20m south (downstream) of a Zone 1 Source Protection Zone for drinking water abstraction. The flow of groundwater is to the south towards the coastline and therefore the flow from the site is away from the abstraction point.
- 2.7 The ground investigation report and copies of the BGS borehole data in the wider locality are attached at the rear of this note.

3 Proposed Sustainable Drainage Solution

- 3.1 Conventional infiltration solutions are not available into the shallow subsoils, no watercourse is available and discharge to public sewer would require surface water pumping.
- 3.2 The proposed sustainable drainage strategy is to discharge to ground gradually by shallow swale and basin to mimic the existing situation, to store large return period storms in shallow basins and to drain the restricted outflow and any exceedance overflow to borehole soakaways into the underlying saturated chalk stratum.

- 3.3 To reduce reliance on the infiltration potential of the chalk, the design storm plus allowance for climate change and future urban creep plus an additional storm volume of a 1 year return period storm will be attenuated by flow restriction upstream of the discharge to borehole.
- 3.4 To mitigate the risk of pollution to the water table from surface water discharge direct to groundwater several stages of sustainable drainage infrastructure will be provided prior to discharge to provide a high level of water quality treatment.
- 3.5 Drainage from house and garage roofs, driveways and parking courts, carriageways and footways will drain to swales and filter trenches which convey water to permanently wet pond and reed bed in the southern landscaped area of the site.
- 3.6 The pond and reedbed will overflow into an attenuation basin which will be dry when not receiving storm water and will attenuate large return period storms via restricted outflow and high level overflow to borehole soakaway chamber. Infiltration to ground will occur gradually within the swales and attenuation basin base.
- 3.7 Any exceedance overflow will overtop the basin and flow to the southwest at a rate far lower than the predevelopment greenfield run off for a large return period storm.
- 3.8 The borehole soakaways will be no deeper than required to provide an adequate infiltration rate for the restricted outflow rate.

4 Water Quality

- 4.1 The basis of this water quality assessment is to follow the simple index approach CIRIA SuDS Manual 2015 (Report C753) but achieve a mitigation standard one higher than required for the level of risk and thereby provide for any uncertainty in ground water level and demonstrate acceptable risk to the environment or drinking water.
- 4.2 The proposed development is for residential use only and includes low traffic flow cul de sac streets and small parking courts. In accordance with CIRIA SuDS Manual 2015 (Report C753) the pollution hazard level for such types of development are considered either low or very low.

- 4.3 As a robust design standard the design will be based upon at least a Medium Hazard Level to exceed water quality standards.
- 4.4 The surface water drainage scheme will include mitigation to ensure water quality before the discharge point will be acceptable and any pollution risk mitigated prior to its discharge to the receiving environment.
- 4.5 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types and uses and defines runoff from residential roofs to be at very low risk potential for pollution. Runoff from low traffic roads and individual property driveways are a low risk potential for pollution. The following table summarises the anticipated pollution index from the proposed development:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very Low	0.2	0.2	0.05
Low traffic roads and individual property driveways	Low	0.5	0.4	0.4
Comparison Hazard Levels				
Robust Design Standard (One Level Above)	Medium	0.7	0.6	0.7
Standard for Sites with Heavy Pollution	High	0.8	0.8	0.9

Pollution Hazard Indices

- 4.6 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered due to reduced performance associated with primary treatment and is represented as a 0.5 reduction factor for each additional treatment stage.
- 4.7 In accordance with Tables 26.3 and 26.4 of The SuDS Manual the mitigation indices for the different drainage components are shown in the following table prior to application of reduction factor:

SuDS Type	Total suspended solids (TSS)	Metals	Hydro-carbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Permeable Paving	0.7	0.6	0.7

Swale	0.5	0.6	0.6
Detention Basin	0.5	0.5	0.5
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Soil with good contamination attenuation potential of at least 300mm in depth	0.4	0.3	0.3

Mitigation Indices

- 4.8 Prior to discharge to saturated ground the development run off will pass through swale and filter drain, pond / wetland and detention basin arranged in series.
- 4.9 The mitigation indices with reduction factor applied and total mitigation is shown below:

SuDS Type	Total suspended solids (TSS)	Metals	Hydro-carbons
Swale (1.0)	0.5	0.6	0.6
Pond (0.5)	0.35	0.35	0.25
Detention Basin (0.5)	0.25	0.25	0.25
Total Mitigation Level	1.1	1.2	1.1

Development Mitigation

- 4.10 The total mitigation level exceeds the development pollution risk and would be suitable for both medium and high risk developments.
- 4.11 The proposed drainage strategy incorporates measures to far exceed the water quality target requirements within the SuDS Manual and therefore complies with the Water Framework Directives for discharge of runoff into controlled waters.
- 4.12 The site will be maintained by a residential estate Management Company. An outline drainage maintenance schedule will be provided with the Planning Application.