



**Residential Development -
Brethergate, Westwoodside
Doncaster**

Drainage Strategy

Project No. 1209

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Drainage Strategy

Introduction

This drainage strategy has been developed as part of the planning application to show the site is being developed in a sustainable manor, in support of a planning application to North Lincolnshire Council, planning ref: PA/2012/1188.

This report is to accompany NC29 Ltd drawing 1209-001 (Proposed SuDS Layout), and its purpose is to support and explain the methodology behind the drainage strategy for the site.

The following sections describes in detail the methods and assumptions behind the drainage strategy and how the site is proposed to drain in a sustainable manor.

Site Description

The site is on land off Brethergate, Doncaster, to the rear of No. 49-53. The site is bounded by residential properties. The site is approximately ½ hectare in area, and the site generally slopes from North to South. The development site access is via Brethergate.

Development Proposals

NC29 Ltd have been appointed to provide consultancy services for a proposed development located on land off Brethergate, Doncaster. The centre of the site is located at approximately SK 75749 99783. The proposed development is for the erection of 9 no. dwellings. The development benefits from sufficient parking spaces and private gardens.

Surface Water Drainage

For new developments there is a requirement to apply sustainable drainage principles (SuDS) to the disposal of surface water from the site. Generally, the aim should be to discharge surface water as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer or highway drain;
4. To a combined sewer.

Infiltration

Infiltration is the preferred method of water disposal as this reflects the natural ground conditions, recharges aquifers, lowers the risk of flooding as a result of urbanisation and lowers the chance of 'flash flooding'.

Infiltration has been identified as the preferred method for disposing of surface water from the proposed development and a desktop study of the local geology suggests infiltration is likely to be viable. The bedrock geology local to the development site is identified as the Mercia Mudstone Group. Preliminary trial holes show layers of weathered sandstone and sandy clay from approximately 1.0m below surface level. Infiltration devices should be located on the weathered sandstone or sandy clay layers.

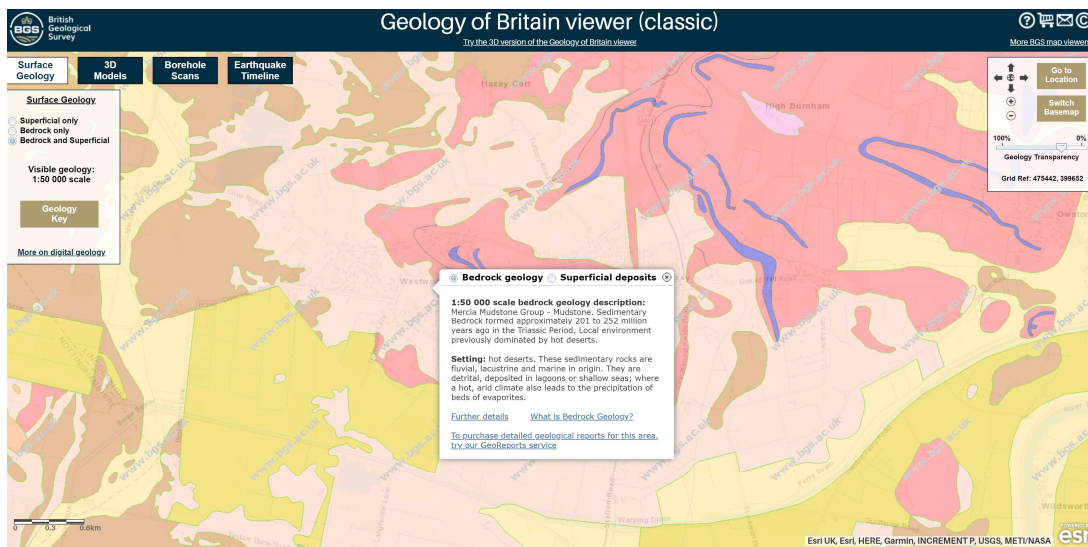


Figure 1 – Geological Map (Source: BGS Maps)

For the purpose of the preliminary drainage design a conservative infiltration rate has been assumed at 5×10^{-6} m/s. Percolation testing to BRE 365 will be undertaken prior to detailed drainage design to confirm the viability of infiltration and infiltration rate. Additionally, for an infiltration device to be viable, consideration of the water table needs to be undertaken. Typically, the water table must be at least 1 metre below the base of the infiltration device.

A search of the DEFRA ‘Magic Map’ shows that the development site is not within the vicinity of a ‘Source Protection Zone’ and proposed infiltration devices will not affect ‘Source Protection Zones’. Figure 2 below is an extract from the DEFRA ‘Magic Map’ showing ‘Source Protection Zones’ indicatively presented in coloured layers.

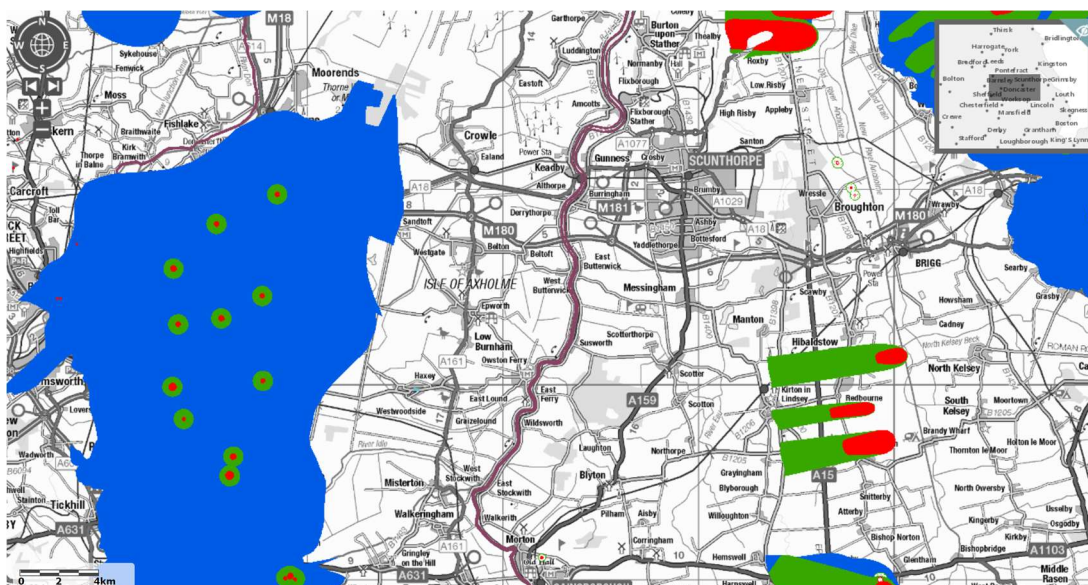


Figure 2 - Source Protection Zones (Source: DEFRA Magic Map)

Other Drainage Options

It is assumed infiltration will be viable, but this is subject to BRE 365 percolation testing. If it is proven that infiltration is not a viable means for disposing of surface water then an alternative method will be identified prior to detailed drainage design.

There is a public sewer in Brethergate and the proposed development could discharge to this at a restricted rate (as close as is reasonably practicable to greenfield runoff rate), subject to agreement with Severn Trent Water.

Drainage Elements

Surface Water – Access Road and Parking Spaces

The proposed access road and parking spaces will consist of permeable construction which will be intended to be a Type A arrangement, i.e. wholly reliant upon infiltration. The permeable pavement construction will likely include surface specifications of porous asphalt to access road areas and permeable block paving to parking areas. The permeable pavement specification will be to current standards or best practice including NHBC specification and CIRIA C753 'The SuDS Manual'.

The porous asphalt permeable pavement would typically include the following build up;

- Porous Surface Course
- Porous Binder Course
- Type 3 (or a suitable open-graded sub-base)
- Separating Layer
- Natural Strata

The permeable block paving would typically include the following build up;

- Permeable Blocks
- Bedding Grit
- Separating Layer
- Type 3 (or a suitable open-graded sub-base)
- Separating Layer
- Natural Strata

The Type 3, or open-graded sub-base, provides the important role of offering attenuation within the sub-base, during storms of higher intensities. Additionally, combined with the porous/permeable surface construction, the sub-base offers water treatment to ensure water that enters the natural ground through the permeable pavement is adequately treated.

The topography of the site will need to be assessed as to whether permeable pavement specification for the access road will be viable. All of the parking areas are also proposed to be permeable pavement construction.

A detailed design is required to confirm the depth of sub-base to the permeable pavement construction, however sub-base thickness for attenuation purposes is going to be in the order of 300mm thick.

For permeable pavement design to be suitable, the saturated sub-grade also needs to be checked. Generally, the soaked CBR values of the supporting sub-grade directly at the formation level of the sub-base needs to be 3% or above. This will need to be established at detailed design stage. If the subgrade is not of sufficient strength, then geo-grids and porous capping can be used to strengthen the carriageway foundation.

Service crossings will also need to be considered, as generally the services should avoid being located within the porous sub-base, or below it. There will be points within the development where the foul drainage also needs to cross the road, and they should also be incorporated in the service crossings.

Surface Water - Roofs

Roof water will be collected within the roof parapet, and it is proposed a rainwater harvesting will be specified where feasible, e.g. water butts. It is however best practice to assume no latent attenuation via rainwater harvesting systems, therefore impermeable roof water area has been included in the preliminary design.

The downpipes from the roof water will discharge into an infiltration device located in the access road. For the purpose of the preliminary design a geo-cellular feature into the permeable pavement sub-base has been specified, however other for detailed design other options could be considered including permeable pavement sub-base diffusers or a separate geo-cellular soakaway beneath/incorporating the permeable pavement sub-base.

General Soakaway Comments

In accordance with the guidance in Building Regulations, and unless the ground investigation report details an additional reason, the soakaways must be positioned a minimum of 5m away from building foundations and recommended 2.5m away from plot boundaries.

Water Quality

The methods of surface water disposal mentioned above have included provisions for water quality. In accordance with CIRIA C753, the pollution hazard features for the drainage areas are;

- Residential roofs - Very low
- Private access - Low

To reduce the risk of pollution, CIRIA have developed 'Pollution Hazard Indices' and the 'Mitigation Indices' that the SuDS components provide, further details of these are found in the figures below.

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/Industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Figure 3 - Pollution Hazard Indices for Different Land use Classifications (Source: CIRIA 753)

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates ¹	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.6 ⁴	0.5	0.6
A soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.8 ⁴	0.8	0.8
Proprietary treatment systems ^{5, 6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

Figure 4 - Indicative SuDS Mitigation Indices for Discharging to Ground Water (Source: CIRIA 753)

To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each containment type) that equals or exceeds the pollution hazard index (for each contaminant type):

$$\text{Total SuDS mitigation index} \geq \text{pollution hazard index}$$

(for each contaminant type) (for each contaminant type)

Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required where:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5 (\text{mitigation index}_2)$$

Where:

$$\text{Mitigation index}_n = \text{mitigation index for component } n$$

Provided the total SuDS mitigation index exceeds the pollution hazard indices, then sufficient water quality will be provided.

For the calculations below the hazards are represented by;

Total suspended solids = Red

Metals = Blue

Hydrocarbons = Green

The figures are presented to show the actual achieved in the right-hand side column. The right-hand side's total must be higher than the left-hand side.

Roofs

0.2 0.2 0.05 = Soakaways 0.4 0.3 0.3

The mitigation provided by the soakaway exceeds all the pollution indices, therefore sufficient treatment has been provided.

Individual property driveways

0.5 0.4 0.4 = Permeable Pavement 0.5 0.5 0.6

The mitigation provided by the permeable paving satisfies the mitigation index, therefore sufficient treatment has been provided.

Main Road

0.5 0.4 0.4 = Permeable Pavement 0.5 0.5 0.6

The mitigation provided by the permeable paving alone satisfies the mitigation index, therefore sufficient treatment has been provided.

All the methods above provide enough water quality in accordance with CIRIA's C753 document. Further evidence will need to be provided at detailed design stage.

Finished Floor Levels

In line with best practice and in accordance with Building Regulations, the finished floor levels will generally be raised 150mm above proposed levels, other than local areas where level access is to be provided.

Maintenance

It is crucial that the elements mentioned in the drainage elements and water quality are maintained to a sufficient standard to ensure that the devices can still function. Generally, the maintenance requirements are either from CIRIA 753, or manufacturer’s guidance.

Permeable Pavement Maintenance

Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer’s recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Figure 5 – Porous Paving Maintenance Requirements (Source: CIRIA 753)

Soakaway Maintenance

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Figure 6 – Soakaway Maintenance Requirements (Source: CIRIA 753)

Catchpits

Catchpits are utilised to help prevent the ingress of heavy sediment and other debris from entering the system. Maintenance requirements are low and it is recommended that catchpits are inspected every six months and any build-up of sediment removed.

Foul Proposal

In contrast to surface water drainage, the preferred method of foul water disposal is via sewers, which will connect into the Severn Trent Water sewer network before eventually reaching a wastewater recycling centre where the water will receive treatment.

In some instances other disposal methods such as drainage fields, private waste treatment plants, cesspits or septic tanks can be considered, but given the proximity of the foul water sewer it is unlikely that these will be considered an option and therefore a sewer will be proposed.

There is a foul drain serving the existing dwelling on the site, and the proposals include an indirect connection into this existing sewer, subject to a drainage survey and agreement with Yorkshire Water. The existing drain requires confirmation of where it connects into the sewer network, but it is believed to be in Brethergate.

The design proposal is for the foul to be collected from the proposed dwellings via below ground drainage and gravity falls to connect onto the existing sewer located to the south of the site.

Conclusion

- The above drainage strategy demonstrates that the site can be drained appropriately including the use of a Sustainable Drainage System.
- All storm water, up to and including the 1 in 100 year event + 40% climate change events are stored below ground.
- The proposals do not increase the risk of flooding and are therefore compatible with the requirements of NPPF.
- Soakaways must be located a minimum 5m away from building foundations and recommended to be 2.5m away from boundaries.
- A maintenance strategy will be further developed at the detailed design stage.
- A preliminary proposed drainage layout can be found on NC29 Ltd drawing 1209-001.
- Infiltration devices are to be located at shallow depths and must be within the sandy strata.
- Exceedance flow is demonstrated to flow safely through the site into lower, non-populated areas.
- Finished floor levels will be set at a minimum of 150mm above existing ground levels. The finished floor levels shown on the drawings are indicative only and are subject to change to suit the specific plot drainage.
- The site is not located in a Source Protection Zone.
- Next steps include percolation testing, drainage survey and detailed design.

Appendices

Appendix A – Proposed SuDS Layout

Appendix B – Surface Water Calculations