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Drainage Strategy Report

LAND TO SOUTH OF SOUTHRIGG, NETHERTOWN ROAD, ST BEES

21-C-16279

Rev B

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Contents

INTRODUCTION

A L Daines & Partners LLP (ALD) have been engaged to undertake a Surface and Foul Water Drainage Strategy, in accordance with the National Planning Policy Framework (NPPF) [1] for the proposed housing development to land south of Southrigg, Nethertown Road, St Bees.

The purpose of this report is to provide a strategy to manage surface and foul water flows from the site, in support of the planning application, while fulfilling the requirements of the Local Planning Authority (LPA) and the Lead Local Flood Authority (LLFA).

PLANNING POLICY

NPPF footnote 55 states that "*a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use*."

Paragraph 169 reads *"Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:*

> *a) take account of advice from the lead local flood authority;*
> *b) have appropriate proposed minimum operational standards;*
> *c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
> *d) where possible, provide multifunctional benefits."*

A major development, as per The Town and Country Planning Order 2015, is partly, buy not wholly, categorised as development involving the provision of dwellinghouses where the number of dwellinghouses to be provided is 10 or more and a development carried out on a site having an area of 1 hectare or more.

The Cumbria Minerals and Local Waste Plan – Strategic Flood Risk Assessment (June 2018) references the same criteria for local planning policy.

The site is therefore to be classed as a minor development under the above criteria due to the proposals having fewer than 10 dwellinghouses.

PLANNING POLICY IN SITE CONTEXT

The site covers 0.42Ha of greenfield land and according to the most recent Environment Agency (EA) flood risk maps, lies entirely within Flood Zone 1.

The NPPF site categorisation Table 1.1 puts a residential development of this nature within the 'More vulnerable' category. Developments in the 'More vulnerable' category are acceptable within Flood Zone 1 and therefore the site-specific Flood Risk Assessment (FRA) need only be brief.

The FRA statement is included within this report.

SITE PLAN

The proposed development is located on an existing area of greenfield land to the south of South Rigg, Nethertown Road, St Bees as shown on red line bordered plan in Figure 1.

Figure 1 Aerial photo of site - Google Maps

The proposed layout of the development is shown on Ashwood Design Associates site plan drawing 1999-22A in Appendix A.

DEVELOPMENT DESCRIPTION

The proposed development will see a new shared access created off the highway (Nethertown Road), leading to 3No. detached dwellings.

The existing ground is generally open grassed landscape, currently used for grazing land. The development splits a green field and covers approximately 0.42Ha, with each dwelling having its own double garage and driveway off a shared tarmac access road.

The remaining land is to remain as existing.

The topography of the site is generally sloping from a highpoint in the northeast corner (approx. 44m AOD) to the low point adjacent to Nethertown Road in the southwest corner (approx. 36.75m AOD). The fall across the site is 1:13.

The western boundary is shared with Nethertown Road, while the northern and eastern boundaries adjoin neighbouring existing dwelling properties. The southern site boundary adjoins the remainder of the field.

PERMEABILITY AND SOIL PROFILE

British Geological Survey (BGS) and Land Information Systems (LandIS) mapping services have been used determine the following land make-up:

Bedrock: St Bees Sandstone

Superficial drift: Glaciofluvial deposits, Devensian – Sand and gravel

Soil: Soilscape 6 – Freely draining slightly acidic loamy soils.

This soilscape is similar to that observed during trial hole excavations which show a 300-600mm topsoil generally underlain by gravely, cobbled sand becoming larger boulders.

The trial hole excavation locations and profiles can be seen on drawing 21-C-16279/04 in Appendix B.

3No. pits were dug to a depth of 2m below ground level to enable percolation tests to determine the infiltration rate of the ground. These tests were carried out in accordance with the guidance in document BRE 365 Soakaway Design.

1No. pits were excavated towards the front of each proposed plot on 7th August 2021. It was raining heavily during the tests following a week of heavy rain.

Excavations to Plots 1&3 were filled to a depth of 1m above the base of the pit and monitored to record infiltration rates. The same volume of water was introduced to the excavation to Plot 2, however the water was draining faster than the IBC could fill it. The results are therefore based on the depth of water that could be achieved from the tests.

The infiltration rate is calculated as per the below formula extracted from the BRE 365 guide.

$$\text{Soil infiltration rate } f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

where:

V_{p75-25} = the effective storage volume of water in the soakage trial pit between 75% and 25% effective storage depth

a_{s50} = the internal surface area of the soakage trial pit up to 50% effective storage depth and including the base area

t_{p75-25} = the time for the water level to fall from 75% to 25% effective storage depth.

The test results are shown in Appendix C along with calculated infiltration rates for each pit.

The average infiltration rate across the three pits is $2.072\text{x}10^{-5}$ m/s (0.0746 m/hr) which is greater than the lowest recommended value of $1\text{x}10^{-5}$ m/s. Infiltration can therefore be utilised across the site.

CURRENT FOUL AND SURFACE WATER DRAINAGE PROVISION

Existing watercourses

There are no open watercourse features within the site, with the nearest one being Pow Beck running north to south approximately 220m beyond the western site boundary. To access this beck from the site would require routes across greenfields, highways, residential plots and the Cumbrian Coast Line railway and is not seen as a feasible route.

Existing sewers

There are no existing United Utilities (UU) owned sewer systems present on the site.

There are no UU sewer assets shown close to the site however approximately 80m to the north along Nethertown Road, site investigation has located an existing manhole outside of a small cul-de-sac. This is a foul manhole (possibly combined), of concrete ring construction at 1200 dia approx. 1.2m deep. The main run of the manhole flows east to west across Nethertown Road and down towards the existing UU network located in the Doe Hill dwelling.

Inspection of the UU asset manhole within the curtilage of Doe Hill was not possible during site investigations as the homeowner was not present to allow access. Consultation with Andrew Fischer (UU rep for Copeland) revealed that although not shown as a red line the UU sewer is known to route across Doe Hill and continue down behind the dwelling of Snaefell to join the rest of the network beyond.

Figure 2 Ex. foul manhole in Nethertown Rd. Coords E:297168.299, N:511035.723

Further dye testing or CCTV inspections will be required prior to any connection being formed, however the positions of both manholes and direction of pipes strongly suggest the manhole is connected to the identified UU assets and therefore is part of the public system – as per the Private Sewers Transfer Regulations 2011.

The UU search records are shown in Appendix D.

<u>FLOOD RISK ASSESSMENT</u>

As described earlier in the report, the current Environment Agency Flood Map for Planning shows the site to be located wholly within Flood Zone 1.

Your selected location is in flood zone 1, an area with a low probability of flooding.

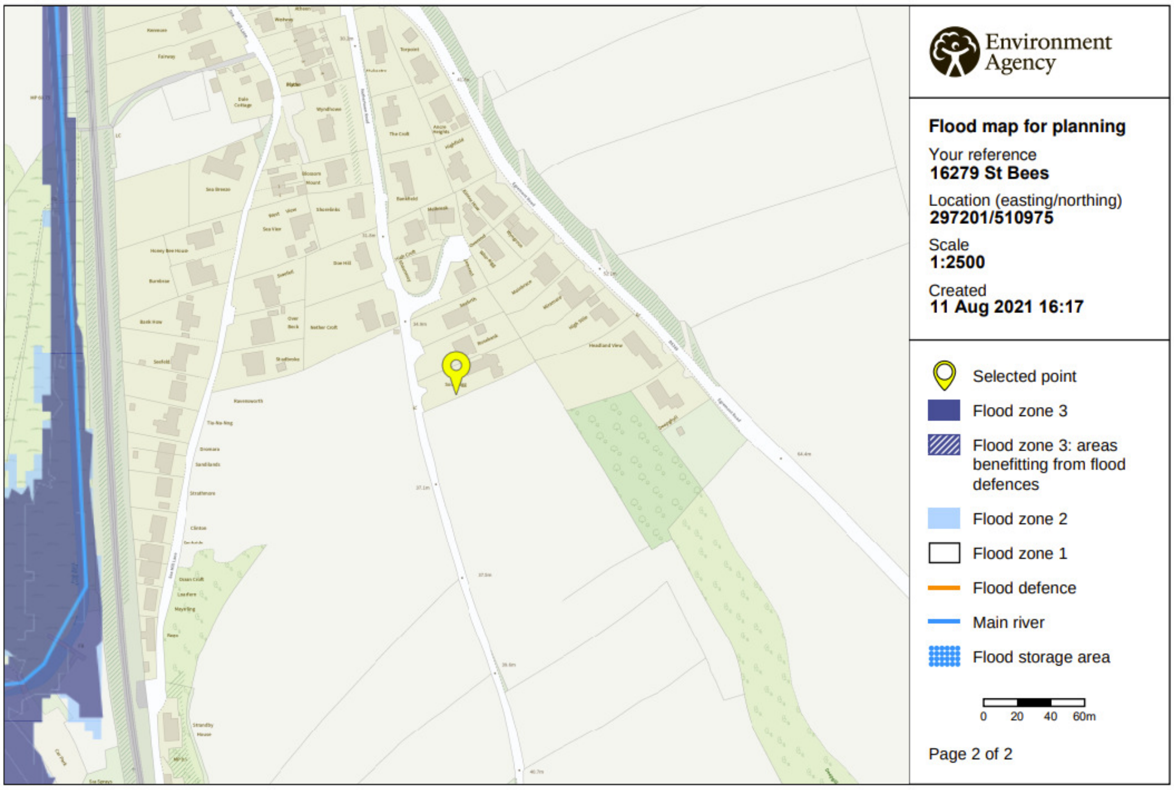

Figure 3 Flood map for planning

A full FRA is therefore not required, although the Environment Agency long term flood risk maps are included below to further inform this report.

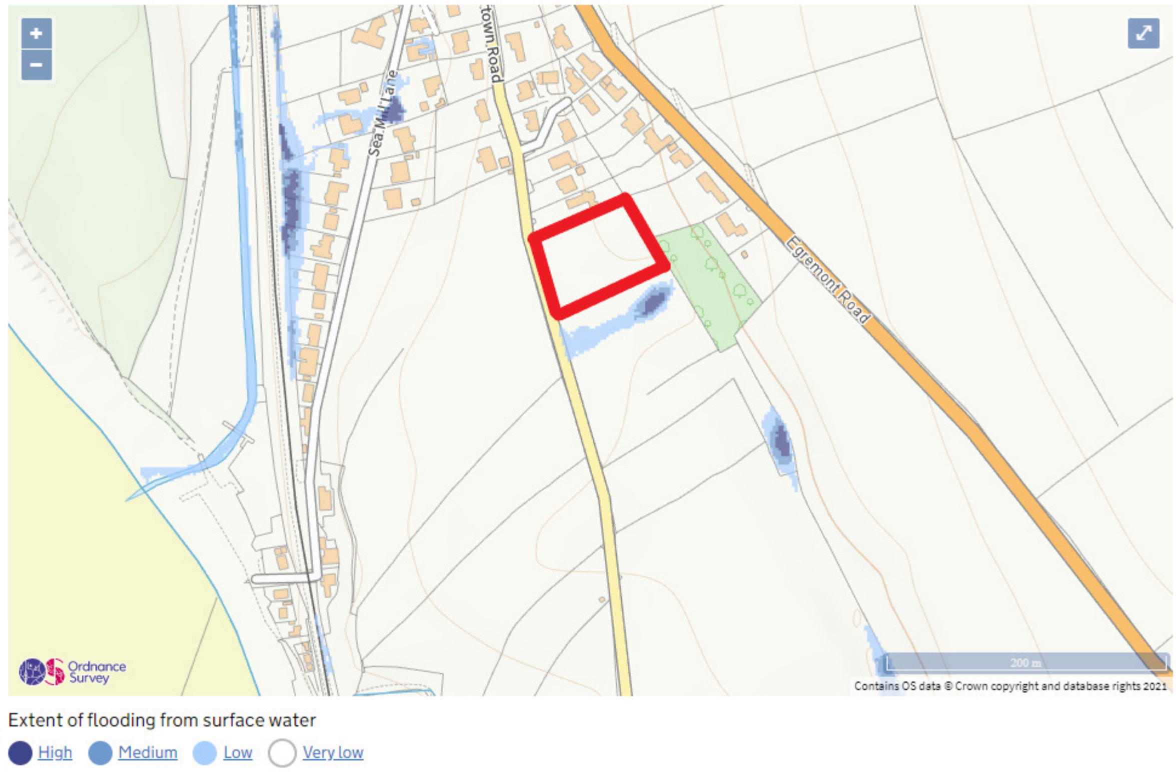

Figure 4 EA long term flooding from surface water

The long-term flood risk from surface water is very low (0.1%) with no areas of the site showing any form of heightened flood risk. It should be noted however that there is a depression in the ground beyond the southern site boundary which shows isolated areas of high probability of surface water flooding.

The topographical survey reveals this ground depression (35.825m) is approximately 1.5 – 2.0m below the ground level at the southern site boundary, while the floor level of the nearest plot is 37.900m. The site rises further towards the northern boundary and therefore the potential risk to the site and its' properties remains very low (0.1%).

The design of the drainage and road systems shall ensure that no additional peak flows leave the site and therefore no increase in flood risk outside of the development boundary will occur.

Figure 5 EA long term flood risk from river or sea

The long-term flood risk from rivers or sea is very low (0.1%) with no areas of the site showing any form of heightened flood risk.

SURFACE WATER DRAINAGE STRATEGY

The aim of the strategy is to provide a design which will avoid, reduce and delay the discharge of surface water flows into public sewers and watercourses. This will aid in the protection of watercourses but will also ensure that no knock-on effects are seen beyond the site and that the risk of localised flooding and pollution within the site are reduced as far as possible.

To satisfy these criteria, surface water flows shall be subject to assessment via the hierarchy of drainage in accordance with the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance. The hierarchy is as follows:

Hierarchy options:

1. Drain into the ground (infiltration);
2. To a surface water body;
3. To a surface water sewer, highway drain or another drainage system;
4. To a combined sewer.

The drainage strategy for the site is to be developed using the first level on the above hierarchy for the following reasons:

Drain into the ground (infiltration) – proved possible.

The site has been shown through trial hole excavation and percolation tests to be suitable for infiltration.

It is therefore proposed to discharge surface water through a combination of permeable paving and below ground infiltration soakaways. This will ensure that drainage will be achieved as close to source as possible, therefore limiting any change to on-site flow paths and that there is no increased risk of flooding beyond the site boundaries.

SURFACE WATER PROPOSED DESIGN

In accordance with the earlier mentioned hierarchy of drainage the system has been designed to utilise infiltration-based SuDS components to offer the best solution for surface water drainage.

As per the LASOO guidance the design is required to prevent flooding to any part of the site for storms up to and including the 1:30yr rainfall event, while any exceedance for the 6 hour 1:100yr event should be controlled within the site and should not flood any properties or service areas.

In this case, the infiltration rates of the ground will allow for storage systems to be sized to store the full 1:100yr events without any overland flow or above ground storage.

The slope of the site, from back to front (front being Nethertown Road), dictates that the storage structures will be best placed to the front of the plots to aid gravity drainage and to keep the storage away from the buildings.

Consideration of SuDS components

A range of SuDS components are available and have been considered for use. Their applicability to the site has been addressed below:

- Rainwater harvesting – suitable for use on the site, however there is no guarantee the systems will be able to capture flows if already at capacity from previous events. Discounted for site flow calculations.
- Green roofs – suitable for use on the site, however due to the nature of the properties and low volume control potential these have been discounted for inclusion within the site flow calculations. Plot owners may still choose to use these and should be encouraged to do so where they would be appropriate.
- Soakaways – underlying ground conditions make this a suitable method for providing site drainage close to source and will be used to store and dissipate rainwater from the hardstanding areas. **Viable**

- Water butts – suitable for use but their effectiveness is dependent on homeowner maintenance which cannot be enforced. Discounted for site flow calculations.
- Permeable paving – underlying ground conditions make this a suitable and cost-effective method of drainage for a large portion of the driveway areas. **Viable**
- Swales – Not considered due to their large land uptake and porosity of the ground.
- Filter drains – Not required.
- Detention basins – Not required due to available ground infiltration rates
- Ponds/wetlands –. Not required due to available ground infiltration rates. Plot owners may introduce these if desired but shall not be used for site flow calculations.
- Underground closed storage crate/tank systems – Not required.

Climate change

Environment Agency guidance issued in 2016 estimates that peak rainfall intensity will increase due to climate change over the next 100 years. There is therefore an allowance of 40% attributed to the 30yr and 100yr storm event calculations in line with the Upper End estimate of rainfall increases for small and urban catchments.

Percentage impermeability (PIMP)

All impermeable areas are modelled as 100% PIMP. This will allow for sufficient capacity for all hardstanding areas to be positively drained.

Volumetric Runoff Coefficient (Cv)

Industry standard Cv values vary for summer and winter and account for water volumes which do not enter the drainage system i.e. that is lost through infiltration, depression storage, evaporation, initial wetting etc. Standard values are 0.75 for summer and 0.84 for winter.

In this instance, only areas of impermeable hardstanding are modelled and therefore the standard values have been uplifted to 0.85 and 0.95 respectively for both summer and winter storms. This results in conservative design with no infiltration allowance.

Surface water quality

In the absence of statutory requirements and prescriptive standards, The SuDS Manual provides best industry practice for assessing the pollutant potential of developments and providing mitigation methods to increase run off water quality through the use of SuDS components.

The simple index approach has been utilised here to assess the pollutant hazard indices and proposed treatment components. Note, this has been carried out in conjunction with the above SuDS component suitability assessment for the site.

Table 26.2 from The SuDS Manual below outlines the pollution hazard indices for different land uses.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
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 6 SuDS Manual Table 26.2 Pollution hazard indices

This development is to be classed as a mix of 'Very low' and 'low' risk land uses due to the presence of residential roofs and individual property driveways.

This level of risk suggests the following level of pollution control:

Land use	Suspended solids	Metal	Hydrocarbons
Residential roofs	0.2	0.2	0.05
Driveways	0.5	0.4	0.4

Table 26.4 from the SUDS Manual, shown below, details pollution mitigation indices for various SUDS components when discharging to groundwater.

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater			
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 7 SuDS Manual Table 26.4 SuDS mitigation indicies

Given the small size of the development and the low-risk land use, a balanced view of risk versus reward should be pursued to ensure that while pollution risks are minimized, there are not onerous requirements imposed.

The highest risk elements (albeit still categorised as ‘low’) originate from the parking and driveways of each plot. It is proposed to provide permeable block paving throughout each plot access and parking, with only the access off the highway and turning head being provided in impermeable tarmac.

The permeable paving mitigation is shown below to exceed the potential risk factors and is therefore deemed satisfactory.

	Suspended solids	Metal	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution mitigation	0.7	0.6	0.7
Suitability	Acceptable	Acceptable	Acceptable

The remainder of the hardstanding areas are allocated for residential roofs which are in the ‘very low’ risk category. These will be treated using ‘a soil with good contaminant attenuation potential of at least 300mm depth’. The hazard versus mitigation table below shows this to be adequate.

	Suspended solids	Metal	Hydrocarbons
Pollution Hazard	0.2	0.2	0.05
Pollution mitigation	0.4	0.3	0.3
Suitability	Acceptable	Acceptable	Acceptable

Surface water drainage proposals

Based on the above assessments, it is proposed that a split drainage system will be utilised for the differing surface uses.

Parking/driveways

All driveways and parking areas, except for the turning head off the highway, shall be designed and constructed as permeable paving effectively maintaining drainage to those areas at source.

As the infiltration rates are acceptable, the system is designed to provide full infiltration as per a Type A system as described in The SuDS Manual section 20.1.9.

Terracing of the system below ground should be considered where slopes exceed 1:20. Finalised design levels have not been set as of the date of this report. An example system is shown below in Figure 7.

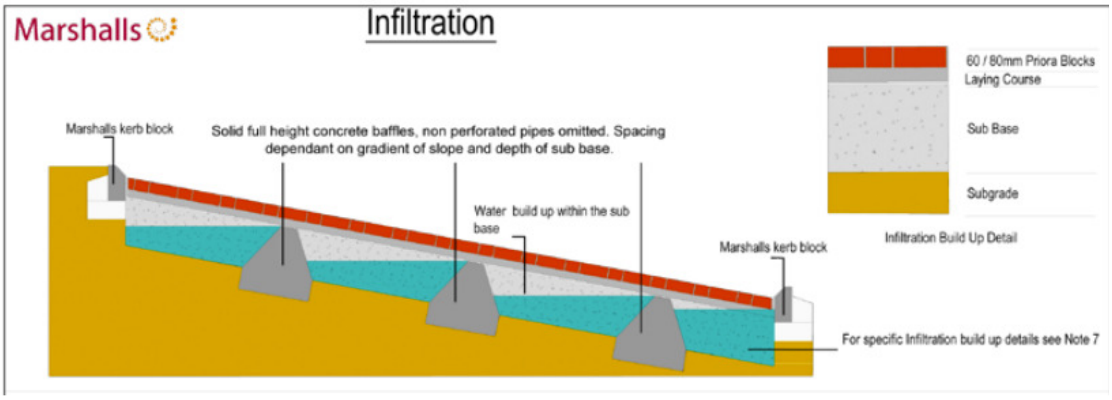

Figure 8 Example permeable paving terracing detail

The permeable paving system shall be designed by specialist manufacturer, however an example material build-up is shown below for reference.

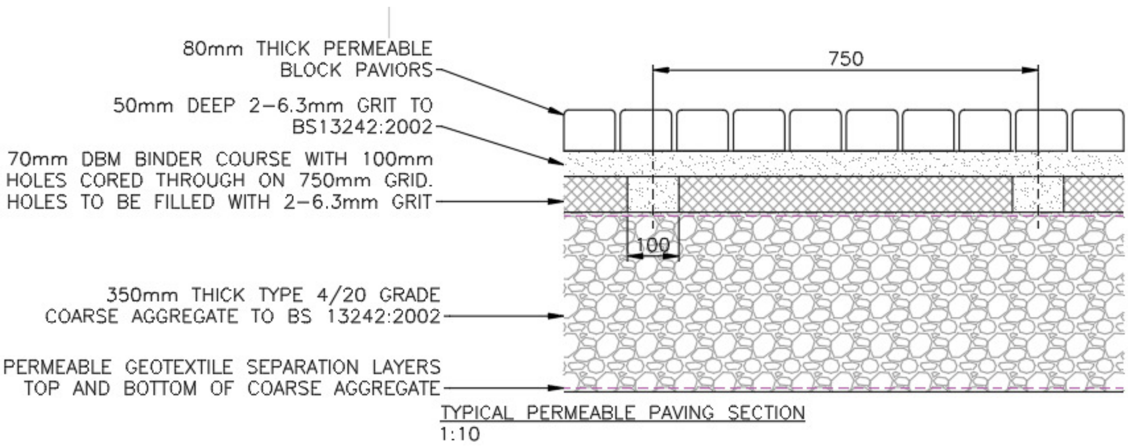

Figure 9 Example permeable paving material make-up

Dwellings & turning head off highway

The dwellings and access turning head shall be positively drained to geocellular crate infiltration systems positioned within each plot and beneath the access turning head. These will store storm flows and prevent any discharge from the site up to and including the 1:100yr +40% storm event.

The average site infiltration rate has been calculated at 0.0746 m/hr, however the positioning of the proposed crate infiltration systems means that each Plot system shall be based on its relative infiltration rate, as shown in Appendix C.

As per The SuDS Manual, a safety factor of 2.0 has been applied to these infiltration rate to allow for potential reduction in performance over time either through silting up or lack of capacity due to saturation.

Microdrainage calculations in Appendix E are provided to prove the storage systems are sufficient up to a 1:100yr + 40% storm of 6 hour duration.

Using a proprietary system, the crates would be 0.4m deep with a minimum of 0.6m ground cover. This will maintain at least the stipulated minimum 1m cover to the groundwater table. Note: groundwater level was not encountered in any of the 3No. trial holes which were excavated to a depth of 2m.

A typical section through geocellular infiltration make-up is shown below:

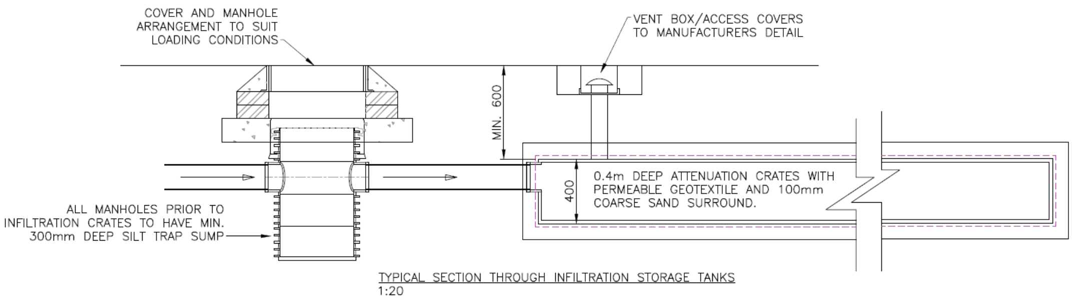

Figure 10 Typical geocellular soakaway makeup

Details of above SuDS systems and drainage plan proposals are shown in Appendix F drawings 21-C-16279/01.

An ACO (or similar approved) drainage channel across the highway access will prevent any run-off from the site onto the highway. This will also be fitted with a sump to ensure silt build up is kept to a minimum.

MAINTENANCE

All components shall be maintained in accordance with the relative requirements shown in the SuDS Manual. These intervals should be deemed as a minimum frequency and reference should also be made to the manufacturers guidance to ensure all components are maintained correctly.

Table 13.1 from the SuDS Manual for soakaways has been included below for reference.

TABLE 13.1 Operation and maintenance requirements for soakaways		
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 11 SuDS Manual table 13.1 Soakaway maintenance

Table 20.15 from the SuDS Manual for permeable paving has been included below for reference.

TABLE 20.15 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 glyphospate 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 12 SuDS Manual table 20.15 Permeable paving maintenance

FOUL WATER DRAINAGE STRATEGY

All foul water from the plots will be positively drained via a new system and is proposed to discharge into the existing public sewer to the north of the site along Nethertown Road.

It is proposed to connect into the existing identified foul sewer and form a new adopted foul drainage pipe run up Nethertown Road to the proposed development site.

The private site drainage will connect in to the new extended adopted sewer adjacent to the site.

Note: if the new drainage run up Nethertown Road is not adopted, a Section 50 Street Works Permit would need to be obtained with Cumbria County Council for private drains beneath a highway.

Further dye testing or CCTV inspections will be required prior to construction in accordance with UU policies.

A plan of the proposed foul sewer is shown in Appendix F drawing 21-C-16279/01.

MANAGEMENT

All separate surface and foul water drainage systems within the site are proposed to remain private and be maintained by a newly formed management company contributed to by all three plot owners.

The new foul sewer up the highway would be adopted by UU and maintained in accordance with their standard procedures.

APPENDICES

Appendix A – Ashwood Design Associates 1999-022A Site plan– see separate document.

Appendix B – 21-C-16279/04 Trial hole location plan – see separate document.

Appendix C – Percolation test results & images

Appendix D – United Utilities Sewer Records – see separate document.

Appendix E – Microdrainage calculations up to and including 1:100yr + 40% – see separate document.

Appendix F – Proposed drainage plan 21-C-16279/01 – see separate document