Drainage and Sustainable Drainage Systems (SuDs)

Introduction

16.1_ General

16.1.1 Highway Authorities have the powers to construct, adopt, and maintain highway drainage infrastructure. This guidance aims to provide a foundation for consistency of highway drainage design to current standards which developers must follow to ensure that systems are satisfactorily designed and constructed.

16.1.2 The new guidance moves away from design specifications to a modern philosophy of source control and performance specification. For instance, high return period design storms must now be simulated, and flood flow paths examined as part of the design of highway drainage, as it no longer matters to the pubic whether a pipe surcharges or a manhole floods, but rather that flooding causes nuisance, inconvenience, damage or health and safety risks.

16.1.3 North Yorkshire Council (NYC) as the Local Highway Authority (LHA) is responsible for the adoption of surface water drainage systems serving highway areas as part of its statutory legal duty to effectively drain the public highway.

16.1.4 In order to ensure that the LHA is able to fulfil this duty, the highway drainage system will only accept surface water received from adopted areas of highway following agreement with the LHA. Additionally, the Water Authority must have indicated that it is prepared to accept and adopt any connection to a sewer system to which they have a controlling interest. Therefore it is important that any highway put up for adoption includes an appropriately designed highway drainage system.

16.1.5 This Interim Guidance Note should be read in conjunction with 'North Yorkshire Council's SuDS Design Guidance 2018' produced in the Council's capacity as the Lead Local Flood Authority (LLFA).

16.1.6 The use of a positive drainage system should be provided for all roads to be offered for adoption as part of S38 agreements, and where possible discharging to a sustainable drainage systems (SuDS) where infiltration to the ground, large waterbody and/or controlled discharge into a system or watercourse can take place. A watercourse being a ditch or stream (not a field gutter), should be maintained / inspected on a regular basis. It shall be free flowing and capable of taking all the site water.

16.1.7 The Building Regulations Part H and CG 501 (DMBR – Design of Highway Drainage Systems) recommend the following order of priority for dealing with surface water runoff:

a) Discharge into the ground (infiltration)
b) Discharge to a surface water body
c) Discharge to a surface water sewer (with the agreement of the Water Authority)[1]
d) Discharge to a combined sewer (with the agreement of the Water Authority)[1]

[1]Note – The LHA will only accept surface water from the development highway into a LHA maintained highway drain. Surface water from open land and watercourses are not accepted.

16.1.8 When designing infiltration systems, one of the greatest uncertainties is future performance. Over time, infiltration rates can reduce, particularly if little or no effective pre-treatment is included in the design or the system is poorly maintained. To account for this, a

factor of safety is introduced into the design procedure. Factors of safety are based upon engineering judgement and depend upon the consequences of failure. The SuDS Manual C753 suggests suitable Factor of Safety values, but NYC reserves the right to apply stricter regulation to ensure that development has a positive, rather than just neutral impact on flood risk.

16.1.9 A commuted sum will be required to cover maintenance/replacement of all ground infiltration systems. Specific guidance on the use of soakaways is offered in section 16.20.

16.2_ Water Authority Consent

16.2.1 Where the discharge of surface water through SuDS features may not be possible, particularly in more urban areas, then normal practice would be to provide highway gullies that discharge directly into a public surface water sewer, with any new connection being subject to a Section 106 agreement under the Water Industry Act (1991) with the Water Authority. As a last resort, the Water Authority may, subject to agreement, allow surface water discharge into a combined sewer. The use of pumps to drain the public highway will only be considered at the discretion of the Water Authority.

16.2.2 The Water Authority must provide Section 104 agreement certification before the Council agrees to adopt the highway layout under the provisions of a Section 38 agreement. Where complications are envisaged on a development it is recommended that the Developer seeks Section 104 approval at an early stage.

16.3_ Connecting to an Existing System or Watercourse

16.3.1 Where a new highway drainage system is reliant upon the existing highway network for an effective surface water outfall, there will be a requirement to prove its capacity in order to receive the additional flows and that the outfall is in a satisfactory condition before any connection approval takes place.

16.3.2 Any works that require the use of an existing drainage systems will be subject to carrying out CCTV surveys accompanied by a technical report with any associated improvement works undertaken at the Developers expense.

16.3.3 The right to discharge surface water from a highway drain into any ditch or watercourse must be agreed in writing by the issue of a permit or consent form from the Environment Agency (for a main river), or, an Internal Drainage Board (IDB) for non-main river within an internal drainage district. Where a watercourse is not within the applicant's land ownership, in addition to the relevant permits, an agreement is generally required in the form of a deed of covenant giving permission from the Riparian Landowner to discharge water must also be provided. NYC will accept no liability for any failure to seek such agreements, which rest outside of the planning process.

16.3.4 Where there is a requirement that a drain is located outside of the limits of the highway, for example the outfall to a watercourse, then a 'Deed of Grant of Easement' will be required, the responsibility for which rests with the Developer to obtain.

16.3.5 Where a highway system discharges to a watercourse the connection should be made in line with the direction of flow and at an angle no less than 65 degrees to the bankside. A detailed headwall design should be submitted to include appropriate erosion/scour protection for the bankside. The design should incorporate flap valve(s)/no return valve(s) as standard.

Confirmation must also be received from the LLFA on whether consent under Section 23 of the Land Drainage Act 1991 (as amended) (Land Drainage Consent) is required for the outfall headwall structure.

16.3.6 Only in exceptional circumstances will elements of a highway drainage system be permitted within an area of public open space requiring the written approval of the Planning Authority. Where such circumstances do arise, the landowner (the Developer) will be required to provide a Grant of Easement giving the Highway and Lead Local Flood Authority right of access at all times for repair and maintenance purposes.

16.4_ Discharging Surface Water to SuDS

16.4.1 Where a drainage system serving the public highway discharges to a SuDS feature then this must be put up for adoption and be located within the highway boundary or forming an integral part of the road being offered for adoption. The adoption of SuDS components that are “off line” or remote from the highway are unable to be adopted and thus this should be fully considered early in the design process. Designs should be in accordance with the CIRIA SuDS Manual and the Councils SuDS Design Guidance.

16.4.2 There may be circumstances where a SuDS system is constructed within the highway boundary and the system takes proportionally more ‘non-highway runoff’ in which case the system would not be adopted under a S38 agreement and future maintenance for the lifetime of the development would need to rest with a management company.

16.4.3 Due to the bespoke nature of SuDS systems, the adoption of each feature will be dependent on the agreement and provision of an appropriate commuted sum to secure the ongoing maintenance of the feature. It is recommended that the Engineer is contacted at an early stage to seek agreement in principal for adoption. The use of Commuted Sums is covered in Interim Guidance Note 28.

16.5_ Design Criteria

16.5.1 The rate of discharge from a new highway scheme must not exceed the greenfield rate for all events up to a 1 in 100 year design storm, plus an appropriate allowance for urban creep (where applicable) and future climate change allowance in accordance with current 30% (20% Commercial) guidance from the Environment Agency.

16.5.2 Highway drainage system designs should include a hydraulic model of the proposed highway network with the modelling parameters being in accordance with NYC’s design guidance.

16.5.3 Hydraulic modelling calculations (MicroDrainage or similar) shall include a design criteria summary, contributing area summary, full network details table, pipeline schedule, control/storage structure details and a results summary.

16.5.4 The drainage network must be designed and demonstrate, that unless an area is designed to hold and/or convey water:

- Surface water flows are contained within the proposed drainage pipes without surcharge for up to a 1 in 2 year flood event;
- Flooding does not occur on any part of the site for a 1 in 30 year rainfall event, with all development surface water flows remaining within the proposed drainage system;

- Flooding does not occur during a 1 in 100 year rainfall event (+CC) in any part of a building (including basement) or in any utility plant susceptible to water (e.g. pumping station or electric substation) within the development.

16.5.5 The following principles should be considered when defining the catchment areas for the road drainage system:

- Areas to be drained are identified, including whether they are permeable (grassed areas) or impermeable (surfaced).
- All high and low points on the longitudinal gradients of the road are identified.
- Crossfall or Camber on the road at all locations, and in particular identify locations where the direction of crossfall or the camber changes. The Design should avoid the creation of flat areas.
- As part of any longitudinal design care should be taken in respect of hog curves created at the top of the vertical curve which can flatten to well below the desirable minimum gradient.
- Confirm the direction that surface water will flow from all other areas.
- Confirm outfall locations.
- Identify any obstacles which will split catchments.

16.5.6 Pollution prevention methods should be incorporated in designs to prevent polluted run-off. The incorporation of SuDS may prevent the need for oil separators. Refer to Pollution Prevention Guidelines (PPG's). The requirements for oil separators should be confirmed with the Environment Agency.

16.5.7 The Hydraulic model must be referenced to a schematic site layout plan with all pipes, manholes, drainage and ancillary features clearly numbered.

16.6_ Designing for Exceedance

16.6.1 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

16.2.2 Typically, areas designated to hold or convey water will be an appropriately designed public open space within the development. Where the designated area is off site on land or into watercourses owned by a third party then evidence of approval will be required as part of any submission.

16.6.3 Safe and appropriate flow routes as a result of blockage and exceedance of the drainage system must be evaluated, and the potential effects of flooding assessed. An exceedance plan drawing is required to show exceedance areas and overland flow routes during an extreme flood event, exceeding the capacity of the proposed drainage system.

16.6.4 Site design must be such that when SuDS features are exceeded due to failure caused by blockages or when the system is overwhelmed by excessive flood flows, the exceedance flows do not cause flooding of properties or infrastructure on or off site. This is achieved by designing suitable flood pathways.

16.6.5 The use of the highway for exceedance flows may not be suitable in all locations, particularly in steeper catchments. Designers should consider the impacts of the velocity of exceedance flows on traffic, pedestrians and adjacent structures.

16.7_ Designing for Urban Creep

16.7.1 Urban creep is defined as future development expansion creating impermeable areas within a development site through activities such as building extensions, paving gardens and creating driveways which often rest outside of the development control processes. As such, an allowance of 10% is required for this increase in the impermeable area of a development.

Design Requirements

16.8_ Highway Gully Specification

16.8.1 Gully gratings and frames shall be class D400 and installed to BS EN124 with a minimum width of 450mm in accordance with the requirements of BS 7903. The use of slot drains on the adoptable highway will not be permitted. All road gully gratings are to be hinged and a minimum of 100mm deep on estate roads and 150mm deep in all locations of block paving. Cycle / Pedestrian friendly grates shall be provided on all Shared Space road layouts.

16.8.2 Emergency accesses, footpaths and cycletracks that are remote and not adjoining the carriageway should be positively drained. Surface water runoff from adoptable footpaths and cycleways that discharges across other footways or carriageways or discharges into adjoining private property and private areas, including gardens, is not acceptable. Particular care should be taken when a footway or cycleway is constructed in cutting, as surface water will be channelled to its lowest point leading to ponding.

16.8.3 For footways and cycleways gully gratings and frames shall be to class C250 with a minimum opening of 350mm x 310mm x 75mm with a captive hinge and cycle/pedestrian friendly grate.

16.8.4 Gully pots should be specified as plastic or pre-cast concrete units with a minimum diameter of 450mm and a minimum depth of 900mm. Brick built gully pots will not normally be accepted unless it can be demonstrated that these are required due to engineering difficulties.

16.8.5 The minimum allowable pipe diameter for gully connections to either the public sewer or a main highway carrier drain is 150mm.

16.8.6 Gullies are to be connected into a catchpit or manhole where reasonably practicable.

16.8.7 Gully spacing should be calculated in accordance with DMRB. The drained area for road gullies should not exceed an area of 150m^2. With the maximum gully spacing not exceeding 35m.

16.8.8 Gullies shall be positioned away from areas of regular vehicle overrun, including the wheel tracked areas of junction bell mouths, driveways, formal and informal pedestrian crossing points and potential informal pedestrian desire lines.

16.8.9 Where it is not possible to meet the above requirements the Council will in exceptional cases accept the use of kerb type drainage systems (beany blocks) in short stretches where it can be demonstrated that kerb drainage can be effectively maintained. The use of kerb drainage should be agreed with the Engineer at an early stage in the design process and will be subject to securing a Commuted Sum.

16.8.10 Standing and running surface water at junctions, transitions, pedestrian crossing points, bus stops and cycle lane entries should be minimised by installing a gully on the upstream side.

16.8.11 The use of Linear Drainage Channels / Slot drains / Aco drains should be carefully considered due to maintenance liability and often still require a positive outlet and therefore their use shall be agreed early in the design stage with the Engineer if required to overcome a particular problem that cannot be addressed by conventional drainage solutions.

16.8.12 New carriageways to be put up for adoption should be designed to avoid the creation of flat areas. Where the development will utilise an existing highway where flat areas are already present, the introduction of false flats should be considered, i.e. reshaping the road surface profile into peaks and troughs between gullies to achieve minimum gradients.

16.8.13 Channels should be used on carriageways where gradients are shallower than 1 in 80 in order to prevent future ponding. Alternatively, the use of combined kerb/drainage systems may be considered in certain circumstances, but with the prior approval of the Engineer due to maintenance liability and will be subject to a commuted sum calculation.

16.8.14 Where possible footways should be designed to fall towards the carriageway. Where backfall is unavoidable and if there is significant longitudinal fall then a 'dish' should be formed in the surfacing and directed such that the water flows off into the channel. At times where this is not possible, a gully will be required within the footway. The use of dished channels should be avoided where possible as they can present a tripping hazard and thus the use of fluted channels is generally more acceptable.

16.8.15 A pair of gullies are required at all low points along a road channel, or at locations where a single blocked gully has the potential to create ponding and subsequent exceedance. Each gully should have an independent connection to the carrier drain unless agreed with suitable reasoning offered at the design stage with the Engineer. The independent connections to the carrier drain must be at least 1m apart to ensure the carrier drain is not weakened.

16.8.16 To assist with the checking of the road layout / drainage designs as part of any Technical Approval for S38/278 works, the application submission should include a road layout/drainage plan overlaid with 100mm contour heights/flow arrows.

16.9_ Pipework

16.9.1 Desirable minimum cover to any highway pipework should be 1200mm where trenches are backfilled with suitable granular material. The absolute minimum cover with the exception of the connection to the road gully should be 600mm, where this occurs all drains must be laid on a bed of, and surrounded by, 150mm of ST2 mix concrete protection with flex cell expansion joints on all bends and every 3m of length.

16.9.2 All pipework should be designed to be self-cleansing with a minimum velocity of 1.0m/sec or an absolute minimum of 0.75m/sec. Any main carrier drain running in the highway should have a minimum diameter of 225mm.

16.9.3 Pipework up to and including under 900mm diameter must comply with Series 500 of the MCHW, and for the avoidance of doubt plastic pipes up to 300mm are acceptable to use, as long as they are twin wall approved for highway use. Plastic pipes greater than 300mm dia are subject to agreement with the Engineer, being CE marked and will be subject to suitable specification for bedding and encasement.

16.9.4 Where;

1. Pipework exceeds 900mm diameter or clear span or

2. Combinations of pipe where combined span is in excess of 0.9m, and the distance between two pipes is less than that of the larger of the two spans.

Then these will be treated as structures requiring a Technical Approval submission and will not be permitted under the highway by NYC.

16.4.5 The current NYC Technical Approval Procedures document can be made available upon request.

16.4.6 For further requirements refer to the Structures Chapter of this Design Guide.

16.10_ Culverts

16.10.1 NYC is, in general opposed to the culverting of watercourses and has recently published a 'Culverting Works and Drainage Maintenance Protocol 2019'.

16.10.2 Culverts must be designed so they do not cause a restriction to flow and this must be demonstrated through the submission of supporting evidence. Culverts must not increase the risk of flooding or prevent maintenance of the adjacent open watercourse. Consideration must also be given to overland flow paths in the event of a culvert becoming obstructed or overloaded. It should also be demonstrated that flows will not affect property or cause unreasonable nuisance or harm.

16.10.3 The responsibility for future maintenance and clearance of a culvert must be agreed and details of those responsible submitted with the consent application. The responsibility for the maintenance of a culvert lies with the riparian landowner or the owner of the culvert unless otherwise arranged.

16.10.4 All culverts that are to be adopted by NYC shall be supervised on-site during the construction phase activities. No works shall start until the Technical Approval and any Section 38/278 agreements have been entered into with consent under the Land Drainage Act 1991 (watercourses) or an Environmental Permit (EA Main River) having been issued by the appropriate bodies.

16.10.5 A technical approval submission will be required for all structures defined as being greater than 900mm diameter or clear span.

16.11_ Catchpits

16.11.1 Catch pits with a minimum clear opening of 600mm x 600mm should be constructed with a minimum sump of 300mm and should be located at every change of direction, at any change of diameter, and where any system joins the main line (Single gully connections may be permitted without the construction of a catch pit with agreement of the Engineer). Changes of direction of more than 90 degrees in catch pits will not be permitted.

16.11.2 Refer to the NYC Technical Approval Procedures for all manholes with a diameter greater than 1250mm

16.12_ Manhole Chambers

16.12.1 Manhole chambers will be required at a maximum spacing of 90m for systems that run for a long distance without any incoming connections to allow access for jetting. All manhole covers on the adoptable network are to be 150mm deep EN124 D400 ductile iron

bedded using a proprietary mortar/polymer resin based product or 100mm deep EN124 C250 in the case of footpaths or verges.

16.12.2 All covers in footpaths and shared surface areas that are to be trafficked for maintenance purposes e.g. access required by tanker, jetter, gully emptier, street lighting hoist shall be fitted with BS EN124 D400 cover and frames.

16.12.3 Manholes must not straddle centrelines/ lane lines, and be kept clear of vehicle wheel tracks with pipework being a minimum of 1.0m from a kerb line, and any manhole being a minimum of 500mm from a kerb line in order to minimise disruption during future maintenance work. Sub-surface drainage will be required where the water table is within 600mm of the formation

16.12.4 Refer to the NYC Technical Approval Procedures for all manholes with a diameter greater than 1250mm

16.13 Flow Control Chambers & Oversized Attenuation Pipes

16.13.1 Flow control chambers and oversized attenuation pipes constructed to control surface water discharge rates to the existing drainage network should be situated outside of the adopted carriageway extents to avoid disruption to the highway during any future maintenance.

16.13.2 It is acknowledged that in some small/medium size developments it may not be viable to provide surface water attenuation tanks and pipes outside the confines of the highway. Appendix CH 16-1 provides an example of a permitted surface water attenuation pipe arrangement within the adoptable highways for smaller development sites where other SuDS options cannot be accommodated. A departure from NYC standards must be negotiated with both the highways engineer and structures engineer.

16.13.3 Large chambers (>3.0m diameter) will not be permitted within the carriageway without consideration of all maintenance activities and safeguarding the movement of members of the public during any works, including the replacement of a chamber cover slab. Where chamber cover slabs are bespoke, a structural design will need to be submitted for approval.

16.13.4 Where pipes/culverts larger than 900mm clear span or diameter are agreed within the highway, they will be classed as structures for the purpose of systematic structural inspection and will require a technical approval submission.

16.13.5 NYC will accept the use of vortex control devices as a method of flow control on a highway system, and will also permit the use of orifice plates with a minimum internal diameter of 75mm for vortex control values and 100mm for orifice plates. Throttle pipes shall be 150mm and should be less than 15m in length. Should this requirement detailed above not be approved then the Applicant is exposed to the risk of the site not being adopted.

16.14_ Cellular Storage Systems

16.14.1 The use of below ground cellular storage systems for surface water attenuation is becoming more common and are permissible where it can be demonstrated that all other options have been considered and dismissed for technical reasons.

16.14.2 The approval of a cellular storage system will be subject to the submission and approval of a detailed design.

16.14.3 The construction of a cellular storage system constructed directly under a carriageway will not be permitted.

16.14.4 As such, any system put forward for adoption must be located in an adjacent area of adopted public highway, preferably in verge area and must be suitable for vehicular trafficking and certified accordingly

16.14.5 The design of the specified system must allow jetting along the entire length of the feature. A plan identifying access arrangements for maintenance should be submitted. It must be demonstrated that the chosen system permits the inspection of the entire tank with conventional CCTV apparatus.

16.14.6 Crates with solid internal walls will not be accepted. Any storage tank must be appropriately vented and include a sump catch pit at the main inlet and adjacent to, or constructed as part of, the outfall/flow control structure to allow the jetting of the entire feature and the removal of sediment. On large systems it is likely that the use of two catchpits could be needed, with flow split between the two catchpits.

16.15_ Subsoil Drainage

16.15.1 An adequate system of subgrade drainage to maximise longevity of the pavement construction and its associated earthworks shall be constructed to the Engineers satisfaction where:

- the winter height of the water table is within 600mm of formation level; or
- the sub-soil is saturated; or
- there is a likelihood of water running from or out of adjacent ground; or
- springs, land drains, leats or other watercourses are encountered; or
- the subgrade is likely to be altered due to groundwater.

16.15.2 The designer should also refer to TRL report PPR341 Drainage of Earthworks Slopes. Future maintenance of drainage systems must be a principal factor in the design and for this reason, fin drains should not be used.

16.16_ CDM Regulations

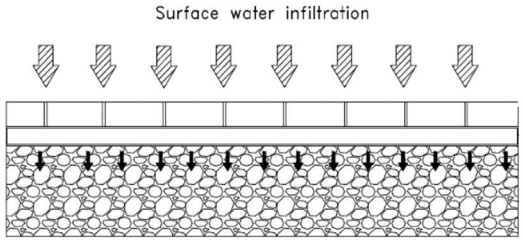
16.16.1 Under the CDM Regulations, the designer must take full account of the general principles of prevention, with the aim, as far as reasonably practicable, of eliminating foreseeable risks. In this respect, Surface Water attenuation tanks are deemed to be a ‘confined space’ structure when undertaking systemic future inspections and maintenance, due primarily to the potential build-up of toxic and contaminated material, harmful gases and water risks. It is expected that the CDM Health and Safety File will include all details to enable future inspection and maintenance.

16.16.2 All relevant information forming the Health and Safety File shall be submitted to the LHA in CD format prior to S278/38 Final Certificates being issued. The Local Highways Area Office will be required to store this information or future reference.

16.17_ Permeable Paving

16.17.1 The use of permeable paving has the potential to both store and treat highway water without the land take of conventional sustainable drainage features. Engagement with the highway authority into the use of permeable paving is encouraged at an early stage in the design process.

16.17.2 At present, NYC are not willing to adopt permeable paving on the adopted highway. The construction of permeable paving within private highways, shared parking areas and private drives is permitted subject to the submission of a detailed design, maintenance plan and future ownership details at the planning stage. A reduction for the use of permeable paving shall not be made in the site drainage design for private driveways as homeowners may replace their drives with cheaper impermeable material in the future.



16.17.3 Any permeable paving systems should be designed in line with the most up to date version of permeable paving design guidance. The use of loose gravel or similar unbound material will not be permitted by NYC as a permeable paving solution, as typically, weed growth takes place; the material gets tracked onto the adjacent highway which can lead to road safety concerns and potential damage to highway surfaces. Additionally, unbound materials can create problems for users of wheelchairs, mobility scooters and pushchairs.

16.17.4 The approval of permeable paving designs being reliant upon infiltration will be subject to infiltration testing undertaken by a UKAS accredited laboratory. This testing will determine if full, partial or no filtration is achievable, which in turn determines if a piped outfall and an impermeable geo-textile layer is required.

16.17.5 In the circumstance there is no other suitable surface water outfall solution available the use of permeable paving via infiltration for the adoptable highway will need to be discussed at the early stages of site design with the Engineer.

16.18_ Private Area Drainage

16.18.1 The drainage of private areas must be considered as part of the technical approval submission. No private drainage element will normally be permitted within the area offered for adoption. Surface water run-off from private driveways, courtyards and footways should be positively drained and thus intercepted by linear channels and private drains and discharged into the private domestic surface water network associated with the proposed dwellin1 in 80g/private structure.

16.18.2 Conversely, the drainage design should ensure that no surface water runoff from the proposed adoptable highway area enters areas in private ownership. Private culverts/structures will not be permitted within areas offered for adoption. This issue should be addressed as early as possible during the design stage.

16.18.3 Private connections not forming part of the adoptable sewer system within the highway limits, are the responsibility of the Developer and his successors, but shall be constructed in accordance with NYC's specification. Any private apparatus located within the adopted public highway will be subject to the provisions of a Section 50 licence.

16.19_ Use of Management Companies

16.19.1 It must be demonstrated to the Local Planning Authorities satisfaction that maintenance of private surface water drainage assets will be assured for the lifetime of the development.

16.19.2 To assist with the maintenance of private areas and private drainage assets that come under the control of a Management Company, it is expected that the Local Planning Authority and the nominated Management Company will be provided with a 'SuDS Scheme Operation and Maintenance Manual' document forming part of the CDM Health and Safety File enclosing all pertinent information.

16.19.3 The SuDS Scheme Operation and Maintenance Manual is to be provided as part of any submission at Full Planning and Approval of Reserve Matters planning stages, as well as for any Draft Section 38 Highway and SuDS Adoption Agreement. As a minimum, this file should contain:

- The Management Companies name, address, email address and contact number. (Where this is not known during the planning stage then full details must be submitted as part is part of the Health and Safety File at S278/38 Final Certificate Stage);
- A description of the site and construction details;
- A brief summary of the design intent, how the SuDS components work, their purpose and potential performance risks;
- An explanation of the objectives of maintenance that is proposed and potential implications of not meeting those objectives split into planted and hard elements;
- Visual indicators that will trigger maintenance plus depth of silt and of oil separators etc. that will trigger requirement for removal;
- A plan of the site that identifies surface water run-off sub-catchments, SuDS components, critical water levels, control structures, flow routes (including exceedance routing) and outfalls;
- A plan clearly showing the extent of the un-adopted area along with easements and rights of way for access to enable maintenance. If other parties are responsible for different parts of a scheme, this should be clearly shown on the plan;
- The access that is required to each management component for maintenance purposes and a plan for the safe and sustainable removal and disposal of waste periodically arising from the drainage system;
- A maintenance schedule (see example in Appendix CH 16-3) itemising the tasks to be undertaken and the frequency at which the tasks should be performed so that the long term performance of the asset is secured. This schedule can then be priced, checked on site and form the basis of an inspection log. It is expected that the schedule would be a living document and will be subject to change where inspections advice that changes are necessary to the maintenance requirements;
- A maintenance specification detailing the materials to be used and the standard of workmanship required. The specification should describe how the work should be carried out, health and safety requirements and should contain clauses giving general instructions to the nominated Contractor;
- Details of how future residents will be made aware of their responsibilities and obligations where these rest outside of the Management Companies remit.
- An action plan for dealing with accidental spillages of pollutants;
- Details of who to contact in the event of pollution or the system is not working;
- Advice on what to do if alterations are to be made to a development, or if service companies need to undertake excavations or similar works that could affect the SuDS.

Highway Soakaways

16.20_ General

16.20.1 When designing infiltration systems, one of the greatest uncertainties is future performance. Over time, infiltration rates can reduce, particularly if little or no effective pre-treatment is included in the design or the system is poorly maintained. To account for this, a factor of safety is introduced into the design procedure. Factors of safety are based upon engineering judgement and depend upon the consequences of failure. The SuDS Manual C753 suggests suitable Factor of Safety values, but NYC reserves the right to apply stricter regulation to ensure that development has a positive, rather than just neutral impact on flood risk.

16.20.2 NYC is generally opposed to the use of highway soakaways due to siltation and future maintenance liabilities and therefore where they are proposed, all other infiltration surface water discharge options should have been considered and discounted.

16.20.3 Where standard soakaway designs and deep borehole soakaways are the proposed method of highway drainage, and are being offered for adoption as part of the S38 Agreement, it is essential that the design is approved at an early stage by NYC.

16.20.4 Evidence that sufficient rates of infiltration are present to effectively drain the highway are required.

16.20.5 For the avoidance of doubt, NYC will not accept soakaways being installed within areas forming the carriageway / footway that will be offered for adoption.

16.21_ Infiltration Test Specification

16.21.1 In order to ensure that infiltration rates are representative of the site ground conditions, infiltration tests should be undertaken on site as close as possible and within 20m for uniform subsoil conditions and in the location of the soakaway for non-uniform subsoil conditions and within the same depth range as the proposed soakaway.

16.21.2 The infiltration tests are to be carried out by a UKAS accredited laboratory in accordance with BRE365 'Soakaway Design' taking into consideration anticipated groundwater levels, ensuring a working filtration zone is achievable. All designs should take into consideration the requirements of HA118/06.

16.21.3 Trial pit logs are to be provided with each test pit, logged in accordance with as EN 1997-2:2007. A minimum of three fillings should be conducted in each test pit. Any submissions with less than 3 tests will be automatically refused.

16.21.4 If it is not possible to carry out a full depth soakage test then the soil infiltration rate calculations should be based on the time of the fall of water from 75% to 25% of the actual maximum water depth achieved in the test.

16.21.5 The Engineer or his Representative shall be advised when infiltration testing is being undertaken allowing the opportunity of superintendence.

16.22_ Soakaway Design Criteria

16.22.1 Soakaways should be designed using the slowest infiltration rate from one of the three tests in each pit. A minimum of a 1 in 100+CC year return period should be used for design

purposes. Soakaways must be designed in accordance with the BRE365 method (2016 or any subsequent update) or the Bettess method (1996). The applicant must apply a suitable safety factor, as referenced in CIRCA C753 Table 25.2 if using the Bettess (1996) method.

16.22.2 It is appreciated that conventional highway drainage systems can only convey a limited volume of water during short duration high intensity events i.e. up to 30 minutes. For this reason, the temporary flooding of the highway during storms above the 1 in 30 year event would be accepted in short duration events, as long as it can be demonstrated that this exceedance volume will be completely contained within the adopted highway or other designated exceedance storage areas, taking into account a total footpath height of 75mm above carriageway level. The flooding of 3rd party land or property curtilages would not be permitted.

16.22.3 Adoptable soakaways should be constructed using either preformed plastic crates or perforated rings being a minimum of 1500mm diameter and installed in accordance with the manufactures instructions. All soakaways put up for adoption must be suitable for use in trafficked areas and certified accordingly.

16.22.4 All soakaways and filter drains are to be encased in a suitable geotextile, in the case of a soakaway laid between the chamber and the filter material to prevent fines being washed away. All soakaways should be designed with a suitable access point at each point of connection to allow future cleansing of the system in the event that it becomes silted.

16.22.5 If plastic crates are utilised, the design of the specified unit type must allow jetting along the entire length of the feature. Crates with solid internal walls will not be accepted and the feature must be appropriately vented. On larger soakaways additional inspection chambers should be provided to allow future cleansing of the system.

16.22.6 If more than one soakaway is planned, they are to be linked by a 225mm diameter pipe, and where possible, the soakaway should incorporate an overflow link (minimum 225mm diameter) to an existing highway drain/outfall system.

16.23_ Highway Soakaway Location

16.23.1 The position of the soakaways should be considered early in the design process. They **must not be located beneath the adopted highway** or areas subject to regular HGV traffic. They should be situated not less than 5m from the edge of the carriageway (or any other area subject to highway vehicular loading) in private car parking or areas of public open space with the agreement of the LPA and the completion of a legal Deed of Easement with the landowner (the Developer).

16.23.2 Designs where highway soakaways are proposed in inaccessible areas for example, between plots will not be accepted. They must not be located directly beneath the adopted highway and the bottom of the soakaway should not extend below a line drawn at 45 degrees from the edge of the carriageway or any structure or boundary.

16.23.3 Soakaways should be situated not less than 5m from any building, wall, retaining structure or the edge of the carriageway. Fences shall also be kept a reasonable distance from the soakaway.

16.23.4 No permanent structures, play equipment, steps or significant landscaping should be placed on or adjacent to the soakaway or within the easements.

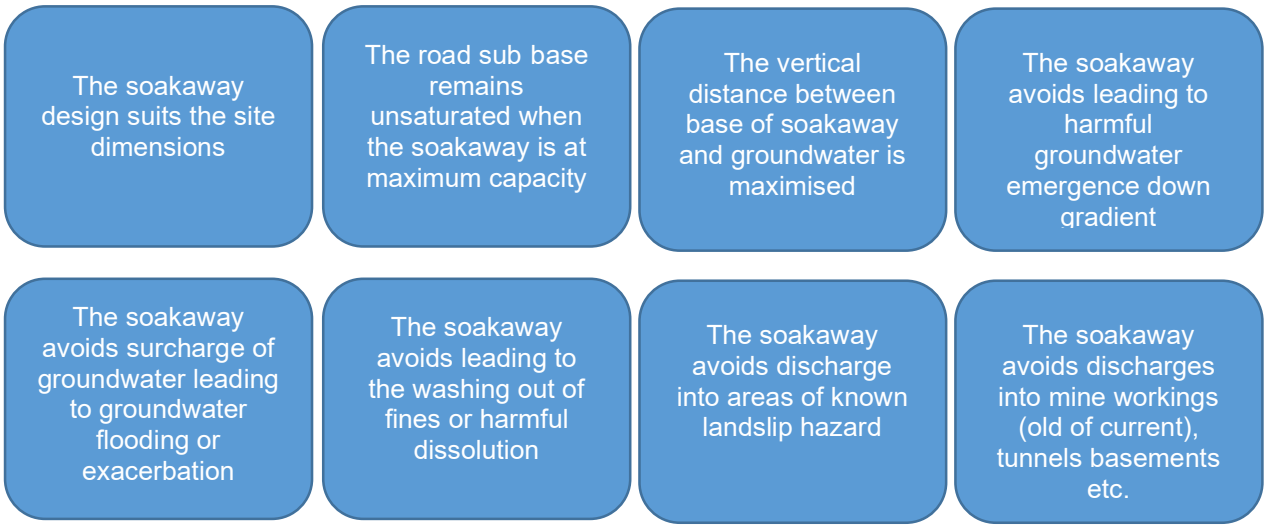
16.23.5 When determining the location of the soakaway, due consideration should be given to future maintenance. Provision must be made for pedestrian and vehicular access from the adopted highway to the whole of the soakaway and associated drainage runs without significant changes in ground level.

16.23.6 Gradients within the easements should not normally be steeper than 1:20 across grassed or landscaped areas without suitable reinforcement. Easements are required for any drainage outside of the adoptable highway and these should be a minimum of 3m around a soakaway and 3m either side of the centre of any pipe. Additional areas for access may be required.

16.23.7 Soakaways and any other form of surface water ground infiltration will not be permitted under any circumstances in the Ripon area of Harrogate Borough, as Ripon sits on a layer of gypsum at a relatively shallow depth. Gypsum is a water soluble rock where dissolution can result in the creation of underground cavities which can lead to sink holes developing. A map showing the central bend of Ripon depicted by the enclosing lines of C-C is included in Appendix CH 16 - 2.

16.24_ Soakaway Design

16.24.1 The design of Soakaways should be selected in accordance with DMRB as such that:



16.24.2 When submitting a soakaway design for approval (this will normally be approved by the LLFA) the following information must be provided to ensure that the design can be promptly checked and subsequently approved:

- Impermeable drainage area assumed in the calculations.
- Infiltration rate assumed for design purposes based on BRE365 testing
- Confirmation that a 100 year +30% CC return storm period has been used in the calculations.
- BRE365 should be used as the design method or Bettess (1996) method
- Confirmation of the Factor of Safety assumed in the design
- Soakaway dimensions proposed and construction detail
- Proposed invert level and effective drainage depth
- Porosity of proposed drainage medium.

- Location plan(s), indicating the position of the infiltration test(s) with respect to the location of the proposed soakaway(s)
- Location plan(s) showing proposed easement details
- The design submission must provide evidence that contaminated land does not exist, or that the construction of the drainage system will not harm the environment. Where appropriate, the design submission must provide evidence that the effects of past mining/quarrying activity has been considered and addressed
- Ground water levels

Further Information on Sustainable Drainage Systems (SuDS)

16.25_ General

16.25.1 As advocated above, NYC promotes the use of Sustainable Drainage Systems for the treatment, attenuation and disposal of surface water runoff from new and retrofitted developments, including the runoff from highways.

16.25.2 SuDS provide a sustainable approach to drainage, mitigating the impacts of developments on flood risk and climate change whilst promoting flood resilience plus they can provide amenity and environmental benefits.

16.25.3 SuDS look to manage surface water runoff from rainfall near to where it falls, in other words 'at source' and water not collected for use must be discharged to one or more of the following in the order of priority shown in accordance with the Building Regulations Part H:

a) Discharge into the ground (infiltration) – Note - in the Ripon Area – See Section 16.23.7
b) Discharge to a surface water body
c) Discharge to a surface water sewer (with the agreement of the Water Authority)
d) Discharge to a combined sewer (with the agreement of the Water Authority)

16.25.4 There are various SuDS components that are particularly suitable for dealing with surface water runoff, these include permeable surfaces, detention basins, ponds, swales, rainwater gardens, wetland systems and attenuation storage.

16.26_ Location of SuDS Features

16.26.1 When determining the location of the SUDs features, due consideration should be given to future maintenance. Provision must be made for pedestrian and vehicular access from the adopted highway to the whole of the SUDs feature and associated drainage runs without significant changes in ground level.

16.26.2 SuDS features should be situated away from any building, wall or retaining structure in accordance with best practice, with a 5m easement being provided around the SuDS feature with a 2.5m easement either side (5m) of any connecting pipework.

16.27_ Water Quality

16.27.1 The adopted highway network has the potential to generate a significant volume of surface water during storm conditions. Due to vehicle traffic this water can often carry pollutants and have a high sediment loading. It is therefore important that highway surface

water is properly attenuated and treated before it reaches a receiving watercourse or other waterbody. Any new highway drainage system put up for adoption must therefore pass through a minimum of two levels of surface water treatment prior to discharging to any outfall.

16.27.2 These levels of treatment can either be provided as part of the design of the highway drainage system or as part of the wider "site wide" drainage design. Features such as highway gullies and catch pits are familiar to Highway Engineers and can provide some pre-treatment and form an effective method for sediment removal, however these do not have the capability to provide any treatment of dissolved pollutants meaning they will not be considered as a level or surface water treatment.

16.27.3 The design of SuDS can incorporate various mechanisms that retain pollutants or prevent the pollution of controlled waters through one or more of the following techniques:

- Sedimentation – *whereby suspended solids are settled out of solution by reducing the velocity of flow through the SUDS component. The design should take into account the risk of re-suspension of solids during extreme rainfall events.*
- Filtration – *where pollutants conveyed with sediment are trapped either within the soil or gravel media matrix, or on geotextile layers that form part of the SuDS construction*.
- Biodegradation – *provides a biological process that allows the creation of microbial communities to be established within the soil or gravel media to degrade organic pollutants including hydrocarbons.*
- Adsorption – *occurs when pollutants attach themselves or bind to soil, gravel media particles or to other media*.
- Uptake by vegetation – *provides a mechanism for removal of nutrients such as phosphorous and nitrogen.*

16.27.4 Attenuation and treatment of highway water can be achieved through the use of filter strips, infiltration trenches/soakaways, swales, rainwater gardens and other sustainable drainage features located in wide adoptable highway verges.

16.27.5 Where larger highway SuDS features are required these should preferably be located in adoptable areas or in exceptional cases located with public open space land with the written approval of the Planning Authority and a legal Grant of Easement by the Landowner (the Developer). The required number of treatment stages can be accommodated in site wide SuDS features if the highway is being designed as part of a wider residential or commercial development.

16.28_ Side Slope Gradients

16.28.1 The gradient of side slopes for swales and other attenuation features should not exceed 1 in 5 (20%) when constructed adjacent to high speed roads, with maximum depths of water not exceeding 200mm. Side slopes should not exceed 1 in 3 (33%) in residential areas, however more shallow gradients are preferred in all locations to permit easier maintenance.

16.29_ Surface Water Management During Construction

16.29.1 Damage caused during construction operations has the potential to prevent SuDS functioning as required. As such, appropriate planning must be applied to surface water management during the construction phase.

16.29.2 A statutory duty requires that surface water quality and quantity is managed throughout construction to prevent the adverse impact of surface water off-site.

16.29.3 The following details should be provided as part of a Construction Management Plan:

16.29.4 Method Statements and plans/drawings detailing surface water management proposals including:

- Temporary drainage systems, including for any dewatering;
- Measures for managing pollution / water quality and protecting controlled waters and watercourses, including emergency control measures;
- Measures for managing any on or off site flood risk associated with construction;
- Required consents, e.g. Land Drainage Act, Environmental Permit (if required);
- Construction management, maintenance and remediation schedule.

16.30_ Commuted Sums

16.30.1 Commuted Sums will be applied to Non-Standard drainage assets and SuDS features that are within the adoptable extent of the public highway to cover future maintenance associated with routine inspection, general maintenance and repair, the risk of the system failing, risk of subsidence induced by the system and reduced performance as a result of siltation. Commuted Sum values for S38/278 works will be derived in accordance with NYC policy and practice utilising the guidance document 'Commuted sums for maintaining infrastructure assets' produced by the Councils Surveyors Society (known now as ADEPT). For further guidance on Commuted Sums see NYC Interim Guidance Note 28.

16.30.2 Commuted sums will be applied to the following Non-standard drainage assets and SuDS features:

- Underground storage incl. oversized pipes, cellular storage and/or in-situ storage tanks, petrol interceptors)
- Above ground storage incl. (swales, ditches, rainwater gardens, dry and wet ponds)
- Precast Concrete Ring Soakaways / Trench Soakaways
- Weirs, Flow Control Devices, Hydro-brakes / Flow Control (vortex) Chambers
- Filter Strips / Filter Drains
- Slot Drains / Aco Drains
- Combined Kerb Drainage Systems (beanie blocks)
- Concrete Bagwork Headwalls (Precast units will not be subject to a Commuted Sum)
- Permeable Paving (if subject to adoption agreement)

16.31_ Construction Records

16.31.1 All works associated with S278/38 legal agreements require 'as-built' drawings to be supplied to NYC as part of the Health and Safety File in digital format (preferably on CD) to enable all new highway assets to be logged and added to maintenance records.

16.32_ Inspections

16.32.1 CCTV surveys and reports are to be provided by the developer for all adoptable highway drainage including all gully connections, catchpits, inspection chambers, soakaways and headwalls.

16.32.2 If as a result of the CCTV and as-built surveys it is found that the constructed drainage differs significantly to the original designs provided, then a full set of revised calculations reflecting all the changes are to be resubmitted to demonstrate that the drainage system remains satisfactory.

16.32.3 Inspection Reports are to include:

- As built plans identifying the runs surveyed with catchpit, gully and pipe line references.
- Sizes of all pipes surveyed
- Cover levels and invert levels of all pipes entering catchpits, together with the size of all the catchpits
- A video in .AVI format of all drainage runs with reports identifying all defects and their locations with relevant '.JPG picture stills' taken from videos being provided where required.
- PDF copies of the report, all plans, notes and defect sheets.

16.33_ Further Design Guidance

16.33.1 Unless otherwise indicated, highway drainage shall be designed in accordance with the Design Manual for Roads and Bridges, and the latest design manuals and guidance notes published by The Construction Industry Research and Information Association (CIRIA).

16.33.2 Construction details should conform to Highway Construction Details in the MCHW, unless an equivalent detail exists in North Yorkshire

Council's Standard Details. Reinstatement should be in accordance with NYC's Standard Details and the NRSWA Specification for the Reinstatement of Openings in Highways (DfT/HAUC ACoP).

16.33.3 Designers are also referred to the National Planning Policy Framework which sets out Government policy on development and flood risk.

16.33.4 Different sites will present different opportunities for sustainable highway drainage systems therefore early engagement with NYC's Development Management Engineer and the LLFA is advised.

16.33.5 There is a range of guidance available on the design and construction of sustainable highway drainage systems which should be adhered to as part of any drainage system serving the adoptable highway.

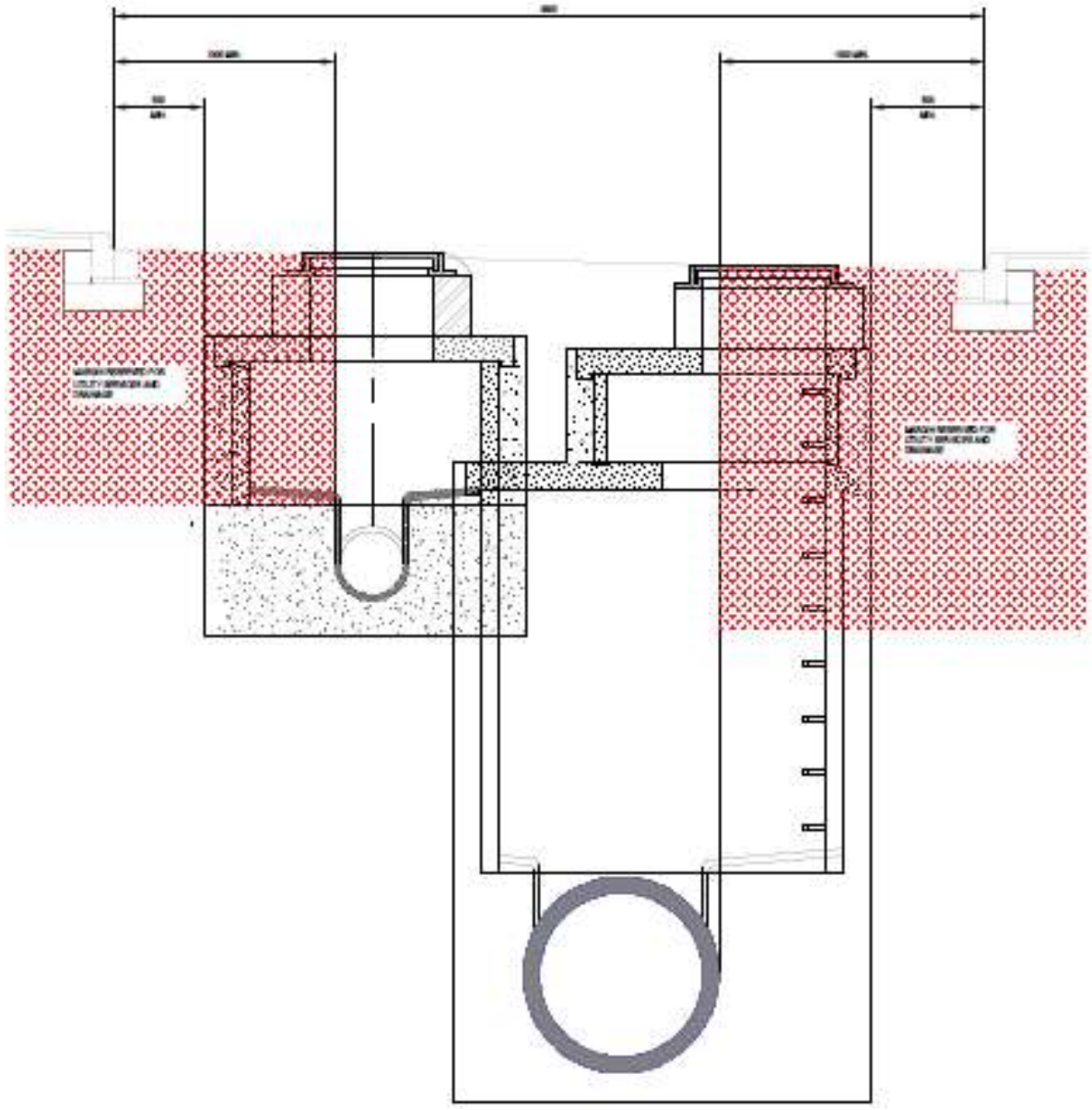
- The SuDS Manual C753
- Specification for housing and Industrial Estate Roads and Private Street Works – 3rd Edition
- North Yorkshire Council SuDS Design Guidance 2018
- Rainfall Runoff Management for Developments
- Susdrain the community for sustainable drainage
- UK SuDS Tools Web site – HR Wallingford
- BS8582:2013 Code of Practice for Surface Water Management for Development Sites
- Building Regulations 2010 Section H3 Rainwater Drainage 2015 Edition
- DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems

- Local Authority SuDS Officer Organisation (LASOO) Non-Statutory Technical Standards for Sustainable Drainage Practice Guidance
- Culvert Design Manual, Ciria168
- NYC Culverting Works and Drainage Maintenance Protocol 2019

Recommended Highway Drainage Design Parameters

Design Consideration	Comments / Value
Minimum Slope / Gradient	1 in 300
Roughness Value (K) – manning "n" should only be used for open channels	0.6mm
Minimum System Velocity	1.0m/sec or an absolute minimum of 0.75m/sec
Maximum System Velocity	5m/sec (if >5m/sec suitable pipe & bedding combinations should be based on manufacturer Spec)
Climate Change	30% (20% Commercial)
Additional Flow – Urban Creep (where applicable)	10%
Minimum pipe run distance from kerb line	1.0m
Minimum Rainfall	Usually capped at 50mm/hour for AutoDesign
Volumetric Run-off Coefficient (Summer/Winter)	1.0 (unless peak flow rates are derived from impermeable area only)
Percentage Impermeable Area (PIMP)	100% for compliance with SfA 100% permeable areas 50% grassed areas & verges
Private impermeable areas	Areas greater than $6m^2$ to be positively drained into the private surface water system
Acceptable Infiltration Rates	Greater than $x10^{-6}$ m/sec
Margin for Flood Risk Warning	300mm
Area Reduction Factor	1
Time of Entry	3 – 8 minutes
Return Period	1, 30, 100 years as a minimum
Maximum Drained Area per Gully	$150m^2$
Maximum Spacing between Gullies	35m
Minimum pipe run distance from kerb line	1.0m
Maximum length of Gully Lead	20m (15m desirable)
Minimum pipe run distance from kerb line	1.0m
Minimum Manhole distance from kerb line	500mm
Maximum Manhole Spacing	Max 90m and at all changes in direction
Gully Grating and Frame and gully pot details	D400 Gully Grating and Frame 900 x 450mm gully pot
Manhole Covers in Carriageway	150mm deep EN124 D400 ductile iron bedded on a proprietary mortar/polymer resin-based product.
Manhole Covers in Footway/verge	100mm deepEN124 C250 ductile iron
Minimum Pipe Depth	1.2m for all highway pipework (Absolute minimum 0.6m with concrete surround)
Minimum Pipe diameters	150mm gully connections 225mm carrier drains
SuDS Scheme Operation and Maintenance Manual	To be provided with Full Planning or at Approval of Reserve Matters planning Stage
Soakaway and other Infiltration Features – Minimum Distance from any building, wall, structure	Not less than 5m
Swales and other Infiltration Features – Minimum Distance from carriageways	Early engagement with Development Management Engineers is required
Soakaway – Easement Distances	5m easement around any soakaway
Soakaway – Gradients within Easement	Not Steeper than 1 in 20

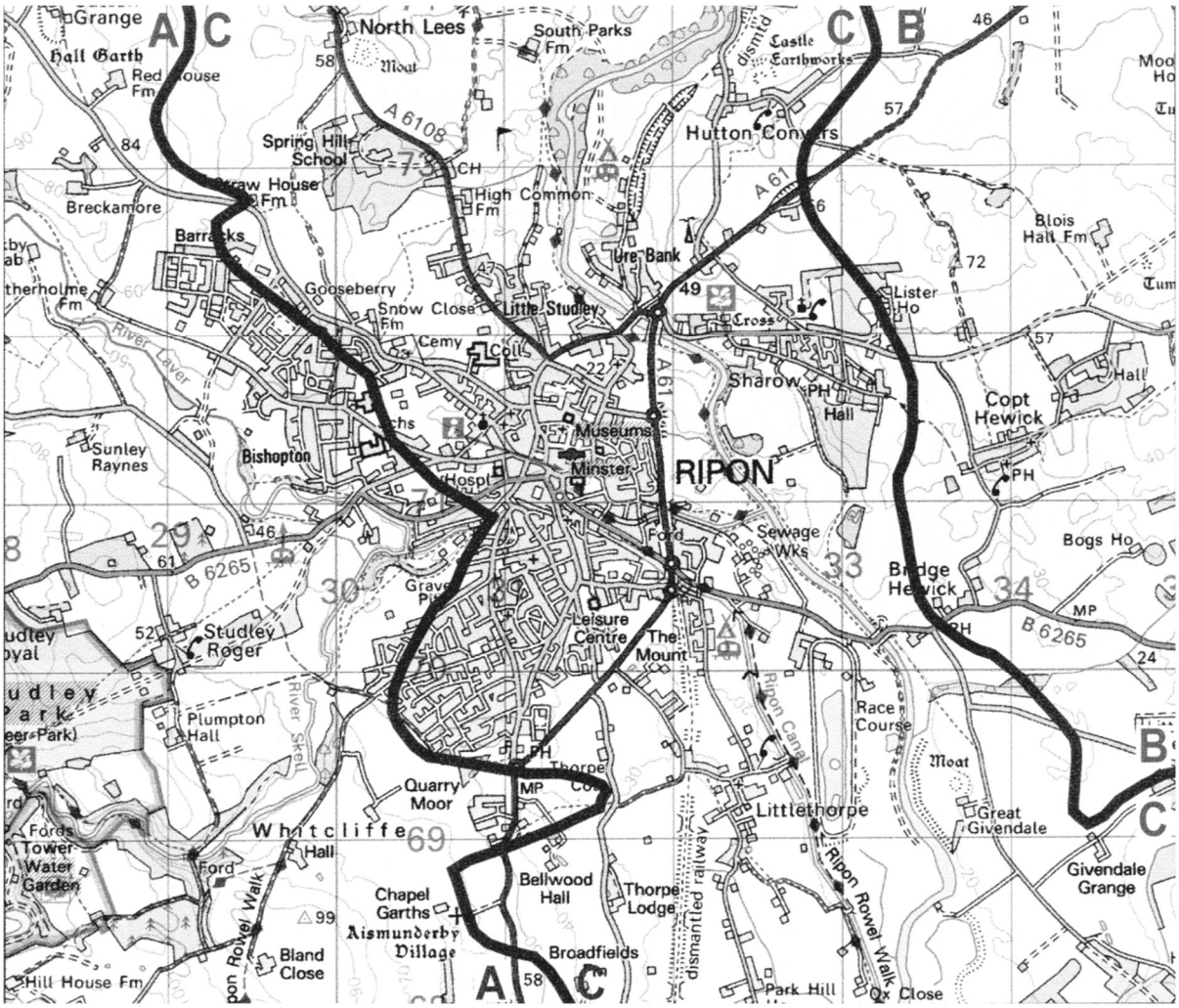
Appendix CH 16 - 1 – Permitted surface water attenuation pipe arrangement in adoptable highways for smaller development sites where other SuDS options cannot be accommodated.



Typical Cross Section showing single 900mm diameter attenuation pipe and foul system within a 4.8m wide carriageway width
(NYC Highways Standard Detail Drawing available upon request)

Appendix CH 16 - 2

DEVELOPMENT GUIDANCE MAP: POTENTIAL SUBSIDENCE ARISING FROM GYPSUM DISSOLUTION IN RIPON



Key:
DEVELOPMENT CONTROL AREAS

- **A** No known gypsum present
- **B** Some gypsum present at depth
- **C** Gypsum present and susceptible to dissolution

Geological details represented on this map are based upon an interpretation of data partly obtained from exising publications of the British Geological Survey and partly from other sources as described in the Symonds Travers Morgan technical report to the DofE: 'Assessment of Subsidence Activity Arising from Gypsum Dissolution (with particular reference to Ripon)'

The map is intended to be used only as a general guide and should not be relied upon to provide detailed information at specific sites.

Appendix CH 16 – 3

Lagoons / Ponds / Swales are to be designed to minimise the requirements for ongoing maintenance and to ensure that the pond does not cause nuisance to nearby properties.

It is expected that off line ponds will be grassed utilising a slow growing grass mixture that will tolerate the prevailing conditions and will be cut at a frequency of 6 cuts per year.

Planting of trees and shrubs will be such that falling leaves branches and root systems will not have an adverse impact on the pond.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal	Monthly
	Grass cutting – access route	Monthly during growing season, or as required
	Grass cutting – in and around basin	Half yearly Spring (before bird nesting season) and Autumn
	Manage other vegetation and removal of nuisance plants	Monthly during growing season (then as required)
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlet and outlet	Annually (or as required)
	Flow control device cleaning	
Occasional Maintenance	Re-seed areas of poor vegetation growth	Annually (or as required)
	Prune and trim trees and remove cuttings	3 years (or as required)
Remedial Actions	Repair of erosion or other damage by re-seeding or re-turfing	As Required
	Repair / Rehabilitation of outlet	As Required
	Re-level uneven surfaces and reinstate design levels	As Required
Monitoring	Inspect outlet for blockages and arrange clearance if required	Monthly / after large storm event
	Inspect bank sides, structures, pipework etc for evidence of physical damage	Monthly / after large storm event
	Inspect facility surface for silt accumulation and establish appropriate silt removal frequencies	Half Yearly
	Check flow control device and arrange clearance/maintenance if required	Monthly / after large storm event

Suggested Maintenance requirements based on Table 16.1 CIRIA C697 'The SuDS Manual'