



Management of Sustainable Urban Drainage Systems

At

Blake's Mead, Felpham

For

Barratt David Wilson, Southampton

January 2011
Revision 4.0

Introduction

Greenbelt Group Ltd (GGL) is the UK's largest private land management company solely set-up to manage open space within new residential developments. Our land portfolio includes the ownership, operation and maintenance of over 100 Sustainable Urban Drainage Systems (SUDS) throughout the UK.

This management document sets out how Greenbelt Group will own and implement the long-term management responsibilities for part of the SUDS on the Blake's Mead development.

Greenbelt Group is actively involved in developing technical knowledge for the long term operation and maintenance of SUDS having participated in a DTI funded Knowledge Transfer Partnership with the University of Abertay, Dundee. This partnership has provided the knowledge and expertise in producing this document based upon CIRIA's latest technical information for SUDS (c697 The SUDS Manual, CIRIA, London: 2007), Greenbelt Group's in-house knowledge of landscape management and advice from specialists from the University of Abertay's Urban Water Technology Centre.

Management Plan for Sustainable Urban Drainage Systems

The cost to manage the SUDS will be funded through a financially sustainable income stream secured against all of the properties on the development. The income is linked to the Retail Prices Index and therefore does not diminish in value and includes capital replacement provisions to cover the long-term replacement of capital items.

Detention basins A, B and 1 on the development side of the Bognor Regis Relief Road (BRRR -which will be the A259) are part of the open space provided on the development for the general use by the public. These features also provide a secondary role as rain water attenuation ponds during periods of prolonged and/or heavy rain.

Attenuation ponds C&D on the north (Hoe Lane) side of the BRRR are designed to remain permanently wet with spare capacity for additional storage during periods of prolonged and/or heavy rain.

Short Term Establishment and Handover

The transfer of management responsibility to GGL may be staged during construction subject to certain contractual obligations being in place which includes the SUDS to be constructed and signed off by the Developer's construction engineer.

Handover of all design information on the SUDS structures will be made in accordance with the Handover Checklist (Appendix A.)

During construction the SUDS will be routinely inspected by GGL personnel to observe silt levels which may build-up owing to run-off during the development phase and the findings reported direct to Barratt David Wilson (BDW). If required the systems will be cleaned to a method determined by an independent consulting engineer and under their supervision. The arising will be tested for contaminants and safely disposed of at a licenced site. Management responsibility will only transfer to GGL on satisfactory completion of the soft landscaping and initial de-silting works.

Following on from the design risk assessment, the GGL emergency site management plan will apply to the area, taking account of the risks and hazards identified. If required, this will include prior liaison with the emergency services to provide details of site location, access routes and maximum depth of water.

Prior to handover, the attenuation ponds and detention basins will be periodically inspected and managed by site personnel, implementing the applicable elements of the long-term summary management specification, attached as Appendix B.

Management Objectives

Short Term

The primary objectives are to ensure satisfactory establishment and stabilisation of the system including the adjoining landscaped areas and to ensure public safety is maintained.

Medium to Long Term

The transfer of management responsibilities are as follows:-

1. Public safety.
2. To maintain an efficient flood attenuation system, in consultation with Arun District Council, Southern Water and the Environment Agency.
3. To maintain regular liaison with the residents and explain the role of the SUDS to the development and the wider community and the role they can play in maintaining clean discharges into and out of the system.
4. To manage and develop the visual amenity of the attenuation ponds and detention basins by maintaining the soft landscaping in accordance with the approved Landscape Management Plan, this includes:
 - a) Grass cutting both amenity and filter grass.
 - b) Litter collection and disposal.
 - c) Shrub maintenance.
 - d) Periodic inspection and management of trees including coppicing where applicable.
 - e) Inspection and repair of perimeter fences, gates, paths and other features.
 - f) Regular inspection of structures associated with the function of the SUDS.
5. To encourage the development of ecological interest, in so far as this can be achieved subject to the incoming water quality (taking account of highway salt and other materials that may be discharged by the public).

Public Safety

It is well understood that bodies of water, whilst they can represent very attractive features which have ecological value and play an essential role in flood attenuation, represent a potential safety hazard, particularly to small children.

Whilst vegetation around the attenuation ponds is of benefit both ecologically, and visually, such planting will also be carried out and subsequently managed as part of the safety mechanisms for open water.

There will be occasions in the life of the system when children may enter areas of open water. To mitigate the potential hazard SUDS are designed with shallow side slopes so that it is possible to escape from the ponds by crawling up the banks. RoSPA recommends that slopes should be sufficiently shallow that any person wading into the water can proceed for at least twice their own height and remain standing with their head well above water. RoSPA also recommends the use of even grades and the avoidance of sudden shelving areas of deep water.

The provision of safety equipment requires very careful consideration as this can often be used as a substitute for proper safety planning. Any equipment, which may be installed, will be subject to periodic inspection in accordance with the summary regime at Appendix B. Appropriate warning signs may also be placed around the edges of the attenuation ponds, and subject to the inspection and maintenance regime.

SUDS information leaflets will be distributed to the local residents as a part of the initial liaison. The GGL free phone number is printed on these leaflets in order to provide an easy point of contact. This allows direct access to the customer care procedure.

Maintenance

The summary maintenance regime for the SUDS in Appendix B will be supplemented by maintenance to the vegetation and perimeter fencing where applicable.

In addition to regular routine items, SUDS maintenance will be carried out, and may include de-silting the attenuation ponds, usually on a 10-15 year cycle. This can be an intrusive operation when carried out within housing areas. Prior to any planned de-silting or dredging, consultation will be undertaken with Arun District Council, Southern Water and the Environment Agency.

Before these operations are carried out, members of the public in the general area will be informed and those in the immediate vicinity will be notified in writing well in advance of commencement of works.

The dredging work will be carried out under the supervision of consulting engineers and to a pre-agreed method statement. In the event that the attenuation ponds develop particular wild life interest then careful consideration will be given to the timing of this operation.

The accumulation of silts in the siphon below the existing pumped foul main and the sumps in the access chambers will be monitored on a monthly basis until the appropriate cycle for de-silting is determined. Monitoring will be carried out from the main access chamber using a flexible, extendable draining rod fitted with a 150mm dia perforated disc which will be used to determine resistance in the siphon due to the accumulation of silt. Cleansing will be carried-out using a vacuum drain clearing unit with all silts disposed at a licenced transfer station.

Inspection of the siphon pipe work will be carried out by CCTV on an initial 6 month basis for the first two years and thereafter on a bi-annual basis or as directed by an appointed drainage engineer.

Interconnecting pipes between the attenuation ponds and the detention basins, the piped outfalls, inspection chambers will be inspected annually by a drainage engineer, or after a flood event for damage to the structure and any build-up of silts or debris. Every five years the pipe work will be inspected using CCTV.

Headwalls and grilles will be inspected once a fortnight to check the security of the grille and guard fence. The accumulation of debris will be removed during each visit and disposed at a licenced tip.

Water Quality

GGL will be responsible for the removal of material deposited within the system as part of the periodic litter inspection. Any contamination entering the system will be reported to the appropriate body and action taken to contain the spillage until it can be safely removed.

In the event of severe pollution GGL will liaise with the Environment Agency and Arun District Council in prosecuting the polluter.

Pond Ecology

As the attenuation ponds C&D become established they will start to develop ecological importance and support amphibians and invertebrates. To facilitate the colonisation, the public will be discouraged from introducing fish into the ponds.

Potentially, wetland birds will come to use the attenuation ponds for feeding, nesting and roosting. To minimize disturbance an ecologist will undertake a walk over survey to identify the presence of any protected or key species. De-silting works can then be timed to avoid the nesting season; spawning and the emergence of invertebrates, in doing so reduce the impact on the local environment.

Periodic Review

The system will be subject to a 5 yearly review to establish if the current management regime is meeting the management objectives. This will require liaison with Arun District Council, Southern Water, the Environment Agency and the Highways Authority. Any significant changes to the approved Management Plan will be first referred to the Planning Authority for approval.

APPENDIX A

SUDS Handover Checklist

This sets out the level of information required by GGL from BDW prior to the transfer of management responsibilities.

The document has been produced by the GGL in consultation with the Urban Water Technology Centre (UWTC) of the University of Abertay Dundee. The criteria reflect the information required for the design and operation of SUDS in order to satisfy water quantity, water quality and amenity requirements.

The level and extent of information accords with latest UK SUDS guidance from design through to implementation, handover and aftercare.

Published guidance used for the checklist includes:

- Drainage Assessment: A Guide for Scotland, SUDSWP (2005),
- The SUDS Manual, CIRIA (2007),
- Site handbook for the construction of SUDS, CIRIA (2007),
- Sustainable Urban Drainage Systems. Design Manual for Scotland and Northern Ireland, CIRIA (2000), and
- Construction (Design and Management) Regulations, HSE.

Further guidance has been obtained from the publication from Scottish Water "Sewers for Scotland 2nd Edition".

SUDS Handover Checklist

The following information must be supplied prior to the adoption of Sustainable Urban Drainage Systems to the Greenbelt Group.

1.A Drainage Assessment for the Development, as detailed by the Sustainable Urban Drainage Scottish Working Party (SUDSWP, 2005) including:

1.1	Method statement detailing how surface water arising during construction will be dealt with and if temporary or sacrificial SUDS will be established for dealing with construction run-off.
1.2	An overview of the historical and current drainage patterns including water courses, ditches, culverts, sewers and general land drainage, both within and adjoining the site and confirmation that the SUDS design includes surface water, or groundwater entering the development from any adjacent land.
1.3	A statement of SUDS to be incorporated and final discharge point(s) where relevant, including how the drainage design satisfies SUDS techniques , both in terms of treatment of water quality and attenuation of water quantity, in accordance with best practice and design.
1.4	A proposed drainage plan identifying the type(s) of SUDS to be incorporated and SUDS land take . Adequate land area must be designated for SUDS facilities , which must also allow for access and maintenance.
1.5	Calculations showing the drain down time of the SUDS.
1.6	Indication of overland flow routes and safeguarding of properties from flooding.
1.7	Confirmation of land ownership of all land required for drainage , including SUDS measures and details of which body will be responsible for vesting and maintaining individual aspects of the surface water drainage.
1.8	Appropriate design calculations are required for the entire surface water drainage system including those where SUDS form part of a drainage network including piped surface water systems, irrespective of ownership or maintenance responsibility.

1.B Additional requirements.

1.9	A description of safety measures to render SUDS acceptably safe including signage and ice strategy assessment (see point 3.3 below).
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2. Design Information

2.1	Site survey (based upon a topographical survey carried out on completion of the works) and as built drawings including drainage layout plans (as approved by the L.A. / Environmental Regulator), SUDS component details (pre-treatment, inlet/outlet, headwall, check dam details etc) and planting specification. This information should include: - Clearly defined boundaries of the land to be maintained. - Levels and contours of land, trees, soft and hard areas. - Location of all features i.e. manholes, banking, SUDS, inlet/outlet structures, fences, paths, roads etc. - Spot levels at significant locations in addition to the contours.
2.2	Specification of materials.
2.3	Summary of hydraulic analysis including: - Maximum and minimum water levels. - Peak flows to critical areas of the system. - Flow control features.

3. Construction Details

3.1	Contractors' method statements for construction of the SUDS.
3.2	Validation report, detailing: - Any inspections of the SUDS, including sediment inspections and any sediment removal undertaken, detailing chosen disposal route - Reasons for any variations from the initial design - Any non-compliance.
3.3	Health and safety file information (as specified by the Construction [Design and Management] Regulations 1994) relevant to the surface water system to be adopted.

References

1. Sustainable Urban Drainage Scottish Working Party (2005). *Drainage Assessment. A guide for Scotland*. [online]. Available from: www.sepa.org.uk
2. Construction Industry Research and Information Association (2000). *Sustainable Urban Drainage Systems. Design Manual for Scotland and Northern Ireland. CIRIA Report C521*. London: CIRIA.
3. Construction Industry Research and Information Association (2007). *Site handbook for the construction of SUDS. CIRIA Report C698*. London: CIRIA
4. Construction Industry Research and Information Association (2007). *The SUDS Manual. CIRIA Report C697*. London: CIRIA
5. Scottish Water. *Sewers for Scotland. Draft SUDS Document*. [online]. Available from: http://www.scottishwater.co.uk/portal/page?_pageid=627,4259793&_dad=portal&_schema=PORTAL
6. Health and Safety Executive (2004). *Construction (Design and Management) Regulations 1994: The Health and Safety File. Construction Information Sheet No 44*. [online]. Available from: <http://www.hse.gov.uk/pubns/conindex.htm>

APPENDIX B

SUMMARY SPECIFICATION FOR THE MAINTENANCE OF SUDS

ATTENUATION PONDS (C&D)

The attenuation ponds will be subject to a routine monitoring and maintenance schedule as part of GGL's site management. This will be carried out at regular intervals between 1 April and 31 October and monthly intervals between 1 November and 31 March unless otherwise detailed below, and shall comprise of the following operations:

1. Collection and removal of litter from the attenuation ponds, inlets, outflows, and water margins once a fortnight;
2. The grass areas surrounding the attenuation ponds will be mown twice yearly to a minimum height of 100mm to prevent weed growth and to establish a dense sward.
3. Inspection of the attenuation ponds to check the following, and repair as necessary:
 - a) any failure in the operation of the inlet and outlet headwalls unless adopted by others in which case they will be notified of any observed defect.
 - b) any damage or erosion to the perimeter edges and slopes of the attenuation ponds;
 - c) damage to, or build-up of weed within, the perimeter aquatic vegetation;
 - d) the integrity of all fences and the condition of all safety equipment, as appropriate;
4. All necessary steps to ensure that oil film, algae or blanket weed growth is not allowed to build up on the water surface, or attenuation pond margins.
5. An annual check carried out by a suitably qualified person, to assess the condition and operation of the attenuation ponds inlet and outflow, and the accumulation of silt/sediment.
6. A record of maintenance visits and remedial operations shall be maintained.

The above operations shall be in conjunction with routine grounds maintenance operations where surrounding landscape is the responsibility of GGL.

The Siphon

The accumulation of silts in the access chamber sumps and the siphon below the existing pumped foul main will be monitored from the inspection chambers on a monthly basis until the appropriate cycle for de-silting is determined. An initial visual inspection in both chambers will determine if the level of silt or debris in the siphon is reducing the flow through the system. If the system is obstructed the siphon will be cleansed using a vacuum drain cleaning unit. If the system is seen to be working correctly, the level of silt in the siphon will be determined by using a flexible, extendable draining rod fitted with a 150mm dia. perforated disc. By pushing the rod from the inlet chamber the resistance felt by the operative will provide an indication on the level of silt in the siphon and the course of action required to maintain the flow within the system. Resistance will indicate

an accumulation of silts which will need to be removed by using a vacuum drain clearing unit with all silts disposed at a licenced transfer station.

Inspection of the siphon pipe work will be carried out by CCTV on a six monthly basis for the first two years, then bi-annually or as directed by a drainage engineer.

Pipe Work

Interconnecting pipes between the attenuation ponds, detention basins, the piped outfalls and inspection chambers will be inspected annually by a drainage engineer, or after a flood event for damage to the structure, a build-up of silts or debris. Every five years the pipe work will be inspected using CCTV.

Hydrobrake Control Chamber

Chambers and hydrobrake control will be inspected annually or after a flood event by a drainage engineer, for damage to the structure or control unit and to check for a build-up of silts and debris.

Headwalls and Grilles

Each head wall will be inspected once a fortnight to check the security of the grille and guard fence. The accumulation of debris will be removed during each visit and disposed at a licenced tip.

MAINTENANCE OF DETENTION BASINS AND DITCHES (A, B & 1)

Generally

The detention basins shall be maintained as amenity grass with the ditches mown twice yearly to a minimum height of 100mm to prevent weed growth and to establish a dense sward. Grassed areas (and any installed flow controls) will be inspected on an annual basis. The surrounding open space shall be managed in accordance with best horticultural practises.

Careful inspection for and noting of, any significant litter and debris and accumulation will be made especially around the flow controls and at the ditch outlet (and around any level spreader if one is located at the inlet). Potentially large blocking objects will be removed and dealt with.

An initial inspection of the detention basins and ditch vegetation will take place within a month of the initial permanent site stabilisation. Any woody or shrubby growth in the channel of the ditch will be removed. Here the grass will never be close mowed as this reduces the hydraulic and filtration capacity of the ditch.

Eroded or failed areas will be re-seeded as soon as possible (preferably within the first seeding season).

The outlet channel will be kept free of all obstructions, bank or rip-rap scouring as well as sediment and debris accumulation likely to impair its function. Immediate action will be taken to remedy any noted defects. Both side slopes and check dams will be inspected for any signs of significant settlement or slumping along the shoulder of the detention basins and ditch. Any damaged areas will be filled, compacted and re-seeded within the first grass seeding season.

Litter will be removed at the same time as other open areas with a minimum two-weekly visit during the summer period and monthly during the winter.

Culvert Headwall

Each headwall will be inspected every six months or after a flood event. The accumulation of debris will be removed during each visit and disposed at a licenced tip.

Pipe Work

Culvert pipes under footways within the open space areas will be inspected every 6 months by a drainage engineer, or after a flood event for damage to the structure and for a build-up of silts or debris.

Every five years the pipe work will be inspected using CCTV.

Amenity Grass

- Prior to all grass cutting operations litter and debris shall be collected and removed off site.
- All arisings on roads, pathways and within the detention basins shall be removed before leaving site.
- All growth at, and around obstacles, fence lines, shrub beds shall be cut at the same time as the mowing operation.
- Where there are bulbs, cutting will not commence until at least 6 weeks after flowering.
- Amenity Grass shall be cut to the frequency sufficient to ensure that the height does not exceed 65mm and that it is cut to a height of 25mm
- All amenity grassed areas will have a spring application of a selective weed and feed.

Shrub Beds

- Where there is no covering of bark mulch beds will be forked at a frequency to ensure effective aeration of soil.
- Where there is bark mulch covering, they will be topped up to a depth of 20mm, to maintain a 50 -75mm depth.
- Weeds will be controlled by chemical or mechanical means at each visit and all dead vegetation removed.
- Formative pruning will be carried out for each species at the appropriate time of the year
- Perimeter growth will be pruned as and when required.
- All dead diseased dying or damaged plants will be removed at each visit and replaced with the same species and size during the next available planting season (September-March). All nursery stock will comply with British Standard BS 3936 -1 1992 Nursery Stock part 1 Specification for Trees and Shrubs
- All amenity grass edges to shrub planting shall be re-formed and maintained, using a half moon edging iron or similar to ensure a distinct edge. Soil edges shall be banked up to approx 45 degrees and residual edgings shall be removed off site.

Standard Trees

- Standard trees will be checked and stakes and ties adjusted on a monthly basis for firmness, vertical positioning, rot or damage. All redundant stakes will be removed not sawn off at ground level. Epicormic growth will be removed as and when required.
- Any dead or damaged trees (including any associated stakes) will be replaced with a similar size and species within the next available planting season. The replanting will comply with British Standard BS 4043 1989 Transplanting Root Balled Trees

Fencelines

- All edges shall receive applications of herbicide at intervals sufficient to prevent encroachment.
- Fencing will be inspected and repaired or tensioned as necessary.

Footpaths

- Footpaths and areas of hard standing will be inspected during every visit for damage or wear and tear which creates a trip hazard. If the damage can be rectified during the visit the repairs will be undertaken before the contractor leaves the site. If the repairs require a specialist contractor to repair the damage the site will be made safe and fenced off from public use until the repair works can be completed.
- The surface of the footpaths and hard standing will be kept free of weed, moss and algae growth by applying a suitable contact herbicide during favourable conditions to avoid herbicide drifting onto the surrounding grass and shrubs
- Following grass cutting operations the footpath and hard standing will be swept for grass cuttings and debris and the arisings taken off site to a licenced tip