

**PROPOSED RESIDENTIAL DEVELOPMENT
MANOR FARM
BEDHAMPTON
HAMPSHIRE**

FLOOD RISK ASSESSMENT & DEVELOPMENT DRAINAGE STRATEGY

BARGATE HOMES LTD

REV B

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Appendices

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- Appendix G – LLFA Response
- Appendix H – SUDS Management and Maintenance Plan

References

Environment Agency Flood Map Information © and database right www.environment_agency.gov.uk

Contains British Geological Survey materials © NERC (2018)

National Planning Policy Framework (Department for Communities and Local Government, March 2012)

PPG Flood risk and coastal change (Department for Communities and Local Government, March 2014)

Havant Borough Council Strategic Flood Risk Assessment, 2018 (SFRA) (HBC, November 2018)

Hampshire County Council Preliminary Flood Risk Assessment (PFRA) (HCC, April 2011)



1 Executive Summary

SITE INFORMATION	CLIENT	Bargate Homes Ltd
	SITE NAME	Manor Farm
	SITE LOCATION	SU 70016 06118 Bedhampton Havant Hampshire
	SITE AREA	3.9 ha
	CURRENT LAND USE	Greenfield – Arable / Agricultural grassland
	PROPOSED LAND USE	No. Residential Dwellings (Class C3A)
	SITE GEOLOGY – Superficial	River Terrace Deposit – Sand, Silt, Clay
	SITE GEOLOGY - Bedrock	Lewis Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations – Chalk
	SOIL INFILTRATION RATE	Superficial: Insufficient. Underlying Chalk: 1×10^{-4} m/s
	GROUNDWATER LEVELS	~3.8m Below Ground Level
	GROUNDWATER SPZ / AQUIFER	SPZ 1 close by/ Principle (Bedrock), Superficial (Secondary A) Vulnerable
	GROUND CONTAMINATION	TBC – None anticipated
FLOOD RISK	ENVIRONMENT AGENCY FLOOD ZONE	Flood Zone 1 - Lowest Risk < 0.1% (<1:1000)
	FLUVIAL (RIVERS & WATERCOURSES)	Not a risk
	PLUVIAL (SURFACE WATER)	Not a risk
	GROUNDWATER	Not a risk
	EXISTING/PROPOSED SEWERS & MAINS	Not a risk
	ARTIFICIAL	Not a risk
	TIDAL	Not a risk
FOUL & SURFACE	PROPOSED SURFACE WATER STRATEGY	Gravity - Infiltration
	PROPOSED SUDS TYPE	Swales, Filter Trenches, Pond, Reed Bed, Attenuation Basin
	EXISTING SW PEAK FLOW RATE	Greenfield QBar: 3.9 l/s
	PROPOSED SW PEAK FLOW RATE	N/A – Infiltrating
	FOUL WATER STRATEGY	Gravity to Portsmouth Water Foul Sewer
	EXISTING FW PEAK FLOW RATE	N/A
	PROPOSED FW PEAK FLOW RATE	2.3 l/s (SFA 4000 l/unit/d) for 50 Units
MISC	FURTHER INVESTIGATIONS	N/A

2 Introduction

2.1 Scope

Bargate Homes is seeking full planning permission for the construction of No.50 residential dwellings with associated infrastructure including development access roads, SuDS, vehicle parking, domestic gardens and areas of public open space. The 38,575m² (3.9ha) site is located at land adjacent to Lower Road, Bedhampton. Refer to Appendix A for site layout.

2.2

MJA Consulting has been appointed to provide a Flood Risk Assessment & Drainage Strategy suitable to submit as part of the planning application for the disposal of foul and surface water from the proposed development.

2.3 Report Structure

The National Planning Policy Framework (NPPF) and the Flood Risk and Coastal Planning Practice Guidance (PPG) is the current guidance on development and flood risk in England and Wales. The Flood Risk technical guidance for the National Planning Policy Framework requires a Flood Risk Assessment (FRA) to be carried out on sites over 1ha to consider all potential forms of flooding including that from river, sea, estuarial, land drainage, groundwater, overland flow, surface water run-off, sewer systems, and artificial water bodies (lakes, reservoirs, canals etc.) to both the development site and to offsite parties and land.

2.4

This report will take the structure of a 'Flood Risk Assessment' in accordance with the National Planning Policy Framework, the Flood Risk and Coastal Planning Practice Guidance, Environment Agency's Flood Risk Assessment Guidance and CIRIA Report 624 'Development and Flood Risk.

2.5

The objectives of this report are:

- To confirm whether the proposed development site is affected by current or anticipated future flooding from all sources for the lifetime of the site.
- To confirm that this development will not increase the risk of flooding to any offsite properties and land or increase the population within a floodplain.
- To undertake calculations to establish the foul and surface water runoff rates from the existing site and to assess the potential foul and surface water runoff from the proposed development.
- To detail a suitable strategy for the management of foul and surface water generated from the proposed development allowing for future climate change.
- To satisfy the approving planning authority that the most sustainable foul and surface water drainage solutions have been considered, in line with Environment Agency guidance, The Building Regulations (Document H 2002) and government legislation such as the Flood and Water Management Act 2010 (Defra) and The National Planning Policy Framework (NPPF & PPG).

3 The Development Site

Figure 1: Site location

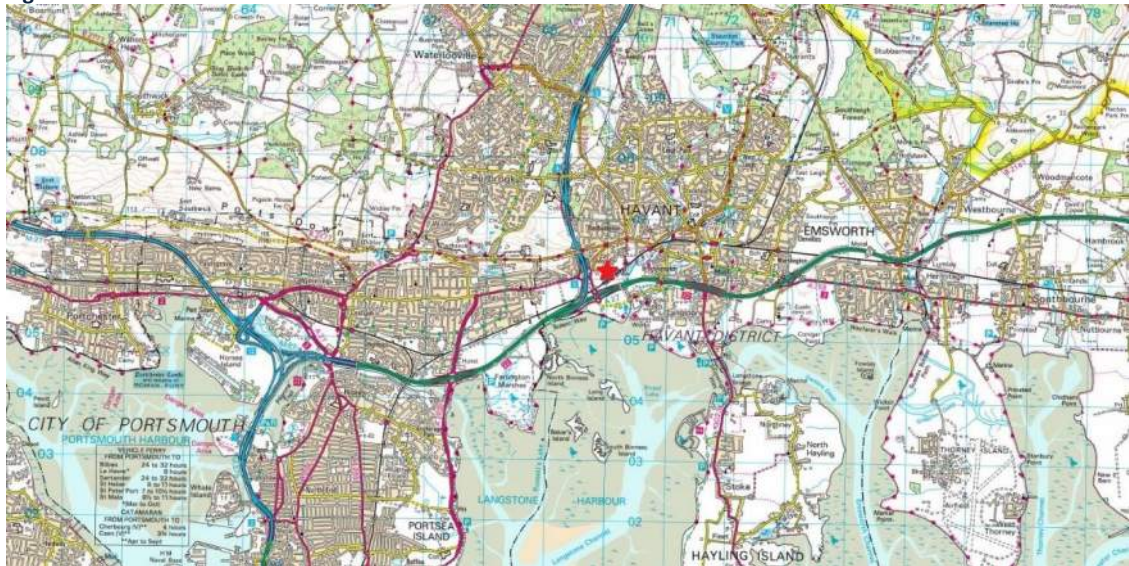


Image courtesy of: Bing Maps, 2018 Microsoft Corporation Image courtesy of Ordnance Survey

Figure 2: Development boundary



Image courtesy of: Google Maps, 2018 Microsoft Corporation

3.1 Site Location and Description

The application site is located at land south west of Bedhampton in Hampshire. The site is centred on National Grid Reference SU 70016 06118 and is bound by Lower Road to the north and the railway line to the south. The A27/A3(M) lies to the west and arable land to the east of the site. The 38,575m² (3.9ha) parcel of land comprises an arable field.

3.2 Topography

A topographical survey of the site was undertaken by Encompass Surveys in Sept 2015 which indicates the site is relatively flat with levels ranging from 6.0mAOD to 9.3mAOD (metres above Ordnance Datum). Refer to Appendix B for a Topographical Survey of the existing site.

3.3 Geology

Information published by the British Geological Society (BGS) indicates the underlying geology at the site as Lewis Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations – Chalk, with superficial deposits of River Terrace Deposits – Sand, Silt and Clay.

3.4 Ground investigations were carried out in September 2017 and confirmed the site is underlain by sandy, silty clay over chalk substrata. The Clay is circa 1-3m thick. The clay is at its thinnest in the south west corner.

3.5 Soil Permeability

Soil infiltration testing in accordance BRE 365 methodology was carried out in eight trial pits on site. The tests failed to achieve 75% drain and therefore failed to comply with BRE 365 “soakaway design”. Additional testing in the chalk just below the clay layer also showed low insufficient infiltration rates. Falling head tests in boreholes circa 14-15m below ground level showed higher soakage rates of 1.4×10^{-4} m/s, likely due to fissures in the chalk.

3.6 Groundwater

Groundwater levels were taken during the intrusive investigation. These tests were carried out in 2017, 2018 and 2019 during and after the winter recharge periods when groundwater levels are typically at their maximum.

3.7 Groundwater was encountered at various depths across the site but on average was 3.8m BGL, with a maximum level recorded at 3.52m BGL.

3.8 Historic BGS borehole records in the *vicinity* of the site are available and show the highest water level as circa 1.2m BGL.

3.9 Hydrogeology

The Environment Agency’s mapping website (<http://magic.defra.gov.uk/MagicMap.aspx>) has classified the site as not within a Source Protection Zone but it is located 20m south (downstream) of a Zone 1 Source Protection Zone. The flow of water from the site is away from the abstraction point, towards the coast.

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- 3.10 The bedrock Chalk formations are classified as ‘Principle’ aquifers. These are layers of rock that provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- 3.11 The superficial deposits are classified as a ‘Secondary A’ aquifer. These are permeable layers of rock that can support water supplies on a local rather than strategic scale. They may be an important source for base flows to rivers.
- 3.12 **Hydrology and existing site drainage characteristics**
The existing site is undeveloped grassland, as such rainfall that lands on the site firstly infiltrates directly at source and into the underlying soils. It is likely the site has relatively poor surface water drainage with some overland flow due to the relatively steep topography.
- 3.13 The closest watercourse is located approximately 85m east of the site and the site is located approximately 730m north of Langstone Harbour.
- 3.14 **Ground Contamination**
The available environment data does not indicate the presence of any significant sources of contamination risk on site and no visual or olfactory evidence of soil contamination was identified during a site walkover.

4 Flood Risk

4.1 The assessment of flood risk to the site requires that all potential forms of flooding are considered. In accordance with the Environment Agency's Flood Risk Assessment Guidance, NPPF, PPG and CIRIA Report 624, sources of flooding to be assessed include tidal, fluvial (rivers, streams and watercourses), pluvial (overland rainfall runoff), groundwater, artificial sources (canals and reservoirs) and existing / proposed sewerage and water mains infrastructure.

4.2 History of Flooding

During the data collection process it is important to consider the information which already exists for the site location with respect to flood risk. The main sources of data for flood risk and recorded incidents of flooding for this site has been the *Havant Borough Council Strategic Flood Risk Assessment (SFRA) (HBC, November 2018)* and the *Hampshire County Council Preliminary Flood Risk Assessment (PFRA) (HCC, April 2011)*. Additional information has been obtained from The Environment Agency, British Society Chronology of Extreme Hydrological Events, local news and media outlets.

4.3 Within the SFRA/PRFA studies, consultation was carried out with all appropriate authorities and organisations including the Environment Agency, Portsmouth Water, Havant Borough Council and local community stakeholders to identify known or perceived problem areas with respect to flooding.

4.4 With reference to the above, and in the context of the proposed development, there are no historic issues of flooding from the following potential sources including:

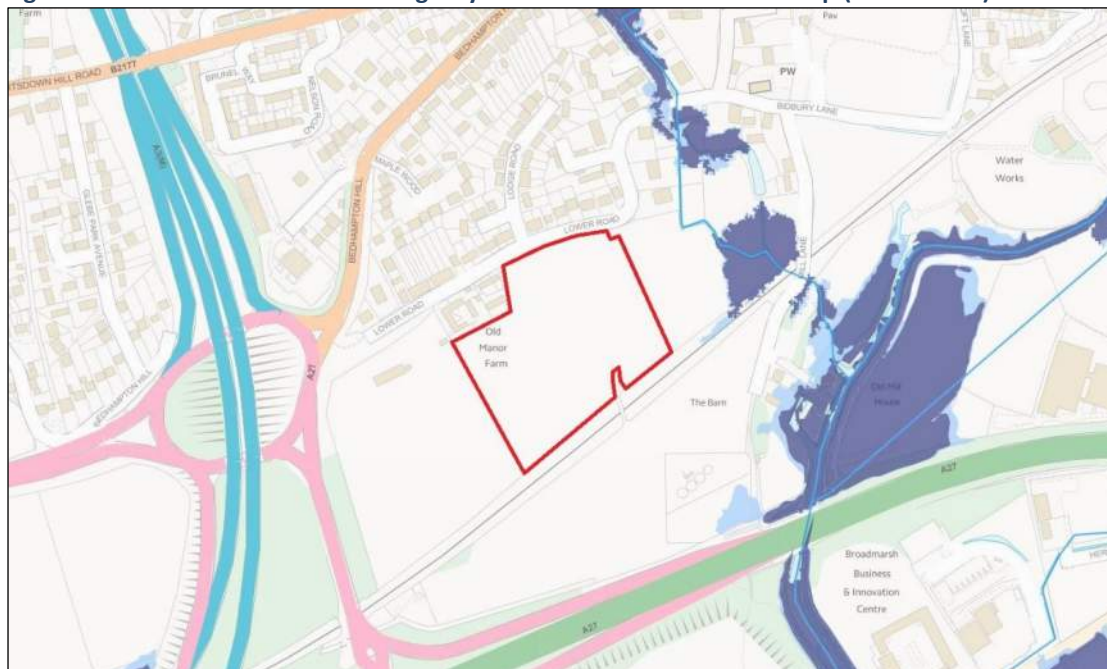
- Fluvial (Rivers)
- Tidal.
- Groundwater.
- Pluvial (Surface water runoff).
- Existing foul, storm and combined sewers or potable water main infrastructure.
- Artificial infrastructure.

4.5 Fluvial

The closest stream, also a main river classification, to the site runs north to south ~340m to the east and flows into Langstone Channel and the Solent. The Environment Agency confirms that no incidents of flooding from main rivers or ordinary watercourses have been recorded within the site boundary.

4.6 The Environment Agency (EA) is the principal flood risk management operating authority in England. The EA have carried out a national flood risk assessment (NaFRA) which assesses the probability of flooding to land from all main rivers in England. The results of this modelling are combined and calibrated against data from recorded flood events to produce the Environment Agency's Flood Zone Map (Figure 3).

Figure 3: Extract from Environment Agency River and Sea Water Flood Map (March 2019)



Contains Environment Agency information © Environment Agency 2019

Key:

 Main Rivers

Dark Blue : (Flood Zone 3)

Shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded: from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light Blue : (Flood Zone 2)

Shows the additional extent of an extreme flood from rivers or the sea.

These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

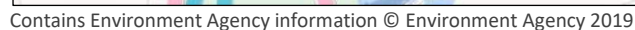
Clear : (Flood Zone 1)

Shows the area where flooding from rivers and the sea is very unlikely.

There is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

- 4.7** The latest Environment Agency 'Flood Zone Map' (March 2019) indicates the site is located within the lowest risk category - Flood Zone 1. 'Flood Zone 1' is land assessed as having a less than 1 in 1000 (<0.1%) annual probability of flooding from a main river in each year and is not within an area of recorded river flooding.
- 4.8** Hampshire County Council as the Lead Local Flood Authority (LLFA) are responsible for assessing the flood risk from all other ordinary watercourses (non-main rivers) in the Bedhampton area, with this information detailed in the Havant SFRA. This study has concluded that the site is not at risk of flooding from all ordinary watercourses within the locality of the development.

- Figure 4: Extract from Environment Agency Surface Water Flood Map (March 2019)**



 High (Greater than 1:30(3.3%) chance of flooding)

 Medium (Between 1:100(1%) and 1:30(3.3%) chance of flooding)

 Low (Between 1:1000 (0.1%) and 1:100 (1%) chance of flooding)

 Very Low (Less than 1:1000 (0.1%) chance of flooding)

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- 4.13 This map indicates that the existing site has a ‘very low’ (less than a 1:1000 or 0.1%) risk of flooding from surface water runoff.
- 4.14 The implementation of a robust SuDS scheme to collect, attenuate and convey the surface water runoff from the proposed development will mitigate any residual risk of surface water flooding to the site in its developed state.
- 4.15 **Groundwater**
The PFRA, SFRA and the Environment Agency confirm that no recorded events of groundwater flooding have been identified at or within the vicinity of the site.
- 4.16 Groundwater was encountered at depth of circa 3.8m during site investigations.
- 4.17 **Artificial Sources**
With reference to the SFRA/PRFA there have been no recorded incidents of flooding to the site or surrounding areas from artificial sources.
- 4.18 There are no additional artificial sources of flooding, such as that from canals, reservoirs and sewage treatment works within a 1 km radius of the site.
- 4.19 **Overland Flood Flow / Exceedance**
The occurrence of overland flooding at the site due to an extreme rainfall event exceeding the design capacity of the drainage system and SuDS, or a failure of the associated flow controls have been considered both during the construction and operational phase of the development.
- 4.20 If SuDS or the piped drainage system becomes overwhelmed by exceptional rainfall then exceedance routes are proposed to protect people and property by providing unobstructed overland flow routes across the development.
- 4.21 The design levels of hard paved and landscaped areas will aim to contain and convey flood flows through areas of the site to cause minimum flood risk to properties and residents such as parking areas and low-lying open space.
- 4.22 All proposed attenuation features within the development are designed to manage the 1 in 100 year return storm (1% chance of occurrence each year) plus an extra allowance of 40% for the potential increase in peak rainfall predicted up to 2115.
- 4.23 Any residual risk of overland flooding to properties is to be mitigated by the provision of raised property slab levels a minimum of 150mm above surrounding ground level.
- 4.24 The described protection measures ensure that properties both within the proposed development and any offsite parties and land will not be affected by overland runoff in the event of a reasonably extreme rainfall event exceeding the design storm or a failure or a blockage of the SuDS structures within the system.
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4.25 Existing Sewers & Water Mains

The SFRA confirms that for the area in which the site lies, there have been no incidents of flooding from sewers in the last 10 years.

4.26 With reference to the Portsmouth Water flood register; there have been no recorded incidents of flooding from the existing foul and surface water sewers or potable water mains within the vicinity of the development.

4.27 With reference to Portsmouth Water records and engineering drawings for the surrounding development there is a 225mm foul water sewer that runs along Lower Road to the north of the site.

4.28 There is also a 300mm foul sewer that lies 30m to the east of the site.

4.29 Portsmouth Water have confirmed that there is adequate capacity for the proposed development flows. The proposed development will have a 'no detriment' impact on the local foul sewer system and does not create an increase in flood risk.

4.30 Proposed Site Drainage

A Flood Risk Assessment requires that an evaluation of all proposed artificial drainage systems and infrastructure within, or in close proximity to the site is carried out. In the context of this development, the following systems are to be installed which need to be assessed in terms of potential flooding through the capacity of the systems being exceeded or the structural, hydraulic, mechanical or operational failure of the system occurring during the lifetime of the development:

- Piped foul water sewers, manholes and potable water mains.
- SuDS for the temporary conveyance and attenuation of surface water.
- Foul water pumping station and associated rising main.

4.31 All adoptable foul and surface water drains, sewers and manholes will be designed and constructed to the Sewers for Adoption 7th edition with all private drainage constructed in accordance with *The Building Regulations Part H, BS EN 752 or BS EN 12056-2* as appropriate, ensuring adequate design capacity and robust structural integrity for the

lifetime of the development. This will not only prevent the risk of flooding to both the development and offsite parties, but will avoid the potential contamination of groundwater by preventing the ingress of groundwater into the pipework and egress of sewage into the underlying soils.

4.32 All SuDS within the drainage system will be sized to manage the runoff from the exceptionally rare 1 in 100 storm event (1% AEP), plus an additional 40% allowance for predicted future climate change effects (in accordance with EA recommendations up to the year 2115).

4.33 The new development as a whole must not create or exacerbate existing flood risk elsewhere and in particular to properties, land and highways downstream of the site. During the design of the proposed development careful consideration has been given to the

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- 4.34 most sustainable method of surface water disposal and strict controls have been imposed to limit the peak rate and volume of runoff generated from the developed site.
- 4.35 All surface water runoff from impermeable areas on the proposed development will be and safely disposed at a controlled rate to mimic the existing natural runoff regime for the undeveloped greenfield site. This will ensure that the risk of flooding to properties and land downstream of the site will not increase as a result of this proposed development.
- 4.36 **Sequential Test**
The flood risk technical guidance to the National Planning Policy Framework (NPPF) categorises residential developments as 'More Vulnerable' within the risk classification. 'More vulnerable' developments located within Flood Zone 1 are considered appropriate under the NPPF.
- 4.37 The NPPF guidance states that planning authorities should complete a risk based 'Sequential Test' at all stages of the planning process, to steer new development to areas with the lowest probability of flooding. Under the requirements of the 'Sequential Test' and as the proposed development is already located within Flood Zone 1 (lowest risk), there are no more suitable, developable and deliverable alternative sites, better located from a flood risk perspective which could accommodate the proposed development.

5 Existing and Proposed Site Runoff

- 5.1 This section aims to calculate the estimated peak rate and volume of surface water runoff from the existing site. These discharge figures are then used to establish the post-development constraints to inform the preliminary design of the site surface water drainage strategy.

5.2 Catchment Areas

The existing and proposed permeable and impermeable areas are listed in the table below.

Site Catchment	Impermeable	Permeable	Total
Existing Site Area	0 m ²	38,575 m ²	38,575 m ²
Proposed Site Area	9942 m ²	28,633 m ²	38,575 m ²

- 5.3 This development represents an overall approximate increase of 9942 m² in impermeable area post development.

5.4 Existing Surface Water Runoff Peak Runoff Rate & Volume (Greenfield)

An assessment of the estimated current greenfield runoff rate has been carried out using the Institute of Hydrology Report 124 (QBar) methodology.

Catchment: 1.094ha (FSR)

1 in 1 year	3.3 l/s
QBAR	3.9 l/s
1 in 30 year	8.8 l/s
1 in 100 year	12.5 l/s
Volume 100y 6hr	346.5 m ³

- 5.5 Refer to Appendix D for calculations. A 10% allowance for urban creep has been included in the calculations.

5.6 Post Development Surface Water Runoff Peak Runoff Rate & Volume

The procedure for surface water management in accordance within 'Rainfall runoff management for developments' (DEFRA/EA Report – SC030219 E, 2013) states; *“For the range of annual flow rate probabilities up to and including the 1% (1 in 100 year) annual exceedance probability event including an appropriate allowance for climate change, the post-developed rate of run-off into a watercourse, sewer, or other receiving water body, should be no greater than the existing pre-developed rate of run-off for the same event”*.

- 5.7 The National Planning Policy Framework requires that consideration is given to the effect of climate change on the surface water flows generated by any new development. Table 2 of the NPPF - Flood Risk Assessments: Climate Change Allowances – Detailed Guidance (Feb 2016), specifies that an assessment of a 40% increase in rainfall intensity allowance is made when calculating post development runoff rates for residential developments.

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- 5.8 The additional volume of runoff generated from a site should also be limited to the greenfield runoff volume where possible. Where infiltration cannot be utilised to dispose of the additional volume; *“The limiting discharge for any return period up to the 1% AEP (1 in 100 year) event including climate change, shall not be greater than the mean annual peak rate of runoff for the greenfield site – Q_{Bar} or 2 l/s/ha, whichever is the greatest”*.
- 5.9 As a result of this development and the increase in impermeable areas, the peak rate and volume of surface water that could potentially runoff the proposed site if not effectively managed, could be greater than in its current undeveloped state.
- 5.10 To mitigate this potential increase, it is proposed that all surface water runoff from impermeable areas on the proposed residential development will be attenuated on site and discharged via infiltration.
- 5.11 Where possible permeable paving will be utilised on driveways and shared parking areas. This will function as under-drained, sealed-tank systems and discharge to the positive drainage network. Swales, reed beds and attenuation basins will also serve as additional attenuation and water quality treatment components.

6 Surface Water Drainage Strategy

- 6.1 The National Planning Policy Framework (NPPF) requires that developments do not exacerbate flood risks both to the development site and to offsite parties and land, which means there is a need to control surface water drainage and overland runoff to ensure there are no increases in peak rates and volumes of runoff as a result of the development.
- 6.2 Environment Agency guidance and government legislation such as the Flood and Water Management Act (Defra 2010) requires surface water drainage strategies for new developments to be in accordance with the ideals of ‘sustainable development’ via the provision of Sustainable Drainage Systems (SuDS).
- 6.3 SuDS are more sustainable than conventional drainage methods because they can mitigate many of the adverse effects of urban stormwater runoff on the environment. This can be achieved through reducing peak runoff rates and volumes to sewer networks and watercourses, reducing the risk of downstream flooding.
- 6.4 The Building Regulations Document H (2015) details the appropriate hierarchy of potential methods for disposing of surface water from a development:
1. A soakaway or some other adequate infiltration system, or where that is not practicable;
 2. A watercourse, or where that is not possible;
 3. A sewer.
- 6.5 Soil permeability rates for the superficial clay are insufficient to use conventional infiltration methods to disposing the surface water runoff generated from the proposed development.
- 6.6 There are no watercourses within the vicinity of the development site.
- 6.7 This site lies with Portsmouth Water’s service region. With reference to sewer records, there are dedicated surface water sewers along the northern boundary of the site but would require pumping to reach them.
- 6.8 Therefore, it is proposed to utilise dry detention basins with deep borehole soakaways into the chalk layer below the clay to dispose of surface water runoff from the proposed development’s hard standing areas including roofs, driveways and roads.
- 6.9 The surface water network will include swales with filter trenches; a reed bed; an attenuation pond and basin; which will all serve as conveyance, storage and water quality treatment.
- 6.10 Drainage from house and garage roofs, driveways and parking courts, carriageways and footways will drain to swales and filter trenches which convey water to a permanently wet pond and reed bed in the southern landscaped area of the site.

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- 6.11 The pond and reedbed will overflow into an attenuation basin which will be dry when not receiving storm water and will attenuate large return period storms via restricted outflow and high-level overflow to borehole soakaway chambers. Infiltration to ground will also occur gradually within the swales and base of the attenuation basin.
- 6.12 Any exceedance overflow will overtop the basin and flow to the southwest at a rate far lower than the predevelopment greenfield run off for a large return period storm.
- 6.13 A 10% allowance for urban creep has been included in the calculations.
- 6.14 The total storage requirement provided by the attenuation basins discharging via deep borehole soakaways is 1273m³. This will provide storage onsite to manage the 1:100year (1% AEP) storm event, plus an extra allowance of 40% for the predicted potential increase in peak rainfall up to 2115.
- 6.15 No.3 deep borehole soakaways, each 16m deep will provide the necessary infiltration to manage the storm water from the development site. Although these deep borehole soakaways would be within groundwater the EA and Portsmouth Water have no concerns with this discharge method in this instance. Quoting from the pre-application advice by the LLFA:
- “Whilst there are times when deep bore soakaways may be appropriate, we would consider this as a drainage option of last resort. A suitable assessment should therefore be provided to prove why other systems are not viable. If it is necessary to consider deep bore soakaways, then appropriate silt removal processes/features will be required upstream. We do note that the system proposed for this site does incorporate several SuDS features prior to water entering the bore hole and note that neither Portsmouth Water nor the EA have concerns.”*
- See Appendix G for the full comments by the LLFA.
- 6.16 A penstock valve within a manhole chamber will be placed upstream of the flow control into the boreholes. This will provide an emergency shut-off system in the event of a pollution event like an oil spillage.
- 6.17 All drains and manholes/inspection chambers will be designed and constructed in accordance with the Building Regulations Part H and BS EN 752, ensuring adequate capacity and robust structural integrity for the lifetime of the development. This will ensure that no polluted discharge from the drainage system to ground will take place.

7 Water Quality and Pollution Prevention

- 7.1 The proposed SuDS scheme has been designed to mitigate against the contamination of the receiving watercourse. The CIRIA SuDS Manual 2015 details an approach for establishing the hazard posed by the intended land use activates and the extent to which the proposed SuDS components can reduce and mitigate the contamination risk to the receiving waterbody.
- 7.2 Referring to Table 26.2 – ‘Pollution hazard indices for different land use classifications’ the proposed development and land use results in a low pollution hazard, therefore a ‘Simple Index’ method can be used to make a qualitative assessment of the proposed SuDS management.

Table 1: Table 26.2 – ‘Pollution hazard indices for different land use classifications’ CIRIA C753, 2015

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

Roof Runoff:

Total SuDS mitigation index $\geq$ pollution hazard index (for each contaminant type)

For the development site: TSS = 0.2, Metals = 0.2, Hydrocarbons = 0.05

Driveway / Parking / Road Runoff:

Total SuDS mitigation index $\geq$ pollution hazard index (for each contaminant type)

For the development site: TSS = 0.5, Metals = 0.4, Hydrocarbons = 0.4

Table 2 - Table 26.3 – ‘Indicative SuDS mitigation indices for discharge to surface waters’ CIRIA C753, 2015

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters				
Type of SuDS component	Mitigation indices¹			
	TSS	Metals	Hydrocarbons	
Filter strip	0.4	0.4	0.5	
Filter drain	0.4 ²	0.4	0.4	
Swale	0.5	0.6	0.6	
Bioretention system	0.8	0.8	0.8	
Permeable pavement	0.7	0.6	0.7	
Detention basin	0.5	0.5	0.6	
Pond ⁴	0.7 ³	0.7	0.5	
Wetland	0.8 ³	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 frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			

Table 3 - Table 26.4 – ‘Indicative SuDS mitigation indices for discharge to groundwater’ CIRIA C753, 2015

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater				
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates¹		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.		

7.3 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type). Where the mitigation index of an individual component is insufficient, two or more components in a series is required, where:

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

- 7.4 The proposed development surface water drainage system consists of the following SuDS component:

Roof Runoff:

Primary Treatment – Swale

Using table 26.3/26.4 – Mitigation Indices

TSS = 0.5 which is > 0.2 therefore ok.

Metals = 0.6 which is > 0.2 therefore ok.

Hydrocarbons = 0.6 which is > 0.05 therefore ok.

+ Secondary Treatment – Detention Basin

Using table 26.3/26.4 – Mitigation Indices

TSS = $0.5 + (0.5 * 0.5) = 0.75$ which is > 0.2 therefore ok.

Metals = $0.6 + (0.5 * 0.5) = 0.15$ which is > 0.2 therefore ok.

Hydrocarbons = $0.6 + (0.6 * 0.5) = 0.18$ which is > 0.05 therefore ok.

Driveway / Parking / Road Runoff:

Primary Treatment – Detention Basin

Using table 26.3/26.4 – Mitigation Indices:

TSS = 0.5 which is ≥ 0.5 therefore ok.

Metals = 0.6 which is > 0.4 therefore ok.

Hydrocarbons = 0.6 which is > 0.4 therefore ok.

- 7.5 The runoff will also pass through filter trenches and a pond with a reed bed which will add to the mitigation indices. The total combination of SuDS will meet the high water quality and silt removal requirements to discharge via deep borehole soakaways.
- 7.6 The total mitigation level exceeds the development pollution risk and would be suitable for both medium and high-risk developments. The proposed drainage strategy incorporates measures to far exceed the water quality target requirements within the SuDS Manual and therefore complies with the Water Framework Directives for discharge of runoff into controlled waters.

8 Foul Water Drainage Strategy

- 8.1 All foul water flows generated from the development will discharge via gravity into the existing Portsmouth Water foul manhole (reference SU70061101) located beyond the eastern boundary of the site.
- 8.2 A package pumping station will not be required.
- 8.3 The predicted peak foul sewer discharge from the 50 units based on the Sewers for Adoption guidance of 4000 l/dwelling/day will be 2.3 l/s.
- 8.4 Portsmouth Water have confirmed that there is adequate capacity for the proposed development flows. The proposed development will have a 'no detriment' impact on the local foul sewer system and does not create an increase in flood risk.



APPENDIX A

SITE LAYOUT



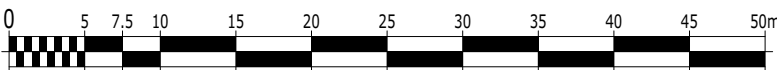
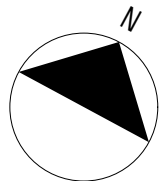
NOTE:
Proposed replacement tree shelter belt, for details refer to drawing nos 1860-TF-00-00-DR-L-1002 to 1006 by Terraforma Landscape Architects

ROOF TILE KEY



CS26 NATURAL ROOFING SLATE

CLAY LARGE PROFILE PLAIN ROOF TILE TO MAIN ROOFS, SMALL PROFILE PLAIN PORCH TILE TO CO-ORDINATE WITH MAIN ROOF TILE



Revisions			
K-	Proposed site layout updated inline with planners comments: Plot 16&17, 42-46 House type amended. Plots 3-7, 10&11, 13-25, 40-46 Gardens updated. Footpaths to north of site, connecting site to lower road have been amended. Plot 48 Garage connected to Plot 47 garage. Plot 10-12 Carport Reduced. 3 bay car barns omitted.	13/08/19	TIM/MW
L-	Inline with clients comments & mark-ups received on 19th & 20th August 2019	28/08/19	TIM/HS
M-	Inline with clients comments & mark-ups received on 30th August 2019	03/09/19	IS/HS

Revisions			
N-	Amendments to farm track and plots 16-17 & 42-46 following client comments.	17/09/19	HS
P-	Footpath annotation amended	20/09/19	HS

Drawing Status

- ☐ Preliminary
☒ Planning
☐ Building Regulations
☐ Construction

Drawing Notes:
For hard and soft landscaping details refer to drawings nos. 1860-TF-00-00-L-1002 - 1006 inclusive by Terraforma Landscape Architects

To be read in conjunction with HGP Architects Ltd drawing nos. 17.043.100-101, 200-202, 204-223 & 226-227 inclusive



Project Title
Manor Farm, Bedhampton
Document Title
Proposed Site Layout
Drawing Scale / Sheet Size
1/500@A1
Job No.
17.043

Date
June/2018
Drawn by / Checked by
CW/--
Signature

Drawing Number / Revision
102 - P



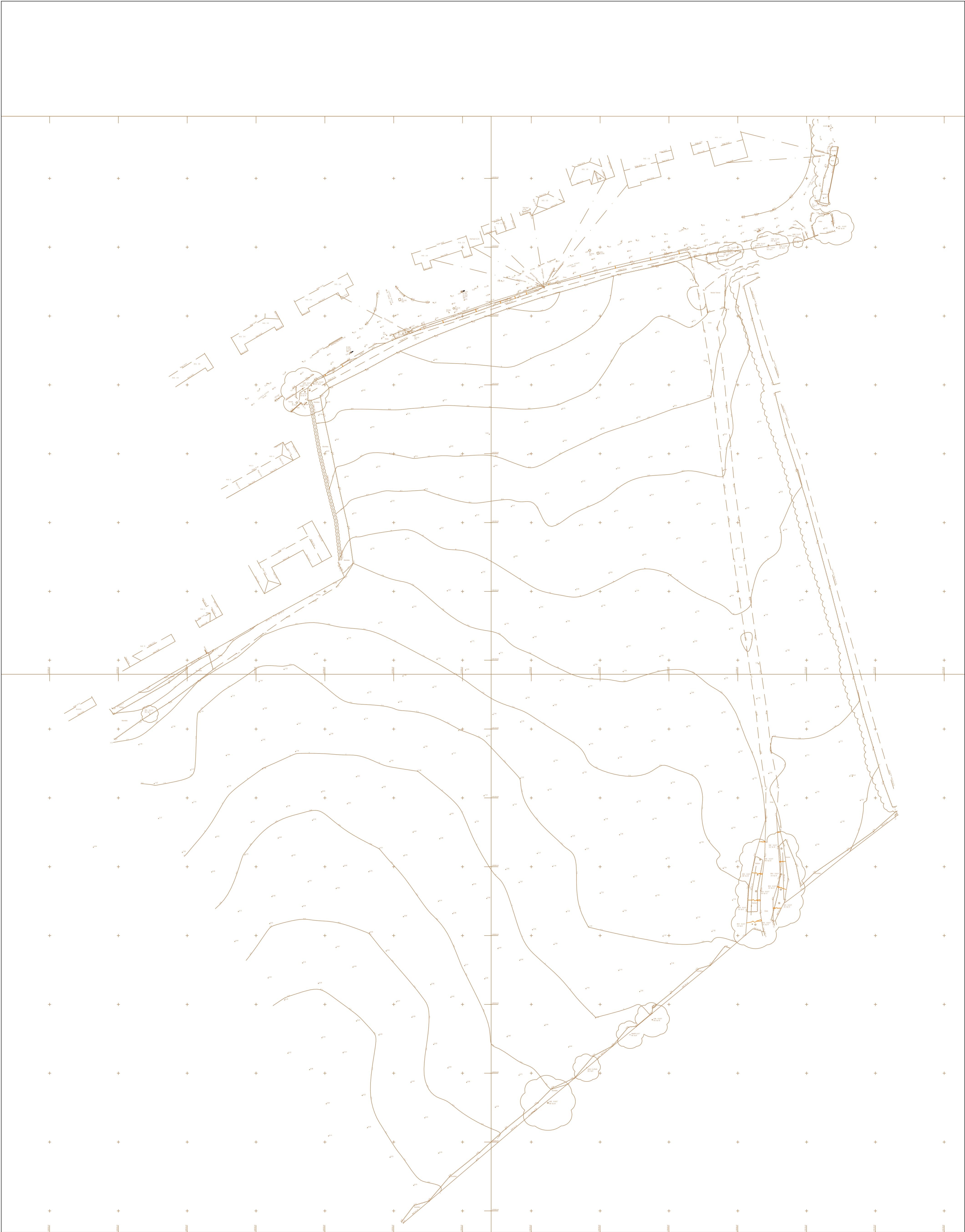
Wickham Road, Fareham
Hampshire, PO16 7JH
01329 283235
email@hgp-architects.co.uk
www.hgp-architects.co.uk

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APPENDIX B

TOPOGRAPHICAL SURVEY

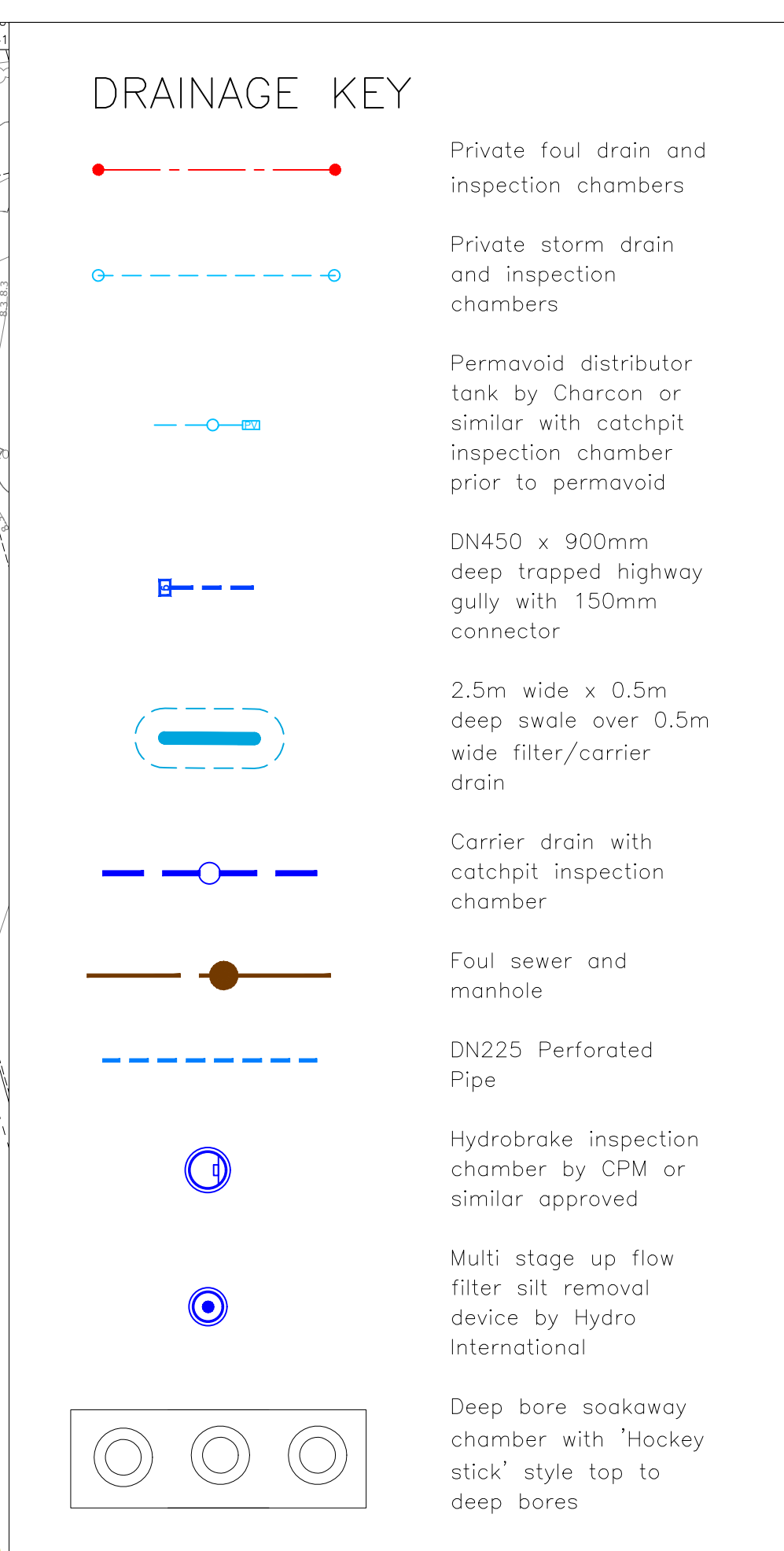


REV. No.	DATE	DESCRIPTION	INITIALS			
Client						
Project	Manor Farm Bedhampton		MJA CONSULTING CIVIL & STRUCTURAL ENGINEERS Ipsium Court, The Quadrant, Abingdon Science Park, Oxon, OX14 3YS Tel: 01235 555173 Fax: 01235 523226			
Title	Topographic Survey		Scale 1:500@A1 Checked CP	Date Nov '18 Drawn SS	Drawing No. Topo	Rev



APPENDIX C

FOUL AND SURFACE WATER DRAINAGE STRATEGY





APPENDIX D

PRE / POST DEVELOPMENT RUNOFF AND STORAGE CALCULATIONS

MJA Consulting		Page 1
Monarch House Barton Lane OX14 3NB	Land off Lower Road Bedhampton Greenfield Rates	
Date 28/03/2019 File	Designed by S.Smith Checked by	
Innovyze Source Control 2017.1.2		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.094	Urban	0.000
SAAR (mm)	729	Region Number	Region 7

Results l/s

QBAR Rural	3.9
QBAR Urban	3.9
Q100 years	12.5
Q1 year	3.3
Q30 years	8.8
Q100 years	12.5

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MJA Consulting		Page 1
Monarch House Barton Lane OX14 3NB	Land off Lower Road Bedhampton Greenfield Volume	
Date 28/03/2019 File	Designed by S.Smith Checked by	
Innovyze	Source Control 2017.1.2	

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.500
Ratio R	0.349
Areal Reduction Factor	1.00
Area (ha)	1.094
SAAR (mm)	789
CWI	116.484
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	49.10
Greenfield Runoff Volume (m ³)	346.526

MJA Consulting					Page 1																																																																																																																																																																																																																								
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Summer</td><td>12.028</td><td>0.0</td><td>229.7</td><td>494</td></tr><tr><td>600 min Summer</td><td>10.141</td><td>0.0</td><td>232.7</td><td>614</td></tr><tr><td>720 min Summer</td><td>8.817</td><td>0.0</td><td>234.7</td><td>734</td></tr><tr><td>960 min Summer</td><td>7.063</td><td>0.0</td><td>237.1</td><td>972</td></tr><tr><td>1440 min Summer</td><td>5.157</td><td>0.0</td><td>238.0</td><td>1450</td></tr><tr><td>2160 min Summer</td><td>3.757</td><td>0.0</td><td>477.1</td><td>2168</td></tr><tr><td>2880 min Summer</td><td>2.997</td><td>0.0</td><td>477.6</td><td>2884</td></tr><tr><td>4320 min Summer</td><td>2.176</td><td>0.0</td><td>469.0</td><td>4320</td></tr><tr><td>5760 min Summer</td><td>1.731</td><td>0.0</td><td>918.6</td><td>5128</td></tr><tr><td>7200 min Summer</td><td>1.449</td><td>0.0</td><td>912.9</td><td>5832</td></tr><tr><td>8640 min Summer</td><td>1.255</td><td>0.0</td><td>897.6</td><td>6576</td></tr></tbody></table>							Upstream Structures	Outflow To	Overflow 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MJA Consulting				Page 2	
Monarch House Barton Lane OX14 3NB					
Date 05/04/2019 14:14 File Pond-DeepBoreholeSoakaw...		Designed by stewart Checked by			
Innovyze		Source Control 2017.1.2			
<u>Cascade Summary of Results for Pond.SRCX</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	99.630	1.030	1.5	843.2	O K
15 min Winter	99.027	0.427	1.2	290.7	O K
30 min Winter	99.151	0.551	1.2	390.4	O K
60 min Winter	99.278	0.678	1.2	499.6	O K
120 min Winter	99.404	0.804	1.3	615.2	O K
180 min Winter	99.474	0.874	1.4	683.1	O K
240 min Winter	99.520	0.920	1.4	729.3	O K
360 min Winter	99.587	0.987	1.4	797.5	O K
480 min Winter	99.634	1.034	1.5	847.1	O K
600 min Winter	99.670	1.070	1.5	885.4	O K
720 min Winter	99.698	1.098	1.5	916.3	O K
960 min Winter	99.741	1.141	1.5	963.6	Flood Risk
1440 min Winter	99.794	1.194	1.6	1024.3	Flood Risk
2160 min Winter	99.836	1.236	1.6	1072.7	Flood Risk
2880 min Winter	99.855	1.255	1.6	1094.9	Flood Risk
4320 min Winter	99.860	1.260	1.6	1100.8	Flood Risk
5760 min Winter	99.843	1.243	1.6	1080.8	Flood Risk
7200 min Winter	99.815	1.215	1.6	1048.9	Flood Risk
8640 min Winter	99.790	1.190	1.5	1019.8	Flood Risk
10080 min Winter	99.766	1.166	1.5	992.7	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
10080 min Summer	1.111	0.0	873.4	7360	
15 min Winter	127.517	0.0	93.0	34	
30 min Winter	85.701	0.0	94.6	49	
60 min Winter	54.957	0.0	198.3	78	
120 min Winter	34.010	0.0	214.1	136	
180 min Winter	25.295	0.0	222.2	194	
240 min Winter	20.351	0.0	227.2	252	
360 min Winter	14.971	0.0	233.9	370	
480 min Winter	12.028	0.0	238.1	488	
600 min Winter	10.141	0.0	240.8	606	
720 min Winter	8.817	0.0	242.7	724	
960 min Winter	7.063	0.0	244.6	960	
1440 min Winter	5.157	0.0	244.3	1428	
2160 min Winter	3.757	0.0	493.6	2128	
2880 min Winter	2.997	0.0	492.1	2820	
4320 min Winter	2.176	0.0	479.2	4160	
5760 min Winter	1.731	0.0	954.7	5472	
7200 min Winter	1.449	0.0	945.0	6632	
8640 min Winter	1.255	0.0	928.8	6920	
10080 min Winter	1.111	0.0	906.6	7776	
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Cascade Rainfall Details for Pond.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.094

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.248	8 12	0.249	16 20	0.100
4 8	0.248	12 16	0.249		

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Cascade Model Details for Pond.SRCX

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.600

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	593.0	0.400	761.0	0.800	948.0	1.200	1153.0
0.100	633.0	0.500	806.0	0.900	998.0	1.300	1206.0
0.200	675.0	0.600	853.0	1.000	1048.0	1.400	1262.0
0.300	718.0	0.700	900.0	1.100	1100.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0055-1500-1200-1500
Design Head (m)	1.200
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	55
Invert Level (m)	98.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	1.5
Flush-Flo™	0.242	1.2
Kick-Flo®	0.493	1.0
Mean Flow over Head Range	-	1.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.1	1.200	1.5	3.000	2.3	7.000	3.4
0.200	1.2	1.400	1.6	3.500	2.4	7.500	3.5
0.300	1.2	1.600	1.7	4.000	2.6	8.000	3.6
0.400	1.2	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.9	9.000	3.8
0.600	1.1	2.200	2.0	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.1	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.3		

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Innovyze		Source Control 2017.1.2																																																																																																																																																																																						
<u>Cascade Summary of Results for Deep Borehole Soakaway.SRCX</u> Upstream Outflow To Overflow To Structures Pond.SRCX (None) (None) Half Drain Time : 13 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>86.653</td><td>38.153</td><td>1.2</td><td>1.2</td><td>O K</td></tr><tr><td>30 min Summer</td><td>83.283</td><td>34.783</td><td>1.1</td><td>1.1</td><td>O K</td></tr><tr><td>60 min Summer</td><td>86.183</td><td>37.683</td><td>1.2</td><td>1.2</td><td>O K</td></tr><tr><td>120 min Summer</td><td>88.823</td><td>40.323</td><td>1.3</td><td>1.3</td><td>O K</td></tr><tr><td>180 min Summer</td><td>90.210</td><td>41.710</td><td>1.3</td><td>1.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>91.101</td><td>42.601</td><td>1.3</td><td>1.3</td><td>O K</td></tr><tr><td>360 min Summer</td><td>92.335</td><td>43.835</td><td>1.4</td><td>1.4</td><td>O K</td></tr><tr><td>480 min Summer</td><td>93.179</td><td>44.679</td><td>1.4</td><td>1.4</td><td>O K</td></tr><tr><td>600 min Summer</td><td>93.804</td><td>45.304</td><td>1.4</td><td>1.4</td><td>O K</td></tr><tr><td>720 min Summer</td><td>94.290</td><td>45.790</td><td>1.4</td><td>1.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>95.001</td><td>46.501</td><td>1.5</td><td>1.5</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>95.854</td><td>47.354</td><td>1.5</td><td>1.5</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>96.458</td><td>47.958</td><td>1.5</td><td>1.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>96.673</td><td>48.173</td><td>1.5</td><td>1.5</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>96.537</td><td>48.037</td><td>1.5</td><td>1.5</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>96.091</td><td>47.591</td><td>1.5</td><td>1.5</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>95.621</td><td>47.121</td><td>1.5</td><td>1.5</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>127.517</td><td>0.0</td><td>1440</td></tr><tr><td>30 min Summer</td><td>85.701</td><td>0.0</td><td>113</td></tr><tr><td>60 min Summer</td><td>54.957</td><td>0.0</td><td>136</td></tr><tr><td>120 min Summer</td><td>34.010</td><td>0.0</td><td>186</td></tr><tr><td>180 min Summer</td><td>25.295</td><td>0.0</td><td>238</td></tr><tr><td>240 min Summer</td><td>20.351</td><td>0.0</td><td>294</td></tr><tr><td>360 min Summer</td><td>14.971</td><td>0.0</td><td>406</td></tr><tr><td>480 min Summer</td><td>12.028</td><td>0.0</td><td>520</td></tr><tr><td>600 min Summer</td><td>10.141</td><td>0.0</td><td>638</td></tr><tr><td>720 min Summer</td><td>8.817</td><td>0.0</td><td>756</td></tr><tr><td>960 min Summer</td><td>7.063</td><td>0.0</td><td>990</td></tr><tr><td>1440 min Summer</td><td>5.157</td><td>0.0</td><td>1466</td></tr><tr><td>2160 min Summer</td><td>3.757</td><td>0.0</td><td>2180</td></tr><tr><td>2880 min Summer</td><td>2.997</td><td>0.0</td><td>2896</td></tr><tr><td>4320 min Summer</td><td>2.176</td><td>0.0</td><td>4332</td></tr><tr><td>5760 min Summer</td><td>1.731</td><td>0.0</td><td>5152</td></tr><tr><td>7200 min Summer</td><td>1.449</td><td>0.0</td><td>5880</td></tr></tbody></table>					Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	86.653	38.153	1.2	1.2	O K	30 min Summer	83.283	34.783	1.1	1.1	O K	60 min Summer	86.183	37.683	1.2	1.2	O K	120 min Summer	88.823	40.323	1.3	1.3	O K	180 min Summer	90.210	41.710	1.3	1.3	O K	240 min Summer	91.101	42.601	1.3	1.3	O K	360 min Summer	92.335	43.835	1.4	1.4	O K	480 min Summer	93.179	44.679	1.4	1.4	O K	600 min Summer	93.804	45.304	1.4	1.4	O K	720 min Summer	94.290	45.790	1.4	1.4	O K	960 min Summer	95.001	46.501	1.5	1.5	O K	1440 min Summer	95.854	47.354	1.5	1.5	O K	2160 min Summer	96.458	47.958	1.5	1.5	O K	2880 min Summer	96.673	48.173	1.5	1.5	O K	4320 min Summer	96.537	48.037	1.5	1.5	O K	5760 min Summer	96.091	47.591	1.5	1.5	O K	7200 min Summer	95.621	47.121	1.5	1.5	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	127.517	0.0	1440	30 min Summer	85.701	0.0	113	60 min Summer	54.957	0.0	136	120 min Summer	34.010	0.0	186	180 min Summer	25.295	0.0	238	240 min Summer	20.351	0.0	294	360 min Summer	14.971	0.0	406	480 min Summer	12.028	0.0	520	600 min Summer	10.141	0.0	638	720 min Summer	8.817	0.0	756	960 min Summer	7.063	0.0	990	1440 min Summer	5.157	0.0	1466	2160 min Summer	3.757	0.0	2180	2880 min Summer	2.997	0.0	2896	4320 min Summer	2.176	0.0	4332	5760 min Summer	1.731	0.0	5152	7200 min Summer	1.449	0.0	5880
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status																																																																																																																																																																																			
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Innovyze		Source Control 2017.1.2			
<u>Cascade Summary of Results for Deep Borehole Soakaway.SRCX</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	95.220	46.720	1.5	1.5	O K
10080 min Summer	94.870	46.370	1.5	1.5	O K
15 min Winter	85.415	36.915	1.2	1.2	O K
30 min Winter	84.579	36.079	1.1	1.1	O K
60 min Winter	87.598	39.098	1.2	1.2	O K
120 min Winter	90.346	41.846	1.3	1.3	O K
180 min Winter	91.793	43.293	1.4	1.4	O K
240 min Winter	92.722	44.222	1.4	1.4	O K
360 min Winter	94.016	45.516	1.4	1.4	O K
480 min Winter	94.902	46.402	1.5	1.5	O K
600 min Winter	95.564	47.064	1.5	1.5	O K
720 min Winter	96.079	47.579	1.5	1.5	O K
960 min Winter	96.845	48.345	1.5	1.5	O K
1440 min Winter	97.785	49.285	1.5	1.5	O K
2160 min Winter	98.500	50.000	1.6	1.6	O K
2880 min Winter	98.571	50.071	1.6	1.7	O K
4320 min Winter	98.646	50.146	1.6	1.9	O K
5760 min Winter	98.537	50.037	1.6	1.7	O K
7200 min Winter	98.157	49.657	1.6	1.6	O K
8640 min Winter	97.728	49.228	1.5	1.5	O K
10080 min Winter	97.311	48.811	1.5	1.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
8640 min Summer	1.255	0.0	6544		
10080 min Summer	1.111	0.0	7440		
15 min Winter	127.517	0.0	1440		
30 min Winter	85.701	0.0	118		
60 min Winter	54.957	0.0	140		
120 min Winter	34.010	0.0	188		
180 min Winter	25.295	0.0	238		
240 min Winter	20.351	0.0	290		
360 min Winter	14.971	0.0	402		
480 min Winter	12.028	0.0	514		
600 min Winter	10.141	0.0	630		
720 min Winter	8.817	0.0	746		
960 min Winter	7.063	0.0	978		
1440 min Winter	5.157	0.0	1444		
2160 min Winter	3.757	0.0	2144		
2880 min Winter	2.997	0.0	3040		
4320 min Winter	2.176	0.0	4444		
5760 min Winter	1.731	0.0	5680		
7200 min Winter	1.449	0.0	6608		
8640 min Winter	1.255	0.0	6912		
10080 min Winter	1.111	0.0	7928		
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Innovyze	Source Control 2017.1.2	

Cascade Rainfall Details for Deep Borehole Soakaway.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.000

Time (mins)		Area
From:	To:	(ha)
0	4	0.000



APPENDIX E

PUBLIC SEWER RECORDS



THE CIVIL ENGINEERING PRACTICE
14 AUG 2017
RECEIVED

P	PM	SEM
Project No:		22863
Engineer:		
Action By:		
Action Date:		

The Civil Engineering Practice
Unit 11
Tungsten Building
George Street
Fishersgate
West Sussex
BN41 1RA

Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW

Tel: 0330 303 0119

Email: developerservices@southernwater.co.uk

Your Ref:

Our Ref:

CC/003497

Date:

09 August 2017

F.A.O: Mr. Magowan,

Site: Manor Farm, Bedhampton, Havant, Hampshire, PO9 3LH.

Dear Mr. Magowan,

We have completed the capacity check for the above development site and the results are as follows:-

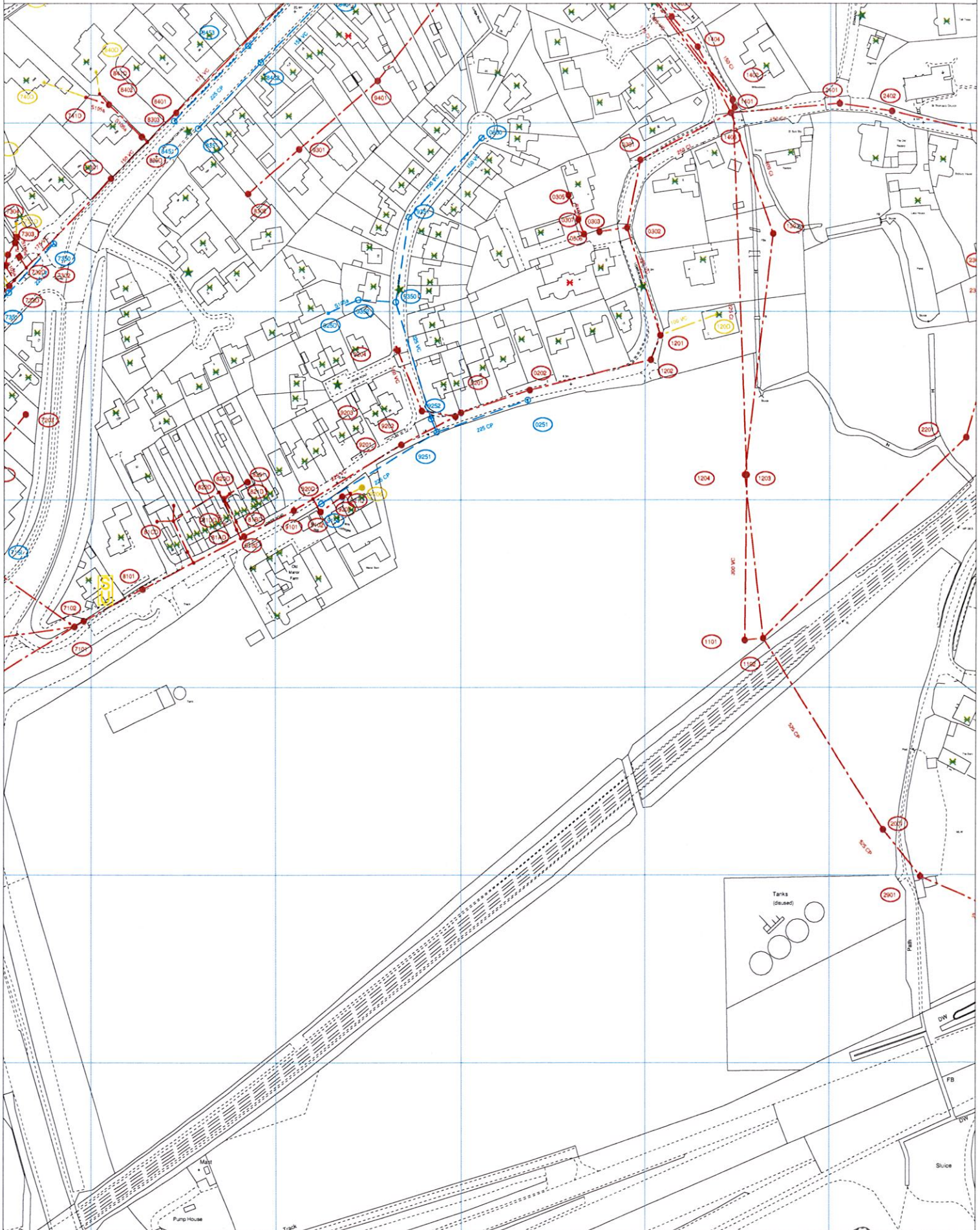
Foul capacity check:

There is currently inadequate capacity within the foul sewerage network to accommodate a foul flow for the above development at manhole reference SU70061101. The proposed development would increase flows to the public sewerage system, and existing properties and land may be subject to a greater risk of flooding as a result. Additional off-site sewers, or improvements to existing sewers, will be required to provide sufficient capacity to service the development.

The nearest point where capacity is currently available is at Budds Farm Havant WTW which is located approximately 880 m South East of the proposed development site.

Section 98 of the Water Industry Act 1991 provides a legal mechanism through which the appropriate infrastructure can be requested (by the developer) and provided to drain a specific location.

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

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O.S. REF: SU7006SW

Scale: 1:1250

Screen Print

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Southern Water

Printed By: Giri

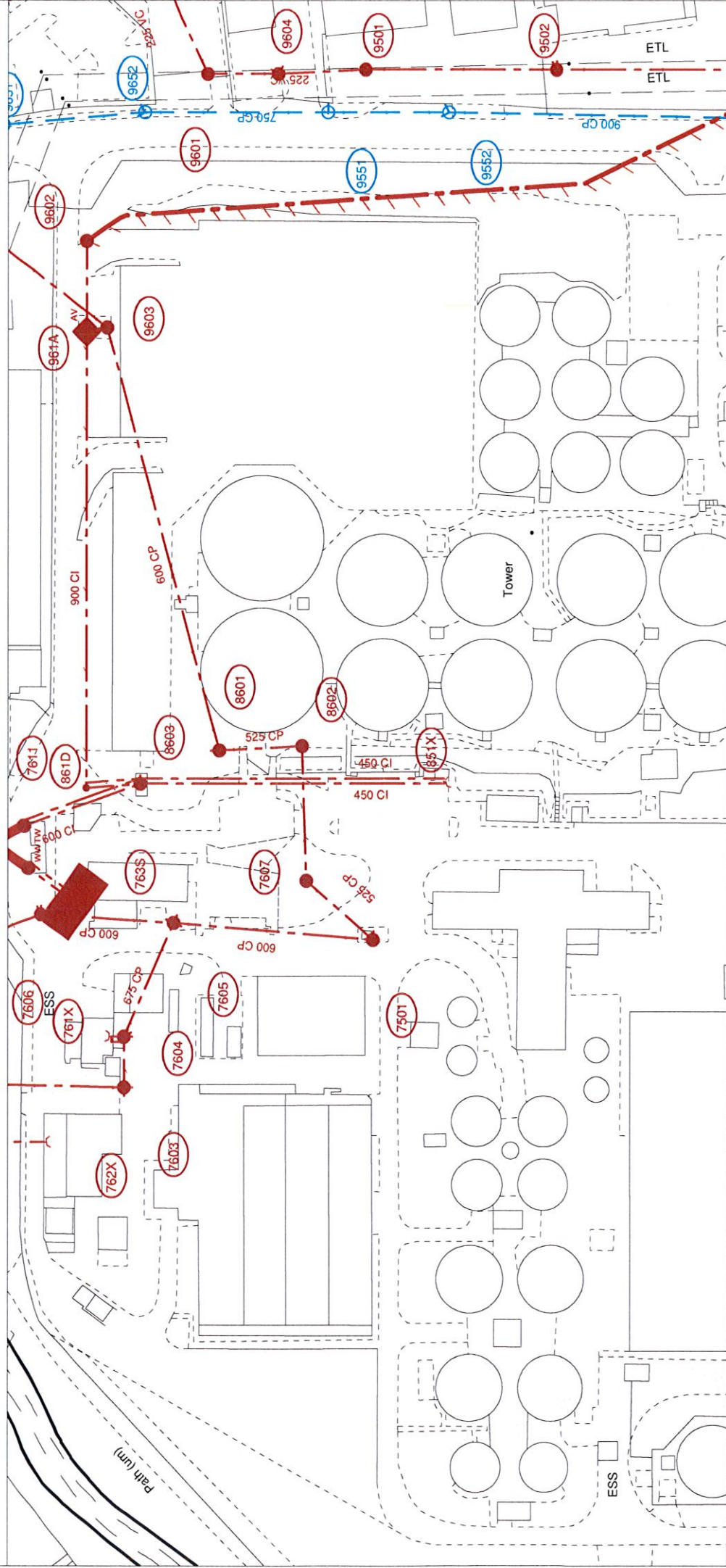
Date: 27-7-2017

Site Plan

Requested By:



SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

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O.S. REF: SU7005NE

Sewer Plot

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Scale: 1:1250



Printed By: kolacha

Nearest Point of Available Capacity

Requested By:

Date: 9-8-2017

APPENDIX F

SUDS COMPATIBILITY MATRIX

SuDS Type	Description	Suitable for this site	Comments
Green Roofs	Green roofs comprise a multi-layered system that covers the roof of a building with vegetation cover over a drainage layer. They are designed to intercept and retain rainfall, reducing the volume of runoff and attenuating		Living Roofs would not be technically feasible at this development due to factors such as loadings, steep roof pitch of proposed dwellings, visual impact and high maintenance burden to homeowners.
Rainwater Harvesting	Re-using rainwater for non-potable purposes such as irrigation and toilet flushing.		Rainwater harvesting cannot be relied upon to guarantee a reduction in the volume of water leaving the site as it relies upon tanks having available capacity. During intense/prolonged periods of rainfall it is likely that the tanks will be full and will overflow into the system. These systems can also be a high maintenance burden for residential home owners. Cost benefit of system is not recovered until 10-15 years.
Soakaways	Soakaways provide stormwater attenuation, stormwater treatment and groundwater recharge.		Onsite infiltration via soakaways is not feasible in the superficial and upper chalk geology. However deep borehole soakaways could be used in this instance where infiltration rates are 1x10 ⁻⁴ m/s about 15m below ground level.
Filter Strip / Trenches / Swales	Filter strips are linear grassed or vegetated strips of land / channels designed to accept runoff as overland sheet flow from impermeable surfaces usually located adjacent road or parking areas and used to treat infiltrated or convey runoff.		Potentially viable on this site.
Permeable Paving	Pervious pavements provide a pavement suitable for pedestrian and vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltration to the ground, reuse, or discharge to a watercourse or other drainage system.		Potentially on private drives / parking areas/ roads. This would improve water quality into the ground and subsequent aquifer/river.
Bio Retention	Bioretention areas are shallow landscaped depressions which are typically under-drained and rely on engineered soils and enhanced vegetation and filtration to remove pollution and reduce runoff downstream. They are aimed at managing and treating runoff from frequent rainfall events.		A bio retention pond could be utilised at this development if the receiving waterbody is considered sensitive and additional treatment is required. Although likely not required.
Ponds / Basins	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.		A pond / basin can be utilised at this development to provide attenuation and improvements in water quality. There is sufficient open space.
Underground Storage	Underground large diameter Concrete pipes or Geocellular Tanks to reduce and attenuate peak flows		Underground storage tanks can be utilised at this development if required.



APPENDIX G

LLFA RESPONSE



Hampshire County Council

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Elizabeth II Court West, The Castle
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<i>Enquiries to</i>	Flood & Water Management	<i>My reference</i>	LLFA/Pre-app/2018/0023
<i>Direct line</i>	01962 846730	<i>Your reference</i>	C4C 101296239
<i>Date</i>	30 th November 2018	<i>E-mail</i>	Swm.consultee@hants.gov.uk

Dear Sir,

Re: Land to the south of Lower Road (Manor Farm), Bedhampton PO9 3LH

We refer to your request for pre-application advice on 14th November 2018 and our subsequent meeting on 22nd November 2018.

Pre-application advice

As the Lead Local Flood Authority (LLFA) Hampshire County Council is a statutory consultee for Surface Water Drainage on applications for major development. From 15 April 2015 Hampshire County Council were required to be consulted on these developments when a planning application is received by the Local Planning Authority. Further to this we have a regulatory role in relation to consenting works on ordinary watercourses.

Historic Flooding information

We have reviewed our records of flood incidents for this area and have the following records of flooding within a 500m radius of the site. Any improvements in the run-off from this site may help alleviate further flooding incidents. This does not necessarily mean that other flood events have not occurred, they either may not have been reported or events may have occurred prior to 2012 – HCC records have only been maintained since then. The EA may hold data on flood events prior to this date.

- **13030:** Pluvial flooding event prior to 2012 on Bedhampton Road. Lack of capacity in SW sewer. Gully grates upsized in 2013/14 drainage programme

Please refer to attached map for the location of flooding events.

There is a range of modelling information from the EA which highlights the potential risk from surface water flooding in a GIS format. Each model makes different assumptions regarding drainage provision, permeability of the area, routing around

buildings etc. Therefore, each model should be considered. The different models are as follows:

Areas susceptible to surface water flooding (AStSWf)

Flood Map for Surface Water (FMfSW)

Updated Flood Map for Surface Water (uFMfSW)

It is recommended that all modelling sets are used to assess the site for surface water flooding events and a suitable model be developed. The level of complexity should be site dependant including for topography and permeability of the area.

In general, it is considered that the surface water flood risk within the site boundaries is low and providing flow routes are considered should be manageable. The site is within **Flood Zone 1** only.

For information regarding Fluvial flooding please contact the Environment Agency. Please refer to the following EA website: <https://flood-map-for-planning.service.gov.uk/>

For information regarding foul flooding, please contact the relevant sewerage provider.

The site is located within the Waterbody Catchment of Hermitage Stream with Main River Bedhampton Brook leading to Hermitage Stream.

Ordinary Watercourse consenting

HCC have no records of Ordinary Watercourse Consents within the search area.

Any works to ordinary watercourses that impact on capacity will require Ordinary Watercourse Consent. Please refer to the HCC [OWC website](#) for further information and the forms for consents. Consenting process takes approximately 2 months.

Drainage Assets

Please refer to the attached map which shows Hampshire CC drainage assets.

Please Note: *The data supplied has been compiled from a variety of sources of varying reliability. The data is constantly being revised and validated to ensure the highest accuracy possible. However, the data should not be relied upon or considered completely accurate and the data is provided on the understanding that neither the County Council nor the disclosing officer is to be held responsible should you rely on this data and consequently suffer damage.*

Surface Water drainage

Notes from meeting held between HCC Flood and Water Management Team, The Civil Engineering Practice and Bargate Homes held on 22nd November 2018.

Summary of Development and location:

- The site is located immediately south of Source Protection Zone 1 (Inner Protection). *HCC note that liaison with the EA and Portsmouth Water has already been undertaken*

- The development will be submitted for full planning permission by Bargate Homes.
- 50 dwellings are proposed
- HCC and Southern Water drainage assets are to the north of the site (uphill) therefore not possible to connect to.

Potential existing flooding constraints:

- The site is currently Greenfield therefore proposed discharge rates and volumes must not exceed existing Greenfield runoff rates.
- The site falls to the South-West with the southern boundary formed by the railway in a cutting
- An access bridge over the railway exists and will be retained for future use by the farmer to access land on the southern side of the railway
- The site does not currently flood, nor does it appear to infiltrate following soakage tests carried out to BRE365 in recent months
- There are no watercourses on or near the site to discharge surface water to

Drainage proposals:

- The site is not thought to be suitable for infiltration following site investigations undertaken in accordance with BRE365. *HCC request that all infiltration testing data be included in the surface water management plan as evidence that the site is not suitable for infiltration.*
- Where possible green corridors should be used to take exceedance flows and follow modelled flow routes thereby mimicking the existing situation.
- Surface level SuDS features such as permanent wet ponds would be considered highly beneficial from both a water quality and quantity point of view as well as providing the site with bio-diversity and amenity value and should be considered at the outset. *HCC note that swales, detention basins and some permeable paving is being considered*
- Increased tree planting – particularly within public open space and as tree belts along with areas of vegetation naturally slow down water and increases infiltration. Appropriately selected tree species can intercept up to 60% of rainfall. Trees (and their associated rooting environments) help to reduce flood risk by increasing transpiration (water loss by vegetation), provide rainfall interception, increase infiltration and storage. Further guidance on appropriate tree species for SuDS can be found in the [Tree Selector tool](#) produced by the Trees and Design Action Group (Tdag). It is also worth noting that at least two credits are available towards BREEAM certification if SuDS schemes are effectively integrated into a development.
- As stated on the HCC website we would expect to have demonstrated existing Greenfield runoff rates and volumes as well as proposed rates and volumes to reflect existing
- The proposals being considered are to eventually discharge surface water into the ground via a deep bore hole incorporating one additional mitigation step more than is required by the Ciria SuDS Manual (Tables 26.2, 3 and 4 within Chapter 26. *Whilst there are times when deep bore soakaways may be appropriate we would consider this as a drainage option of last resort. A suitable assessment should therefore be provided to prove why other*

systems are not viable. If it is necessary to consider deep bore soakaways, then appropriate silt removal processes/features will be required upstream. We do note that the system proposed for this site does incorporate several SuDS features prior to water entering the bore hole and note that neither Portsmouth Water nor the EA have concerns.

- HCC would expect to see reference made to a maintenance/management plan in the Surface Water Drainage Plan for all SuDS features within the site – who will be responsible for which features. *HCC note that the whole site will be managed through the developer. Details of the management strategy must be provided as part of the Surface Water Plan submission.*
- *We would also recommend consideration of phasing work in particular SuDS features throughout the construction period in order to ensure they are protected and thereby work effectively following completion of the works.*

Drainage Provision

The SuDS Manual Ciria C753 provides best practise and design advice on SuDS design and should be referred to during the design process. Drainage systems should look to mimic the natural processes as far as practicable, collecting and storing / infiltrating rain water as close to the source as possible. If infiltration is not possible, attenuation options should be considered with a controlled outfall so that water leaving the site is minimised and the 'peak runoff value' flattened.

The site geology appears to be located bedrock: Lewes Nodular Chalk formation and Seaford Chal with a superficial layer of: River terrace deposits, Sand, silt, clay
<http://www.bgs.ac.uk/downloads/start.cfm?id=2920>

Vulnerability of site from surface or ground water information

- EA mapping shows that the site is at low risk of surface water flooding.
- The site is at a greater risk of groundwater flooding (greater than 75%) on the eastern side to the western at around 50-75% chance

For further information on the vulnerability of the area from either surface water or river/sea flooding, please see the maps available from the Environment Agency on the .GOV website.

Hampshire also have a draft [Groundwater Management Plan](#) that was never published but is available on our website which contains useful information

HCC prepared [Surface Water Management Plans](#) which are available on our website however these will be replaced by Catchment Approach Plans over the forthcoming months.

Planning requirements

Hampshire County Council's website lists all the information required when assessing planning applications. This information should be provided within a Flood Risk Assessment, Drainage Strategy, drawings and calculations.

We would recommend the inclusion of an executive summary to provide key information in a more accessible format or the inclusion of our checklist (available in section 3 on our website)

Please note: the Environment Agency guidance relating to climate change was updated in February 2016. A [link](#) is provided on the County Council webpage. *We would expect that the system is tested to a 40% climate change uplift.*

We would also expect to see a suitable allowance for urban creep, this factor reflects the future predicted increase of urban development, and with it, the increase of the impervious area. An allowance of 10% on impermeable areas is suitable in relation to confirming that the proposed system is acceptable.

This response has been provided using the best knowledge and information submitted as part of the planning application at the time of responding and is reliant on the accuracy of that information.

If you have any queries on this pre-application advice please contact the FWM Team quoting the above reference.

Regards



FWM Team
fwm@hants.gov.uk

Users' declaration

I understand that in using advice provided by the Hampshire Flood and Water Management Team I am aware of the following:

1. The Flood and Water Management (FWM) Team is part of Hampshire County Council ("We/Us/Our"). The Council holds copyright of this information and advice on behalf of the FWM team except where service level agreements state otherwise. No direct reproduction of this advice will be allowed as a direct copy, except for the purpose of Environment Information Requests.
2. Advice provided by the Hampshire FWM Team will only be used for the purpose stated and will not be stored beyond the life of the project for which it was acquired.
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4. Whilst every reasonable effort is made to validate information supplied to and by the Hampshire FWM Team owing to the dynamic and judgmental nature of information relating to flooding, the Hampshire disclaims any responsibility for the accuracy or comprehensiveness of the information supplied, and accepts no liability for any indirect, consequential, or incidental damages or losses arising from use of the information.
5. I am aware of the Hampshire FWM Team charging schedule and understand I may be charged for the advice.



Appendix H

SUDS MANAGEMENT AND MAINTENANCE PLAN

**PROPOSED RESIDENTIAL DEVELOPMENT
MANOR FARM
BEDHAMPTON
HAMPSHIRE**

SUDS MANAGEMENT & MAINTENANCE PLAN

BARGATE HOMES LTD

APRIL 2019

REF: SS/19/0185/5992



DOCUMENT CONTROL RECORD

Document Issue:

Rev	Date	Issue Status	Prepared by	Checked by
-	04.04.19	First Issue	S. Smith	C. Pendle

References:

The SUDS manual – CIRIA C753 (2015) ISBN 9780-86017-760-9

National Planning Policy Framework (NPPF) – Communities and Local Government
Technical Guidance - Flood Risk & Coastal Change (March 2012)



1 Introduction

- 1.1 This document sets out the principles for the long term management and maintenance of the proposed surface water Sustainable Drainage Systems (SuDS) installed at the residential development at land adjacent to Lower Road, Bedhampton.
- 1.2 The purpose of this document is to set out the basis of the development SuDS Maintenance Plan and to ensure that the adopting management company is entrusted with a robust inspection and maintenance programme, ensuring the optimum operation of the surface water drainage network is continually maintained for the lifetime of the development and to prevent the increased risk of flooding both on and off site in accordance with the National Planning Policy Framework (NPPF).
- 1.3 The activities listed in this document are generic to the relative SuDS types and represent the minimum maintenance and inspection requirements, however additional tasks or varied maintenance frequency may be instructed by the maintenance company as required. Specific maintenance needs of the SuDS elements should be monitored and maintenance schedules adjusted to suit requirements.
- 1.4 The installed SuDS system at this development are the initial responsibility of Bargate Homes.
Following installation and after an initial period (TBC) of operation, all SuDS are to be transferred to an appointed Management Company.
An agreement shall be set up by Bargate Homes, who shall confirm in writing to the Principle Planning Officer at Hampshire County Council when the maintenance agreement is completed and is operative.
- 1.5 The Management Company will then be responsible for maintaining the surface water system including all SuDS in perpetuity. All property owners should be advised that an annual management fee will need to be paid to the management company for this service.
- 1.6 All those responsible for maintenance should follow relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) for all activities listed within this report including lone working, if relevant) and risk assessments should always be undertaken.
- 1.7 Any contractor employed by the Management Company shall carry out periodic maintenance of all such SuDS in accordance with the schedules listed in this report. Inspection checks shall be carried out by a qualified and competent person, at the minimum intervals listed within the schedules and the appropriate work carried out.
- 1.8 This report is to read in conjunction with MJA drawing '5992:P01 *'Drainage Strategy'* for the location of all SuDS elements present within the development. Reference should also be made to the detailed landscape proposals for the proposed treatment / maintenance regime for all landscape features. The operations contained within this plan shall (where feasible) be in conjunction with routine grounds maintenance operations to the surrounding landscape.

2 SuDS Layout & Design

- 2.1 The storm water drainage strategy for the proposed development is to utilise a range of SuDS features to attenuate all surface water runoff from impermeable areas, with a restricted discharge via a flow control into deep borehole soakaways.
- 2.2 The proposed storm water system consists of the following drainage and SuDS components:
- Attenuation Basin
 - Storm water pipe work and road gullies
 - Flow control chambers
 - Outfall headwall
 - Linear Filter Trench (with perforated pipe)
- 2.3 There are three categories of maintenance activities referred to in this report:
- **Regular maintenance** (including inspections and monitoring).
Consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.
 - **Occasional maintenance**
Comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).
 - **Remedial maintenance**
Comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design.
Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

3 SUDS Management & Maintenance

3.1 Storm water pipe work and road gullies

- 3.2 The key maintenance requirement for the upstream surface water drainage system includes the removal of sediments and debris from the system as required.
- 3.3 All storm water pipe work should be visually inspected a minimum of monthly for the first three months after installation and then a minimum of once a year.
As road gullies are the first on the treatment train and susceptible to higher silt loadings, these will need to be inspected a minimum of monthly for the first three months after installation and then a minimum of every four months.
- 3.4 During this inspection identify any gully pots or pipes that require remedial maintenance such removal of sediment, debris, leaves and litter as required.
This involves the removal all protective covers and grids and the cleaning out of channels or gully pots by hand or with suitable jetting equipment.
- 3.5 During the inspections the general operation and structural integrity of all components should be recorded and repaired as required.

3.6 Flow Control Chamber

- 3.7 The key maintenance requirement for the flow control chambers will be the inspection of the units for blockages of the vortex flow control unit and silt removal from sump of chamber.
- 3.8 The hydraulic vortex flow control unit has no moving parts and is self-activating, requiring minimal maintenance. After initial installation, it is recommended that the unit be inspected monthly for three months.
- 3.9 Thereafter the manhole chamber and control device should be inspected at least every six months to verify the condition and operation of the unit and check for blockages within the inlet of the chamber and of the flow control device. During these inspections, accumulated silts should be removed and the sump cleaned out using a conventional sump vacuum cleaner. Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.

3.10 Outfall Headwalls

- 3.11 Outfall headwalls should be visually inspected a minimum of monthly for the first three months after installation and then a minimum of once a year.
Accumulated sediments, debris and any overgrown vegetative material should be removed from the culvert and margins of the outlet headwalls as necessary.

- 3.12 During the inspections the general operation, and structural condition of the headwall and any erosion of banks or scour control features should be identified and rehabilitated as required.

3.13 Attenuation Basins

Key Maintenance Requirements:

- Litter/trash removal
- Inlet/outlet headwall inspection and cleaning
- Vegetation management
- Sediment monitoring and removal when required

- 3.14 Regular inspection and maintenance is important for the effective operation of the attenuation basin.
The basin will be subject to a routine monitoring and maintenance schedule as part of the general site management.
This will be carried out at intervals detailed below, and shall comprise of the following operations:
Collection and removal of all litter/large debris from the attenuation pond, inlets, outflows, and water margins once a month.
Monthly inspection of the attenuation ponds to check the following, and repair as necessary:
1. 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.
 2. Any damage or erosion to the perimeter edges and slopes of the attenuation ponds.
- 3.15 The attenuation basin will be sown with two grassland seed mixes to create a simple mosaic of grassland habitat. The floor of the basin will be seeded with a wet meadow mix (WF2), whilst the banks will be seeded with a standard wildflower meadow mix (WF1) as detailed on the landscape proposals drawings.
- 3.16 **Ground preparation**
The basin should be constructed of predominantly low fertility subsoil, with only a thin upper layer of topsoil to be left after ground modelling to take up in-perfections in the soil surface. Final surface to be harrowed / fully cultivated to break-up large soil clods.
The basin area should then be continually cultivated of a period of several weeks to remove unwanted surface vegetation and weeds prior to meadow seeding.
No herbicide is to be used due to the sensitive location for the basin construction. The ground should be cultivated to form a medium tilth and basin to be seeded at the recommended sowing rate, followed by light rolling (if necessary) throughout the meadow area.
- 3.17 **Landscape Maintenance (Year 1)**
In the first year, meadow areas should be managed more intensively to prevent the intrusion of invasive ground flora and allow a diverse sward to develop. The first cut should occur when the grass reaches approximately 100mm, down to 50mm, followed by subsequent cuts every 4-6 weeks down to 50mm throughout the first growing season.

Meadow areas should be monitored to assess the growth of any invasive species and grassland areas should be hand-weeded or spot swiped for any perennial weeds such as docks, nettles and ragwort.

3.18 Landscape Maintenance (Year 2 onwards)

Meadow areas will be maintained with a bi-annual cuts in May / June and after seed has dropped in late September. Meadow grassland should be cut to a height of approximately 100mm. All arising should be allowed to lay in-situ for 24 hours before being removed from site in order to allow any wildlife using the basin to disperse.

No fertiliser should be added to the grassland at any time and an annual monitoring visit to the grassland should be conducted to inform management that may be required.

3.19 An annual check carried out by a suitably qualified person, to assess the condition and operation of the attenuation basin inlet and outflow, and the accumulation of silt/sediment.

3.20 A record of maintenance visits and remedial operations shall be maintained.

3.21 The above operations shall (where feasible) be in conjunction with routine grounds maintenance operations to the surrounding landscape.

Basin Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter, debris and trash removal.	Monthly.
	Grass cutting – for landscaped areas and access routes.	Monthly (during growing season), or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring – before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
Occasional maintenance	Re-seed areas of poor vegetation growth.	Annually, or as required.
	Prune and trim trees and remove cuttings.	As required.
	Remove sediment from pre-treatment system when 50% full.	As required.
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required.
	Realignment of rip-rap.	As required.
	Repair/rehabilitation of inlets, outlets and overflows.	As required.
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates.	As required.
	Re-level uneven surfaces and reinstate design levels.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly.
	Inspect banksides, structures, pipework, etc for evidence of physical damage.	Monthly.
	Inspect inlets and pre-treatment systems for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Inspect infiltration surfaces for compaction and ponding.	Monthly.

3.22 Desilting of Attenuation Basins

In addition to regular routine items, SuDS maintenance will be carried out which may include de-silting the attenuation ponds, usually on a 10-15 year cycle depending on the on-going silt level checking.

This can be an intrusive operation when carried out within housing areas and prior to any planned desilting or dredging, consultation will be undertaken with both Buckinghamshire County Council and the Environment Agency.

3.23 Before any desilting operations are carried out, residents and 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.

3.24 The desilting work will be carried out under the supervision of consulting engineers and to a pre-agreed method statement. Such a method statement should be submitted in writing to the local authority and agreed in advance of the commencement of the works.

3.25 Prior to desilting works commencing, a suitably qualified ecologist shall be appointed to undertake an assessment of the ecological interest within the pond and its margins. In the event that the attenuation ponds develop particular ecological interest, then careful consideration will be given to the timing of this operation.

3.26 Linear Filter Trench

3.27 The filter trench is a below ground linear excavation filled with stone and a perforated pipe running the length.

At each end of the trench there are catchpit inspection chambers.

These catchpit chambers allow for the collection of sediments/debris from the catchpit sump and for the internal inspection / clearance of blockages of the perforated pipe if required.

3.28 Filter trenches require minimal maintenance, such and inspection of the catchpit manhole for accumulation of sediment or debris and cleaned out as required.
It is recommended that the catchpits be inspected no less frequently than 3 monthly intervals for the first year and thereafter at 6 monthly intervals.

3.29 If the filter trench becomes blocked or fails to operate as designed, then further inspection / repairs may be required from an external drainage contractor.
The perforated pipe that runs the length of the soakaway allows for internal CCTV / jet rod access for inspection and clearance of blockages.

Infiltration Trench Operation and Maintenance Requirements

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber.	Annually.
	Cleaning of gutters and any filters on downpipes.	Annually.
	Trimming any roots that may be causing blockages.	Annually, or as required.
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required.
	Replacement of clogged geotextile.	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.

4 Contact Information

For further information on the management and maintenance of SuDS on the development please contact:

MJA Consulting
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24 The Quadrant
Abingdon Science Park
Oxfordshire
OX14 3YS

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