

LAND ADJACENT TO 4 BROOKFIELD, PROVIDENCE HILL, BURSLEDON

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

April 2024

Colten Care

CARE HOME
LAND ADJACENT TO 4 BROOKFIELD
PROVIDENCE HILL, BURSLEDON

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

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1. EXECUTIVE SUMMARY

- 1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Paul Basham Associates on behalf of Colten Care to support a Full planning application for a care home development in Bursledon. The land is located to the west of 4 Brookfield, Providence Hill. The nearest postcode is SO31 8AU.
- 1.2 The development is in Flood Zone 1.
- 1.3 Residual flood risk from:
- Fluvial and tidal flooding is considered to be low
 - Surface water flooding is considered to be very low
 - Groundwater flooding is considered to be very low
 - Sewers flooding is considered to be very low
- 1.4 Discharge rates shall be restricted to 2 l/s.
- 1.5 Long-term storage has been allowed for.



2. INTRODUCTION

- 2.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Paul Basham Associates on behalf of Colten Care to support a Full planning application for a care home development in Bursledon. The land is located to the west of 4 Brookfield, Providence Hill. The nearest postcode is SO31 8AU.
- 2.2 The site is situated on the outskirts of Bursledon, Southampton, is approximately 300m south of the M27 and 1.3km west of the river Hamble. See **Figure 1** below for site location.
- 2.3 The plot size is approximately 1.08ha and the land is currently open field with a small number of outhouses.



Figure 1: Site Location Plan (Source: Google Maps)

- 2.4 The site is currently accessed via a gravel driveway adjacent to the property at 4 Brookfield, Providence Hill. See **Figure 2** below.



Figure 2: Existing Site Access

- 2.5 The development aspirations are for a residential care development comprising of a 73-bed care home in addition to 5 residential cottages with private back gardens. The proposal also includes parking spaces and communal open spaces. See **Appendix A** for the site layout plan.

3. SITE DESCRIPTION

Topography

- 3.1 The topographical survey shows the site's highest point is 52.7m AOD located in the far west corner of the site, while the lowest point is 34.59m AOD located in the northeast corner of the site. The topographical survey can be found in **Appendix B**.

Geology

- 3.2 A review of the British Geological Survey (BGS) mapping indicates that the bedrock geology beneath the site is “*Wittering Formation - Sand, silt and clay. Sedimentary bedrock formed between 56 and 41.2 million years ago during the Palaeogene period*”. No superficial deposits were recorded on site. See **Figure 3** for the BGS map extract.



Figure 3: BGS bedrock mapping

3.3 A BGS 'Infiltration SuDS GeoReport' has been obtained (Included in **Appendix C**) and shows the below;

Drainage Potential

The report found that the site sat between “may be compatible for infiltration SuDS” and “opportunities for infiltration SuDS”. Further investigation will be required to gain a better understanding of the properties of the soil. See **Figure 4** below.

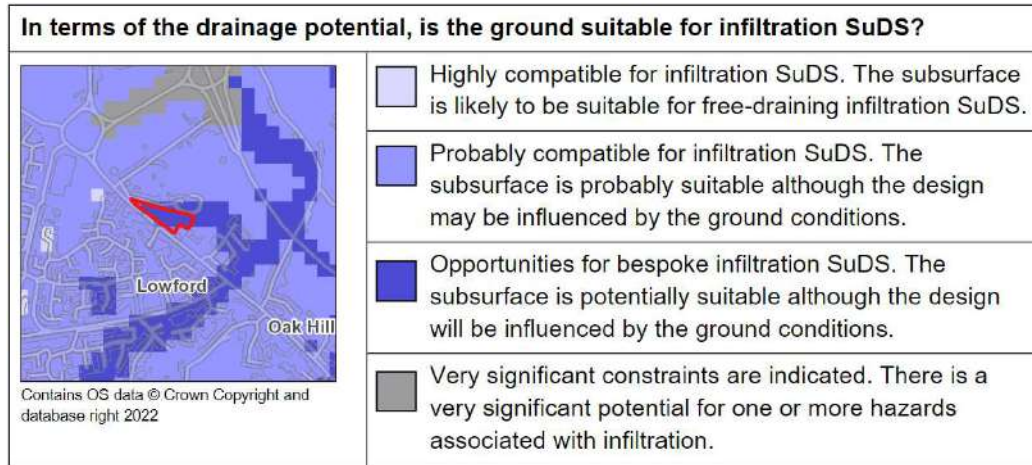


Figure 4: SuDS GeoReport Drainage Potential Extract

Ground Instability

3.4 The report found that “ground instability problems are probably present. Increased infiltration may result in ground instability”. As a result, although drainage potential may be present, ground instability concerns make infiltration not viable for this site. See **Figure 5** below.

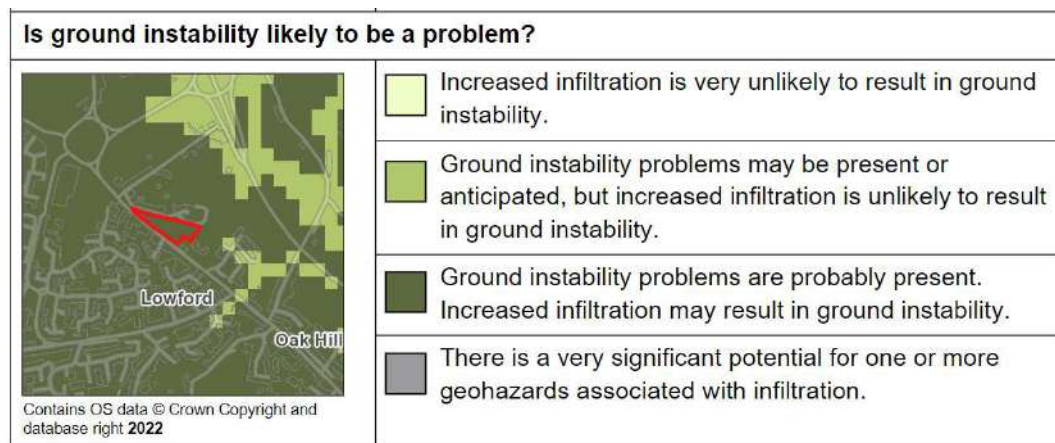


Figure 5: SuDS GeoReport Ground Instability Extract

Groundwater Susceptibility

- 3.5 The report found that “the groundwater is not expected to be especially vulnerable to contamination. See **Figure 6** below.

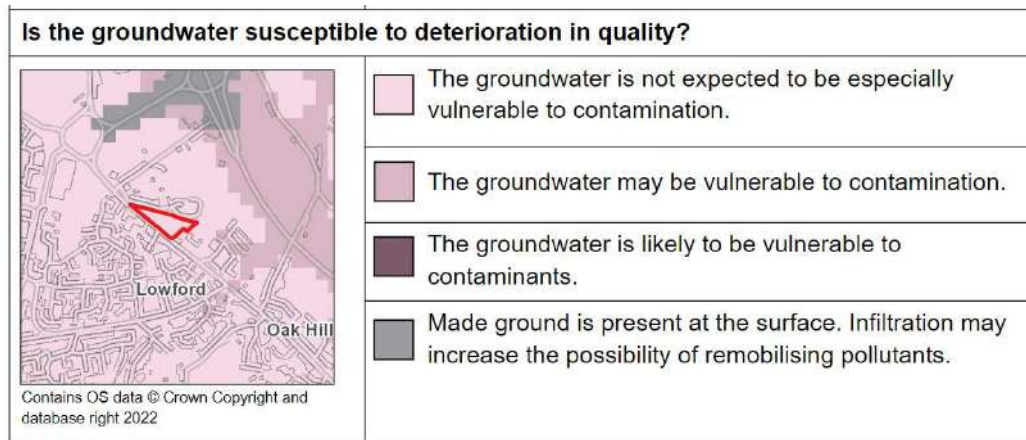


Figure 6: SuDS GeoReport Groundwater Susceptibility Extract

Hydrology

- 3.6 There is an existing unnamed watercourse which runs adjacent to the northern boundary of the site.

Hydrogeology

- 3.7 The EA "Magic Map" was employed to assess the site's proximity to source protection zones. Figure 7, extracted from the Magic Map, confirms that the site is situated outside of any source protection zones. (The site's postcode is marked by a blue hatch)

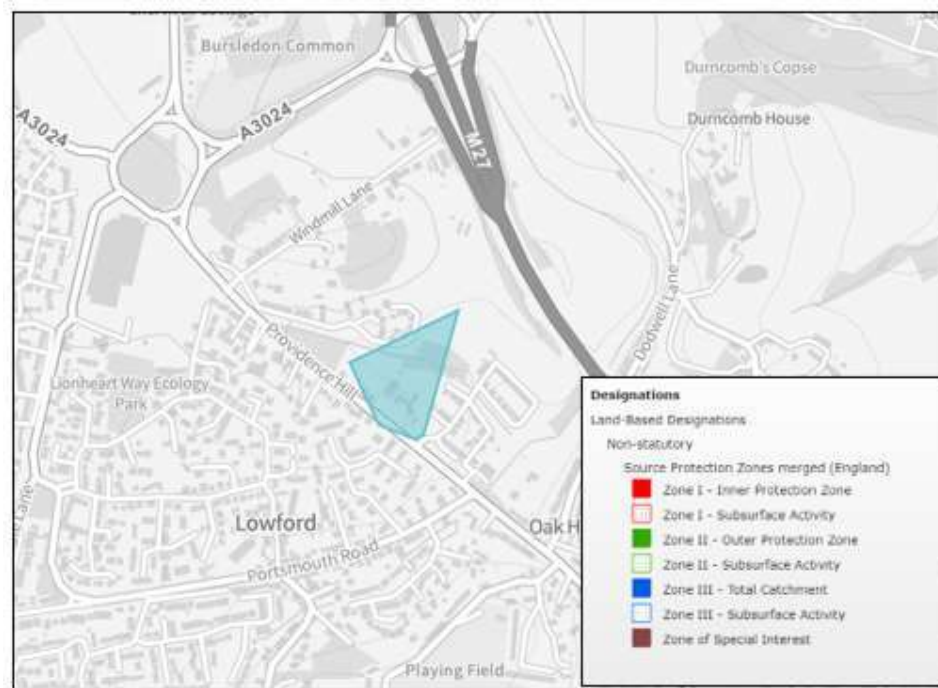


Figure 7: DEFRA Source Protection Zone Mapping

Public Sewer

- 3.8 The site is currently an open, undeveloped field and drains naturally. There is no apparent connection to a southern water public sewer.

Existing Foul Water Drainage

- 3.9 The site does not currently produce any foul flows. No connections to existing Southern Water sewers are evident. There is a Southern Water foul water public sewer running in Providence Hill A27 to the south of the site. Southern Water sewer records can be found in **Appendix D**.

Greenfield rates and volumes

- 3.10 The greenfield run-off rates for the site have been estimated using the HR Wallingford online calculator on the UK SuDS website. The run-off rate for the full site area of 1.08 hectares is 5.95 l/s while the rate for the proposed developed area of 0.33 hectares for the existing site is 1.82 l/s and is shown in **Figure 8** below. The soil type has been edited to type 5, to reflect the impermeability of the underlying soil, which results in higher runoff rates as summarised in **Figure 8** below.
- 3.11 Whilst the Qbar rate is estimated to be 2.36l/s using the HR Wallingford calculations, the proposal is to limit the discharge to 2 l/s to provide an additional margin of safety.
- 3.12 The estimated runoff rates result in a total storage volume of 244m³ for the 1in 100 year event (including a long term storage volume of 565m³). The full calculation outputs can be found in **Appendix E**.

Greenfield rate	Soil Type 4 (default)	Soil Type 5 (edited)
Qbar (l/s)	1.82	2.36
1in1 year (l/s)	2	2
1in30 year (l/s)	4.2	5.4
1in100 year (l/s)	5.8	7.5

Figure 8: Greenfield Runoff Rates



4. PLANNING POLICY

- 4.1 The planning policies and guidance that are relevant to the proposed Development with regard to flood risk and surface water management are outlined below.

National Planning policy

- 4.2 2021 updated National Planning Policy Framework (NPPF) and the associated 2021 updated Planning Practice Guidance (PPG) by the Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government

- 2022 updated EA Standing Advice
- EA National Strategy for Flood and Coastal Erosion Risk Management 2020
- DEFRA Sustainable Drainage System: Non-Statutory Technical Standards 2015
- CIRIA C753 The SuDS Manual 2015
- Flood and Water Management Act 2010
- Flood Risk Regulations 2009
- Flood risk assessments: climate change allowances 2016 (updated in 2021).

Regional Planning policy

- 4.3 Hampshire County Council as the Lead Local Flood Authority provides the following planning strategies and policies:

- Hampshire Local flood and water management strategy
- Hampshire County Council Preliminary Flood Risk Assessment

Local Planning Policy

- 4.4 The Eastleigh Borough Council (EBC) local plan contains the following policies relating to flooding, drainage, and surface water:

- Policy DM3, Adaption to climate change.
- Policy DM5, Managing Flood Risk.
- Policy DM6, Sustainable Surface Water Management and Watercourse Management.



4.5 Based on the above policies, the key requirements in relation to the surface water management and flood risk for the proposed Development are considered as to be follows:

- National Planning Policy Framework (2021): “A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.”
- Environment Agency Standing Advice: “The surface water management needs to meet requirements set out in either your local authority’s Surface Water Management Plan (SWMP), Strategic Flood Risk Assessment (SFRA) and Building Regulations Part H. Emergency escape plans for any parts of a building that are below the estimated flood level are required”
- CIRIA C753 The SuDS manual 2015: “Control the quantity of runoff to support the management of flood risk and maintain and protect the natural water cycle. To ensure that the surface water runoff from a developed site does not have a detrimental impact on people, property, and the environment, it is important to control how fast runoff is discharged from the site (i.e., the peak runoff rate) and how much runoff is discharged from the site (i.e., the runoff volume). Suds that are designed to manage water quantity in this way reduce the likelihood of flooding caused by the development. They can help protect natural water cycles by promoting the recharge of soil moisture levels, by maintaining stream and river baseflows and by replenishing groundwater”.



5. CLIMATE CHANGE

Peak Rainfall Intensity Allowance

- 5.1 The “Flood Risk Assessments: Climate Change Allowances Guidance” 2016 (updated in 2021) published by the EA indicates that climate change is currently expected to result in increased peak rainfall and rising sea and river levels.
- 5.2 Table 1 and Table 2 show anticipated changes in peak rainfall intensity in small and urban catchments within the East Hampshire Management Catchment. The development is classed as more vulnerable, and the design life is approximately 75 years.
- 5.3 The peak rainfall intensity allowance during the 3.3% Annual Exceedance Probability (AEP) event is 40%

Epoch	Central Allowance	Upper End Allowance
2050s	20%	35%
2070s	25%	40%

Table 1: Peak Rainfall Intensity allowance in small and urban catchments. 3.3%AEP Events ([Source link](#))

- 5.4 The peak rainfall intensity allowance during the 1% Annual Exceedance Probability (AEP) event is 45%

Epoch	Central Allowance	Upper End Allowance
2050s	20%	40%
2070s	25%	45%

Table 2: Peak Rainfall Intensity allowance in small and urban catchments. 1%AEP Events ([Source link](#))

Peak River Flow Allowances

- 5.5 Table 3 shows the anticipated changes in the peak river flow allowances

Epoch	Central Allowance	Upper End Allowance
2050s	19%	37%
2070s	22%	51%
2080s	37%	88%

Table 3: Peak River Flow Allowances ([Source link](#))

- 5.6 Considering the development is in Flood Zone 1, is classed as “more vulnerable”, and the design life is approximately 75 years, the peak river flows allowance is 37% (based on the Central Allowance).



National Planning Policy Framework (NPPF)

- 5.7 This report has been prepared considering the National Planning Policy Framework (NPPF) Technical Guidance and the Environment Agency's (EA) flood risk standing advice.
- 5.8 Table 2 from the Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government Flood risk and coastal change guidance has been included as **Figure 9** below. This provides the classes of development (based on flood risk vulnerability) that are permitted within each of the flood zones. The Flood Risk Vulnerability Classification for the site is 'More Vulnerable' as it is a residential care home development, which is defined in Annex 3 of the NPPF.
- 5.9 The development is in Flood Zone 1; therefore no sequential test or exception test is required.

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Table 2 - Flood risk vulnerability and flood zone 'compatibility'

Key: ✓ Exception test not required X Development should not be permitted.

Notes to table 2:

- This table does not show the application of the [Sequential Test](#) which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and [Exception Tests](#) do not need to be applied to [minor developments](#) and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* "In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Figure 9: NPPF Planning Practice Guidance Table – Flood Risk Vulnerability and Flood Zone Compatibility



6. FLOOD RISK

6.1 In line with the EA Standing Advice, the estimated flood level is considered to be the higher of:

- A river flood level with a 1 in 100 or greater annual probability plus an allowance for climate change; and
- A tidal flood level with a 1 in 200 or greater annual probability plus an allowance for climate change.

6.2 The following Flood Zone definitions ignoring flood defence, are set out in the Planning Practice Guidance:

- Zone 1 Low Probability - Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- Zone 2 Medium Probability - Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%– 0.1%) in any year; and
- Zone 3 High Probability - Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.



Fluvial / Tidal Flood Risk

- 6.3 Flood mapping obtained from the government's 'flood map for planning' website has identified that the site falls within Flood Zone 1. See **Figure 10** below.

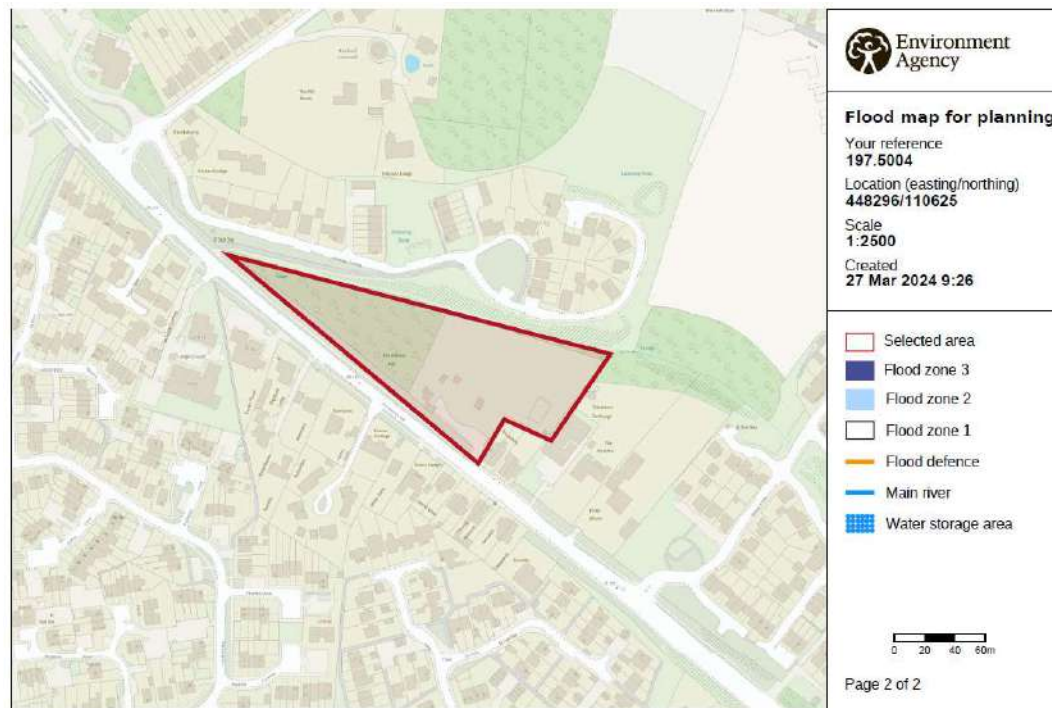


Figure 10: Flood Map for Rivers and Seas

Long term flood risk from rivers and seas

- 6.4 The long-term flood risk and from rivers and seas mapping shows the site is not considered to be at risk from river or sea flooding. See **Figure 11** below.

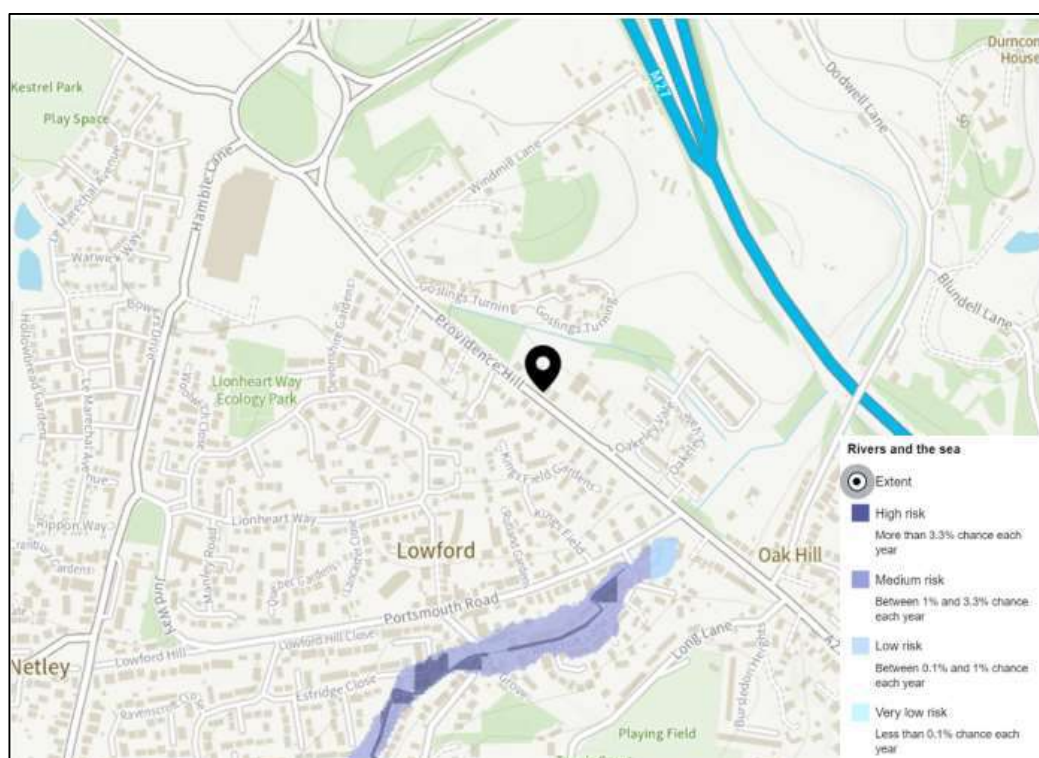


Figure 11: Long-term flood risk from rivers and seas map

Fluvial flooding – Residual Risk

- 6.5 Based on the above, it can be concluded that residual risk from fluvial flooding is low for the proposed site.

Long-term Flood Risk from Reservoirs

- 6.6 The long-term flood risk from reservoirs shows that the site is not considered to be at risk of long-term flooding from reservoirs.

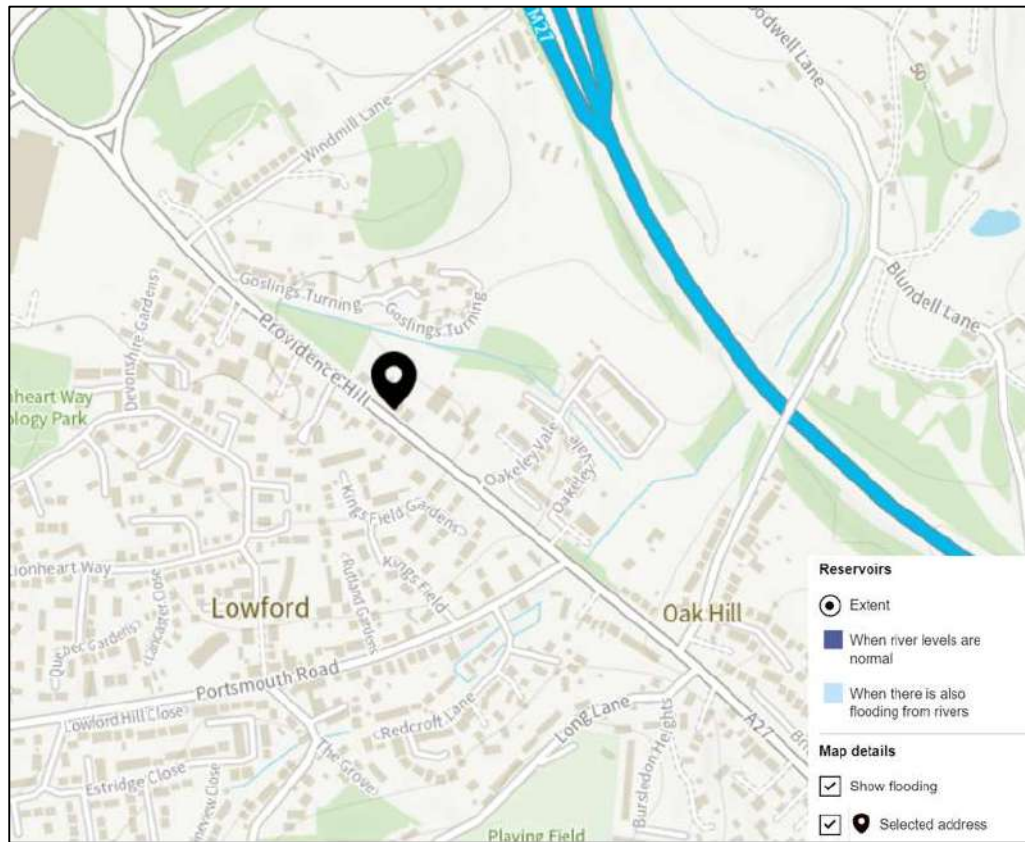


Figure 12: Long term flood risk from reservoirs map

Reservoirs – Residual Risk

- 6.7 Based on the above map (Figure 12), there is no residual risk considered from reservoir flooding.

Surface Water Flood Risk

- 6.8 Surface water or 'pluvial' flooding results from rainfall running over ground before eventually entering a watercourse or sewer. It is usually associated with high intensity rainfall events but can also occur with lower intensity rainfall or melting snow where the ground is already saturated, frozen, developed (for example in an urban setting), or otherwise has low permeability.
- 6.9 The surface water flood risk map is shown in **Figure 13** and indicates that the majority of the site is at a very low risk of pluvial flooding, with the existing watercourse along the northern boundary providing a small area of high to low risk.

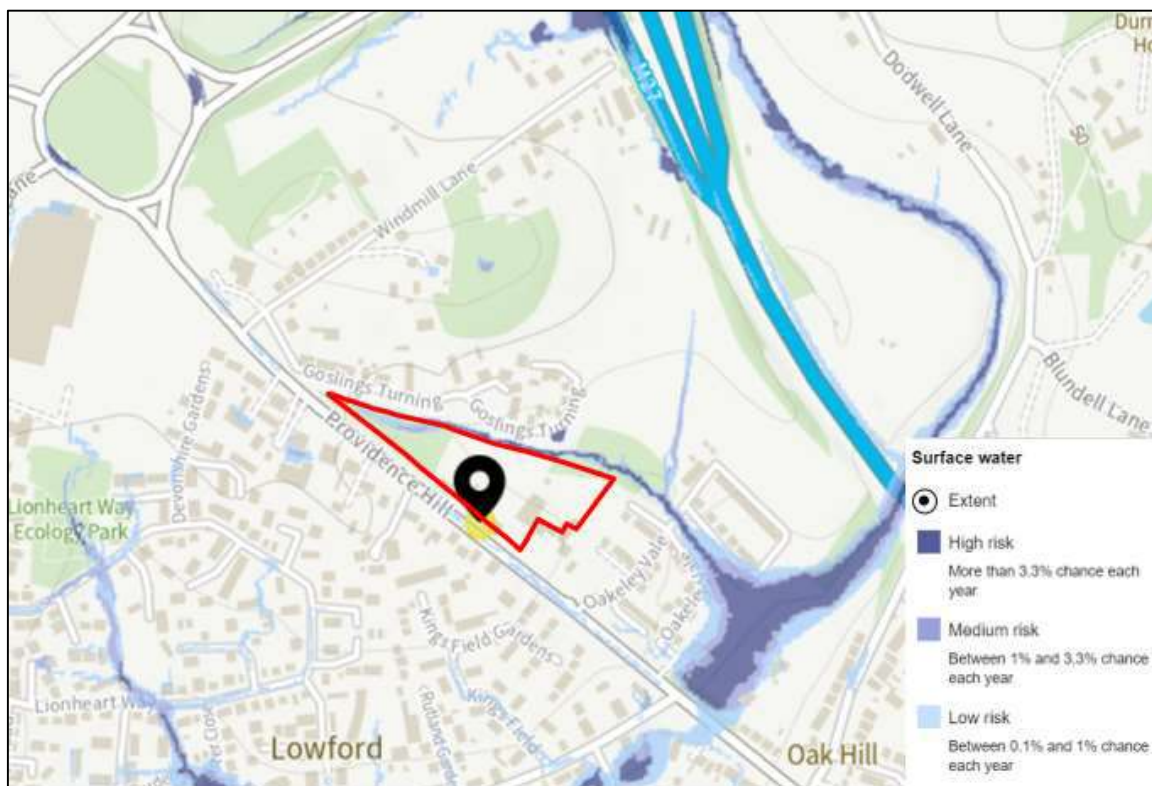


Figure 13: Long term flood risk from surface water

Surface Water – Residual Risk

- 6.10 Accordingly, residual risk from surface water flooding is considered to be very low.

Surface Water – Mitigation Measures and Considerations

- 6.11 The drainage strategy will incorporate SuDS features which will reduce surface water runoff. Furthermore, the proposed cottages in the western portion of the site are at grade with the existing ground levels, and the ground falls away from the cottages, hence imposing very little risk of flows impacting the houses.

Groundwater Flood Risk

- 6.12 Groundwater flooding occurs when groundwater levels increase sufficiently for the water table to intersect the ground surface. Groundwater flooding can occur in a variety of geological settings including valleys and in areas underlain by chalk, and in river valleys with thick deposits of alluvium and river gravels.
- 6.13 There are no groundwater flooding incidents recorded in the proximity of the site as shown in the SFRA map set 1E data as seen in **Figure 14** below (site boundary in white).



Figure 14: SFRA Groundwater Flooding & Bedrock Permeability

- 6.14 The BGS Geo-report (**Appendix C**) suggests that the site does not have persistent shallow groundwater, as shown in **Figure 15** below. However, the report does also suggest that the majority of the site groundwater are likely to be less than 3m below the existing ground surface for at least part of the year. See **Figure 16** below.

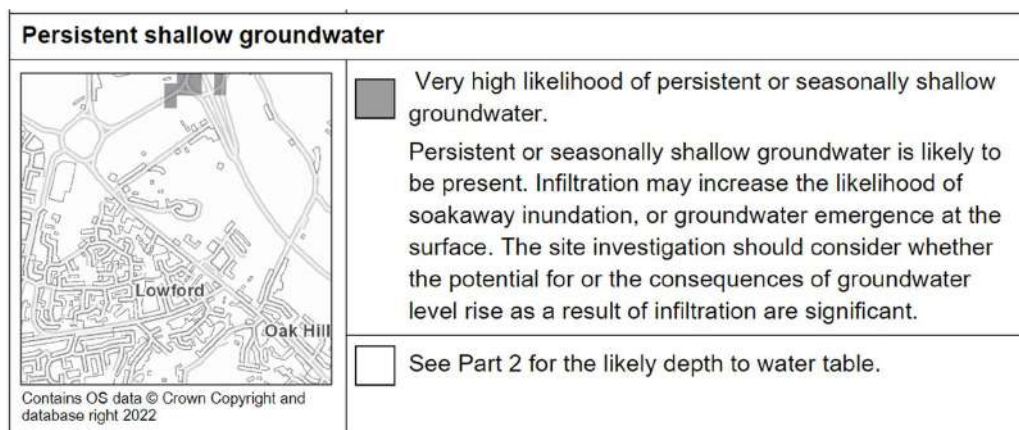


Figure 15: BGS GeoReport Persistent Shallow Groundwater

Sewer – Residual Risk

6.19 Based on this, the site is considered to be at low risk of sewer flooding.

7. RESIDUAL FLOOD RISK

7.1 Table 4 outlines the initial qualitative assessment of risk posed by the potential sources of flooding, the mechanisms for flooding and the likely consequences. It also includes a review of possible mitigation measures and the effect that the proposed mitigation measures are likely to have on the residual risk posed by the potential flood source.

Flood Risk	Flood Mechanism and Possible Consequences	Existing Assessment of Risk	Mitigation Measures	Residual Risk
Fluvial / Tidal	Flooding driven by rise in water levels in ditch.	Low	EA flood mapping shows the site is in Flood Zone 1 with low risk of Fluvial flooding. Additionally, ditch levels are lower than the proposed levels on site.	Low
Reservoirs	N/A	Very Low	N/A	Very Low
Surface Water (Pluvial)	Surface Water Flooding during heavy rainfall. Existing surface water flood risk.	Very Low	The proposed drainage system will capture and attenuate surface water run-off. Existing run-off will not affect the proposed cottages as they are at grade with the existing ground levels and the surrounding ground falls away from the houses.	Very Low
Groundwater	Ground Water Exceedance events	Very Low	Soil permeability is very low which would not allow ground water to rise to the surface and cause flood risk.	Very Low
Sewers	Sewer Surcharging	Low	The surface water drainage strategy shall attenuate runoff onsite and discharge into the watercourse, which will reduce the discharged load into the existing sewers. Hence, reducing sewer overload.	Very Low

Table 4: Summary of Existing and Residual Flood Risk



8. DRAINAGE STRATEGY

Potential Surface Water Drainage Strategy

- 8.1 In line with the Building Regulations Part H3, surface water shall discharge to one of the following, listed in order of priority:
- An adequate infiltration system: or, where not reasonably practicable,
 - A watercourse; or, where not reasonably practicable,
 - A sewer.
- 8.2 As per paragraphs 3.4 and 6.15, infiltration is not considered viable for this site, therefore the proposals for the surface water drainage are to attenuate runoff on site and discharge at a controlled rate of 2l/s via a HydroBrake into the existing watercourse running along the northern boundary of the site.
- 8.3 The pre- and post-development volumes have been calculated for the site for the 6-hour storm event as shown in **Table 5**

Rainfall Event	Net Area	Greenfield Rate	Greenfield Volume	Post Development Rate	Post Development Volume
	Ha.	l/s	m ³	l/s	m ³
Qbar	0.33	2.36	50.98	Restricted to 2 l/s	43.2
1:1 yr		2.00	43.20		43.2
1:30 Yr		5.40	116.64		43.2
1:100 Yr		7.50	162.00		43.2

Table 5: Run-off volumes

- 8.4 The total storage estimated using the HR Wallingford calculator (including long term storage) is 244m³. The drainage strategy proposes a total storage volume of 683m³.
- 8.5 The drainage strategy proposes restricting discharge to 2 l/s rate, which is lower than the estimated Qbar of 2.36l/s. This significantly reduces the pre-development greenfield volumes, specifically during the 1 in 30 and 1in 100 year storms (see **Table 5**).
- 8.6 Per the statutory process, an Ordinary Watercourse Consent will need to be sought post planning for discharging into the ditch.
- 8.7 Runoff from roofs and roads shall be collected and temporarily stored in attenuation crates prior to discharging. The cates shall be installed underneath the parking spaces, whilst the largest crate shall be located in the northeastern corner, upstream of the HydroBrake.
- 8.8 Type C permeable paving is proposed for parking spaces to collect surface runoff at source and to provide water treatment.
- 8.9 A vortex separator (Downstream Defender – or similar approved) has been proposed downstream of the network in order to uplift water quality and remove oils and floatables, in line with CIRIA C375 pollution mitigation indices.



8.10 Further to the permeable paving and the vortex separator, a train of open SuDS has been proposed to provide secondary and tertiary stages of natural water filtration for the site (in accordance with Eastleigh Borough Council's planning policy DM6). The additional filtration will be achieved through a bio-retention filter strip (located downstream of the vortex separator) and a swale proposed immediately upstream of the outfall headwall.

8.11 The proposed drainage layout is included in **Appendix F**.

Hydraulic Calculations

8.12 Hydraulic calculations have been undertaken using Site3D software and show that in the 1 in 100 year storm event (including 45% Climate change) there is no flooding in the drainage system. The full network calculations are included in **Appendix G**.

8.13 The below table contains the parameters used in the supporting hydraulic network modelling.

Parameter	Input	Guidance/notes
Rainfall Data	FSR	HCC Surface Water Checklist: FSR or FEH acceptable.
Urban Creep	0%	HCC Surface Water Checklist: 10% Urban Creep is only applicable for residential developments and excludes flats or apartments.
CV (Summer and Winter)	1.0	SFA 7
Climate Change		EA Climate change allowances for peak rainfall in England
3.3% AEP	40%	https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall
1% AEP	45%	

Table 6: MicroDrainage Modelling Parameters

8.14 Whilst the network is designed to ensure no flooding occurs during all storm events, including the 1 in 100 year (+ 45% climate change), exceedance flow arrows have been shown on the drainage layout in **Appendix F** (Ref:197.5005.0002) to indicate the water flow in the event of a network failure or in extreme storm events.



Potential Foul Water Drainage Strategy

- 8.15 Southern Water mapping shows there is an existing sewer within Providence Hill, where the nearest manhole available for connection is Manhole 3502 (IL: 43.41m AOD).
- 8.16 The proposals for the foul drainage are to drain foul water generated from the site via gravity towards a private package pump located near the northwestern corner of the care-home. The proposed pump will pump the foul water through a rising main running towards the site's access where it will eventually connect into a break chamber upstream of existing manhole 3502.
- 8.17 Based the site layout plan (**Appendix A**) the foul flows from the 5 residential cottages (with 5 residents) are estimated to be approximately 3,750 l/day. This figure is derived from an assumption of 150 l/day per person as per Flows & Loads 4 guidance, where each cottage is assumed to house 5 people.
- 8.18 Whilst the British Flows and Loads 4 guidance, estimates the foul flows from the residential cottages to be 150 l/day per person, it should be noted that the water consumption for the site has been improved to be 110 l/day per person (according to the Nutrient Neutrality Report prepared by Ecosupport, April 2024). Based on this, it is estimated that 85% of the total water consumption generates foul flow, which provides an estimated foul flow of 2,338 l/day generated by the 5 cottages.
- 8.19 British Flows and Loads 4 guidance estimates that a residential care home would have approximately 350 l/day per activity. Based on this, the flows from the 73-bed care home are estimated to be around 25,550 l/day.
- 8.20 To provide for up to 24-hours storage in the event of a pump failure, a minimum of 29.3m³ is required for the pump. The proposed pump allows for up to 44m³. The 24-hour storage volume has been based on the higher estimate of foul flow, derived from the British Flows & Loads 4 as noted in paragraphs 8.17 and 8.19, where the total estimated flow from the site is 29,300 l/day. This provides an additional margin of safety in the event of an emergency.
- 8.21 See **Appendix F** for full details of the proposed foul drainage strategy.



9. WATER QUALITY

9.1 Figure 18 to 19 are extracted from the SuDS Manual and demonstrate the pollution risks associated with various discharge situations.

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

Figure 18: Table 26.2 of the SuDS Manual

Type of SuDS component	Mitigation indices ¹		
	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.		

Figure 19: Table 26.3 of the SuDS Manual

- 9.2 The most acute source of pollution on the site is the roads throughout the development. As the roads are not through routes, they are considered low traffic roads and the pollution hazard level for the development is considered to be low.
- 9.3 The UKSuDS Water Quality toolkits (based on the Simple Index Assessment method) has been used to assess water quality improvement for the site for the first stages of pollution treatment. It can be seen that the first stages of treatment provide sufficient water quality uplift, which indicates that the secondary and tertiary stages provided by the bio-retention filter strip followed by the swale will provide further treatment benefits. **Table 7** below summarises the results of the toolkit, and a full copy of the toolkit can be found in **Appendix H**.

Land Use			SuDS Component			Water Treatment
Low Traffic Roads			Vortex Separator			Sufficient
Pollution Indices			Mitigation Indices			
TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	
0.5	0.4	0.4	0.5	0.4	0.8	
Low Traffic Roads			Permeable Pavement			Sufficient
Pollution Indices			Mitigation Indices			
TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	
0.5	0.4	0.4	0.7	0.6	0.7	
Residential Roofs			Vortex Separator			Sufficient
Pollution Indices			Mitigation Indices			
TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	
0.5	0.4	0.4	0.5	0.5	0.6	

Table 7: Water Quality Summary



10. MANAGEMENT AND MAINTENANCE STRATEGY

10.1 The management and maintenance of any SuDS features would be the responsibility of the homeowner if within the curtilage of the property, or the estate management company, if in a communal area.

Pervious Pavements

10.2 The proposed maintenance schedule for the permeable paving is shown in **Table 8**.

Maintenance Category	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over the whole surface)	Once a year (after autumnal leaf fall) or based on manufacturer's recommendations
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or manage using glyphosphate applied directly on to the weeds by an applicator rather than spray	As required
Remedial Actions	Remediate any landscaping which, through vegetation maintenance and soil slip, has been raised 50mm from the level of paving	As required
	Remedial work to any depressions, rutting, cracked or broken blocks considered detrimental to the structural performance or hazard to users, replace jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 – 15 years or as required
Monitoring	Initial inspection	Monthly for the first 3 months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hr after large storm events in the first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 8: Maintenance schedule for pervious pavements



Attenuation Crates

10.3 The proposed maintenance schedule for an attenuation crate is shown in **Table 9**.

Maintenance Category	Required Action	Frequency
Regular Inspections	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause a risk to the performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae, or other matter, remove and replace surface infiltration medium if necessary	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Regular Maintenance	Repair/ rehabilitate inlets, outlets, overflows, and vents	As required
Occasional Maintenance	Inspect/ check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of the tank for sediment build-up and remove if necessary	Every 5 years or as required.

Table 9: Maintenance schedule for an attenuation storage system

Flow Control Device (HydroBrake)

10.4 The proposed maintenance schedule for a flow control device is shown in **Table 10**.

Maintenance Category	Maintenance Activity	Frequency
Routine Maintenance	Inspect and identify any areas that are not operating correctly	Monthly (for the first 3 months), then six monthly
	Remove sediment from upstream silt trap (sump)	Six monthly, or as required
	Hose down unit/chamber	Six monthly, or as required

Table 10: Proposed maintenance regime for a flow control device



Vortex Separator

- 10.5 Hydro-dynamic or vortex separators are vault structures that remove medium to large sized sediments by creating a vertical vortex. This allows the suspended solids to settle down in a sludge chamber, whilst floatable are collected at the surface.
- 10.6 The proposed Vortex filters require a regular maintenance regime. The unit should be inspected every 6 months, and the oil and floatables chamber and sludge trap emptied between 6 months and 3 years depending on pollution load.
- 10.7 The design life for the proposed hydro-dynamic separator is 50 years.

Swales

- 10.8 The proposed maintenance schedule for the swales is shown in **Table 11**.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly (Or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or as required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required.
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by reseeded or re-turfing	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Table 11: Proposed Maintenance Regime for a Swale



Bio-retention Filter Strip

10.9 The proposed maintenance schedule for a filter strip is shown in **Table 12**.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season) or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation, and contamination (e.g., oils)	Monthly (at start, then half yearly)
	Check flow spreader and filter strip surface for even gradients	Monthly (at start, then half yearly)
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly (at start, then half yearly)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then half yearly)
Occasional Maintenance	Reseed areas of poor vegetation growth; alter plant types to better suit conditions (if required)	As required or if bare soil is exposed over >10% of the filter strip
Remedial Actions	Repair erosion or other damage by re-turfing or re-seeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve filtration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of upstream sediment, flow spreader or at of a filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Table 12: Maintenance schedule for a filter strip.



11. SUMMARY AND CONCLUSION

- 11.1 This FRA has been prepared by Paul Basham Associates to help assess the suitability of the site for a care home development.
- 11.2 The site is entirely located within Flood Zone 1 and is considered appropriate in accordance with the NPPF.
- 11.3 Summary of residual flood risk:
- Fluvial and tidal flooding is considered to be low
 - Surface water flooding is considered to be very low
 - Groundwater flooding is considered to be very low
 - Sewers flooding is considered to be very low
- 11.4 Infiltration is not considered to be a viable drainage solution for the site due to soil impermeability and the potential for soil instability cause by infiltration, based on information provided by the BGS SuDS Infiltration Report. (Please refer to Section 3)
- 11.5 The surface water drainage proposals are to attenuate on-site using geo-cellular crates and discharging at a limited rate of 2 l/s via a HydroBrake into the existing watercourse near the northern boundary.
- 11.6 Permeable paving has been proposed for parking spaces to provide at-source control and increase water quality. Additionally, a Vortex Separator has been proposed to sufficiently treat pollutants from road and roof runoff, prior to discharging into the watercourse. UK SuDS Water Quality Toolkit has been used to assess the water quality uplift for the site and is included in Appendix H.
- 11.7 Secondary and tertiary stages of water treatment have been provided by a series of Bio-retention filter stir and swale further downstream in the network.
- 11.8 Hydraulic Calculations have been undertaken using Site 3D (Included in Appendix G) and ensure that no flooding occurs in the 100% AEP, 10%AEP, 3.3%AEP (40% Climate Change (CC)) +the 1% AEP (+45% CC).
- 11.9 Foul water is proposed to be drained via gravity to a private package pump, which will pump the sewage via. a rising main towards the site's access, where it will eventually connect into the existing Southern Water Manhole 3502.



Appendix A

REVISION NOTES

Rev	Date	Description	Drw	Chk
A	06/03/2024	Initial issue for comment	HJ	LS
B	12/03/2024	Parking amended	HJ	LS
C	22/03/2024	For coordination	HJ	LS
D	26/03/2024	For coordination	LS	LS
E	27/03/2024	For coordination	LS	LS

Area Schedule (GIA)

73 Bed C2 Residential Care Home 4800m²

Open Market Cottages
@ 90m² x 5 450m²

Total 5250m²

Car Parking:
Care Home 34 spaces o/a
Residential cottages 24 Spaces
Existing spaces retained 6 Spaces
4 Spaces

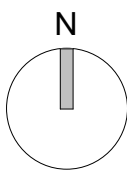
Drawing Key:

- [1] 73 Bed C2 Residential Care Home
- [2] 5 no. Residential Cottages
- [3] Parking
- [4] Existing parkign retained
- [5] Service Access
- [6] Main entrance to Care home
- [7] Resident's Sunken Garden
- [8] Resident's Shade Garden
- [9] Residents roof garden
- [10] New Vehicular Access
- [11] Pedestrian Entry - less than 1:20 slope
- [12] Defined edge of View cone to Bursledon Mill

- Existing Trees to be retained
- Existing trees to be removed
- SSEN 3m easement, 1.5m either side of cable
- Line of ecological buffer zone based upon 10m offset from top of stream bank
- Site Boundary
- Root Protection Zone



1 Proposed Site Plan 500
1 : 500



0m 10m 20m 30m 40m 50m
1:500

Project
Providence Hill
Bursledon

Client



WLAWilliamsLester.

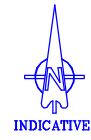
1 Star Lane, Ringwood, BH24 1AL
www.williamslester.com 01425 485234 mail@williamslester.com

Title
Proposed Site Plan

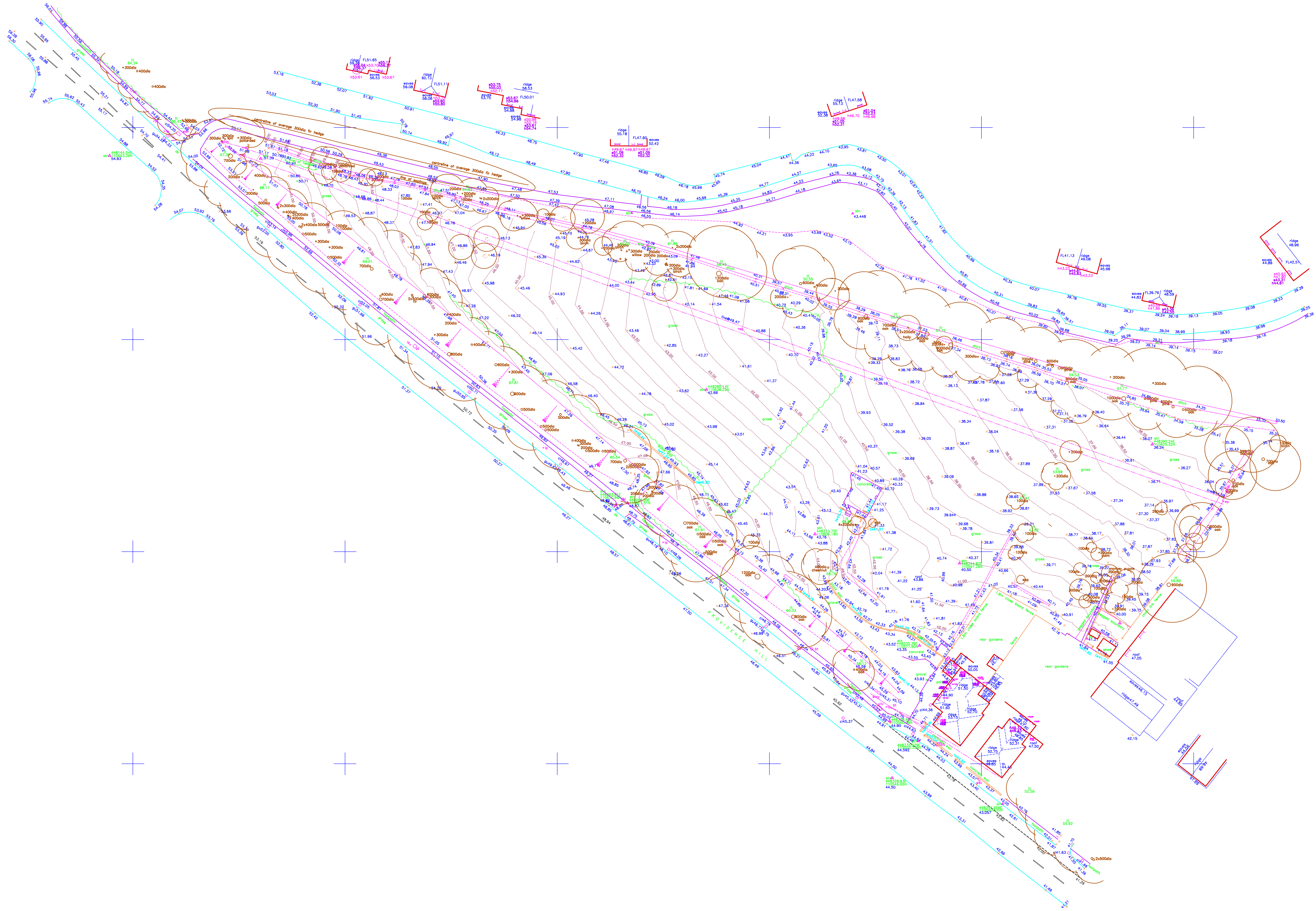
Scale A1 @ 1 : 500
Revision E Drawing Status
Suitability S2 Feasibility
For Information
Drawing No.
6185-WLA-ZZ-XX-DR-A-0010

Appendix B





KEY:	
bt	British Telecom
cb	Control Box
cl	Cover Level
ctv	Cable Television
dk	Drop Kerb
el	Electric
ep	Electricity Pole
fh	Fire Hydrant
gu	Gully
gsv	Gas Stop Valve
ht	Height
ic	Inspection Cover
il	Invert Level
lp	Lamp Post
mk	Marker
o/n	Overhead
ob	Post Box
pxg	Prom Crossing
np	None Place
sv	Stop Valve
rs	Road Sign
tb	Telephone Box
tl	Traffic Light
tt	Top of Tree
th	Threshold
tw	Top of Wall
utl	Unable to Lift
vp	Vent Pipe
vm	Water Meter
wsv	Water Stop Valve



NOTES:
LEVELS RELATE TO O.S. DATUM
TREE SPECIES SHOULD BE VERIFIED WHERE OF
CRITICAL IMPORTANCE
THE ARCHITECT SHOULD SATISFY HIMSELF THAT ALL TREES
LIKELY TO AFFECT HIS DESIGN HAVE BEEN SHOWN
INTER CONNECTION OF MANHOLES SHOULD BE VERIFIED
WHERE OF CRITICAL IMPORTANCE USING CCTV
PIPE SIZES & INVERTS DETERMINED WITHOUT
ENTRY INTO MANHOLE

P. STUBBINGTON LAND SURVEYS LTD

THE MEAD
DURLEY BROOK ROAD
DURLEY
SOUTHAMPTON
HAMPSHIRE
SO52 2AR

TEL : 023 8060 1876
MOBILE :
07973 348165
EMAIL :
PAUL@PSLANDSURVEYS.COM

CLIENT: - COLTEN
CONTRACT: - 4 BROOKFIELD,
PROVIDENCE HILL,
BURSLEDON
TITLE: - TOPOGRAPHIC SURVEY
SCALE: - 1:500 @A1
DRAWING NO. 10880/01/B
DATE: - DECEMBER 2023
SURVEYOR: - PS

Appendix C

Paul Basham Associates
The Bothy
Cams Hall Estate
Fareham
PO16 8UT

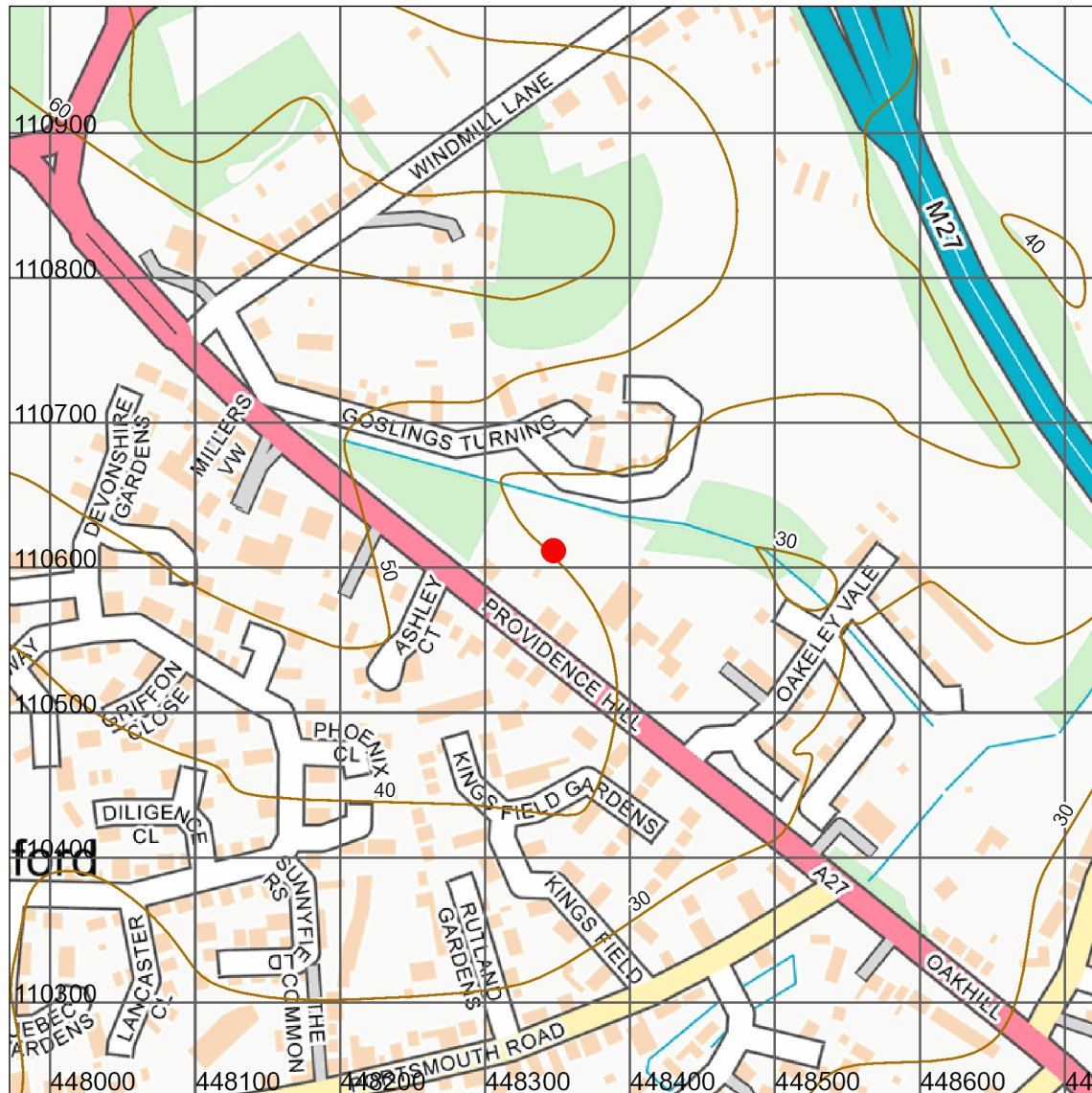
Infiltration SuDS GeoReport:

This report provides information on the suitability of the subsurface for the installation of infiltration sustainable drainage systems (SuDS). It provides information on the properties of the subsurface with respect to significant constraints, drainage, ground stability and groundwater quality protection.

Report Id: *BGS_325123/32696*

Client reference: Providence PO8502

Search location



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Search location indicated in red

Point centred at: 448347,110612

Assessment for an infiltration sustainable drainage system

Introduction

Sustainable drainage systems (SuDS) are drainage solutions that manage the volume and quality of surface water close to where it falls as rain. They aim to reduce flow rates to rivers, increase local water storage capacity and reduce the transport of pollutants to the water environment. There are four main types of SuDS, which are often designed to be used in sequence. They comprise:

- **source control:** systems that control the rate of runoff
- **pre-treatment:** systems that remove sediments and pollutants
- **retention:** systems that delay the discharge of water by providing surface storage
- **infiltration:** systems that mimic natural recharge to the ground.

This report focuses on infiltration SuDS. It provides subsurface information on the properties of the ground with respect to drainage, ground stability and groundwater quality protection. It is intended principally for those involved in the preliminary assessment of the suitability of the ground for infiltration SuDS, and those involved in assessing proposals from others for sustainable drainage, but it may also be useful to help house-holders judge whether or not further professional advice should be sought. If in doubt, users should consult a suitably-qualified professional about the results in this report before making any decisions based upon it.

This GeoReport is structured in two parts:

- **Part 1. Summary data.**

Comprises three maps that summarise the data contained within Part 2.

- **Part 2. Detailed data.**

Comprises a further 24 maps in four thematic sections:

- **Very significant constraints.** Maps highlight areas where infiltration may result in adverse impacts due to factors including: ground instability (soluble rocks, non-coal shallow mining and landslide hazards); persistent shallow groundwater, or the presence of made ground, which may represent a ground stability or contamination hazard.
- **Drainage potential.** Maps indicate the drainage potential of the ground, by considering subsurface permeability, depth to groundwater and the presence of floodplain deposits.
- **Ground stability.** Maps indicate the presence of hazards that have the potential to cause ground instability resulting in damage to some buildings and structures, if water is infiltrated to the ground.
- **Groundwater protection.** Maps provide key indicators to help determine whether the groundwater may be susceptible to deterioration in quality as a result of infiltration.

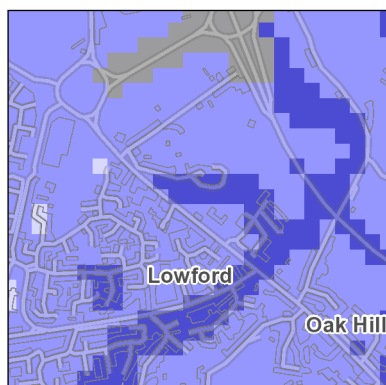
This report considers the suitability of the subsurface for the installation of infiltration SuDS, such as soakaways, infiltration basins or permeable pavements. It provides subsurface data to indicate whether, and which type of infiltration system may be appropriate. It does not state that infiltration SuDS are, or are not, appropriate as this is highly dependent on the design of the individual system. This report therefore describes the subsurface conditions at the site, allowing the reader to determine the suitability of the site for infiltration SuDS.

The map and text data in this report is similar to that provided in the '*Infiltration SuDS Map: Detailed*' national map product. For further information about the data, consult the '*User Guide for the Infiltration SuDS Map: Detailed*', available from <http://nora.nerc.ac.uk/16618/>.

PART 1: SUMMARY DATA

This section provides a summary of the data.

In terms of the drainage potential, is the ground suitable for infiltration SuDS?



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-  Highly compatible for infiltration SuDS. The subsurface is likely to be suitable for free-draining infiltration SuDS.
-  Probably compatible for infiltration SuDS. The subsurface is probably suitable although the design may be influenced by the ground conditions.
-  Opportunities for bespoke infiltration SuDS. The subsurface is potentially suitable although the design will be influenced by the ground conditions.
-  Very significant constraints are indicated. There is a very significant potential for one or more hazards associated with infiltration.

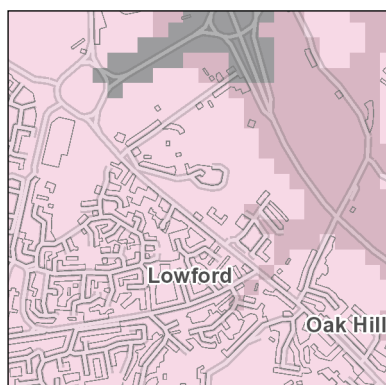
Is ground instability likely to be a problem?



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-  Increased infiltration is very unlikely to result in ground instability.
-  Ground instability problems may be present or anticipated, but increased infiltration is unlikely to result in ground instability.
-  Ground instability problems are probably present. Increased infiltration may result in ground instability.
-  There is a very significant potential for one or more geohazards associated with infiltration.

Is the groundwater susceptible to deterioration in quality?



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-  The groundwater is not expected to be especially vulnerable to contamination.
-  The groundwater may be vulnerable to contamination.
-  The groundwater is likely to be vulnerable to contaminants.
-  Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

PART 2: DETAILED DATA

This section provides further information about the properties of the ground and will help assess the suitability of the ground for infiltration SuDS.

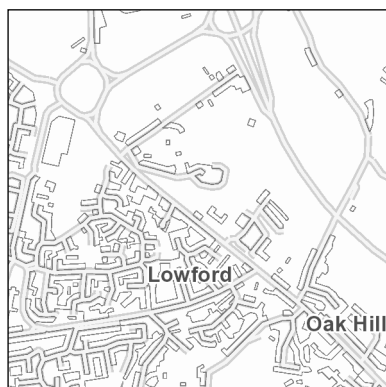
Section 1. Very significant constraints

Where maps are overlain by grey polygons, geological or hydrogeological hazards may exist that could be made worse by infiltration. The following hazards are considered:

- soluble rocks
- landslides
- shallow mining
- shallow groundwater
- made ground

For more information read 'Explanation of terms' at the end of this report.

Soluble rock hazard

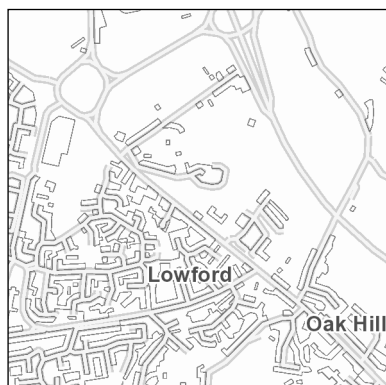


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☒ Very significant soluble rock hazard.
Soluble rocks are present with a very significant possibility of localised subsidence that could be initiated or made worse by infiltration. The site investigation should consider whether the potential for or the consequences of subsidence as a result of infiltration are significant.

☐ Very significant soluble rock hazards are not present; however this hazard may still need to be considered. See Part 3.

Landslide hazard

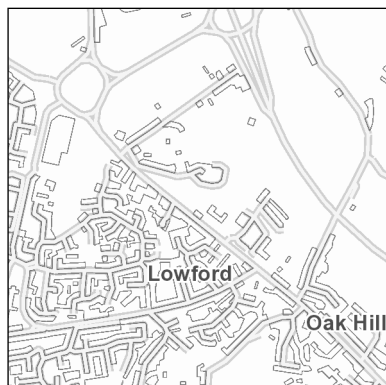


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☒ Very significant landslide hazard.
Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail. The site investigation should consider whether the potential for or the consequences of landslide as a result of infiltration are significant.

☐ Very significant landslide hazards are not present; however this hazard may still need to be considered. See Part 3.

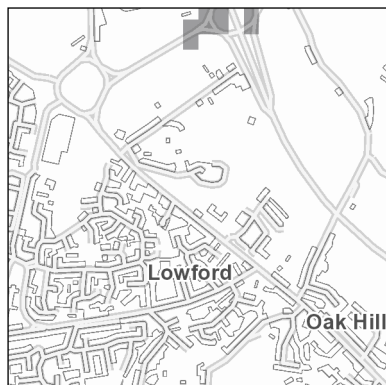
Shallow mining hazard



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- ☒ Very significant mining hazard.
Shallow mining is likely to be present with a very significant possibility of localised subsidence that could be initiated or made worse by increased infiltration. Also, infiltration may increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of subsidence and/or remobilisation of pollutants as a result of infiltration are significant.
- ☐ Very significant mining hazards are not present; however this hazard may still need to be considered. See Part 3.

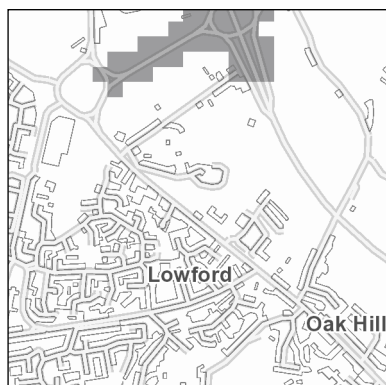
Persistent shallow groundwater



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- ☒ Very high likelihood of persistent or seasonally shallow groundwater.
Persistent or seasonally shallow groundwater is likely to be present. Infiltration may increase the likelihood of soakaway inundation, or groundwater emergence at the surface. The site investigation should consider whether the potential for or the consequences of groundwater level rise as a result of infiltration are significant.
- ☐ See Part 2 for the likely depth to water table.

Made ground



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- ☒ Made ground present.
Made ground is present at the surface. Infiltration may affect ground stability or increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of ground instability and/or pollutant leaching as a result of infiltration are significant.
- ☐ None recorded

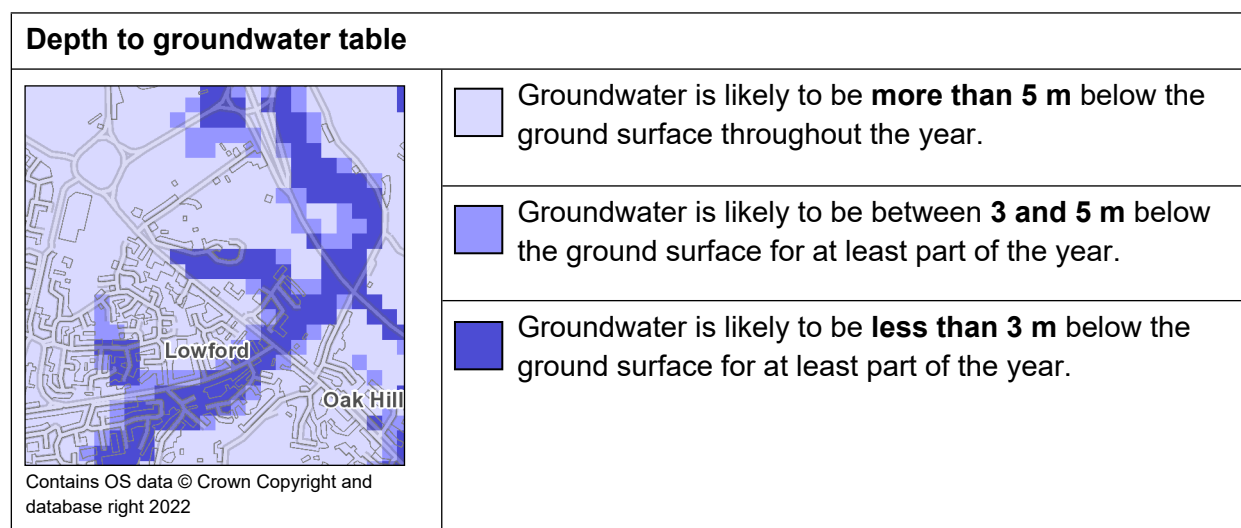
Section 2. Drainage potential

The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

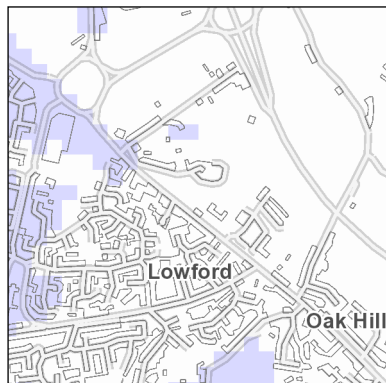
- depth to water table
- permeability of the superficial deposits
- thickness of the superficial deposits
- permeability of the bedrock
- presence of floodplains

Superficial deposits are not present everywhere and therefore some areas of the *superficial deposit permeability* map may not be coloured. Where this is the case, the *bedrock permeability* map shows the likely permeability of the ground. Superficial deposits in some places are very thin and hence in these places you may wish to consider both the permeability of the superficial deposits and the permeability of the bedrock. The *superficial thickness* map will tell you whether the superficial deposits are thin (< 3 m thick) or thick (>3 m). Where they are over 3 m thick, the permeability of the bedrock may not be relevant.

For more information read 'Explanation of terms' at the end of this report.



Superficial deposit permeability



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 Superficial deposits are likely to be **free-draining**.

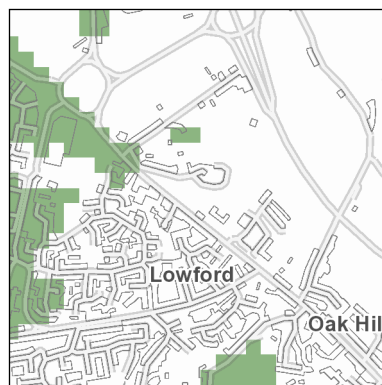
 The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

 Superficial deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

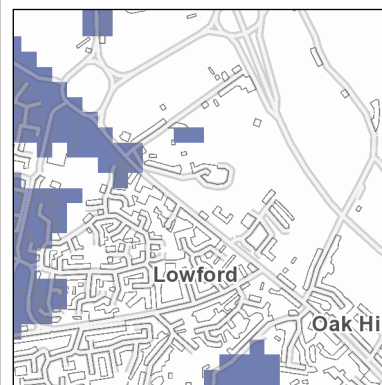
-  Very Low
-  Low
-  Moderate
-  High
-  Very High

Minimum



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Maximum



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Superficial deposit thickness



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 The thickness of superficial deposits is **< 3 m** and hence the permeability of the ground may be dependent on both the superficial deposits (where present) and underlying bedrock (see below).

 The thickness of superficial deposits is **> 3 m** and hence the permeability of the superficial deposits is likely to determine the permeability of the ground.

Bedrock permeability



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Bedrock deposits are likely to be **free-draining**.



The bedrock permeability is **spatially variable**, but likely to permit moderate infiltration.



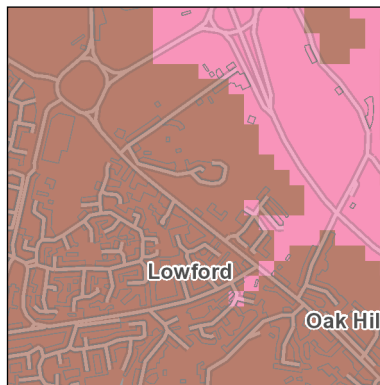
Bedrock deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

Key

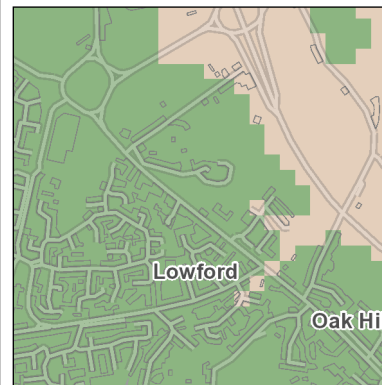
-  Very Low
-  Low
-  Moderate
-  High
-  Very High

Minimum



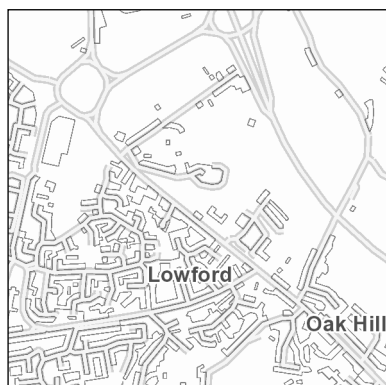
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Maximum



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Geological indicators of flooding



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Superficial floodplain deposits or low-lying coastal areas have been identified. Groundwater levels may rise in response to high river or tide levels, potentially causing inundation of subsurface infiltration SuDS.

Section 3. Ground stability

The following pages contain maps that will help you assess whether infiltration may impact the stability of the ground. They consider hazards associated with:

- soluble rocks
- landslides
- shallow mining
- running sands
- swelling clays
- compressible ground, and
- collapsible ground

In the following maps, geohazards that are identified in green are unlikely to prevent infiltration SuDS from being installed, but they should be considered during design. For more information read 'Explanation of terms' at the end of this report.

Soluble rocks	
 Contains OS data © Crown Copyright and database right 2022	Increased infiltration is unlikely to result in subsidence.
	Increased infiltration is unlikely to cause localised subsidence, but potential impacts should be considered.
	Increased infiltration may result in localised subsidence. The potential for or the consequences of subsidence associated with soluble rocks should be considered.
	Very significant possibility of localised subsidence that could be initiated or made worse by infiltration.

Landslides



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-  Increased infiltration is unlikely to lead to slope instability.
-  Slope instability problems may be present or anticipated, but increased infiltration is unlikely to cause instability
-  Slope instability problems are probably present or have occurred in the past, and increased infiltration may result in slope instability.
-  Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail.

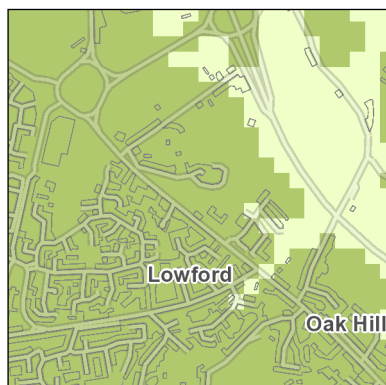
Shallow mining



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-  Increased infiltration is unlikely to lead to subsidence.
-  Shallow mining is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
-  Shallow mining could be present with a significant possibility that localised subsidence could be initiated or made worse by increased infiltration.
-  Shallow mining is likely to be present, with a very significant possibility that localised subsidence may be initiated or made worse by increased infiltration.

Running sand



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-  Increased infiltration is unlikely to cause ground collapse associated with running sands.
-  Running sand is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
-  Significant possibility for running sand problems. Increased infiltration may result in a geohazard.

Swelling clays



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-  Increased infiltration is unlikely to cause shrink-swell ground movement.
-  Ground is susceptible to shrink-swell ground movement. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
-  Ground is susceptible to shrink-swell ground movement. Increased infiltration may result in a geohazard.

Compressible ground



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-  Increased infiltration is unlikely to lead to ground compression.
-  Compressibility and uneven settlement hazards are probably present. Increased infiltration may result in a geohazard.

Collapsible ground



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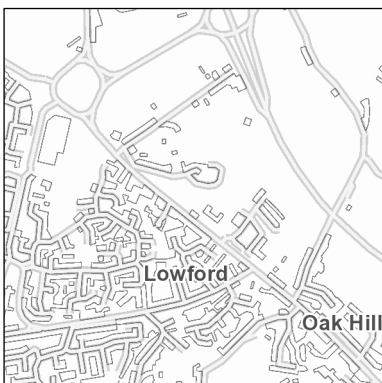
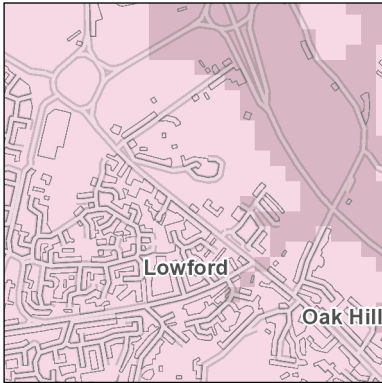
-  Increased infiltration is unlikely to result in subsidence.
-  Deposits with potential to collapse when loaded and saturated are possibly present in places. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
-  Deposits with potential to collapse when loaded and saturated are probably present in places. Increased infiltration may result in a geohazard.

Section 4. Groundwater quality protection

The following pages contain maps showing some of the information required to ensure the protection of groundwater quality. Data presented includes:

- groundwater source protection zones (Environment Agency data)
- predominant flow mechanism
- made ground

For more information read 'Explanation of terms' at the end of this report.

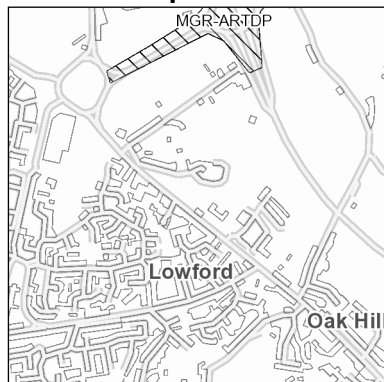
Groundwater source protection zones	
 Contains OS data © Crown Copyright and database right 2022 Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2022.	 Groundwater is not within a source protection zone.
	 Source protection zone IV
	 Source protection zone III
	 Source protection zone II
	 Source protection zone I
Predominant flow mechanism	
 Contains OS data © Crown Copyright and database right 2022	 Water is likely to percolate through the unsaturated zone to the groundwater through either the pore space in granular media or through porespace and fractures; these processes have some potential for contaminant removal and breakdown.
	 Water is likely to percolate through the unsaturated zone to the groundwater through fractures, a process which has little potential for contaminant removal and breakdown.

Made ground	
 Lowford Oak Hill Contains OS data © Crown Copyright and database right 2022	 Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

Section 5. Geological Maps

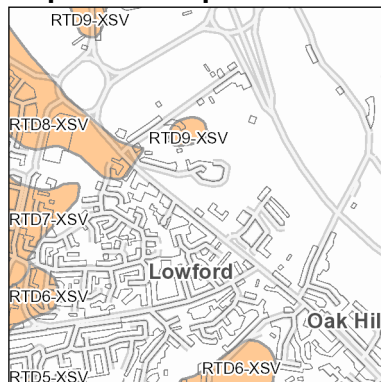
The following maps show the artificial, superficial and bedrock geology within the area of interest.

Artificial deposits



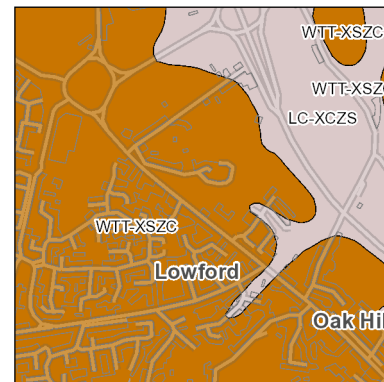
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Superficial deposits

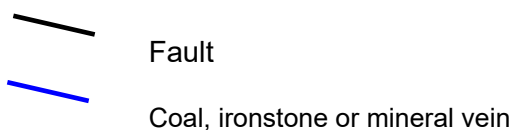


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Bedrock



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Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

Key to Artificial deposits:

Map colour	Computer Code	Rock name	Rock type
	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

Key to Superficial deposits:

Map colour	Computer Code	Rock name	Rock type
	RTD5-XSV	RIVER TERRACE DEPOSITS, 5	SAND AND GRAVEL
	RTD6-XSV	RIVER TERRACE DEPOSITS, 6	SAND AND GRAVEL
	RTD7-XSV	RIVER TERRACE DEPOSITS, 7	SAND AND GRAVEL
	RTD8-XSV	RIVER TERRACE DEPOSITS, 8	SAND AND GRAVEL
	RTD9-XSV	RIVER TERRACE DEPOSITS, 9	SAND AND GRAVEL

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	LC-XCZS	LONDON CLAY FORMATION	CLAY, SILT AND SAND
	WTT-XSZC	WITTERING FORMATION	SAND, SILT AND CLAY

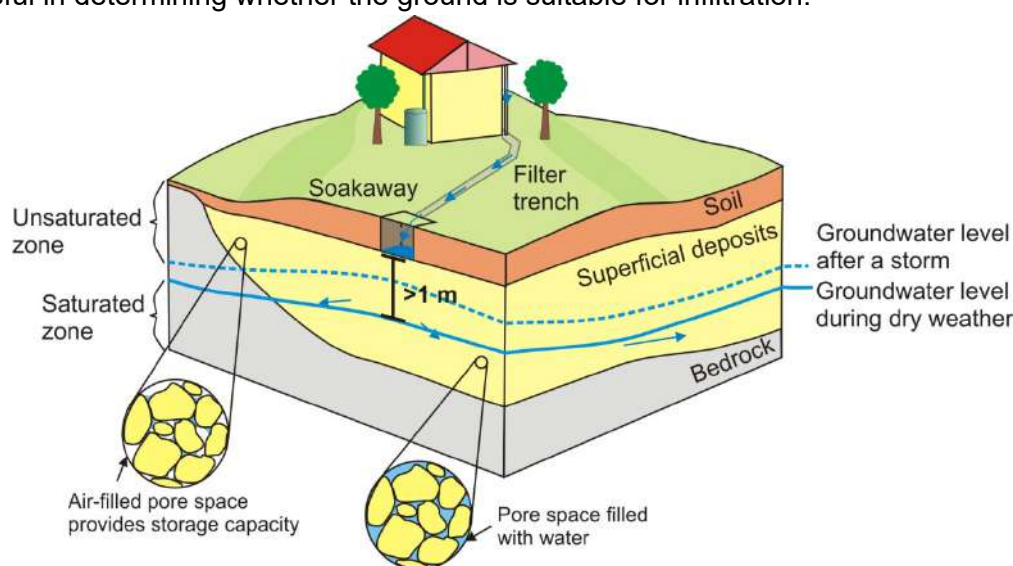
Limitations of this report:

- This report is concerned with the potential for infiltration-to-the-ground to be used as a SuDS technique at the site described. It only considers the subsurface beneath the search area and does NOT consider potential surface or subsurface impacts outside of that area.
- This report is NOT an alternative for an on-site investigation or soakaway test, which might reach a different conclusion.
- This report must NOT be used to justify disposal of foul waste or grey water.
- This report is based on and limited to an interpretation of the records held by the British Geological Survey (BGS) at the time the search is performed. The datasets used (with the exception of that showing depth to water table) are based on 1:50 000 digital geological maps and not site-specific data.
- Other more specific and detailed ground instability information for the site may be held by BGS, and an assessment of this could result in a modified assessment.
- To interpret the maps correctly, the report must be viewed and printed in colour.
- The search does NOT consider the suitability of sites with regard to:
 - previous land use,
 - potential for, or presence of contaminated land
 - presence of perched water tables
 - shallow mining hazards relating to coal mining. Searches of coal mining should be carried out via The Coal Authority Mine Reports Service: www.coalminingreports.co.uk.
 - made ground, where not recorded
 - proximity to landfill sites (searches for landfill sites or contaminated land should be carried out through consultation with local authorities/Environment Agency)
 - zones around private water supply boreholes that are susceptible to groundwater contamination.
- This report is supplied in accordance with the GeoReports Terms & Conditions available separately, and the copyright restrictions described at the end of this report

Explanation of terms

Depth to groundwater

In the shallow subsurface, the ground is commonly unsaturated with respect to water. Air fills the spaces within the soil and the underlying superficial deposits and bedrock. At some depth below the ground surface, there is a level below which these spaces are full of water. This level is known as the groundwater level, and the water below it is termed the groundwater. When water is infiltrated, the groundwater level may rise temporarily. To ensure that there is space in the unsaturated zone to accommodate this, there should be a minimum thickness of 1 m between the base of the infiltration system and the water table. An estimate of the *depth to groundwater* is therefore useful in determining whether the ground is suitable for infiltration.



Groundwater flooding

Groundwater flooding occurs when a rise in groundwater level results in very shallow groundwater or the emergence of groundwater at the surface. If infiltration systems are installed in areas that are susceptible to groundwater flooding, it is possible that the system could become inundated. The susceptibility map seeks to identify areas where the geological conditions and water tables indicate that groundwater level rise could occur under certain circumstances. A high susceptibility to groundwater flooding classification does not mean that groundwater flooding has ever occurred in the past, or will do so in the future as the susceptibility maps do not contain information on how often flooding may occur. The susceptibility maps are designed for planning; identifying areas where groundwater flooding might be an issue that needs to be taken into account.

Geological indicators of flooding

In floodplain deposits, groundwater level can be influenced by the water level in the adjacent river. Groundwater level may increase during periods of fluvial flood and therefore this should be taken into account when designing infiltration systems on such deposits. The *geological indicators of flooding* dataset shows where there is geological evidence (floodplain deposits) that flooding has occurred in the past.

For further information on flood-risk, the likely frequency of its recurrence in relation to any proposed development of the site, and the status of any flood prevention measures in place, you are advised to contact the local office of the Environment Agency (England and Wales) at www.environment-agency.gov.uk/ or the Scottish Environment Protection Agency (Scotland) at www.sepa.org.uk.

Artificial ground

Artificial ground comprises deposits and excavations that have been created or modified by human activity. It includes ground that is worked (quarries and road cuttings), infilled (back-filled quarries), landscaped (surface re-shaping), disturbed (near surface mineral workings) or classified as made ground (embankments and spoil heaps). The composition and properties of artificial ground are often unknown. In particular, the permeability and chemical composition of the artificial ground should be determined to ensure that the ground will drain and that any contaminants present will not be remobilised.

Superficial permeability

Superficial deposits are those geological deposits that were formed during the most recent period of geological time (as old as 2.6 million years before present). They generally comprise relatively thin deposits of gravel, sand, silt and clay and are present beneath the pedological soil in patches or larger spreads over much of Britain. The ease with which water can percolate through these deposits is controlled by their permeability and varies widely depending on their composition. Those deposits comprising clays and silts are less permeable and thus infiltration is likely to be slow, such that water may pool on the surface. In comparison, deposits comprising sands and gravels are more permeable allowing water to percolate freely.

Bedrock permeability

Bedrock forms the main mass of rock forming the Earth. It is present everywhere, commonly beneath superficial deposits. Where the superficial deposits are thin or absent, the ease with which water will percolate into the ground depends on the permeability of the bedrock.

Natural ground instability

Natural ground instability refers to the propensity for upward, lateral or downward movement of the ground that can be caused by a number of natural geological hazards (e.g. ground dissolution/compressible ground). Some movements associated with particular hazards may be gradual and of millimetre or centimetre scale, whilst others may be sudden and of metre or tens of metres scale. Significant natural ground instability has the potential to cause damage to buildings and structures, especially when the drainage characteristics of a site are altered. It should be noted, however, that many buildings, particularly more modern ones, are built to such a standard that they can remain unaffected in areas of significant ground movement.

Shrink-swell

A shrinking and swelling clay changes volume significantly according to how much water it contains. All clay deposits change volume as their water content varies, typically swelling in winter and shrinking in summer, but some do so to a greater extent than others. Contributory circumstances could include drought, leaking service pipes, tree roots drying-out the ground or changes to local drainage patterns, such as the creation of soakaways. Shrinkage may remove support from the foundations of buildings and structures, whereas clay expansion may lead to uplift (heave) or lateral stress on part or all of a structure; any such movements may cause cracking and distortion.

Landslides (slope stability)

A landslide is a relatively rapid outward and downward movement of a mass of ground on a slope, due to the force of gravity. A slope is under stress from gravity but will not move if its strength is greater than this stress. If the balance is altered so that the stress exceeds the strength, then movement will occur. The stability of a slope can be reduced by removing ground at the base of the slope, by placing material on the slope, especially at the top, or by increasing the water content of the materials forming the slope. Increase in subsurface water content beneath a soakaway could increase susceptibility to landslide hazards. The assessment of landslide hazard refers to the stability of the present land surface. It does not encompass a consideration of the stability of excavations.

Soluble rocks (dissolution)

Some rocks are soluble in water and can be progressively removed by the flow of water through the ground. This process tends to create cavities, potentially leading to the collapse of overlying materials and possibly subsidence at the surface. The release of water into the subsurface from infiltration systems may increase the dissolution of rock or destabilise material above or within a cavity. Dissolution cavities may create a pathway for rapid transport of contaminated water to an aquifer or water course.

Compressible ground

Many ground materials contain water-filled pores (the spaces between solid particles). Ground is compressible if a building (or other load) can cause the water in the pore space to be squeezed out, causing the ground to decrease in thickness. If ground is extremely compressible the building may sink. If the ground is not uniformly compressible, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The compressibility of the ground may alter as a result of changes in subsurface water content caused by the release of water from soakaways.

Collapsible deposits

Collapsible ground comprises certain fine-grained materials with large pore spaces (the spaces between solid particles). It can collapse when it becomes saturated by water and/or a building (or other structure) places too great a load on it. If the material below a building collapses it may cause the building to sink. If the collapsible ground is variable in thickness or distribution, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The subsurface underlying a soakaway will experience an increase in water content that may affect the stability of the ground. This hazard is most likely to be encountered only in parts of southern England.

Running sand

Running sand conditions occur when loosely-packed sand, saturated with water, flows into an excavation, borehole or other type of void. The pressure of the water filling the spaces between the sand grains reduces the contact between the grains and they are carried along by the flow. This can lead to subsidence of the surrounding ground. Running sand is potentially hazardous during the drainage system installation. During installation, excavation of the ground may create a space into which sand can flow, potentially causing subsidence of surrounding ground.

Shallow mining hazards (non coal)

Current or past underground mining for coal or for other commodities can give rise to cavities at shallow or intermediate depths, which may cause fracturing, general settlement, or the formation of crown-holes in the ground above. Spoil from mineral workings may also present a pollution hazard. The release of water into the subsurface from soakaways may destabilise material above or within a cavity. Cavities arising as a consequence of mining may also create a pathway for rapid transport of contaminated water to an aquifer or watercourse. The mining hazards map is derived from the geological map and considers the potential for subsidence associated with mining on the basis of geology type. Therefore if mining is known to occur within a certain rock, the map will highlight the potential for a hazard within the area covered by that geology.

For more information regarding underground and opencast **coal mining**, the location of mine entries (shafts and adits) and matters relating to subsidence or other ground movement induced by **coal mining** please contact the Coal Authority, Mining Reports, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG; telephone 0845 762 6848 or at www.coal.gov.uk. For more information regarding other types of mining (i.e. non-coal), please contact the British Geological Survey.

Groundwater source protection zones

In England and Wales, the Environment Agency has defined areas around wells, boreholes and springs that are used for the abstraction of public drinking water as source protection zones. In conjunction with Groundwater Protection Policy the zones are used to restrict activities that may impact groundwater quality, thereby preventing pollution of underlying aquifers, such that drinking water quality is upheld. The Environment Agency can provide advice on the location and implications of source protection zones in your area (www.environment-agency.gov.uk/)

Contact Details

Keyworth Office

British Geological Survey
Environmental Science Centre
Nicker Hill
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363143
Email: enquiries@bgs.ac.uk

Wallingford Office

British Geological Survey
Maclean Building
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OX10 8BB
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Email: enquiry@bgs.ac.uk

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- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
- Data, information and related records, which have been donated to BGS, have been produced for a specific purpose, and that may affect the type and completeness of the data recorded and any interpretation. The nature and purpose of data collection, and the age of the resultant material may render it unsuitable for certain applications/uses. You must verify the suitability of the material for your intended usage.
- If a report or other output is produced for you on the basis of data you have provided to BGS, or your own data input into a BGS system, please do not rely on it as a source of information about other areas or geological features, as the report may omit important details.
- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

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**Report issued by
BGS Enquiry Service**

Appendix D



Foreman Homes Ltd
Unit 1 Station Industrial Park
Duncan Road
Park Gate
SO31 1BX

Your Ref smk
Our Ref 191464
Date 12 March 2015
Contact searches@southernwater.co.uk
Fax 01634 844514
DX:400450 Chatham 5

Attention: Laura Whitaker

Dear Sirs

Provision of Public Sewer and Water Main Record Extracts – VAT Receipt
Misery, Bursledon, Hampshire

Further to your recent enquiry regarding the provision of Southern Water apparatus record extracts for the above location.

Please be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Therefore actual positions of the disclosed (and any undisclosed) infrastructure should be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan and accordingly it should not be considered to be a definitive document.

I confirm payment of the appropriate fee in the sum of £ **48.00**

The breakdown of costs is as follows: -

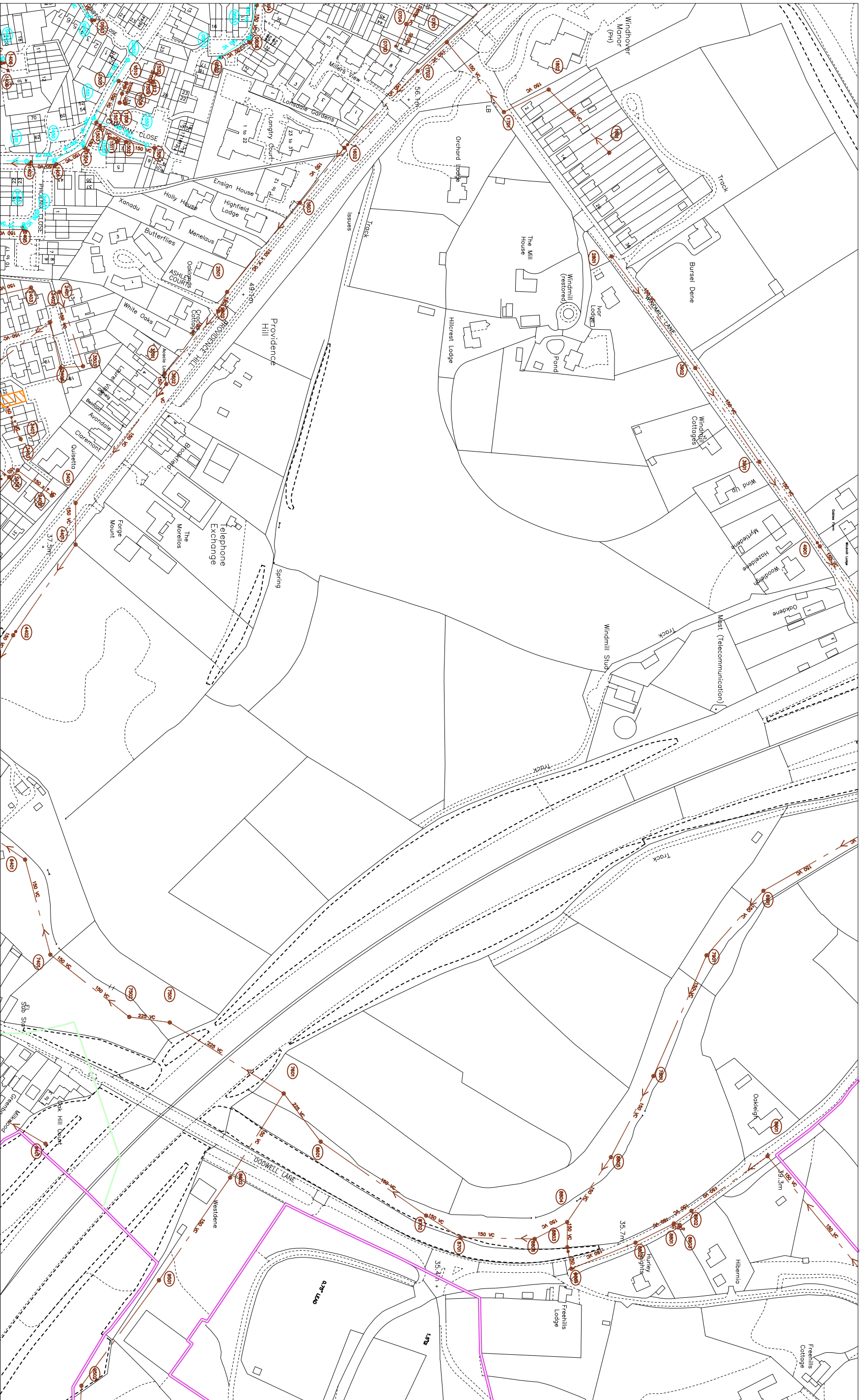
- Provision of record extracts £ 40.00
- VAT @ 20.0% £ 8.00

VAT Registration Number 813 0378 56

Should you require any additional information regarding this matter please contact this office at the address given at the foot of this letter.

Yours faithfully

Land Search Department



110446

O.S. REF.

SU4810NE

448059

Title: 191464_Misery, Bursledon, Hamp

Date: 12/03/2015

12/03/2015

Drawn by: mondalb

Scale: 1:2500

Date: 12/03/2015

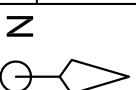
The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.

The actual positions should

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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

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Southern
Water

449005

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0453X	37.66	35.77	150	VC	CIRC	7502X	23.64	22.21	150	VC	CIRC						
0502X	51.06	48.62	150	VC	CIRC	7601X	24.96	23.45	225	VC	CIRC						
0503X	43.9	40.62	150	VC	CIRC	7801X	29.84	28.21	150	VC	CIRC						
0551X	51.03	48.98	150	VC	CIRC	7901X	31.41	29.68	150	VC	CIRC						
0552X	46.28	44.63	150	VC	CIRC	8401X			150	VC	UNK						
0553X	43.42		150	VC	CIRC	8601X	25.55	23.87	225	VC	CIRC						
0604X	49.98	47.65	150	VC	CIRC	8602X	34.06	25.46	150	VC	CIRC						
0605X	51.46	48.44	150	VC	CIRC	8701X	29.05	25.46	150	VC	CIRC						
0653X	51.42	48.87	150	VC	CIRC	8702X	27.28	25.04	150	VC	CIRC						
0701X	57.3	55.03	150	VC	CIRC	8801X	35.93	34.43	150	VC	CIRC						
0704X	53.83		UNK	UNK	CIRC	8802X	35.53	33.85	150	VC	CIRC						
1401X	45.34	42.25	150	VC	CIRC	8803X	42.48	38.01	150	VC	CIRC						
1402X	44.19	41.39	150	VC	CIRC	8804X	28.94	26.35	150	VC	CIRC						
1406X	37.55	35.7	150	VC	CIRC	8805X	28.9	27.14	150	VC	CIRC						
140DX			UNK	VC	CIRC	8806X	29.27	26.09	150	VC	CIRC						
1450X	45.24	42.4	300	CP	CIRC	8901X	39.1	37.2	150	VC	CIRC						
1451X	44.14	41.47	300	CP	CIRC	8902X	36.38	34.83	150	VC	CIRC						
1501X	48.8	47.45	150	VC	CIRC	8903X			150	VC	CIRC						
1502X	47.08	45.81	150	VC	CIRC	9501X	37.68		150	VC	CIRC						
1503X	45.04	42.6	150	VC	CIRC	9502X	34.87		150	VC	UNK						
1504X	45.62	42.49	150	VC	CIRC					UNK	UNK						
1505X	45.42	44.02	150	VC	CIRC	9801X			150	VC	UNK						
1506X			UNK	VC	CIRC												
1507X			UNK	VC	CIRC												
1508X			UNK	VC	CIRC												
1509X			UNK	VC	CIRC												
1510X			100	VC	CIRC												
1511X			UNK	VC	CIRC												
152DX			UNK	UNK	CIRC												
1550X	48.32	46.55	150	VC	CIRC												
1551X	44.94	43.08	300	CP	CIRC												
1552X	45.59	42.55	300	CP	CIRC												
1602X	54.16	51.12	150	VC	CIRC												
1603X			150	VC	UNK												
1701X	58.86	57.29	150	VC	CIRC	8602X											
1702X	56.89	54.62	150	VC	CIRC	8701X											
1801X	61.57	58.41	150	VC	CIRC												
1802X	59.76	57.72	150	VC	CIRC												
2401X	46.97	45.65	150	VC	CIRC												
2402X	43.37	41.92	150	VC	CIRC												
2403X	44.8	42.95	150	VC	CIRC												
2405X	44.91	42.24	150	VC	CIRC												
2450X	45.48	43.73	150	VC	CIRC												
2451X	44.91	42.12	150	VC	CIRC												
2501X	48.72	47.11	150	VC	CIRC												
2502X	48.43	46.81	150	VC	CIRC												
2801X	59.21	57.45	150	VC	CIRC												
3401X	39.31	37.43	150	VC	CIRC												
3402X			150	VC	UNK												
3403X			150	VC	UNK												
3404X	40.06	38.05	150	VC	CIRC												
3406X	43.61	42.16	150	VC	CIRC												
3407X			150	VC	UNK												
3501X			150	VC	UNK												
3502X	45.41	43.41	150	VC	CIRC												
3503X			150	VC	UNK												
3901X	49.89	48.13	150	VC	CIRC												
3902X	54.4	52.7	150	VC	CIRC												
4401X			UNK	VC	UNK												
4402X	31.33	29.18	150	VC	CIRC												
4901X	46.28	43.62	150	VC	CIRC												
6401X			150	VC	CIRC												
6901X			150	VC	CIRC												
7401X			150	VC	CIRC												
7501X	24.85	22.48	225	VC	CIRC												

LINE STYLES / COLOURS

Brown

AK Asphalt

BAC Black Adhesive Cement

BBC Black (Common)

BSC Black (Sewer)

CC Concrete Box Culvert

CI Cast Iron

CO Concrete (in-Situ)

CS Concrete Segment (boxed)

CSB Concrete Segment (boxed)

CSU Concrete Segment (unboxed)

DI Ductile Iron

GC Glass Reinforced Concrete

GCPR Glass Reinforced Plastic

MAC Masonry in regular Courses

MACP Masonry in random Courses

MC Concrete

PF Pitch Fibre

PP Polypropylene

PR Polypropylene

PS Polypropylene

ST Steel

XXX Other

ZZZ Unlabeled

Orange

Building Over/Agreement Area

Treated Effluent

Dark Blue

Section 104 Area

Surface Water

Purple

Sludge

Surface Water Ruling Main

Light Blue

Private

Access Shaft

Yellow

Discommissioned

Green

Discommissioned

MATERIALS

AK Asphalt

BAC Black Adhesive Cement

BBC Black (Common)

BSC Black (Sewer)

CC Concrete Box Culvert

CI Cast Iron

CO Concrete (in-Situ)

CS Concrete Segment (boxed)

CSB Concrete Segment (boxed)

CSU Concrete Segment (unboxed)

DI Ductile Iron

GC Glass Reinforced Concrete

GCPR Glass Reinforced Plastic

MAC Masonry in regular Courses

MACP Masonry in random Courses

MC Concrete

PF Pitch Fibre

PP Polypropylene

PR Polypropylene

PS Polypropylene

ST Steel

XXX Other

ZZZ Unlabeled

LEGEND - SEWERS

Manhole (SV)

Lamp hole (F&C)

Lamp hole (SV)

Pumping Station (SV)

Pumping Station (F&C)

Site entry manhole (SV)

Blind shaft (SV)

Blind shaft (F&C)

Ejector station (SV)

Ejector station (F&C)

Waterlight door (SV)

Waterlight door (F&C)

Flushing on, Man-1 (SV)

Flushing on, Man-1 (F&C)

Flushing on, Man-2 (SV)

Flushing on, Man-2 (F&C)

Demarcation Chamber

Without (SV)

Without (F&C)

Roading Eye (SV)

Roading Eye (F&C)

Gauging point (SV)

Gauging point (F&C)

Intercept chamber (SV)

Intercept chamber (F&C)

Storm Trunk (SV)

Storm Trunk (F&C)

Vortex chamber (SV)

Vortex chamber (F&C)

Label ellipse

Cutbill

Peristock chamber

Storm Overflow

Backdrop manhole

Other (S)

Other

Change to sewer (S)

Change to sewer (F)

Relief valve

Flap valve

Cutbill

Valve

Air Valve

Check Valve

Hatch box (SV)

Hatch box (F&C)

Decision arrow

Clutch

Scaleway

Label

Balancing Pond

Wastewater treatment works

Mature treatment works

Cutbill headworks

Vertical column

Trial storage tank

Blank end

Head of Public Sewer

Micro Pumping Station

SHAPES (S)

A Arch

C Circular

E Ellipse

H Hexagon

T Triangle

U U-shape

NODE REFERENCING SYSTEM

1st digit: sewer type identifier

2nd digit: hundred metre numbering identifier

3rd digit: 5m = Surface Water

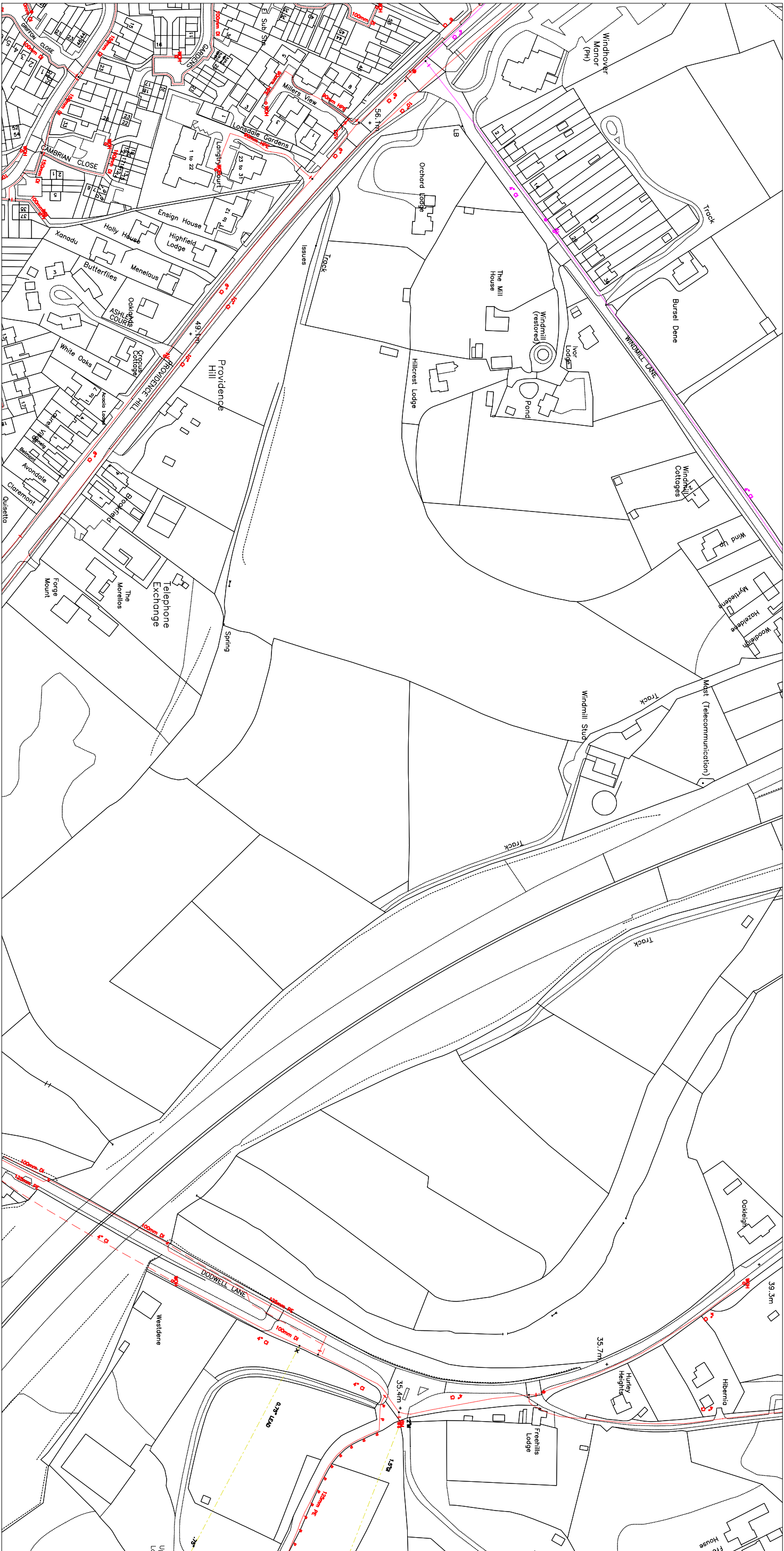
4th digit: next sequential node

Drawn by:mondalb

Title:191464_Misery, Bursledon, Hamp

Date:12/03/2015





LEGEND - MAINS

- Distribution Main / Communication pipe

Trunk Main

Raw water main

Non potable

Abandoned main

Proposed Main

Fire main

Non SWS

Sluice valve

Closed valve

Air valve

Butterfly valve

Pressure reducing valve

Reflux valve

Motorised valve

Clockwise closing valve

Fire Hydrant

Washout

Washout hydrant

Meier

Capped end

Emptying plug

Stopcock

Leak Noise Correlator Survey Point

Anode

Telemetry cable

Access point / hatchbox

Dialysis machine

Break pressure tank

Change node

Pumping station

Booster station

Insertion Flow Meter Point

Water tower

Service reservoir

Water Supply Works

Bore hole / Well

Intake

Customer sife

Swab insertion point
- MATERIALS
- Alkalithene

Cast iron

Span (grey) iron

Concrete

Ductile iron

Bonded Asbestos Cement

Glass reinforced plastic

Glass reinforced epoxy

(Unplastised) Polyvinyl chloride

Polyethylene

Steel

Concrete segments bolted

Concrete segments unbolted

Galvanised iron

Ductile sleeve

Concrete pre-stressed

High performance polyethylene

Unknown

AK

CI

SI

CO

DI

BAC

GRP

GRE

PVC

PE

ST

CSB

CSU

GI

DS

CPS

HPE

??
- | | | |
|-----------|------------|---------------------------------------|
| Drawn by: | mondalb | O.S.Ref: SU4810NE |
| Scale: | 1:2500 | |
| Date: | 12/03/2015 | TITLE: 191464_Misery, Bursledon, Hamp |
- 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 of pipes should be determined on site.
- Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.
-
-
- WARNING: BAC pipes are constructed of Bonded Asbestos Cement
- WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Appendix E





Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Rob Wilson
Site name:	4 Brookfield
Site location:	Providence Hill bursledon

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.89306° N
Longitude:	1.31452° W
Reference:	3838749398
Date:	Jan 22 2024 18:05

Site characteristics

Total site area (ha):	1.08
Significant public open space (ha):	0.75
Area positively drained (ha):	0.33000000
Impermeable area (ha):	0.33
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.33
Net impermeable area for storage volume design (ha):	0.33
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q _{BAR} estimation method:	Calculate from SPR and SAAR
000000007 SPR estimation method:	Calculate from SOIL type

Soil characteristics

characteristics	Default	Edited
SOIL type:	4	5
SPR:	0.47	0.53

Hydrological characteristics

characteristics	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	86.24
FEH / FSR conversion factor:	1.12	1.12
SAAR (mm):	784	784
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	5.95	7.73
Q_{BAR} for net site area (l/s):	1.82	2.36

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	4.2	5.4
1 in 100 year (l/s):	5.8	7.5

Estimated storage volumes

volumes	Default	Edited
Attenuation storage 1/100 years (m³):	192	188
Long term storage 1/100 years (m³):	40	56
Total storage 1/100 years (m³):	231	244

This report was produced using the storage estimation tool developed by HRWallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Appendix F



The drawings, information and data recorded in this document ("the information") is the property of Paul Basham Associates. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purposes other than which it was supplied by Paul Basham Associates. Paul Basham Associates makes no representation, undertakes no duty and accepts no responsibilities to any third party who may use or rely upon this document or the information.

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1. THIS DRAWING IS INTENDED TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SERVICES AND SPECIALIST DRAWINGS, DETAILS AND SPECIFICATIONS.
2. ANY VARIATIONS OR DISCREPANCIES BETWEEN THESE DRAWINGS IN TERMS OF DIMENSIONS OR DETAILS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER FOR CLARIFICATION.
3. ALL FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED DIMENSIONS.
4. PAUL BASHAM ASSOCIATES ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF BACKGROUND INFORMATION PRODUCED BY THIRD PARTIES - THIS MUST BE TREATED AS INDICATIVE ONLY.
5. THE MAIN CONTRACTOR SHALL BE RESPONSIBLE FOR THE SETTING OUT AND ACCURACY OF ALL DIMENSIONS.
6. THIS DRAWING SHOULD ONLY BE USED FOR CONSTRUCTION IF THE PROJECT PHASE IN THE TITLE FRAME BELOW IS SHOWN AS "CONSTRUCTION". PAUL BASHAM ASSOCIATES TAKE NO RESPONSIBILITY FOR CONSTRUCTION WORKS UNDERTAKEN TO DRAWINGS WHICH ARE NOT MARKED UNDER THIS PHASE.

LEGEND:

- SITE BOUNDARY
- ADOPTABLE FOUL WATER SEWER
- ADOPTABLE STORM WATER SEWER
- PRIVATE FOUL WATER DRAIN
- PRIVATE STORM WATER DRAIN
- FOUL WATER RISING MAIN
- ADOPTABLE FOUL WATER MANHOLE
- ADOPTABLE SURFACE WATER MANHOLE
- PRIVATE FOUL WATER CHAMBER
- PRIVATE SURFACE WATER CHAMBER / CATCHPIT
- ROAD GULLY
- FFL XXXX FINISHED FLOOR LEVELS
- VORTEX SEPARATOR
- HYDROBRAKE CHAMBER
- HEADWALL
- SURFACE WATER ATTENUATION TANKS
- F.W. PUMPING STATION
- PERMEABLE PAVING
- SWALE
- PROPOSED EXCEEDANCE FLOW PATH

PRELIMINARY
DRAWING/DESIGN IS STILL 'IN DEVELOPMENT'
YOU ARE ADVISED TO MAKE DUE ALLOWANCE

P02	UPDATED TO LATEST ARCHITECT'S LAYOUT	05.04.2024	RL	RW
P01	FIRST ISSUE	25.03.2024	RL	RW
Rev	Description	Date	By	App'd

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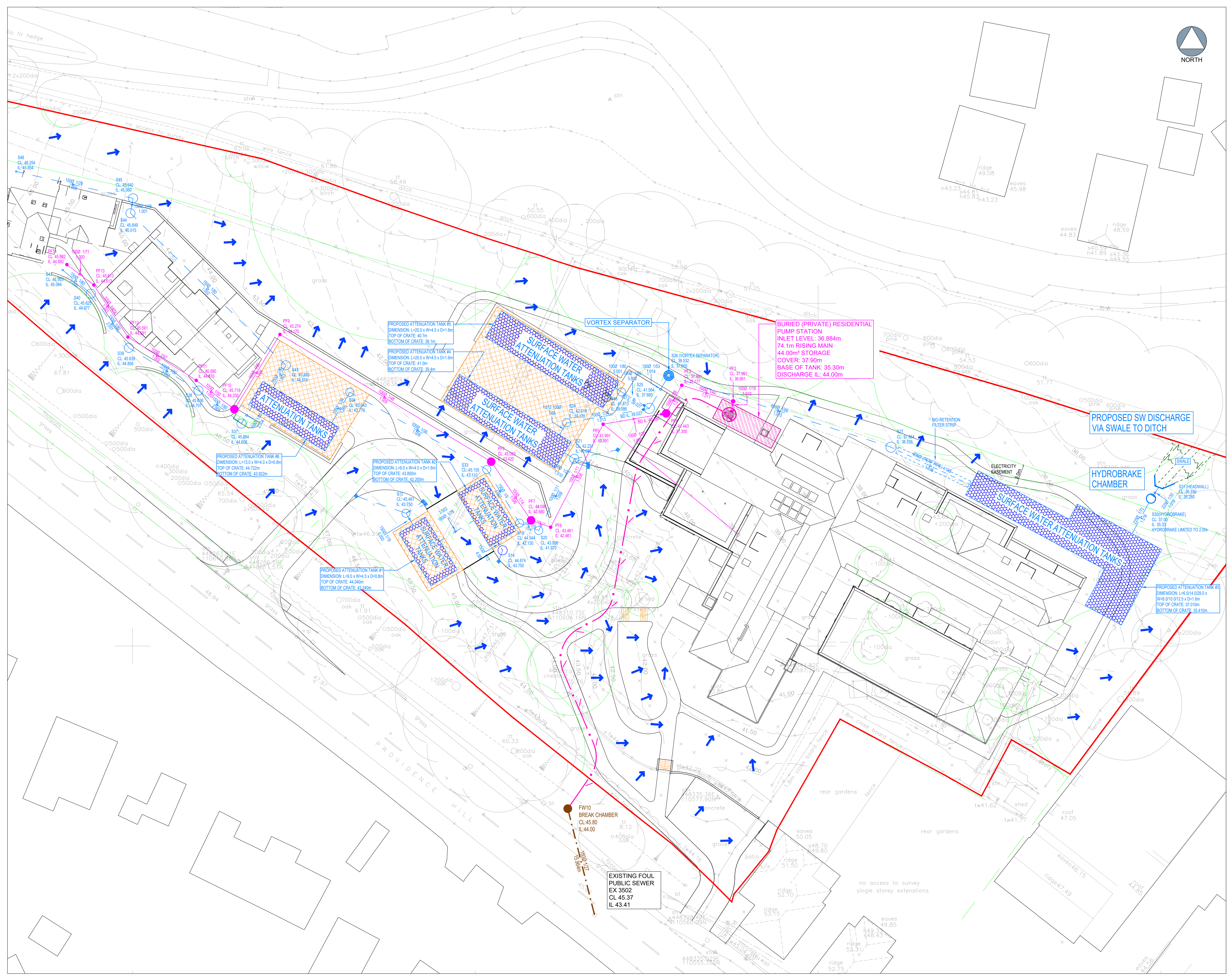
Client

COLTEN CARE
"Challenging the Way"

CARE HOME, BROOKFIELD
PROVIDENCE HILL, BURSLEDON

**PROPOSED DRAINAGE
STRATEGY LAYOUT**

Project Phase			
PLANNING			
Date Created	Drawn By	Approved By	Suitability Code
5.03.2024	RL	RW	-
3A Project Number		Scale	(AT A1)
197.5004		1:250	
3A Drawing No:			Revision
197.5004-0002			P02



Appendix G

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S46	0.007	0.250	250	46.254	45.654	0.450	448233.025	110669.229
S45	0.000	1.350	Type C	45.640	45.060	0.430	448250.082	110665.314
S44	0.014	1.350	Type C	45.649	45.015	0.484	448249.700	110663.131
S43	0.000	1.350	Type C	45.483	44.618	0.715	448272.374	110640.949
S42	0.000	1.350	Type C	45.612	44.572	0.890	448270.538	110637.723
S41	0.013	0.250	250	45.703	45.044	0.509	448239.820	110654.857
S40	0.000	1.350	Type C	45.625	44.977	0.498	448243.917	110651.406
S39	0.000	1.350	Type C	45.639	44.856	0.632	448249.460	110643.506
S38	0.018	1.350	Type C	45.636	44.707	0.779	448259.624	110637.265
S37	0.017	1.350	Type C	45.884	44.608	1.126	448265.892	110632.457
S36	0.000	1.350	Type C	45.711	44.572	0.989	448267.427	110634.930
S35	0.000	1.200	Type B	46.117	43.922	2.095	448279.045	110632.581
S34	0.000	1.200	Type B	45.943	43.320	2.073	448281.706	110637.027
S33	0.000	1.200	Type B	45.155	43.110	1.945	448301.676	110625.739
S12	0.025	0.135	Unknown	45.461	43.750	1.561	448289.886	110619.368
S13	0.000	1.200	Type B	45.319	43.650	1.519	448290.893	110617.720
S16	0.000	1.200	Type B	45.072	43.240	1.732	448294.811	110615.320
S17	0.000	1.200	Type B	44.921	43.160	1.661	448299.944	110618.417
S14	0.017	1.350	Type C	44.674	43.750	0.774	448303.982	110613.960
S15	0.000	0.000	Unknown	44.651	43.650	0.851	448303.307	110615.084
S18	0.000	0.000	Unknown	44.585	42.200	2.285	448305.605	110617.414
S19	0.000	1.200	Type B	44.544	42.130	2.314	448306.447	110617.929
S20	0.000	1.200	Type B	43.936	41.520	1.866	448309.254	110616.850
S21	0.039	1.350	Type C	42.231	40.881	1.250	448314.437	110627.315
S22	0.000	0.000	Unknown	42.142	40.820	1.172	448313.040	110628.161
S23	0.000	0.000	Unknown	42.068	39.400	2.568	448312.373	110630.866
S24	0.000	1.200	Type B	42.019	38.920	2.549	448313.342	110632.595
S47	0.015	0.000	Unknown	41.607	40.550	0.907	448301.470	110645.051
S32	0.000	0.000	Unknown	41.798	39.100	2.598	448320.386	110637.682
S48	0.000	1.200	Type B	41.813	38.636	2.627	448321.318	110637.070
S25	0.138	1.500	Type A	41.564	37.210	3.754	448325.385	110634.660
S26	0.000	1.500	Unknown	38.532	37.055	0.877	448328.204	110639.459
S27	0.058	1.500	Unknown	37.864	36.535	0.729	448360.635	110629.007
S28	0.000	0.000	Unknown	37.010	35.440	-0.030	448372.263	110623.490
S29	0.000	0.000	Unknown	37.010	35.410	1.375	448395.960	110616.328
S30	0.000	1.350	Type C	37.000	34.880	1.445	448398.547	110621.513
S31	0.000	0.000	Type C	35.750	35.125	0.400	448403.502	110628.766

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Diameter (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S46	45.654	S45	45.060	0.150	17.501	29.4	0.600	0.450	0.430
1.001	S45	45.060	S44	45.015	0.150	2.216	49.1	0.600	0.430	0.484
1.002	S44	45.015	S43	44.618	0.150	31.719	80.0	0.600	0.484	0.715
1.003	S43	44.618	S42	44.572	0.150	3.711	80.0	0.600	0.715	0.890
1.004	S42	44.572	S35	43.922	0.150	9.940	15.3	0.600	0.890	2.045
2.000	S41	45.044	S40	44.977	0.150	5.357	80.0	0.600	0.509	0.498
2.001	S40	44.977	S39	44.856	0.150	9.651	80.0	0.600	0.498	0.632
2.002	S39	44.856	S38	44.707	0.150	11.926	80.0	0.600	0.632	0.779
2.003	S38	44.707	S37	44.608	0.150	7.900	80.0	0.600	0.779	1.126
2.004	S37	44.608	S36	44.572	0.150	2.911	80.0	0.600	1.126	0.989
2.005	S36	44.572	S35	43.922	0.150	11.853	18.2	0.600	0.989	2.045
1.005	S35	43.922	S34	43.770	0.100	5.181	34.1	0.600	2.095	2.073
1.006	S34	43.770	S33	43.110	0.100	22.940	34.8	0.600	2.073	1.945
1.007	S33	43.110	S19	42.130	0.150	9.153	9.3	0.600	1.895	2.264
3.000	S12	43.750	S13	43.650	0.150	1.932	19.3	0.600	1.561	1.519
3.001	S13	43.650	S16	43.240	0.150	4.595	11.2	0.600	1.519	1.682
3.002	S16	43.240	S17	43.160	0.100	5.995	74.9	0.600	1.732	1.661
3.003	S17	43.160	S18	42.200	0.150	5.749	6.0	0.600	1.611	2.235
4.000	S14	43.750	S15	43.650	0.150	1.311	13.1	0.600	0.774	0.851
4.001	S15	43.650	S18	42.200	0.150	3.272	2.3	0.600	0.851	2.235

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Diameter (m)	Length (m)	Gradient (1:X)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
3.004	S18	42.200	S19	42.130	0.100	0.988	14.1	0.600	2.285	2.314
1.008	S19	42.130	S20	41.970	0.100	3.007	18.8	0.600	2.314	1.866
1.009	S20	41.970	S21	40.881	0.100	11.678	10.7	0.600	1.866	1.250
1.010	S21	40.881	S22	40.820	0.150	1.633	26.8	0.600	1.200	1.172
1.011	S22	40.820	S23	39.400	0.150	2.786	2.0	0.600	1.172	2.518
1.012	S23	39.400	S24	39.370	0.100	1.982	66.1	0.600	2.568	2.549
1.013	S24	39.370	S25	39.027	0.100	12.219	35.6	0.600	2.549	2.437
5.000	S47	40.550	S32	39.100	0.150	20.300	14.0	0.600	0.907	2.548
5.001	S32	39.100	S48	39.086	0.100	1.114	80.0	0.600	2.598	2.627
5.002	S48	39.086	S25	39.027	0.100	4.727	80.0	0.600	2.627	2.437
1.014	S25	37.660	S26	37.555	0.150	5.565	53.0	0.600	3.754	0.827
1.015	S26	37.055	S27	36.535	0.600	34.074	65.5	0.600	0.877	0.729
1.016	S27	36.535	S28	36.440	0.600	12.870	135.5	0.600	0.729	-0.030
1.017	S28	35.440	S29	35.410	1.600	24.756	825.2	0.600	-0.030	-0.000
1.018	S29	35.410	S30	35.330	0.225	5.794	72.4	0.600	1.375	1.445
1.019	S30	35.330	S31	35.125	0.225	8.783	42.8	0.600	1.445	0.400

Outfall Details

Outfall Manhole S31 : Free Discharge

Flow Control Details

Tank Structure at Manhole S35

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
43.922	0.800	95.00	52.000	49.400	39.520	0.00000000	0.00000000	2.00

Tank Structure at Manhole S16

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
43.240	0.800	95.00	40.500	38.475	30.780	0.00000000	0.00000000	2.00

Tank Structure at Manhole S18

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
42.200	1.600	95.00	40.500	38.475	61.560	0.00000000	0.00000000	2.00

Tank Structure at Manhole S22

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
40.820	1.600	95.00	85.203	80.943	129.509	0.00000000	0.00000000	2.00

Controls within Manhole S24

Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.030	0.600

Tank Structure at Manhole S32

Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
39.100	1.600	95.00	90.000	85.500	136.800	0.00000000	0.00000000	2.00

Controls within Manhole S48

Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.020	0.600

Tank Structure at Manhole S29

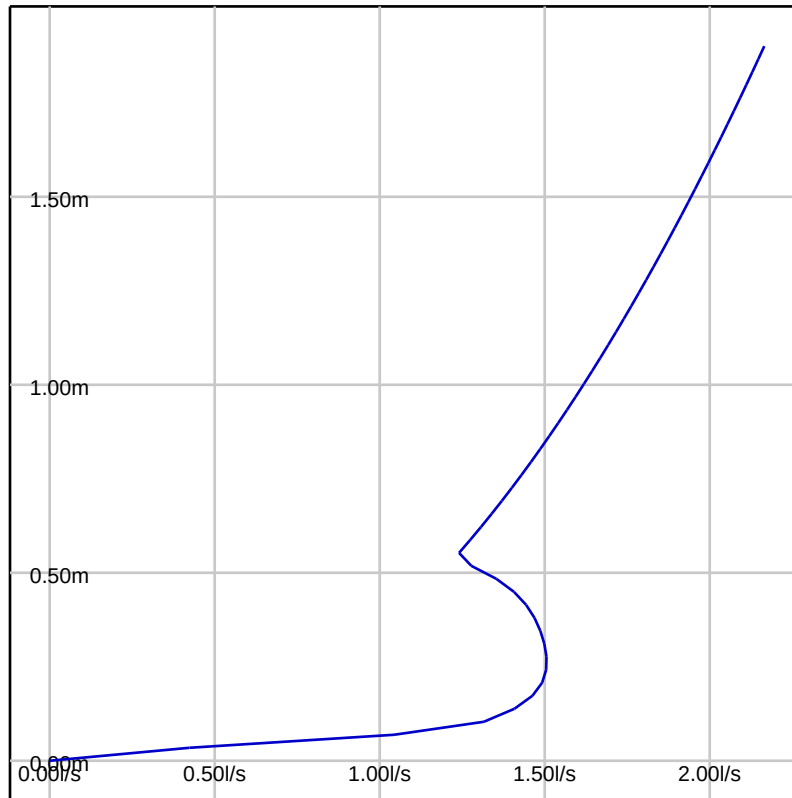
Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
35.410	1.600	95.00	187.591	178.211	285.138	0.00000000	0.00000000	2.00

Controls within Manhole S30

Hydro-Brake® Optimum Control at Manhole S30

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0060-2000-1600-2000 ID:613954	1.600	2.000	0.000	0.263	1.506	0.537	1.224

Hydro-Brake® Optimum Control at S30



Simulation Settings

FSR: M5-60=19.40, R=0.35, Locale=England and Wales

Summer (Cv: 1.00), Winter (Cv: 1.00)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760

Return Periods (yrs) + Climate Change: (1, +0%), (10, +0%), (30, +40%), (100, +45%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Winter	33.957	0.00	7.05	30Yr +40% 15Min Summer	98.523	0.00	4.64
1Yr 15Min Summer	33.957	0.00	6.57	30Yr +40% 15Min Winter	98.523	0.00	4.25
1Yr 30Min Winter	21.996	0.00	8.12	30Yr +40% 30Min Summer	65.580	0.00	3.45
1Yr 30Min Summer	21.996	0.00	7.92	30Yr +40% 30Min Winter	65.580	0.00	3.36
1Yr 60Min Winter	13.802	0.00	6.73	30Yr +40% 60Min Summer	41.816	0.00	2.86
1Yr 60Min Summer	13.802	0.00	6.89	30Yr +40% 60Min Winter	41.816	0.00	2.80
1Yr 120Min Winter	8.541	0.00	2.69	30Yr +40% 120Min Summer	25.877	0.00	2.32
1Yr 120Min Summer	8.541	0.00	2.75	30Yr +40% 120Min Winter	25.877	0.00	2.28
1Yr 180Min Winter	6.444	0.00	2.35	30Yr +40% 180Min Summer	19.319	0.00	2.01
1Yr 180Min Summer	6.444	0.00	2.42	30Yr +40% 180Min Winter	19.319	0.00	1.99
1Yr 240Min Winter	5.283	0.00	2.14	30Yr +40% 240Min Summer	15.620	0.00	1.79
1Yr 240Min Summer	5.283	0.00	2.20	30Yr +40% 240Min Winter	15.620	0.00	1.77
1Yr 360Min Winter	3.985	0.00	1.88	30Yr +40% 360Min Summer	11.565	0.00	1.19
1Yr 360Min Summer	3.985	0.00	1.94	30Yr +40% 360Min Winter	11.565	0.00	1.48
1Yr 480Min Summer	3.259	0.00	1.78	30Yr +40% 480Min Summer	9.336	0.00	0.75
1Yr 480Min Winter	3.259	0.00	1.72	30Yr +40% 480Min Winter	9.336	0.00	0.74
1Yr 600Min Summer	2.789	0.00	1.69	30Yr +40% 600Min Summer	7.902	0.00	0.71
1Yr 600Min Winter	2.789	0.00	1.62	30Yr +40% 600Min Winter	7.902	0.00	0.69
1Yr 720Min Winter	2.455	0.00	1.56	30Yr +40% 720Min Summer	6.892	0.00	0.67
1Yr 720Min Summer	2.455	0.00	1.61	30Yr +40% 720Min Winter	6.892	0.00	0.66
1Yr 960Min Winter	2.008	0.00	1.43	30Yr +40% 960Min Summer	5.551	0.00	0.61
1Yr 960Min Summer	2.008	0.00	1.48	30Yr +40% 960Min Winter	5.551	0.00	0.60
1Yr 1440Min Summer	1.513	0.00	1.31	30Yr +40% 1440Min Summer	4.087	0.00	0.52
1Yr 1440Min Winter	1.513	0.00	1.27	30Yr +40% 1440Min Winter	4.087	0.00	0.51
1Yr 2160Min Winter	1.141	0.00	1.12	30Yr +40% 2160Min Summer	3.004	0.00	0.43
1Yr 2160Min Summer	1.141	0.00	1.16	30Yr +40% 2160Min Winter	3.004	0.00	0.41
1Yr 2880Min Summer	0.934	0.00	1.06	30Yr +40% 2880Min Summer	2.413	0.00	0.41
1Yr 2880Min Winter	0.934	0.00	1.03	30Yr +40% 2880Min Winter	2.413	0.00	0.40
1Yr 4320Min Summer	0.705	0.00	0.93	30Yr +40% 4320Min Summer	1.770	0.00	0.37
1Yr 4320Min Winter	0.705	0.00	0.91	30Yr +40% 4320Min Winter	1.770	0.00	0.36
1Yr 5760Min Summer	0.578	0.00	0.85	30Yr +40% 5760Min Summer	1.419	0.00	0.35
1Yr 5760Min Winter	0.578	0.00	0.83	30Yr +40% 5760Min Winter	1.419	0.00	0.34
10Yr 15Min Summer	55.614	0.00	7.67	100Yr +45% 15Min Summer	132.071	0.00	3.71
10Yr 15Min Winter	55.614	0.00	6.90	100Yr +45% 15Min Winter	132.071	0.00	3.41
10Yr 30Min Summer	36.694	0.00	5.44	100Yr +45% 30Min Summer	88.761	0.00	2.78
10Yr 30Min Winter	36.694	0.00	5.26	100Yr +45% 30Min Winter	88.761	0.00	2.71
10Yr 60Min Summer	23.276	0.00	4.39	100Yr +45% 60Min Summer	56.919	0.00	2.34
10Yr 60Min Winter	23.276	0.00	4.28	100Yr +45% 60Min Winter	56.919	0.00	2.30
10Yr 120Min Summer	14.404	0.00	3.48	100Yr +45% 120Min Summer	35.224	0.00	1.94
10Yr 120Min Winter	14.404	0.00	3.39	100Yr +45% 120Min Winter	35.224	0.00	1.91
10Yr 180Min Summer	10.791	0.00	2.45	100Yr +45% 180Min Summer	26.199	0.00	1.70
10Yr 180Min Winter	10.791	0.00	2.73	100Yr +45% 180Min Winter	26.199	0.00	1.68
10Yr 240Min Winter	8.764	0.00	1.39	100Yr +45% 240Min Summer	21.078	0.00	1.54
10Yr 240Min Summer	8.764	0.00	1.43	100Yr +45% 240Min Winter	21.078	0.00	1.52
10Yr 360Min Summer	6.528	0.00	1.27	100Yr +45% 360Min Summer	15.506	0.00	1.27
10Yr 360Min Winter	6.528	0.00	1.24	100Yr +45% 360Min Winter	15.506	0.00	1.27
10Yr 480Min Summer	5.292	0.00	1.17	100Yr +45% 480Min Summer	12.458	0.00	1.09
10Yr 480Min Winter	5.292	0.00	1.14	100Yr +45% 480Min Winter	12.458	0.00	1.08
10Yr 600Min Summer	4.495	0.00	1.08	100Yr +45% 600Min Summer	10.503	0.00	0.57
10Yr 600Min Winter	4.495	0.00	1.06	100Yr +45% 600Min Winter	10.503	0.00	0.55
10Yr 720Min Summer	3.932	0.00	1.01	100Yr +45% 720Min Summer	9.132	0.00	0.54
10Yr 720Min Winter	3.932	0.00	0.99	100Yr +45% 720Min Winter	9.132	0.00	0.53
10Yr 960Min Summer	3.183	0.00	0.91	100Yr +45% 960Min Summer	7.315	0.00	0.50
10Yr 960Min Winter	3.183	0.00	0.89	100Yr +45% 960Min Winter	7.315	0.00	0.49
10Yr 1440Min Summer	2.361	0.00	0.83	100Yr +45% 1440Min Summer	5.341	0.00	0.43

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
10Yr 1440Min Winter	2.361	0.00	0.81	100Yr +45% 1440Min Winter	5.341	0.00	0.43
10Yr 2160Min Summer	1.750	0.00	0.75	100Yr +45% 2160Min Summer	3.891	0.00	0.36
10Yr 2160Min Winter	1.750	0.00	0.73	100Yr +45% 2160Min Winter	3.891	0.00	0.35
10Yr 2880Min Summer	1.414	0.00	0.70	100Yr +45% 2880Min Summer	3.104	0.00	0.31
10Yr 2880Min Winter	1.414	0.00	0.68	100Yr +45% 2880Min Winter	3.104	0.00	0.30
10Yr 4320Min Summer	1.047	0.00	0.63	100Yr +45% 4320Min Summer	2.253	0.00	0.29
10Yr 4320Min Winter	1.047	0.00	0.61	100Yr +45% 4320Min Winter	2.253	0.00	0.28
10Yr 5760Min Summer	0.846	0.00	0.58	100Yr +45% 5760Min Winter	1.793	0.00	0.27
10Yr 5760Min Winter	0.846	0.00	0.57	100Yr +45% 5760Min Summer	1.793	0.00	0.28

Simulation Results

Return Period Yrs: 1.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S46	15 min Winter	8	45.674	0.019	1.178		OK
S45	15 min Winter	9	45.082	0.022	1.116		OK
S44	15 min Winter	8	45.058	0.043	3.735		OK
S43	15 min Winter	9	44.662	0.043	3.647		OK
S42	15 min Winter	9	44.601	0.029	3.666		OK
S41	15 min Winter	8	45.078	0.034	2.325		OK
S40	15 min Winter	8	45.011	0.034	2.303		OK
S39	15 min Winter	9	44.890	0.034	2.241		OK
S38	15 min Winter	9	44.760	0.053	5.263		OK
S37	15 min Winter	9	44.675	0.067	8.165		OK
S36	15 min Winter	8	44.619	0.047	8.169		OK
S35	30 min Summer	19	43.984	0.062	7.923		OK
S34	30 min Summer	20	43.838	0.518	7.258		OK
S33	30 min Summer	20	43.146	0.036	7.306		OK
S12	15 min Winter	8	43.784	0.034	4.580		OK
S13	15 min Winter	8	43.681	0.031	4.556		OK
S16	30 min Summer	19	43.280	0.040	2.412		OK
S17	30 min Summer	20	43.178	0.018	2.143		OK
S14	15 min Winter	8	43.776	0.026	3.031		OK
S15	15 min Winter	7	43.667	0.017	2.778		OK
S18	30 min Winter	21	42.231	0.031	3.378		OK
S19	30 min Summer	20	42.195	0.065	10.526		OK
S20	30 min Summer	20	42.024	0.504	10.528		OK
S21	30 min Summer	18	40.947	0.066	13.970		OK
S22	120 min Winter	102	40.939	0.119	1.304		OK
S23	120 min Winter	100	40.939	1.539	2.289		Surcharged
S24	120 min Winter	100	40.937	2.017	2.387		Surcharged
S47	15 min Winter	8	40.578	0.028	2.662		OK
S32	720 min Summer	446	39.120	0.020	0.126		OK
S48	720 min Summer	438	39.125	0.489	0.074		OK
S25	15 min Winter	8	37.783	0.573	24.952		OK
S26	15 min Winter	8	37.123	0.068	24.617		OK
S27	15 min Winter	8	36.631	0.096	34.746		OK
S28	600 min Winter	512	35.706	0.266	1.483		OK
S29	600 min Winter	512	35.706	0.296	1.480		Surcharged
S30	600 min Winter	512	35.705	0.825	1.482		Surcharged
S31	1440 min Summer	1187	35.146	0.021	1.505		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S46	S45	0.020	0.810	1.167	0.035	OK
1.001	15 min Winter	9	S45	S44	0.032	0.405	1.137	0.045	OK
1.002	15 min Winter	8	S44	S43	0.043	0.870	3.628	0.183	OK
1.003	15 min Winter	9	S43	S42	0.036	1.124	3.666	0.185	OK
1.004	15 min Winter	9	S42	S35	0.037	1.084	3.664	0.080	OK
2.000	15 min Winter	8	S41	S40	0.034	0.758	2.303	0.116	OK
2.001	15 min Winter	8	S40	S39	0.034	0.759	2.261	0.114	OK
2.002	15 min Winter	9	S39	S38	0.043	0.535	2.267	0.114	OK
2.003	15 min Winter	9	S38	S37	0.060	0.809	5.313	0.268	OK
2.004	15 min Winter	9	S37	S36	0.056	1.364	8.220	0.414	OK
2.005	15 min Winter	8	S36	S35	0.041	2.091	8.155	0.195	OK
1.005	30 min Summer	19	S35	S34	0.065	1.355	7.330	0.705	OK
1.006	30 min Summer	20	S34	S33	0.052	1.769	7.306	0.709	OK
1.007	30 min Summer	20	S33	S19	0.050	1.413	7.320	0.125	OK
3.000	15 min Winter	8	S12	S13	0.032	1.622	4.556	0.112	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
3.001	15 min Winter	8	S13	S16	0.027	2.054	4.560	0.085	OK
3.002	30 min Summer	19	S16	S17	0.029	1.147	2.150	0.308	OK
3.003	30 min Summer	20	S17	S18	0.024	1.166	2.148	0.029	OK
4.000	15 min Winter	8	S14	S15	0.021	1.949	3.007	0.061	OK
4.001	15 min Winter	7	S15	S18	0.014	3.210	2.765	0.023	OK
3.004	30 min Winter	21	S18	S19	0.047	0.899	3.285	0.202	OK
1.008	30 min Summer	20	S19	S20	0.065	1.963	10.528	0.750	OK
1.009	30 min Summer	20	S20	S21	0.059	2.189	10.524	0.565	OK
1.010	30 min Summer	18	S21	S22	0.045	3.098	13.948	0.405	OK
1.011	120 min Winter	102	S22	S23	0.134	0.160	2.670	0.021	OK
1.012	120 min Winter	100	S23	S24	0.100	0.304	2.387	0.321	Surcharged
1.013	120 min Winter	100	S24	S25	0.032	1.052	2.327	0.229	OK
5.000	15 min Winter	8	S47	S32	0.018	2.283	2.654	0.056	OK
5.001	720 min Summer	446	S32	S48	0.026	0.113	0.181	0.027	OK
5.002	720 min Summer	438	S48	S25	0.010	0.342	0.133	0.020	OK
1.014	15 min Winter	8	S25	S26	0.123	1.588	24.617	1.007	OK
1.015	15 min Winter	8	S26	S27	0.082	1.050	24.315	0.029	OK
1.016	15 min Winter	8	S27	S28	0.095	1.173	33.948	0.057	OK
1.017	600 min Winter	512	S28	S29	0.281	0.006	1.480	0.000	OK
1.018	600 min Winter	512	S29	S30	0.225	0.037	1.482	0.024	OK
1.019	600 min Winter	512	S30	S31	0.021	0.787	1.482	0.019	OK

Return Period Yrs: 10.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S46	15 min Winter	8	45.679	0.024	1.931		OK
S45	15 min Winter	8	45.087	0.027	1.916		OK
S44	15 min Winter	8	45.071	0.057	6.136		OK
S43	15 min Winter	9	44.675	0.056	5.963		OK
S42	15 min Winter	9	44.609	0.037	6.022		OK
S41	15 min Winter	8	45.088	0.044	3.808		OK
S40	15 min Winter	8	45.021	0.044	3.780		OK
S39	15 min Winter	9	44.900	0.044	3.656		OK
S38	15 min Winter	8	44.778	0.070	8.867		OK
S37	15 min Winter	8	44.698	0.090	13.679		OK
S36	15 min Winter	8	44.631	0.059	13.497		OK
S35	30 min Summer	20	44.024	0.102	9.751		Surcharged
S34	15 min Winter	13	43.906	0.586	9.626		Surcharged
S33	30 min Summer	17	43.152	0.042	9.917		OK
S12	15 min Winter	8	43.794	0.044	7.500		OK
S13	15 min Winter	8	43.688	0.038	7.470		OK
S16	30 min Summer	19	43.298	0.058	3.968		OK
S17	30 min Summer	19	43.185	0.025	4.329		OK
S14	15 min Winter	8	43.784	0.034	4.965		OK
S15	15 min Winter	8	43.670	0.020	4.939		OK
S18	30 min Winter	22	42.253	0.053	5.449		OK
S19	30 min Winter	23	42.247	0.117	14.763		Surcharged
S20	30 min Winter	19	42.038	0.518	14.943		OK
S21	180 min Winter	151	41.126	0.245	2.484		Surcharged
S22	180 min Winter	151	41.126	0.306	2.484		Surcharged
S23	180 min Winter	151	41.125	1.725	2.464		Surcharged
S24	180 min Winter	151	41.122	2.202	2.464		Surcharged
S47	15 min Winter	8	40.585	0.035	4.360		OK
S32	480 min Winter	348	39.139	0.039	0.176		OK
S48	480 min Winter	347	39.144	0.508	0.176		OK
S25	15 min Winter	8	37.976	0.766	40.866		Surcharged
S26	15 min Winter	9	37.141	0.086	39.287		OK
S27	15 min Winter	9	36.657	0.122	55.566		OK
S28	720 min Winter	708	35.981	0.541	1.299		OK
S29	720 min Winter	708	35.981	0.571	1.297		Surcharged
S30	720 min Winter	708	35.981	1.101	1.315		Surcharged
S31	2160 min Winter	1048	35.146	0.021	1.505		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S46	S45	0.026	0.936	1.916	0.058	OK
1.001	15 min Winter	8	S45	S44	0.042	0.462	1.873	0.074	OK
1.002	15 min Winter	8	S44	S43	0.056	1.000	6.002	0.302	OK
1.003	15 min Winter	9	S43	S42	0.047	1.290	6.022	0.303	OK
1.004	15 min Winter	9	S42	S35	0.054	1.043	6.034	0.132	OK
2.000	15 min Winter	8	S41	S40	0.044	0.873	3.780	0.190	OK
2.001	15 min Winter	8	S40	S39	0.044	0.874	3.723	0.188	OK
2.002	15 min Winter	9	S39	S38	0.057	0.603	3.706	0.187	OK
2.003	15 min Winter	8	S38	S37	0.080	0.903	8.695	0.438	OK
2.004	15 min Winter	8	S37	S36	0.074	1.544	13.497	0.680	OK
2.005	15 min Winter	8	S36	S35	0.058	2.131	13.483	0.322	OK
1.005	30 min Summer	20	S35	S34	0.100	1.211	9.513	0.915	Surcharged
1.006	15 min Winter	13	S34	S33	0.070	1.621	9.588	0.931	OK
1.007	30 min Summer	17	S33	S19	0.064	1.388	9.906	0.169	OK
3.000	15 min Winter	8	S12	S13	0.041	1.918	7.470	0.184	OK
3.001	15 min Winter	8	S13	S16	0.038	2.098	7.450	0.139	OK
3.002	30 min Summer	19	S16	S17	0.041	1.408	4.329	0.620	OK
3.003	30 min Summer	19	S17	S18	0.037	1.275	4.332	0.059	OK
4.000	15 min Winter	8	S14	S15	0.027	2.297	4.939	0.100	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
4.001	15 min Winter	8	S15	S18	0.024	2.767	4.927	0.041	OK
3.004	30 min Winter	22	S18	S19	0.077	0.807	5.208	0.321	OK
1.008	30 min Winter	23	S19	S20	0.100	1.880	14.767	1.051	Surcharged
1.009	30 min Winter	19	S20	S21	0.077	2.304	14.927	0.801	OK
1.010	180 min Winter	151	S21	S22	0.150	0.141	2.484	0.072	Surcharged
1.011	180 min Winter	151	S22	S23	0.150	0.139	2.464	0.019	Surcharged
1.012	180 min Winter	151	S23	S24	0.100	0.314	2.464	0.331	Surcharged
1.013	180 min Winter	151	S24	S25	0.033	1.070	2.463	0.242	OK
5.000	15 min Winter	8	S47	S32	0.023	2.483	4.353	0.091	OK
5.001	480 min Winter	348	S32	S48	0.044	0.025	0.085	0.013	OK
5.002	480 min Winter	347	S48	S25	0.011	0.367	0.172	0.025	OK
1.014	15 min Winter	8	S25	S26	0.150	2.237	39.527	1.617	Surcharged
1.015	15 min Winter	9	S26	S27	0.104	1.209	39.550	0.046	OK
1.016	15 min Winter	9	S27	S28	0.122	1.369	56.264	0.095	OK
1.017	720 min Winter	708	S28	S29	0.556	0.002	1.297	0.000	OK
1.018	720 min Winter	708	S29	S30	0.225	0.033	1.315	0.022	OK
1.019	720 min Winter	708	S30	S31	0.020	0.758	1.315	0.017	OK

Return Period Yrs: 30.0

Climate Change %: 40

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S46	15 min Winter	8	45.687	0.032	3.420		OK
S45	15 min Winter	8	45.097	0.037	3.400		OK
S44	15 min Winter	8	45.093	0.078	10.895		OK
S43	15 min Winter	9	44.696	0.078	10.538		OK
S42	15 min Winter	9	44.621	0.049	10.667		OK
S41	15 min Winter	8	45.104	0.060	6.746		OK
S40	15 min Winter	8	45.036	0.059	6.706		OK
S39	15 min Winter	9	44.915	0.059	6.452		OK
S38	15 min Winter	8	44.811	0.104	15.777		OK
S37	15 min Winter	8	44.749	0.141	24.328		OK
S36	15 min Winter	8	44.653	0.081	22.798		OK
S35	30 min Winter	23	44.155	0.233	10.934		Surcharged
S34	30 min Winter	24	44.007	0.687	10.267		Surcharged
S33	30 min Winter	24	43.152	0.042	10.257		OK
S12	15 min Winter	8	43.809	0.059	13.286		OK
S13	15 min Winter	8	43.701	0.051	13.247		OK
S16	30 min Summer	19	43.331	0.091	7.005		OK
S17	30 min Summer	19	43.194	0.034	8.177		OK
S14	15 min Winter	8	43.794	0.044	8.796		OK
S15	15 min Winter	8	43.677	0.027	8.761		OK
S18	30 min Winter	25	42.331	0.131	7.091		Surcharged
S19	30 min Winter	25	42.317	0.187	17.462		Surcharged
S20	60 min Winter	47	42.052	0.532	16.788		OK
S21	240 min Winter	211	41.540	0.659	2.758		Surcharged
S22	240 min Winter	211	41.540	0.720	2.758		Surcharged
S23	240 min Winter	211	41.539	2.139	2.743		Surcharged
S24	240 min Winter	211	41.535	2.615	2.742		Surcharged
S47	15 min Winter	8	40.596	0.046	7.724		OK
S32	480 min Winter	365	39.180	0.080	0.238		OK
S48	480 min Winter	359	39.181	0.544	0.253		OK
S25	15 min Winter	9	38.531	1.321	67.865		Surcharged
S26	15 min Winter	9	37.168	0.113	69.214		OK
S27	15 min Winter	9	36.696	0.161	97.712		OK
S28	1440 min Winter	1369	36.540	1.100	1.745		OK
S29	1440 min Winter	1369	36.540	1.130	1.744		Surcharged
S30	1440 min Winter	1369	36.540	1.660	1.747		Surcharged
S31	1440 min Winter	1369	35.148	0.023	1.747		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S46	S45	0.035	1.106	3.400	0.103	OK
1.001	15 min Winter	8	S45	S44	0.057	0.536	3.343	0.132	OK
1.002	15 min Winter	8	S44	S43	0.078	1.161	10.697	0.539	OK
1.003	15 min Winter	9	S43	S42	0.063	1.498	10.667	0.537	OK
1.004	15 min Winter	9	S42	S35	0.090	0.962	10.701	0.234	OK
2.000	15 min Winter	8	S41	S40	0.060	1.024	6.706	0.338	OK
2.001	15 min Winter	8	S40	S39	0.059	1.023	6.619	0.333	OK
2.002	15 min Winter	9	S39	S38	0.081	0.671	6.541	0.329	OK
2.003	15 min Winter	8	S38	S37	0.123	1.002	15.499	0.781	OK
2.004	15 min Winter	8	S37	S36	0.111	1.625	22.798	1.148	OK
2.005	15 min Winter	8	S36	S35	0.091	2.141	24.057	0.575	OK
1.005	30 min Winter	23	S35	S34	0.100	1.317	10.341	0.994	Surcharged
1.006	30 min Winter	24	S34	S33	0.071	1.716	10.257	0.996	OK
1.007	30 min Winter	24	S33	S19	0.096	0.857	10.257	0.175	OK
3.000	15 min Winter	8	S12	S13	0.055	2.262	13.247	0.326	OK
3.001	15 min Winter	8	S13	S16	0.057	2.118	13.202	0.247	OK
3.002	30 min Summer	19	S16	S17	0.062	1.587	8.177	1.172	OK
3.003	30 min Summer	19	S17	S18	0.070	1.019	8.183	0.112	OK
4.000	15 min Winter	8	S14	S15	0.036	2.734	8.761	0.177	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
4.001	15 min Winter	8	S15	S18	0.037	2.579	8.745	0.073	OK
3.004	30 min Winter	25	S18	S19	0.100	0.918	7.209	0.444	Surcharged
1.008	30 min Winter	25	S19	S20	0.100	2.224	17.464	1.243	Surcharged
1.009	60 min Winter	47	S20	S21	0.091	2.241	16.789	0.901	OK
1.010	240 min Winter	211	S21	S22	0.150	0.156	2.758	0.080	Surcharged
1.011	240 min Winter	211	S22	S23	0.150	0.155	2.743	0.021	Surcharged
1.012	240 min Winter	211	S23	S24	0.100	0.349	2.742	0.369	Surcharged
1.013	240 min Winter	211	S24	S25	0.035	1.102	2.742	0.270	OK
5.000	15 min Winter	8	S47	S32	0.033	2.692	7.718	0.161	OK
5.001	480 min Winter	365	S32	S48	0.087	0.030	0.218	0.032	OK
5.002	480 min Winter	359	S48	S25	0.013	0.406	0.238	0.035	OK
1.014	15 min Winter	9	S25	S26	0.150	3.917	69.214	2.831	Surcharged
1.015	15 min Winter	9	S26	S27	0.137	1.425	69.339	0.081	OK
1.016	15 min Winter	9	S27	S28	0.161	1.607	98.341	0.166	OK
1.017	1440 min Winter	1369	S28	S29	1.115	0.001	1.744	0.001	OK
1.018	1440 min Winter	1369	S29	S30	0.225	0.044	1.747	0.029	OK
1.019	1440 min Winter	1369	S30	S31	0.023	0.828	1.747	0.022	OK

Return Period Yrs: 100.0

Climate Change %: 45

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S46	15 min Winter	8	45.692	0.038	4.585		OK
S45	15 min Winter	8	45.103	0.043	4.561		OK
S44	15 min Winter	8	45.109	0.094	14.558		OK
S43	15 min Winter	9	44.712	0.094	14.141		OK
S42	15 min Winter	9	44.630	0.058	14.294		OK
S41	15 min Winter	8	45.114	0.071	9.043		OK
S40	15 min Winter	8	45.047	0.070	8.993		OK
S39	15 min Winter	9	44.925	0.069	8.637		OK
S38	15 min Winter	9	44.875	0.168	20.408		Surcharged
S37	15 min Winter	9	44.772	0.164	31.640		Surcharged
S36	15 min Winter	9	44.669	0.097	31.704		OK
S35	30 min Winter	24	44.278	0.356	11.735		Surcharged
S34	30 min Winter	25	44.110	0.790	10.930		Surcharged
S33	30 min Winter	25	43.154	0.044	10.909		OK
S12	15 min Winter	8	43.819	0.069	17.811		OK
S13	15 min Winter	8	43.709	0.059	17.763		OK
S16	30 min Summer	19	43.368	0.128	9.432		Surcharged
S17	30 min Summer	19	43.195	0.035	8.769		OK
S14	15 min Winter	8	43.801	0.051	11.792		OK
S15	15 min Winter	8	43.681	0.031	11.750		OK
S18	60 min Winter	47	42.424	0.224	6.028		Surcharged
S19	60 min Winter	48	42.415	0.285	16.502		Surcharged
S20	120 min Winter	106	42.222	0.702	12.570		Surcharged
S21	240 min Winter	227	41.897	1.016	2.987		Surcharged
S22	240 min Winter	228	41.896	1.076	2.937		Flood Risk
S23	240 min Winter	228	41.896	2.496	2.961		Flood Risk
S24	240 min Winter	228	41.891	2.971	2.961		Flood Risk
S47	15 min Winter	8	40.602	0.052	10.354		OK
S32	480 min Winter	375	39.214	0.114	0.281		Surcharged
S48	480 min Winter	375	39.214	0.578	0.282		Surcharged
S25	15 min Winter	9	39.123	1.913	90.973		Surcharged
S26	15 min Winter	9	37.184	0.129	90.646		OK
S27	2160 min Winter	1920	36.923	0.388	2.010		OK
S28	2160 min Winter	1916	36.923	1.483	5.745		OK
S29	2160 min Winter	1928	36.920	1.510	0.000		Flood Risk
S30	2160 min Winter	1927	36.920	2.040	2.013		Flood Risk
S31	2160 min Winter	1926	35.149	0.024	1.982		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S46	S45	0.040	1.189	4.561	0.139	OK
1.001	15 min Winter	8	S45	S44	0.069	0.562	4.435	0.175	OK
1.002	15 min Winter	8	S44	S43	0.093	1.240	14.310	0.721	OK
1.003	15 min Winter	9	S43	S42	0.076	1.603	14.294	0.720	OK
1.004	15 min Winter	9	S42	S35	0.104	1.099	14.330	0.313	OK
2.000	15 min Winter	8	S41	S40	0.070	1.106	8.993	0.453	OK
2.001	15 min Winter	8	S40	S39	0.070	1.105	8.883	0.447	OK
2.002	15 min Winter	9	S39	S38	0.110	0.632	8.752	0.441	OK
2.003	15 min Winter	9	S38	S37	0.150	1.163	20.544	1.035	Surcharged
2.004	15 min Winter	9	S37	S36	0.124	2.035	31.704	1.597	OK
2.005	15 min Winter	9	S36	S35	0.124	2.035	31.706	0.757	OK
1.005	30 min Winter	24	S35	S34	0.100	1.402	11.008	1.058	Surcharged
1.006	30 min Winter	25	S34	S33	0.072	1.806	10.909	1.059	OK
1.007	30 min Winter	25	S33	S19	0.097	0.904	10.909	0.186	OK
3.000	15 min Winter	8	S12	S13	0.064	2.455	17.763	0.437	OK
3.001	15 min Winter	8	S13	S16	0.071	2.144	17.708	0.331	OK
3.002	30 min Summer	19	S16	S17	0.067	1.556	8.769	1.257	OK
3.003	30 min Summer	19	S17	S18	0.091	0.787	8.767	0.120	OK
4.000	15 min Winter	8	S14	S15	0.041	2.988	11.750	0.238	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
4.001	15 min Winter	8	S15	S18	0.048	2.406	11.732	0.098	OK
3.004	60 min Winter	47	S18	S19	0.100	0.744	5.844	0.360	Surcharged
1.008	60 min Winter	48	S19	S20	0.100	2.102	16.506	1.175	Surcharged
1.009	120 min Winter	106	S20	S21	0.100	1.597	12.541	0.673	Surcharged
1.010	240 min Winter	227	S21	S22	0.150	0.169	2.987	0.087	Surcharged
1.011	240 min Winter	228	S22	S23	0.150	0.168	2.961	0.023	Surcharged
1.012	240 min Winter	228	S23	S24	0.100	0.377	2.961	0.398	Surcharged
1.013	240 min Winter	228	S24	S25	0.037	1.125	2.962	0.291	OK
5.000	15 min Winter	8	S47	S32	0.039	2.786	10.350	0.216	OK
5.001	480 min Winter	375	S32	S48	0.100	0.036	0.282	0.042	Surcharged
5.002	480 min Winter	375	S48	S25	0.014	0.427	0.282	0.042	OK
1.014	15 min Winter	9	S25	S26	0.150	5.129	90.646	3.708	Surcharged
1.015	15 min Winter	9	S26	S27	0.157	1.535	90.640	0.106	OK
1.016	2160 min Winter	1920	S27	S28	0.432	0.009	1.892	0.003	OK
1.017	2160 min Winter	1916	S28	S29	1.496	0.004	7.186	0.002	OK
1.018	2160 min Winter	1928	S29	S30	0.225	0.050	2.002	0.033	OK
1.019	2160 min Winter	1927	S30	S31	0.024	0.856	1.982	0.025	OK

Appendix H

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type Pollution Hazard Level Pollution Hazard Indices TSS Metals Hydrocarbons	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day) Low 0.5 0.4 0.4				
SuDS components proposed		SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 1	Filter strip				
Component 2	Swale				
Component 3	None				
SuDS Pollution Mitigation Indices TSS Metals Hydrocarbons	0.65 0.7 0.8				
Groundwater protection type Groundwater protection Pollution Mitigation Indices TSS Metals Hydrocarbons	None 0 0 0				
Combined Pollution Mitigation Indices TSS Metals Hydrocarbons Acceptability of Pollution Mitigation TSS Metals Hydrocarbons	0.65 0.7 0.8 Sufficient Sufficient Sufficient	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type Pollution Hazard Level Pollution Hazard Indices TSS Metals Hydrocarbons	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day) Low 0.5 0.4 0.4				
SuDS components proposed		Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of adopted indices. Enter indices approved by the environmental regulator in appropriate 'User Defined Indices' row below	SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. WAT-RM-08 (SEPA, 2014) also provides a flow chart with a summary of checks on suitability of a proprietary system	See Chapter 15 Proprietary treatment systems for approaches to demonstrate product performance. Note: a British Water/Environment Agency assessment Code of Practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: http://www.britishwater.co.uk/Publications/codes-of-practise.aspx .	
Component 1	Vortex Separator				
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices TSS Metals Hydrocarbons	 				
Groundwater protection type Groundwater protection Pollution Mitigation Indices TSS Metals Hydrocarbons	None 0 0 0				
Combined Pollution Mitigation Indices TSS Metals Hydrocarbons Acceptability of Pollution Mitigation TSS Metals Hydrocarbons	 Sufficient Sufficient Sufficient	0.5 0.4 0.8 Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Residential parking				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed		SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 1	Vortex Separator				
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.7				
Metals	0.6				
Hydrocarbons	0.7				
Groundwater protection type	None				
Groundwater protection					
Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices		Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
TSS	0.7				
Metals	0.6				
Hydrocarbons	0.7				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type Pollution Hazard Level Pollution Hazard Indices TSS Metals Hydrocarbons	Residential roofing Very low 0.2 0.2 0.05				
SuDS components proposed		Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of adopted indices. Enter indices approved by the environmental regulator in appropriate 'User Defined Indices' row below	SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. WAT-RM-08 (SEPA, 2014) also provides a flow chart with a summary of checks on suitability of a proprietary system	See Chapter 15 Proprietary treatment systems for approaches to demonstrate product performance. Note: a British Water/Environment Agency assessment Code of Practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: http://www.britishwater.co.uk/Publications/codes-of-practise.aspx .	
Component 1	Vortex Separator				
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices TSS Metals Hydrocarbons	 				
Groundwater protection type Groundwater protection Pollution Mitigation Indices TSS Metals Hydrocarbons	None 0 0 0				
Combined Pollution Mitigation Indices TSS Metals Hydrocarbons Acceptability of Pollution Mitigation TSS Metals Hydrocarbons	 	0.5 0.4 0.8 Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			