Flood Risk Assessment & SuDS Report

December 2022

EAS

Grange Paddocks,
Elmdon, Uttlesford,
Essex
CB11 4GR

BRD Tech Ltd

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The content of this report is based on information available as of December 2022, the validity of the statements made may therefore vary over time as planning guidance / policies and the evidence base change.

Contents

1 Introduction

1.1 This Flood Risk Assessment and SuDS report has been prepared in support of an Outline Planning Application by BRB Ltd for a planning application proposal, to provide 18no. residential dwellings in agricultural land to the north of Ickleton Road located off Grange Paddocks, Ickleton Road, Elmdon, CB11 4GR. A location plan is included in **Appendix A.**

1.2 The site comprises arable land over three fields with a small farm building locate in the far north-eastern corner of the site. A development layout is enclosed in **Appendix B.**

1.3 The site is located in Flood Zone 1, at low risk of fluvial flooding and the entirety of the site is shown to be at very low risk of surface water flooding. This report will briefly examine all sources of flood risk to the site, as well as outlining a suitable a sustainable drainage strategy.

1.4 The contents of this FRA and drainage report are based on the advice set out in the National Planning Policy Framework (NPPF) published in July 2021 and Annex 3: Flood risk vulnerability classification, also from the NPPF and the Planning Practice Guidance (PPG), published November 2016.

1.5 This document includes the following sections:

Section 2 - describes relevant policy;

Section 3 - site description, including site levels, proximity to watercourses etc.;

Section 4 – provides a brief review of potential sources of flooding;

Section 5 – details of the proposed surface water management;

Section 6 – details of management and maintenance;

Section 7 – provides a summary and conclusions.

2 Policy Context

Introduction

2.1 This section sets out the policy context. The contents of this SuDS Statement are based on the advice set out in the National Planning Policy Framework (NPPF) published in July 2021 and Annex 3: Flood risk vulnerability classification, also from the NPPF and the Planning Practice Guidance (PPG) published November 2016, which is updated on an ad hoc basis.

2.2 Paragraph 167 footnote 55 of the NPPF states:

> *"A site-specific flood risk assessment should be provided for all developments 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."*

2.3 The flood risk zones are defined as:

- Flood Zone 1- This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1%)
- Flood Zone 2- This zone comprises land assessed as having between a 1 in a 100 and 1 in 1,000 annual probability of river flooding.
- Flood Zone 3a- This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), and for tidal flooding at least a 0.5% annual probability of flooding from tidal sources.
- Flood Zone 3b- This zone comprises land where water has to flow or be stored in times of flood.

2.4 The site is located in Flood Zone 1 with an extract from the Flood Map for Planning enclosed in **Appendix C.**

2.5 Paragraph 159 discusses the suitability of development location, particularly with regard to future risks induced by climate change:

> *"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere".*

2.6 Paragraphs 169 NPPF discusses the application of sustainable drainage systems:

> *"Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:*
>
> - *Take account of advice from the lead local flood authority;*
> - *Have appropriate proposed minimum operational standards;*

- *Have maintenance arrangements in place to ensure an acceptable standard of operation of the lifetime of the development; and*

- *Where possible, provide multifunctional benefits."*

Local Policy

The Sustainable Drainage Systems Design Guide for Essex

2.7 This guide was prepared by Essex County Council to aid developers, designers and consultants in the design of Sustainable Drainage Systems (SuDS) in Essex. The guidance is intended to advise on the planning, design and delivery of attractive and high-quality SuDS scheme to benefit both the environment and the community. The website contains all the information on the SuDS Design Guide for Essex and can be accessed here: https://www.essexdesignguide.co.uk/suds

2.8 This guidance was considered and used to inform the development of the proposed SuDS strategy for the site.

Uttlesford District Adopted Local Plan 2005

2.9 The 'Uttlesford Local Plan 2019' draft was withdrawn in April 2020 and will now commence a new draft.

2.10 Once complete the new Local Plan will guide development in the district until 2033. The new local plan will set out areas suitable for new housing and will ensure the necessary infrastructure is put in place to support the growth expected in the district.

2.11 In the meantime, the Uttlesford Adopted Local Plan 2005 is the relevant document.

2.12 Policy GEN3: Flood Protection of the Adopted Local Plan 2005 states:

> *"Outside flood risk areas development must not increase the risk of flooding through surface water run-off. A flood risk assessment will be required to demonstrate this. Sustainable Drainage Systems should also be considered as an appropriate flood mitigation measure in the first instance.*
>
> *For all areas where development will be exposed to or may lead to an increase in the risk of flooding applications will be accompanied by a full Flood Risk Assessment (FRA) which sets out the level of risk associated with the proposed development. The FRA will show that the proposed development can be provided with the appropriate minimum standard of protection throughout its lifetime and will demonstrate the effectiveness of flood mitigation measures proposed."*

2.13 This report demonstrates that the proposed development will use SuDS methods to manage the volume and rate of surface water runoff and the proposals will not increase flood risk to the local area.

Uttlesford District Council Strategic Flood Risk Assessment (May 2016)

2.14 The Uttlesford Strategic Flood Risk Assessment (SFRA) was published in May 2016, providing an update to the original report which was published in 2008 in response to several legislative changes including the Flood and Water Management Act of 2010 and SuDS guidance published in 2015.

2.15 Uttlesford is located within the headwaters of three major catchments including the Great Ouse, North Essex and Thames. Surface water flooding and flooding sourced from ordinary watercourses is noted as a significant issue across the district.

2.16 Map 4 of the SFRA shows the site is located within an area of white chalk bedrock.

2.17 Map 5 of the SFRA shows there have been no recorded flood incidents at the site or within the vicinity of the site.

2.18 Map 6 confirms the site is located in Flood Zone 1.

2.19 Map 8 shows the extent of surface water flooding across the district. The site is shown not be located within a surface water flood extent.

2.20 Map 9 of the SFRA shows the susceptibility of groundwater flooding across the district. The site is shown to not be located in an area susceptibility to groundwater flooding.

2.21 Map 10 shows the number of recorded sewer flooding incidents across the district categorised by postcode. The site is located within an area with 1-5 sewer flooding incidents have been recorded.

2.22 Assessing the data within the SFRA, it is concluded that there are no significant flood risks at the site.

3 Existing Site Assessment

Site Description

3.1 The site consists of agricultural land located to the north of Ickleton Road, Elmdon, CB11 4GR. A location plan is included in **Appendix A.**

3.2 The site comprises arable land over three fields with a small farm building locate in the far north-eastern corner of the site. To the north lies an agricultural field, Ickleton Road to the south with existing residential properties beyond. To the east is a thick hedgerow of shrubs and trees, to the west an existing dirt track that currently provides vehicle access to the site. Beyond the track is Farm Drive that runs along the western boundary and further large open farm fields and residential properties.

3.3 The proposed development contains up to 18 new residential dwellings. Each property contains private driveway spaces, with associated garden spaces. In the centre of the site is a circular access road with the main access via Ickleton Road continues to be from the south-west corner. The open space in the centre of the site includes a large new pond and a public open space. A development layout is enclosed in **Appendix B**.

Local Watercourses and Ditches

3.4 The nearest EA 'Main River' is the River Cam, which is located approximately 4.6 km north-east of the site.

3.5 A number of unnamed tributary water channel from the River Cam are located approximately 670m north of the site and 150m south-east of the site.

3.6 Another unnamed water ditch is located approximately 50m south of the site.

3.7 A number of small ponds are located 370-600m north-west of the site.

3.8 Within a 2km radius of the site there are a number of unnamed water channel ditches located in the surrounding farm farms surrounding the site.

Site Levels

3.9 A topographical survey is enclosed in **Appendix D.** The survey shows a general fall trend from north to south, with high points in the site shown to be in the north-west corner at 109.55m aOD – 110.48m aOD, while a low point at the site is shown along the southern site boundary at 102.57m AOD – 102.85m AOD.

Geology

3.10 With reference to the British Geological viewer online mapping, the site is located within an area with a bedrock of Lewes Nodular Chalk Formation and Seaford Chalk Formation – chalk sedimentary bedrock with much of the sites northern and western sections showing superficial deposits of Lowestoft Formation - diamicton.

3.11 Further investigation into the site geology including infiltration tests was carried out and have been discussed below.

Sewer Records

3.12 Sewer records obtained by Anglian Water are enclosed in **Appendix E.** The mapping indicates that there are a number of public foul sewers located within the nearby vicinity and residential areas next to the site. There are no foul sewers shown to be located directly adjacent to the site and not along the section of Ickleton Road directly adjacent to the site either.

3.13 There is a 100mm foul sewer connection shown to run southwards along Elm Court road. This is the closest foul sewer to the site. This foul sewer then connects to another more extensive foul sewer, which is running between the residential property boundary of the village and the neighbouring farm fields in the south. This boundary sewer is shown to run east / north-eastwards and another foul sewer from Horseshoe Close road connects to this foul sewer.

3.14 Further west from the site along Ickleton Road, a 150mm foul sewer is shown to run along the main road in an eastern direction which then runs southwards along an unnamed residential road and connects to the more extensive village boundary foul sewer in the south.

Infiltration Tests

3.15 Infiltration Tests to BRE 365 Standard were undertaken in September 2022 by Subadra Geotechnical Consultants. Tests were undertaken at a range of depths from 0.7m to 3m below ground level to ascertain the viability of disposal of surface water via infiltration methods. The test results are contained in Appendix F, it can be concluded that infiltration rates increase the deeper the test pit is. At this Outline Planning Stage it is clear that infiltration methods are viable and it is considered appropriate to use the infiltration rate from TP006 – 1.0m/day for soakaways and/or infiltration basins. For permeable paving systems, rates taken from TP004 and TP005 shall be applied. At a later design stage, it is advised that further infiltration tests are undertaken and also deep bore soakaway tests. The results are included in **Appendix F**.

4 Potential Sources of Flooding

Fluvial

4.1 A copy of the Environment Agency's Flood Map is enclosed in **Appendix C.** The site is located entirely in Flood Zone 1, at low risk of fluvial flooding, Land in Flood Zone 1 is defined as land having less than 1 in 1000 annual probability of river or sea flooding (<0.1%) in any year.

Surface Water

4.2 Surface water flooding refers to flooding caused when the intensity of rainfall, particularly in urban areas, can create runoff which temporarily overwhelms the capacity of the local drainage systems including sewers, rivers and watercourses or does not infiltrate into the ground. The water ponds on the ground and flows towards low-lying land. This source of flood risk is also known as 'pluvial'.

4.3 The surface water mapping on the check long term flood risk gov.uk website shows the site is mostly at 'very low' risk of surface water flooding. Very low risk means that this area has a chance of flooding of less than 0.1% each year.

4.4 An effective and sustainable drainage system will prevent surface water flooding within the development. The EA's surface water flood risk map can be seen in **Appendix G.**

Groundwater

4.5 The BGS website shows there are no borehole records within the site boundary. However, there are historic borehole records located approximately 400m east of the site along Quickset Road.

4.6 (BGS Reference: TL44SE87) drilled to a depth of 150m, recorded top soil at 0.1m, clay flint and stone at 1m, chalk and flint to 54m, chalk to 97m, hard chalk to 104m, clay and chalk to 150m. Groundwater was shown to be struck at a depth of 40m.

4.7 Another borehole record (BGS Reference: TL43NE18), was drilled approximately 500m south-west from the site to a depth of 119m. The borehole recorded; chalk sand & gravel to 3m, soft chalk to 80m and hard chalk to 119m. Groundwater was shown to be struck at a depth of 113m.

4.8 These boreholes were recorded 400m – 500m away from the site. The exact geology at the site may differ, to what was recorded at these borehole locations.

4.1 Map 9 of the SFRA shows the susceptibility of groundwater flooding across the district. The site is shown to not be located in an area susceptibility to groundwater flooding.

4.2 The MAGIC Map website (https://magic.defra.gov.uk/MagicMap.aspx) confirms the site is not located in a groundwater source protection zone.

4.3 The Groundwater Vulnerability Map on the MAGIC Map website shows the site to be in an area labelled as 'Medium-High'. 'Medium-High' vulnerability is defined as:

''High: areas that can easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits. Medium: areas that offer some groundwater protection. Intermediate between high and low vulnerability.''

4.4 The MAGIC Mapping also shows that the site is located on land identified as having a 'Soluble Rock Risk'. A 'Soluble Rock Risk' is defined as:

''Soluble rock risk: areas where solution features that enable rapid movement of a pollutant may be present (identified as stippled).''

4.5 The site is located above a primary Aquifer based on the deposits of chalk. A principal aquafer is defined on the gov.uk website as:

"Geology that exhibits high permeability and/or provides a high level of water storage. They may support water supply and/or river base flow on a strategic scale."

4.6 Given the above, the risk of flooding from groundwater is considered to be low.

4.7 It is important the site does not introduce pollution pathways into groundwater supply via surface activities. The proposed residential use of the site is considered at low risk and the proposed sustainable drainage strategy provides the necessary treatment stages. Ground investigations should be undertaken by a hydrogeologist prior to construction to confirm groundwater levels and the suitability of infiltration.

Reservoir

4.8 The EA Flood Map for Planning shows the site is not at risk of flooding from reservoirs. Online OS mapping shows not show any other large artificial sources nearby which would pose a significant risk to the site, so the risk of flooding from reservoirs sources is considered to be low.

Sewer Flooding

4.9 Sewer flooding generally results from localised short-term intense rainfall events overloading the capacity of the private and public drainage or due to failures within the public sewer.

4.1 Map 10 from the Uttlesford District Council SFRA shows the number of recorded sewer flooding incidents across the district categorised by postcode. The site is located within an area with 1-5 sewer flooding incidents have been recorded.

4.2 The mapping does not provide any details as to the exact location of theses flooding incidents and the sector of land that the site is categorised in, covers a large area. This makes the occurrence of 1-5 sewer flooding incidents a low-risk probability.

4.3 There are no sewers shown to be located in the public roads directly adjacent to the site, in the west along Farm Drive and in the south along Ickleton Road. The closest sewer shown to the site is the Thames Water Foul sewer, located approximately 30m south of the site, along Elm Court road. If this sewer was to flood, it is predicted that sewer water would remain in the public roads and would not flood onto the site, as site levels along the southern boundary show to be 2-3m higher than the levels found along Ickleton Road. Flooded sewer water would likely remain either in Elm Court road or Ickleton Road and slowly recede away into nearby street drains.

4.4 The risk of sewer flooding at the site is considered to be Low.

Flood Risk Summary

4.5 Given the risk from flooding from all assessed sources is low, there are no specific mitigation measures required.

5 Drainage Strategy

5.1 The existing site is 100% greenfield. The proposed site hardstanding is to be managed via a series of infiltration techniques. Therefore, the surface water runoff from the site will remain at greenfield runoff rates.

Relevant SuDS Policy

5.2 SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.

5.3 The SuDS management train incorporates a hierarchy of techniques and considers all three SuDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:

- Discharge to ground.
- Discharge to a surface water body.
- Discharge to a surface water sewer.
- Discharge to a combined sewer.

5.4 The philosophy of SuDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:

- Reducing runoff rates, thus reducing the flood risk downstream.
- Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
- Groundwater recharge.
- Contributing to the enhanced amenity and aesthetic value of development areas.
- Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

Site-Specific SuDS

5.5 The various SuDS methods need to be considered in relation to site-specific constraints. Several SuDS options are available to reduce or temporarily hold back the discharge of surface water runoff. Table 5.1 outlines the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C753. It also indicates what could and could not be incorporated within the development, based upon site-specific criteria.

Device	Description	Constraints / Comments	Appropriate
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	Not feasible due to the pitch of roofs	No
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	Soakaways are proposed as part of the drainage strategy	Yes
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	Unlined permeable paving is proposed using shallow infiltration rates	Yes
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the site by reusing water for non-potable uses e.g. toilet flushing, recycling processes.	To be determined at a detailed design stage	Possible
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Not viable due to site constraints	No
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	Not necessary as part of the drainage strategy	No
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from run-off from adjacent areas.	Not necessary as part of the drainage strategy	No
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	An infiltration basin is proposed as part of the strategy	Yes
Wet ponds & constructed wetlands (end of pipe treatment)	Provide water quality treatment & temporary storage above the permanent water level.	Not necessary as part of the drainage strategy	No
Attenuation Underground (end of pipe treatment)	Oversized pipes or geo-cellular tanks designed to store water below ground level.	Not required due to other SuDS features being used.	No

Table 5.1: Site Specific Sustainable Drainage

Proposed Drainage Strategy

5.6 Infiltration devices are sized using a 1m/day infiltration rate based on the testing undertaken in September 2022.

5.7 The permeable paving has been modelled with a rate of 0.24m/day in the western half of the site and 0.1m/day in the eastern half of the site, based on the shallow infiltration tests TP004 and TP005.

5.8 Permeable Paving (at source) infiltration system is proposed to be utilised on the shared access road areas. Permeable paving can take the form of porous asphalt, permeable blocks or a gravel retention system – it is likely that permeable block paving shall be utilised, however any permeable surfaced system could be allowed for. Surface water run-off falling on the permeable paving as well as adjacent hardstanding areas (driveways and visitor parking bays) shall be collected within the subbase layers. This system also collects runoff from roof/patio areas for Plots 9 to 18 where run-off is collected in a surface water piped network with outfall into the subbase layers via a rainwater disbursement box. Due to gradients, the permeable paving is primarily for conveyance and water quality prior to discharging into a infiltration basin/ pond proposed in the centre of the site. The permeable paving is to have a minimum sub-base between 300 and 500mm and is to be left unlined for infiltration purposes.

5.9 Unlike other infiltration systems, the pollutants carried within the surface water run-off are filtered out as they pass through the course grade aggregate and sub-base. Once trapped they are then broken down over time; figures from the Construction Industry Research and Information Association have shown that 60-95% of suspended solids and 70-90% of hydrocarbons are removed by permeable surfaces.

5.10 An infiltration pond/basin is to be sited in the open space area in the centre of the site and shall collect outfall from the permeable paving system. The permeable paving system does not wholly rely on infiltration to dispose of all surface water run-off and therefore provides some attenuation volume with a restricted outfall into the infiltration pond/basin. The infiltration pond/basin is sized to collect a restricted outfall from the permeable paving and to manage all storms up to and including the 1:100yr + 40% Climate Change event and shall have a base area of $58m^2$ and top-of-bank area of $210m^2$ with a depth of 1.15m.

5.11 Due to site gradients, two sections of permeable paving leading to the site entrance is to be managed by a separate soakaway $28.8m^2$, 1.32m deep. This soakaway provides sufficient storage to manage the runoff from these two areas of permeable paving in all storm events up to and including a 1 in 100 +40% CC event.

5.12 Surface water runoff from roof/patio and driveways of Plots 1 to 8 shall be managed by private soakaways, to be located in rear gardens. Prior to discharge into the soakaway, each system will be fitted with a Smart Sponge for pollution mitigation purposes. Each soakaway tank has been sized to manage runoff in all storm events up to and including a 1 in 100 +40% CC event.

5.13 A Causeway Flow model results are included in **Appendix H**. The SuDS Drainage strategy drawing is included in **Appendix I**.

5.14 With unlined permeable paving as proposed, a structural engineer should be consulted to confirm the strategy will not impact the proposed structures on site, in line with CIRIA SuDS guidance.

Water Quality

5.15 The drainage system will meet the water quality requirements set out by Table 26.2 of the CIRIA SuDS Manual C753 which sets out the specific pollution hazard indices for residential parking or low trafficked roads in Table 5.3 below.

Land Use	Hazard Level	Pollution Hazard Indices		
		Suspended Solids	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways and low traffic roads	Low	0.5	0.4	0.4

Table 5.2 Land Use Pollution Hazard Ratings. Extracted from the CIRIA SuDS Manual C753 Simple Index Approach Tool

SuDS Component	Pollution Mitigation Indices		
	Suspended Solids	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
Total Pollution Mitigation Provided	0.7	0.6	0.7

Table 5.3 SuDS Component Pollution Mitigation for Catchpits and Swales Extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool

SuDS Component	Pollution Mitigation Indices		
	Suspended Solids	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
Pond	0.7 (*0.5) = 0.35	0.7 (*0.5) = 0.35	0.5 (*0.5) = 0.25
Total Pollution Mitigation Provided	>0.95	0.95	0.95

Table 5.4 SuDS Component Pollution Mitigation for Permeable Paving and Swales Extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool

SuDS Component	Pollution Mitigation Indices		
	Suspended Solids	Metals	Hydrocarbons
Smart sponge	0.7	0.6	0.7

Total Pollution Mitigation Provided	0.7	0.6	0.7

Table 5.5 SuDS Component Pollution Mitigation for Downstream Defender Extracted and adapted from the CIRIA SuDS Manual C753 Simple Index Approach Tool

5.16 From Table 6.3 – 6.5 above, the combination of permeable paving and a pond and catchpit and a pond both will meet the required level of pollution mitigation is provided and exceeded for removing total suspended solids, metals and hydrocarbons from the surface water runoff.

Essex SuDS Proforma

5.17 A completed SuDS proforma is enclosed in **Appendix J.**

Exceedance Flow Paths and Areas

5.18 In a storm event greater than that modelled, the capacity of surface water drainage system could become overwhelmed. In this instance, surface water would flow southward, intercepted by the treeline to the south of the site and Ickleton Road.

6 Maintenance of Development Drainage

6.1 All maintenance tasks for drainage within private areas are to remain private, with all shared drainage to be the responsibility of the site's residential management and maintenance teams.

6.2 The following CIRIA guidance set out in Table 6.1 highlights the actions required to maintain the permeable paving, soakaway storage and infiltration basins.

6.3 Regular inspections of the permeable paving and the pipe network should be made, to ensure they are effective throughout the lifetime of the development and do not become blocked or damaged over time. Some maintenance activities for the permeable paving, infiltration basins and cellular storage soakaway detailed in CIRIA C753 'The SuDS Manual' are set out in Tables 6.1-6.3 below.

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times per year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturer's recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas. Removal of weeds.	As required. As required.
Remedial actions	Remediate any landscaping which, through vegetation maintenance of soil slip, has been raised to within 50mm of the level of the paving. Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance of a hazard to the user. Rehabilitation of surface and upper sub-surface.	As required As required As required (if infiltration performance is reduced as a result of significant clogging.)
Monitoring	Initial inspection Inspect for evidence of poor operation and/or weed growth. If required, take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies. Monitor inspection chambers.	Monthly for 3 months after installation. 3 monthly, 48 hours after large storms. Annually. Annually.

Table 6.1: Maintenance tasks for permeable paving (Source: CIRIA C753, The SUDS Manual)

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required.
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt Accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Table 6.2: Maintenance tasks for infiltration basins (Source: CIRIA C753, The SUDS Manual)

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)

	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Table 6.3: Maintenance tasks for cellular storage soakaway (Source: CIRIA C753, The SUDS Manual)

6.4 It is recommended that during the first 12 months of operation all SuDS features are visually inspected on a monthly basis to determine any seasonal patterns. This will determine whether or not the recommended service intervals set out by CIRIA in Tables 6.1 above will be sufficient for maintenance beyond the first year.

6.5 After the first 12 months, the maintenance schedule should be designed to at least meet the requirements set out by CIRIA for the permeable paving based on the outcome of the monitoring.

7 Summary and Conclusion

7.1 This Flood Risk Assessment and SuDS report has been prepared in support of an Outline Planning Application by BRB Ltd for a planning application proposal, to provide 18no. residential dwellings in agricultural land to the north of Ickleton Road located off Grange Paddocks, Ickleton Road, Elmdon, CB11 4GR

7.2 The site is located in Flood Zone 1 and shown to be at a low risk of other sources of flood risk.

7.3 Infiltration testing identified that infiltration methods are viable at the site. For this Outline Planning Application, infiltration devices such as permeable paving, soakaways and an infiltration pond/basin have been utilised to demonstrate how surface water run-off could be effectively be managed for all storms up to and including the 1 in 100yr + 40 % Climate Change event. At a later design stage, it is advised that further infiltration tests are undertaken and also deep bore soakaway tests to detail the infiltration drainage strategy.

7.4 All maintenance tasks for drainage within private areas are to remain private, with all shared drainage to be the responsibility of the site's residential management and maintenance teams.

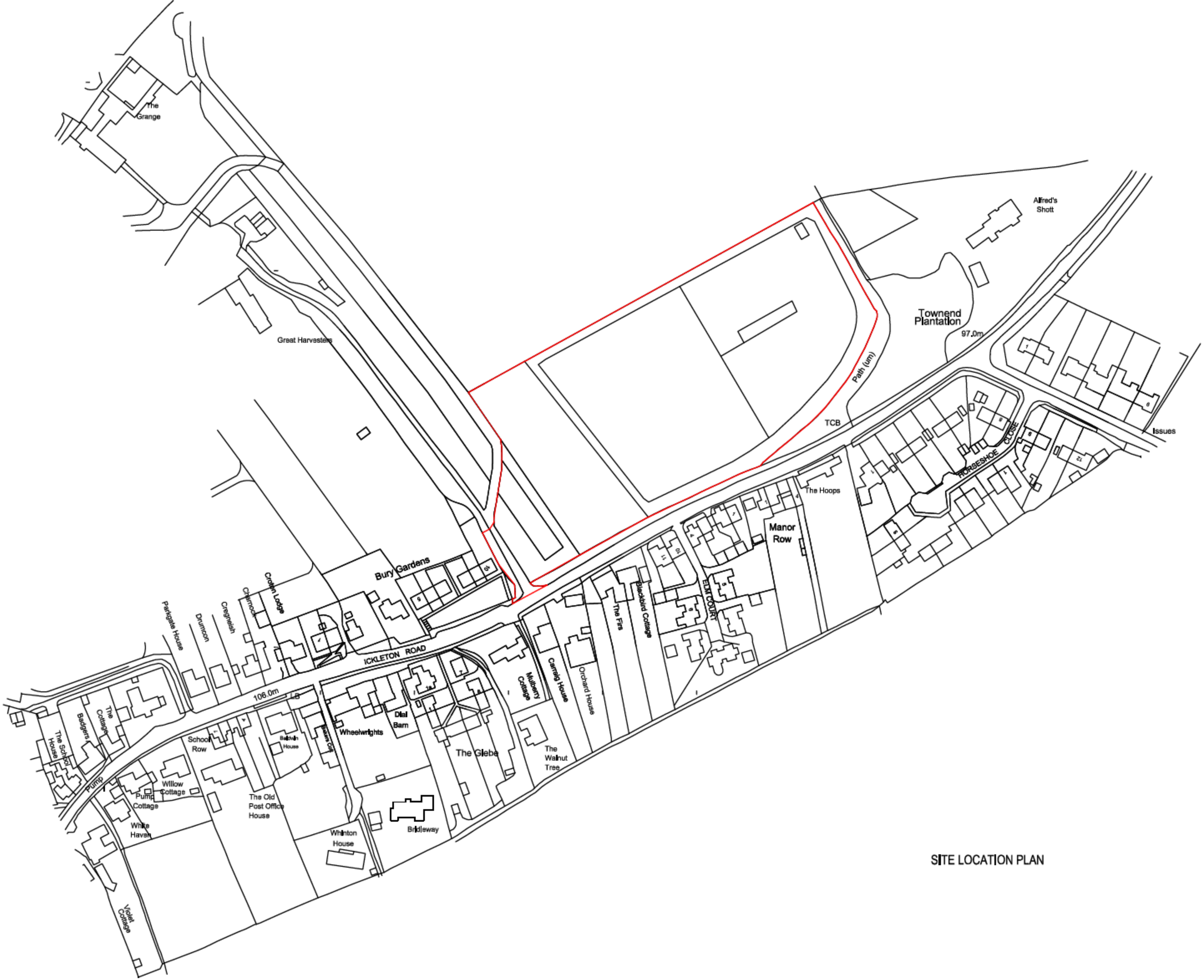
7.5 The site is at a low risk of flooding and the proposals do not increase flood risk onsite or elsewhere. The proposed SuDS strategy effectively manages the surface water runoff associated with all new impermeable areas.

7.6 In conclusion, the proposals have been shown to be policy compliant on flood risk and SuDS grounds.

8 Appendices

Appendix: A – Location Plan
Appendix: B – Development Plans
Appendix: C – EA Flood Map for Planning
Appendix: D – Topographical Survey
Appendix: E - Thames Water Sewer Records
Appendix: F - Infiltration testing results
Appendix: G – Surface Water Flood Maps
Appendix: H – Causeway Flow Results
Appendix: I – SuDS Drainage Strategy Drawing
Appendix: J – Essex CC SuDS Proforma

Appendix: A – Location Plan



SITE LOCATION PLAN

Appendix: B – Development Plans

All dimensions, levels and information indicated is to be verified on site prior to the commencement of any work on site. Any discrepancies are to be reported to BRD TECH LTD directly.

REVISIONS

House Type	No of bedrooms	No. of units	Size m² (ft²)	
Type 1	2 Bedroom Bungalow	1	85m² (915ft²)	🟪
Type 2	3 Bedroom Semi Detached	6	93m² (1001ft²)	🟦
Type 3	2 Bedroom Semi Detached	2	83m² (903ft²)	🟨
Type 4	4 Bedroom Detached	2	148m² (1593ft²)	🟪
Type 5	4 Bedroom Detached	3	180m² (1937ft²)	🟦
Type 6	5 Bedroom Detached	2	300m² (3230ft²)	🟩
Type 7	5 Bedroom Detached	2	280m² (3013ft²)	🟧

Metres 1:500
0 5 10 15 20 25 30 35 40
0 10 20 30 40 50 60 80 100
Metres 1:1000

1A Church Street
Sawbridgeworth
Hertfordshire
CM21 9AB

T:01279 600110

enquiries@brdtech.co.uk

bd TECH
[redacted]
SUSTAINABLE ARCHITECTURE

**GRANGE PADDOCK
ICKLETON ROAD
ELMDON
CB114GR**

Title
PROPOSED SITE PLAN

Scale @ A1 **1:500** Date **MAR 22** Drawn by **TAC**

Status **SKETCH**

Ref **BRD/22/014/002**

Corporate Building Engineers
ACCREDITED
CIAT

SCALE FROM THIS DRAWING AT YOUR OWN RISK.

Appendix: C – EA Flood Map for Planning

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
grange	**546601/239904**	**15 Dec 2022 11:38**

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

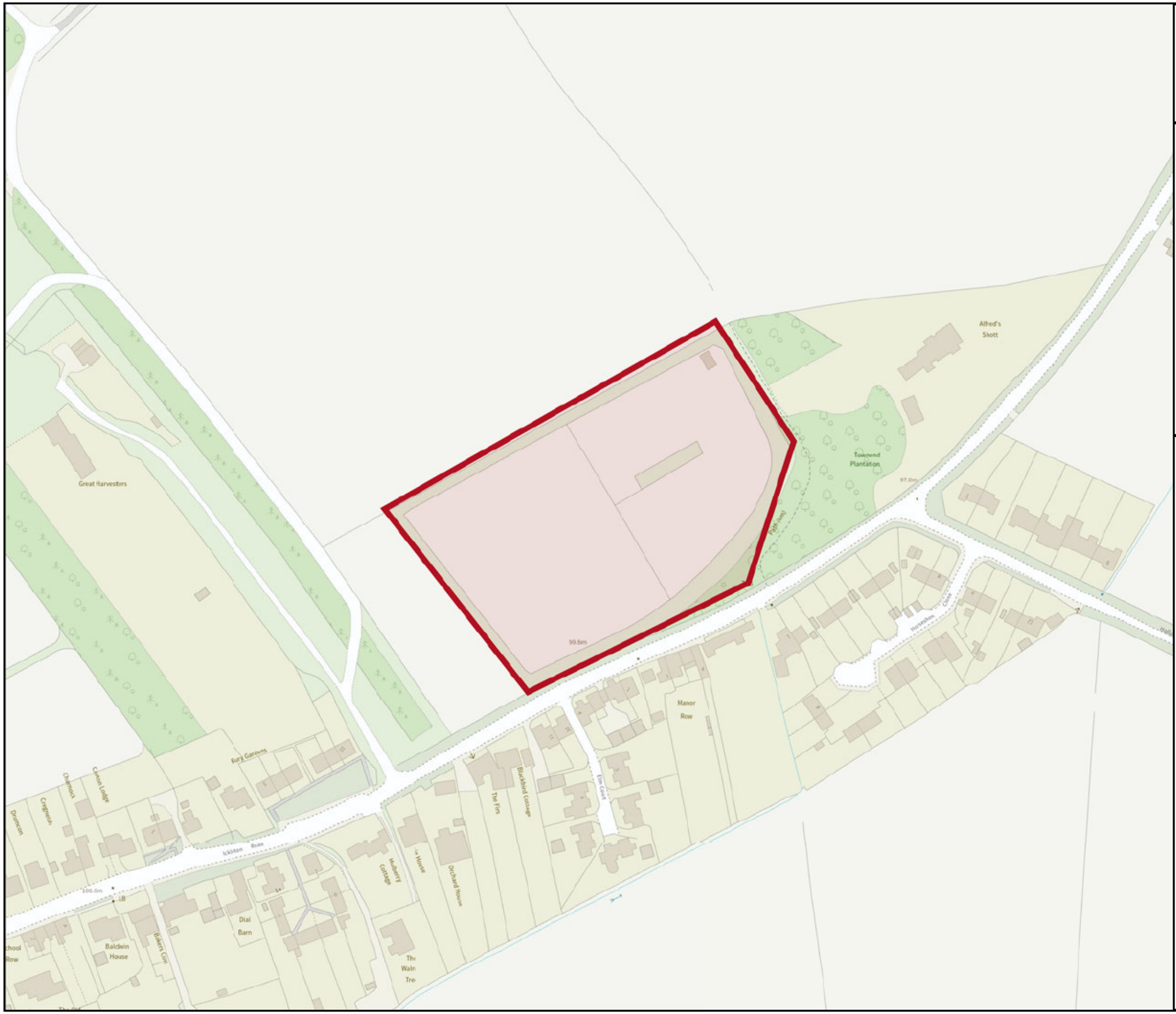
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- in an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority’s strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn’t include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
grange

Location (easting/northing)
546601/239904

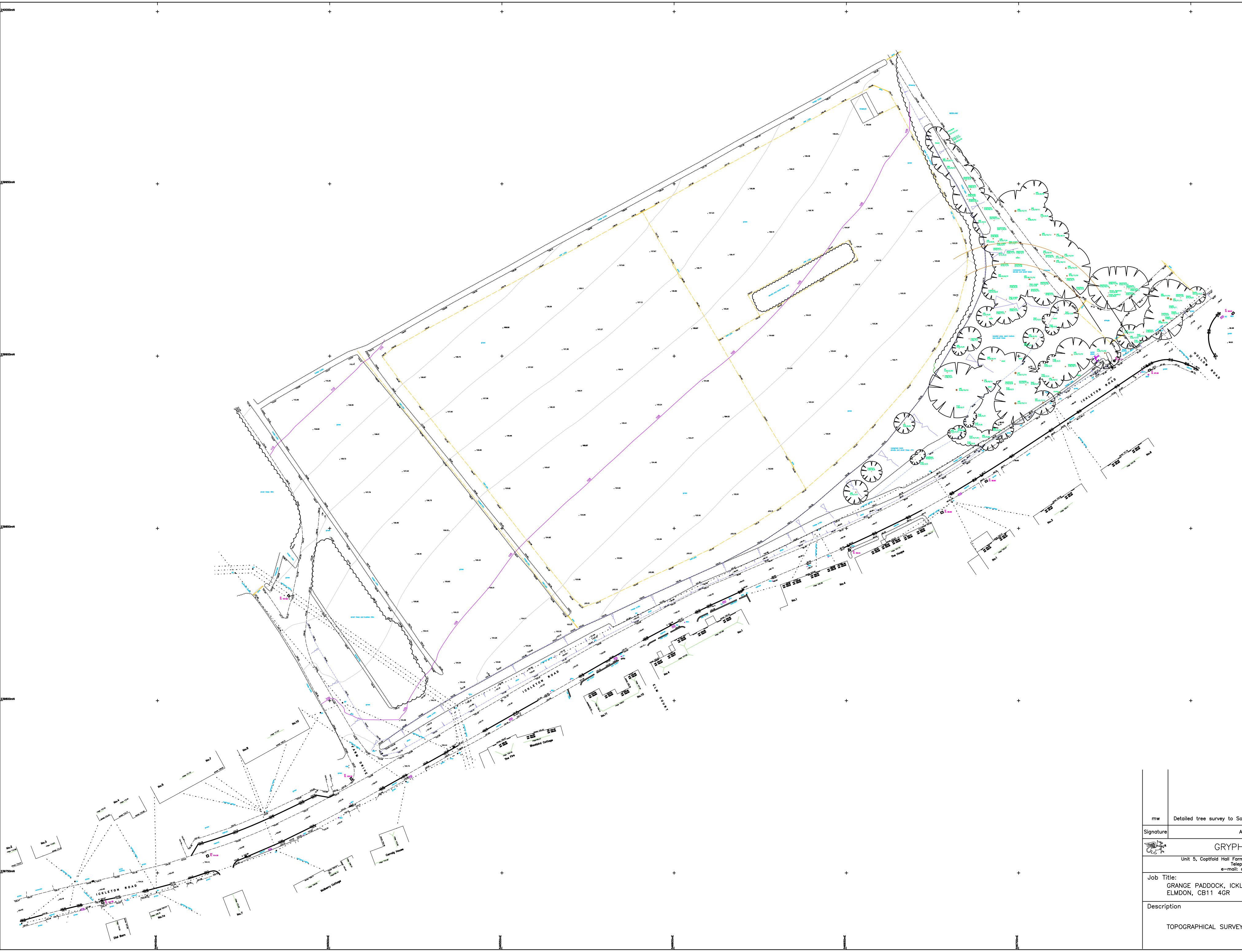
Scale
1:2500

Created
15 Dec 2022 11:38

- 🟥 Selected area
- 🟦 Flood zone 3
- 🟦 Flood zone 2
- ☐ Flood zone 1
- ▬ Flood defence
- ▬ Main river
- ▨ Water storage area

0 20 40 60m

Appendix: D – Topographical Survey



N

KEY

IC	⊡	INSPECTION COVER
MH	⊡	MANHOLE
CL		COVER LEVEL
IL		INVERT LEVEL
TIC	TIC	TELEPHONE INSPECTION COVER
EIC	EIC	ELECTRICITY INSPECTION COVER
WSV	W	WATER STOP VALVE
GV	G	GAS VALVE
FH	H	FIRE HYDRANT
G	■	GULLY
KI	■	KERB INLET
WM	▣	WATER METER
RE	⊕	RODDING EYE
ER	ER	EARTHING ROD
TP	⊕	TELEGRAPH POLE
EP	●	ELECTRICITY POLE
LP	☼	LAMP POST
RS	⊘	ROAD SIGN
TS	⦶	TRAFFIC SIGNAL
STN	△	CONTROL STATION
CPQ	△	COORDINATED CHECK POINT
GP	◔	GATE POST
BD	○ □	BOLLARD (ROUND & SQUARE)
BS	⊠	BUS STOP
CH	●	COAL HOLE
LB	◐	LIGHT BOLLARD
PT	▣	POST
SP	T	STAND PIPE
TAP	Γ	TAP
TCB	▣	TELEPHONE CALL BOX
CE	ϟ	CABLE
MKR	Y	MARKER
PE	◎	PIPE
CLF		CHAIN LINK FENCE
PWM		POST & WIRE FENCE
CBF		CLOSE BOARD FENCE
BWF		BARBED WIRE FENCE
CPF		CHESTNUT PALING FENCE
LLF		LARCH-LAP FENCE
OBF		OPEN BOARD FENCE
PRF		POST AND RAIL FENCE
h		HEIGHT

THE ORIGIN AND ORIENTATION OF THE SURVEY ARE BASED UPON O.S. NATIONAL GRID ADJUSTED LOCALLY TO A PLANE PROJECTION.

ALL LEVELS ARE BASED UPON O.S. GPS DATUM.

Signature	Amendment	Date	Rev.
mw	Detailed tree survey to South-East of site.	17/10/22	a

GRYPHON SURVEYS

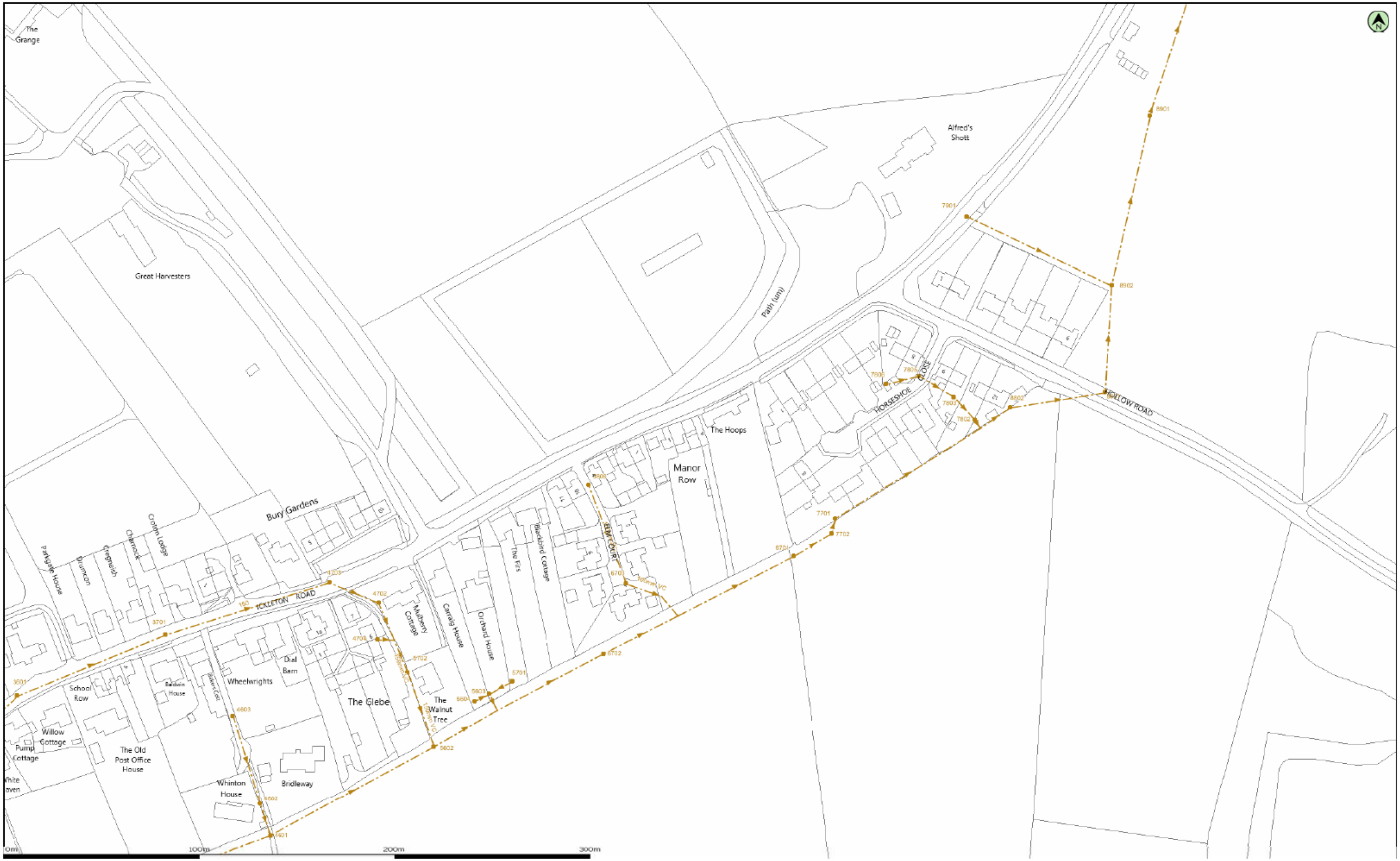
Unit 5, Coptfold Hall Farm, Writtle Road, Margaretting, Essex, CM4 0EL
Telephone: 01277 212794
e-mail: admin@gryphonsurveys.co.uk

Job Title:
GRANGE PADDOCK, ICKLETON ROAD
ELMDON, CB11 4GR

Description
TOPOGRAPHICAL SURVEY

Drawn: MW
Checked: LR
Scale: 1/500@A1
Date: 05/22
Ref: G7155-1

Appendix: E - Thames Water Sewer Records



(c) Crown copyright and database rights 2022 Ordnance Survey 100022432 | Date: 09/08/22 | Scale: 1:1250 | Map Centre: 546652,239833 | Data updated: 31/07/22 | Our Ref: 921864 - 1 | Wastewater Plan A2

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2022 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decommissioned Pumping Station
*(Colour denotes effluent type)

hugh.leekam@eastp.co.uk
Grange Paddock

love every drop
anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
3601	F	-	-	-
3701	F	-	-	1.7
4601	F	-	-	-
4602	F	-	-	-
4603	F	-	-	-
4702	F	-	-	-
4703	F	-	-	1.5
4704	F	-	-	-
5602	F	-	-	-
5603	F	-	-	-
5604	F	-	-	-
5701	F	-	-	-
5702	F	-	-	-
5800	F	-	-	-
6701	F	-	-	-
6702	F	-	-	-
6703	F	-	-	-
7701	F	-	-	-
7702	F	-	-	-
7802	F	-	-	-
7803	F	-	-	-
7805	F	-	-	-
7806	F	-	-	-
7901	F	-	-	-
8801	F	-	-	-
8802	F	-	-	-
8901	F	-	-	-
8902	F	-	-	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix: F - Infiltration testing results

Grange Paddock, Elmdon

SUBADRA

Environmental - Geotechnical - Laboratory - Foundations

13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

INFILTRATION TEST REPORT

Report Prepared By:	Report Reviewed By:
[redacted]	
Alex David	Steven Partridge

Client: Russell Smith Farms Ltd	Subadra Consulting Ltd. Registered in England No. 4586038 Registered Office 13 Triangle Business Park, Stoke Mandeville, HP22 5BL	Report	IN22790 CL 001
		Date	September 2022
		Page	1

Contents

List of Attachments

Attachment One:	Notice to Interested Parties
Attachment Two:	Test Pit Logs
Attachment Three:	Infiltration Test Data
Attachment Four:	Public Utility Drawings

1 Introduction

1.1 The Purpose of Our Testing

The site is located on Ickleton Road in Elmdon and comprises an undeveloped land with a paddock. We understand that Russell Smith Farms Limited proposed to develop the site for residential end-use.

We have been commissioned by Russell Smith Farms Limited to carry out infiltration testing of the underlying soil to provide data to assist others with developing a drainage strategy for the proposed development of the site, which we understand will comprise nine detached and eight semi-detached properties and one bungalow. The development will include car parking and a new pond.

Our infiltration testing was undertaken in accordance with the guidelines and methodology presented in British Research Establishment (BRE) Digest 365 (2016).

Your attention is drawn to the Notice to Interested Parties included as Attachment One.

1.2 The Scope of Our Work

Our work at the site was carried out in the following parts:

- Collection of public utility drawings for the sites locality to assist with locating public utilities that may be present;
- Logging seven test pits (denoted TP001 to TP007) excavated by the client in locations specified by the projects drainage engineers EAS Transport and Planning Ltd (EAS);
- Monitoring the water level within the test pits on two to three occasions over two consecutive days once filled using a refillable water bowser supplied and operated by the client;
- The client backfilled the test pits on completion;
- Provision of this report, which details the results of our testing and conclusions, and makes recommendations for further works (if necessary).

All the activities comprising this assessment were carried out in accordance with the procedures set out in our Quality Manual.

1.3 Site Description, Location and Setting

Item	Data		
Site Description	The central and eastern section of site comprises a paddock. The western portion of the site is undeveloped and predominantly covered with grass. The site is surrounded with hedgerows in all directions.		
Grid Reference	548925 221997	Location	The site is located ~500m north east of Elmdon village.
Elevation	~60mAOD		
Size (approx)	~2.0ha		
Surrounding Land use	North	Agricultural land farms (adjacent)	
	East	Residential building (60m) and Quickset Road beyond	
	South	Ickleton Road (5m) and residential properties (>10m)	
	West	Farm drive way (20m), residential properties and land farms (>30m)	
Geology and Hydrogeology	Drift	The British Geological Survey (BGS) described shallow drift geology at the site to be Lowestoft Formation, which is comprised of chalky clay of less than 10m thickness. This unit is classified by the Environment Agency as a Secondary 'undifferentiated' Aquifer	
	Solid	The BGS shows underlying solid geology at the site location to comprise Lewes Nodular Chalk Formation And Seaford Chalk Formation (Undifferentiated). The Chalk is likely to be in excess of 50m thick. This unit is classified by the Environment Agency as a Principal Aquifer.	
	Nearby boreholes	The nearest borehole record held by the BGS is located 200m to the east (Ref. TL44SE87) and describes geology as 0.1m of topsoil, clay flints and gravel to 1.0m depth, overlying chalk and occasional layers of flints to the borehole termination depth of 150m. The record states groundwater was encountered at 40m below ground level.	
	Source Protection Zone	The site lies within a designated Source Protection Zone III (Total catchment zone). The aquifer associated with the SPZ is the principal aquifer.	
Hydrology	Unnamed ponds located 400 and 450m north west of the site, respectively.		

Table One: Summary of Desk Based Sensitivity Review

1.4 Proposed Development Plans

Proposed Developments	We understand our client proposes to develop the site with nine detached and eight semi-detached properties and one bungalow. The development will include car parking and a new pond. We understand that planning permission has yet to be sought for the proposed development. A plan showing the proposed development plan is provided below.

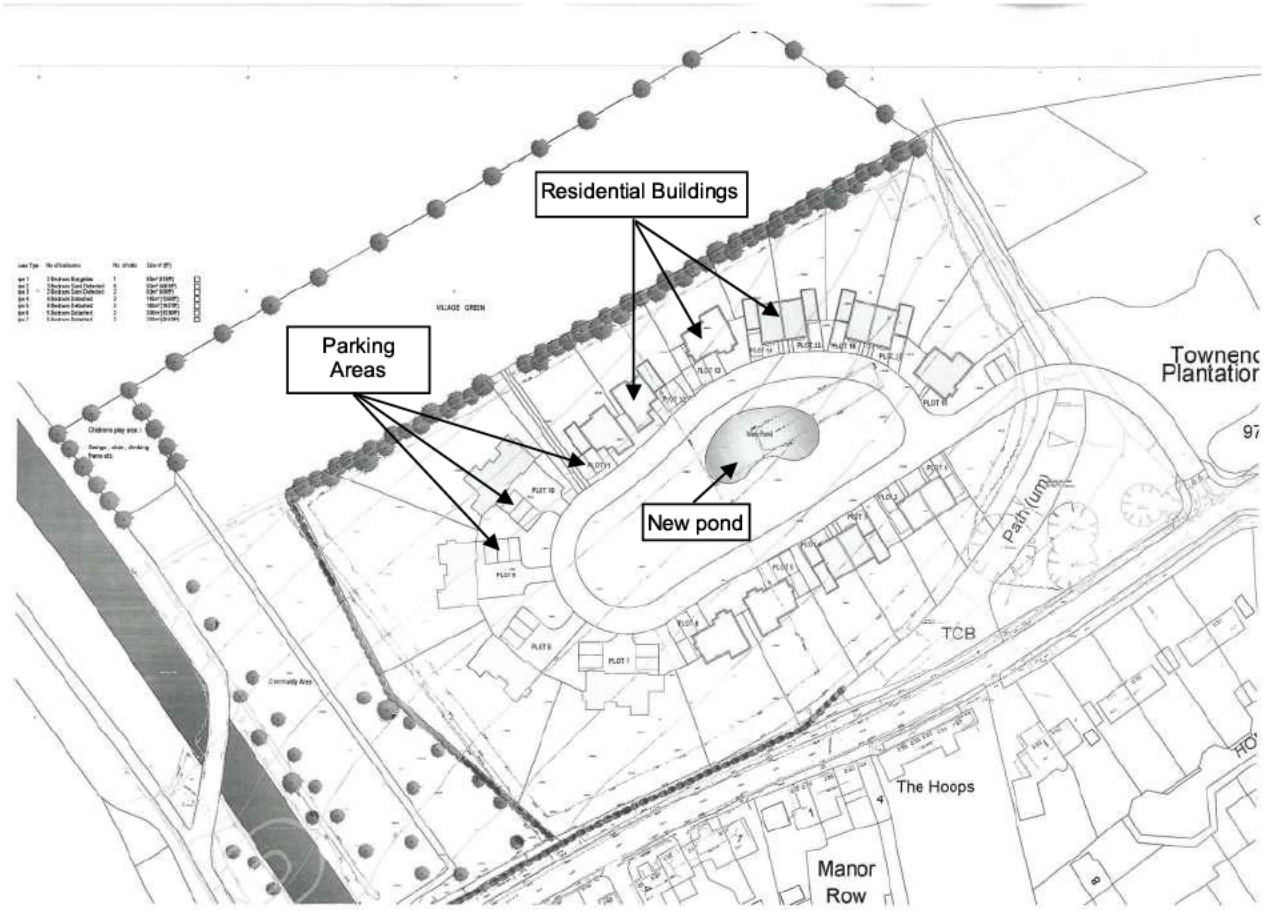


Table Two: Proposed Development Plans

2 Infiltration Results

2.1 BRE 365 Requirements

The British Research Establishment Digest 365 (2016) (BRE 365) guidance document sets out the recommended procedure for undertaking soakaway testing and design. This guidance specifies that the following procedures must be adhered to:

- Tests must be completed a minimum of 1.0m above groundwater level;
- Record the water level in the test pits until they fall to a depth equivalent to less than 25% of the original effective storage volume;
- Each test pit should be filled and the infiltration rate recorded three times during either the same, or on consecutive days;
- The soakaway should discharge from full to half empty in a 24hour period.

Table Three: BRE Testing Requirements

2.2 Details of Our Works

Activity		Description of Works
Service Clearance	Public Utility Drawings	We have obtained and reviewed public utility drawings from the relevant service provider. This provides information regarding major services that supply the site and neighbouring properties. Copies of these plans are included as Attachment Four.
	On-site	Prior to excavating, all trial pit locations underwent a final service check using a Cable Avoidance Tool (CAT).
Infiltration Testing	Excavating Test Pits	Our infiltration testing was completed on 5th and 6th of September 2022. Our client excavated seven test pits; denoted TP001 to TP006, on 5th September 2022 and, due to our observation that infiltration was highest in deepest soils, an additional deep test pit TP007 on 6th September 2022. The test pits were excavated various depths, as specified by the projects drainage engineers (EAS), in order to target gathering infiltration rates for different depths. The test pit depths were as follows; ➢ TP004 and TP005 to 0.7m ➢ TP001,TP002 and TP003 to 2.0m ➢ TP006 and TP007 to 3.0m A test pit location plan is provided as Figure One.Test pits were logged on site by a suitably qualified technician. Copies of our Test pit logs are provided in Attachment Two.

Continued on the following page

Continued from the previous page

Activity		Description of Works
Infiltration Testing	Groundwater Present	No groundwater was encountered in any of the test pits.
	Filling of Test Pits	Testing was carried out over a two day period using a refillable fresh water bowser, supplied and operated by the client. On the first day, infiltration rate of the first fill of test pits TP004 and TP005 was slow. In agreement with the client, testing of pits TP004 and TP005 was suspended at the end of the first day. Testing continued into the second day for the remaining pits. On the morning of the second day, an additional pit was dug (TP007) to 3.0m depth to assist with collecting infiltration rates from deeper depths. By the end of the second day, we were able to complete 3No. Fills in TP006, in accordance with BRE365 guidance. All testing at the site was suspended at the end of the second day in agreement with EAS. All test pits will backfilled with arisings at the end of the works.

Table Four: Our Methodologies

2.3 Test Pit Locations

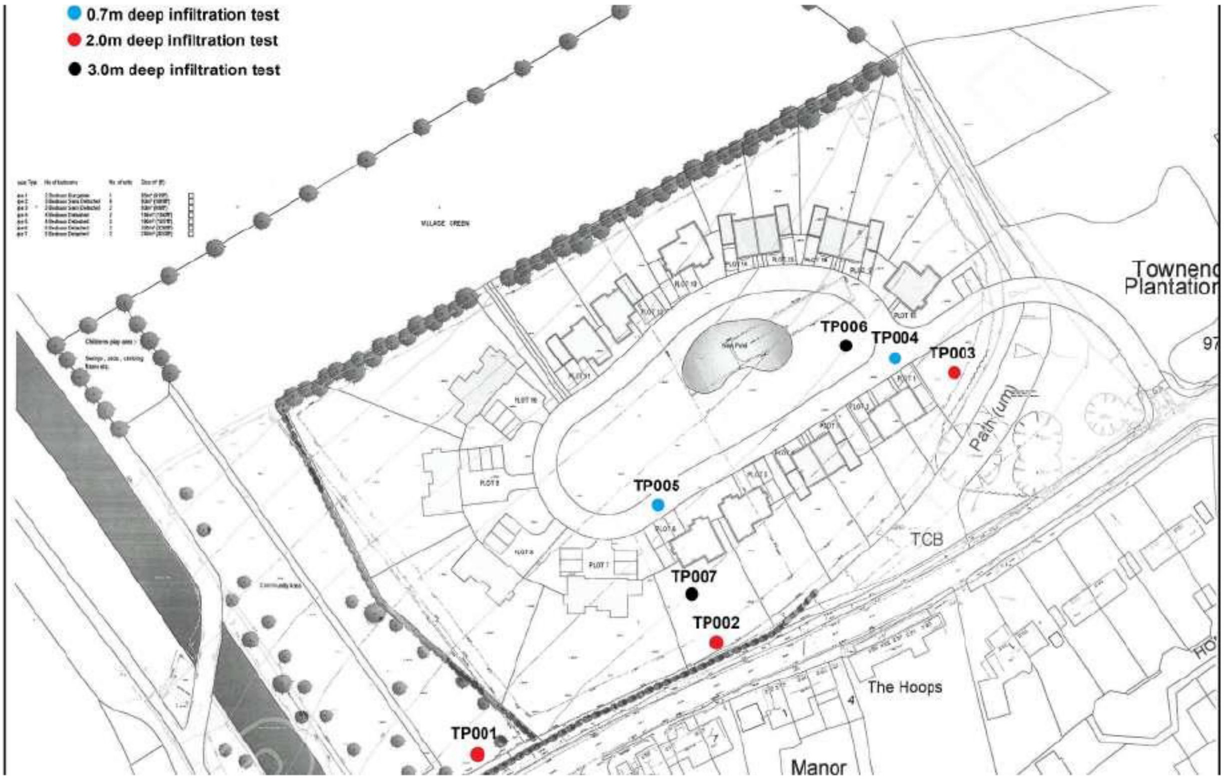


Figure One: Test Pit Locations

2.4 Site Geology

	Unit	Description				
Layer I	Made Ground	Dark brown sand (top soil)				
Layer II	Lowestoft Formation	Very stiff dark brown friable clay and occasional sand with frequent angular gravel and fragments of chalk				
Layer III	Lewes Nodular Chalk and Seaford Chalk Formation	White chalk with occasional flint gravel				
	Depth to Base of Layer					
	TP001	TP002	TP003	TP004	TP005	TP006	TP007
Layer I	0.1m	0.1m	0.1m	0.1m	0.1m	0.1m	0.1m
Layer II	0.85m	1.0m	0.7m	0.5m	0.5m	0.3m	0.7m
Layer II	>2.0m	>2.0m	>2.0m	>0.7m	>0.75m	>3.0m	>3.0m

All dimensions in metres below ground level

Table Five: Soil Lithology

2.5 Groundwater Observations

No groundwater was encountered within the test pits.

2.6 Infiltration Test Results

Location	Test Pit Depth	Soil Infiltration Rate (m/day)			Observations
		First Fill	Second Fill	Third Fill	
TP001	2.0m	0.19*	0.80	Insufficient data to provide interpolation	Day 1: Water level fell by 630mm in 6 hours and slowed to a fall rate of 10mm per hour; test incomplete. Day 2: Test restarted and second fill complete. Insufficient time in the day to complete third fill.
TP002	2.0m	0.37*	0.24*	-	Day 1: Water level fell by 489mm in 6-hours; test incomplete. Day 2: Water dropped by 420mm in 5 hours and slowed to a fall rate of 24mm per hour; test incomplete

Continued on the following page

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Location	Test Pit Depth	Soil Infiltration Rate (m/day)			Observations
		First Fill	Second Fill	Third Fill	
TP003	2.0m	0.25*	0.04*	-	Day 1: Water level fell by 290mm in 5 hours test incomplete. Day 2: Water level fell by 260mm in 5 hours and slowed to a fall rate of 30mm per hour; test incomplete.
TP004	0.7	0.10*	-	-	Day 1: Water level fell by 150mm in 4 hours and slowed to a fall rate of 10mm per hour; test incomplete
TP005	0.7	0.24*	-	-	Day 1: Water level fell by 212mm in 3 hours and slowed to a fall rate of 23mm per hour; test incomplete
TP006	3.0	0.27*	1.56	1.17	Day 1: water level fell by 510mm in 3 hours - end of day (noted pit drained empty overnight) Day 2: two test pits completed, each within 3 hours
TP007	3.0	0.55*	-	-	Day 1: water level fell by 530mm in 5 hours - end of day

Table Six: Soakaway Test Results

3 Conclusions and Recommendations

The results of our infiltration testing indicate the following:

- We understand our infiltration testing data is to be used to inform the design of the surface water drainage strategy for the site's proposed development, which we understand comprises nine detached and eight semi-detached properties and one bungalow.
- We have identified relatively consistent geology beneath the site. The geology comprises of top soil to 0.1m depth following Lowestoft Formation to ~1.0m depth, overlying chalk with occasional flints that form part of the Lewes Nodular Chalk Formation And Seaford Chalk Formation (Undifferentiated) to the maximum excavated depth of 3.0m. No groundwater was encountered in the pits.
- Infiltration testing was undertaken in TP001 to TP007 over two consecutive days.
- Our data generally indicates that soakaways are unlikely to be suitable at 0.7m depth and 2.0m depth. Noted that whilst initial infiltration at the start on tests in these locations was good, rates slowed significantly as each test continued.
- Our data indicates that soakaways are likely to be suitable at 3.0m depth, especially in the area around TP006 where we were able to complete two test fills and prove the pit drained from half full to half empty in 24hr period in the remaining fill.
- As BRE 365 requires the slowest infiltration rate for test to be used for soakaway design, we recommend a preliminary infiltration rate of 0.27m/day be used for soils at 3.0m depth at this stage.
- Due to large area of the site ~2.0ha, we recommend additional infiltration testing be undertaken at 3m depth, once preliminary drainage designs have been confirmed, to provide finalised infiltration rates (which may be higher than those we are able to provide at this stage).

Table Seven: Conclusions

ATTACHMENT ONE:
NOTICE TO INTERESTED PARTIES

NOTICE TO INTERESTED PARTIES

The purpose of our work Is to provide general information on the environmental And/Or geotechnical conditions existing at the site And related to soil And/Or groundwater. The Client Or others specified the scope of the investigation And the validity of our conclusions Is limited by the scope of work specified. We are Not responsible for any such limitations Or omissions.

Where stated in this report, we have used information supplied by third parties. While we have evaluated As far As possible the validity Of this information, we cannot guarantee its accuracy In any way whatsoever.

No investigation technique Is capable Of completely identifying all Of the contaminants that might be present In the soil Or groundwater under a site. Where specified In our report, we have examined the ground by constructing a number Of boreholes And/Or trial pits. We recovered samples Of soil And/Or groundwater from available exposures.

The depth And spacing Of our Sampling locations were selected To ensure With a reasonable probability that they would be representative Of the actual conditions across the whole site. However, safety considerations relating To existing site infrastructure may have restricted our ability To investigate all potential contaminant sources. Specifically, we were unable To investigate the soil And groundwater condition immediately adjacent To the underground structures And/Or buried services. These limitations must be borne In mind When considering the conclusions reached In this report.

Soil Is intrinsically variable And the spread Of contaminants within the soil Is therefore subject To a degree Of non-uniformity. For these reasons no sampling technique can completely eliminate the possibility Of obtaining samples that are Not representative Of the actual conditions. Our sampling techniques are intended To reduce the possibility To an acceptable level, within the limits imposed by the scope of the investigation.

Groundwater levels And soil vapour levels that we report were accurate at the time of the investigation. Groundwater And soil vapour levels are variable. Long term monitoring may be required to ensure that the levels recorded during our investigation are representative of long term And possible 'worst case’ conditions. In accepting our recommendations and/or conclusions the Client acknowledges that further, more detailed investigation would allow a more accurate assessment of site conditions to be made and that this would reduce any consequential risk to the Client.

Our investigation was carried out to assess the significance of contamination resulting from use of the site as identified in this report. Unless we have indicated otherwise, no assessment of the potential impact of any other previous uses has been made. No investigation was carried out to determine whether or not any deleterious or hazardous materials (such as asbestos) have been used in the construction of the buildings present on the site. Unless otherwise stated no investigation or assessment has been made of the presence or otherwise of invasive plant species including but not limited to Japanese Knotweed.

Unless specifically stated otherwise, we have not assessed the effect of any proposed future construction activities on existing structures on or near to the site. Nor, unless stated otherwise, have we assessed the likely effect of trees on existing or proposed structures on or near the site.

We do not accept any responsibility for the cost of remedial works or other costs incurred in whatever way whatsoever as a result of any omissions, errors or other shortcomings in this report unless we have been given reasonable opportunity to verify ourselves that such faults exist and we have been given a reasonable opportunity to carry out works to remedy such faults ourselves using the most practicable means available to us. We do not accept liability for any consequential losses incurred by you while either we or others carry out any remedial works we deem necessary.

This report has been prepared for the Client, as specified on the cover page of this report. In accepting our recommendations and/or conclusions the Client accepts that the terms of our appointment were as detailed in the Proposal, or Proposals, that we provided to the Client before being appointed and that these terms supersede any other terms and/or conditions set out in any contracts agreed between ourselves and the Client, regardless of when such terms and/or conditions were agreed to by us and/or signed by us.

Use of, and reliance on, this report by other third parties will be at such third parties own risk, and we do not accept any liability or responsibility to them.

Neither the whole nor any part of this report, or any reference to it, may be included in any published document circular or statement or published in any way without our prior written approval.

This report and its contents, together with any supporting correspondence or other documentation, remain the property of Subadra Consulting Limited until paid for in full. The copyright to this report remains vested in Subadra Consulting Ltd at all times.

ATTACHMENT TWO:
TEST PIT LOGS

Borehole Log
TP001

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	5th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
			▨					0.00m - 0.85m Lowestoft Formation VERY STIFF dark brown slightly sandy friable CLAY.
1			▦					0.85m - 2.00m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
2								Borehole terminated at 2.00m
3								
4								
5								
6								
7								
8								
9								
10								

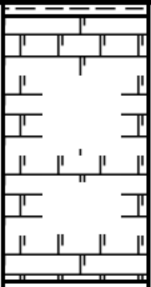
Prism.NET
www.prismerp.co.uk

Well Diameter		Depth of Borehole	2.00m
Well Casing Length		Depth to Groundwater	Dry
Well Screen Length		Page	One of One

Borehole Log
TP002

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	5th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

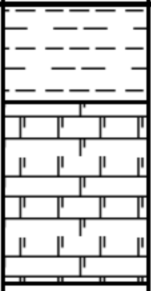
Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
								0.00m - 0.10m Lowestoft Formation VERY STIFF dark brown friable CLAY. Frequent chalk gravel.
1								0.10m - 2.00m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
2								Borehole terminated at 2.00m
3								
4								
5								
6								
7								
8								
9								
10								

Prism.NET www.prismerp.co.uk	Well Diameter		Depth of Borehole	2.00m
	Well Casing Length		Depth to Groundwater	Dry
	Well Screen Length		Page	One of One

Borehole Log
TP003

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	5th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
								0.00m - 0.70m Lowestoft Formation VERY STIFF dark brown friable CLAY. Frequent chalk gravel.
1								0.70m - 2.00m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
2								Borehole terminated at 2.00m
3								
4								
5								
6								
7								
8								
9								
10								

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Well Diameter		Depth of Borehole	2.00m
Well Casing Length		Depth to Groundwater	Dry
Well Screen Length		Page	One of One

Borehole Log
TP004

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	5th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
								0.00m - 0.50m Lowestoft Formation VERY STIFF dark brown friable CLAY. Frequent chalk gravel.
								0.50m - 0.70m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
								Borehole terminated at 0.70m
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

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Well Diameter		Depth of Borehole	0.70m
Well Casing Length		Depth to Groundwater	Dry
Well Screen Length		Page	One of One

Borehole Log
TP005

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13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	5th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

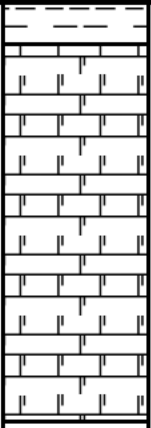
Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
								0.00m - 0.50m Lowestoft Formation VERY STIFF dark brown friable CLAY. Frequent chalk gravel.
								0.50m - 0.70m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
1								Borehole terminated at 0.70m
2								
3								
4								
5								
6								
7								
8								
9								
10								

Well Diameter		Depth of Borehole	0.70m
Well Casing Length		Depth to Groundwater	Dry
Well Screen Length		Page	One of One

Borehole Log
TP006

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	5th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

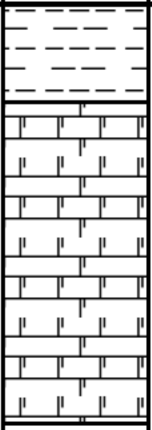
Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
								0.00m - 0.30m Lowestoft Formation VERY STIFF dark brown friable CLAY. Frequent chalk gravel.
1 2								0.30m - 3.00m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
3 4 5 6 7 8 9 10								Borehole terminated at 3.00m

Prism.NET www.prismerp.co.uk	Well Diameter		Depth of Borehole	3.00m
	Well Casing Length		Depth to Groundwater	Dry
	Well Screen Length		Page	One of One

Borehole Log
TP007

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	IN22790 Grange Paddock	Coordinates	
Date	6th September 2022	Ground Level	
Site Engineer	Alex David	Drilling Method	Excavator

Depth (m)	Well	Water Level	Log	Sample	Laboratory Analysis	Headspace (ppm)	SPT 'N' or Su (kPa)	Description
								0.00m - 0.70m Lowestoft Formation VERY STIFF dark brown friable CLAY. Frequent chalk gravel.
								0.70m - 3.00m Lewes Nodular Chalk Formation And Seaford Chalk Formation (undifferentiated) STRUCTURELESS creamy white CHALK.
1								
2								
3								Borehole terminated at 3.00m
4								
5								
6								
7								
8								
9								
10								

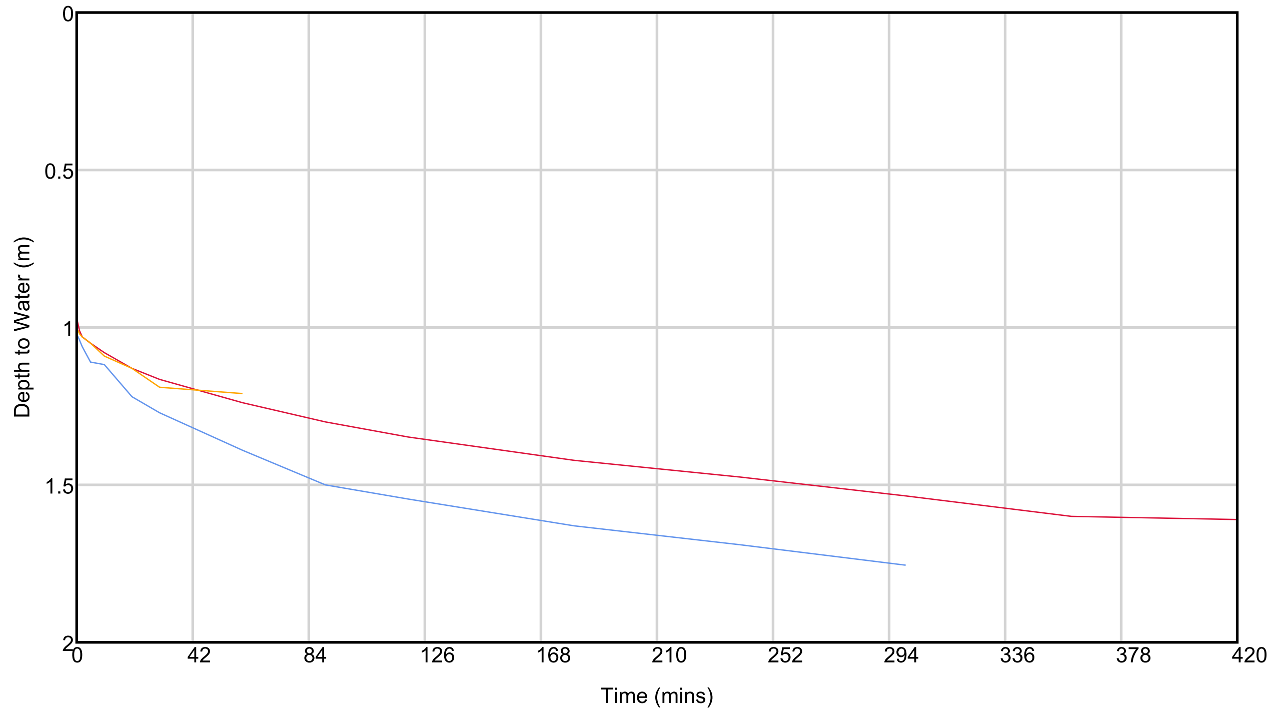
Prism.NET www.prismerp.co.uk	Well Diameter		Depth of Borehole	3.00m
	Well Casing Length		Depth to Groundwater	Dry
	Well Screen Length		Page	One of One

ATTACHMENT THREE:
INFILTRATION TEST DATA

Soakaway Test - TP001

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.190m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	0.970	0.00	1.020	0.00	1.000
0.25	0.980	0.25	1.030	0.25	1.010
0.50	0.990	0.50	1.030	0.50	1.010
1.00	1.010	1.00	1.040	1.00	1.020
2.00	1.030	2.00	1.061	2.00	1.030
5.00	1.050	5.00	1.110	5.00	1.050
10.00	1.080	10.00	1.118	10.00	1.091
20.00	1.130	20.00	1.220	20.00	1.130
30.00	1.165	30.00	1.271	30.00	1.190
60.00	1.239	60.00	1.390	60.00	1.210
90.00	1.300	90.00	1.500		
120.00	1.348	120.00	1.545		
180.00	1.422	180.00	1.630		

Pit Length	1.60m	Backfill	None
Pit Width	0.60m	Number of Cycles	Three
Pit Depth	2.00m	Page	One of Two

Soakaway Test - TP001

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.190m/day***

240.00	1.475	240.00	1.690		
300.00	1.535	300.00	1.755		
360.00	1.600				
420.00	1.610				
T75 (mins)	55.34	T75 (mins)	28.82		
T25 (mins)	1,215.00*	T25 (mins)	300.00		
Permeability (m/day)	0.19*	Permeability (m/day)	0.80		

* Interpolated data. Insufficient time to complete test.

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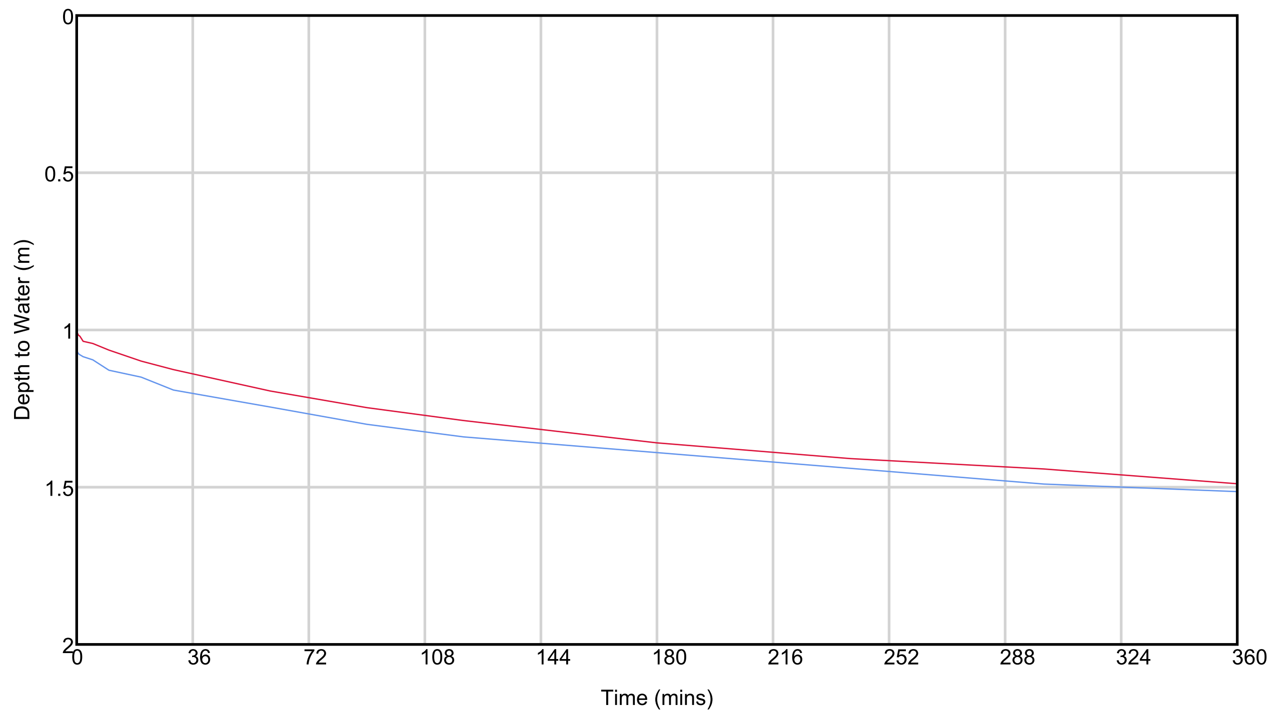
Pit Length	1.60m	Backfill	None
Pit Width	0.60m	Number of Cycles	Three
Pit Depth	2.00m	Page	Two of Two

Soakaway Test - TP002

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.238m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	1.000	0.00	1.070		
0.25	1.010	0.25	1.070		
0.50	1.016	0.50	1.075		
1.00	1.020	1.00	1.079		
2.00	1.036	2.00	1.085		
5.00	1.043	5.00	1.095		
10.00	1.064	10.00	1.128		
20.00	1.099	20.00	1.150		
30.00	1.126	30.00	1.191		
60.00	1.194	60.00	1.245		
90.00	1.247	90.00	1.300		
120.00	1.288	120.00	1.340		
180.00	1.359	180.00	1.390		

Prism.NET www.prismerp.co.uk	Pit Length	1.65m	Backfill	None
	Pit Width	0.60m	Number of Cycles	Two
	Pit Depth	2.00m	Page	One of Two

Soakaway Test - TP002

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.238m/day***

240.00	1.409	240.00	1.440		
300.00	1.442	300.00	1.490		
360.00	1.489	360.00	1.514		
T75 (mins)	92.20	T75 (mins)	91.88		
T25 (mins)	693.19*	T25 (mins)	993.75*		
Permeability (m/day)	0.37*	Permeability (m/day)	0.24*		

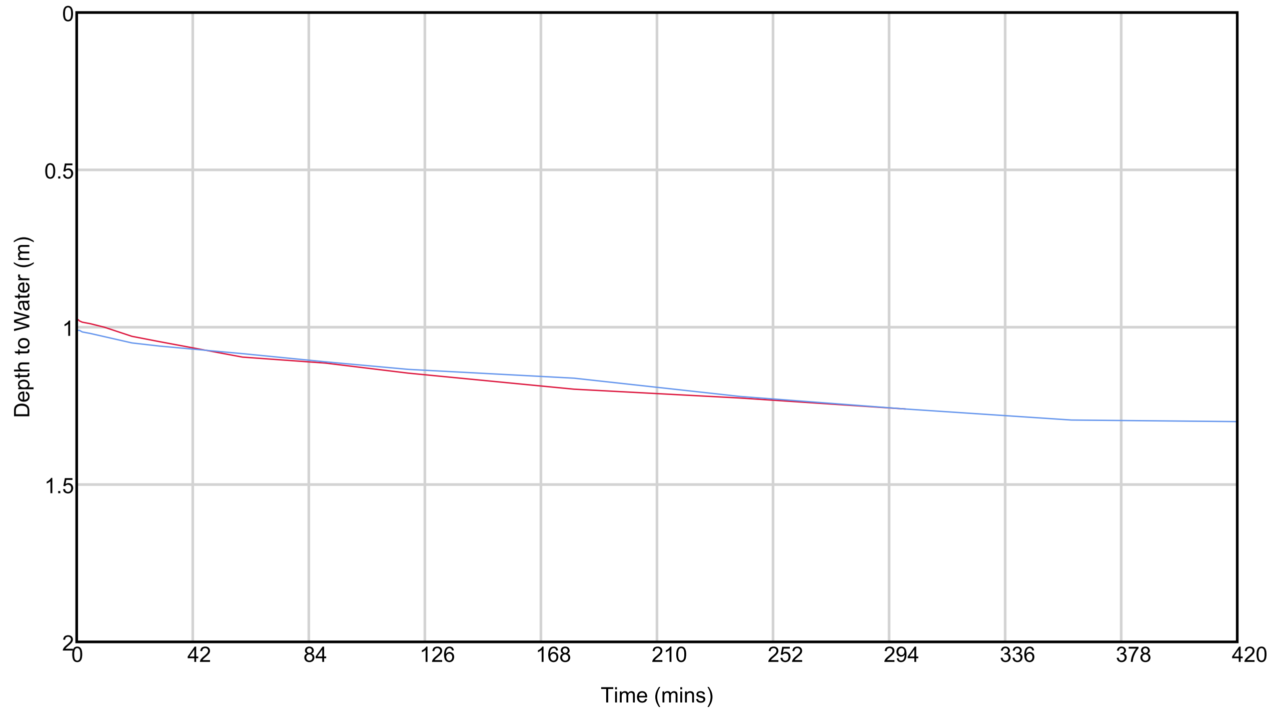
* Interpolated data. Insufficient time to complete test.

Pit Length	1.65m	Backfill	None
Pit Width	0.60m	Number of Cycles	Two
Pit Depth	2.00m	Page	Two of Two

Soakaway Test - TP003

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.040m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	0.970	0.00	1.000		
0.25	0.975	0.25	1.010		
0.50	0.976	0.30	1.010		
1.00	0.980	1.00	1.010		
2.00	0.984	2.00	1.015		
5.00	0.989	5.00	1.020		
10.00	1.000	10.00	1.030		
20.00	1.029	20.00	1.050		
30.00	1.046	30.00	1.060		
60.00	1.095	60.00	1.084		
90.00	1.114	90.00	1.110		
120.00	1.146	120.00	1.134		
180.00	1.197	180.00	1.162		

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Pit Length	1.60m	Backfill	None
Pit Width	0.60m	Number of Cycles	Two
Pit Depth	2.00m	Page	One of Two

Soakaway Test - TP003

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.040m/day***

240.00	1.225	240.00	1.220		
300.00	1.260	300.00	1.260		
		360.00	1.295		
		420.00	1.300		
T75 (mins)	244.29	T75 (mins)	285.00		
T25 (mins)	1,127.14*	T25 (mins)	5,820.00*		
Permeability (m/day)	0.25*	Permeability (m/day)	0.04*		

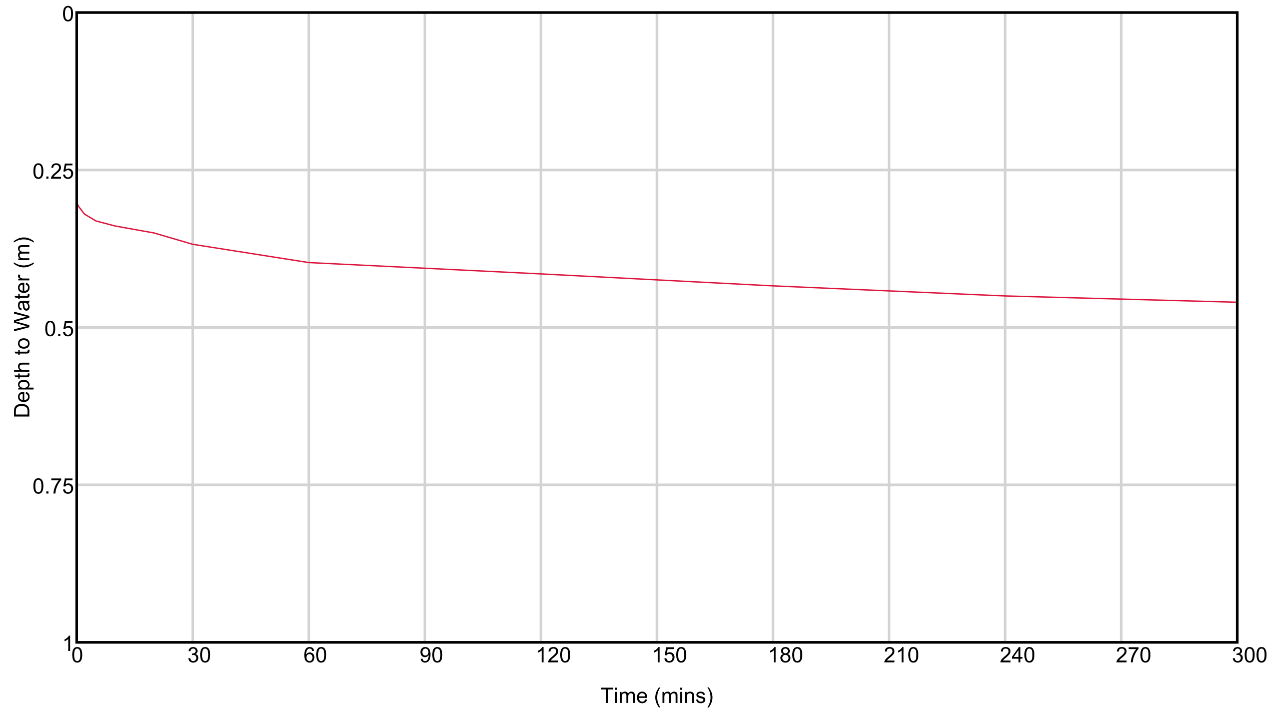
* Interpolated data. Insufficient time to complete test.

Pit Length	1.60m	Backfill	None
Pit Width	0.60m	Number of Cycles	Two
Pit Depth	2.00m	Page	Two of Two

Soakaway Test - TP004

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.098m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	0.300				
0.25	0.305				
0.50	0.308				
1.00	0.312				
2.00	0.320				
5.00	0.331				
10.00	0.339				
20.00	0.350				
30.00	0.368				
60.00	0.397				
90.00	0.406				
120.00	0.415				
180.00	0.434				

Pit Length	1.00m	Backfill	None
Pit Width	0.30m	Number of Cycles	One
Pit Depth	0.70m	Page	One of Two

Soakaway Test - TP004

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.098m/day***

240.00	0.450						
300.00	0.460						
T75 (mins)	70.00						
T25 (mins)	1,140.00*						
Permeability (m/day)	0.10*						

* Interpolated data. Insufficient time to complete test.

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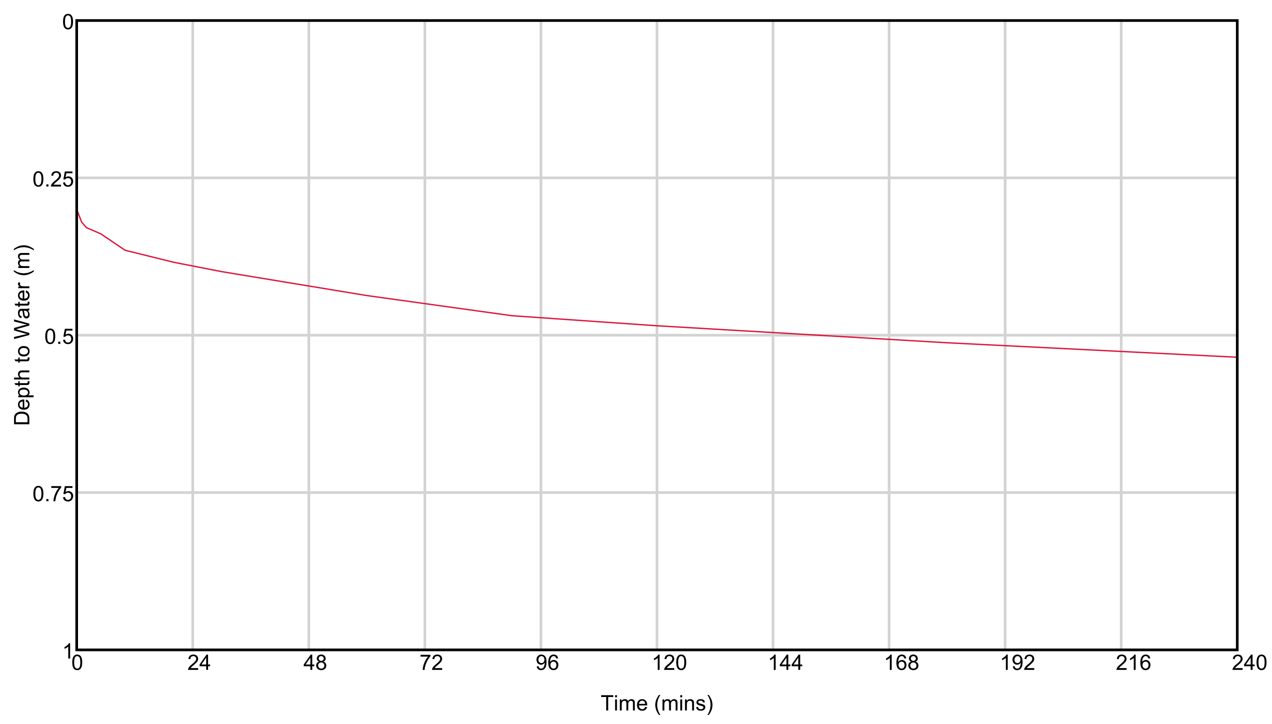
Pit Length	1.00m	Backfill	None
Pit Width	0.30m	Number of Cycles	One
Pit Depth	0.70m	Page	Two of Two

Soakaway Test - TP005

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.235m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	0.300				
0.25	0.305				
0.50	0.310				
1.00	0.320				
2.00	0.329				
5.00	0.339				
10.00	0.365				
20.00	0.384				
30.00	0.399				
60.00	0.437				
90.00	0.469				
120.00	0.485				
180.00	0.512				

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Pit Length	1.00m	Backfill	None
Pit Width	0.30m	Number of Cycles	One
Pit Depth	0.75m	Page	One of Two

Soakaway Test - TP005

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.235m/day***

240.00	0.535				
T75 (mins)	40.66				
T25 (mins)	507.39*				
Permeability (m/day)	0.24*				

* Interpolated data. Insufficient time to complete test.

Prism.NET
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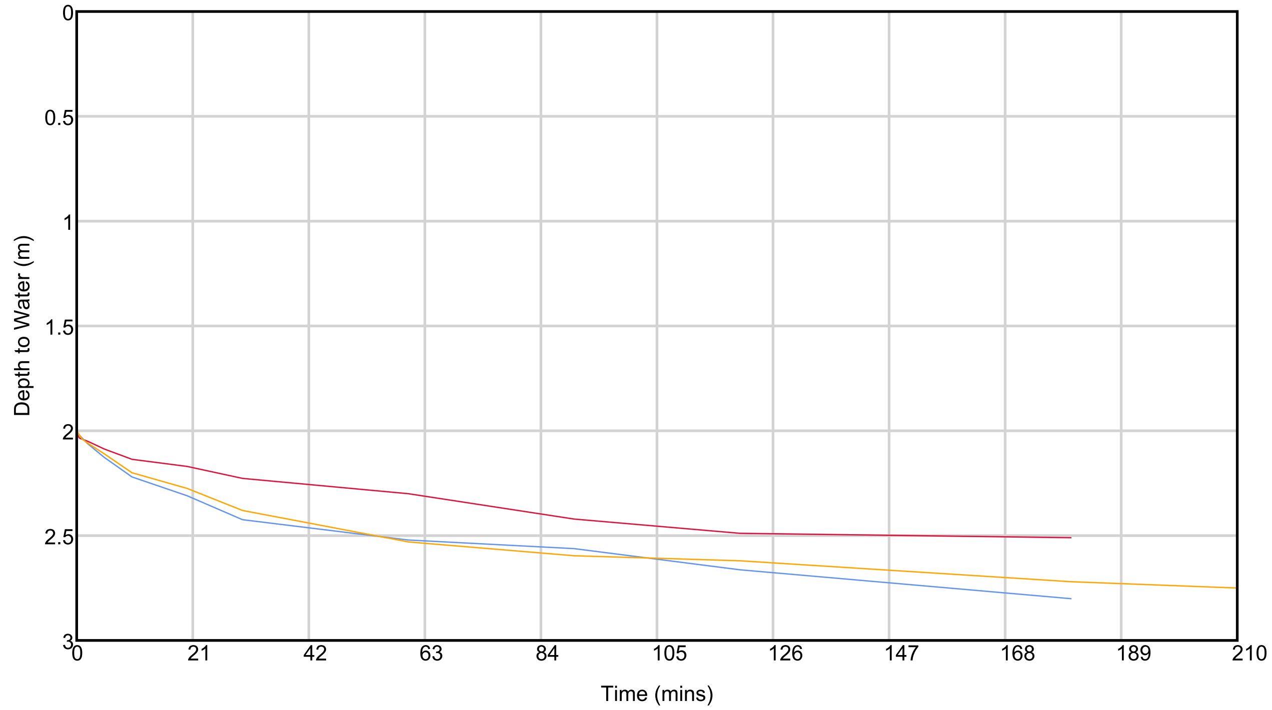
Pit Length	1.00m	Backfill	None
Pit Width	0.30m	Number of Cycles	One
Pit Depth	0.75m	Page	Two of Two

Soakaway Test - TP006

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.273m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	2.000	0.00	2.000	0.00	2.000
0.25	2.025	0.25	2.016	0.25	2.010
0.50	2.035	0.50	2.021	0.50	2.020
1.00	2.040	1.00	2.035	1.00	2.040
2.00	2.050	2.00	2.062	2.00	2.059
5.00	2.087	5.00	2.127	5.00	2.110
10.00	2.136	10.00	2.220	10.00	2.200
20.00	2.170	20.00	2.310	20.00	2.275
30.00	2.227	30.00	2.424	30.00	2.380
60.00	2.300	60.00	2.521	60.00	2.530
90.00	2.421	90.00	2.562	90.00	2.596
120.00	2.489	120.00	2.663	120.00	2.620
180.00	2.510	180.00	2.801	180.00	2.720

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Pit Length	1.90m	Backfill	None
Pit Width	0.60m	Number of Cycles	Three
Pit Depth	3.00m	Page	One of Two

Soakaway Test - TP006

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	5th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.273m/day***

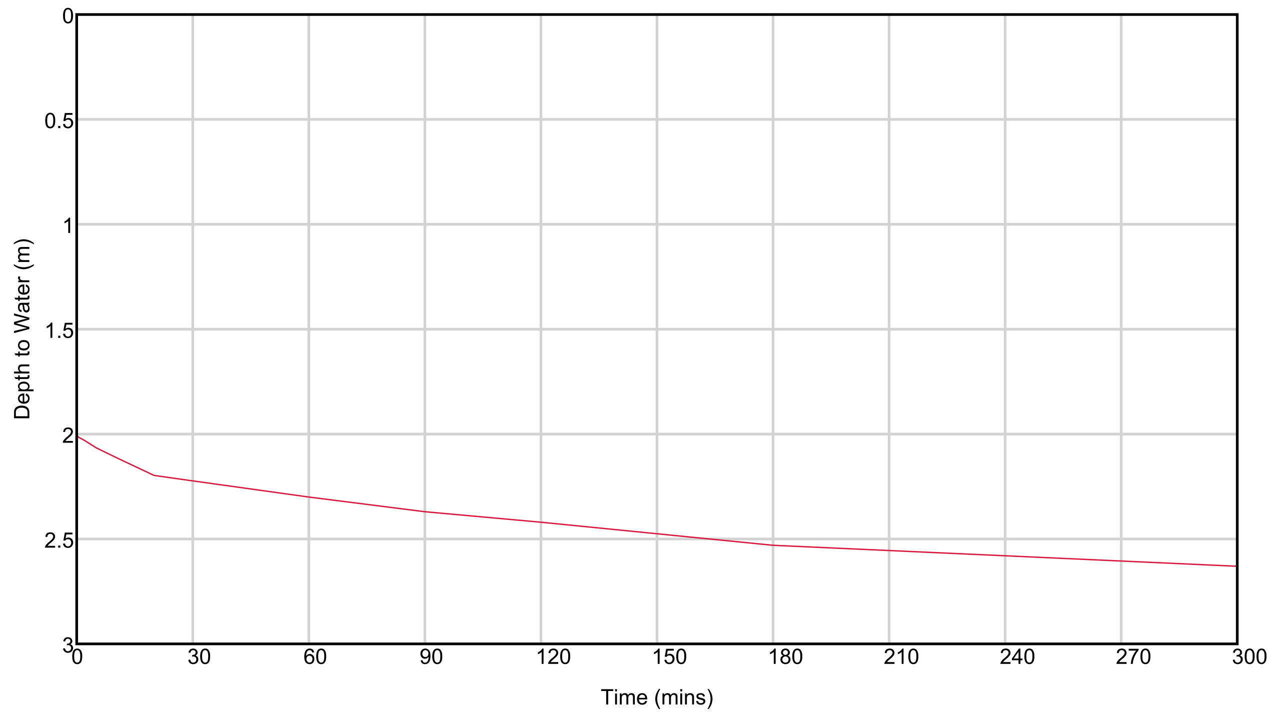
				210.00	2.750
T75 (mins)	39.45	T75 (mins)	13.33	T75 (mins)	16.67
T25 (mins)	865.71*	T25 (mins)	157.83	T25 (mins)	210.00
Permeability (m/day)	0.27*	Permeability (m/day)	1.56	Permeability (m/day)	1.17

* Interpolated data. Insufficient time to complete test.

Prism.NET www.prismerp.co.uk	Pit Length	1.90m	Backfill	None
	Pit Width	0.60m	Number of Cycles	Three
	Pit Depth	3.00m	Page	Two of Two

# Soakaway Test - TP007	SUBADRA Environmental - Geotechnical - Laboratory - Foundations 13 Triangle Business Park, Stoke Mandeville, HP22 5BL Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	6th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.548m/day***



First Fill		Second Fill		Third Fill	
Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)	Time (mins)	Depth to Water (m)
0.00	2.000				
0.25	2.010				
0.50	2.015				
1.00	2.020				
2.00	2.030				
5.00	2.065				
10.00	2.110				
20.00	2.197				
30.00	2.223				
60.00	2.300				
90.00	2.370				
120.00	2.420				
180.00	2.530				

Pit Length	1.70m	Backfill	None
Pit Width	0.60m	Number of Cycles	One
Pit Depth	3.00m	Page	One of Two

Soakaway Test - TP007

SUBADRA
Environmental - Geotechnical - Laboratory - Foundations
13 Triangle Business Park, Stoke Mandeville, HP22 5BL
Tel: 01296 739400 Email: consultants@subadra.com

Project Name	Grange Paddock, Elmdon	Date	6th September 2022
Project Code	IN22790	Technician	Alex David
Test	BRE Special Digest 365	**Permeability**	**0.548m/day***

240.00	2.580				
300.00	2.630				
T75 (mins)	40.52				
T25 (mins)	444.00*				
Permeability (m/day)	0.55*				

* Interpolated data. Insufficient time to complete test.

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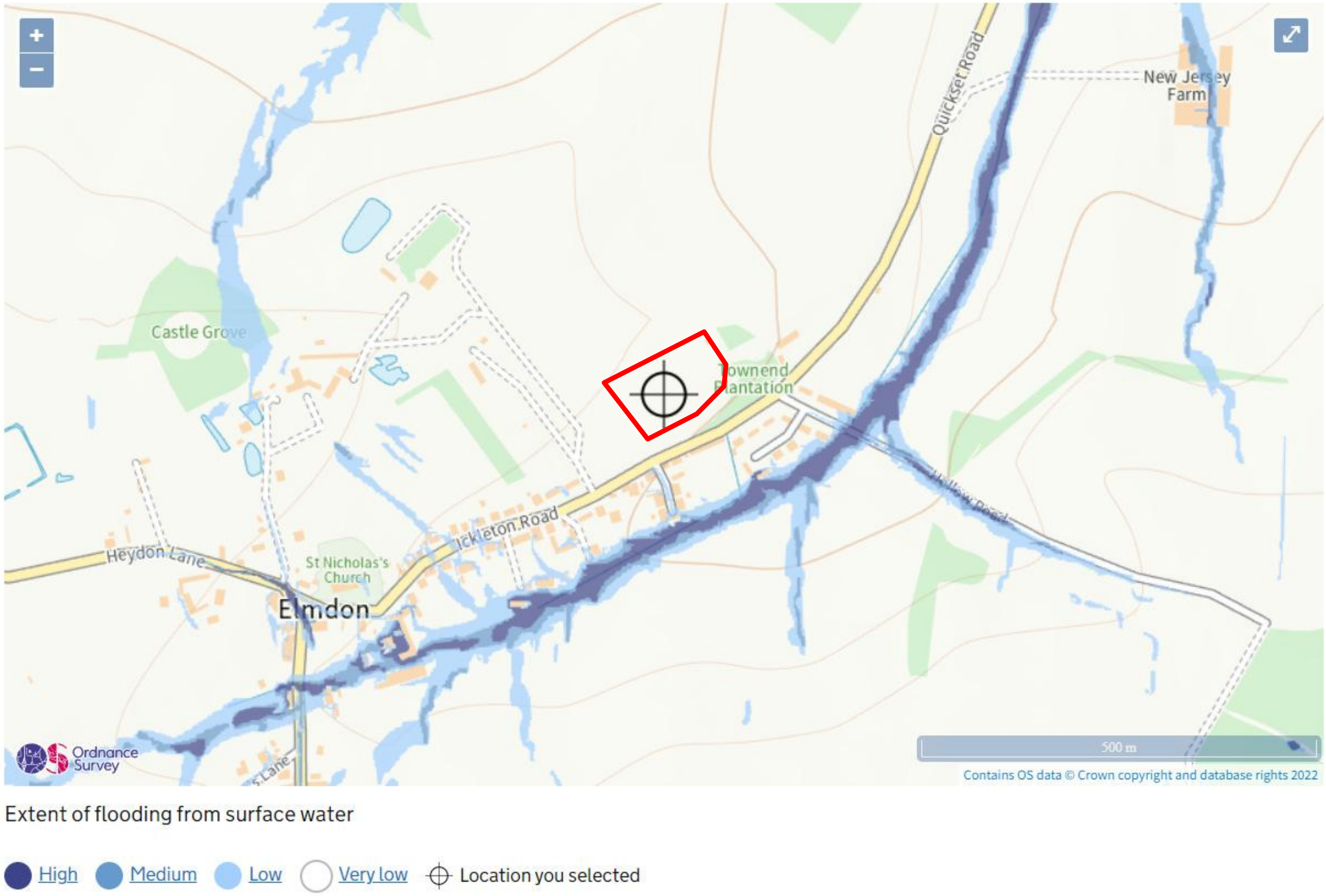
Pit Length	1.70m	Backfill	None
Pit Width	0.60m	Number of Cycles	One
Pit Depth	3.00m	Page	Two of Two

Appendix: G – Surface Water Flood Maps

EA Risk of Surface Water Flooding - Extent

🟥 Site Boundary



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Appendix: H – Causeway Flow Results

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	10	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	0.900
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.003	4.00	106.850	300	239843.906	546584.698	0.750
2	0.004	4.00	106.850	300	239844.946	546574.753	0.850
3			106.850	300	239856.384	546575.949	0.965
4	0.003	4.00	106.850	300	239855.344	546585.895	0.900
5	0.003	4.00	106.850	300	239855.864	546580.922	1.015
6			106.100	300	239870.783	546582.482	0.598
6_OUT			106.100	300	239874.265	546582.846	0.700
7	0.003	4.00	108.000	300	239858.484	546613.481	1.000
8			108.000	300	239862.367	546618.055	1.101
9			108.000	300	239870.753	546610.935	1.286
10	0.004	4.00	108.000	300	239851.825	546599.457	1.000
11	0.004	4.00	108.000	300	239857.161	546594.927	1.118
12	0.004	4.00	108.000	300	239864.280	546603.312	1.455
12_OUT			107.100	300	239874.953	546594.251	1.700
13	0.003	4.00	104.200	300	239974.151	546634.175	0.750
14	0.001	4.00	104.200	300	239966.480	546640.589	0.850
15			104.200	300	239958.462	546631.000	0.975
16	0.003	4.00	104.200	300	239966.133	546624.585	0.800
17	0.003	4.00	104.200	300	239962.297	546627.793	1.100
18	0.028	4.00	104.100	300	239955.798	546623.806	1.000
19			104.100	300	239955.161	546622.650	1.148
20			104.000	300	239953.919	546621.628	1.064
21	0.041	4.00	104.100	450	239954.804	546611.091	1.125
22			104.100	300	239954.110	546612.339	1.134
23			104.000	300	239953.546	546613.299	1.045
24	0.021	4.00	104.000		239952.841	546617.589	1.070
24_OUT			104.000	300	239951.817	546617.473	1.076
25	0.002	4.00	105.400	300	239943.277	546651.163	0.750
26	0.005	4.00	105.400	300	239951.065	546649.329	0.830
27	0.002	4.00	105.400	300	239960.802	546647.051	0.930
28	0.003	4.00	105.400	300	239942.211	546638.492	0.700
29	0.003	4.00	105.400	300	239949.514	546636.782	0.825
30			105.200	300	239957.930	546635.024	0.854
30_OUT			104.900	300	239956.706	546629.150	0.614
31	0.002	4.00	106.350	300	239918.534	546648.898	0.750
32	0.005	4.00	106.350	300	239926.456	546650.017	0.830
33	0.002	4.00	106.350	300	239936.643	546651.472	0.933
34	0.003	4.00	106.350	300	239922.428	546636.758	1.000
35	0.003	4.00	106.350	300	239929.853	546637.816	1.127
36			106.200	300	239938.334	546639.235	1.172
36_OUT			105.800	300	239938.750	546635.348	1.507
37	0.018	4.00	104.350	300	239886.255	546561.708	1.000

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
38			104.350	300	239878.756	546561.665	1.126
39	0.004	4.00	104.200	300	239878.821	546550.075	1.171
40	0.004	4.00	104.350	300	239900.521	546560.683	1.000
41			104.200	300	239900.581	546550.183	1.027
42	0.003	4.00	104.200	300	239889.083	546550.117	1.344
42_OUT			103.800		239889.299	546545.217	1.027
43	0.003	4.00	103.650	300	239939.816	546593.097	1.000
44	0.002	4.00	103.650	300	239932.783	546588.785	1.139
45			103.500	300	239938.945	546578.064	1.197
46	0.003	4.00	103.500	300	239946.598	546582.509	1.000
47	0.002	4.00	103.500	300	239942.771	546580.286	1.272
47_OUT			103.000		239945.264	546575.951	1.000
48	0.003	4.00	103.850	300	239918.650	546579.690	1.000
49	0.010	4.00	103.850	300	239929.215	546585.380	1.202
50	0.003	4.00	103.600	300	239924.577	546568.685	1.000
51	0.002	4.00	103.600	300	239935.142	546574.375	1.202
51_OUT			103.200		239937.514	546569.972	1.000
52	0.002	4.00	107.450	300	239875.209	546618.245	1.000
53	0.005	4.00	107.450	300	239884.982	546625.637	1.206
54		4.00	107.450	300	239887.428	546610.096	1.000
55	0.004	4.00	107.300	300	239893.313	546614.563	1.289
55_OUT			107.000	300	239894.816	546612.565	1.032
56	0.003	4.00	103.850	300	239914.033	546575.700	1.000
57	0.010	4.00	103.850	300	239904.336	546570.507	1.185
58	0.003	4.00	103.600	300	239921.020	546565.829	1.000
59	0.002	4.00	103.600	300	239910.000	546559.928	1.211
59_OUT			103.200		239912.362	546555.520	1.000
60	0.002	4.00	107.250	300	239902.045	546639.577	0.950
61	0.003	4.00	107.250	300	239906.897	546630.832	1.050
62	0.003	4.00	107.250	300	239912.836	546647.461	1.000
63	0.003	4.00	107.250	300	239917.881	546638.370	1.173
64			107.150	300	239917.390	546636.654	1.153
64_OUT			106.500	300	239919.836	546632.245	0.553
65	0.005	4.00	107.450	300	239886.506	546628.522	0.750
66	0.002	4.00	107.450	300	239895.752	546635.512	0.866
67	0.004	4.00	107.450	300	239897.731	546622.867	1.000
68			107.300	300	239902.341	546626.366	1.050
68_OUT	0.034		106.800	300	239904.680	546623.121	0.733
69	0.003	4.00	103.650	300	239942.075	546594.418	1.000
70	0.002	4.00	103.650	300	239949.426	546598.686	1.143
71	0.003	4.00	103.500	300	239947.837	546583.243	1.000
72	0.002	4.00	103.500	300	239955.808	546587.856	1.205
72_OUT			103.000		239958.348	546583.548	1.000
73	0.020	4.00	105.850	300	239867.365	546564.546	1.000
74	0.004	4.00	105.850	300	239872.301	546560.316	1.110
75	0.005	4.00	105.850	300	239853.862	546560.314	1.000
76			105.700	300	239864.492	546551.204	1.162
76_OUT			105.400		239861.891	546548.166	1.000
77	0.002	4.00	103.650	300	239959.041	546603.449	1.000
78	0.004	4.00	103.650	300	239954.815	546600.778	1.084
79	0.002	4.00	103.500	300	239964.383	546594.996	1.000
80			103.500	300	239960.157	546592.325	1.103

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
80_OUT			103.000		239962.829	546588.098	1.000
81	0.002	4.00	103.650	300	239962.487	546605.239	1.000
82	0.004	4.00	103.650	300	239966.714	546607.911	1.085
83	0.002	4.00	103.500	300	239967.562	546597.209	1.000
84			103.500	300	239971.789	546599.880	1.095
84_OUT			103.000		239974.328	546595.873	1.000
85	0.034	4.00	97.700	300	240023.859	546609.954	1.050
85_OUT			97.700		240018.036	546606.103	1.400
86	0.027	4.00	103.100		239980.474	546624.257	1.125
87			103.100	300	239981.884	546625.059	1.135
87_OUT			103.100	300	239983.464	546626.055	1.267
88	0.025	4.00	106.200	600	239926.994	546630.913	0.800
89			106.200	600	239928.058	546631.190	1.200
89_OUT			106.200	600	239929.113	546631.468	1.907
90	0.066	4.00	104.200	600	239903.733	546577.886	0.650
91			104.200	600	239904.539	546578.499	0.660
91_OUT			104.200	600	239905.339	546579.077	0.670

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	9.999	0.600	106.100	106.000	0.100	100.0	150	4.17	50.0
1.001	2	3	11.500	0.600	106.000	105.885	0.115	100.0	150	4.36	50.0
1.002	3	5	5.000	0.600	105.885	105.835	0.050	100.0	150	4.44	50.0
2.000	4	5	5.000	0.600	105.950	105.885	0.065	76.9	100	4.09	50.0
1.003	5	6	15.000	0.600	105.835	105.502	0.333	45.0	150	4.61	50.0
1.004	6	6_OUT	3.501	0.600	105.502	105.467	0.035	100.0	150	4.66	50.0
3.000	7	8	6.000	0.600	107.000	106.899	0.101	59.4	100	4.10	50.0
3.001	8	9	11.001	0.600	106.899	106.714	0.185	59.5	100	4.28	50.0
3.002	9	12	10.000	0.600	106.714	106.545	0.169	59.2	100	4.45	50.0
4.000	10	11	7.000	0.600	107.000	106.882	0.118	59.3	100	4.12	50.0
4.001	11	12	10.999	0.600	106.882	106.545	0.337	32.6	100	4.25	50.0
3.003	12	12_OUT	14.001	0.600	106.545	106.100	0.445	31.5	100	4.62	50.0
5.000	13	14	9.999	0.600	103.450	103.350	0.100	100.0	150	4.17	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	0.4	0.600	0.700	0.003	0.0	16	0.407
1.001	1.005	17.8	0.9	0.700	0.815	0.007	0.0	23	0.527
1.002	1.005	17.8	0.9	0.815	0.865	0.007	0.0	23	0.527
2.000	0.878	6.9	0.4	0.800	0.865	0.003	0.0	18	0.495
1.003	1.503	26.6	1.8	0.865	0.448	0.013	0.0	26	0.852
1.004	1.005	17.8	1.8	0.448	0.483	0.013	0.0	32	0.642
3.000	1.001	7.9	0.4	0.900	1.001	0.003	0.0	15	0.515
3.001	1.000	7.9	0.4	1.001	1.186	0.003	0.0	15	0.515
3.002	1.003	7.9	0.4	1.186	1.355	0.003	0.0	15	0.516
4.000	1.002	7.9	0.5	0.900	1.018	0.004	0.0	17	0.549
4.001	1.355	10.6	1.0	1.018	1.355	0.007	0.0	21	0.847
3.003	1.380	10.8	2.0	1.355	0.900	0.014	0.0	29	1.041
5.000	1.005	17.8	0.4	0.600	0.700	0.003	0.0	15	0.397

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
5.001	14	15	12.499	0.600	103.350	103.225	0.125	100.0	150	4.37	50.0
5.002	15	17	4.999	0.600	103.225	103.175	0.050	100.0	150	4.46	50.0
6.000	16	17	5.001	0.600	103.400	103.317	0.083	60.0	100	4.08	50.0
5.003	17	19	8.796	0.600	103.100	102.952	0.148	59.4	225	4.54	50.0
7.000	18	19	1.320	0.600	103.100	103.077	0.023	57.4	100	4.02	50.0
5.004	19	20	1.608	0.600	102.952	102.936	0.016	100.0	225	4.56	50.0
5.005	20	24	1.000	0.600	102.936	102.930	0.006	166.7	225	4.58	50.0
8.000	21	22	1.428	0.600	102.975	102.966	0.009	158.7	225	4.02	50.0
8.001	22	23	1.113	0.600	102.966	102.955	0.011	100.0	225	4.04	50.0
8.002	23	24	1.000	0.600	102.955	102.949	0.006	166.7	225	4.05	50.0
5.006	24	24_OUT	1.031	0.600	102.930	102.924	0.006	171.8	225	4.60	50.0
9.000	25	26	8.001	0.600	104.650	104.570	0.080	100.0	150	4.13	50.0
9.001	26	27	10.000	0.600	104.570	104.470	0.100	100.0	150	4.30	50.0
9.002	27	30	12.365	0.600	104.470	104.346	0.124	99.7	150	4.50	50.0
10.000	28	29	7.501	0.600	104.700	104.575	0.125	60.0	100	4.13	50.0
10.001	29	30	8.598	0.600	104.575	104.432	0.143	60.1	100	4.27	50.0
9.003	30	30_OUT	6.000	0.600	104.346	104.286	0.060	100.0	150	4.60	50.0
11.000	31	32	8.001	0.600	105.600	105.520	0.080	100.0	150	4.13	50.0
11.001	32	33	10.290	0.600	105.520	105.417	0.103	100.0	150	4.30	50.0
11.002	33	36	12.353	0.600	105.417	105.128	0.289	42.7	150	4.44	50.0
12.000	34	35	7.500	0.600	105.350	105.223	0.127	59.1	100	4.12	50.0
12.001	35	36	8.599	0.600	105.223	105.078	0.145	59.3	100	4.27	50.0
11.003	36	36_OUT	3.910	0.600	105.028	104.963	0.065	60.0	150	4.49	50.0
13.000	37	38	7.499	0.600	103.350	103.224	0.126	59.5	100	4.12	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
5.001	1.005	17.8	0.6	0.700	0.825	0.004	0.0	18	0.456
5.002	1.005	17.8	0.6	0.825	0.875	0.004	0.0	18	0.456
6.000	0.996	7.8	0.4	0.700	0.783	0.003	0.0	15	0.513
5.003	1.699	67.6	1.3	0.875	0.923	0.010	0.0	22	0.668
7.000	1.019	8.0	3.7	0.900	0.923	0.028	0.0	48	1.001
5.004	1.307	52.0	5.1	0.923	0.839	0.037	0.0	47	0.833
5.005	1.010	40.1	5.1	0.839	0.845	0.037	0.0	54	0.697
8.000	1.035	41.2	5.6	0.900	0.909	0.041	0.0	56	0.727
8.001	1.307	52.0	5.6	0.909	0.820	0.041	0.0	50	0.860
8.002	1.010	40.1	5.6	0.820	0.826	0.041	0.0	57	0.716
5.006	0.994	39.5	13.5	0.845	0.851	0.100	0.0	90	0.900
9.000	1.005	17.8	0.3	0.600	0.680	0.002	0.0	14	0.386
9.001	1.005	17.8	1.0	0.680	0.780	0.008	0.0	25	0.552
9.002	1.006	17.8	1.4	0.780	0.704	0.010	0.0	28	0.599
10.000	0.996	7.8	0.4	0.600	0.725	0.003	0.0	15	0.513
10.001	0.995	7.8	0.7	0.725	0.668	0.005	0.0	21	0.621
9.003	1.005	17.8	2.1	0.704	0.464	0.016	0.0	35	0.676
11.000	1.005	17.8	0.3	0.600	0.680	0.002	0.0	14	0.386
11.001	1.005	17.8	1.0	0.680	0.783	0.008	0.0	25	0.552
11.002	1.543	27.3	1.4	0.783	0.922	0.010	0.0	23	0.812
12.000	1.004	7.9	0.4	0.900	1.027	0.003	0.0	15	0.517
12.001	1.002	7.9	0.7	1.027	1.022	0.005	0.0	21	0.625
11.003	1.301	23.0	2.1	1.022	0.687	0.016	0.0	31	0.814
13.000	1.000	7.9	2.5	0.900	1.026	0.018	0.0	39	0.887

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
13.001	38	39	11.590	0.600	103.224	103.029	0.195	59.4	100	4.32	50.0
13.002	39	42	10.262	0.600	103.029	102.856	0.173	59.3	100	4.49	50.0
14.000	40	41	10.500	0.600	103.350	103.173	0.177	59.3	100	4.17	50.0
14.001	41	42	11.498	0.600	103.173	102.856	0.317	36.3	100	4.32	50.0
13.003	42	42_OUT	4.905	0.600	102.856	102.773	0.083	59.1	100	4.57	50.0
15.000	43	44	8.250	0.600	102.650	102.511	0.139	59.3	100	4.14	50.0
15.001	44	45	12.366	0.600	102.511	102.303	0.208	59.5	100	4.34	50.0
15.002	45	47	4.424	0.600	102.303	102.228	0.075	59.0	100	4.42	50.0
16.000	46	47	4.426	0.600	102.500	102.228	0.272	16.3	100	4.04	50.0
15.003	47	47_OUT	5.001	0.600	102.228	102.000	0.228	21.9	100	4.47	50.0
17.000	48	49	12.000	0.600	102.850	102.648	0.202	59.4	100	4.20	50.0
17.001	49	51	12.500	0.600	102.648	102.398	0.250	50.0	100	4.39	50.0
18.000	50	51	12.000	0.600	102.600	102.398	0.202	59.4	100	4.20	50.0
17.002	51	51_OUT	5.001	0.600	102.398	102.200	0.198	25.3	100	4.44	50.0
19.000	52	53	12.254	0.600	106.450	106.244	0.206	59.5	100	4.20	50.0
19.001	53	55	13.858	0.600	106.244	106.011	0.233	59.5	100	4.44	50.0
20.000	54	55	7.388	0.600	106.450	106.300	0.150	49.3	100	4.11	50.0
19.002	55	55_OUT	2.500	0.600	106.011	105.968	0.043	58.1	100	4.48	50.0
21.000	56	57	11.000	0.600	102.850	102.665	0.185	59.5	100	4.18	50.0
21.001	57	59	12.000	0.600	102.665	102.389	0.276	43.5	100	4.35	50.0
22.000	58	59	12.500	0.600	102.600	102.389	0.211	59.2	100	4.21	50.0
21.002	59	59_OUT	5.001	0.600	102.389	102.200	0.189	26.5	100	4.41	50.0
23.000	60	61	10.001	0.600	106.300	106.200	0.100	100.0	150	4.17	50.0
23.001	61	64	12.000	0.600	106.200	105.997	0.203	59.1	150	4.32	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
13.001	1.001	7.9	2.5	1.026	1.071	0.018	0.0	39	0.888
13.002	1.002	7.9	3.0	1.071	1.244	0.022	0.0	43	0.932
14.000	1.002	7.9	0.5	0.900	0.927	0.004	0.0	18	0.565
14.001	1.285	10.1	0.5	0.927	1.244	0.004	0.0	15	0.663
13.003	1.004	7.9	3.9	1.244	0.927	0.029	0.0	50	1.000
15.000	1.001	7.9	0.4	0.900	1.039	0.003	0.0	15	0.515
15.001	1.001	7.9	0.7	1.039	1.097	0.005	0.0	20	0.610
15.002	1.005	7.9	0.7	1.097	1.172	0.005	0.0	19	0.597
16.000	1.924	15.1	0.4	0.900	1.172	0.003	0.0	11	0.783
15.003	1.656	13.0	1.3	1.172	0.900	0.010	0.0	21	1.059
17.000	1.001	7.9	0.4	0.900	1.102	0.003	0.0	16	0.532
17.001	1.092	8.6	1.8	1.102	1.102	0.013	0.0	31	0.860
18.000	1.001	7.9	0.4	0.900	1.102	0.003	0.0	15	0.515
17.002	1.542	12.1	2.4	1.102	0.900	0.018	0.0	30	1.198
19.000	1.000	7.9	0.3	0.900	1.106	0.002	0.0	14	0.480
19.001	1.000	7.9	1.0	1.106	1.189	0.007	0.0	24	0.679
20.000	1.101	8.6	0.0	0.900	0.900	0.000	0.0	0	0.000
19.002	1.012	7.9	1.5	1.189	0.932	0.011	0.0	29	0.774
21.000	1.001	7.9	0.4	0.900	1.085	0.003	0.0	16	0.532
21.001	1.172	9.2	1.8	1.085	1.111	0.013	0.0	29	0.897
22.000	1.002	7.9	0.4	0.900	1.111	0.003	0.0	15	0.516
21.002	1.506	11.8	2.4	1.111	0.900	0.018	0.0	31	1.187
23.000	1.005	17.8	0.3	0.800	0.900	0.002	0.0	13	0.364
23.001	1.310	23.2	0.6	0.900	1.003	0.005	0.0	17	0.572

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
24.000	62	63	10.397	0.600	106.250	106.077	0.173	60.0	100	4.17	50.0
24.001	63	64	1.785	0.600	106.077	106.047	0.030	59.5	100	4.20	50.0
23.002	64	64_OUT	5.042	0.600	105.997	105.947	0.050	100.0	150	4.40	50.0
25.000	65	66	11.591	0.600	106.700	106.584	0.116	100.0	150	4.19	50.0
25.001	66	68	11.272	0.600	106.584	106.250	0.334	33.7	150	4.30	50.0
26.000	67	68	5.787	0.600	106.450	106.300	0.150	38.6	100	4.08	50.0
25.002	68	68_OUT	4.000	0.600	106.250	106.210	0.040	100.0	150	4.37	50.0
27.000	69	70	8.500	0.600	102.650	102.507	0.143	59.4	100	4.14	50.0
27.001	70	72	12.571	0.600	102.507	102.295	0.212	59.3	100	4.35	50.0
28.000	71	72	9.210	0.600	102.500	102.295	0.205	44.9	100	4.13	50.0
27.002	72	72_OUT	5.001	0.600	102.295	102.000	0.295	17.0	100	4.39	50.0
29.000	73	74	6.501	0.600	104.850	104.740	0.110	59.1	100	4.11	50.0
29.001	74	76	12.000	0.600	104.740	104.538	0.202	59.4	100	4.31	50.0
30.000	75	76	14.000	0.600	104.850	104.538	0.312	44.9	100	4.20	50.0
29.002	76	76_OUT	3.999	0.600	104.538	104.400	0.138	29.0	100	4.35	50.0
31.000	77	78	4.999	0.600	102.650	102.566	0.084	59.5	100	4.08	50.0
31.001	78	80	10.000	0.600	102.566	102.397	0.169	59.2	100	4.25	50.0
32.000	79	80	4.999	0.600	102.500	102.397	0.103	48.5	100	4.08	50.0
31.002	80	80_OUT	5.001	0.600	102.397	102.000	0.397	12.6	100	4.29	50.0
33.000	81	82	5.001	0.600	102.650	102.565	0.085	58.8	100	4.08	50.0
33.001	82	84	9.500	0.600	102.565	102.405	0.160	59.4	100	4.24	50.0
34.000	83	84	5.000	0.600	102.500	102.405	0.095	52.6	100	4.08	50.0
33.002	84	84_OUT	4.743	0.600	102.405	102.000	0.405	11.7	100	4.28	50.0
35.000	85	85_OUT	7.000	0.600	96.650	96.300	0.350	20.0	150	4.05	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
24.000	0.996	7.8	0.4	0.900	1.073	0.003	0.0	15	0.513
24.001	1.000	7.9	0.8	1.073	1.003	0.006	0.0	21	0.638
23.002	1.005	17.8	1.4	1.003	0.403	0.010	0.0	28	0.599
25.000	1.005	17.8	0.6	0.600	0.716	0.005	0.0	20	0.474
25.001	1.738	30.7	1.0	0.716	0.900	0.007	0.0	18	0.793
26.000	1.245	9.8	0.5	0.900	0.900	0.004	0.0	15	0.642
25.002	1.005	17.8	1.5	0.900	0.440	0.011	0.0	29	0.606
27.000	1.001	7.9	0.4	0.900	1.043	0.003	0.0	15	0.515
27.001	1.002	7.9	0.7	1.043	1.105	0.005	0.0	20	0.611
28.000	1.153	9.1	0.4	0.900	1.105	0.003	0.0	14	0.554
27.002	1.885	14.8	1.4	1.105	0.900	0.010	0.0	21	1.180
29.000	1.004	7.9	2.7	0.900	1.010	0.020	0.0	40	0.908
29.001	1.001	7.9	3.3	1.010	1.062	0.024	0.0	45	0.955
30.000	1.154	9.1	0.6	0.900	1.062	0.005	0.0	18	0.651
29.002	1.439	11.3	3.9	1.062	0.900	0.029	0.0	40	1.302
31.000	1.000	7.9	0.3	0.900	0.984	0.002	0.0	14	0.498
31.001	1.003	7.9	0.9	0.984	1.003	0.007	0.0	23	0.668
32.000	1.109	8.7	0.3	0.900	1.003	0.002	0.0	14	0.533
31.002	2.189	17.2	1.3	1.003	0.900	0.009	0.0	18	1.274
33.000	1.006	7.9	0.3	0.900	0.985	0.002	0.0	14	0.500
33.001	1.001	7.9	0.9	0.985	0.995	0.007	0.0	23	0.667
34.000	1.064	8.4	0.3	0.900	0.995	0.002	0.0	14	0.511
33.002	2.270	17.8	1.3	0.995	0.900	0.009	0.0	18	1.322
35.000	2.262	40.0	4.6	0.900	1.250	0.034	0.0	34	1.513

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
36.000	86	87	1.622	0.600	101.975	101.965	0.010	162.2	225	4.03	50.0
36.001	87	87_OUT	1.868	0.600	101.965	101.954	0.011	169.8	225	4.06	50.0
37.000	88	89	1.099	0.600	105.400	105.378	0.022	50.0	300	4.01	50.0
37.001	89	89_OUT	1.091	0.600	105.000	104.982	0.018	60.0	300	4.02	50.0
38.000	90	91	1.000	0.600	103.550	103.540	0.010	100.0	225	4.01	50.0
38.001	91	91_OUT	1.000	0.600	103.540	103.530	0.010	100.0	225	4.03	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
36.000	1.024	40.7	3.7	0.900	0.910	0.027	0.0	45	0.637
36.001	1.000	39.8	3.7	0.910	0.921	0.027	0.0	46	0.629
37.000	2.228	157.5	3.4	0.500	0.522	0.025	0.0	30	0.915
37.001	2.033	143.7	3.4	0.900	0.918	0.025	0.0	32	0.864
38.000	1.307	52.0	8.9	0.425	0.435	0.066	0.0	63	0.982
38.001	1.307	52.0	8.9	0.435	0.445	0.066	0.0	63	0.982

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	9.999	100.0	150	Circular	106.850	106.100	0.600	106.850	106.000	0.700
1.001	11.500	100.0	150	Circular	106.850	106.000	0.700	106.850	105.885	0.815
1.002	5.000	100.0	150	Circular	106.850	105.885	0.815	106.850	105.835	0.865
2.000	5.000	76.9	100	Circular	106.850	105.950	0.800	106.850	105.885	0.865
1.003	15.000	45.0	150	Circular	106.850	105.835	0.865	106.100	105.502	0.448
1.004	3.501	100.0	150	Circular	106.100	105.502	0.448	106.100	105.467	0.483
3.000	6.000	59.4	100	Circular	108.000	107.000	0.900	108.000	106.899	1.001
3.001	11.001	59.5	100	Circular	108.000	106.899	1.001	108.000	106.714	1.186
3.002	10.000	59.2	100	Circular	108.000	106.714	1.186	108.000	106.545	1.355
4.000	7.000	59.3	100	Circular	108.000	107.000	0.900	108.000	106.882	1.018
4.001	10.999	32.6	100	Circular	108.000	106.882	1.018	108.000	106.545	1.355
3.003	14.001	31.5	100	Circular	108.000	106.545	1.355	107.100	106.100	0.900
5.000	9.999	100.0	150	Circular	104.200	103.450	0.600	104.200	103.350	0.700
5.001	12.499	100.0	150	Circular	104.200	103.350	0.700	104.200	103.225	0.825

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	300	Manhole	Adoptable	2	300	Manhole	Adoptable
1.001	2	300	Manhole	Adoptable	3	300	Manhole	Adoptable
1.002	3	300	Manhole	Adoptable	5	300	Manhole	Adoptable
2.000	4	300	Manhole	Adoptable	5	300	Manhole	Adoptable
1.003	5	300	Manhole	Adoptable	6	300	Manhole	Adoptable
1.004	6	300	Manhole	Adoptable	6_OUT	300	Manhole	Adoptable
3.000	7	300	Manhole	Adoptable	8	300	Manhole	Adoptable
3.001	8	300	Manhole	Adoptable	9	300	Manhole	Adoptable
3.002	9	300	Manhole	Adoptable	12	300	Manhole	Adoptable
4.000	10	300	Manhole	Adoptable	11	300	Manhole	Adoptable
4.001	11	300	Manhole	Adoptable	12	300	Manhole	Adoptable
3.003	12	300	Manhole	Adoptable	12_OUT	300	Manhole	Adoptable
5.000	13	300	Manhole	Adoptable	14	300	Manhole	Adoptable
5.001	14	300	Manhole	Adoptable	15	300	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.002	4.999	100.0	150	Circular	104.200	103.225	0.825	104.200	103.175	0.875
6.000	5.001	60.0	100	Circular	104.200	103.400	0.700	104.200	103.317	0.783
5.003	8.796	59.4	225	Circular	104.200	103.100	0.875	104.100	102.952	0.923
7.000	1.320	57.4	100	Circular	104.100	103.100	0.900	104.100	103.077	0.923
5.004	1.608	100.0	225	Circular	104.100	102.952	0.923	104.000	102.936	0.839
5.005	1.000	166.7	225	Circular	104.000	102.936	0.839	104.000	102.930	0.845
8.000	1.428	158.7	225	Circular	104.100	102.975	0.900	104.100	102.966	0.909
8.001	1.113	100.0	225	Circular	104.100	102.966	0.909	104.000	102.955	0.820
8.002	1.000	166.7	225	Circular	104.000	102.955	0.820	104.000	102.949	0.826
5.006	1.031	171.8	225	Circular	104.000	102.930	0.845	104.000	102.924	0.851
9.000	8.001	100.0	150	Circular	105.400	104.650	0.600	105.400	104.570	0.680
9.001	10.000	100.0	150	Circular	105.400	104.570	0.680	105.400	104.470	0.780
9.002	12.365	99.7	150	Circular	105.400	104.470	0.780	105.200	104.346	0.704
10.000	7.501	60.0	100	Circular	105.400	104.700	0.600	105.400	104.575	0.725
10.001	8.598	60.1	100	Circular	105.400	104.575	0.725	105.200	104.432	0.668
9.003	6.000	100.0	150	Circular	105.200	104.346	0.704	104.900	104.286	0.464
11.000	8.001	100.0	150	Circular	106.350	105.600	0.600	106.350	105.520	0.680
11.001	10.290	100.0	150	Circular	106.350	105.520	0.680	106.350	105.417	0.783
11.002	12.353	42.7	150	Circular	106.350	105.417	0.783	106.200	105.128	0.922
12.000	7.500	59.1	100	Circular	106.350	105.350	0.900	106.350	105.223	1.027
12.001	8.599	59.3	100	Circular	106.350	105.223	1.027	106.200	105.078	1.022
11.003	3.910	60.0	150	Circular	106.200	105.028	1.022	105.800	104.963	0.687
13.000	7.499	59.5	100	Circular	104.350	103.350	0.900	104.350	103.224	1.026
13.001	11.590	59.4	100	Circular	104.350	103.224	1.026	104.200	103.029	1.071
13.002	10.262	59.3	100	Circular	104.200	103.029	1.071	104.200	102.856	1.244

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.002	15	300	Manhole	Adoptable	17	300	Manhole	Adoptable
6.000	16	300	Manhole	Adoptable	17	300	Manhole	Adoptable
5.003	17	300	Manhole	Adoptable	19	300	Manhole	Adoptable
7.000	18	300	Manhole	Adoptable	19	300	Manhole	Adoptable
5.004	19	300	Manhole	Adoptable	20	300	Manhole	Adoptable
5.005	20	300	Manhole	Adoptable	24		Junction	
8.000	21	450	Manhole	Adoptable	22	300	Manhole	Adoptable
8.001	22	300	Manhole	Adoptable	23	300	Manhole	Adoptable
8.002	23	300	Manhole	Adoptable	24		Junction	
5.006	24		Junction		24_OUT	300	Manhole	Adoptable
9.000	25	300	Manhole	Adoptable	26	300	Manhole	Adoptable
9.001	26	300	Manhole	Adoptable	27	300	Manhole	Adoptable
9.002	27	300	Manhole	Adoptable	30	300	Manhole	Adoptable
10.000	28	300	Manhole	Adoptable	29	300	Manhole	Adoptable
10.001	29	300	Manhole	Adoptable	30	300	Manhole	Adoptable
9.003	30	300	Manhole	Adoptable	30_OUT	300	Manhole	Adoptable
11.000	31	300	Manhole	Adoptable	32	300	Manhole	Adoptable
11.001	32	300	Manhole	Adoptable	33	300	Manhole	Adoptable
11.002	33	300	Manhole	Adoptable	36	300	Manhole	Adoptable
12.000	34	300	Manhole	Adoptable	35	300	Manhole	Adoptable
12.001	35	300	Manhole	Adoptable	36	300	Manhole	Adoptable
11.003	36	300	Manhole	Adoptable	36_OUT	300	Manhole	Adoptable
13.000	37	300	Manhole	Adoptable	38	300	Manhole	Adoptable
13.001	38	300	Manhole	Adoptable	39	300	Manhole	Adoptable
13.002	39	300	Manhole	Adoptable	42	300	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
14.000	10.500	59.3	100	Circular	104.350	103.350	0.900	104.200	103.173	0.927
14.001	11.498	36.3	100	Circular	104.200	103.173	0.927	104.200	102.856	1.244
13.003	4.905	59.1	100	Circular	104.200	102.856	1.244	103.800	102.773	0.927
15.000	8.250	59.3	100	Circular	103.650	102.650	0.900	103.650	102.511	1.039
15.001	12.366	59.5	100	Circular	103.650	102.511	1.039	103.500	102.303	1.097
15.002	4.424	59.0	100	Circular	103.500	102.303	1.097	103.500	102.228	1.172
16.000	4.426	16.3	100	Circular	103.500	102.500	0.900	103.500	102.228	1.172
15.003	5.001	21.9	100	Circular	103.500	102.228	1.172	103.000	102.000	0.900
17.000	12.000	59.4	100	Circular	103.850	102.850	0.900	103.850	102.648	1.102
17.001	12.500	50.0	100	Circular	103.850	102.648	1.102	103.600	102.398	1.102
18.000	12.000	59.4	100	Circular	103.600	102.600	0.900	103.600	102.398	1.102
17.002	5.001	25.3	100	Circular	103.600	102.398	1.102	103.200	102.200	0.900
19.000	12.254	59.5	100	Circular	107.450	106.450	0.900	107.450	106.244	1.106
19.001	13.858	59.5	100	Circular	107.450	106.244	1.106	107.300	106.011	1.189
20.000	7.388	49.3	100	Circular	107.450	106.450	0.900	107.300	106.300	0.900
19.002	2.500	58.1	100	Circular	107.300	106.011	1.189	107.000	105.968	0.932
21.000	11.000	59.5	100	Circular	103.850	102.850	0.900	103.850	102.665	1.085
21.001	12.000	43.5	100	Circular	103.850	102.665	1.085	103.600	102.389	1.111
22.000	12.500	59.2	100	Circular	103.600	102.600	0.900	103.600	102.389	1.111
21.002	5.001	26.5	100	Circular	103.600	102.389	1.111	103.200	102.200	0.900
23.000	10.001	100.0	150	Circular	107.250	106.300	0.800	107.250	106.200	0.900
23.001	12.000	59.1	150	Circular	107.250	106.200	0.900	107.150	105.997	1.003
24.000	10.397	60.0	100	Circular	107.250	106.250	0.900	107.250	106.077	1.073
24.001	1.785	59.5	100	Circular	107.250	106.077	1.073	107.150	106.047	1.003
23.002	5.042	100.0	150	Circular	107.150	105.997	1.003	106.500	105.947	0.403

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
14.000	40	300	Manhole	Adoptable	41	300	Manhole	Adoptable
14.001	41	300	Manhole	Adoptable	42	300	Manhole	Adoptable
13.003	42	300	Manhole	Adoptable	42_OUT		Junction	
15.000	43	300	Manhole	Adoptable	44	300	Manhole	Adoptable
15.001	44	300	Manhole	Adoptable	45	300	Manhole	Adoptable
15.002	45	300	Manhole	Adoptable	47	300	Manhole	Adoptable
16.000	46	300	Manhole	Adoptable	47	300	Manhole	Adoptable
15.003	47	300	Manhole	Adoptable	47_OUT		Junction	
17.000	48	300	Manhole	Adoptable	49	300	Manhole	Adoptable
17.001	49	300	Manhole	Adoptable	51	300	Manhole	Adoptable
18.000	50	300	Manhole	Adoptable	51	300	Manhole	Adoptable
17.002	51	300	Manhole	Adoptable	51_OUT		Junction	
19.000	52	300	Manhole	Adoptable	53	300	Manhole	Adoptable
19.001	53	300	Manhole	Adoptable	55	300	Manhole	Adoptable
20.000	54	300	Manhole	Adoptable	55	300	Manhole	Adoptable
19.002	55	300	Manhole	Adoptable	55_OUT	300	Manhole	Adoptable
21.000	56	300	Manhole	Adoptable	57	300	Manhole	Adoptable
21.001	57	300	Manhole	Adoptable	59	300	Manhole	Adoptable
22.000	58	300	Manhole	Adoptable	59	300	Manhole	Adoptable
21.002	59	300	Manhole	Adoptable	59_OUT		Junction	
23.000	60	300	Manhole	Adoptable	61	300	Manhole	Adoptable
23.001	61	300	Manhole	Adoptable	64	300	Manhole	Adoptable
24.000	62	300	Manhole	Adoptable	63	300	Manhole	Adoptable
24.001	63	300	Manhole	Adoptable	64	300	Manhole	Adoptable
23.002	64	300	Manhole	Adoptable	64_OUT	300	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
25.000	11.591	100.0	150	Circular	107.450	106.700	0.600	107.450	106.584	0.716
25.001	11.272	33.7	150	Circular	107.450	106.584	0.716	107.300	106.250	0.900
26.000	5.787	38.6	100	Circular	107.450	106.450	0.900	107.300	106.300	0.900
25.002	4.000	100.0	150	Circular	107.300	106.250	0.900	106.800	106.210	0.440
27.000	8.500	59.4	100	Circular	103.650	102.650	0.900	103.650	102.507	1.043
27.001	12.571	59.3	100	Circular	103.650	102.507	1.043	103.500	102.295	1.105
28.000	9.210	44.9	100	Circular	103.500	102.500	0.900	103.500	102.295	1.105
27.002	5.001	17.0	100	Circular	103.500	102.295	1.105	103.000	102.000	0.900
29.000	6.501	59.1	100	Circular	105.850	104.850	0.900	105.850	104.740	1.010
29.001	12.000	59.4	100	Circular	105.850	104.740	1.010	105.700	104.538	1.062
30.000	14.000	44.9	100	Circular	105.850	104.850	0.900	105.700	104.538	1.062
29.002	3.999	29.0	100	Circular	105.700	104.538	1.062	105.400	104.400	0.900
31.000	4.999	59.5	100	Circular	103.650	102.650	0.900	103.650	102.566	0.984
31.001	10.000	59.2	100	Circular	103.650	102.566	0.984	103.500	102.397	1.003
32.000	4.999	48.5	100	Circular	103.500	102.500	0.900	103.500	102.397	1.003
31.002	5.001	12.6	100	Circular	103.500	102.397	1.003	103.000	102.000	0.900
33.000	5.001	58.8	100	Circular	103.650	102.650	0.900	103.650	102.565	0.985
33.001	9.500	59.4	100	Circular	103.650	102.565	0.985	103.500	102.405	0.995
34.000	5.000	52.6	100	Circular	103.500	102.500	0.900	103.500	102.405	0.995
33.002	4.743	11.7	100	Circular	103.500	102.405	0.995	103.000	102.000	0.900
35.000	7.000	20.0	150	Circular	97.700	96.650	0.900	97.700	96.300	1.250
36.000	1.622	162.2	225	Circular	103.100	101.975	0.900	103.100	101.965	0.910
36.001	1.868	169.8	225	Circular	103.100	101.965	0.910	103.100	101.954	0.921
37.000	1.099	50.0	300	Circular	106.200	105.400	0.500	106.200	105.378	0.522
37.001	1.091	60.0	300	Circular	106.200	105.000	0.900	106.200	104.982	0.918

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
25.000	65	300	Manhole	Adoptable	66	300	Manhole	Adoptable
25.001	66	300	Manhole	Adoptable	68	300	Manhole	Adoptable
26.000	67	300	Manhole	Adoptable	68	300	Manhole	Adoptable
25.002	68	300	Manhole	Adoptable	68_OUT	300	Manhole	Adoptable
27.000	69	300	Manhole	Adoptable	70	300	Manhole	Adoptable
27.001	70	300	Manhole	Adoptable	72	300	Manhole	Adoptable
28.000	71	300	Manhole	Adoptable	72	300	Manhole	Adoptable
27.002	72	300	Manhole	Adoptable	72_OUT		Junction	
29.000	73	300	Manhole	Adoptable	74	300	Manhole	Adoptable
29.001	74	300	Manhole	Adoptable	76	300	Manhole	Adoptable
30.000	75	300	Manhole	Adoptable	76	300	Manhole	Adoptable
29.002	76	300	Manhole	Adoptable	76_OUT		Junction	
31.000	77	300	Manhole	Adoptable	78	300	Manhole	Adoptable
31.001	78	300	Manhole	Adoptable	80	300	Manhole	Adoptable
32.000	79	300	Manhole	Adoptable	80	300	Manhole	Adoptable
31.002	80	300	Manhole	Adoptable	80_OUT		Junction	
33.000	81	300	Manhole	Adoptable	82	300	Manhole	Adoptable
33.001	82	300	Manhole	Adoptable	84	300	Manhole	Adoptable
34.000	83	300	Manhole	Adoptable	84	300	Manhole	Adoptable
33.002	84	300	Manhole	Adoptable	84_OUT		Junction	
35.000	85	300	Manhole	Adoptable	85_OUT		Junction	
36.000	86		Junction		87	300	Manhole	Adoptable
36.001	87	300	Manhole	Adoptable	87_OUT	300	Manhole	Adoptable
37.000	88	600	Manhole	Adoptable	89	600	Manhole	Adoptable
37.001	89	600	Manhole	Adoptable	89_OUT	600	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
38.000	1.000	100.0	225	Circular	104.200	103.550	0.425	104.200	103.540	0.435
38.001	1.000	100.0	225	Circular	104.200	103.540	0.435	104.200	103.530	0.445

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
38.000	90	600	Manhole	Adoptable	91	600	Manhole	Adoptable
38.001	91	600	Manhole	Adoptable	91_OUT	600	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	10	0

Node 22 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.038
Downstream Link	8.001	Invert Level (m)	102.966	Discharge Coefficient	0.600

Node 87 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	✓	Diameter (m)	0.075
Downstream Link	36.001	Invert Level (m)	101.965	Discharge Coefficient	0.600

Node 18 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00420	Porosity	0.30	Main Channel Length (m)	22.500
Side Inf Coefficient (m/hr)	0.00420	Invert Level (m)	103.650	Main Channel Slope (1:X)	35.0
Safety Factor	2.0	Time to half empty (mins)	1125	Main Channel n	4.000

Inlets

89_OUT	36_OUT	30_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	202.5	202.5	0.300	202.5	202.5	0.301	0.0	202.5

Node 24_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	102.850
Side Inf Coefficient (m/hr)	0.04170	Porosity	1.00	Time to half empty (mins)	1016

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	58.1	58.1	1.000	210.0	285.0

Node 88 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.01000	Porosity	0.30	Main Channel Length (m)	50.000
Side Inf Coefficient (m/hr)	0.01000	Invert Level (m)	105.650	Main Channel Slope (1:X)	120.0
Safety Factor	2.0	Time to half empty (mins)	108	Main Channel n	1.000

Inlets

55_OUT	68_OUT	64_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	338.7	338.7	0.400	338.7	338.7	0.401	0.0	338.7

Node 90 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.01000	Porosity	0.30	Main Channel Length (m)	52.500
Side Inf Coefficient (m/hr)	0.01000	Invert Level (m)	103.650	Main Channel Slope (1:X)	30.0
Safety Factor	2.0	Time to half empty (mins)	888	Main Channel n	1.000

Inlets

12_OUT	6_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	328.2	328.2	0.400	328.2	328.2	0.401	0.0	328.2

Node 21 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00420	Porosity	0.30	Main Channel Length (m)	50.000
Side Inf Coefficient (m/hr)	0.00420	Invert Level (m)	103.450	Main Channel Slope (1:X)	500.0
Safety Factor	2.0	Time to half empty (mins)	952	Main Channel n	1.000

Inlets

91_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	361.8	361.8	0.500	361.8	361.8	0.501	0.0	361.8

Node 85 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00420	Porosity	0.30	Main Channel Length (m)	55.000
Side Inf Coefficient (m/hr)	0.00420	Invert Level (m)	97.250	Main Channel Slope (1:X)	12.0
Safety Factor	2.0	Time to half empty (mins)	280	Main Channel n	1.000

Inlets

87_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	340.0	340.0	0.300	340.0	340.0	0.301	0.0	340.0

Node 86 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00420	Invert Level (m)	102.650	Slope (1:X)	20.0
Side Inf Coefficient (m/hr)	0.00420	Time to half empty (mins)	4	Depth (m)	0.300
Safety Factor	2.0	Width (m)	8.100	Inf Depth (m)	
Porosity	0.30	Length (m)	30.000		

Node 85_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	95.180
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	996

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	28.8	28.8	1.320	28.8	66.8	1.321	0.0	66.8

Node 84_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.740
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	685

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.7	7.7	0.660	7.7	15.1	0.661	0.0	15.1

Node 80_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.740
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	685

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.7	7.7	0.660	7.7	15.1	0.661	0.0	15.1

Node 72_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.740
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	685

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.7	7.7	0.660	7.7	15.1	0.661	0.0	15.1

Node 47_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.740
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	685

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.7	7.7	0.660	7.7	15.1	0.661	0.0	15.1

Node 51_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.950
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	797

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	17.9	17.9	0.660	17.9	29.5	0.661	0.0	29.5

Node 59 OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.940
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	789

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	17.9	17.9	0.660	17.9	29.5	0.661	0.0	29.5

Node 42 OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	101.940
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	1318

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	25.6	25.6	1.320	25.6	53.1	1.321	0.0	53.1

Node 76_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04170	Safety Factor	2.0	Invert Level (m)	103.540
Side Inf Coefficient (m/hr)	0.04170	Porosity	0.95	Time to half empty (mins)	1318

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	25.6	25.6	1.320	25.6	53.1	1.321	0.0	53.1

Results for 2 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	1	11	106.116	0.016	0.4	0.0011	0.0000	OK
15 minute winter	2	10	106.023	0.023	0.9	0.0017	0.0000	OK
15 minute winter	3	11	105.909	0.024	0.9	0.0017	0.0000	OK
15 minute winter	4	10	105.969	0.019	0.5	0.0013	0.0000	OK
15 minute winter	5	10	105.862	0.027	1.9	0.0019	0.0000	OK
15 minute winter	6	11	105.537	0.035	1.9	0.0025	0.0000	OK
15 minute winter	6_OUT	11	105.433	0.033	1.8	0.0024	0.0000	OK
15 minute summer	7	10	107.016	0.016	0.4	0.0011	0.0000	OK
15 minute winter	8	10	106.915	0.016	0.4	0.0011	0.0000	OK
15 minute winter	9	11	106.729	0.015	0.4	0.0011	0.0000	OK
15 minute winter	10	11	107.017	0.017	0.5	0.0012	0.0000	OK
15 minute winter	11	11	106.903	0.021	1.0	0.0015	0.0000	OK
15 minute winter	12	10	106.574	0.029	2.0	0.0021	0.0000	OK
15 minute winter	12_OUT	12	105.534	0.134	1.9	0.0095	0.0000	OK
15 minute winter	13	10	103.466	0.015	0.4	0.0011	0.0000	OK
15 minute summer	14	10	103.369	0.019	0.6	0.0013	0.0000	OK
360 minute winter	15	408	103.262	0.037	0.1	0.0026	0.0000	OK
15 minute winter	16	11	103.416	0.016	0.4	0.0011	0.0000	OK
360 minute winter	17	408	103.262	0.162	0.3	0.0115	0.0000	OK
360 minute winter	18	408	103.262	0.162	2.5	0.0115	0.0000	SURCHARGED
360 minute winter	19	408	103.262	0.310	2.8	0.0220	0.0000	SURCHARGED
360 minute winter	20	408	103.262	0.326	2.7	0.0231	0.0000	SURCHARGED
30 minute winter	21	23	103.500	0.525	4.5	0.0834	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)
15 minute winter	1	1.000	2	0.4	0.300	0.023	0.0135
15 minute winter	2	1.001	3	0.9	0.522	0.051	0.0201
15 minute winter	3	1.002	5	0.9	0.470	0.051	0.0097
15 minute winter	4	2.000	5	0.5	0.501	0.072	0.0049
15 minute winter	5	1.003	6	1.9	0.723	0.070	0.0390
15 minute winter	6	1.004	6_OUT	1.8	0.622	0.103	0.0103
15 minute winter	6_OUT	Flow through pond	90	0.3	0.011	0.012	1.4638
15 minute summer	7	3.000	8	0.4	0.517	0.051	0.0046
15 minute winter	8	3.001	9	0.4	0.543	0.051	0.0084
15 minute winter	9	3.002	12	0.4	0.331	0.051	0.0133
15 minute winter	10	4.000	11	0.5	0.486	0.064	0.0072
15 minute winter	11	4.001	12	1.0	0.679	0.094	0.0170
15 minute winter	12	3.003	12_OUT	1.9	1.032	0.180	0.0264
15 minute winter	12_OUT	Flow through pond	90	0.3	0.011	0.012	1.4638
15 minute winter	13	5.000	14	0.4	0.355	0.022	0.0111
15 minute summer	14	5.001	15	0.6	0.473	0.033	0.0159
360 minute winter	15	5.002	17	0.1	0.269	0.006	0.0346
15 minute winter	16	6.000	17	0.4	0.515	0.051	0.0039
360 minute winter	17	5.003	19	0.3	0.182	0.004	0.3091
360 minute winter	18	7.000	19	2.5	0.812	0.317	0.0103
360 minute winter	18	Infiltration		0.0			
360 minute winter	19	5.004	20	2.7	0.365	0.052	0.0640
360 minute winter	20	5.005	24	2.6	0.275	0.065	0.0398
30 minute winter	21	8.000	22	3.2	0.373	0.078	0.0568
30 minute winter	21	Infiltration		0.2			

Results for 2 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	22	23	103.500	0.534	3.2	0.0379	0.0000	SURCHARGED
360 minute winter	23	408	103.262	0.307	1.8	0.0218	0.0000	SURCHARGED
360 minute winter	24	408	103.262	0.332	4.7	0.0000	0.0000	SURCHARGED
360 minute winter	24_OUT	408	103.262	0.338	4.7	36.7961	0.0000	OK
15 minute summer	25	10	104.666	0.016	0.4	0.0011	0.0000	OK
15 minute summer	26	10	104.596	0.026	1.2	0.0019	0.0000	OK
15 minute winter	27	10	104.500	0.030	1.6	0.0021	0.0000	OK
15 minute winter	28	10	104.715	0.015	0.4	0.0011	0.0000	OK
15 minute winter	29	10	104.597	0.022	0.8	0.0015	0.0000	OK
240 minute winter	30	160	104.389	0.043	0.6	0.0030	0.0000	OK
240 minute winter	30_OUT	160	104.389	0.103	0.6	0.0073	0.0000	OK
15 minute summer	31	10	105.616	0.016	0.4	0.0011	0.0000	OK
15 minute summer	32	10	105.547	0.027	1.2	0.0019	0.0000	OK
15 minute winter	33	10	105.442	0.025	1.6	0.0018	0.0000	OK
15 minute winter	34	10	105.365	0.015	0.4	0.0011	0.0000	OK
15 minute winter	35	10	105.245	0.022	0.8	0.0015	0.0000	OK
15 minute winter	36	10	105.062	0.034	2.3	0.0024	0.0000	OK
15 minute winter	36_OUT	13	104.652	0.359	2.3	0.0255	0.0000	OK
15 minute summer	37	10	103.392	0.042	2.7	0.0030	0.0000	OK
15 minute winter	38	10	103.265	0.041	2.7	0.0029	0.0000	OK
15 minute summer	39	10	103.074	0.045	3.2	0.0032	0.0000	OK
15 minute winter	40	9	103.368	0.018	0.5	0.0013	0.0000	OK
15 minute winter	41	11	103.188	0.015	0.5	0.0011	0.0000	OK
15 minute winter	42	11	102.909	0.053	4.1	0.0038	0.0000	OK
360 minute winter	42_OUT	264	102.091	-0.682	0.8	3.6627	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute winter	22	Orifice	23	2.1			
360 minute winter	23	8.002	24	1.7	0.441	0.044	0.0398
360 minute winter	24	5.006	24_OUT	4.7	0.577	0.119	0.0410
360 minute winter	24_OUT	Infiltration		0.8			
15 minute summer	25	9.000	26	0.4	0.265	0.022	0.0122
15 minute summer	26	9.001	27	1.2	0.520	0.067	0.0228
15 minute winter	27	9.002	30	1.5	0.520	0.087	0.0369
15 minute winter	28	10.000	29	0.4	0.397	0.051	0.0075
15 minute winter	29	10.001	30	0.8	0.627	0.099	0.0106
240 minute winter	30	9.003	30_OUT	0.6	0.247	0.034	0.0511
240 minute winter	30_OUT	Flow through pond	18	2.2	0.008	0.338	5.8154
15 minute summer	31	11.000	32	0.4	0.259	0.022	0.0124
15 minute summer	32	11.001	33	1.2	0.586	0.067	0.0208
15 minute winter	33	11.002	36	1.5	0.827	0.057	0.0231
15 minute winter	34	12.000	35	0.4	0.399	0.050	0.0075
15 minute winter	35	12.001	36	0.8	0.630	0.098	0.0106
15 minute winter	36	11.003	36_OUT	2.3	0.793	0.099	0.0112
15 minute winter	36_OUT	Flow through pond	18	0.8	0.006	0.117	3.0475
15 minute summer	37	13.000	38	2.7	0.872	0.344	0.0232
15 minute winter	38	13.001	39	2.7	0.835	0.344	0.0375
15 minute summer	39	13.002	42	3.2	0.839	0.404	0.0389
15 minute winter	40	14.000	41	0.5	0.606	0.064	0.0088
15 minute winter	41	14.001	42	0.5	0.217	0.050	0.0286
15 minute winter	42	13.003	42_OUT	4.1	0.986	0.515	0.0202
360 minute winter	42_OUT	Infiltration		0.2			

Results for 2 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	43	10	102.665	0.015	0.4	0.0011	0.0000	OK
15 minute summer	44	10	102.531	0.020	0.7	0.0014	0.0000	OK
15 minute winter	45	11	102.323	0.020	0.7	0.0014	0.0000	OK
15 minute winter	46	10	102.511	0.011	0.4	0.0008	0.0000	OK
15 minute winter	47	10	102.251	0.023	1.5	0.0016	0.0000	OK
240 minute winter	47_OUT	164	101.910	-0.090	0.4	1.2408	0.0000	OK
15 minute winter	48	10	102.867	0.017	0.5	0.0012	0.0000	OK
15 minute summer	49	10	102.681	0.033	1.9	0.0023	0.0000	OK
15 minute winter	50	11	102.615	0.015	0.4	0.0011	0.0000	OK
15 minute winter	51	10	102.430	0.032	2.6	0.0023	0.0000	OK
240 minute winter	51_OUT	168	102.079	-0.121	0.6	2.1855	0.0000	OK
15 minute summer	52	10	106.465	0.015	0.4	0.0011	0.0000	OK
15 minute winter	53	10	106.269	0.025	1.1	0.0018	0.0000	OK
15 minute summer	54	1	106.450	0.000	0.0	0.0000	0.0000	OK
15 minute winter	55	12	106.154	0.143	1.6	0.0101	0.0000	SURCHARGED
15 minute winter	55_OUT	12	106.153	0.185	1.2	0.0131	0.0000	OK
15 minute winter	56	10	102.867	0.017	0.5	0.0012	0.0000	OK
15 minute summer	57	10	102.696	0.031	1.9	0.0022	0.0000	OK
15 minute winter	58	11	102.615	0.015	0.4	0.0011	0.0000	OK
15 minute winter	59	10	102.422	0.033	2.6	0.0023	0.0000	OK
240 minute winter	59_OUT	168	102.069	-0.131	0.6	2.1858	0.0000	OK
15 minute winter	60	10	106.314	0.013	0.3	0.0010	0.0000	OK
15 minute winter	61	10	106.218	0.018	0.7	0.0012	0.0000	OK
15 minute winter	62	10	106.265	0.015	0.4	0.0011	0.0000	OK
180 minute winter	63	124	106.120	0.043	0.2	0.0030	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)
15 minute winter	43	15.000	44	0.4	0.421	0.050	0.0078
15 minute summer	44	15.001	45	0.7	0.620	0.087	0.0136
15 minute winter	45	15.002	47	0.7	0.560	0.086	0.0054
15 minute winter	46	16.000	47	0.4	0.577	0.026	0.0041
15 minute winter	47	15.003	47_OUT	1.4	1.072	0.110	0.0067
240 minute winter	47_OUT	Infiltration		0.1			
15 minute winter	48	17.000	49	0.5	0.327	0.063	0.0186
15 minute summer	49	17.001	51	1.9	0.860	0.220	0.0275
15 minute winter	50	18.000	51	0.4	0.303	0.051	0.0176
15 minute winter	51	17.002	51_OUT	2.6	1.199	0.212	0.0107
240 minute winter	51_OUT	Infiltration		0.1			
15 minute summer	52	19.000	53	0.4	0.351	0.050	0.0140
15 minute winter	53	19.001	55	1.1	0.278	0.137	0.0648
15 minute summer	54	20.000	55	0.0	0.000	0.000	0.0000
15 minute winter	55	19.002	55_OUT	1.2	0.160	0.157	0.0196
15 minute winter	55_OUT	Flow through pond	88	0.6	0.009	0.034	3.3566
15 minute winter	56	21.000	57	0.5	0.341	0.063	0.0163
15 minute summer	57	21.001	59	1.9	0.880	0.206	0.0258
15 minute winter	58	22.000	59	0.4	0.298	0.051	0.0186
15 minute winter	59	21.002	59_OUT	2.6	1.180	0.217	0.0109
240 minute winter	59_OUT	Infiltration		0.1			
15 minute winter	60	23.000	61	0.3	0.305	0.016	0.0096
15 minute winter	61	23.001	64	0.7	0.123	0.029	0.0802
15 minute winter	62	24.000	63	0.4	0.373	0.051	0.0111
180 minute winter	63	24.001	64	0.8	0.230	0.101	0.0082

Results for 2 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	64	160	106.120	0.123	1.2	0.0087	0.0000	OK
180 minute winter	64_OUT	120	106.119	0.172	1.1	0.0122	0.0000	OK
15 minute summer	65	10	106.721	0.021	0.7	0.0015	0.0000	OK
15 minute winter	66	10	106.603	0.019	1.1	0.0014	0.0000	OK
15 minute winter	67	11	106.466	0.016	0.5	0.0011	0.0000	OK
15 minute winter	68	10	106.282	0.032	1.6	0.0023	0.0000	OK
15 minute winter	68_OUT	10	106.144	0.077	6.5	0.0055	0.0000	OK
15 minute winter	69	10	102.665	0.015	0.4	0.0011	0.0000	OK
15 minute winter	70	10	102.527	0.020	0.7	0.0014	0.0000	OK
15 minute winter	71	10	102.514	0.014	0.4	0.0010	0.0000	OK
15 minute winter	72	10	102.317	0.022	1.5	0.0015	0.0000	OK
240 minute winter	72_OUT	160	101.910	-0.090	0.4	1.2465	0.0000	OK
15 minute winter	73	10	104.894	0.044	2.9	0.0031	0.0000	OK
15 minute summer	74	10	104.789	0.049	3.5	0.0035	0.0000	OK
15 minute winter	75	10	104.869	0.019	0.7	0.0013	0.0000	OK
15 minute winter	76	10	104.582	0.044	4.2	0.0031	0.0000	OK
360 minute winter	76_OUT	264	103.696	-0.704	0.7	3.8009	0.0000	OK
15 minute winter	77	10	102.665	0.015	0.4	0.0011	0.0000	OK
15 minute winter	78	10	102.591	0.025	1.0	0.0018	0.0000	OK
15 minute winter	79	10	102.515	0.015	0.4	0.0010	0.0000	OK
15 minute winter	80	10	102.417	0.020	1.4	0.0014	0.0000	OK
180 minute winter	80_OUT	136	101.896	-0.104	0.4	1.1400	0.0000	OK
15 minute winter	81	10	102.665	0.015	0.4	0.0011	0.0000	OK
15 minute winter	82	10	102.590	0.025	1.0	0.0018	0.0000	OK
15 minute winter	83	10	102.515	0.015	0.4	0.0011	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
240 minute winter	64	23.002	64_OUT	-1.2	-0.113	-0.070	0.0832
180 minute winter	64_OUT	Flow through pond	88	1.3	0.012	0.072	5.3221
15 minute summer	65	25.000	66	0.7	0.500	0.039	0.0162
15 minute winter	66	25.001	68	1.1	0.548	0.036	0.0228
15 minute winter	67	26.000	68	0.5	0.645	0.051	0.0045
15 minute winter	68	25.002	68_OUT	1.6	0.597	0.088	0.0104
15 minute winter	68_OUT	Flow through pond	88	0.6	0.009	0.034	3.3566
15 minute winter	69	27.000	70	0.4	0.428	0.050	0.0079
15 minute winter	70	27.001	72	0.7	0.585	0.087	0.0148
15 minute winter	71	28.000	72	0.4	0.416	0.044	0.0089
15 minute winter	72	27.002	72_OUT	1.5	1.183	0.098	0.0061
240 minute winter	72_OUT	Infiltration		0.1			
15 minute winter	73	29.000	74	2.9	0.814	0.368	0.0232
15 minute summer	74	29.001	76	3.5	0.980	0.446	0.0429
15 minute winter	75	30.000	76	0.7	0.393	0.077	0.0305
15 minute winter	76	29.002	76_OUT	4.2	1.289	0.369	0.0129
360 minute winter	76_OUT	Infiltration		0.2			
15 minute winter	77	31.000	78	0.4	0.349	0.051	0.0058
15 minute winter	78	31.001	80	1.0	0.756	0.126	0.0131
15 minute winter	79	32.000	80	0.4	0.450	0.046	0.0044
15 minute winter	80	31.002	80_OUT	1.4	1.293	0.080	0.0053
180 minute winter	80_OUT	Infiltration		0.1			
15 minute winter	81	33.000	82	0.4	0.349	0.050	0.0058
15 minute winter	82	33.001	84	1.0	0.762	0.126	0.0124
15 minute winter	83	34.000	84	0.4	0.451	0.048	0.0044

Results for 2 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	84	10	102.424	0.019	1.4	0.0014	0.0000	OK
180 minute winter	84_OUT	136	101.896	-0.104	0.4	1.1401	0.0000	OK
15 minute winter	85	10	96.687	0.037	5.0	0.0026	0.0000	OK
480 minute winter	85_OUT	472	95.505	-0.795	1.1	8.8791	0.0000	OK
15 minute winter	86	11	102.092	0.116	3.9	0.0000	0.0000	OK
15 minute winter	87	11	102.091	0.126	3.7	0.0090	0.0000	OK
120 minute winter	87_OUT	80	101.853	0.020	1.4	0.0014	0.0000	OK
15 minute winter	88	10	105.438	0.038	3.9	0.0109	0.0000	OK
15 minute winter	89	10	105.040	0.040	3.9	0.0113	0.0000	OK
15 minute winter	89_OUT	13	105.011	0.718	3.9	0.2032	0.0000	OK
15 minute winter	90	10	103.632	0.082	9.6	0.0232	0.0000	OK
360 minute winter	91	248	103.626	0.086	2.0	0.0244	0.0000	OK
360 minute winter	91_OUT	248	103.626	0.096	2.0	0.0272	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	84	33.002	84_OUT	1.4	1.326	0.077	0.0049
180 minute winter	84_OUT	Infiltration		0.1			
15 minute winter	85	35.000	85_OUT	5.0	1.522	0.126	0.0231
15 minute winter	85	Infiltration		0.0			
480 minute winter	85_OUT	Infiltration		0.2			
15 minute winter	86	36.000	87	3.7	0.400	0.090	0.0354
15 minute winter	86	Infiltration		0.0			
15 minute winter	87	Orifice	87_OUT	3.5			
120 minute winter	87_OUT	Flow through pond	85	0.7	0.020	0.039	1.9993
15 minute winter	88	37.000	89	3.9	0.834	0.025	0.0051
15 minute winter	88	Infiltration		0.0			
15 minute winter	89	37.001	89_OUT	3.9	0.782	0.027	0.0054
15 minute winter	89_OUT	Flow through pond	18	0.8	0.006	0.117	3.0475
15 minute winter	90	38.000	91	9.6	0.803	0.185	0.0120
15 minute winter	90	Infiltration		0.0			
360 minute winter	91	38.001	91_OUT	2.0	0.222	0.038	0.0151
360 minute winter	91_OUT	Flow through pond	21	1.3	0.008	0.080	8.2822

Results for 30 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	1	10	106.125	0.025	1.1	0.0018	0.0000	OK
15 minute summer	2	10	106.038	0.038	2.4	0.0027	0.0000	OK
15 minute winter	3	10	105.924	0.039	2.4	0.0028	0.0000	OK
15 minute winter	4	10	105.980	0.030	1.2	0.0021	0.0000	OK
15 minute winter	5	10	105.878	0.043	4.8	0.0030	0.0000	OK
15 minute winter	6	10	105.560	0.058	4.7	0.0041	0.0000	OK
15 minute winter	6_OUT	11	105.467	0.067	4.6	0.0048	0.0000	OK
15 minute winter	7	10	107.026	0.026	1.1	0.0019	0.0000	OK
15 minute summer	8	10	106.925	0.026	1.1	0.0018	0.0000	OK
15 minute winter	9	10	106.739	0.025	1.1	0.0018	0.0000	OK
15 minute summer	10	10	107.028	0.028	1.3	0.0020	0.0000	OK
15 minute summer	11	10	106.916	0.034	2.7	0.0024	0.0000	OK
15 minute winter	12	10	106.596	0.051	5.3	0.0036	0.0000	OK
15 minute winter	12_OUT	11	105.757	0.357	5.2	0.0254	0.0000	OK
720 minute winter	13	720	103.553	0.103	0.1	0.0073	0.0000	OK
720 minute winter	14	720	103.553	0.203	0.1	0.0144	0.0000	SURCHARGED
720 minute winter	15	720	103.553	0.328	0.1	0.0233	0.0000	SURCHARGED
720 minute winter	16	720	103.553	0.153	0.1	0.0108	0.0000	SURCHARGED
720 minute winter	17	720	103.553	0.453	0.3	0.0321	0.0000	SURCHARGED
720 minute winter	18	720	103.553	0.453	3.9	0.0321	0.0000	SURCHARGED
720 minute winter	19	720	103.553	0.601	4.0	0.0426	0.0000	SURCHARGED
720 minute winter	20	720	103.553	0.617	3.9	0.0438	0.0000	SURCHARGED
180 minute winter	21	152	103.718	0.743	6.7	0.1182	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)
15 minute winter	1	1.000	2	1.1	0.406	0.062	0.0273
15 minute summer	2	1.001	3	2.4	0.666	0.135	0.0413
15 minute winter	3	1.002	5	2.4	0.607	0.133	0.0196
15 minute winter	4	2.000	5	1.2	0.641	0.174	0.0094
15 minute winter	5	1.003	6	4.7	0.913	0.178	0.0779
15 minute winter	6	1.004	6_OUT	4.6	0.793	0.260	0.0204
15 minute winter	6_OUT	Flow through pond	90	2.1	0.023	0.087	4.7554
15 minute winter	7	3.000	8	1.1	0.681	0.140	0.0097
15 minute summer	8	3.001	9	1.1	0.706	0.140	0.0171
15 minute winter	9	3.002	12	1.1	0.402	0.135	0.0275
15 minute summer	10	4.000	11	1.3	0.629	0.165	0.0145
15 minute summer	11	4.001	12	2.7	0.875	0.254	0.0349
15 minute winter	12	3.003	12_OUT	5.2	1.333	0.478	0.0544
15 minute winter	12_OUT	Flow through pond	90	2.1	0.023	0.087	4.7554
720 minute winter	13	5.000	14	0.1	0.270	0.006	0.1522
720 minute winter	14	5.001	15	0.1	0.270	0.006	0.2200
720 minute winter	15	5.002	17	-0.1	0.269	-0.006	0.0880
720 minute winter	16	6.000	17	0.1	0.341	0.013	0.0391
720 minute winter	17	5.003	19	0.3	0.081	0.004	0.3498
720 minute winter	18	7.000	19	3.8	0.812	0.479	0.0103
720 minute winter	18	Infiltration		0.0			
720 minute winter	19	5.004	20	3.9	0.310	0.076	0.0640
720 minute winter	20	5.005	24	3.9	0.206	0.097	0.0398
180 minute winter	21	8.000	22	2.5	0.182	0.060	0.0568
180 minute winter	21	Infiltration		0.2			

Results for 30 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	22	152	103.718	0.752	2.5	0.0534	0.0000	SURCHARGED
720 minute winter	23	720	103.553	0.598	1.9	0.0424	0.0000	SURCHARGED
720 minute winter	24	720	103.553	0.623	6.0	0.0000	0.0000	SURCHARGED
720 minute winter	24_OUT	720	103.553	0.629	6.0	78.3495	0.0000	OK
15 minute winter	25	10	104.673	0.023	0.9	0.0016	0.0000	OK
15 minute winter	26	10	104.611	0.041	2.8	0.0029	0.0000	OK
15 minute summer	27	10	104.517	0.047	3.7	0.0033	0.0000	OK
15 minute winter	28	10	104.724	0.024	1.0	0.0017	0.0000	OK
15 minute winter	29	10	104.611	0.036	2.0	0.0025	0.0000	OK
120 minute winter	30	98	104.460	0.114	1.8	0.0081	0.0000	OK
120 minute winter	30_OUT	98	104.460	0.174	1.7	0.0124	0.0000	OK
15 minute winter	31	10	105.623	0.023	0.9	0.0016	0.0000	OK
15 minute winter	32	10	105.562	0.042	2.8	0.0030	0.0000	OK
15 minute winter	33	10	105.455	0.038	3.7	0.0027	0.0000	OK
15 minute winter	34	10	105.374	0.024	1.0	0.0017	0.0000	OK
15 minute winter	35	10	105.259	0.036	2.0	0.0025	0.0000	OK
15 minute winter	36	13	105.135	0.107	5.7	0.0076	0.0000	OK
15 minute winter	36_OUT	13	105.132	0.839	5.6	0.0596	0.0000	OK
15 minute summer	37	10	103.428	0.078	6.7	0.0056	0.0000	OK
15 minute winter	38	11	103.299	0.075	6.7	0.0053	0.0000	OK
15 minute winter	39	11	103.183	0.154	7.9	0.0109	0.0000	SURCHARGED
15 minute summer	40	10	103.380	0.030	1.4	0.0021	0.0000	OK
15 minute winter	41	10	103.198	0.025	1.4	0.0018	0.0000	OK
15 minute winter	42	11	103.006	0.150	9.5	0.0107	0.0000	SURCHARGED
180 minute winter	42_OUT	180	102.310	-0.463	2.4	9.0033	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
180 minute winter	22	Orifice	23	2.2			
720 minute winter	23	8.002	24	1.8	0.406	0.046	0.0398
720 minute winter	24	5.006	24_OUT	6.0	0.482	0.151	0.0410
720 minute winter	24_OUT	Infiltration		1.2			
15 minute winter	25	9.000	26	0.9	0.326	0.051	0.0225
15 minute winter	26	9.001	27	2.8	0.652	0.157	0.0429
15 minute summer	27	9.002	30	3.7	0.624	0.208	0.0733
15 minute winter	28	10.000	29	1.0	0.509	0.128	0.0149
15 minute winter	29	10.001	30	2.0	0.813	0.255	0.0211
120 minute winter	30	9.003	30_OUT	1.7	0.379	0.095	0.0961
120 minute winter	30_OUT	Flow through pond	18	5.3	0.012	0.827	10.1545
15 minute winter	31	11.000	32	0.9	0.322	0.051	0.0228
15 minute winter	32	11.001	33	2.8	0.741	0.158	0.0389
15 minute winter	33	11.002	36	3.7	1.058	0.135	0.0429
15 minute winter	34	12.000	35	1.0	0.512	0.127	0.0148
15 minute winter	35	12.001	36	2.0	0.818	0.253	0.0262
15 minute winter	36	11.003	36_OUT	5.6	1.003	0.246	0.0608
15 minute winter	36_OUT	Flow through pond	18	3.0	0.010	0.466	7.1000
15 minute summer	37	13.000	38	6.7	1.051	0.853	0.0478
15 minute winter	38	13.001	39	6.6	0.974	0.838	0.0820
15 minute winter	39	13.002	42	7.2	0.941	0.911	0.0803
15 minute summer	40	14.000	41	1.4	0.801	0.178	0.0184
15 minute winter	41	14.001	42	1.4	0.251	0.138	0.0539
15 minute winter	42	13.003	42_OUT	9.3	1.191	1.182	0.0378
180 minute winter	42_OUT	Infiltration		0.2			

Results for 30 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	43	10	102.674	0.024	1.0	0.0017	0.0000	OK
15 minute winter	44	10	102.543	0.032	1.7	0.0023	0.0000	OK
15 minute winter	45	10	102.336	0.033	1.7	0.0023	0.0000	OK
15 minute summer	46	10	102.518	0.018	1.0	0.0012	0.0000	OK
15 minute winter	47	10	102.265	0.037	3.6	0.0026	0.0000	OK
480 minute winter	47_OUT	328	102.149	0.148	0.4	2.9881	0.0000	OK
15 minute winter	48	10	102.875	0.025	1.1	0.0018	0.0000	OK
15 minute winter	49	10	102.703	0.055	4.7	0.0039	0.0000	OK
15 minute winter	50	10	102.625	0.025	1.1	0.0018	0.0000	OK
15 minute winter	51	10	102.453	0.055	6.5	0.0039	0.0000	OK
480 minute winter	51_OUT	336	102.248	0.048	0.7	5.0723	0.0000	OK
15 minute winter	52	10	106.473	0.023	0.9	0.0016	0.0000	OK
15 minute winter	53	12	106.296	0.052	2.6	0.0037	0.0000	OK
15 minute summer	54	1	106.450	0.000	0.0	0.0000	0.0000	OK
15 minute winter	55	12	106.285	0.274	4.0	0.0195	0.0000	SURCHARGED
15 minute winter	55_OUT	12	106.278	0.310	3.1	0.0220	0.0000	OK
15 minute winter	56	10	102.875	0.025	1.1	0.0018	0.0000	OK
15 minute winter	57	10	102.717	0.052	4.7	0.0037	0.0000	OK
15 minute winter	58	10	102.625	0.025	1.1	0.0018	0.0000	OK
15 minute winter	59	10	102.445	0.056	6.5	0.0040	0.0000	OK
480 minute winter	59_OUT	344	102.243	0.043	0.7	5.1532	0.0000	OK
15 minute winter	60	10	106.320	0.020	0.7	0.0014	0.0000	OK
15 minute winter	61	10	106.227	0.027	1.7	0.0019	0.0000	OK
15 minute winter	62	10	106.274	0.024	1.0	0.0017	0.0000	OK
120 minute winter	63	80	106.171	0.094	0.6	0.0067	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)
15 minute winter	43	15.000	44	1.0	0.554	0.127	0.0149
15 minute winter	44	15.001	45	1.7	0.770	0.216	0.0273
15 minute winter	45	15.002	47	1.7	0.696	0.213	0.0108
15 minute summer	46	16.000	47	1.0	0.602	0.066	0.0078
15 minute winter	47	15.003	47_OUT	3.6	1.379	0.274	0.0129
480 minute winter	47_OUT	Infiltration		0.1			
15 minute winter	48	17.000	49	1.1	0.381	0.140	0.0357
15 minute winter	49	17.001	51	4.7	1.068	0.548	0.0550
15 minute winter	50	18.000	51	1.1	0.375	0.140	0.0357
15 minute winter	51	17.002	51_OUT	6.5	1.518	0.535	0.0213
480 minute winter	51_OUT	Infiltration		0.1			
15 minute winter	52	19.000	53	0.9	0.432	0.114	0.0314
15 minute winter	53	19.001	55	2.6	0.411	0.328	0.0827
15 minute summer	54	20.000	55	0.0	0.000	0.000	0.0000
15 minute winter	55	19.002	55_OUT	3.1	0.400	0.393	0.0196
15 minute winter	55_OUT	Flow through pond	88	2.6	0.016	0.144	8.1656
15 minute winter	56	21.000	57	1.1	0.395	0.140	0.0312
15 minute winter	57	21.001	59	4.7	1.092	0.511	0.0517
15 minute winter	58	22.000	59	1.1	0.369	0.139	0.0377
15 minute winter	59	21.002	59_OUT	6.5	1.492	0.548	0.0217
480 minute winter	59_OUT	Infiltration		0.1			
15 minute winter	60	23.000	61	0.7	0.388	0.039	0.0181
15 minute winter	61	23.001	64	1.7	0.214	0.073	0.1114
15 minute winter	62	24.000	63	1.0	0.439	0.128	0.0323
120 minute winter	63	24.001	64	0.8	0.247	0.102	0.0138

Results for 30 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	64	80	106.171	0.174	1.3	0.0123	0.0000	SURCHARGED
120 minute winter	64_OUT	80	106.171	0.224	1.7	0.0159	0.0000	OK
15 minute summer	65	10	106.732	0.032	1.7	0.0023	0.0000	OK
15 minute summer	66	10	106.614	0.030	2.6	0.0021	0.0000	OK
15 minute winter	67	10	106.477	0.027	1.4	0.0019	0.0000	OK
15 minute winter	68	10	106.303	0.053	4.0	0.0037	0.0000	OK
15 minute winter	68_OUT	10	106.213	0.146	16.3	0.0104	0.0000	OK
15 minute winter	69	10	102.674	0.024	1.0	0.0017	0.0000	OK
15 minute winter	70	10	102.540	0.033	1.8	0.0023	0.0000	OK
15 minute winter	71	10	102.523	0.022	1.0	0.0016	0.0000	OK
15 minute winter	72	10	102.330	0.035	3.7	0.0025	0.0000	OK
480 minute winter	72_OUT	328	102.149	0.149	0.4	2.9918	0.0000	OK
15 minute winter	73	11	104.966	0.116	7.2	0.0082	0.0000	SURCHARGED
15 minute winter	74	11	104.866	0.126	8.5	0.0089	0.0000	SURCHARGED
15 minute winter	75	10	104.879	0.028	1.6	0.0020	0.0000	OK
15 minute winter	76	11	104.615	0.077	9.5	0.0055	0.0000	OK
240 minute winter	76_OUT	232	103.923	-0.477	1.9	9.3169	0.0000	OK
15 minute winter	77	10	102.673	0.023	0.9	0.0016	0.0000	OK
15 minute winter	78	10	102.607	0.041	2.5	0.0029	0.0000	OK
15 minute winter	79	10	102.522	0.022	0.9	0.0015	0.0000	OK
15 minute winter	80	10	102.428	0.031	3.4	0.0022	0.0000	OK
240 minute winter	80_OUT	224	102.128	0.128	0.7	2.8356	0.0000	OK
15 minute winter	81	10	102.673	0.023	0.9	0.0016	0.0000	OK
15 minute winter	82	10	102.607	0.042	2.5	0.0030	0.0000	OK
15 minute winter	83	10	102.522	0.022	0.9	0.0016	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
120 minute winter	64	23.002	64_OUT	1.7	-0.131	0.098	0.0888
120 minute winter	64_OUT	Flow through pond	88	4.0	0.019	0.217	10.6287
15 minute summer	65	25.000	66	1.7	0.651	0.096	0.0303
15 minute summer	66	25.001	68	2.6	0.669	0.085	0.0447
15 minute winter	67	26.000	68	1.4	0.861	0.143	0.0094
15 minute winter	68	25.002	68_OUT	4.0	0.766	0.223	0.0207
15 minute winter	68_OUT	Flow through pond	88	2.6	0.016	0.144	8.1656
15 minute winter	69	27.000	70	1.0	0.544	0.127	0.0157
15 minute winter	70	27.001	72	1.8	0.764	0.228	0.0295
15 minute winter	71	28.000	72	1.0	0.535	0.110	0.0174
15 minute winter	72	27.002	72_OUT	3.7	1.529	0.249	0.0120
480 minute winter	72_OUT	Infiltration		0.1			
15 minute winter	73	29.000	74	6.9	0.939	0.881	0.0509
15 minute winter	74	29.001	76	8.0	1.129	1.018	0.0857
15 minute winter	75	30.000	76	1.6	0.385	0.176	0.0578
15 minute winter	76	29.002	76_OUT	9.5	1.538	0.842	0.0247
240 minute winter	76_OUT	Infiltration		0.2			
15 minute winter	77	31.000	78	0.9	0.415	0.115	0.0110
15 minute winter	78	31.001	80	2.5	0.976	0.317	0.0257
15 minute winter	79	32.000	80	0.9	0.551	0.103	0.0083
15 minute winter	80	31.002	80_OUT	3.4	1.668	0.197	0.0102
240 minute winter	80_OUT	Infiltration		0.1			
15 minute winter	81	33.000	82	0.9	0.414	0.114	0.0110
15 minute winter	82	33.001	84	2.5	0.983	0.318	0.0242
15 minute winter	83	34.000	84	0.9	0.552	0.108	0.0083

Results for 30 year Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	84	10	102.436	0.031	3.4	0.0022	0.0000	OK
240 minute winter	84_OUT	224	102.128	0.128	0.7	2.8367	0.0000	OK
15 minute winter	85	10	96.711	0.061	12.7	0.0043	0.0000	OK
600 minute winter	85_OUT	585	95.934	-0.366	1.9	20.6305	0.0000	OK
15 minute winter	86	11	102.432	0.457	9.9	0.0000	0.0000	SURCHARGED
15 minute winter	87	11	102.432	0.466	8.6	0.0331	0.0000	SURCHARGED
30 minute winter	87_OUT	27	101.872	0.038	6.4	0.0027	0.0000	OK
120 minute winter	88	86	105.757	0.357	5.8	0.1009	0.0000	SURCHARGED
120 minute winter	89	86	105.757	0.757	5.1	0.2141	0.0000	SURCHARGED
120 minute winter	89_OUT	86	105.756	1.463	4.7	0.4141	0.0000	OK
180 minute winter	90	148	103.723	0.173	6.7	0.0490	0.0000	OK
180 minute winter	91	148	103.723	0.183	6.2	0.0518	0.0000	OK
180 minute winter	91_OUT	148	103.723	0.193	6.2	0.0547	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	84	33.002	84_OUT	3.4	1.711	0.190	0.0094
240 minute winter	84_OUT	Infiltration		0.1			
15 minute winter	85	35.000	85_OUT	12.7	1.956	0.319	0.0456
15 minute winter	85	Infiltration		0.0			
600 minute winter	85_OUT	Infiltration		0.3			
15 minute winter	86	36.000	87	8.6	0.564	0.210	0.0645
15 minute winter	86	Infiltration		0.0			
15 minute winter	87	Orifice	87_OUT	7.7			
30 minute winter	87_OUT	Flow through pond	85	2.2	0.031	0.118	3.8915
120 minute winter	88	37.000	89	5.1	0.886	0.033	0.0774
120 minute winter	88	Infiltration		0.5			
120 minute winter	89	37.001	89_OUT	4.7	0.735	0.032	0.0768
120 minute winter	89_OUT	Flow through pond	18	5.3	0.012	0.827	10.1545
180 minute winter	90	38.000	91	6.2	0.454	0.120	0.0337
180 minute winter	90	Infiltration		0.5			
180 minute winter	91	38.001	91_OUT	6.2	0.406	0.119	0.0355
180 minute winter	91_OUT	Flow through pond	21	3.6	0.011	0.225	23.9706

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	1	10	106.135	0.035	2.1	0.0025	0.0000	OK
15 minute winter	2	10	106.055	0.055	4.7	0.0039	0.0000	OK
15 minute winter	3	10	105.943	0.058	4.7	0.0041	0.0000	OK
15 minute winter	4	10	105.994	0.043	2.4	0.0031	0.0000	OK
15 minute winter	5	10	105.896	0.061	9.4	0.0044	0.0000	OK
15 minute winter	6	10	105.589	0.087	9.3	0.0062	0.0000	OK
15 minute winter	6_OUT	11	105.512	0.112	9.2	0.0080	0.0000	OK
15 minute winter	7	10	107.037	0.037	2.1	0.0026	0.0000	OK
15 minute summer	8	10	106.936	0.036	2.1	0.0026	0.0000	OK
15 minute winter	9	10	106.749	0.035	2.1	0.0025	0.0000	OK
15 minute summer	10	10	107.041	0.041	2.6	0.0029	0.0000	OK
15 minute summer	11	10	106.932	0.050	5.3	0.0035	0.0000	OK
15 minute winter	12	10	106.628	0.083	10.3	0.0059	0.0000	OK
15 minute winter	12_OUT	11	106.111	0.711	10.1	0.0505	0.0000	OK
600 minute winter	13	615	103.917	0.467	0.2	0.0332	0.0000	FLOOD RISK
600 minute winter	14	615	103.917	0.567	0.3	0.0403	0.0000	FLOOD RISK
600 minute winter	15	615	103.917	0.692	0.3	0.0491	0.0000	FLOOD RISK
600 minute winter	16	615	103.917	0.517	0.2	0.0367	0.0000	FLOOD RISK
600 minute winter	17	615	103.917	0.817	0.5	0.0580	0.0000	FLOOD RISK
600 minute winter	18	600	103.918	0.818	10.0	0.0581	0.0000	FLOOD RISK
600 minute winter	19	615	103.917	0.965	9.9	0.0685	0.0000	FLOOD RISK
600 minute winter	20	615	103.917	0.981	9.8	0.0697	0.0000	FLOOD RISK
360 minute winter	21	344	104.084	1.109	6.9	0.1763	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)
15 minute winter	1	1.000	2	2.1	0.478	0.118	0.0444
15 minute winter	2	1.001	3	4.7	0.778	0.265	0.0695
15 minute winter	3	1.002	5	4.7	0.716	0.264	0.0327
15 minute winter	4	2.000	5	2.4	0.767	0.348	0.0156
15 minute winter	5	1.003	6	9.3	1.073	0.352	0.1307
15 minute winter	6	1.004	6_OUT	9.2	0.939	0.521	0.0345
15 minute winter	6_OUT	Flow through pond	90	7.3	0.034	0.301	11.4500
15 minute winter	7	3.000	8	2.1	0.805	0.267	0.0156
15 minute summer	8	3.001	9	2.1	0.837	0.267	0.0276
15 minute winter	9	3.002	12	2.1	0.446	0.264	0.0470
15 minute summer	10	4.000	11	2.6	0.753	0.331	0.0242
15 minute summer	11	4.001	12	5.3	1.002	0.498	0.0597
15 minute winter	12	3.003	12_OUT	10.1	1.509	0.933	0.0939
15 minute winter	12_OUT	Flow through pond	90	7.3	0.034	0.301	11.4500
600 minute winter	13	5.000	14	0.2	0.289	0.011	0.1760
600 minute winter	14	5.001	15	0.3	0.334	0.016	0.2200
600 minute winter	15	5.002	17	0.2	0.325	0.011	0.0880
600 minute winter	16	6.000	17	0.2	0.420	0.026	0.0391
600 minute winter	17	5.003	19	0.5	0.086	0.007	0.3498
600 minute winter	18	7.000	19	9.9	1.270	1.242	0.0103
600 minute winter	18	Infiltration		0.1			
600 minute winter	19	5.004	20	9.8	0.327	0.189	0.0640
600 minute winter	20	5.005	24	9.7	0.245	0.242	0.0398
360 minute winter	21	8.000	22	2.6	0.126	0.063	0.0568
360 minute winter	21	Infiltration		0.2			

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	22	344	104.084	1.117	2.6	0.0793	0.0000	FLOOD RISK
600 minute winter	23	615	103.917	0.962	1.9	0.0683	0.0000	FLOOD RISK
600 minute winter	24	615	103.917	0.987	12.7	0.0000	0.0000	FLOOD RISK
600 minute winter	24_OUT	615	103.917	0.993	12.7	148.1972	0.0000	OK
15 minute winter	25	10	104.682	0.032	1.8	0.0023	0.0000	OK
15 minute winter	26	10	104.631	0.061	5.6	0.0043	0.0000	OK
15 minute summer	27	10	104.537	0.067	7.4	0.0048	0.0000	OK
15 minute winter	28	10	104.735	0.035	2.0	0.0025	0.0000	OK
15 minute winter	29	10	104.629	0.054	4.0	0.0038	0.0000	OK
120 minute winter	30	84	104.509	0.163	3.4	0.0116	0.0000	SURCHARGED
120 minute winter	30_OUT	84	104.508	0.222	3.3	0.0158	0.0000	OK
15 minute winter	31	10	105.632	0.032	1.8	0.0023	0.0000	OK
15 minute winter	32	10	105.581	0.061	5.6	0.0043	0.0000	OK
15 minute winter	33	13	105.487	0.070	7.4	0.0050	0.0000	OK
15 minute winter	34	13	105.492	0.142	2.0	0.0101	0.0000	SURCHARGED
15 minute winter	35	13	105.492	0.268	4.0	0.0191	0.0000	SURCHARGED
15 minute winter	36	13	105.487	0.459	11.0	0.0326	0.0000	SURCHARGED
15 minute winter	36_OUT	13	105.483	1.190	7.9	0.0845	0.0000	OK
15 minute winter	37	12	104.061	0.711	13.3	0.0505	0.0000	FLOOD RISK
15 minute winter	38	12	103.841	0.617	10.4	0.0438	0.0000	SURCHARGED
15 minute winter	39	12	103.536	0.507	10.9	0.0360	0.0000	SURCHARGED
15 minute summer	40	10	103.393	0.043	2.7	0.0030	0.0000	OK
15 minute winter	41	10	103.208	0.035	2.7	0.0025	0.0000	OK
15 minute winter	42	12	103.171	0.315	14.0	0.0223	0.0000	SURCHARGED
360 minute winter	42_OUT	352	102.833	0.060	3.0	21.7113	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
360 minute winter	22	Orifice	23	2.1			
600 minute winter	23	8.002	24	1.9	0.406	0.047	0.0398
600 minute winter	24	5.006	24_OUT	12.7	0.510	0.320	0.0410
600 minute winter	24_OUT	Infiltration		1.7			
15 minute winter	25	9.000	26	1.8	0.387	0.101	0.0379
15 minute winter	26	9.001	27	5.6	0.780	0.315	0.0718
15 minute summer	27	9.002	30	7.4	0.716	0.418	0.1279
15 minute winter	28	10.000	29	2.0	0.605	0.256	0.0250
15 minute winter	29	10.001	30	4.0	0.968	0.511	0.0355
120 minute winter	30	9.003	30_OUT	3.3	0.480	0.185	0.1056
120 minute winter	30_OUT	Flow through pond	18	9.1	0.012	1.401	15.9532
15 minute winter	31	11.000	32	1.8	0.386	0.101	0.0380
15 minute winter	32	11.001	33	5.6	0.908	0.315	0.0635
15 minute winter	33	11.002	36	7.4	1.167	0.271	0.1588
15 minute winter	34	12.000	35	2.0	0.626	0.254	0.0587
15 minute winter	35	12.001	36	3.9	0.899	0.494	0.0673
15 minute winter	36	11.003	36_OUT	7.9	1.082	0.345	0.0688
15 minute winter	36_OUT	Flow through pond	18	8.3	0.012	1.280	14.6268
15 minute winter	37	13.000	38	10.4	1.333	1.328	0.0587
15 minute winter	38	13.001	39	8.9	1.138	1.133	0.0907
15 minute winter	39	13.002	42	10.4	1.329	1.322	0.0803
15 minute summer	40	14.000	41	2.7	0.955	0.343	0.0297
15 minute winter	41	14.001	42	2.7	0.443	0.267	0.0592
15 minute winter	42	13.003	42_OUT	13.7	1.756	1.743	0.0380
360 minute winter	42_OUT	Infiltration		0.3			

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	43	232	102.807	0.157	0.4	0.0111	0.0000	SURCHARGED
240 minute winter	44	232	102.807	0.296	0.7	0.0210	0.0000	SURCHARGED
240 minute winter	45	232	102.807	0.504	0.7	0.0358	0.0000	SURCHARGED
240 minute winter	46	232	102.807	0.307	0.4	0.0218	0.0000	SURCHARGED
240 minute winter	47	232	102.807	0.579	1.4	0.0411	0.0000	SURCHARGED
240 minute winter	47_OUT	232	102.807	0.807	1.4	4.8316	0.0000	OK
15 minute winter	48	10	102.887	0.037	2.3	0.0026	0.0000	OK
360 minute winter	49	344	102.874	0.226	1.3	0.0161	0.0000	SURCHARGED
360 minute winter	50	344	102.874	0.274	0.3	0.0195	0.0000	SURCHARGED
360 minute winter	51	344	102.874	0.476	1.8	0.0338	0.0000	SURCHARGED
360 minute winter	51_OUT	344	102.874	0.674	1.8	11.2318	0.0000	OK
15 minute winter	52	12	106.523	0.073	1.8	0.0052	0.0000	OK
15 minute winter	53	12	106.519	0.275	5.2	0.0195	0.0000	SURCHARGED
15 minute winter	54	13	106.486	0.036	0.4	0.0025	0.0000	OK
15 minute winter	55	13	106.485	0.474	6.3	0.0336	0.0000	SURCHARGED
15 minute winter	55_OUT	13	106.469	0.501	4.8	0.0355	0.0000	OK
360 minute winter	56	344	102.891	0.041	0.3	0.0029	0.0000	OK
360 minute winter	57	344	102.891	0.226	1.3	0.0160	0.0000	SURCHARGED
360 minute winter	58	344	102.890	0.290	0.3	0.0206	0.0000	SURCHARGED
360 minute winter	59	344	102.891	0.501	1.8	0.0356	0.0000	SURCHARGED
360 minute winter	59_OUT	344	102.890	0.690	1.8	11.2318	0.0000	OK
15 minute winter	60	10	106.329	0.028	1.4	0.0020	0.0000	OK
30 minute winter	61	24	106.290	0.090	2.5	0.0064	0.0000	OK
30 minute winter	62	24	106.292	0.042	1.5	0.0030	0.0000	OK
30 minute winter	63	24	106.291	0.214	3.1	0.0152	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
240 minute winter	43	15.000	44	0.4	0.428	0.051	0.0646
240 minute winter	44	15.001	45	0.7	0.615	0.089	0.0968
240 minute winter	45	15.002	47	0.7	0.572	0.089	0.0346
240 minute winter	46	16.000	47	0.4	0.464	0.026	0.0346
240 minute winter	47	15.003	47_OUT	1.4	0.951	0.108	0.0391
240 minute winter	47_OUT	Infiltration		0.1			
15 minute winter	48	17.000	49	2.3	0.413	0.292	0.0628
360 minute winter	49	17.001	51	1.3	0.783	0.152	0.0978
360 minute winter	50	18.000	51	0.3	0.279	0.038	0.0939
360 minute winter	51	17.002	51_OUT	1.8	1.030	0.149	0.0391
360 minute winter	51_OUT	Infiltration		0.2			
15 minute winter	52	19.000	53	1.8	0.444	0.229	0.0853
15 minute winter	53	19.001	55	3.6	0.455	0.454	0.1084
15 minute winter	54	20.000	55	-0.4	-0.070	-0.047	0.0381
15 minute winter	55	19.002	55_OUT	4.8	0.615	0.605	0.0196
15 minute winter	55_OUT	Flow through pond	88	11.5	0.027	0.629	22.2382
360 minute winter	56	21.000	57	0.3	0.292	0.038	0.0594
360 minute winter	57	21.001	59	1.3	0.801	0.141	0.0939
360 minute winter	58	22.000	59	0.3	0.275	0.038	0.0978
360 minute winter	59	21.002	59_OUT	1.8	1.030	0.152	0.0391
360 minute winter	59_OUT	Infiltration		0.2			
15 minute winter	60	23.000	61	1.4	0.481	0.079	0.0449
30 minute winter	61	23.001	64	2.4	0.199	0.106	0.1719
30 minute winter	62	24.000	63	1.5	0.449	0.189	0.0567
30 minute winter	63	24.001	64	2.5	0.413	0.316	0.0140

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
30 minute winter	64	24	106.290	0.293	4.9	0.0208	0.0000	SURCHARGED
30 minute winter	64_OUT	24	106.289	0.342	4.3	0.0243	0.0000	OK
15 minute summer	65	10	106.746	0.046	3.4	0.0033	0.0000	OK
15 minute winter	66	10	106.625	0.041	5.1	0.0029	0.0000	OK
15 minute winter	67	10	106.488	0.038	2.7	0.0027	0.0000	OK
15 minute winter	68	10	106.332	0.082	7.8	0.0058	0.0000	OK
15 minute winter	68_OUT	11	106.306	0.239	32.2	0.0170	0.0000	OK
240 minute winter	69	232	102.942	0.292	0.4	0.0208	0.0000	SURCHARGED
240 minute winter	70	232	102.942	0.435	0.7	0.0309	0.0000	SURCHARGED
240 minute winter	71	232	102.942	0.442	0.6	0.0314	0.0000	SURCHARGED
240 minute winter	72	232	102.942	0.647	1.4	0.0460	0.0000	SURCHARGED
240 minute winter	72_OUT	232	102.942	0.942	1.4	4.8316	0.0000	OK
15 minute winter	73	11	105.702	0.852	14.4	0.0605	0.0000	FLOOD RISK
15 minute winter	74	12	105.438	0.697	14.2	0.0495	0.0000	SURCHARGED
15 minute winter	75	10	104.892	0.042	3.3	0.0030	0.0000	OK
15 minute winter	76	12	104.800	0.262	15.3	0.0186	0.0000	SURCHARGED
480 minute winter	76_OUT	464	104.435	0.035	2.3	21.7620	0.0000	OK
240 minute winter	77	232	102.829	0.179	0.3	0.0127	0.0000	SURCHARGED
240 minute winter	78	232	102.829	0.263	0.9	0.0187	0.0000	SURCHARGED
240 minute winter	79	232	102.829	0.329	0.3	0.0234	0.0000	SURCHARGED
240 minute winter	80	232	102.829	0.432	1.2	0.0307	0.0000	SURCHARGED
240 minute winter	80_OUT	232	102.829	0.829	1.2	4.8316	0.0000	OK
240 minute winter	81	232	102.833	0.183	0.3	0.0130	0.0000	SURCHARGED
240 minute winter	82	232	102.833	0.268	0.9	0.0190	0.0000	SURCHARGED
240 minute winter	83	232	102.833	0.333	0.4	0.0236	0.0000	SURCHARGED

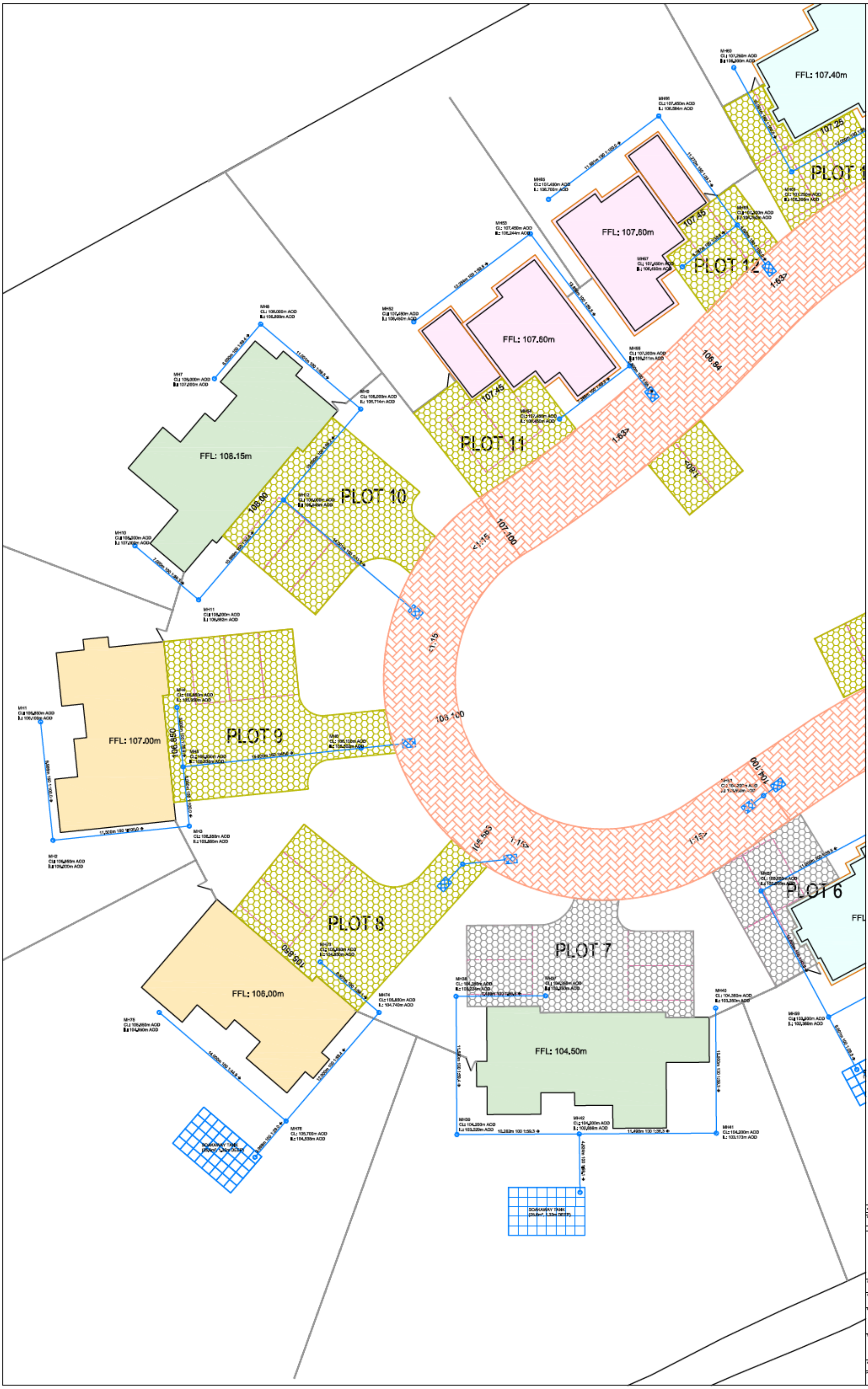
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)
30 minute winter	64	23.002	64_OUT	4.3	-0.389	0.242	0.0888
30 minute winter	64_OUT	Flow through pond	88	13.2	0.028	0.720	26.9415
15 minute summer	65	25.000	66	3.4	0.794	0.192	0.0497
15 minute winter	66	25.001	68	5.1	0.771	0.166	0.0777
15 minute winter	67	26.000	68	2.7	1.025	0.276	0.0152
15 minute winter	68	25.002	68_OUT	7.8	0.832	0.437	0.0431
15 minute winter	68_OUT	Flow through pond	88	11.5	0.027	0.629	22.2382
240 minute winter	69	27.000	70	0.4	0.437	0.051	0.0665
240 minute winter	70	27.001	72	0.7	0.609	0.090	0.0984
240 minute winter	71	28.000	72	0.4	0.432	0.044	0.0721
240 minute winter	72	27.002	72_OUT	1.4	1.044	0.095	0.0391
240 minute winter	72_OUT	Infiltration		0.1			
15 minute winter	73	29.000	74	11.2	1.433	1.423	0.0509
15 minute winter	74	29.001	76	12.7	1.620	1.612	0.0939
15 minute winter	75	30.000	76	3.3	0.518	0.364	0.0765
15 minute winter	76	29.002	76_OUT	15.0	1.921	1.330	0.0313
480 minute winter	76_OUT	Infiltration		0.3			
240 minute winter	77	31.000	78	0.3	0.312	0.038	0.0391
240 minute winter	78	31.001	80	0.9	0.749	0.114	0.0782
240 minute winter	79	32.000	80	0.3	0.409	0.034	0.0391
240 minute winter	80	31.002	80_OUT	1.2	1.192	0.070	0.0391
240 minute winter	80_OUT	Infiltration		0.1			
240 minute winter	81	33.000	82	0.3	0.311	0.038	0.0391
240 minute winter	82	33.001	84	0.9	0.755	0.114	0.0743
240 minute winter	83	34.000	84	0.3	0.410	0.036	0.0391

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 96.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	84	232	102.833	0.428	1.2	0.0304	0.0000	SURCHARGED
240 minute winter	84_OUT	232	102.833	0.833	1.2	4.8316	0.0000	OK
480 minute winter	85	472	97.408	0.758	4.7	0.0538	0.0000	FLOOD RISK
480 minute winter	85_OUT	472	97.408	1.108	4.7	36.1289	0.0000	OK
15 minute winter	86	12	103.067	1.092	19.7	0.8790	0.0000	FLOOD RISK
15 minute winter	87	12	103.065	1.099	14.3	0.0781	0.0000	FLOOD RISK
30 minute winter	87_OUT	27	101.901	0.067	11.3	0.0048	0.0000	OK
120 minute winter	88	98	106.186	0.786	15.7	0.2224	0.0000	FLOOD RISK
120 minute winter	89	98	106.186	1.185	6.4	0.3355	0.0000	FLOOD RISK
120 minute winter	89_OUT	98	106.185	1.892	5.8	0.5355	0.0000	OK
360 minute winter	90	344	104.084	0.534	9.3	0.1511	0.0000	FLOOD RISK
360 minute winter	91	344	104.084	0.544	5.5	0.1539	0.0000	FLOOD RISK
360 minute winter	91_OUT	344	104.084	0.554	5.4	0.1567	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
240 minute winter	84	33.002	84_OUT	1.2	1.223	0.067	0.0371
240 minute winter	84_OUT	Infiltration		0.1			
480 minute winter	85	35.000	85_OUT	4.7	1.496	0.118	0.1232
480 minute winter	85	Infiltration		0.2			
480 minute winter	85_OUT	Infiltration		0.4			
15 minute winter	86	36.000	87	14.3	0.481	0.350	0.0645
15 minute winter	86	Infiltration		0.0			
15 minute winter	87	Orifice	87_OUT	12.1			
30 minute winter	87_OUT	Flow through pond	85	5.6	0.045	0.299	6.8678
120 minute winter	88	37.000	89	6.4	0.906	0.041	0.0774
120 minute winter	88	Infiltration		0.5			
120 minute winter	89	37.001	89_OUT	5.8	0.737	0.040	0.0768
120 minute winter	89_OUT	Flow through pond	18	9.1	0.012	1.401	15.9532
360 minute winter	90	38.000	91	5.5	0.419	0.106	0.0398
360 minute winter	90	Infiltration		0.5			
360 minute winter	91	38.001	91_OUT	5.4	0.412	0.104	0.0398
360 minute winter	91_OUT	Flow through pond	21	3.4	0.010	0.214	54.8331

Appendix: I – SuDS Drainage Strategy Drawing



KEY

▨	PERMEABLE PAVING WITH MIN. 300mm SUB-BASE, DISCHARGING TO THE POND
▨	PERMEABLE PAVING WITH MIN. 300mm SUB-BASE, DISCHARGING TO A SOAKAWAY TANK
⬡	HARDSTANDING AREA FLOWING ONTO THE PERMEABLE PAVING
⬡	HARDSTANDING AREA TO BE DRAINED BY A PIPED NETWORK
▦	PROPOSED SOAKAWAY STORAGE TANK
—	SURFACE WATER PIPE NETWORK
▭	STORAGE POND (DEPTH: 1.15m; TOP OF POND: 210m²; BASE OF POND: 58m²)
○	SURFACE WATER MANHOLE
⊠	PERMAVOID DIFFUSER UNIT
•	RAINWATER DOWNPIPE
●	ORIFICE PLATE WITH SUITABLE FILTER TO RESTRICT RUNOFF RATES
◡	HEADWALL

FOR PLANNING

EAS

BRD TECH

GRANGE PADDOCKS, ICKLETON ROAD
ELMDON

SuDS DRAINAGE STRATEGY
SHEET 1 OF 3

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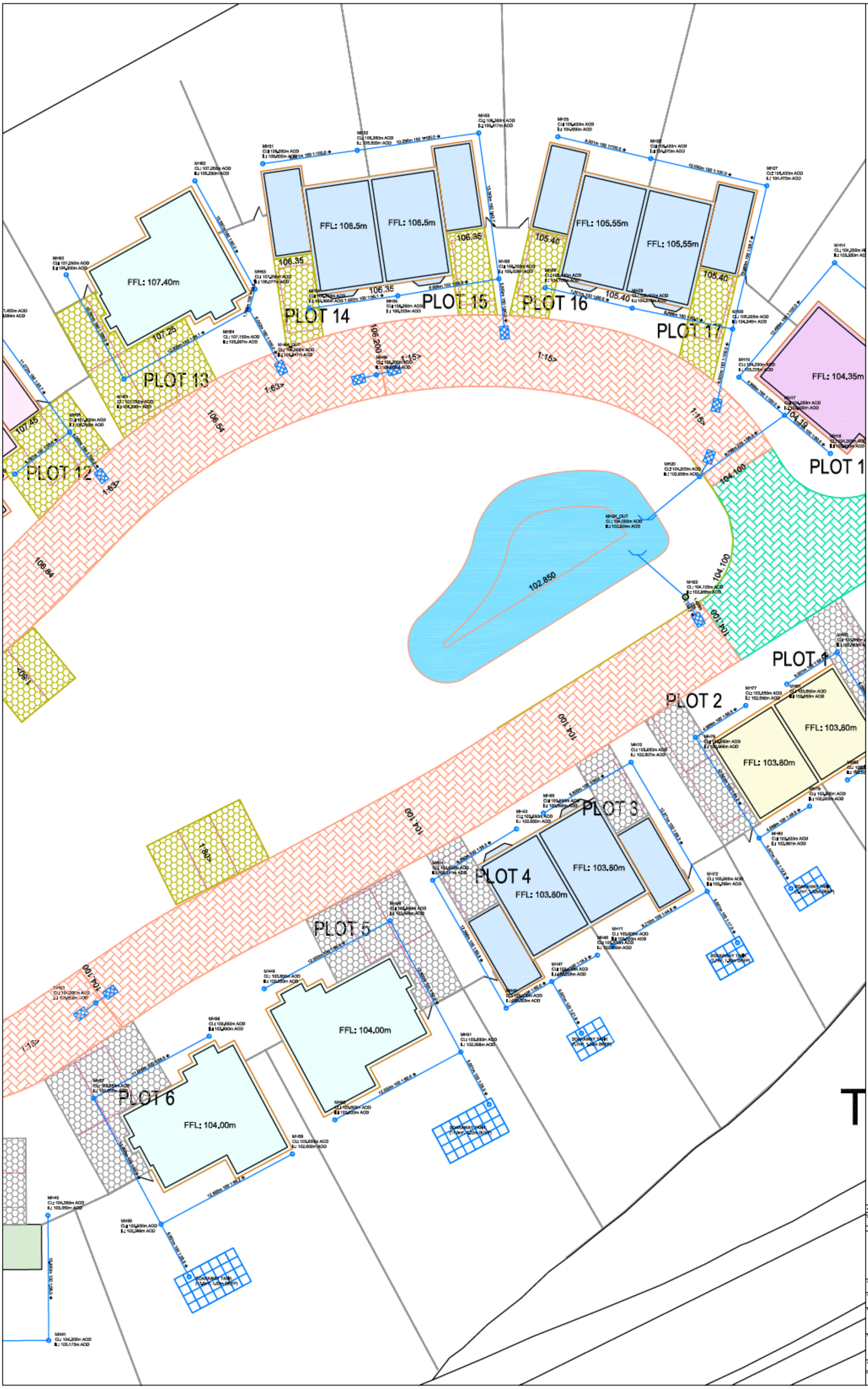

KEY

▨	PERMEABLE PAVING WITH MIN. 350mm SUB-BASE, DISCHARGING TO THE POND
▨	PERMEABLE PAVING WITH MIN. 350mm SUB-BASE, DISCHARGING TO A SOAKAWAY TANK
▨	HARDSTANDING AREA FLOWING ONTO THE PERMEABLE PAVING
▨	HARDSTANDING AREA TO BE DRAINED BY A PIPED NETWORK
▦	PROPOSED SOAKAWAY STORAGE TANK
—	SURFACE WATER PIPE NETWORK
▭	STORAGE POND (DEPTH: 1.15m; TOP OF POND: 210m²; BASE OF POND: 58m²)
○	SURFACE WATER MANHOLE
▩	PERMAVOID DIFFUSER UNIT
•	RAINWATER DOWNPIPE
●	ORIFICE PLATE WITH SUITABLE FILTER TO RESTRICT RUNOFF RATES
⌣	HEADWALL

FOR PLANNING

EAS

SRD TECH

GRANGE PADDOCKS, ICKLETON ROAD
ELMDON

SuDS DRAINAGE STRATEGY
SHEET 2 OF 3

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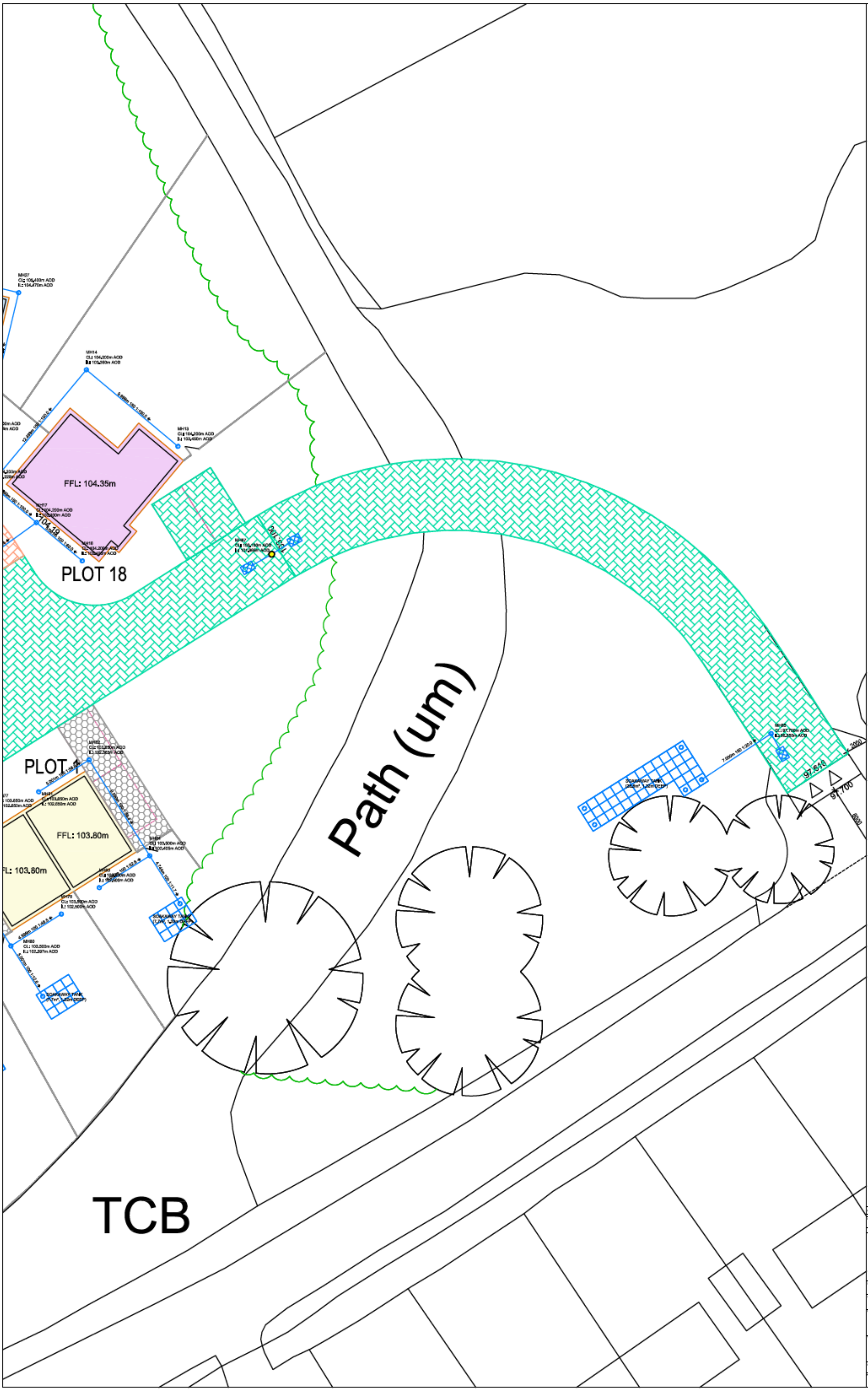

KEY

▨	PERMEABLE PAVING WITH MIN. 300mm SUB-BASE, DISCHARGING TO THE POND
▨	PERMEABLE PAVING WITH MIN. 300mm SUB-BASE, DISCHARGING TO A SOAKAWAY TANK
▨	HARDSTANDING AREA FLOWING ONTO THE PERMEABLE PAVING
▨	HARDSTANDING AREA TO BE DRAINED BY A PIPED NETWORK
▦	PROPOSED SOAKAWAY STORAGE TANK
—	SURFACE WATER PIPE NETWORK
▭	STORAGE POND (DEPTH: 1.15m; TOP OF POND: 210m²; BASE OF POND: 58m²)
○	SURFACE WATER MANHOLE
▩	PERMAVOID DIFFUSER UNIT
•	RAINWATER DOWNPIPE
●	ORIFICE PLATE WITH SUITABLE FILTER TO RESTRICT RUNOFF RATES
◡	HEADWALL

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SuDS DRAINAGE STRATEGY
SHEET 3 OF 3

3304

SK08

Appendix: J – Essex CC SuDS Proforma

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Introduction

This proforma identifies the information required by Essex LLFA to enable technical assessment the Designers approach to water quantity and water quality as part of SuDS design approach in compliance with Essex SuDS Design Guide.

Completion of the proforma will also allow for technical assessment against Non-statutory technical standards (NSTS) for Sustainable Drainage. The proforma will accompany the site specific Flood Risk Assessment and Drainage Strategy submitted as part of the planning application.

Please complete this form in full for full applications and the coloured sections for outline appllications. This will help us identify what information has been included and will assist with a smoother and quicker application.

Instructions for use

Use the units defined for input of figures.

Numbers in brackets refer to accompanying notes.

Where ………m^3 ....m^3/m^2 *are noted – both values should be filled in.*

Site details

1.1 Planning application reference (if known) Unknown

1.2 Site name Grange Paddock, Ickelton Road

1.3 Total application site area (1) TBD ha

1.4 Predevelopment use (4) Greenfield

1.5 Post development use Residential

If other, please sepcify

1.6 Urban creep applicable Yes if yes, factor applied:

1.7 Proposed design life / planning application life 100

1.8 Method(s) of discharge: (5)

☐ *Reuse* ☑ *Infiltration* ☐ *Hybrid* ☐ *Waterbody* ☐ *Storm sewer* ☐ *Combined sewer*

1.9 Is discharge <u>direct</u> to estuary / sea No

1.10 Have agreements in principle (where applicable) for discharge been provided No

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment

Calculation Inputs

2.1 Area within site which is drained by SuDS (2) 5230 m^2

2.2 Impermeable area drained pre development (3) 0 m^2

2.3 Impermeable area drained post development (3) 5230 m^2

2.4 Additional impermeable area (2.3 minus 2.2) 5230 m^2

2.5 Method for assessing greenfield runoff rate N/A

2.6 Method for assessing brownfield runoff rate N/A

2.7 Coefficient of runoff (Cv) (6) 0.6

2.8 Source of rainfall data (FEH Preferred) FEH

2.9 Climate change factor applied 40 %

<u>Attenuation (positive outlet)</u>

2.10 Drainage outlet at risk of drowning (tidal locking, elevated water levels in watercourse/sewer)
Note: Vortex controls require conditions of free discharge to operate as per manufacturers specification.

2.11 Invert level at final outlet mAOD

2.12 Design level used for surcharge water level at point of discharge (16) mAOD

<u>Infiltration (Discharge to Ground)</u>

2.13 Have infiltration tests been undertaken Yes

2.14 If yes, which method has been used BRE 365

2.15 Infiltration rate (where applicable) 1.16e-5 m/s

2.16 Depth to highest known ground water table mAOD

2.17 If there are multiple infiltration features please specify where they can be found in the FRA

2.18 Depth of infiltration feature mAOD

2.19 Factor of safety used for sizing infiltration storage

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Calculation outputs

Sections 3 and 4 refer to site where storage is provided by full attenuation or partial infiltration. Where all flows are infiltrated to ground go straight to Section 6.

3.0 Greenfield runoff rates (incl. Urban Creep)

3.1 1 in 1 year rainfall N/A l/s/ha, l/s for the site

3.2 1 in 30 year rainfall N/A l/s/ha, l/s for the site

3.3 1 in 100 year rainfall + CCA N/A l/s/ha, l/s for the site

4.0 Brownfield runoff rates (incl. Urban Creep)

4.1 1 in 1 year rainfall N/A l/s/ha, l/s for the site

4.2 1 in 30 year rainfall N/A l/s/ha, l/s for the site

4.3 1 in 100 year rainfall + CCA N/A l/s/ha, l/s for the site

5.0 Proposed maximum rate of runoff from site (incl. Urban Creep) (7)

5.1 1 in 1 year rainfall N/A l/s/ha, N/A l/s for the site

5.2 1 in 30 year rainfall N/A l/s/ha, N/A l/s for the site

5.3 1 in 100 year rainfall + CCA N/A l/s/ha, N/A l/s for the site

6.0 Attenuation storage to manage flow rates from site (incl. Climate Change Allowance (CCA) and Urban Creep)

6.1 Storage - 1 in 100 year + CCA (9) m^3 m^3/m^2

6.2 50% storage drain down time 1 in 30 years hours

7.0 Controlling volume of runoff from the site(10)

7.1 Pre development runoff volume(12) (development area) m^3 for the site

7.2 Post development runoff volume (unmitigated) (12) m^3 for the site

7.3 Volume to be controlled (5.2 - 5.1) m^3 for the site

7.4 Volume control provided by:

- Interception losses(13) m^3
- Rain harvesting (14) m^3
- Infiltration m^3
- Attenuation m^3
- Separate volume designated as long term storage(15) m^3

7.5 Total volume control (sum of inputs for 5.4) m^3 (17)

8.0 Site storage volumes (full infiltration only)

8.1 Storage - 1in 30 year + CCA (8) m^3 m^3/m^2 (of developed impermeable area)

8.2 Storage - 1 in 100 year + CCA (11) m^3 m^3/m^2

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Design Inputs

Proposed site use Residential and Low frequency roads

Pollution hazard category (see C753 Table 26.2) Low

High risk area defined as area storing fuels chemicals, refuelling area, washdown area, loading bay.

Design Outputs

List order of SuDS techniques proposed for treatment Permeable Paving, infiltration pond, smart sponges

Note that gully pots, pipes and tanks are not accepted by Essex LLFA as a form of treatment (for justification see C753 Section 4.1, Table 26.15 and Box B.2)

Are very high pollution risk areas drained separate from SuDS to foul system No

Other

Please include any other information that is relevant to your application

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Notes

1. All area with the proposed application site boundary to be included.
2. The site area which is positively drained includes all green areas which drain to the SuDS system and area of surface SuDS features. It excludes large open green spaces which do not drain to the SuDS system.
3. Impermeable area should be measured pre and post development. Impermeable surfaces include, roofs, pavements, driveways and paths where runoff is conveyed to the drainage system.
4. Predevelopment use may impact on the allowable discharge rate. The LLFA will seek for reduction in flow rates to GF (Essex SuDS Design Guide).
5. Runoff may be discharge via one or more methods.
6. Sewers for Adoption 6th Edition recommends a Cv of 100% when designing drainage for impermeable area (assumes no loss of runoff from impermeable surfaces) and 0% for permeable areas. Where lower Cv's are used the applicant should justify the selection of Cv.
7. It is Essex County Council's preference that discharge rates for all events up to the 1 in 100 year event plus climate change are limited to the 1 in 1 greenfield rate. This is also considered to mitigate the increased runoff volumes that occur with the introduction of impermeable surfaces. If discharge rates are limited to a range of matched greenfield flows then it is necessary to provide additional mitigation of increased runoff volumes by the provision of Long-term Storage.
8. Storage for the 1 in 30 year must be fully contained within the SuDS components. Note that standing water within SuDS components such as ponds, basins and swales is not classified as flooding. Storage should be calculated for the critical duration rainfall event.
9. Runoff generated from rainfall events up to the 1 in 100 year will not be allowed to leave the site in an uncontrolled way. Temporary flooding of designated areas to shallow depths and velocities may be acceptable.
10. The following information should only be provided if increased runoff volumes are not mitigated by limiting all discharge rates back to the greenfield 1 in 1 year rate.
11. Climate change is specified as 40% increase to rainfall intensity, unless otherwise agreed with the LLFA / EA.
12. To be determined using the 100 year return period 6 hour duration winter rainfall event.
13. Where Source Control is provided Interception losses will occur. An allowance of 5mm rainfall depth can be subtracted from the net inflow to the storage calculation where interception losses are demonstrated. The Applicant should demonstrate use of subcatchments and source control techniques. Further information is available in the SuDS Design Guide.
14. Please refer to Rain harvesting BS for guidance on available storage.
15. Flows within long term storage areas should be infiltrated to the ground or discharged at low flow rate of maximum 2 l/s/ha.
16. Careful consideration should be used for calculations where flow control / storage is likely to be influenced by surcharged sewer or peak levels within a watercourse. Outlets can be tidally locked where discharge is direct to estuary or sea. Calculations should demonstrate that risk of downed outlet has been taken into consideration. Vortex controls require conditions of free discharge to operate as per specification.
17. In controlling the volume of runoff the total volume from mitigation measures should be greater than or equal to the additional volume generated.