HAZELTON HOMES LTD

LAND ADJACENT CEDAR DRIVE

BOURNE

LINCOLNSHIRE

PE10 9SQ

# FLOOD RISK ASSESSMENT

DECEMBER 2021

FW2038_FRA_001 V2

## REVISION HISTORY

| Revision | Reason for Issue | Author | Checker | Approved | Date |
|---|---|---|---|---|---|
| v1 | First Issue | DM | OP | JD | 02.08.2021 |
| v2 | Drainage strategy revised to suit updated development layout | DM | OP | JD | 09.12.2021 |

## EXECUTIVE SUMMARY

1. The site is at **NO** quantifiable risk of flooding from tidal events.

2. The property is identified within the Environment Agency Flood Risk mapping as being at **Low** risk of flooding from Rivers and Seas.

3. The site is identified by the Environment Agency as having a **Low-Medium** chance of flooding from overland Surface Water.

4. The site is at a **Low** quantifiable risk of flooding from groundwater sources.

5. The site is identified by the Environment Agency as being at **NO** quantifiable risk of flooding from manmade lakes within the topographical catchment of the site.

6. The site is at a negligible risk of flooding from the existing sewerage network in the vicinity of the site.

7. The site is at a negligible risk of flooding from its own private drainage connections, however this can be mitigated by regular maintenance to ensure the ongoing performance of the system.

8. We therefore conclude that the proposed residential units are above the modelled flood level of the local watercourses and sits within Flood Zone 1 as defined in the National Planning Policy Framework February 2019 Table 1.

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## APPENDICES



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## FIGURES

# 1.0 INTRODUCTION

1.1.1 Farrow Walsh Consulting has been engaged by the applicant Hazelton Homes Ltd to produce a Flood Risk Assessment to accompany the planning application for a proposed residential development to be situated on Cedar Drive, Bourne, Lincolnshire.

1.1.2 The development proposals include for the construction of 45 new detached, semi-detached and terrace residential dwellings. A site location plan is included within Appendix A and the development proposals can be found within Appendix B.

1.1.3 This report considers the flood risk associated with a development proposal of this type and considers mitigation measures to ensure user safety.

1.1.4 The Flood Risk Assessment (FRA) report has been informed by the guidance contained within The National Planning Framework (February 2019, Department for Communities and Local Government) (NPPF).

1.1.5 Reference has been made to basic flood maps contained within the Environment Agency websites and the Environment Agency Standing Advice for Local Planning Authorities.

1.1.6 In consulting the Environment Agency website this report examines the following:

- Assessment of Flood risk and the likely sources of flooding
- Managing Residual Flood Risk
- Managing surface water
- Remedial Measures

1.1.7 This FRA examines the flood implications of the proposed development based on the following objectives, set out within the NPPF.

- Appraising risk
- Managing risk
- Reducing risk
- A partnership approach

1.1.8 This report has been prepared using the following policy and guidance documentation:

- National Planning Policy Guidance (NPPG)
- Ciria C753 – The SUDs Manual
- Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (EA - February 2016)
- Joint Lincolnshire Flood Risk and Drainage Management Strategy 2012-2025
- Non-Statutory Technical Standards 2015
- Written Ministerial Statement regarding Sustainable Drainage (HCWS161) 2014
- The Water Framework Directive (2000)
- Building Regulations Part H 2015

1.1.9 In consulting with key stakeholders and policies this report aims to assess the risk of flooding both to the site and the impact of any development on the downstream network.

1.1.10 The flood management strategy, including consideration of safe access / egress to and from the site and flood resilience measures, is based on relevant British Standards (BS8533), the standing advice provided by the Environment Agency and on best engineering judgement. The approach for the FRA is based on the requirements of the Environment Agency and Lincolnshire County Council.

1.1.11 Any comments and opinions expressed in this report, including any conclusions are based on the information available to Farrow Walsh Consulting Ltd at the time of writing. The conclusions therefore could differ if the information is found to be inaccurate, incomplete or misleading. Farrow Walsh Consulting Ltd. accepts no liability should this be proven to be the case, or, if additional information is made available with respect to this site.

## 2.0 SITE DETAILS

### 2.1 SITE LOCATION

2.1.1 The proposed development site is located to the north-eastern boundary of the market town of Bourne, Lincolnshire.

2.1.2 The site location is bounded by the adopted highway Cedar Drive to the south-east and residential properties to the south-eastern, eastern and norther eastern boundaries. The western, north-western, and south-western boundaries comprise of open agricultural fields and woodland.

2.1.3 A site location plan can be found within Appendix A.

### 2.2 SITE DESCRIPTION

2.2.1 The application site is irregular in shape and covers an area of 31,647m$^2$ or 3.165 Hectares.

2.2.2 The site is currently classified as greenfield land.

2.2.3 Access to the site is directly from the adopted highway Cedar Drive to the south-eastern boundary.

### 2.3 TOPOGRAPHY

2.3.1 The ground levels within the site boundary are recorded to OS datum as between 20.79 to 16.20mAOD and the site generally slopes in a west to east direction.

2.3.2 A copy of the topographical survey can be located within Appendix C.

### 2.4 HYDROLOGICAL CONTEXT

2.4.1 Online OS mapping indicates that there are drains and watercourses located to both the northern and southern boundaries of the site.

2.4.2 The northern watercourse to the site is unnamed and extends a further 280m to the east before entering a culvert beneath Hazelwood Drive. Its outfall, via open ditches and culverts, is deemed to be the Car Dyke Drain situated 1.5km to the east.

2.4.3 The drain to the southern boundary is unnamed and enters a culvert at the southern point of the site. Its eventual outfall point is unknown.

2.4.4 The site lies within the operation catchment of the Glens and the management catchment of the Welland.

2.4.5 The site lies within the upper reaches of the River Glen operational catchment area.

## 2.5 GEOLOGICAL CONTEXT

2.5.1 The British Geological Society (BGS) online mapping indicates that the site geology comprises of no superficial deposits across the entire development area.

2.5.2 The bedrock is identified by the British Geological Society as comprising the Kellaways Sand Member Sandstone and Siltstone (interbedded), and Kellaways Clay Member Mudstone.

2.5.3 The BGS online borehole records indicate 2no. boreholes, undertaken in April 1973, within the field of the site development. The records for boreholes TF02DE35 and TF02SE36 are in Appendix D.

2.5.4 Both borehole records extend to a depth of 3.0m and indicate firm to stiff clay with no groundwater encountered in either borehole to a reduced level of 15.87m.

2.5.5 The groundwater is deemed to follow the general topography and flow in a south-eastern direction towards the River Bourne Eau to the south of Bourne town centre.

## 2.6 GROUNDWATER VULNERABILITY

2.6.1 The bedrock stratum below the site is not classified by the Environment Agency as an aquifer.

2.6.2 In terms of vulnerability, the ground is classified as a combination of High and Unproductive.

2.6.3 The site does not lie within a Source Protection Zone.

## 2.7 EXISTING DRAINAGE

2.7.1 Anglian Water are responsible for maintaining the public sewers within the area of Bourne and the sewer records have been obtained and can be found within Appendix E.

2.7.2 The sewer records confirm an existing 150mm diameter vitrified clay foul sewer, and 300mm diameter vitrified clay storm sewer, running west to east within Cedar Drive.

2.7.3 The existing highway Cedar Drive is drained via road gullies along its length and the Lincolnshire County Council highway drain record is shown in Appendix F.

2.7.4 The site is an open grass field with no evidence of land drains beneath.

2.7.5 There are existing drains and watercourse to the fields western, southern, and northern boundaries.

2.7.6 An existing surface water ditch runs within a line of trees towards the eastern extent of the field and outfalls into the northern watercourse.

2.7.7 There exists a water source marked as Blind Well (Chalybeate) on OS mapping to the north-west of the proposed development area. The feature is described as a locally shallow damp grassy depression with no prominent issue outfall.

## 2.8 ARTIFICIAL WATER BODIES

2.8.1 There are no reservoirs or canals located within 10km of the site.

# 3.0 ASSESSMENT OF FLOOD RISK

## 3.1 FLUVIAL

3.1.1 The site lies in the River Bourne Eau catchment classified as a main river and falls under the administrative jurisdiction of the Environment Agency.

3.1.2 The Environment Agency have derived flood maps of England from which it is possible to initially identify whether a site is located within an area that is at risk of fluvial flooding. The maps, which are available on the Environment Agency's website, categorise land as being within Flood Zone 1, Flood Zone 2 or Flood Zone 3, with Flood Zone 1 being all land falling outside of the flood plain and Flood Zones 2 and 3 being all land within the floodplain. Flood Zone 3 is split into two further categories, namely Flood Zone 3a and Flood Zone 3b with Flood Zone 3b considered to be the functional floodplain.

3.1.3 The definitions of the Flood Zones extracted from the National Planning Policy Framework (NPPF) are described below:

- Flood Zone 1 – low probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 – medium probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (15 – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.
- Flood Zone 3a – high probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b – the functional floodplain. This zone comprises land where water has to flow or be stored in times of flood. Typically, land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood.

3.1.4 The extent of flooding on main rivers is indicated on the Environment Agency website and an extract from the indicative flood maps can be seen in Figure 1. The areas of dark blue identify flooding probability of 1 percent (1 in 100 year) and the light blue areas are areas of extreme flood between the 1 percent and 0.1 percent (1 in 1000 year) probability.

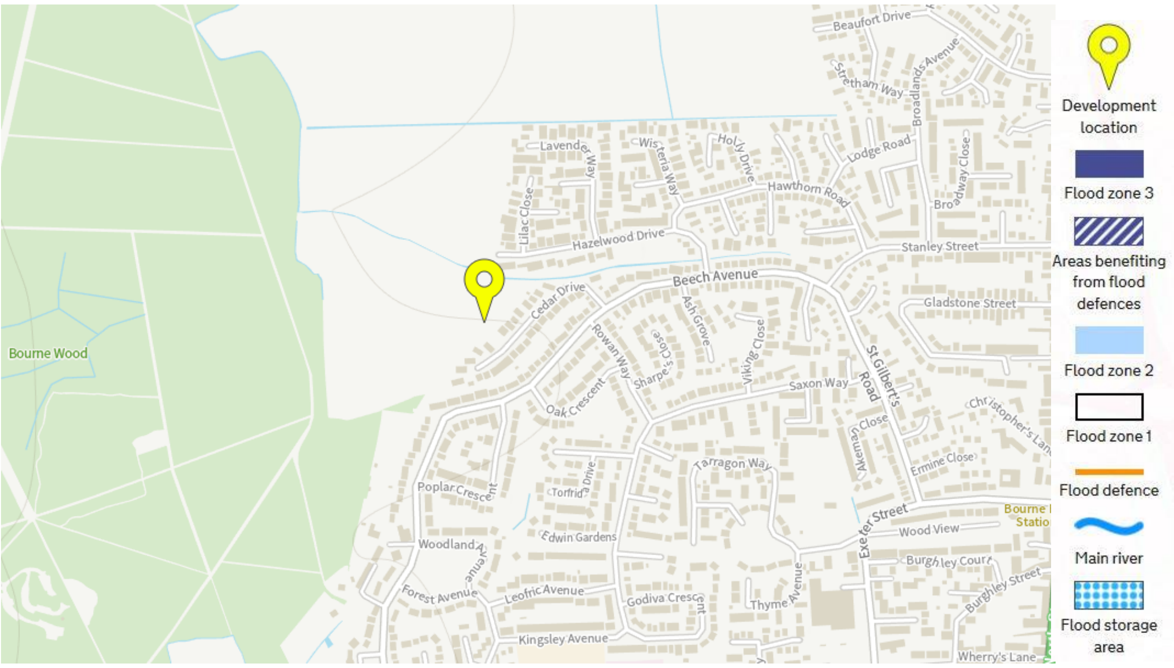



Figure 1 - Extract from EA Flood Map for Planning (December 2021)

3.1.5 The site is identified on the EA planning flood mapping that the site lies wholly within Flood Zone 1 (annual probability of flooding over 1 in 1000 years). The EA flood mapping confirmation is found in Appendix G.

3.1.6 Based on Table 1 of the NPPF the site has a Low probability of flooding due to main rivers.

3.1.7 The North Kesteven District Council and South Kesteven District Council flood investigation report, dated February 2020, does not have any record of flooding events in the vicinity of the site due to fluvial sources.

## 3.2 TIDAL OR COASTAL

3.2.1 The site has an elevational range of 20.79 to 16.20mAOD metres above sea level, as shown within the topographical survey within Appendix C.

3.2.2 The site is geographically remote from any coastline. The site lies within the Welland river basin and the catchment of the River Bourne Eau, classified by the Environment Agency as a main river, a tributary of the River Glen.

3.2.3 The site is indicated by mapping as being remote from the areas at risk of tidal flooding with the existing coastal defences intact or removed.

3.2.4 The site is therefore considered comprehensively free from risk from tidal or coastal flooding effects, being horizontally and vertically remote from such influences at present, and after consideration of climate change effects.

## 3.3 GROUNDWATER FLOODING

3.3.1 Groundwater flooding occurs as a result of rising water from underlying aquifers or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although it is increasingly being associated with localised floodplain sand and gravels.

3.3.2 The Joint Lincolnshire Flood Risk and Drainage Management Strategy classifies the site as low risk of groundwater flooding (<25%). The Joint Lincolnshire Flood Risk and Drainage Management Strategy mapping extract in shown in Appendix H.

## 3.4 ARTIFICIAL WATER BODIES FLOODING

3.4.1 There are no reservoirs or manmade lakes within the vicinity of the site.

3.4.2 The EA online mapping indicates that there are no areas within the vicinity of the site at risk of flooding from reservoirs.

3.4.3 The failure of the water mains running within Cedar Drive, to the south-east of the site, is considered statistically remote.

3.4.4 We conclude that the risk of failure of the water main is remote. It must however be noted that for a failure adjacent to the site the nature of the escape and probable pressurized column of water could itself cause some local flood damage, but this is beyond practical mitigation.

3.4.5 The North Kesteven District Council and South Kesteven District Council flood investigation report, dated February 2020, does not have any record of flooding events in the vicinity of the site due to artificial sources.

### 3.5 SURFACE WATER FLOODING

3.5.1 Surface water flooding occurs when natural and engineered systems drainage network capacity is exceeded and thus cannot accommodate the volume of rainfall / runoff. Surface water flooding occurs often in urban areas during extreme, high intensity, low duration rainfall events which overwhelm the local surface water drainage systems. In rural areas this type of flooding can occur during medium intensity, long duration events where saturated ground conditions prevent natural infiltration into the subsoils below the surface. Flood water arising from such events is then conveyed above ground following the topography of the surrounding land.

3.5.2 The site is located within the upper reaches of the overall catchment the River Bourne Eau, as on the Environment Agency catchment website. The local catchment tends North-West to South-East towards to the River Bourne Eau.

3.5.3 The Environment Agency have modelled locations along critical flow paths and area situated in topographic depressions, which could flood following an extreme rainfall event when drainage capacity has been exceeded. Figure 2 indicates the predicted surface water flood risk map taken from the Environment Agency’s website.

3.5.4 The Joint Lincolnshire Flood Risk and Drainage Management Strategy does not show any areas in the vicinity of the site to be at risk of local flooding. The mapping can be found within Appendix I.

3.5.5 The majority of site is considered to be at very low to low risk from overland flows by the EA, with an area along the northern boundary watercourse, noted to be medium to high risk. Interrogating the topographical survey and flood mapping further would suggest that the rear residential gardens to the south-eastern boundary of the site are at low risk of flooding. It is noted that the existing drain present to the south of the site does not collect, or intercept, the surface water flows towards the residential properties.


Figure 2 - Extract from EA Mapping Risk of Surface Water Flooding (December 2021)

## 3.6 EXISTING SEWER FLOODING

3.6.1 The sewer network surrounding the development is owned and maintained by Anglian Water. A copy of the sewer records for the area can be found within Appendix E.

3.6.2 These records indicate a 150mm diameter vitrified clay sewer foul surface water and 300mm diameter vitrified clay storm sewers running outside the south-eastern boundary of the site within Cedar Drive.

3.6.3 Generally, due to the site levels and those of the surrounding areas it is considered that any breach of the sewers would follow the natural topography and flow East along Cedar Drive and away from the site.

3.6.4 The site is also not recorded as a critical drainage area by South Kesteven District Council.

3.6.5 The North Kesteven District Council and South Kesteven District Council flood investigation report, dated February 2020, records a single residential flood incident occurring in June 2016 in Beech Avenue. The incident is 400m remote from the development site and was due to 'Inadequate drainage system capacity'. Due to the age, nature, and distance of this localised flooding event it is deemed to have no influence on the development drainage proposals.

3.6.6 It should be noted that the sewerage systems are design to accommodate the 1 in 30 year storm events and thus for storm events above this probability may cause flooding from sewers to occur.

# 4.0 PROPOSED DEVELOPMENT

## 4.1 DEVELOPMENT PROPOSALS

4.1.1 The development proposal include for construction of 45 new detached, semi-detached and terrace residential dwellings. A site location plan is included within Appendix A and the development proposals can be found within Appendix B.

4.1.2 Since the site is located within flood zone 1 and potential flood water will not reach the site, the finished floor levels for each block will be set at a minimum of 300mm above the existing recorded topographical survey levels.

4.1.3 All plots shall be a minimum 150mm above the final ground levels to ensure that overland flows do not enter the properties.

4.1.4 The current use of the application site is classed as greenfield use, with no existing private drainage network evident.

4.1.5 In accordance with Table 3 of NPPG (2019), a residential land use has a flood vulnerability classification of 'more vulnerable'.

# 5.0 SURFACE WATER MANAGEMENT

## 5.1 FLOOD RISK FROM THE DEVELOPMENT

5.1.1 In accordance with NPPG site specific flood risk assessments should consider and assess how runoff from the development will be managed and whether it will increase flood risk elsewhere.

5.1.2 The primary flood risk generated by the new development is likely to be the risk posed by overland surface water flooding due to exceedance of the existing drainage network.

## 5.2 EXISTING SURFACE WATER DISCHARGE

5.2.1 There is no evidence of existing private drainage on the site.

5.2.2 The existing site is classified as greenfield.

5.2.3 Existing greenfield runoff rates have been calculated, using the FEH Statistical Method, for the permeable area of 1.805ha and can be found within Appendix J. They are also summarised below.

- $Q_{BAR}$ = 4.67 l/s
- $Q_{30,GR}$ = 11.45 l/s
- $Q_{100,GR}$ = 16.63 l/s

## 5.3 CLIMATE CHANGE

5.3.1 National Planning Policy Guidance requires that climate change be incorporated within the surface water drainage design in accordance with The Environment Agency's 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities' February 2016 when assessing flood risk for a development.

5.3.2 The design life of the development is beyond 2070, therefore in accordance with the Environment Agency guidance the development should make allowances for an increase in extreme rainfall intensity of an additional 40% when compared to the 1961-1990 baseline.

## 5.4 PROPOSED SURFACE WATER DRAINAGE STRATEGY

5.4.1 Surface Water runoff from the proposed development should mimic, as far as possible, the surface flows from an undeveloped greenfield site.

5.4.2 Building Regulations 2010 Part H guidance for disposal of surface water is as follows:

- A soakaway or infiltration system, or where not reasonably practical;
- A surface water ditch or watercourse, or where not reasonably practical;
- A below ground sewer.

5.4.3 The British Geological Society (BGS) online mapping indicates that the site geology comprises of no superficial deposits across the entire development area.

5.4.4 The bedrock is identified by the British Geological Society as comprising the Kellaways Sand Member Sandstone and Siltstone (interbedded), and Kellaways Clay Member Mudstone.

5.4.5 The BGS online borehole records indicate 2no. boreholes, undertaken in April 1973, within the field of the site development. The records for boreholes TF02DE35 and TF02SE36 are in Appendix D. Both borehole records extend to a depth of 3.0m and indicate firm to stiff clay, with no groundwater encountered in either borehole to a reduced level of 15.87m.

5.4.6 On the basis of the above points, for the purposes of this report, it is assumed that infiltration will not be feasible for the disposal of surface water from the site.

5.4.7 The nearest appropriate watercourse to the site is an unnamed watercourse, which runs alongside the northern boundary of the site. This unnamed watercourse is a tributary of the River Bourne Eau, via the Car Dyke Drain situated 1.5km to the east. The existing drain to the southern boundary of the site, which is deemed to enter a culvert at the rear garden of No. 17 Cedar Drive, is deemed as inappropriate due to its higher elevation relative to the site and the unknown capacity of the culvert. The topographical survey does not record a water level for the primary watercourse, whilst the surface water flooding mapping suggests that in storm events the location of this watercourse is at medium to high risk of flooding. Therefore, a connection to this primary watercourse would be preferable, as the drainage system and connection to this watercourse would mimic the existing greenfield flow routes as shown in Appendix K.

5.4.8 The Anglian Water mapping indicates that there are surface water sewers located within Cedar Drive to the south-east of the site.

5.4.9 Therefore, due to the availability of a suitable watercourse, surface water disposal by the means of treatment and detention prior to controlled release into the watercourse is deemed the most appropriate solution.

5.4.10 The development area is 1.911 hectares, and it is proposed that 51% of the development will be impermeable and require collecting and attenuating prior to discharge. For the purposes of this report the impermeable area of the proposed site has been taken as 0.978 hectares based on the current site layout available.

5.4.11 It is currently proposed that the drains within the site will remain will be a mixed of private, Highway Authority and Water Authority ownership.

5.4.12 It is proposed that the surface water from the development will be controlled using a flow control prior to discharge into the existing watercourse to the north-eastern site boundary.

5.4.13 A copy of the Drainage Strategy can be found within Appendix L.

## 5.5 PROPOSED SURFACE WATER DISCHARGE

5.5.1 Surface water drainage will be provided in a new below ground gravity drains constructed around the properties and in the shared driveway mirroring the existing runoff arrangement with surplus flows being attenuated using both the voided stone sub-base below the permeable paving and the vegetated attenuation pond. The proposed surface water runoff rate for the development area is:

- Q100+40%cc = 4.6 l/s to the northern watercourse (up to a 24-hour storm event)

5.5.2 This rate is subject to approval from the LLFA.

5.5.3 By controlling the discharge rate from the site for a 1in100 year + 40% storm event to 4.6 l/s the site is offering a betterment to the downstream network by utilising on site flood storage at an earlier stage in the overall river catchment potentially reducing flooding downstream.

5.5.4 All sewers and drainage are to be constructed in accordance with all relevant industry standards, including but not limited to:

- Building Regulations Approved Document Part H 2010
- Sector Guidance in relation to the adoption of sewerage assets by sewerage companies in England
- LASOO Guidance for Urban Creep

5.5.5 The drawings & schedules of the as-built site drainage system are to be made available to the building occupier to enable drainage maintenance and future works to be undertaken.

## 5.6 CONSIDERATION OF SUDS

5.6.1 With reference to CIRIA 753 and the surface water treatment process, the provision of permeable block paving in conjunction with the voided stone will aid in the removal of sediment, hydrocarbons and heavy metals. All runoff from roofs and hardstand will be drained via voided stone and catch pits prior to connection into the new adoptable sewer network.

5.6.2 Both the Environment Agency and Lincolnshire County Council require Sustainable Drainage (SuDS) techniques to be incorporated within new developments where possible.

5.6.3 Consideration should therefore be given to the use of the Sustainable Urban Drainage Systems. Table 1 below gives commentary in relation to the suitability of SuDS techniques for the proposed development.

| SUDS Technique | Commentary | Suitability |
|---|---|---|
| Green Roof | Due to the small roof sizes and pitched nature of roofs within the development, the option of incorporating green roofs into the development is not suitable for this site. | No |
| Infiltration by Soakaway | Historic borehole logs have been provided which show a minimum 3.0m depth of firm to stiff Clay beneath the site, therefore it is assumed that soakaways are not a suitable method for disposal of runoff. | No |
| Water Butt | Storage of roof runoff via the use of water butts has the potential to be utilised. | Potential |
| Filter Strip | There is potential, to mitigate existing surface flows into residential gardens. | Potential |
| Infiltration Trench/Filter Trench | The site geology is deemed not suitable for infiltration trenches/filter trenches. | No |
| Swale | There is potential, to mitigate existing surface flows into residential gardens. | Yes |
| Bio-retention | There is limited areas for this to be sited, and concerns over maintenance by the owners. | No |
| Permeable Paving | Permeable paving has been used across the site to provide both treatment of hydrocarbons and storage. | Yes |
| Geocellular/modular system | Geocellular systems may be required in conjunction with permeable paving with voided stone below for critical locations. | Yes |
| Infiltration Basin | It cannot be confirmed as to whether this is viable due to no infiltration testing having yet been undertaken | No |
| Detention Basin | A large open soft landscaped area to the north-east of the site has been deemed suitable for providing a basin/pond. | Yes |
| Pond | A large open soft landscaped area to the north-east of the site has been deemed suitable for providing a basin/pond. | Yes |
| Stormwater Wetland | It is not viable or practical to accommodate stormwater wetland on site due to the volume of attenuation required and the available extent of soft landscaping areas. | No |

Table 1 - SuDS Consideration Table

5.6.4 The table above identifies that due to site constraints, the most feasible method for providing SuDS is to utilise lined permeable paving stone sub-base and an attenuation pond. Further SuDS can be offered if required by means of including water butts to each dwelling.

## 5.7 ATTENUATION PROPOSALS

5.7.1 In accordance with current design guidelines the attenuation volume for a site should be calculated based on a 1 in 100 year + climate change allowance.

5.7.2 It is proposed that roof areas are to be collected and drained through below ground drains and permeable paving prior to being attenuated, within voided stone sub-base and an attenuation pond, before being discharged into the existing watercourse.

5.7.3 Preliminary hydraulic modelling of a drainage network has been undertaken, using industry recognised software, to confirm the drainage design suitability and these calculations can be found within Appendix M. The water level within the outfall watercourse is currently unknown, therefore hydraulic modelling with a surcharge outfall has also been considered for a depth of 800mm for all storm events. During a surcharged outfall event exceedance flows are expected within the confines of the site.

5.7.4 Any exceedance flows resulting from a surcharged outfall will be managed and directed away from any dwellings.

## 5.8 MAINTENANCE

5.8.1 At this stage it has been assumed that the dwelling owners will maintain the drainage elements as outlined within this report. Future maintenance schedules for the SuDS features have been provided within Appendix N.

5.8.2 The drawings and schedules of the as built drainage are to be made available to the building owner to enable drainage maintenance and future works to be undertaken.

5.8.3 At this stage, the maintenance company has not yet been appointed and as such the applicant will be responsible until such time as they are appointed. Once appointed the contact details will be provided to the LLFA for their records.

## 5.9 EXCEEDANCE FLOWS

5.9.1 Exceedance flows are to be contained within the within the site and directed away from buildings towards the areas of driveway and landscaping.

5.9.2 Exceedance flow routes can be seen on the flow route analysis drawing within Appendix K.

## 5.10 DRAINAGE SUMMARY

5.10.1 The proposed surface water drainage system can be summarised as follows:

- Surface water runoff from the site will be conveyed by pipes, stored within voided stone base and attenuation pond, then discharged into the existing watercourse at a controlled rate.
- The intention is to utilise permeable paving in conjunction with catch pits and voided stone, with the intention of trapping, filtering, and removing hydrocarbons by biodegradation in line with CIRIA reports C753, C609 & C582 and 'Pollution Prevention Guideline' PPG3 (Environment Agency, 2006) guidance.
- Use of voided stone and an attenuation pond to store runoff volumes in extreme storm events up to the 1 in 100 year +40% climate change storm event.

# 6.0 FOUL WATER DRAINAGE STRATEGY

## 6.1 FOUL WATER DRAINAGE DESIGN

6.1.1 It is proposed that all foul drainage will be conveyed from the properties by below ground private gravity drains prior to connection into the existing Anglian Water sewers within Cedar Drive.

6.1.2 This new foul connection will be subject to S106 approval by Anglian Water.

# 7.0 FLOOD MITIGATION STRATEGY

## 7.1 PRINCIPLES FOR MITIGATION STRATEGY

7.1.1 In accordance with Table 3 of NPPG (2019), a residential land use has a flood vulnerability classification of ‘more vulnerable’.

| Flood Zones | Flood Risk Vulnerability Classification | | | | |
|---|---|---|---|---|---|
| | Essential Infrastructure | Highly Vulnerable | More Vulnerable | Less Vulnerable | Water Compatible |
| Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Zone 2 | ✓ | Exception Test Required | ✓ | ✓ | ✓ |
| Zone 3a | Exception Test Required | × | Exception Test Required | ✓ | ✓ |
| Zone 3b | Exception Test Required | × | × | × | ✓ |

Table 2 - Extract from NPPG 2019 (Table 3)

✓ Denotes Development is appropriate

× Development should not be permitted

7.1.2 The findings of the FRA indicate that the site is located within FZ1. However, the site is down slope of a large are of undeveloped field which is to remain as an environment buffer zone. As such, the following mitigation measures should be introduced to protect the site during its lifetime.

- Surface water ditches and dry swales to be constructed to the perimeter of the proposed development to direct surface flows away from existing and proposed dwellings into the existing watercourse to mimic the current greenfield flow routes.

7.1.3 The drainage design should account for any residual risk of flooding from surface water as a result of exceedance events.

## 7.2 SEQUENTIAL APPROACH

7.2.1 The site is located within Flood Zone 1, the buildings have been positioned where possible outside of the watercourse surface water risk extents to ensure a sequential approach is taken by trying to position buildings as far away from the source of flooding as practical.

## 7.3 FINISHED FLOOR LEVELS

7.3.1 Floor levels should be set such that they are a minimum of 300mm above the existing recorded ground levels and should be no less than 150mm above the final surrounding ground levels.

## 7.4 SAFE ACCESS

7.4.1 In accordance with current guidance and DEFRA FD2320 safe access is to be provided for residents in the event of flooding. Where safe access cannot be provided measures are to be implemented to ensure the residents' safety until the emergency services have been able to reach them.

7.4.2 The EA online mapping indicates that the site access lies within FZ1 have therefore has a low probability of flooding. This would allow all users to safely access and egress the site up to the 1 in 1000 year storm event probability.

## 7.5 FLOOD WARNING & EVACUATION

7.5.1 The site is considered to have a very low probability of flooding from all sources and therefore it is deemed no requirement for a flood warning or evacuation plan exists.

# 8.0 SEQUENTIAL AND EXCEPTION TESTS

## 8.1 SEQUENTIAL TEST

8.1.1 For clarity, the aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Furthermore, approval of the Sequential Test lies with the Local Planning Authority.

8.1.2 The NPPF indicates that for a more vulnerable land use within Flood Zones 1, development is appropriate. The site is identified as being within FZ1 as defined by the NPPF, identified on the EA Indicative Flood Map and also within the Wiltshire Council Strategic Flood Risk Assessment.

8.1.3 The site is in an existing suburban area with prominent residential, retail and commercial uses within the vicinity of the site.

8.1.4 In view of the facts as identified the applicant does not own other sites considered to be more suitable for residential accommodation in the immediate vicinity.

8.1.5 The above clearly demonstrates that, although not required for this site, a sequential test would be satisfied provided it can be demonstrated that flood water will not pose excessive risk to the development, safe ingress and egress can be created and the development will not increase risk of flooding elsewhere.

8.1.6 The NPPF defines what type of development is appropriate in an individual location and seeks to guide development generally away from areas of flood risk. It nevertheless accepts implicitly That some development in areas of higher potential risk may be appropriate or indeed essential, and seeks to classify zones of risks, types of development and development suitability.

## 8.2 EXCEPTION TEST

8.2.1 Table 3 within the NPPF indicates that the site is appropriate for use as a more vulnerable land use due to the site being within Flood Zones 1.

8.2.2 Wider sustainable benefits to the community include:

- Potential for reduced risk of flooding elsewhere by increasing flood storage volume within the site
- Reduction in surface water runoff when compared to the existing situation delaying discharge into the sewers and potentially providing a betterment downstream
- Better use of existing overgrown land within a built-up residential area

8.2.3 The FRA demonstrates safety and flooding sustainability by:

- Maintaining floor levels and introducing flood mitigation measures to limit the effects of flood water on the properties
- Controlling runoff to existing greenfield rates on site to delay the discharge into the adjacent watercourse
- Safe ingress and egress routes for pedestrians being available from the properties to the surrounding highways.
- Mitigation measures provided to offer better protection to the properties along the southern boundary of the site.

8.2.4 There will be no increase in the level of surface water runoff over the current land use.

8.2.5 In view of the above the exception test is deemed to have passed.

# 9.0 CONCLUSIONS & RECOMMENDATIONS

## 9.1 CONCLUSIONS

9.1.1 The site proposed for development is free of potential risk of flooding from tidal events.

9.1.2 The site is outside the extents of the mapped flood plain of main river systems while being classified as a low risk area.

9.1.3 The site is at very low to medium risk of flooding from overland flow routing from surface water.

9.1.4 The site is at a low susceptibility of flooding from groundwater sources.

9.1.5 The site is at no risk of flooding from manmade lakes.

9.1.6 The escape flow route from the strategic water mains has also been considered. In the unlikely event of failure of the mains the flows would not reach the properties.

9.1.7 The site is at no risk of flooding from existing sewerage systems for the same reason as the water mains issue.

9.1.8 The Joint Lincolnshire Flood Risk and Drainage Management Strategy does not show any areas in the vicinity of the site to be at risk of local flooding.

9.1.9 The proposed surface water discharge rate of 4.6 l/s for the 1in100 year + 40% climate change combined with the use of above ground SuDS will treat and delay runoff entering the watercourse.

9.1.10 The site is at a negligible risk of flooding from its own private drainage systems; however, this can be mitigated against by regular maintenance and channelling of flows within the development away from the properties.

9.1.11 We therefore conclude the application site lies within Flood Zone 1 as defined in the NPPF Table 1 and since the exception test for this has been passed more vulnerable development uses should be permitted.

## 9.2 RECOMMENDATIONS

9.2.1 It is recommended that the existing water level of the watercourse at the outfall is determined.

9.2.2 Infiltration testing and ground water monitoring should be undertaken in the location of the proposed attenuation pond to confirm the viability of localised infiltration and the depth of groundwater. In the event infiltration is deemed viable for the attenuation pond, the drainage strategy shall be updated as required.

# APPENDICES

# APPENDIX A – SITE LOCATION PLAN

farrow walsh
CONSULTING

Farrow Walsh Consulting Limited

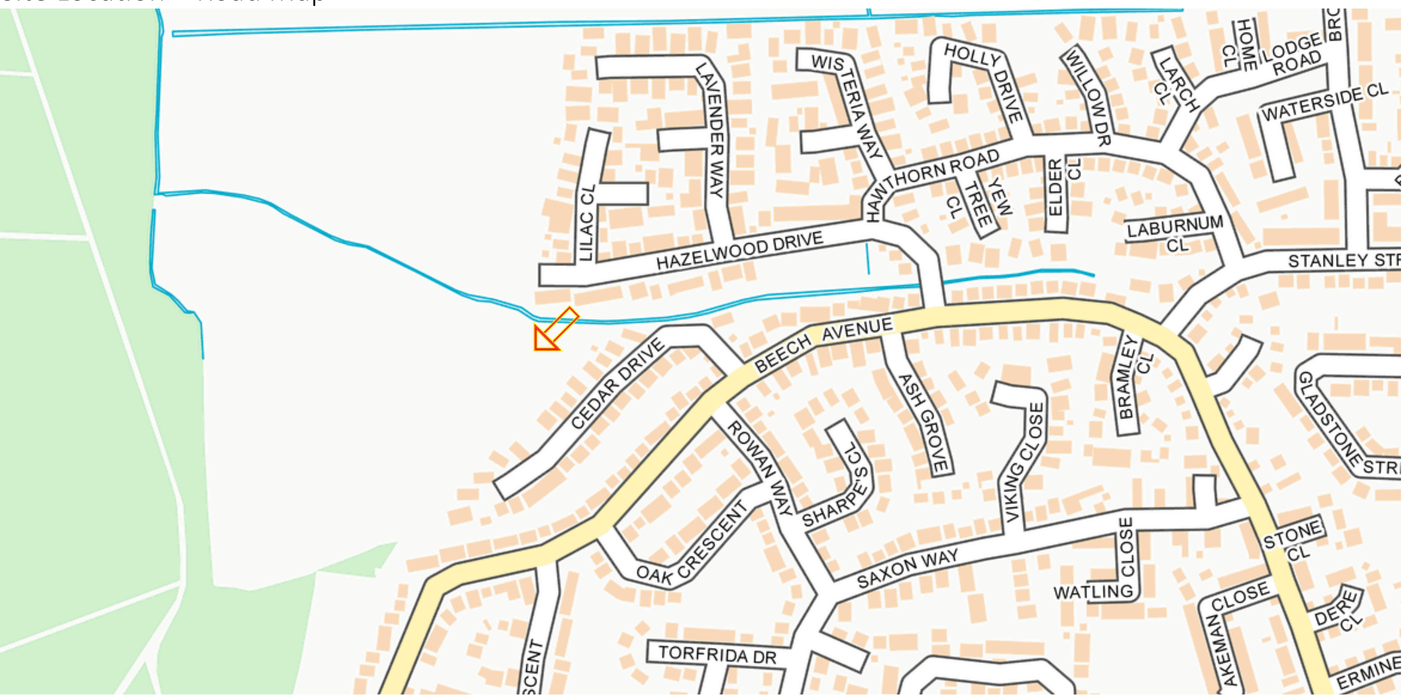
# SITE LOCATION PLAN

FW2038 Land off Cedar Drive, Bourne, PE10 9SQ

X 508707 Y 320840

## Site Location – Aerial Photograph


## Site Location – Road Map



# APPENDIX B – DEVELOPMENT PROPOSALS

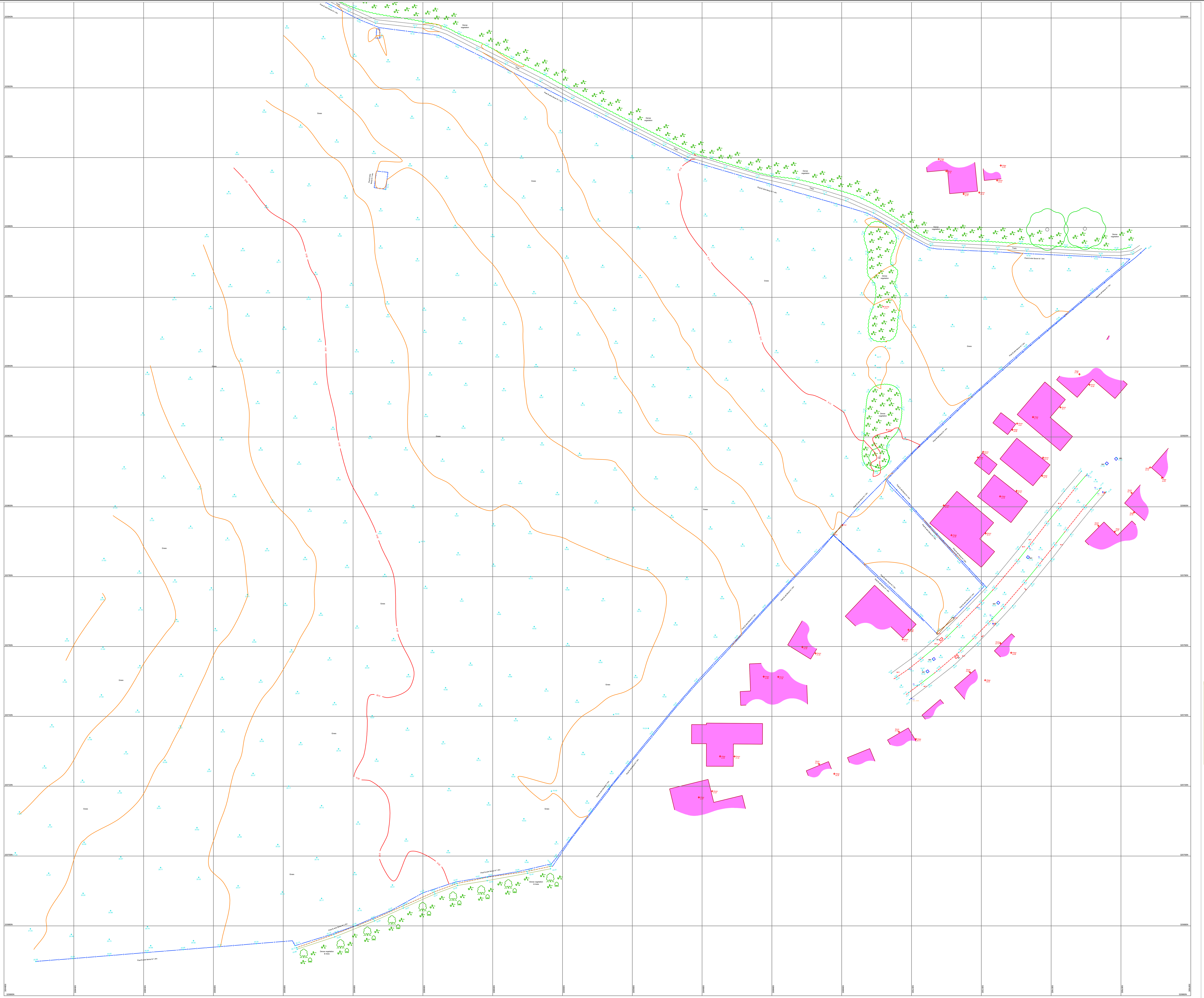

RDC development consultants
Tel:01604 500040 Web:www.rdcllc.co.uk



| Project: | Client: | Drawing: | Drawing No: | Drawn By: |
|---|---|---|---|---|
| LAND OFF CEDAR DRIVE Bourne | HAZLETON HOMES | INDICATIVE MASTERPLAN | Revision: - | MA |
| | | Scale: 1:500 @ A0 | Date: Oct 21 | Checked By: SC |
| | | | | Cad Ref: |

| Rev. No. | Date. | Amendment. | Initial. |
|---|---|---|---|
| | | | |

# APPENDIX C – TOPOGRAPHICAL SURVEY



N
W E
S

Key:

| | | | |
|---|---|---|---|
| FL: | Floor level | Building line | |
| CL: | Ceiling level | Beam | |
| SusCL: | Suspended ceiling level | Window | |
| U/S: | Underside level | Dimension | 10.00m |
| SHL: | Sill height level | | |
| HHL: | Head height level | | |
| SPR: | Spring Point | | Ground light |
| | Sanitary ware | | Door / sliding door |
| Heater | Heater / radiator | | Inspection cover |

| | | | | | |
|---|---|---|---|---|---|
| Av | Air valve | G: | Girth circumference | Sv | Stop valve |
| Bg | Back gully | Gy | Gully | TCB | Telephone call box |
| BH | Borehole | Ht. | Height | TTL: | Tree top level |
| BM | Benchmark | IC | Inspection cover | THL | Threshold level |
| Boll | Bollard | IFL | Internal floor level | TCB | Telephone call box |
| Bs | Bus stop | IL | Invert level | TL | Traffic light |
| BT | British Telecom | Lb | Letter box | THL | Threshold level |
| Bg | Back Gully | Lp | Lamp Post | Tp | Telegraph post |
| CL | Cover Level | MG | Multigirth | Ts | Traffic signal |
| CBX | Control box | MH | Manhole | TT | Tactile paving |
| CPS | Concrete paving slab | Mkr | Marker post | Twl: | Top of wall level |
| CTV | Cable TV cover | NVP | No visible pipes | UTL | Unable to lift |
| Elc | Electric cover | PInv | Pipe invert | WL | Water level |
| Ep | Electricity post | Pb | Post box | Wm | Water meter |
| Er | Earth rod | Re | Rodding eye | Wo | Wash out |
| Fh | Fire hydrant | Sp | Sign post | | |
| Fs | Flagstaff | St | Stop tap | | |

Road
Drop Kerb
Verge Tarmac
Verge Concrete
Verge Grass
Verge
Tops
Bottoms

Ordnance Survey information is provided for a guide only.
OS BUILDING OUTLINE
OS DETAIL

| Station | Easting (m) | Northing (m) | Level (m) |
|---|---|---|---|
| M1 | 508754.814 | 320804.245 | 17.460 |
| M2 | 508723.341 | 320766.537 | 18.164 |
| M3 | 508699.935 | 320745.142 | 18.584 |

| REV | DATE | DESCRIPTION OF WORK | SURVEYOR | CHECKED BY |
|---|---|---|---|---|

MAPMATIC
MEASURED SURVEYS

SETTING OUT M UTILITY SURVEYS M CAMERA SURVEYS M FLOOD RISK ASSESSMENT
AERIAL PHOTOGRAPHY M EARTHWORK CALCULATIONS M MEASURED BUILDING SURVEYS M TOPOGRAPHICAL SURVEYS

Mapmatic, Suite 1, Woburn House, South Street, Vernon Gate, Derby, DE1 1UL
Tel: 01332 650 580 www.mapmatic.com Email: info@mapmatic.com

CLIENT
Hazelton Homes

PROJECT
Cedar Drive
Bourne
PE10 9SB

TITLE
Topographical Survey

| | | | |
|---|---|---|---|
| Scale | 1: 500@A1 | Date | 06.03.2021 |
| Drawn | AB/DE | Checked | AW |
| Level datum | GNSS | Grid orientation | GNSS |
| Job number | 4187 | Revision | 0 |
| Drawing no. | 0001 | Sheet | 4 of 4 |

Notes:

All critical measurements should be checked on site prior to design. No liability will be taken for this plan if passed onto 3rd parties. Trees and other survey data may be omitted due to dense vegetation. Some services may have been omitted due to parked vehicles and vegetation. Please note the drainage information has been ascertained by visual inspection from the surface and therefore values are estimated.

This survey has been orientated to the Ordnance Survey (OS) national grid via a Global Navigation Satellite System (GNSS) and the OS Active Network (OS NET). A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15 & OSGM15 transformation models. The survey has been correlated to this point and a further one or more OSGB36 points established to create a true OS bearing for angle orientation. No scale factor has been applied to the survey therefore the coordinates shown are arbitrary and not true OS coordinates.
Please refer to the survey station table to enable establishment of the on-site grid.

RICS ICES

# APPENDIX D – BGS BOREHOLE RECORDS

TF/02 SE/35

0854. 2076.

# BOREHOLE LOG

Client: Kesteven County Council

B.H. No.: 6

Date(s): 27.4.73

Ground Level: 20.70m

Scale: 1:50 metres

Location: Bourne By - Pass

Type of boring: Shell and Auger

Dia. of boring: 200mm

casing not used

| Description of Strata | Reduced Level | Legend | Thickness | Depth | SAMPLES Type | SAMPLES Depth | NOTES |
|---|---|---|---|---|---|---|---|
| TOPSOIL | 20.30 | | 0.40 | 0.40 | D | 0.00 - 0.40 | |
| | | | | | U | 0.40 - 0.80 | |
| Brown and grey extremely sandy silty CLAY. | 19.20 | | 1.10 | 1.50 | D | 0.80 - 0.90 | |
| | | | | | B | 0.90 - 1.50 | |
| | | | | | U | 1.50 - 1.90 | |
| Firm brown silty CLAY with traces of sand | 18.20 | | 1.00 | 2.50 | B | 1.90 - 2.20 | |
| | | | | | B | 2.20 - 2.50 | |
| | | | | | U | 2.50 - 2.90 | |
| Stiff grey blue laminated silty shaly CLAY. | 17.70 | | 0.50 | 3.00 | D | 2.90 - 3.00 | |
| Borehole Complete | | | | | | | Groundwater not encountered |

PROJECT Lincolnshire Relief Roads Scheme

S ) Standard Penetration Test
U Undisturbed Sample
B Bulk Sample
D Disturbed Sample
W.S. Water Sample

Tarmac Construction Ltd., Geotechnical Division.

TF/02 SE/36

0364 ...

# BOREHOLE LOG

Client: Kesteven County Council

B.H. No.: 7

Date(s): 27.4.73

Ground Level: 18.87m

Scale: 1:50 metres

Location: Bourne By - Pass

Type of boring: Shell and Auger

Dia. of boring: 200mm

casing not used

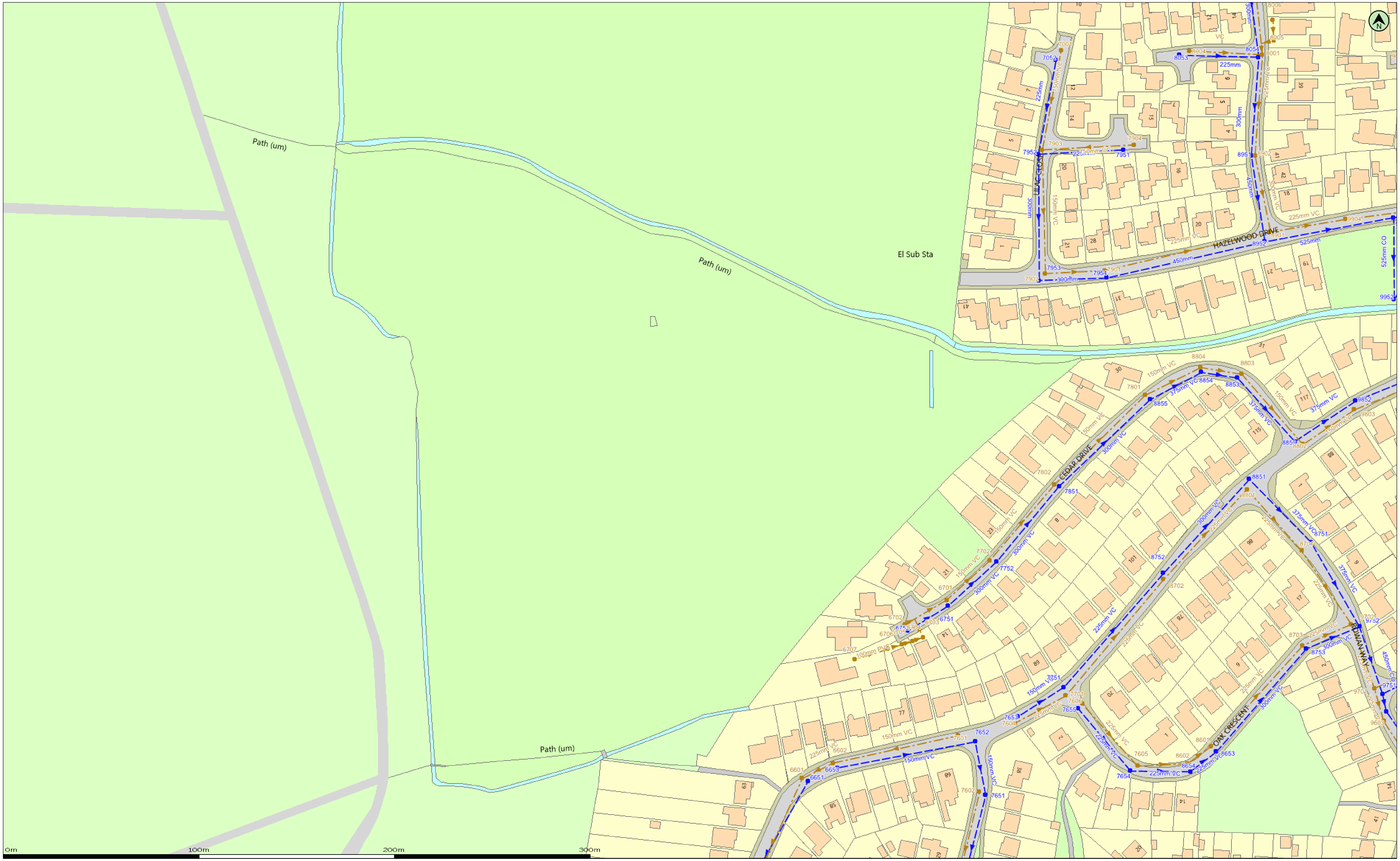
| Description of Strata | Reduced Level | Legend | Thickness | Depth | SAMPLES Type | SAMPLES Depth | NOTES |
|---|---|---|---|---|---|---|---|
| TOPSOIL | 18.37 | | 0.50 | 0.50 | D | 0.00 - 0.50 | |
| Stiff brown and blue grey mottled silty CLAY with occasional sandstone fragments. | 16.87 | | 1.50 | 2.00 | U<br>D<br>B | 0.50 - 0.90<br>0.90 - 1.00<br>1.00 - 2.00 | |
| Stiff predominately blue grey with occasional brown mottling silty CLAY. | 15.87 | | 1.00 | 3.00 | U<br>D<br>B | 2.00 - 2.40<br>2.40 - 2.50<br>2.50 - 3.00 | |
| Borehole Complete | | | | | | | Groundwater not encountered |

PROJECT: Lincolnshire Relief RoadsScheme.

S.( ) Standard Penetration Test
U. Undisturbed Sample
B. Bulk Sample
D. Disturbed Sample
W.S. Water Sample

Tarmac Construction Ltd Geotechnical Division.

# APPENDIX E – ANGLIAN WATER SEWER RECORDS




| | | | | | | |
|---|---|---|---|---|---|---|
| (c) Crown copyright and database rights 2021 Ordnance Survey 100022432 | Date: 24/06/21 | Scale: 1:1250 | Map Centre: 508572,320838 | Data updated: 31/05/21 | Our Ref: 585214 - 1 | Wastewater Plan A2 |



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)

calum@farrowwalsh.co.uk

FW2038

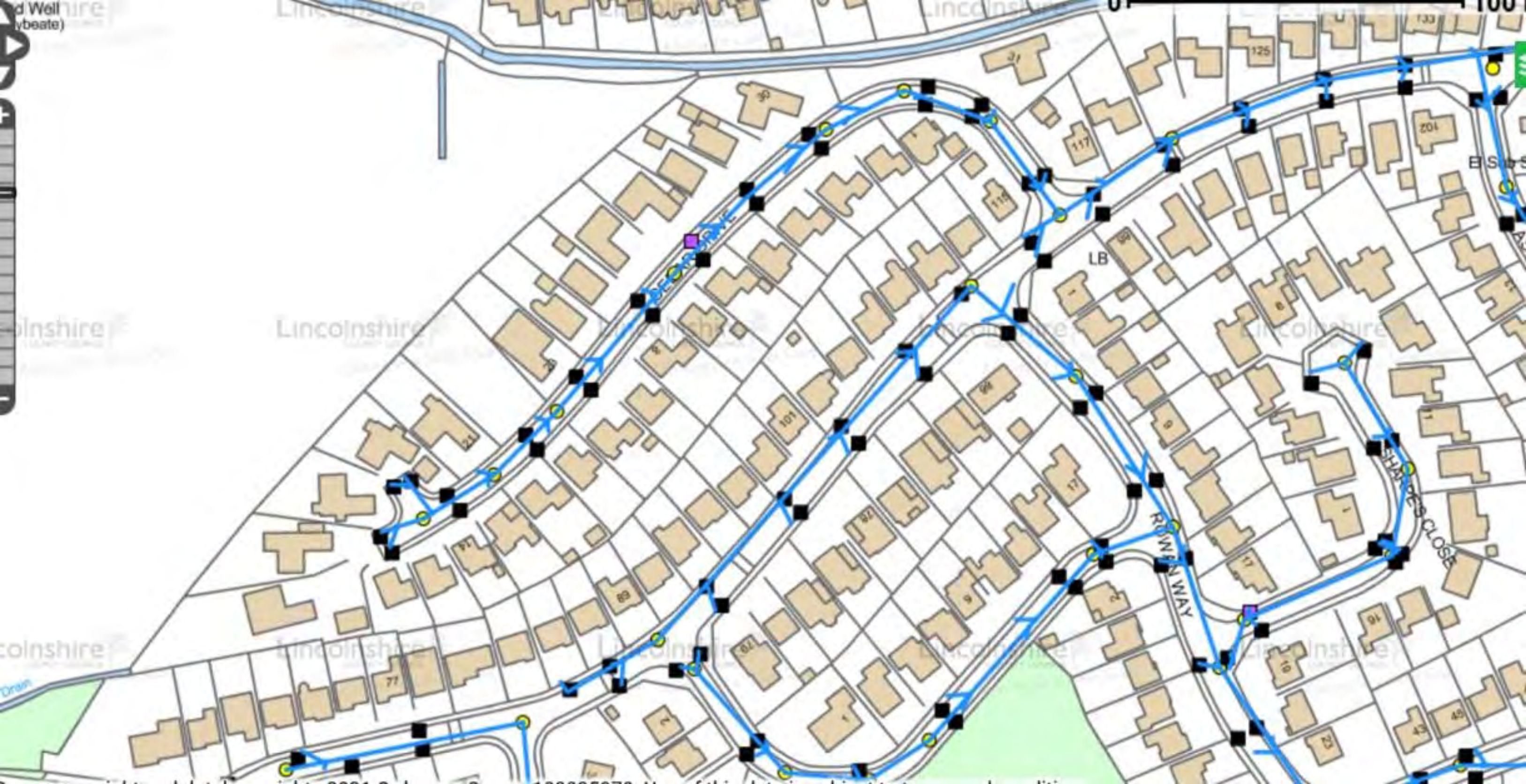
love every drop
anglianwater

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|
| 6601 | F | 20.18 | 17.94 | 2.24 |
| 6602 | F | 20.35 | 18.09 | 2.26 |
| 6701 | F | - | - | - |
| 6702 | F | - | - | - |
| 6703 | F | - | - | - |
| 6704 | F | - | - | - |
| 6705 | F | - | - | - |
| 6706 | F | - | - | - |
| 6707 | F | - | - | - |
| 7001 | F | 51.715 | 49.95 | 1.765 |
| 7601 | F | 20.76 | 18.87 | 1.89 |
| 7602 | F | 20.65 | 19.34 | 1.31 |
| 7604 | F | 20.8 | 19.02 | 1.78 |
| 7605 | F | 19.82 | 17.84 | 1.98 |
| 7606 | F | 20.88 | 18.83 | 2.05 |
| 7701 | F | 20.71 | 18.15 | 2.56 |
| 7702 | F | - | - | - |
| 7801 | F | - | - | - |
| 7802 | F | - | - | - |
| 7901 | F | - | 49.05 | - |
| 7902 | F | 50.9 | 49.15 | 1.75 |
| 7903 | F | 51.335 | 49.66 | 1.675 |
| 7904 | F | 51.005 | 49.945 | 1.06 |
| 8001 | F | 50.315 | 49.065 | 1.25 |
| 8004 | F | - | 49.365 | - |
| 8005 | F | - | - | - |
| 8006 | F | - | - | - |
| 8601 | F | 18.28 | 15.23 | 3.05 |
| 8602 | F | 18.58 | 17.27 | 1.31 |
| 8701 | F | 17.11 | 15.12 | 1.99 |
| 8702 | F | 19.49 | 16.63 | 2.86 |
| 8703 | F | 17.51 | 14.84 | 2.67 |
| 8801 | F | 17 | 15.5 | 1.5 |
| 8802 | F | - | - | - |
| 8803 | F | - | - | - |
| 8804 | F | - | - | - |
| 8901 | F | 49.95 | 48.76 | 1.19 |
| 8902 | F | - | 48.895 | - |
| 9603 | F | 16.68 | 14.53 | 2.15 |
| 9701 | F | - | - | - |
| 9702 | F | 17.1 | 14.76 | 2.34 |
| 9803 | F | - | - | - |
| 9904 | F | - | - | - |
| 6651 | S | 20.27 | 18.95 | 1.32 |
| 6653 | S | 20.28 | 18.84 | 1.44 |
| 6751 | S | - | - | - |
| 6752 | S | - | - | - |
| 7052 | S | 51.715 | 50.425 | 1.29 |
| 7651 | S | 20.58 | 18.4 | 2.18 |
| 7652 | S | 20.8 | 18.58 | 2.22 |
| 7653 | S | 20.78 | 19.34 | 1.44 |
| 7654 | S | 19.88 | 17.52 | 2.36 |
| 7655 | S | 20.79 | 18.89 | 1.9 |
| 7751 | S | 20.7 | 18.52 | 2.18 |
| 7752 | S | - | - | - |
| 7851 | S | - | - | - |
| 7951 | S | 51.005 | 50.28 | 0.725 |
| 7952 | S | 51.335 | 50.045 | 1.29 |
| 7953 | S | 50.9 | 49.535 | 1.365 |
| 7954 | S | - | 49.14 | - |
| 8053 | S | 50.665 | 49.74 | 0.925 |
| 8054 | S | 50.315 | 49.47 | 0.845 |
| 8653 | S | 18.35 | 14.75 | 3.6 |
| 8654 | S | 18.61 | 16.49 | 2.12 |
| 8751 | S | 16.96 | 14.56 | 2.4 |
| 8752 | S | 19.42 | 16.94 | 2.48 |
| 8753 | S | 17.52 | 14.37 | 3.15 |
| 8851 | S | 16.95 | 15.01 | 1.94 |
| 8852 | S | - | - | - |
| 8853 | S | - | - | - |
| 8854 | S | - | - | - |
| 8855 | S | - | - | - |
| 8951 | S | 50 | 49.3 | 0.7 |
| 8952 | S | 49.95 | 48.45 | 1.5 |
| 9654 | S | 16.62 | 13.98 | 2.64 |
| 9751 | S | - | - | - |
| 9752 | S | 17.06 | 14.16 | 2.9 |
| 9852 | S | - | - | - |
| 9952 | S | - | - | - |
| 9953 | S | - | - | - |

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

# APPENDIX F – LINCOLNSHIRE HIGHWAY DRAINAGE RECORD



LB
ROWAN WAY
El Sub Sta

# APPENDIX G – EA FLOOD MAPPING FOR PLANNING [JULY 2021]

Environment Agency

# Flood map for planning

| Your reference | Location (easting/northing) | Created |
|---|---|---|
| **FW2038** | **508695/320835** | **30 Jul 2021 16:37** |

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

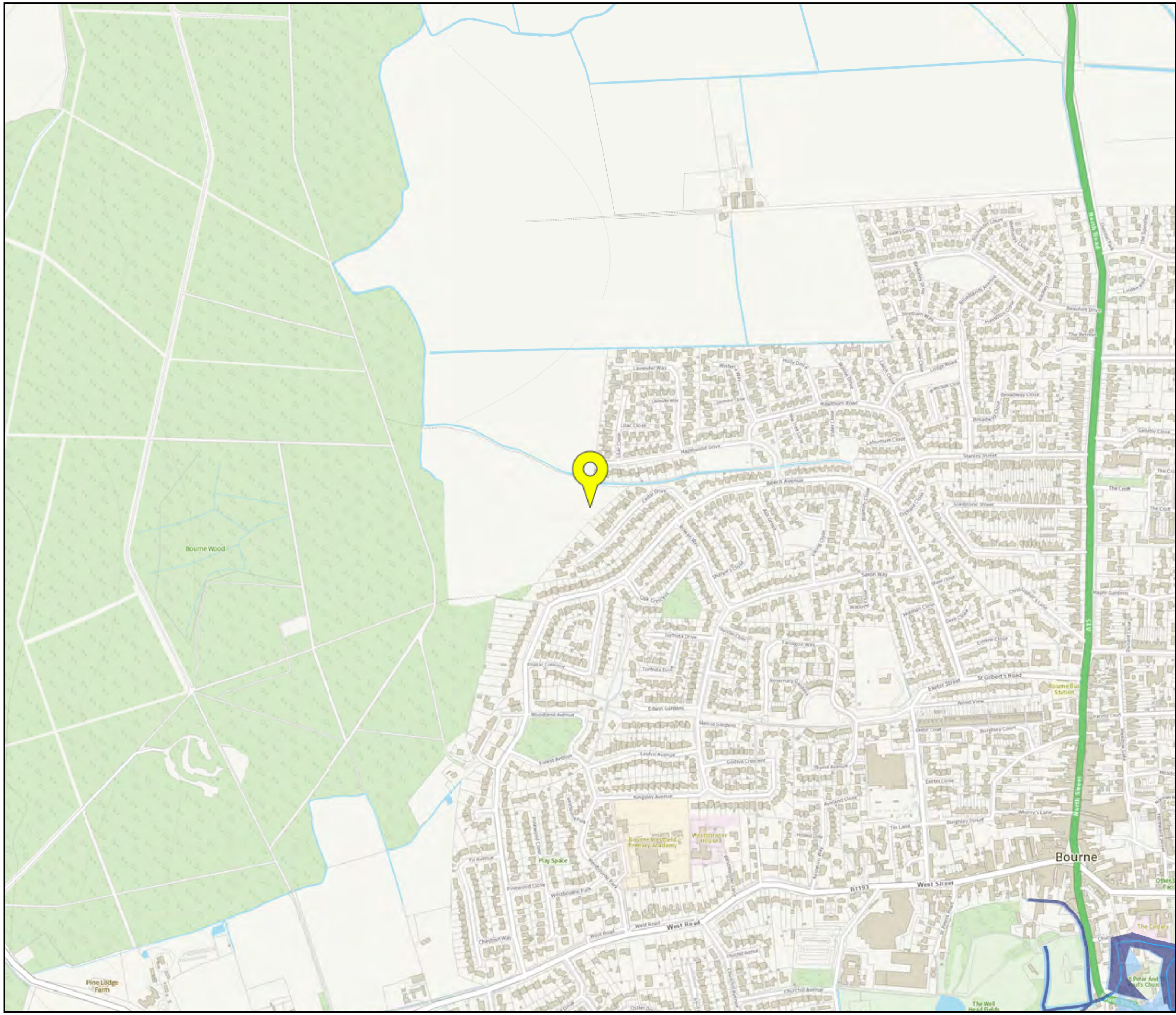
## This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

**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
**FW2038**

Location (easting/northing)
**508695/320835**

Scale
**1:10000**

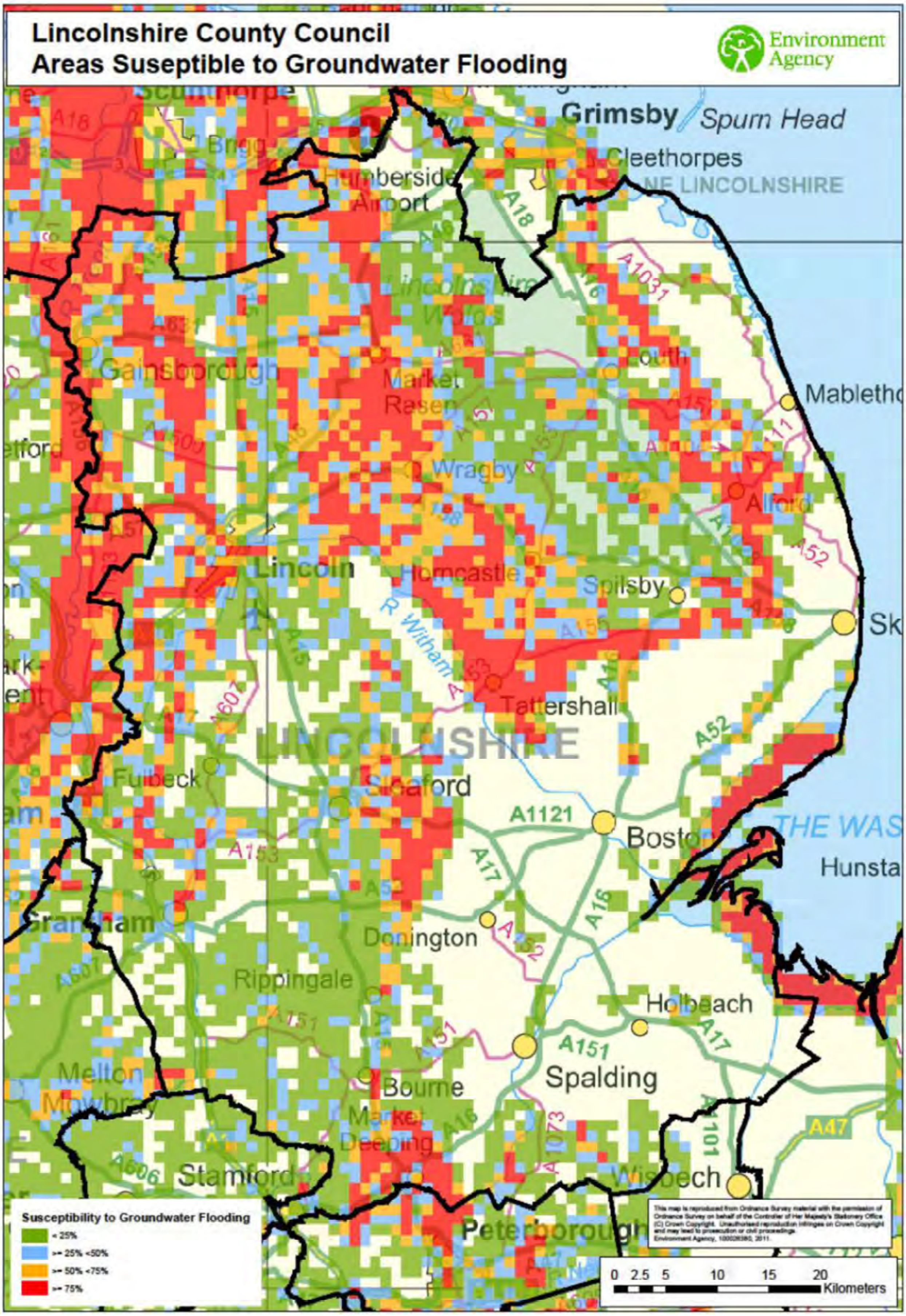
Created
**30 Jul 2021 16:37**

Selected point
Flood zone 3
Flood zone 3: areas benefitting from flood defences
Flood zone 2
Flood zone 1
Flood defence
Main river
Flood storage area

0 100 200 300m

# APPENDIX H – LINCOLNSHIRE GROUNDWATER FLOOD RISK

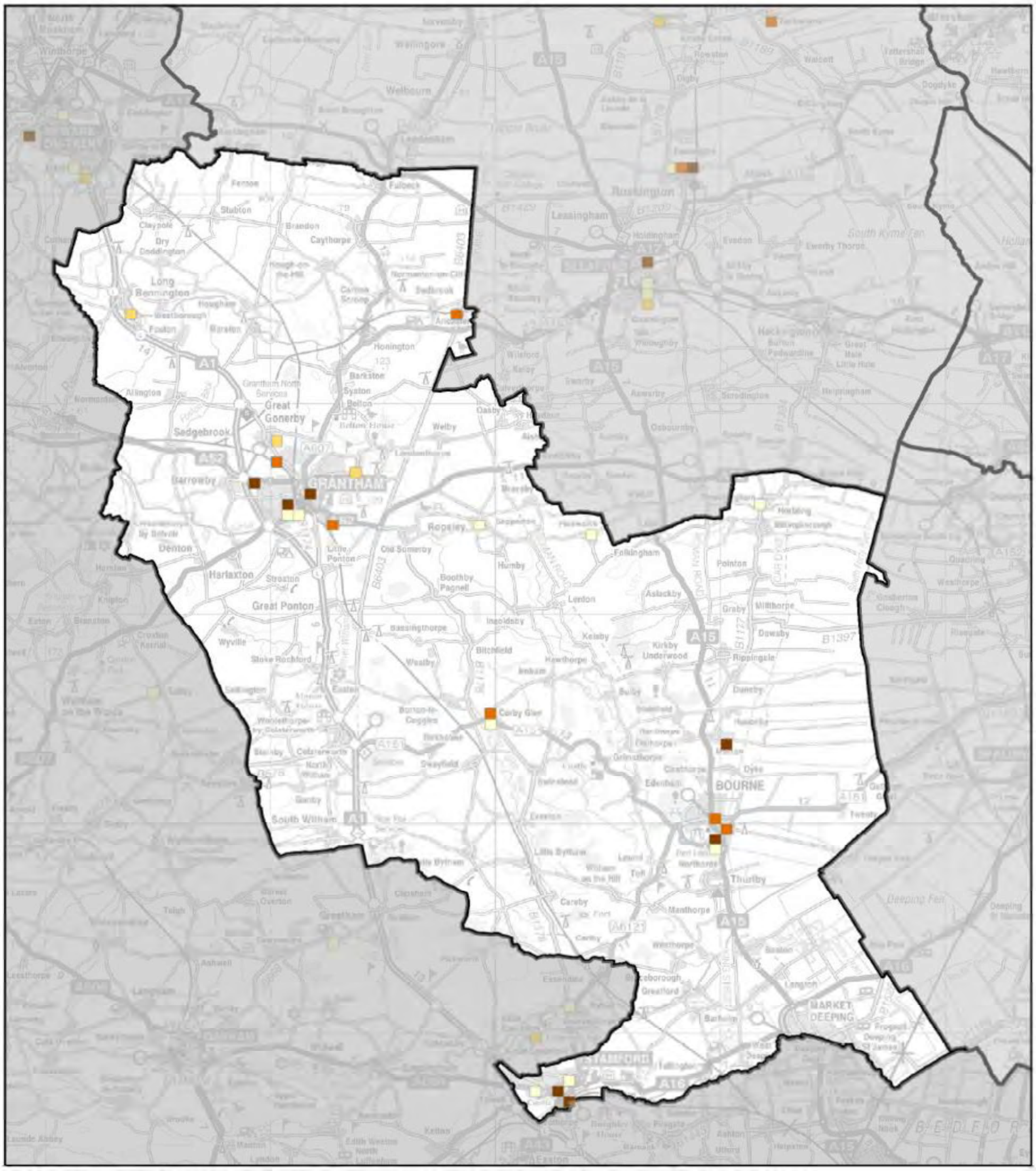
***D4: Groundwater flood risk***



# APPENDIX I – LINCOLNSHIRE FLOOD RISK MAPPING

***D3c: Surface water: preliminary flood risk assessment, South Kesteven – initial areas where potential flood risk requires further investigation***

***NOTE: Map should be viewed at no larger than 1:50,000 scale***






Legend – Estimated number of properties within a 0.5 km sq at potential risk of local flooding

20 to 29 | 30 to 39 | 40 to 49 | 50 and over

# APPENDIX J – GREENFIELD FEH RUNOFF CALCULATIONS

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

| | |
|---|---|
| Calculated by: | Darren Marriott |
| Site name: | FW2038 |
| Site location: | Bourne |

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

**Site Details**

| | |
|---|---|
| Latitude: | 52.77415° N |
| Longitude: | 0.39091° W |
| Reference: | 3377521490 |
| Date: | Jul 26 2021 10:32 |

**Runoff estimation approach** FEH Statistical

**Site characteristics**

| | |
|---|---|
| Total site area (ha): | 1.805 |

**Methodology**

| | |
|---|---|
| $Q_{MED}$ estimation method: | Calculate from BFI and SAAR |
| BFI and SPR method: | Calculate from dominant HOST |
| HOST class: | 22 |
| BFI / BFIHOST: | 0.374 |
| $Q_{MED}$ (l/s): | 4.16 |
| $Q_{BAR}$ / $Q_{MED}$ factor: | 1.12 |

**Hydrological characteristics**

| | Default | Edited |
|---|---|---|
| SAAR (mm): | 575 | 575 |
| Hydrological region: | 5 | 5 |
| Growth curve factor 1 year: | 0.87 | 0.87 |
| Growth curve factor 30 years: | 2.45 | 2.45 |
| Growth curve factor 100 years: | 3.56 | 3.56 |
| Growth curve factor 200 years: | 4.21 | 4.21 |

**Notes**

**(1) Is $Q_{BAR}$ < 2.0 l/s/ha?**

When $Q_{BAR}$ is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

**(2) Are flow rates < 5.0 l/s?**

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

**(3) Is SPR/SPRHOST ≤ 0.3?**

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

**Greenfield runoff rates**

| | Default | Edited |
|---|---|---|
| $Q_{BAR}$ (l/s): | 4.67 | 4.67 |
| 1 in 1 year (l/s): | 4.06 | 4.06 |
| 1 in 30 years (l/s): | 11.45 | 11.45 |
| 1 in 100 year (l/s): | 16.63 | 16.63 |
| 1 in 200 years (l/s): | 19.67 | 19.67 |

# APPENDIX K – GREENFIELD FLOW ROUTES ANALYSIS

**SAFETY, HEALTH AND ENVIRONMENTAL HAZARD INFORMATION BOX**

THE HAZARDS NOTED BELOW ARE IN ADDITION TO THE NORMAL HAZARDS AND RISKS FACED BY A COMPETENT CONTRACTOR WHEN DEALING WITH THE TYPES OF WORKS DETAILED ON THIS DRAWING.

CONSTRUCTION RISKS

NONE RELEVANT TO THIS DRAWING.

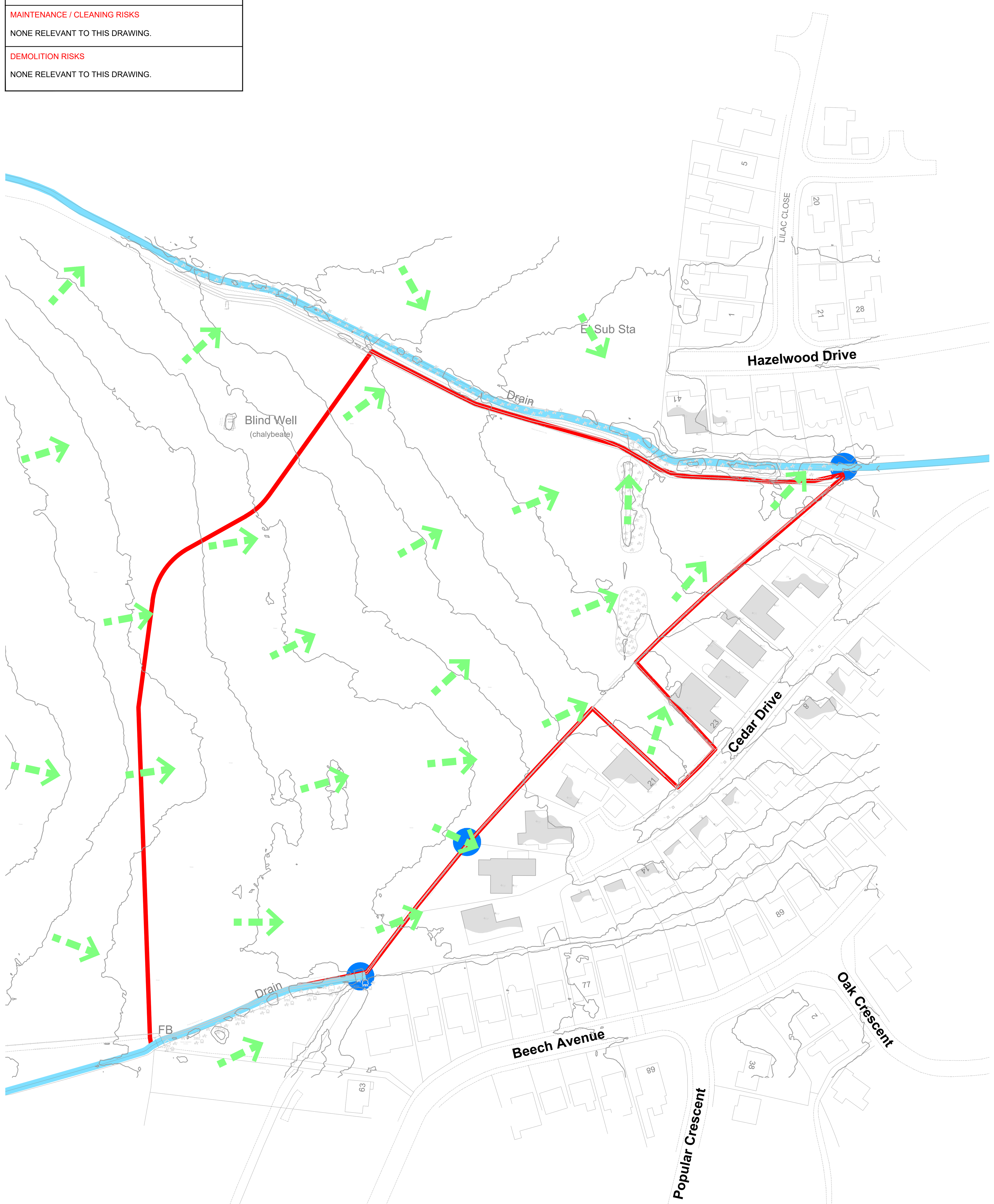
MAINTENANCE / CLEANING RISKS

NONE RELEVANT TO THIS DRAWING.

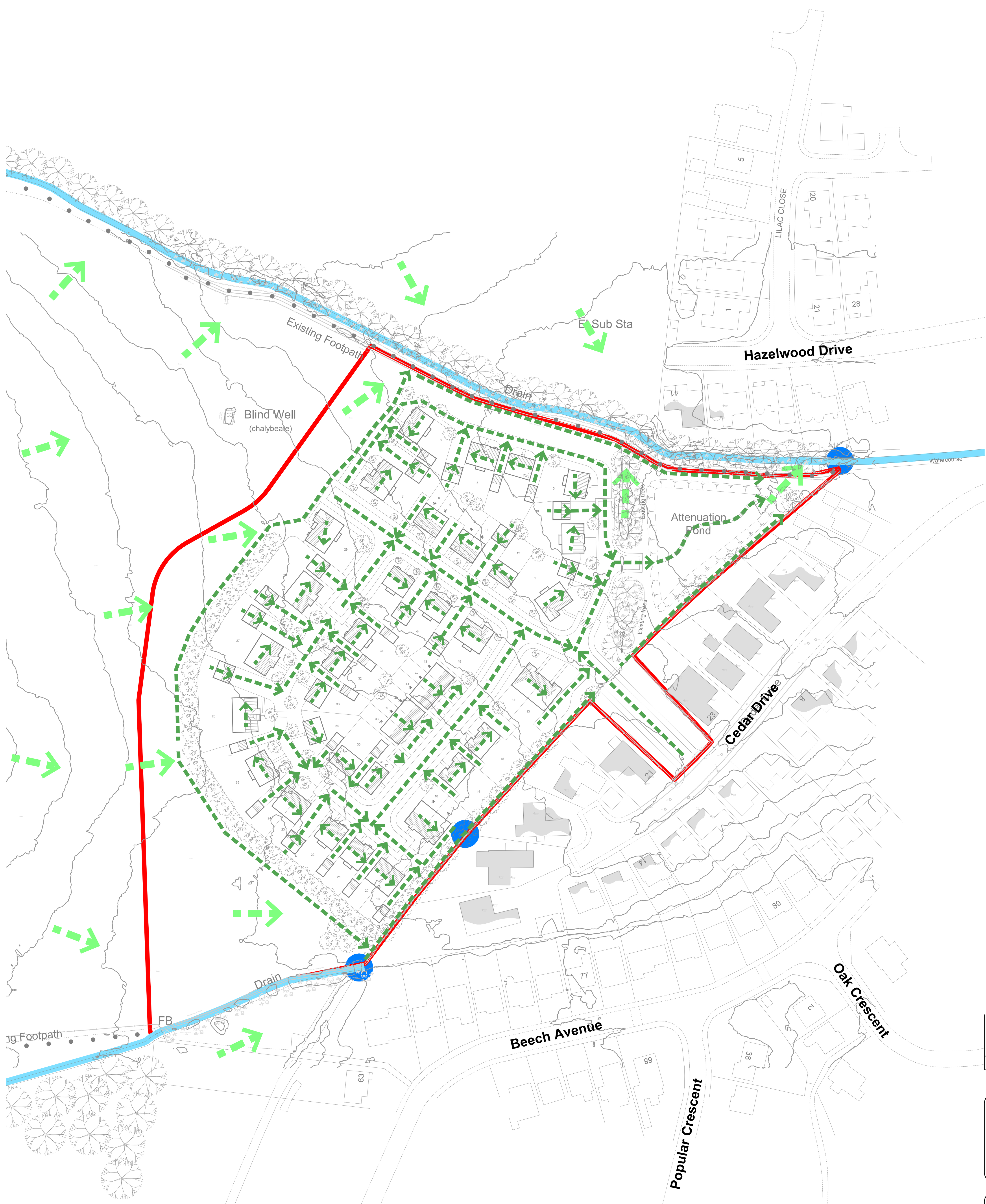
DEMOLITION RISKS

NONE RELEVANT TO THIS DRAWING.

## Existing Flow Route Analysis




## Modified Flow Route Analysis




General Notes

1. DO NOT SCALE.
2. This drawing is to be read in conjunction with all other relevant drawings and details.
3. Should there be any conflict between the details indicated on this drawing and those on other drawings the Engineer should be informed PRIOR to construction on site.
4. Until technical approval has been obtained from the relevant Authority, it should be understood that all drawings issued are Preliminary and NOT for construction. Should the Contractor commence site work prior to such approval being given it is entirely at their own risk.
5. Sketch proposals are for illustrative purposes only and as such are subject to detailed site investigation including ground conditions / contaminants, drainage, design and planning / density negotiations.
6. All dimensions are in millimetres unless otherwise stated.
7. The Farrow Walsh Consulting Designers Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site.

## NOTES

1. Topographical contours produced from national LiDAR data (2020 1m DTM).

## LEGEND

- Site Boundary
- Existing surface flow route
- Modified surface flow route
- Existing surface water drain/watercourse
- Historic surface water outfall point

| Rev | Description of updates | Drawn | Check'd | App'd | Date |
|---|---|---|---|---|---|
| A2 | Analysis updated to suit revised development layout. | EC | DM | JD | 08.12.21 |
| A1 | Issued for Approval. | DM | OP | JD | 30.07.21 |

Revision Schedule


farrow walsh CONSULTING

62 Highcross Street, Leicester LE1 4NN

321 Bradford Street, Birmingham B5 6ET

0330 100 0363

www.farrowwalsh.com


**FOR APPROVAL**

Client:
Hazelton Homes Ltd

Project:
Land adjacent Cedar Drive, Bourne, Lincolnshire

Title:
Flow Route Analysis

| Drawn: | Checked: | Approved: | Date: | Scale: |
|---|---|---|---|---|
| DM | OP | JD | July 2021 | 1:1,000 @ A1 |

Drawing No.: FW2038-D-400

Revision: A2

# APPENDIX L – DRAINAGE STRATEGY

**SAFETY, HEALTH AND ENVIRONMENTAL HAZARD INFORMATION BOX**

THE HAZARDS NOTED BELOW ARE IN ADDITION TO THE NORMAL HAZARDS AND RISKS FACED BY A COMPETENT CONTRACTOR WHEN DEALING WITH THE TYPES OF WORKS DETAILED ON THIS DRAWING.

CONSTRUCTION RISKS

NONE RELEVANT TO THIS DRAWING.

MAINTENANCE / CLEANING RISKS

NONE RELEVANT TO THIS DRAWING.

DEMOLITION RISKS

NONE RELEVANT TO THIS DRAWING.

## Drainage Strategy Summary Details

| | |
|---|---|
| Site Area (red boundary) | : 31,647m² / 3.165ha |
| Development Area | : 19,105m² / 1.911ha |
| Existing Impermeable Area | : 0m² / 0.000ha |
| Proposed Impermeable Area | : 9,780m² / 0.978ha |
| FEH $Q_{BAR}$ for Development Area | : 4.67 l/s |
| Proposed Surface Water Discharge Rate | : 4.6 l/s |

### Surface Water Network

- Development impermeable areas to be drained into the existing watercourse to mimic the historic Greenfield flow routes. Subject to LLFA approval.
- FEH $Q_{BAR}$ discharge rate to be used for all storm events up to the 1 in 100 year + climate change intensity.
- Climate change allowance of 40% to be applied, utilising Upper End Projection for development Design Life 2070-2115.
- Urban Creep allowance of 10% to be added to impermeable areas, as dwellings per hectare is <25.
- All drainage systems to provide SuDS treatment to Ciria753 Guidance.
- Surface runoff from roofs of buildings to be directed into granular sub-base of permeable paving (First Treatment).
- Private vehicle areas to be drained via permeable block paving with perforated carrier drains, catchpits and orifice flow controls (First Treatment).
- Adoptable roads are proposed to drain via trapped road gullies (First Treatment).
- All surface water run-off is directed through vegetated Attenuation Pond, before controlled discharge into existing watercourse (Second Treatment).

### Foul Water Network

- All foul water from private properties is proposed to be directed via gravity drains and sewers into the Anglian Water Foul sewer in Cedar Drive. Subject to S106 approval.

| Storm Event | FEH Greenfield Runoff Rate | Proposed Max. Discharge Rate |
|---|---|---|
| $Q_{BAR}$ | 4.67 l/s | 4.6 l/s |
| 1 in 1 year | 4.06 l/s | 4.6 l/s |
| 1 in 30 year | 11.45 l/s | 4.6 l/s |
| 1 in 100 year | 16.63 l/s | 4.6 l/s |
| 1 in 100+40%CC | - | 4.6 l/s |

Produced using HR Wallingford FEH Statistical Greenfield Runoff tool July 2021.

**Minimum pipe cover to soffits to be as per The Building Regulations 2010 Part H for thermoplastic pipes:**

- **0.6m in pedestrian or landscaped areas**
- **0.9m in vehicle accessible areas**

**Any pipes with cover to soffit less than those stated above are to have a Class Z concrete pipe bed & surround**

**Internal foul drain pipe minimum gradients:**

- **1:80 from SVP & WC to IC**
- **1:40 from Basin & Sink to IC**

**Refer to Architect's/M&E drawings for pipe sizes and setting-out information.**

**All drainage to be constructed in accordance with Sewer Sector Guidance and Building Regulations Part H.**

**A CCTV and level survey of the as-built drainage is to be undertaken by the Contractor and provided to the Engineer for final approval.**

**Sewer details shown have been taken from Anglian Water sewer records and are to be confirmed by Contractor prior to commencement of the works.**


General Notes

1. DO NOT SCALE.
2. This drawing is to be read in conjunction with all other relevant drawings and details.
3. Should there be any conflict between the details indicated on this drawing and those on other drawings the Engineer should be informed PRIOR to construction on site.
4. Until technical approval has been obtained from the relevant Authority, it should be understood that all drawings issued are Preliminary and NOT for construction. Should the Contractor commence site work prior to such approval being given it is entirely at their own risk.
5. Sketch proposals are for illustrative purposes only and as such are subject to detailed site investigation including ground conditions / contaminants, drainage, design and planning / density negotiations.
6. All dimensions are in millimetres unless otherwise stated.
7. The Farrow Walsh Consulting Designers Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site.

## NOTES

1. Information shown is for **PLANNING** purposes only and is not to be used for construction.
2. This drawing to be read in conjunction with all other relevant Engineer's and Architect's details/reports.
3. All work is to be carried out in accordance with the current British Standards, codes of practice, building regulations and Sewer Sector Guidance.
4. The exact position, level, size and use of existing sewers to be confirmed on site by the Contractor prior to commencement of any drainage works. Any discrepancies to be reported to the Engineer.

## LEGEND

Site Boundary

Existing surface water drain/watercourse

Historic surface water outfall point

Vegetated Attenuation Pond with Low Flow Channel

Surface water ditch/dry swale

Permeable Block Paving with Perforated Carrier Drain Beneath, with Catchpits and orifice flow controls

Foul Drain

Surface Water Drain

Trapped Road Gully

Headwall

Anglian Water Sewers

## DRAINAGE NOTES

1 **Proposed S106 Connection**
New connection into foul sewer subject to S106 application approval by Anglian Water.

2 **Mesh Screening**
Mesh screen to be placed over the outlet pipe of last chambers during site construction works and removed immediately prior to the first occupancy of the dwellings served by the sewers.

3 **Sewer Connection**
Invert levels and location of the sewer to be validated by Contractor prior to commencement of any foul drainage works.

4 **Surface Water Discharge Rate**
Storm discharge from the site are shown in the tables for up to a 1 in 100 year +40% climate change storm event, using a flow control device in last chamber (S19).

5 **Surface Water Ditch / Dry Swale**
Surface water or dry swale to intercept runoff running towards proposed development and third-party land. Outfalls directed into adjacent watercourses to mimic existing Greenfield runoff routes.

6 **Rain Water Pipes**
All rain water pipes from roofs of buildings to be drained into the granular sub-base of the adjacent permeable block paving.

7 **Surface Water Outfall**
Surface water discharge into the watercourse subject to approval by the LLFA.

| Rev | Description of updates | Drawn | Check'd | App'd | Date |
|---|---|---|---|---|---|
| A2 | Drainage strategy updated to suit revised development layout. | EC | DM | JD | 08.12.21 |
| A1 | Issued for Approval. | DM | OP | JD | 30.07.21 |

Revision Schedule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# FOR APPROVAL

Client:
Hazelton Homes Ltd

Project:
Land Adjacent Cedar Drive, Bourne, Lincolnshire

Title:
Drainage Strategy

| Drawn: | Checked: | Approved: | Date: | Scale: |
|---|---|---|---|---|
| DM | OP | JD | July 2021 | 1:500 @ A1 |

Drawing No.: FW2038-D-401
Revision: A2

# APPENDIX M – HYDRAULIC CALCULATIONS

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-99 | Time of Entry (mins) | 4.00 |
| Return Period (years) | 2 | Maximum Time of Concentration (mins) | 30.00 |
| Additional Flow (%) | 0 | Maximum Rainfall (mm/hr) | 50.0 |
| C (1km) | -0.020 | Minimum Velocity (m/s) | 1.00 |
| D1 (1km) | 0.339 | Connection Type | Level Soffits |
| D2 (1km) | 0.314 | Minimum Backdrop Height (m) | 0.200 |
| D3 (1km) | 0.183 | Preferred Cover Depth (m) | 1.200 |
| E (1km) | 0.304 | Include Intermediate Ground | ✓ |
| F (1km) | 2.509 | Enforce best practice design rules | ✓ |
| CV | 0.750 | | |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| S1LA | 0.064 | 4.00 | 19.899 | 600 | 508578.855 | 320748.136 | 1.050 |
| S1 | 0.034 | 4.00 | 19.966 | 1200 | 508589.755 | 320738.884 | 1.726 |
| S1LB | 0.030 | 4.00 | 19.485 | 600 | 508603.348 | 320726.906 | 1.000 |
| S2 | 0.000 | | 19.856 | 1200 | 508600.609 | 320751.670 | 1.715 |
| S2L | 0.016 | 4.00 | 19.895 | 600 | 508597.464 | 320754.339 | 1.266 |
| S3 | 0.029 | 4.00 | 19.801 | 1200 | 508613.156 | 320766.452 | 1.849 |
| S3LA | 0.013 | 4.00 | 19.820 | 600 | 508606.988 | 320765.419 | 1.092 |
| S3LB | 0.056 | 4.00 | 19.839 | 600 | 508609.904 | 320769.213 | 1.310 |
| S3LC | 0.008 | 4.00 | 19.759 | 600 | 508616.075 | 320759.541 | 1.050 |
| S4 | 0.000 | | 19.782 | 1200 | 508621.089 | 320775.797 | 1.880 |
| S4L | 0.013 | 4.00 | 19.659 | 600 | 508626.212 | 320771.449 | 1.050 |
| S5 | 0.013 | 4.00 | 19.344 | 1200 | 508631.300 | 320787.827 | 1.506 |
| S5LA | 0.021 | 4.00 | 19.514 | 600 | 508623.891 | 320785.565 | 1.050 |
| S5LB | 0.017 | 4.00 | 19.338 | 600 | 508636.467 | 320783.441 | 1.050 |
| S6 | 0.038 | 4.00 | 19.157 | 1200 | 508635.584 | 320792.874 | 1.346 |
| S6L | 0.014 | 4.00 | 19.167 | 600 | 508632.075 | 320795.361 | 1.050 |
| S7 | 0.035 | 4.00 | 19.029 | 1200 | 508585.685 | 320864.527 | 1.808 |
| S7L | 0.083 | 4.00 | 19.306 | 600 | 508576.586 | 320851.532 | 1.050 |
| S8 | 0.026 | 4.00 | 18.640 | 1200 | 508610.146 | 320847.400 | 1.595 |
| S8LA | 0.017 | 4.00 | 18.563 | 600 | 508610.273 | 320855.272 | 1.050 |
| S8LB | 0.015 | 4.00 | 18.698 | 600 | 508607.542 | 320843.681 | 1.124 |
| S9 | 0.000 | | 18.484 | 1200 | 508622.671 | 320838.630 | 1.529 |
| S9LA | 0.016 | 4.00 | 18.399 | 600 | 508621.256 | 320847.544 | 1.050 |
| S9LB | 0.020 | 4.00 | 18.590 | 600 | 508620.062 | 320834.904 | 1.105 |
| S10 | 0.028 | 4.00 | 18.361 | 1200 | 508636.401 | 320829.016 | 1.579 |
| S10LA | 0.020 | 4.00 | 18.276 | 600 | 508632.732 | 320839.531 | 1.050 |
| S10LB | 0.022 | 4.00 | 18.507 | 600 | 508633.812 | 320825.319 | 1.124 |
| S11 | 0.004 | 4.00 | 18.333 | 1200 | 508642.300 | 320824.886 | 1.581 |
| S11L | 0.018 | 4.00 | 18.146 | 600 | 508645.996 | 320830.164 | 1.050 |
| S12 | 0.025 | 4.00 | 18.276 | 1500 | 508652.722 | 320817.588 | 1.726 |
| S13 | 0.029 | 4.00 | 18.487 | 1200 | 508700.125 | 320781.318 | 1.425 |
| S14 | 0.017 | 4.00 | 18.019 | 1200 | 508679.241 | 320802.047 | 1.463 |
| S14L | 0.027 | 4.00 | 18.050 | 600 | 508676.227 | 320799.010 | 1.050 |
| S15 | 0.032 | 4.00 | 17.916 | 1500 | 508672.361 | 320808.875 | 1.650 |
| S16 | 0.008 | 4.00 | 17.301 | 1200 | 508684.201 | 320849.001 | 1.264 |
| S16LA | 0.120 | 4.00 | 17.169 | 600 | 508682.952 | 320863.717 | 0.909 |
| S16LB | 0.033 | 4.00 | 17.357 | 600 | 508679.002 | 320848.913 | 1.050 |
| S17 | 0.020 | 4.00 | 17.328 | 1500 | 508686.810 | 320841.444 | 1.563 |
| S18 | 0.000 | | 17.180 | 1500 | 508699.687 | 320841.201 | 1.446 |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| HW1 | 0.000 | | 17.004 | 1200 | 508705.770 | 320843.350 | 1.286 |
| HW2 | 0.000 | 4.00 | 16.720 | 1200 | 508737.158 | 320860.706 | 1.002 |
| S19 | 0.000 | | 16.720 | 1200 | 508741.900 | 320865.062 | 1.040 |
| HW3 | 0.000 | | 16.581 | 1200 | 508750.200 | 320875.859 | 0.981 |

## 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 | S1LA | S1 | 14.297 | 0.600 | 18.849 | 18.315 | 0.534 | 26.8 | 150 | 4.12 | 50.0 |
| 1.001 | S1 | S2 | 16.772 | 0.600 | 18.240 | 18.141 | 0.099 | 169.4 | 225 | 4.59 | 50.0 |
| 2.000 | S1LB | S1 | 18.117 | 0.600 | 18.485 | 18.315 | 0.170 | 106.6 | 150 | 4.31 | 50.0 |
| 1.002 | S2 | S3 | 19.390 | 0.600 | 18.141 | 18.027 | 0.114 | 170.1 | 225 | 4.91 | 50.0 |
| 3.000 | S2L | S2 | 4.124 | 0.600 | 18.629 | 18.216 | 0.413 | 10.0 | 150 | 4.02 | 50.0 |
| 1.003 | S3 | S4 | 12.258 | 0.600 | 17.952 | 17.902 | 0.050 | 245.2 | 300 | 5.12 | 50.0 |
| 4.000 | S3LA | S3 | 6.254 | 0.600 | 18.728 | 18.102 | 0.626 | 10.0 | 150 | 4.03 | 50.0 |
| 5.000 | S3LB | S3 | 4.266 | 0.600 | 18.529 | 18.102 | 0.427 | 10.0 | 150 | 4.02 | 50.0 |
| 6.000 | S3LC | S3 | 7.502 | 0.600 | 18.709 | 18.102 | 0.607 | 12.4 | 150 | 4.04 | 50.0 |
| 1.004 | S4 | S5 | 15.779 | 0.600 | 17.902 | 17.838 | 0.064 | 246.5 | 300 | 5.38 | 50.0 |
| 7.000 | S4L | S4 | 6.720 | 0.600 | 18.609 | 18.052 | 0.557 | 12.1 | 150 | 4.04 | 50.0 |
| 1.005 | S5 | S6 | 6.621 | 0.600 | 17.838 | 17.811 | 0.027 | 245.2 | 300 | 5.49 | 50.0 |
| 8.000 | S5LA | S5 | 7.746 | 0.600 | 18.464 | 17.988 | 0.476 | 16.3 | 150 | 4.05 | 50.0 |
| 9.000 | S5LB | S5 | 6.778 | 0.600 | 18.288 | 17.988 | 0.300 | 22.6 | 150 | 4.05 | 50.0 |
| 1.006 | S6 | S12 | 30.074 | 0.600 | 17.811 | 16.700 | 1.111 | 27.1 | 300 | 5.66 | 50.0 |
| 10.000 | S6L | S6 | 4.301 | 0.600 | 18.117 | 17.961 | 0.156 | 27.6 | 150 | 4.04 | 50.0 |
| 11.001 | S7 | S8 | 29.861 | 0.600 | 17.221 | 17.045 | 0.176 | 169.7 | 225 | 4.60 | 50.0 |
| 11.000 | S7L | S7 | 15.865 | 0.600 | 18.256 | 17.296 | 0.960 | 16.5 | 150 | 4.11 | 50.0 |
| 11.002 | S8 | S9 | 15.290 | 0.600 | 17.045 | 16.955 | 0.090 | 169.9 | 225 | 4.86 | 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) |
|---|---|---|---|---|---|---|---|
| 1.000 | 1.953 | 34.5 | 8.7 | 0.900 | 1.501 | 0.064 | 0.0 |
| 1.001 | 1.001 | 39.8 | 17.3 | 1.501 | 1.490 | 0.128 | 0.0 |
| 2.000 | 0.973 | 17.2 | 4.1 | 0.850 | 1.501 | 0.030 | 0.0 |
| 1.002 | 0.999 | 39.7 | 19.5 | 1.490 | 1.549 | 0.144 | 0.0 |
| 3.000 | 3.207 | 56.7 | 2.2 | 1.116 | 1.490 | 0.016 | 0.0 |
| 1.003 | 0.999 | 70.6 | 33.9 | 1.549 | 1.580 | 0.250 | 0.0 |
| 4.000 | 3.206 | 56.7 | 1.8 | 0.942 | 1.549 | 0.013 | 0.0 |
| 5.000 | 3.206 | 56.7 | 7.6 | 1.160 | 1.549 | 0.056 | 0.0 |
| 6.000 | 2.881 | 50.9 | 1.1 | 0.900 | 1.549 | 0.008 | 0.0 |
| 1.004 | 0.997 | 70.4 | 35.6 | 1.580 | 1.206 | 0.263 | 0.0 |
| 7.000 | 2.916 | 51.5 | 1.8 | 0.900 | 1.580 | 0.013 | 0.0 |
| 1.005 | 0.999 | 70.6 | 42.6 | 1.206 | 1.046 | 0.314 | 0.0 |
| 8.000 | 2.509 | 44.3 | 2.8 | 0.900 | 1.206 | 0.021 | 0.0 |
| 9.000 | 2.127 | 37.6 | 2.3 | 0.900 | 1.206 | 0.017 | 0.0 |
| 1.006 | 3.033 | 214.4 | 49.6 | 1.046 | 1.276 | 0.366 | 0.0 |
| 10.000 | 1.925 | 34.0 | 1.9 | 0.900 | 1.046 | 0.014 | 0.0 |
| 11.001 | 1.001 | 39.8 | 16.0 | 1.583 | 1.370 | 0.118 | 0.0 |
| 11.000 | 2.490 | 44.0 | 11.2 | 0.900 | 1.583 | 0.083 | 0.0 |
| 11.002 | 1.000 | 39.8 | 23.9 | 1.370 | 1.304 | 0.176 | 0.0 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.000 | S8LA | S8 | 7.873 | 0.600 | 17.513 | 17.120 | 0.393 | 20.0 | 150 | 4.06 | 50.0 |
| 13.000 | S8LB | S8 | 4.540 | 0.600 | 17.574 | 17.120 | 0.454 | 10.0 | 150 | 4.02 | 50.0 |
| 11.003 | S9 | S10 | 16.761 | 0.600 | 16.955 | 16.857 | 0.098 | 171.0 | 225 | 5.14 | 50.0 |
| 14.000 | S9LA | S9 | 9.025 | 0.600 | 17.349 | 17.030 | 0.319 | 28.3 | 150 | 4.08 | 50.0 |
| 15.000 | S9LB | S9 | 4.548 | 0.600 | 17.485 | 17.030 | 0.455 | 10.0 | 150 | 4.02 | 50.0 |
| 11.004 | S10 | S11 | 7.201 | 0.600 | 16.782 | 16.752 | 0.030 | 240.0 | 300 | 5.26 | 50.0 |
| 16.000 | S10LA | S10 | 11.137 | 0.600 | 17.226 | 16.932 | 0.294 | 37.9 | 150 | 4.11 | 50.0 |
| 17.000 | S10LB | S10 | 4.513 | 0.600 | 17.383 | 16.932 | 0.451 | 10.0 | 150 | 4.02 | 50.0 |
| 11.005 | S11 | S12 | 12.723 | 0.600 | 16.752 | 16.700 | 0.052 | 244.7 | 300 | 5.47 | 50.0 |
| 18.000 | S11L | S11 | 6.444 | 0.600 | 17.096 | 16.902 | 0.194 | 33.2 | 150 | 4.06 | 50.0 |
| 1.007 | S12 | S15 | 21.485 | 0.600 | 16.550 | 16.266 | 0.284 | 75.7 | 450 | 5.81 | 50.0 |
| 19.000 | S13 | S14 | 29.425 | 0.600 | 17.062 | 16.556 | 0.506 | 58.2 | 225 | 4.29 | 50.0 |
| 19.001 | S14 | S15 | 9.694 | 0.600 | 16.556 | 16.491 | 0.065 | 149.1 | 225 | 4.44 | 50.0 |
| 20.000 | S14L | S14 | 4.278 | 0.600 | 17.000 | 16.631 | 0.369 | 11.6 | 150 | 4.02 | 50.0 |
| 1.008 | S15 | S17 | 35.630 | 0.600 | 16.266 | 15.765 | 0.501 | 71.1 | 450 | 6.06 | 50.0 |
| 21.000 | S16LA | S16 | 14.769 | 0.600 | 16.260 | 16.112 | 0.148 | 99.8 | 150 | 4.24 | 50.0 |
| 21.001 | S16 | S17 | 7.994 | 0.600 | 16.037 | 15.990 | 0.047 | 170.1 | 225 | 4.38 | 50.0 |
| 22.000 | S16LB | S16 | 5.200 | 0.600 | 16.307 | 16.112 | 0.195 | 26.7 | 150 | 4.04 | 50.0 |
| 1.009 | S17 | S18 | 12.879 | 0.600 | 15.765 | 15.734 | 0.031 | 415.5 | 450 | 6.27 | 50.0 |
| 1.010 | S18 | HW1 | 6.452 | 0.600 | 15.734 | 15.718 | 0.016 | 403.3 | 450 | 6.38 | 50.0 |
| 1.011 | HW2 | S19 | 6.440 | 0.600 | 15.718 | 15.680 | 0.038 | 169.5 | 225 | 4.11 | 50.0 |
| 1.012 | S19 | HW3 | 13.618 | 0.600 | 15.680 | 15.600 | 0.080 | 170.2 | 225 | 4.33 | 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) |
|---|---|---|---|---|---|---|---|
| 12.000 | 2.260 | 39.9 | 2.3 | 0.900 | 1.370 | 0.017 | 0.0 |
| 13.000 | 3.204 | 56.6 | 2.0 | 0.974 | 1.370 | 0.015 | 0.0 |
| 11.003 | 0.997 | 39.6 | 28.7 | 1.304 | 1.279 | 0.212 | 0.0 |
| 14.000 | 1.900 | 33.6 | 2.2 | 0.900 | 1.304 | 0.016 | 0.0 |
| 15.000 | 3.205 | 56.6 | 2.7 | 0.955 | 1.304 | 0.020 | 0.0 |
| 11.004 | 1.010 | 71.4 | 38.2 | 1.279 | 1.281 | 0.282 | 0.0 |
| 16.000 | 1.640 | 29.0 | 2.7 | 0.900 | 1.279 | 0.020 | 0.0 |
| 17.000 | 3.203 | 56.6 | 3.0 | 0.974 | 1.279 | 0.022 | 0.0 |
| 11.005 | 1.000 | 70.7 | 41.2 | 1.281 | 1.276 | 0.304 | 0.0 |
| 18.000 | 1.752 | 31.0 | 2.4 | 0.900 | 1.281 | 0.018 | 0.0 |
| 1.007 | 2.339 | 372.0 | 94.2 | 1.276 | 1.200 | 0.695 | 0.0 |
| 19.000 | 1.718 | 68.3 | 3.9 | 1.200 | 1.238 | 0.029 | 0.0 |
| 19.001 | 1.068 | 42.5 | 9.9 | 1.238 | 1.200 | 0.073 | 0.0 |
| 20.000 | 2.975 | 52.6 | 3.7 | 0.900 | 1.238 | 0.027 | 0.0 |
| 1.008 | 2.413 | 383.7 | 108.4 | 1.200 | 1.113 | 0.800 | 0.0 |
| 21.000 | 1.006 | 17.8 | 16.3 | 0.759 | 1.039 | 0.120 | 0.0 |
| 21.001 | 0.999 | 39.7 | 21.8 | 1.039 | 1.113 | 0.161 | 0.0 |
| 22.000 | 1.957 | 34.6 | 4.5 | 0.900 | 1.039 | 0.033 | 0.0 |
| 1.009 | 0.991 | 157.6 | 133.0 | 1.113 | 0.996 | 0.981 | 0.0 |
| 1.010 | 1.006 | 160.0 | 133.0 | 0.996 | 0.836 | 0.981 | 0.0 |
| 1.011 | 1.001 | 39.8 | 0.0 | 0.777 | 0.815 | 0.000 | 0.0 |
| 1.012 | 0.999 | 39.7 | 0.0 | 0.815 | 0.756 | 0.000 | 0.0 |

## 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 | 14.297 | 26.8 | 150 | 1 | 19.899 | 18.849 | 0.900 | 19.966 | 18.315 | 1.501 |
| 1.001 | 16.772 | 169.4 | 225 | 1 | 19.966 | 18.240 | 1.501 | 19.856 | 18.141 | 1.490 |
| 2.000 | 18.117 | 106.6 | 150 | 1 | 19.485 | 18.485 | 0.850 | 19.966 | 18.315 | 1.501 |
| 1.002 | 19.390 | 170.1 | 225 | 1 | 19.856 | 18.141 | 1.490 | 19.801 | 18.027 | 1.549 |
| 3.000 | 4.124 | 10.0 | 150 | 1 | 19.895 | 18.629 | 1.116 | 19.856 | 18.216 | 1.490 |
| 1.003 | 12.258 | 245.2 | 300 | 1 | 19.801 | 17.952 | 1.549 | 19.782 | 17.902 | 1.580 |
| 4.000 | 6.254 | 10.0 | 150 | 1 | 19.820 | 18.728 | 0.942 | 19.801 | 18.102 | 1.549 |
| 5.000 | 4.266 | 10.0 | 150 | 1 | 19.839 | 18.529 | 1.160 | 19.801 | 18.102 | 1.549 |
| 6.000 | 7.502 | 12.4 | 150 | 1 | 19.759 | 18.709 | 0.900 | 19.801 | 18.102 | 1.549 |
| 1.004 | 15.779 | 246.5 | 300 | 1 | 19.782 | 17.902 | 1.580 | 19.344 | 17.838 | 1.206 |
| 7.000 | 6.720 | 12.1 | 150 | 1 | 19.659 | 18.609 | 0.900 | 19.782 | 18.052 | 1.580 |
| 1.005 | 6.621 | 245.2 | 300 | 1 | 19.344 | 17.838 | 1.206 | 19.157 | 17.811 | 1.046 |
| 8.000 | 7.746 | 16.3 | 150 | 1 | 19.514 | 18.464 | 0.900 | 19.344 | 17.988 | 1.206 |
| 9.000 | 6.778 | 22.6 | 150 | 1 | 19.338 | 18.288 | 0.900 | 19.344 | 17.988 | 1.206 |
| 1.006 | 30.074 | 27.1 | 300 | 1 | 19.157 | 17.811 | 1.046 | 18.276 | 16.700 | 1.276 |
| 10.000 | 4.301 | 27.6 | 150 | 1 | 19.167 | 18.117 | 0.900 | 19.157 | 17.961 | 1.046 |
| 11.001 | 29.861 | 169.7 | 225 | 1 | 19.029 | 17.221 | 1.583 | 18.640 | 17.045 | 1.370 |
| 11.000 | 15.865 | 16.5 | 150 | 1 | 19.306 | 18.256 | 0.900 | 19.029 | 17.296 | 1.583 |
| 11.002 | 15.290 | 169.9 | 225 | 1 | 18.640 | 17.045 | 1.370 | 18.484 | 16.955 | 1.304 |
| 12.000 | 7.873 | 20.0 | 150 | 1 | 18.563 | 17.513 | 0.900 | 18.640 | 17.120 | 1.370 |
| 13.000 | 4.540 | 10.0 | 150 | 1 | 18.698 | 17.574 | 0.974 | 18.640 | 17.120 | 1.370 |
| 11.003 | 16.761 | 171.0 | 225 | 1 | 18.484 | 16.955 | 1.304 | 18.361 | 16.857 | 1.279 |
| 14.000 | 9.025 | 28.3 | 150 | 1 | 18.399 | 17.349 | 0.900 | 18.484 | 17.030 | 1.304 |
| 15.000 | 4.548 | 10.0 | 150 | 1 | 18.590 | 17.485 | 0.955 | 18.484 | 17.030 | 1.304 |
| 11.004 | 7.201 | 240.0 | 300 | 1 | 18.361 | 16.782 | 1.279 | 18.333 | 16.752 | 1.281 |

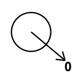
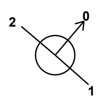
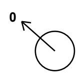
| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | S1LA | 600 | Manhole | 1 | S1 | 1200 | Manhole | 1 |
| 1.001 | S1 | 1200 | Manhole | 1 | S2 | 1200 | Manhole | 1 |
| 2.000 | S1LB | 600 | Manhole | 1 | S1 | 1200 | Manhole | 1 |
| 1.002 | S2 | 1200 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 3.000 | S2L | 600 | Manhole | 1 | S2 | 1200 | Manhole | 1 |
| 1.003 | S3 | 1200 | Manhole | 1 | S4 | 1200 | Manhole | 1 |
| 4.000 | S3LA | 600 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 5.000 | S3LB | 600 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 6.000 | S3LC | 600 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 1.004 | S4 | 1200 | Manhole | 1 | S5 | 1200 | Manhole | 1 |
| 7.000 | S4L | 600 | Manhole | 1 | S4 | 1200 | Manhole | 1 |
| 1.005 | S5 | 1200 | Manhole | 1 | S6 | 1200 | Manhole | 1 |
| 8.000 | S5LA | 600 | Manhole | 1 | S5 | 1200 | Manhole | 1 |
| 9.000 | S5LB | 600 | Manhole | 1 | S5 | 1200 | Manhole | 1 |
| 1.006 | S6 | 1200 | Manhole | 1 | S12 | 1500 | Manhole | 1 |
| 10.000 | S6L | 600 | Manhole | 1 | S6 | 1200 | Manhole | 1 |
| 11.001 | S7 | 1200 | Manhole | 1 | S8 | 1200 | Manhole | 1 |
| 11.000 | S7L | 600 | Manhole | 1 | S7 | 1200 | Manhole | 1 |
| 11.002 | S8 | 1200 | Manhole | 1 | S9 | 1200 | Manhole | 1 |
| 12.000 | S8LA | 600 | Manhole | 1 | S8 | 1200 | Manhole | 1 |
| 13.000 | S8LB | 600 | Manhole | 1 | S8 | 1200 | Manhole | 1 |
| 11.003 | S9 | 1200 | Manhole | 1 | S10 | 1200 | Manhole | 1 |
| 14.000 | S9LA | 600 | Manhole | 1 | S9 | 1200 | Manhole | 1 |
| 15.000 | S9LB | 600 | Manhole | 1 | S9 | 1200 | Manhole | 1 |
| 11.004 | S10 | 1200 | Manhole | 1 | S11 | 1200 | Manhole | 1 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| 16.000 | 11.137 | 37.9 | 150 | 1 | 18.276 | 17.226 | 0.900 | 18.361 | 16.932 | 1.279 |
| 17.000 | 4.513 | 10.0 | 150 | 1 | 18.507 | 17.383 | 0.974 | 18.361 | 16.932 | 1.279 |
| 11.005 | 12.723 | 244.7 | 300 | 1 | 18.333 | 16.752 | 1.281 | 18.276 | 16.700 | 1.276 |
| 18.000 | 6.444 | 33.2 | 150 | 1 | 18.146 | 17.096 | 0.900 | 18.333 | 16.902 | 1.281 |
| 1.007 | 21.485 | 75.7 | 450 | 1 | 18.276 | 16.550 | 1.276 | 17.916 | 16.266 | 1.200 |
| 19.000 | 29.425 | 58.2 | 225 | 1 | 18.487 | 17.062 | 1.200 | 18.019 | 16.556 | 1.238 |
| 19.001 | 9.694 | 149.1 | 225 | 1 | 18.019 | 16.556 | 1.238 | 17.916 | 16.491 | 1.200 |
| 20.000 | 4.278 | 11.6 | 150 | 1 | 18.050 | 17.000 | 0.900 | 18.019 | 16.631 | 1.238 |
| 1.008 | 35.630 | 71.1 | 450 | 1 | 17.916 | 16.266 | 1.200 | 17.328 | 15.765 | 1.113 |
| 21.000 | 14.769 | 99.8 | 150 | 1 | 17.169 | 16.260 | 0.759 | 17.301 | 16.112 | 1.039 |
| 21.001 | 7.994 | 170.1 | 225 | 1 | 17.301 | 16.037 | 1.039 | 17.328 | 15.990 | 1.113 |
| 22.000 | 5.200 | 26.7 | 150 | 1 | 17.357 | 16.307 | 0.900 | 17.301 | 16.112 | 1.039 |
| 1.009 | 12.879 | 415.5 | 450 | 1 | 17.328 | 15.765 | 1.113 | 17.180 | 15.734 | 0.996 |
| 1.010 | 6.452 | 403.3 | 450 | 1 | 17.180 | 15.734 | 0.996 | 17.004 | 15.718 | 0.836 |
| 1.011 | 6.440 | 169.5 | 225 | 1 | 16.720 | 15.718 | 0.777 | 16.720 | 15.680 | 0.815 |
| 1.012 | 13.618 | 170.2 | 225 | 1 | 16.720 | 15.680 | 0.815 | 16.581 | 15.600 | 0.756 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 16.000 | S10LA | 600 | Manhole | 1 | S10 | 1200 | Manhole | 1 |
| 17.000 | S10LB | 600 | Manhole | 1 | S10 | 1200 | Manhole | 1 |
| 11.005 | S11 | 1200 | Manhole | 1 | S12 | 1500 | Manhole | 1 |
| 18.000 | S11L | 600 | Manhole | 1 | S11 | 1200 | Manhole | 1 |
| 1.007 | S12 | 1500 | Manhole | 1 | S15 | 1500 | Manhole | 1 |
| 19.000 | S13 | 1200 | Manhole | 1 | S14 | 1200 | Manhole | 1 |
| 19.001 | S14 | 1200 | Manhole | 1 | S15 | 1500 | Manhole | 1 |
| 20.000 | S14L | 600 | Manhole | 1 | S14 | 1200 | Manhole | 1 |
| 1.008 | S15 | 1500 | Manhole | 1 | S17 | 1500 | Manhole | 1 |
| 21.000 | S16LA | 600 | Manhole | 1 | S16 | 1200 | Manhole | 1 |
| 21.001 | S16 | 1200 | Manhole | 1 | S17 | 1500 | Manhole | 1 |
| 22.000 | S16LB | 600 | Manhole | 1 | S16 | 1200 | Manhole | 1 |
| 1.009 | S17 | 1500 | Manhole | 1 | S18 | 1500 | Manhole | 1 |
| 1.010 | S18 | 1500 | Manhole | 1 | HW1 | 1200 | Manhole | 1 |
| 1.011 | HW2 | 1200 | Manhole | 1 | S19 | 1200 | Manhole | 1 |
| 1.012 | S19 | 1200 | Manhole | 1 | HW3 | 1200 | Manhole | 1 |

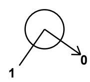
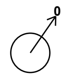
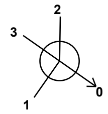
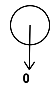
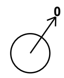
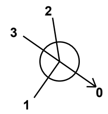
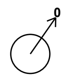
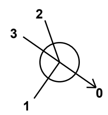
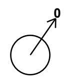
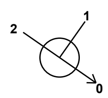
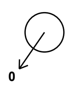
## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1LA | 508578.855 | 320748.136 | 19.899 | 1.050 | 600 |  | 0 | 1.000 | 18.849 | 150 |
| S1 | 508589.755 | 320738.884 | 19.966 | 1.726 | 1200 |  | 1 | 2.000 | 18.315 | 150 |
| | | | | | | | 2 | 1.000 | 18.315 | 150 |
| | | | | | | | 0 | 1.001 | 18.240 | 225 |
| S1LB | 508603.348 | 320726.906 | 19.485 | 1.000 | 600 |  | 0 | 2.000 | 18.485 | 150 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| S2 | 508600.609 | 320751.670 | 19.856 | 1.715 | 1200 | 1 | 3.000 | 18.216 | 150 |
| | | | | | | 2 | 1.001 | 18.141 | 225 |
| | | | | | | 0 | 1.002 | 18.141 | 225 |
| S2L | 508597.464 | 320754.339 | 19.895 | 1.266 | 600 | 0 | 3.000 | 18.629 | 150 |
| S3 | 508613.156 | 320766.452 | 19.801 | 1.849 | 1200 | 1 | 6.000 | 18.102 | 150 |
| | | | | | | 2 | 5.000 | 18.102 | 150 |
| | | | | | | 3 | 4.000 | 18.102 | 150 |
| | | | | | | 4 | 1.002 | 18.027 | 225 |
| | | | | | | 0 | 1.003 | 17.952 | 300 |
| S3LA | 508606.988 | 320765.419 | 19.820 | 1.092 | 600 | 0 | 4.000 | 18.728 | 150 |
| S3LB | 508609.904 | 320769.213 | 19.839 | 1.310 | 600 | 0 | 5.000 | 18.529 | 150 |
| S3LC | 508616.075 | 320759.541 | 19.759 | 1.050 | 600 | 0 | 6.000 | 18.709 | 150 |
| S4 | 508621.089 | 320775.797 | 19.782 | 1.880 | 1200 | 1 | 7.000 | 18.052 | 150 |
| | | | | | | 2 | 1.003 | 17.902 | 300 |
| | | | | | | 0 | 1.004 | 17.902 | 300 |
| S4L | 508626.212 | 320771.449 | 19.659 | 1.050 | 600 | 0 | 7.000 | 18.609 | 150 |
| S5 | 508631.300 | 320787.827 | 19.344 | 1.506 | 1200 | 1 | 9.000 | 17.988 | 150 |
| | | | | | | 2 | 8.000 | 17.988 | 150 |
| | | | | | | 3 | 1.004 | 17.838 | 300 |
| | | | | | | 0 | 1.005 | 17.838 | 300 |
| S5LA | 508623.891 | 320785.565 | 19.514 | 1.050 | 600 | 0 | 8.000 | 18.464 | 150 |
| S5LB | 508636.467 | 320783.441 | 19.338 | 1.050 | 600 | 0 | 9.000 | 18.288 | 150 |
| S6 | 508635.584 | 320792.874 | 19.157 | 1.346 | 1200 | 1 | 10.000 | 17.961 | 150 |
| | | | | | | 2 | 1.005 | 17.811 | 300 |
| | | | | | | 0 | 1.006 | 17.811 | 300 |
| S6L | 508632.075 | 320795.361 | 19.167 | 1.050 | 600 | 0 | 10.000 | 18.117 | 150 |

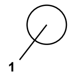
**Manhole Schedule**

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| S7 | 508585.685 | 320864.527 | 19.029 | 1.808 | 1200 |  | 1 | 11.000 | 17.296 | 150 |
| | | | | | | | 0 | 11.001 | 17.221 | 225 |
| S7L | 508576.586 | 320851.532 | 19.306 | 1.050 | 600 |  | 0 | 11.000 | 18.256 | 150 |
| S8 | 508610.146 | 320847.400 | 18.640 | 1.595 | 1200 |  | 1 | 13.000 | 17.120 | 150 |
| | | | | | | | 2 | 12.000 | 17.120 | 150 |
| | | | | | | | 3 | 11.001 | 17.045 | 225 |
| | | | | | | | 0 | 11.002 | 17.045 | 225 |
| S8LA | 508610.273 | 320855.272 | 18.563 | 1.050 | 600 |  | 0 | 12.000 | 17.513 | 150 |
| S8LB | 508607.542 | 320843.681 | 18.698 | 1.124 | 600 |  | 0 | 13.000 | 17.574 | 150 |
| S9 | 508622.671 | 320838.630 | 18.484 | 1.529 | 1200 |  | 1 | 15.000 | 17.030 | 150 |
| | | | | | | | 2 | 14.000 | 17.030 | 150 |
| | | | | | | | 3 | 11.002 | 16.955 | 225 |
| | | | | | | | 0 | 11.003 | 16.955 | 225 |
| S9LA | 508621.256 | 320847.544 | 18.399 | 1.050 | 600 |  | 0 | 14.000 | 17.349 | 150 |
| S9LB | 508620.062 | 320834.904 | 18.590 | 1.105 | 600 |  | 0 | 15.000 | 17.485 | 150 |
| S10 | 508636.401 | 320829.016 | 18.361 | 1.579 | 1200 |  | 1 | 17.000 | 16.932 | 150 |
| | | | | | | | 2 | 16.000 | 16.932 | 150 |
| | | | | | | | 3 | 11.003 | 16.857 | 225 |
| | | | | | | | 0 | 11.004 | 16.782 | 300 |
| S10LA | 508632.732 | 320839.531 | 18.276 | 1.050 | 600 |  | 0 | 16.000 | 17.226 | 150 |
| S10LB | 508633.812 | 320825.319 | 18.507 | 1.124 | 600 |  | 0 | 17.000 | 17.383 | 150 |
| S11 | 508642.300 | 320824.886 | 18.333 | 1.581 | 1200 |  | 1 | 18.000 | 16.902 | 150 |
| | | | | | | | 2 | 11.004 | 16.752 | 300 |
| | | | | | | | 0 | 11.005 | 16.752 | 300 |
| S11L | 508645.996 | 320830.164 | 18.146 | 1.050 | 600 |  | 0 | 18.000 | 17.096 | 150 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| S12 | 508652.722 | 320817.588 | 18.276 | 1.726 | 1500 | 1 | 11.005 | 16.700 | 300 |
| | | | | | | 2 | 1.006 | 16.700 | 300 |
| | | | | | | 0 | 1.007 | 16.550 | 450 |
| S13 | 508700.125 | 320781.318 | 18.487 | 1.425 | 1200 | 0 | 19.000 | 17.062 | 225 |
| S14 | 508679.241 | 320802.047 | 18.019 | 1.463 | 1200 | 1 | 20.000 | 16.631 | 150 |
| | | | | | | 2 | 19.000 | 16.556 | 225 |
| | | | | | | 0 | 19.001 | 16.556 | 225 |
| S14L | 508676.227 | 320799.010 | 18.050 | 1.050 | 600 | 0 | 20.000 | 17.000 | 150 |
| S15 | 508672.361 | 320808.875 | 17.916 | 1.650 | 1500 | 1 | 19.001 | 16.491 | 225 |
| | | | | | | 2 | 1.007 | 16.266 | 450 |
| | | | | | | 0 | 1.008 | 16.266 | 450 |
| S16 | 508684.201 | 320849.001 | 17.301 | 1.264 | 1200 | 1 | 22.000 | 16.112 | 150 |
| | | | | | | 2 | 21.000 | 16.112 | 150 |
| | | | | | | 0 | 21.001 | 16.037 | 225 |
| S16LA | 508682.952 | 320863.717 | 17.169 | 0.909 | 600 | 0 | 21.000 | 16.260 | 150 |
| S16LB | 508679.002 | 320848.913 | 17.357 | 1.050 | 600 | 0 | 22.000 | 16.307 | 150 |
| S17 | 508686.810 | 320841.444 | 17.328 | 1.563 | 1500 | 1 | 21.001 | 15.990 | 225 |
| | | | | | | 2 | 1.008 | 15.765 | 450 |
| | | | | | | 0 | 1.009 | 15.765 | 450 |
| S18 | 508699.687 | 320841.201 | 17.180 | 1.446 | 1500 | 1 | 1.009 | 15.734 | 450 |
| | | | | | | 0 | 1.010 | 15.734 | 450 |
| HW1 | 508705.770 | 320843.350 | 17.004 | 1.286 | 1200 | 1 | 1.010 | 15.718 | 450 |
| HW2 | 508737.158 | 320860.706 | 16.720 | 1.002 | 1200 | 0 | 1.011 | 15.718 | 225 |
| S19 | 508741.900 | 320865.062 | 16.720 | 1.040 | 1200 | 1 | 1.011 | 15.680 | 225 |
| | | | | | | 0 | 1.012 | 15.680 | 225 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| HW3 | 508750.200 | 320875.859 | 16.581 | 0.981 | 1200 |  | 1 1.012 | 15.600 | 225 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-99 | F (1km) | 2.509 | Additional Storage (m³/ha) | 0.0 |
| C (1km) | -0.020 | Summer CV | 0.950 | Check Discharge Rate(s) | ✓ |
| D1 (1km) | 0.339 | Winter CV | 0.950 | 100 year (l/s) | 4.6 |
| D2 (1km) | 0.314 | Analysis Speed | Detailed | Check Discharge Volume | x |
| D3 (1km) | 0.183 | Skip Steady State | x | | |
| E (1km) | 0.304 | Drain Down Time (mins) | 240 | | |

### Storm Durations

| 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 | 10 | 0 |
| 30 | 0 | 10 | 0 |
| 100 | 40 | 10 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | QBar/QMed conversion factor | 1.111 |
| Greenfield Method | FEH | Growth Factor 100 year | 2.48 |
| Positively Drained Area (ha) | 1.805 | Betterment (%) | 0 |
| SAAR (mm) | 594 | QMed | 4.6 |
| Host | 1 | QBar | 5.1 |
| BFIHost | 0.379 | Q 100 year (l/s) | 12.6 |
| Region | 1 | | |

## Node S19 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 15.680 | Product Number | CTL-SHE-0100-4600-1100-4600 |
| Design Depth (m) | 1.100 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 4.6 | Min Node Diameter (mm) | 1200 |

## Node S1LA Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.849 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

## Node S1LB Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.485 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S2L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.629 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S3LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.728 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S3LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.529 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S3LC Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.709 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S4L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.609 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S5LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.464 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S5LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.288 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S6L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.117 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S7L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.256 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S8LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.513 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S8LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.574 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S9LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.349 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S9LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.485 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S10LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.226 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S10LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.383 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S11L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.096 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S14L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.000 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S16LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 16.260 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S16LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 16.307 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node HW2 Flow through Pond Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Main Channel Length (m) | 35.867 |
| Side Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 15.718 | Main Channel Slope (1:X) | 1000.0 |
| Safety Factor | 2.0 | Time to half empty (mins) | | Main Channel n | 0.400 |

**Inlets**
HW1

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 1021.0 | 0.0 | 1.000 | 1389.1 | 0.0 |

**Node S1LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.419 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 37 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 21.300 | Inf Depth (m) | 0.500 |
| Porosity | 0.30 | Length (m) | 21.300 | | |

**Node S2L Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.540 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.600 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.600 | | |

**Node S3LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.465 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 2 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.400 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.400 | | |

**Node S5LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.159 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 9 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 8.800 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 8.800 | | |

**Node S6L Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.812 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.900 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.900 | | |

**Node S8LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.933 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 9 | Depth (m) | 0.500 |
| Safety Factor | 2.0 | Width (m) | 7.200 | Inf Depth (m) | 0.500 |
| Porosity | 0.30 | Length (m) | 7.200 | | |

**Node S9LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.044 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 7 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.700 | | |

**Node S10LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.921 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 14.200 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 14.200 | | |

## Node S11L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.791 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 7.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 7.700 | | |

## Node S14L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.570 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 12 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 10.900 | Inf Depth (m) | 0.350 |
| Porosity | 0.30 | Length (m) | 10.900 | | |

## Node S16LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 16.539 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 80 | Depth (m) | 0.500 |
| Safety Factor | 2.0 | Width (m) | 25.100 | Inf Depth (m) | 0.500 |
| Porosity | 0.30 | Length (m) | 25.100 | | |

## Node S1LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.005 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 15 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 12.600 | Inf Depth (m) | 0.350 |
| Porosity | 0.30 | Length (m) | 12.600 | | |

## Node S3LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.484 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 28 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 19.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 19.700 | | |

## Node S3LC Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.404 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 0 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 8.900 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 8.900 | | |

## Node S5LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.983 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 5 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.000 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.000 | | |

## Node S7L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.766 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 46 | Depth (m) | 0.410 |
| Safety Factor | 2.0 | Width (m) | 20.500 | Inf Depth (m) | 0.410 |
| Porosity | 0.30 | Length (m) | 20.500 | | |

## Node S8LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.168 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 5 | Depth (m) | 0.400 |
| Safety Factor | 2.0 | Width (m) | 6.900 | Inf Depth (m) | 0.400 |
| Porosity | 0.30 | Length (m) | 6.900 | | |

## Node S9LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.235 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.800 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.800 | | |

## Node S10LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.152 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.700 | | |

## Node S16LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 16.877 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 17 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 9.400 | Inf Depth (m) | 0.350 |
| Porosity | 0.30 | Length (m) | 9.400 | | |

## Node S4L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.304 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.300 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.300 | | |

**Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.76%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | 19 | 19.463 | 0.614 | 12.5 | 0.6650 | 0.0000 | SURCHARGED |
| 30 minute summer | S1 | 18 | 18.355 | 0.115 | 20.6 | 0.1303 | 0.0000 | OK |
| 30 minute summer | S1LB | 18 | 18.739 | 0.254 | 5.9 | 0.0720 | 0.0000 | SURCHARGED |
| 30 minute summer | S2 | 18 | 18.265 | 0.124 | 23.6 | 0.1399 | 0.0000 | OK |
| 30 minute summer | S2L | 18 | 18.730 | 0.101 | 3.1 | 0.0287 | 0.0000 | OK |
| 30 minute summer | S3 | 18 | 18.121 | 0.169 | 42.4 | 0.1912 | 0.0000 | OK |
| 30 minute summer | S3LA | 18 | 18.808 | 0.080 | 2.5 | 0.0228 | 0.0000 | OK |
| 30 minute summer | S3LB | 18 | 19.215 | 0.686 | 10.9 | 0.1941 | 0.0000 | SURCHARGED |
| 30 minute summer | S3LC | 17 | 18.767 | 0.058 | 1.6 | 0.0164 | 0.0000 | OK |
| 30 minute summer | S4 | 18 | 18.078 | 0.176 | 44.8 | 0.1990 | 0.0000 | OK |
| 30 minute summer | S4L | 18 | 18.689 | 0.080 | 2.5 | 0.0228 | 0.0000 | OK |
| 30 minute summer | S5 | 18 | 18.026 | 0.188 | 54.2 | 0.2125 | 0.0000 | OK |
| 30 minute summer | S5LA | 18 | 18.613 | 0.149 | 4.1 | 0.0422 | 0.0000 | OK |
| 30 minute summer | S5LB | 18 | 18.398 | 0.110 | 3.3 | 0.0311 | 0.0000 | OK |
| 30 minute summer | S6 | 18 | 17.922 | 0.111 | 63.7 | 0.1256 | 0.0000 | OK |
| 30 minute summer | S6L | 18 | 18.205 | 0.088 | 2.7 | 0.0248 | 0.0000 | OK |
| 30 minute summer | S7 | 17 | 17.317 | 0.096 | 15.3 | 0.1081 | 0.0000 | OK |
| 30 minute summer | S7L | 20 | 18.847 | 0.591 | 16.2 | 1.8054 | 0.0000 | SURCHARGED |
| 30 minute summer | S8 | 18 | 17.179 | 0.134 | 26.2 | 0.1521 | 0.0000 | OK |
| 30 minute summer | S8LA | 18 | 17.623 | 0.110 | 3.3 | 0.0311 | 0.0000 | OK |
| 30 minute summer | S8LB | 18 | 17.669 | 0.095 | 2.9 | 0.0270 | 0.0000 | OK |
| 30 minute summer | S9 | 18 | 17.109 | 0.154 | 32.8 | 0.1738 | 0.0000 | OK |
| 30 minute summer | S9LA | 18 | 17.450 | 0.101 | 3.1 | 0.0287 | 0.0000 | OK |
| 30 minute summer | S9LB | 18 | 17.624 | 0.139 | 3.9 | 0.0393 | 0.0000 | OK |
| 30 minute summer | S10 | 18 | 16.958 | 0.176 | 45.9 | 0.1992 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | Orifice | S1 | 8.9 | | | | |
| 30 minute summer | S1 | 1.001 | S2 | 20.7 | 0.967 | 0.519 | 0.3590 | |
| 30 minute summer | S1LB | Orifice | S1 | 5.5 | | | | |
| 30 minute summer | S2 | 1.002 | S3 | 23.7 | 1.059 | 0.595 | 0.4333 | |
| 30 minute summer | S2L | Orifice | S2 | 3.0 | | | | |
| 30 minute summer | S3 | 1.003 | S4 | 42.4 | 1.011 | 0.600 | 0.5140 | |
| 30 minute summer | S3LA | Orifice | S3 | 2.4 | | | | |
| 30 minute summer | S3LB | Orifice | S3 | 9.5 | | | | |
| 30 minute summer | S3LC | Orifice | S3 | 1.5 | | | | |
| 30 minute summer | S4 | 1.004 | S5 | 44.7 | 1.001 | 0.635 | 0.7051 | |
| 30 minute summer | S4L | Orifice | S4 | 2.4 | | | | |
| 30 minute summer | S5 | 1.005 | S6 | 54.0 | 1.542 | 0.765 | 0.2322 | |
| 30 minute summer | S5LA | Orifice | S5 | 3.9 | | | | |
| 30 minute summer | S5LB | Orifice | S5 | 3.2 | | | | |
| 30 minute summer | S6 | 1.006 | S12 | 63.5 | 2.683 | 0.296 | 0.7124 | |
| 30 minute summer | S6L | Orifice | S6 | 2.6 | | | | |
| 30 minute summer | S7 | 11.001 | S8 | 15.2 | 0.773 | 0.382 | 0.6081 | |
| 30 minute summer | S7L | Orifice | S7 | 8.7 | | | | |
| 30 minute summer | S8 | 11.002 | S9 | 26.1 | 0.973 | 0.656 | 0.4101 | |
| 30 minute summer | S8LA | Orifice | S8 | 3.2 | | | | |
| 30 minute summer | S8LB | Orifice | S8 | 2.8 | | | | |
| 30 minute summer | S9 | 11.003 | S10 | 32.9 | 1.146 | 0.830 | 0.4813 | |
| 30 minute summer | S9LA | Orifice | S9 | 3.0 | | | | |
| 30 minute summer | S9LB | Orifice | S9 | 3.7 | | | | |
| 30 minute summer | S10 | 11.004 | S11 | 46.0 | 1.059 | 0.644 | 0.3127 | |

**Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.76%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol ($m^3$) | Flood ($m^3$) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | 18 | 17.365 | 0.139 | 3.9 | 0.0393 | 0.0000 | OK |
| 30 minute summer | S10LB | 18 | 17.543 | 0.160 | 4.3 | 0.0453 | 0.0000 | SURCHARGED |
| 30 minute summer | S11 | 18 | 16.931 | 0.179 | 50.0 | 0.2025 | 0.0000 | OK |
| 30 minute summer | S11L | 18 | 17.215 | 0.119 | 3.5 | 0.0337 | 0.0000 | OK |
| 30 minute summer | S12 | 18 | 16.721 | 0.171 | 118.2 | 0.3028 | 0.0000 | OK |
| 30 minute summer | S13 | 17 | 17.105 | 0.043 | 5.7 | 0.0491 | 0.0000 | OK |
| 30 minute summer | S14 | 18 | 16.643 | 0.087 | 13.7 | 0.0981 | 0.0000 | OK |
| 30 minute summer | S14L | 18 | 17.217 | 0.217 | 5.3 | 0.0614 | 0.0000 | SURCHARGED |
| 30 minute summer | S15 | 18 | 16.449 | 0.183 | 137.7 | 0.3228 | 0.0000 | OK |
| 30 minute summer | S16 | 18 | 16.130 | 0.093 | 14.4 | 0.1052 | 0.0000 | OK |
| 30 minute summer | S16LA | 22 | 16.671 | 0.411 | 23.4 | 5.3558 | 0.0000 | SURCHARGED |
| 30 minute summer | S16LB | 18 | 16.601 | 0.294 | 6.4 | 0.0833 | 0.0000 | SURCHARGED |
| 30 minute summer | S17 | 19 | 16.085 | 0.320 | 155.1 | 0.5652 | 0.0000 | OK |
| 30 minute summer | S18 | 19 | 16.046 | 0.312 | 153.0 | 0.5518 | 0.0000 | OK |
| 720 minute summer | HW1 | 525 | 15.926 | 0.208 | 27.8 | 0.2353 | 0.0000 | OK |
| 720 minute summer | HW2 | 525 | 15.926 | 0.208 | 23.0 | 0.2353 | 0.0000 | OK |
| 720 minute summer | S19 | 525 | 15.926 | 0.246 | 8.8 | 0.2778 | 0.0000 | SURCHARGED |
| 30 minute summer | HW3 | 1 | 15.600 | 0.000 | 4.4 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol ($m^3$) | Discharge Vol ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | Orifice | S10 | 3.7 | | | | |
| 30 minute summer | S10LB | Orifice | S10 | 4.1 | | | | |
| 30 minute summer | S11 | 11.005 | S12 | 50.0 | 1.163 | 0.708 | 0.5476 | |
| 30 minute summer | S11L | Orifice | S11 | 3.4 | | | | |
| 30 minute summer | S12 | 1.007 | S15 | 118.1 | 2.042 | 0.318 | 1.2435 | |
| 30 minute summer | S13 | 19.000 | S14 | 5.6 | 0.595 | 0.082 | 0.2841 | |
| 30 minute summer | S14 | 19.001 | S15 | 13.6 | 0.966 | 0.321 | 0.1368 | |
| 30 minute summer | S14L | Orifice | S14 | 5.0 | | | | |
| 30 minute summer | S15 | 1.008 | S17 | 137.1 | 1.507 | 0.357 | 3.2220 | |
| 30 minute summer | S16 | 21.001 | S17 | 14.3 | 0.923 | 0.360 | 0.1254 | |
| 30 minute summer | S16LA | Orifice | S16 | 7.2 | | | | |
| 30 minute summer | S16LB | Orifice | S16 | 6.0 | | | | |
| 30 minute summer | S17 | 1.009 | S18 | 153.0 | 1.298 | 0.971 | 1.5321 | |
| 30 minute summer | S18 | 1.010 | HW1 | 153.4 | 2.114 | 0.959 | 0.4961 | |
| 720 minute summer | HW1 | Flow through pond | HW2 | 16.7 | 0.006 | 0.007 | 200.8651 | |
| 720 minute summer | HW2 | 1.011 | S19 | 8.8 | 0.497 | 0.221 | 0.2516 | |
| 720 minute summer | S19 | Hydro-Brake® | HW3 | 4.5 | | | | 194.6 |

**Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.76%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol ($m^3$) | Flood ($m^3$) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | 22 | 19.587 | 0.738 | 32.6 | 7.4027 | 0.0000 | SURCHARGED |
| 30 minute summer | S1 | 18 | 18.408 | 0.168 | 35.5 | 0.1898 | 0.0000 | OK |
| 30 minute summer | S1LB | 20 | 19.098 | 0.613 | 15.3 | 1.4750 | 0.0000 | SURCHARGED |
| 30 minute summer | S2 | 18 | 18.345 | 0.204 | 42.1 | 0.2308 | 0.0000 | OK |
| 30 minute summer | S2L | 18 | 19.060 | 0.431 | 8.2 | 0.1220 | 0.0000 | SURCHARGED |
| 30 minute summer | S3 | 18 | 18.247 | 0.295 | 77.4 | 0.3331 | 0.0000 | OK |
| 30 minute summer | S3LA | 18 | 19.034 | 0.306 | 6.6 | 0.0866 | 0.0000 | SURCHARGED |
| 30 minute summer | S3LB | 21 | 19.623 | 1.094 | 28.5 | 4.4879 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3LC | 18 | 18.855 | 0.146 | 4.1 | 0.0414 | 0.0000 | OK |
| 30 minute summer | S4 | 18 | 18.195 | 0.293 | 83.3 | 0.3316 | 0.0000 | OK |
| 30 minute summer | S4L | 18 | 18.915 | 0.306 | 6.6 | 0.0866 | 0.0000 | SURCHARGED |
| 30 minute summer | S5 | 18 | 18.123 | 0.285 | 106.8 | 0.3218 | 0.0000 | OK |
| 30 minute summer | S5LA | 18 | 19.129 | 0.665 | 10.7 | 0.1881 | 0.0000 | SURCHARGED |
| 30 minute summer | S5LB | 18 | 18.764 | 0.476 | 8.7 | 0.1346 | 0.0000 | SURCHARGED |
| 30 minute summer | S6 | 17 | 17.978 | 0.167 | 141.8 | 0.1884 | 0.0000 | OK |
| 30 minute summer | S6L | 18 | 18.462 | 0.345 | 7.1 | 0.0976 | 0.0000 | SURCHARGED |
| 30 minute summer | S7 | 18 | 17.644 | 0.423 | 27.1 | 0.4785 | 0.0000 | SURCHARGED |
| 30 minute summer | S7L | 23 | 18.982 | 0.726 | 42.3 | 11.6847 | 0.0000 | SURCHARGED |
| 30 minute summer | S8 | 18 | 17.570 | 0.525 | 51.7 | 0.5932 | 0.0000 | SURCHARGED |
| 30 minute summer | S8LA | 19 | 17.960 | 0.447 | 8.7 | 0.1907 | 0.0000 | SURCHARGED |
| 30 minute summer | S8LB | 18 | 17.960 | 0.386 | 7.6 | 0.1093 | 0.0000 | SURCHARGED |
| 30 minute summer | S9 | 18 | 17.417 | 0.462 | 66.5 | 0.5220 | 0.0000 | SURCHARGED |
| 30 minute summer | S9LA | 18 | 17.784 | 0.435 | 8.2 | 0.1231 | 0.0000 | SURCHARGED |
| 30 minute summer | S9LB | 18 | 18.099 | 0.614 | 10.2 | 0.1738 | 0.0000 | SURCHARGED |
| 30 minute summer | S10 | 18 | 17.134 | 0.352 | 97.6 | 0.3980 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol ($m^3$) | Discharge Vol ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | Orifice | S1 | 9.8 | | | | |
| 30 minute summer | S1 | 1.001 | S2 | 35.1 | 1.055 | 0.883 | 0.5840 | |
| 30 minute summer | S1LB | Orifice | S1 | 8.9 | | | | |
| 30 minute summer | S2 | 1.002 | S3 | 41.6 | 1.153 | 1.046 | 0.7501 | |
| 30 minute summer | S2L | Orifice | S2 | 7.4 | | | | |
| 30 minute summer | S3 | 1.003 | S4 | 77.2 | 1.112 | 1.093 | 0.8588 | |
| 30 minute summer | S3LA | Orifice | S3 | 6.1 | | | | |
| 30 minute summer | S3LB | Orifice | S3 | 12.1 | | | | |
| 30 minute summer | S3LC | Orifice | S3 | 3.9 | | | | |
| 30 minute summer | S4 | 1.004 | S5 | 83.5 | 1.201 | 1.186 | 1.0973 | |
| 30 minute summer | S4L | Orifice | S4 | 6.1 | | | | |
| 30 minute summer | S5 | 1.005 | S6 | 116.2 | 2.133 | 1.646 | 0.3616 | |
| 30 minute summer | S5LA | Orifice | S5 | 9.3 | | | | |
| 30 minute summer | S5LB | Orifice | S5 | 7.8 | | | | |
| 30 minute summer | S6 | 1.006 | S12 | 131.1 | 3.251 | 0.612 | 1.2129 | |
| 30 minute summer | S6L | Orifice | S6 | 6.5 | | | | |
| 30 minute summer | S7 | 11.001 | S8 | 24.9 | 0.828 | 0.627 | 1.1876 | |
| 30 minute summer | S7L | Orifice | S7 | 9.7 | | | | |
| 30 minute summer | S8 | 11.002 | S9 | 50.5 | 1.270 | 1.270 | 0.6081 | |
| 30 minute summer | S8LA | Orifice | S8 | 7.4 | | | | |
| 30 minute summer | S8LB | Orifice | S8 | 6.9 | | | | |
| 30 minute summer | S9 | 11.003 | S10 | 66.7 | 1.677 | 1.683 | 0.6666 | |
| 30 minute summer | S9LA | Orifice | S9 | 7.1 | | | | |
| 30 minute summer | S9LB | Orifice | S9 | 8.9 | | | | |
| 30 minute summer | S10 | 11.004 | S11 | 97.2 | 1.381 | 1.362 | 0.5071 | |

**Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.76%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | 18 | 17.840 | 0.614 | 10.2 | 0.1738 | 0.0000 | SURCHARGED |
| 30 minute summer | S10LB | 18 | 18.099 | 0.716 | 11.2 | 0.2026 | 0.0000 | SURCHARGED |
| 30 minute summer | S11 | 18 | 17.076 | 0.324 | 107.3 | 0.3665 | 0.0000 | SURCHARGED |
| 30 minute summer | S11L | 18 | 17.618 | 0.522 | 9.2 | 0.1477 | 0.0000 | SURCHARGED |
| 30 minute summer | S12 | 18 | 16.820 | 0.270 | 250.0 | 0.4775 | 0.0000 | OK |
| 30 minute summer | S13 | 17 | 17.132 | 0.070 | 14.8 | 0.0796 | 0.0000 | OK |
| 30 minute summer | S14 | 17 | 16.700 | 0.144 | 32.3 | 0.1627 | 0.0000 | OK |
| 30 minute summer | S14L | 19 | 17.645 | 0.645 | 13.8 | 0.9255 | 0.0000 | SURCHARGED |
| 30 minute summer | S15 | 18 | 16.570 | 0.304 | 297.2 | 0.5374 | 0.0000 | OK |
| 30 minute summer | S16 | 19 | 16.311 | 0.274 | 21.1 | 0.3095 | 0.0000 | SURCHARGED |
| 30 minute winter | S16LA | 29 | 16.814 | 0.554 | 47.2 | 22.8499 | 0.0000 | SURCHARGED |
| 30 minute summer | S16LB | 20 | 16.995 | 0.688 | 16.8 | 1.7616 | 0.0000 | SURCHARGED |
| 30 minute summer | S17 | 18 | 16.295 | 0.530 | 324.9 | 0.9367 | 0.0000 | SURCHARGED |
| 960 minute winter | S18 | 930 | 16.211 | 0.477 | 32.5 | 0.8437 | 0.0000 | SURCHARGED |
| 960 minute winter | HW1 | 930 | 16.211 | 0.493 | 32.4 | 0.5581 | 0.0000 | OK |
| 960 minute winter | HW2 | 930 | 16.211 | 0.493 | 19.3 | 0.5581 | 0.0000 | SURCHARGED |
| 960 minute winter | S19 | 930 | 16.211 | 0.531 | 14.6 | 0.6005 | 0.0000 | SURCHARGED |
| 30 minute summer | HW3 | 1 | 15.600 | 0.000 | 4.6 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | Orifice | S10 | 8.9 | | | | |
| 30 minute summer | S10LB | Orifice | S10 | 9.7 | | | | |
| 30 minute summer | S11 | 11.005 | S12 | 106.9 | 1.539 | 1.512 | 0.8505 | |
| 30 minute summer | S11L | Orifice | S11 | 8.2 | | | | |
| 30 minute summer | S12 | 1.007 | S15 | 250.0 | 2.387 | 0.672 | 2.2922 | |
| 30 minute summer | S13 | 19.000 | S14 | 14.6 | 0.786 | 0.214 | 0.5501 | |
| 30 minute summer | S14 | 19.001 | S15 | 31.8 | 1.192 | 0.748 | 0.2593 | |
| 30 minute summer | S14L | Orifice | S14 | 9.2 | | | | |
| 30 minute summer | S15 | 1.008 | S17 | 294.6 | 1.981 | 0.768 | 4.8534 | |
| 30 minute summer | S16 | 21.001 | S17 | 23.0 | 0.995 | 0.580 | 0.3179 | |
| 30 minute winter | S16LA | Orifice | S16 | 8.4 | | | | |
| 30 minute summer | S16LB | Orifice | S16 | 9.5 | | | | |
| 30 minute summer | S17 | 1.009 | S18 | 322.0 | 2.032 | 2.043 | 2.0391 | |
| 960 minute winter | S18 | 1.010 | HW1 | 32.4 | 0.574 | 0.202 | 1.0223 | |
| 960 minute winter | HW1 | Flow through pond | HW2 | 18.5 | 0.008 | 0.008 | 527.3679 | |
| 960 minute winter | HW2 | 1.011 | S19 | 14.6 | 0.491 | 0.367 | 0.2561 | |
| 960 minute winter | S19 | Hydro-Brake® | HW3 | 4.6 | | | | 268.3 |

**Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.76%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol ($m^3$) | Flood ($m^3$) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | 25 | 19.719 | 0.870 | 67.2 | 22.9695 | 0.0000 | FLOOD RISK |
| 30 minute summer | S1 | 18 | 19.102 | 0.862 | 50.4 | 0.9748 | 0.0000 | SURCHARGED |
| 30 minute summer | S1LB | 22 | 19.255 | 0.770 | 31.5 | 8.3938 | 0.0000 | FLOOD RISK |
| 30 minute summer | S2 | 18 | 18.973 | 0.832 | 58.4 | 0.9415 | 0.0000 | SURCHARGED |
| 30 minute summer | S2L | 20 | 19.633 | 1.004 | 16.8 | 1.2958 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3 | 18 | 18.766 | 0.814 | 115.8 | 0.9205 | 0.0000 | SURCHARGED |
| 30 minute summer | S3LA | 19 | 19.533 | 0.805 | 13.7 | 0.5914 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3LB | 23 | 19.761 | 1.232 | 58.8 | 16.7304 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3LC | 18 | 19.160 | 0.451 | 8.4 | 0.1275 | 0.0000 | SURCHARGED |
| 30 minute summer | S4 | 18 | 18.643 | 0.741 | 121.8 | 0.8385 | 0.0000 | SURCHARGED |
| 30 minute summer | S4L | 19 | 19.380 | 0.771 | 13.7 | 0.6565 | 0.0000 | FLOOD RISK |
| 30 minute summer | S5 | 18 | 18.459 | 0.621 | 150.7 | 0.7019 | 0.0000 | SURCHARGED |
| 30 minute summer | S5LA | 20 | 19.331 | 0.867 | 22.1 | 2.9650 | 0.0000 | FLOOD RISK |
| 30 minute summer | S5LB | 20 | 19.105 | 0.817 | 17.9 | 1.8264 | 0.0000 | FLOOD RISK |
| 30 minute summer | S6 | 18 | 18.334 | 0.523 | 195.1 | 0.5915 | 0.0000 | SURCHARGED |
| 30 minute summer | S6L | 20 | 18.911 | 0.794 | 14.7 | 1.0209 | 0.0000 | FLOOD RISK |
| 30 minute summer | S7 | 18 | 18.516 | 1.295 | 45.8 | 1.4641 | 0.0000 | SURCHARGED |
| 30 minute winter | S7L | 29 | 19.159 | 0.903 | 67.3 | 33.7157 | 0.0000 | FLOOD RISK |
| 30 minute summer | S8 | 18 | 18.302 | 1.257 | 72.2 | 1.4220 | 0.0000 | SURCHARGED |
| 30 minute summer | S8LA | 21 | 18.309 | 0.796 | 22.0 | 5.3773 | 0.0000 | FLOOD RISK |
| 30 minute summer | S8LB | 21 | 18.407 | 0.833 | 15.8 | 3.0301 | 0.0000 | FLOOD RISK |
| 30 minute summer | S9 | 18 | 18.041 | 1.086 | 82.6 | 1.2277 | 0.0000 | SURCHARGED |
| 30 minute summer | S9LA | 21 | 18.268 | 0.919 | 16.8 | 2.7203 | 0.0000 | FLOOD RISK |
| 30 minute summer | S9LB | 21 | 18.408 | 0.923 | 21.0 | 3.4749 | 0.0000 | FLOOD RISK |
| 30 minute summer | S10 | 18 | 17.652 | 0.870 | 122.7 | 0.9836 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol ($m^3$) | Discharge Vol ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | Orifice | S1 | 10.7 | | | | |
| 30 minute summer | S1 | 1.001 | S2 | 48.0 | 1.208 | 1.207 | 0.6670 | |
| 30 minute summer | S1LB | Orifice | S1 | 10.1 | | | | |
| 30 minute summer | S2 | 1.002 | S3 | 55.9 | 1.406 | 1.407 | 0.7712 | |
| 30 minute summer | S2L | Orifice | S2 | 11.5 | | | | |
| 30 minute summer | S3 | 1.003 | S4 | 112.0 | 1.590 | 1.585 | 0.8632 | |
| 30 minute summer | S3LA | Orifice | S3 | 10.3 | | | | |
| 30 minute summer | S3LB | Orifice | S3 | 12.8 | | | | |
| 30 minute summer | S3LC | Orifice | S3 | 7.4 | | | | |
| 30 minute summer | S4 | 1.004 | S5 | 120.1 | 1.706 | 1.705 | 1.1111 | |
| 30 minute summer | S4L | Orifice | S4 | 10.1 | | | | |
| 30 minute summer | S5 | 1.005 | S6 | 152.6 | 2.183 | 2.160 | 0.4662 | |
| 30 minute summer | S5LA | Orifice | S5 | 10.7 | | | | |
| 30 minute summer | S5LB | Orifice | S5 | 10.4 | | | | |
| 30 minute summer | S6 | 1.006 | S12 | 194.2 | 3.342 | 0.906 | 2.1178 | |
| 30 minute summer | S6L | Orifice | S6 | 10.2 | | | | |
| 30 minute summer | S7 | 11.001 | S8 | 43.1 | 1.083 | 1.082 | 1.1876 | |
| 30 minute winter | S7L | Orifice | S7 | 10.9 | | | | |
| 30 minute summer | S8 | 11.002 | S9 | 67.0 | 1.684 | 1.685 | 0.6081 | |
| 30 minute summer | S8LA | Orifice | S8 | 9.9 | | | | |
| 30 minute summer | S8LB | Orifice | S8 | 10.1 | | | | |
| 30 minute summer | S9 | 11.003 | S10 | 80.5 | 2.024 | 2.031 | 0.6666 | |
| 30 minute summer | S9LA | Orifice | S9 | 10.4 | | | | |
| 30 minute summer | S9LB | Orifice | S9 | 10.9 | | | | |
| 30 minute summer | S10 | 11.004 | S11 | 122.0 | 1.733 | 1.708 | 0.5071 | |

**Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.76%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | 21 | 18.056 | 0.830 | 21.0 | 3.3590 | 0.0000 | FLOOD RISK |
| 30 minute summer | S10LB | 21 | 18.323 | 0.940 | 23.1 | 3.3890 | 0.0000 | FLOOD RISK |
| 30 minute summer | S11 | 18 | 17.562 | 0.810 | 133.5 | 0.9162 | 0.0000 | SURCHARGED |
| 30 minute summer | S11L | 20 | 17.976 | 0.880 | 18.9 | 2.6808 | 0.0000 | FLOOD RISK |
| 30 minute summer | S12 | 18 | 17.375 | 0.825 | 350.6 | 1.4572 | 0.0000 | SURCHARGED |
| 30 minute summer | S13 | 18 | 17.313 | 0.251 | 30.5 | 0.2835 | 0.0000 | SURCHARGED |
| 30 minute summer | S14 | 18 | 17.219 | 0.663 | 54.2 | 0.7499 | 0.0000 | SURCHARGED |
| 30 minute summer | S14L | 21 | 17.795 | 0.795 | 28.4 | 5.8283 | 0.0000 | FLOOD RISK |
| 30 minute summer | S15 | 18 | 17.120 | 0.854 | 432.2 | 1.5086 | 0.0000 | SURCHARGED |
| 1440 minute winter | S16 | 1410 | 16.716 | 0.679 | 7.4 | 0.7675 | 0.0000 | SURCHARGED |
| 30 minute winter | S16LA | 31 | 17.005 | 0.745 | 97.3 | 58.6556 | 0.0000 | FLOOD RISK |
| 30 minute summer | S16LB | 22 | 17.330 | 1.023 | 34.7 | 8.0159 | 0.0000 | FLOOD RISK |
| 1440 minute winter | S17 | 1410 | 16.716 | 0.951 | 44.7 | 1.6796 | 0.0000 | SURCHARGED |
| 1440 minute winter | S18 | 1410 | 16.716 | 0.982 | 44.5 | 1.7344 | 0.0000 | SURCHARGED |
| 1440 minute winter | HW1 | 1410 | 16.716 | 0.998 | 44.5 | 1.1282 | 0.0000 | OK |
| 1440 minute winter | HW2 | 1410 | 16.716 | 0.998 | 24.4 | 1.1282 | 0.0000 | FLOOD RISK |
| 1440 minute winter | S19 | 1410 | 16.715 | 1.035 | 13.7 | 1.1706 | 0.0000 | FLOOD RISK |
| 30 minute summer | HW3 | 1 | 15.600 | 0.000 | 4.6 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | Orifice | S10 | 10.4 | | | | |
| 30 minute summer | S10LB | Orifice | S10 | 11.2 | | | | |
| 30 minute summer | S11 | 11.005 | S12 | 134.1 | 1.904 | 1.896 | 0.8959 | |
| 30 minute summer | S11L | Orifice | S11 | 10.7 | | | | |
| 30 minute summer | S12 | 1.007 | S15 | 349.5 | 2.446 | 0.940 | 3.4042 | |
| 30 minute summer | S13 | 19.000 | S14 | 28.0 | 0.911 | 0.409 | 1.1703 | |
| 30 minute summer | S14 | 19.001 | S15 | 51.0 | 1.282 | 1.200 | 0.3855 | |
| 30 minute summer | S14L | Orifice | S14 | 10.2 | | | | |
| 30 minute summer | S15 | 1.008 | S17 | 431.7 | 2.725 | 1.125 | 5.6453 | |
| 1440 minute winter | S16 | 21.001 | S17 | 7.3 | 0.712 | 0.185 | 0.3179 | |
| 30 minute winter | S16LA | Orifice | S16 | 9.9 | | | | |
| 30 minute summer | S16LB | Orifice | S16 | 11.6 | | | | |
| 1440 minute winter | S17 | 1.009 | S18 | 44.5 | 0.531 | 0.283 | 2.0406 | |
| 1440 minute winter | S18 | 1.010 | HW1 | 44.5 | 0.519 | 0.278 | 1.0223 | |
| 1440 minute winter | HW1 | Flow through pond | HW2 | 24.4 | 0.008 | 0.010 | 1177.3784 | |
| 1440 minute winter | HW2 | 1.011 | S19 | 13.7 | 0.528 | 0.343 | 0.2561 | |
| 1440 minute winter | S19 | Hydro-Brake® | HW3 | 4.6 | | | | 392.3 |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-99 | Time of Entry (mins) | 4.00 |
| Return Period (years) | 2 | Maximum Time of Concentration (mins) | 30.00 |
| Additional Flow (%) | 0 | Maximum Rainfall (mm/hr) | 50.0 |
| C (1km) | -0.020 | Minimum Velocity (m/s) | 1.00 |
| D1 (1km) | 0.339 | Connection Type | Level Soffits |
| D2 (1km) | 0.314 | Minimum Backdrop Height (m) | 0.200 |
| D3 (1km) | 0.183 | Preferred Cover Depth (m) | 1.200 |
| E (1km) | 0.304 | Include Intermediate Ground | ✓ |
| F (1km) | 2.509 | Enforce best practice design rules | ✓ |
| CV | 0.750 | | |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| S1LA | 0.064 | 4.00 | 19.899 | 600 | 508578.855 | 320748.136 | 1.050 |
| S1 | 0.034 | 4.00 | 19.966 | 1200 | 508589.755 | 320738.884 | 1.726 |
| S1LB | 0.030 | 4.00 | 19.485 | 600 | 508603.348 | 320726.906 | 1.000 |
| S2 | 0.000 | | 19.856 | 1200 | 508600.609 | 320751.670 | 1.715 |
| S2L | 0.016 | 4.00 | 19.895 | 600 | 508597.464 | 320754.339 | 1.266 |
| S3 | 0.029 | 4.00 | 19.801 | 1200 | 508613.156 | 320766.452 | 1.849 |
| S3LA | 0.013 | 4.00 | 19.820 | 600 | 508606.988 | 320765.419 | 1.092 |
| S3LB | 0.056 | 4.00 | 19.839 | 600 | 508609.904 | 320769.213 | 1.310 |
| S3LC | 0.008 | 4.00 | 19.759 | 600 | 508616.075 | 320759.541 | 1.050 |
| S4 | 0.000 | | 19.782 | 1200 | 508621.089 | 320775.797 | 1.880 |
| S4L | 0.013 | 4.00 | 19.659 | 600 | 508626.212 | 320771.449 | 1.050 |
| S5 | 0.013 | 4.00 | 19.344 | 1200 | 508631.300 | 320787.827 | 1.506 |
| S5LA | 0.021 | 4.00 | 19.514 | 600 | 508623.891 | 320785.565 | 1.050 |
| S5LB | 0.017 | 4.00 | 19.338 | 600 | 508636.467 | 320783.441 | 1.050 |
| S6 | 0.038 | 4.00 | 19.157 | 1200 | 508635.584 | 320792.874 | 1.346 |
| S6L | 0.014 | 4.00 | 19.167 | 600 | 508632.075 | 320795.361 | 1.050 |
| S7 | 0.035 | 4.00 | 19.029 | 1200 | 508585.685 | 320864.527 | 1.808 |
| S7L | 0.083 | 4.00 | 19.306 | 600 | 508576.586 | 320851.532 | 1.050 |
| S8 | 0.026 | 4.00 | 18.640 | 1200 | 508610.146 | 320847.400 | 1.595 |
| S8LA | 0.017 | 4.00 | 18.563 | 600 | 508610.273 | 320855.272 | 1.050 |
| S8LB | 0.015 | 4.00 | 18.698 | 600 | 508607.542 | 320843.681 | 1.124 |
| S9 | 0.000 | | 18.484 | 1200 | 508622.671 | 320838.630 | 1.529 |
| S9LA | 0.016 | 4.00 | 18.399 | 600 | 508621.256 | 320847.544 | 1.050 |
| S9LB | 0.020 | 4.00 | 18.590 | 600 | 508620.062 | 320834.904 | 1.105 |
| S10 | 0.028 | 4.00 | 18.361 | 1200 | 508636.401 | 320829.016 | 1.579 |
| S10LA | 0.020 | 4.00 | 18.276 | 600 | 508632.732 | 320839.531 | 1.050 |
| S10LB | 0.022 | 4.00 | 18.507 | 600 | 508633.812 | 320825.319 | 1.124 |
| S11 | 0.004 | 4.00 | 18.333 | 1200 | 508642.300 | 320824.886 | 1.581 |
| S11L | 0.018 | 4.00 | 18.146 | 600 | 508645.996 | 320830.164 | 1.050 |
| S12 | 0.025 | 4.00 | 18.276 | 1500 | 508652.722 | 320817.588 | 1.726 |
| S13 | 0.029 | 4.00 | 18.487 | 1200 | 508700.125 | 320781.318 | 1.425 |
| S14 | 0.017 | 4.00 | 18.019 | 1200 | 508679.241 | 320802.047 | 1.463 |
| S14L | 0.027 | 4.00 | 18.050 | 600 | 508676.227 | 320799.010 | 1.050 |
| S15 | 0.032 | 4.00 | 17.916 | 1500 | 508672.361 | 320808.875 | 1.650 |
| S16 | 0.008 | 4.00 | 17.301 | 1200 | 508684.201 | 320849.001 | 1.264 |
| S16LA | 0.120 | 4.00 | 17.169 | 600 | 508682.952 | 320863.717 | 0.909 |
| S16LB | 0.033 | 4.00 | 17.357 | 600 | 508679.002 | 320848.913 | 1.050 |
| S17 | 0.020 | 4.00 | 17.328 | 1500 | 508686.810 | 320841.444 | 1.563 |
| S18 | 0.000 | | 17.180 | 1500 | 508699.687 | 320841.201 | 1.446 |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| HW1 | 0.000 | | 17.004 | 1200 | 508705.770 | 320843.350 | 1.286 |
| HW2 | 0.000 | 4.00 | 16.720 | 1200 | 508737.158 | 320860.706 | 1.002 |
| S19 | 0.000 | | 16.720 | 1200 | 508741.900 | 320865.062 | 1.040 |
| HW3 | 0.000 | | 16.581 | 1200 | 508750.200 | 320875.859 | 0.981 |

## 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 | S1LA | S1 | 14.297 | 0.600 | 18.849 | 18.315 | 0.534 | 26.8 | 150 | 4.12 | 50.0 |
| 1.001 | S1 | S2 | 16.772 | 0.600 | 18.240 | 18.141 | 0.099 | 169.4 | 225 | 4.59 | 50.0 |
| 2.000 | S1LB | S1 | 18.117 | 0.600 | 18.485 | 18.315 | 0.170 | 106.6 | 150 | 4.31 | 50.0 |
| 1.002 | S2 | S3 | 19.390 | 0.600 | 18.141 | 18.027 | 0.114 | 170.1 | 225 | 4.91 | 50.0 |
| 3.000 | S2L | S2 | 4.124 | 0.600 | 18.629 | 18.216 | 0.413 | 10.0 | 150 | 4.02 | 50.0 |
| 1.003 | S3 | S4 | 12.258 | 0.600 | 17.952 | 17.902 | 0.050 | 245.2 | 300 | 5.12 | 50.0 |
| 4.000 | S3LA | S3 | 6.254 | 0.600 | 18.728 | 18.102 | 0.626 | 10.0 | 150 | 4.03 | 50.0 |
| 5.000 | S3LB | S3 | 4.266 | 0.600 | 18.529 | 18.102 | 0.427 | 10.0 | 150 | 4.02 | 50.0 |
| 6.000 | S3LC | S3 | 7.502 | 0.600 | 18.709 | 18.102 | 0.607 | 12.4 | 150 | 4.04 | 50.0 |
| 1.004 | S4 | S5 | 15.779 | 0.600 | 17.902 | 17.838 | 0.064 | 246.5 | 300 | 5.38 | 50.0 |
| 7.000 | S4L | S4 | 6.720 | 0.600 | 18.609 | 18.052 | 0.557 | 12.1 | 150 | 4.04 | 50.0 |
| 1.005 | S5 | S6 | 6.621 | 0.600 | 17.838 | 17.811 | 0.027 | 245.2 | 300 | 5.49 | 50.0 |
| 8.000 | S5LA | S5 | 7.746 | 0.600 | 18.464 | 17.988 | 0.476 | 16.3 | 150 | 4.05 | 50.0 |
| 9.000 | S5LB | S5 | 6.778 | 0.600 | 18.288 | 17.988 | 0.300 | 22.6 | 150 | 4.05 | 50.0 |
| 1.006 | S6 | S12 | 30.074 | 0.600 | 17.811 | 16.700 | 1.111 | 27.1 | 300 | 5.66 | 50.0 |
| 10.000 | S6L | S6 | 4.301 | 0.600 | 18.117 | 17.961 | 0.156 | 27.6 | 150 | 4.04 | 50.0 |
| 11.001 | S7 | S8 | 29.861 | 0.600 | 17.221 | 17.045 | 0.176 | 169.7 | 225 | 4.60 | 50.0 |
| 11.000 | S7L | S7 | 15.865 | 0.600 | 18.256 | 17.296 | 0.960 | 16.5 | 150 | 4.11 | 50.0 |
| 11.002 | S8 | S9 | 15.290 | 0.600 | 17.045 | 16.955 | 0.090 | 169.9 | 225 | 4.86 | 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) |
|---|---|---|---|---|---|---|---|
| 1.000 | 1.953 | 34.5 | 8.7 | 0.900 | 1.501 | 0.064 | 0.0 |
| 1.001 | 1.001 | 39.8 | 17.3 | 1.501 | 1.490 | 0.128 | 0.0 |
| 2.000 | 0.973 | 17.2 | 4.1 | 0.850 | 1.501 | 0.030 | 0.0 |
| 1.002 | 0.999 | 39.7 | 19.5 | 1.490 | 1.549 | 0.144 | 0.0 |
| 3.000 | 3.207 | 56.7 | 2.2 | 1.116 | 1.490 | 0.016 | 0.0 |
| 1.003 | 0.999 | 70.6 | 33.9 | 1.549 | 1.580 | 0.250 | 0.0 |
| 4.000 | 3.206 | 56.7 | 1.8 | 0.942 | 1.549 | 0.013 | 0.0 |
| 5.000 | 3.206 | 56.7 | 7.6 | 1.160 | 1.549 | 0.056 | 0.0 |
| 6.000 | 2.881 | 50.9 | 1.1 | 0.900 | 1.549 | 0.008 | 0.0 |
| 1.004 | 0.997 | 70.4 | 35.6 | 1.580 | 1.206 | 0.263 | 0.0 |
| 7.000 | 2.916 | 51.5 | 1.8 | 0.900 | 1.580 | 0.013 | 0.0 |
| 1.005 | 0.999 | 70.6 | 42.6 | 1.206 | 1.046 | 0.314 | 0.0 |
| 8.000 | 2.509 | 44.3 | 2.8 | 0.900 | 1.206 | 0.021 | 0.0 |
| 9.000 | 2.127 | 37.6 | 2.3 | 0.900 | 1.206 | 0.017 | 0.0 |
| 1.006 | 3.033 | 214.4 | 49.6 | 1.046 | 1.276 | 0.366 | 0.0 |
| 10.000 | 1.925 | 34.0 | 1.9 | 0.900 | 1.046 | 0.014 | 0.0 |
| 11.001 | 1.001 | 39.8 | 16.0 | 1.583 | 1.370 | 0.118 | 0.0 |
| 11.000 | 2.490 | 44.0 | 11.2 | 0.900 | 1.583 | 0.083 | 0.0 |
| 11.002 | 1.000 | 39.8 | 23.9 | 1.370 | 1.304 | 0.176 | 0.0 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.000 | S8LA | S8 | 7.873 | 0.600 | 17.513 | 17.120 | 0.393 | 20.0 | 150 | 4.06 | 50.0 |
| 13.000 | S8LB | S8 | 4.540 | 0.600 | 17.574 | 17.120 | 0.454 | 10.0 | 150 | 4.02 | 50.0 |
| 11.003 | S9 | S10 | 16.761 | 0.600 | 16.955 | 16.857 | 0.098 | 171.0 | 225 | 5.14 | 50.0 |
| 14.000 | S9LA | S9 | 9.025 | 0.600 | 17.349 | 17.030 | 0.319 | 28.3 | 150 | 4.08 | 50.0 |
| 15.000 | S9LB | S9 | 4.548 | 0.600 | 17.485 | 17.030 | 0.455 | 10.0 | 150 | 4.02 | 50.0 |
| 11.004 | S10 | S11 | 7.201 | 0.600 | 16.782 | 16.752 | 0.030 | 240.0 | 300 | 5.26 | 50.0 |
| 16.000 | S10LA | S10 | 11.137 | 0.600 | 17.226 | 16.932 | 0.294 | 37.9 | 150 | 4.11 | 50.0 |
| 17.000 | S10LB | S10 | 4.513 | 0.600 | 17.383 | 16.932 | 0.451 | 10.0 | 150 | 4.02 | 50.0 |
| 11.005 | S11 | S12 | 12.723 | 0.600 | 16.752 | 16.700 | 0.052 | 244.7 | 300 | 5.47 | 50.0 |
| 18.000 | S11L | S11 | 6.444 | 0.600 | 17.096 | 16.902 | 0.194 | 33.2 | 150 | 4.06 | 50.0 |
| 1.007 | S12 | S15 | 21.485 | 0.600 | 16.550 | 16.266 | 0.284 | 75.7 | 450 | 5.81 | 50.0 |
| 19.000 | S13 | S14 | 29.425 | 0.600 | 17.062 | 16.556 | 0.506 | 58.2 | 225 | 4.29 | 50.0 |
| 19.001 | S14 | S15 | 9.694 | 0.600 | 16.556 | 16.491 | 0.065 | 149.1 | 225 | 4.44 | 50.0 |
| 20.000 | S14L | S14 | 4.278 | 0.600 | 17.000 | 16.631 | 0.369 | 11.6 | 150 | 4.02 | 50.0 |
| 1.008 | S15 | S17 | 35.630 | 0.600 | 16.266 | 15.765 | 0.501 | 71.1 | 450 | 6.06 | 50.0 |
| 21.000 | S16LA | S16 | 14.769 | 0.600 | 16.260 | 16.112 | 0.148 | 99.8 | 150 | 4.24 | 50.0 |
| 21.001 | S16 | S17 | 7.994 | 0.600 | 16.037 | 15.990 | 0.047 | 170.1 | 225 | 4.38 | 50.0 |
| 22.000 | S16LB | S16 | 5.200 | 0.600 | 16.307 | 16.112 | 0.195 | 26.7 | 150 | 4.04 | 50.0 |
| 1.009 | S17 | S18 | 12.879 | 0.600 | 15.765 | 15.734 | 0.031 | 415.5 | 450 | 6.27 | 50.0 |
| 1.010 | S18 | HW1 | 6.452 | 0.600 | 15.734 | 15.718 | 0.016 | 403.3 | 450 | 6.38 | 50.0 |
| 1.011 | HW2 | S19 | 6.440 | 0.600 | 15.718 | 15.680 | 0.038 | 169.5 | 225 | 4.11 | 50.0 |
| 1.012 | S19 | HW3 | 13.618 | 0.600 | 15.680 | 15.600 | 0.080 | 170.2 | 225 | 4.33 | 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) |
|---|---|---|---|---|---|---|---|
| 12.000 | 2.260 | 39.9 | 2.3 | 0.900 | 1.370 | 0.017 | 0.0 |
| 13.000 | 3.204 | 56.6 | 2.0 | 0.974 | 1.370 | 0.015 | 0.0 |
| 11.003 | 0.997 | 39.6 | 28.7 | 1.304 | 1.279 | 0.212 | 0.0 |
| 14.000 | 1.900 | 33.6 | 2.2 | 0.900 | 1.304 | 0.016 | 0.0 |
| 15.000 | 3.205 | 56.6 | 2.7 | 0.955 | 1.304 | 0.020 | 0.0 |
| 11.004 | 1.010 | 71.4 | 38.2 | 1.279 | 1.281 | 0.282 | 0.0 |
| 16.000 | 1.640 | 29.0 | 2.7 | 0.900 | 1.279 | 0.020 | 0.0 |
| 17.000 | 3.203 | 56.6 | 3.0 | 0.974 | 1.279 | 0.022 | 0.0 |
| 11.005 | 1.000 | 70.7 | 41.2 | 1.281 | 1.276 | 0.304 | 0.0 |
| 18.000 | 1.752 | 31.0 | 2.4 | 0.900 | 1.281 | 0.018 | 0.0 |
| 1.007 | 2.339 | 372.0 | 94.2 | 1.276 | 1.200 | 0.695 | 0.0 |
| 19.000 | 1.718 | 68.3 | 3.9 | 1.200 | 1.238 | 0.029 | 0.0 |
| 19.001 | 1.068 | 42.5 | 9.9 | 1.238 | 1.200 | 0.073 | 0.0 |
| 20.000 | 2.975 | 52.6 | 3.7 | 0.900 | 1.238 | 0.027 | 0.0 |
| 1.008 | 2.413 | 383.7 | 108.4 | 1.200 | 1.113 | 0.800 | 0.0 |
| 21.000 | 1.006 | 17.8 | 16.3 | 0.759 | 1.039 | 0.120 | 0.0 |
| 21.001 | 0.999 | 39.7 | 21.8 | 1.039 | 1.113 | 0.161 | 0.0 |
| 22.000 | 1.957 | 34.6 | 4.5 | 0.900 | 1.039 | 0.033 | 0.0 |
| 1.009 | 0.991 | 157.6 | 133.0 | 1.113 | 0.996 | 0.981 | 0.0 |
| 1.010 | 1.006 | 160.0 | 133.0 | 0.996 | 0.836 | 0.981 | 0.0 |
| 1.011 | 1.001 | 39.8 | 0.0 | 0.777 | 0.815 | 0.000 | 0.0 |
| 1.012 | 0.999 | 39.7 | 0.0 | 0.815 | 0.756 | 0.000 | 0.0 |

## 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 | 14.297 | 26.8 | 150 | 1 | 19.899 | 18.849 | 0.900 | 19.966 | 18.315 | 1.501 |
| 1.001 | 16.772 | 169.4 | 225 | 1 | 19.966 | 18.240 | 1.501 | 19.856 | 18.141 | 1.490 |
| 2.000 | 18.117 | 106.6 | 150 | 1 | 19.485 | 18.485 | 0.850 | 19.966 | 18.315 | 1.501 |
| 1.002 | 19.390 | 170.1 | 225 | 1 | 19.856 | 18.141 | 1.490 | 19.801 | 18.027 | 1.549 |
| 3.000 | 4.124 | 10.0 | 150 | 1 | 19.895 | 18.629 | 1.116 | 19.856 | 18.216 | 1.490 |
| 1.003 | 12.258 | 245.2 | 300 | 1 | 19.801 | 17.952 | 1.549 | 19.782 | 17.902 | 1.580 |
| 4.000 | 6.254 | 10.0 | 150 | 1 | 19.820 | 18.728 | 0.942 | 19.801 | 18.102 | 1.549 |
| 5.000 | 4.266 | 10.0 | 150 | 1 | 19.839 | 18.529 | 1.160 | 19.801 | 18.102 | 1.549 |
| 6.000 | 7.502 | 12.4 | 150 | 1 | 19.759 | 18.709 | 0.900 | 19.801 | 18.102 | 1.549 |
| 1.004 | 15.779 | 246.5 | 300 | 1 | 19.782 | 17.902 | 1.580 | 19.344 | 17.838 | 1.206 |
| 7.000 | 6.720 | 12.1 | 150 | 1 | 19.659 | 18.609 | 0.900 | 19.782 | 18.052 | 1.580 |
| 1.005 | 6.621 | 245.2 | 300 | 1 | 19.344 | 17.838 | 1.206 | 19.157 | 17.811 | 1.046 |
| 8.000 | 7.746 | 16.3 | 150 | 1 | 19.514 | 18.464 | 0.900 | 19.344 | 17.988 | 1.206 |
| 9.000 | 6.778 | 22.6 | 150 | 1 | 19.338 | 18.288 | 0.900 | 19.344 | 17.988 | 1.206 |
| 1.006 | 30.074 | 27.1 | 300 | 1 | 19.157 | 17.811 | 1.046 | 18.276 | 16.700 | 1.276 |
| 10.000 | 4.301 | 27.6 | 150 | 1 | 19.167 | 18.117 | 0.900 | 19.157 | 17.961 | 1.046 |
| 11.001 | 29.861 | 169.7 | 225 | 1 | 19.029 | 17.221 | 1.583 | 18.640 | 17.045 | 1.370 |
| 11.000 | 15.865 | 16.5 | 150 | 1 | 19.306 | 18.256 | 0.900 | 19.029 | 17.296 | 1.583 |
| 11.002 | 15.290 | 169.9 | 225 | 1 | 18.640 | 17.045 | 1.370 | 18.484 | 16.955 | 1.304 |
| 12.000 | 7.873 | 20.0 | 150 | 1 | 18.563 | 17.513 | 0.900 | 18.640 | 17.120 | 1.370 |
| 13.000 | 4.540 | 10.0 | 150 | 1 | 18.698 | 17.574 | 0.974 | 18.640 | 17.120 | 1.370 |
| 11.003 | 16.761 | 171.0 | 225 | 1 | 18.484 | 16.955 | 1.304 | 18.361 | 16.857 | 1.279 |
| 14.000 | 9.025 | 28.3 | 150 | 1 | 18.399 | 17.349 | 0.900 | 18.484 | 17.030 | 1.304 |
| 15.000 | 4.548 | 10.0 | 150 | 1 | 18.590 | 17.485 | 0.955 | 18.484 | 17.030 | 1.304 |
| 11.004 | 7.201 | 240.0 | 300 | 1 | 18.361 | 16.782 | 1.279 | 18.333 | 16.752 | 1.281 |

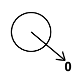
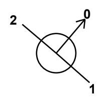
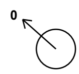
| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | S1LA | 600 | Manhole | 1 | S1 | 1200 | Manhole | 1 |
| 1.001 | S1 | 1200 | Manhole | 1 | S2 | 1200 | Manhole | 1 |
| 2.000 | S1LB | 600 | Manhole | 1 | S1 | 1200 | Manhole | 1 |
| 1.002 | S2 | 1200 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 3.000 | S2L | 600 | Manhole | 1 | S2 | 1200 | Manhole | 1 |
| 1.003 | S3 | 1200 | Manhole | 1 | S4 | 1200 | Manhole | 1 |
| 4.000 | S3LA | 600 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 5.000 | S3LB | 600 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 6.000 | S3LC | 600 | Manhole | 1 | S3 | 1200 | Manhole | 1 |
| 1.004 | S4 | 1200 | Manhole | 1 | S5 | 1200 | Manhole | 1 |
| 7.000 | S4L | 600 | Manhole | 1 | S4 | 1200 | Manhole | 1 |
| 1.005 | S5 | 1200 | Manhole | 1 | S6 | 1200 | Manhole | 1 |
| 8.000 | S5LA | 600 | Manhole | 1 | S5 | 1200 | Manhole | 1 |
| 9.000 | S5LB | 600 | Manhole | 1 | S5 | 1200 | Manhole | 1 |
| 1.006 | S6 | 1200 | Manhole | 1 | S12 | 1500 | Manhole | 1 |
| 10.000 | S6L | 600 | Manhole | 1 | S6 | 1200 | Manhole | 1 |
| 11.001 | S7 | 1200 | Manhole | 1 | S8 | 1200 | Manhole | 1 |
| 11.000 | S7L | 600 | Manhole | 1 | S7 | 1200 | Manhole | 1 |
| 11.002 | S8 | 1200 | Manhole | 1 | S9 | 1200 | Manhole | 1 |
| 12.000 | S8LA | 600 | Manhole | 1 | S8 | 1200 | Manhole | 1 |
| 13.000 | S8LB | 600 | Manhole | 1 | S8 | 1200 | Manhole | 1 |
| 11.003 | S9 | 1200 | Manhole | 1 | S10 | 1200 | Manhole | 1 |
| 14.000 | S9LA | 600 | Manhole | 1 | S9 | 1200 | Manhole | 1 |
| 15.000 | S9LB | 600 | Manhole | 1 | S9 | 1200 | Manhole | 1 |
| 11.004 | S10 | 1200 | Manhole | 1 | S11 | 1200 | Manhole | 1 |

## Pipeline Schedule

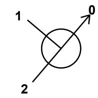
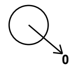
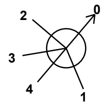
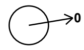
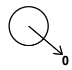
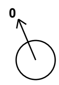
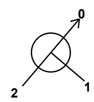
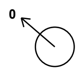
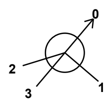
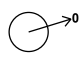
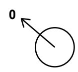
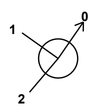
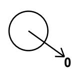
| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 16.000 | 11.137 | 37.9 | 150 | 1 | 18.276 | 17.226 | 0.900 | 18.361 | 16.932 | 1.279 |
| 17.000 | 4.513 | 10.0 | 150 | 1 | 18.507 | 17.383 | 0.974 | 18.361 | 16.932 | 1.279 |
| 11.005 | 12.723 | 244.7 | 300 | 1 | 18.333 | 16.752 | 1.281 | 18.276 | 16.700 | 1.276 |
| 18.000 | 6.444 | 33.2 | 150 | 1 | 18.146 | 17.096 | 0.900 | 18.333 | 16.902 | 1.281 |
| 1.007 | 21.485 | 75.7 | 450 | 1 | 18.276 | 16.550 | 1.276 | 17.916 | 16.266 | 1.200 |
| 19.000 | 29.425 | 58.2 | 225 | 1 | 18.487 | 17.062 | 1.200 | 18.019 | 16.556 | 1.238 |
| 19.001 | 9.694 | 149.1 | 225 | 1 | 18.019 | 16.556 | 1.238 | 17.916 | 16.491 | 1.200 |
| 20.000 | 4.278 | 11.6 | 150 | 1 | 18.050 | 17.000 | 0.900 | 18.019 | 16.631 | 1.238 |
| 1.008 | 35.630 | 71.1 | 450 | 1 | 17.916 | 16.266 | 1.200 | 17.328 | 15.765 | 1.113 |
| 21.000 | 14.769 | 99.8 | 150 | 1 | 17.169 | 16.260 | 0.759 | 17.301 | 16.112 | 1.039 |
| 21.001 | 7.994 | 170.1 | 225 | 1 | 17.301 | 16.037 | 1.039 | 17.328 | 15.990 | 1.113 |
| 22.000 | 5.200 | 26.7 | 150 | 1 | 17.357 | 16.307 | 0.900 | 17.301 | 16.112 | 1.039 |
| 1.009 | 12.879 | 415.5 | 450 | 1 | 17.328 | 15.765 | 1.113 | 17.180 | 15.734 | 0.996 |
| 1.010 | 6.452 | 403.3 | 450 | 1 | 17.180 | 15.734 | 0.996 | 17.004 | 15.718 | 0.836 |
| 1.011 | 6.440 | 169.5 | 225 | 1 | 16.720 | 15.718 | 0.777 | 16.720 | 15.680 | 0.815 |
| 1.012 | 13.618 | 170.2 | 225 | 1 | 16.720 | 15.680 | 0.815 | 16.581 | 15.600 | 0.756 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 16.000 | S10LA | 600 | Manhole | 1 | S10 | 1200 | Manhole | 1 |
| 17.000 | S10LB | 600 | Manhole | 1 | S10 | 1200 | Manhole | 1 |
| 11.005 | S11 | 1200 | Manhole | 1 | S12 | 1500 | Manhole | 1 |
| 18.000 | S11L | 600 | Manhole | 1 | S11 | 1200 | Manhole | 1 |
| 1.007 | S12 | 1500 | Manhole | 1 | S15 | 1500 | Manhole | 1 |
| 19.000 | S13 | 1200 | Manhole | 1 | S14 | 1200 | Manhole | 1 |
| 19.001 | S14 | 1200 | Manhole | 1 | S15 | 1500 | Manhole | 1 |
| 20.000 | S14L | 600 | Manhole | 1 | S14 | 1200 | Manhole | 1 |
| 1.008 | S15 | 1500 | Manhole | 1 | S17 | 1500 | Manhole | 1 |
| 21.000 | S16LA | 600 | Manhole | 1 | S16 | 1200 | Manhole | 1 |
| 21.001 | S16 | 1200 | Manhole | 1 | S17 | 1500 | Manhole | 1 |
| 22.000 | S16LB | 600 | Manhole | 1 | S16 | 1200 | Manhole | 1 |
| 1.009 | S17 | 1500 | Manhole | 1 | S18 | 1500 | Manhole | 1 |
| 1.010 | S18 | 1500 | Manhole | 1 | HW1 | 1200 | Manhole | 1 |
| 1.011 | HW2 | 1200 | Manhole | 1 | S19 | 1200 | Manhole | 1 |
| 1.012 | S19 | 1200 | Manhole | 1 | HW3 | 1200 | Manhole | 1 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1LA | 508578.855 | 320748.136 | 19.899 | 1.050 | 600 |  | 0 | 1.000 | 18.849 | 150 |
| S1 | 508589.755 | 320738.884 | 19.966 | 1.726 | 1200 |  | 1 | 2.000 | 18.315 | 150 |
| | | | | | | | 2 | 1.000 | 18.315 | 150 |
| | | | | | | | 0 | 1.001 | 18.240 | 225 |
| S1LB | 508603.348 | 320726.906 | 19.485 | 1.000 | 600 |  | 0 | 2.000 | 18.485 | 150 |

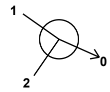
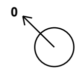
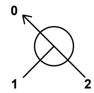
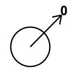
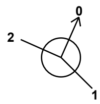
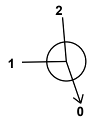
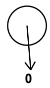
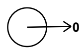
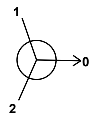
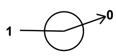
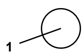
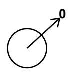
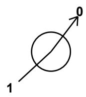
**Manhole Schedule**

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| S2 | 508600.609 | 320751.670 | 19.856 | 1.715 | 1200 |  | 1 | 3.000 | 18.216 | 150 |
| | | | | | | | 2 | 1.001 | 18.141 | 225 |
| | | | | | | | 0 | 1.002 | 18.141 | 225 |
| S2L | 508597.464 | 320754.339 | 19.895 | 1.266 | 600 |  | 0 | 3.000 | 18.629 | 150 |
| S3 | 508613.156 | 320766.452 | 19.801 | 1.849 | 1200 |  | 1 | 6.000 | 18.102 | 150 |
| | | | | | | | 2 | 5.000 | 18.102 | 150 |
| | | | | | | | 3 | 4.000 | 18.102 | 150 |
| | | | | | | | 4 | 1.002 | 18.027 | 225 |
| | | | | | | | 0 | 1.003 | 17.952 | 300 |
| S3LA | 508606.988 | 320765.419 | 19.820 | 1.092 | 600 |  | 0 | 4.000 | 18.728 | 150 |
| S3LB | 508609.904 | 320769.213 | 19.839 | 1.310 | 600 |  | 0 | 5.000 | 18.529 | 150 |
| S3LC | 508616.075 | 320759.541 | 19.759 | 1.050 | 600 |  | 0 | 6.000 | 18.709 | 150 |
| S4 | 508621.089 | 320775.797 | 19.782 | 1.880 | 1200 |  | 1 | 7.000 | 18.052 | 150 |
| | | | | | | | 2 | 1.003 | 17.902 | 300 |
| | | | | | | | 0 | 1.004 | 17.902 | 300 |
| S4L | 508626.212 | 320771.449 | 19.659 | 1.050 | 600 |  | 0 | 7.000 | 18.609 | 150 |
| S5 | 508631.300 | 320787.827 | 19.344 | 1.506 | 1200 |  | 1 | 9.000 | 17.988 | 150 |
| | | | | | | | 2 | 8.000 | 17.988 | 150 |
| | | | | | | | 3 | 1.004 | 17.838 | 300 |
| | | | | | | | 0 | 1.005 | 17.838 | 300 |
| S5LA | 508623.891 | 320785.565 | 19.514 | 1.050 | 600 |  | 0 | 8.000 | 18.464 | 150 |
| S5LB | 508636.467 | 320783.441 | 19.338 | 1.050 | 600 |  | 0 | 9.000 | 18.288 | 150 |
| S6 | 508635.584 | 320792.874 | 19.157 | 1.346 | 1200 |  | 1 | 10.000 | 17.961 | 150 |
| | | | | | | | 2 | 1.005 | 17.811 | 300 |
| | | | | | | | 0 | 1.006 | 17.811 | 300 |
| S6L | 508632.075 | 320795.361 | 19.167 | 1.050 | 600 |  | 0 | 10.000 | 18.117 | 150 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| S7 | 508585.685 | 320864.527 | 19.029 | 1.808 | 1200 | 1 | 11.000 | 17.296 | 150 |
| | | | | | | 0 | 11.001 | 17.221 | 225 |
| S7L | 508576.586 | 320851.532 | 19.306 | 1.050 | 600 | 0 | 11.000 | 18.256 | 150 |
| S8 | 508610.146 | 320847.400 | 18.640 | 1.595 | 1200 | 1 | 13.000 | 17.120 | 150 |
| | | | | | | 2 | 12.000 | 17.120 | 150 |
| | | | | | | 3 | 11.001 | 17.045 | 225 |
| | | | | | | 0 | 11.002 | 17.045 | 225 |
| S8LA | 508610.273 | 320855.272 | 18.563 | 1.050 | 600 | 0 | 12.000 | 17.513 | 150 |
| S8LB | 508607.542 | 320843.681 | 18.698 | 1.124 | 600 | 0 | 13.000 | 17.574 | 150 |
| S9 | 508622.671 | 320838.630 | 18.484 | 1.529 | 1200 | 1 | 15.000 | 17.030 | 150 |
| | | | | | | 2 | 14.000 | 17.030 | 150 |
| | | | | | | 3 | 11.002 | 16.955 | 225 |
| | | | | | | 0 | 11.003 | 16.955 | 225 |
| S9LA | 508621.256 | 320847.544 | 18.399 | 1.050 | 600 | 0 | 14.000 | 17.349 | 150 |
| S9LB | 508620.062 | 320834.904 | 18.590 | 1.105 | 600 | 0 | 15.000 | 17.485 | 150 |
| S10 | 508636.401 | 320829.016 | 18.361 | 1.579 | 1200 | 1 | 17.000 | 16.932 | 150 |
| | | | | | | 2 | 16.000 | 16.932 | 150 |
| | | | | | | 3 | 11.003 | 16.857 | 225 |
| | | | | | | 0 | 11.004 | 16.782 | 300 |
| S10LA | 508632.732 | 320839.531 | 18.276 | 1.050 | 600 | 0 | 16.000 | 17.226 | 150 |
| S10LB | 508633.812 | 320825.319 | 18.507 | 1.124 | 600 | 0 | 17.000 | 17.383 | 150 |
| S11 | 508642.300 | 320824.886 | 18.333 | 1.581 | 1200 | 1 | 18.000 | 16.902 | 150 |
| | | | | | | 2 | 11.004 | 16.752 | 300 |
| | | | | | | 0 | 11.005 | 16.752 | 300 |
| S11L | 508645.996 | 320830.164 | 18.146 | 1.050 | 600 | 0 | 18.000 | 17.096 | 150 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| S12 | 508652.722 | 320817.588 | 18.276 | 1.726 | 1500 |  | 1 | 11.005 | 16.700 | 300 |
| | | | | | | | 2 | 1.006 | 16.700 | 300 |
| | | | | | | | 0 | 1.007 | 16.550 | 450 |
| S13 | 508700.125 | 320781.318 | 18.487 | 1.425 | 1200 |  | 0 | 19.000 | 17.062 | 225 |
| S14 | 508679.241 | 320802.047 | 18.019 | 1.463 | 1200 |  | 1 | 20.000 | 16.631 | 150 |
| | | | | | | | 2 | 19.000 | 16.556 | 225 |
| | | | | | | | 0 | 19.001 | 16.556 | 225 |
| S14L | 508676.227 | 320799.010 | 18.050 | 1.050 | 600 |  | 0 | 20.000 | 17.000 | 150 |
| S15 | 508672.361 | 320808.875 | 17.916 | 1.650 | 1500 |  | 1 | 19.001 | 16.491 | 225 |
| | | | | | | | 2 | 1.007 | 16.266 | 450 |
| | | | | | | | 0 | 1.008 | 16.266 | 450 |
| S16 | 508684.201 | 320849.001 | 17.301 | 1.264 | 1200 |  | 1 | 22.000 | 16.112 | 150 |
| | | | | | | | 2 | 21.000 | 16.112 | 150 |
| | | | | | | | 0 | 21.001 | 16.037 | 225 |
| S16LA | 508682.952 | 320863.717 | 17.169 | 0.909 | 600 |  | 0 | 21.000 | 16.260 | 150 |
| S16LB | 508679.002 | 320848.913 | 17.357 | 1.050 | 600 |  | 0 | 22.000 | 16.307 | 150 |
| S17 | 508686.810 | 320841.444 | 17.328 | 1.563 | 1500 |  | 1 | 21.001 | 15.990 | 225 |
| | | | | | | | 2 | 1.008 | 15.765 | 450 |
| | | | | | | | 0 | 1.009 | 15.765 | 450 |
| S18 | 508699.687 | 320841.201 | 17.180 | 1.446 | 1500 |  | 1 | 1.009 | 15.734 | 450 |
| | | | | | | | 0 | 1.010 | 15.734 | 450 |
| HW1 | 508705.770 | 320843.350 | 17.004 | 1.286 | 1200 |  | 1 | 1.010 | 15.718 | 450 |
| HW2 | 508737.158 | 320860.706 | 16.720 | 1.002 | 1200 |  | 0 | 1.011 | 15.718 | 225 |
| S19 | 508741.900 | 320865.062 | 16.720 | 1.040 | 1200 |  | 1 | 1.011 | 15.680 | 225 |
| | | | | | | | 0 | 1.012 | 15.680 | 225 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| HW3 | 508750.200 | 320875.859 | 16.581 | 0.981 | 1200 | 1 | 1.012 | 15.600 | 225 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-99 | F (1km) | 2.509 | Additional Storage (m³/ha) | 0.0 |
| C (1km) | -0.020 | Summer CV | 0.950 | Check Discharge Rate(s) | ✓ |
| D1 (1km) | 0.339 | Winter CV | 0.950 | 100 year (l/s) | 4.6 |
| D2 (1km) | 0.314 | Analysis Speed | Detailed | Check Discharge Volume | x |
| D3 (1km) | 0.183 | Skip Steady State | x | | |
| E (1km) | 0.304 | Drain Down Time (mins) | 240 | | |

**Storm Durations**

| 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 | 10 | 0 |
| 30 | 0 | 10 | 0 |
| 100 | 40 | 10 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | QBar/QMed conversion factor | 1.111 |
| Greenfield Method | FEH | Growth Factor 100 year | 2.48 |
| Positively Drained Area (ha) | 1.805 | Betterment (%) | 0 |
| SAAR (mm) | 594 | QMed | 4.6 |
| Host | 1 | QBar | 5.1 |
| BFIHost | 0.379 | Q 100 year (l/s) | 12.6 |
| Region | 1 | | |

## Node S19 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | x | Sump Available | ✓ |
| Invert Level (m) | 15.680 | Product Number | CTL-SHE-0100-4600-1100-4600 |
| Design Depth (m) | 1.100 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 4.6 | Min Node Diameter (mm) | 1200 |

## Node S1LA Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.849 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

## Node S1LB Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.485 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S2L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.629 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S3LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.728 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S3LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.529 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S3LC Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.709 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S4L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.609 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S5LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.464 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S5LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.288 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S6L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.117 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S7L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 18.256 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S8LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.513 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S8LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.574 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S9LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.349 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S9LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.485 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S10LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.226 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S10LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.383 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S11L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.096 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S14L Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 17.000 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S16LA Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 16.260 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node S16LB Online Orifice Control**

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 16.307 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m) | 0.075 | | |

**Node HW2 Flow through Pond Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Main Channel Length (m) | 35.867 |
| Side Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 15.718 | Main Channel Slope (1:X) | 1000.0 |
| Safety Factor | 2.0 | Time to half empty (mins) | | Main Channel n | 0.400 |

**Inlets**
HW1

| Depth (m) | Area ($m^2$) | Inf Area ($m^2$) | Depth (m) | Area ($m^2$) | Inf Area ($m^2$) |
|---|---|---|---|---|---|
| 0.000 | 1021.0 | 0.0 | 1.000 | 1389.1 | 0.0 |

## Node S1LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.419 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 37 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 21.300 | Inf Depth (m) | 0.500 |
| Porosity | 0.30 | Length (m) | 21.300 | | |

## Node S2L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.540 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.600 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.600 | | |

## Node S3LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.465 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 2 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.400 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.400 | | |

## Node S5LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.159 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 9 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 8.800 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 8.800 | | |

## Node S6L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.812 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.900 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.900 | | |

## Node S8LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.933 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 9 | Depth (m) | 0.500 |
| Safety Factor | 2.0 | Width (m) | 7.200 | Inf Depth (m) | 0.500 |
| Porosity | 0.30 | Length (m) | 7.200 | | |

## Node S9LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.044 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 7 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.700 | | |

## Node S10LA Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.921 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 14.200 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 14.200 | | |

**Node S11L Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.791 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 7.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 7.700 | | |

**Node S14L Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 17.570 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 12 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 10.900 | Inf Depth (m) | 0.350 |
| Porosity | 0.30 | Length (m) | 10.900 | | |

**Node S16LA Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 16.539 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 79 | Depth (m) | 0.500 |
| Safety Factor | 2.0 | Width (m) | 25.100 | Inf Depth (m) | 0.500 |
| Porosity | 0.30 | Length (m) | 25.100 | | |

**Node S1LB Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.005 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 15 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 12.600 | Inf Depth (m) | 0.350 |
| Porosity | 0.30 | Length (m) | 12.600 | | |

**Node S3LB Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.484 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 28 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 19.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 19.700 | | |

**Node S3LC Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.404 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 0 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 8.900 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 8.900 | | |

**Node S5LB Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.983 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 5 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.000 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.000 | | |

**Node S7L Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.766 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 46 | Depth (m) | 0.410 |
| Safety Factor | 2.0 | Width (m) | 20.500 | Inf Depth (m) | 0.410 |
| Porosity | 0.30 | Length (m) | 20.500 | | |

## Node S8LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.168 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 5 | Depth (m) | 0.400 |
| Safety Factor | 2.0 | Width (m) | 6.900 | Inf Depth (m) | 0.400 |
| Porosity | 0.30 | Length (m) | 6.900 | | |

## Node S9LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.235 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.800 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.800 | | |

## Node S10LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 18.152 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 8 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 9.700 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 9.700 | | |

## Node S16LB Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 16.877 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 17 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 9.400 | Inf Depth (m) | 0.350 |
| Porosity | 0.30 | Length (m) | 9.400 | | |

## Node S4L Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 19.304 | Slope (1:X) | 80.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 3 | Depth (m) | 0.225 |
| Safety Factor | 2.0 | Width (m) | 6.300 | Inf Depth (m) | 0.225 |
| Porosity | 0.30 | Length (m) | 6.300 | | |

**Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.79%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | 19 | 19.463 | 0.614 | 12.5 | 0.6650 | 0.0000 | SURCHARGED |
| 30 minute summer | S1 | 18 | 18.355 | 0.115 | 20.6 | 0.1303 | 0.0000 | OK |
| 30 minute summer | S1LB | 18 | 18.739 | 0.254 | 5.9 | 0.0720 | 0.0000 | SURCHARGED |
| 30 minute summer | S2 | 18 | 18.265 | 0.124 | 23.6 | 0.1399 | 0.0000 | OK |
| 30 minute summer | S2L | 18 | 18.730 | 0.101 | 3.1 | 0.0287 | 0.0000 | OK |
| 30 minute summer | S3 | 18 | 18.121 | 0.169 | 42.4 | 0.1912 | 0.0000 | OK |
| 30 minute summer | S3LA | 18 | 18.808 | 0.080 | 2.5 | 0.0228 | 0.0000 | OK |
| 30 minute summer | S3LB | 18 | 19.215 | 0.686 | 10.9 | 0.1941 | 0.0000 | SURCHARGED |
| 30 minute summer | S3LC | 17 | 18.767 | 0.058 | 1.6 | 0.0164 | 0.0000 | OK |
| 30 minute summer | S4 | 18 | 18.078 | 0.176 | 44.8 | 0.1990 | 0.0000 | OK |
| 30 minute summer | S4L | 18 | 18.689 | 0.080 | 2.5 | 0.0228 | 0.0000 | OK |
| 30 minute summer | S5 | 18 | 18.026 | 0.188 | 54.2 | 0.2125 | 0.0000 | OK |
| 30 minute summer | S5LA | 18 | 18.613 | 0.149 | 4.1 | 0.0422 | 0.0000 | OK |
| 30 minute summer | S5LB | 18 | 18.398 | 0.110 | 3.3 | 0.0311 | 0.0000 | OK |
| 30 minute summer | S6 | 18 | 17.922 | 0.111 | 63.7 | 0.1256 | 0.0000 | OK |
| 30 minute summer | S6L | 18 | 18.205 | 0.088 | 2.7 | 0.0248 | 0.0000 | OK |
| 30 minute summer | S7 | 17 | 17.317 | 0.096 | 15.3 | 0.1081 | 0.0000 | OK |
| 30 minute summer | S7L | 20 | 18.847 | 0.591 | 16.2 | 1.8054 | 0.0000 | SURCHARGED |
| 30 minute summer | S8 | 18 | 17.179 | 0.134 | 26.2 | 0.1521 | 0.0000 | OK |
| 30 minute summer | S8LA | 18 | 17.623 | 0.110 | 3.3 | 0.0311 | 0.0000 | OK |
| 30 minute summer | S8LB | 18 | 17.669 | 0.095 | 2.9 | 0.0270 | 0.0000 | OK |
| 30 minute summer | S9 | 18 | 17.109 | 0.154 | 32.8 | 0.1738 | 0.0000 | OK |
| 30 minute summer | S9LA | 18 | 17.450 | 0.101 | 3.1 | 0.0287 | 0.0000 | OK |
| 30 minute summer | S9LB | 18 | 17.624 | 0.139 | 3.9 | 0.0393 | 0.0000 | OK |
| 30 minute summer | S10 | 18 | 16.958 | 0.176 | 45.9 | 0.1992 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | Orifice | S1 | 8.9 | | | | |
| 30 minute summer | S1 | 1.001 | S2 | 20.7 | 0.967 | 0.519 | 0.3590 | |
| 30 minute summer | S1LB | Orifice | S1 | 5.5 | | | | |
| 30 minute summer | S2 | 1.002 | S3 | 23.7 | 1.059 | 0.595 | 0.4333 | |
| 30 minute summer | S2L | Orifice | S2 | 3.0 | | | | |
| 30 minute summer | S3 | 1.003 | S4 | 42.4 | 1.011 | 0.600 | 0.5140 | |
| 30 minute summer | S3LA | Orifice | S3 | 2.4 | | | | |
| 30 minute summer | S3LB | Orifice | S3 | 9.5 | | | | |
| 30 minute summer | S3LC | Orifice | S3 | 1.5 | | | | |
| 30 minute summer | S4 | 1.004 | S5 | 44.7 | 1.001 | 0.635 | 0.7051 | |
| 30 minute summer | S4L | Orifice | S4 | 2.4 | | | | |
| 30 minute summer | S5 | 1.005 | S6 | 54.0 | 1.542 | 0.765 | 0.2322 | |
| 30 minute summer | S5LA | Orifice | S5 | 3.9 | | | | |
| 30 minute summer | S5LB | Orifice | S5 | 3.2 | | | | |
| 30 minute summer | S6 | 1.006 | S12 | 63.5 | 2.683 | 0.296 | 0.7124 | |
| 30 minute summer | S6L | Orifice | S6 | 2.6 | | | | |
| 30 minute summer | S7 | 11.001 | S8 | 15.2 | 0.773 | 0.382 | 0.6081 | |
| 30 minute summer | S7L | Orifice | S7 | 8.7 | | | | |
| 30 minute summer | S8 | 11.002 | S9 | 26.1 | 0.973 | 0.656 | 0.4101 | |
| 30 minute summer | S8LA | Orifice | S8 | 3.2 | | | | |
| 30 minute summer | S8LB | Orifice | S8 | 2.8 | | | | |
| 30 minute summer | S9 | 11.003 | S10 | 32.9 | 1.146 | 0.830 | 0.4813 | |
| 30 minute summer | S9LA | Orifice | S9 | 3.0 | | | | |
| 30 minute summer | S9LB | Orifice | S9 | 3.7 | | | | |
| 30 minute summer | S10 | 11.004 | S11 | 46.0 | 1.059 | 0.644 | 0.3127 | |

**Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.79%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | 18 | 17.365 | 0.139 | 3.9 | 0.0393 | 0.0000 | OK |
| 30 minute summer | S10LB | 18 | 17.543 | 0.160 | 4.3 | 0.0453 | 0.0000 | SURCHARGED |
| 30 minute summer | S11 | 18 | 16.931 | 0.179 | 50.0 | 0.2025 | 0.0000 | OK |
| 30 minute summer | S11L | 18 | 17.215 | 0.119 | 3.5 | 0.0337 | 0.0000 | OK |
| 30 minute summer | S12 | 18 | 16.721 | 0.171 | 118.2 | 0.3028 | 0.0000 | OK |
| 30 minute summer | S13 | 17 | 17.105 | 0.043 | 5.7 | 0.0491 | 0.0000 | OK |
| 30 minute summer | S14 | 18 | 16.643 | 0.087 | 13.7 | 0.0981 | 0.0000 | OK |
| 30 minute summer | S14L | 18 | 17.217 | 0.217 | 5.3 | 0.0614 | 0.0000 | SURCHARGED |
| 30 minute summer | S15 | 18 | 16.449 | 0.183 | 137.7 | 0.3228 | 0.0000 | OK |
| 30 minute summer | S16 | 18 | 16.130 | 0.093 | 14.4 | 0.1052 | 0.0000 | OK |
| 30 minute summer | S16LA | 22 | 16.671 | 0.411 | 23.4 | 5.3558 | 0.0000 | SURCHARGED |
| 30 minute summer | S16LB | 18 | 16.601 | 0.294 | 6.4 | 0.0833 | 0.0000 | SURCHARGED |
| 30 minute summer | S17 | 19 | 16.085 | 0.320 | 155.1 | 0.5652 | 0.0000 | OK |
| 1440 minute winter | S18 | 1590 | 16.083 | 0.349 | 11.5 | 0.6173 | 0.0000 | OK |
| 1440 minute winter | HW1 | 1680 | 16.083 | 0.365 | 11.4 | 0.4132 | 0.0000 | OK |
| 1440 minute winter | HW2 | 1620 | 16.083 | 0.365 | 5.7 | 0.4132 | 0.0000 | SURCHARGED |
| 1440 minute winter | S19 | 1620 | 16.083 | 0.403 | 0.1 | 0.4562 | 0.0000 | SURCHARGED |
| 30 minute summer | HW3 | 1 | 16.400 | 0.800 | 0.0 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | Orifice | S10 | 3.7 | | | | |
| 30 minute summer | S10LB | Orifice | S10 | 4.1 | | | | |
| 30 minute summer | S11 | 11.005 | S12 | 50.0 | 1.163 | 0.708 | 0.5476 | |
| 30 minute summer | S11L | Orifice | S11 | 3.4 | | | | |
| 30 minute summer | S12 | 1.007 | S15 | 118.1 | 2.042 | 0.318 | 1.2435 | |
| 30 minute summer | S13 | 19.000 | S14 | 5.6 | 0.595 | 0.082 | 0.2841 | |
| 30 minute summer | S14 | 19.001 | S15 | 13.6 | 0.966 | 0.321 | 0.1368 | |
| 30 minute summer | S14L | Orifice | S14 | 5.0 | | | | |
| 30 minute summer | S15 | 1.008 | S17 | 137.1 | 1.507 | 0.357 | 3.2220 | |
| 30 minute summer | S16 | 21.001 | S17 | 14.3 | 0.923 | 0.360 | 0.1254 | |
| 30 minute summer | S16LA | Orifice | S16 | 7.2 | | | | |
| 30 minute summer | S16LB | Orifice | S16 | 6.0 | | | | |
| 30 minute summer | S17 | 1.009 | S18 | 153.0 | 1.298 | 0.971 | 1.5321 | |
| 1440 minute winter | S18 | 1.010 | HW1 | 11.4 | 0.347 | 0.071 | 0.8706 | |
| 1440 minute winter | HW1 | Flow through pond | HW2 | 5.7 | 0.005 | 0.002 | 377.0808 | |
| 1440 minute winter | HW2 | 1.011 | S19 | 0.1 | 0.122 | 0.002 | 0.2561 | |
| 1440 minute winter | S19 | 1.012 | HW3 | 0.0 | 0.000 | 0.000 | 0.5416 | 0.0 |

**Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.79%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | 22 | 19.587 | 0.738 | 32.6 | 7.4026 | 0.0000 | SURCHARGED |
| 30 minute summer | S1 | 18 | 18.408 | 0.168 | 35.5 | 0.1898 | 0.0000 | OK |
| 30 minute summer | S1LB | 20 | 19.098 | 0.613 | 15.3 | 1.4750 | 0.0000 | SURCHARGED |
| 30 minute summer | S2 | 18 | 18.345 | 0.204 | 42.1 | 0.2308 | 0.0000 | OK |
| 30 minute summer | S2L | 18 | 19.060 | 0.431 | 8.2 | 0.1220 | 0.0000 | SURCHARGED |
| 30 minute summer | S3 | 18 | 18.248 | 0.296 | 77.4 | 0.3350 | 0.0000 | OK |
| 30 minute summer | S3LA | 18 | 19.034 | 0.306 | 6.6 | 0.0866 | 0.0000 | SURCHARGED |
| 30 minute summer | S3LB | 21 | 19.623 | 1.094 | 28.5 | 4.4877 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3LC | 18 | 18.855 | 0.146 | 4.1 | 0.0414 | 0.0000 | OK |
| 30 minute summer | S4 | 18 | 18.195 | 0.293 | 83.0 | 0.3318 | 0.0000 | OK |
| 30 minute summer | S4L | 18 | 18.915 | 0.306 | 6.6 | 0.0866 | 0.0000 | SURCHARGED |
| 30 minute summer | S5 | 18 | 18.115 | 0.277 | 105.9 | 0.3127 | 0.0000 | OK |
| 30 minute summer | S5LA | 18 | 19.129 | 0.665 | 10.7 | 0.1881 | 0.0000 | SURCHARGED |
| 30 minute summer | S5LB | 18 | 18.764 | 0.476 | 8.7 | 0.1346 | 0.0000 | SURCHARGED |
| 30 minute summer | S6 | 18 | 17.980 | 0.169 | 149.0 | 0.1909 | 0.0000 | OK |
| 30 minute summer | S6L | 18 | 18.462 | 0.345 | 7.1 | 0.0976 | 0.0000 | SURCHARGED |
| 30 minute summer | S7 | 18 | 17.644 | 0.423 | 27.1 | 0.4785 | 0.0000 | SURCHARGED |
| 30 minute summer | S7L | 23 | 18.982 | 0.726 | 42.3 | 11.6845 | 0.0000 | SURCHARGED |
| 30 minute summer | S8 | 18 | 17.570 | 0.525 | 51.7 | 0.5932 | 0.0000 | SURCHARGED |
| 30 minute summer | S8LA | 19 | 17.960 | 0.447 | 8.7 | 0.1907 | 0.0000 | SURCHARGED |
| 30 minute summer | S8LB | 18 | 17.960 | 0.386 | 7.6 | 0.1093 | 0.0000 | SURCHARGED |
| 30 minute summer | S9 | 18 | 17.417 | 0.462 | 66.5 | 0.5220 | 0.0000 | SURCHARGED |
| 30 minute summer | S9LA | 18 | 17.784 | 0.435 | 8.2 | 0.1231 | 0.0000 | SURCHARGED |
| 30 minute summer | S9LB | 18 | 18.099 | 0.614 | 10.2 | 0.1738 | 0.0000 | SURCHARGED |
| 30 minute summer | S10 | 18 | 17.134 | 0.352 | 97.6 | 0.3980 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | Orifice | S1 | 9.8 | | | | |
| 30 minute summer | S1 | 1.001 | S2 | 35.1 | 1.055 | 0.883 | 0.5839 | |
| 30 minute summer | S1LB | Orifice | S1 | 8.9 | | | | |
| 30 minute summer | S2 | 1.002 | S3 | 41.6 | 1.153 | 1.047 | 0.7511 | |
| 30 minute summer | S2L | Orifice | S2 | 7.4 | | | | |
| 30 minute summer | S3 | 1.003 | S4 | 76.9 | 1.112 | 1.088 | 0.8598 | |
| 30 minute summer | S3LA | Orifice | S3 | 6.1 | | | | |
| 30 minute summer | S3LB | Orifice | S3 | 12.1 | | | | |
| 30 minute summer | S3LC | Orifice | S3 | 3.9 | | | | |
| 30 minute summer | S4 | 1.004 | S5 | 82.6 | 1.204 | 1.173 | 1.0877 | |
| 30 minute summer | S4L | Orifice | S4 | 6.1 | | | | |
| 30 minute summer | S5 | 1.005 | S6 | 124.2 | 2.216 | 1.758 | 0.3598 | |
| 30 minute summer | S5LA | Orifice | S5 | 9.3 | | | | |
| 30 minute summer | S5LB | Orifice | S5 | 7.8 | | | | |
| 30 minute summer | S6 | 1.006 | S12 | 130.9 | 3.223 | 0.611 | 1.2218 | |
| 30 minute summer | S6L | Orifice | S6 | 6.5 | | | | |
| 30 minute summer | S7 | 11.001 | S8 | 24.9 | 0.828 | 0.627 | 1.1876 | |
| 30 minute summer | S7L | Orifice | S7 | 9.7 | | | | |
| 30 minute summer | S8 | 11.002 | S9 | 50.5 | 1.270 | 1.270 | 0.6081 | |
| 30 minute summer | S8LA | Orifice | S8 | 7.4 | | | | |
| 30 minute summer | S8LB | Orifice | S8 | 6.9 | | | | |
| 30 minute summer | S9 | 11.003 | S10 | 66.7 | 1.677 | 1.683 | 0.6666 | |
| 30 minute summer | S9LA | Orifice | S9 | 7.1 | | | | |
| 30 minute summer | S9LB | Orifice | S9 | 8.9 | | | | |
| 30 minute summer | S10 | 11.004 | S11 | 97.2 | 1.381 | 1.362 | 0.5071 | |

**Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.79%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | 18 | 17.840 | 0.614 | 10.2 | 0.1738 | 0.0000 | SURCHARGED |
| 30 minute summer | S10LB | 18 | 18.099 | 0.716 | 11.2 | 0.2026 | 0.0000 | SURCHARGED |
| 30 minute summer | S11 | 18 | 17.076 | 0.324 | 107.3 | 0.3665 | 0.0000 | SURCHARGED |
| 30 minute summer | S11L | 18 | 17.618 | 0.522 | 9.2 | 0.1477 | 0.0000 | SURCHARGED |
| 30 minute summer | S12 | 18 | 16.820 | 0.270 | 249.8 | 0.4769 | 0.0000 | OK |
| 30 minute summer | S13 | 17 | 17.132 | 0.070 | 14.8 | 0.0796 | 0.0000 | OK |
| 30 minute summer | S14 | 17 | 16.700 | 0.144 | 32.3 | 0.1627 | 0.0000 | OK |
| 30 minute summer | S14L | 19 | 17.645 | 0.645 | 13.8 | 0.9255 | 0.0000 | SURCHARGED |
| 30 minute summer | S15 | 18 | 16.570 | 0.304 | 296.8 | 0.5380 | 0.0000 | OK |
| 1440 minute winter | S16 | 1440 | 16.434 | 0.397 | 3.9 | 0.4493 | 0.0000 | SURCHARGED |
| 30 minute winter | S16LA | 29 | 16.814 | 0.554 | 47.2 | 22.8499 | 0.0000 | SURCHARGED |
| 30 minute summer | S16LB | 20 | 16.995 | 0.688 | 16.8 | 1.7616 | 0.0000 | SURCHARGED |
| 1440 minute winter | S17 | 1440 | 16.434 | 0.669 | 23.7 | 1.1825 | 0.0000 | SURCHARGED |
| 1440 minute winter | S18 | 1440 | 16.434 | 0.700 | 23.4 | 1.2373 | 0.0000 | SURCHARGED |
| 1440 minute winter | HW1 | 1440 | 16.434 | 0.716 | 23.3 | 0.8101 | 0.0000 | OK |
| 1440 minute winter | HW2 | 1440 | 16.434 | 0.716 | 11.7 | 0.8101 | 0.0000 | FLOOD RISK |
| 1440 minute winter | S19 | 1440 | 16.434 | 0.754 | 0.6 | 0.8530 | 0.0000 | FLOOD RISK |
| 30 minute summer | HW3 | 1 | 16.400 | 0.800 | 0.0 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | Orifice | S10 | 8.9 | | | | |
| 30 minute summer | S10LB | Orifice | S10 | 9.7 | | | | |
| 30 minute summer | S11 | 11.005 | S12 | 106.9 | 1.539 | 1.512 | 0.8505 | |
| 30 minute summer | S11L | Orifice | S11 | 8.2 | | | | |
| 30 minute summer | S12 | 1.007 | S15 | 249.6 | 2.390 | 0.671 | 2.2923 | |
| 30 minute summer | S13 | 19.000 | S14 | 14.6 | 0.786 | 0.214 | 0.5501 | |
| 30 minute summer | S14 | 19.001 | S15 | 31.8 | 1.192 | 0.748 | 0.2593 | |
| 30 minute summer | S14L | Orifice | S14 | 9.2 | | | | |
| 30 minute summer | S15 | 1.008 | S17 | 294.4 | 1.979 | 0.767 | 4.8561 | |
| 1440 minute winter | S16 | 21.001 | S17 | 3.9 | 0.625 | 0.098 | 0.3179 | |
| 30 minute winter | S16LA | Orifice | S16 | 8.4 | | | | |
| 30 minute summer | S16LB | Orifice | S16 | 9.5 | | | | |
| 1440 minute winter | S17 | 1.009 | S18 | 23.4 | 0.437 | 0.149 | 2.0406 | |
| 1440 minute winter | S18 | 1.010 | HW1 | 23.3 | 0.394 | 0.146 | 1.0223 | |
| 1440 minute winter | HW1 | Flow through pond | HW2 | 11.7 | 0.007 | 0.005 | 803.1384 | |
| 1440 minute winter | HW2 | 1.011 | S19 | 0.6 | 0.139 | 0.015 | 0.2561 | |
| 1440 minute winter | S19 | 1.012 | HW3 | 0.6 | 0.015 | 0.015 | 0.5416 | 11.3 |

**Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.79%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | 25 | 19.719 | 0.870 | 67.2 | 22.9695 | 0.0000 | FLOOD RISK |
| 30 minute summer | S1 | 18 | 19.102 | 0.862 | 50.4 | 0.9748 | 0.0000 | SURCHARGED |
| 30 minute summer | S1LB | 22 | 19.255 | 0.770 | 31.5 | 8.3934 | 0.0000 | FLOOD RISK |
| 30 minute summer | S2 | 18 | 18.973 | 0.832 | 58.4 | 0.9415 | 0.0000 | SURCHARGED |
| 30 minute summer | S2L | 20 | 19.633 | 1.004 | 16.8 | 1.2958 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3 | 18 | 18.766 | 0.814 | 115.8 | 0.9205 | 0.0000 | SURCHARGED |
| 30 minute summer | S3LA | 19 | 19.533 | 0.805 | 13.7 | 0.5914 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3LB | 23 | 19.761 | 1.232 | 58.8 | 16.7304 | 0.0000 | FLOOD RISK |
| 30 minute summer | S3LC | 18 | 19.160 | 0.451 | 8.4 | 0.1275 | 0.0000 | SURCHARGED |
| 30 minute summer | S4 | 18 | 18.643 | 0.741 | 121.8 | 0.8385 | 0.0000 | SURCHARGED |
| 30 minute summer | S4L | 19 | 19.380 | 0.771 | 13.7 | 0.6565 | 0.0000 | FLOOD RISK |
| 30 minute summer | S5 | 18 | 18.459 | 0.621 | 150.7 | 0.7018 | 0.0000 | SURCHARGED |
| 30 minute summer | S5LA | 20 | 19.331 | 0.867 | 22.1 | 2.9650 | 0.0000 | FLOOD RISK |
| 30 minute summer | S5LB | 20 | 19.105 | 0.817 | 17.9 | 1.8263 | 0.0000 | FLOOD RISK |
| 30 minute summer | S6 | 18 | 18.334 | 0.523 | 195.1 | 0.5915 | 0.0000 | SURCHARGED |
| 30 minute summer | S6L | 20 | 18.911 | 0.794 | 14.7 | 1.0209 | 0.0000 | FLOOD RISK |
| 30 minute summer | S7 | 18 | 18.516 | 1.295 | 45.8 | 1.4641 | 0.0000 | SURCHARGED |
| 30 minute winter | S7L | 29 | 19.160 | 0.903 | 67.3 | 33.7158 | 0.0000 | FLOOD RISK |
| 30 minute summer | S8 | 18 | 18.302 | 1.257 | 72.2 | 1.4220 | 0.0000 | SURCHARGED |
| 30 minute summer | S8LA | 21 | 18.309 | 0.796 | 22.0 | 5.3772 | 0.0000 | FLOOD RISK |
| 30 minute summer | S8LB | 21 | 18.407 | 0.833 | 15.8 | 3.0301 | 0.0000 | FLOOD RISK |
| 30 minute summer | S9 | 18 | 18.041 | 1.086 | 82.6 | 1.2277 | 0.0000 | SURCHARGED |
| 30 minute summer | S9LA | 21 | 18.268 | 0.919 | 16.8 | 2.7203 | 0.0000 | FLOOD RISK |
| 30 minute summer | S9LB | 21 | 18.408 | 0.923 | 21.0 | 3.4748 | 0.0000 | FLOOD RISK |
| 30 minute summer | S10 | 18 | 17.652 | 0.870 | 122.7 | 0.9836 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S1LA | Orifice | S1 | 10.7 | | | | |
| 30 minute summer | S1 | 1.001 | S2 | 48.0 | 1.208 | 1.207 | 0.6670 | |
| 30 minute summer | S1LB | Orifice | S1 | 10.1 | | | | |
| 30 minute summer | S2 | 1.002 | S3 | 55.9 | 1.406 | 1.407 | 0.7712 | |
| 30 minute summer | S2L | Orifice | S2 | 11.5 | | | | |
| 30 minute summer | S3 | 1.003 | S4 | 112.0 | 1.590 | 1.585 | 0.8632 | |
| 30 minute summer | S3LA | Orifice | S3 | 10.3 | | | | |
| 30 minute summer | S3LB | Orifice | S3 | 12.8 | | | | |
| 30 minute summer | S3LC | Orifice | S3 | 7.4 | | | | |
| 30 minute summer | S4 | 1.004 | S5 | 120.1 | 1.706 | 1.705 | 1.1111 | |
| 30 minute summer | S4L | Orifice | S4 | 10.1 | | | | |
| 30 minute summer | S5 | 1.005 | S6 | 152.6 | 2.183 | 2.160 | 0.4662 | |
| 30 minute summer | S5LA | Orifice | S5 | 10.7 | | | | |
| 30 minute summer | S5LB | Orifice | S5 | 10.4 | | | | |
| 30 minute summer | S6 | 1.006 | S12 | 194.2 | 3.342 | 0.906 | 2.1178 | |
| 30 minute summer | S6L | Orifice | S6 | 10.2 | | | | |
| 30 minute summer | S7 | 11.001 | S8 | 43.1 | 1.083 | 1.082 | 1.1876 | |
| 30 minute winter | S7L | Orifice | S7 | 10.9 | | | | |
| 30 minute summer | S8 | 11.002 | S9 | 67.0 | 1.684 | 1.685 | 0.6081 | |
| 30 minute summer | S8LA | Orifice | S8 | 9.9 | | | | |
| 30 minute summer | S8LB | Orifice | S8 | 10.1 | | | | |
| 30 minute summer | S9 | 11.003 | S10 | 80.5 | 2.024 | 2.031 | 0.6666 | |
| 30 minute summer | S9LA | Orifice | S9 | 10.4 | | | | |
| 30 minute summer | S9LB | Orifice | S9 | 10.9 | | | | |
| 30 minute summer | S10 | 11.004 | S11 | 122.0 | 1.733 | 1.708 | 0.5071 | |

**Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.79%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | 21 | 18.056 | 0.830 | 21.0 | 3.3590 | 0.0000 | FLOOD RISK |
| 30 minute summer | S10LB | 21 | 18.323 | 0.940 | 23.1 | 3.3889 | 0.0000 | FLOOD RISK |
| 30 minute summer | S11 | 18 | 17.562 | 0.810 | 133.5 | 0.9162 | 0.0000 | SURCHARGED |
| 30 minute summer | S11L | 20 | 17.976 | 0.880 | 18.9 | 2.6808 | 0.0000 | FLOOD RISK |
| 30 minute summer | S12 | 18 | 17.375 | 0.825 | 350.6 | 1.4571 | 0.0000 | SURCHARGED |
| 30 minute summer | S13 | 18 | 17.313 | 0.251 | 30.5 | 0.2834 | 0.0000 | SURCHARGED |
| 30 minute summer | S14 | 18 | 17.219 | 0.663 | 54.2 | 0.7499 | 0.0000 | SURCHARGED |
| 30 minute summer | S14L | 21 | 17.795 | 0.795 | 28.4 | 5.8283 | 0.0000 | FLOOD RISK |
| 30 minute summer | S15 | 18 | 17.120 | 0.854 | 432.2 | 1.5085 | 0.0000 | SURCHARGED |
| 1440 minute winter | S16 | 990 | 16.721 | 0.684 | 7.1 | 0.7735 | 0.0000 | SURCHARGED |
| 30 minute winter | S16LA | 31 | 17.005 | 0.745 | 97.3 | 58.6490 | 0.0000 | FLOOD RISK |
| 30 minute summer | S16LB | 22 | 17.330 | 1.023 | 34.7 | 8.0159 | 0.0000 | FLOOD RISK |
| 1440 minute winter | S17 | 990 | 16.721 | 0.956 | 44.4 | 1.6887 | 0.0000 | SURCHARGED |
| 1440 minute winter | S18 | 990 | 16.720 | 0.986 | 44.2 | 1.7427 | 0.0000 | SURCHARGED |
| 1440 minute winter | HW1 | 990 | 16.720 | 1.002 | 44.1 | 1.1333 | 0.0000 | OK |
| 1440 minute winter | HW2 | 990 | 16.720 | 1.002 | 37.0 | 1.1333 | 141.6538 | FLOOD |
| 960 minute winter | S19 | 750 | 16.719 | 1.039 | 4.6 | 1.1756 | 0.0000 | FLOOD RISK |
| 30 minute summer | HW3 | 1 | 16.400 | 0.800 | 0.0 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | S10LA | Orifice | S10 | 10.4 | | | | |
| 30 minute summer | S10LB | Orifice | S10 | 11.2 | | | | |
| 30 minute summer | S11 | 11.005 | S12 | 134.1 | 1.904 | 1.896 | 0.8959 | |
| 30 minute summer | S11L | Orifice | S11 | 10.7 | | | | |
| 30 minute summer | S12 | 1.007 | S15 | 349.5 | 2.440 | 0.940 | 3.4042 | |
| 30 minute summer | S13 | 19.000 | S14 | 28.0 | 0.911 | 0.409 | 1.1703 | |
| 30 minute summer | S14 | 19.001 | S15 | 51.0 | 1.282 | 1.200 | 0.3855 | |
| 30 minute summer | S14L | Orifice | S14 | 10.2 | | | | |
| 30 minute summer | S15 | 1.008 | S17 | 431.7 | 2.725 | 1.125 | 5.6453 | |
| 1440 minute winter | S16 | 21.001 | S17 | 7.4 | 0.663 | 0.186 | 0.3179 | |
| 30 minute winter | S16LA | Orifice | S16 | 9.9 | | | | |
| 30 minute summer | S16LB | Orifice | S16 | 11.6 | | | | |
| 1440 minute winter | S17 | 1.009 | S18 | 44.2 | 0.529 | 0.280 | 2.0406 | |
| 1440 minute winter | S18 | 1.010 | HW1 | 44.1 | 0.512 | 0.276 | 1.0223 | |
| 1440 minute winter | HW1 | Flow through pond | HW2 | 37.0 | 0.008 | 0.015 | 1183.6033 | |
| 1440 minute winter | HW2 | 1.011 | S19 | 4.6 | 0.117 | 0.116 | 0.2561 | |
| 960 minute winter | S19 | 1.012 | HW3 | 4.6 | 0.115 | 0.116 | 0.5416 | 180.1 |

# APPENDIX N – DRAINAGE MAINTENANCE SCHEDULE

farrow walsh CIVIL

# Drainage Maintenance Schedule - FW2038 Bourne, Lincolnshire

| Schedule | Feature | Location | Inspection Type | Inspection Frequency | Required Action | Maintenance Works | Maintenance Intervals | Comments |
|---|---|---|---|---|---|---|---|---|
| Regular Maintenance | Permeable Paving | Parking bays and access road | Visual | 3 Months | Removal of litter and debris | Litter removal | Monthly (or as required). | Maintenace interval subject to condition of porous paving |
| | Permeable Paving | Parking bays and access road | Visual | 3 Times per year (see comments) | Sweeping and jet wash to remove silt and sediment build up from permable paving surface | Silt removal | 3 Times per year (see comments) | Inspection/Maintenance should be as follows:<br>- End of winter (April)<br>- Mid Summer (July/Aug) to remove dust, flower/grass deposits<br>- After Autumn leaf fall (November) |
| | Flow Control Chamber | At Attenuation Pond Outfall chamber | Visual | 3 Months | Removal of litter and debris | Silt / Debris removal | 6 Months (or as required) | Maintenance interval subject to Visual Inspection findings |
| | Orifice Plate Manhole | Demarcation chambers to permable paved driveways | Visual | 3 Months | Inspection of outlet and cover grate, remove debris and litter and ensure outlet is clear | Silt / Debris removal | 6 Months (or as required) | Maintenance interval subject to Visual Inspection findings |
| Occasional Maintenance | Foul & Surface Water Chambers | Entire site | Visual | 6 Months | Remove silt and leaf build up from gullies, chambers, gutters etc. | Silt / Debris removal | As required (debris max. 60% of capacity) | Maintenance interval subject to Visual Inspection findings |
| | Road & Yard Gullies | Entire site | Visual | 6 Months | Mechanical silt removal from sump | Silt / Debris removal | As required (debris max. 60% of capacity) | Maintenance interval subject to Visual Inspection findings |
| | Flow Control Chamber | At Attenuation Pond Outfall chamber | Visual | 6 Months | Mechanical silt removal from sump | Silt / Debris removal | As required (debris max. 60% of capacity) | Maintenance interval subject to Visual Inspection findings |
| | Orifice Plate Manhole | Demarcation chambers to permable paved driveways | Visual | 6 Months | Mechanical silt removal from sump | Silt / Debris removal | As required (debris max. 60% of capacity) | Maintenance interval subject to Visual Inspection findings |
| | Permeable Paving | Parking bays and access road | Visual | 6 Months | Manual removal of weeds | Weed removal * | 6 Months (or as required) | Maintenance interval subject to Visual Inspection findings |

| Schedule | Feature | Location | Inspection Type | Inspection Frequency | Required Action | Maintenance Works | Maintenance Intervals | Comments |
|---|---|---|---|---|---|---|---|---|
| Occasional Maintenance | Perforated Carrier Drains | Parking bays and access road | Visual | 6 Months | CCTV / Jetting | Silt / Debris removal | As required (debris max. 60% of capacity) | Maintenance interval subject to Visual Inspection findings |
| | Atteunation Pond | North-east of site | Visual | 6 Months | Removal from debris | Silt / Debris removal | 6 Months (or as required) | Maintenance interval subject to Visual Inspection findings |
| | Catchpit Chambers | Entire Site | Visual | 6 Months | Mechanical silt removal from sump | Silt / Debris removal | As required (debris max. 60% of capacity) | Maintenance interval subject to Visual Inspection findings |
| Remedial Actions | Foul & Surface Water Drainage | Entire site | Visual | 12 Months | Remove and dispose of oils or fuel (diesel & petrol) residues using safe standard practices. | Safe removal or contaminant residues | As required. | As required. |
| | Attenuation Pond | North-east of site | Visual | 6 Months | Removal from debris | Silt / Debris removal | As required. | Maintenance interval subject to Visual Inspection findings |
| | Permeable Paving | Parking bays and access road | Visual | 12 Months | Infiltration surface rehabilitation | Replace broken or cracked pavious ** | As required or following poor performance. | Maintenance interval subject to Visual Inspection findings |
| | Permeable Paving | Parking bays and access road | Visual | 12 Months | Infiltration surface rehabilitation | Relay any areas of settlement | As required or following poor performance. | Maintenance interval subject to Visual Inspection findings |
| Monitoring | Foul & Surface Water Drainage | Entire site | Visual | 12 Months | Walk over inspection for condition (breaks, lifting & missing) of chamber covers and grates. | Replace broken or cracked inspection chamber covers | As required. | Maintenance interval subject to Visual Inspection findings |
| | Permeable Paving | Parking bays and access road | Visual | Monthly for first 3 Months | Initial inspection to ensure performance | Top up grit between paviours | As required. | Maintenance interval subject to Visual Inspection findings |
| | Attenuation Pond | North-east of site | Visual | 12 Months | Survey inside of pond for sediment build-up and remove if necessary | Remove sediment as required | 5 Years or as required. | Maintenance interval subject to Visual Inspection findings |
| | Permeable Paving | Parking bays and access road | Visual | Monthly for first 3 Months | Initial inspection to ensure performance | Top up grit between paviours | As required. | Maintenance interval subject to Visual Inspection findings |

* If weeds are persitent, weed killer may be used to reduce the requirement for manual weed removal.

** Any block which is to be replaced should be bedded on anew layer of grit / sand.

*** If re-construction is necessary, the following procedure should be followed: 1. Lift surface layer and laying course, 2. Remove and geotextile filter layer, 3. inspect sub-base and wash/replace if required, 4. Renew any geotextile layer as required, 5. Renew laying course, jointing material and block paviours. Note: this is deemed unlikely to occur and thus unlikely to be implemented

Maintenance procedures to be undertaken in accordance with Ciria 753. This schedule should be read in conjunction with all engineering drawings