Junction 11 M40, Banbury, Oxfordshire

NPPF Flood Risk Assessment and Surface Water Drainage Strategy (Phase 3)

Curtins Ref: 072305-CUR-00-XX-RP-C-00002

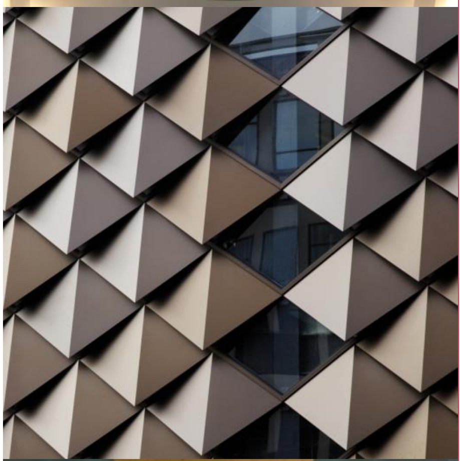
Revision: [00]

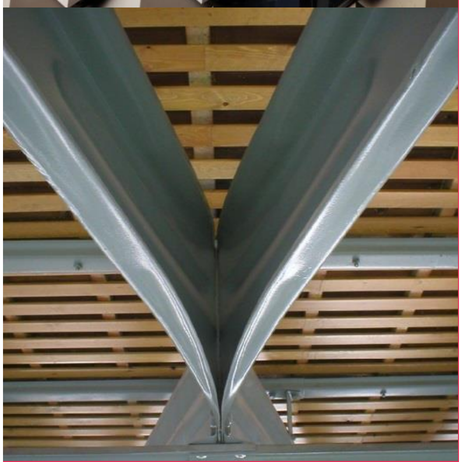
Issue Date: 09 July 2021

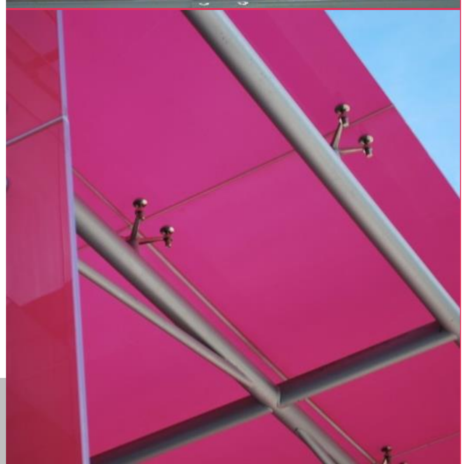
Client Name: Monte Blackburn Ltd

Client Address: Euro House, Beehive Trading Park, Blackburn BB1 2EE

Site Address: Daventry Road (A361), Junction 11 M40, Banbury, Oxfordshire OX16 3AB







Curtins Consulting Limited
Units 24 & 25 Riverside Place
K Village
Lound Road
Kendal
LA9 7FH
Tel: 01539 724 823
Email: kendal@curtins.com
www.curtins.com

Rev	Description	Issued by	Checked	Date
00	Text (Arial 10/regular/colour auto)	CJS	AJR	09/07/2021

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
Chris Scott IEng ACIWEM Principal Engineer	[redacted]	09/07/2021

Reviewed	Signature	Date
Andy Roberts MEng (Hons) CEng MICE Director	[redacted]	09/07/2021

Table of Contents

Figures

Tables

This report is prepared following the standard section format and order of the Planning Practice Guidance GOV.UK - Flood risk and coastal change site specific flood risk assessment: Checklist.

1.0 Development Site and Location

1.1 Site Location

The application site is located to the east of Banbury in Oxfordshire. The site lies to the north east quadrant of Junction 11 of the M40 motorway, with the southbound carriageway forming the western boundary and the A361 Daventry Road forming the eastern boundary. The northern boundary is formed by the flood defence banks of the River Cherwell Flood Alleviation Scheme

The approximate postcode of the application site is OX16 3AB. The approximate Ordnance Survey grid reference of the site is SP472421.

The Google Earth aerial map showing the extent of the application site location, outlined **RED** is shown below in Figure 1-1.

Figure 1-1: Site Location Plan

1.2 Current and Historic Use

It can be seen from Figure 1-1 that the area is currently shown as farmland which would appear to be used for grazing livestock.

A review of Google Earth timeline would suggest that the site has always been farmland and never developed. On this basis, for the purpose of flood risk and drainage, the site is considered 'Greenfield'.

The current application site forms the third phase of a master plan of a wider development, with . The, with this being the third phase of a master plan for the site shown in Figure 1-2 below.

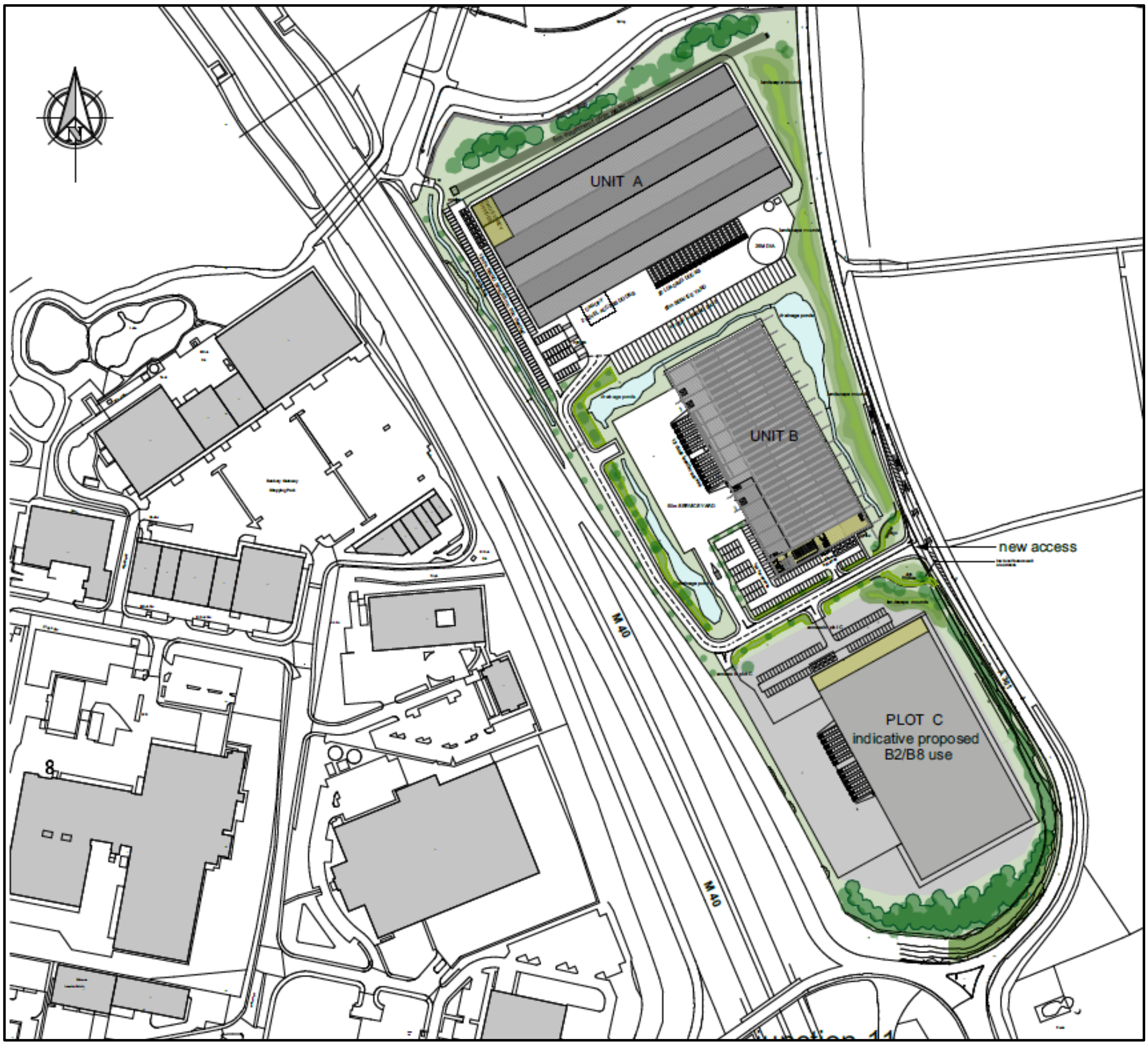


Figure 1-2: Context of Application Site within Master Plan

A Hybrid Planning Application, ref 19/00128/HYBRID for development of land at Junction 11 of the M40, Banbury, Oxfordshire was approved by Cherwell District Council on 30 July 2020, with all Conditions discharged, ref 20/20153/DISC, on 24 February 2021. The approved development comprises:-

Part A: Full planning application for the development of a new priority junction to the A361, internal roads and associated landscaping with 2 no. commercial buildings having a maximum floorspace of 33,110m2 and with a flexible use [to enable changes in accordance with Part 6 Class V of the Town and Country Planning (General Permitted Development) Order 2015 (as amended)] within Class B2 or B8 of the Town and Country Planning (Use Classes) Order 1987 as amended, and ancillary Class B1 offices; and

Part B: Outline planning application for the development of up to 2 no. commercial buildings having a maximum floorspace of 16,890m2 and having a flexible use [to enable changes in accordance with Part 6 Class V of the Town and Country Planning (General Permitted Development) Order 2015 (as amended)] within Class B2 or B8 of the Town and Country Planning (Use Classes) Order 1987 as amended, and ancillary Class B1 offices, with all other matters reserved for future approval.

Where , Part A includes the site area covering Unit A and Unit B and Part B includes the area indicated as Unit in Figure 1-2 above.

At the time of writing, construction is due to commence on Units A and B (Phases 1 and 2).

2.0 Development Proposals

2.1 Proposals

This Flood Risk Assessment has been prepared on behalf of Monte Blackburn Ltd ('the Applicant") in support of a Full Planning Application for development of land at Junction 11 of the M40, Banbury, Oxfordshire comprising:-

Phase 3 - A 240 bed hotel, 4 storey office building, 3 no. drive-thru hot food and coffee outlets, fuel filling station, car parks and hard and soft landscaping. The development has been determined as approximately 4.0ha.

The Proposed development layout, Drawing **16.145.03.301H phase 3 site plan**, by Campbell Driver Partnership is provided in Appendix A.

2.2 Flood Zone

An initial review of the Environment Agency Flood Map for Planning shows that the application site lies in area designated as Flood Zone 1, Low Probability on the Environment Agency's Flood Map for Planning (FMP).

2.3 Vulnerability

With reference to the National Planning Policy Guidance GOV.UK Flood risk and Coastal Change Site Specific Flood Risk Assessment – Guidance Table 2, the development proposals can be regarded as:-

Less Vulnerable, e.g. Buildings used for **shops; financial, professional, and other services; restaurants, cafes, and hot food takeaways; offices**; general industry, storage, and distribution; non - residential institutions not included in the 'more vulnerable' class; and assembly and leisure.

and :-

More Vulnerable, e.g. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and **hotels**

Therefore, the higher Flood risk vulnerability classification, **More Vulnerable**, will apply to this development.

2.4 Flood risk vulnerability and flood zone 'compatibility'

With reference to the National Planning Policy Guidance GOV.UK Flood risk and Coastal Change Site Specific Flood Risk Assessment – Guidance Table 3, the development proposals can be regarded as **Appropriate within Flood Zone 1.**

2.5 Sequential Test

Environment Agency mapping and guidance confirms that the developable area of the site is in Flood Zone 1, classified as More Vulnerable and therefore appropriate for this flood zone . On this basis, it is considered that it will not be necessary to consider Sequential Testing.

2.6 Estimated Lifecycle of Development

As the planning application is for commercial development, it is assumed that the overall lifecycle will be 60 years. This will be factored in consideration of the impact of climate change on any assessed flood risk to the site throughout this flood risk assessment.

2.7 Climate Change

The impacts of climate change will be considered within each of the following report sections on site specific flood risk and surface water drainage strategy.

On the basis the risk from the impacts of climate change are considered throughout this assessment, the risk is considered **LOW** unless identified for a specific element of flood risk later in this report.

3.0 Site Specific Flood Risk Assessment

3.1 Environment Agency Flood Map for Planning

The Environment Agency's website provides on-line mapping to identify flood zoning associated with rivers and the sea for planning purposes. An extract is shown in Figure 3-1 with the site area outlined **RED**

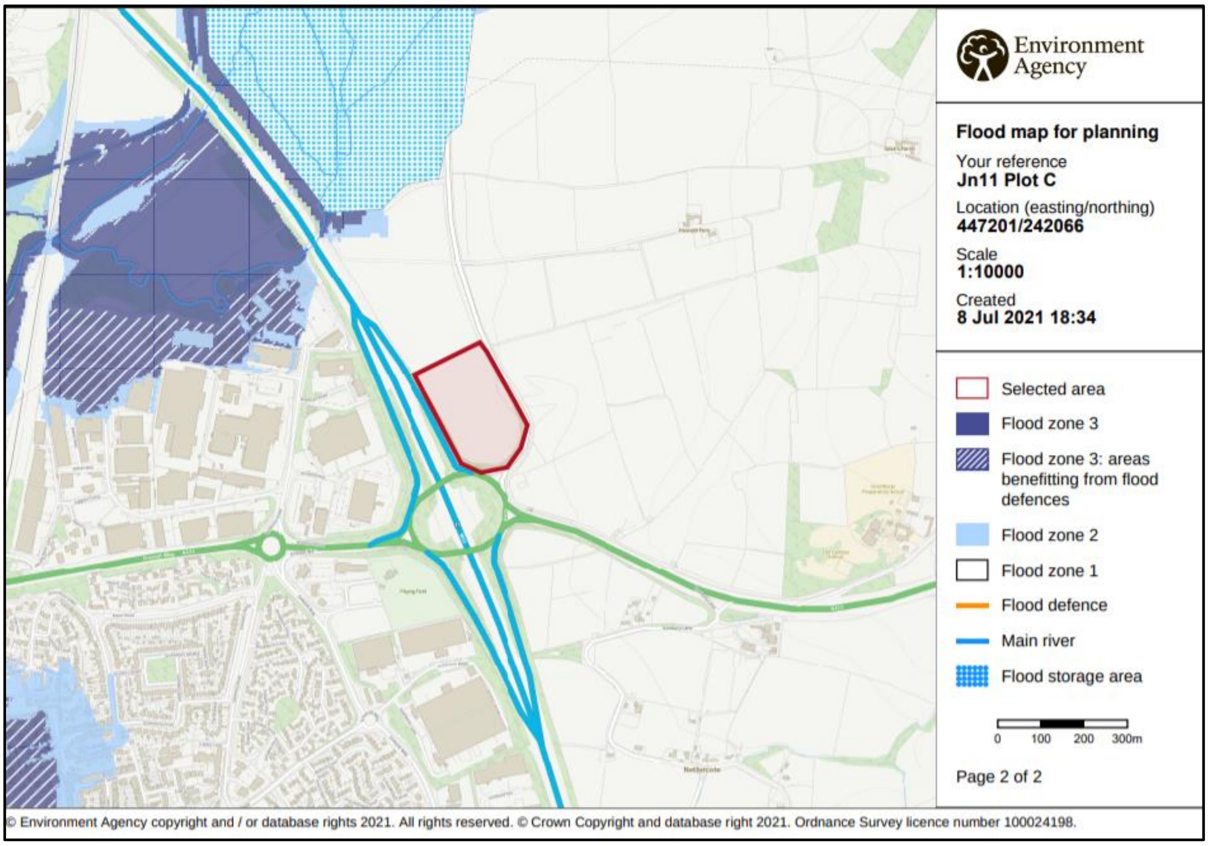


Figure 3-1: Environment Agency Flood Map for Planning

The mapping shows the redline area of the site to be within Flood Zone 1 Low Probability.

The blue line to the north of the site area denotes on the route of the River Cherwell and confirms the 'Main River' status.

The flood defences to the northern boundary of the recent flood alleviation scheme are not identified on the mapping (brown line) however, the flood zones dot-hatched identify the area as to the north designated as a flood storage area.

3.2 Environment Agency Surface Water Flood Risk Mapping

Extracts of the Environment Agency 'Flood Risk from Surface Water' maps showing overall extent of flood risk, together with Low Risk (1 in 1000), Medium Risk (1 in 100) and High Risk (1 in 30) are shown in Figure 3-2 following with the site area outlined **RED**

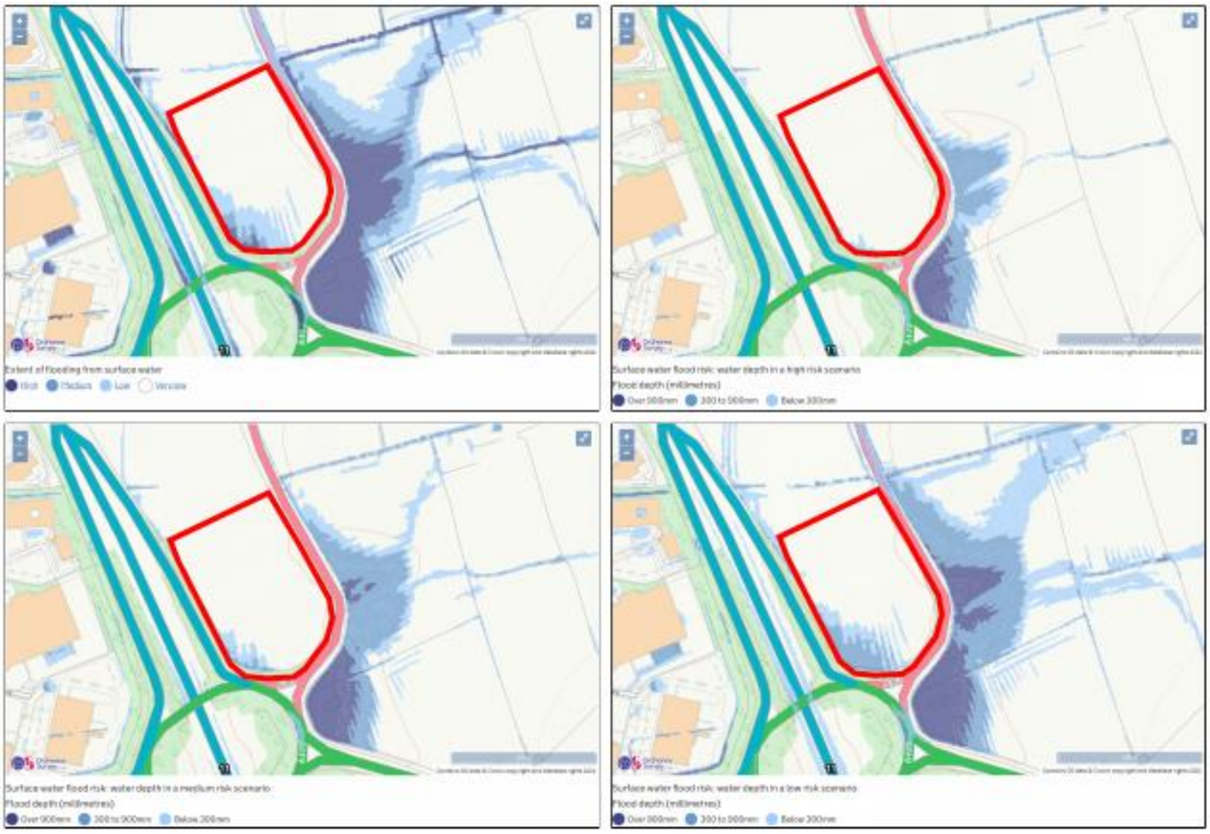


Figure 3-2: Environment Agency Flood Risk from Surface Water (Extents/1in30/1in100/1in1000)

The first map extract (top left) shows an overall combination of the varying levels of risk similar to that of the low risk (1 in 1000 annual probability) mapping. The areas at risk within the site area can be seen to be predominantly located within the southwest corner of the site, adjacent to the motorway roundabout. The presence of the ditches/culverts will be considered in detail within Section 4 Surface Water Management.

A much lower level of risk is identified on the High Risk (1 in 30 annual probability) and the Medium Risk (1 in 100 annual probability) surface water flood map extracts. These annual return periods are typically used to assess surface water risk for planning purposes. On this basis the risk from surface water flooding is considered **LOW**

With respect to impacts on climate change on surface water flood risk, the proposed drainage scheme for the development will allow for the impacts of climate change, thus ensuring there is no increase and where possible reducing the current level of risk.

3.3 Flood Risk from Reservoirs, Canals & Other Artificial Sources

The Environment Agency produce mapping showing areas at risk should catastrophic failure of reservoirs occur. An extract is shown in Figure 3-3 with the site area outlined **RED**

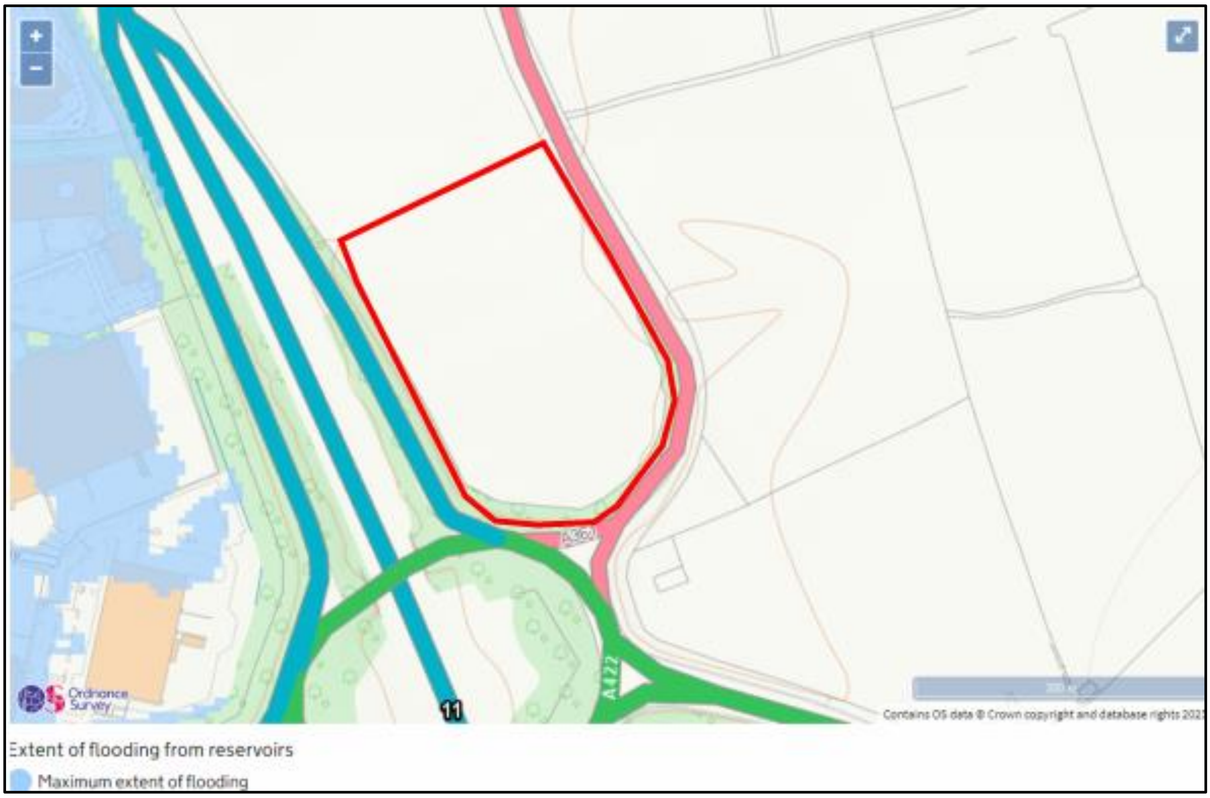


Figure 3-3: Environment Agency Flood Risk from Reservoirs – Extent of Flooding

The risk extents can be seen to mimic that of the Flood Zone 3 extents, and as such it is assumed that should such a catastrophic flood incident happen, that the same flood protection measures adopted for the scheme to protect against primary river flooding will provide a similar level of protection.

It should however be noted that the majority of reservoirs are maintained and under constant close scrutiny from the Water Authorities, Environment Agency, and Local Authorities, so the probability of such an incident occurring is extremely low. On this basis the risk can be considered **LOW**.

As with other flood risk sources, climate change will have an impact with regards the level of risk. However, given the constant maintenance and close scrutiny reservoirs have from the 'Authorities', the risk associated with climate change is considered **LOW**.

The Oxford canal is located approximately 500 metres to the north west of the site. The SFRA Level 2 states that the Oxford canal would not pose a risk of flooding if it was to overtop as the River Cherwell would act as a cut off and intercept any overland flows.

3.4 Flooding from Land and Sewers

A review of the Strategic Flood Risk Assessment document data on historical flooding incidents which has indicated sources of foul, land drainage, surface water, sewer highways drainage, private drainage, and mains sewers, but due to the undeveloped nature of the site area there are no recoded incidents.

A Thames Water pre-development enquiry advises that they had no record of sewer flood incidents in the vicinity of the application site. This is as expected with no public sewers on, or in the vicinity, of the site.

Flooding from drains can present a flood risk which will generally relate to surface water flooding during extreme rainfall rather than foul sewer flooding. The application site has open ditches and culverts running through the site conveying land drainage from land to the east towards the River Cherwell. These are mapped on the survey information provided in Appendix E. These ditches/culverts will be diverted through the new development, kept as open ditches wherever possible and only culverted where necessary for vehicular and pedestrian access. They will also be fully interfaced with the new drainage to be provided for the site development. Therefore, the risk of flooding from existing drains and sewers is therefore considered **LOW**.

Flooding from new drainage can present a risk of flooding. New drainage is to be designed to modern British Standard, Building Regulation, Sewers for Adoption and SuDS legislation standards in full liaison with Thames Water (where relevant) and Oxfordshire County Councils Lead Local Flood Authority team. Further information on proposed drainage strategy is contained in Section 6. Surface Water Management. On this basis the risk of flooding from the new drainage is therefore considered **LOW**.

3.5 Flooding from Groundwater

The Strategic Flood Risk Assessment contains information on risk form groundwater flooding. The SFRA Level 2 'Areas Susceptible to groundwater Flooding' map shows the general area of the application location to be 0 to 25%. Given the development proposals, and that new drainage will continue to ensure the land is well drained, the risk from groundwater is considered **LOW**.

3.6 Flood Risk Mitigation – Proposed Finished Floor Levels

3.6.1 Fluvial Flood Risk

The development site lies entirely within Flood Zone 1 and therefore is at no risk of fluvial and tidal flooding. No specific measures are required at this location to mitigate against fluvial and tidal flooding.

3.6.2 Reservoir Flooding Mitigation

There are reservoirs within the wider vicinity of the site. The EA Flood Risk from Reservoir map indicates the site is not at risk from this source. No specific measures are required at this location to mitigate against reservoir flooding.

3.6.3 Groundwater Flooding Mitigation

Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than hours or days. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises; however, it can cause significant risk to property.

The site is considered at low risk of groundwater flooding from the SFRA evidence base.

External ground levels across the site should fall away from the proposed buildings and ensure that the creation of low points are avoided (other than those used intentionally for drainage features) in order that in the unlikely event of groundwater flooding, the flood water is safely routed away from the buildings on site.

Providing the above mitigation measures are imposed, the risk from groundwater flooding would be considered **LOW** post development.

3.6.4 Surface Water Flooding to the site Mitigation

The flood mapping reviewed shows that a very small area to the southwest corner of the site is potentially at risk from flooding related to the surface water.

The Environment Agency flood risk from surface water maps suggest flooding in this area could be up to 900mm in depth. Surveyed ground levels are around 97.60mAOD, suggesting a surface water flood level of up to 98.50mAOD.

In this location, the site abuts a raised an embankment and general topography indicates and surface runoff from the site in its current form will tend towards the south west and be held against the embankment.

The proposed hotel is to be located in this area with a proposed Finished Floor Level (FFL) of 98.75mAOD (TBC) along with the office block, proposed FFL 98.50mAOD (TBC).

Ground reprofiling will also be undertaken to facilitate development, and in accordance with best practice, levels should, wherever possible fall away from buildings.

A formal surface water drainage system has been designed for site, presented in Section X, to deal with to manage surface water runoff from the site up to the 100-year plus climate change critical rainfall event.

Providing the above measures are implemented the flooding risk to the development site from surface water is therefore considered **LOW** post development.

3.7 Summary of Flood Risk

Flood risk has been assessed in accordance of the requirements of the updated 2019 NPPF and NPPG.

The following can therefore be summarised in terms of flood risk:-

Primary River Flood Risk	**LOW**
Surface Water Flood Risk	**LOW**
Reservoir Flood Risk	**LOW**
Existing Drainage Flood Risk	**LOW**
New Drainage Flood Risk	**LOW**
Groundwater Flood Risk	**LOW**
Risk from Climate Change	**LOW**

4.0 Surface Water Management

4.1 Introduction

The application site formed part of an overall master plan, approved under Hybrid Planning Application, ref 19/00128/HYBRID for development of land at Junction 11 of the M40, Banbury.

In developing the master plan drainage strategy, a Sustainable Drainage (SuDS) assessment was undertaken undertaking the In accordance with NPPF surface water disposal hierarchy; surface water should in the first instance be discharged to the ground by infiltration. If ground conditions prevent this, surface water should be disposed of to a watercourse or waterbody. If this is not possible, surface water should be discharged to a surface water sewer or drain and only as a very last resort to a combined sewer.

Soakage tests were undertaken by ASL Environmental in January 2017 which indicated that the permeability of the underlying soils is very low (approx. 2 x 10-6 m/s) and therefore the use of soakaways for surface water disposal is not considered to be feasible. It was therefore proposed to discharge surface water from the proposed development into the river Cherwell.

The LLFA indicated in their response to a previous planning application related to the master plan site that they would require any new surface water drainage discharge to be limited to 2.0 l/s per ha of drained area (i.e. greenfield run-off).

The approved Phase 1 and 2 development has applied this discharge limit.

The Phase 3 drainage proposal also limits discharge from the site to 2.0 l/s/ha.

4.2 Proposed Drainage Strategy

The surface water will enter the system via a number of surface drainage features including rainwater pipes, gullies, and permeable surfaces. Discharge is then by gravity to the site outfall where flows are restricted to a discharge rate of 2l/s/ha into the drainage channel diverted as part of the Phase 2 (Plot B) development. This Phase 3 discharge rate is calculated as 5.5l/s.

The Phase 3 site is divided into a four sub-catchments, one for each of the future development units, to aid site buildout. Outflow from each sub-catchment is controlled by its own flow control device and associated attenuation. Attenuation is provided by a combination of above ground open SuDS features, permeable paving with sub-base storage, below ground geocellular structures and oversized pipes.

Attenuation across the site has been designed to accommodate the 100-yr plus 40% climate change critical design storm event.

The proposed Surface water Drainage Systems have been hydraulically modelled using the Causeway Flow hydraulic modelling software and both input data and model results are provided in Appendix C.

The Surface Water Drainage Strategy Drawings are provided in Appendix D as:-

- 072305-CUR-XX-XX-DR-C-92101-P01_ Unit C Drainage Layout
- 072305-CUR-XX-XX-DR-C-92102-P01_ Unit C Impermeable Areas Plan
- 072305-CUR-XX-XX-DR-C-92103-P01_ Unit C Exceedance Flows
- 072305-CUR-XX-XX-DR-C-92104-P01- Unit C Drainage Details
- 072305-CUR-XX-XX-DR-C-92004-P01_ Unit B Drainage Layout

The unit B Drainage Layout drawing is provided to show the relationship between Phase 2 (Unit B) Phase 3 (Unit C) and existing watercourse diversion as part of the Unit B approved development.

4.3 Designing for Local Drainage System Failure

In accordance with general principles discussed in CIRIA Report C635, Designing for Exceedance in Urban Drainage the proposed surface water drainage, where practical, should be designed to ensure no increased risk of flooding to buildings on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages or other causes.

Blockage

It is thought that the highest risk would be due to blockage of the flow control devices prior to flow entering the receiving drainage system, diverted watercourse or, the receiving system itself suffering a blockage.

If this were to happen, the surface water would back up within each of the Phase 3 systems, filling the attenuation and eventually flooding out of the top of the flow control chambers, as these are the lowest points the attenuated parts of each system.

To mitigate this risk, the systems should be adequately maintained. Maintenance requirements are discussed in Section 5 below.

Exceedance

The site drainage has been designed to attenuate the 100-yr rainfall event, including a 40% allowance for climate change.

Exceedance flows will be retained on site within the drainage system as far as practical however for rainfall events in excess of the design return period (1 in 100-year plus 40% climate change) it may be necessary to pass forward more flow or to spill flow from the system.

Should flooding of the below drainage system occur, this would initially be upstream of the flow control devices. Exceedance flow would tend towards the west of the site. Given the large areas of permeable paving and swales within the site, overland would be collected within these structures and re-enter the below ground system.

Overland Flow Routes

Overland flow routes as described above are indicated on 072305-CUR-XX-XX-DR-C-92103 in Appendix D.

Drainage Contingency

The proposed surface water drainage system has been designed to provide adequate storage volume against flooding, including a 40% allowance to account for potential climate change.

Building Layout and Detail

It is anticipated buildings will have level access and therefore, external levels will be set wherever possible to fall away from the building ensuring any flood water runs away from, rather than towards the building.

4.4 Water Quality Treatment

Surface Water run-off from hard paved areas at risk from contamination should receive water quality treatment where appropriate. Neither the teaching accommodation or sports pitch drainage systems accept flows from vehicle trafficked areas and the contributing drainage areas are considered Low hazard in terms of contamination.

Figure 4-1 illustrates the pollution hazard indices for different land use classifications from The CIRIA SuDS Manual C753 (2015).

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 4-1: Pollution Hazard indices for land use classification (Table 26.2 the CIRIA SuDS manual 2015)

Treatment could be provided using sustainable methods such as: filter strips, filter drains, swales, bio-retention systems, and/or permeable paving. Figure 4-2 illustrates the SuDS Component mitigation indices from The CIRIA SuDS Manual C753 (2015).

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.

2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.

3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.

4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.

5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: http://tinyurl.com/qf7yuj7

6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

Figure 4-2: Indicative SuDS mitigation indices (Table 26.3 the CIRIA SuDS manual 2015)

The selection of treatment should ensure that the SuDS mitigation component index (Figure 4-2) exceeds the pollution hazard index (Figure 4-1). Where two stages of treatment are required, the second stage of treatment should account for reduced performance due to lower inflows; therefore 0.5 (mitigation index) should be used.

In key areas, the provision of permeable paving and swales would provide the level of water quality treatment required before final discharge to watercourse.

5.0 Maintenance of SuDS

This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details. Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.

The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

The surface water network has been designed to accommodate the 1 in 100-year storm rainfall event plus an allowance for climate change particular to the requirements of the site. It may be that the exceedance flows above the 1 in 100-year plus climate change storm rainfall event are stored within the site partially above ground, on non-habitable external landscaping or other space. As the flows are generally being attenuated on site and within SuDS features there will be a period of time after storm events where the network is still partially or fully surcharged and is draining down. Where this surcharging is still present after 48hrs appropriate action should be taken as noted in this section.

5.1 Components

The following components have been included within the drainage design for the proposed development:

- Inspection, Manhole and Catchpit Chambers
- Pipes
- Drainage Channels and Gullies
- Geocellular Attenuation Structures
- Attenuation Swale
- Flow Control Units

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

It is assumed that the maintenance of the drainage network will be the responsibility of an on-site facilities management team.

A copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.

It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.

Significant sediment deposition is likely in areas used for storage, so a post clean-up operation may be required including the removal of litter, vegetation, sewerage debris and larger objects.

Long-term management practices include monthly sweeping of external paved areas. The sweeping program will remove sand and contaminants directly from paved surfaces before they become mobilised during storm events and transported to the drainage system.

During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris, or litter

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the filter drains and the upstream/downstream chambers.

5.2 Inspection, Manhole and Catchpit Chambers

The indicative locations of the Inspection Chambers, Manholes are indicated on Curtins drainage drawing 072305-CUR-XX-XX-DR-C-92101 in Appendix D.

Access points should be located at the head of each run, at a change in direction and at a change of pipe size in accordance with Building Regulations Part H.

The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access.

5.3 Pipes

The indicative locations of the drainage pipes are indicated on Curtins drainage strategy drawing 072305-CUR-XX-XX-DR-C-92101 in Appendix D.

Pipes are proprietary products and the materials can vary across the site and as such where used the manufacture’s recommendations should be followed. Regardless of the product used the pipes will be fully compliant with the Curtins drainage specification.

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers and manholes.

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk.

Table 5-1: Maintenance Schedule - Pipes

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Initial Inspection should be provided as post construction CCTV survey.	N/A
Regular maintenance\ inspection	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.
	Check and remove large vegetation growth near pipe runs.	Monthly or as required
Remedial Action	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required If above does not improve performance.

5.4 Drainage Channels and Gullies

The indicative locations of and typical details of the drainage channels and gullies are indicated on Curtins drainage drawing 072305-CUR-XX-XX-DR-C-92101 in Appendix D.

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the car park channels.

Table 5-2: Maintenance Schedule – Channels and Gulleys

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Initial Inspection including channel outlet boxes.	Half yearly and after large storms.
Regular maintenance\ inspection	Litter and debris removal	Monthly or as required.
	Check and remove large vegetation growth near channel runs.	Monthly or as required
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent landscaping areas which should be reprofiled to provide a flat area or berm adjacent to the paving.	3-monthly, 48 hours after large storms.
Remedial Action	Inspect access/outlet boxes and rod through poorly performing channels and outlets as initial remediation.	As required.

5.5 Permeable Pavements

The indicative locations and build-up of the permeable paving areas are indicated on Curtins drainage drawings 072305-CUR-XX-XX-DR-C-92101 and 072305-CUR-XX-XX-DR-C-92104 in Appendix D

Permeable pavements contain proprietary products and as such where used the manufacturer's recommendations should be followed.

The permeable pavements are intended to be water quality and attenuation storage features. These features are intended to be dry except during rainfall events.

The surface has been designed to contain gaps where rain can flow through the upper construction layers into the voided stone or geocellular structure which makes up the subbase. Where these features are intended to be used as infiltration devices or soakaways any capping also needs to be permeable to permit the flows to the formation.

Access for maintenance is provided by inspection/access pipes, although access will be limited as this is a surface feature only.

Regular inspection and maintenance is important for the effective operation of the pervious pavement.

Table 5-3: Maintenance Schedule – Permeable Pavements

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Initial Inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent landscaping areas which should be reprofiled to provide a flat area or berm adjacent to the paving.	3-monthly, 48 hours after large storms.

Regular maintenance\ inspection	Brushing and Vacuuming	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required and as per landscape architect's specification.
	Removal of weeds	As required.
Remedial Action	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure. This could include replacement of the jointing and bedding material. The upper geotextiles layer may also need replacing if clogged and Terram 1000 has a life span of 25 years.	As required (if infiltration performance is reduced as a result of significant clogging).

5.6 Attenuation Structures

The location and typical details of the geocellular attenuation structures is indicated on Curtins drainage drawings 072305-CUR-XX-XX-DR-C-92101 and 072305-CUR-XX-XX-DR-C-92104 in Appendix D.

Access for maintenance should be provided, for example by locating inspection chambers within the crate structure.

Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols.

Table 5-4: Maintenance Schedule – Attenuation Structure

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance\ inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Litter and Debris removal from catchment surface (where may cause risks to performance).	Monthly
	Remove sediment from pre-treatment structures, catchpits and filter chambers.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets/outlets.	As required.

	Rehabilitation of surface and upper sub-structure. This could include replacement of the jointing and bedding material. The upper geotextiles layer may also need replacing if clogged and Terram 1000 has a life span of 25 years.	As required (if performance is reduced as a result of significant eroding).
	Reconstruct sub-base and or replace or clean void area / fill, if performance deteriorates or failure occurs	As required
	Replace clogged geotextile (will required reconstruction of soakaway). Terram 1000 has a life span of 25 years.	As required

5.7 Swales

The indicative location and typical details of the attenuation swales are shown on Curtin's drainage drawing 072305-CUR-XX-XX-DR-C-92101 in Appendix D.

The swales are intended to provide an element of above ground attenuation and water quality treatment. The swales will collect runoff from roads and some hard standings within the development. Outflow from the swales is to flow control devices, forming part of the drainage system.

The swales will require little in the way of routine maintenance, primarily only a small amount of extra work over and above what is necessary for standard public open space.

Table 5-5: Maintenance Schedule – Swales

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.

Regular maintenance\ inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Litter and Debris removal from catchment surface and within swale (where may cause risks to performance).	Monthly
	Remove sediment from pre-treatment structures, catchpits and filter chambers.	Annually (or as required after heavy rainfall events)
	Grass Cutting should be undertaken as part of the regular site maintenance of other areas of soft landscaping. Mowing should ideally retain grass lengths of 75-150mm across the main “treatment” surface to assist in filtering pollutants and retaining sediments.	As part of regular site maintenance.
Remedial Actions	Repair/rehabilitation of inlets/outlets.	As required.
	Rehabilitation of surface and upper sub-structure. This could include replacement of the vegetation or impermeable / permeable membrane. Geotextiles layer may also need replacing if clogged and Terram 1000 has a life span of 25 years.	As required (if performance is reduced as a result of significant eroding).
	Reconstruct sub-base and or replace or clean void area / fill, if performance deteriorates or failure occurs	As required

5.8 Flow Control Units

The indicative locations and typical details of flow control chambers are shown on Curtin's drainage drawings 072305-CUR-XX-XX-DR-C-92101 and 072305-CUR-XX-XX-DR-C-92104 in Appendix D.

The flow control units are intended for flood control and flow restriction. The flow control specification is subject to detailed design. The manufacturer's recommendations should also be taken into consideration.

Access for maintenance has been provided by locating within manhole chambers.

Table 5-6: Maintenance Schedule – Flow Controls

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance\ inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly
	Remove sediment from pre-treatment structures and flow control chambers.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets.	As required.

6.0 Proposed Foul Water Drainage Strategy

A separate foul water drainage system is proposed for the site.

The development proposal is for a 240 bed hotel, 4 storey office building, 3 no. drive-thru hot food and coffee outlets, fuel filling station.

A foul network has been provisionally designed to accommodate the development and is shown on drawing 072305-CUR-XX-XX-DR-C-92101 in Appendix D

There are no public sewers in the vicinity of the site and therefore foul drainage will need to be dealt with by an on-site commercial package treatment plant.

The sizing of the treatment plant will be undertaken in accordance with British Water Code of Practice 4 - Flow and Loads once confirmation of People Equivalent (PE) occupancy is confirmed.

It is proposed to discharge treated effluent to the diverted watercourse just beyond the northern boundary of the site.

Given the size and type of development, a discharge greater than $10m^3$ per day is anticipated. Should this be the case, an Environmental Permit will be required from the Environment Agency to discharge to a watercourse.

7.0 Conclusions and Recommendations

The Flood Risk Assessment Surface Water Drainage Strategy has determined the level of risk associated with the proposed development.

In consideration of the Flood Risk Assessment and proposed Drainage Strategy for the site the following conclusions and recommendations are made:

- The site is located within Flood Zone 1 (FZ1) and is at Low Risk of flooding from fluvial, tidal, surface water, ground water, sewers, and artificial sources.
- The site, following review of Master Plan Phase 2 Site Investigation Report and Infiltration Testing, has been determined as unsuitable for drainage by infiltration.
- The site has access to watercourses and these have been utilised as means of surface water disposal in accordance with the SuDS hierarchy.
- The hybrid application 19/00128/HYBRID for development of land at Junction 11 of the M40, Banbury, Oxfordshire was approved by Cherwell District Council on 30 July 2020, with all Conditions discharged, ref 20/20153/DISC, on 24 February 2021.
- The Lead Local Flood Authority set a discharge rate at 2l/s/ha for the Master Plan site and this forms the basis of surface water drainage strategy for the Phase 3 development.
- A surface water drainage system for the Phase 3 development has been designed which attenuated flows up to the 100-year rainfall event including a 40% allowance or climate change.
- Sustainable drainage features, including permeable paving, swales and geocellular storage have been incorporated into the surface water drainage design.
- The inclusion of the swale structures in additional to permeable paving will provide the required water quality treatment for the site.
- The site layout and drainage systems will be designed to ensure that there is no increased risk of flooding on or off site as a result of extreme rainfall, lack of maintenance, blockages, or other causes. The measures that will be implemented comprise of additional freeboard capacity in the basin, consideration of exceedance flow routes and mitigation measures to retain exceedance flow on site or to areas not occupied by buildings. Level access is anticipated for all buildings on the site and building layout should consider all external levels to fall away from the buildings.
- In addition to the above measures, where applicable, a SuDS Operations and Maintenance Plan should be made available prior to the occupation of the site, detailing future maintenance requirements. An outline of typical requirements for the SuDS features has been provided for information.
- Foul flows are proposed to be connected to the diverted watercourse, north of the Phase 3 site via a commercial foul water treatment plant, sized to accommodate the projected population equivalent PE and designed in accordance with BW Flows and Loads 4 and EA Permitting.

8.0 Appendices

Appendix A Development Proposals

issue:

A: original issue
B: 11.03.21: PFS layout amended
C: 29.03.21: hotel car park amended, car wash added
D: 09.04.21: auto car wash omitted
E: 13.05.21: drive-thru unit added, hotel changed to 240 bed, hydrogen pump / station added, elec. parking reconfigured
F: 08.06.21: PFS increased to 8,500 sq ft; kerb lines adjusted to suit vehicle tracking
G: 08.06.21: PFS increased to 10,000 sq ft; EV to 20 spaces, jet and wash bays omitted; air lines added

campbelldriverpartnership
architects

client: monte blackburn ltd

project: Phase 3

junction 11, banbury

sheet: phase 3 site plan

job no: 16.145.03	dwg no: 301	H

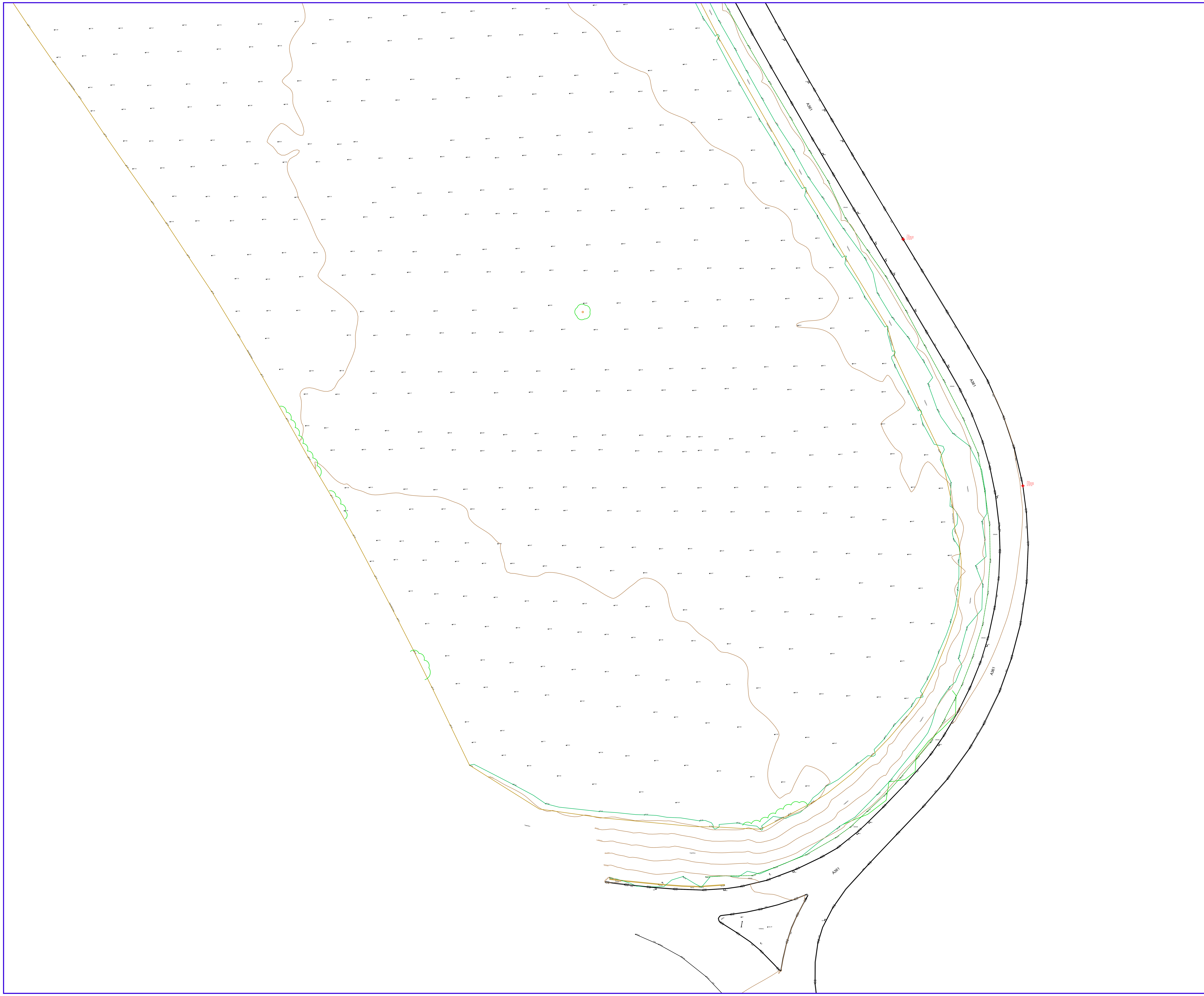
scale: 1:500 @ A1

date: 27.01.21

drawn: dp

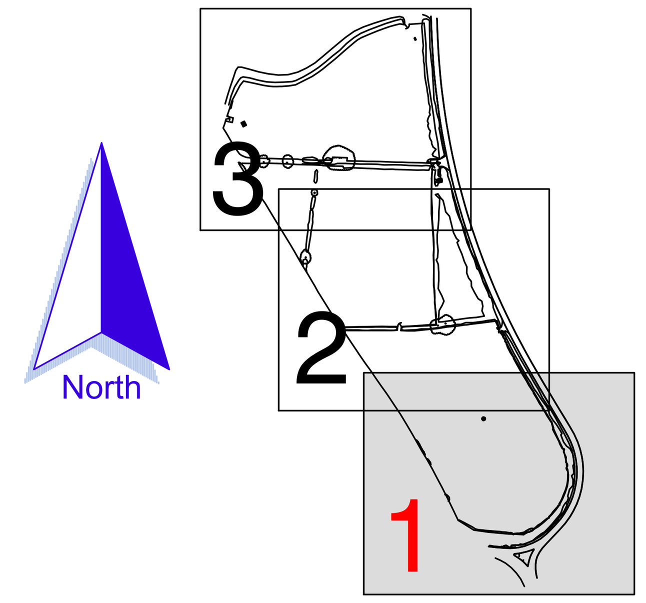
capricorn park
blakewater road
blackburn bb1 5qr
t: 01254 297700
e: design@cdparchitects.co.uk

Appendix B Topographic Survey



Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & stability should be checked for thickness, construction, load bearing capacity & stability.



0 5 10 15 20 25 30 35 40 45 50
Metres

ABBREVIATIONS

CL	Cover Level
DK	Drop Kerb
EH	Eaves Height
GU	Gully
LP	Lamp Post
MH	Man Hole
RH	Ridge/Roof Height
SP	Sign Post
WV	Water Valve

NOTE
All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.0 Description. Issued

TriCAD Solutions Ltd.
BUILDING & LAND SURVEYORS
2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

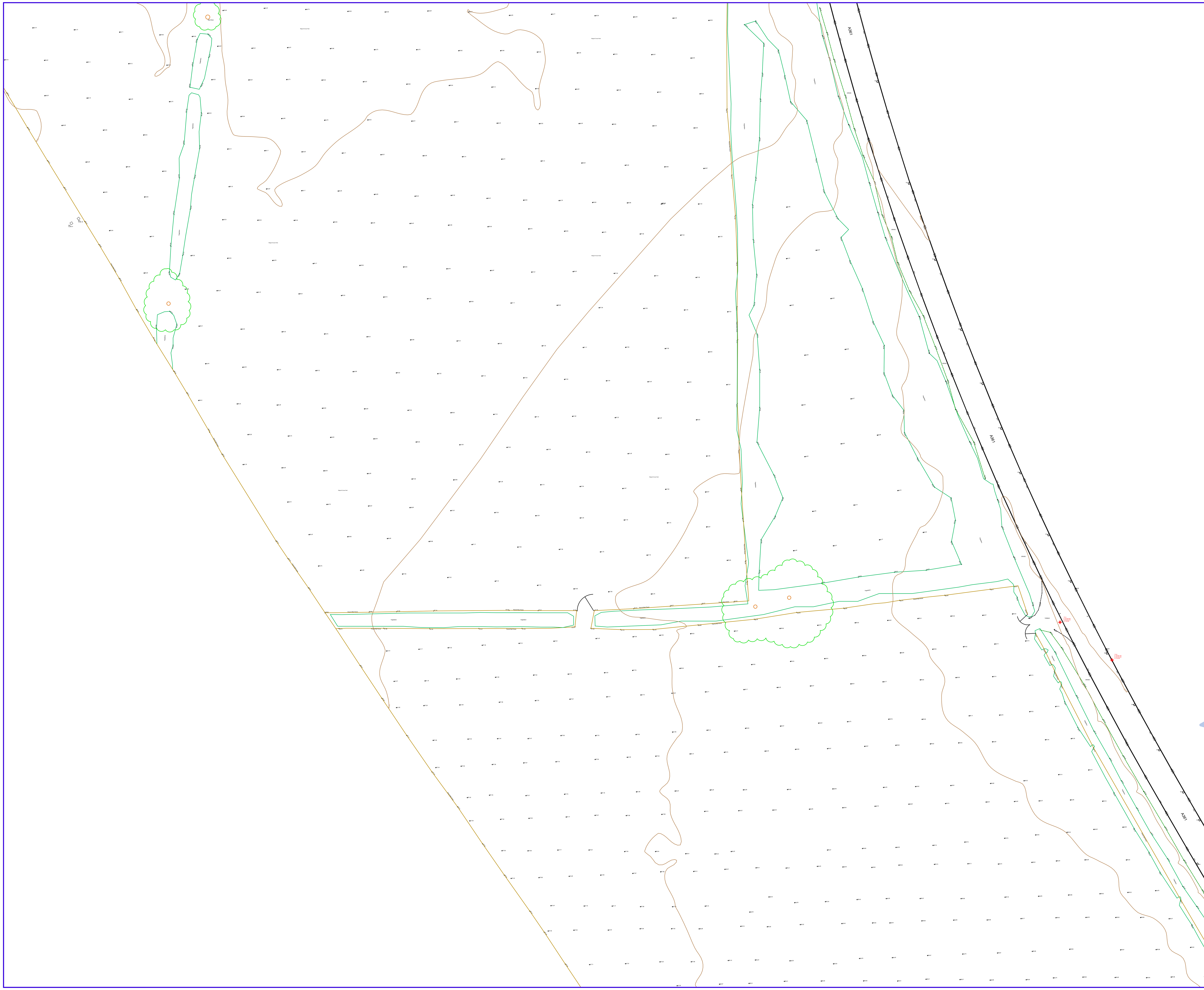
Site Address
BAN15
Banbury
OX17 2B

Project Description
Site Survey

Drawing Title
Existing Site Layout

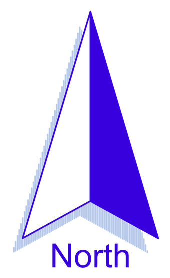
Scale	Date	Drawn By
1:500@A1	18/10/2016	MW

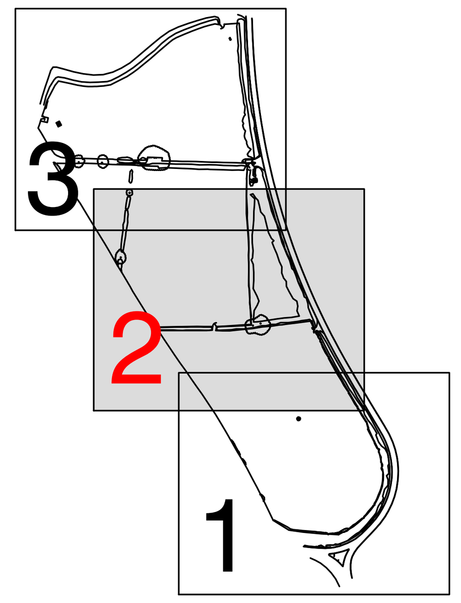
Drawing Number
TRI-1835-01

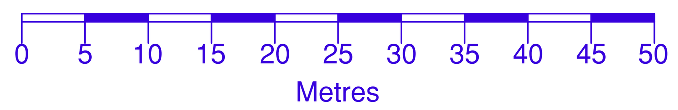


Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.







ABBREVIATIONS

CL	Cover Level
DK	Drop Kerb
EH	Eaves Height
GU	Gully
LP	Lamp Post
MH	Man Hole
RH	Ridge/Roof Height
SP	Sign Post
WV	Water Valve

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.0 Description. Issued

TriCAD Solutions Ltd.
BUILDING & LAND SURVEYORS
2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address
BAN15
Banbury
OX17 2B

Project Description
Site Survey

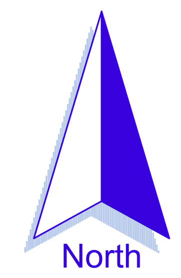
Drawing Title
Existing Site Layout

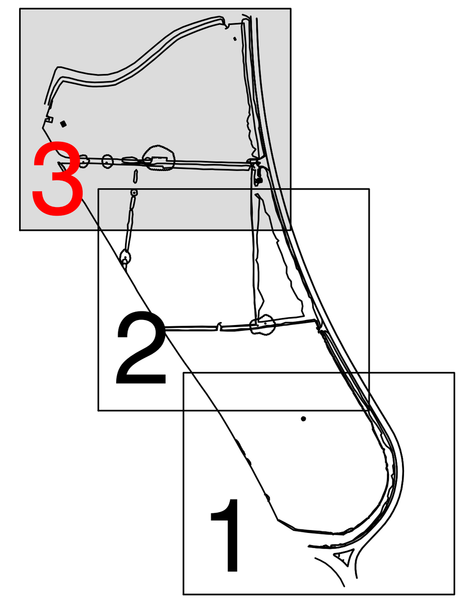
Scale	Date	Drawn By
1:500@A1	18/10/2016	MW

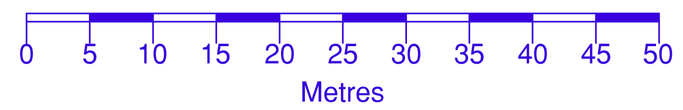
Drawing Number
TRI-1835-02

Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.







ABBREVIATIONS

CL	Cover Level
DK	Drop Kerb
EH	Eaves Height
GU	Gully
LP	Lamp Post
MH	Man Hole
RH	Ridge/Roof Height
SP	Sign Post
WV	Water Valve

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.0 Description. Issued

TriCAD Solutions Ltd.
BUILDING & LAND SURVEYORS
2 Berkshire Close | Wilpshire | Blackburn | Lancashire | BB1 9NG
tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address

BAN15
Banbury
OX17 2B

Project Description

Site Survey

Drawing Title

Existing Site Layout

Scale	Date	Drawn By
1:500@A1	18/10/2016	MW

Drawing Number

TRI-1835-03

Appendix C Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	0.900
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	x
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	1.200		

Circular Default Sewer Type Link Type

Shape	Circular	Barrels	1	Auto Increment (mm)	75	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.069	4.00	98.600	1200	447275.815	241978.295	1.125
2	0.044	4.00	98.500	1200	447214.793	241944.845	1.509
3	0.109	4.00	98.400	1350	447201.600	241968.660	1.672
4	0.032	4.00	98.600	1200	447293.353	241987.909	1.125
5			98.600	1200	447318.488	242008.403	1.316
6	0.153	4.00	98.500	1350	447286.548	242060.677	1.275
7	0.138	4.00	98.600	1350	447305.748	242025.661	1.667
8	0.165	4.00	98.500	1350	447257.507	242044.552	1.350
9			98.550	1350	447276.707	242009.536	1.699
10			98.500	1350	447247.666	241993.411	1.900
11	0.071	4.00	98.500	1800	447230.264	242026.957	1.993
12	0.033	4.00	98.350	1200	447159.615	242004.703	1.125
13	0.013	4.00	98.350	1200	447147.573	242027.591	1.277
14	0.082	4.00	98.200	1200	447175.840	242043.557	1.393
15	0.033	4.00	98.350	1200	447167.206	241990.955	1.125
16	0.019	4.00	98.350	1200	447179.662	241968.471	1.276
17	0.084	4.00	98.200	1200	447208.400	241984.392	1.394
18			98.200	1350	447193.396	242012.476	1.617
19	0.107	4.00	98.200	1200	447190.041	242054.387	1.200
20	0.105	4.00	98.200	1200	447223.625	241994.074	1.200
21			98.350	1350	447208.762	242021.244	1.822

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
22			98.500	1800	447221.505	242028.515	2.018
23			98.500	1350	447227.640	242032.015	2.122
24			98.400	1350	447203.730	242075.346	2.175
25	0.010	4.00	98.350	1200	447156.386	242041.500	1.050
26	0.068	4.00	98.200	1200	447148.921	242055.709	1.082
27			98.200	1200	447162.207	242063.198	1.172
28	0.031	4.00	97.850	1200	447134.660	242057.190	1.125
29	0.050	4.00	98.000	1350	447158.135	242070.421	1.584
30	0.032	4.00	97.850	1200	447119.710	242085.371	1.000
31			98.000	1350	447142.784	242098.377	1.759
32	0.031	4.00	97.850	1200	447100.700	242114.222	1.125
33	0.055	4.00	97.800	1200	447113.155	242091.739	1.301
34	0.036	4.00	97.850	1200	447128.185	242130.195	1.050
35	0.018	4.00	98.000	1500	447141.017	242107.063	1.856
36	0.016	4.00	98.350	1200	447190.512	242062.995	1.050
37			98.200	1200	447183.600	242075.256	1.069
38	0.169	4.00	98.200	1350	447182.867	242081.325	1.255
39			98.150	1350	447166.214	242111.365	1.311
40	0.089	4.00	98.100	1500	447162.136	242118.721	2.005
41	0.099	4.00	98.200	1800	447170.101	242123.118	2.124
42			98.500	1350	447175.783	242126.242	2.454
43	0.053	4.00	98.600	1200	447241.477	242057.003	1.125
44			98.500	1350	447228.243	242053.052	1.256
45	0.183	4.00	98.500	1350	447214.628	242079.608	1.348
46			98.800	1350	447263.991	242105.817	1.821
47	0.165	4.00	98.500	1200	447207.048	242094.913	1.200
48	0.056	4.00	98.500	1350	447255.450	242122.130	1.578
49	0.143	4.00	98.500	1200	447192.428	242121.370	1.200
50			98.500	1350	447241.245	242148.120	1.745
51			98.600	1350	447241.611	242162.788	1.881
52	0.127	4.00	99.000	1200	447213.492	242174.552	2.634
53	0.025	4.00	97.611	1800	447163.440	242148.698	1.644
53_OUT			97.662	1200	447151.481	242150.714	1.746

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	69.589	0.600	97.475	97.066	0.409	170.0	225	5.16	50.0
1.001	2	3	27.225	0.600	96.991	96.878	0.113	240.0	300	5.61	50.0
1.002	3	10	52.294	0.600	96.728	96.600	0.128	407.0	450	6.48	50.0
2.000	4	5	32.431	0.600	97.475	97.284	0.191	170.0	225	4.54	50.0
2.001	5	7	21.451	0.600	97.284	97.158	0.126	170.0	225	4.90	50.0
3.000	6	7	39.934	0.600	97.225	97.008	0.217	184.0	375	4.50	50.0
2.002	7	9	33.217	0.600	96.933	96.851	0.082	405.1	450	5.45	50.0
4.000	8	9	39.934	0.600	97.150	96.851	0.299	133.6	450	4.38	50.0
2.003	9	10	33.217	0.600	96.851	96.600	0.251	132.3	450	5.76	50.0
1.003	10	11	37.791	0.600	96.600	96.507	0.093	406.4	450	7.11	50.0
1.004	11	23	5.698	0.600	96.507	96.453	0.054	105.5	300	7.17	50.0
5.000	12	13	25.863	0.600	97.225	97.073	0.152	170.0	225	4.43	50.0
5.001	13	14	32.464	0.600	97.073	96.882	0.191	170.0	225	4.97	50.0
5.002	14	18	35.697	0.600	96.807	96.658	0.149	240.0	300	5.56	50.0
6.000	15	16	25.704	0.600	97.225	97.074	0.151	170.0	225	4.43	50.0
6.001	16	17	32.853	0.600	97.074	96.881	0.193	170.0	225	4.98	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.000	39.7	13.1	0.900	1.209	0.069	0.0	88	0.896
1.001	1.010	71.4	21.4	1.209	1.222	0.113	0.0	112	0.886
1.002	1.001	159.2	42.1	1.222	1.450	0.222	0.0	158	0.851
2.000	1.000	39.7	6.1	0.900	1.091	0.032	0.0	59	0.727
2.001	1.000	39.7	6.1	1.091	1.217	0.032	0.0	59	0.727
3.000	1.332	147.1	29.0	0.900	1.217	0.153	0.0	112	1.044
2.002	1.004	159.6	61.3	1.217	1.249	0.323	0.0	193	0.939
4.000	1.757	279.5	31.3	0.900	1.249	0.165	0.0	101	1.176
2.003	1.765	280.8	92.6	1.249	1.450	0.488	0.0	177	1.589
1.003	1.002	159.4	134.7	1.450	1.543	0.710	0.0	319	1.118
1.004	1.530	108.1	148.2	1.693	1.747	0.781	0.0	300	1.550
5.000	1.000	39.7	6.3	0.900	1.052	0.033	0.0	60	0.733
5.001	1.000	39.7	8.7	1.052	1.093	0.046	0.0	72	0.806
5.002	1.010	71.4	24.3	1.093	1.242	0.128	0.0	120	0.916
6.000	1.000	39.7	6.3	0.900	1.051	0.033	0.0	60	0.733
6.001	1.000	39.7	9.9	1.051	1.094	0.052	0.0	76	0.831

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)
6.002	17	18	31.841	0.600	96.806	96.658	0.148	215.1	300	5.47	50.0
5.003	18	21	17.692	0.600	96.583	96.528	0.055	321.7	375	5.85	50.0
7.000	19	21	38.065	0.600	97.000	96.603	0.397	95.9	300	4.40	50.0
8.000	20	21	30.970	0.600	97.000	96.603	0.397	78.0	300	4.29	50.0
5.004	21	22	14.671	0.600	96.528	96.482	0.046	318.9	375	6.10	50.0
5.005	22	23	7.063	0.600	96.482	96.453	0.029	240.0	300	6.21	50.0
1.005	23	24	49.490	0.600	96.378	96.225	0.153	324.0	375	7.99	50.0
1.006	24	42	58.064	0.600	96.225	96.046	0.179	324.0	375	8.96	50.0
9.000	25	26	16.051	0.600	97.300	97.193	0.107	150.0	150	4.33	50.0
9.001	26	27	15.251	0.600	97.118	97.028	0.090	169.5	225	4.58	50.0
9.002	27	29	8.292	0.600	97.028	96.566	0.462	17.9	225	4.63	50.0
10.000	28	29	26.947	0.600	96.725	96.566	0.159	170.0	225	4.45	50.0
9.003	29	31	31.893	0.600	96.416	96.316	0.100	320.0	375	5.15	50.0
11.000	30	31	26.487	0.600	96.850	96.541	0.309	85.7	150	4.41	50.0
9.004	31	35	8.864	0.600	96.241	96.219	0.022	402.9	450	5.30	50.0
12.000	32	33	25.702	0.600	96.725	96.574	0.151	170.0	225	4.43	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
6.002	1.068	75.5	25.8	1.094	1.242	0.136	0.0	121	0.971
5.003	1.005	110.9	50.1	1.242	1.447	0.264	0.0	177	0.980
7.000	1.606	113.5	20.3	0.900	1.447	0.107	0.0	85	1.222
8.000	1.781	125.9	19.9	0.900	1.447	0.105	0.0	80	1.310
5.004	1.009	111.4	90.3	1.447	1.643	0.476	0.0	257	1.119
5.005	1.010	71.4	90.3	1.718	1.747	0.476	0.0	300	1.023
1.005	1.001	110.5	238.5	1.747	1.800	1.257	0.0	375	1.014
1.006	1.001	110.5	238.5	1.800	2.079	1.257	0.0	375	1.014
9.000	0.818	14.5	1.9	0.900	0.857	0.010	0.0	37	0.566
9.001	1.001	39.8	14.8	0.857	0.947	0.078	0.0	94	0.927
9.002	3.103	123.4	14.8	0.947	1.209	0.078	0.0	52	2.109
10.000	1.000	39.7	5.9	0.900	1.209	0.031	0.0	58	0.721
9.003	1.007	111.2	30.2	1.209	1.309	0.159	0.0	133	0.860
11.000	1.086	19.2	6.1	0.850	1.309	0.032	0.0	58	0.963
9.004	1.006	160.1	36.2	1.309	1.331	0.191	0.0	145	0.819
12.000	1.000	39.7	5.9	0.900	1.001	0.031	0.0	58	0.721

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)
12.001	33	35	31.798	0.600	96.499	96.369	0.130	244.6	300	4.96	50.0
13.000	34	35	26.453	0.600	96.800	96.444	0.356	74.3	225	4.29	50.0
9.005	35	40	24.123	0.600	96.144	96.095	0.049	492.3	525	5.70	50.0
14.000	36	37	14.075	0.600	97.300	97.206	0.094	150.0	150	4.29	50.0
14.001	37	38	6.113	0.600	97.131	97.095	0.036	169.8	225	4.39	50.0
14.002	38	39	34.347	0.600	96.945	96.839	0.106	324.0	375	4.96	50.0
14.003	39	40	8.411	0.600	96.839	96.245	0.594	14.2	375	4.99	50.0
9.006	40	41	9.098	0.600	96.095	96.076	0.019	478.8	525	5.85	50.0
9.007	41	42	6.484	0.600	96.076	96.046	0.030	216.1	375	5.94	50.0
1.007	42	53	25.625	0.600	96.046	95.967	0.079	324.0	375	9.39	50.0
15.000	43	44	13.811	0.600	97.475	97.394	0.081	170.0	225	4.23	50.0
15.001	44	45	29.843	0.600	97.244	97.152	0.092	324.4	375	4.73	50.0
15.002	45	46	55.889	0.600	97.152	96.979	0.173	323.1	375	5.66	50.0
15.003	46	48	18.414	0.600	96.979	96.922	0.057	323.0	375	5.96	50.0
16.000	47	48	55.529	0.600	97.300	96.997	0.303	183.3	300	4.80	50.0
15.004	48	50	29.619	0.600	96.922	96.830	0.092	321.9	375	6.45	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
12.001	1.001	70.7	16.3	1.001	1.331	0.086	0.0	98	0.817
13.000	1.518	60.4	6.8	0.825	1.331	0.036	0.0	51	1.010
9.005	1.002	217.0	62.8	1.331	1.480	0.331	0.0	193	0.872
14.000	0.818	14.5	3.0	0.900	0.844	0.016	0.0	47	0.648
14.001	1.000	39.8	3.0	0.844	0.880	0.016	0.0	42	0.593
14.002	1.001	110.5	35.1	0.880	0.936	0.185	0.0	145	0.891
14.003	4.836	534.1	35.1	0.936	1.480	0.185	0.0	64	2.772
9.006	1.017	220.1	114.8	1.480	1.599	0.605	0.0	269	1.027
9.007	1.228	135.6	133.6	1.749	2.079	0.704	0.0	304	1.391
1.007	1.001	110.5	372.1	2.079	1.269	1.961	0.0	375	1.014
15.000	1.000	39.7	10.1	0.900	0.881	0.053	0.0	77	0.836
15.001	1.000	110.5	10.1	0.881	0.973	0.053	0.0	76	0.629
15.002	1.002	110.7	44.8	0.973	1.446	0.236	0.0	166	0.951
15.003	1.002	110.7	44.8	1.446	1.203	0.236	0.0	166	0.951
16.000	1.158	81.8	31.3	0.900	1.203	0.165	0.0	129	1.083
15.004	1.004	110.9	86.7	1.203	1.295	0.457	0.0	250	1.106

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)
17.000	49	50	55.666	0.600	97.300	96.905	0.395	140.9	300	4.70	50.0
15.005	50	51	14.673	0.600	96.755	96.719	0.036	407.6	450	6.70	50.0
15.006	51	52	30.481	0.600	96.719	96.516	0.203	150.0	150	7.32	50.0
15.007	52	53	56.335	0.600	96.366	95.967	0.399	141.2	300	8.03	50.0
1.008	53	53_OUT	12.128	0.600	95.967	95.916	0.051	240.0	300	9.59	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
17.000	1.322	93.5	27.1	0.900	1.295	0.143	0.0	110	1.150
15.005	1.001	159.1	113.8	1.295	1.431	0.600	0.0	283	1.084
15.006	0.818	14.5	113.8	1.731	2.334	0.600	0.0	150	0.833
15.007	1.321	93.4	137.9	2.334	1.344	0.727	0.0	300	1.338
1.008	1.010	71.4	514.8	1.344	1.446	2.713	0.0	300	1.023

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	69.589	170.0	225	Circular_Default Sewer Type	98.600	97.475	0.900	98.500	97.066	1.209
1.001	27.225	240.0	300	Circular_Default Sewer Type	98.500	96.991	1.209	98.400	96.878	1.222
1.002	52.294	407.0	450	Circular_Default Sewer Type	98.400	96.728	1.222	98.500	96.600	1.450
2.000	32.431	170.0	225	Circular_Default Sewer Type	98.600	97.475	0.900	98.600	97.284	1.091
2.001	21.451	170.0	225	Circular_Default Sewer Type	98.600	97.284	1.091	98.600	97.158	1.217
3.000	39.934	184.0	375	Circular_Default Sewer Type	98.500	97.225	0.900	98.600	97.008	1.217
2.002	33.217	405.1	450	Circular_Default Sewer Type	98.600	96.933	1.217	98.550	96.851	1.249

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable
2.000	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
2.001	5	1200	Manhole	Adoptable	7	1350	Manhole	Adoptable
3.000	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
2.002	7	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	39.934	133.6	450	Circular_Default Sewer Type	98.500	97.150	0.900	98.550	96.851	1.249
2.003	33.217	132.3	450	Circular_Default Sewer Type	98.550	96.851	1.249	98.500	96.600	1.450
1.003	37.791	406.4	450	Circular_Default Sewer Type	98.500	96.600	1.450	98.500	96.507	1.543
1.004	5.698	105.5	300	Circular_Default Sewer Type	98.500	96.507	1.693	98.500	96.453	1.747
5.000	25.863	170.0	225	Circular_Default Sewer Type	98.350	97.225	0.900	98.350	97.073	1.052
5.001	32.464	170.0	225	Circular_Default Sewer Type	98.350	97.073	1.052	98.200	96.882	1.093
5.002	35.697	240.0	300	Circular_Default Sewer Type	98.200	96.807	1.093	98.200	96.658	1.242
6.000	25.704	170.0	225	Circular_Default Sewer Type	98.350	97.225	0.900	98.350	97.074	1.051
6.001	32.853	170.0	225	Circular_Default Sewer Type	98.350	97.074	1.051	98.200	96.881	1.094
6.002	31.841	215.1	300	Circular_Default Sewer Type	98.200	96.806	1.094	98.200	96.658	1.242
5.003	17.692	321.7	375	Circular_Default Sewer Type	98.200	96.583	1.242	98.350	96.528	1.447
7.000	38.065	95.9	300	Circular_Default Sewer Type	98.200	97.000	0.900	98.350	96.603	1.447
8.000	30.970	78.0	300	Circular_Default Sewer Type	98.200	97.000	0.900	98.350	96.603	1.447
5.004	14.671	318.9	375	Circular_Default Sewer Type	98.350	96.528	1.447	98.500	96.482	1.643
5.005	7.063	240.0	300	Circular_Default Sewer Type	98.500	96.482	1.718	98.500	96.453	1.747
1.005	49.490	324.0	375	Circular_Default Sewer Type	98.500	96.378	1.747	98.400	96.225	1.800
1.006	58.064	324.0	375	Circular_Default Sewer Type	98.400	96.225	1.800	98.500	96.046	2.079

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
2.003	9	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable
1.003	10	1350	Manhole	Adoptable	11	1800	Manhole	Adoptable
1.004	11	1800	Manhole	Adoptable	23	1350	Manhole	Adoptable
5.000	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
5.001	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
5.002	14	1200	Manhole	Adoptable	18	1350	Manhole	Adoptable
6.000	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
6.001	16	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable
6.002	17	1200	Manhole	Adoptable	18	1350	Manhole	Adoptable
5.003	18	1350	Manhole	Adoptable	21	1350	Manhole	Adoptable
7.000	19	1200	Manhole	Adoptable	21	1350	Manhole	Adoptable
8.000	20	1200	Manhole	Adoptable	21	1350	Manhole	Adoptable
5.004	21	1350	Manhole	Adoptable	22	1800	Manhole	Adoptable
5.005	22	1800	Manhole	Adoptable	23	1350	Manhole	Adoptable
1.005	23	1350	Manhole	Adoptable	24	1350	Manhole	Adoptable
1.006	24	1350	Manhole	Adoptable	42	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
9.000	16.051	150.0	150	Circular_Default Sewer Type	98.350	97.300	0.900	98.200	97.193	0.857
9.001	15.251	169.5	225	Circular_Default Sewer Type	98.200	97.118	0.857	98.200	97.028	0.947
9.002	8.292	17.9	225	Circular_Default Sewer Type	98.200	97.028	0.947	98.000	96.566	1.209
10.000	26.947	170.0	225	Circular_Default Sewer Type	97.850	96.725	0.900	98.000	96.566	1.209
9.003	31.893	320.0	375	Circular_Default Sewer Type	98.000	96.416	1.209	98.000	96.316	1.309
11.000	26.487	85.7	150	Circular_Default Sewer Type	97.850	96.850	0.850	98.000	96.541	1.309
9.004	8.864	402.9	450	Circular_Default Sewer Type	98.000	96.241	1.309	98.000	96.219	1.331
12.000	25.702	170.0	225	Circular_Default Sewer Type	97.850	96.725	0.900	97.800	96.574	1.001
12.001	31.798	244.6	300	Circular_Default Sewer Type	97.800	96.499	1.001	98.000	96.369	1.331
13.000	26.453	74.3	225	Circular_Default Sewer Type	97.850	96.800	0.825	98.000	96.444	1.331
9.005	24.123	492.3	525	Circular_Default Sewer Type	98.000	96.144	1.331	98.100	96.095	1.480
14.000	14.075	150.0	150	Circular_Default Sewer Type	98.350	97.300	0.900	98.200	97.206	0.844
14.001	6.113	169.8	225	Circular_Default Sewer Type	98.200	97.131	0.844	98.200	97.095	0.880
14.002	34.347	324.0	375	Circular_Default Sewer Type	98.200	96.945	0.880	98.150	96.839	0.936
14.003	8.411	14.2	375	Circular_Default Sewer Type	98.150	96.839	0.936	98.100	96.245	1.480
9.006	9.098	478.8	525	Circular_Default Sewer Type	98.100	96.095	1.480	98.200	96.076	1.599
9.007	6.484	216.1	375	Circular_Default Sewer Type	98.200	96.076	1.749	98.500	96.046	2.079

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
9.000	25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
9.001	26	1200	Manhole	Adoptable	27	1200	Manhole	Adoptable
9.002	27	1200	Manhole	Adoptable	29	1350	Manhole	Adoptable
10.000	28	1200	Manhole	Adoptable	29	1350	Manhole	Adoptable
9.003	29	1350	Manhole	Adoptable	31	1350	Manhole	Adoptable
11.000	30	1200	Manhole	Adoptable	31	1350	Manhole	Adoptable
9.004	31	1350	Manhole	Adoptable	35	1500	Manhole	Adoptable
12.000	32	1200	Manhole	Adoptable	33	1200	Manhole	Adoptable
12.001	33	1200	Manhole	Adoptable	35	1500	Manhole	Adoptable
13.000	34	1200	Manhole	Adoptable	35	1500	Manhole	Adoptable
9.005	35	1500	Manhole	Adoptable	40	1500	Manhole	Adoptable
14.000	36	1200	Manhole	Adoptable	37	1200	Manhole	Adoptable
14.001	37	1200	Manhole	Adoptable	38	1350	Manhole	Adoptable
14.002	38	1350	Manhole	Adoptable	39	1350	Manhole	Adoptable
14.003	39	1350	Manhole	Adoptable	40	1500	Manhole	Adoptable
9.006	40	1500	Manhole	Adoptable	41	1800	Manhole	Adoptable
9.007	41	1800	Manhole	Adoptable	42	1350	Manhole	Adoptable

Pipeline Schedule

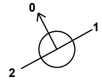
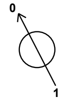
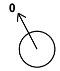
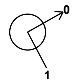
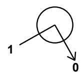
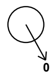
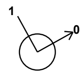
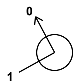
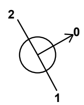
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	25.625	324.0	375	Circular_Default Sewer Type	98.500	96.046	2.079	97.611	95.967	1.269
15.000	13.811	170.0	225	Circular_Default Sewer Type	98.600	97.475	0.900	98.500	97.394	0.881
15.001	29.843	324.4	375	Circular_Default Sewer Type	98.500	97.244	0.881	98.500	97.152	0.973
15.002	55.889	323.1	375	Circular_Default Sewer Type	98.500	97.152	0.973	98.800	96.979	1.446
15.003	18.414	323.0	375	Circular_Default Sewer Type	98.800	96.979	1.446	98.500	96.922	1.203
16.000	55.529	183.3	300	Circular_Default Sewer Type	98.500	97.300	0.900	98.500	96.997	1.203
15.004	29.619	321.9	375	Circular_Default Sewer Type	98.500	96.922	1.203	98.500	96.830	1.295
17.000	55.666	140.9	300	Circular_Default Sewer Type	98.500	97.300	0.900	98.500	96.905	1.295
15.005	14.673	407.6	450	Circular_Default Sewer Type	98.500	96.755	1.295	98.600	96.719	1.431
15.006	30.481	150.0	150	Circular_Default Sewer Type	98.600	96.719	1.731	99.000	96.516	2.334
15.007	56.335	141.2	300	Circular_Default Sewer Type	99.000	96.366	2.334	97.611	95.967	1.344
1.008	12.128	240.0	300	Circular_Default Sewer Type	97.611	95.967	1.344	97.662	95.916	1.446

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	42	1350	Manhole	Adoptable	53	1800	Manhole	Adoptable
15.000	43	1200	Manhole	Adoptable	44	1350	Manhole	Adoptable
15.001	44	1350	Manhole	Adoptable	45	1350	Manhole	Adoptable
15.002	45	1350	Manhole	Adoptable	46	1350	Manhole	Adoptable
15.003	46	1350	Manhole	Adoptable	48	1350	Manhole	Adoptable
16.000	47	1200	Manhole	Adoptable	48	1350	Manhole	Adoptable
15.004	48	1350	Manhole	Adoptable	50	1350	Manhole	Adoptable
17.000	49	1200	Manhole	Adoptable	50	1350	Manhole	Adoptable
15.005	50	1350	Manhole	Adoptable	51	1350	Manhole	Adoptable
15.006	51	1350	Manhole	Adoptable	52	1200	Manhole	Adoptable
15.007	52	1200	Manhole	Adoptable	53	1800	Manhole	Adoptable
1.008	53	1800	Manhole	Adoptable	53_OUT	1200	Manhole	Adoptable

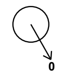
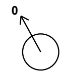
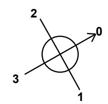
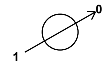
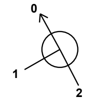
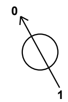
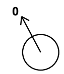
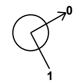
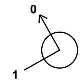
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	447275.815	241978.295	98.600	1.125	1200	0	1.000	97.475	225
2	447214.793	241944.845	98.500	1.509	1200	1	1.000	97.066	225
						0	1.001	96.991	300
3	447201.600	241968.660	98.400	1.672	1350	1	1.001	96.878	300
						0	1.002	96.728	450
4	447293.353	241987.909	98.600	1.125	1200	0	2.000	97.475	225
5	447318.488	242008.403	98.600	1.316	1200	1	2.000	97.284	225
						0	2.001	97.284	225
6	447286.548	242060.677	98.500	1.275	1350	0	3.000	97.225	375
7	447305.748	242025.661	98.600	1.667	1350	1	3.000	97.008	375
						2	2.001	97.158	225
						0	2.002	96.933	450
8	447257.507	242044.552	98.500	1.350	1350	0	4.000	97.150	450
9	447276.707	242009.536	98.550	1.699	1350	1	4.000	96.851	450
						2	2.002	96.851	450
						0	2.003	96.851	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
10	447247.666	241993.411	98.500	1.900	1350		1	2.003	96.600	450
							2	1.002	96.600	450
							0	1.003	96.600	450
11	447230.264	242026.957	98.500	1.993	1800		1	1.003	96.507	450
							0	1.004	96.507	300
12	447159.615	242004.703	98.350	1.125	1200					
							0	5.000	97.225	225
13	447147.573	242027.591	98.350	1.277	1200		1	5.000	97.073	225
							0	5.001	97.073	225
14	447175.840	242043.557	98.200	1.393	1200		1	5.001	96.882	225
							0	5.002	96.807	300
15	447167.206	241990.955	98.350	1.125	1200					
							0	6.000	97.225	225
16	447179.662	241968.471	98.350	1.276	1200		1	6.000	97.074	225
							0	6.001	97.074	225
17	447208.400	241984.392	98.200	1.394	1200		1	6.001	96.881	225
							0	6.002	96.806	300
18	447193.396	242012.476	98.200	1.617	1350		1	6.002	96.658	300
							2	5.002	96.658	300
							0	5.003	96.583	375

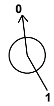
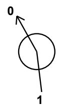
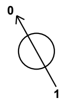
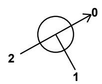
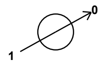
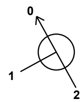
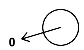
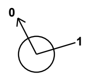
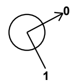
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
19	447190.041	242054.387	98.200	1.200	1200		0	7.000	97.000	300
20	447223.625	241994.074	98.200	1.200	1200		0	8.000	97.000	300
21	447208.762	242021.244	98.350	1.822	1350		1	8.000	96.603	300
							2	7.000	96.603	300
							3	5.003	96.528	375
							0	5.004	96.528	375
22	447221.505	242028.515	98.500	2.018	1800		1	5.004	96.482	375
							0	5.005	96.482	300
23	447227.640	242032.015	98.500	2.122	1350		1	5.005	96.453	300
							2	1.004	96.453	300
							0	1.005	96.378	375
24	447203.730	242075.346	98.400	2.175	1350		1	1.005	96.225	375
							0	1.006	96.225	375
25	447156.386	242041.500	98.350	1.050	1200		0	9.000	97.300	150
26	447148.921	242055.709	98.200	1.082	1200		1	9.000	97.193	150
							0	9.001	97.118	225
27	447162.207	242063.198	98.200	1.172	1200		1	9.001	97.028	225
							0	9.002	97.028	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
28	447134.660	242057.190	97.850	1.125	1200	0	10.000	96.725	225
29	447158.135	242070.421	98.000	1.584	1350	1	10.000	96.566	225
						2	9.002	96.566	225
						0	9.003	96.416	375
30	447119.710	242085.371	97.850	1.000	1200	0	11.000	96.850	150
31	447142.784	242098.377	98.000	1.759	1350	1	11.000	96.541	150
						2	9.003	96.316	375
						0	9.004	96.241	450
32	447100.700	242114.222	97.850	1.125	1200	0	12.000	96.725	225
33	447113.155	242091.739	97.800	1.301	1200	1	12.000	96.574	225
						0	12.001	96.499	300
34	447128.185	242130.195	97.850	1.050	1200	0	13.000	96.800	225
35	447141.017	242107.063	98.000	1.856	1500	1	13.000	96.444	225
						2	12.001	96.369	300
						3	9.004	96.219	450
						0	9.005	96.144	525
36	447190.512	242062.995	98.350	1.050	1200	0	14.000	97.300	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
37	447183.600	242075.256	98.200	1.069	1200		1	14.000	97.206	150
							0	14.001	97.131	225
38	447182.867	242081.325	98.200	1.255	1350		1	14.001	97.095	225
							0	14.002	96.945	375
39	447166.214	242111.365	98.150	1.311	1350		1	14.002	96.839	375
							0	14.003	96.839	375
40	447162.136	242118.721	98.100	2.005	1500		1	14.003	96.245	375
							2	9.005	96.095	525
							0	9.006	96.095	525
41	447170.101	242123.118	98.200	2.124	1800		1	9.006	96.076	525
							0	9.007	96.076	375
42	447175.783	242126.242	98.500	2.454	1350		1	9.007	96.046	375
							2	1.006	96.046	375
							0	1.007	96.046	375
43	447241.477	242057.003	98.600	1.125	1200					
							0	15.000	97.475	225
44	447228.243	242053.052	98.500	1.256	1350		1	15.000	97.394	225
							0	15.001	97.244	375
45	447214.628	242079.608	98.500	1.348	1350		1	15.001	97.152	375
							0	15.002	97.152	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
46	447263.991	242105.817	98.800	1.821	1350	1	15.002	96.979	375
						0	15.003	96.979	375
47	447207.048	242094.913	98.500	1.200	1200	0	16.000	97.300	300
48	447255.450	242122.130	98.500	1.578	1350	1	16.000	96.997	300
						2	15.003	96.922	375
						0	15.004	96.922	375
49	447192.428	242121.370	98.500	1.200	1200	0	17.000	97.300	300
50	447241.245	242148.120	98.500	1.745	1350	1	17.000	96.905	300
						2	15.004	96.830	375
						0	15.005	96.755	450
51	447241.611	242162.788	98.600	1.881	1350	1	15.005	96.719	450
						0	15.006	96.719	150
52	447213.492	242174.552	99.000	2.634	1200	1	15.006	96.516	150
						0	15.007	96.366	300
53	447163.440	242148.698	97.611	1.644	1800	1	15.007	95.967	300
						2	1.007	95.967	375
						0	1.008	95.967	300
53_OUT	447151.481	242150.714	97.662	1.746	1200	1	1.008	95.916	300

Simulation Settings

Rainfall Methodology	FEH-13	Winter CV	0.840	Skip Steady State	✓	Additional Storage (m³/ha)	0.0	Check Discharge Volume	✓
Summer CV	0.750	Analysis Speed	Normal	Drain Down Time (mins)	240	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Soil Index	1	Growth Factor 30 year	1.95	Q 1 year (l/s)	
Greenfield Method	IH124	SPR	0.10	Growth Factor 100 year	2.48	Q 30 year (l/s)	
Positively Drained Area (ha)		Region	1	Betterment (%)	0	Q 100 year (l/s)	
SAAR (mm)		Growth Factor 1 year	0.85	QBar			

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	1	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.10	Climate Change (%)	0	PR	
Positively Drained Area (ha)		CWI		Storm Duration (mins)	360	Runoff Volume (m³)	

Node 11 Online Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	1.5	Min Outlet Diameter (m)	0.075
Replaces Downstream Link	✓	Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1200
Invert Level (m)	96.507	Sump Available	✓		
Design Depth (m)	2.000	Product Number	CTL-SHE-0049-1500-2000-1500		

Node 22 Online Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	1.0	Min Outlet Diameter (m)	0.075
Replaces Downstream Link	✓	Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1200
Invert Level (m)	96.482	Sump Available	✓		
Design Depth (m)	1.600	Product Number	CTL-SHE-0042-1000-1600-1000		

Node 41 Online Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	1.4	Min Outlet Diameter (m)	0.075
Replaces Downstream Link	✓	Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1200
Invert Level (m)	96.076	Sump Available	✓		
Design Depth (m)	1.600	Product Number	CTL-SHE-0050-1400-1600-1400		

Node 51 Online Orifice Control

Flap Valve	x	Invert Level (m)	96.719	Design Flow (l/s)	1.3	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	1.800	Diameter (m)	0.021		

Node 53 Online Hydro-Brake® Control

Flap Valve	x	Design Flow (l/s)	5.5	Min Outlet Diameter (m)	0.150
Replaces Downstream Link	✓	Objective	(HE) Minimise upstream storage	Min Node Diameter (mm)	1200
Invert Level (m)	95.967	Sump Available	✓		
Design Depth (m)	1.650	Product Number	CTL-SHE-0101-5500-1650-5500		

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	98.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	3160.0	0.0	0.350	3160.0	0.0	0.351	0.0	0.0

Node 9 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	96.851
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	370.0	0.0	1.000	370.0	0.0	1.001	0.0	0.0

Node 18 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	97.750
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	2590.0	0.0	0.350	2590.0	0.0	0.351	0.0	0.0

Node 21 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	96.528
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	135.0	0.0	1.000	135.0	0.0	1.001	0.0	0.0

Node 31 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	96.241
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	700.0	0.0	1.000	700.0	0.0	1.001	0.0	0.0

Node 39 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	97.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1274.0	0.0	0.350	1274.0	0.0	0.351	0.0	0.0

Node 44 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	97.244
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	17.0	0.0	1.000	135.0	0.0	1.001	0.0	0.0

Node 48 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	96.922
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	310.0	0.0	1.000	310.0	0.0	1.001	0.0	0.0

Node 50 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	98.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1278.0	0.0	0.350	1278.0	0.0	0.351	0.0	0.0

Node 52 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	96.366
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	220

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	30.0	0.0	1.000	30.0	0.0	1.001	0.0	0.0

Node 53 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	97.111
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	84

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	9.0	0.0	0.500	45.0	0.0	0.501	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	97.554	0.079	11.2	0.0897	0.0000	OK
960 minute winter	2	930	97.231	0.240	1.3	0.2719	0.0000	OK
960 minute winter	3	930	97.231	0.503	2.6	0.7204	0.0000	SURCHARGED
15 minute summer	4	10	97.531	0.056	5.2	0.0632	0.0000	OK
15 minute winter	5	11	97.339	0.055	5.2	0.0620	0.0000	OK
15 minute winter	6	10	97.330	0.105	24.7	0.1508	0.0000	OK
960 minute winter	7	930	97.231	0.298	4.0	0.4270	0.0000	OK
15 minute summer	8	9	97.261	0.111	26.7	0.1582	0.0000	OK
960 minute winter	9	930	97.231	0.380	7.8	134.2635	0.0000	OK
960 minute winter	10	930	97.231	0.631	2.3	0.9036	0.0000	SURCHARGED
960 minute winter	11	930	97.231	0.724	1.3	1.8437	0.0000	SURCHARGED
15 minute summer	12	10	97.281	0.056	5.3	0.0629	0.0000	OK
960 minute winter	13	915	97.146	0.073	0.6	0.0824	0.0000	OK
960 minute winter	14	915	97.146	0.339	1.6	0.3833	0.0000	SURCHARGED
15 minute summer	15	10	97.280	0.055	5.3	0.0624	0.0000	OK
960 minute winter	16	915	97.146	0.072	0.6	0.0813	0.0000	OK
960 minute winter	17	915	97.146	0.340	1.6	0.3844	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	10.4	0.849	0.262	0.8567	
15 minute winter	2	1.001	3	17.1	0.826	0.240	0.5643	
15 minute winter	3	1.002	10	33.2	0.738	0.209	5.7417	
15 minute summer	4	2.000	5	5.2	0.715	0.132	0.2429	
15 minute winter	5	2.001	7	5.0	0.682	0.126	0.1576	
15 minute summer	6	3.000	7	24.7	0.967	0.168	1.0758	
15 minute summer	7	2.002	9	54.1	1.729	0.339	1.1553	
15 minute summer	8	4.000	9	27.4	1.739	0.098	0.7029	
30 minute winter	9	2.003	10	-27.0	-0.342	-0.096	3.1179	
15 minute summer	10	1.003	11	-18.4	0.214	-0.116	5.4478	
960 minute winter	11	Hydro-Brake®	23	1.0				
15 minute summer	12	5.000	13	5.3	0.642	0.135	0.2203	
15 minute winter	13	5.001	14	7.1	0.757	0.178	0.3038	
15 minute winter	14	5.002	18	19.6	0.864	0.275	0.8188	
15 minute summer	15	6.000	16	5.3	0.614	0.133	0.2302	
15 minute winter	16	6.001	17	8.0	0.783	0.201	0.3378	
15 minute winter	17	6.002	18	21.1	0.911	0.279	0.7401	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	18	915	97.146	0.563	3.2	0.8055	0.0000	SURCHARGED
960 minute winter	19	915	97.146	0.146	1.3	0.1650	0.0000	OK
960 minute winter	20	915	97.146	0.146	1.3	0.1650	0.0000	OK
960 minute winter	21	915	97.146	0.618	5.2	80.1265	0.0000	SURCHARGED
960 minute winter	22	915	97.146	0.664	0.8	1.6896	0.0000	SURCHARGED
960 minute winter	23	930	96.410	0.032	1.6	0.0455	0.0000	OK
120 minute winter	24	86	96.365	0.140	3.7	0.1997	0.0000	OK
15 minute winter	25	10	97.334	0.034	1.6	0.0386	0.0000	OK
15 minute winter	26	10	97.209	0.091	12.6	0.1033	0.0000	OK
15 minute winter	27	10	97.080	0.052	12.6	0.0583	0.0000	OK
15 minute winter	28	10	96.779	0.054	5.0	0.0615	0.0000	OK
15 minute winter	29	10	96.541	0.125	25.6	0.1789	0.0000	OK
15 minute winter	30	10	96.904	0.054	5.2	0.0614	0.0000	OK
960 minute winter	31	930	96.445	0.204	7.4	135.8165	0.0000	OK
15 minute summer	32	10	96.779	0.054	5.0	0.0616	0.0000	OK
15 minute summer	33	11	96.724	0.225	13.8	0.2539	0.0000	OK
15 minute summer	34	10	96.847	0.047	5.8	0.0530	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	5.003	21	40.2	1.342	0.362	0.9979	
15 minute winter	19	7.000	21	17.3	1.159	0.152	0.6592	
15 minute winter	20	8.000	21	17.0	1.238	0.135	0.5309	
15 minute winter	21	5.004	22	8.9	0.456	0.079	1.1182	
960 minute winter	22	Hydro-Brake®	23	0.7				
960 minute winter	23	1.005	24	1.6	0.369	0.015	0.2192	
30 minute winter	24	1.006	42	-5.0	0.292	-0.045	3.2510	
15 minute winter	25	9.000	26	1.6	0.535	0.109	0.0475	
15 minute winter	26	9.001	27	12.6	1.163	0.316	0.1673	
15 minute winter	27	9.002	29	12.6	1.924	0.102	0.0542	
15 minute winter	28	10.000	29	4.9	0.681	0.124	0.1956	
15 minute winter	29	9.003	31	25.1	0.842	0.226	0.9593	
15 minute winter	30	11.000	31	5.2	0.914	0.270	0.1498	
15 minute winter	31	9.004	35	-91.1	-1.428	-0.569	0.7156	
15 minute winter	32	12.000	33	5.2	0.659	0.130	0.4152	
15 minute winter	33	12.001	35	23.1	0.614	0.327	1.9715	
15 minute summer	34	13.000	35	5.8	0.843	0.096	0.5975	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	35	11	96.688	0.544	80.9	0.9609	0.0000	SURCHARGED
15 minute winter	36	10	97.344	0.044	2.6	0.0498	0.0000	OK
15 minute winter	37	10	97.172	0.041	2.6	0.0458	0.0000	OK
15 minute winter	38	10	97.081	0.136	29.8	0.1944	0.0000	OK
15 minute winter	39	10	96.899	0.060	29.9	0.0853	0.0000	OK
15 minute winter	40	11	96.695	0.600	58.0	1.0596	0.0000	SURCHARGED
15 minute winter	41	11	96.696	0.620	16.0	1.5774	0.0000	SURCHARGED
120 minute winter	42	88	96.364	0.318	3.3	0.4550	0.0000	OK
15 minute summer	43	10	97.549	0.074	8.6	0.0838	0.0000	OK
1440 minute winter	44	1380	97.317	0.073	0.5	1.6554	0.0000	OK
1440 minute winter	45	1380	97.317	0.165	2.1	0.2359	0.0000	OK
1440 minute winter	46	1380	97.317	0.338	2.1	0.4835	0.0000	OK
15 minute winter	47	10	97.419	0.119	26.7	0.1344	0.0000	OK
1440 minute winter	48	1380	97.317	0.395	4.3	116.8556	0.0000	SURCHARGED
15 minute summer	49	10	97.402	0.102	23.1	0.1154	0.0000	OK
1440 minute winter	50	1380	97.317	0.562	1.3	0.8040	0.0000	SURCHARGED
1440 minute winter	51	1380	97.317	0.598	0.7	0.8556	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	35	9.005	40	-57.4	-0.266	-0.265	5.2114	
15 minute winter	36	14.000	37	2.6	0.613	0.179	0.0595	
15 minute winter	37	14.001	38	2.6	0.550	0.065	0.0286	
15 minute winter	38	14.002	39	29.9	1.310	0.270	0.8110	
15 minute winter	39	14.003	40	29.9	1.750	0.056	0.5111	
15 minute winter	40	9.006	41	-13.7	0.129	-0.062	1.9655	
30 minute summer	41	Hydro-Brake®	42	1.0				
15 minute summer	42	1.007	53	-9.3	-0.277	-0.084	2.0103	
15 minute summer	43	15.000	44	8.6	0.782	0.216	0.1520	
15 minute winter	44	15.001	45	6.8	0.324	0.061	0.7424	
15 minute winter	45	15.002	46	32.7	0.870	0.295	2.1226	
15 minute winter	46	15.003	48	33.7	1.547	0.304	0.4646	
15 minute winter	47	16.000	48	26.2	1.029	0.320	1.4126	
15 minute winter	48	15.004	50	-18.4	-0.476	-0.166	1.4122	
15 minute summer	49	17.000	50	23.6	1.037	0.252	1.4283	
15 minute summer	50	15.005	51	5.7	0.386	0.036	1.7181	
1440 minute winter	51	Orifice	52	0.7				

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	52	11	96.454	0.088	21.0	2.6083	0.0000	OK
120 minute winter	53	88	96.364	0.397	8.3	1.0107	0.0000	SURCHARGED
15 minute summer	53_OUT	1	95.916	0.000	5.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	52	15.007	53	17.9	0.576	0.191	2.2971	
120 minute winter	53	Hydro-Brake®	53_OUT	5.2				79.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	1	945	97.746	0.271	1.6	0.3066	0.0000	SURCHARGED
960 minute winter	2	945	97.746	0.755	2.6	0.8539	0.0000	SURCHARGED
960 minute winter	3	945	97.746	1.018	5.0	1.4568	0.0000	SURCHARGED
960 minute winter	4	945	97.746	0.271	0.8	0.3065	0.0000	SURCHARGED
960 minute winter	5	945	97.746	0.462	0.8	0.5226	0.0000	SURCHARGED
960 minute winter	6	945	97.746	0.521	3.7	0.7456	0.0000	SURCHARGED
960 minute winter	7	945	97.746	0.813	7.8	1.1634	0.0000	SURCHARGED
960 minute winter	8	945	97.746	0.596	3.9	0.8529	0.0000	SURCHARGED
960 minute winter	9	945	97.746	0.895	15.8	315.8823	0.0000	SURCHARGED
960 minute winter	10	945	97.746	1.146	5.5	1.6400	0.0000	SURCHARGED
960 minute winter	11	945	97.746	1.239	1.7	3.1533	0.0000	SURCHARGED
960 minute winter	12	945	97.817	0.592	0.8	0.6697	0.0000	SURCHARGED
960 minute winter	13	945	97.817	0.744	1.1	0.8416	0.0000	SURCHARGED
960 minute winter	14	945	97.817	1.010	2.8	1.1425	0.0000	SURCHARGED
960 minute winter	15	945	97.817	0.592	0.8	0.6698	0.0000	SURCHARGED
960 minute winter	16	945	97.817	0.743	1.3	0.8405	0.0000	SURCHARGED
960 minute winter	17	945	97.817	1.011	3.0	1.1436	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	26.9	1.069	0.678	1.9079	
15 minute summer	2	1.001	3	43.4	0.988	0.608	1.7139	
15 minute winter	3	1.002	10	81.0	0.817	0.508	8.2855	
15 minute summer	4	2.000	5	13.1	0.891	0.331	0.4865	
15 minute winter	5	2.001	7	12.8	0.879	0.321	0.3131	
15 minute winter	6	3.000	7	62.5	1.110	0.425	2.2493	
15 minute summer	7	2.002	9	134.4	2.095	0.842	2.6776	
15 minute summer	8	4.000	9	68.5	1.995	0.245	2.0938	
15 minute winter	9	2.003	10	-105.6	-0.836	-0.376	4.5216	
15 minute winter	10	1.003	11	-37.1	0.238	-0.233	5.9877	
960 minute winter	11	Hydro-Brake®	23	1.2				
15 minute summer	12	5.000	13	13.5	0.783	0.341	0.4487	
15 minute summer	13	5.001	14	18.9	0.922	0.475	0.6838	
15 minute winter	14	5.002	18	51.9	1.049	0.727	2.3771	
15 minute summer	15	6.000	16	13.5	0.755	0.340	0.4688	
15 minute summer	16	6.001	17	21.3	0.983	0.537	0.7355	
15 minute winter	17	6.002	18	55.1	1.101	0.730	2.1228	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	18	945	97.817	1.234	6.4	59.6009	0.0000	SURCHARGED
960 minute winter	19	945	97.817	0.817	2.6	0.9242	0.0000	SURCHARGED
960 minute winter	20	945	97.817	0.817	2.5	0.9242	0.0000	SURCHARGED
960 minute winter	21	945	97.817	1.289	9.9	130.1589	0.0000	SURCHARGED
960 minute winter	22	945	97.817	1.335	2.3	3.3980	0.0000	SURCHARGED
120 minute winter	23	102	96.749	0.371	5.1	0.5312	0.0000	OK
120 minute winter	24	98	96.749	0.524	9.5	0.7497	0.0000	SURCHARGED
15 minute winter	25	10	97.354	0.054	4.1	0.0615	0.0000	OK
15 minute winter	26	10	97.273	0.155	31.9	0.1752	0.0000	OK
15 minute winter	27	10	97.115	0.087	31.9	0.0980	0.0000	OK
15 minute winter	28	10	96.815	0.090	12.7	0.1014	0.0000	OK
1440 minute winter	29	1410	96.716	0.300	2.8	0.4294	0.0000	OK
15 minute winter	30	10	96.944	0.094	13.1	0.1067	0.0000	OK
1440 minute winter	31	1410	96.716	0.475	10.5	316.5714	0.0000	SURCHARGED
15 minute summer	32	9	97.150	0.425	12.7	0.4812	0.0000	SURCHARGED
15 minute summer	33	9	97.154	0.655	54.1	0.7408	0.0000	SURCHARGED
15 minute summer	34	9	97.120	0.320	14.7	0.3622	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	18	5.003	21	96.9	1.470	0.874	1.9514	
15 minute summer	19	7.000	21	44.4	1.444	0.392	1.6898	
15 minute summer	20	8.000	21	43.6	1.552	0.346	1.3460	
15 minute summer	21	5.004	22	19.1	0.494	0.172	1.6182	
960 minute winter	22	Hydro-Brake®	23	0.9				
15 minute summer	23	1.005	24	-14.7	0.441	-0.133	3.2478	
15 minute winter	24	1.006	42	-41.2	-0.501	-0.373	6.1894	
15 minute winter	25	9.000	26	4.1	0.628	0.283	0.1228	
15 minute winter	26	9.001	27	31.9	1.470	0.801	0.3297	
15 minute winter	27	9.002	29	31.9	2.433	0.259	0.1087	
15 minute winter	28	10.000	29	12.7	0.881	0.319	0.3877	
15 minute winter	29	9.003	31	64.6	1.087	0.581	1.8955	
15 minute winter	30	11.000	31	13.1	1.148	0.681	0.3017	
15 minute winter	31	9.004	35	-265.4	-2.421	-1.658	0.8062	
15 minute winter	32	12.000	33	-24.6	0.747	-0.618	1.0222	
15 minute summer	33	12.001	35	52.3	0.881	0.740	2.2392	
15 minute winter	34	13.000	35	24.3	0.928	0.402	1.0521	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	35	10	97.063	0.919	249.6	1.6241	0.0000	SURCHARGED
15 minute winter	36	10	97.374	0.074	6.5	0.0831	0.0000	OK
15 minute winter	37	10	97.203	0.072	6.5	0.0812	0.0000	OK
15 minute summer	38	10	97.200	0.255	75.1	0.3656	0.0000	OK
15 minute summer	39	10	97.131	0.292	77.1	0.4174	0.0000	OK
15 minute summer	40	10	97.100	1.005	177.0	1.7757	0.0000	SURCHARGED
15 minute summer	41	10	97.096	1.020	40.4	2.5948	0.0000	SURCHARGED
120 minute winter	42	98	96.749	0.703	9.8	1.0060	0.0000	SURCHARGED
1440 minute winter	43	1410	97.729	0.254	0.9	0.2872	0.0000	SURCHARGED
1440 minute winter	44	1410	97.729	0.485	1.1	22.8128	0.0000	SURCHARGED
1440 minute winter	45	1410	97.729	0.577	3.6	0.8256	0.0000	SURCHARGED
1440 minute winter	46	1410	97.729	0.750	3.2	1.0731	0.0000	SURCHARGED
1440 minute winter	47	1410	97.729	0.429	2.8	0.4851	0.0000	SURCHARGED
1440 minute winter	48	1410	97.729	0.807	7.7	238.7890	0.0000	SURCHARGED
1440 minute winter	49	1380	97.730	0.430	2.4	0.4861	0.0000	SURCHARGED
1440 minute winter	50	1410	97.732	0.977	2.3	1.3978	0.0000	SURCHARGED
1440 minute winter	51	1410	97.727	1.008	1.8	1.4419	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	35	9.005	40	-187.6	-0.869	-0.865	5.2114	
15 minute winter	36	14.000	37	6.5	0.780	0.449	0.1172	
15 minute winter	37	14.001	38	6.4	0.713	0.160	0.0861	
15 minute summer	38	14.002	39	77.1	1.527	0.698	2.9533	
15 minute summer	39	14.003	40	103.1	1.852	0.193	0.8508	
15 minute winter	40	9.006	41	-48.8	-0.226	-0.222	1.9655	
15 minute winter	41	Hydro-Brake®	42	1.0				
15 minute winter	42	1.007	53	-45.8	-0.415	-0.414	2.8264	
15 minute summer	43	15.000	44	21.6	0.987	0.544	0.3023	
15 minute winter	44	15.001	45	27.2	0.574	0.246	1.8766	
15 minute winter	45	15.002	46	82.2	1.122	0.742	4.0914	
15 minute winter	46	15.003	48	78.8	1.685	0.711	1.5992	
15 minute winter	47	16.000	48	66.6	1.283	0.813	2.8876	
15 minute winter	48	15.004	50	-54.6	-0.773	-0.492	3.0585	
15 minute summer	49	17.000	50	58.5	1.199	0.626	2.9534	
15 minute winter	50	15.005	51	9.6	0.511	0.060	2.3248	
1440 minute winter	51	Orifice	52	0.9				

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	52	100	96.750	0.383	15.8	11.3635	0.0000	SURCHARGED
120 minute winter	53	100	96.749	0.782	16.2	1.9904	0.0000	SURCHARGED
15 minute summer	53_OUT	1	95.916	0.000	5.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	52	15.007	53	47.3	0.783	0.506	3.2919	
15 minute summer	53	Hydro-Brake®	53_OUT	5.2				63.2

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	98.417	0.942	51.1	1.0648	0.0000	FLOOD RISK
1440 minute winter	2	1440	98.349	1.358	3.4	1.5361	0.0000	FLOOD RISK
1440 minute winter	3	1440	98.349	1.621	6.7	2.3199	0.0000	FLOOD RISK
1440 minute winter	4	1440	98.349	0.874	1.0	0.9886	0.0000	FLOOD RISK
1440 minute winter	5	1440	98.349	1.065	1.0	1.2047	0.0000	FLOOD RISK
1440 minute winter	6	1440	98.349	1.124	4.6	1.6086	0.0000	FLOOD RISK
1440 minute winter	7	1440	98.349	1.416	22.1	314.4774	0.0000	FLOOD RISK
1440 minute winter	8	1440	98.349	1.199	5.0	1.7160	0.0000	FLOOD RISK
1440 minute winter	9	1440	98.349	1.498	21.7	353.8196	0.0000	FLOOD RISK
1440 minute winter	10	1440	98.349	1.749	8.1	2.5030	0.0000	FLOOD RISK
1440 minute winter	11	1440	98.349	1.842	2.2	4.6883	0.0000	FLOOD RISK
1440 minute winter	12	1440	98.070	0.845	1.0	0.9557	0.0000	FLOOD RISK
1440 minute winter	13	1440	98.070	0.997	1.4	1.1273	0.0000	FLOOD RISK
1440 minute winter	14	1440	98.070	1.263	3.9	1.4282	0.0000	FLOOD RISK
1440 minute winter	15	1440	98.070	0.845	1.0	0.9558	0.0000	FLOOD RISK
1440 minute winter	16	1440	98.070	0.996	1.6	1.1266	0.0000	FLOOD RISK
1440 minute winter	17	1440	98.070	1.264	4.1	1.4294	0.0000	FLOOD RISK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	49.8	1.253	1.254	2.7676	
15 minute summer	2	1.001	3	80.8	1.148	1.132	1.9172	
15 minute summer	3	1.002	10	165.6	1.045	1.040	8.2856	
15 minute summer	4	2.000	5	23.7	1.018	0.597	0.7606	
15 minute winter	5	2.001	7	23.6	0.812	0.593	0.7209	
15 minute summer	6	3.000	7	113.4	1.184	0.771	3.7799	
15 minute summer	7	2.002	9	235.3	2.197	1.474	5.2229	
15 minute summer	8	4.000	9	121.7	2.131	0.435	4.7118	
15 minute winter	9	2.003	10	-211.2	-1.463	-0.752	5.2630	
15 minute summer	10	1.003	11	-58.9	-0.371	-0.369	5.9877	
1440 minute winter	11	Hydro-Brake®	23	1.3				
15 minute winter	12	5.000	13	24.5	0.868	0.616	1.0286	
15 minute winter	13	5.001	14	27.9	0.873	0.702	1.2911	
15 minute summer	14	5.002	18	80.0	1.136	1.120	2.5138	
15 minute winter	15	6.000	16	24.2	0.821	0.609	1.0223	
15 minute winter	16	6.001	17	31.9	0.922	0.803	1.3066	
15 minute winter	17	6.002	18	84.3	1.197	1.117	2.2422	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	18	1440	98.070	1.487	13.4	275.9153	0.0000	FLOOD RISK
1440 minute winter	19	1440	98.070	1.070	3.2	1.2100	0.0000	FLOOD RISK
1440 minute winter	20	1440	98.070	1.070	3.2	1.2100	0.0000	FLOOD RISK
1440 minute winter	21	1440	98.070	1.542	11.0	130.5205	0.0000	FLOOD RISK
1440 minute winter	22	1440	98.070	1.588	1.0	4.0410	0.0000	SURCHARGED
120 minute winter	23	118	97.602	1.224	5.2	1.7513	0.0000	SURCHARGED
120 minute winter	24	118	97.601	1.376	8.9	1.9688	0.0000	SURCHARGED
15 minute winter	25	10	97.474	0.174	7.4	0.1963	0.0000	SURCHARGED
15 minute winter	26	10	97.442	0.324	57.3	0.3663	0.0000	SURCHARGED
1440 minute winter	27	1440	97.229	0.201	2.4	0.2268	0.0000	OK
1440 minute winter	28	1440	97.229	0.504	0.9	0.5696	0.0000	SURCHARGED
1440 minute winter	29	1440	97.228	0.812	4.8	1.1626	0.0000	SURCHARGED
1440 minute winter	30	1440	97.228	0.378	1.0	0.4278	0.0000	SURCHARGED
1440 minute winter	31	1440	97.228	0.987	21.0	657.8834	0.0000	SURCHARGED
15 minute summer	32	10	97.600	0.875	24.2	0.9900	0.0000	FLOOD RISK
15 minute summer	33	9	97.530	1.031	66.6	1.1666	0.0000	FLOOD RISK
15 minute summer	34	9	97.479	0.679	26.7	0.7677	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	18	5.003	21	161.0	1.493	1.451	1.9514	
15 minute summer	19	7.000	21	79.4	1.534	0.700	2.6805	
15 minute summer	20	8.000	21	77.9	1.662	0.619	2.1809	
30 minute winter	21	5.004	22	-19.5	0.506	-0.175	1.6182	
30 minute summer	22	Hydro-Brake®	23	0.9				
15 minute winter	23	1.005	24	-34.5	0.463	-0.312	5.4586	
15 minute summer	24	1.006	42	-62.1	-0.632	-0.561	6.4043	
15 minute summer	25	9.000	26	8.3	0.629	0.576	0.2826	
15 minute winter	26	9.001	27	56.8	1.642	1.427	0.4641	
15 minute winter	27	9.002	29	56.6	2.468	0.459	0.2186	
15 minute summer	28	10.000	29	23.2	0.907	0.585	0.7260	
15 minute winter	29	9.003	31	114.0	1.284	1.025	2.8243	
15 minute winter	30	11.000	31	22.4	1.272	1.166	0.4535	
15 minute winter	31	9.004	35	-430.6	-3.644	-2.690	1.1262	
15 minute summer	32	12.000	33	27.2	0.768	0.685	1.0222	
15 minute winter	33	12.001	35	71.7	1.018	1.014	2.2392	
15 minute winter	34	13.000	35	30.8	0.887	0.511	1.0521	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	35	9	97.409	1.265	410.9	2.2357	0.0000	SURCHARGED
15 minute summer	36	10	97.924	0.624	11.8	0.7054	0.0000	SURCHARGED
15 minute summer	37	10	97.831	0.700	17.8	0.7917	0.0000	SURCHARGED
15 minute summer	38	10	97.820	0.875	140.3	1.2519	0.0000	SURCHARGED
15 minute summer	39	10	97.589	0.750	141.9	1.0727	0.0000	SURCHARGED
15 minute summer	40	9	97.516	1.421	291.9	2.5115	0.0000	SURCHARGED
15 minute summer	41	9	97.516	1.440	73.2	3.6659	0.0000	SURCHARGED
120 minute winter	42	116	97.599	1.553	11.4	2.2229	0.0000	SURCHARGED
1440 minute winter	43	1440	98.400	0.925	1.6	1.0458	0.0000	FLOOD RISK
1440 minute winter	44	1440	98.400	1.156	3.7	77.7213	0.0000	FLOOD RISK
1440 minute winter	45	1440	98.400	1.248	7.9	1.7855	0.0000	FLOOD RISK
1440 minute winter	46	1440	98.400	1.421	7.9	2.0331	0.0000	SURCHARGED
1440 minute winter	47	1440	98.400	1.100	5.0	1.2438	0.0000	FLOOD RISK
1440 minute winter	48	1440	98.400	1.478	13.7	296.7619	0.0000	FLOOD RISK
1440 minute winter	49	1440	98.400	1.100	4.3	1.2437	0.0000	FLOOD RISK
1440 minute winter	50	1440	98.400	1.645	16.9	150.0729	0.0000	FLOOD RISK
1440 minute winter	51	1440	98.400	1.681	1.5	2.4052	0.0000	FLOOD RISK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	35	9.005	40	-304.7	-1.411	-1.404	5.2114	
15 minute summer	36	14.000	37	17.8	1.011	1.232	0.2478	
15 minute summer	37	14.001	38	26.7	0.921	0.670	0.2431	
15 minute winter	38	14.002	39	146.3	1.786	1.324	3.7884	
15 minute winter	39	14.003	40	156.2	1.992	0.293	0.9277	
15 minute winter	40	9.006	41	-81.2	-0.376	-0.369	1.9655	
15 minute summer	41	Hydro-Brake®	42	1.2				
15 minute summer	42	1.007	53	-61.5	-0.558	-0.556	2.8264	
15 minute summer	43	15.000	44	39.3	1.137	0.989	0.4744	
15 minute summer	44	15.001	45	50.4	0.542	0.456	3.0670	
15 minute summer	45	15.002	46	126.7	1.218	1.144	6.1009	
15 minute winter	46	15.003	48	121.8	1.733	1.100	2.0310	
15 minute winter	47	16.000	48	119.9	1.706	1.465	3.8451	
15 minute summer	48	15.004	50	-106.0	-1.085	-0.956	3.2669	
15 minute winter	49	17.000	50	105.8	1.503	1.132	3.9200	
15 minute summer	50	15.005	51	12.5	0.488	0.079	2.3248	
1440 minute winter	51	Orifice	52	1.1				

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	52	114	97.601	1.235	28.2	29.9106	0.0000	SURCHARGED
120 minute winter	53	116	97.600	1.633	19.4	17.1504	0.0000	FLOOD RISK
15 minute summer	53_OUT	1	95.916	0.000	5.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	52	15.007	53	62.5	0.954	0.670	3.9671	
120 minute winter	53	Hydro-Brake®	53_OUT	5.5				100.5