

Potter Bar High Street

**Flood Risk Assessment and
Drainage Strategy**

Project No 25094

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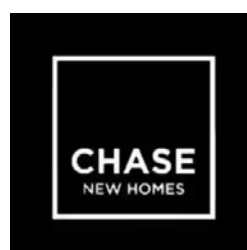
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Building Design Consultants
Unit 5 – First Floor
Lake Meadows Business Park
Woodbrook Crescent,
Billericay
Essex, CM12 0EQ
T. +44 (0)1277 314455

Prepared for:



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1 Executive Summary

Building Design Consultants (BDC) have been commissioned by Chase New Homes Ltd ('the applicant') to prepare a Flood Risk Assessment (FRA) and Drainage Strategy (DS) to support a full planning application for the proposed development at 2-6 High Street, Potter Bar, Herts, EN6 5BA.

In accordance, with the fundamental objectives of the National Planning Policy Framework (NPPF), the FRA demonstrates that:

- (i) The development is safe;
- (ii) The development does not increase flood risk; and,
- (iii) The development does not detrimentally affect third parties.

The online Flood Map for Planning and the Environment Agency (EA) data confirms that the Site is located within Flood Zone 1 'Low Probability' [as defined in Planning Practice Guidance (PPG) Table 1] as follows:

Flood Zone 1 'Low Probability' less than a 1 in 1000 (0.1%) Annual Probability of flooding from rivers and sea

The proposals for development of the Site for residential uses are classified as 'More Vulnerable' as defined in PPG Table 2. According to PPG Table 3, this land use is appropriate for Flood Zone 1.

Whilst the majority of the Site is considered as being at a 'Very Low' susceptibility to surface water flooding, there are some areas located within the site boundary of higher susceptibility. It should be noted that there are no surface water flood flow paths that run through the Site. These isolated areas of flooding within the Site occur within topographic depressions, with flooding in these areas to be either removed due to raising of levels or managed through the proposed onsite drainage network and SuDS train. Therefore, a NPPF Sequential Test is not required due to the mitigation measures for surface water flooding being proposed.

The surface water drainage strategy has been developed using best practice and utilising a combination of Sustainable Drainage Systems (SuDS), including attenuation swale, SuDS pipes, bio-retention areas such as rain gardens, permeable paving and tree root cells. Surface water discharge rates will be restricted to the 1 in 2year greenfield runoff rate for all storms up to and including 1 in 100year plus climate change.

The foul water drainage strategy for the Site is to connect/discharge into the existing Thames Water sewers in the immediate vicinity of the site.

In conclusion, the future occupants and users of the proposed development will be at a low risk of flooding. It is demonstrated that the proposal complies with the NPPF, PPG and the local planning policy with respect to flood risk and is an appropriate development at this location.

2 Introduction

2.1 Scope of the Report

Building Design Consultants (BDC) have been commissioned by Chase New Homes Ltd ('the applicant') to prepare a Flood Risk Assessment (FRA) and Drainage Strategy (DS) to support a full planning application for the proposed development at 2-6 High Street, Potter Bar, Herts, EN6 5BA (hereafter referred to as the 'Site').

The FRA and DS has been prepared in accordance with the National Planning Policy Framework (NPPF) and the relevant Planning Practice Guidance (PPG) and local policy and guidance. The aims of the assessment are to identify any potential sources of flooding or surface water management issues related to the Proposed Development and demonstrate how residual flood risks will be managed. The FRA will describe the Site in terms of topography, hydrology and geology and reviews existing available flood information.

2.2 Development Proposals

The proposed development comprises the partial demolition of existing buildings (with retention of existing two-storey car park and substation) and redevelopment of the site to provide a mixed-use development comprising residential apartments (Class C3) and flexible commercial floorspace (Class E) across 4 Blocks and associated internal roads, parking, drainage, landscaping, amenity space and associated works. The total number of residential units is 293 and 1,742 sqm flexible Class E of commercial floorspace.

It should be noted that outside the planning application boundary is the Canada Life Building, an existing 6-storey purpose-built office block with prior approval for use as residential. An application for Prior Approval for the change of use of the Canada Life building to 74no Class C3 residential dwellings under Class MA of the GDPO received deemed consent which expires on 9 February 2029 (ref 25/1764/PD56M).

A full planning application for external alterations to the Canada Life building, including new windows and replacement cladding, has been submitted.

2.3 Sources of Information

The FRA and Drainage Strategy has been prepared based on the following sources of information:

- Development Proposals by Architects and Landscape Architects (see **Appendix A**);
- Topographic Survey and Drainage Records (see **Appendix B**);
- BGS Maps, Ground Investigation and Infiltration Tests (see **Appendix C**)
- Thames Water Asset Records (see **Appendix D**);
- Environment Agency (EA) Flood Maps, (see **Appendix E**); and
- Hertfordshire County Council, Local Flood Risk Management Strategy (2), February 2019 (see **Appendix F**).

2.4 Policy Context

2.4.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) (December 2024) includes paragraphs 170 to 186 inclusive which establish the Planning Policy relating to flood risk management. The Technical Guide to the NPPF has been superseded by the Planning Practice Guidance (PPG) in March 2014. The flood risk and coastal change guidance was updated in September 2025.

The PPG states that when planning or decision making in terms of flood risk, the process followed should be to avoid, control, mitigate and manage residual risk.

‘Avoiding’ risk relates to the application of the sequential and exception tests, as discussed in detail for the site in Section 5 and summarised below:

- In plan-making, a sequential approach should be employed. This involves applying the ‘Sequential Test’ and, if needed, the ‘Exception Test’
- In decision-making, where necessary, planning authorities also apply the Sequential Test and, if needed, the Exception Test, to ensure that flood risk is minimised and appropriately addressed.
- Where the sequential and the exception tests have been applied as necessary and not met, development should not be allowed.
- Substituting lower vulnerability uses for higher vulnerability uses.
- Within sites, using site layout to locate the most vulnerable aspects of development in areas of lowest flood risk, unless there are overriding reasons to prefer a different location. In addition, measures to avoid flood risk vertically can then be taken, by locating the most vulnerable uses on upper storeys, and by raising finished floor and/or ground levels, where appropriate and that such techniques are suitably designed. Such measures should also account for residual flood risks from flood risk management infrastructure.

The PPG provides the methodology required to undertake the Sequential and Exception Tests and this should be applied to all sources of flooding.

The sequential test should be applied to ‘Major’ and ‘Non-major’ development proposed in areas at risk of flooding, as set out in paragraphs 173 to 174 of the NPPF. Paragraphs 175, 176 and 180 set out exemptions from the sequential test.

In applying paragraph 175 a proportionate approach should be taken. Where a site-specific flood risk assessment demonstrates clearly that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development (therefore addressing the risks identified e.g. by Environment Agency flood risk mapping), without increasing flood risk elsewhere, then the sequential test need not be applied.

The absence of a 5-year housing land supply is not a relevant consideration in applying the sequential test for individual applications. However, housing considerations, including housing land supply, may be relevant in the planning balance, alongside the outcome of the sequential test.

‘Controlling’ the risk relates to measures that will control the risk of flooding affecting the site. Early discussions with relevant flood risk management authorities, reference to Strategic Flood Risk Assessments and any programme of flood and coastal erosion risk management schemes will help to identify such opportunities.

‘Mitigating’ the risk relates to the use of flood resistance and resilience measures to address any residual risks after the use of avoidance and control measures.

‘Managing’ the risk relates to considering further management measures to deal with any residual risk remaining after avoidance, control and mitigation have been utilized such as providing safe access and escape routes and considering whether adequate flood warning would be available to people using the development. Residual risks will need to be safely managed to ensure people are not exposed to hazardous flooding.

In December 2025, the Government published a draft NPPF for consultation. The timescales for adoption are yet to be confirmed and limited weight can be attached to the draft policies until such time.

2.4.2 National Standards for Sustainable Drainage Systems (SuDS), June 2025

The National Standards for sustainable drainage systems (SuDS) were published in June 2025 which supersede the Non-statutory Technical Standards for SuDS published in March 2015. This document sets out seven standards that are complementary and the delivery of each standard should support delivery of the other standards.

There may be specific circumstances or constraints, such as the type or size of a development that mean it is not possible to deliver one or more of the standards. In these circumstances the opportunity to meet the standard shall be maximised and justification be developed in consultation with the approving body, who may agree to a departure.

They standards should be used in conjunction with the Planning Practice Guidance (PPG).

The Local Planning Authority (LPA) may set local requirements for planning permission that have the effect of more stringent requirements than these non-statutory technical standards.

In addition, SuDS should be designed in accordance with CIRIA 753 SuDS Manual, which represents current best practice.

2.4.3 Local Planning Policies

In preparing this FRA reference has been made to the Hertsmere Borough Council, Local Plan Core Strategy, DPD Adopted 2013, which states:

Policy SP1 Creating Sustainable Development

The Council will work with Hertfordshire County Council, Hertfordshire Constabulary, NHS Hertfordshire, Registered Housing Providers and other key local stakeholders to enable development in the Borough to make a sustainable contribution to delivering the Core Strategy Spatial Vision and Strategy. Accordingly new development will be required to prioritise the efficient use of brownfield land in delivering the land use requirements of the private sector, local service providers and the different needs of the hierarchy of

settlements across the Borough. There will be a focus on prioritising development opportunities in Borehamwood but all existing built-up areas within urban settlements will be expected to accommodate opportunities which arise for meeting local housing, jobs growth and other development and service needs.

All development across the Borough should:

xiv) avoiding development in the floodplain and close to river corridors unless the requirements of the sequential and exceptions tests have been met and flood prevention/mitigation measures are in place;

xv) incorporate the use of Sustainable Urban Drainage Systems (SUDS) where appropriate and where required by the Flood and Water Management Act 2010 to help reduce the risk of flooding;

xvi) ensure that pollutants are minimised, including emissions to air, water, soil, light and noise;

Policy CS16 Environmental impact of development

The Council will work with key partners, including the Environment Agency and Natural England, to ensure that development proposals do not create an unacceptable level of risk to occupiers of a site, the local community and the wider environment. Development proposals should take account of the policy recommendations of the Councils SFRA and the guidance set out in the jointly produced guidance of the Hertfordshire Planning Authorities 'Building Futures' the Hertfordshire Guide to Promoting Sustainability in Development.

Proposals will be required to incorporate sustainability principles, minimising their impact on the environment and ensuring prudent use of natural resources by measures including the following (only relevant requirements shown):

i) avoiding development in the floodplain and close to river corridors unless the requirements of the sequential and exceptions tests have been met and flood prevention/mitigation measures are in place as required by the Environment Agency;

ii) improving water efficiency by reducing water consumption through measures such as water saving devices in line with the Code for Sustainable Homes and BREEAM as a minimum requirement;

iii) incorporating the use of Sustainable Urban Drainage Systems (SUDS) where appropriate and where required by the Flood and Water Management Act 2010 to help reduce the risk of flooding;

iv) ensuring that pollutants are minimised (including emissions to air, water, soil, light and noise);

2.4.4 Hertfordshire County Council, Local Flood Risk Management Strategy (2), February 2019

The Local Flood Risk Management Strategy (2) (LFRMS), February 2019 presents a strategy in managing the flood risk in the borough based on the knowledge and experience gained as the Lead Local Flood Authority since May 2010.

2.4.5 Sequential and Exception Test

The objective of the sequential test is to steer new developments toward areas with the lowest probability of flooding. Where there are no reasonably available sites in lower flood risk areas, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in higher flood risk areas.

The exception test should be applied in line with the Flood Risk Vulnerability Classification set out in Annex 3 of the NPPF. To pass the exception test it should be demonstrated that:

- The development would provide wider sustainability benefits to the community that outweigh the flood risk; and
- The development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.

The Council is in the process of preparing a new Local Plan, with a Regulation 18 Consultation taking place between April-May 2026. Within this, the site is identified as a 'candidate site' for allocation at Regulation 19 stage – ref HPBA SA2

2.4.6 Climate Change Allowances

As required by NPPF Technical Guidance, peak rainfall intensity allowances should be applied to rainfall modelling of the proposed site's drainage system to make allowance for climate change throughout the lifetime of the development.

A residential development has a minimum lifetime of 100 years and sits within the 2070s epoch (2061 to 2125). The development must therefore be designed for the upper end allowance in the 1% annual exceedance probability (AEP) event so that:

- There is no increase in flood risk elsewhere; and
- The development will be safe from surface water flooding.

Climate change allowances are now broken down into management catchments. According to the DEFRA Climate Change Allowances maps, the Site is in the Colne Management Catchment where the following peak rainfall intensity allowances apply:

Table 2-1 – DEFRA Climate Change Peak Rainfall Intensity Allowance for Colne Management Catchment

3.3% AEP rainfall event		
Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	20%	35%
1% AEP rainfall event		
Epoch	Central allowance	Upper end allowance

2050s	20%	40%
2070s	25%	40%

The 3% AEP peak rainfall intensity allowance applied to the development is **35%**.

The 1% AEP peak rainfall intensity allowance applied to the development is **40%**.

2.5 Caveats and Exclusions

This FRA and DS has been prepared in accordance with the NPPF, the associated PPG and Local Planning Policy. The proposed flood management (including ground floor level recommendations) and surface water management strategies are based on the relevant British Standards (BS 8533), the standing advice provided by the EA or based on common practice.

Activities during the construction phase may have an impact on the existing and future flood risk. Thus, an assessment of the risks and appropriate mitigation measures should be identified and managed by the Contractor.

The Construction (Design and Management) Regulations 2015 (CDM Regulations) will apply to any future development of this site which involves “construction” work, as defined by the CDM Regulations. As such it is the responsibility of the proposed developer to fulfil its duties under the CDM Regulations.

The approach for the FRA and proposals for the surface water management strategy are based on the requirements of the EA and Hertfordshire County Council in its role as Lead Local Flood Authority (LLFA). The findings of this FRA are based on data available at the time of the study.

3 Site Setting

3.1 Existing Site and Location

The Site is located in Potters Bar, a town on the southern edge of Hertfordshire, and extends to approximately 1.63 hectares. The site address is Maple House, Nos 8-16 (even) & 30-32 High Street and Nos 1-7 Princes Parade, Potters Bar. It occupies a prominent position on the north-western side of a major four-arm junction at the heart of the local road network.

The Site is bounded by Mutton Lane to the south and Potters Bar High Street to the east. Properties along both frontages are predominantly in commercial use, with residential accommodation above. Notable buildings opposite the site on the eastern side of the High Street include Key Point, a former office block currently undergoing conversion to residential use, and the Cask and Stillage public house.

To the west of the Site lies a Tesco superstore, which includes a large surface car park and petrol filling station. A prominent phone mast is also located within the Tesco car park. Immediately north of the Site is Goodacre Court, a sheltered housing development, and a BP petrol station.

The site itself comprises a mix of buildings and uses, including the Canada Life Building, Maple House office building, two parades of commercial units fronting the High Street with residential flats above, a car wash, and associated surface car parking (providing approximately 355 spaces).

An aerial photograph of the Site is provided in **Figure 3-1** below (Site boundary indicated in red). Where this boundary differs within this report this is the actual redline for the planning application.



Figure 3-1 – Site Location Plan

3.2 Topography

A detailed topographical survey of the Site was undertaken by Land Utility Group Ltd in 2025 and most recently updated in February 2026.

The topographical survey provides level data to OSGPS datum. Copies of the topographical survey are included in **Appendix B**.

The topographical survey indicates that the Site falls in a south-easterly direction with the highest and lowest levels being circa 125.44m and 122.00m in the north-west and south-east respectively.

Additionally, the Environment Agency's 0.5m LIDAR DTM has been obtained for the Site and surrounding area and is presented in **Figure 3-2** below and included in **Appendix B**.

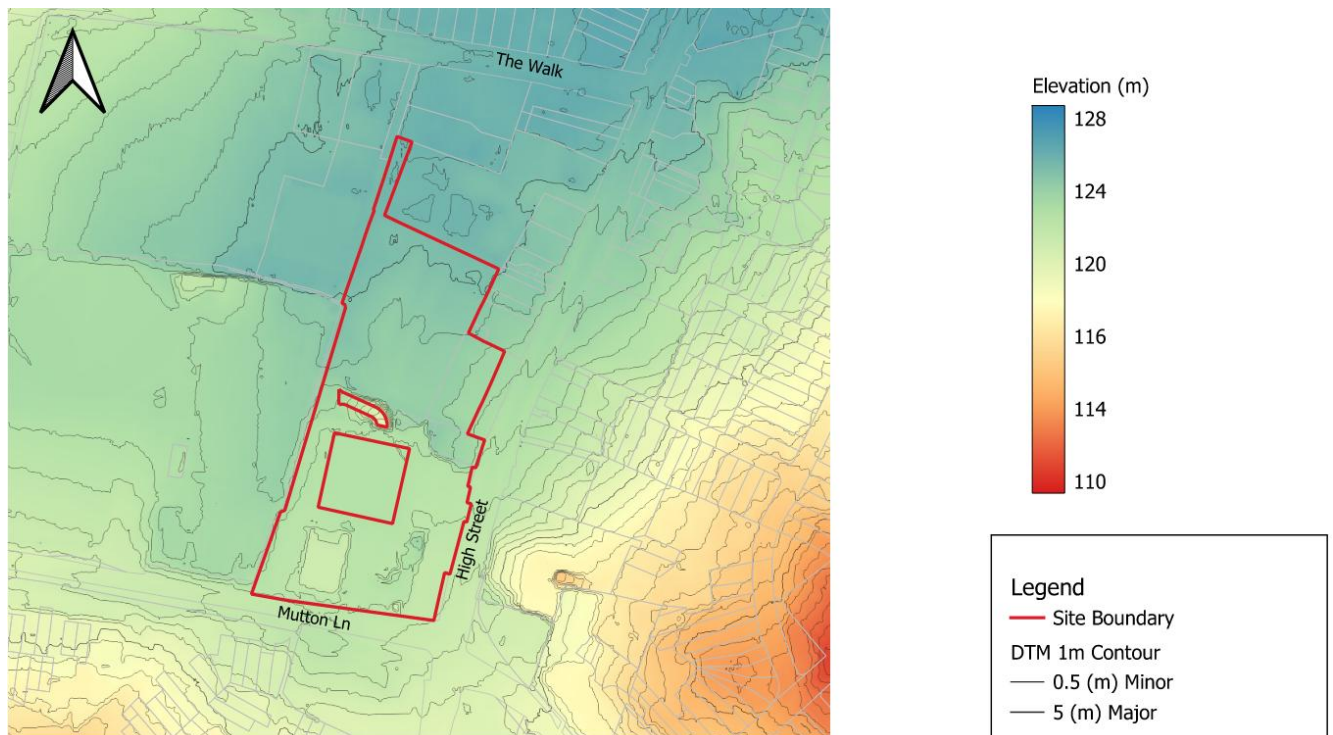


Figure 3-2 – Site Topography

3.3 Hydrological Setting

A review of OS mapping and EA's Statutory River Maps indicates that the nearest 'main river' is Turkey Brook, originating at Oakmere Park and Potters Bar Brook originating to the west of Oakmere Park, both approximately 350m north of the Site.

3.4 Geology and Hydrogeology

British Geological Survey Maps

A review of the 1:50,000 scale British Geological Survey (BGS) maps (see **Figure 3-3**) indicates that the Site is overlain by the Sand and Gravel of uncertain age and origin. The origin of these deposits is

uncertain (fluvial, glacial or marine) and precludes a simple classification of their environmental setting or mode of formation. This is shown in **Figure 3-3** and larger scale plan in **Appendix C**.

The River Terrace Deposits comprises sand and gravel, locally with lenses of silt, clay or peat. These are sedimentary superficial deposits formed between 2.588 million years ago and the present during the Quaternary period.

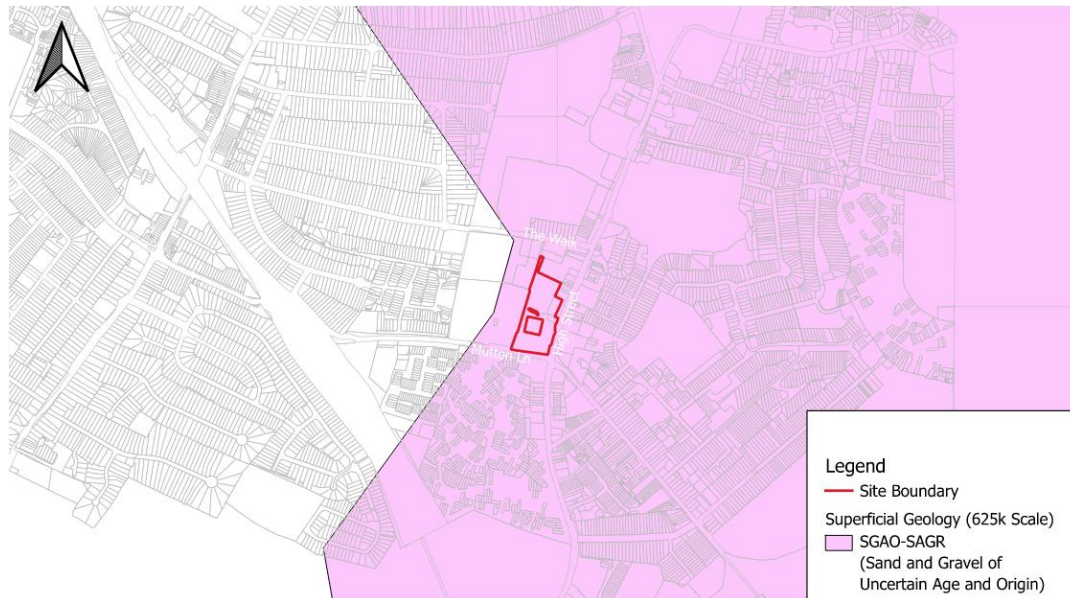


Figure 3-3 – BGS Geology Map, Superficial Geology

The BGS maps indicate that the bedrock geology of the Site comprises London Clay Formation-Clay, silt and sand. These sedimentary rocks are marine in origin. They are detrital and comprise coarse- to fine-grained slurries of debris from the continental shelf flowing into a deep-sea environment, forming distinctively graded beds. This is shown in **Figure 3-4** and larger scale plan in **Appendix C**.

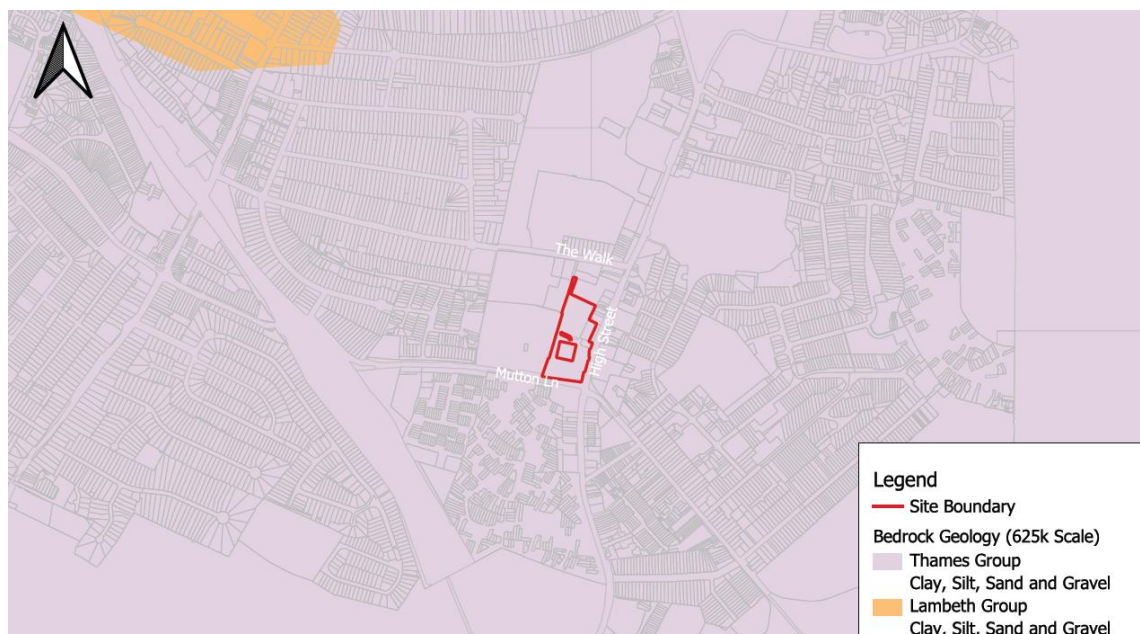


Figure 3-4 – BGS Geology Map, Bedrock Geology

Ground Investigation

A ground investigation was undertaken by A2 Site Investigation in December 2025 (see **Appendix C**). The ground investigation indicates Made Ground overlaying the London Clay Formation. Made Ground was encountered within all exploratory hole locations, with thicknesses varying from 0.6m below ground level (bgl) to 1.2m bgl. The London Clay Formation was encountered in the majority of the boreholes. The superficial deposits mapped (BGS Maps) on the Site were not encountered.

During the ground investigation three infiltration pits (INF01 – INF03) were machine excavated to a maximum depth of 1.30m bgl. Infiltration testing was completed within the trial pits in accordance with BRE Digest 365. Location INF01 was deemed unsuitable for infiltration testing due to significant perched water encountered during the excavation. Attempts were made to pump this out, however it was found to recharge very quickly and as such the testing in this location was terminated.

Due to the low permeability of the soil in INFL02 and INF03, the testing was also terminated after 5 hours.

The full set of exploratory hole logs, soakage testing is presented in **Appendix C** and summarised in **Table 3.1** below.

Table 3-1 – Ground Conditions Encountered (Table 7.1 of Ground Investigation Report, Dec 2025)

Units	Depth to Top of Stratum (m bgl)	Elevation at Top of Stratum (m OD)	Strata Thickness (m)	Description
Hard-standing ⁽¹⁾	0	122.80 to 125.07	0.07 to 0.25	Brick Paving / Concrete
Topsoil ⁽²⁾	0	122.60	0.20 to 0.35	Grass over brown slightly silty clayey fine to coarse SAND with frequent rootlets.
Made Ground	0.07 to 0.35	122.73 to 125.00	0.60 to 1.20	Reddish to light yellowish brown gravelly fine to coarse SAND, with medium to high cobble content of angular brick. Gravel is angular to subangular fine to coarse of flint. Yellowish brown gravelly sandy CLAY with frequent thin rootlets. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint and concrete.
London Clay Formation	0.35 to 1.20	122.38 to 124.40	Upoven >4.35	Firm becoming stiff locally initially soft brown silty sandy CLAY with frequent pockets of orange-brown sand.
(1) – Only encountered in WS01, WS02, WS03, WS04, WS05, WS06, WS07, INF01 and IN02				
(2) – Only encountered in WS08 and INF03				

Hydrogeology

The EA's groundwater SPZ maps (Magic Map) show that the Site is located within Groundwater Source Protection Zone I (SPZ1), Inner Protection Zone. This is shown in **Figure 3-5** and larger scale plan in **Appendix C**. Groundwater SPZ1 is defined as the area immediately around an abstraction point for domestic supply or for food production purposes. Groundwater in a SPZ1 is most vulnerable to pollution given the close proximity of the abstraction point and the water's intended use for human consumption. It

is defined within the Environmental Permitting (England and Wales) Regulations 2016 as one of the following.

- The area within 50 metres of a point where the groundwater is abstracted for domestic supply or food production purposes.
- The area where it takes groundwater that is intended to be used to supply water for domestic or food production purposes up to 50 days to travel to the groundwater abstraction point.

The EA's groundwater vulnerability maps (Magic Map) indicate that the Site is located in an area with low groundwater vulnerability.

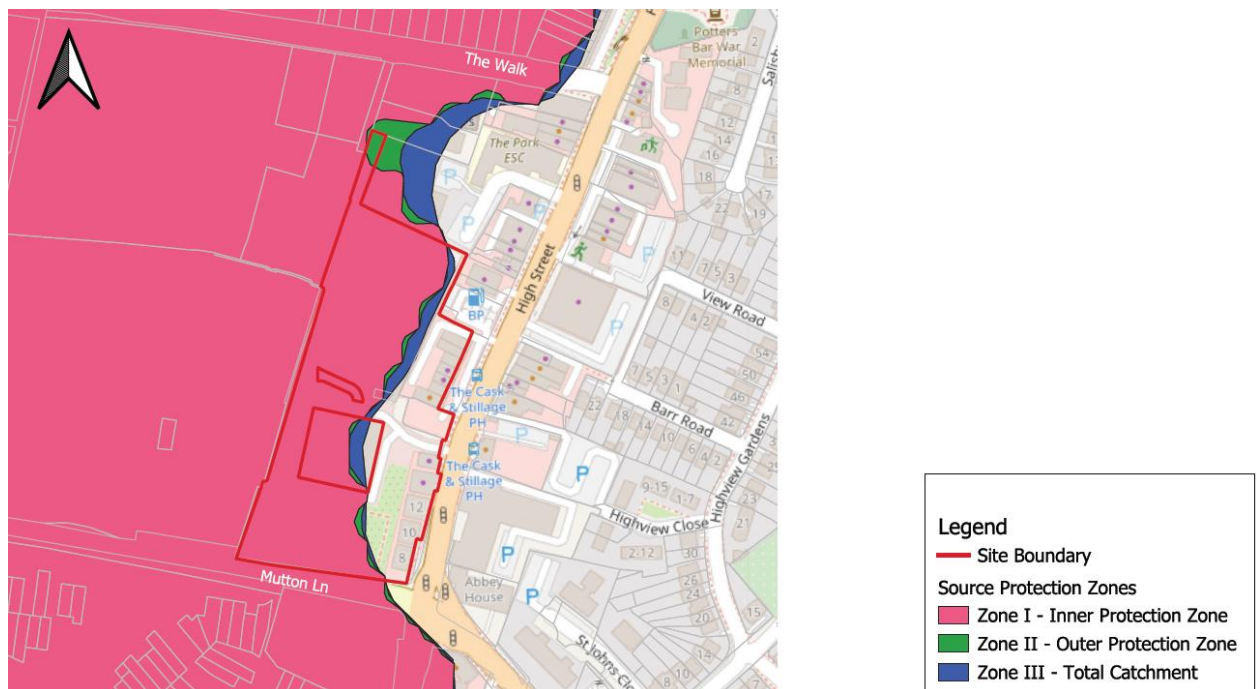


Figure 3-5 – EAs Source Protection Zones Map (Magic Map)

3.5 Existing Drainage

3.5.1 Private Drainage

The Site is currently predominately urban in character and is served by separate private foul and surface water drainage networks that outfall into the existing public sewers in the immediate vicinity of the Site.

The layout of the existing private foul and surface water sewers is shown in the topographic survey and historic drainage records in **Appendix B**.

The surface water runoff from the existing access road, external car park and deck car park drains through existing oil interceptors before discharging freely into the public sewer in High Street, as detailed below.

3.5.2 Public Drainage

The drainage authority for the Site is Thames Water Utilities Limited (TWUL). An extract of their asset records is shown in **Figure 3-6** and a copy is included in **Appendix D**.

The TWUL asset records indicate the presence of four public surface water sewers in the immediate vicinity of the Site, as summarised below:

- 300-450mm diameter sewer running to the west of the Site (adjacent to the Tesco access road) and draining in a northerly direction. The nearest surface water drainage manhole references on this run are 8903, 9901, 9001, 9002, 9003, 9004, 9103, 9104 and 9105.
- 225-300mm diameter sewer running to the east of the Site (in High Street) and draining in a southerly direction. The nearest surface water drainage manhole references on this run are 0001, 0902, 0903, 9904, 9902, 9810, and 9808.
- 150-225mm diameter sewer running to the south of the Site (in Mutton Lane) and draining in an easterly and southerly direction. The nearest surface water drainage manhole references on this run are 9801, 9802 and 9806.
- 150-225mm diameter sewer running to the southeast of the Site (in Mutton Lane) and draining in a westerly direction. The nearest surface water drainage manhole references on this run are 8803 and 8807.

The TWUL asset records indicate the presence of a 225mm diameter public foul water sewer in High Street, which drains in a southerly direction.

3.5.3 Existing Drainage Connections

The TWUL asset records, topographic survey and historic drainage records indicate the presence of various drainage connections from the Site into the public sewers, as summarised below and in the existing drainage drawings in **Appendix G**.

Foul Drainage

- 100mm diameter pipe connection from the northeastern corner of the Site into the existing 225mm Thames Water foul water sewer (junction connection) in High Street. This connection appears to be serving the commercial units within the Site and BP garage to the north of the Site.
- 100 OR 150mm diameter pipe connection from the eastern part of the Site into the existing 225mm Thames Water foul water sewer (connection into MH 0901) in High Street. This connection appears to be serving commercial units and Canada Life Building within the Site.
- 100 OR 150mm diameter pipe connection from the southern part of the Site into the existing 225mm Thames Water foul water sewer (connection into MH 9809) in High Street. This connection appears to be serving commercial units and Regus Building within the Site.

Surface Water Drainage

- 150mm diameter pipe connection from the eastern part of the Site into the existing 300mm Thames Water surface water sewer (connection into MH 0902) in High Street. This connection appears to be draining runoff from the north-eastern commercial units within the Site.
- 300mm diameter pipe connection from the eastern part of the Site into the existing 300mm Thames Water surface water sewer (connection into MH 9904) in High Street. This connection appears to be draining runoff from the commercial units, Canada Life Building, part of access road and existing external car park and deck car park, all within the Site.
- 300mm diameter pipe connection from the eastern part of the Site into the existing 300mm Thames Water surface water sewer (connection into MH 9801) in High Street. This connection appears to be draining runoff from the commercial units, Regus Building and part of access road, all within the Site.

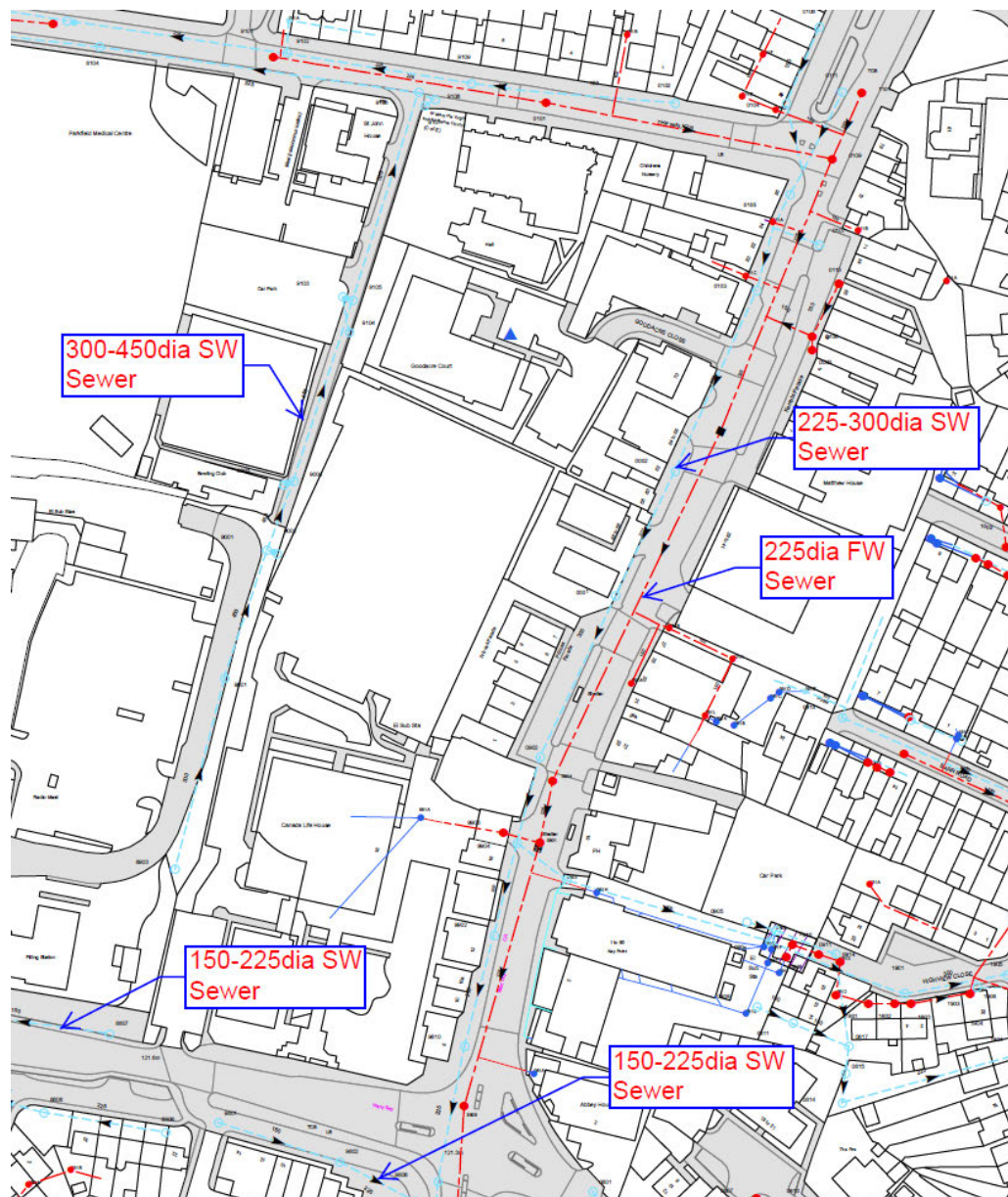


Figure 3-6 – Extract from Thames Water Asset Records

4 Sources of Flooding

4.1 Sources of Flooding

The assessment of flood risk has been undertaken based on the sources of information, listed in **Section 2.3**. The NPPF requires flood risk from the following sources to be assessed, each of which are assessed separately below:

- Tidal sources (flooding from the sea).
- Fluvial sources (river flooding).
- Pluvial sources (flooding resulting from overland flows).
- Groundwater sources.
- Sewer Flooding.
- Artificial sources, canals, reservoirs etc.
- It also requires the risk from increases in surface water discharge to be assessed (surface water management).

4.2 Flood Zone Designation

Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. The NPPF Planning Practice Guidance defines Flood Zones as follows:

- Flood Zone 1: Low Probability. Land having a less than 1 in 1,000 annual probability of river or sea flooding.
- Flood Zone 2: Medium Probability. Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
- Flood Zone 3a: High Probability. Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
- Flood Zone 3b: The Functional Floodplain. This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:
 - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
 - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

4.3 Fluvial / Tidal Flooding

The Environment Agency's (EA) Flood Map for Planning is shown in **Figure 4-1** and a larger scale plan and relevant correspondence with EA is included in **Appendix E**. The Site is shown to be entirely

located within Flood Zone 1, an area with low flood risk with an annual risk of flooding from fluvial sources is <0.1% AEP (annual exceedance probability).

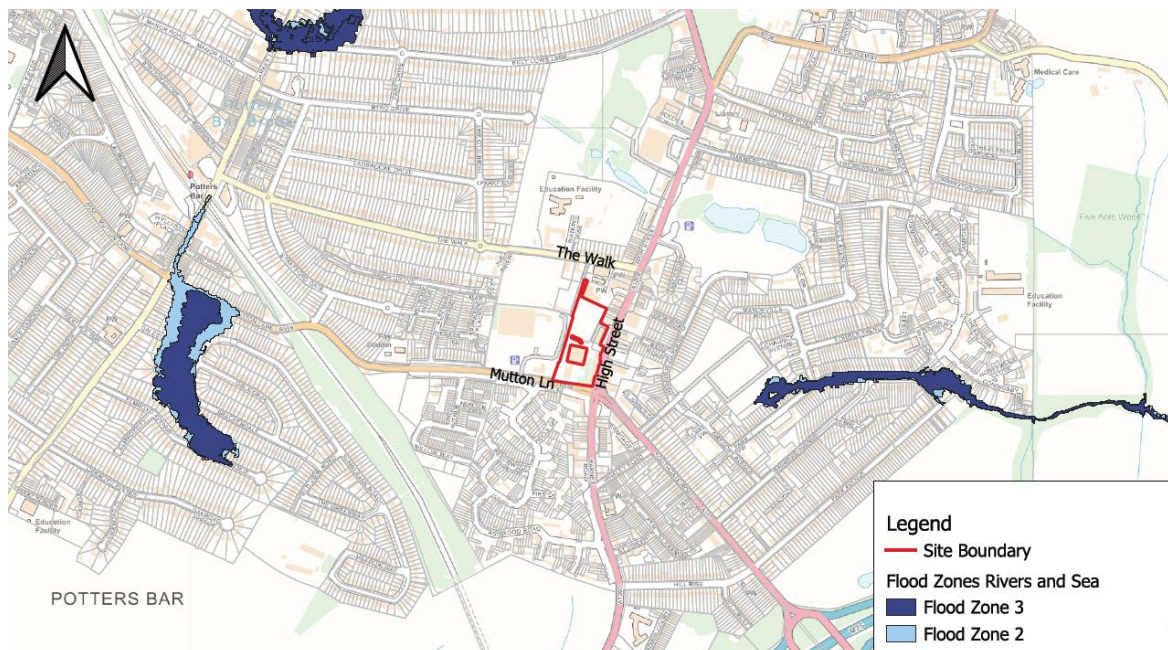


Figure 4-3 – EA's Flood Map for Planning

4.4 Pluvial Flooding

The Environment Agency Risk of Flooding from Surface Water (RoFSW) is shown in **Figure 4-2** below. Most of the Site is shown to be at a very low risk of flooding from surface water (<0.1% annual probability of flooding). There is however medium risk of surface water flooding (1% to 3.3% chance of a flood each year) in isolated areas in the centre, eastern and southern part of the Site. Furthermore, there is a high risk of surface water flooding (more than 3.3% chance of a flood each year) in isolated areas in the centre and southern part of the Site.



Figure 4-4.1 – EA's Risk of Flooding from Surface Water Map for Planning 1 in 30

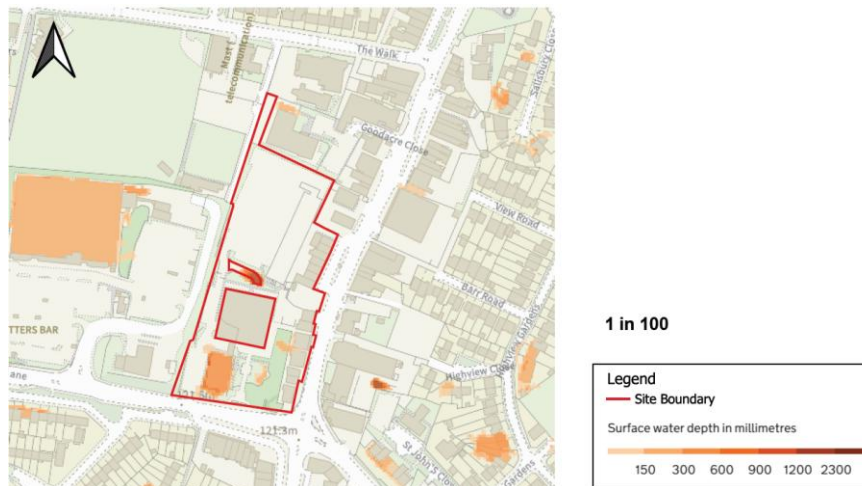


Figure 4-4.2 – EA's Risk of Flooding from Surface Water Map for Planning 1 in 100

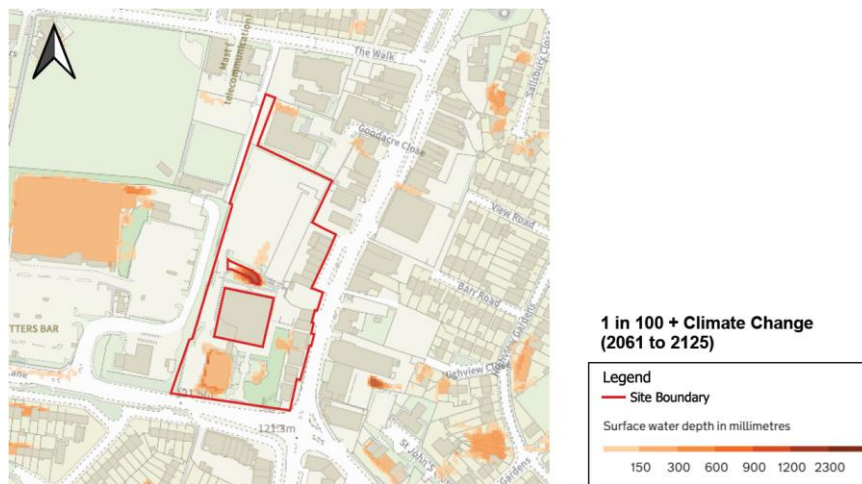


Figure 4-4.3 – EA's Risk of Flooding from Surface Water Map for Planning 1 in 100 + CC

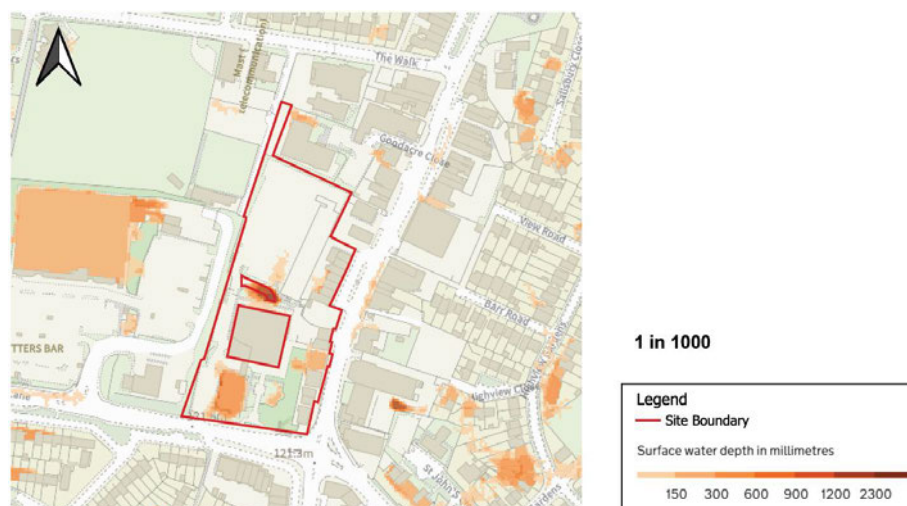


Figure 4-4.4 – EA's Risk of Flooding from Surface Water Map for Planning 1 in 1000

The isolated areas of flooding within the Site occur within topographic depressions, with flooding in these areas to be either removed due to raising of levels or managed through the proposed onsite drainage network and SuDS train.

It should be noted that there are no surface water flood flow paths that run through the Site.

We have provided an assessment of flood risk from surface water whilst referring to the EA Flood Maps for planning below.

It should be noted that the EA Flood Maps for Planning are based on Lidar Data, which is not considered as accurate as Topographic Survey, referred in the assessment below.

Proposed Block A

The existing ground levels within the footprint of proposed Block A generally range between 121.425m and 121.51m AOD.

The flood maps for planning indicate there is an isolated area at risk of flooding from surface water for 1 in 100y+CC. The maximum depth of flooding is over 900mm but less than 1200mm. The proposed Finished Floor Level of Block A is 122.625m, which is more than 900mm above the existing ground levels.

As it is good practice, linear threshold drains will be installed across all access thresholds of Block B to intercept any exceedance runoff and reduce risk of flooding.

Therefore, the flood risk of Block A due to surface water is considered to be low.

Proposed Block B

The existing ground levels within the footprint of proposed Block B generally range between 122.02m and 123.02mAOD.

The eastern and southern elevations of Block B are set to have level access from public highway A1000 - High Street and Mutton Lane respectively. Therefore, Block B FFLs step in a way to achieve such level threshold access from the existing public highway (footway) and fall away gently towards A1000 - High Street and Mutton Lane. The FFLs of Block B range between 122.100m AOD and 122.775m AOD.

The flood maps for planning indicate that there is an isolated area to the south-east of Canada Life House that is at risk of flooding from surface water for 1 in 100y+CC. The maximum depth of flooding is over 300mm but less than 600mm.

The existing levels within this area of flooding range between 122.32m and 122.45m AOD. The proposed FFLs of Block B within this area are 122.475m and 122.700mAOD.

The ground floor part of Block B with an FFL of 122.475m will be occupied by a Bin Store and a Commercial Unit with threshold access from both A1000 – High Street (to the east) and the proposed courtyard (to the west). It is the existing levels on public highway that set the FFL of this part of Block B. This FFL is set generally higher than the existing levels by as much as 150mm.

The ground floor part of Block B with an FFL of 122.700m AOD will be occupied by Bin Stores, Core Access (Stairs + Lift) and Commercial Units with threshold access from both A1000 – High Street (to the east) and the proposed courtyard (to the west). This is generally 300mm above the existing ground levels.

As it is good practice linear threshold drains will be installed across all access thresholds of Block B to intercept any exceedance runoff and reduce risk of flooding.

Therefore, the flood risk of Block B due to surface water is considered to be low.

Proposed Block D

The existing ground levels within the footprint of proposed Block D generally range between 123.50m and 123.70mAOD (along public highway A1000 - High Street).

The eastern elevation of Block D is set to have level access from public highway A1000 - High Street. Therefore, Block D FFLs step in a way to achieve such level threshold access from the existing public highway (footway) and fall away gently towards A1000 - High Street. The FFLs of Block D range between 123.050m and 123.725m AOD.

Along the western elevation of Block D, stepped access (internal steps) will be provided to get to an external level of 124.350m AOD.

The external area along the western elevation will fall away from the Block D accesses, therefore draining runoff and any exceedance flows in a north-westerly direction away from Block D.

The FFL of the southern part of Block D is set at 123.05m AOD and the external levels in this area fall away from the threshold access in a southerly direction.

The ground floor of Block D will be occupied by commercial units.

The flood maps for planning indicate that there is no surface water flooding in this area.

As it is good practice linear threshold drains will be installed across all access of Block D to intercept any exceedance runoff and reduce risk of flooding.

Therefore, the flood risk of Block D due to surface water is considered to be low.

Proposed Block E

The existing ground levels within the footprint of proposed Block E vary between 124.23m and 125.05m AOD.

The proposed FFLs of Block E range between 124.875m and 125.475m AOD.

The flood maps for planning indicate that there is an isolated area to the south-east of Block E that is at risk of flooding from surface water for 1 in 100y+CC. The maximum depth of flooding is over 300mm but less than 600mm.

The existing levels within this area of flooding range between 124.02m and 124.21m AOD. The proposed FFL of Block E nearest to this area of surface water flooding is set at 124.875m AOD. This FFL is set more than 300mm above existing ground level.

As it is good practice linear threshold drains will be installed across all access thresholds of Block E to intercept any exceedance runoff and reduce risk of flooding.

Therefore, the flood risk of Block E due to surface water is considered to be low.

Proposed Swale (between Deck Car Park and Block E)

The existing ground levels within the footprint of proposed Swale (between Deck Car Park and Block E) range between 124.10m and 124.45m AOD.

The proposed top of bank level of Swale is set at circa 125.65m AOD.

The flood maps for planning indicate that there is an isolated area to the south-east of Block E that is at risk of flooding from surface water for 1 in 100y+CC. The maximum depth of flooding is over 300mm but less than 600mm.

The existing levels within this area of flooding range between 124.02m and 124.21m AOD. As noted above the proposed top of bank level of Swale is set at circa 125.65m AOD. This level is set more than 300mm above existing ground level.

Therefore, the flood risk of Swale due to surface water is considered to be low.

Proposed 1-S24 Bio-retention (courtyard between Block A-B)

The existing ground levels within the footprint of proposed 1-S24 Bio-retention (courtyard between Block A-B) range between 122.39m and 122.48m AOD.

The proposed top of bank level of Bio-retention area is set at circa 122.16m AOD.

The flood maps for planning indicate that there is an isolated area between Block A and B that is at risk of flooding from surface water for 1 in 100y+CC. The maximum depth of flooding is over 150mm but less than 300mm.

The existing levels within this area of flooding range between 122.39m and 122.48m AOD. As noted above the proposed top of bank level of this Bio-retention area is set at circa 122.16m AOD. Even though this level is set below the existing levels, the risk of flooding from surface water is low as this is an isolated area not linked to a surface water flood path, with buildings proposed on all sides. The levels within the proposed development have been set such as to route exceedance flows away from the buildings.

Therefore, the flood risk of Bio-retention area due to surface water is considered to be low.

Considering the above, the overall flood risk due to surface water is considered to be low.

4.5 Groundwater Flooding

LFRMS (2)'s groundwater flood map indicates that the Site is either at low or very risk of flooding from groundwater (see flood maps in **Appendix F**).

The proposed development will be set higher than the existing levels and as such risk of flooding due to groundwater will be reduced. Therefore, overall groundwater flood risk post-development is considered to be low.

4.6 Flood Risk from Reservoirs

The Environment Agency's Reservoir Breach Flood mapping shows the Site is not predicted to be at risk of flooding from a reservoir breach event. The risk of flooding to the Site from artificial sources is therefore considered to be negligible.

4.7 Flood Risk from Existing Sewers

LFRMS (2)'s flood incidents maps indicate that there are no records of historic flooding occurrences within the Site. The nearest records of such occurrence appear to be in Darkes Lane, Baker Street, Barnet Road and east of High Street (all dated January 2016). Correspondence with the LLFA (see **Appendix F**) confirms that the flood incidents nearest to the Site are recorded as follows:

- on Ashwood Road near the junction with Holly Drive;
- on Willow Way near the junction with Ashwood Road;
- on Mutton Lane near Potters Bar Fire Station; and
- east of the Site on Highview Gardens.

LFRMS (2) notes that the majority of these flooding events are due to intense rainfall and sewer flooding.

The risk of sewer flooding to the development is considered to be negligible.

4.8 Summary of Flood Risk

A summary of the assessed risk of flooding from all sources is shown in **Table 4-1** below.

Table 2-2 – Summary of Flood Risk

Source	Level of Flood Risk
Tidal / Fluvial	Low
Pluvial	Low
Groundwater	Low
Sewer	Negligible
Artificial Sources	Negligible

5 Flood Risk Management

This site-specific flood risk assessment aims to demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible however, it is practicable to minimise the risk by allowing a freeboard (safety margin) and by using suitable construction and management techniques and by following best practice. The proposed development will have finished floor levels set above the existing levels.

As such, the residual risk is considered to be acceptable for the lifetime of the development.

6 Surface Water Management

The surface water drainage strategy detailed in this report has been prepared in accordance with the National Standards for SuDS (June 2025).

As part of the proposed development, the small private external areas between Block B and D and the High Street will be dedicated as public highway and the surface water runoff will drain into the existing highway drainage. As the public highway catchment area adjoining the site will increase slightly, it is acknowledged that there may be a need for additional highway gullies. Such drainage proposals will be covered under a detailed S278 application post planning. Therefore, these small additional external areas are not part of the surface water management proposals detailed in the following sections.

It is proposed to retain the existing surface water sewers that serve Canada Life Place and divert a short length to enable the proposed development. It should be noted that Canada Life Place building is not part of this planning application.

A meeting with the LLFA was held on the 17th June. Correspondence with the LLFA can be found in **Appendix F**). They were in agreement with the proposals with some refinement at detailed design.

6.1 Standard 1: Runoff Destinations

The National Standards for Sustainable Drainage Systems (NS-SuDS) published in June 2025, which follow the NPPF Planning Practice Guidance, state that surface water runoff should be disposed of according to the following hierarchy:

- Priority 1: collected for non-potable use;
- Priority 2: infiltrated to ground;
- Priority 3: discharged to an above ground surface water body;
- Priority 4: discharged to a surface water sewer, or another piped surface water drainage system; and
- Priority 5: discharged to a combined sewer

6.1.1 Priority 1: Collected for Non-potable use

A large-scale rainwater recycling system for the irrigation of soft landscape is not considered feasible for this site. Generally, a rainwater recycling system would require additional plantroom/s for the irrigation tanks and pumps. Furthermore, based on experience on other projects, the irrigation system would also use mains water. Due to the nature of the proposed development, it has not been possible to allocate space for plantrooms to serve a large-scale irrigation system.

The Landscape will not require irrigation but will require manual watering during the establishment period and during prolonged hot and dry weather. Therefore, rainwater butts are not incorporated.

Surface water runoff from some of the communal areas is to be directed to Tree Root Cells (where shown), where it would be stored for irrigation of the trees. The Tree Root Cells will be equipped with an

overflow into the drainage system and will be wrapped in geotextile and geomembrane layers to prevent groundwater ingress.

6.1.2 Priority 2: Infiltrated to Ground

As discussed in **Section 3.4**, the underlying geology of the Site is the London Clay Formation and as shown in the soakage tests included in **Appendix C** the Site is not suitable for infiltration-based drainage features. Furthermore, the Site is in SPZ1 and therefore infiltration is not considered suitable for infiltration.

6.1.3 Priority 3: Discharged to an Above Ground Surface Water Body

As detailed in **Section 3.3** of this report, there are no above ground surface water bodies in the immediate vicinity of the Site.

6.1.4 Priority 4: Discharged to a Surface Water Sewer, or another Piped Surface Water Drainage System

Therefore, it is proposed to mimic the existing drainage system and continue to discharge into the existing TWUL surface water sewers albeit at a limited discharge rate.

6.1.5 Priority 5: Discharged to a Combined Sewer

There are no existing combined sewers in the immediate vicinity of the Site. As this is further down the priority list than discharge to a surface water sewer, this method of discharge has not been considered.

6.2 Standard 2: Management of Everyday Rainfall (Interception)

The new Standard 2 requires all development to “apply a ‘SuDS approach’ so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems.

It is a requirement of the NPPF that SuDS are used in all major developments, if feasible. The LLFA also strongly advocate the use of SuDS within new development.

CIRIA report C753 ‘The SuDS Manual’ outlines the various types of SuDS, their benefits and limitations, and design considerations associated with each. Not all SuDS components / methods are feasible or appropriate for all developments, factors such as available space, ground conditions and site gradient will influence the feasibility of different methods for a particular development.

The constraints and opportunities for the use of SuDS techniques are appraised using the Management Train approach outlined in CIRIA C753 ‘The SuDS Manual’ and guidance in National Standards for SuDS (June 2025), and are summarised in **Table 6-1** below.

After consideration of the CIRIA C753 SuDS Management Train approach and National Standards for SuDS (June 2025) the most viable SuDS options for the Site would be a combined solution of swale, geo-cellular tanks, swale, SuDS pipes, bio-retention areas such as rain gardens, permeable paving and tree root cells.

Below is a summary of the how interception of the first 5mm rainfall is achieved on Site through the use of the proposed SuDS. This is further detailed in the drainage drawings in **Appendix G**.

- **Roofs:** It is proposed that the roofs of all blocks will include a layer of granular material. The first 5mm of rainfall on the roofs will be intercepted by this layer of granular material (similar to that of permeable paving/ porous surfacing). Hardstanding areas of MEP plant at roof level will drain into the proposed open SuDSs at ground level, where interception will be provided.
- **Roads and Footways:** It is proposed that the majority of roads and footways are surfaced in permeable paving / porous surfacing. Service corridors will be paved in standard paving and drain overland onto either adjacent permeable surfaces or raingardens, which are considered to provide interception for the first 5mm rainfall.
- It should be noted that all areas of permeable paving / porous surfacing and open SuDS (incl. raingardens and swale) will be tanked to avoid infiltration due to the site being in SPZ1.
- NS-SuDS suggests that where the permeable surface also drains an adjacent impermeable area and is lined, compliance shall not be deemed to have been achieved, and additional downstream interception features will be required. Due to the spatial constraints and nature of the proposed development, it is not possible to provide downstream interception features and extent of open SuDS is limited. As a result, it is proposed to increase the thickness of porous sub-base within the permeable paving / porous surfacing to account for holding runoff from small areas of impermeable surfaces over the services corridor.
- **Existing Deck Car Park:** A swale has been provided between the car park and Block E for attenuation, water quality treatment and interception of the first 5mm of rainfall. Furthermore, SuDS pipes have been included downstream of the swale to provide the 2nd stage of treatment.

Table 6-1 – C753 SuDS Management Train

Type	Infiltration Devices (Source Control)
Constraints	The bedrock geology of the entire site consists of the London Clay Formation. The bedrock geology of London Clay does not support infiltration as a drainage solution. Even if infiltration was to be feasible the Site is in SPZ1 and therefore should be avoided.
Opportunities	Not applicable
Type	Permeable Paving (Source Control)
Constraints	It is not good practice to use permeable paving over the proposed utility services corridors. Where permeable paving / porous surfaces are being used, these should be lined due to the Site being in SPZ1.
Opportunities	Roads and footways (except utility services corridors) to be paved in permeable paving / porous surfaces.
Type	Rainwater Harvesting (Source Control)
Constraints	The benefits of rainwater harvesting on a specific design storm event cannot be quantified, due to the seasonal availability of storage within the structure. Furthermore, a large-scale rainwater recycling system for the irrigation of soft landscape is not considered feasible for this kind of development site. Generally, a rainwater recycling system would require additional plantroom/s for the irrigation tanks, pumps, etc.
Opportunities	Rainwater butts to be utilised where suitable. Tree Root Cells to be utilised where suitable.
Type	Swales etc. (Conveyance)
Constraints	Significant land requirement to accommodate 1:3.5- 1:4 side slopes.
Opportunities	It is proposed to use a swale to the west of the existing deck car park for conveyance and water quality treatment.
Type	Bio Retention Systems
Constraints	Limited benefits to attenuation requirements in larger developments.
Opportunities	Opportunities to use bioretention areas / raingardens in the courtyard/s.
Type	Living Roofs
Constraints	Limited benefits to attenuation requirements in larger developments and require additional structural integrity.
Opportunities	Living Roofs could be used on the roofs of the blocks
Type	Attenuation Basins
Constraints	Large areas are required to create enough volume and safe side slopes.
Opportunities	None considering the spatial constraints onsite.
Type	Attenuation Tanks (End of Line Treatment)
Constraints	None.
Opportunities	Geo-cellular storage could be utilised external to the building in the landscaped areas.

6.3 Standard 2: Management of Extreme Rainfall and Flooding

This standard requires the development to comply with the following:

“a ‘SuDS approach’ shall be adopted to address the management of development runoff during extreme rainfall, including allowances for climate change and urban creep”.

The overall Site is split into two separate surface water drainage catchments to mimic the existing drainage routes. The surface water discharge rate from each drainage catchment has been set at greenfield runoff rate of Q2 (1 in 2-year storm) for all return periods up to and including 1 in 100-year plus climate change which complies with National Standards requirements (in terms of discharge and volume respectively).

6.3.1 Greenfield Runoff Rates

In line with National Standards for SuDS, the greenfield runoff rates have been calculated using the Environment Agency Flood Estimation Guidelines and the industry-standard online tool provided by HR Wallingford. Details of the greenfield runoff rate calculations are provided in **Appendix H** and summarised in **Table 6-2** below.

Table 6-2 – Greenfield Runoff Rates

Rainfall Event (Year)	Runoff Rate per Hectare (l/s/ha)
Qbar	5.6
Q1 (1 year)	4.8
Q2 (2 years)	5.0
Q30 (30years)	12.9
Q100 (100 years)	18.0

6.3.2 Existing Catchments and Discharge Rates

The Site is split into 4no surface water drainage catchments draining via piped networks into the existing TWUL surface water sewers in High Street and to the west of the site. The topographic survey and historic records do not show presence of any flow control measures and therefore the existing drainage catchments are considered to be draining freely into the public sewers.

The pipe outfall connections are detailed in **Section 3.5** and drainage drawings in **Appendix G**, and summarised below:

- Existing SW Catchment No.1 drains into the Thames Water MH 9810 via a 300mm pipe connection.
- Existing SW Catchment No.2 drains into the Thames Water MH 9904 via a 300mm pipe connection.

- Existing SW Catchment No.3 drains into the Thames Water MH 0902 via a 150mm pipe connection.
- Existing SW Catchment No.4 drains into the Thames Water MH 9103 / 9104 / 9105 via gully connections.

In the absence of detailed drainage information (i.e. existing manhole invert levels and pipe sizes within the Site), a simple drainage network consisting of a few nodes/manholes has been modelled for each drainage catchment using the design software Site3D and Flood Estimation Handbook (FEH) point data. These models have been subjected to a range of theoretical design storms to estimate the peak flows, and the results are included in **Appendix H** and summarised in **Table 6-3** below.

Table 6-3 – Existing SW Catchment No.1 to 4 Peak Discharge Rates

Rainfall Event (Year)	SW Catchment No.1 (l/s)	SW Catchment No.2 (l/s)	SW Catchment No.3 (l/s)	SW Catchment No.4 (l/s)
1 in 2	29.0	131.0	2.9	3.6
1 in 30	79.1	253.7	8.1	9.9
1 in 30 + 35% CC	-	-	-	-
1 in 100	100.6	257.0	10.5	12.8
1 in 100 + 40% CC	-	-	-	-

6.3.3 Proposed Catchments and Discharge Rates

The proposed surface water drainage catchment areas are detailed in the drainage drawings in **Appendix G** of this report.

The National Standards for SuDS (June 2015) states the following:

- [Clause 3.18] the peak allowable discharge rate from the development to surface waters or sewers for the 1 in 2year event shall be limited to the equivalent 1 in 2year greenfield runoff rate, or 3 l/s/ha, whichever is the greater.
- [Clause 3.19] Where the volume of runoff discharged from the development to surface waters or sewers for the 1 in 100year, 6-hour rainfall event is greater than the volume of greenfield runoff for the same rainfall event, the peak allowable discharge rate from the development for the 1 in 100year event shall be limited to the 1 in 2year greenfield runoff rate or 3l/s/ha, whichever is the greater.

Therefore, in light of the above it is proposed to limit the surface water runoff from the development to the 1 in 2year greenfield runoff rate for all storms up to and including 1 in 100years plus climate change.

The Site is split into two surface water drainage catchments namely SW Catchment No 1 (south) and No 2 (north). The impermeable area of SW Catchment No 1 and No 2 are estimated to be 0.577ha and 0.512ha respectively.

It is proposed that SW Catchment No 1 drains into the existing Thames Water manhole with reference 9801 via the existing surface water drainage connection. A new demarcation chamber is proposed on an area proposed to be dedicated as public highway.

It is proposed that SW Catchment No 2 drains into the existing Thames Water manhole with reference 9904 via the existing surface water drainage connection.

Urban Creep

Considering that the proposed development consists of blocks of flats and that the Open Space will be maintained by a Management Company, urban creep is not considered to be applicable and therefore an additional 10% of the overall hardstanding area has not been applied to the drainage calculations.

Coefficient of Volumetric Runoff

The Coefficients of Volumetric Runoff considered in the drainage design is 1.0. The drainage simulation results indicate that the Site will not flood and the additional runoff will be accommodated within the freeboard of the proposed SuDS. The drainage calculations including the sensitivity test results are provided in **Appendix H** of this report.

The proposed discharge rates and the betterment to existing discharge rates are presented in **Table 6-4** and **6-5** below. As shown the proposed development will provide up to 99% betterment in the surface water discharge rate for all storms up to and including 1 in 100years.

A Surface Water Preplanning Enquiry has been submitted to TWUL to confirm capacity at the connection / discharge points.

Table 6-4 – SW Catchment No.1 Existing and Proposed Discharge Rate Comparison

Rainfall Event (Year)	Greenfield Rate (l/s)	Existing Discharge Rate (l/s)	Proposed Discharge Rate (l/s) 5.0l/s/ha x 0.512ha	Betterment (%)
1 in 2	2.6	29.0	2.6	91.0
1 in 30	7.4	79.1	2.6	96.7
1 in 30 + 35% CC	-	-	2.6	-
1 in 100	9.2	100.6	2.6	97.4
1 in 100 + 40% CC	-	-	2.6	-

Table 6-5 – SW Catchment No.2 Existing and Proposed Discharge Rate Comparison

Rainfall Event (Year)	Greenfield Rate (l/s)	Existing Discharge Rate (l/s)	Proposed Discharge Rate (l/s) 5.0l/s/ha x 0.577ha	Betterment (%)
1 in 2	2.9	137.5 (131.0+2.9+3.6)	2.9	97.9
1 in 30	7.4	271.7 (253.7+8.1+9.9)	2.9	98.9
1 in 30 + 35% CC	-	-	2.9	-

1 in 100	10.4	280.3 (257.0+10.5+12.8)	2.9	99.0
1 in 100 + 40% CC	-	-	2.9	-

6.3.4 Required Surface Water Attenuation

In order to limit the surface water discharge rate from each drainage catchment to Q2 (1 in 2-year storm), it is necessary to provide attenuation across the Site for the surface water runoff. As such, it is proposed to utilise a combination of geo-cellular tank/s, swale, SuDS pipes, bio-retention areas such as rain gardens, permeable paving / porous surfaces (roads and footways) and tree root cells to provide the necessary storage across the development site prior to discharging into the existing TWUL surface water sewers in High Street.

The proposed surface water drainage strategy layout is provided in **Appendix G**.

As noted above the drainage calculations are included in **Appendix H**.

During periods of heavy rainfall, flows will be attenuated in the proposed SuDS, providing the storage volumes detailed in **Table 6-6** below.

The Site3D design software has been utilised to calculate the storage requirements for the 1 in 2 year, 1 in 30-year, 1 in 30-year + 35% Climate Change allowance, 1 in 100-year and 1 in 100-year + 45% Climate Change allowance events.

The Site 3D storm simulation function is built on top of the latest version of the EPA Storm Water Management Model Engine. EPA SWMM is an open-source, dynamic hydrology, hydraulic, and water quality simulation engine.

It should be noted that a conservative approach has been adopted in that the calculations do not reflect attenuation provided by the permeable block paving and granular material on the roofs of the building.

Table 6-6 – Proposed Surface Water Attenuation (m³)

Required Volume of Attenuation (m ³)			
Catchment Ref.	Impermeable Area (ha)	Discharge Rate (Impermeable Area x 5.0l/s/ha)	Volume of Attenuation 1 in 100Y+CC (m ³)
SW Catchment No.1	0.517	2.6 l/s	405
SW Catchment No.2	0.577	2.9 l/s	464

The half drain times for the attenuation tank ref: 1-S19 Tank, 2-S5 Tank 2 and Swale ref: 2-S16 Swale are included in Appendix H.

The minimum simulation run-on time has been set at 2880min (48hrs) such as to force the simulation to run for the storm duration plus this value. This is useful to ensure storms run long enough to see the half-drain-down point.

As shown in the drainage calculations in Appendix H, the half drain times of the attenuation tanks and swales are less than 2880min (48hrs).

6.3.5 Long Term Storage

The proposed hardstanding/impermeable areas are less than the existing, this combined with the proposal to discharge at Q2 (1 in 2-year storm) for all return periods up to and including 1 in 100year plus climate change, means that there is no requirement for Long Term Storage.

6.3.6 Exceedance Routes

As a result of heavy or extreme storm events, it is sometimes unavoidable for the capacity of sewers and other drainage systems to be exceeded. Drainage exceedance will occur when the rate of surface water runoff exceeds the inlet capacity of the drainage system, when the receiving water or pipe system becomes overloaded, blocked or when the outfall is restricted due to flood levels in the receiving water.

The proposed attenuation features have been located towards the lowest-lying areas of the Site, to ensure the internal access roads flow away from residential units. The routes will ultimately mimic the current flow routes associated with the existing site as a result of the topography.

Additionally, proposed ground levels across the site will be set higher than then the existing ground levels and designed to manage exceedance flows accordingly.

Finally, as it is good practice linear threshold drains will be installed across all access thresholds of the proposed development to intercept any runoff and reduce risk of flooding.

Given the above approach, the surface water drainage design is considered compliant with Standard 3.

6.4 Standard 4: Water Quality

This standard requires all development to “apply a ‘SuDS approach’ that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runoff to adequately address water quality risks from the development.”

To ensure that the SuDS measures proposed are sufficient in removing pollutants from the generated run-off, a SuDS pollutant analysis has been carried out. This is performed in conjunction with the guidelines and steps set out in Section 26.7 of CIRIA SuDS Manual (2015).

The main form of pollutant is from surface water run-off from the roads. It is assumed that the spine road is likely to have more than 300 traffic movements a day and the access road to the north of Block B will have less than 300 traffic movements a day. Table 26.2 (CIRIA, SuDS Manual 2015) highlights the pollution hazards for different land uses (see **Table 6-7** below).

As already noted in the previous sections, the drainage proposals comprise a combination of SuDS including swale, SuDS pipes, bio-retention areas such as rain gardens, permeable paving / porous surfaces and tree root cells. These SuDS features provide treatment to surface water runoff prior to discharging into the TWUL surface water sewers in High Street. **Table 6-8** to **6-14** below provide a breakdown of the mitigation indices for each SuDS combination.

As the Site is in SPZ1 it is proposed that the permeable paving / porous surfaces and all open SuDS are lined to avoid infiltration and therefore avoid risk of impacting the quality of the groundwater.

Table 6-7 – C753 SuDS Pollution Hazard Indices for Different Land-use Classifications (land-use shaded grey applicable for the Site)

Land-use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except trunk roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. 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	High	0.8	0.8	0.9

Table 6-8 – C753 SuDS Indicative SuDS Mitigation Indices for Discharges to Surface Waters (SuDS Components Shaded Grey Applicable to this Development)

Type of SuDS component	Mitigation indices		
	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bio Retention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Attenuation basin	0.5	0.5	0.6

Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Downstream Defender (Proprietary Treatment System*)	0.5	0.4	0.8
*Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1-year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 6-9 – SuDS Mitigation Indices for Permeable Paving

<i>For Surface Water Runoff from Spine Road</i>			
	<i>Required mitigation indices</i>		
Source	TSS	Metals	Hydrocarbons
Medium	0.70	0.60	0.70
<i>Type of SuDS Component Provided</i>			
Permeable Paving	0.70	0.60	0.70
Total	0.70	0.60	0.70
Check	Met	Met	Met

Table 6-10 – SuDS Mitigation Indices for Permeable Paving and Attenuation Basins

<i>For Surface Water Runoff from Roads with Traffic less than 300 Movements/day</i>			
	<i>Required mitigation indices</i>		
Source	TSS	Metals	Hydrocarbons
Low	0.50	0.40	0.40
<i>Type of SuDS Component Provided</i>			
Permeable Paving	0.70	0.60	0.70
Total	0.70	0.60	0.70
Check	+0.20	+0.20	+0.30

Table 6-11 – SuDS Mitigation Indices for Roofs with Granular Layer

<i>For Surface Water Runoff from Roofs</i>			
	<i>Required mitigation indices</i>		
Source	TSS	Metals	Hydrocarbons
Medium	0.20	0.20	0.05
<i>Type of SuDS Component Provided</i>			
Roofs with Granular Layer (assumed as filter drain)	0.40	0.40	0.40
Total	0.40	0.40	0.40
Check	+0.20	+0.20	+0.35

Table 6-12 – SuDS Mitigation Indices for Bioretention Areas (Raingardens)

<i>For Surface Water Runoff from Spine Road (Services Strip)</i>			
	<i>Required mitigation indices</i>		
Source	TSS	Metals	Hydrocarbons
Medium	0.70	0.60	0.70
<i>Type of SuDS Component Provided</i>			
Bioretention / Raingarden	0.80	0.80	0.80
Total	0.80	0.80	0.80
Check	+0.10	+0.20	+0.10

Table 6-13 – SuDS Mitigation Indices for Bioretention Areas (Raingardens)

<i>For Surface Water Runoff from Footpaths</i>			
	<i>Required mitigation indices</i>		
Source	TSS	Metals	Hydrocarbons
Low	0.50	0.40	0.40

<i>Type of SuDS Component Provided</i>			
Bioretention / Raingarden	0.80	0.80	0.80
Total	0.80	0.80	0.80
Check	+0.30	+0.40	+0.40

Table 6-14 – SuDS Mitigation Indices for Swale and SuDS Pipe

<i>For Surface Water Runoff from Existing Deck Car Park</i>			
	<i>Required mitigation indices</i>		
<i>Source</i>	<i>TSS</i>	<i>Metals</i>	<i>Hydrocarbons</i>
Medium	0.70	0.60	0.70
<i>Type of SuDS Component Provided</i>			
Swale	0.50	0.60	0.60
Bypass Oil Interceptor	0.20 (0.40/2)	0.20 (0.40/2)	0.20 (0.40/2)
Total	0.70	0.80	0.80
Check	+0.10	+0.20	+0.10

Therefore, the surface water drainage design is considered compliant with Standard 4.

6.5 Standard 5: Amenity

This standard requires “a ‘SuDS approach’ shall be adopted that maximises benefits for amenity through the creation of multi-functional places and landscapes”.

The proposed SuDS strategy incorporates bio-retention areas and a swale which have been designed with relatively flat side slopes and merge with the landscaping of the proposed development. The bio-retention areas and swale will be seeded with the same mix as the proposed landscaping across the development and reflects the local context of the area.

The above measures comply with the requirements of Standard 5 and are therefore considered appropriate.

6.6 Standard 6: Biodiversity

This standard requires “a ‘SuDS approach’ shall be adopted to ensure the surface water drainage system maximises biodiversity benefits throughout the development lifecycle”.

The surface water drainage system to add biodiversity value by:

- creating diverse, self-sustaining, resilient local ecosystems which contribute to net gains in biodiversity;
- supporting and promoting natural local habitat and species, for example, through local nature recovery strategies (LNRS);
- contributing to the delivery of local biodiversity strategies;
- contributing to habitat connectivity

The proposed SuDS strategy has been considered as part of the wider landscaping of the proposed development, which has been developed with biodiversity in mind, and is in line with CIRIA guidance and LLFA requirements. There are no ecology constraints on site which would have an influence on the positioning of the proposed SuDS.

The main SuDS features on site will be the bio-retention areas and a swale. These will enhance biodiversity through the selection of appropriate plant species.

There are limited additional measures that can be incorporated across the site within the drainage strategy, but the above measures are considered compliant with Standard 6.

6.7 Standard 7: Design of Drainage for Construction, Operation, Maintenance, Decommissioning and Structural Integrity

This standard requires “a ‘SuDS approach’ shall be adopted to ensure that surface water drainage systems are designed so they can be easily and safely constructed, operated and maintained taking account of the need to minimise negative impacts on natural resources and the environment.”

The drainage design has been produced with consideration to longer term construction methods, to ensure that the proposals are deliverable. This includes details on the levels of the associated drainage works, alongside appropriate specification of materials and design to ensure that the proposals remain operational for the lifetime of the development.

A Management and Maintenance Plan for the proposed drainage network has been included in **Section 7** of this report. This sets out the mitigation works to ensure the on-going functionality of the design following construction.

The design is considered deliverable in a sustainable and safe manner and, as such, is considered compliant with Standard 7.

7 SuDS and Drainage Management and Maintenance Plan

The proposed SuDS, Drainage Management and Maintenance strategy detailed below is based on the drainage proposals detailed in **Appendix G** of this report. The long-term management of surface water drainage assets, including any SuDS components, is essential to ensure they continue to function to their design standard.

7.1.1 Timetable

The relevant attenuation basins, bio-retention areas and a swale will be constructed after the construction of the proposed buildings. During construction the developer will adopt temporary measures to ensure adequate treatment and attenuation of run-off is provided. During this period, enhanced maintenance will be undertaken to ensure that such drainage measures continue to operate as designed and any defects can be rectified prior to completion of site works.

7.1.2 Maintenance and Management

The proposed drainage system will consist of inspection chambers, manholes, flow control manholes, pipes and rainwater downpipes. The proposed SuDS features comprise of swale, SuDS pipes, bio-retention areas (raingardens), tree root cells and permeable paving.

The piped drainage networks (incl. inspection chambers, pipes etc) and SuDS (incl. swale, SuDS pipes, bio-raingardens, tree root cells and permeable paving) will be maintained by a management company (currently unknown), which will be appointed by the developer. The developer shall ensure that the measures outlined below form part of the management company contract details, for the ongoing maintenance of all private drainage and SuDS features on site.

The adoptable drainage pipes (laterals), inspection chambers / manholes (demarcation chambers) are to be maintained by the statutory adopting drainage authority (i.e. TWUL).

The proposed maintenance requirements for each proposed private / adoptable drainage component and SuDS solutions is detailed in **Table 7-1** to **Table 7-6**. These requirements are in line with the recommendations of the CIRIA report C753 “The SuDS Manual, 2015”.

In addition to the information shown below, reference shall be made to the Aquacell Manual, GBU Rootspace Manual, Hydro International Manual and Kalrgester manual for maintenance guidelines / recommendations.

Table 7-1 – Maintenance Schedule of Private/Adoptable Drainage

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove sediment and debris from inspection chambers, manholes and catchpits	Annually
	Cleaning of gutters and any filters on downpipes	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals

Table 7-2 – Maintenance Schedule of SuDS Pipe

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from catchpit manhole	Annually
	Remove sediment from catchpit manhole	Annually
	Remove any root ingress	As required
Occasional Maintenance	Clear perforated pipework of blockages	As required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals

Table 7-3 – Maintenance Schedule of Roofs with Granular Material

Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of water and structural stability.	Annually and after severe storms.
	Inspect granular layer for evidence of erosion channels and identify any sediment sources.	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage.	Annually and after severe storms
Regular Maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with any plant growth if present.	Six monthly and annually or as required.

	Remove fallen leaves and debris from deciduous plant foliage.	Six monthly or as required.
	Remove nuisance and invasive vegetation including weeds.	Six monthly or as required.
	Mow grasses, prune shrubs and manage other planting (if applicable) as required. Clippings should be removed and not allowed to accumulate.	Six monthly or as required.
Remedial Actions	If erosion channels are evident, these should be stabilized with extra soil substrate similar to the original material, and sources of erosion damage should be identified and control.	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate.	As required

Table 7-4 – Maintenance Schedule of Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record dewatering time of facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary.	Quarterly
	Check operation of underdrains.	Annually
	Assess plants for disease, infection poor growth, invasive species etc. and replace as necessary	Quarterly
	Inspect inlets and outlets for blockages	Quarterly
Regular Maintenance	Cleaning, Brush regularly and remove sweepings from all hard surfaces	Monthly
	Brush and vacuum surface once a year to prevent silt blockage and enhance design life	Annually
Occasional Maintenance	Brush and vacuum surface once a year to prevent silt blockage and enhance design life	Annually
Remedial Actions	Monitor effectiveness of permeable pavements, and when water does not infiltrate immediately advise the client of possible need for reinstatement of top layer or specialist cleaning. Recent experience suggests that jet washing and suction cleaning will substantially reinstate pavement to 90% efficiency	As required

Table 7-5 – Maintenance Schedule of Bio-retention Areas (Raingardens)

Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect infiltration surface for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate to determine if maintenance is necessary)	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth and, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockages	Quarterly
Regular Maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetics reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build up from around the inlets or from forebays	Quarterly to biannually
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial Actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Table 7-6 – Maintenance Schedule of Swales

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and surface debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season) or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect vegetation coverage	Monthly for 6months, quarterly for 2years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth after plant types to better suit conditions if required.	As required or if base soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or re-seeding	As required
	Re-level uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As Required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

8 Foul Water Drainage Strategy

New drainage infrastructure will be provided to collect foul flows from the Site and discharge to the nearby public foul sewer network. It is proposed to upgrade the existing 150mm diameter pipe connection into the TWUL manhole with reference 0901 to a 225mm diameter pipe, subject to S106 agreement with TWUL.

The foul water from the proposed buildings will be directed to the proposed foul drainage network shown in the drainage drawings in **Appendix G**.

The proposed onsite foul water sewers are sized based on 4000l/dwelling/day in accordance with the guidance provided by *'Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code")* and as detailed below:

$$Q \text{ Peak Foul Flows Residential} = 293 \text{ dwellings} \times 4000 / (24 \times 60 \times 60) = 13.6 \text{ l/s}$$

The foul water flows from the proposed flexible Class E commercial floorspace have been estimated using the "Foul Sewer Design Flow", Surveyor Publication 1992 (6.0DWF) based on an assumed 750l/day use per 100m² of commercial floorspace, and as detailed below:

$$Q \text{ Peak Foul Flows Commercial} = 1,742\text{m}^2 / 100\text{m}^2 \times 750\text{l} / (10 \times 60 \times 60) \times 6 = 2.2 \text{ l/s}$$

Therefore, the total foul water flows from the proposed development have been estimated to be 15.8l/s

$$Q \text{ Peak Total} = Q \text{ Peak Foul Flows Residential} + Q \text{ Peak Foul Flows Commercial} = 15.8 \text{ l/s}$$

The proposed main/carrier foul water sewer within the Site is detailed as 225mm diameter at a gradient 1 in 150. The full-bore capacity of this pipe is estimated to be 37.2l/s based on the Colebrook White formula. This means that the proposed carrier pipe will have sufficient capacity to drain the peak foul water flows from the proposed development.

A Preplanning Enquiry has been submitted to TWUL to confirm capacity at the proposed connection point.

9 Conclusions

Building Design Consultants has been appointed by Chase New Homes Ltd to prepare a Flood Risk Assessment and Drainage Strategy to support a full planning application for the proposed development at 2-6 High Street, Potter Bar, Herts, EN6 5BA.

There are no Environment Agency 'main rivers' within the Site. The nearest 'main river' is Turkey Brook, originating at Oakmere Park and Potters Bar Brook originating to the west of Oakmere Park, both approximately 350m north of the Site.

The EA's groundwater SPZ maps (Magic Map) show that the Site is located within Groundwater Source Protection Zone I (SPZ1), Inner Protection Zone.

According to the Environment Agency's indicative floodplain mapping, the Site is entirely located within Flood Zone 1, an area with low flood risk with an annual risk of flooding from fluvial sources is <0.1% AEP.

Whilst the majority of the Site is considered as being at a 'Very Low' susceptibility to surface water flooding, there are some areas located within the site boundary of higher susceptibility. These isolated areas of flooding within the Site occur within topographic depressions, with flooding in these areas to be either removed due to raising of levels or managed through the proposed onsite drainage network and SuDS train. Therefore, a NPPF Sequential Test is not required due to the mitigation measures for surface water flooding being proposed.

The risk of flooding from groundwater, sewers, and artificial sources is considered low.

The surface water drainage strategy detailed in this report has been prepared in accordance with the National Standards for SuDS (June 2025).

Various SuDS techniques have been considered viable for this development and have been integrated within the proposals to form a SuDS management train. This will provide an adequate level of treatment and attenuation.

The proposed drainage system will be capable of managing runoff from all rainfall events up to and including the critical duration of a 1 in 100-year storm event plus 40% allowance for climate change. Residual surface water runoff will be wholly stored on-site by means of a series of SuDS features. Discharge of surface water will be limited to the 1 in 2year greenfield runoff rate for all storms up to and including 1 in 100years plus climate change and offer the requisite treatment of surface water as informed by CIRIA Guidance Document C753.

The foul drainage from the proposed development will drain into the existing public foul sewers in High Street

In conclusion, this FRA demonstrates that the proposals are consistent with the aims of NPPF, PPG, Development Plan as well as being compliant with all the necessary standards from the new National Standards for SuDS.

The Site would not be at risk of flooding or increase the flood risk to others as a result of the proposed development, and the proposed management of surface water runoff is proportionate for the development.

Appendix A

Development Plans

Appendix B

Topographic Survey and Drainage Records

Appendix C

BGS Maps, Ground Investigation and Infiltration Tests

Appendix D

TWUL Records and Predev Report

Appendix E

EA Flood Maps

Appendix F

LLFA Flood Maps and Correspondence

Appendix G

Surface Water Drainage Drawings

Appendix H

Surface Water Drainage Calculations

Appendix J

Attenuation Tank, Tree Root Cells, and Hydrobrake Maintenance Manuals

Appendix K

Drainage and SuDS Checklist



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Billericay

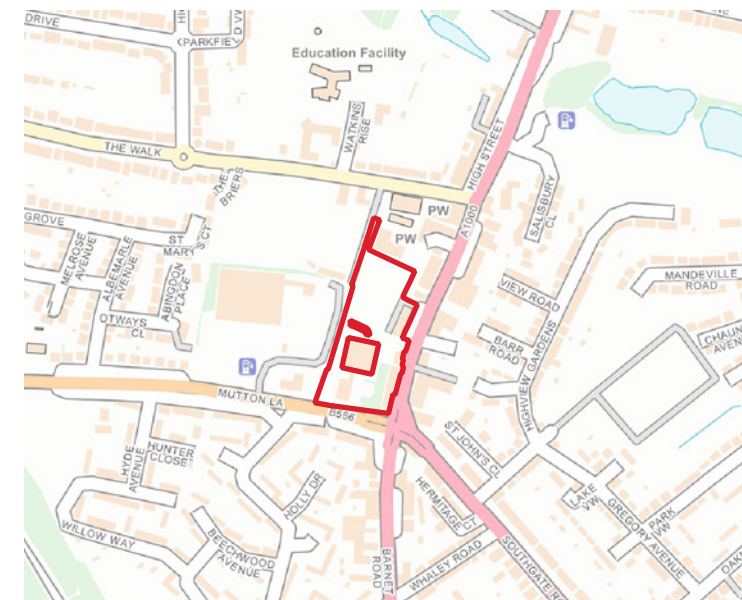
Unit 5 – First Floor
Lake Meadows Business Park
Woodbrook Crescent,
Billericay, Essex
CM12 0EQ
T: +44 (0)1277 314 455

London

Tower Bridge Business Centre
Office.311
46-48 East Smithfield
London
E1W 1AW
T: +44 (0)207 871 7783

Appendix A

Development Plans



Not to scale

Legend
— Site Boundary

Site Location Plan

0 100 200 m

Scale 1:2500 @ A4

bdc



Room Key

- 1 Bed
- 2 Bed
- 3 Bed
- Plant Room
- Bikes
- Class E (Commercial)
- Lobby
- Refuse
- Commercial Refuse

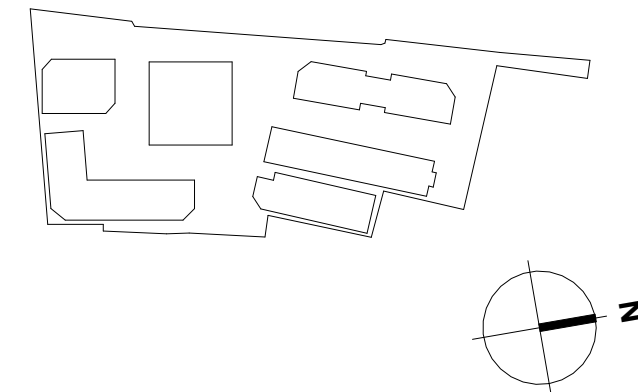
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NOTES

Check and verify all dimensions prior to commencement of work.
This drawing shall be read in conjunction with all other contract documents including those by other consultants, and including specifications. Seek clarification of inconsistencies / conflicts.
Figured dimensions shall take precedence to scaled dimensions.

P08	29.06.2025	Planning Issue	JW	AK
P07	26.06.2025	Planning Issue	JW	AK
P06	24.04.2025	Planning Issue Draft	FM	AK
P05	07.04.2025	Stage 3 Coordination	JW	AK
P04	19.03.2025	Stage 3 Coordination Update	JW	AK
P03	13.03.2025	Stage 3 Coordination Update	JW	AK
P02	06.03.2025	Stage 3 Coordination Update	JW	AK
P01	16.02.2025	Stage 3 Coordination Update	JW	AK
P00	13.02.2025	Stage 3 Initial Issue	JW	AK
REV	00/00/00	DESCRIPTION	ISSUED BY	CHECK BY

LOCATION PLAN



ARCHITECTS

44-46 Scullion Street
London
EC2A 4HH
London / Melbourne /
Sydney
Tel +44 20 3772 7320
Web www.afkstudios.com



PLANNING CONSULTANT

Baker Parry
33 Bancroft
Hitchin / SG5 1LA

LANDSCAPE

MRG Studio
70 St John Street
London / EC1M 4DT

CLIENT:



PROJECT

Potters Bar High Street
Canada Life Place, High Street
Potters Bar, EN6 5BA

DRAWING TITLE

General Arrangement
Ground Floor Plan

PROJECT No.

44261

STATUS

For Planning

DRAWN

JW

CHECKED

AK

SCALE

1 : 500 @ A1

DRAWING No.

PB-AFK-XX-00-DR-A-20000

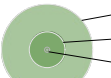
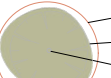
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P08

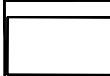
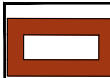
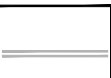
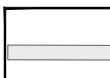
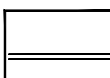
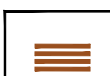
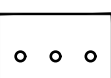
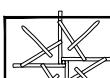




Trees

- **Tree type 1**
40-45 cm girth - single stem
- **Tree type 2**
30-35 cm girth tree - single stem
- **Tree type 3**
20-25 cm girth tree - single stem
- **Tree type 4**
2.0-2.5 m high tree - multi stem
- **Tree type 5**
18-20 cm girth tree - single stem
- **Tree type 6**
2.0 m high tree - multi stem
- **Shrub type 1**
1.0 - 1.5 m high
- **Tree type 7**
Crown spread at 20+ years
Trunk girth at 20+ years (outer circle)
+ at installation (inner circle)
- **Tree type 8**
Existing category A tree
- **Tree type 9**
Existing category B tree
- **Tree type 10**
Existing category C tree
- **Tree type 11**
Root protection zone from tree survey
Crown outline from tree survey
Tree symbol with trunk from survey (Rev C)

Structure & Furniture

- **Edge type 1**
Raised planters along eastern car park
frontage - 1000mm high x 1000mm
deep x width as shown in plan
- **Edge type 2**
Flush planters with brick edge - High
street extension 3000mm x 450mm
wide x 1600mm x 450mm deep
- **Edge type 3**
Raised brick planters - High street
extension 300mm high
- **Edge type 4**
Raised brick planters - High street
extension 500mm high
- **Edge type 5**
Brick edge along main paths in private
communal courtyards
- **Edge type 6**
Existing wall along the western
boundary
- **Wall type 1**
Retaining wall at retained car park
access to lower deck and
south-western corner
- **Wall type 2**
Balustrade along Steps type 1 and 2
- **Balustrade type 1**
Balustrade along Steps type 1 and 2
- **Balustrade type 2**
Balustrade along Steps type 1 and 2
- **Steps type 1**
Steps adjacent to Block D
- **Steps type 2**
Steps up to the existing substation -
Concrete steps
- **Steps type 3**
Steps to the southern entrance of the
retained car park
- **Steps type 4**
Retainable borders to control service
access
- **Furniture type 1**
Bench
- **Furniture type 2**
Sheffield cycle stands
- **Play type 1**
Formal play element
- **Furniture type 3**
Formal play element

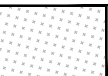
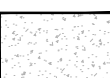
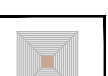
Note

LEGEND - General arrangement

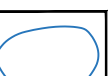
Site

- **Red line boundary**
- **Land within applicant ownership (outside application boundary)**

Paving

- **Paving type 1**
General shared surface, exclusively
pedestrian access and surface with
occasional vehicular access for servicing
- **Paving type 2**
Shared surface
(Utility corridor running beneath -
impermeable paving)
- **Paving type 3**
Tactile and visually contrasting paving
line between occasional vehicular and
exclusively pedestrian shared surface
- **Paving type 4**
Permeable visually contrasting paving
on vehicular part of shared surface at
formal crossings
- **Paving type 5**
Tactile and visually contrasting paving
on pedestrian part of shared surface at
formal crossings
- **Paving type 6**
Vehicle and cycle parking
(Cobble stone with open gaps)
- **Paving type 7**
Transitional areas from public to private
communal
- **Paving type 8**
Paths associated with southern
courtyard
- **Paving type 9**
Paths associated with southern
courtyard (Utility corridor running
beneath - impermeable paving)
- **Paving type 10**
Paths associated with northern
courtyard and southern courtyard path
on mound
- **Paving type 11**
High Street and Falcon Lane frontage
(Matching existing following Hertsmere
guidance)
- **Paving type 12**
Play surface for high impact areas
- **Paving type 13**
Stepping stone trails for informal
movement - Flush to 300mm high
- **Paving type 14**
Lightweight gravel fill
- **Paving type 15**
Tree root protection grille

Planting

- **Layered planting**
- **Layered planting on mounds**
- **Extended existing boundary hedgerow**
- **Existing hedgerow**
- **Multifunctional depression area**
- **Densely planted depression**
- **Planting type 1**
Private gardens with hedges
- **Planting type 2**
Climber planting along retained car
park western frontage - Planted in
ground
- **Planting type 3**
Climber planting along retained car
park eastern frontage - Planted in
planters
- **Mound outline**
- **SuDS depression outline**

revision	date	by	chkd	appr	description
01	26-06-26	OR	JM	JM	Planning issue
00	19-06-26	OR	JM	JM	Planning draft issue for comment

landscape architect

MRG Studio

client

Chase New Homes

project

Potters Bar High Street

drawing title

General landscape arrangement

drawing number

MRG-268-PBH-PL-0100

scale	date	revision
1:500 on A1 1:1000 on A3	01-05-26	01

drawn by	checked by	approved by
OR	JM	JM

Do not scale off this drawing. Use figured dimensions only. All dimensions and levels to be checked and confirmed on site. MRG Studio does not accept responsibility for accuracy of survey information. Do not build from this drawing. This drawing is copyright.



Note

LEGEND - Roof plan

Site

	Red line boundary		Land within applicant ownership (outside application boundary)
--	-------------------	--	--

Structure with planting on retained car park

	Planter type 1 Raised planters along eastern car park frontage - 1000mm high x 1000mm deep x width as shown in plan		Planting type 8 Vertical planting with climbers - Planted in ground on the west and in planters on the east retained car park frontages
	Planting type 13 Climbers reaching horizontally over the car park deck on the lightweight structure		Structure type 1 Lightweight structure on the retained car park top deck with horizontal and vertical rigid posts and wires in between
	Structure type 2 Climber trellis - Parallel anchored, self supporting but attached to retained car park frontage		Structure type 3 Climber trellis - Parallel anchored, self supporting but attached to retained car park frontage

revision	date	by	chkd	appr	description
01	26-06-26	OR	JM	JM	Planning issue
00	19-06-26	OR	JM	JM	Planning draft issue for comment
revision	date	by	chkd	appr	description

landscape architect

MRG Studio

client

Chase New Homes

project

Potters Bar High Street

drawing title

Roof plan

drawing number

MRG-268-PBH-PL-0200

scale	date	revision
1:500 on A1 1:1000 on A3	01-05-26	01

drawn by	checked by	approved by
OR	JM	JM

Do not scale off this drawing. Use figured dimensions only. All dimensions and levels to be checked and confirmed on site. MRG Studio does not accept responsibility for accuracy of survey information. Do not build from this drawing. This drawing is copyright.

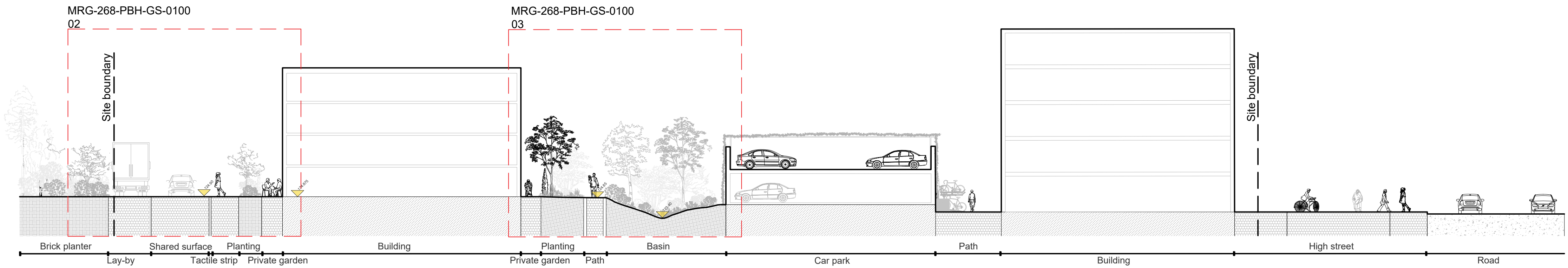
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Roof plan

Scale 1:500 @A1

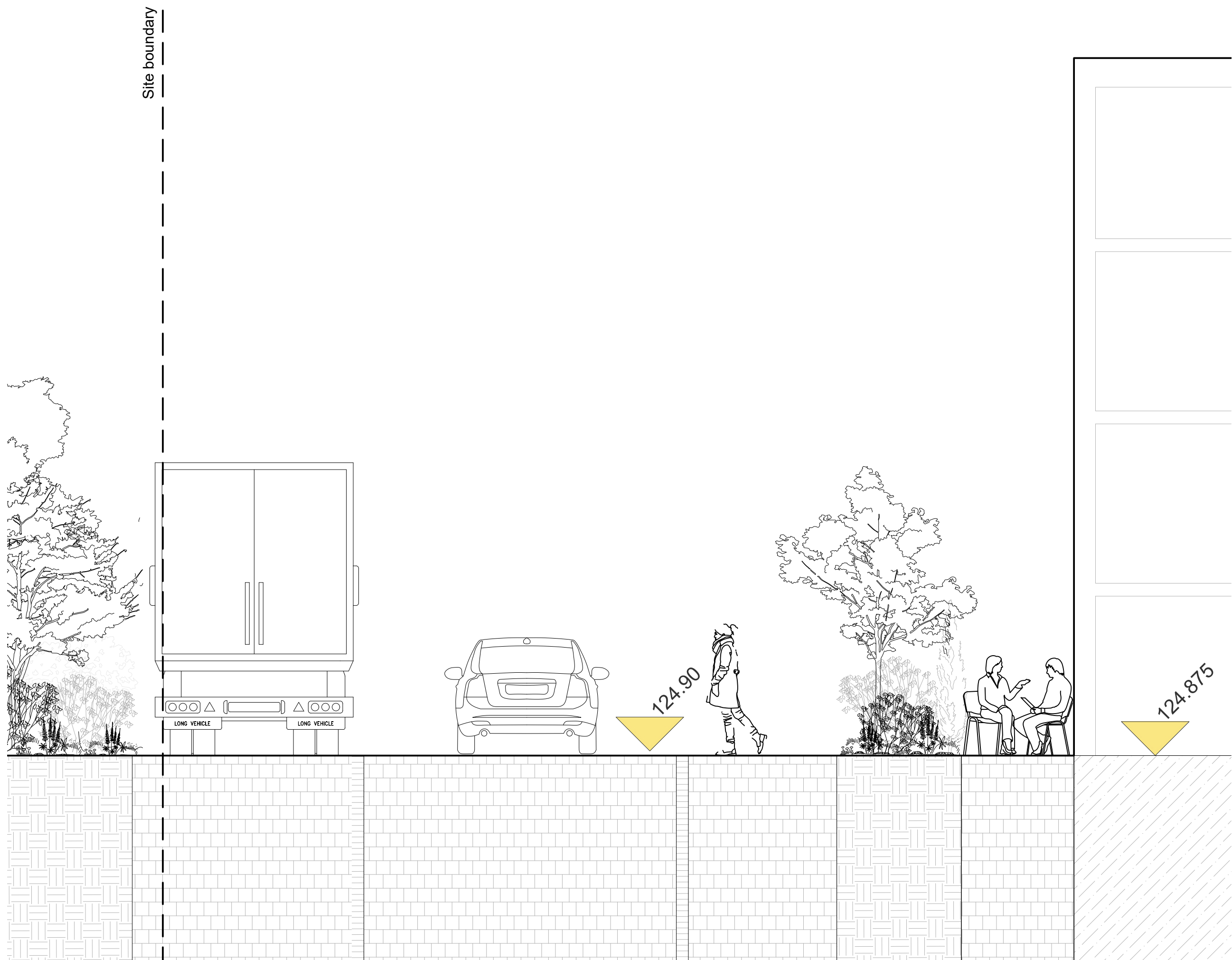
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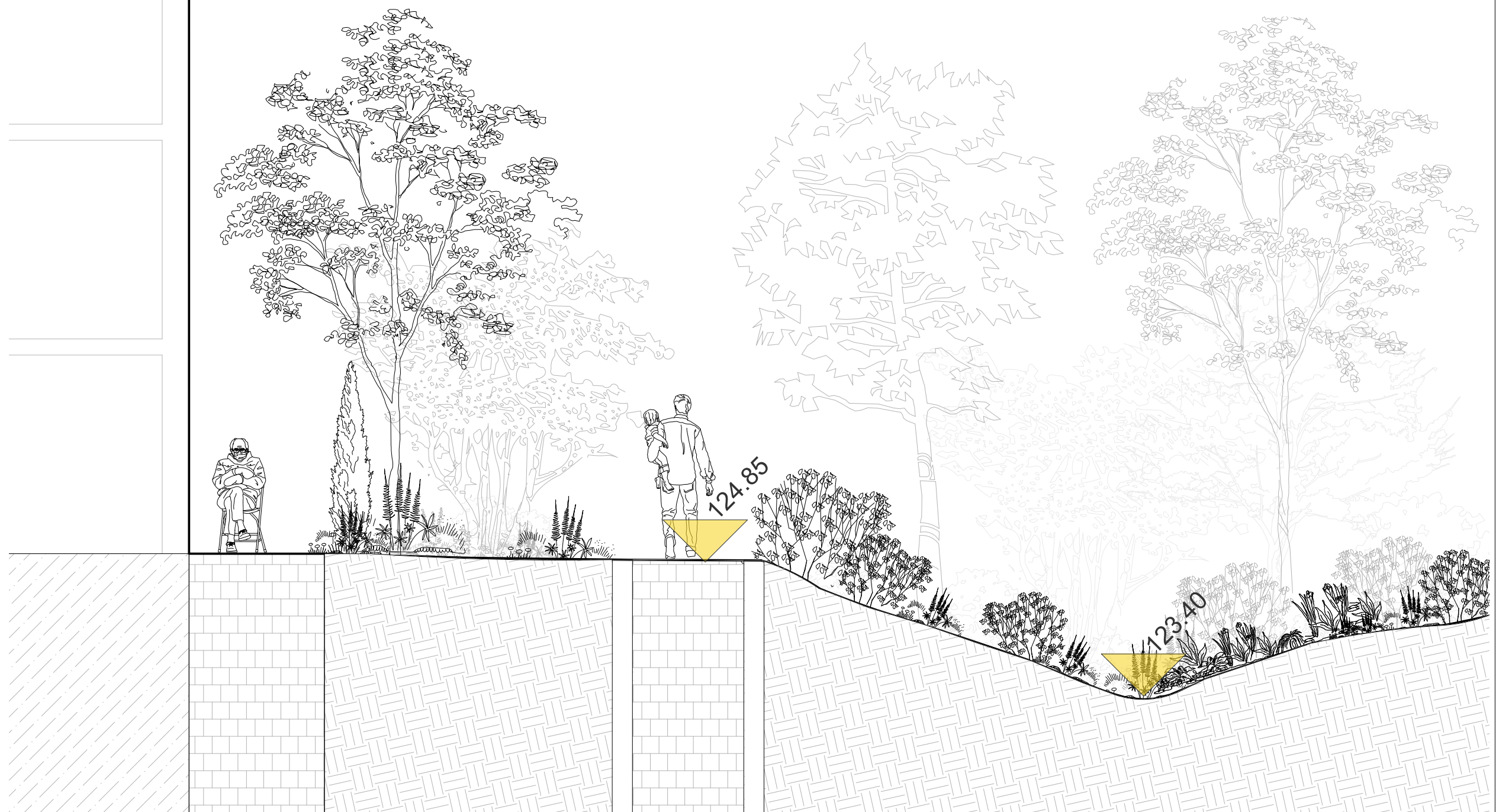


01 Section north AA
Scale 1:200 @A1

0m 10 20

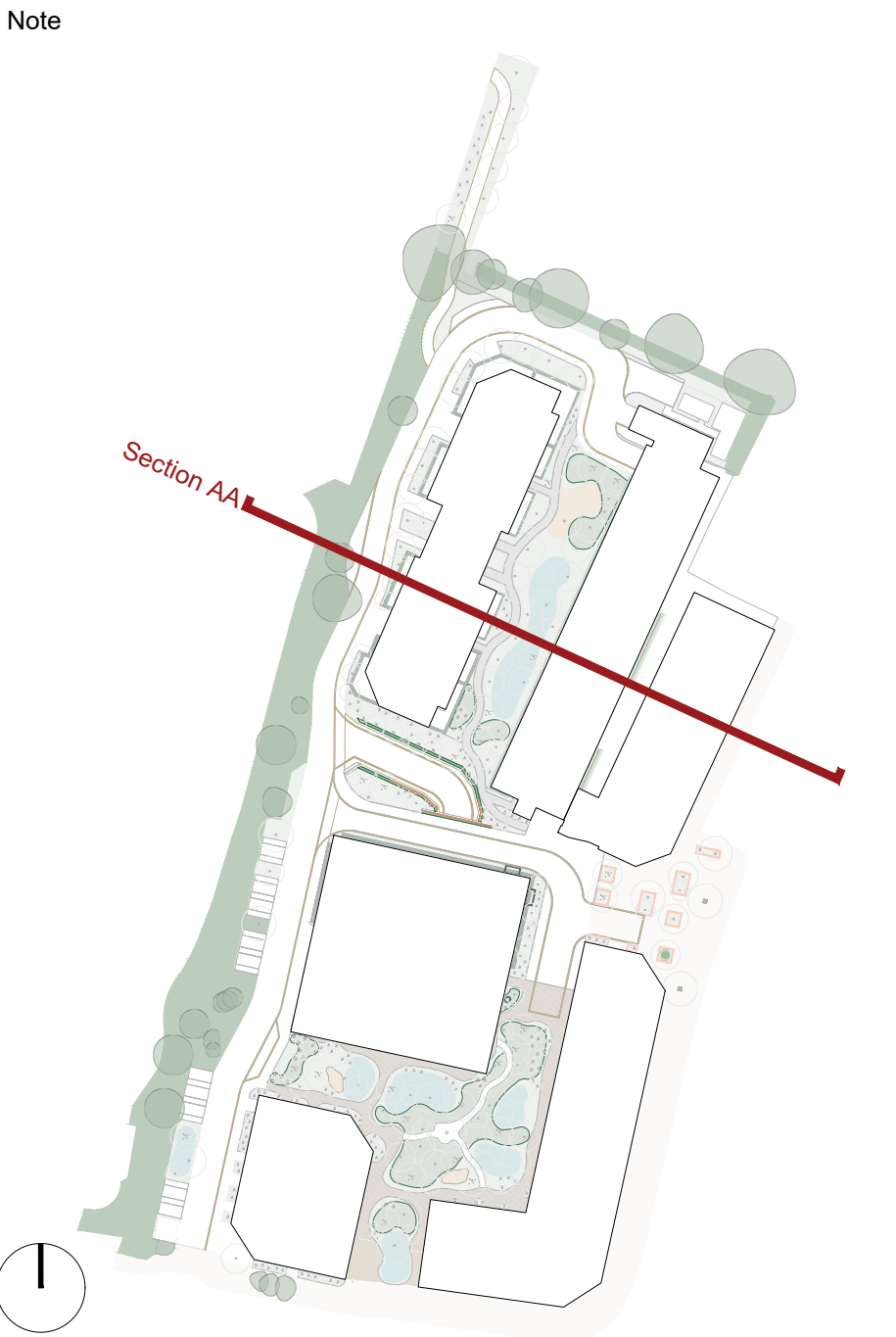


02 Section north-south axis
Scale 1:50 @A1



03 Section northern courtyard
Scale 1:50 @A1

0m 5



Note

revision	date	by	chkd	appr	description
01	26-06-26	AO	OR	JM	Planning issue
00	19-06-26	AO	OR	JM	Planning draft issue for comment

landscape architect

MRG Studio

client

Chase New Homes

project

Potters Bar High Street

drawing title

General Section - North (Sheet 1 / 3)

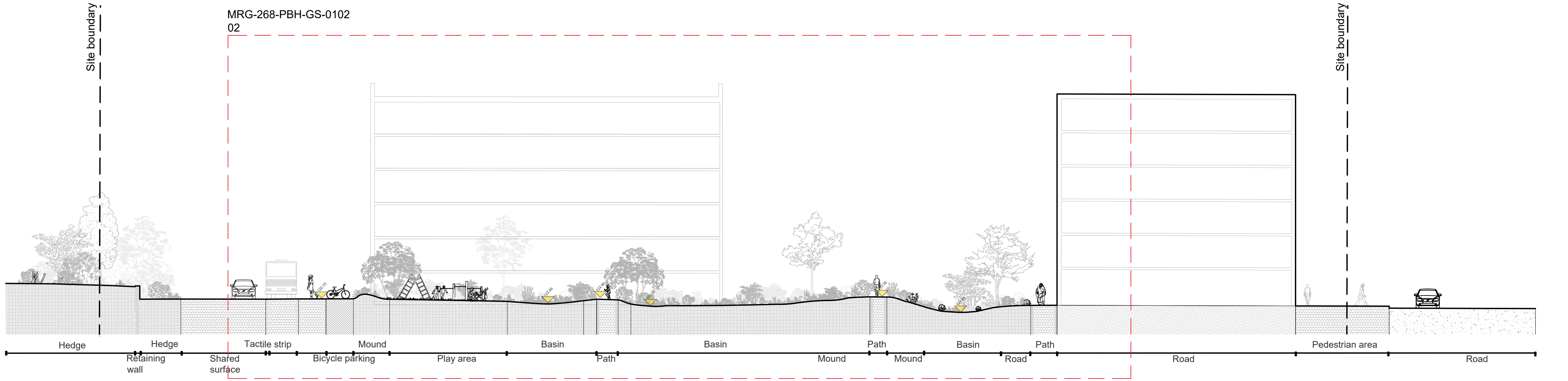
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MRG-268-PBH-GS-0100

scale	date	revision
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1:400 on A3		
1:50 on A1		
1:100 on A3		

drawn by	checked by	approved by
AO	OR	JM

Do not scale off this drawing. Use figured dimensions only. All dimensions and levels to be checked and confirmed on site. MRG Studio does not accept responsibility for accuracy of survey information. Do not build from this drawing. This drawing is copyright.



01 Section south CC
Scale 1:200 @A1

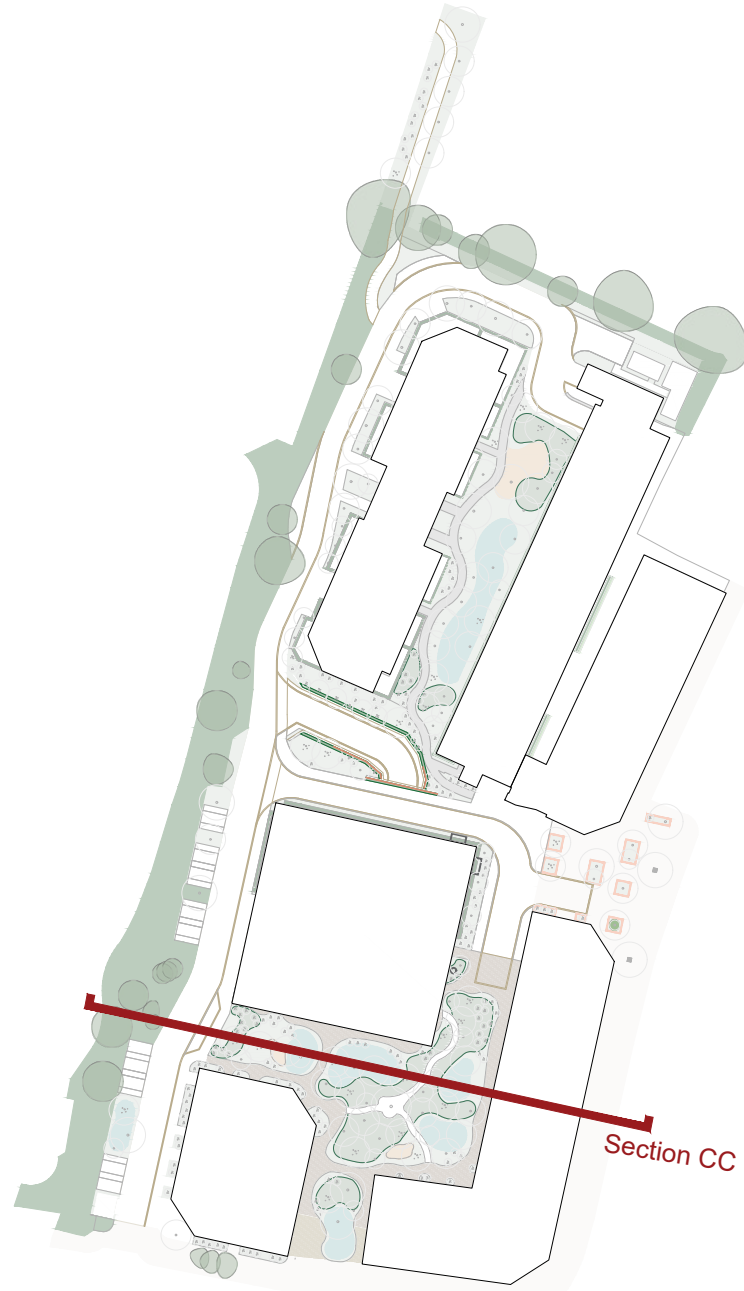
0m 10 20



02 Section south CC
Scale 1:100 @A1

0m 5 10

Note



1

01	26-06-26	AO	OR	JM	Planning issue
00	19-06-26	AO	OR	JM	Planning draft issue for comment
revision	date	by	chkd	appr	description

landscape architect

MRG Studio

client

Chase New Homes

project

Potters Bar High Street

drawing title

General Section - South (Sheet 3 / 3)

drawing number

MRG-268-PBH-GS-0102

scale	date	revision
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drawn by	checked by	approved by
AO	OR	JM

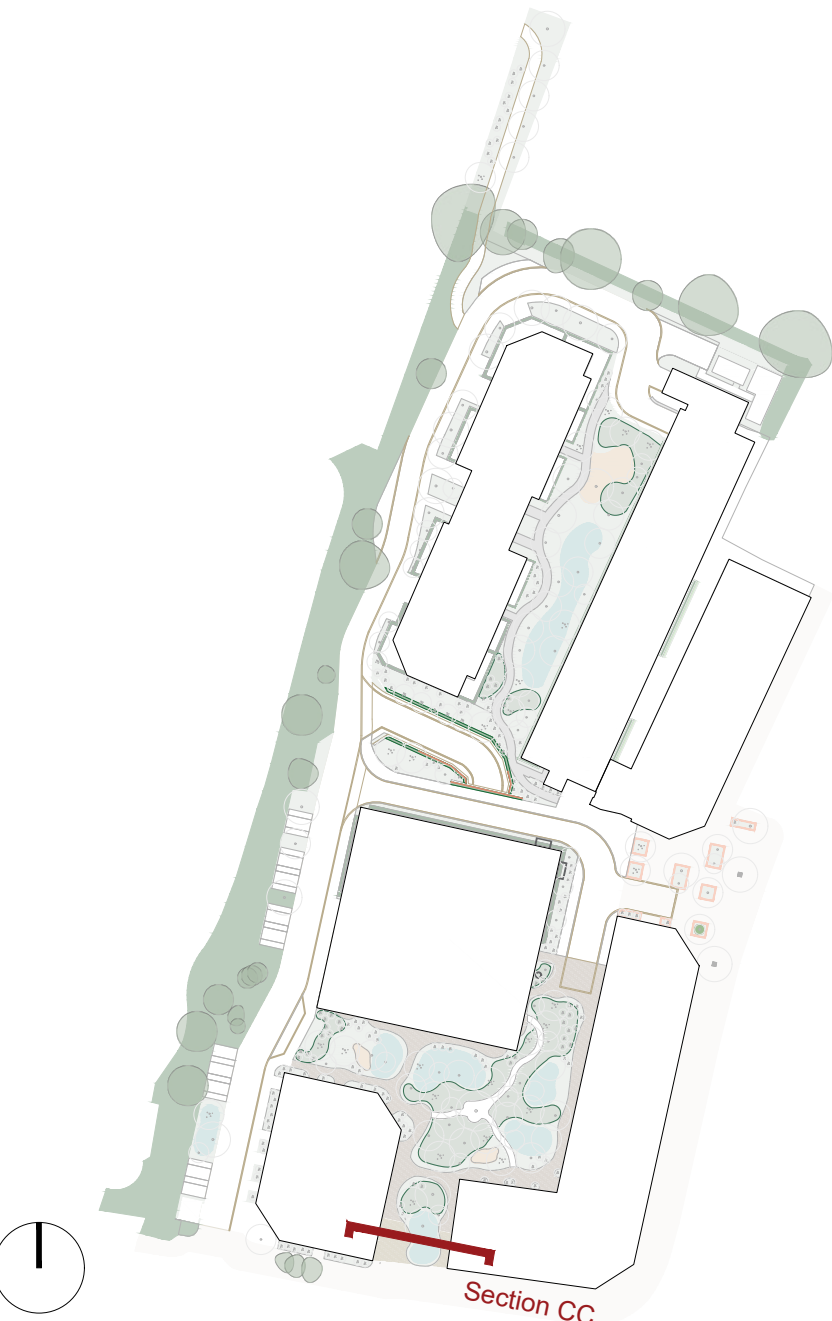
Do not scale off this drawing. Use figured dimensions only. All dimensions and levels to be checked and confirmed on site. MRG Studio does not accept responsibility for accuracy of survey information. Do not build from this drawing. This drawing is copyright.



01 Section south bioswale AA
Scale 1:50 @A1

0m 5

Note



01	26-06-26	AO	OR	JM	Planning issue
00	19-06-26	AO	OR	JM	Planning draft issue for comment
revision	date	by	chkd	appr	description

landscape architect

MRG Studio

client

Chase New Homes

project

Potters Bar High Street

drawing title

Threshold Section - South Bioswale (Sheet 1 / 2)

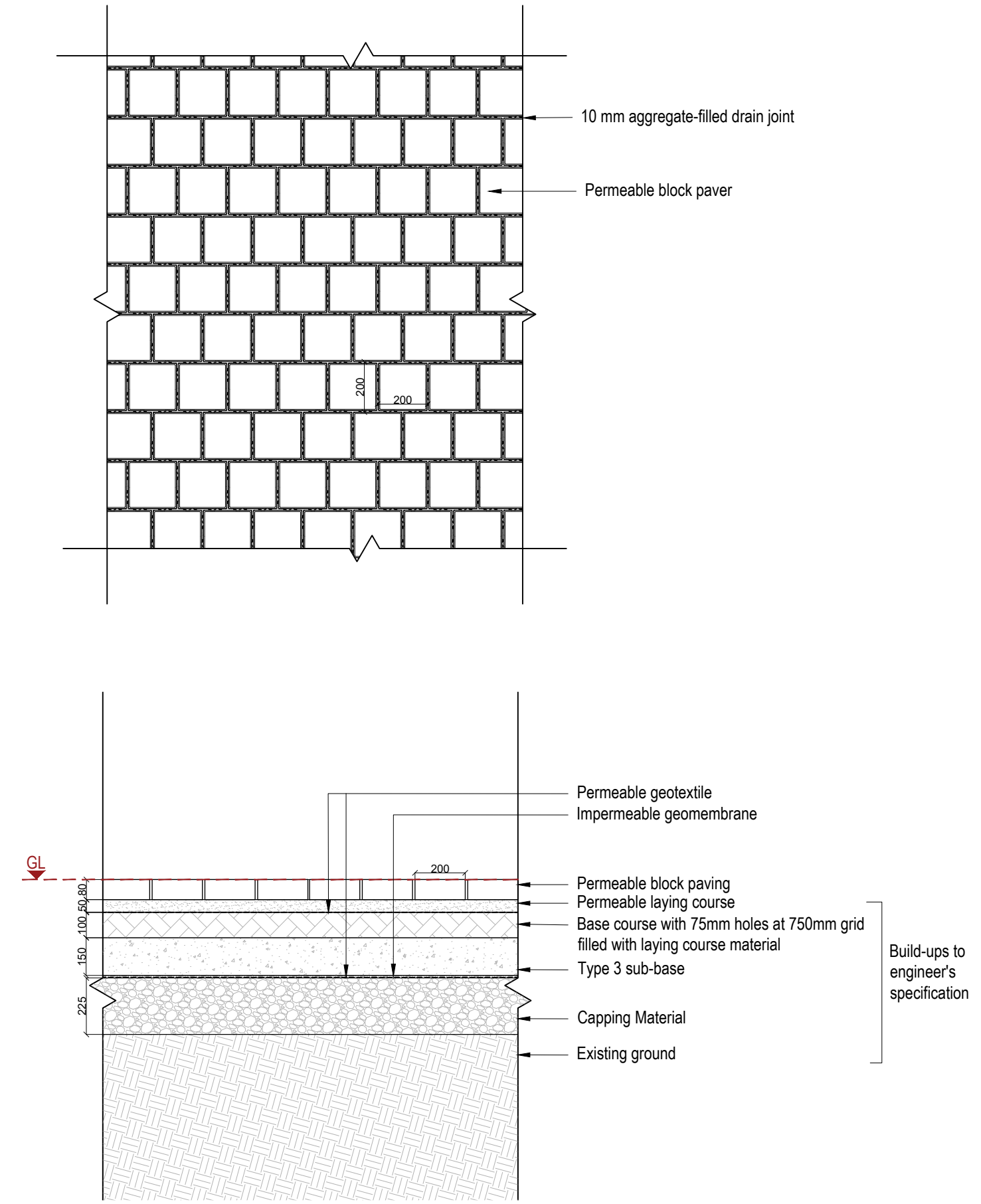
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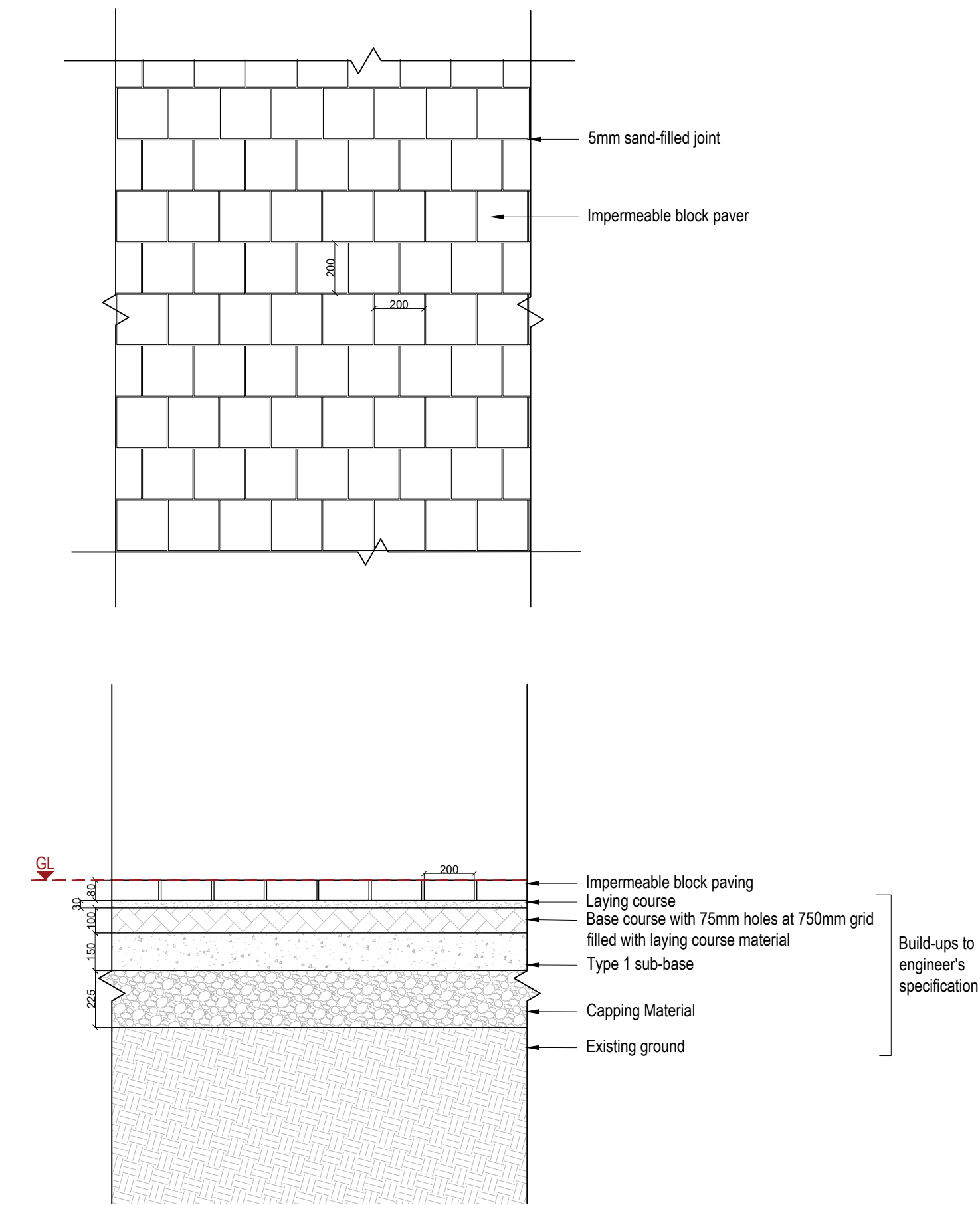
scale	date	revision
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1:100 on A3		

drawn by	checked by	approved by
AO	OR	JM

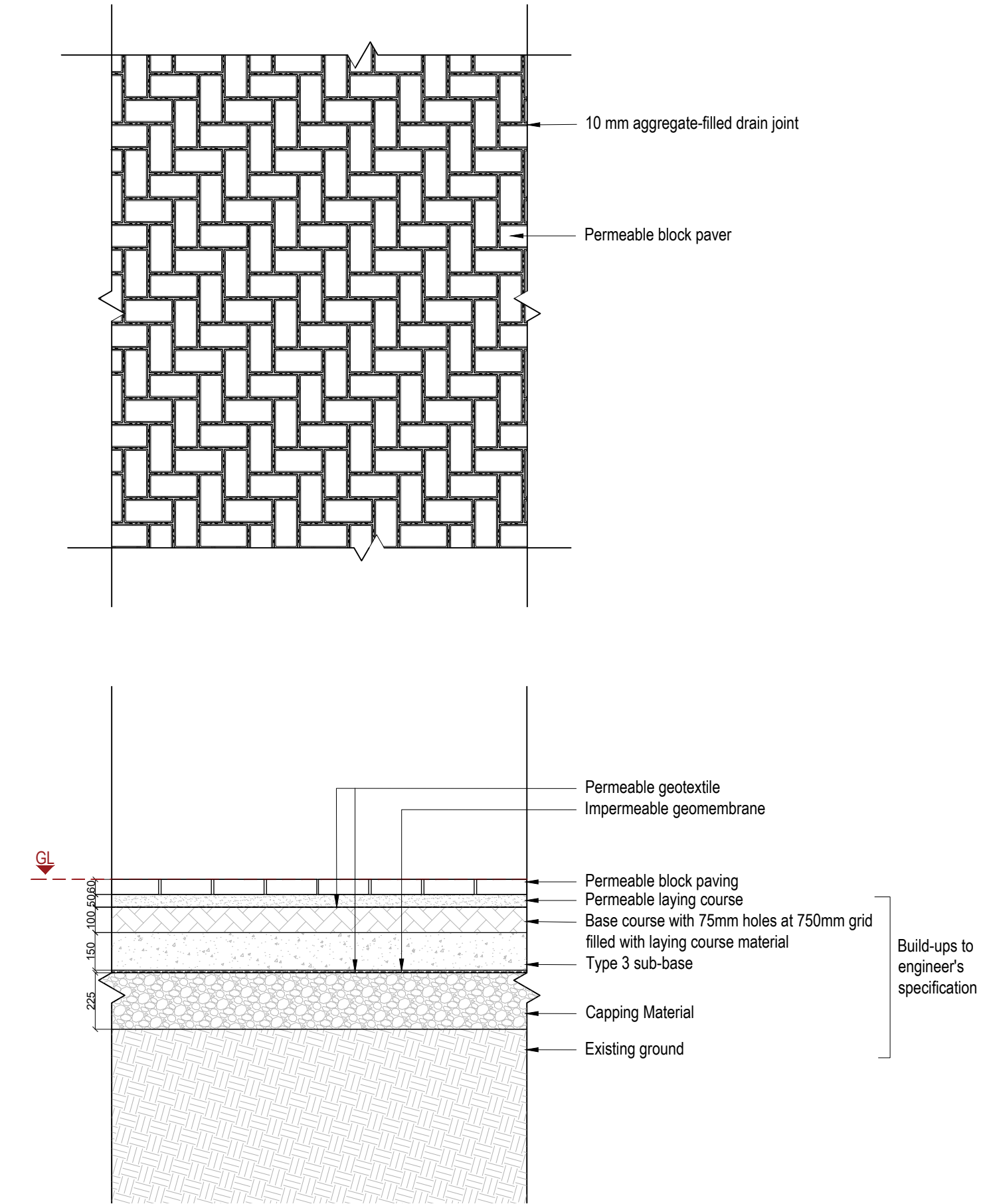
Do not scale off this drawing. Use figured dimensions only. All dimensions and levels to be checked and confirmed on site. MRG Studio does not accept responsibility for accuracy of survey information. Do not build from this drawing. This drawing is copyright.



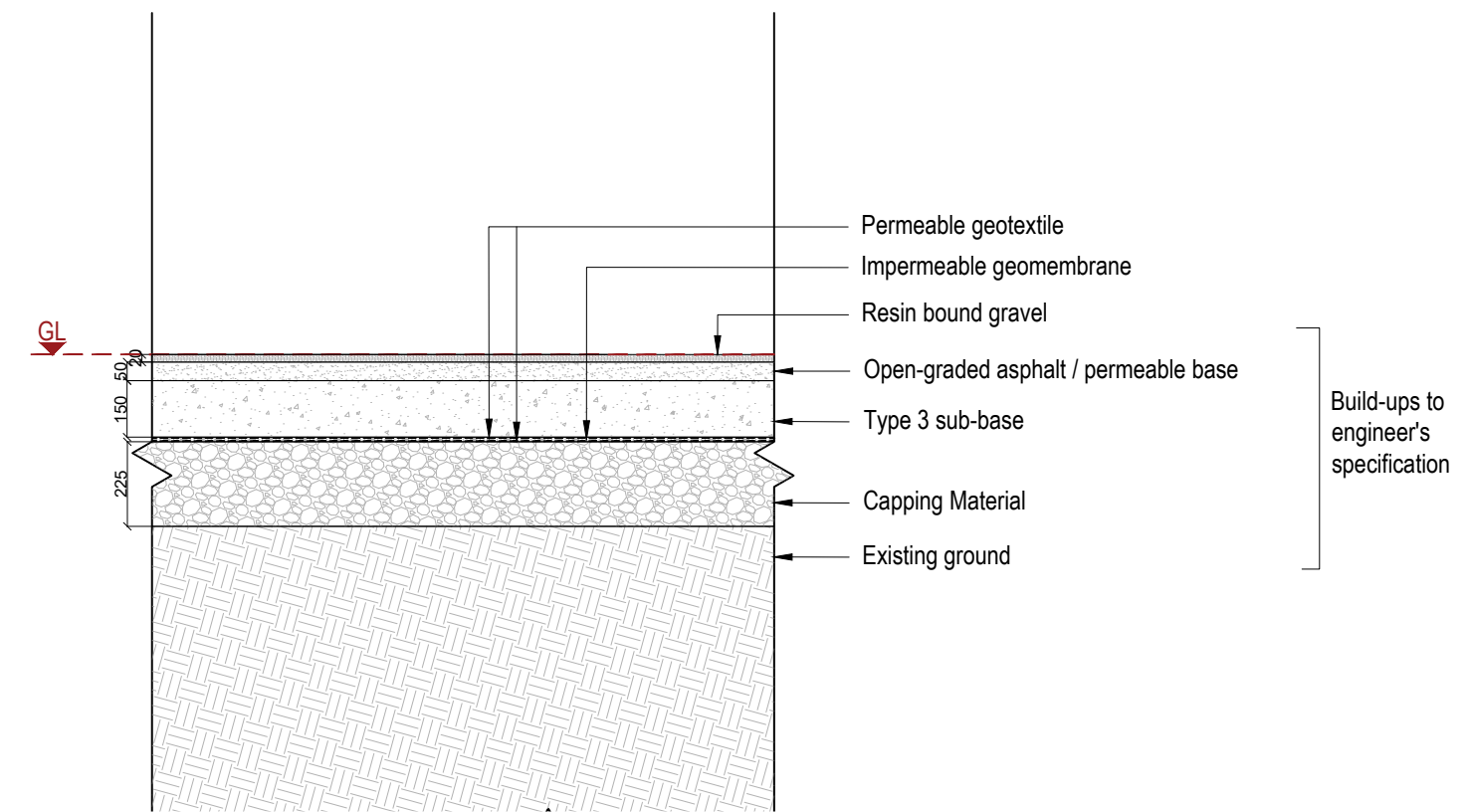
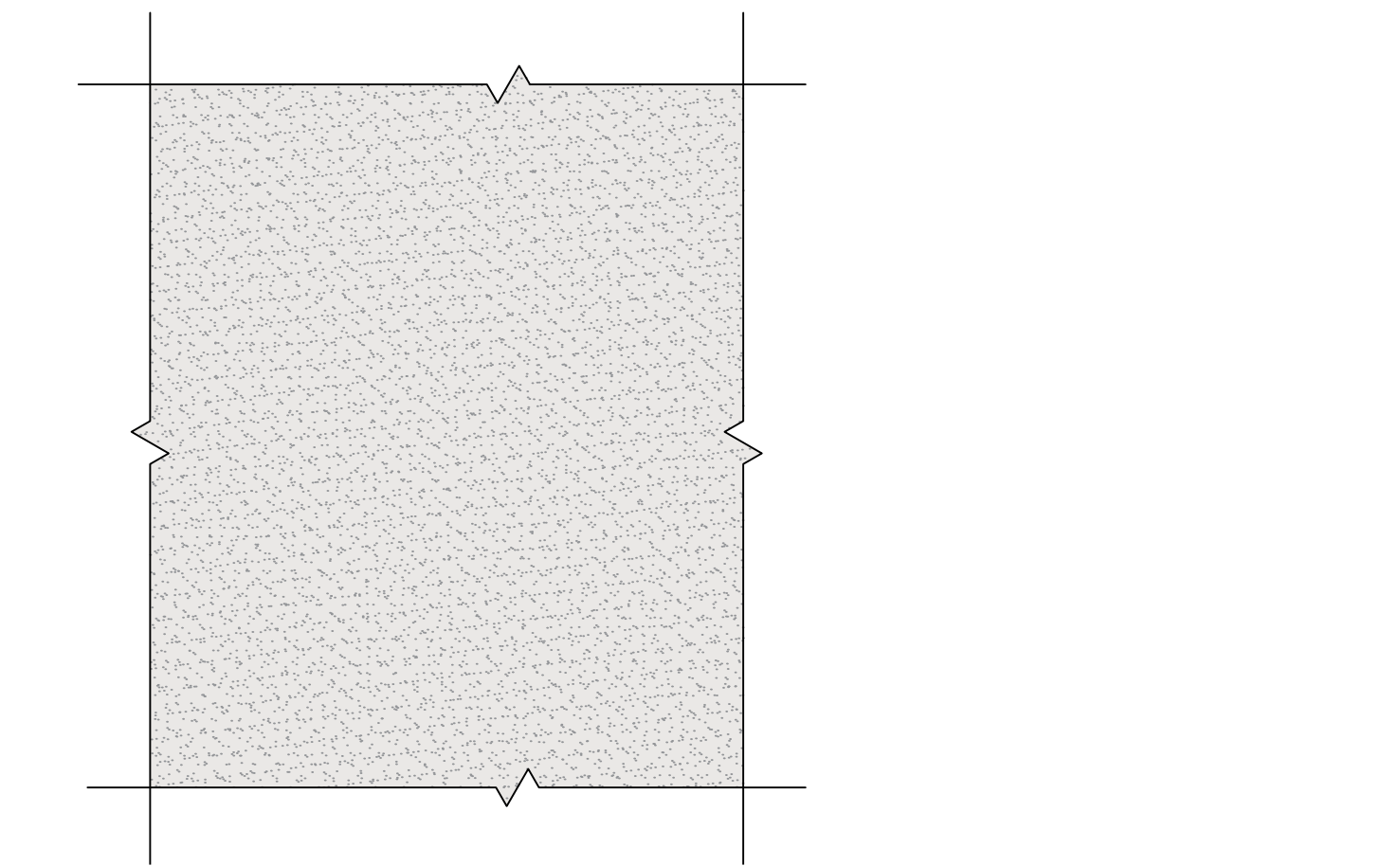
01 Permeable shared surface paving - Paving type 1
Scale 1: 20 @A1



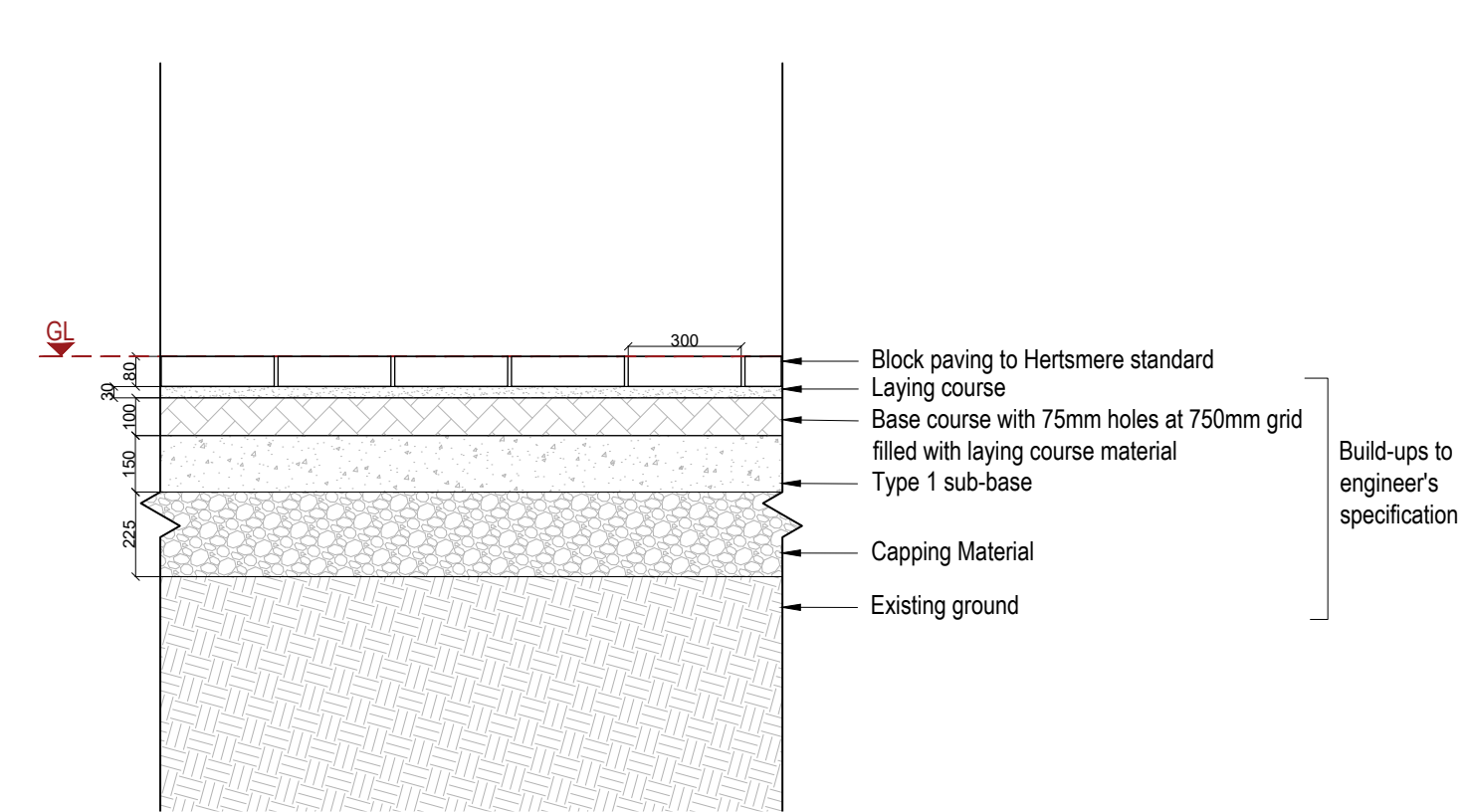
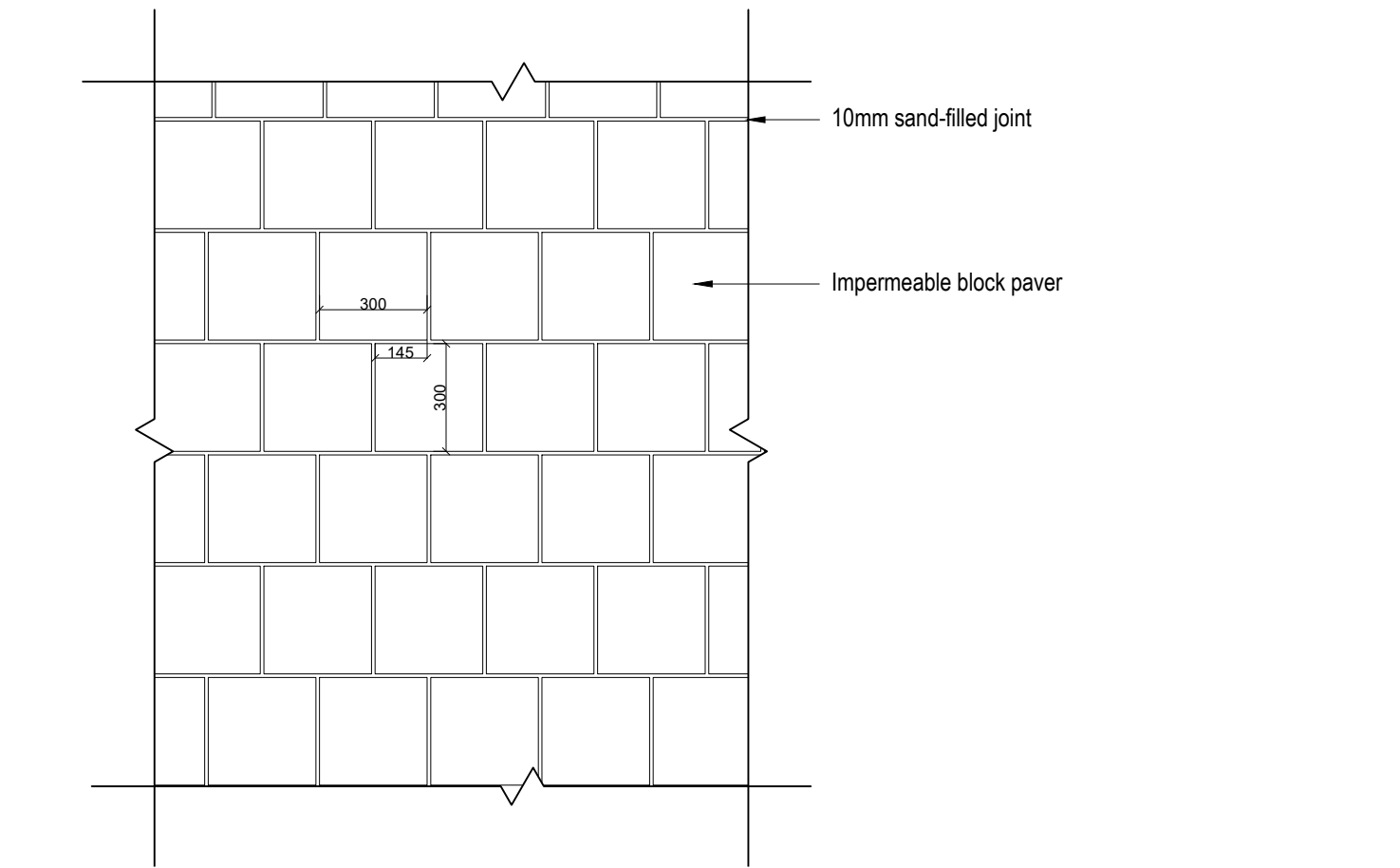
02 Impermeable shared surface paving - Paving type 2
Scale 1: 20 @A1



03 Permeable courtyard block paving - Paving type 9
Scale 1: 20 @A1



04 Permeable courtyard resin bound gravel paving - Paving type 10
Scale 1: 20 @A1



05 Impermeable High Street and Mutton lane paving - Paving type 11
Scale 1: 20 @A1

Note

01	26-06-26	OR	JM	JM	Planning issue
00	19-06-26	OR	JM	JM	Planning draft issue for comment
revision	date	by	chkd	appr	description

landscape architect

MRG Studio

client

Chase New Homes

project

Potters Bar High Street

drawing title

Hard landscape details

drawing number

MRG-268-PBH-DE-0100

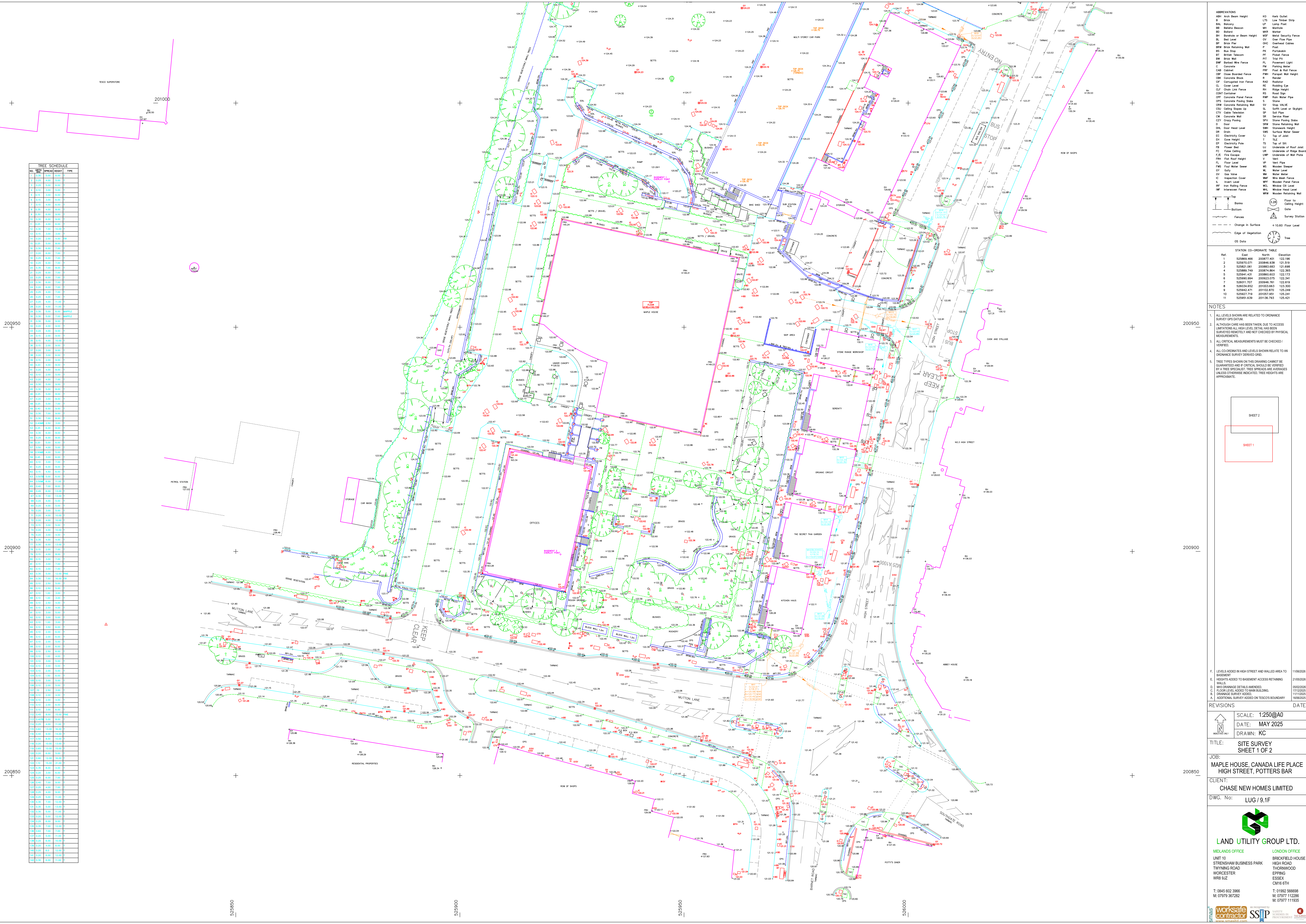
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drawn by	checked by	approved by
OR	JM	JM

Do not scale off this drawing. Use figured dimensions only. All dimensions and levels to be checked and confirmed on site. MRG Studio does not accept responsibility for accuracy of survey information. Do not build from this drawing. This drawing is copyright.

Appendix B

Topographic Survey and Drainage Records



STATION CO-ORDINATE TABLE			
Ref.	East	North	Elevation
1	525869.466	200877.401	122.196
2	525970.071	200846.938	121.519
3	525821.061	200883.683	121.698
4	525889.749	200874.864	122.365
5	525694.431	200860.603	122.173
6	525990.991	200923.075	122.341
7	526011.707	200846.761	122.619
8	526034.652	201003.663	123.300
9	525942.471	201012.870	125.249
10	525927.719	201057.951	125.241
11	525951.639	201136.793	125.421

- | |
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| |
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REVISIONS		DATE
	SCALE: 1:250@A0	
	DATE: MAY 2025	
	DRAWN: KC	
TITLE: SITE SURVEY SHEET 1 OF 2		
JOB: MAPLE HOUSE, CANADA LIFE PLACE HIGH STREET, POTTERS BAR		
CLIENT: CHASE NEW HOMES LIMITED		

DWG. No: LUG / 9.1F



LAND UTILITY GROUP LTD.

MIDLANDS OFFICE LONDON OFFICE

UNIT 10
STRENHAM BUSINESS PARK
TWINING ROAD
WORCESTER
WS9 6JZ

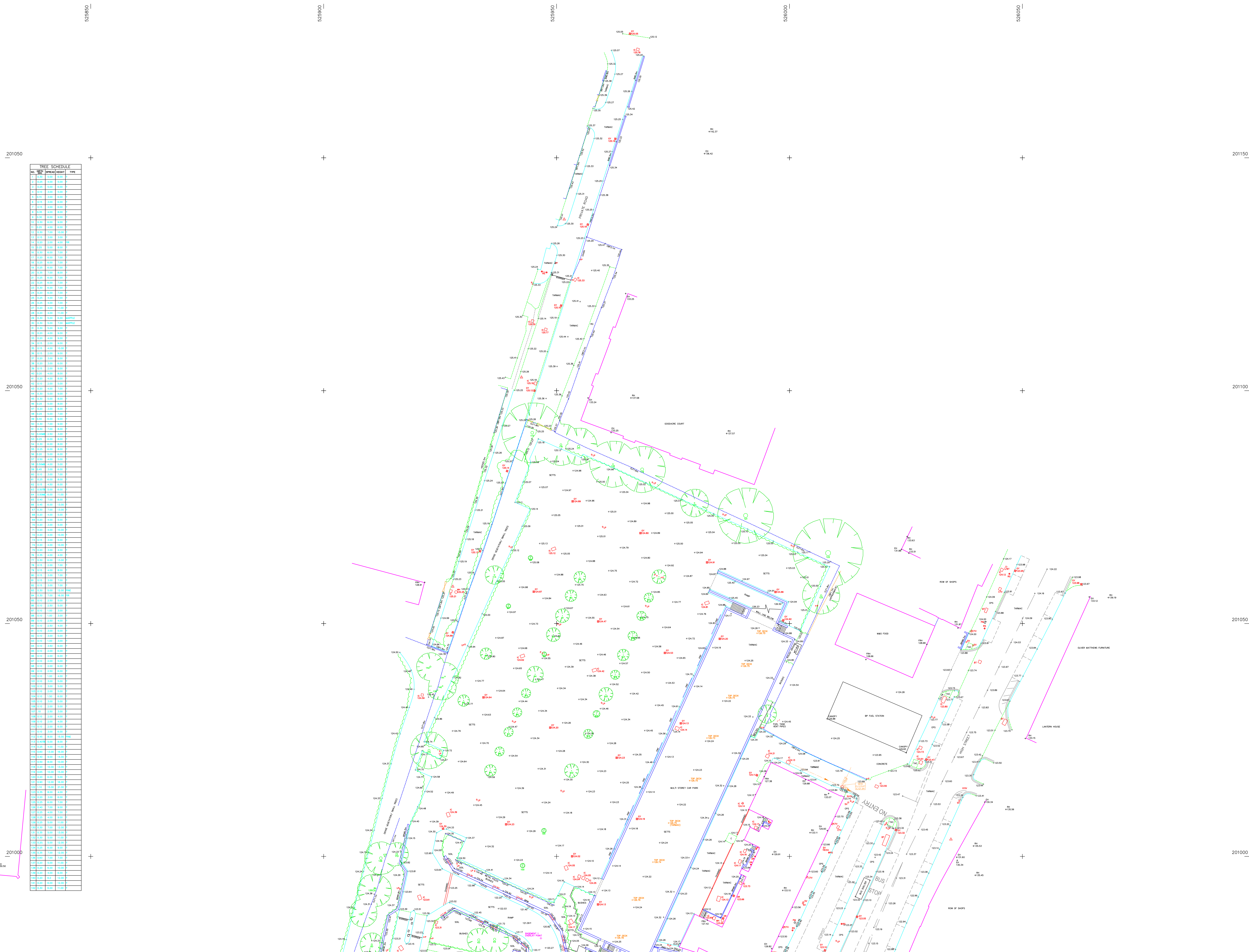
BRICKFIELD HOUSE
HIGH ROAD
THORNWOOD
EPPING
ESSEX
CM16 6TH

T: 0845 602 3966
M: 07979 367262

T: 01992 566698
M: 07977 112298
M: 07977 119353

  as managed by  SAFETY
SERVICES
FOR
PERMANENT
ASSESSMENT

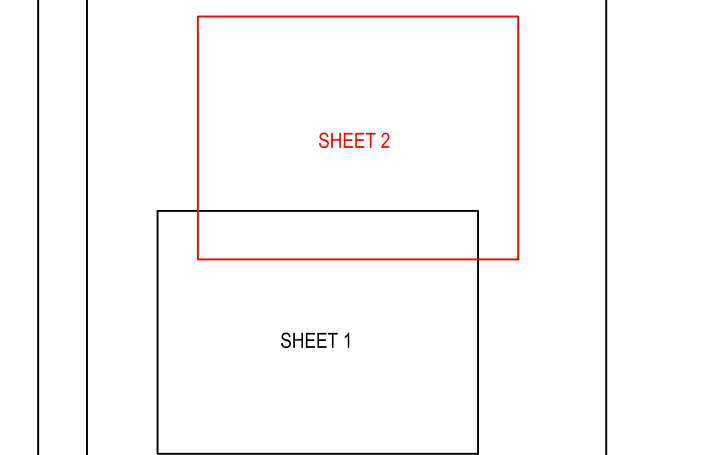

www.emas4all.co.uk

[illegible]

STATION CO-ORDINATE TABLE			
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3	525821.061	520883.683	121.698
4	525889.749	520874.864	122.365
5	525941.431	520860.603	122.173
6	525990.994	520923.075	122.341
7	525051.707	520485.767	122.619
8	525034.652	521003.663	123.300
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11	525991.639	521136.793	125.421

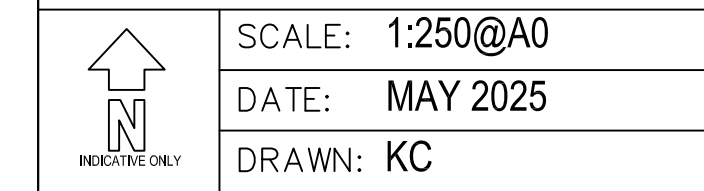
NOTES

- | | |
|----|---|
| 1. | ALL LEVELS SHOWN ARE RELATED TO ORDNANCE SURVEY GPS DATUM. |
| 2. | ALTHOUGH CARE HAS BEEN TAKEN, DUE TO ACCESS LIMITATIONS ALL HIGH LEVEL DETAIL HAS BEEN SURVEYED REMOTELY AND NOT CHECKED BY PHYSICAL MEASUREMENTS. |
| 3. | ALL CRITICAL MEASUREMENTS MUST BE CHECKED / VERIFIED. |
| 4. | ALL CO-ORDINATES AND LEVELS SHOWN RELATE TO AN ORDNANCE SURVEY DERIVED GRID. |
| 5. | THREE TYPES SHOWN ON THIS DRAWING CANNOT BE GUARANTEED AND IF CRITICAL SHOULD BE VERIFIED BY A TREE SPECIALIST. TREE SPREADS ARE AVERAGES UNLESS OTHERWISE INDICATED. TREE HEIGHTS ARE APPROXIMATE. |



F.	LEVELS ADDED IN HIGH STREET AND WALLED AREA TO BASEMENT	11/06/2026
E.	HEIGHTS ADDED TO BASEMENT ACCESS RETAINING WALLS.	21/05/2026
D.	MH3 DRAINAGE DETAILS AMENDED.	05/02/2026
C.	FLOOR LEVEL ADDED TO MAIN BUILDING.	17/12/2025
B.	DRAINAGE SURVEY ADDED.	11/11/2025
A.	ADDITIONAL SURVEY ADDED ON TESCO'S BOUNDARY	16/06/2025

REVISIONS	DATE
-----------	------



TITLE: SITE SURVEY
SHEET 2 OF 2

JOB:
MAPLE HOUSE, CANADA LIFE PLACE

CLIENT:

CHASE NEW HOMES LIMITED

LUG / 9.2F

LAND UTILITY GROUP LTD.

MIDLANDS OFFICE	LONDON OFFICE
UNIT 10	BRICKFIELD HOUSE

STRENSHAM BUSINESS PARK
TWYNING ROAD
WORCESTER

WORCESTER	LEITHING
WR8 9JZ	ESSEX
	CM16 6TH

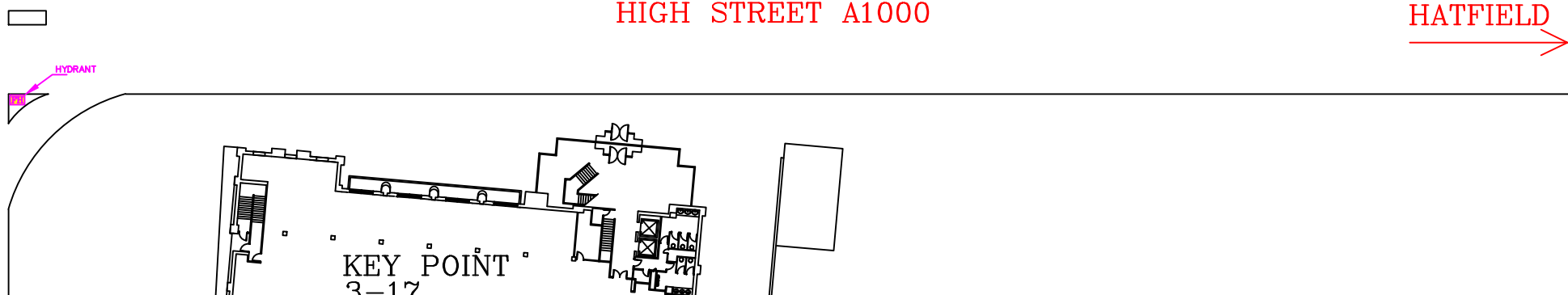
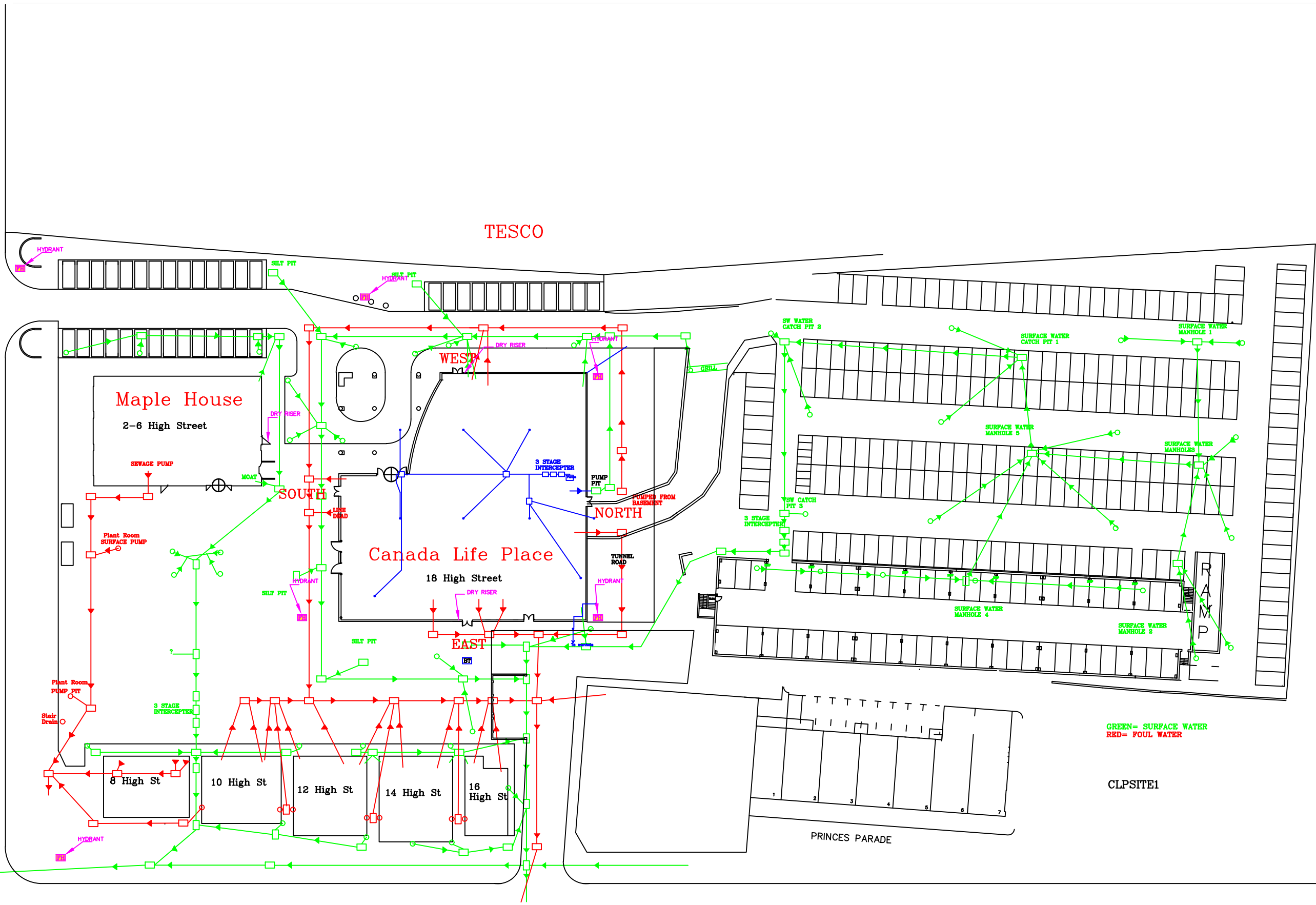
T: 0845 602 3966
M: 07979 367282



 as recognised by

 SAFETY
 SCHEMES IN
 PROCUREMENT
 

www.smasltd.com



Rev	Revision	Description	Date

C:\Documents - Area\CLPS\Draw Layout\4 Hatfield - CLPSite.dwg

Floor
SITE

Address
CANADA LIFE PLACE, HIGH STREET,
POTTERS BAR, HERTS. EN6 5BA

Drawing Description
CANADA LIFE PLACE, MAPLE HOUSE
AND KEY POINT SITE LAYOUT

Project Number	Scale	Date
	NTS	06-10-00
Drawing Number	Revision	
POCLPKPSL_06-10-00		
CAD File Reference	Drawn	
CURRENT/HO/SITE	GF	

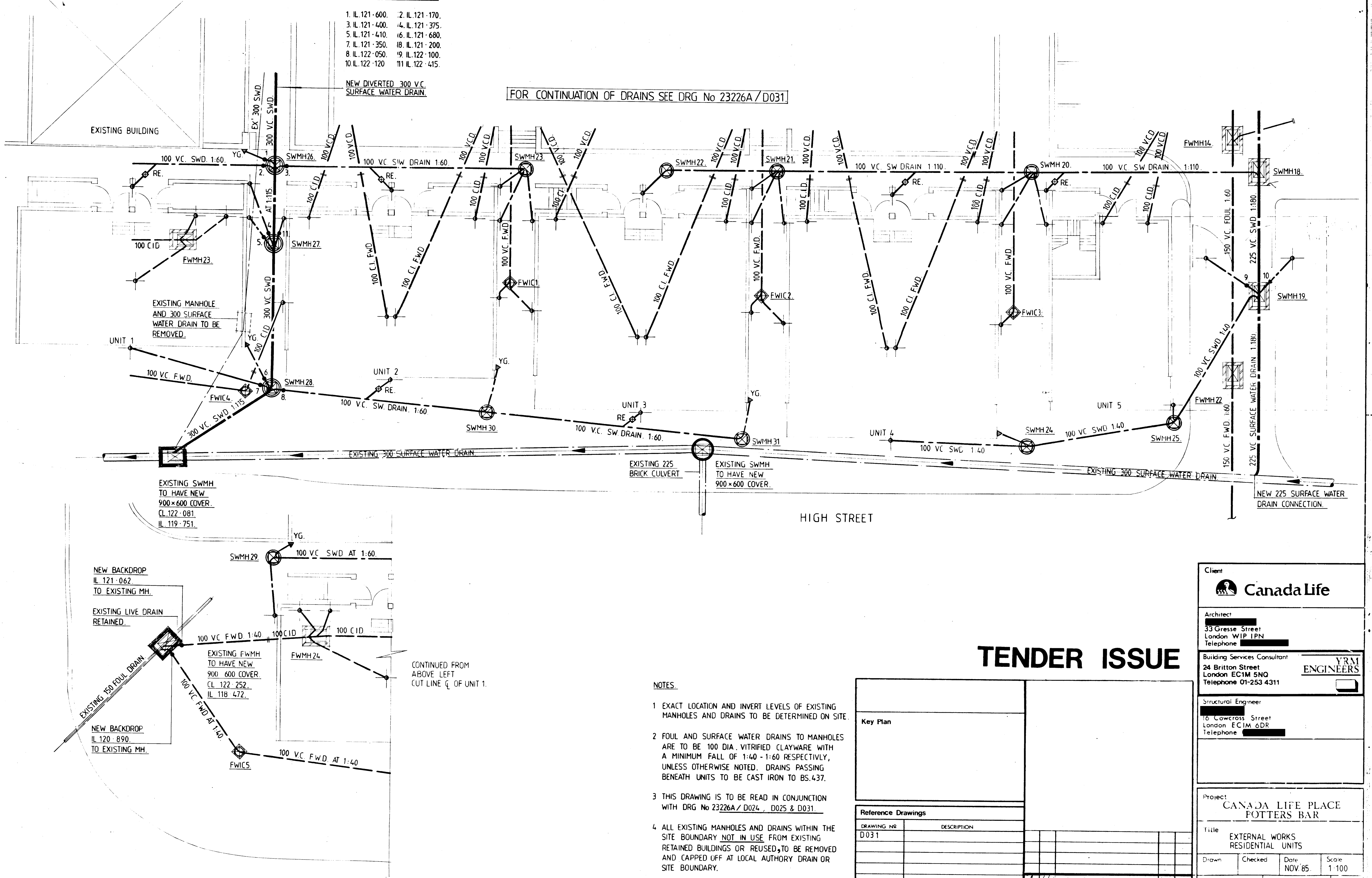
THIS DRAWING IS THE PROPERTY OF CANADA LIFE LTD & MUST NOT BE COPIED, TRACED OR REPRODUCED WITHOUT THEIR WRITTEN CONSENT

**SURFACE WATER MANHOLE
BACKDROP INVERT LEVELS :-**

- | | |
|-----------------|-----------------|
| 1. IL 121-600. | 2. IL 121-170. |
| 3. IL 121-400. | 4. IL 121-375. |
| 5. IL 121-410. | 6. IL 121-680. |
| 7. IL 121-350. | 8. IL 121-200. |
| 8. IL 122-050. | 9. IL 122-100. |
| 10. IL 122-120. | 11. IL 122-415. |

NEW DIVERTED 300 V.C.
SURFACE WATER DRAIN.

FOR CONTINUATION OF DRAINS SEE DRG No 23226A/D031.



EXISTING SWMH
TO HAVE NEW
900x600 COVER.
CL 122-081.
IL 119-751.

NEW BACKDROP
IL 121-062
TO EXISTING MH.

EXISTING LIVE DRAIN
RETAINED.

EXISTING FWMH
TO HAVE NEW
900 600 COVER.
CL 122-252.
IL 118-472.

NEW BACKDROP
IL 120-890.
TO EXISTING MH.

CONTINUED FROM
ABOVE LEFT
CUT LINE Q OF UNIT 1.

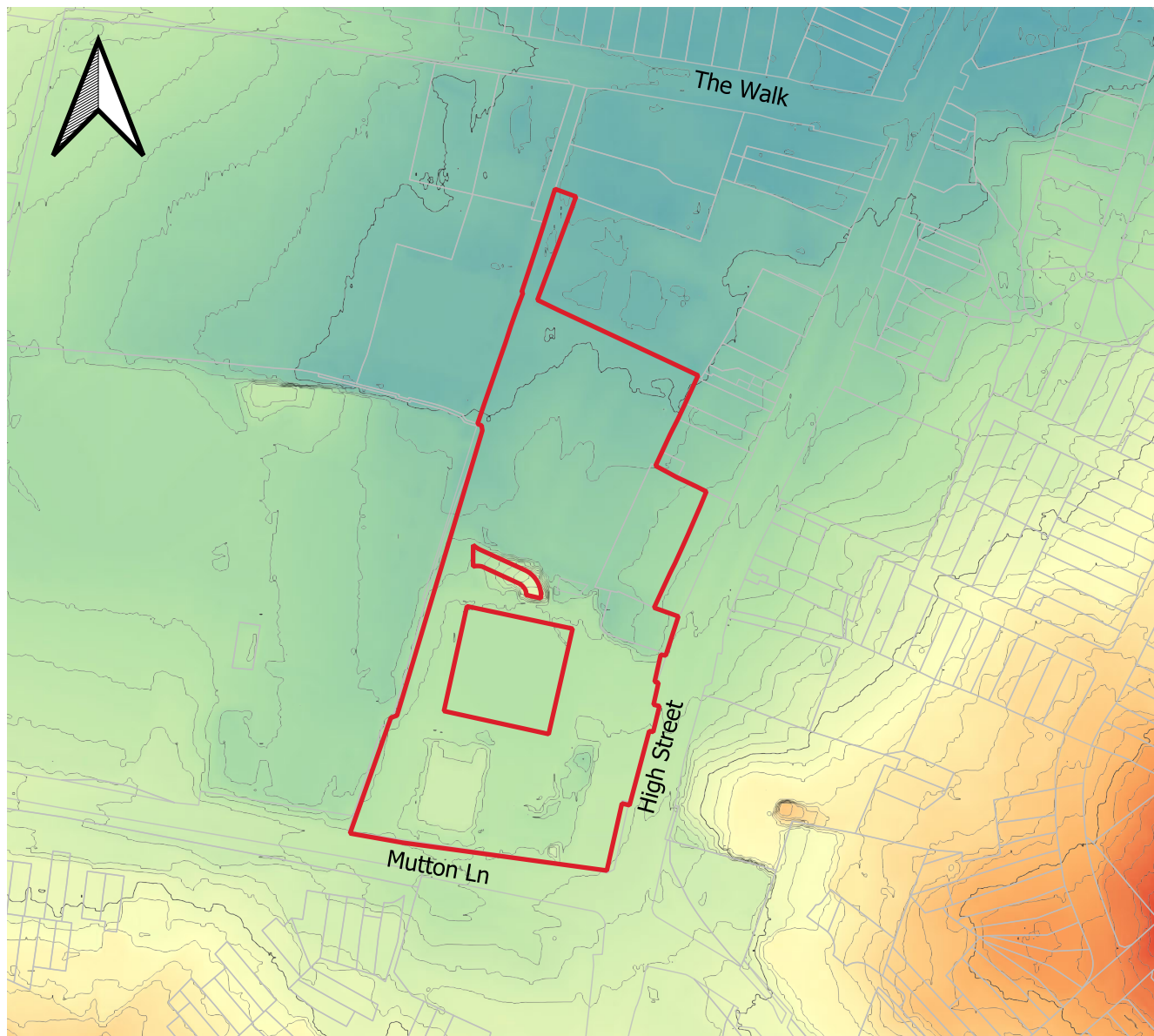
NOTES.

- 1 EXACT LOCATION AND INVERT LEVELS OF EXISTING MANHOLES AND DRAINS TO BE DETERMINED ON SITE.
- 2 FOUL AND SURFACE WATER DRAINS TO MANHOLES ARE TO BE 100 DIA. VITRIFIED CLAYWARE WITH A MINIMUM FALL OF 1:40 - 1:60 RESPECTIVELY, UNLESS OTHERWISE NOTED. DRAINS PASSING BENEATH UNITS TO BE CAST IRON TO BS.437.
- 3 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRG No 23226A/D024, D025 & D031.
- 4 ALL EXISTING MANHOLES AND DRAINS WITHIN THE SITE BOUNDARY NOT IN USE FROM EXISTING RETAINED BUILDINGS OR REUSED, TO BE REMOVED AND CAPPED OFF AT LOCAL AUTHORITY DRAIN OR SITE BOUNDARY.

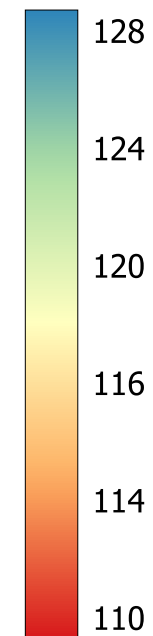
TENDER ISSUE

Key Plan	
Reference Drawings	
DRAWING NO	DESCRIPTION
D031	
REV	DATE
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Client	
Architect	
33 Gresse Street London W1P 1PN Telephone	
Building Services Consultant	
24 Britton Street London EC1M 5NQ Telephone 01-253 4311	
Structural Engineer	
16 Cowcross Street London EC1M 6DR Telephone	
Project	
CANADA LIFE PLACE POTTERS BAR	
Title	
EXTERNAL WORKS RESIDENTIAL UNITS	
Drawn	Checked
Date	Scale
NOV. 85	1:100
Job	Drawing
23226A	D 032
Rev.	A



Elevation (m)



Legend

— Site Boundary

DTM 1m Contour

— 0.5 (m) Minor

— 5 (m) Major

0 100 200 m

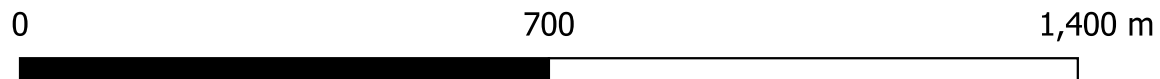
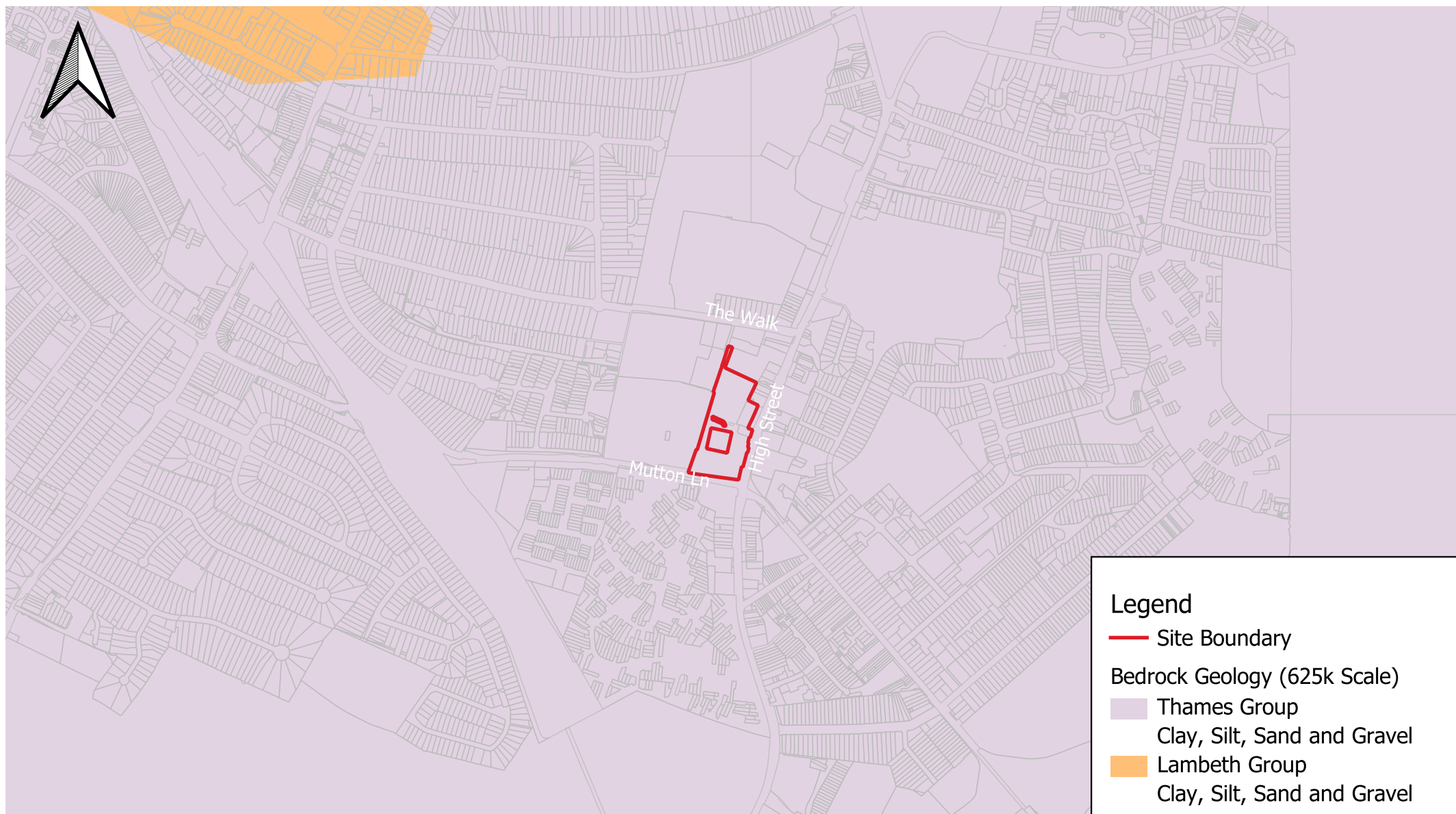
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Topography

bdc

Appendix C

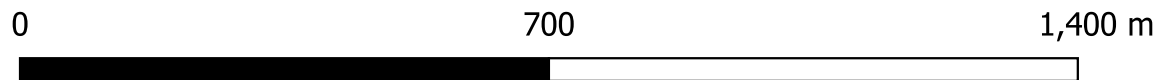
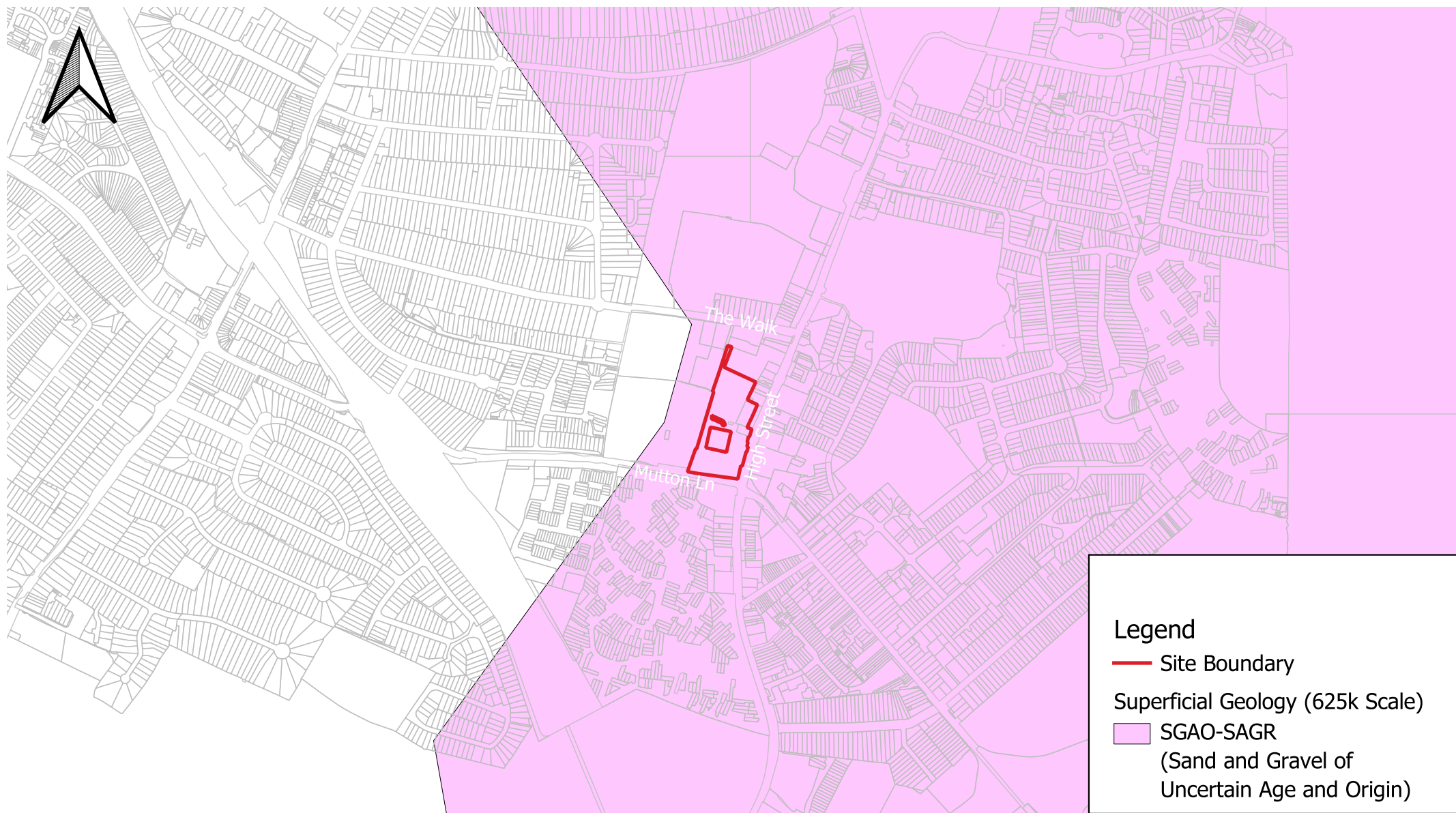
BGS Maps, Ground Investigation and Infiltration Tests



Scale 1:10 000 @ A4

BGS Bedrock Geology

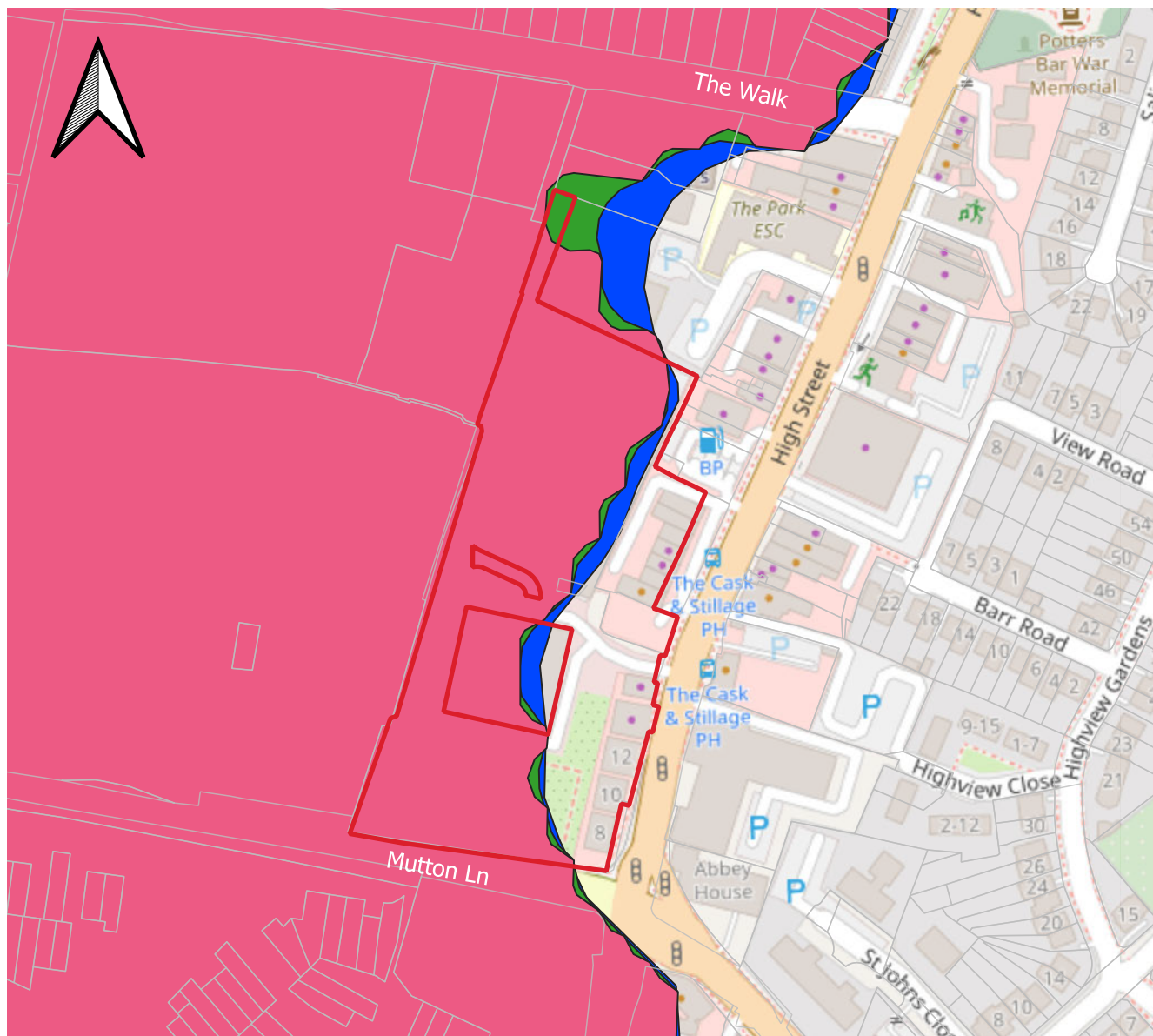
bdc



Scale 1:10 000 @ A4

BGS Superficial Geology

bdc



Legend

— Site Boundary

Source Protection Zones

■ Zone I - Inner Protection Zone

■ Zone II - Outer Protection Zone

■ Zone III - Total Catchment

0 100 200 m

Scale 1:2500 @ A4

EA Source Protection Zone

bdc



A2 Site Investigation

Maple House - Potters Bar Ground Investigation Factual Report

January 2026

75225-A2SI-XX-XX-RP-X-0002-00

Project Name	Maple House - Potters Bar
Project Number	75225
Client	Chase New Homes
Document Name	Ground Investigation Factual Report

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A2 Site Investigation Limited

100 Westminster Bridge Road
 London, SE1 7XA
 020 7021 0396
contact@a2-si.com
www.a2-si.com

Prepared by

Beatriz Grimm-Rossi
 Beng

Graduate Engineer

Checked by

George Clifton
 BSc MSc CGeol RoGEP FGS

Principal Engineer

Approved by

Darren Seeley
 FCMI MAPM

Director

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Abbreviations

Abbreviation	Full name	Abbreviation	Full name
ACM	Asbestos-containing Material	BGS	British Geological Survey
BH	Borehole	BRE	Building Research Establishment
BSI	British Standards Institution	BS	British Standard
BTEX	Benzene; Toluene; Ethylbenzene; Xylenes	CIRIA	Construction Industry Research and Information Association
CPT	Cone Penetration Test	GAC	Generic Assessment Criteria
LL	Liquid Limit	m bbl	Metres Below Basement Level
m bgl	Metres Below Ground Level	m OD	Metres Above Ordnance Datum
MTBE	Methyl Tertiary-Butyl Ether	PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl	PID	Photo Ionisation Detector
PI	Plasticity Index	PL	Plastic Limit
PSD	Particle Size Distribution	SGV	Soil Guideline Value
SOM	Soil Organic Matter	SPT	Standard Penetration Test
TPH	Total Petroleum Hydrocarbon	VOC	Volatile Organic Compound
UXO	Unexploded Ordnance		

1. Introduction

A2 Site Investigation (A2SI) were appointed to undertake a ground investigation at Canada Life Place, High Street, Potters Bar EN6 5AF. The ground investigation was specified by A2SI in conjunction with the client. This issue of the report describes the work undertaken and presents the findings of the investigation. A desk study has been completed for the site in conjunction with this investigation, (report ref 75225-A2SI-XX-XX-RP-Y-0001-00, dated December 2025), which has been referred to in this report

2. Site Location

The site at Canada Life Place, High Street, EN6 5AF is located in the town of Potters Bar, Hertfordshire, England, United Kingdom. It is located at National Grid Reference 52552E, 200976N and falls within the administrative boundaries of Hertfordshire County Council and Hertsmere Borough Council. The site is bounded to the west by a grassed area belonging to a Bowls Club and adjoining parking lots belonging to the Bowling Club and St John's Ambulance Centre, to the south by Mutton Road, to the east by High Street and to the northeast by petrol garage and to the north by Goodacre Court. The site is occupied by a number of existing buildings including multi-storey commercial buildings, a two-storey car park, with surrounding hardstanding, minor soft landscaping, and associated vehicle parking.



Figure 2.1 Site location and extent shown in red

3. Scope and Purpose of the Investigation

A2SI have been commissioned to undertake a site investigation comprising:

- 8 No. dynamic sampling boreholes up to 5.00m bgl.
- 8 No. standpipe installations within the boreholes for ground gas / groundwater monitoring.
- 3 No. machine excavated trial pits up to 1.2m for soil investigation and to facilitate soakage tests.
- Soakage testing within the trial pits, carried out in accordance with BRE Digest 365
- Appropriate soil sampling
- Geotechnical in situ testing
- Geoenvironmental laboratory testing

3.1 Investigation Strategy

Table 3.1 summarises the strategy for the intrusive investigation.

Table 3.1 Investigation Strategy

Location ID	Method	Purpose/comments
WS01 to WS08	Dynamic sampling boreholes to depth of 5.00m bgl	To determine ground conditions, to carry out soil sampling and to facilitate the installation of gas/vapour and groundwater monitoring standpipes.
INF01-INF03	Machine excavated trial pits to 1.2m bgl	To determine ground conditions, facilitate soil sampling and perform soakage testing in accordance with BRE Digest 365.

4. Limitations of the Report

This report has been prepared in accordance with the specification provided by the client. The data reported relates to the specific locations where each exploratory hole was formed and may not represent the ground and groundwater conditions of the site as a whole. Furthermore, it should be considered that groundwater levels may vary throughout the year due to seasonal conditions and other influences such as flooding, leaking mains, storm drainage and foul water systems.

5. Standards and References

The site investigation, soil descriptions and laboratory testing were undertaken in accordance with the following standards:

- AGS Assessment and Control of Asbestos Risk in Soil – Part 1: Protection of Personnel working on Ground Investigations, May 2021
- BGS Geology Viewer: 2025. <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>. British Geological Survey
- BGS GeoIndex: 2025. <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>. British Geological Survey
- BS 10175:2011+A2:2017, Investigation of potentially contaminated sites – code of practice
- BS 5930:2015+A1:2020, Code of practice for site investigations
- BS 1377-1:2016, Methods of test for soils for civil engineering purposes - General requirements and sample preparation
- BS 1377-2:2022, Methods of test for soils for civil engineering purposes – Part 2: Classification tests and determination of geotechnical properties
- BS 1377-9:1990, Methods for test for soils for civil engineering purposes - In-situ tests
- BS 8576:2013 Guidance on investigations for ground gas - permanent gases and volatile organic compounds (VOCs)
- BS EN ISO 14688-1:2018, Geotechnical investigation and testing – identification and classification of soil. Identification and description
- BS EN ISO 14688-2:2018, Geotechnical investigation and testing. Identification and classification of soil - Principles for a classification
- BS EN ISO 17892, Geotechnical investigation and testing. Laboratory testing of soil
- BS EN ISO 22476, Geotechnical investigation and testing. Field testing
- Building Research Establishment (2005), BRE Special Digest 1: Concrete in aggressive ground
- UK Specification for Ground Investigation 3rd Edition, published by ICE Publishing (2022)

6. Ground Investigation Summary

6.1 Fieldwork Overview

The fieldwork was carried out between 16th December and 22nd December 2025. A site walkover was conducted prior to the ground investigation and confirmed the anticipated layout of the site.

Up to date utility drawings were procured prior to the site work, which can be provided upon request.

A Detailed Unexploded Ordnance (UXO) Risk Assessment was carried out for the site by RMS UXO (Ref: INO6123, dated December 2025) and is included in the previous Phase I Desk Study. The report concluded there to be a potential risk from buried Second World War UXOs on site. The site was divided into two distinct zones, Zone 1 which covers the majority of the site, presents Medium UXO risk and Zone 2, classifying the eastern boundary of the site as Low UXO risk. The intrusive works within Medium Risk Zone 1 required the attendance of an UXO specialist during the drilling of all exploratory locations. Mitigation measures included safety briefing toolbox talks, a watching brief, downhole magnetometer clearance and safety briefing toolbox talks. Works in either zone required safety awareness briefings.

After reviewing all available service information and site reconnaissance, all locations were scanned using Ground Penetrating Radar (GPR) & Electromagnetic (CAT & Genny) techniques, to check for services within proximity to exploratory hole locations.

The specific details of the investigation undertaken are discussed throughout Section 7 and comprised:

- 8 No. dynamic sampling boreholes (WS01 to WS08) to depths of up to 5.00m bgl
- 8 No. standpipe installations within the boreholes for ground gas monitoring
- 3 No. Machine-excavated trial pits up to 1.2m for soil investigation and to facilitate soakage tests
- Appropriate sampling in the form of small disturbed samples
- Geotechnical in situ testing
- Geoenvironmental laboratory testing

All works were supervised by an experienced ground engineer.

An exploratory hole location plan and detailed exploratory hole logs are presented in Appendices B and C respectively. The coordinates and / or Ordnance Datum levels, which are presented on the exploratory logs, have been interpreted from the topographic survey of the site provided by the client (Drawing ref LUG / 9.1B, dated May 2025)

6.2 Dynamic Sampling Boreholes

6 No. dynamic sampling boreholes (WS02, WS03, WS04, WS06, WS07 and WS08) were progressed using a tracked dynamic sampling rig to the target depth of 5.00m bgl.

At the location of WS01, the sampler could not proceed further than 0.6 m bgl due to dense granular fill material which was composed of compacted sands and gravel of flint, brick and cobbles and the perched water table found during excavation.

A starter pit was excavated at the location of WS05 where a concrete obstruction was encountered at 0.60m bgl. The borehole could not be relocated to a new position due to time constraints.

Borehole WS06 was terminated at 3.50m bgl due to time constraints and diminishing daylight.

SPTs were carried out at regular intervals within the boreholes. All soils encountered were logged on site and samples recovered for geotechnical and geoenvironmental laboratory analysis.

A standpipe was installed in the successful dynamic sampling locations (WS02, WS04, WS06, WS07 and WS08) for monitoring of ground gas, vapour and groundwater levels.

6.3 Infiltration Testing

3 No. infiltration pits (INF01 – INF03) were machine excavated to a maximum depth of 1.30m bgl. Infiltration testing was completed within the trial pits in accordance with BRE Digest 365. The infiltration tests were facilitated by a 1000l IBC.

Location INF01 was deemed unsuitable for infiltration testing due to significant perched water encountered during the excavation. Attempts were made to pump this out, however it was found to recharge very quickly and as such the testing in this location was terminated.

Due to the low permeability of the soil in INF02 and INF03, the testing was also terminated after 5 hours in agreement with the client. The full results of the testing are presented in Appendix C.

6.4 Gas and Groundwater Monitoring Installations

5 No. combined gas and groundwater monitoring pipes were installed within a selection of the boreholes (WS02, WS04, WS06, WS07 and WS08). The monitoring installations comprise of a 50mm internal diameter HDPE casing and well screen. Details are presented in Table 6.1.

Table 6.1 Gas and groundwater monitoring installations

Location Ref	Base of Borehole (m bgl)	Installation Diameter (mm)	Top of Response Zone (m bgl)	Bottom of Response Zone (m bgl)	Target Strata
WS02	5.0	50	0.5	1.1	Made Ground
WS04	5.0	50	1.0	1.8	Made Ground
WS06	3.5	50	0.6	1.5	Made Ground
WS07	5.0	50	0.7	1.2	Made Ground
WS08	5.0	50	0.8	1.8	Made Ground

7. Ground Conditions

The investigation encountered Made Ground overlaying the London Clay Formation. Made Ground was encountered within all exploratory hole locations, with thicknesses varying from 0.6m bgl to 1.2m bgl. The London Clay Formation was encountered in the majority of the boreholes. The superficial deposits mapped on the site were not encountered.

The full set of exploratory hole logs are presented in Appendix C. The encountered ground conditions are presented in Table 7.1.

7.1 Encountered Geology

The following ground conditions were encountered at the site. Detailed exploratory hole logs are presented in Appendix C.

Table 7.1 Ground conditions encountered

Unit	Depth to top of stratum (m bgl)	Elevation at top of stratum (m OD)	Strata Thickness (m)	Description
Hardstanding ⁽¹⁾	0.00	122.80 to 125.07	0.07 to 0.25	Brick Paving / Concrete
Topsoil ⁽²⁾	0.00	122.60	0.20 to 0.35	Grass over brown slightly silty clayey fine to coarse SAND with frequent rootlets.
Made Ground	0.07 to 0.35	122.73 to 125.00	0.60 to 1.20	Reddish to light yellowish brown gravelly fine to coarse SAND, with medium to high cobble content of angular brick. Gravel is angular to subangular fine to coarse of flint. Yellowish brown gravelly sandy CLAY with frequent thin rootlets. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint and concrete.
London Clay Formation	0.35 to 1.20	122.38 to 124.40	Unproven >4.35	Firm becoming stiff locally initially soft brown silty sandy CLAY with frequent pockets of orange brown sand.

(1) - Only encountered in WS01, WS02, WS03, WS04, WS05, WS06, WS07, INF01 and INF02

(2) - Only encountered in WS08 and INF03

7.2 Groundwater

Perched water was encountered in WS01 and INF01 within the Made Ground.

Table 7.2 Groundwater details

Location Ref	Depth of inflow (m bgl)	Depth after 20 minutes (m bgl)	Strata / Remarks
WS01	0.5	0.5	Made Ground
INF01	0.5	0.5	Made Ground

8. In-situ Testing

8.1 Standard Penetration Testing

Standard Penetration Tests were completed within the dynamic sampling boreholes. The tests were completed in accordance with BS EN ISO 22476-3.

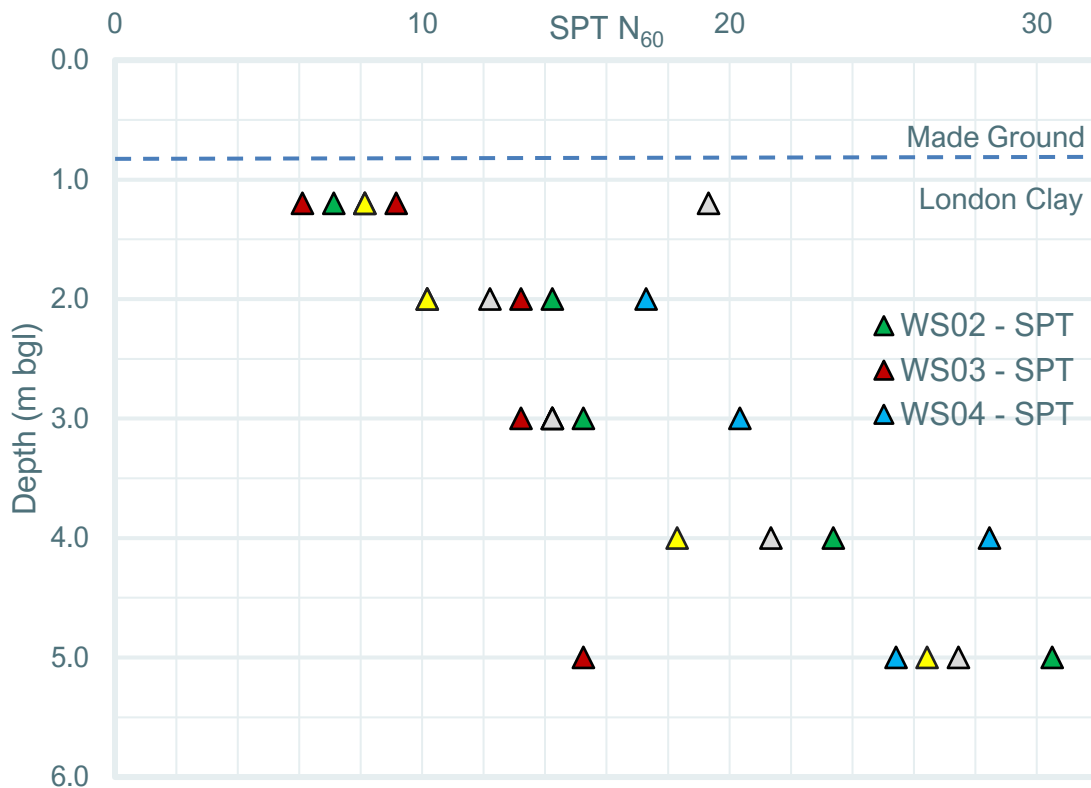


Figure 8.1 Groundwater details

8.2 Soakage Testing

2 No. soakage tests were carried out in locations INF02 and INF03 to determine the infiltration rate of the soil. The pits were excavated to a suitable size to be representative of a soakaway and advanced to a sufficient depth into natural soil. The pits were then filled quickly with a 1000L IBC. The tests were carried out in accordance with BRE Digest 365 – Soakaway Design. A summary of test results is presented in Table 8.1.

Table 8.1 Soakaway Testing results

Exploratory Hole Reference	Test No.	Base of Pit (m bgl)	Water Level at start of test (m bgl)	Duration of Test (min)	Water level at end of test (m bgl)
INF02	1	1.10	0.56	300	0.56
INF03	1	1.0	0.70	300	0.70

As outlined in the BRE365 methodology, the rate at which the water level dropped from 75% to 25%, from the effective depth of the test, is used to calculate the infiltration rate. After 5 hours, the water had not dropped at all in either pit. This is thought to be associated with the low permeability of the shallow soil and the potential presence of perched groundwater. At this stage, it was deemed highly unlikely that any drop in the water level would occur and the testing was terminated in agreement with the client. On the basis that no soakage was achieved in either location in differing areas of the site, the shallow geology across the site is not suitable for the disposal of surface water as part of the proposed development.

9. Laboratory Testing

9.1 Geoenvironmental Laboratory Testing

Selected soil samples were sent for geoenvironmental laboratory testing which was undertaken by i2 Analytical, a United Kingdom Accreditation Service (UKAS) accredited laboratory. The following type and number of tests scheduled is presented in Table 9.1 the results are presented in Appendix E.

Table 9.1 Summary of geoenvironmental testing on soils

Test description	Number of tests
A2SI RA Suite - Asbestos Identification, Heavy Metals, Fraction Organic Carbon, pH, Soil Organic Matter, Total Organic Carbon, Polyaromatic Hydrocarbons, Total Petroleum Hydrocarbons incl BTEX & MTBE, Sulphate (water soluble)	8
VOCs	8
Glycol Suite	3
PCBs (WHO 12)	1
Asbestos Quantification	3

Appendix A: Summary of Exploratory Holes

Exploratory Hole Reference	Method	Easting	Northing	Ground Level (m OD)	Final Depth	Start Date	Start Date
WS01	WLS	525949	201079	125.07	0.60	16/12/2025	16/12/2025
WS02	WLS	525927	201027	124.80	5.45	16/12/2025	16/12/2025
WS03	WLS	525949	201007	124.25	5.45	16/12/2025	16/12/2025
WS04	WLS	525989	200999	124.17	5.45	17/12/2025	17/12/2025
WS05	WLS	525910	200961	123.05	0.60	16/12/2025	16/12/2025
WS06	WLS	525972	200943	122.80	3.50	17/12/2025	17/12/2025
WS07	WLS	525898	200914	122.85	5.45	16/12/2025	17/12/2025
WS08	WLS	525952	200904	122.60	5.45	17/12/2025	17/12/2025
INF01	TP	525949	201079	125.07	0.80	18/12/2025	18/12/2025
INF02	TP	525949	200999	124.25	1.30	18/12/2025	18/12/2025
INF03	TP	525952	200904	122.60	0.90	18/12/2025	18/12/2025

Appendix B: Exploratory Hole Location Plan



Key:



BRE 365 -
Infiltration tests



Dynamic Window Sample
Borehole

Rev	Date	By	Chkd	Appd
00	26/01/2026	BGR	GC	DS

 A2 Site Investigation

100 Westminster Bridge Rd
London SE1 7XW
+44(0)20 7021 0396
www.a2-si.com

Client
Chase New Homes

Project Title
Maple House - Potters Bar

Drawing Title
Exploratory Hole Location Plan

A2SI Project Number	Rev
75225	00

Drawing Number
75225-A2SI-XX-XX-
DR-Y-0001-00

Appendix C: Exploratory Hole Logs



Borehole Log

Keys

SAMPLES	INSTALLATION DETAILS
ES - Environmental Sample (Tub, Vial, Jar)	SPIE - Standpipe Piezometer
AZCL-Assumed Zone of Core Loss	SPGW - Groundwater Monitor Standpipe
U - 100mm Diameter Undisturbed Sample	SPG/GW - Gas / Groundwater Monitor Standpipe
UT - 100mm Diameter Thin Wall Undisturbed Sample	VWP - Vibrating Wire Piezometer
U38 - 38mm Diameter Undisturbed Sample	ICM - Inclinator
D - Disturbed Sample, B-Bulk Sample,	Hole Type
LB- Large Bulk Sample, BLK-Block Sample	IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
C - Core Sample, W-Water Sample, R-Root Sample	CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic
	DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary
TESTS	DC -Diamond Coring, CP/R-Cable Percussion
S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer,	Rotary down on
MP-Mackintosh Probe, VOC-Volatile Organic Compound	



Borehole Log

[illegible]

A2 Site Investigation

Borehole Log

Project

Maple House - Potters Bar

Borehole No

WS02

Job No

75225

Start

16/12/2025

Ground Level (mOD)

124.80

Co-ordinates

E 525927.00 N 201027.00

Depth (m)

5.45

Client

Chase New Homes

Status

FINAL

Standard Penetration Test Summary					
Test Type	Depth Top	Depth Casing	Depth Water	N Value	Reported Result
S	1.20		Dry	7	N=7 (0,1/2,1,2,2)
S	2.00		Dry	14	N=14 (1,1/2,3,4,5)
S	3.00		Dry	15	N=15 (2,3/3,4,4,4)
S	4.00		Dry	23	N=23 (3,4/5,6,6,6)
S	5.00		Dry	30	N=30 (9 for 75mm/6,7,8,9)

Installation / Instrument Details				
Date	Instr. Type	To (m)	Response Zone (m)	Remarks
17/12/2025	SP	1.10	0.50-1.10	

Dynamic Sampling Runs			
Depth Top	Dia. (mm)	Rec. %	Remarks
1.20	102	100	
2.00	87	100	
3.00	77	100	
4.00	67	100	

Boring Progress and Backfill									
Drilling Progress			Hole Diameter		Casing		Backfill		
Date	Time	Depth(m)	Depth(m)	Dia.(mm)	Depth (m)	Dia(mm)	Depth (m)	Backfill	
16/12/2025	11:00	0.00					0.00 - 0.20	Concrete	
16/12/2025	16:00	5.45					0.20 - 0.50	Bentonite Pellets	
							0.50 - 1.10	Gravel	
							1.10 - 5.45	Bentonite Pellets	

Water Observations					
Date/Time	Depth Strike (m)	Depth Casing (m)	Time Elapsed (min)	Depth Sealed (m)	Rose To (m)

General Remarks

1. Borehole scanned with GPR and CAT & Genny.

2. Hand excavated pit to 1.20m bgl.

3. No groundwater encountered.

4. Borehole drilled with dynamic sampling method with SPT tests to 5.0m bgl.

5. Monitoring standpipe installed at 1.10m with response zone between 0.5m and 1.10m bgl.

Keys

SAMPLES

ES - Environmental Sample (Tub, Vial, Jar)

AZCL Assumed Zone of Core Loss

U - 100mm Diameter Undisturbed Sample

UT - 100mm Diameter Thin Wall Undisturbed Sample

U38 - 38mm Diameter Undisturbed Sample

D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample

C - Core Sample, W-Water Sample, R-Root Sample

TESTS

S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compound

INSTALLATION DETAILS

SPIE - Standpipe Piezometer

SPGW - Groundwater Monitor Standpipe

SPG/GW - Gas / Groundwater Monitor Standpipe

VWP - Vibrating Wire Piezometer

ICM - Inclinator

Hole Type

IP - Inspection Pit, TP-Trial Pit TT - Trial Trench

CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic

DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary

DC -Diamond Coring, CPR-Cable Percussion Rotary follow on



Borehole Log



A2 Site Investigation

Borehole Log

Project

Maple House - Potters Bar

Borehole No

WS03

Job No

75225

Start

16/12/2025

Ground Level (mOD)

124.25

Co-ordinates

E 525949.00 N 201007.00

Depth (m)

5.45

Client

Chase New Homes

Status

FINAL

Standard Penetration Test Summary					
Test Type	Depth Top	Depth Casing	Depth Water	N Value	Reported Result
S	1.20		Dry	6	N=6 (0,1/1,1,2,2)
S	2.00		Dry	10	N=10 (2,2/2,3,2,3)
S	3.00		Dry	13	N=13 (2,2/3,3,3,4)
S	5.00		Dry	15	N=15 (2,3/3,4,4,4)

Installation / Instrument Details				
Date	Instr. Type	To (m)	Response Zone (m)	Remarks

Dynamic Sampling Runs			
Depth Top	Dia. (mm)	Rec. %	Remarks
1.20	102	10	
2.00	87	100	
3.00	77	10	
4.00	67	0	

Boring Progress and Backfill									
Drilling Progress			Hole Diameter		Casing		Backfill		
Date	Time	Depth(m)	Depth(m)	Dia.(mm)	Depth (m)	Dia(mm)	Depth (m)	Backfill	
16/12/2025	12:00	0.00					0.00 - 0.10	Paving slab	
17/12/2025	16:00	5.45						Concrete	
16/01/2026	16:00	3.45					0.10 - 0.45 0.45 - 5.45	Arisings	

Water Observations					
Date/Time	Depth Strike (m)	Depth Casing (m)	Time Elapsed (min)	Depth Sealed (m)	Rose To (m)

General Remarks

1. Borehole scanned with GPR and CAT & Genny.
2. Hand excavated pit to 1.20m bgl.
3. Borehole drilled with dynamic samplig method with SPT tests up to 5.0m bgl.
4. No groundwater encountered.
5. Borehole terminated and backfilled with arisings.

Keys

SAMPLES

ES - Environmental Sample (Tub, Vial, Jar)
AZCL Assumed Zone of Core Loss
U - 100mm Diameter Undisturbed Sample
UT - 100mm Diameter Thin Wall Undisturbed Sample
U38 - 38mm Diameter Undisturbed Sample
D - Disturbed Sample, B-Bulk Sample,
LB- Large Bulk Sample, BLK-Block Sample
C - Core Sample, W-Water Sample, R-Root Sample

TESTS

S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer,
MP-Mackintosh Probe, VOC-Volatile Organic Compound

INSTALLATION DETAILS

SPIE - Standpipe Piezometer
SPGW - Groundwater Monitor Standpipe
SPG/GW - Gas / Groundwater Monitor Standpipe
VWP - Vibrating Wire Piezometer
ICM - Inclinator
Hole Type
IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic
DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary
DC -Diamond Coring, CPR-Cable Percussion
Rotary follow on



A2 Site Investigation

Borehole Log

Project Maple House - Potters Bar				Borehole No WS03	
Job No 75225	Start 16/12/2025 End 17/12/2025	Ground Level (mOD) 124.25	Co-Ordinates (Local Grid) E 525949.00 N 201007.00		Depth (m) 5.45
Client Chase New Homes			SPT Energy Ratio % 61	Sheet Sheet 1 of 1	Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend	Instrument / Backfill
Depth (m)	Type No	Test Result						
0.30	PID	VOC 0ppm	BRICK PAVING	0.00	124.18			
0.30	D 1		[MADE GROUND]	(0.07)				
0.30	ES 2		Yellowish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint	0.07	124.08			
0.50	PID	VOC 0ppm	[MADE GROUND]	(0.10)				
0.50	D 3		Light brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint	0.17	123.88			
0.50	ES		[MADE GROUND]	(0.20)				
0.50	ES 4		Reddish brown gravelly SAND with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of flint. Cobble is angular brick	0.37	123.58			
			[MADE GROUND]	(0.30)				
			Yellowish brown gravelly sandy CLAY with frequent thin rootlets. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint and concrete	0.67				
			[MADE GROUND]	(0.53)				
1.20	SPT	N=6 (0,1/1,1,2,2)	Firm brownish grey sandy CLAY with orange and grey fine sand partings. [LONDON CLAY FORMATION]	1.20	123.05			
2.00	SPT	N=10 (2,2/2,3,2,3)						
3.00	SPT	N=13 (2,2/3,3,3,4)	3.00 to 5.45m - ... becoming stiff.					
3.50	PID	VOC 0ppm		(4.25)				
5.00	SPT	N=15 (2,3/3,4,4,4)						
			End of Borehole at 5.45m		118.80			

A2 Site Investigation

Borehole Log

Project

Maple House - Potters Bar

Borehole No

WS04

Job No

75225

Start

17/12/2025

Ground Level (mOD)

124.17

Co-ordinates

E 525989.00 N 200999.00

Depth (m)

5.45

Client

Chase New Homes

Status

FINAL

Standard Penetration Test Summary					
Test Type	Depth Top	Depth Casing	Depth Water	N Value	Reported Result
S	1.20		Dry	8	N=8 (2,2/2,2,2,2)
S	2.00		Dry	17	N=17 (2,2/3,4,4,6)
C	3.00		Dry	20	N=20 (4,4/4,5,5,6)
S	4.00		Dry	28	N=28 (4,4/5,7,8,8)
S	5.00		Dry	25	N=25 (5,5/5,6,6,8)

Installation / Instrument Details				
Date	Instr. Type	To (m)	Response Zone (m)	Remarks
17/12/2025	SP	1.80	1.00-1.80	

Dynamic Sampling Runs			
Depth Top	Dia. (mm)	Rec. %	Remarks
1.20	102	100	
2.00	87	100	
3.00	77	100	
4.00	67	100	

Boring Progress and Backfill									
Drilling Progress			Hole Diameter		Casing		Backfill		
Date	Time	Depth(m)	Depth(m)	Dia.(mm)	Depth (m)	Dia(mm)	Depth (m)	Backfill	
17/12/2025	09:00	0.00					0.00 - 0.20	Concrete	
17/12/2025	12:00	5.45					0.20 - 1.00	Bentonite Pellets	
							1.00 - 1.80	Gravel	
							1.80 - 5.45	Bentonite Pellets	

Water Observations					
Date/Time	Depth Strike (m)	Depth Casing (m)	Time Elapsed (min)	Depth Sealed (m)	Rose To (m)

General Remarks

1. Borehole scanned with GPR and CAT & Genny.

2. Hand excavated pit to 1.20m bgl.

3. No groundwater encountered.

4. Borehole drilled with dynamic sampling method with SPT tests to 5.0m bgl.

5. Monitoring standpipe installed at 1.80m with response zone between 1.0m and 1.80m bgl.

Keys

SAMPLES

ES - Environmental Sample (Tub, Vial, Jar)

AZCL Assumed Zone of Core Loss

U - 100mm Diameter Undisturbed Sample

UT - 100mm Diameter Thin Wall Undisturbed Sample

U38 - 38mm Diameter Undisturbed Sample

D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample

C - Core Sample, W-Water Sample, R-Root Sample

TESTS

S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compound

INSTALLATION DETAILS

SPIE - Standpipe Piezometer

SPGW - Groundwater Monitor Standpipe

SPG/GW - Gas / Groundwater Monitor Standpipe

VWP - Vibrating Wire Piezometer

ICM - Inclinator

Hole Type

IP - Inspection Pit, TP-Trial Pit TT - Trial Trench

CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic

DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary

DC -Diamond Coring, CPR-Cable Percussion Rotary follow on

A2 Site Investigation				Borehole Log						
Project Maple House - Potters Bar						Borehole No WS04				
Job No 75225		Start 17/12/2025 End 17/12/2025		Ground Level (mOD) 124.17		Co-Ordinates (Local Grid) E 525989.00 N 200999.00		Depth (m) 5.45		
Client Chase New Homes				SPT Energy Ratio % 61		Sheet Sheet 1 of 1		Status FINAL		
SAMPLES & TESTS			Stratum Description			Depth (thickness)	Reduced Level	Water	Legend	Instrument / Backfill
Depth (m)	Type No	Test Result								
0.30	PID	VOC 0ppm	CONCRETE [MADE GROUND] TARMAC HARDCORE [MADE GROUND] Reddish brown gravelly fine to coarse SAND. Gravel is angular subrounded of fine to coarse of flint, cobbles and brick [MADE GROUND] Yellowish brown gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint [MADE GROUND]			0.00	124.07			
0.30	D 1					(0.10)				
0.30	ES					0.10	123.92			
0.30	ES 2	VOC 1ppm				(0.15)				
0.50	PID					0.25				
0.50	D 3		(0.20)	123.72	0.45					
0.50	ES 4		(0.75)							
1.20	SPT	N=8 (2,2/2,2,2,2)	Orangish brown very gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint [MADE GROUND]			1.20	122.97			
1.50	PID	VOC 0ppm				(0.60)				
1.50	D 5									
1.50	ES 6									
2.00	SPT	N=17 (2,2/3,4,4,6)	Firm brownish grey sandy CLAY with orange and grey fine sand partings. [LONDON CLAY FORMATION] 2.00 to 5.45m - ... becoming stiff.			1.80	122.37			
2.50	PID	VOC 0ppm								
2.50	D 7									
2.50	ES 8									
3.00	SPT	N=20 (4,4/4,5,5,6)								
3.50	PID	VOC 0ppm								
3.50	D 9									
3.50	ES 10					(3.65)				
4.00	SPT	N=28 (4,4/5,7,8,8)								
4.50	PID	VOC 0ppm								
4.50	D 11									
4.50	ES 12									
5.00	SPT	N=25 (5,5/5,6,6,8)								
			End of Borehole at 5.45m				118.72			
AGS REGISTERED USER 2021		Contractor A2 Site Investigation			Method Dynamic Sampling		Logged By BGR		Approved by GC	



Borehole Log

Keys

SAMPLES	INSTALLATION DETAILS
ES - Environmental Sample (Tub, Vial, Jar)	SPIE - Standpipe Piezometer
AZCL-Assumed Zone of Core Loss	SPGW - Groundwater Monitor Standpipe
U - 100mm Diameter Undisturbed Sample	UT - 100mm Diameter Thin Wall Undisturbed Sample
U38 - 38mm Diameter Undisturbed Sample	U38 - 38mm Diameter Undisturbed Sample
D - Disturbed Sample, B-Bulk Sample.	ICM - Inclinatormeter
LB- Large Bulk Sample, BLK-Block Sample	Hole Type
C - Core Sample, W-Water Sample, R-Root Sample	IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
	CP - Cable Percussion, RC-Rotary Coring, R/S- Rotary/Sonic
TESTS	DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary
SIC-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer,	DC -Diamond Coring, CP/R-Cable Percussion Monitoring
MP-Mackintosh Probe, VOC-Volatile Organic Compound	



A2 Site Investigation

Borehole Log

Project Maple House - Potters Bar				Borehole No WS05	
Job No 75225	Start 16/12/2025 End 16/12/2025	Ground Level (mOD) 123.05	Co-Ordinates (Local Grid) E 525910.00 N 200961.00		Depth (m) 0.60
Client Chase New Homes			SPT Energy Ratio %	Sheet Sheet 1 of 1	Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend	Instrument / Backfill
Depth (m)	Type No	Test Result						
0.30	PID	VOC 0ppm	BRICK PAVING	0.00	122.98			
0.30	D 1		[MADE GROUND]	(0.07)	122.88			
0.30	ES 2		Yellowish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint	0.07				
0.50	PID	VOC 0ppm	[MADE GROUND]	(0.10)	122.68			
0.50	D 3		Light brown sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint	0.17				
0.50	ES		[MADE GROUND]	(0.20)				
0.50	ES 4		Reddish brown gravelly SAND with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of flint. Cobble is angular brick	0.37	122.45			
0.50			[MADE GROUND]	(0.23)				
			End of Borehole at 0.60m					

A2 Site Investigation

Borehole Log

Project

Maple House - Potters Bar

Borehole No

WS06

Job No

75225

Start

17/12/2025

Ground Level (mOD)

122.80

Co-ordinates

E 525972.00 N 200943.00

Depth (m)

3.50

Client

Chase New Homes

Status

FINAL

Standard Penetration Test Summary					
Test Type	Depth Top	Depth Casing	Depth Water	N Value	Reported Result
C	1.20		Dry	9	N=9 (1,2/2,2,2,3)
C	2.00		Dry	13	N=13 (2,3/3,3,4,3)
C	3.00		Dry	14	N=14 (2,3/3,4,3,4)

Installation / Instrument Details				
Date	Instr. Type	To (m)	Response Zone (m)	Remarks
18/12/2025	SP	1.50	0.60-1.50	

Dynamic Sampling Runs			
Depth Top	Dia. (mm)	Rec. %	Remarks
1.20	102	100	
2.00	87	100	

Boring Progress and Backfill									
Drilling Progress			Hole Diameter		Casing		Backfill		
Date	Time	Depth(m)	Depth(m)	Dia.(mm)	Depth (m)	Dia(mm)	Depth (m)	Backfill	
17/12/2025	14:00	0.00					0.00 - 0.20	Concrete	
17/12/2025	16:00	3.45					0.20 - 0.60	Bentonite Pellets	
							0.60 - 1.50	Gravel	
							1.50 - 3.50	Bentonite Pellets	

Water Observations					
Date/Time	Depth Strike (m)	Depth Casing (m)	Time Elapsed (min)	Depth Sealed (m)	Rose To (m)

General Remarks

1. Borehole scanned with GPR and CAT & Genny.

2. Hand excavated pit to 1.20m bgl.

3. No groundwater encountered.

4. Borehole drilled with dynamic sampling method with SPT tests to 3.5m bgl.

5. Monitoring standpipe installed at 1.50m with response zone between 0.6m and 1.50m bgl.

Keys

SAMPLES

ES - Environmental Sample (Tub, Vial, Jar)

AZCL Assumed Zone of Core Loss

U - 100mm Diameter Undisturbed Sample

UT - 100mm Diameter Thin Wall Undisturbed Sample

U38 - 38mm Diameter Undisturbed Sample

D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample

C - Core Sample, W-Water Sample, R-Root Sample

TESTS

S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compound

INSTALLATION DETAILS

SPIE - Standpipe Piezometer

SPGW - Groundwater Monitor Standpipe

SPG/GW - Gas / Groundwater Monitor Standpipe

VWP - Vibrating Wire Piezometer

ICM - Inclinator

Hole Type

IP - Inspection Pit, TP-Trial Pit TT - Trial Trench

CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic

DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary

DC -Diamond Coring, CPR-Cable Percussion Rotary follow on



Project Maple House - Potters Bar				Borehole No WS06	
Job No 75225	Start 17/12/2025 End 17/12/2025	Ground Level (mOD) 122.80	Co-Ordinates (Local Grid) E 525972.00 N 200943.00		Depth (m) 3.50
Client Chase New Homes			SPT Energy Ratio % 61	Sheet Sheet 1 of 1	Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend	Instrument / Backfill
Depth (m)	Type No	Test Result						
0.50	PID	VOC 0ppm	BRICK PAVING [MADE GROUND]	0.00	122.73			
0.50	D 1		Yellowish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint	(0.07)	122.68			
0.50	ES		[MADE GROUND]	0.07				
0.50	ES 2		Light grey weak CONCRETE. 80% aggregate of subangular to subrounded medium to coarse of flint, with 2-3% voids	(0.05)	122.50			
			[MADE GROUND]	0.12				
			Reddish brown gravelly SAND with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of flint. Cobble is angular brick	(0.18)				
			[MADE GROUND]	(0.30)	122.20			
			Brown fine to coarse sandy CLAY.	0.60				
			[MADE GROUND]	(0.60)				
1.20	SPT	N=9 (1,2/2,2,2,3)	Grey mottled brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse flint, and concrete and brick fragments	1.20	121.60			
			[MADE GROUND]	(0.30)				
1.50	PID	VOC 0ppm	Firm greyish brown mottled bluish grey sandy CLAY.	1.50	121.30			
1.50	D 3		[LONDON CLAY FORMATION]					
1.50	ES 4							
2.00	SPT	N=13 (2,3/3,3,4,3)						
2.50	PID	VOC 0ppm		(2.00)				
2.50	D 5							
2.50	ES 6							
3.00	SPT	N=14 (2,3/3,4,3,4)						
			End of Borehole at 3.50m		119.30			

A2 Site Investigation

Borehole Log

Project

Maple House - Potters Bar

Borehole No

WS07

Job No

75225

Start

16/12/2025

Ground Level (mOD)

122.85

Co-ordinates

E 525898.00 N 200914.00

Depth (m)

5.45

End

17/12/2025

Client

Chase New Homes

Status

FINAL

Standard Penetration Test Summary					
Test Type	Depth Top	Depth Casing	Depth Water	N Value	Reported Result
C	1.20		Dry	8	N=8 (0,1/2,2,2,2)
S	2.00		Dry	10	N=10 (2,2/2,3,2,3)
S	3.00		Dry	14	N=14 (2,3/3,3,4,4)
C	4.00		Dry	18	N=18 (2,3/3,4,5,6)
C	5.00		Dry	26	N=26 (3,4/5,7,6,8)

Installation / Instrument Details				
Date	Instr. Type	To (m)	Response Zone (m)	Remarks
18/12/2025	SP	1.20	0.70-1.20	

Dynamic Sampling Runs			
Depth Top	Dia. (mm)	Rec. %	Remarks
4.00	67	100	

Boring Progress and Backfill									
Drilling Progress			Hole Diameter		Casing		Backfill		
Date	Time	Depth(m)	Depth(m)	Dia.(mm)	Depth (m)	Dia(mm)	Depth (m)	Backfill	
16/12/2025	14:00	0.00					0.00 - 0.20	Concrete	
16/12/2025	16:00	3.45					0.20 - 0.70	Bentonite Pellets	
17/12/2025	15:00	5.45					0.70 - 1.20	Gravel	
							1.20 - 5.45	Bentonite Pellets	

Water Observations					
Date/Time	Depth Strike (m)	Depth Casing (m)	Time Elapsed (min)	Depth Sealed (m)	Rose To (m)

General Remarks

1. Borehole scanned with GPR and CAT & Genny.
2. Hand excavated pit to 1.20m bgl.
3. No groundwater encountered.
4. Borehole drilled with dynamic sampling method with SPT tests to 5.0m bgl.
5. Monitoring standpipe installed at 1.20m with response zone between 0.7m and 1.20m bgl.

Keys

SAMPLES

ES - Environmental Sample (Tub, Vial, Jar)
AZCL Assumed Zone of Core Loss
U - 100mm Diameter Undisturbed Sample
UT - 100mm Diameter Thin Wall Undisturbed Sample
U38 - 38mm Diameter Undisturbed Sample
D - Disturbed Sample, B-Bulk Sample,
LB- Large Bulk Sample, BLK-Block Sample
C - Core Sample, W-Water Sample, R-Root Sample

TESTS

S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer,
MP-Mackintosh Probe, VOC-Volatile Organic Compound

INSTALLATION DETAILS

SPIE - Standpipe Piezometer
SPGW - Groundwater Monitor Standpipe
SPG/GW - Gas / Groundwater Monitor Standpipe
VWP - Vibrating Wire Piezometer
ICM - Inclinator
Hole Type
IP - Inspection Pit, TP-Trial Pit TT - Trial Trench
CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic
DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary
DC -Diamond Coring, CPR-Cable Percussion Rotary follow on



A2 Site Investigation

Borehole Log

Project Maple House - Potters Bar				Borehole No WS07	
Job No 75225	Start 16/12/2025 End 17/12/2025	Ground Level (mOD) 122.85	Co-Ordinates (Local Grid) E 525898.00 N 200914.00		Depth (m) 5.45
Client Chase New Homes			SPT Energy Ratio % 61	Sheet Sheet 1 of 1	Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend	Instrument / Backfill
Depth (m)	Type No	Test Result						
0.50	PID	VOC 0ppm	BRICK PAVING [MADE GROUND]	0.00	122.78			
0.50	D 1		Yellowish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint	(0.07)	122.68			
0.50	ES		[MADE GROUND]	0.17	122.48			
0.50	ES 2		Light brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint	(0.20)				
			[MADE GROUND]	0.37				
			Light brown gravelly fine to coarse SAND with high cobble content. Gravel is angular to subangular fine to coarse of flint. Cobble is angular brick	(0.35)	122.13			
			[MADE GROUND]	0.72				
1.00	PID	VOC 0ppm		(0.48)				
1.00	D 3		Brown gravelly CLAY with frequent coarse gravel size wood. Gravel is angular medium to coarse brick					
1.20	SPT	N=8 (0,1/2,2,2,2)	[MADE GROUND]	1.20	121.65			
			Firm brownish grey sandy CLAY with orange and grey fine sand partings.					
1.50	ES 4		[LONDON CLAY FORMATION]					
2.00	SPT	N=10 (2,2/2,3,2,3)						
2.50	PID	VOC 0ppm						
2.50	D 5							
2.50	ES 6							
3.00	SPT	N=14 (2,3/3,3,4,4)	3.00 to 5.45m - ... becoming stiff.					
3.50	PID	VOC 0ppm		(4.25)				
3.50	D 7							
3.50	ES 8							
4.00	SPT	N=18 (2,3/3,4,5,6)						
4.50	PID	VOC 0ppm						
4.50	D 9							
4.50	ES 10							
5.00	SPT	N=26 (3,4/5,7,6,8)						
			End of Borehole at 5.45m		117.40			

A2 Site Investigation

Borehole Log

Project

Maple House - Potters Bar

Borehole No

WS08

Job No

75225

Start

17/12/2025

Ground Level (mOD)

122.60

Co-ordinates

E 525952.00 N 200904.00

Depth (m)

5.45

Client

Chase New Homes

Status

FINAL

Standard Penetration Test Summary					
Test Type	Depth Top	Depth Casing	Depth Water	N Value	Reported Result
S	1.20		Dry	19	N=19 (3,4/19 for 982mm)
S	2.00		Dry	12	N=12 (2,2/3,3,3,3)
S	3.00		Dry	14	N=14 (2,2/2,3,4,5)
S	4.00		Dry	21	N=21 (3,3/4,5,6,6)
S	5.00		Dry	27	N=27 (4,4/5,7,7,8)

Installation / Instrument Details				
Date	Instr. Type	To (m)	Response Zone (m)	Remarks
18/12/2025	SP	1.80	0.80-1.80	

Dynamic Sampling Runs			
Depth Top	Dia. (mm)	Rec. %	Remarks
1.20	102	80	
2.00	87	100	
3.00	77	100	
4.00	67	100	

Boring Progress and Backfill									
Drilling Progress			Hole Diameter		Casing		Backfill		
Date	Time	Depth(m)	Depth(m)	Dia.(mm)	Depth (m)	Dia(mm)	Depth (m)	Backfill	
17/12/2025	15:00	0.00					0.00 - 0.20	Concrete	
17/12/2025	16:00	5.45					0.20 - 0.80	Bentonite Pellets	
							0.80 - 1.80	Gravel	
							1.80 - 5.45	Bentonite Pellets	

Water Observations					
Date/Time	Depth Strike (m)	Depth Casing (m)	Time Elapsed (min)	Depth Sealed (m)	Rose To (m)

General Remarks

1. Borehole scanned with GPR and CAT & Genny.

2. Hand excavated pit to 1.20m bgl.

3. No groundwater encountered.

4. Borehole drilled with dynamic sampling method with SPT tests to 5.0m bgl.

5. Monitoring standpipe installed at 1.80m with response zone between 0.8m and 1.80m bgl.

Keys

SAMPLES

ES - Environmental Sample (Tub, Vial, Jar)

AZCL Assumed Zone of Core Loss

U - 100mm Diameter Undisturbed Sample

UT - 100mm Diameter Thin Wall Undisturbed Sample

U38 - 38mm Diameter Undisturbed Sample

D - Disturbed Sample, B-Bulk Sample, LB- Large Bulk Sample, BLK-Block Sample

C - Core Sample, W-Water Sample, R-Root Sample

TESTS

S/C-SPT / CPT, V-Shear Vane, PP-Pocket Penetrometer, MP-Mackintosh Probe, VOC-Volatile Organic Compound

INSTALLATION DETAILS

SPIE - Standpipe Piezometer

SPGW - Groundwater Monitor Standpipe

SPG/GW - Gas / Groundwater Monitor Standpipe

VWP - Vibrating Wire Piezometer

ICM - Inclinator

Hole Type

IP - Inspection Pit, TP-Trial Pit TT - Trial Trench

CP - Cable Percussion, RC-Rotary Coring, R/S-Rotary/Sonic

DS -Dynamic Sampling, DS/R-Dynamic Sampling / Rotary

DC -Diamond Coring, CPR-Cable Percussion Rotary follow on

A2 Site Investigation					Borehole Log						
Project Maple House - Potters Bar							Borehole No WS08				
Job No 75225		Start 17/12/2025 End 17/12/2025		Ground Level (mOD) 122.60		Co-Ordinates (Local Grid) E 525952.00 N 200904.00		Depth (m) 5.45			
Client Chase New Homes					SPT Energy Ratio % 61		Sheet Sheet 1 of 1		Status FINAL		
SAMPLES & TESTS			Stratum Description				Depth (thickness)	Reduced Level	Water	Legend	Instrument / Backfill
Depth (m)	Type No	Test Result									
0.50 0.50 0.50	PID D 1 ES 2	VOC 0ppm	Brown slightly silty clayey fine to coarse SAND with frequent rootlets [TOPSOIL]				0.00 (0.35)	122.25			
			Light brown fine to coarse SAND with high cobble content. Cobble is angular brick [MADE GROUND]				0.35 (0.40)				
			Yellowish brown gravelly clayey fine to coarse SAND with medium cobble content. Gravel is angular to subangular fine to coarse of flint. Cobble is angular brick [MADE GROUND]				0.75 (0.45)				
1.00 1.00 1.00 1.00 1.20	PID D 3 ES ES 4 SPT	N=19 (3,4/19 for 982mm)	Orangish brown very gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint [MADE GROUND]				1.20 (0.60)	121.40			
1.50 1.50 1.50	PID D 5 ES 6		Firm brownish grey sandy CLAY with orange and grey fine sand partings. [LONDON CLAY FORMATION]				1.80				
2.00	SPT	N=12 (2,2/3,3,3,3)						120.80			
2.50 2.50 2.50	PID D 7 ES 8	VOC 0ppm									
3.00	SPT	N=14 (2,2/2,3,4,5)	3.00 to 5.45m - ... becoming stiff.								
3.50 3.50	PID D 9	VOC 0ppm					(3.65)				
4.00	SPT	N=21 (3,3/4,5,6,6)									
4.50 4.50	PID D 10	VOC 0ppm									
5.00	SPT	N=27 (4,4/5,7,7,8)						117.15			
				End of Borehole at 5.45m							
		Contractor A2 Site Investigation			Method Dynamic Sampling		Logged By BGR		Approved by GC		



Project Maple House - Potters Bar				Trial Pit No INF01	
Job No 75225	Start 18/12/2025 End 18/12/2025	Ground Level (mOD) 125.07	Co-Ordinates E 525949.00 N 201079.00		Depth (m) 0.80
Client Chase New Homes			Sheet Sheet 1 of 1		Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend
Depth (m)	Type No	Test Result					
0.30 0.30	PID D 1	VOC 0ppm	BRICK PAVING [MADE GROUND] Orangish brown gravelly fine to coarse SAND with frequent cobbles. Gravel is angular to subrounded fine to coarse of flint. Cobbles are 50mm diameter. [MADE GROUND] Light brown sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of flint, brick and cobbles. [MADE GROUND]	0.00 (0.07) 0.07 (0.05) 0.12	125.00 124.95		
0.50	ES 2			(0.58)		▼	
0.70 0.70	PID D 3	VOC 0ppm	Brown sandy CLAY (Water softened). [LONDON CLAY FORMATION] End of Pit at 0.80m	0.70 (0.10)	124.37 124.27		

General Remarks

1. Trial pit scanned with GPR and CAT & Genny.
2. Machine excavated pit to 0.8m bgl.
3. BRE 365 infiltration test not proceeded due water table found.
4. Trial pit terminated and backfilled with arisings.





Project Maple House - Potters Bar				Trial Pit No INF02	
Job No 75225	Start 18/12/2025 End 18/12/2025	Ground Level (mOD) 124.25	Co-Ordinates E 525949.00 N 200999.00		Depth (m) 1.30
Client Chase New Homes			Sheet Sheet 1 of 1		Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend
Depth (m)	Type No	Test Result					
0.50 0.50 0.50	PID D 1 ES 2	VOC 0ppm	BRICK PAVING [MADE GROUND]	0.00 (0.07)	124.18		
			Yellowish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint [MADE GROUND]	0.07 (0.10) 0.17			
			Light brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of flint [MADE GROUND]	(0.20)	123.88		
			Reddish brown gravelly SAND with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of flint. Cobble is angular brick. [MADE GROUND]	0.37 (0.30)			
			Soft becoming firm light brown silty sandy CLAY. Sand is fine to coarse. [LONDON CLAY FORMATION]	0.67	123.58		
1.00 1.00 1.00	PID D 3 ES 4	VOC 0ppm	End of Pit at 1.30m	(0.63)	122.95		

General Remarks

1. Trial pit scanned with GPR and CAT & Genny.
2. Machine excavated pit to 1.3m bgl.
3. BRE 365 infiltration carried out.
4. Trial pit remained dry and stable.
5. Trial pit terminated and backfilled with arisings.





A2 Site Investigation

Trial Pit Log

Project Maple House - Potters Bar				Trial Pit No INF03	
Job No 75225	Start 18/12/2025 End 18/12/2025	Ground Level (mOD) 122.60	Co-Ordinates E 525952.00 N 200904.00		Depth (m) 0.90
Client Chase New Homes			Sheet Sheet 1 of 1		Status FINAL

SAMPLES & TESTS			Stratum Description	Depth (thickness)	Reduced Level	Water	Legend
Depth (m)	Type No	Test Result					
			Brown slightly silty clayey fine to coarse SAND with frequent rootlets. Roots are 40mm and 20mm diameter. [TOPSOIL]	0.00 (0.20)			
			Yellowish clayey gravelly fine to coarse SAND, Gravel is angular to subrounded fine to coarse of flint. [MADE GROUND]	0.20 (0.15)	122.40		
			Soft becoming firm brown silty sandy CLAY. Sand is fine to coarse. [LONDON CLAY FORMATION]	0.35	122.25		
0.50 0.50 0.50	PID D 1 ES 2	VOC 0ppm		(0.55)			
0.90 0.90 0.90	PID D 3 ES 4	VOC 0ppm	End of Pit at 0.90m		121.70		

General Remarks

1. Trial pit scanned with GPR and CAT & Genny.
2. Machine excavated pit to 1.3m bgl.
3. BRE 365 infiltration carried out.
4. Trial pit remained dry and stable.
5. Trial pit terminated and backfilled with arisings.

Appendix D: Soakage Testing Results



A2 Site Investigation

SOIL INFILTRATION TEST

In accordance with BRE Digest 365

Client: Chase New Homes

Engineer: BGR

Project: Maple House - Potters Bar

Date: 18.12.25

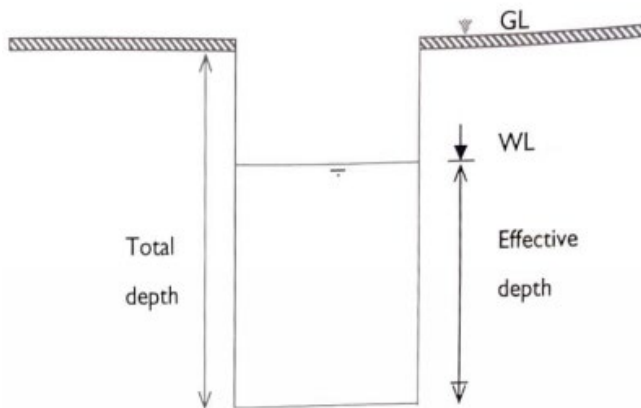
Job Number: 75225

Time to fill pit: < 1 min

INF02 - Test 1

Pit Dimensions

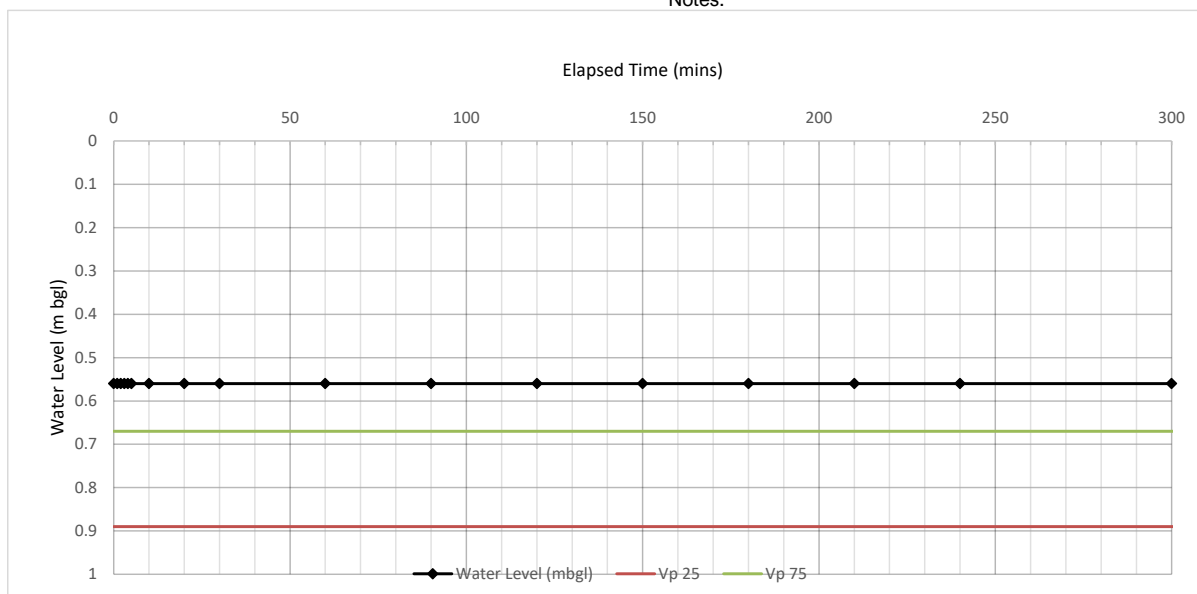
Length (m)	Width (m)	Total depth (m)	Effective depth (m)
1.1	0.5	1	0.44



Elapsed Time (mins)	Water Level (mbgl)	Head (m)	Head (%)
0	0.56	0.44	100.0
1	0.56	0.44	100.0
2	0.56	0.44	100.0
3	0.56	0.44	100.0
4	0.56	0.44	100.0
5	0.56	0.44	100.0
10	0.56	0.44	100.0
20	0.56	0.44	100.0
30	0.56	0.44	100.0
60	0.56	0.44	100.0
90	0.56	0.44	100.0
120	0.56	0.44	100.0
150	0.56	0.44	100.0
180	0.56	0.44	100.0
210	0.56	0.44	100.0
240	0.56	0.44	100.0
300	0.56	0.44	100.0

Soil Infiltration Rate: N/A m/s

Notes:





A2 Site Investigation

SOIL INFILTRATION TEST

In accordance with BRE Digest 365

Client: Chase New Homes

Engineer: BGR

Project: Maple House - Potters Bar

Date: 18.12.25

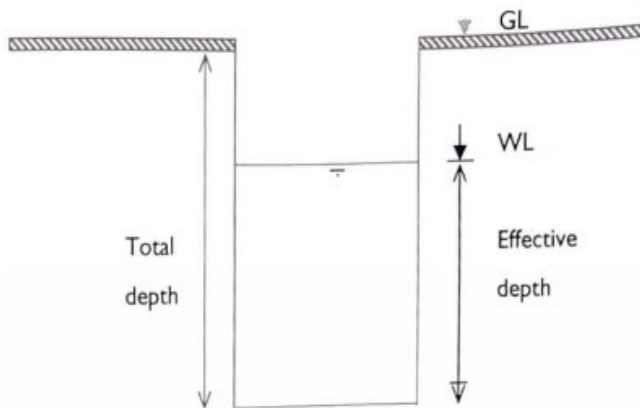
Job Number: 75225

Time to fill pit: < 1 min

INF03 - Test 1

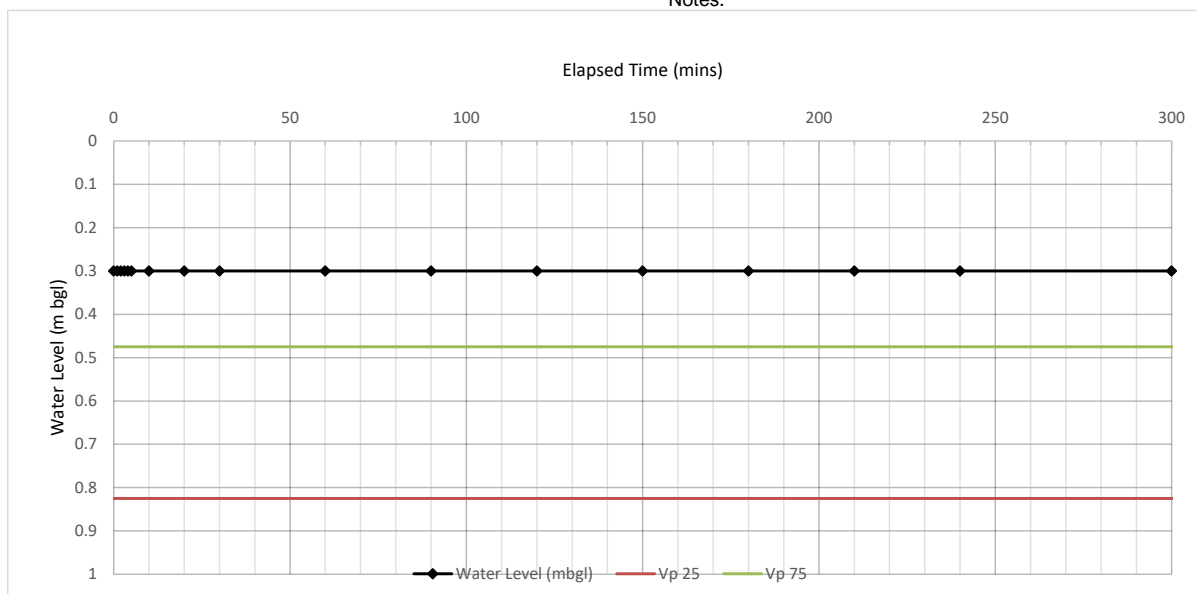
Pit Dimensions

Length (m)	Width (m)	Total depth (m)	Effective depth (m)
1.45	0.45	1	0.7



Elapsed Time (mins)	Water Level (mbgl)	Head (m)	Head (%)
0	0.3	0.7	100.0
1	0.3	0.7	100.0
2	0.3	0.7	100.0
3	0.3	0.7	100.0
4	0.3	0.7	100.0
5	0.3	0.7	100.0
10	0.3	0.7	100.0
20	0.3	0.7	100.0
30	0.3	0.7	100.0
60	0.3	0.7	100.0
90	0.3	0.7	100.0
120	0.3	0.7	100.0
150	0.3	0.7	100.0
180	0.3	0.7	100.0
210	0.3	0.7	100.0
240	0.3	0.7	100.0
300	0.3	0.7	100.0

Soil Infiltration Rate: N/A m/s
Notes:



Appendix E: Geoenvironmental Laboratory Testing Results

A2 Site Investigation Limited
100 Westminster Bridge Road
South Bank
London
SE1 7XW

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t:

t: 01923 225404

e: [redacted]@a2-si.com

f: 01923 237404

[redacted]@a2-si.com

e: info-i2analytical@normecgroup.com

[redacted]@a2-si.com

labs@a2-si.com

Analytical Report Number : 25-068813

Project / Site name:	Maple House - Potters Bar	Samples received on:	19/12/2025
Your job number:	75225	Samples instructed on/ Analysis started on:	22/12/2025
Your order number:	PO6173-I2-01	Analysis completed by:	15/01/2026
Report Issue Number:	1	Report issued on:	15/01/2026
Samples Analysed:	8 soil samples		



Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-068813
Project / Site name: Maple House - Potters Bar
Your Order No: PO6173-12-01

Lab Sample Number	789649	789650	789651	789652	789653
Sample Reference	WS01	WS02	WS03	WS04	WS05
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.50	0.50	0.50	0.30	0.50
Date Sampled	16/12/2025	16/12/2025	16/12/2025	17/12/2025	18/12/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.1	12	21	13	10
Total mass of sample received	kg	0.1	NONE	0.8	0.6	0.6	0.7	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Detected	Not-detected	Not-detected	Detected
Asbestos Analyst ID	N/A	N/A	N/A	MJN	MJN	MJN	MJN	MJN
Analysis completed	N/A	N/A	N/A	09/01/2026	09/01/2026	09/01/2026	09/01/2026	09/01/2026
Actinolite detected	Type	N/A	ISO 17025	-	Not-detected	-	-	Not-detected
Amosite detected	Type	N/A	ISO 17025	-	Not-detected	-	-	Detected
Anthophyllite detected	Type	N/A	ISO 17025	-	Not-detected	-	-	Not-detected
Chrysotile detected	Type	N/A	ISO 17025	-	Detected	-	-	Not-detected
Crocidolite detected	Type	N/A	ISO 17025	-	Not-detected	-	-	Not-detected
Tremolite detected	Type	N/A	ISO 17025	-	Not-detected	-	-	Not-detected

Asbestos % by hand picking/weighing	%	0.001	ISO 17025	-	0.002	-	-	0.019
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Asbestos Containing Material Types Detected (ACM)	Type	N/A	ISO 17025	-	Loose Fibrous Debris	-	-	Sheeting/Board Debris
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General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.7	9.7	8.5	8	10
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	80	310	440	110	1100
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	40.2	154	220	54	528
Organic Matter (automated)	%	0.1	MCERTS	0.5	1.3	0.8	0.7	0.9
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.0027	0.0074	0.0046	0.0042	0.0054
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.3	0.7	0.5	0.4	0.5

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.07	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.42	< 0.05	< 0.05	0.06
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.07	< 0.05	< 0.05	0.06
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.28	< 0.05	< 0.05	0.06
Phenanthrene	mg/kg	0.05	MCERTS	0.17	3	0.21	0.13	1.3
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.68	< 0.05	< 0.05	0.29
Fluoranthene	mg/kg	0.05	MCERTS	0.34	3.7	0.47	0.18	2.2
Pyrene	mg/kg	0.05	MCERTS	0.34	3.2	0.39	0.15	1.9
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.24	2	0.2	0.12	1.2
Chrysene	mg/kg	0.05	MCERTS	0.25	1.8	0.2	0.11	1.2
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.33	2.1	0.22	0.11	1.4
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.19	0.81	0.13	0.1	0.64
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.31	2.1	0.17	0.12	1.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.19	0.94	0.1	< 0.05	0.61
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.26	< 0.05	< 0.05	0.17
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.21	1.3	0.11	0.08	0.73

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	2.56	22.6	2.21	1.1	12.9
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Analytical Report Number: 25-068813
Project / Site name: Maple House - Potters Bar
Your Order No: PO6173-12-01

Lab Sample Number	789649	789650	789651	789652	789653
Sample Reference	WS01	WS02	WS03	WS04	WS05
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.50	0.50	0.50	0.30	0.50
Date Sampled	16/12/2025	16/12/2025	16/12/2025	17/12/2025	18/12/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.1	8.6	19	9	12
Barium (aqua regia extractable)	mg/kg	1	MCERTS	160	300	100	69	270
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.29	0.93	1	0.59	0.8
Boron (water soluble)	mg/kg	0.2	MCERTS	0.3	0.6	1.8	0.7	0.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	0.5	< 0.2	< 0.2	0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	7.8	24	51	23	22
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	7.8	24	51	23	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	12	26	32	15	31
Lead (aqua regia extractable)	mg/kg	1	MCERTS	37	210	61	31	210
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	0.42	1.4	1.1	0.57	1.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	6.9	17	19	9.7	17
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.4	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	11	37	75	46	50
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	97	180	65	46	360

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	15
TPHCWG - Aliphatic >EC35 - EC40 _{EH_CU_1D_AL}	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPHCWG - Aliphatic >EC5 - EC40 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10	< 10	< 10	15

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	4.9	< 2.0	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	11	< 10	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	63	< 10	< 10	16
TPHCWG - Aromatic >EC35 - EC40 _{EH_CU_1D_AR}	mg/kg	10	NONE	< 10	12	< 10	< 10	< 10
TPHCWG - Aromatic >EC5 - EC40 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	< 10	91	< 10	< 10	16

TPH Total >EC5 - EC40 _{EH_CU+HS_1D_TOTAL}	mg/kg	10	NONE	< 10	91	< 10	< 10	31
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VOCs

Chloromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Bromomethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Vinyl Chloride	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trichlorofluoromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,1-Dichloroethene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Analytical Report Number: 25-068813
Project / Site name: Maple House - Potters Bar
Your Order No: PO6173-12-01

Lab Sample Number				789649	789650	789651	789652	789653
Sample Reference				WS01	WS02	WS03	WS04	WS05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.50	0.50	0.50	0.30	0.50
Date Sampled				16/12/2025	16/12/2025	16/12/2025	17/12/2025	18/12/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trans 1,2-dichloroethylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,1-Dichloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
2,2-Dichloropropane	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chloroform	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,1,1-Trichloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dichloroethane	µg/kg	7	MCERTS	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0
1,1-Dichloropropene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Carbontetrachloride	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dichloropropane	µg/kg	6	MCERTS	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Trichloroethene	µg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
Dibromomethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Bromodichloromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trans-1,3-dichloropropene	µg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,1,2-Trichloroethane	µg/kg	6	MCERTS	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
1,3-Dichloropropane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Dibromochloromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Tetrachloroethene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dibromoethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Styrene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Bromoform	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Isopropylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,1,2,2-Tetrachloroethane	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Bromobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
n-Propylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
2-Chlorotoluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
4-Chlorotoluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
tert-Butylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
sec-Butylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,3-Dichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p-Isopropyltoluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,4-Dichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Butylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
1,2,4-Trichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Hexachlorobutadiene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Analytical Report Number: 25-068813
 Project / Site name: Maple House - Potters Bar
 Your Order No: PO6173-12-01

Lab Sample Number	789649	789650	789651	789652	789653
Sample Reference	WS01	WS02	WS03	WS04	WS05
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.50	0.50	0.50	0.30	0.50
Date Sampled	16/12/2025	16/12/2025	16/12/2025	17/12/2025	18/12/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
1,2,3-Trichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0

PCBs by GC-MS

PCB Congener 118	mg/kg	0.001	MCERTS	-	-	< 0.001	-	-
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PCBs

PCB Congener 077	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 081	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 105	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 114	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 118	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 123	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 126	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 156	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 157	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 167	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 169	mg/kg	0.001	NONE	-	-	< 0.001	-	-
PCB Congener 189	mg/kg	0.001	NONE	-	-	< 0.001	-	-

Total PCBs	mg/kg	0.012	NONE	-	-	< 0.012	-	-
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Glycols

1,2-Butanediol	mg/kg	10	NONE	-	-	< 10	< 10	-
1,3-Butanediol	mg/kg	10	NONE	-	-	< 10	< 10	-
1,4-Butanediol	mg/kg	10	NONE	-	-	< 10	< 10	-
Diethylene Glycol	mg/kg	10	NONE	-	-	< 10	< 10	-
Ethylene Glycol	mg/kg	10	NONE	-	-	< 10	< 10	-
1,2-Propanediol	mg/kg	10	NONE	-	-	< 10	< 10	-
1,3-Propanediol	mg/kg	10	NONE	-	-	< 10	< 10	-
1,5-Pentanediol	mg/kg	10	NONE	-	-	< 10	< 10	-
Triethylene Glycol	mg/kg	10	NONE	-	-	< 10	< 10	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 25-068813
Project / Site name: Maple House - Potters Bar
Your Order No: PO6173-12-01

Lab Sample Number	789654	789655	789656
Sample Reference	WS06	WS07	WS08
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	0.50	0.50	1.00
Date Sampled	18/12/2025	18/12/2025	18/12/2025
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	12	15	9.5
Total mass of sample received	kg	0.1	NONE	0.6	0.6	0.3

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MJN	MJN	MJN
Analysis completed	N/A	N/A	N/A	09/01/2026	09/01/2026	09/01/2026
Actinolite detected	Type	N/A	ISO 17025	Not-detected	-	-
Amosite detected	Type	N/A	ISO 17025	Detected	-	-
Anthophyllite detected	Type	N/A	ISO 17025	Not-detected	-	-
Chrysotile detected	Type	N/A	ISO 17025	Not-detected	-	-
Crocidolite detected	Type	N/A	ISO 17025	Not-detected	-	-
Tremolite detected	Type	N/A	ISO 17025	Not-detected	-	-

Asbestos % by hand picking/weighing	%	0.001	ISO 17025	< 0.001	-	-
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Asbestos Containing Material Types Detected (ACM)	Type	N/A	ISO 17025	Bitumen	-	-
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General Inorganics

pH (L099)	pH Units	N/A	MCERTS	10.1	8.2	7.2
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	380	1200	630
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	192	581	315
Organic Matter (automated)	%	0.1	MCERTS	0.8	1.4	0.2
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.0049	0.0081	0.0013
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.5	0.8	0.1

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.07	0.29	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.08	0.54	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.14	0.32	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.26	0.71	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.6	10	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.4	1.6	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	4	14	< 0.05
Pyrene	mg/kg	0.05	MCERTS	4.5	12	0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.5	5.6	< 0.05
Chrysene	mg/kg	0.05	MCERTS	4	4.9	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	6.1	5.7	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.3	2.7	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5.3	4.8	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	3	2.6	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.66	0.7	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.3	2.8	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	40.1	69.7	< 0.80
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Analytical Report Number: 25-068813
Project / Site name: Maple House - Potters Bar
Your Order No: PO6173-12-01

Lab Sample Number	789654	789655	789656
Sample Reference	WS06	WS07	WS08
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	0.50	0.50	1.00
Date Sampled	18/12/2025	18/12/2025	18/12/2025
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.7	13	13
Barium (aqua regia extractable)	mg/kg	1	MCERTS	98	350	26
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.5	0.53	0.49
Boron (water soluble)	mg/kg	0.2	MCERTS	0.8	0.8	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	0.3	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	26	16	28
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	16	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23	38	16
Lead (aqua regia extractable)	mg/kg	1	MCERTS	76	760	26
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	0.76	2.1	0.51
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	12	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.2	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	36	38	42
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	280	23

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	0.12	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	1.7	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	43	6.1	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	90	13	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	110	19	< 8.0
TPHCWG - Aliphatic >EC35 - EC40 _{EH_CU_1D_AL}	mg/kg	10	NONE	24	< 10	< 10
TPHCWG - Aliphatic >EC5 - EC40 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	270	38	< 10

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	27	4.4	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	60	25	< 10
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	85	30	< 10
TPHCWG - Aromatic >EC35 - EC40 _{EH_CU_1D_AR}	mg/kg	10	NONE	11	< 10	< 10
TPHCWG - Aromatic >EC5 - EC40 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	180	60	< 10

TPH Total >EC5 - EC40 _{EH_CU+HS_1D_TOTAL}	mg/kg	10	NONE	450	97	< 10
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VOCs

Chloromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Chloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Bromomethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Vinyl Chloride	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0
Trichlorofluoromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,1-Dichloroethene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

Analytical Report Number: 25-068813
Project / Site name: Maple House - Potters Bar
Your Order No: PO6173-12-01

Lab Sample Number				789654	789655	789656
Sample Reference				WS06	WS07	WS08
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.50	0.50	1.00
Date Sampled				18/12/2025	18/12/2025	18/12/2025
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Trans 1,2-dichloroethylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,1-Dichloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
2,2-Dichloropropane	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0
Chloroform	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,1,1-Trichloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,2-Dichloroethane	µg/kg	7	MCERTS	< 7.0	< 7.0	< 7.0
1,1-Dichloropropene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Carbontetrachloride	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,2-Dichloropropane	µg/kg	6	MCERTS	< 6.0	< 6.0	< 6.0
Trichloroethene	µg/kg	10	MCERTS	< 10	< 10	< 10
Dibromomethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Bromodichloromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Trans-1,3-dichloropropene	µg/kg	10	MCERTS	< 10	< 10	< 10
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,1,2-Trichloroethane	µg/kg	6	MCERTS	< 6.0	< 6.0	< 6.0
1,3-Dichloropropane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Dibromochloromethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Tetrachloroethene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,2-Dibromoethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Chlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
Styrene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Bromoform	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Isopropylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,1,2,2-Tetrachloroethane	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0
Bromobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
n-Propylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
2-Chlorotoluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
4-Chlorotoluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
tert-Butylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
sec-Butylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,3-Dichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p-Isopropyltoluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,4-Dichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,2-Dichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Butylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
1,2,4-Trichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Hexachlorobutadiene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

Analytical Report Number: 25-068813
 Project / Site name: Maple House - Potters Bar
 Your Order No: PO6173-12-01

Lab Sample Number				789654	789655	789656
Sample Reference				WS06	WS07	WS08
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.50	0.50	1.00
Date Sampled				18/12/2025	18/12/2025	18/12/2025
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status			
1,2,3-Trichlorobenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

PCBs by GC-MS

PCB Congener 118	mg/kg	0.001	MCERTS	-	-	-
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PCBs

PCB Congener 077	mg/kg	0.001	NONE	-	-	-
PCB Congener 081	mg/kg	0.001	NONE	-	-	-
PCB Congener 105	mg/kg	0.001	NONE	-	-	-
PCB Congener 114	mg/kg	0.001	NONE	-	-	-
PCB Congener 118	mg/kg	0.001	NONE	-	-	-
PCB Congener 123	mg/kg	0.001	NONE	-	-	-
PCB Congener 126	mg/kg	0.001	NONE	-	-	-
PCB Congener 156	mg/kg	0.001	NONE	-	-	-
PCB Congener 157	mg/kg	0.001	NONE	-	-	-
PCB Congener 167	mg/kg	0.001	NONE	-	-	-
PCB Congener 169	mg/kg	0.001	NONE	-	-	-
PCB Congener 189	mg/kg	0.001	NONE	-	-	-

Total PCBs	mg/kg	0.012	NONE	-	-	-
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Glycols

1,2-Butanediol	mg/kg	10	NONE	< 10	-	-
1,3-Butanediol	mg/kg	10	NONE	< 10	-	-
1,4-Butanediol	mg/kg	10	NONE	< 10	-	-
Diethylene Glycol	mg/kg	10	NONE	< 10	-	-
Ethylene Glycol	mg/kg	10	NONE	< 10	-	-
1,2-Propanediol	mg/kg	10	NONE	< 10	-	-
1,3-Propanediol	mg/kg	10	NONE	< 10	-	-
1,5-Pentanediol	mg/kg	10	NONE	< 10	-	-
Triethylene Glycol	mg/kg	10	NONE	< 10	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



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Analytical Report Number: **25-068813**
Project / Site name: **Maple House - Potters Bar**
Your Order No: **PO6173-I2-01**

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample	Analysis completed	Analyst ID
789650	WS02	0.50-	102	Loose Fibrous Debris	Chrysotile	0.002	0.002	09/01/2026	MJN
789653	WS05	0.50-	179	Sheeting/Board Debris	Amosite	0.019	0.019	09/01/2026	MJN
789654	WS06	0.50-	153	Bitumen	Amosite	< 0.001	< 0.001	09/01/2026	MJN

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 25-068813

Project / Site name: Maple House - Potters Bar

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
789649	WS01	None Supplied	0.5	Brown sand with gravel
789650	WS02	None Supplied	0.5	Brown sand with gravel
789651	WS03	None Supplied	0.5	Brown sandy clay with gravel
789652	WS04	None Supplied	0.3	Brown clay and sand with gravel
789653	WS05	None Supplied	0.5	Brown sand with gravel
789654	WS06	None Supplied	0.5	Brown sand with gravel
789655	WS07	None Supplied	0.5	Brown sand with gravel and vegetation
789656	WS08	None Supplied	1	Brown sandy clay with gravel

Analytical Report Number : 25-068813

Project / Site name: Maple House - Potters Bar

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content (Wet Weight)	Moisture content (% wet weight), determined gravimetrically (up to 30°C)	In-house-procedure based on BS EN 12880:2000	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID in soil	Determination of total petroleum hydrocarbons in soil by GC-FID with carbon banding aliphatic and aromatic	In-house method	L076B	D	MCERTS
Chromium III in soil	In-house method by calculation from total Cr and Cr VI	In-house method by calculation	L080-PL/L130B	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Total petroleum hydrocarbons with carbon banding by HS-GC/MS in soil	Determination of total petroleum hydrocarbons in soil by HS-GC/MS with carbon banding aliphatic and aromatic	In-house method	L088-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil (Summed Bands)	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic (Summed Bands).	Calculation	L076B/L088-PL	D/W	NONE

Analytical Report Number : 25-068813

Project / Site name: Maple House - Potters Bar

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate	In-house method	L009B	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references	HSE Report No: 83/1996, HSG 248 (2021), HSG 264 (2012) & SCA Blue Book (draft)	A006B	D	ISO 17025
PCBs WHO 12 in soil	Determination of PCBs (WHO-12 Congeners) by GC-MS	In-house method based on USEPA 8082	L027B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
Determination of Glycols in soil by GC-MS	Determination of Glycols in soil by GC-MS.	In-house method	L059B	D	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution



Sample Deviation Report



Normec
i2 Analytical

Analytical Report Number : 25-068813

Project / Site name: Maple House - Potters Bar

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container/Insufficient material provided c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS03	N/A	S	789651	b	Determination of Glycols in soil by GC-MS	L059B	b
WS04	N/A	S	789652	b	Determination of Glycols in soil by GC-MS	L059B	b



A2 Site Investigation

100 Westminster Bridge Road
South Bank
London
SE1 7XA

020 7021 0396
contact@a2-si.com
www.a2-si.com

Appendix D

TWUL Records and Predev Report



ATKINSRÉALIS UK LIMITED
PO Box 997
WORCESTER
WR4 4LS

Search address supplied 2a
High Street
Princes Parade
Potters Bar
EN6 5AE

Your reference 242723/SJ

Our reference ALS/ALS Standard/2025_5138863

Search date 24 March 2025

Keeping you up-to-date

We have a new website and email address

Website URL: thameswater.co.uk/propertysearches

Email address: property.searches@thameswater.co.uk

Please do get in contact with us if you have any questions.



Thames Water Utilities Ltd
Property Searches,
Clearwater Court, Vastern Road, Reading RG1 8DB



property.searches@thameswater.co.uk



0800 009 4540

Search address supplied: 2a, High Street, Princes Parade, Potters Bar, EN6 5AE

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This search provides maps showing the position and size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the contact details below:

Thames Water Utilities Ltd
Property Searches
Clearwater Court
Vastern Road
Reading
RG1 8DB

Email: property.searches@thameswater.co.uk

Web: 

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority. Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners. The public sewer map relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus. The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd
Tamblin Way



Hatfield
AL10 9EZ
Tel: 0345 3572401

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. You can do this by emailing customer.feedback@thameswater.co.uk with the email subject header 'Enquiry – TWOSA', along with details of the request.

If you have any questions regarding sewer connections, budget estimates, diversions or building over issues please direct them to our service desk which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 525943,201000
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map (2024) with the Sanction of the controller of H.M. Stationery Office, License no. AC0000849556 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
191K	n/a	n/a
191L	n/a	n/a
091K	n/a	n/a
091L	n/a	n/a
701C	n/a	n/a
701D	n/a	n/a
111C	n/a	n/a
9101	124.56	123.44
9102	124.55	123.66
911A	n/a	n/a
921C	n/a	n/a
781C	n/a	n/a
781K	n/a	n/a
781E	n/a	n/a
781D	n/a	n/a
781H	n/a	n/a
881A	n/a	n/a
881B	n/a	n/a
9703	119.82	116.68
071E	n/a	n/a
191J	n/a	n/a
771C	n/a	n/a
781I	n/a	n/a
1003	122.25	120.44
1004	122.25	120.19
1102	123.27	121.69
1103	123.28	121.34
1104	123.88	122.27
1105	123.93	122.04
1106	125.24	123.84
1107	125.69	124.23
1207	126.42	124.9
1205	126.02	124.97
9105	125.34	120.32
9103	125.5	123.21
0103	124.89	123.62
0110	125.03	122.78
111A	n/a	n/a
011C	n/a	n/a
0107	125.08	124.37
111B	n/a	n/a
011A	n/a	n/a
0105	125.4	124.17
0109	125.52	122.1
011D	n/a	n/a
9107	125.46	124.45
0104	125.87	124.99
0101	125.54	122.81
0102	125.8	124.56
9108	125.54	124.32
011E	n/a	n/a
0111	125.79	124.99
1101	125.77	122.49
9106	125.31	119.94
9109	125.48	124.12
011F	n/a	n/a
011B	n/a	n/a
0108	126.1	125.33
711A	n/a	n/a
7101	122	120.36
8104	123.56	119.28
8102	123.12	119.36
711B	n/a	n/a
8103	123.12	119.9
8101	122.2	121.35
7206	121.5	118.52
7204	121.03	117.55
7208	121.92	119.3
7205	121.39	120.57
721A	n/a	n/a
7202	119.94	115.26
7201	119.65	117.67
721B	n/a	n/a
09AC	n/a	n/a
19BA	n/a	n/a
191B	n/a	n/a
191C	n/a	n/a
091B	n/a	n/a
19AJ	n/a	n/a
0915	120.29	118.21
19BD	n/a	n/a
091C	n/a	n/a
19BC	n/a	n/a
19AI	n/a	n/a
091D	n/a	n/a
091E	n/a	n/a
091A	n/a	n/a
001A	n/a	n/a
001B	n/a	n/a
0001	123.72	122.5
9002	125.34	123.51

Manhole Reference	Manhole Cover Level	Manhole Invert Level
10CG	n/a	n/a
10CH	n/a	n/a
9003	125.32	123.87
9004	125.37	120.71
10AH	n/a	n/a
0002	124.18	123.09
0003	124.75	122.94
0106	124.75	122.32
9104	125.29	123.98
7902	120.35	118.17
8903	123.65	121.9
791A	n/a	n/a
8901	123.65	121.48
8902	123.66	121.5
791D	n/a	n/a
7903	123.17	120.38
791C	n/a	n/a
7904	123.17	120.36
791B	n/a	n/a
9901	124.5	121.13
9001	124.5	120.9
701B	n/a	n/a
6005	122.59	121.12
7102	122	119.82
091I	n/a	n/a
0907	118.36	117.56
0913	117.9	117.03
0908	118.33	117.56
0911	118.06	117.21
0914	117.91	117.08
091F	n/a	n/a
091G	n/a	n/a
0910	118.3	117.3
0906	118.48	115.95
9902	122.4	121.29
0909	118.36	117.44
0905	119.42	118.38
091H	n/a	n/a
191A	n/a	n/a
0903	122.65	120.35
9904	122.72	121.48
0901	122.87	118.92
9903	122.8	119.19
991A	n/a	n/a
0904	123.02	119.09
19AD	n/a	n/a
19AC	n/a	n/a
19AB	n/a	n/a
0902	123.12	121.78
1902	119.14	117.76
09AB	n/a	n/a
1905	116.08	113.79
191D	n/a	n/a
191F	n/a	n/a
191E	n/a	n/a
1908	116.88	n/a
1909	116.95	114.45
10DC	n/a	n/a
10DA	n/a	n/a
10CJ	n/a	n/a
10CI	n/a	n/a
10BI	n/a	n/a
1001	121.3	119.8
1002	121.28	119.17
10BA	n/a	n/a
10BG	n/a	n/a
10AI	n/a	n/a
7712	116.3	113.9
781F	n/a	n/a
7713	116.71	113.83
7812	118.2	114.87
781G	n/a	n/a
7905	121.49	119.76
8801	117.97	115.62
8802	121.28	118.04
8803	121.86	120.03
8804	121.89	121.89
8805	120.74	117.8
8806	121.33	119.13
8807	122.13	120.65
8808	122.21	119.91
9801	122.38	121.17
9802	122.12	120.34
9803	120.72	119.64
9804	120.61	119.53
9806	121.21	119.97
9805	120.51	119.42
9807	120.48	118.74
1802	117.53	116.17
1901	117.38	114.87
1803	117.39	116.13
1703	117.27	115.11
1705	117.03	113.88

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1903	116.57	n/a
1904	116.55	115.41
1708	116.39	113.69
1906	115.81	113.96
1907	115.82	113.35
1804	115.12	112.56
1805	115.01	113.1
1806	113.69	111
1808	113.78	111.73
1807	113.8	112.8
1809	113.67	112.59
1810	112.47	110.47
171A	n/a	n/a
1811	111.26	109.69
9808	121.45	119.55
9809	121.61	117.7
9810	122.04	n/a
971B	n/a	n/a
081A	n/a	n/a
0801	120.68	119.56
071A	n/a	n/a
0802	n/a	n/a
0803	119.78	117.01
0804	119.86	117.01
0805	119.44	116.76
081B	n/a	n/a
0806	118.71	116.24
0704	119.47	119.02
0807	117.74	115.85
0808	118.04	117.18
0809	118.37	115.82
0810	117.08	115.29
0811	117.77	116.79
0812	116.82	115.06
0813	116.06	115.54
0912	117.6	116.42
0814	n/a	n/a
0815	116.83	115.8
0816	115.75	114.46
0817	117.15	116.19
1801	117.46	116.25
781J	n/a	n/a
7901	120.26	118.84
781A	n/a	n/a
7702	113.57	111.71
7801	115.79	114.87
7703	113.58	112.03
7802	115.89	114.91
7803	117.35	117.35
7804	117.38	116.43
7806	117.14	116.02
7805	117.19	116.3
7704	114.6	113.32
7807	115.64	114.26
7705	114.56	113.56
7808	115.73	114.64
7810	117.37	115.92
7809	117.35	116.13
781B	n/a	n/a
7811	121.13	118.68
771E	n/a	n/a
7709	111.97	110.01
6721	111.66	110.17
771F	n/a	n/a
7701	112	110.82
771A	n/a	n/a
7714	115.17	113.16
7711	114.35	111.92
0707	119.21	118.29
1702	118.46	116.1
8704	116.11	112.81
8706	170.6	168.53
8707	117.64	114.47
9701	119.85	118.45
9706	119.08	118.12
071B	n/a	n/a
0701	120.11	119.37
0702	119.72	118.95
0703	119.59	118.8
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

	Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Storm Sewer
	Sludge Sewer
	Foul Trunk Sewer
	Surface Trunk Sewer
	Combined Trunk Sewer
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Vacuum
	Thames Water Proposed
	Vent Pipe
	Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

	Sewer		Culverted Watercourse
	Proposed		Decommissioned Sewer
	Content of this drainage network is currently unknown		Ownership of this drainage network is currently unknown

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plan are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

	Air Valve		Meter
	Dam Chase		Vent
	Fitting		

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

	Ancillary		Drop Pipe
	Control Valve		Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

	Inlet		Outfall
	Undefined End		

Other Symbols

Symbols used on maps which do not fall under other general categories.

	Change of Characteristic Indicator		Public / Private Pumping Station
	Invert Level		Summit

Areas

Lines denoting areas of underground surveys, etc.

	Agreement
	Chamber
	Operational Site

Ducts or Crossings

	Casement	Ducts may contain high voltage cables. Please check with Thames Water.
	Conduit Bridge	
	Subway	
	Tunnel	

5) 'na' or '0' on a manhole indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Appendix E

EA Flood Maps

Flood map for planning

Your reference
Unspecified

Location (easting/northing)
525951/200977

Created
28 January 2026 05:41

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

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

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

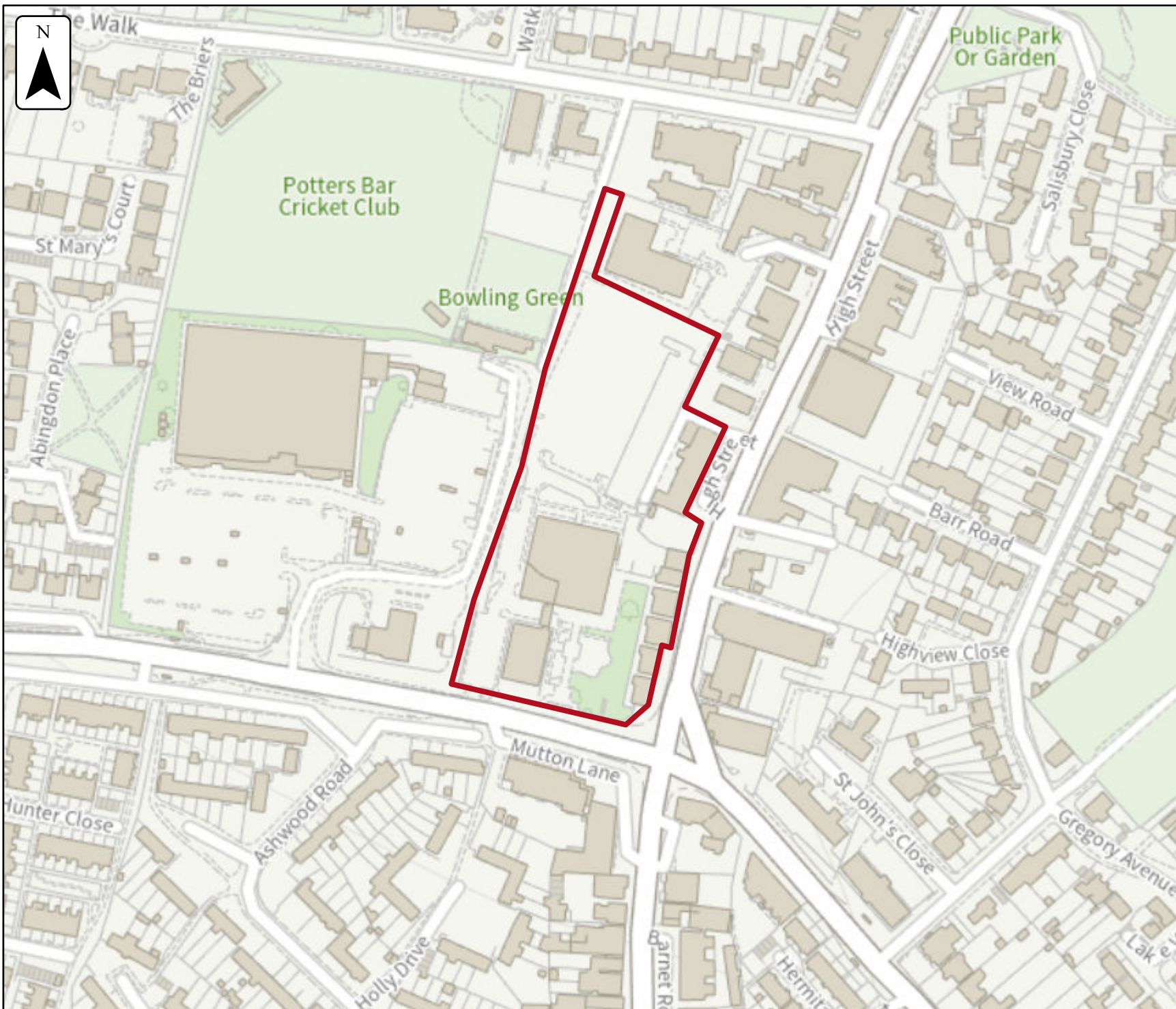
Notes

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

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

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2026 AC0000807064.



Flood map for planning

Your reference

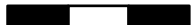
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Location (easting/northing)
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Scale
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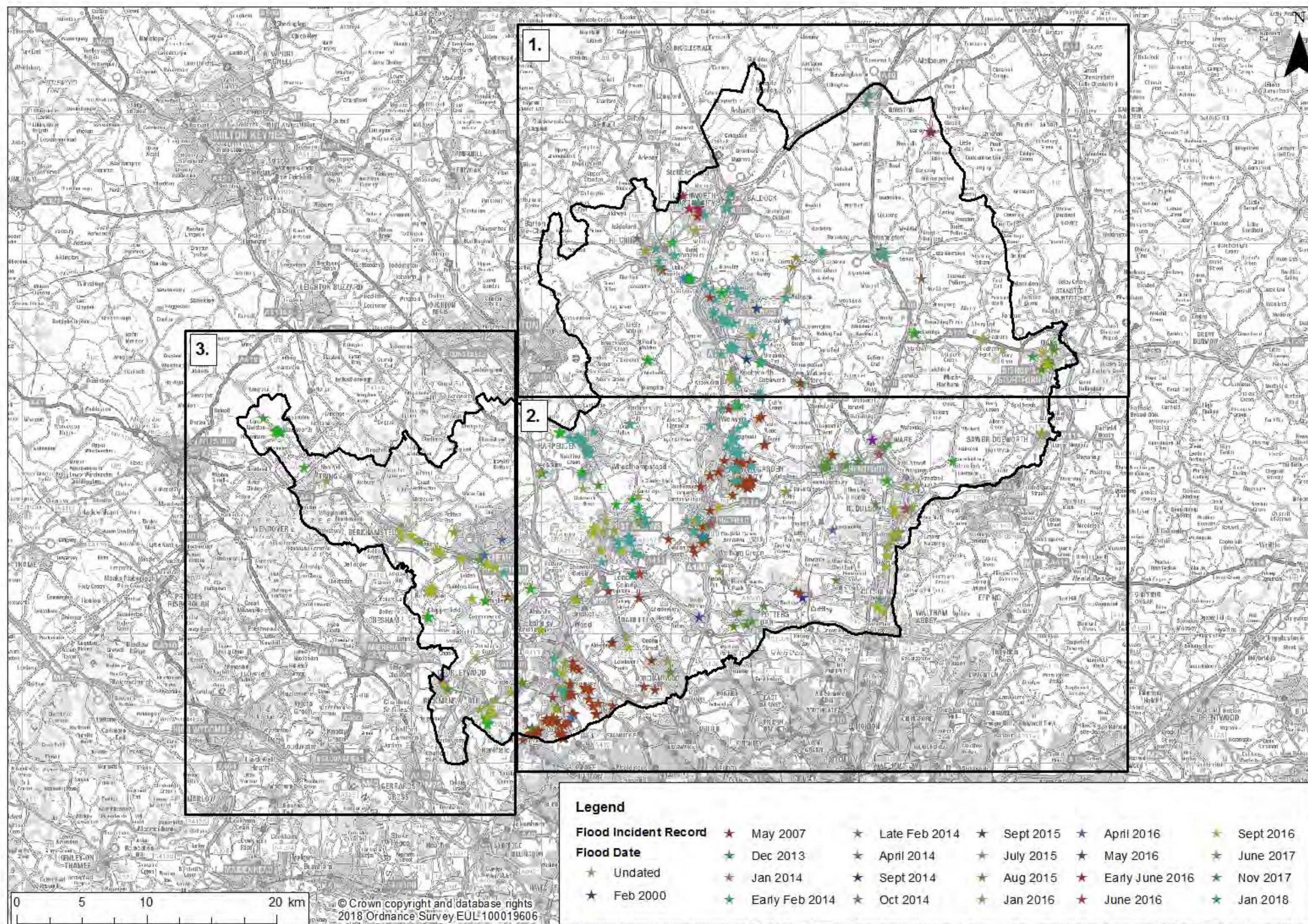
Created
28 Jan 2026 05:41

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area

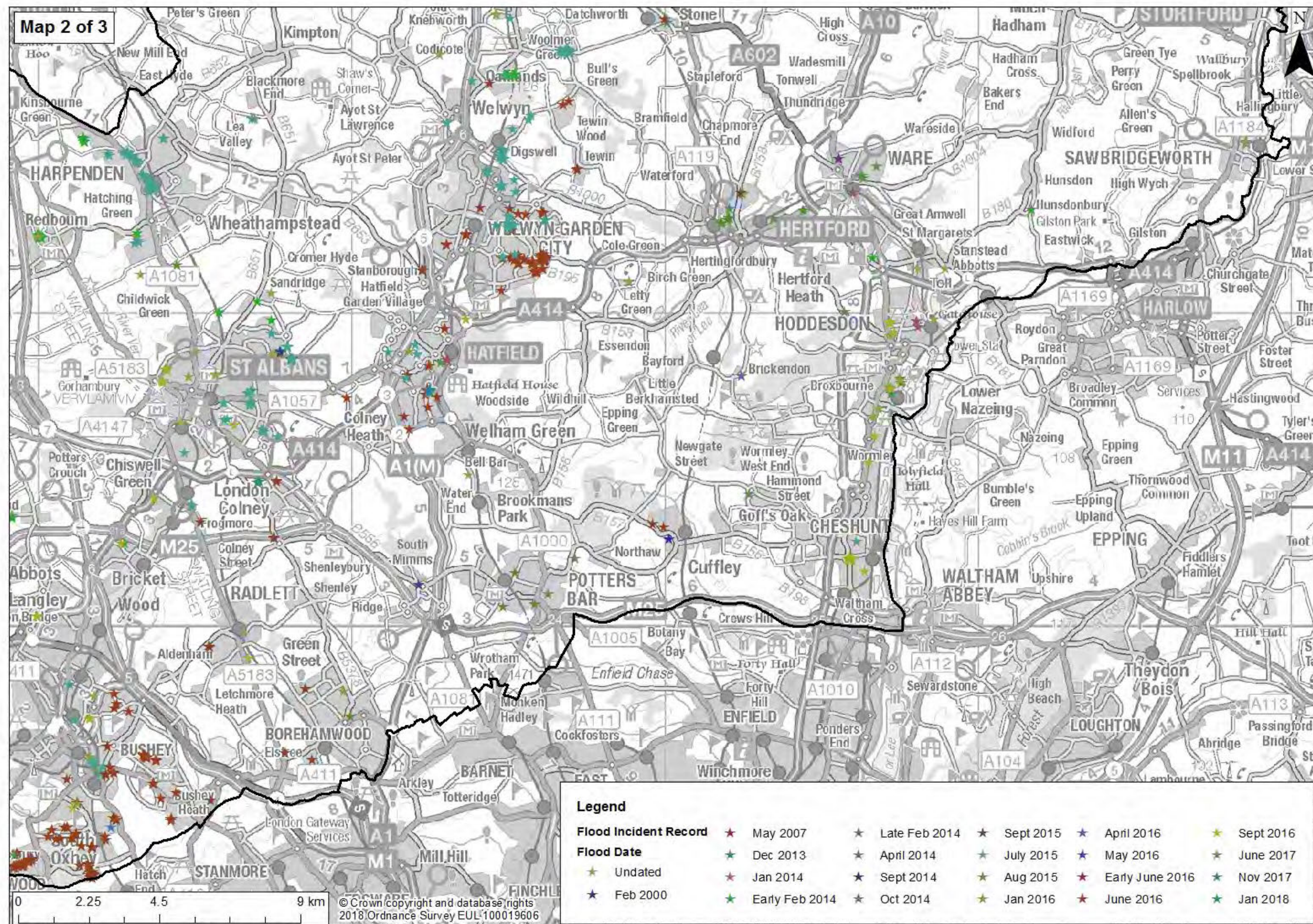

0 20 40 60m

Appendix F

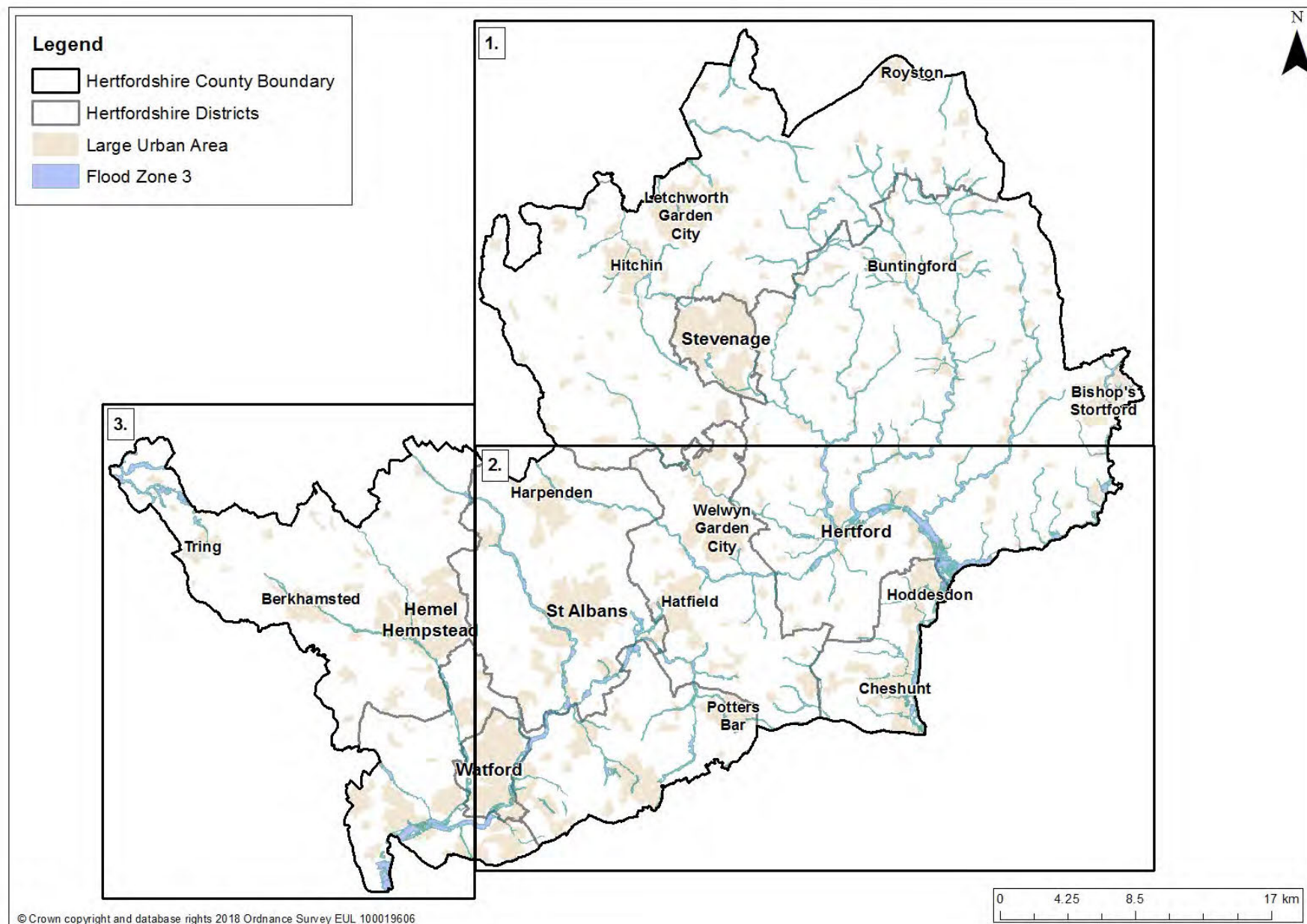
LLFA Flood Maps and Correspondence



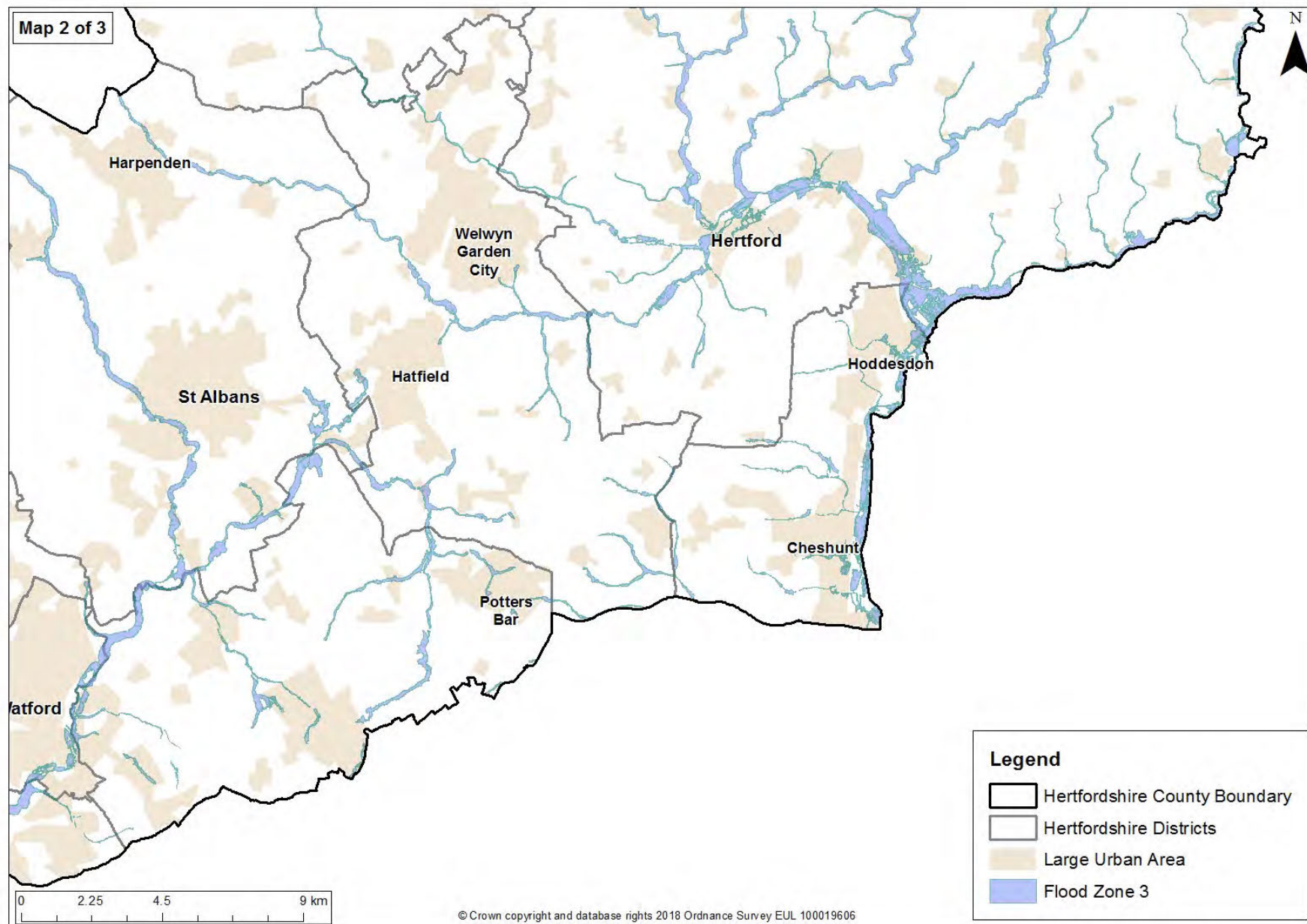
Map 1: Overview Map – Flood Incident Record for Hertfordshire



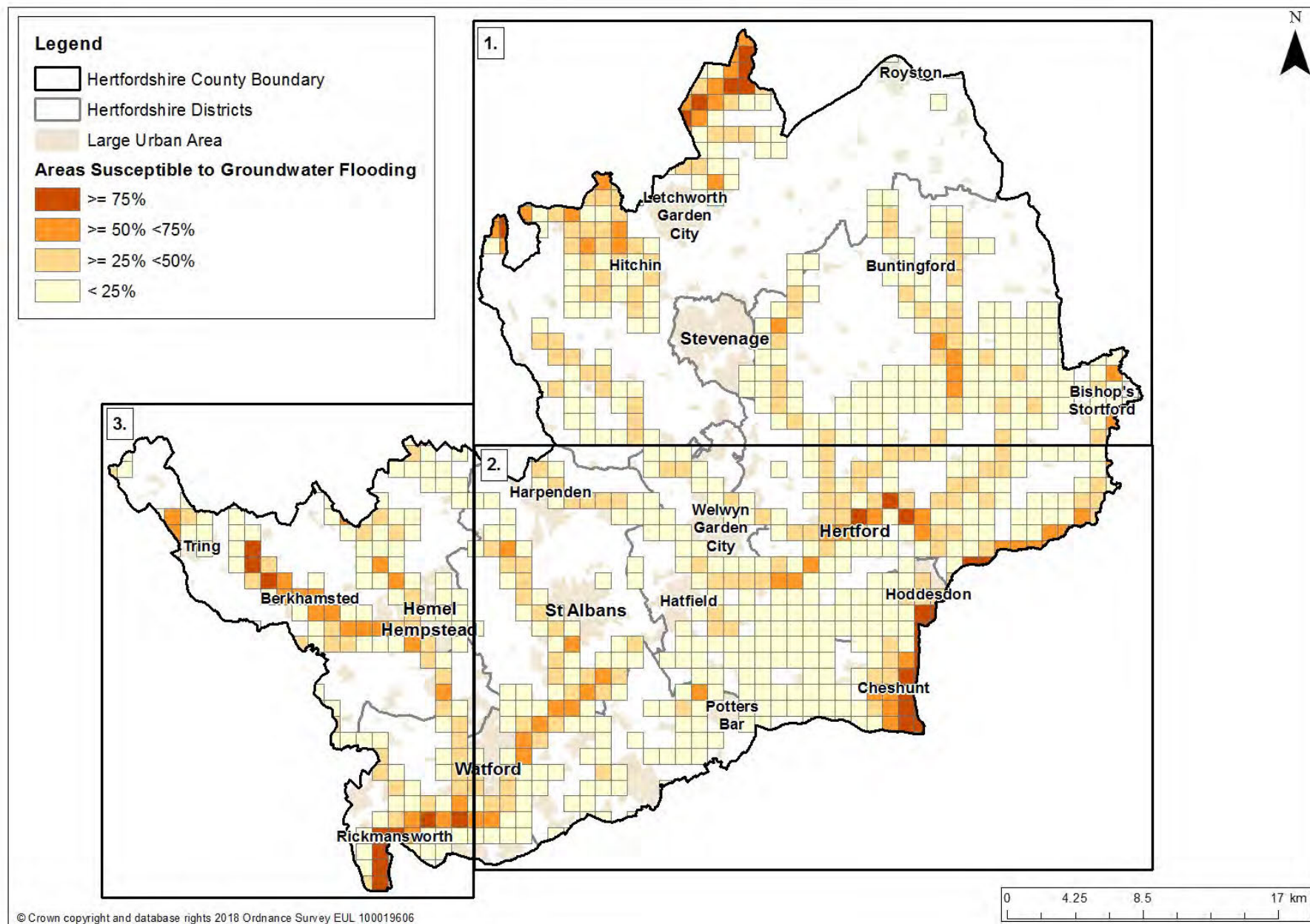
Map 1b: Map 2 of 3 – Flood Incident Record for Hertfordshire (South)



Map 3: Overview Map – Fluvial Flood Zone 3 in Hertfordshire

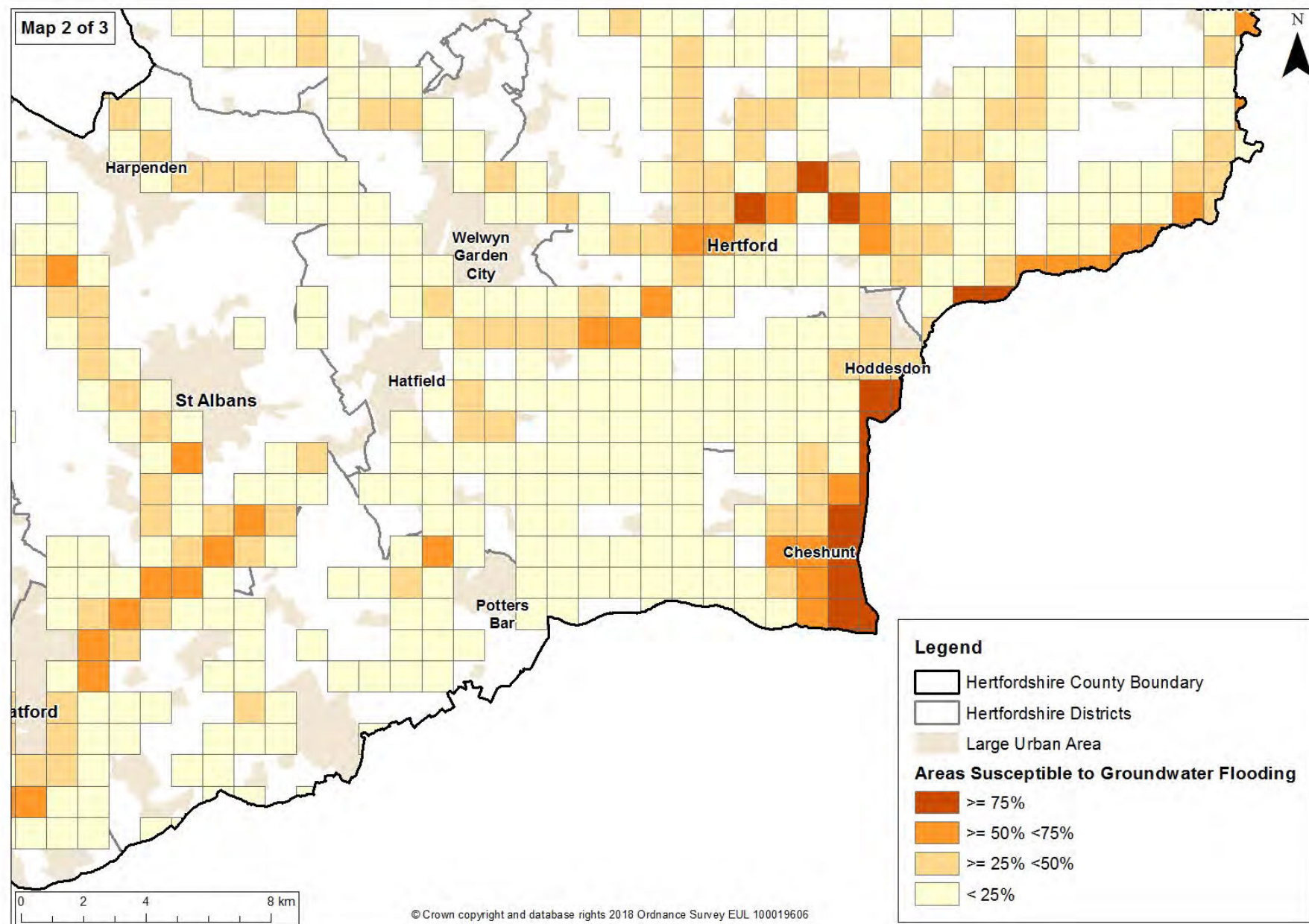


Map 3b: Map 1 of 3 – Fluvial Flood Zone 3 in Hertfordshire (South)

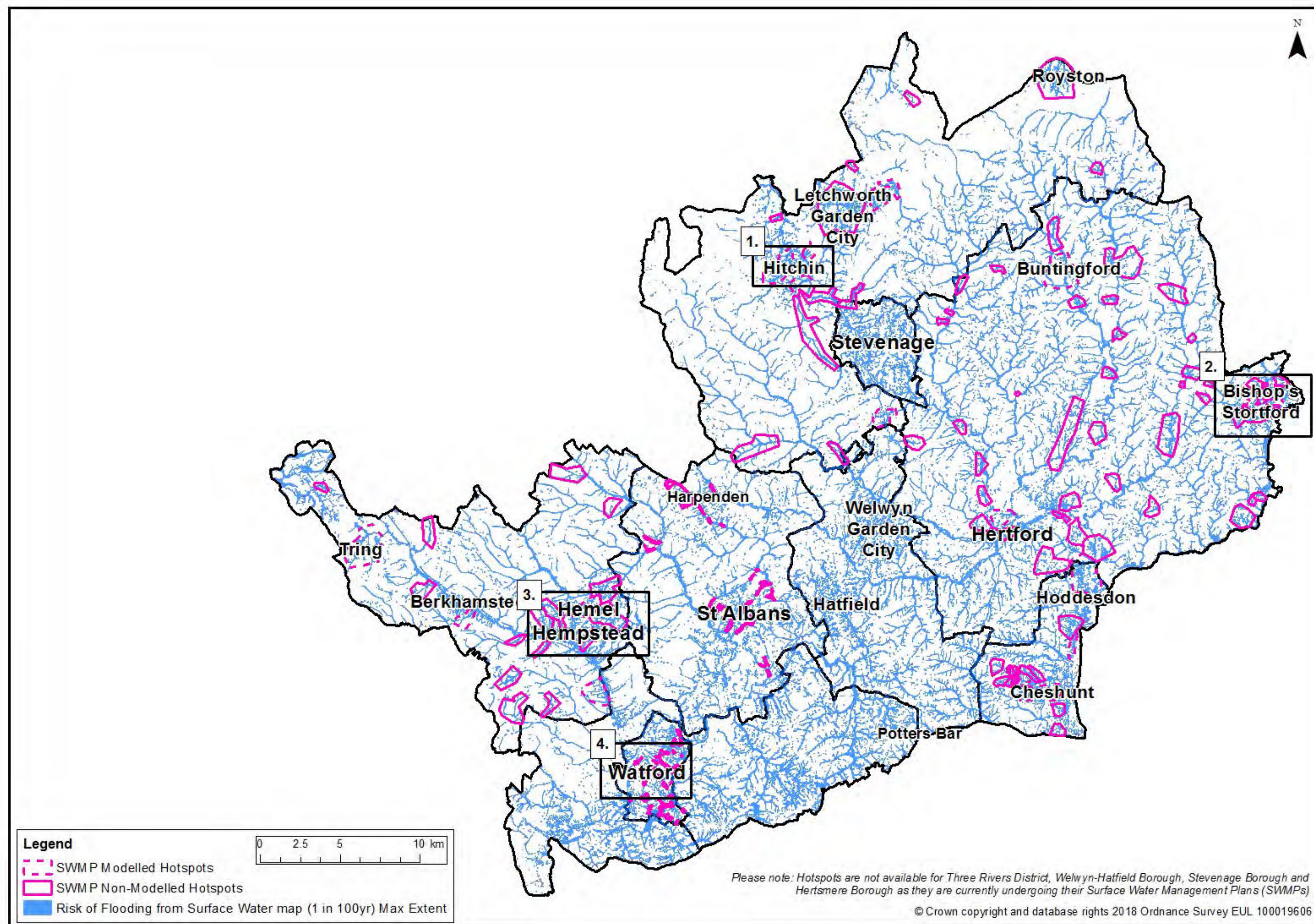


Map 6: Overview Map – Areas Susceptible to Groundwater Flooding in Hertfordshire

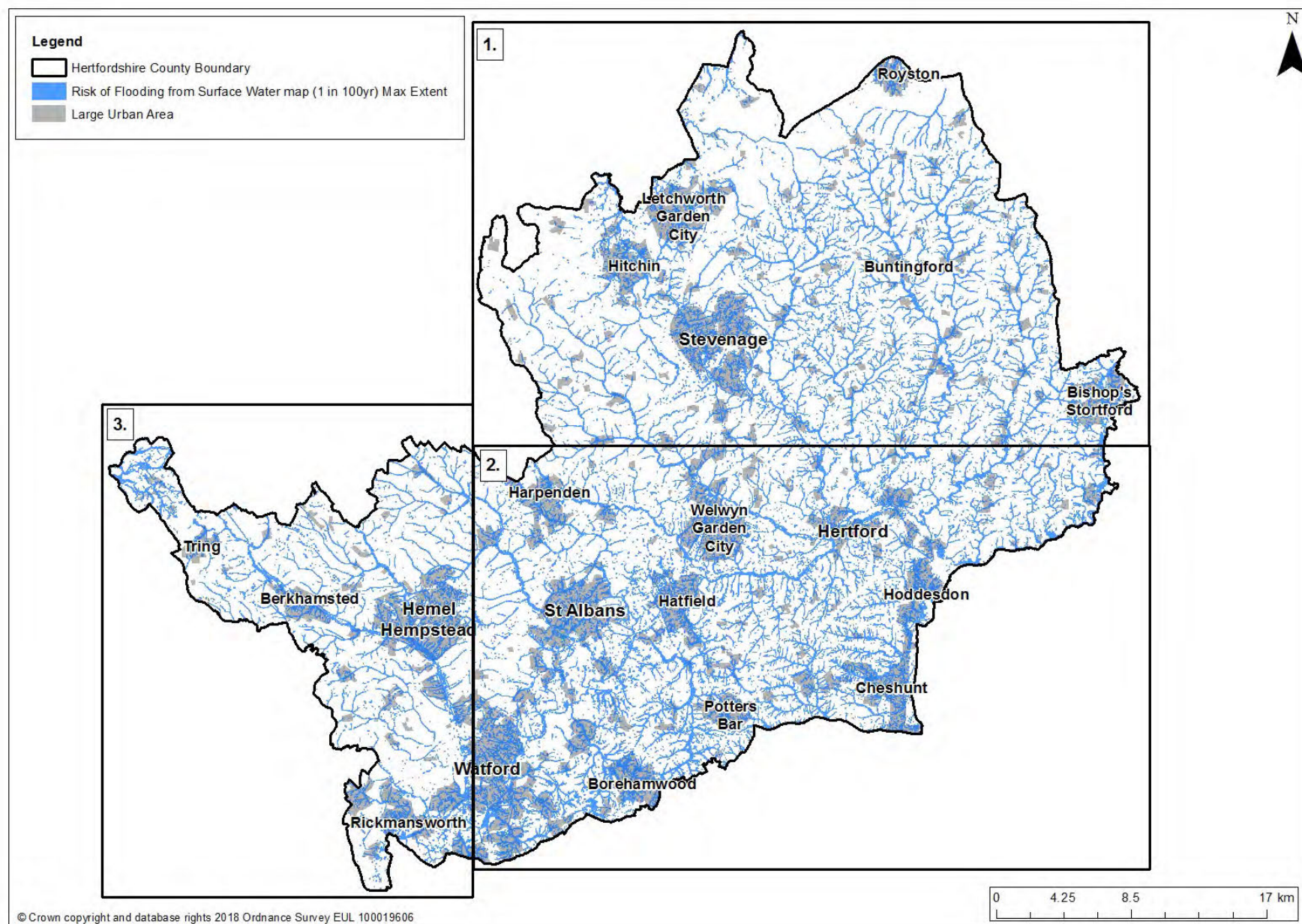
Adopted 18 February 2019



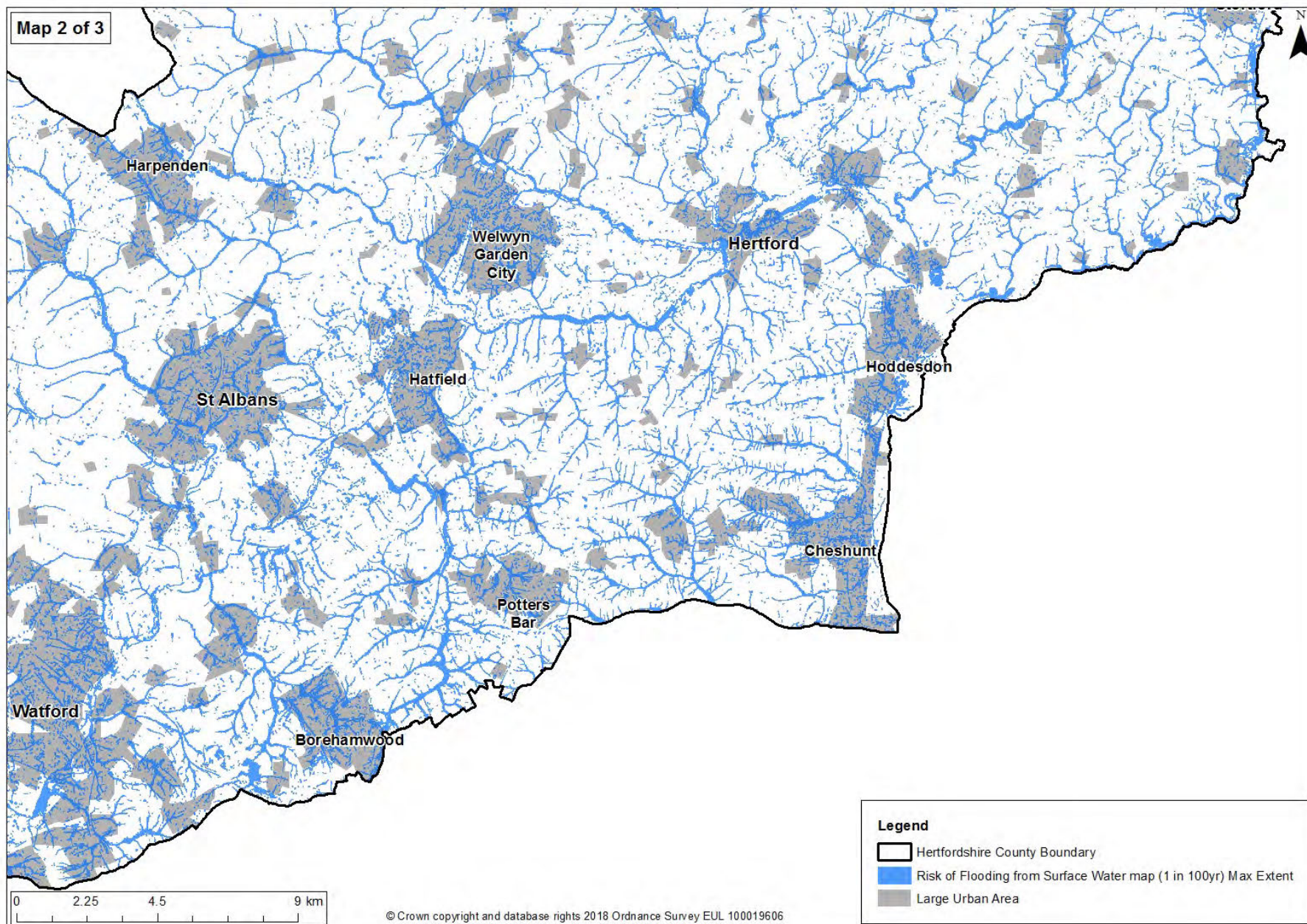
Map 6b: Map 2 of 3 – Areas Susceptible to Groundwater Flooding in Hertfordshire (South)



Map 10: Overview Map – SWMP Hotspots and the Risk of Flooding from Surface Water map (1% AEP event) for Hertfordshire

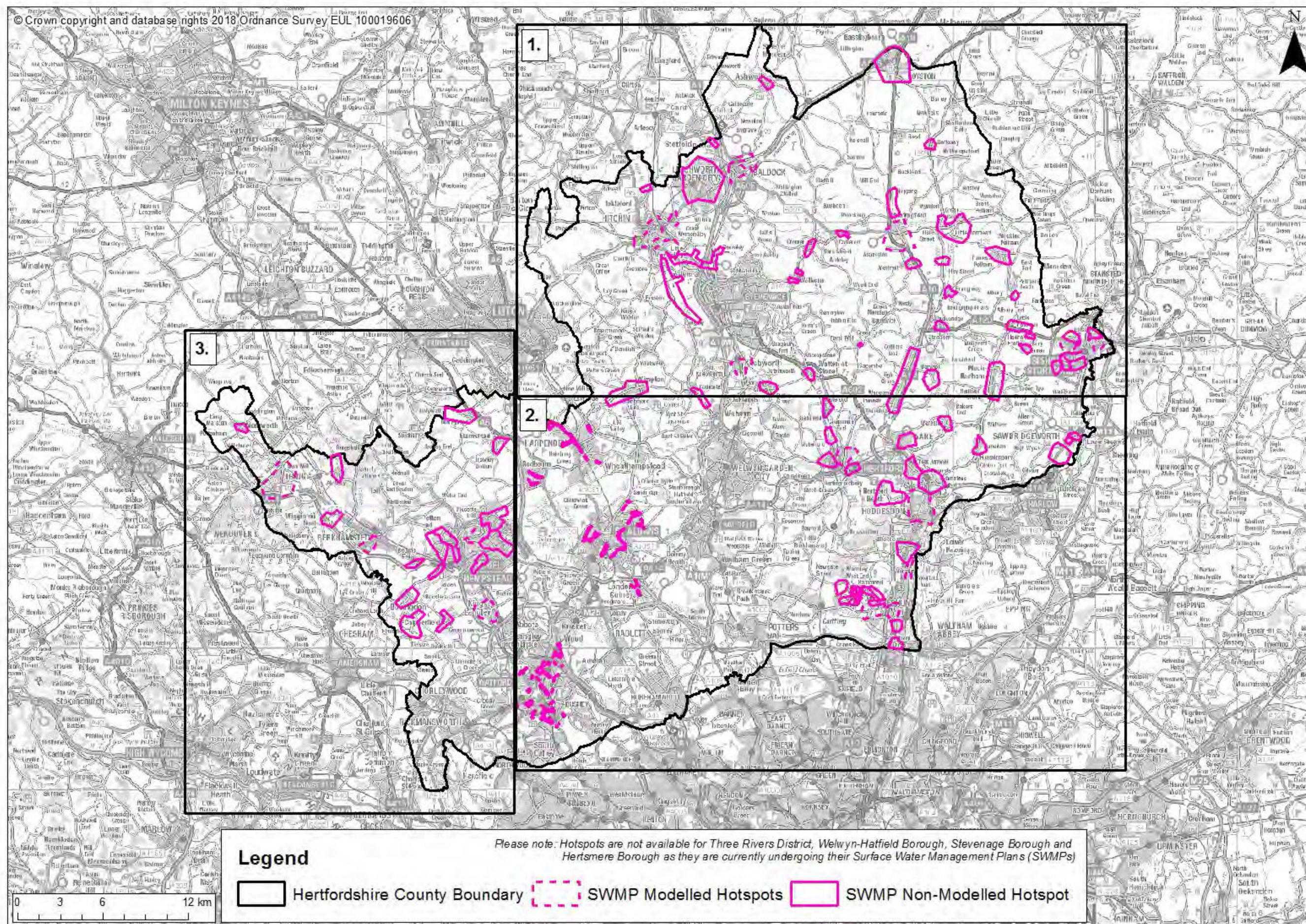


Map 2: Overview Map – Risk of Flooding from Surface Water map (1% AEP event) for Hertfordshire

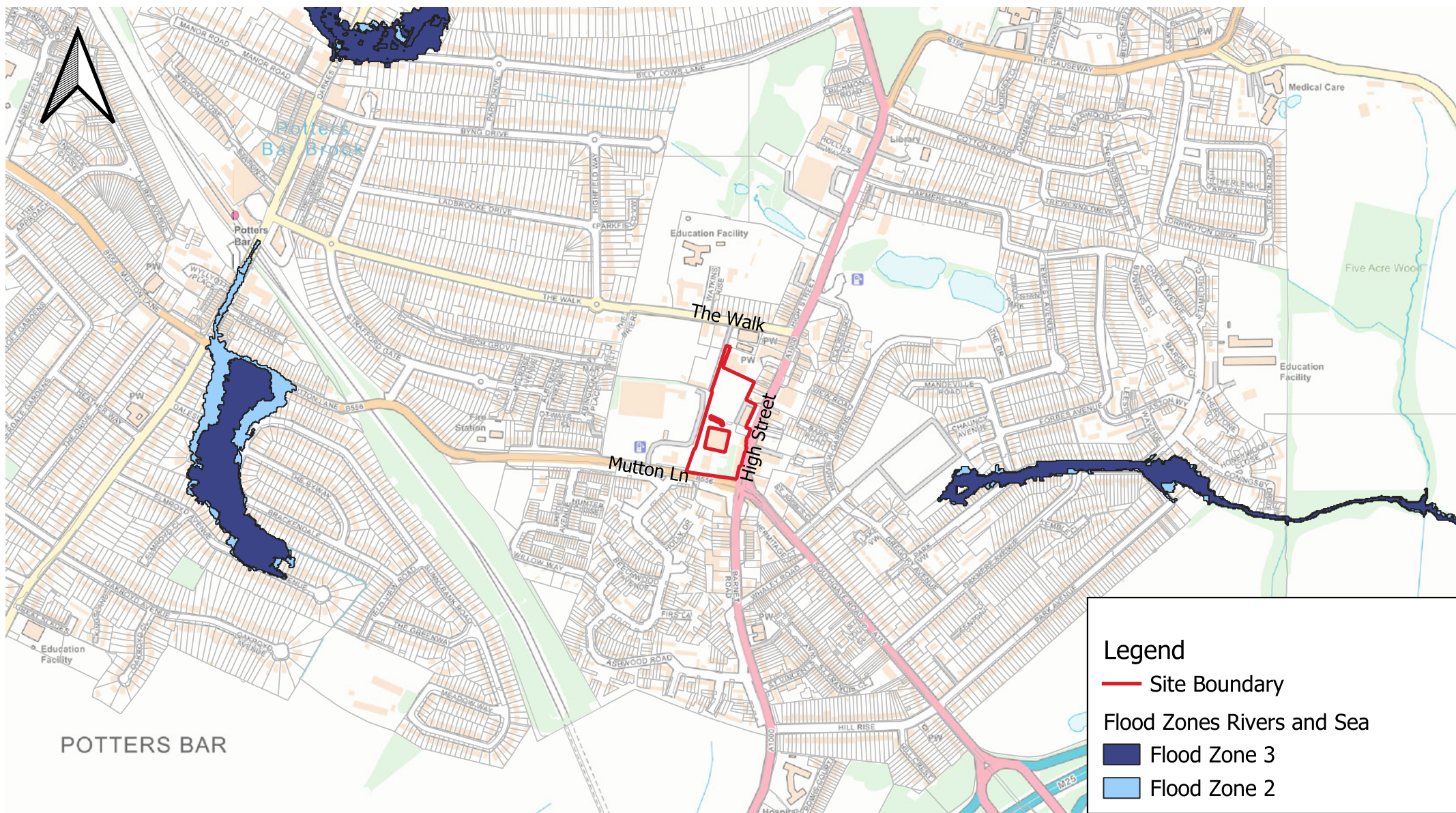


Map 2b: Map 2 of 3 – Risk of Flooding from Surface Water map (1% AEP event) in Hertfordshire (South)

Adopted 18 February 2019



Map 11: Overview Map – Surface Water Management Plan (SWMP) Hotspots for Hertfordshire



Legend

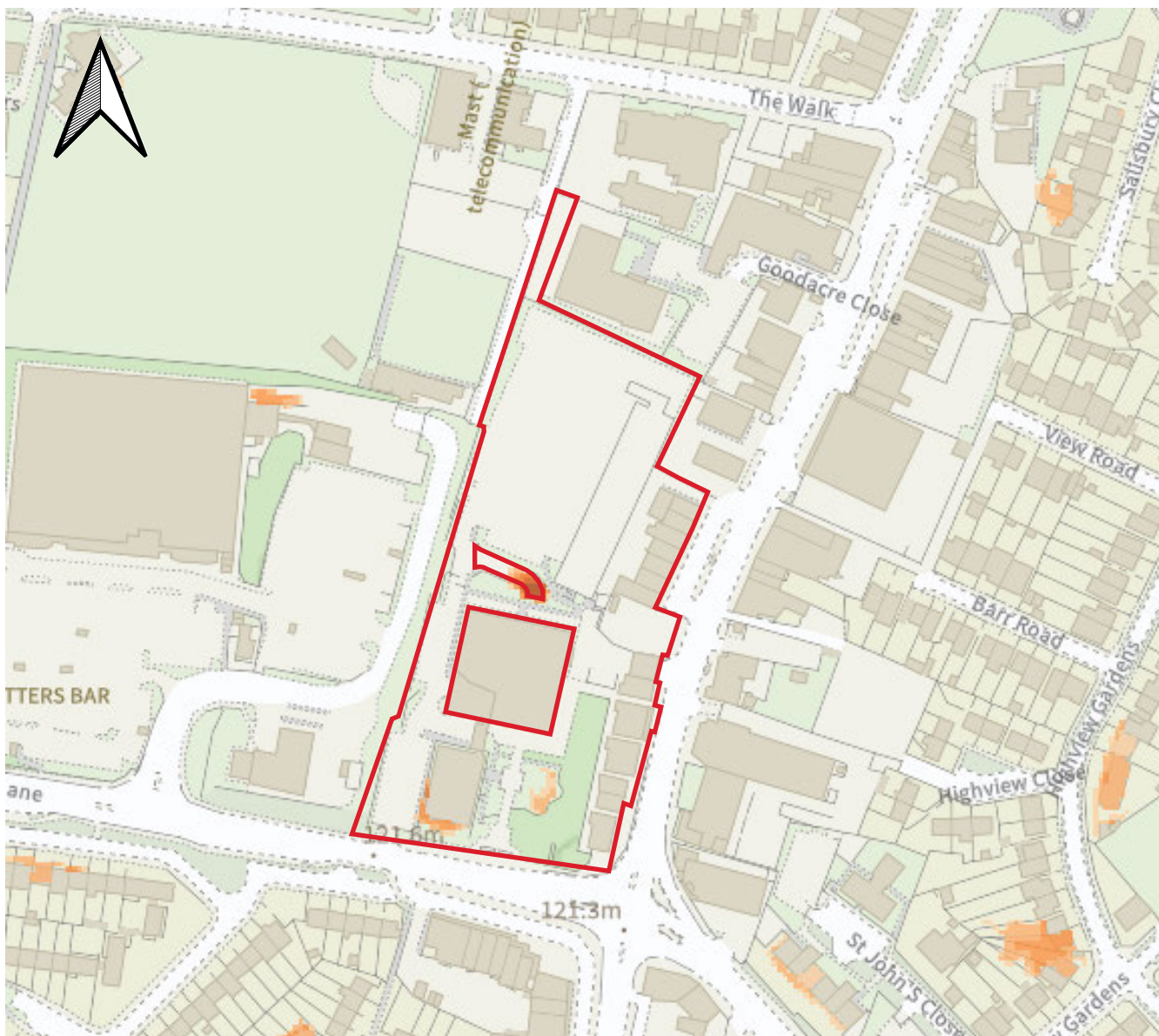
- Site Boundary
- Flood Zones Rivers and Sea
 - Flood Zone 3
 - Flood Zone 2



Scale 1:10 000 @ A4

EA Flood Zones





1 in 30

Legend

— Site Boundary

Surface water depth in millimetres

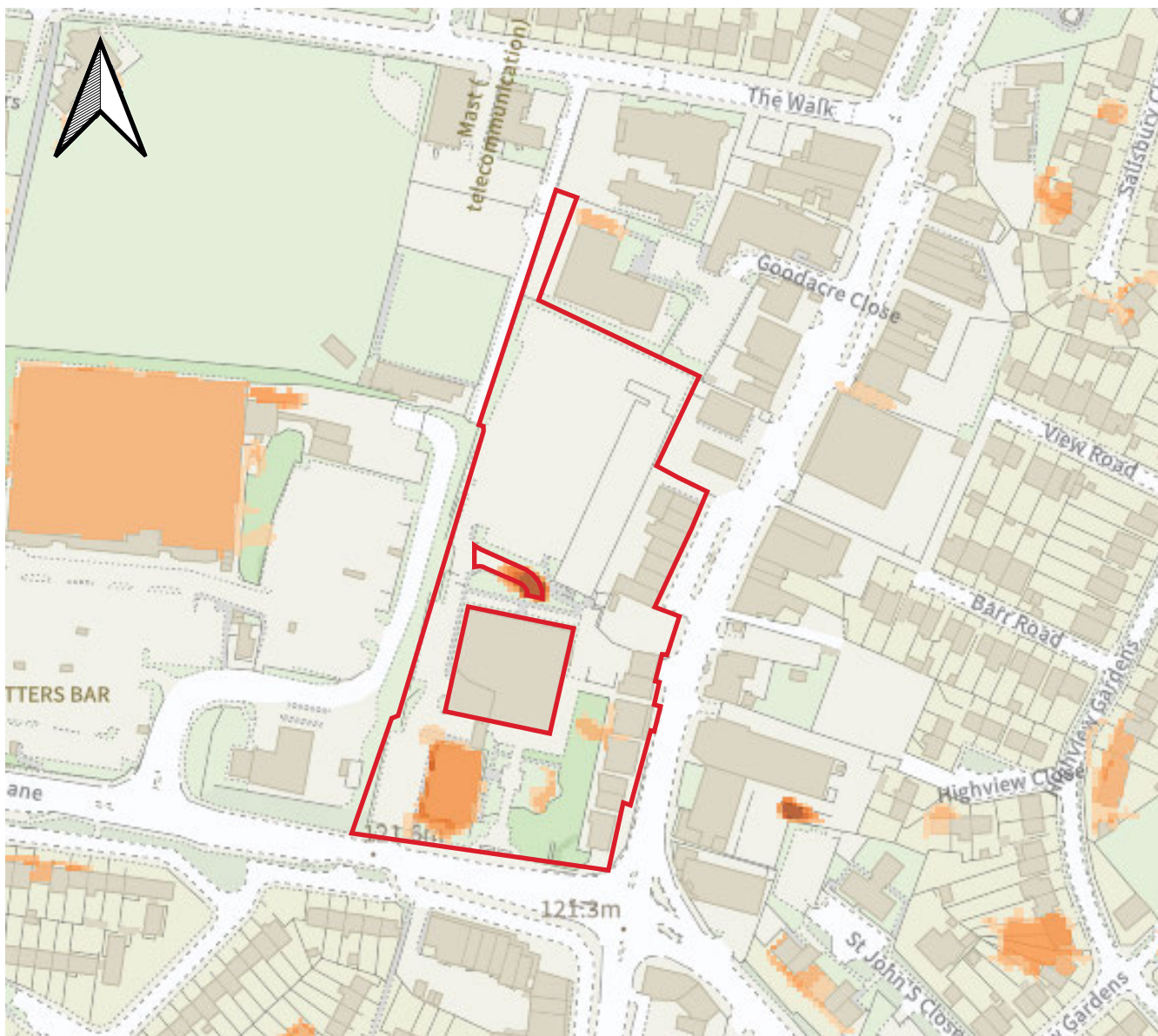


0 100 200 m

Scale 1:2500 @ A4

EA Surface Water Flood Risk

bdc



1 in 100

Legend

— Site Boundary

Surface water depth in millimetres



0 100 200 m

Scale 1:2500 @ A4

EA Surface Water Flood Risk

bdc



1 in 100 + Climate Change (2061 to 2125)

Legend

— Site Boundary

Surface water depth in millimetres

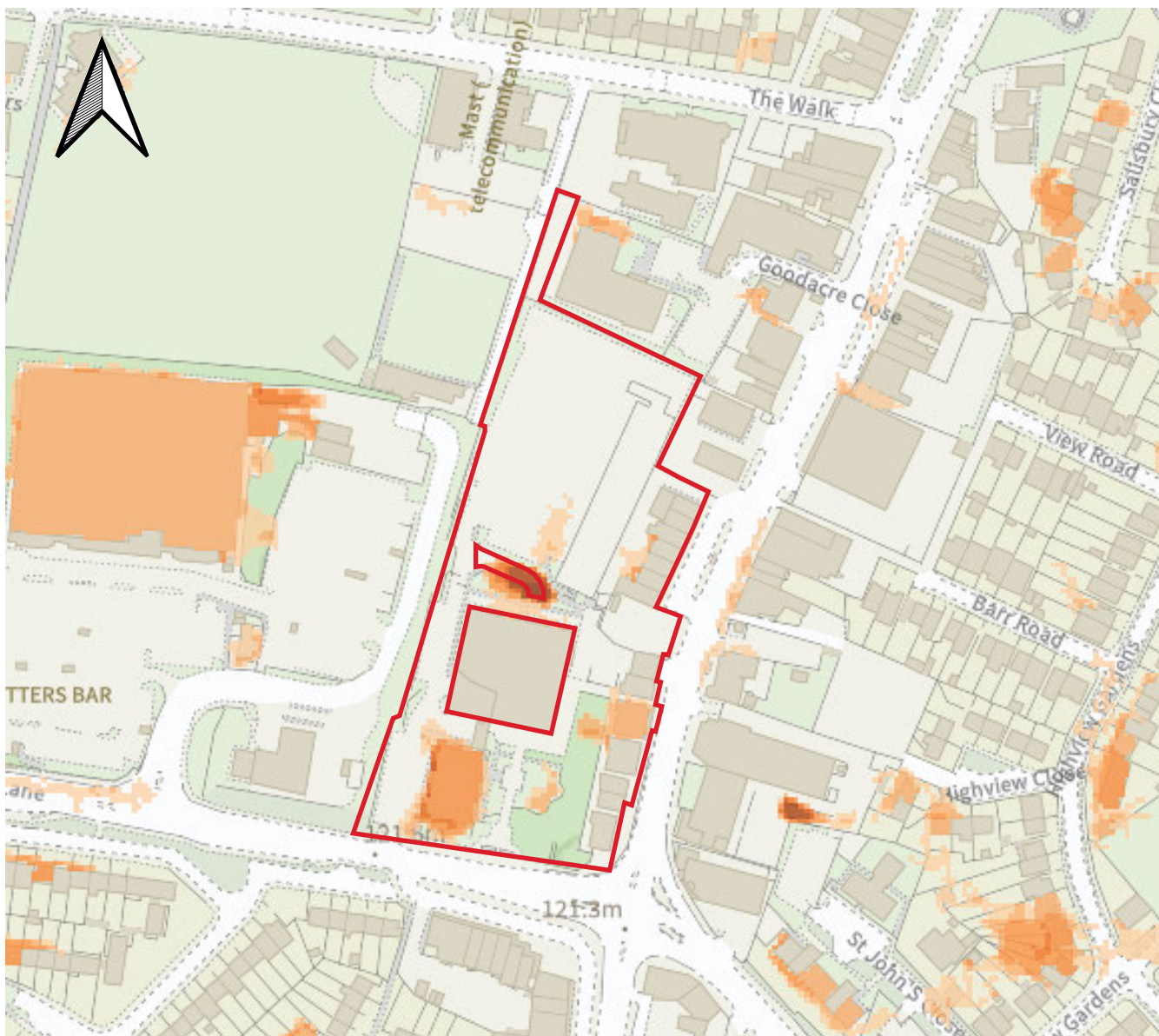


0 100 200 m

Scale 1:2500 @ A4

EA Surface Water Flood Risk

bdc



1 in 1000

Legend

— Site Boundary

Surface water depth in millimetres



0 100 200 m

Scale 1:2500 @ A4

EA Surface Water Flood Risk

bdc

Iris Kalaci

From: David Uncle [REDACTED]
Sent: 29 January 2026 10:16
To: Iris Kalaci
Cc: Peter D'Souza; FRMConsultations
Subject: RE: Mapple House, Potters Bar, EN6 5BA - Request for Latest Flood Records and Maps

Hi Iris

Thank you for your email.

Yes, the latest/current LFRMS is LFRMS 2 (2019 – 2029).

We cannot share the precise location of flooded properties. The nearest flood incident to the site is on Ashwood Road near the junction with Holly Drive. There is a further flood incident on Willow Way near the junction with Ashwood Road. We have a flood incident on Mutton Lane near Potters Bar Fire Station, and east of the site on Highview Gardens.

When considering the drainage design, it should be in accordance with the National Standards for SuDS 2025. For flood risk, please use the Flood Map for Planning.

Best wishes,



David Uncle
Senior Flood Risk Officer
Lead Local Flood Authority | Growth and Environment
Hertfordshire County Council
Address: Farnham and Robertson House, Six Hills Way, Stevenage, SG1 2ST
Postal Point: CHN215
T: [REDACTED] E: [REDACTED]



Out of office: 30 January, 6 Feb (PM), 9 Feb (PM), 16 – 20 March

From: Iris Kalaci <[REDACTED]>
Sent: 29 January 2026 08:33
To: FRMConsultations <FRMConsultations@hertfordshire.gov.uk>
Cc: Peter D'Souza <[REDACTED]>; David Uncle <[REDACTED]>
Subject: Mapple House, Potters Bar, EN6 5BA - Request for Latest Flood Records and Maps

You don't often get email from iris.kalaci@bdcgroup.co.uk. [Learn why this is important](#)

Dear Sir, Madame,

We have been commissioned to assist with the Flood Risk Assessment and Surface Water Drainage Strategy for the re-development of Mapple House, Potters Bar, EN6 5BA (see attached Site Location Plan).

We understand that the latest Local Flood Risk Management (2) – LFRM 2 is that for 2012-2029, adopted February 2019, please advise otherwise.

We would be grateful if you could assist with copies of the latest Flood Maps/Plans documenting your flood records if different from those included in the LFRM 2.

We look forward to hearing from you.

Many thanks

Iris Kalaci

Civil Engineer

Tel: [REDACTED]

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AGENDA & MEETING NOTES

REF NUMBER	Preapp/2026/HBC/03	MEETING DATE	17 June 2026
SITE NAME	Maple House, Potters Bar	VENUE	Microsoft Teams
CLIENT	Building Design Consultants (BDC)	RECORDED BY	E.B., S.A., B.E., A.T.
MEETING SUBJECT	Pre-application meeting to discuss the surface water drainage at Maple House, Potters Bar		

PRESENT	Peter D'Souza – BDC Iris Kalaci – BDC Emma Bullen – Hertfordshire County Council (HCC) LLFA Samantha Ashford – HCC LLFA Bethany Elam – HCC LLFA Alusine Tholley - HCC LLFA
APOLOGIES	No apologies
DISTRIBUTION	As above
CONFIDENTIALITY	Confidential

ITEM	SUBJECT	ACTION	DUE
1	Introductions and Background		
1.1	Applicant: Overview of the full planning application for the former Canada Life site, including site context (adjacent Tesco, High Street frontage) and development components (residential, commercial, car parks).		
1.2	Applicant: The existing site within the red line boundary includes – retail, car park and two office buildings. The existing car park will be retained.		
1.2.1	Applicant: Note the Canada Life building has prior development approval – the building and the ramp is permitted development and excluded from the red line boundary. The building has a basement which has the same footprint as the building.		
1.3	Applicant: Confirm proposal for 294 residential units, the ground floor and along the high street are proposed to be commercial uses to replicate and enhance the existing offer.		

1.4	Applicant: Planning to submit the Flood Risk Assessment and Drainage Strategy by the end of next week (26 June 2026). This will be a full planning application.		
2	Flood Risk		
2.1	In the meeting the applicant went through the FRA final draft.		
2.2	Applicant: Confirm site is in Flood Zone 1 and partially within Source Protection Zone 1 (western part of the site). The geology is gravel and the bedrock clay.		
2.2.1	EB - Consider incorporating latest EA Flood Map updates (surface water, 100-year + climate change, depth data).		
3	Drainage		
3.1	Applicant: Finalise drainage strategy in accordance with SuDS hierarchy.		
3.2	Applicant: Confirm rainwater harvesting not feasible due to system complexity and maintenance. The landscape areas are communal and pumps and tanks would be required.		
3.3	Applicant: The drainage associated with the remaining Canada Life building that is being retained.		
3.4	Applicant: Confirm infiltration is not suitable due to SPZ1 constraints and infiltration testing done showing that it is not feasible; test results included in an appendix.		
3.5	Applicant: Confirmed that there are no watercourses in the area.		
3.6	Applicant: Confirm discharge to Thames Water surface water sewer proposed. The Thames Water sewers (surface and foul) are located in the High Street. The surface water network splits one to the south and one to the east – the site has been split into catchments and the discharge split between these two surface water networks. A discussion with Thames Water has taken place, there are currently queries regarding the foul water and the impact on the system, a full response is still awaiting. Combined sewer not proposed.		

3.7	Applicant: The retained existing drainage from the remaining building may need repair works required following a CCTV survey.		
3.8	Applicant: Greenfield runoff rates 50% AEP 2.9l/s north and 2.6l/s south (50% AEP is greater than 3l/s/ha). 50% AEP = 5l/s/ha. The existing discharge was calculated by modelling the hardstanding areas. EB confirmed that using the 50% AEP was ok and suggested that the Brownfield rate is calculated using the existing drainage outfall pipe size. EB confirmed that HCC accept QBar, 50% AEP or 2l/s/ha.		
4	SuDS		
4.1	Applicant: Tree root cells are proposed – these include a 10-15% void ration the runoff will be directed to these. The tree root cells will have an overflow which goes to underground storage.		
4.2	SuDS across the site to include trees root cells, swales, rain gardens, and limited permeable paving for attenuation		
4.3	Applicant: <u>North – Car Park, Block D & E</u> Existing two storey car park – this is to be retained. The runoff from the car park and Block D & E and the roads will be attenuated to a tank, swale/longitudinal SuDS feature (approx. 900mm deep) Tanks used to provide attenuation Permeable paving to the north and west of the building. There is a service strip along the western boundary – standard paving for maintenance of services and durability of services. Roof level or Block D & E will have 100-110mm granular material – these will also meet the 5mm retention is this ok? Action EB – check if granular material on building meets 5mm interception.	EB	Complete

	Response: To be interception the 5mm of rainfall cannot enter the drainage network. This needs to be confirmed. Section 2.6 of the National SuDS Standards "...for at least 5mm of rainfall, it either collected for use, infiltrated into the ground, or else captured, conveyed and stored within SuDS features. These features shall naturally absorb or retain runoff and from these the runoff will be 'lost' to soils or the atmosphere and will not discharge off the site." Therefore, if the first 5mm is kept within the granular material on the roof and does not enter the drainage network then this is considered interception. Has a green roof been considered? Service strip – if runoff flows to the permeable paving road surface is the 5mm met? The permeable paving is tanked. Confirm the location of the service strip – this may move. Can the permeable paving sub-base depth be increased to take the additional service strip – does this meet the 5mm interception? Action EB – storing water in the permeable paving sub-base, is this interception? Response: Permeable paving if lined or not is considered to comply with Standard 2. Increasing the sub-base depth of the permeable paving to enable the 5mm interception for the service strip does not strictly comply with Section 2.7 of the National SuDS Standards. However, at this moment we would accept this approach. The car park (existing) drains to the swale. Car park to be used by residents. Discussion about the need for a petrol interceptor. IK stated it would have to go downstream of the swale. Doesn't think it will have much benefit there as the swale would have dealt with the pollution. EB confirmed it wouldn't be needed if the SuDS meet the hazard indices. A petrol interceptor can be used as an extra level of treatment to the above ground SuDS. Open area near to the High Street goes to the tree root cells which overflow to a tank. The discharge is restricted from the tank. The landscape plan mimics the drainage strategy.	EB	Complete
4.4	Applicant: <u>South – Block A & B</u>		

	The drainage network will discharge to the existing chamber which is to be rebuilt then go to the Thames Water sewer Block B six stories, Block A is taller Bio-retention areas – four rainwater gardens providing attenuation and water quality treatment. Orifice from the rain garden to provide storage. Adds biodiversity Tank for remaining attenuation 1.2m deep and 1m below ground. EB queried trees over tanks. IK this has been through about and have detail from the tank manufacturer. Interception calculations to be provided Perforated pipe surrounded by granular material – is this considered a filter drain? Action EB – check the above question. Response: If the runoff is going through the granular material to then enter the pipe, then continue to the drainage network, then this would be considered a filter drain.	EB	Complete
4.5	Applicant: SuDs maintenance plan has been considered and supporting modelling outputs		
4.6	EB confirmed a CV value of 1 to be used IK confirmed calculations for 1 in 2yr, 1 in 30yr, 1 in 30yr +cc, 1 in 100yr and 1 in 100yr +cc. IK said there was some flooding in the 1 in 100yr +cc which will be looked at and removed. ½ drain time shown on the hydrographs, they will provide explanation for these. Applicant query – Are they for the 1 in 100yr+cc or 30yr. Action EB: query above Response: For a lined system the half drain should be within 48 hours for the design event (1% AEP event plus climate change). If the lined system cannot half drain within 48 hours, then we ask for the 1% AEP plus climate change followed by the 3.33% AEP event and flooding does not leave the site uncontrolled.	EB	Complete

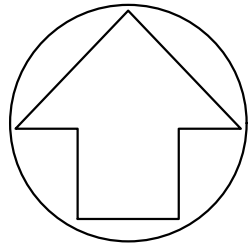
4.7	In the meeting EB sent a link to the HCC webpage which includes the validation list and proforma. [REDACTED]		
4.8	Applicant: The application will be a full planning application.		
4.9	Applicant & EB: Discussion around the sort of conditions that we often suggest for full applications (e.g. surface water management during construction phase, validation condition).		
5	Next Steps		
5.1	Applicant: Prepare final submission documents.		
5.2	Submit application and provide any additional information required (e.g. Thames Water response).		
5.3	EB - Post meeting comments for a full application. - Finished Flood Levels (FFLs) to be 150mm above the proposed ground level where there is no flood risk. 300mm above design flood level. Provide cross sections through SuDS (swale, permeable paving, bio-retention, tanks and tree root cells) and long sections of the drainage network		

NEXT MEETING

An invitation will be issued if an additional meeting is required.

Appendix G

Surface Water Drainage Drawings



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 - EXISTING PRIVATE SURFACE WATER SEWER AND MANHOLE
 - EXISTING PRIVATE FOUL WATER SEWER AND MANHOLE
 - EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.1 [AREA = 0.257ha] DRAINING INTO THAMES WATER MH 9810
 - EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.2 [AREA = 1.171ha] DRAINING INTO THAMES WATER MH 9904
 - EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.3 [AREA = 0.026ha] DRAINING INTO THAMES WATER MH 0902
 - EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.4 [AREA = 0.032ha] DRAINING INTO THAMES WATER MH 9104 & 9105

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PRELIMINARY ISSUE	IK	05/03/26	P01
Revision Details	By	Date	Suffix
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Drawing Status
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Client
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NEW HOMES
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Project Name
MAPPLE HOUSE

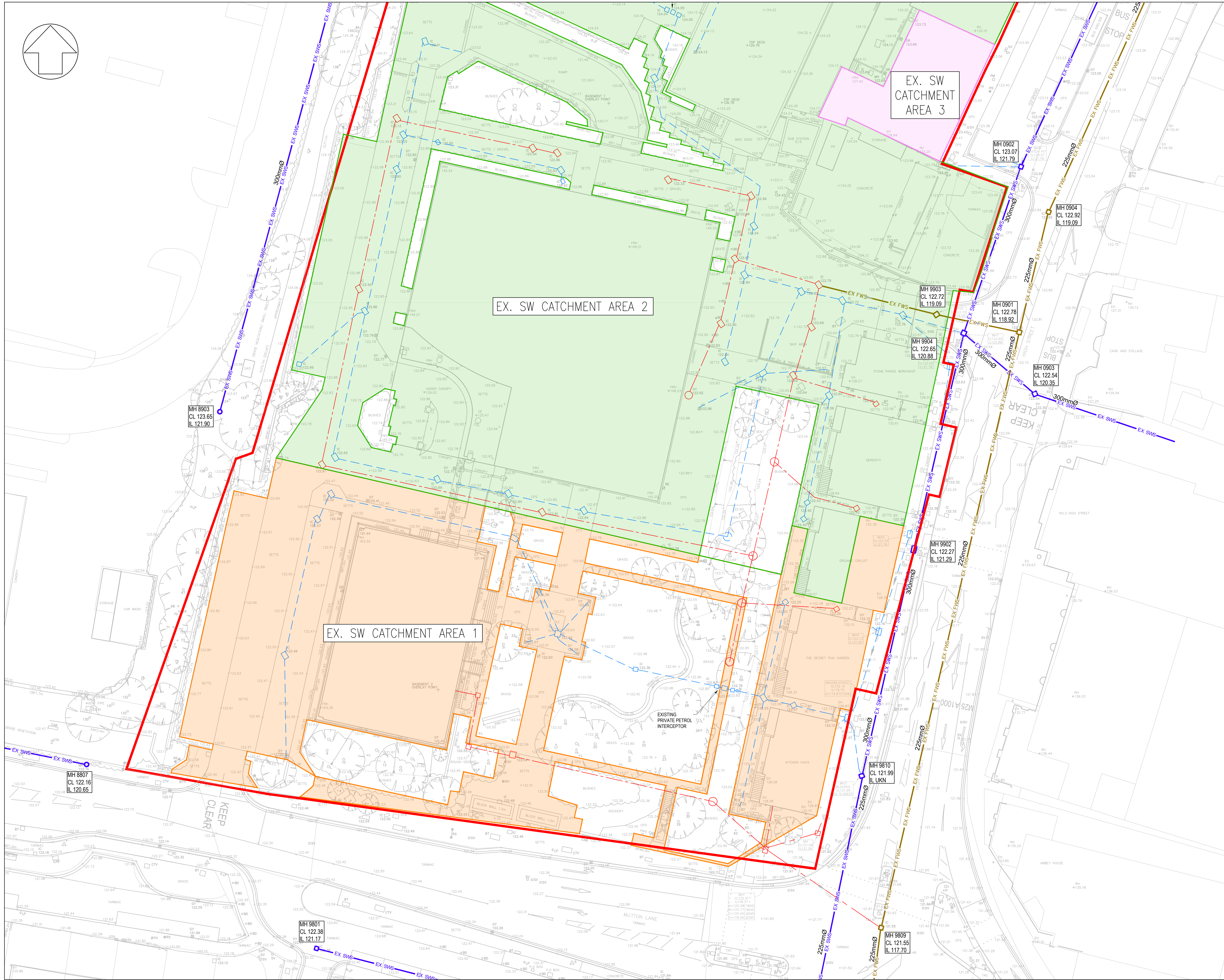
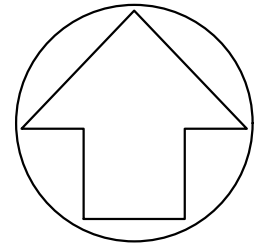
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Approved PDS	Date 05.03.2026

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 - EX SWS — EXISTING PRIVATE SURFACE WATER SEWER AND MANHOLE
 - EX FWS — EXISTING PRIVATE FOUL WATER SEWER AND MANHOLE
 - EX SWS — EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.1 [AREA = 0.257ha] DRAINING INTO THAMES WATER MH 9810
 - EX SWS — EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.2 [AREA = 1.171ha] DRAINING INTO THAMES WATER MH 9904
 - EX SWS — EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.3 [AREA = 0.026ha] DRAINING INTO THAMES WATER MH 0902
 - EX SWS — EXISTING SURFACE WATER DRAINAGE CATCHMENT NO.4 [AREA = 0.032ha] DRAINING INTO THAMES WATER MH 9104 & 9105

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Client	CHASE NEW HOMES The Excitement & Building

Project Name	MAPPLE HOUSE
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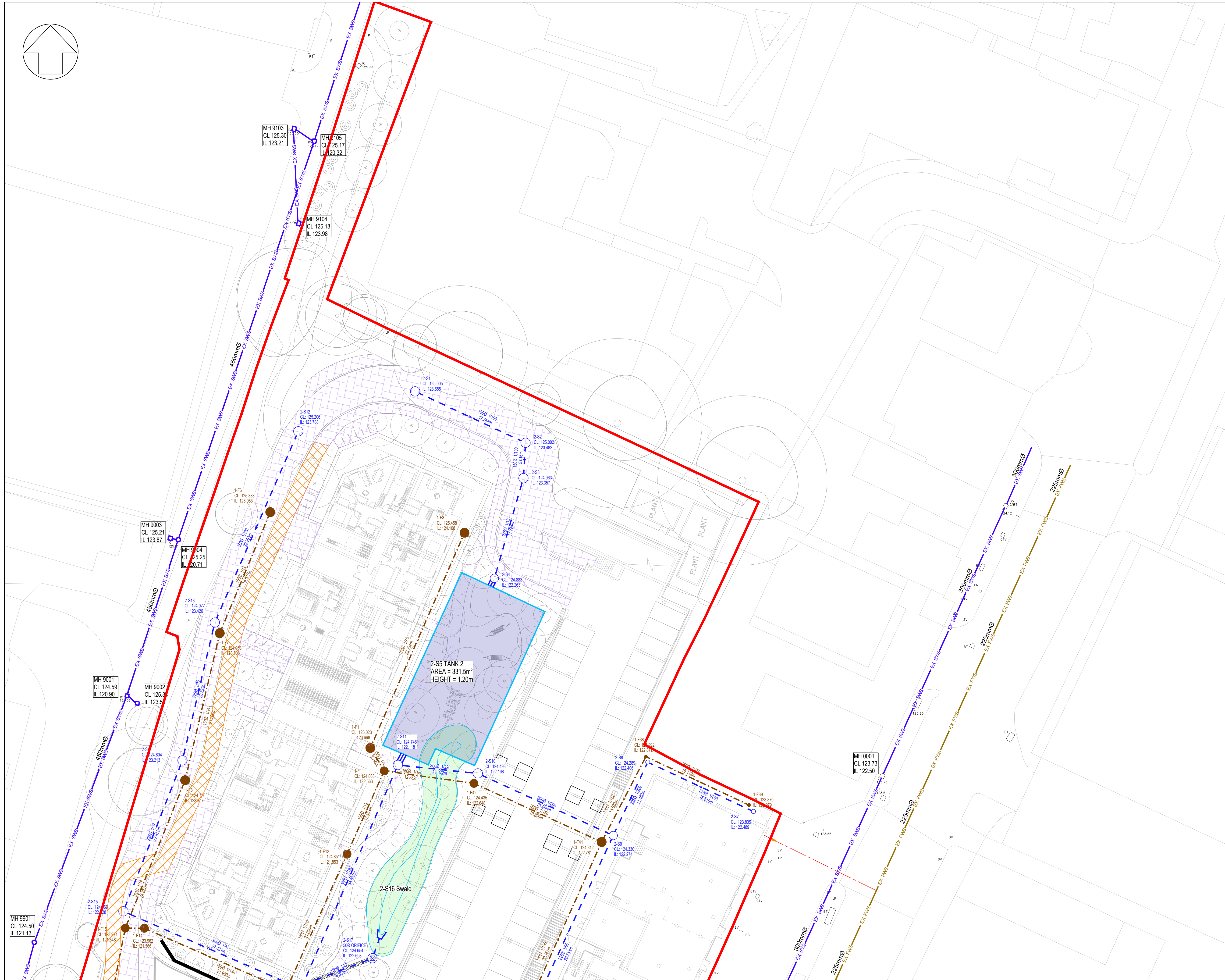
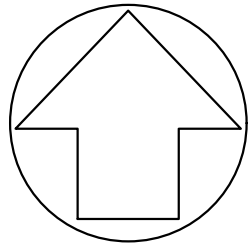
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 - EXISTING PUBLIC FOUL WATER SEWER AND MANHOLE
 - EXISTING PRIVATE SURFACE WATER SEWER AND MANHOLE
 - EXISTING PRIVATE FOUL WATER SEWER AND MANHOLE
 - Tank
 - PROPOSED GEOCELLULAR ATTENUATION TANK
 - PROPOSED BIO-RETENTION (RAINGARDEN) AREA
 - PROPOSED SWALE
 - PROPOSED POROUS PAVEMENT CONSTRUCTION (LINED)
 - UTILITY SERVICES CORRIDOR BELOW NON-POROUS PAVEMENT BUILD UP
 - PROPOSED SURFACE WATER SEWER AND MANHOLE
 - PROPOSED FOUL WATER SEWER AND MANHOLE
 - PROPOSED SUDS PIPE (PERFORATED PIPE SURROUNDED IN 200mm GRANULAR MATERIAL, AND WRAPPED IN GEOTEXTILE AND GEOMEMBRANE)

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PRELIMINARY ISSUE	IK	07/04/26	P01
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Drawing Status	PRELIMINARY
Client	CHASE NEW HOMES The Excitement is Building

Project Name	MAPPLE HOUSE
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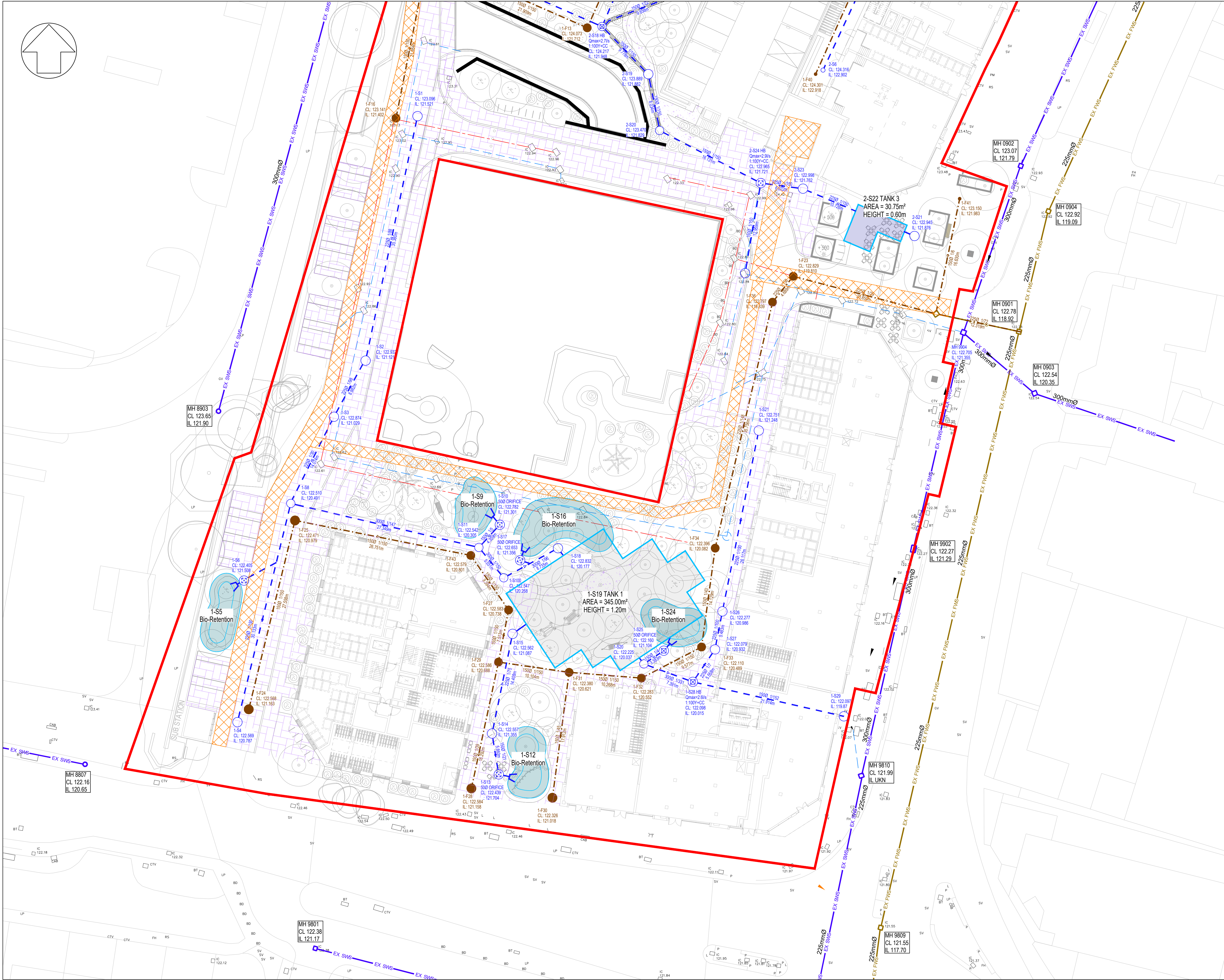
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Drawing Number	Rev
25094-BDC-C-XX-XX-DR-0005	P02



NOTES:

- DO NOT SCALE, IF IN DOUBT ASK.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURAL ENGINEER'S DRAWINGS AND DETAILS, THE SPECIFICATION FOR THE WORKS, THE RELEVANT ARCHITECT'S DRAWINGS AND ANY OTHER SPECIALIST'S DRAWINGS.

DRAWING KEY

- SITE BOUNDARY
- EXISTING PUBLIC SURFACE WATER SEWER AND MANHOLE
- EXISTING PUBLIC FOUL WATER SEWER AND MANHOLE
- EXISTING PRIVATE SURFACE WATER SEWER AND MANHOLE
- EXISTING PRIVATE FOUL WATER SEWER AND MANHOLE
- Tank
- PROPOSED BIO-RETENTION (RAINGARDEN) AREA
- PROPOSED SWALE
- PROPOSED POROUS PAVEMENT CONSTRUCTION (LINED)
- UTILITY SERVICES CORRIDOR BELOW NON-POROUS PAVEMENT BUILD UP
- PROPOSED SURFACE WATER SEWER AND MANHOLE
- PROPOSED FOUL WATER SEWER AND MANHOLE
- PROPOSED SUDS PIPE (PERFORATED PIPE SURROUNDED IN 200mm GRANULAR MATERIAL, AND WRAPPED IN GEOTEXTILE AND GEOMEMBRANE)

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THIS DRAWING IS FOR PRELIMINARY PURPOSES ONLY
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PRELIMINARY ISSUE	IK	17/06/26	P02
PRELIMINARY ISSUE	IK	05/03/26	P01
Revision Details	By	Date	Suffix
Check			

Drawing Status

PRELIMINARY

Client

CHASE
NEW HOMES
The Excitement is Building

Project Name

MAPPLE HOUSE

Drawing Title

PROPOSED DRAINAGE
STRATEGY (2 OF 2)

Scale at A1	Client Project Number
1:250	-
Drawn	BDC Project Number
IK	25094
Approved	Date
PDS	05.03.2026

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buildingdesignconsultants

Lake View House, Unit 5B - First Floor
Lake Meadows Business Park, Woodbrook Crescent,
Billerica, Essex, CM12 0EQ
Telephone 01277 314 455
www.buildingdesignconsultants.co

Drawing Number	Rev
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Appendix H

Surface Water Drainage Calculations

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
EX.1-S1	0.150	1200	Type B	122.624	119.986	2.338	525939.360	200907.076
EX.1-S2	0.043	1350	Type B	122.377	119.906	2.171	525950.361	200902.309
EX.1-S3	0.030	1350	Type C	122.330	121.760	0.470	525989.313	200921.351
EX.1-S4	0.000	1350	Type C	122.130	121.500	0.530	525984.812	200907.327
EX.1-S5	0.032	1200	Type B	122.100	119.700	2.100	525980.398	200895.222
MH 9810	0.000	1350	Type B	121.975	119.645	2.031	525982.500	200887.213

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	EX.1-S1	119.986	EX.1-S2	119.906	Circ	300	11.989	150	0.600	2.338	2.171
1.001	EX.1-S2	119.906	EX.1-S5	119.700	Circ	300	30.861	150	0.600	2.171	2.100
2.000	EX.1-S3	121.760	EX.1-S4	121.500	Circ	100	14.728	57	0.600	0.470	0.530
2.001	EX.1-S4	121.500	EX.1-S5	119.900	Circ	100	12.885	8	0.600	0.530	2.100
1.002	EX.1-S5	119.700	MH 9810	119.645	Circ	300	8.280	150	0.600	2.100	2.031

Outfall Details

Outfall Manhole MH 9810 : Free Discharge

Flow Control Details

Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +0%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 30Min Winter	19.200	0.00	0.00	30Yr 360Min Winter	8.805	0.00	0.00
2Yr 30Min Summer	19.200	0.00	0.00	30Yr 480Min Summer	6.992	0.00	0.00
2Yr 60Min Winter	11.700	0.00	0.00	30Yr 480Min Winter	6.992	0.00	0.00
2Yr 60Min Summer	11.700	0.00	0.00	30Yr 600Min Summer	5.814	0.00	0.00
2Yr 120Min Summer	8.500	0.00	0.00	30Yr 600Min Winter	5.814	0.00	0.00
2Yr 120Min Winter	8.500	0.00	0.00	30Yr 720Min Summer	4.984	0.00	0.00
2Yr 180Min Summer	6.873	0.00	0.00	30Yr 720Min Winter	4.984	0.00	0.00
2Yr 180Min Winter	6.873	0.00	0.00	30Yr 960Min Summer	3.905	0.00	0.00
2Yr 240Min Summer	5.603	0.00	0.00	30Yr 960Min Winter	3.905	0.00	0.00
2Yr 240Min Winter	5.603	0.00	0.00	30Yr 1440Min Summer	2.770	0.00	0.00
2Yr 360Min Winter	4.221	0.00	0.00	30Yr 1440Min Winter	2.770	0.00	0.00
2Yr 360Min Summer	4.221	0.00	0.00	100Yr 30Min Summer	68.456	0.00	0.00
2Yr 480Min Summer	3.432	0.00	0.00	100Yr 30Min Winter	68.456	0.00	0.00
2Yr 480Min Winter	3.432	0.00	0.00	100Yr 60Min Summer	41.870	0.00	0.00
2Yr 600Min Summer	2.888	0.00	0.00	100Yr 60Min Winter	41.870	0.00	0.00
2Yr 600Min Winter	2.888	0.00	0.00	100Yr 120Min Summer	25.800	0.00	0.00
2Yr 720Min Summer	2.493	0.00	0.00	100Yr 120Min Winter	25.800	0.00	0.00
2Yr 720Min Winter	2.493	0.00	0.00	100Yr 180Min Summer	19.309	0.00	0.00
2Yr 960Min Summer	1.982	0.00	0.00	100Yr 180Min Winter	19.309	0.00	0.00
2Yr 960Min Winter	1.982	0.00	0.00	100Yr 240Min Summer	15.512	0.00	0.00
2Yr 1440Min Winter	1.438	0.00	0.00	100Yr 240Min Winter	15.512	0.00	0.00
2Yr 1440Min Summer	1.438	0.00	0.00	100Yr 360Min Summer	11.329	0.00	0.00
30Yr 30Min Summer	53.018	0.00	0.00	100Yr 360Min Winter	11.329	0.00	0.00
30Yr 30Min Winter	53.018	0.00	0.00	100Yr 480Min Summer	9.024	0.00	0.00
30Yr 60Min Summer	32.285	0.00	0.00	100Yr 480Min Winter	9.024	0.00	0.00
30Yr 60Min Winter	32.285	0.00	0.00	100Yr 600Min Summer	7.522	0.00	0.00
30Yr 120Min Summer	20.143	0.00	0.00	100Yr 600Min Winter	7.522	0.00	0.00
30Yr 120Min Winter	20.143	0.00	0.00	100Yr 720Min Summer	6.458	0.00	0.00
30Yr 180Min Summer	15.123	0.00	0.00	100Yr 720Min Winter	6.458	0.00	0.00
30Yr 180Min Winter	15.123	0.00	0.00	100Yr 960Min Summer	5.063	0.00	0.00
30Yr 240Min Summer	12.112	0.00	0.00	100Yr 960Min Winter	5.063	0.00	0.00
30Yr 240Min Winter	12.112	0.00	0.00	100Yr 1440Min Winter	3.575	0.00	0.00
30Yr 360Min Summer	8.805	0.00	0.00	100Yr 1440Min Summer	3.575	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.1-S1	30 min Summer	16	120.076	0.091	17.033		OK
EX.1-S2	30 min Summer	16	120.006	0.100	21.930		OK
EX.1-S3	30 min Summer	16	121.808	0.048	3.427		OK
EX.1-S4	30 min Summer	16	121.527	0.027	3.427		OK
EX.1-S5	30 min Summer	16	119.818	0.118	28.998		OK
MH 9810	30 min Summer	16	119.755	0.110	28.976		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.1-S1	EX.1-S2	0.095	0.884	17.038	0.188	OK
1.001	30 min Summer	16	EX.1-S2	EX.1-S5	0.109	0.946	21.961	0.243	OK
2.000	30 min Summer	16	EX.1-S3	EX.1-S4	0.037	1.277	3.427	0.426	OK
2.001	30 min Summer	16	EX.1-S4	EX.1-S5	0.026	2.054	3.424	0.159	OK
1.002	30 min Summer	16	EX.1-S5	MH 9810	0.114	1.175	28.976	0.320	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.1-S1	30 min Summer	16	120.154	0.168	47.033		OK
EX.1-S2	30 min Summer	16	120.090	0.184	60.558		OK
EX.1-S3	30 min Summer	17	121.920	0.160	8.635		Surcharged
EX.1-S4	30 min Summer	17	121.544	0.044	8.744		OK
EX.1-S5	30 min Summer	16	119.920	0.220	79.113		OK
MH 9810	30 min Summer	16	119.844	0.199	79.054		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.1-S1	EX.1-S2	0.176	1.089	47.050	0.520	OK
1.001	30 min Summer	16	EX.1-S2	EX.1-S5	0.202	1.196	60.618	0.670	OK
2.000	30 min Summer	17	EX.1-S3	EX.1-S4	0.072	1.493	8.744	1.087	OK
2.001	30 min Summer	17	EX.1-S4	EX.1-S5	0.044	2.649	8.741	0.406	OK
1.002	30 min Summer	16	EX.1-S5	MH 9810	0.210	1.497	79.054	0.874	OK

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.1-S1	30 min Summer	16	120.189	0.204	60.729		OK
EX.1-S2	30 min Summer	16	120.130	0.225	78.169		OK
EX.1-S3	30 min Summer	17	122.099	0.339	11.145		Flood Risk
EX.1-S4	30 min Summer	18	121.550	0.050	10.575		OK
EX.1-S5	30 min Summer	16	119.979	0.279	101.184		OK
MH 9810	30 min Summer	16	119.889	0.244	100.644		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.1-S1	EX.1-S2	0.214	1.132	60.727	0.671	OK
1.001	30 min Summer	16	EX.1-S2	EX.1-S5	0.252	1.247	78.068	0.863	OK
2.000	30 min Summer	18	EX.1-S3	EX.1-S4	0.075	1.716	10.725	1.333	OK
2.001	30 min Summer	17	EX.1-S4	EX.1-S5	0.063	2.781	10.702	0.497	OK
1.002	30 min Summer	16	EX.1-S5	MH 9810	0.262	1.542	100.644	1.112	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
EX.2-S1	0.680	1200	Type B	123.054	121.176	1.578	525968.092	200970.661
EX.2-S2	0.433	1350	Type C	122.840	121.092	1.448	525966.284	200958.114
EX.2-S3	0.060	1500	Type B	122.774	120.941	1.533	525988.069	200951.918
MH 9904	0.000	1500	Type C	122.650	120.880	1.470	525996.934	200949.755

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	EX.2-S1	121.176	EX.2-S2	121.092	Circ	300	12.677	150	0.600	1.578	1.448
1.001	EX.2-S2	121.092	EX.2-S3	120.941	Circ	300	22.650	150	0.600	1.448	1.533
1.002	EX.2-S3	120.941	MH 9904	120.880	Circ	300	9.125	150	0.600	1.533	1.470

Outfall Details

Outfall Manhole MH 9904 : Free Discharge

Flow Control Details

Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +0%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 30Min Winter	19.200	0.00	0.00	30Yr 360Min Winter	8.805	0.00	0.00
2Yr 30Min Summer	19.200	0.00	0.00	30Yr 480Min Summer	6.992	0.00	0.00
2Yr 60Min Winter	11.700	0.00	0.00	30Yr 480Min Winter	6.992	0.00	0.00
2Yr 60Min Summer	11.700	0.00	0.00	30Yr 600Min Summer	5.814	0.00	0.00
2Yr 120Min Summer	8.500	0.00	0.00	30Yr 600Min Winter	5.814	0.00	0.00
2Yr 120Min Winter	8.500	0.00	0.00	30Yr 720Min Summer	4.984	0.00	0.00
2Yr 180Min Summer	6.873	0.00	0.00	30Yr 720Min Winter	4.984	0.00	0.00
2Yr 180Min Winter	6.873	0.00	0.00	30Yr 960Min Summer	3.905	0.00	0.00
2Yr 240Min Summer	5.603	0.00	0.00	30Yr 960Min Winter	3.905	0.00	0.00
2Yr 240Min Winter	5.603	0.00	0.00	30Yr 1440Min Summer	2.770	0.00	0.00
2Yr 360Min Winter	4.221	0.00	0.00	30Yr 1440Min Winter	2.770	0.00	0.00
2Yr 360Min Summer	4.221	0.00	0.00	100Yr 30Min Summer	68.456	0.00	-0.06
2Yr 480Min Summer	3.432	0.00	0.00	100Yr 30Min Winter	68.456	0.00	-0.01
2Yr 480Min Winter	3.432	0.00	0.00	100Yr 60Min Summer	41.870	0.00	0.00
2Yr 600Min Summer	2.888	0.00	0.00	100Yr 60Min Winter	41.870	0.00	0.00
2Yr 600Min Winter	2.888	0.00	0.00	100Yr 120Min Summer	25.800	0.00	0.00
2Yr 720Min Summer	2.493	0.00	0.00	100Yr 120Min Winter	25.800	0.00	0.00
2Yr 720Min Winter	2.493	0.00	0.00	100Yr 180Min Summer	19.309	0.00	0.00
2Yr 960Min Summer	1.982	0.00	0.00	100Yr 180Min Winter	19.309	0.00	0.00
2Yr 960Min Winter	1.982	0.00	0.00	100Yr 240Min Summer	15.512	0.00	0.00
2Yr 1440Min Winter	1.438	0.00	0.00	100Yr 240Min Winter	15.512	0.00	0.00
2Yr 1440Min Summer	1.438	0.00	0.00	100Yr 360Min Summer	11.329	0.00	0.00
30Yr 30Min Summer	53.018	0.00	-0.06	100Yr 360Min Winter	11.329	0.00	0.00
30Yr 30Min Winter	53.018	0.00	-0.03	100Yr 480Min Summer	9.024	0.00	0.00
30Yr 60Min Summer	32.285	0.00	0.00	100Yr 480Min Winter	9.024	0.00	0.00
30Yr 60Min Winter	32.285	0.00	0.00	100Yr 600Min Summer	7.522	0.00	0.00
30Yr 120Min Summer	20.143	0.00	0.00	100Yr 600Min Winter	7.522	0.00	0.00
30Yr 120Min Winter	20.143	0.00	0.00	100Yr 720Min Summer	6.458	0.00	0.00
30Yr 180Min Summer	15.123	0.00	0.00	100Yr 720Min Winter	6.458	0.00	0.00
30Yr 180Min Winter	15.123	0.00	0.00	100Yr 960Min Summer	5.063	0.00	0.00
30Yr 240Min Summer	12.112	0.00	0.00	100Yr 960Min Winter	5.063	0.00	0.00
30Yr 240Min Winter	12.112	0.00	0.00	100Yr 1440Min Winter	3.575	0.00	0.00
30Yr 360Min Summer	8.805	0.00	0.00	100Yr 1440Min Summer	3.575	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.2-S1	30 min Summer	16	121.681	0.505	77.335		Surcharged
EX.2-S2	30 min Summer	16	121.611	0.519	125.935		Surcharged
EX.2-S3	30 min Summer	16	121.308	0.367	131.565		Surcharged
MH 9904	30 min Summer	16	121.151	0.271	131.007		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.2-S1	EX.2-S2	0.300	1.084	76.645	0.847	Surcharged
1.001	30 min Summer	16	EX.2-S2	EX.2-S3	0.300	1.765	124.731	1.379	Surcharged
1.002	30 min Summer	16	EX.2-S3	MH 9904	0.286	1.887	131.007	1.448	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.2-S1	30 min Summer	16	123.054	1.878	213.548	17.729	Flood
EX.2-S2	30 min Summer	16	122.840	1.748	270.617	6.645	Flood
EX.2-S3	30 min Summer	16	121.760	0.819	254.933		Surcharged
MH 9904	30 min Summer	13	121.180	0.300	199.001		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Winter	13	EX.2-S1	EX.2-S2	0.300	2.105	148.793	1.645	Surcharged
1.001	30 min Winter	18	EX.2-S2	EX.2-S3	0.300	3.357	237.326	2.623	Surcharged
1.002	30 min Winter	16	EX.2-S3	MH 9904	0.300	3.589	253.678	2.804	Surcharged

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.2-S1	30 min Winter	16	123.054	1.878	248.297	42.478	Flood
EX.2-S2	30 min Summer	16	122.840	1.748	310.251	19.435	Flood
EX.2-S3	30 min Summer	16	121.777	0.836	258.590		Surcharged
MH 9904	30 min Summer	12	121.180	0.300	190.546		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Winter	28	EX.2-S1	EX.2-S2	0.300	2.072	146.479	1.619	Surcharged
1.001	30 min Winter	12	EX.2-S2	EX.2-S3	0.300	3.372	238.356	2.635	Surcharged
1.002	30 min Winter	16	EX.2-S3	MH 9904	0.300	3.636	256.980	2.840	Surcharged

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
EX.3-S1	0.026	600	Unknown	123.692	122.891	0.651	525992.152	200976.375
MH 0902	0.000	600	Type D	123.070	121.790	1.130	526008.126	200973.113

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	EX.3-S1	122.891	MH 0902	121.790	Circ	150	16.304	15	0.600	0.651	1.130

Outfall Details

Outfall Manhole MH 0902 : Free Discharge

Flow Control Details

Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +0%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 30Min Winter	19.200	0.00	0.00	30Yr 360Min Winter	8.805	0.00	0.00
2Yr 30Min Summer	19.200	0.00	0.00	30Yr 480Min Summer	6.992	0.00	0.00
2Yr 60Min Winter	11.700	0.00	0.00	30Yr 480Min Winter	6.992	0.00	0.00
2Yr 60Min Summer	11.700	0.00	0.00	30Yr 600Min Summer	5.814	0.00	0.00
2Yr 120Min Summer	8.500	0.00	0.00	30Yr 600Min Winter	5.814	0.00	0.00
2Yr 120Min Winter	8.500	0.00	0.00	30Yr 720Min Summer	4.984	0.00	0.00
2Yr 180Min Summer	6.873	0.00	0.00	30Yr 720Min Winter	4.984	0.00	0.00
2Yr 180Min Winter	6.873	0.00	0.00	30Yr 960Min Summer	3.905	0.00	0.00
2Yr 240Min Summer	5.603	0.00	0.00	30Yr 960Min Winter	3.905	0.00	0.00
2Yr 240Min Winter	5.603	0.00	0.00	30Yr 1440Min Summer	2.770	0.00	0.00
2Yr 360Min Winter	4.221	0.00	0.00	30Yr 1440Min Winter	2.770	0.00	0.00
2Yr 360Min Summer	4.221	0.00	0.00	100Yr 30Min Summer	68.456	0.00	0.00
2Yr 480Min Summer	3.432	0.00	0.00	100Yr 30Min Winter	68.456	0.00	0.00
2Yr 480Min Winter	3.432	0.00	0.00	100Yr 60Min Summer	41.870	0.00	0.00
2Yr 600Min Summer	2.888	0.00	0.00	100Yr 60Min Winter	41.870	0.00	0.00
2Yr 600Min Winter	2.888	0.00	0.00	100Yr 120Min Summer	25.800	0.00	0.00
2Yr 720Min Summer	2.493	0.00	0.00	100Yr 120Min Winter	25.800	0.00	0.00
2Yr 720Min Winter	2.493	0.00	0.00	100Yr 180Min Summer	19.309	0.00	0.00
2Yr 960Min Summer	1.982	0.00	0.00	100Yr 180Min Winter	19.309	0.00	0.00
2Yr 960Min Winter	1.982	0.00	0.00	100Yr 240Min Summer	15.512	0.00	0.00
2Yr 1440Min Winter	1.438	0.00	0.00	100Yr 240Min Winter	15.512	0.00	0.00
2Yr 1440Min Summer	1.438	0.00	0.00	100Yr 360Min Summer	11.329	0.00	0.00
30Yr 30Min Summer	53.018	0.00	0.00	100Yr 360Min Winter	11.329	0.00	0.00
30Yr 30Min Winter	53.018	0.00	0.00	100Yr 480Min Summer	9.024	0.00	0.00
30Yr 60Min Summer	32.285	0.00	0.00	100Yr 480Min Winter	9.024	0.00	0.00
30Yr 60Min Winter	32.285	0.00	0.00	100Yr 600Min Summer	7.522	0.00	0.00
30Yr 120Min Summer	20.143	0.00	0.00	100Yr 600Min Winter	7.522	0.00	0.00
30Yr 120Min Winter	20.143	0.00	0.00	100Yr 720Min Summer	6.458	0.00	0.00
30Yr 180Min Summer	15.123	0.00	0.00	100Yr 720Min Winter	6.458	0.00	0.00
30Yr 180Min Winter	15.123	0.00	0.00	100Yr 960Min Summer	5.063	0.00	0.00
30Yr 240Min Summer	12.112	0.00	0.00	100Yr 960Min Winter	5.063	0.00	0.00
30Yr 240Min Winter	12.112	0.00	0.00	100Yr 1440Min Winter	3.575	0.00	0.00
30Yr 360Min Summer	8.805	0.00	0.00	100Yr 1440Min Summer	3.575	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.3-S1	30 min Summer	16	122.917	0.026	2.946		OK
MH 0902	30 min Summer	16	121.815	0.025	2.946		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.3-S1	MH 0902	0.025	1.485	2.946	0.063	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.3-S1	30 min Summer	16	122.934	0.043	8.134		OK
MH 0902	30 min Summer	16	121.832	0.042	8.134		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.3-S1	MH 0902	0.042	1.985	8.134	0.175	OK

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.3-S1	30 min Summer	16	122.940	0.049	10.503		OK
MH 0902	30 min Summer	16	121.838	0.048	10.503		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.3-S1	MH 0902	0.048	2.130	10.503	0.226	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
EX.4-S1	0.032	1350	Type C	125.411	124.261	1.000	525952.496	201108.873
EX.4-S2	0.000	1350	Type C	125.329	123.979	1.200	525946.483	201096.966
MH 9103	0.000	1350	Type B	125.300	123.210	1.940	525944.775	201114.946

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	EX.4-S1	124.261	EX.4-S2	123.979	Circ	150	13.339	47	0.600	1.000	1.200
1.001	EX.4-S2	123.979	MH 9103	123.210	Circ	150	18.061	23	0.600	1.200	1.940

Outfall Details

Outfall Manhole MH 9103 : Free Discharge

Flow Control Details

Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +0%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 30Min Winter	19.200	0.00	0.00	30Yr 360Min Winter	8.805	0.00	0.00
2Yr 30Min Summer	19.200	0.00	0.00	30Yr 480Min Summer	6.992	0.00	0.00
2Yr 60Min Winter	11.700	0.00	0.00	30Yr 480Min Winter	6.992	0.00	0.00
2Yr 60Min Summer	11.700	0.00	0.00	30Yr 600Min Summer	5.814	0.00	0.00
2Yr 120Min Summer	8.500	0.00	0.00	30Yr 600Min Winter	5.814	0.00	0.00
2Yr 120Min Winter	8.500	0.00	0.00	30Yr 720Min Summer	4.984	0.00	0.00
2Yr 180Min Summer	6.873	0.00	0.00	30Yr 720Min Winter	4.984	0.00	0.00
2Yr 180Min Winter	6.873	0.00	0.00	30Yr 960Min Summer	3.905	0.00	0.00
2Yr 240Min Summer	5.603	0.00	0.00	30Yr 960Min Winter	3.905	0.00	0.00
2Yr 240Min Winter	5.603	0.00	0.00	30Yr 1440Min Summer	2.770	0.00	0.00
2Yr 360Min Winter	4.221	0.00	0.00	30Yr 1440Min Winter	2.770	0.00	0.00
2Yr 360Min Summer	4.221	0.00	0.00	100Yr 30Min Summer	68.456	0.00	0.00
2Yr 480Min Summer	3.432	0.00	0.00	100Yr 30Min Winter	68.456	0.00	0.00
2Yr 480Min Winter	3.432	0.00	0.00	100Yr 60Min Summer	41.870	0.00	0.00
2Yr 600Min Summer	2.888	0.00	0.00	100Yr 60Min Winter	41.870	0.00	0.00
2Yr 600Min Winter	2.888	0.00	0.00	100Yr 120Min Summer	25.800	0.00	0.00
2Yr 720Min Summer	2.493	0.00	0.00	100Yr 120Min Winter	25.800	0.00	0.00
2Yr 720Min Winter	2.493	0.00	0.00	100Yr 180Min Summer	19.309	0.00	0.00
2Yr 960Min Summer	1.982	0.00	0.00	100Yr 180Min Winter	19.309	0.00	0.00
2Yr 960Min Winter	1.982	0.00	0.00	100Yr 240Min Summer	15.512	0.00	0.00
2Yr 1440Min Winter	1.438	0.00	0.00	100Yr 240Min Winter	15.512	0.00	0.00
2Yr 1440Min Summer	1.438	0.00	0.00	100Yr 360Min Summer	11.329	0.00	0.00
30Yr 30Min Summer	53.018	0.00	0.00	100Yr 360Min Winter	11.329	0.00	0.00
30Yr 30Min Winter	53.018	0.00	0.00	100Yr 480Min Summer	9.024	0.00	0.00
30Yr 60Min Summer	32.285	0.00	0.00	100Yr 480Min Winter	9.024	0.00	0.00
30Yr 60Min Winter	32.285	0.00	0.00	100Yr 600Min Summer	7.522	0.00	0.00
30Yr 120Min Summer	20.143	0.00	0.00	100Yr 600Min Winter	7.522	0.00	0.00
30Yr 120Min Winter	20.143	0.00	0.00	100Yr 720Min Summer	6.458	0.00	0.00
30Yr 180Min Summer	15.123	0.00	0.00	100Yr 720Min Winter	6.458	0.00	0.00
30Yr 180Min Winter	15.123	0.00	0.00	100Yr 960Min Summer	5.063	0.00	0.00
30Yr 240Min Summer	12.112	0.00	0.00	100Yr 960Min Winter	5.063	0.00	0.00
30Yr 240Min Winter	12.112	0.00	0.00	100Yr 1440Min Winter	3.575	0.00	0.00
30Yr 360Min Summer	8.805	0.00	0.00	100Yr 1440Min Summer	3.575	0.00	0.00

Simulation Results

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.4-S1	30 min Summer	16	124.299	0.038	3.584		OK
EX.4-S2	30 min Summer	16	124.010	0.031	3.585		OK
MH 9103	30 min Summer	16	123.241	0.031	3.585		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.4-S1	EX.4-S2	0.035	1.159	3.585	0.138	OK
1.001	30 min Summer	16	EX.4-S2	MH 9103	0.031	1.354	3.585	0.097	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.4-S1	30 min Summer	16	124.326	0.065	9.896		OK
EX.4-S2	30 min Summer	16	124.032	0.053	9.895		OK
MH 9103	30 min Summer	16	123.262	0.052	9.897		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.4-S1	EX.4-S2	0.059	1.526	9.895	0.382	OK
1.001	30 min Summer	16	EX.4-S2	MH 9103	0.052	1.800	9.897	0.269	OK

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
EX.4-S1	30 min Summer	16	124.337	0.076	12.778		OK
EX.4-S2	30 min Summer	16	124.040	0.061	12.777		OK
MH 9103	30 min Summer	16	123.269	0.059	12.778		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	16	EX.4-S1	EX.4-S2	0.068	1.627	12.777	0.493	OK
1.001	30 min Summer	16	EX.4-S2	MH 9103	0.060	1.926	12.778	0.347	OK

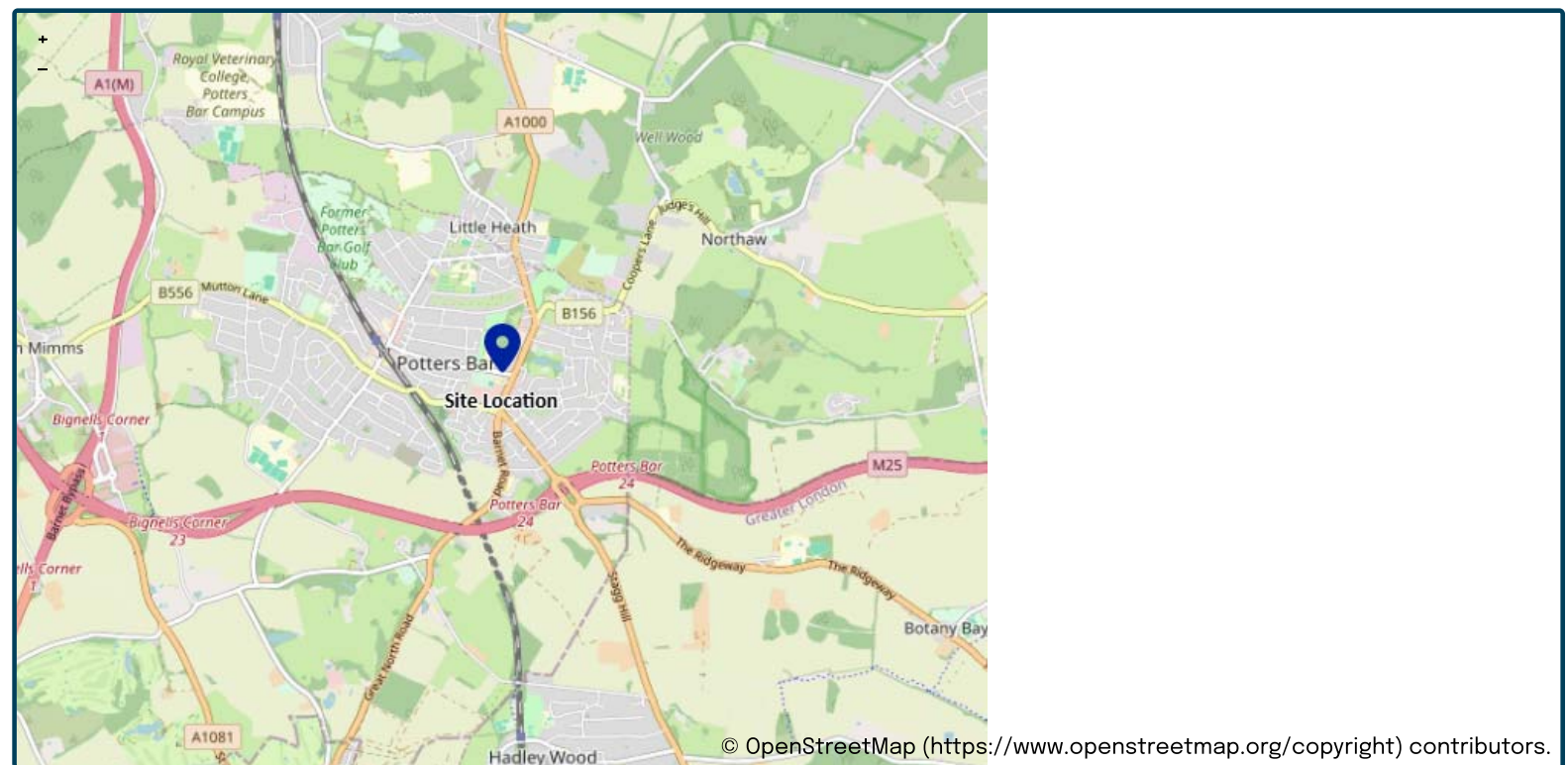
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	29/01/2026
Calculated by	I Kalaci
Reference	Potters Bar
Model version	2.2.2

Location

Site name	Mapple House
Site location	Potters Bar



Site easting (British National Grid)	526003
Site northing (British National Grid)	201001

Site details

Total site area (ha)	1	ha
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Greenfield runoff

Method

Method	FEH statistical (2025)
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FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	691 mm	
BFIHOST19scaled	0.258	
QMed-QBar conversion	1.136	1.136
QMed (l/s)	5 l/s	
QBar (FEH statistical 2025) (l/s)	5.6 l/s	

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	6	6
1 year growth factor	0.85	
2 year growth factor	0.88	
10 year growth factor	1.62	
30 year growth factor	2.3	
100 year growth factor	3.19	
200 year growth factor	3.74	

Results

Method	FEH statistical (2025)	
Flow rate 1 year (l/s)	4.8	l/s
Flow rate 2 year (l/s)	5.0	l/s
Flow rate 10 years (l/s)	9.1	l/s
Flow rate 30 years (l/s)	12.9	l/s
Flow rate 100 years (l/s)	18.0	l/s
Flow rate 200 years (l/s)	21.1	l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com) (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
1-S1	0.111	1350	Type C	123.096	121.521	1.350	525919.687	200980.488
1-S2	0.000	1350	Type B	122.932	121.121	1.586	525912.340	200945.880
1-S3	0.021	1350	Type B	122.874	121.029	1.621	525907.852	200937.935
1-S4	0.046	1350	Type B	122.569	120.787	1.557	525894.198	200894.697
1-S5	0.049	1350	Type C	122.400	122.100	0.150	525891.826	200908.683
1-S6	0.000	1350	Type C	122.405	121.508	0.747	525895.132	200914.751
1-S8	0.000	1200	Type B	122.510	120.491	1.718	525901.747	200925.672
1-S9	0.007	1350	Type C	122.750	122.450	0.150	525928.936	200925.556
1-S10	0.000	1350	Type C	122.782	121.301	1.332	525931.322	200922.645
1-S11	0.000	1200	Type B	122.542	120.305	1.937	525928.375	200919.434
1-S16	0.011	1350	Type C	122.750	122.450	0.150	525935.709	200921.021
1-S17	0.000	1350	Type C	122.653	121.356	1.147	525932.701	200918.496
1-S100	0.000	1200	Type B	122.547	120.268	1.979	525931.889	200915.136
1-S18	0.000	1350	Type B	122.832	120.177	2.355	525939.555	200919.324
1-S12	0.011	1350	Type C	122.400	122.000	0.250	525935.687	200886.410
1-S13	0.000	1350	Type C	122.439	121.704	0.585	525931.175	200887.308
1-S14	0.060	1350	Type C	122.557	121.355	0.977	525930.231	200893.091
1-S15	0.000	1350	Type C	122.562	121.087	1.250	525933.137	200907.203
1-S19 TANK	0.000	1200	Type B	123.304	120.121	2.883	525944.649	200912.444
1-S24	0.013	1350	Type C	122.400	122.000	0.250	525956.289	200908.355
1-S25	0.000	1350	Type C	122.160	121.104	0.906	525954.529	200904.815
1-S20	0.055	1200	Type B	122.225	120.037	1.888	525951.710	200902.945
1-S21	0.102	1350	Type C	122.751	121.248	1.279	525967.973	200935.986
1-S26	0.027	1350	Type C	122.277	120.986	1.065	525962.828	200910.381
1-S27	0.000	1350	Type C	122.079	120.932	0.922	525961.777	200905.000
1-S28 HB	0.000	1350	Type B	122.098	120.015	1.933	525958.650	200900.405
1-S29	0.000	1350	Type B	122.097	119.870	2.077	525980.015	200895.529

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	1-S1	121.521	1-S2	121.121	Circ	225	35.380	88	0.600	1.350	1.586
1.001	1-S2	121.121	1-S3	121.029	Circ	225	9.125	99	0.600	1.586	1.621
1.002	1-S3	121.029	1-S8	120.566	Circ	225	13.699	30	0.600	1.621	1.718
2.000	1-S4	120.787	1-S8	120.586	Circ	225	31.882	159	0.600	1.557	1.699
3.000	1-S5	122.100	1-S6	121.508	Circ	150	6.910	12	0.600	0.150	0.747
3.001	1-S6	121.508	1-S8	121.426	Circ	150	12.769	155	0.600	0.747	0.934
1.003	1-S8	120.491	1-S11	120.305	Circ	300	27.349	147	0.600	1.718	1.937
4.000	1-S9	122.450	1-S10	121.301	Circ	150	3.764	3	0.600	0.150	1.332
4.001	1-S10	121.301	1-S11	120.455	Circ	150	4.359	5	0.600	1.332	1.937
1.004	1-S11	120.305	1-S100	120.268	Circ	300	5.551	150	0.600	1.937	1.979
5.000	1-S16	122.450	1-S17	121.356	Circ	150	3.928	4	0.600	0.150	1.147
5.001	1-S17	121.356	1-S100	120.418	Circ	150	3.456	4	0.600	1.147	1.979
1.005	1-S100	120.268	1-S18	120.177	Circ	300	8.735	96	0.600	1.979	2.355
1.006	1-S18	120.177	1-S19 TANK	120.121	Circ	300	8.561	153	0.600	2.355	2.883
6.000	1-S12	122.000	1-S13	121.704	Circ	150	4.600	16	0.600	0.250	0.585
6.001	1-S13	121.704	1-S14	121.430	Circ	150	5.860	21	0.600	0.585	0.977
6.002	1-S14	121.355	1-S15	121.162	Circ	225	14.408	75	0.600	0.977	1.175
6.003	1-S15	121.087	1-S19 TANK	120.196	Circ	225	12.649	14	0.600	1.250	2.883
1.007	1-S19 TANK	120.121	1-S20	120.037	Circ	300	11.835	140	0.600	2.883	1.888
7.000	1-S24	122.000	1-S25	121.104	Circ	150	3.954	4	0.600	0.250	0.906
7.001	1-S25	121.104	1-S20	120.187	Circ	150	3.383	4	0.600	0.906	1.888
1.008	1-S20	120.037	1-S28 HB	120.015	Circ	300	7.391	331	0.600	1.888	1.783
8.000	1-S21	121.248	1-S26	120.986	Circ	225	26.117	100	0.600	1.279	1.065
8.001	1-S26	120.986	1-S27	120.932	Circ	225	5.483	100	0.600	1.065	0.922
8.002	1-S27	120.932	1-S28 HB	120.090	Circ	225	5.558	7	0.600	0.922	1.783
1.009	1-S28 HB	120.015	1-S29	119.870	Circ	150	21.914	152	0.600	1.933	2.077

Outfall Details

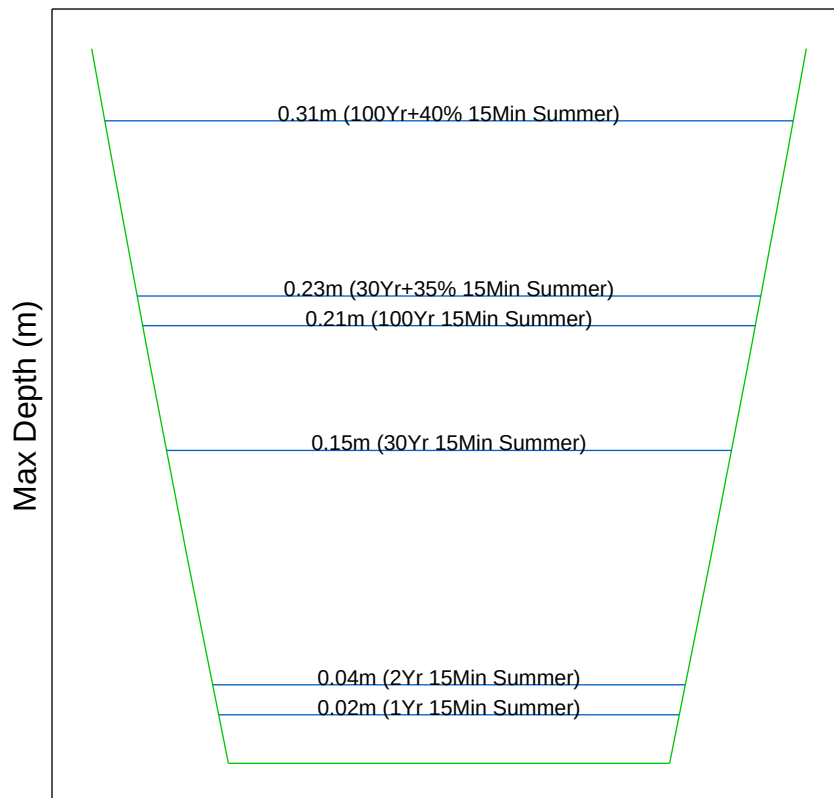
Outfall Manhole 1-S29 : Free Discharge

Flow Control Details

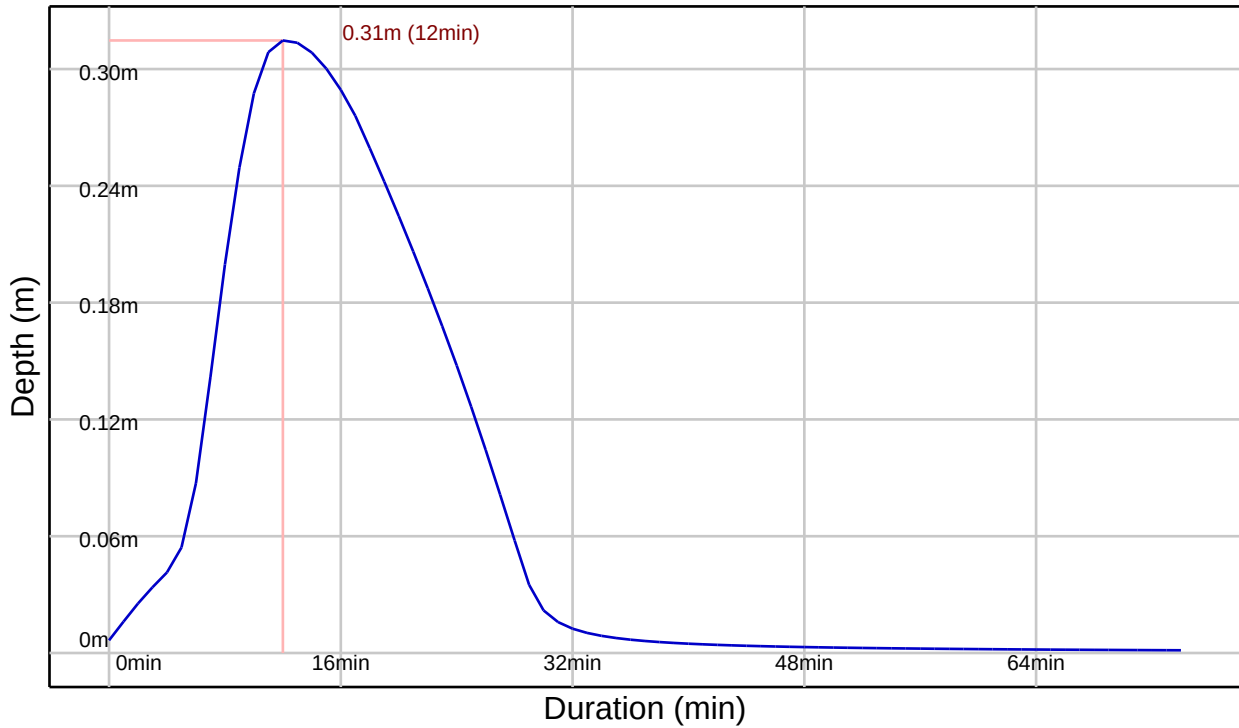
Pond Structure at Manhole 1-S5

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.100	0.350	11.064	122.450	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S5



Pond 2 at 1-S5 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S6

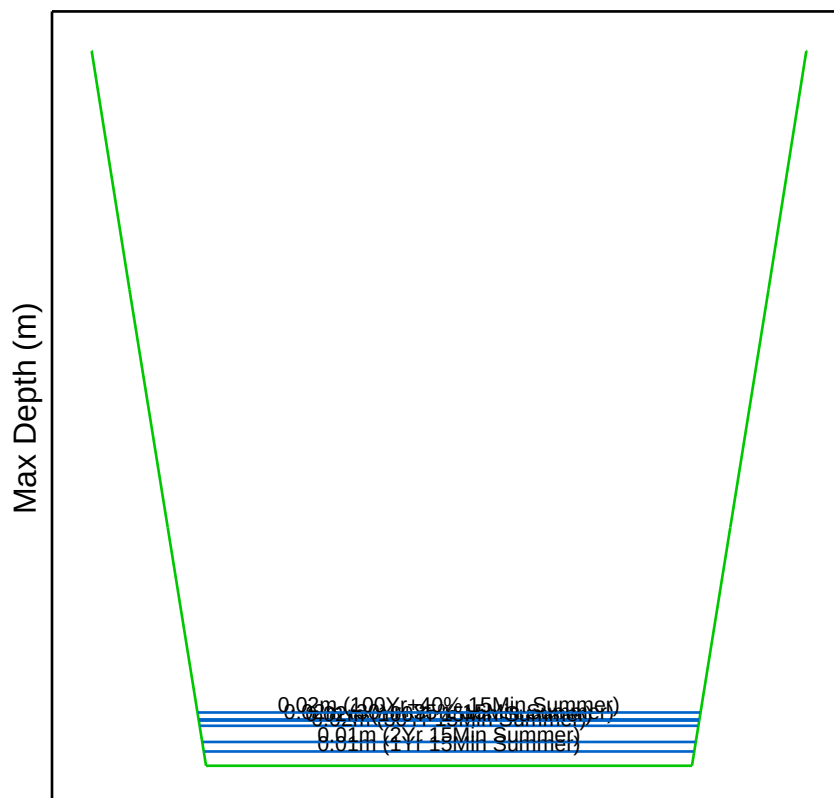
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.080	0.600

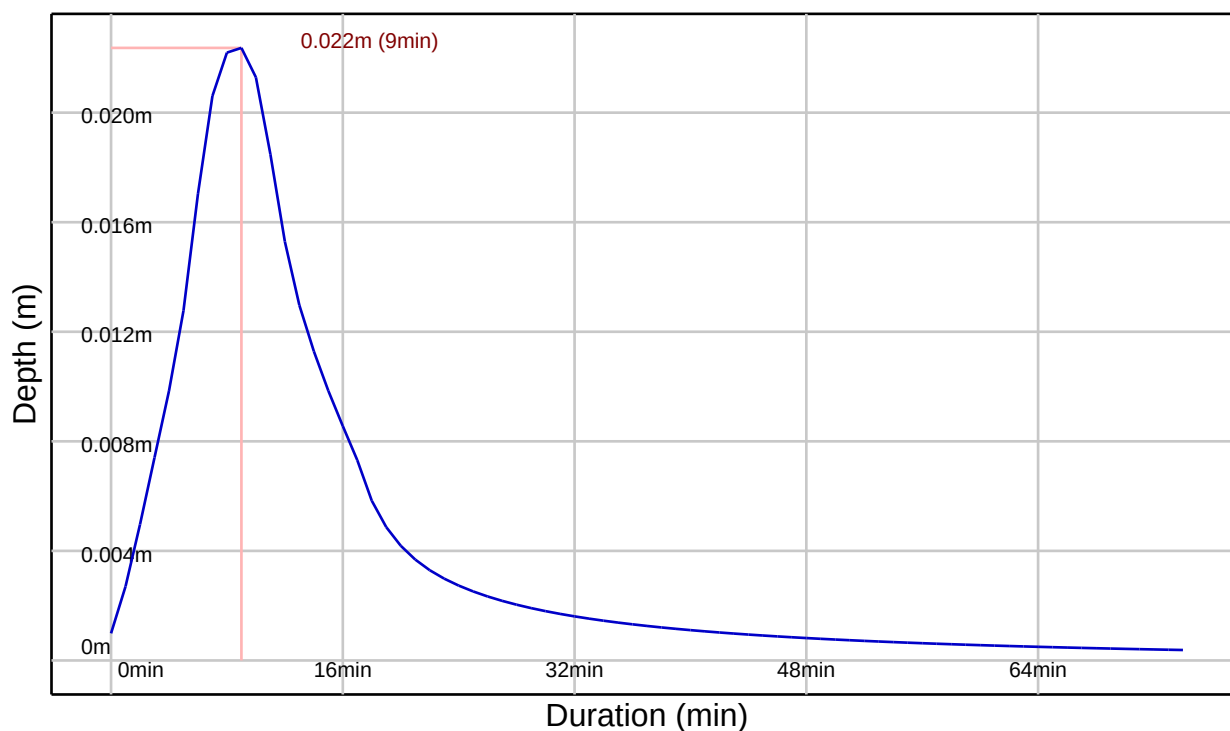
Pond Structure at Manhole 1-S9

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.450	0.300	8.280	122.750	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S9



Pond 6 at 1-S9 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S10

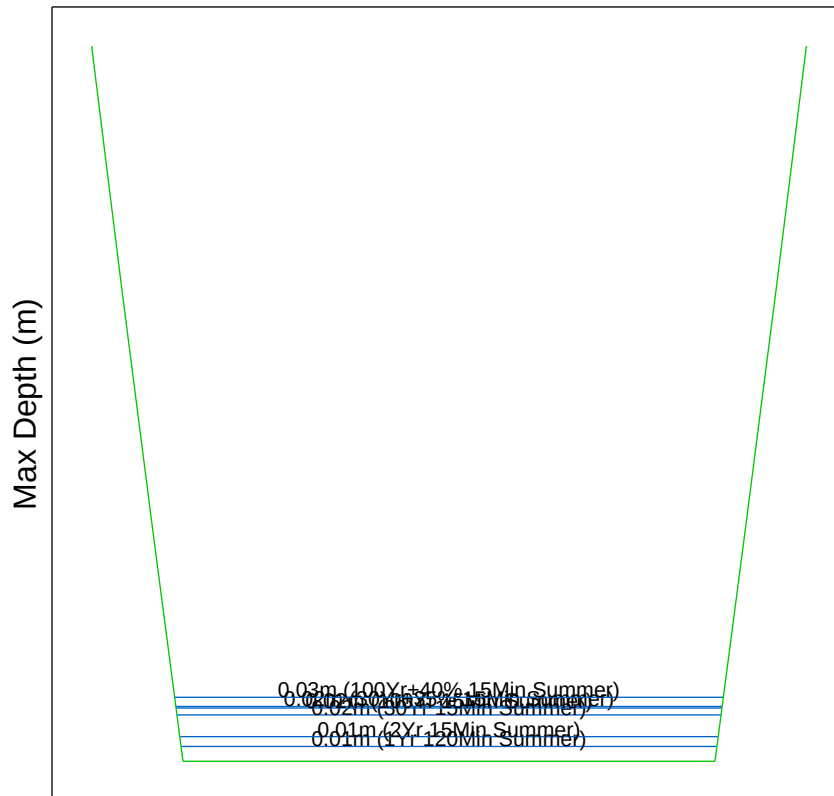
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

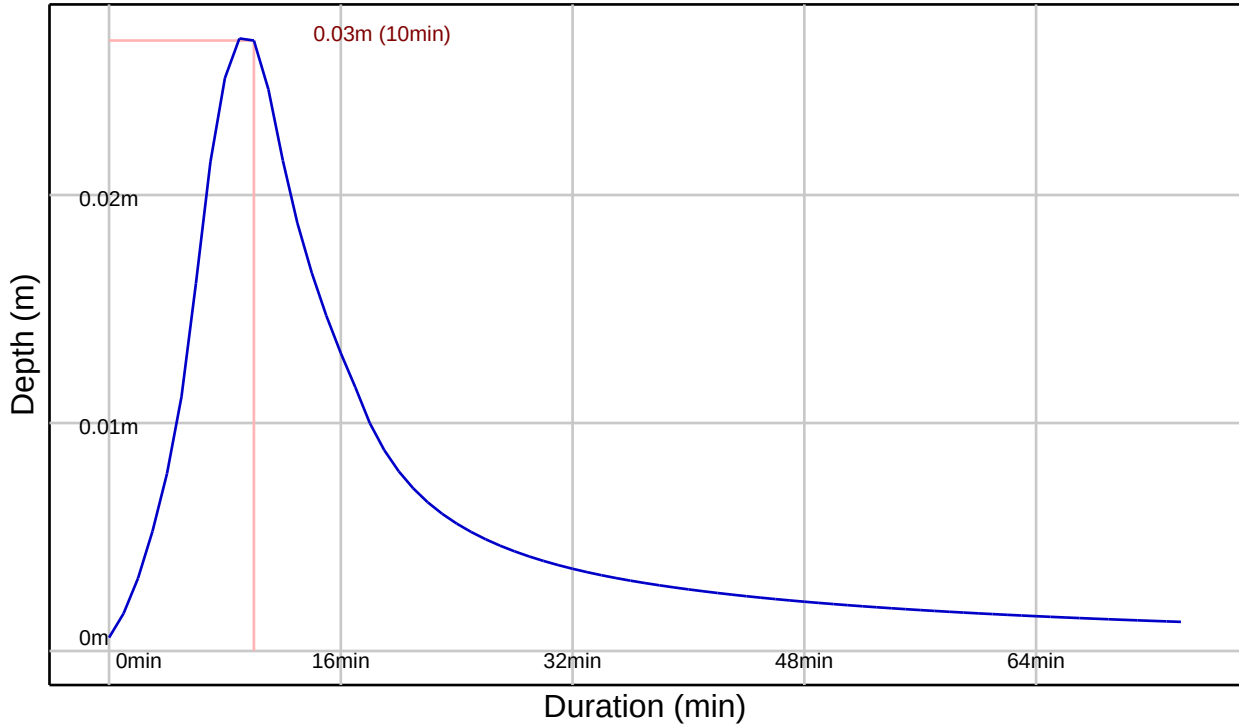
Pond Structure at Manhole 1-S16

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.450	0.300	18.961	122.750	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S16



Pond 5 at 1-S16 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S17

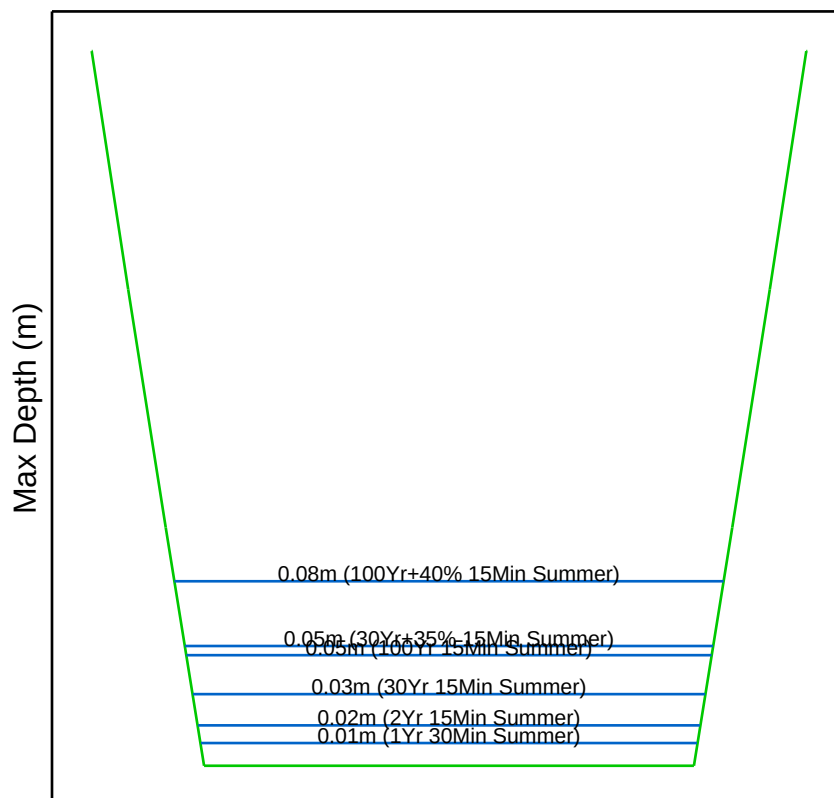
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

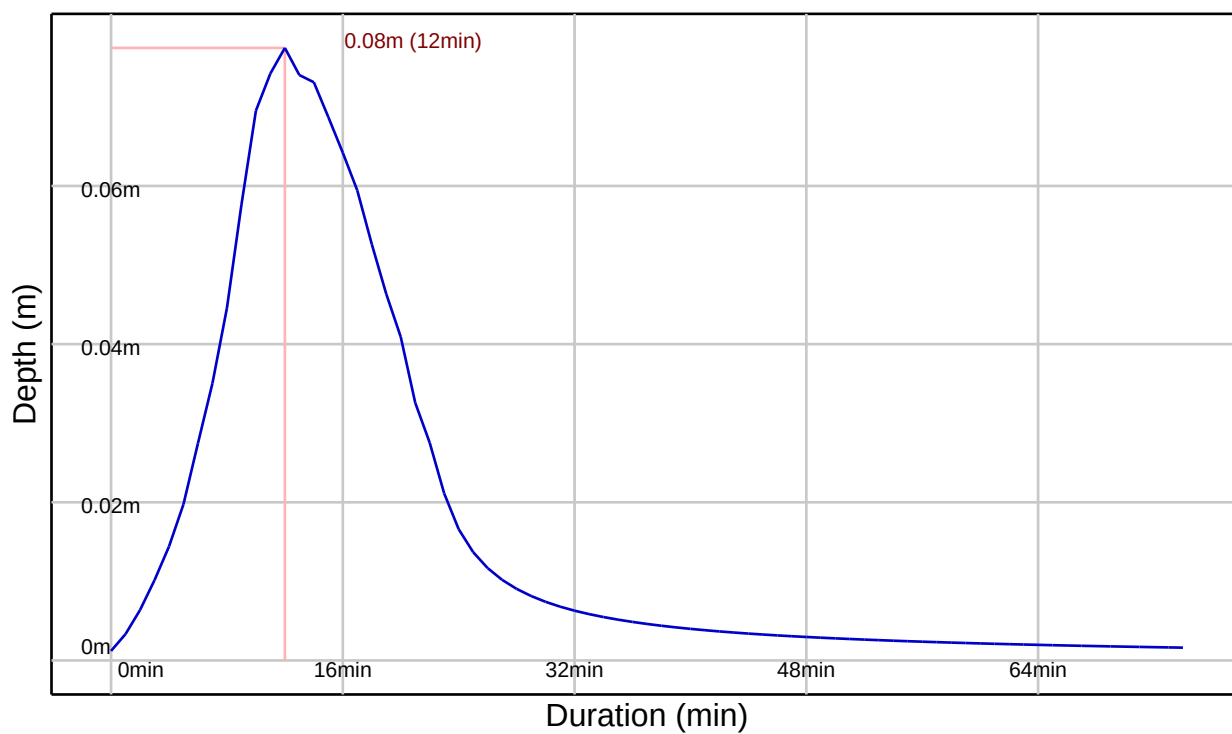
Pond Structure at Manhole 1-S12

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.000	0.300	10.384	122.300	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S12



Pond 7 at 1-S12 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S13

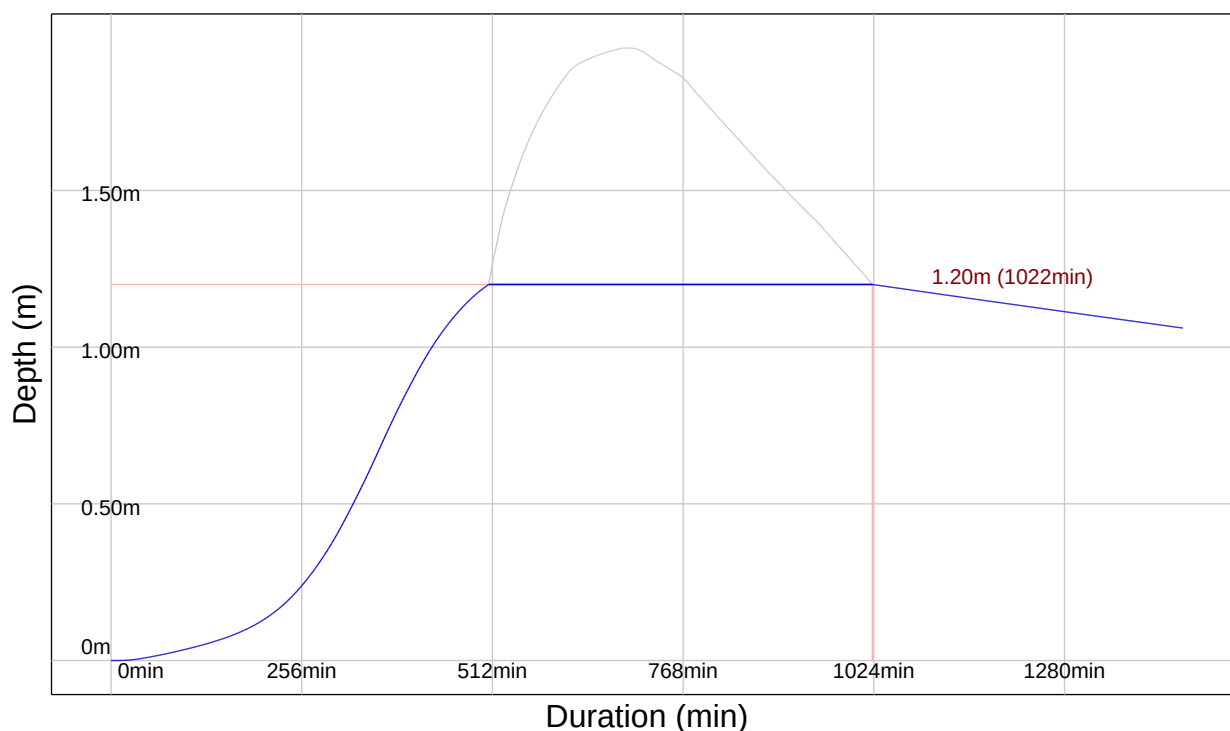
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Tank Structure at Manhole 1-S19 TANK

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
120.121	1.200	95.00	344.969	327.721	393.265	0.00000000	0.00000000	2.00

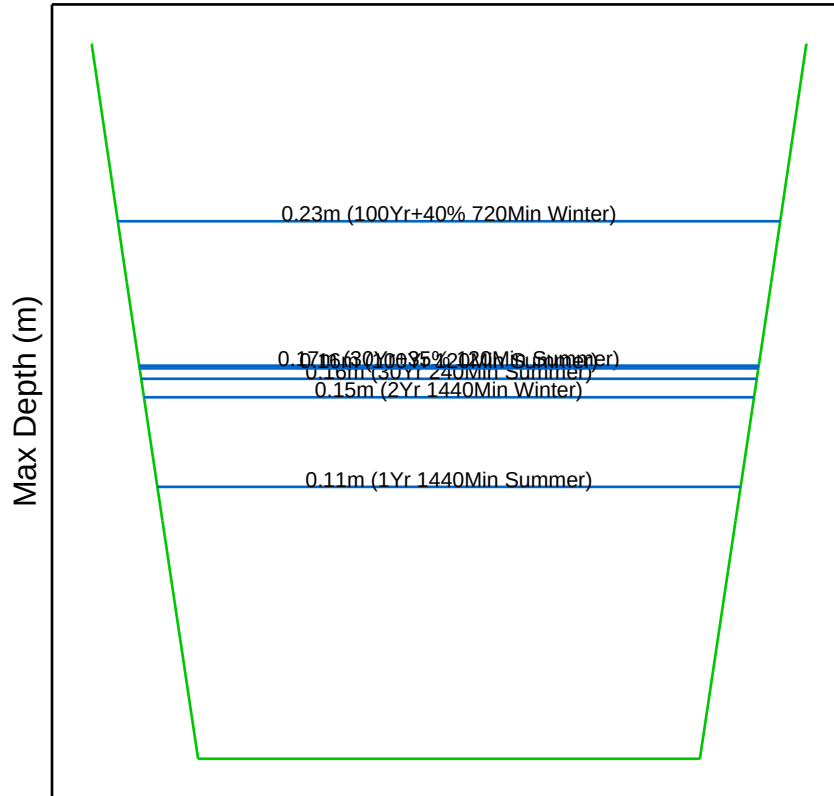
Tank 2 at 1-S19 TANK (100Yr+40% 720Min Winter)



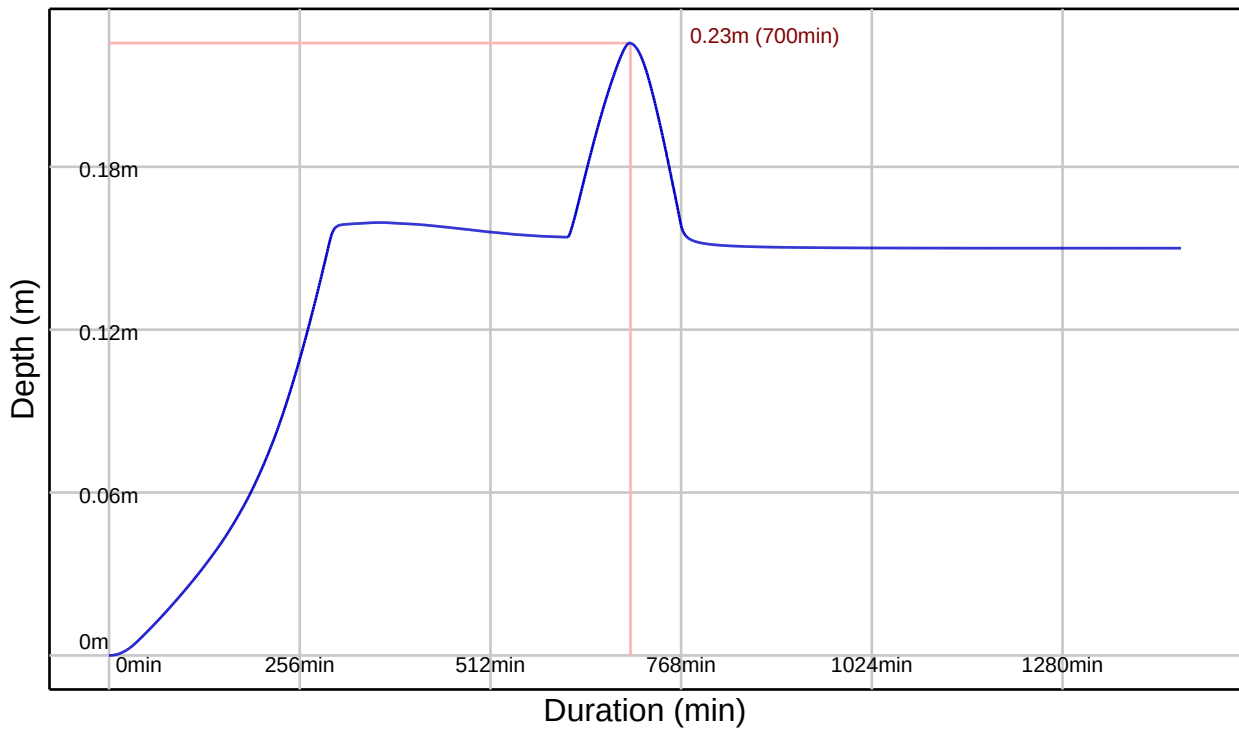
Pond Structure at Manhole 1-S24

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
121.850	0.300	10.085	122.150	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S24



Pond 3 at 1-S24 (100Yr+40% 720Min Winter)



Controls within Manhole 1-S25

Orifice Control

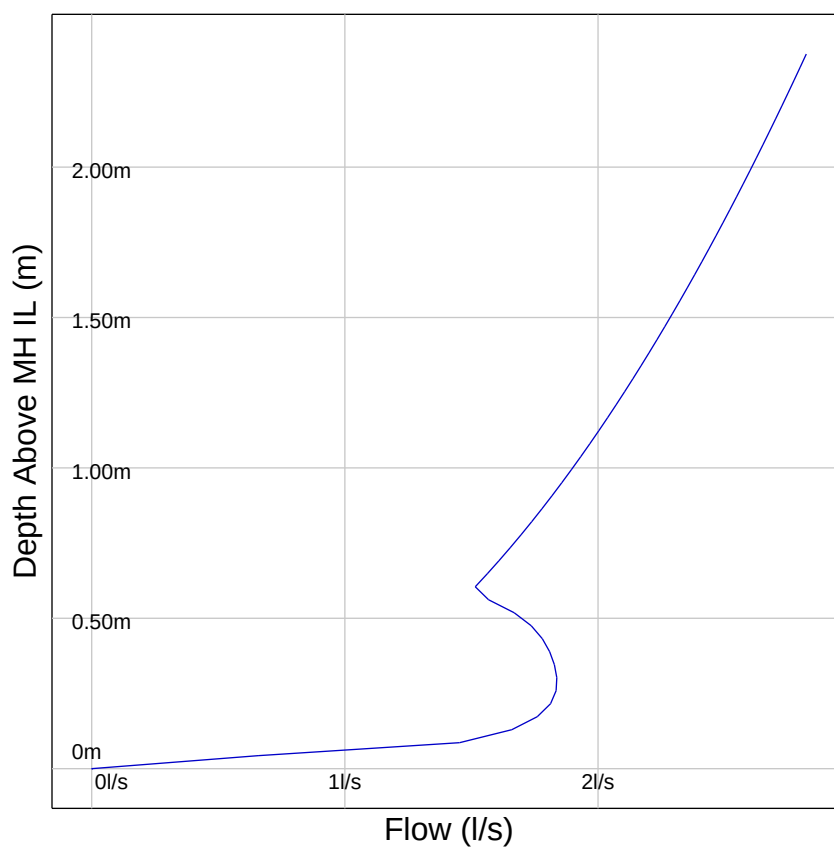
Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Controls within Manhole 1-S28 HB

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0065-2600-2000-2600	2.000	2.600	0.000	0.288	1.838	0.585	1.492

Hydro-Brake® Optimum Control from 1-S28 HB to 1-S29



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

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

Global Time of Entry: 5.0 mins

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

Return Periods (yrs) + Climate Change: (1, +0%), (2, +0%), (30, +0%), (30, +35%), (100, +0%), (100, +40%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Winter	12.422	0.00	0.49	30Yr+35% 15Min Summer	112.146	0.00	0.08
1Yr 15Min Summer	12.422	0.00	0.50	30Yr+35% 15Min Winter	112.146	0.00	0.10
1Yr 30Min Winter	8.143	0.00	0.25	30Yr+35% 30Min Summer	71.574	0.00	0.36
1Yr 30Min Summer	8.143	0.00	0.30	30Yr+35% 30Min Winter	71.574	0.00	0.42
1Yr 60Min Winter	4.943	0.00	0.00	30Yr+35% 60Min Summer	43.585	0.00	0.71
1Yr 60Min Summer	4.943	0.00	0.00	30Yr+35% 60Min Winter	43.585	0.00	0.72
1Yr 120Min Winter	4.361	0.00	0.00	30Yr+35% 120Min Summer	27.193	0.00	1.01
1Yr 120Min Summer	4.361	0.00	0.00	30Yr+35% 120Min Winter	27.193	0.00	1.01
1Yr 180Min Summer	3.794	0.00	-0.06	30Yr+35% 180Min Summer	20.416	0.00	1.16
1Yr 180Min Winter	3.794	0.00	-0.07	30Yr+35% 180Min Winter	20.416	0.00	1.17
1Yr 240Min Winter	3.191	0.00	-0.07	30Yr+35% 240Min Summer	16.351	0.00	1.18
1Yr 240Min Summer	3.191	0.00	-0.07	30Yr+35% 240Min Winter	16.351	0.00	1.19
1Yr 360Min Winter	2.507	0.00	-0.05	30Yr+35% 360Min Summer	11.887	0.00	1.14
1Yr 360Min Summer	2.507	0.00	-0.06	30Yr+35% 360Min Winter	11.887	0.00	1.14
1Yr 480Min Summer	2.095	0.00	0.00	30Yr+35% 480Min Summer	9.439	0.00	1.04
1Yr 480Min Winter	2.095	0.00	0.00	30Yr+35% 480Min Winter	9.439	0.00	1.04
1Yr 600Min Winter	1.796	0.00	0.00	30Yr+35% 600Min Summer	7.849	0.00	0.92
1Yr 600Min Summer	1.796	0.00	0.00	30Yr+35% 600Min Winter	7.849	0.00	0.93
1Yr 720Min Summer	1.571	0.00	0.00	30Yr+35% 720Min Summer	6.728	0.00	0.79
1Yr 720Min Winter	1.571	0.00	0.00	30Yr+35% 720Min Winter	6.728	0.00	0.80
1Yr 960Min Winter	1.272	0.00	0.00	30Yr+35% 960Min Summer	5.271	0.00	0.53
1Yr 960Min Summer	1.272	0.00	0.00	30Yr+35% 960Min Winter	5.271	0.00	0.54
1Yr 1440Min Summer	0.946	0.00	0.00	30Yr+35% 1440Min Summer	3.739	0.00	0.22
1Yr 1440Min Winter	0.946	0.00	0.00	30Yr+35% 1440Min Winter	3.739	0.00	0.23
2Yr 15Min Summer	30.753	0.00	0.48	100Yr 15Min Summer	106.446	0.00	0.00
2Yr 15Min Winter	30.753	0.00	0.47	100Yr 15Min Winter	106.446	0.00	0.03
2Yr 30Min Summer	19.200	0.00	0.20	100Yr 30Min Summer	68.456	0.00	0.29
2Yr 30Min Winter	19.200	0.00	0.19	100Yr 30Min Winter	68.456	0.00	0.35
2Yr 60Min Winter	11.700	0.00	0.00	100Yr 60Min Summer	41.870	0.00	0.65
2Yr 60Min Summer	11.700	0.00	0.00	100Yr 60Min Winter	41.870	0.00	0.67
2Yr 120Min Summer	8.500	0.00	-0.07	100Yr 120Min Summer	25.800	0.00	0.88
2Yr 120Min Winter	8.500	0.00	-0.07	100Yr 120Min Winter	25.800	0.00	0.89
2Yr 180Min Summer	6.873	0.00	-0.07	100Yr 180Min Summer	19.309	0.00	1.04
2Yr 180Min Winter	6.873	0.00	-0.06	100Yr 180Min Winter	19.309	0.00	1.05
2Yr 240Min Summer	5.603	0.00	-0.07	100Yr 240Min Summer	15.512	0.00	1.08
2Yr 240Min Winter	5.603	0.00	-0.06	100Yr 240Min Winter	15.512	0.00	1.08
2Yr 360Min Summer	4.221	0.00	-0.06	100Yr 360Min Summer	11.329	0.00	1.04
2Yr 360Min Winter	4.221	0.00	-0.06	100Yr 360Min Winter	11.329	0.00	1.05
2Yr 480Min Summer	3.432	0.00	-0.05	100Yr 480Min Summer	9.024	0.00	0.95
2Yr 480Min Winter	3.432	0.00	-0.05	100Yr 480Min Winter	9.024	0.00	0.95
2Yr 600Min Summer	2.888	0.00	-0.04	100Yr 600Min Summer	7.522	0.00	0.83
2Yr 600Min Winter	2.888	0.00	-0.04	100Yr 600Min Winter	7.522	0.00	0.84
2Yr 720Min Summer	2.493	0.00	-0.04	100Yr 720Min Summer	6.458	0.00	0.69
2Yr 720Min Winter	2.493	0.00	-0.04	100Yr 720Min Winter	6.458	0.00	0.70
2Yr 960Min Summer	1.982	0.00	0.00	100Yr 960Min Summer	5.063	0.00	0.48
2Yr 960Min Winter	1.982	0.00	0.00	100Yr 960Min Winter	5.063	0.00	0.49
2Yr 1440Min Winter	1.438	0.00	0.00	100Yr 1440Min Summer	3.575	0.00	0.17
2Yr 1440Min Summer	1.438	0.00	0.00	100Yr 1440Min Winter	3.575	0.00	0.17
30Yr 15Min Summer	83.071	0.00	-0.12	100Yr+40% 15Min Summer	149.024	0.00	0.43
30Yr 15Min Winter	83.071	0.00	-0.16	100Yr+40% 15Min Winter	149.024	0.00	0.48
30Yr 30Min Summer	53.018	0.00	0.00	100Yr+40% 30Min Summer	95.839	0.00	0.69
30Yr 30Min Winter	53.018	0.00	0.00	100Yr+40% 30Min Winter	95.839	0.00	0.73
30Yr 60Min Summer	32.285	0.00	0.26	100Yr+40% 60Min Summer	58.618	0.00	1.21
30Yr 60Min Winter	32.285	0.00	0.28	100Yr+40% 60Min Winter	58.618	0.00	1.24

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 120Min Summer	20.143	0.00	0.52	100Yr+40% 120Min Summer	36.120	0.00	1.53
30Yr 120Min Winter	20.143	0.00	0.55	100Yr+40% 120Min Winter	36.120	0.00	1.55
30Yr 180Min Summer	15.123	0.00	0.62	100Yr+40% 180Min Summer	27.033	0.00	1.66
30Yr 180Min Winter	15.123	0.00	0.64	100Yr+40% 180Min Winter	27.033	0.00	1.67
30Yr 240Min Summer	12.112	0.00	0.63	100Yr+40% 240Min Summer	21.716	0.00	1.70
30Yr 240Min Winter	12.112	0.00	0.65	100Yr+40% 240Min Winter	21.716	0.00	1.70
30Yr 360Min Winter	8.805	0.00	0.60	100Yr+40% 360Min Summer	15.861	0.00	1.53
30Yr 360Min Summer	8.805	0.00	0.60	100Yr+40% 360Min Winter	15.861	0.00	1.53
30Yr 480Min Summer	6.992	0.00	0.52	100Yr+40% 480Min Summer	12.634	0.00	1.18
30Yr 480Min Winter	6.992	0.00	0.53	100Yr+40% 480Min Winter	12.634	0.00	1.14
30Yr 600Min Summer	5.814	0.00	0.43	100Yr+40% 600Min Summer	10.531	0.00	1.06
30Yr 600Min Winter	5.814	0.00	0.43	100Yr+40% 600Min Winter	10.531	0.00	1.04
30Yr 720Min Summer	4.984	0.00	0.32	100Yr+40% 720Min Summer	9.041	0.00	0.96
30Yr 720Min Winter	4.984	0.00	0.33	100Yr+40% 720Min Winter	9.041	0.00	0.94
30Yr 960Min Summer	3.905	0.00	0.14	100Yr+40% 960Min Summer	7.088	0.00	0.75
30Yr 960Min Winter	3.905	0.00	0.15	100Yr+40% 960Min Winter	7.088	0.00	0.74
30Yr 1440Min Summer	2.770	0.00	-0.03	100Yr+40% 1440Min Winter	5.005	0.00	0.41
30Yr 1440Min Winter	2.770	0.00	-0.02	100Yr+40% 1440Min Summer	5.005	0.00	0.53

Simulation Results

Return Period (yrs) + Climate Change (%):

1yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	8	121.579	0.057	8.153		OK
1-S2	15 min Summer	9	121.180	0.059	7.929		OK
1-S3	15 min Summer	9	121.076	0.048	9.474		OK
1-S4	15 min Summer	9	120.829	0.042	3.214		OK
1-S5	15 min Summer	9	122.124	0.024	3.420		OK
1-S6	15 min Summer	10	121.606	0.098	3.146		OK
1-S8	15 min Summer	9	120.575	0.084	15.551		OK
1-S9	15 min Summer	10	122.456	0.006	0.417		OK
1-S10	30 min Summer	19	121.329	0.028	0.337		OK
1-S11	15 min Summer	10	120.390	0.084	15.340		OK
1-S16	120 min Summer	65	122.456	0.006	0.384		OK
1-S17	120 min Summer	67	121.386	0.030	0.376		OK
1-S100	15 min Summer	10	120.348	0.080	15.615		OK
1-S18	15 min Winter	8	120.328	0.150	12.372		OK
1-S12	30 min Summer	19	122.010	0.010	0.376		OK
1-S13	120 min Summer	65	121.737	0.033	0.423		OK
1-S14	15 min Summer	8	121.395	0.040	4.386		OK
1-S15	15 min Summer	9	121.114	0.027	4.290		OK
1-S19 TANK	480 min Summer	346	120.263	0.141	1.160		OK
1-S24	1440 min Summer	1442	121.964	0.114	0.000		OK
1-S25	15 min Winter	0	121.104	0.000	0.000		OK
1-S20	15 min Summer	9	120.278	0.241	11.856		OK
1-S21	15 min Summer	8	121.304	0.056	7.474		OK
1-S26	15 min Summer	8	121.049	0.062	9.415		OK
1-S27	15 min Summer	8	120.962	0.030	9.316		OK
1-S28 HB	15 min Summer	9	120.279	0.264	9.295		Surcharged
1-S29	15 min Summer	9	119.905	0.035	1.820		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	1-S1	1-S2	0.058	0.989	8.066	0.146	OK
1.001	15 min Summer	9	1-S2	1-S3	0.053	1.112	8.029	0.154	OK
1.002	15 min Summer	9	1-S3	1-S8	0.047	1.582	9.519	0.099	OK
2.000	15 min Summer	9	1-S4	1-S8	0.042	0.633	3.254	0.079	OK
3.000	15 min Summer	10	1-S5	1-S6	0.061	0.812	3.197	0.061	OK
3.001	15 min Summer	10	1-S6	1-S8	0.046	0.660	3.012	0.212	OK
1.003	15 min Summer	9	1-S8	1-S11	0.083	0.974	15.576	0.170	OK
4.000	30 min Summer	19	1-S9	1-S10	0.017	0.541	0.364	0.004	OK
4.001	30 min Summer	19	1-S10	1-S11	0.006	1.224	0.330	0.004	OK
1.004	15 min Summer	10	1-S11	1-S100	0.082	1.033	15.534	0.172	OK
5.000	120 min Summer	66	1-S16	1-S17	0.018	0.338	0.384	0.004	OK
5.001	120 min Summer	67	1-S17	1-S100	0.006	1.489	0.378	0.004	OK
1.005	15 min Winter	10	1-S100	1-S18	0.107	0.882	14.610	0.129	OK
1.006	480 min Summer	346	1-S18	1-S19 TANK	0.113	0.654	5.495	0.061	OK
6.000	120 min Summer	65	1-S12	1-S13	0.021	0.293	0.428	0.009	OK
6.001	120 min Summer	66	1-S13	1-S14	0.010	0.783	0.420	0.011	OK
6.002	15 min Summer	8	1-S14	1-S15	0.040	0.908	4.324	0.072	OK
6.003	480 min Summer	334	1-S15	1-S19 TANK	0.037	1.206	1.583	0.011	OK
1.007	480 min Summer	690	1-S19 TANK	1-S20	0.183	0.290	5.714	0.061	OK
7.000	15 min Winter	0	1-S24	1-S25	0.000	0.000	0.000	0.000	OK
7.001	15 min Summer	9	1-S25	1-S20	0.045	0.000	0.000	0.000	OK
1.008	15 min Summer	34	1-S20	1-S28 HB	0.252	0.356	2.565	0.042	OK
8.000	15 min Summer	8	1-S21	1-S26	0.059	0.885	7.397	0.142	OK
8.001	15 min Summer	8	1-S26	1-S27	0.046	1.580	9.316	0.179	OK
8.002	15 min Summer	9	1-S27	1-S28 HB	0.110	1.815	9.295	0.046	OK
1.009	15 min Summer	9	1-S28 HB	1-S29	0.035	0.572	1.820	0.127	OK

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	8	121.614	0.093	20.189		OK
1-S2	15 min Summer	8	121.217	0.096	20.005		OK
1-S3	15 min Summer	9	121.105	0.076	23.376		OK
1-S4	15 min Summer	8	120.854	0.067	8.300		OK
1-S5	15 min Summer	9	122.138	0.038	8.463		OK
1-S6	15 min Summer	10	121.871	0.363	7.864		Surcharged
1-S8	15 min Summer	9	120.628	0.137	38.087		OK
1-S9	15 min Summer	9	122.460	0.010	1.239		OK
1-S10	15 min Summer	11	121.363	0.062	0.950		OK
1-S11	15 min Summer	9	120.449	0.144	38.991		OK
1-S16	15 min Summer	11	122.460	0.010	0.917		OK
1-S17	30 min Summer	20	121.419	0.063	1.000		OK
1-S100	15 min Summer	9	120.403	0.135	39.481		OK
1-S18	480 min Winter	358	120.401	0.223	2.125		OK
1-S12	15 min Summer	10	122.017	0.017	1.581		OK
1-S13	15 min Summer	12	121.785	0.081	1.162		OK
1-S14	15 min Summer	9	121.421	0.066	11.227		OK
1-S15	15 min Summer	9	121.131	0.044	11.236		OK
1-S19 TANK	480 min Winter	420	120.395	0.274	0.644		OK
1-S24	1440 min Winter	1155	122.002	0.152	0.025		OK
1-S25	1440 min Winter	1164	121.109	0.005	0.025		OK
1-S20	15 min Summer	7	120.408	0.372	26.854		Surcharged
1-S21	15 min Summer	8	121.340	0.092	18.508		OK
1-S26	15 min Summer	8	121.085	0.098	23.345		OK
1-S27	15 min Summer	8	120.979	0.047	23.182		OK
1-S28 HB	15 min Summer	7	120.412	0.397	21.009		Surcharged
1-S29	180 min Summer	234	119.905	0.035	1.837		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	1-S1	1-S2	0.095	1.261	20.005	0.362	OK
1.001	15 min Summer	9	1-S2	1-S3	0.086	1.417	19.799	0.380	OK
1.002	15 min Summer	9	1-S3	1-S8	0.075	2.029	23.518	0.245	OK
2.000	15 min Summer	9	1-S4	1-S8	0.067	0.821	8.109	0.197	OK
3.000	15 min Summer	9	1-S5	1-S6	0.094	0.938	8.452	0.161	OK
3.001	15 min Summer	11	1-S6	1-S8	0.074	0.830	7.185	0.506	OK
1.003	15 min Summer	9	1-S8	1-S11	0.140	1.178	38.143	0.417	OK
4.000	15 min Summer	11	1-S9	1-S10	0.036	0.899	1.124	0.011	OK
4.001	15 min Summer	11	1-S10	1-S11	0.011	1.716	1.010	0.013	OK
1.004	15 min Summer	9	1-S11	1-S100	0.139	1.221	38.990	0.431	OK
5.000	30 min Summer	20	1-S16	1-S17	0.036	0.580	1.105	0.012	OK
5.001	30 min Summer	20	1-S17	1-S100	0.010	2.001	1.020	0.011	OK
1.005	480 min Winter	420	1-S100	1-S18	0.172	0.789	12.924	0.114	OK
1.006	480 min Winter	398	1-S18	1-S19 TANK	0.248	0.693	13.957	0.156	OK
6.000	15 min Summer	12	1-S12	1-S13	0.048	0.700	1.467	0.032	OK
6.001	15 min Summer	12	1-S13	1-S14	0.017	1.082	1.239	0.032	OK
6.002	15 min Summer	9	1-S14	1-S15	0.065	1.189	11.236	0.187	OK
6.003	480 min Winter	406	1-S15	1-S19 TANK	0.103	1.166	1.676	0.012	OK
1.007	480 min Winter	612	1-S19 TANK	1-S20	0.287	0.064	1.814	0.019	OK
7.000	1440 min Winter	1163	1-S24	1-S25	0.003	0.256	0.025	0.000	OK
7.001	960 min Summer	963	1-S25	1-S20	0.075	0.002	0.013	0.000	OK
1.008	1440 min Summer	1626	1-S20	1-S28 HB	0.300	0.184	3.559	0.059	Surcharged
8.000	15 min Summer	8	1-S21	1-S26	0.095	1.146	18.348	0.353	OK
8.001	15 min Summer	8	1-S26	1-S27	0.073	2.077	23.182	0.446	OK
8.002	15 min Summer	8	1-S27	1-S28 HB	0.136	1.940	23.148	0.114	OK
1.009	960 min Winter	627	1-S28 HB	1-S29	0.036	0.573	1.837	0.128	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	8	121.704	0.183	54.547		OK
1-S2	15 min Summer	8	121.300	0.179	53.947		OK
1-S3	15 min Summer	8	121.165	0.137	63.522		OK
1-S4	15 min Summer	8	120.902	0.115	22.424		OK
1-S5	15 min Summer	11	122.253	0.153	11.234		Surcharged
1-S6	15 min Summer	11	122.228	0.720	10.646		Flood Risk
1-S8	600 min Winter	584	120.802	0.311	0.706		Surcharged
1-S9	15 min Summer	9	122.467	0.017	3.346		OK
1-S10	15 min Summer	11	121.546	0.246	2.413		Surcharged
1-S11	600 min Winter	584	120.802	0.497	0.740		Surcharged
1-S16	15 min Summer	10	122.469	0.019	4.204		OK
1-S17	15 min Summer	12	121.693	0.337	3.098		Surcharged
1-S100	600 min Winter	584	120.802	0.534	0.791		Surcharged
1-S18	600 min Winter	583	120.802	0.625	0.817		Surcharged
1-S12	15 min Summer	11	122.030	0.030	2.526		OK
1-S13	15 min Summer	11	122.046	0.343	3.692		Surcharged
1-S14	15 min Summer	8	121.472	0.116	31.144		OK
1-S15	15 min Summer	8	121.163	0.075	30.807		OK
1-S19 TANK	600 min Winter	583	120.802	0.681	1.049		Surcharged
1-S24	240 min Summer	141	122.010	0.160	0.844		OK
1-S25	240 min Summer	142	121.155	0.051	0.843		OK
1-S20	600 min Winter	583	120.802	0.765	1.270		Surcharged
1-S21	15 min Summer	8	121.429	0.181	50.004		OK
1-S26	15 min Summer	8	121.176	0.189	62.982		OK
1-S27	15 min Summer	8	121.022	0.090	62.328		OK
1-S28 HB	600 min Winter	583	120.802	0.788	1.672		Surcharged
1-S29	1440 min Winter	2704	119.905	0.035	1.837		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	1-S1	1-S2	0.181	1.576	53.947	0.976	OK
1.001	15 min Summer	9	1-S2	1-S3	0.158	1.802	53.455	1.025	OK
1.002	15 min Summer	9	1-S3	1-S8	0.171	2.239	63.390	0.661	OK
2.000	15 min Summer	9	1-S4	1-S8	0.150	0.927	22.213	0.540	OK
3.000	15 min Summer	11	1-S5	1-S6	0.150	1.119	13.735	0.262	Surcharged
3.001	15 min Summer	12	1-S6	1-S8	0.094	0.905	10.549	0.744	OK
1.003	600 min Summer	558	1-S8	1-S11	0.300	0.854	14.267	0.156	Surcharged
4.000	15 min Summer	9	1-S9	1-S10	0.083	1.067	3.350	0.034	OK
4.001	180 min Summer	112	1-S10	1-S11	0.079	1.751	1.119	0.014	OK
1.004	180 min Summer	112	1-S11	1-S100	0.300	1.108	36.040	0.398	Surcharged
5.000	15 min Summer	10	1-S16	1-S17	0.085	0.966	4.283	0.045	OK
5.001	180 min Summer	105	1-S17	1-S100	0.080	2.215	1.572	0.017	OK
1.005	180 min Summer	105	1-S100	1-S18	0.300	0.947	36.869	0.326	Surcharged
1.006	30 min Winter	28	1-S18	1-S19 TANK	0.300	1.875	72.407	0.808	Surcharged
6.000	15 min Summer	11	1-S12	1-S13	0.090	0.774	4.708	0.104	OK
6.001	15 min Summer	12	1-S13	1-S14	0.032	1.385	2.905	0.075	OK
6.002	15 min Summer	8	1-S14	1-S15	0.113	1.542	30.807	0.512	OK
6.003	120 min Summer	64	1-S15	1-S19 TANK	0.135	1.732	14.131	0.102	OK
1.007	1440 min Summer	720	1-S19 TANK	1-S20	0.300	0.160	2.156	0.023	Surcharged
7.000	240 min Summer	142	1-S24	1-S25	0.030	1.145	0.850	0.010	OK
7.001	240 min Summer	142	1-S25	1-S20	0.079	0.088	0.841	0.009	OK
1.008	15 min Winter	24	1-S20	1-S28 HB	0.300	0.511	1.934	0.032	Surcharged
8.000	15 min Summer	8	1-S21	1-S26	0.185	1.413	49.481	0.953	OK
8.001	15 min Summer	8	1-S26	1-S27	0.140	2.470	62.328	1.200	OK
8.002	15 min Summer	8	1-S27	1-S28 HB	0.158	2.336	62.384	0.306	OK
1.009	1440 min Winter	2704	1-S28 HB	1-S29	0.036	0.573	1.837	0.128	OK

Return Period (yrs) + Climate Change (%):

30yr+35%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	9	122.040	0.519	70.532		Surcharged
1-S2	15 min Summer	10	121.445	0.324	64.630		Surcharged
1-S3	15 min Summer	10	121.288	0.259	75.846		Surcharged
1-S4	720 min Winter	698	121.082	0.295	0.160		Surcharged
1-S5	15 min Summer	12	122.329	0.229	9.415		Surcharged
1-S6	15 min Summer	12	122.302	0.794	11.090		Flood Risk
1-S8	720 min Winter	698	121.082	0.590	0.871		Surcharged
1-S9	15 min Summer	9	122.469	0.019	4.517		OK
1-S10	15 min Summer	11	121.680	0.379	3.173		Surcharged
1-S11	720 min Winter	699	121.082	0.776	0.878		Surcharged
1-S16	15 min Summer	10	122.473	0.023	5.672		OK
1-S17	15 min Summer	12	121.904	0.549	4.096		Surcharged
1-S100	720 min Winter	699	121.082	0.813	0.933		Surcharged
1-S18	720 min Winter	699	121.082	0.904	0.933		Surcharged
1-S12	15 min Summer	11	122.050	0.050	5.452		OK
1-S13	15 min Winter	13	122.069	0.365	4.117		Surcharged
1-S14	15 min Summer	8	121.496	0.141	41.999		OK
1-S15	15 min Summer	8	121.177	0.090	41.563		OK
1-S19 TANK	720 min Winter	698	121.082	0.960	1.238		Surcharged
1-S24	120 min Summer	69	122.015	0.165	2.194		OK
1-S25	180 min Summer	102	121.268	0.164	1.922		Surcharged
1-S20	600 min Winter	580	121.084	1.047	1.160		Surcharged
1-S21	15 min Summer	9	121.658	0.411	64.658		Surcharged
1-S26	15 min Summer	9	121.239	0.253	82.905		Surcharged
1-S27	600 min Winter	580	121.083	0.152	0.379		OK
1-S28 HB	600 min Winter	580	121.085	1.070	1.781		Surcharged
1-S29	600 min Winter	583	119.906	0.036	1.927		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	1-S1	1-S2	0.225	1.626	64.276	1.163	OK
1.001	15 min Summer	10	1-S2	1-S3	0.225	1.783	67.673	1.298	OK
1.002	15 min Summer	10	1-S3	1-S8	0.225	2.209	78.216	0.816	OK
2.000	360 min Summer	312	1-S4	1-S8	0.225	0.750	5.881	0.143	OK
3.000	15 min Winter	9	1-S5	1-S6	0.150	1.167	13.621	0.260	Surcharged
3.001	15 min Summer	12	1-S6	1-S8	0.098	0.916	11.132	0.785	OK
1.003	15 min Winter	9	1-S8	1-S11	0.300	1.514	107.024	1.171	Surcharged
4.000	15 min Summer	9	1-S9	1-S10	0.085	1.224	4.558	0.046	OK
4.001	15 min Summer	11	1-S10	1-S11	0.084	1.452	3.105	0.039	OK
1.004	15 min Winter	10	1-S11	1-S100	0.300	1.535	108.262	1.197	Surcharged
5.000	15 min Summer	10	1-S16	1-S17	0.087	1.109	6.058	0.064	OK
5.001	15 min Summer	12	1-S17	1-S100	0.084	1.245	3.774	0.040	OK
1.005	15 min Winter	10	1-S100	1-S18	0.300	1.590	110.088	0.972	Surcharged
1.006	15 min Winter	12	1-S18	1-S19 TANK	0.300	2.259	109.139	1.217	Surcharged
6.000	15 min Summer	12	1-S12	1-S13	0.100	0.810	7.838	0.173	OK
6.001	15 min Summer	13	1-S13	1-S14	0.045	1.401	3.030	0.078	OK
6.002	15 min Summer	8	1-S14	1-S15	0.136	1.649	41.563	0.691	OK
6.003	30 min Summer	18	1-S15	1-S19 TANK	0.146	2.769	36.502	0.263	OK
1.007	600 min Winter	483	1-S19 TANK	1-S20	0.300	0.076	5.404	0.058	Surcharged
7.000	180 min Summer	99	1-S24	1-S25	0.082	1.503	2.172	0.025	OK
7.001	180 min Summer	102	1-S25	1-S20	0.082	0.198	1.946	0.021	OK
1.008	960 min Summer	774	1-S20	1-S28 HB	0.300	0.255	4.910	0.081	Surcharged
8.000	15 min Summer	9	1-S21	1-S26	0.225	1.646	65.448	1.260	OK
8.001	15 min Summer	9	1-S26	1-S27	0.171	2.578	83.169	1.602	OK
8.002	600 min Winter	580	1-S27	1-S28 HB	0.188	1.357	8.385	0.041	OK
1.009	600 min Winter	583	1-S28 HB	1-S29	0.036	0.581	1.927	0.134	OK

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	9	121.952	0.431	66.934		Surcharged
1-S2	15 min Summer	9	121.382	0.261	65.965		Surcharged
1-S3	15 min Summer	10	121.223	0.195	74.320		OK
1-S4	720 min Winter	698	121.038	0.252	0.153		Surcharged
1-S5	15 min Summer	12	122.314	0.214	8.914		Surcharged
1-S6	15 min Summer	12	122.288	0.780	10.964		Flood Risk
1-S8	720 min Winter	700	121.038	0.547	0.800		Surcharged
1-S9	15 min Summer	9	122.469	0.019	4.286		OK
1-S10	15 min Summer	11	121.652	0.352	3.026		Surcharged
1-S11	720 min Winter	698	121.039	0.733	0.845		Surcharged
1-S16	15 min Summer	10	122.472	0.022	5.385		OK
1-S17	15 min Summer	12	121.861	0.505	3.903		Surcharged
1-S100	720 min Winter	698	121.039	0.770	0.930		Surcharged
1-S18	720 min Winter	698	121.038	0.861	0.947		Surcharged
1-S12	15 min Summer	12	122.046	0.046	2.357		OK
1-S13	15 min Summer	11	122.068	0.364	4.921		Surcharged
1-S14	15 min Summer	8	121.492	0.136	39.876		OK
1-S15	15 min Summer	8	121.174	0.087	39.460		OK
1-S19 TANK	720 min Winter	698	121.038	0.917	1.228		Surcharged
1-S24	120 min Summer	70	122.014	0.164	1.922		OK
1-S25	180 min Summer	103	121.238	0.134	1.722		OK
1-S20	720 min Winter	675	121.048	1.011	2.005		Surcharged
1-S21	15 min Summer	9	121.590	0.342	61.360		Surcharged
1-S26	15 min Summer	9	121.215	0.228	78.485		Surcharged
1-S27	720 min Winter	681	121.054	0.122	1.748		OK
1-S28 HB	720 min Winter	689	121.047	1.032	3.299		Surcharged
1-S29	720 min Winter	690	119.906	0.036	1.893		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	9	1-S1	1-S2	0.225	1.659	65.965	1.194	OK
1.001	15 min Summer	10	1-S2	1-S3	0.210	1.795	64.845	1.244	OK
1.002	15 min Summer	10	1-S3	1-S8	0.210	2.211	76.437	0.797	OK
2.000	600 min Summer	529	1-S4	1-S8	0.225	0.658	3.736	0.091	OK
3.000	15 min Winter	9	1-S5	1-S6	0.150	1.149	13.298	0.254	Surcharged
3.001	15 min Summer	12	1-S6	1-S8	0.097	0.914	11.026	0.777	OK
1.003	15 min Winter	9	1-S8	1-S11	0.300	1.485	104.953	1.148	Surcharged
4.000	15 min Summer	9	1-S9	1-S10	0.084	1.213	4.321	0.044	OK
4.001	15 min Summer	11	1-S10	1-S11	0.084	1.685	2.982	0.038	OK
1.004	15 min Winter	10	1-S11	1-S100	0.300	1.519	106.486	1.177	Surcharged
5.000	15 min Summer	10	1-S16	1-S17	0.086	1.101	5.713	0.060	OK
5.001	15 min Summer	12	1-S17	1-S100	0.084	1.183	3.613	0.039	OK
1.005	15 min Winter	10	1-S100	1-S18	0.300	1.585	108.179	0.955	Surcharged
1.006	15 min Winter	17	1-S18	1-S19 TANK	0.300	2.256	107.144	1.195	Surcharged
6.000	15 min Summer	13	1-S12	1-S13	0.098	0.806	6.861	0.151	OK
6.001	15 min Summer	14	1-S13	1-S14	0.043	1.396	2.985	0.077	OK
6.002	15 min Summer	8	1-S14	1-S15	0.132	1.631	39.460	0.656	OK
6.003	60 min Summer	32	1-S15	1-S19 TANK	0.144	2.179	26.154	0.189	OK
1.007	720 min Winter	686	1-S19 TANK	1-S20	0.300	0.072	5.100	0.054	Surcharged
7.000	180 min Summer	103	1-S24	1-S25	0.074	1.397	1.885	0.022	OK
7.001	180 min Summer	103	1-S25	1-S20	0.081	0.176	1.722	0.018	OK
1.008	720 min Summer	720	1-S20	1-S28 HB	0.300	0.279	5.214	0.086	Surcharged
8.000	15 min Summer	9	1-S21	1-S26	0.225	1.557	61.919	1.192	OK
8.001	15 min Summer	9	1-S26	1-S27	0.167	2.488	78.654	1.515	OK
8.002	720 min Winter	681	1-S27	1-S28 HB	0.174	1.313	5.795	0.028	OK
1.009	720 min Winter	690	1-S28 HB	1-S29	0.036	0.579	1.893	0.132	OK

Return Period (yrs) + Climate Change (%):

100yr+40%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	10	122.769	1.248	77.865		Surcharged
1-S2	720 min Winter	692	122.076	0.955	0.663		Surcharged
1-S3	720 min Winter	692	122.076	1.047	0.786		Surcharged
1-S4	720 min Winter	691	122.076	1.289	0.282		Surcharged
1-S5	15 min Summer	12	122.415	0.315	12.502		Surcharged
1-S6	15 min Summer	12	122.384	0.876	11.801		Flood Risk
1-S8	720 min Winter	692	122.076	1.585	1.384		Surcharged
1-S9	15 min Summer	9	122.472	0.022	6.001		OK
1-S10	720 min Winter	692	122.076	0.776	0.050		Surcharged
1-S11	720 min Winter	692	122.076	1.771	1.436		Surcharged
1-S16	15 min Summer	9	122.477	0.027	9.070		OK
1-S17	15 min Summer	12	122.206	0.851	5.278		Surcharged
1-S100	720 min Winter	692	122.076	1.808	1.484		Surcharged
1-S18	720 min Winter	692	122.076	1.899	1.485		Surcharged
1-S12	15 min Summer	12	122.077	0.077	2.810		OK
1-S13	15 min Winter	13	122.096	0.393	2.462		Surcharged
1-S14	720 min Winter	692	122.076	0.721	0.355		Surcharged
1-S15	720 min Winter	694	122.076	0.989	0.393		Surcharged
1-S19 TANK	720 min Winter	692	122.076	1.955	1.781		Surcharged
1-S24	720 min Winter	699	122.076	0.226	0.060		OK
1-S25	720 min Winter	699	122.076	0.972	0.072		Flood Risk
1-S20	720 min Winter	692	122.076	2.039	2.107		Flood Risk
1-S21	15 min Summer	9	122.124	0.877	85.915		Surcharged
1-S26	720 min Winter	692	122.076	1.090	0.771		Flood Risk
1-S27	720 min Winter	692	122.076	1.144	0.771		Flood Risk
1-S28 HB	720 min Winter	692	122.076	2.061	2.618		Flood Risk
1-S29	720 min Winter	692	119.912	0.042	2.618		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	1-S1	1-S2	0.225	2.008	79.858	1.445	OK
1.001	15 min Winter	10	1-S2	1-S3	0.225	1.860	73.971	1.419	OK
1.002	15 min Winter	10	1-S3	1-S8	0.225	2.207	85.476	0.891	OK
2.000	15 min Winter	8	1-S4	1-S8	0.225	0.939	32.371	0.788	OK
3.000	15 min Winter	8	1-S5	1-S6	0.150	1.219	14.052	0.268	Surcharged
3.001	480 min Summer	413	1-S6	1-S8	0.150	0.812	6.610	0.466	Surcharged
1.003	15 min Winter	10	1-S8	1-S11	0.300	1.720	121.606	1.330	Surcharged
4.000	15 min Summer	9	1-S9	1-S10	0.086	1.258	6.080	0.061	OK
4.001	480 min Summer	381	1-S10	1-S11	0.150	1.372	0.968	0.012	Surcharged
1.004	15 min Winter	10	1-S11	1-S100	0.300	1.735	122.676	1.356	Surcharged
5.000	15 min Summer	9	1-S16	1-S17	0.088	1.056	8.312	0.088	OK
5.001	480 min Summer	388	1-S17	1-S100	0.150	1.709	1.439	0.015	Surcharged
1.005	15 min Winter	10	1-S100	1-S18	0.300	1.771	125.212	1.106	Surcharged
1.006	15 min Winter	11	1-S18	1-S19 TANK	0.300	2.309	123.463	1.377	Surcharged
6.000	15 min Summer	16	1-S12	1-S13	0.114	0.847	8.274	0.182	OK
6.001	600 min Summer	522	1-S13	1-S14	0.150	1.081	1.237	0.032	Surcharged
6.002	480 min Summer	399	1-S14	1-S15	0.225	1.139	9.611	0.160	OK
6.003	480 min Summer	358	1-S15	1-S19 TANK	0.225	1.105	9.609	0.069	OK
1.007	1440 min Summer	782	1-S19 TANK	1-S20	0.300	0.134	3.472	0.037	Surcharged
7.000	720 min Winter	752	1-S24	1-S25	0.113	0.759	1.513	0.018	OK
7.001	360 min Summer	263	1-S25	1-S20	0.150	0.222	2.199	0.024	Surcharged
1.008	1440 min Winter	830	1-S20	1-S28 HB	0.300	0.131	5.035	0.083	Surcharged
8.000	15 min Winter	9	1-S21	1-S26	0.225	1.999	79.470	1.531	OK
8.001	240 min Summer	191	1-S26	1-S27	0.225	2.162	30.126	0.580	OK
8.002	240 min Summer	169	1-S27	1-S28 HB	0.225	1.844	30.097	0.148	OK
1.009	720 min Winter	692	1-S28 HB	1-S29	0.043	0.634	2.618	0.182	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
2-S1	0.021	1350	Type C	125.005	123.655	1.200	525961.953	201077.756
2-S2	0.044	1350	Type C	125.002	123.482	1.370	525977.582	201070.470
2-S3	0.049	1350	Type C	124.963	123.357	1.381	525977.283	201065.463
2-S4	0.000	1200	Type B	124.883	122.263	2.394	525973.172	201051.298
2-S5 TANK 2	0.054	1350	Type B	125.155	122.222	2.708	525969.554	201043.861
2-S6	0.090	600	Unknown	124.316	122.902	1.189	525977.067	200987.002
2-S7	0.022	600	Unknown	123.835	122.489	1.122	526009.847	201018.286
2-S8	0.000	600	Type D	124.289	122.406	1.658	525994.886	201025.269
2-S9	0.007	1200	Type B	124.330	122.274	1.756	525989.999	201014.881
2-S10	0.000	1350	Type B	124.493	122.168	2.025	525970.820	201023.676
2-S11	0.000	1350	Type B	124.746	122.118	2.403	525959.510	201024.868
2-S12	0.043	1350	Type C	125.206	123.788	1.268	525945.412	201072.099
2-S13	0.034	1350	Type C	124.977	123.426	1.326	525933.585	201045.026
2-S14	0.045	1350	Type C	124.804	123.213	1.365	525929.007	201025.513
2-S15	0.000	1350	Type C	124.069	122.528	1.241	525920.651	201004.149
2-S16 SWALE	0.130	1350	Type C	124.000	123.275	0.500	525957.578	201001.927
2-S17	0.000	1350	Type B	124.328	122.698	1.480	525955.914	200997.514
2-S18 HB	0.000	1200	Type B	124.217	121.948	2.119	525945.792	200993.176
2-S19	0.000	1350	Type B	123.889	121.882	1.857	525952.856	200986.416
2-S20	0.000	1200	Unknown	123.470	121.829	1.491	525953.940	200978.456
2-S21	0.038	1350	Type C	122.945	121.876	0.844	525990.003	200963.524
2-S22 TANK 3	0.000	1350	Type C	123.010	121.833	0.952	525984.096	200966.031
2-S23	0.000	1350	Type C	122.998	121.762	1.011	525974.223	200970.221
2-S24 HB	0.000	1350	Type C	122.965	121.721	1.093	525968.254	200971.018
2-S25	0.000	1350	Type C	122.959	121.635	1.174	525966.036	200958.250
2-S26	0.000	1350	Type C	122.827	121.430	1.096	525973.864	200955.802
2-S27	0.000	1350	Type C	122.820	121.411	1.109	525979.810	200954.560
2-S28	0.000	1350	Type C	122.742	121.383	1.058	525988.291	200952.397
MH 9904	0.000	1500	Type C	122.705	121.355	1.050	525996.934	200949.755

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	2-S1	123.655	2-S2	123.482	Circ	150	17.244	100	0.600	1.200	1.370
1.001	2-S2	123.482	2-S3	123.432	Circ	150	5.016	100	0.600	1.370	1.381
1.002	2-S3	123.357	2-S4	122.263	Circ	225	14.749	13	0.600	1.381	2.394
1.003	2-S4	122.263	2-S5 TANK 2	122.222	Circ	3No. 225	8.271	200	0.600	2.394	2.708
1.004	2-S5 TANK 2	122.222	2-S11	122.118	Circ	3No. 225	21.485	207	0.600	2.708	2.403
2.000	2-S6	122.902	2-S9	122.349	Circ	225	30.733	56	0.600	1.189	1.756
3.000	2-S7	122.489	2-S8	122.406	Circ	225	16.510	200	0.600	1.122	1.658
3.001	2-S8	122.406	2-S9	122.349	Circ	225	11.480	200	0.600	1.658	1.756
2.001	2-S9	122.274	2-S10	122.168	Circ	300	21.099	200	0.600	1.756	2.025
2.002	2-S10	122.168	2-S11	122.118	Circ	300	11.372	226	0.600	2.025	2.328
1.005	2-S11	122.118	2-S18 HB	121.948	Circ	300	34.533	203	0.600	2.328	1.969
4.000	2-S12	123.788	2-S13	123.501	Circ	150	29.544	103	0.600	1.268	1.326
4.001	2-S13	123.426	2-S14	123.213	Circ	225	20.043	94	0.600	1.326	1.365
4.002	2-S14	123.213	2-S15	122.603	Circ	225	22.940	38	0.600	1.365	1.241
4.003	2-S15	122.528	2-S18 HB	121.948	Circ	300	27.431	47	0.600	1.241	1.969
5.000	2-S16 SWALE	123.275	2-S17	122.698	Circ	225	4.717	8	0.600	0.500	1.405
5.001	2-S17	122.698	2-S18 HB	121.948	Circ	150	11.011	15	0.600	1.480	2.119
1.006	2-S18 HB	121.948	2-S19	121.882	Circ	150	9.778	150	0.600	2.119	1.857
1.007	2-S19	121.882	2-S20	121.829	Circ	150	8.034	150	0.600	1.857	1.491
1.008	2-S20	121.829	2-S24 HB	121.721	Circ	150	16.131	150	0.600	1.491	1.093
6.000	2-S21	121.876	2-S22 TANK 3	121.833	Circ	225	6.416	150	0.600	0.844	0.952
6.001	2-S22 TANK 3	121.833	2-S23	121.762	Circ	225	10.726	150	0.600	0.952	1.011
6.002	2-S23	121.762	2-S24 HB	121.721	Circ	225	6.022	150	0.600	1.011	1.018
1.009	2-S24 HB	121.721	2-S25	121.635	Circ	150	12.959	150	0.600	1.093	1.174
1.010	2-S25	121.635	2-S26	121.580	Circ	150	8.201	150	0.600	1.174	1.096
1.011	2-S26	121.430	2-S27	121.411	Circ	300	6.074	315	0.600	1.096	1.109

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.012	2-S27	121.411	2-S28	121.383	Circ	300	8.753	315	0.600	1.109	1.058
1.013	2-S28	121.383	MH 9904	121.355	Circ	300	9.038	315	0.600	1.058	1.050

Outfall Details

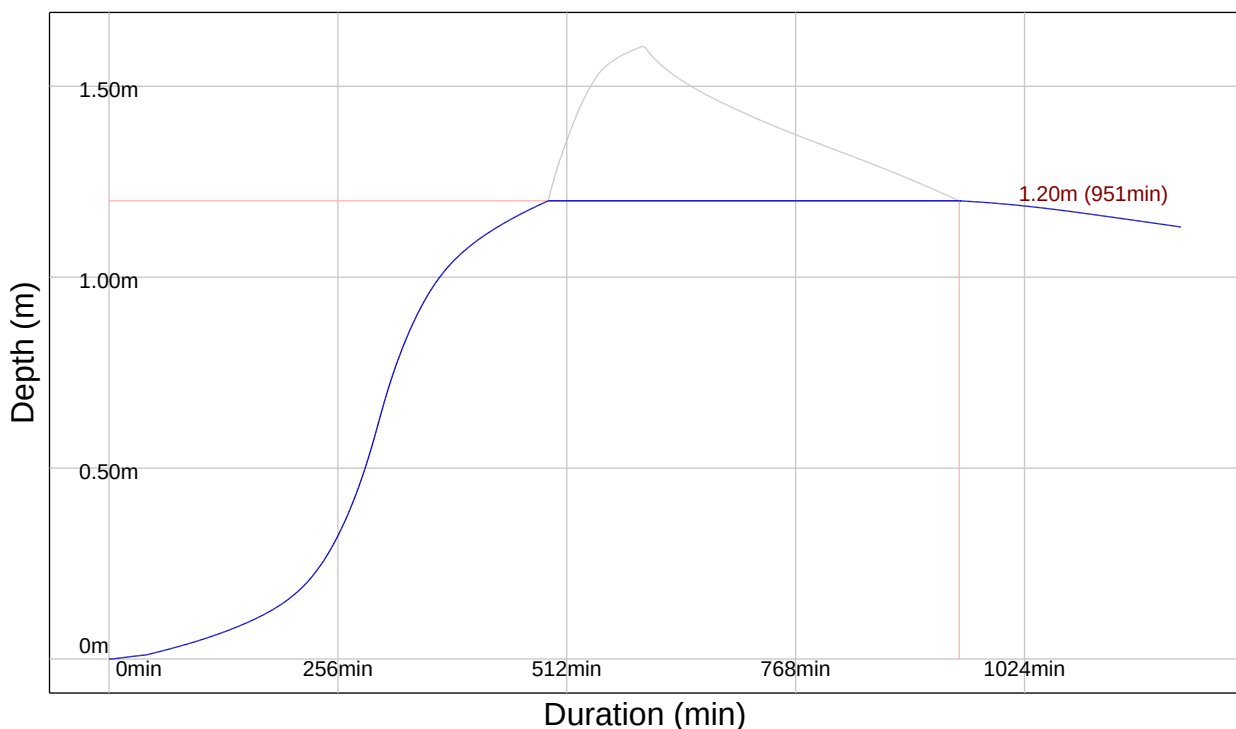
Outfall Manhole MH 9904 : Free Discharge

Flow Control Details

Tank Structure at Manhole 2-S5 TANK 2

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.222	1.200	95.00	331.577	314.998	377.997	0.00000000	0.00000000	2.00

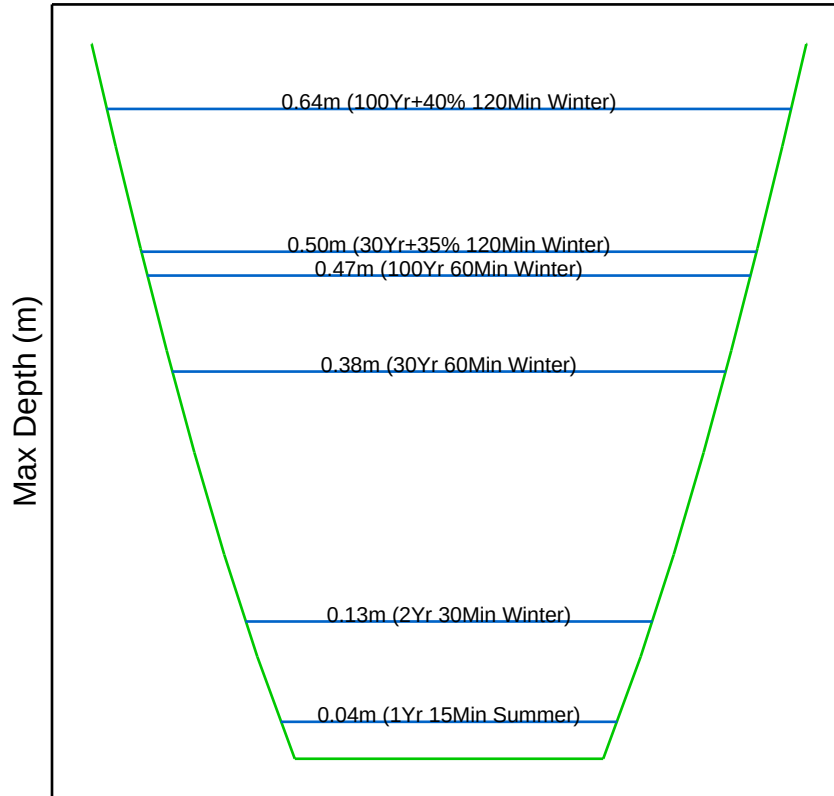
Tank 3 at 2-S5 TANK 2 (100Yr+40% 600Min Summer)



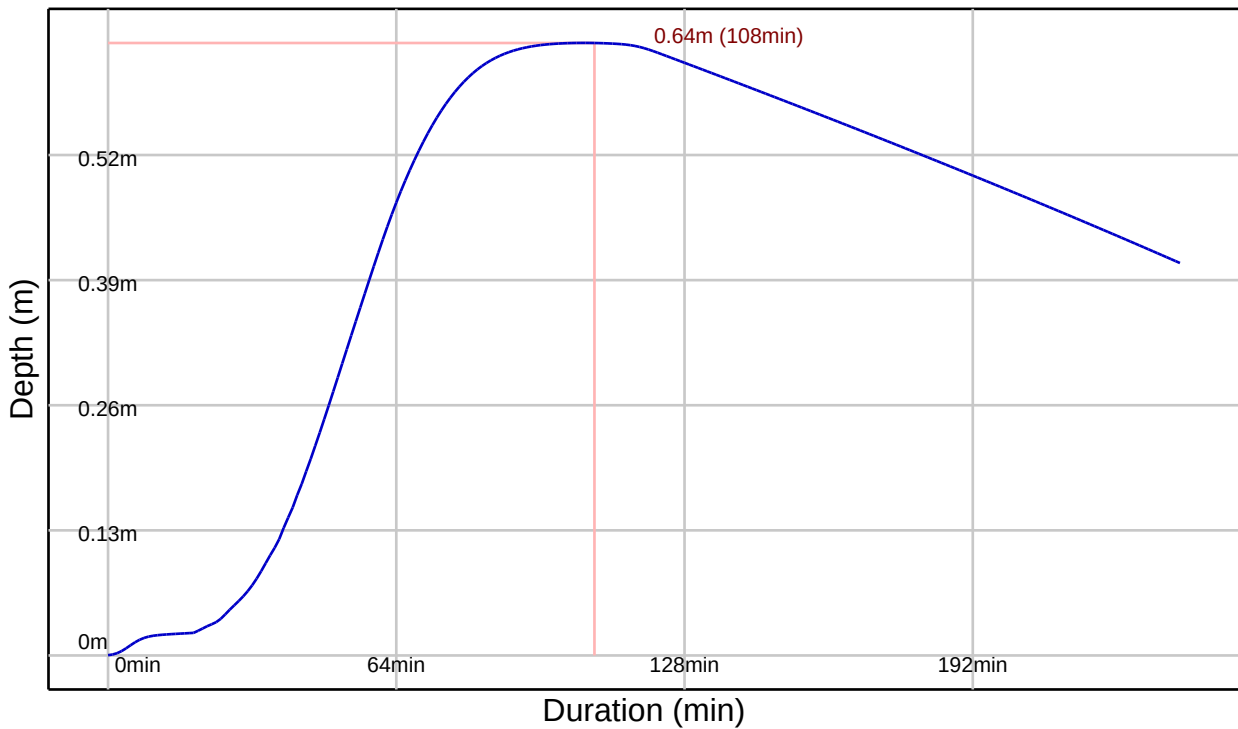
Pond Structure at Manhole 2-S16 SWALE

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
123.300	0.700	28.388	123.700	0.300	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 2-S16 SWALE



Pond 1 at 2-S16 SWALE (100Yr+40% 120Min Winter)



Controls within Manhole 2-S17

Orifice Control

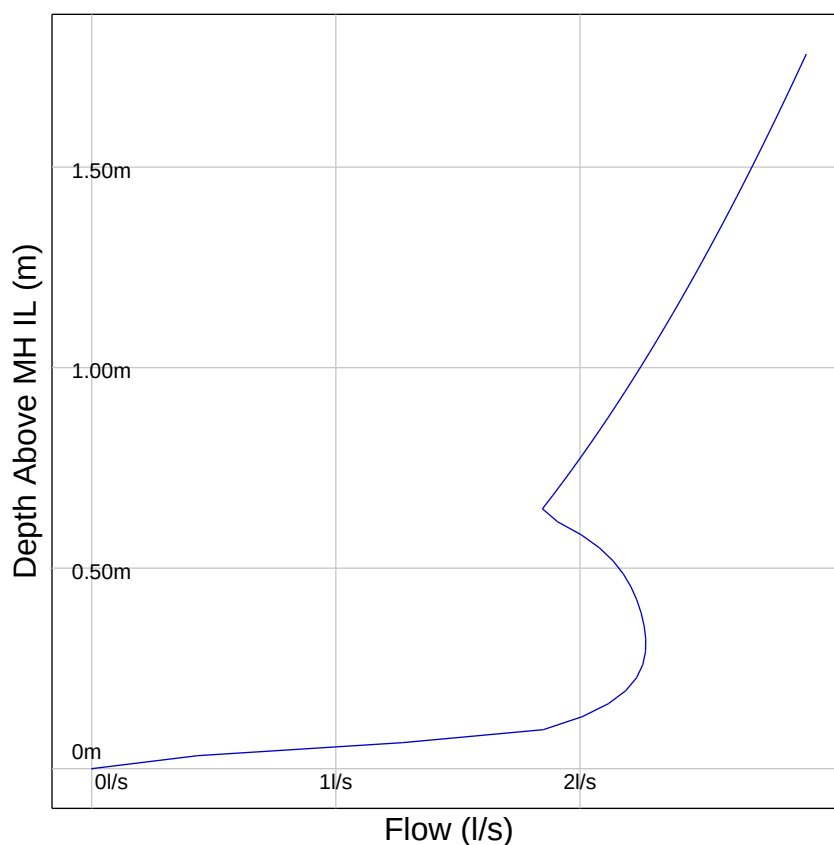
Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Controls within Manhole 2-S18 HB

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0071-2700-1500-2700	1.500	2.700	0.000	0.310	2.270	0.636	1.831

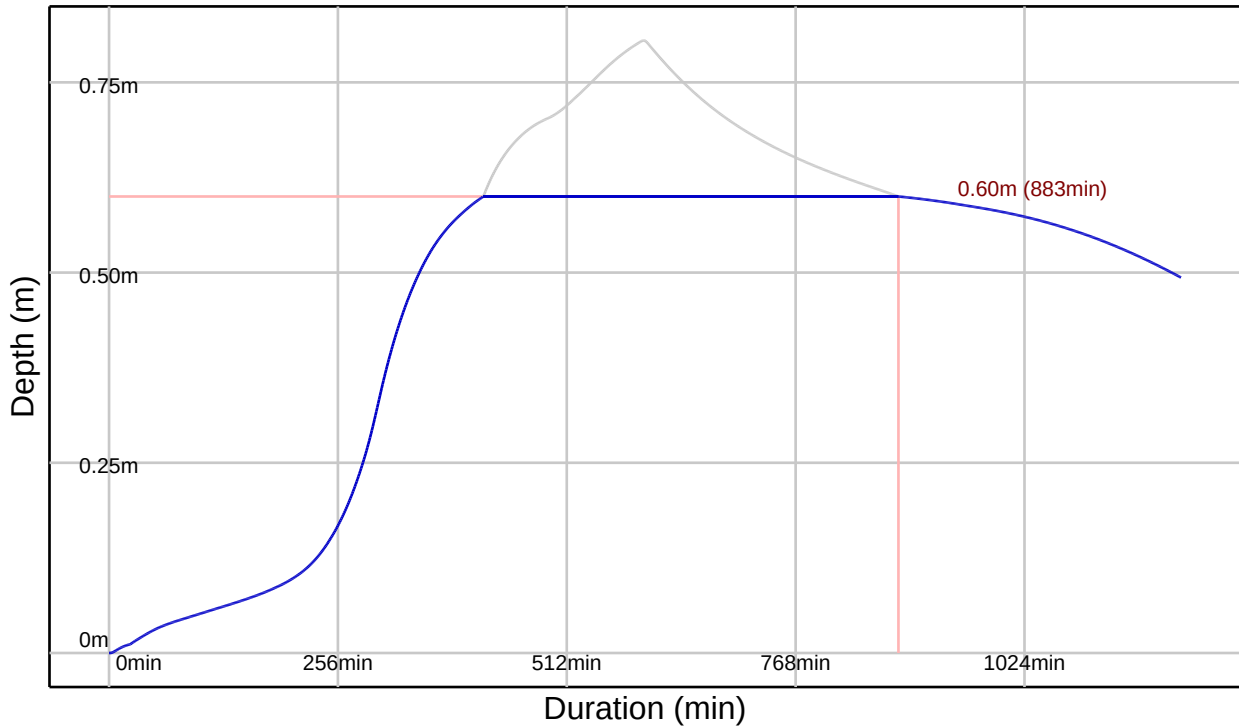
Hydro-Brake® Optimum Control from 2-S18 HB to 2-S19



Tank Structure at Manhole 2-S22 TANK 3

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
121.833	0.600	95.00	30.756	29.218	17.531	0.00000000	0.00000000	2.00

Tank 4 at 2-S22 TANK 3 (100Yr+40% 600Min Summer)

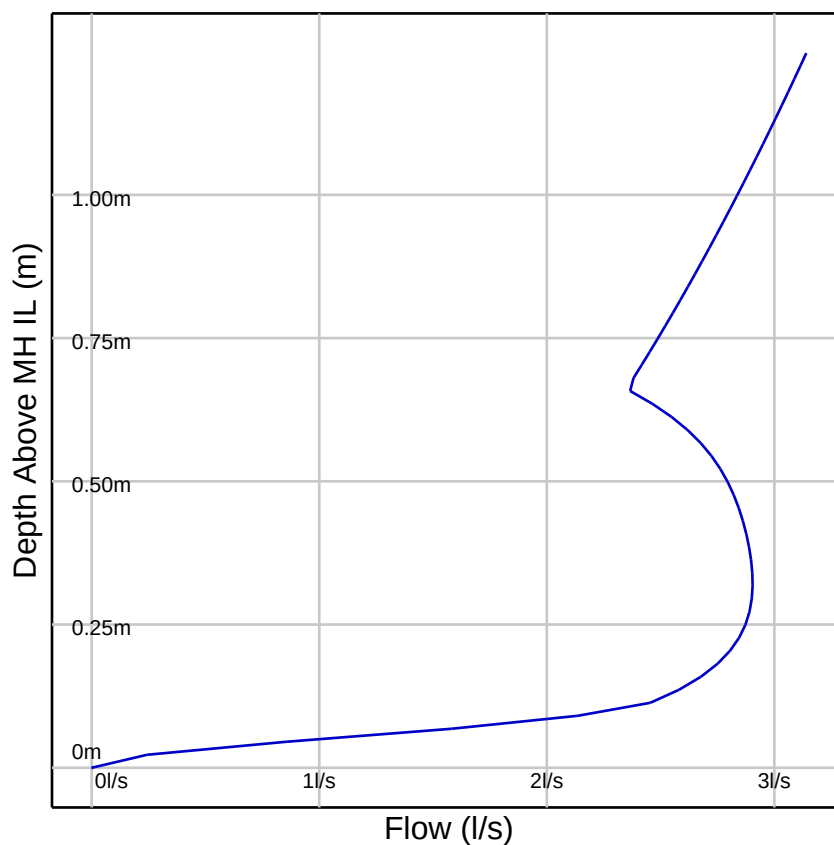


Controls within Manhole 2-S24 HB

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0080-2900-1050-2900	1.050	2.900	0.000	0.322	2.905	0.660	2.349

Hydro-Brake® Optimum Control from 2-S24 HB to 2-S25



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

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

Global Time of Entry: 5.0 mins

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

Return Periods (yrs) + Climate Change: (1, +0%), (2, +0%), (30, +0%), (30, +35%), (100, +0%), (100, +40%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Winter	12.422	0.00	0.00	30Yr+35% 15Min Summer	112.146	0.00	2.81
1Yr 15Min Summer	12.422	0.00	0.00	30Yr+35% 15Min Winter	112.146	0.00	2.75
1Yr 30Min Winter	8.143	0.00	0.44	30Yr+35% 30Min Summer	71.574	0.00	3.23
1Yr 30Min Summer	8.143	0.00	0.44	30Yr+35% 30Min Winter	71.574	0.00	3.21
1Yr 60Min Winter	4.943	0.00	0.44	30Yr+35% 60Min Summer	43.585	0.00	3.60
1Yr 60Min Summer	4.943	0.00	0.45	30Yr+35% 60Min Winter	43.585	0.00	3.59
1Yr 120Min Winter	4.361	0.00	0.43	30Yr+35% 120Min Summer	27.193	0.00	4.14
1Yr 120Min Summer	4.361	0.00	0.43	30Yr+35% 120Min Winter	27.193	0.00	4.14
1Yr 180Min Winter	3.794	0.00	0.30	30Yr+35% 180Min Summer	20.416	0.00	4.20
1Yr 180Min Summer	3.794	0.00	0.30	30Yr+35% 180Min Winter	20.416	0.00	4.20
1Yr 240Min Winter	3.191	0.00	0.06	30Yr+35% 240Min Summer	16.351	0.00	4.02
1Yr 240Min Summer	3.191	0.00	0.07	30Yr+35% 240Min Winter	16.351	0.00	4.03
1Yr 360Min Winter	2.507	0.00	0.00	30Yr+35% 360Min Summer	11.887	0.00	3.65
1Yr 360Min Summer	2.507	0.00	0.00	30Yr+35% 360Min Winter	11.887	0.00	3.65
1Yr 480Min Winter	2.095	0.00	0.00	30Yr+35% 480Min Summer	9.439	0.00	3.26
1Yr 480Min Summer	2.095	0.00	0.00	30Yr+35% 480Min Winter	9.439	0.00	3.27
1Yr 600Min Winter	1.796	0.00	0.00	30Yr+35% 600Min Summer	7.849	0.00	2.87
1Yr 600Min Summer	1.796	0.00	0.00	30Yr+35% 600Min Winter	7.849	0.00	2.89
1Yr 720Min Winter	1.571	0.00	0.00	30Yr+35% 720Min Summer	6.728	0.00	2.47
1Yr 720Min Summer	1.571	0.00	0.00	30Yr+35% 720Min Winter	6.728	0.00	2.49
1Yr 960Min Winter	1.272	0.00	0.00	30Yr+35% 960Min Summer	5.271	0.00	1.76
1Yr 960Min Summer	1.272	0.00	0.00	30Yr+35% 960Min Winter	5.271	0.00	1.78
1Yr 1440Min Winter	0.946	0.00	0.00	30Yr+35% 1440Min Summer	3.739	0.00	0.67
1Yr 1440Min Summer	0.946	0.00	0.00	30Yr+35% 1440Min Winter	3.739	0.00	0.70
2Yr 15Min Summer	30.753	0.00	1.17	100Yr 15Min Summer	106.446	0.00	2.71
2Yr 15Min Winter	30.753	0.00	1.15	100Yr 15Min Winter	106.446	0.00	2.63
2Yr 30Min Summer	19.200	0.00	1.23	100Yr 30Min Summer	68.456	0.00	3.13
2Yr 30Min Winter	19.200	0.00	1.23	100Yr 30Min Winter	68.456	0.00	3.12
2Yr 60Min Summer	11.700	0.00	1.25	100Yr 60Min Summer	41.870	0.00	3.53
2Yr 60Min Winter	11.700	0.00	1.25	100Yr 60Min Winter	41.870	0.00	3.52
2Yr 120Min Summer	8.500	0.00	1.15	100Yr 120Min Summer	25.800	0.00	4.04
2Yr 120Min Winter	8.500	0.00	1.16	100Yr 120Min Winter	25.800	0.00	4.04
2Yr 180Min Summer	6.873	0.00	1.01	100Yr 180Min Summer	19.309	0.00	4.03
2Yr 180Min Winter	6.873	0.00	1.02	100Yr 180Min Winter	19.309	0.00	4.03
2Yr 240Min Summer	5.603	0.00	0.84	100Yr 240Min Summer	15.512	0.00	3.87
2Yr 240Min Winter	5.603	0.00	0.84	100Yr 240Min Winter	15.512	0.00	3.87
2Yr 360Min Summer	4.221	0.00	0.51	100Yr 360Min Summer	11.329	0.00	3.50
2Yr 360Min Winter	4.221	0.00	0.51	100Yr 360Min Winter	11.329	0.00	3.51
2Yr 480Min Summer	3.432	0.00	0.24	100Yr 480Min Summer	9.024	0.00	3.12
2Yr 480Min Winter	3.432	0.00	0.25	100Yr 480Min Winter	9.024	0.00	3.13
2Yr 600Min Summer	2.888	0.00	-0.04	100Yr 600Min Summer	7.522	0.00	2.71
2Yr 600Min Winter	2.888	0.00	-0.04	100Yr 600Min Winter	7.522	0.00	2.73
2Yr 720Min Summer	2.493	0.00	0.00	100Yr 720Min Summer	6.458	0.00	2.32
2Yr 720Min Winter	2.493	0.00	0.00	100Yr 720Min Winter	6.458	0.00	2.34
2Yr 960Min Summer	1.982	0.00	0.00	100Yr 960Min Summer	5.063	0.00	1.63
2Yr 960Min Winter	1.982	0.00	0.00	100Yr 960Min Winter	5.063	0.00	1.66
2Yr 1440Min Summer	1.438	0.00	0.00	100Yr 1440Min Summer	3.575	0.00	0.52
2Yr 1440Min Winter	1.438	0.00	0.00	100Yr 1440Min Winter	3.575	0.00	0.55
30Yr 15Min Summer	83.071	0.00	2.20	100Yr+40% 15Min Summer	149.024	0.00	3.29
30Yr 15Min Winter	83.071	0.00	2.18	100Yr+40% 15Min Winter	149.024	0.00	3.27
30Yr 30Min Summer	53.018	0.00	2.60	100Yr+40% 30Min Summer	95.839	0.00	3.63
30Yr 30Min Winter	53.018	0.00	2.59	100Yr+40% 30Min Winter	95.839	0.00	3.67
30Yr 60Min Summer	32.285	0.00	3.04	100Yr+40% 60Min Summer	58.618	0.00	4.09
30Yr 60Min Winter	32.285	0.00	3.02	100Yr+40% 60Min Winter	58.618	0.00	4.11

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 120Min Summer	20.143	0.00	3.35	100Yr+40% 120Min Summer	36.120	0.00	4.57
30Yr 120Min Winter	20.143	0.00	3.35	100Yr+40% 120Min Winter	36.120	0.00	4.58
30Yr 180Min Summer	15.123	0.00	3.27	100Yr+40% 180Min Summer	27.033	0.00	4.76
30Yr 180Min Winter	15.123	0.00	3.27	100Yr+40% 180Min Winter	27.033	0.00	4.77
30Yr 240Min Summer	12.112	0.00	3.09	100Yr+40% 240Min Summer	21.716	0.00	4.79
30Yr 240Min Winter	12.112	0.00	3.10	100Yr+40% 240Min Winter	21.716	0.00	4.80
30Yr 360Min Summer	8.805	0.00	2.69	100Yr+40% 360Min Summer	15.861	0.00	4.61
30Yr 360Min Winter	8.805	0.00	2.69	100Yr+40% 360Min Winter	15.861	0.00	4.61
30Yr 480Min Summer	6.992	0.00	2.28	100Yr+40% 480Min Summer	12.634	0.00	4.31
30Yr 480Min Winter	6.992	0.00	2.29	100Yr+40% 480Min Winter	12.634	0.00	4.32
30Yr 600Min Summer	5.814	0.00	1.87	100Yr+40% 600Min Summer	10.531	0.00	4.00
30Yr 600Min Winter	5.814	0.00	1.89	100Yr+40% 600Min Winter	10.531	0.00	4.01
30Yr 720Min Summer	4.984	0.00	1.48	100Yr+40% 720Min Summer	9.041	0.00	3.68
30Yr 720Min Winter	4.984	0.00	1.51	100Yr+40% 720Min Winter	9.041	0.00	3.68
30Yr 960Min Summer	3.905	0.00	0.76	100Yr+40% 960Min Summer	7.088	0.00	2.94
30Yr 960Min Winter	3.905	0.00	0.79	100Yr+40% 960Min Winter	7.088	0.00	2.94
30Yr 1440Min Summer	2.770	0.00	0.02	100Yr+40% 1440Min Summer	5.005	0.00	1.74
30Yr 1440Min Winter	2.770	0.00	0.03	100Yr+40% 1440Min Winter	5.005	0.00	1.70

Simulation Results

Return Period (yrs) + Climate Change (%):

1yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	8	123.683	0.029	1.543		OK
2-S2	15 min Summer	8	123.533	0.051	4.733		OK
2-S3	15 min Summer	8	123.393	0.036	8.249		OK
2-S4	480 min Summer	332	122.340	0.077	0.469		OK
2-S5 TANK 2	480 min Summer	332	122.340	0.118	0.688		OK
2-S6	15 min Summer	8	122.948	0.046	6.633		OK
2-S7	15 min Summer	8	122.521	0.032	1.628		OK
2-S8	15 min Summer	9	122.438	0.032	1.580		OK
2-S9	480 min Summer	334	122.340	0.067	0.479		OK
2-S10	480 min Summer	331	122.340	0.172	0.500		OK
2-S11	480 min Summer	331	122.340	0.222	1.156		OK
2-S12	15 min Summer	9	123.830	0.042	3.008		OK
2-S13	15 min Summer	9	123.474	0.048	5.432		OK
2-S14	15 min Summer	9	123.262	0.048	8.611		OK
2-S15	15 min Summer	9	122.574	0.046	8.667		OK
2-S16 SWALE	15 min Summer	11	123.336	0.036	5.572		OK
2-S17	15 min Summer	13	123.355	0.657	0.730		Surcharged
2-S18 HB	480 min Summer	331	122.340	0.393	2.259		Surcharged
2-S19	720 min Winter	609	121.922	0.040	2.269		OK
2-S20	360 min Summer	221	121.912	0.083	2.266		OK
2-S21	15 min Summer	8	121.915	0.039	2.803		OK
2-S22 TANK 3	360 min Summer	222	121.910	0.077	0.394		OK
2-S23	360 min Summer	223	121.910	0.148	0.351		OK
2-S24 HB	360 min Summer	223	121.910	0.189	2.618		Surcharged
2-S25	360 min Summer	222	121.677	0.042	2.623		OK
2-S26	360 min Summer	224	121.471	0.041	2.622		OK
2-S27	360 min Summer	224	121.452	0.041	2.622		OK
2-S28	360 min Summer	224	121.424	0.041	2.622		OK
MH 9904	360 min Summer	224	121.392	0.038	2.622		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	2-S1	2-S2	0.040	0.400	1.511	0.085	OK
1.001	15 min Summer	8	2-S2	2-S3	0.050	0.915	4.654	0.262	OK
1.002	480 min Summer	321	2-S3	2-S4	0.043	1.327	2.594	0.018	OK
1.003	480 min Summer	332	2-S4	2-S5 TANK 2	0.098	0.387	2.593	0.024	OK
1.004	480 min Summer	609	2-S5 TANK 2	2-S11	0.170	0.168	2.088	0.019	OK
2.000	15 min Summer	8	2-S6	2-S9	0.046	1.117	6.529	0.093	OK
3.000	15 min Summer	8	2-S7	2-S8	0.032	0.475	1.613	0.044	OK
3.001	15 min Summer	9	2-S8	2-S9	0.031	0.477	1.600	0.044	OK
2.001	480 min Summer	334	2-S9	2-S10	0.119	0.407	2.719	0.035	OK
2.002	480 min Summer	331	2-S10	2-S11	0.197	0.321	2.571	0.035	OK
1.005	480 min Summer	586	2-S11	2-S18 HB	0.261	0.124	2.217	0.029	OK
4.000	15 min Summer	9	2-S12	2-S13	0.042	0.758	3.056	0.175	OK
4.001	15 min Summer	9	2-S13	2-S14	0.048	0.880	5.468	0.102	OK
4.002	15 min Summer	9	2-S14	2-S15	0.048	1.406	8.667	0.102	OK
4.003	15 min Summer	10	2-S15	2-S18 HB	0.172	0.741	8.671	0.054	OK
5.000	15 min Summer	11	2-S16 SWALE	2-S17	0.131	0.756	8.751	0.048	OK
5.001	15 min Summer	12	2-S17	2-S18 HB	0.090	0.377	4.153	0.089	OK
1.006	720 min Winter	609	2-S18 HB	2-S19	0.039	0.626	2.269	0.157	OK
1.007	360 min Summer	221	2-S19	2-S20	0.060	0.617	2.275	0.158	OK
1.008	360 min Summer	253	2-S20	2-S24 HB	0.116	0.391	2.279	0.158	OK
6.000	360 min Summer	223	2-S21	2-S22 TANK 3	0.056	0.317	1.038	0.025	OK
6.001	360 min Summer	636	2-S22 TANK 3	2-S23	0.113	0.169	0.576	0.014	OK
6.002	360 min Summer	636	2-S23	2-S24 HB	0.168	0.036	0.652	0.015	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.009	360 min Summer	223	2-S24 HB	2-S25	0.042	0.639	2.623	0.182	OK
1.010	360 min Summer	222	2-S25	2-S26	0.042	0.655	2.622	0.182	OK
1.011	360 min Summer	224	2-S26	2-S27	0.041	0.455	2.622	0.042	OK
1.012	360 min Summer	224	2-S27	2-S28	0.041	0.456	2.622	0.042	OK
1.013	360 min Summer	224	2-S28	MH 9904	0.039	0.483	2.622	0.042	OK

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	8	123.700	0.046	3.821		OK
2-S2	15 min Summer	8	123.569	0.087	11.752		OK
2-S3	15 min Summer	8	123.413	0.056	20.514		OK
2-S4	360 min Winter	328	122.477	0.214	0.458		OK
2-S5 TANK 2	360 min Winter	328	122.477	0.255	0.673		Surcharged
2-S6	15 min Summer	8	122.976	0.074	16.425		OK
2-S7	15 min Summer	8	122.539	0.050	4.033		OK
2-S8	360 min Winter	330	122.477	0.071	0.088		OK
2-S9	360 min Winter	330	122.477	0.204	0.473		OK
2-S10	360 min Winter	329	122.477	0.309	0.470		Surcharged
2-S11	360 min Winter	329	122.477	0.359	1.147		Surcharged
2-S12	15 min Summer	8	123.857	0.069	7.766		OK
2-S13	15 min Summer	8	123.503	0.077	13.691		OK
2-S14	15 min Summer	9	123.291	0.077	21.334		OK
2-S15	15 min Summer	9	122.601	0.072	21.522		OK
2-S16 SWALE	30 min Winter	24	123.434	0.134	6.747		OK
2-S17	15 min Summer	11	123.464	0.766	6.891		Surcharged
2-S18 HB	360 min Winter	329	122.477	0.530	2.173		Surcharged
2-S19	180 min Summer	122	121.967	0.085	2.222		OK
2-S20	180 min Summer	122	121.967	0.138	2.222		OK
2-S21	180 min Summer	122	121.965	0.089	0.570		OK
2-S22 TANK 3	180 min Summer	122	121.965	0.132	0.569		OK
2-S23	180 min Summer	122	121.965	0.203	0.571		OK
2-S24 HB	180 min Summer	122	121.965	0.243	2.793		Surcharged
2-S25	180 min Summer	122	121.679	0.044	2.793		OK
2-S26	180 min Summer	123	121.472	0.042	2.793		OK
2-S27	180 min Summer	123	121.453	0.042	2.793		OK
2-S28	180 min Summer	123	121.425	0.042	2.793		OK
MH 9904	180 min Summer	124	121.393	0.039	2.793		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	8	2-S1	2-S2	0.067	0.499	3.774	0.213	OK
1.001	15 min Summer	8	2-S2	2-S3	0.083	1.149	11.610	0.655	OK
1.002	360 min Winter	319	2-S3	2-S4	0.112	1.351	3.337	0.023	OK
1.003	360 min Winter	328	2-S4	2-S5 TANK 2	0.219	0.424	3.158	0.029	OK
1.004	720 min Winter	1149	2-S5 TANK 2	2-S11	0.225	0.168	2.091	0.019	OK
2.000	15 min Summer	8	2-S6	2-S9	0.073	1.444	16.237	0.232	OK
3.000	15 min Summer	8	2-S7	2-S8	0.050	0.611	4.000	0.109	OK
3.001	360 min Winter	330	2-S8	2-S9	0.100	0.368	0.650	0.018	OK
2.001	360 min Winter	330	2-S9	2-S10	0.252	0.412	3.358	0.043	OK
2.002	360 min Summer	280	2-S10	2-S11	0.300	0.403	4.938	0.067	Surcharged
1.005	720 min Summer	1045	2-S11	2-S18 HB	0.300	0.129	2.223	0.029	Surcharged
4.000	15 min Summer	9	2-S12	2-S13	0.068	0.971	7.582	0.434	OK
4.001	15 min Summer	8	2-S13	2-S14	0.077	1.127	13.560	0.253	OK
4.002	15 min Summer	9	2-S14	2-S15	0.076	1.813	21.522	0.253	OK
4.003	15 min Summer	9	2-S15	2-S18 HB	0.186	0.889	21.596	0.133	OK
5.000	30 min Winter	24	2-S16 SWALE	2-S17	0.180	0.730	18.081	0.099	OK
5.001	15 min Winter	11	2-S17	2-S18 HB	0.090	0.401	4.450	0.095	OK
1.006	180 min Summer	122	2-S18 HB	2-S19	0.061	0.626	2.276	0.158	OK
1.007	180 min Summer	122	2-S19	2-S20	0.111	0.616	2.277	0.158	OK
1.008	180 min Summer	183	2-S20	2-S24 HB	0.144	0.470	2.257	0.156	OK
6.000	180 min Summer	122	2-S21	2-S22 TANK 3	0.110	0.340	2.726	0.064	OK
6.001	180 min Summer	122	2-S22 TANK 3	2-S23	0.167	0.211	1.151	0.027	OK
6.002	180 min Summer	122	2-S23	2-S24 HB	0.214	0.027	0.936	0.022	OK
1.009	180 min Summer	122	2-S24 HB	2-S25	0.044	0.649	2.793	0.194	OK
1.010	180 min Summer	123	2-S25	2-S26	0.043	0.667	2.793	0.194	OK
1.011	180 min Summer	123	2-S26	2-S27	0.042	0.463	2.793	0.045	OK
1.012	180 min Summer	123	2-S27	2-S28	0.042	0.465	2.793	0.045	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.013	180 min Summer	124	2-S28	MH 9904	0.040	0.492	2.793	0.045	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	9	123.777	0.122	9.901		OK
2-S2	15 min Summer	9	123.734	0.251	30.497		Surcharged
2-S3	15 min Summer	8	123.452	0.095	53.865		OK
2-S4	480 min Winter	466	122.897	0.634	0.432		Surcharged
2-S5 TANK 2	480 min Winter	466	122.897	0.675	0.623		Surcharged
2-S6	15 min Summer	7	123.030	0.128	42.392		OK
2-S7	480 min Winter	466	122.897	0.408	0.078		Surcharged
2-S8	480 min Winter	466	122.897	0.491	0.078		Surcharged
2-S9	480 min Winter	466	122.897	0.623	0.436		Surcharged
2-S10	480 min Winter	466	122.897	0.729	0.436		Surcharged
2-S11	480 min Winter	466	122.897	0.779	1.067		Surcharged
2-S12	15 min Summer	9	123.971	0.183	20.120		Surcharged
2-S13	15 min Summer	9	123.562	0.136	35.403		OK
2-S14	15 min Summer	8	123.351	0.138	57.204		OK
2-S15	480 min Winter	465	122.897	0.369	0.509		Surcharged
2-S16 SWALE	60 min Winter	50	123.679	0.379	5.174		Surcharged
2-S17	60 min Winter	50	123.679	0.981	5.084		Surcharged
2-S18 HB	480 min Winter	465	122.897	0.949	2.153		Surcharged
2-S19	180 min Summer	134	122.139	0.257	2.031		Surcharged
2-S20	180 min Summer	134	122.138	0.309	2.031		Surcharged
2-S21	180 min Summer	135	122.136	0.261	0.861		Surcharged
2-S22 TANK 3	180 min Summer	135	122.136	0.303	0.861		Surcharged
2-S23	180 min Summer	135	122.136	0.375	0.867		Surcharged
2-S24 HB	180 min Summer	135	122.136	0.415	2.894		Surcharged
2-S25	480 min Summer	327	121.680	0.045	2.904		OK
2-S26	480 min Summer	327	121.473	0.043	2.904		OK
2-S27	360 min Summer	288	121.454	0.043	2.904		OK
2-S28	360 min Winter	286	121.426	0.043	2.904		OK
MH 9904	480 min Summer	328	121.394	0.040	2.904		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	10	2-S1	2-S2	0.136	0.640	10.043	0.566	OK
1.001	15 min Summer	9	2-S2	2-S3	0.150	1.727	30.525	1.722	Surcharged
1.002	120 min Summer	64	2-S3	2-S4	0.141	1.775	23.656	0.166	OK
1.003	30 min Winter	24	2-S4	2-S5 TANK 2	0.225	1.067	36.996	0.337	OK
1.004	1440 min Winter	2833	2-S5 TANK 2	2-S11	0.225	0.138	2.091	0.019	OK
2.000	15 min Summer	9	2-S6	2-S9	0.175	1.726	44.187	0.633	OK
3.000	180 min Summer	135	2-S7	2-S8	0.225	0.580	3.552	0.097	OK
3.001	60 min Winter	119	2-S8	2-S9	0.225	0.639	4.869	0.133	OK
2.001	60 min Summer	50	2-S9	2-S10	0.300	0.642	34.401	0.440	Surcharged
2.002	15 min Winter	9	2-S10	2-S11	0.300	0.974	50.370	0.685	Surcharged
1.005	15 min Winter	7	2-S11	2-S18 HB	0.300	0.300	10.023	0.129	Surcharged
4.000	15 min Summer	9	2-S12	2-S13	0.139	1.160	19.508	1.116	OK
4.001	15 min Summer	9	2-S13	2-S14	0.137	1.406	35.459	0.663	OK
4.002	15 min Summer	8	2-S14	2-S15	0.134	2.303	56.958	0.670	OK
4.003	360 min Summer	291	2-S15	2-S18 HB	0.300	0.624	11.551	0.071	Surcharged
5.000	60 min Winter	30	2-S16 SWALE	2-S17	0.225	0.760	20.150	0.110	OK
5.001	240 min Winter	256	2-S17	2-S18 HB	0.150	0.438	4.910	0.105	Surcharged
1.006	120 min Winter	78	2-S18 HB	2-S19	0.150	0.626	2.276	0.158	Surcharged
1.007	30 min Winter	22	2-S19	2-S20	0.150	0.655	2.334	0.162	Surcharged
1.008	30 min Winter	17	2-S20	2-S24 HB	0.150	0.600	2.565	0.178	Surcharged
6.000	180 min Summer	105	2-S21	2-S22 TANK 3	0.225	0.410	5.862	0.139	OK
6.001	120 min Summer	67	2-S22 TANK 3	2-S23	0.225	0.298	2.416	0.057	OK
6.002	15 min Winter	12	2-S23	2-S24 HB	0.225	0.391	6.405	0.151	OK
1.009	360 min Winter	285	2-S24 HB	2-S25	0.045	0.656	2.904	0.201	OK
1.010	480 min Summer	327	2-S25	2-S26	0.044	0.674	2.904	0.201	OK
1.011	360 min Summer	288	2-S26	2-S27	0.043	0.468	2.904	0.047	OK
1.012	360 min Summer	288	2-S27	2-S28	0.043	0.470	2.904	0.047	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.013	480 min Summer	328	2-S28	MH 9904	0.041	0.498	2.904	0.047	OK

Return Period (yrs) + Climate Change (%):

30yr+35%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	9	123.949	0.295	13.365		Surcharged
2-S2	15 min Summer	9	123.855	0.373	41.032		Surcharged
2-S3	15 min Summer	8	123.470	0.113	71.949		OK
2-S4	600 min Winter	590	123.191	0.928	0.294		Surcharged
2-S5 TANK 2	600 min Winter	590	123.191	0.969	0.418		Surcharged
2-S6	600 min Winter	591	123.191	0.289	0.188		Surcharged
2-S7	600 min Winter	591	123.191	0.702	0.046		Surcharged
2-S8	600 min Winter	591	123.191	0.785	0.055		Surcharged
2-S9	600 min Winter	591	123.191	0.917	0.262		Surcharged
2-S10	600 min Winter	591	123.191	1.023	0.256		Surcharged
2-S11	600 min Winter	591	123.191	1.073	0.796		Surcharged
2-S12	15 min Summer	9	124.193	0.404	27.159		Surcharged
2-S13	15 min Summer	9	123.592	0.166	46.296		OK
2-S14	15 min Summer	8	123.380	0.167	74.576		OK
2-S15	600 min Winter	590	123.191	0.662	0.332		Surcharged
2-S16 SWALE	120 min Winter	95	123.797	0.497	5.141		Flood Risk
2-S17	120 min Winter	95	123.796	1.098	5.122		Surcharged
2-S18 HB	600 min Winter	590	123.191	1.243	2.332		Surcharged
2-S19	180 min Winter	151	122.269	0.387	1.865		Surcharged
2-S20	180 min Winter	150	122.268	0.439	1.862		Surcharged
2-S21	180 min Winter	150	122.266	0.391	0.934		Surcharged
2-S22 TANK 3	180 min Winter	150	122.266	0.433	0.934		Surcharged
2-S23	180 min Winter	150	122.266	0.505	0.931		Surcharged
2-S24 HB	180 min Winter	150	122.266	0.545	2.792		Surcharged
2-S25	720 min Summer	651	121.680	0.045	2.904		OK
2-S26	720 min Winter	642	121.473	0.043	2.904		OK
2-S27	960 min Summer	692	121.454	0.043	2.904		OK
2-S28	720 min Summer	652	121.426	0.043	2.904		OK
MH 9904	720 min Summer	652	121.394	0.040	2.904		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	2-S1	2-S2	0.150	0.693	12.245	0.691	Surcharged
1.001	15 min Winter	9	2-S2	2-S3	0.150	2.144	37.891	2.137	Surcharged
1.002	30 min Summer	18	2-S3	2-S4	0.158	2.891	62.976	0.442	OK
1.003	15 min Winter	12	2-S4	2-S5 TANK 2	0.225	1.436	65.511	0.597	OK
1.004	720 min Summer	795	2-S5 TANK 2	2-S11	0.225	0.067	2.232	0.021	OK
2.000	480 min Summer	429	2-S6	2-S9	0.225	0.915	9.278	0.133	OK
3.000	60 min Summer	54	2-S7	2-S8	0.225	0.743	9.054	0.248	OK
3.001	15 min Winter	9	2-S8	2-S9	0.225	0.629	12.851	0.352	OK
2.001	15 min Winter	9	2-S9	2-S10	0.300	0.974	67.797	0.867	Surcharged
2.002	15 min Winter	9	2-S10	2-S11	0.300	0.980	66.957	0.911	Surcharged
1.005	15 min Winter	6	2-S11	2-S18 HB	0.300	0.315	7.212	0.093	Surcharged
4.000	15 min Summer	10	2-S12	2-S13	0.144	1.428	24.920	1.426	OK
4.001	15 min Summer	9	2-S13	2-S14	0.166	1.508	46.308	0.866	OK
4.002	15 min Summer	9	2-S14	2-S15	0.194	2.407	74.983	0.882	OK
4.003	120 min Summer	97	2-S15	2-S18 HB	0.300	0.811	33.887	0.209	Surcharged
5.000	60 min Summer	28	2-S16 SWALE	2-S17	0.225	0.990	19.851	0.108	OK
5.001	120 min Winter	100	2-S17	2-S18 HB	0.150	0.468	5.277	0.113	Surcharged
1.006	720 min Winter	806	2-S18 HB	2-S19	0.150	0.632	2.412	0.167	Surcharged
1.007	720 min Winter	806	2-S19	2-S20	0.150	0.618	2.438	0.169	Surcharged
1.008	720 min Winter	806	2-S20	2-S24 HB	0.150	0.376	2.456	0.170	Surcharged
6.000	30 min Winter	22	2-S21	2-S22 TANK 3	0.225	0.914	16.956	0.401	OK
6.001	15 min Winter	13	2-S22 TANK 3	2-S23	0.225	0.720	8.446	0.200	OK
6.002	15 min Winter	9	2-S23	2-S24 HB	0.225	0.383	7.722	0.183	OK
1.009	720 min Summer	651	2-S24 HB	2-S25	0.045	0.656	2.904	0.201	OK
1.010	720 min Summer	651	2-S25	2-S26	0.044	0.674	2.904	0.201	OK
1.011	720 min Winter	642	2-S26	2-S27	0.043	0.468	2.904	0.047	OK
1.012	960 min Summer	692	2-S27	2-S28	0.043	0.470	2.904	0.047	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.013	720 min Summer	652	2-S28	MH 9904	0.041	0.498	2.904	0.047	OK

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	9	123.915	0.261	12.680		Surcharged
2-S2	15 min Summer	9	123.829	0.347	38.996		Surcharged
2-S3	15 min Summer	8	123.467	0.110	68.429		OK
2-S4	600 min Winter	582	123.143	0.880	0.466		Surcharged
2-S5 TANK 2	600 min Winter	582	123.143	0.921	0.675		Surcharged
2-S6	600 min Winter	582	123.143	0.241	0.350		Surcharged
2-S7	600 min Winter	582	123.143	0.654	0.086		Surcharged
2-S8	600 min Winter	582	123.143	0.737	0.086		Surcharged
2-S9	600 min Winter	582	123.143	0.869	0.463		Surcharged
2-S10	600 min Winter	582	123.143	0.975	0.466		Surcharged
2-S11	600 min Winter	582	123.143	1.025	1.161		Surcharged
2-S12	15 min Summer	9	124.146	0.358	25.766		Surcharged
2-S13	15 min Summer	9	123.586	0.160	44.165		OK
2-S14	15 min Summer	8	123.374	0.161	71.124		OK
2-S15	600 min Winter	582	123.143	0.615	0.514		Surcharged
2-S16 SWALE	60 min Winter	54	123.773	0.473	5.413		Flood Risk
2-S17	60 min Winter	54	123.773	1.075	5.328		Surcharged
2-S18 HB	600 min Winter	582	123.143	1.195	2.307		Surcharged
2-S19	180 min Winter	146	122.241	0.358	1.857		Surcharged
2-S20	180 min Winter	146	122.240	0.411	1.858		Surcharged
2-S21	180 min Winter	146	122.238	0.362	0.958		Surcharged
2-S22 TANK 3	180 min Winter	146	122.238	0.405	0.958		Surcharged
2-S23	180 min Winter	146	122.238	0.477	0.966		Surcharged
2-S24 HB	180 min Winter	146	122.238	0.517	2.825		Surcharged
2-S25	600 min Summer	572	121.680	0.045	2.904		OK
2-S26	960 min Summer	642	121.473	0.043	2.904		OK
2-S27	720 min Winter	583	121.454	0.043	2.904		OK
2-S28	720 min Winter	583	121.426	0.043	2.904		OK
MH 9904	600 min Summer	573	121.394	0.040	2.904		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	9	2-S1	2-S2	0.150	0.677	11.655	0.657	Surcharged
1.001	15 min Winter	9	2-S2	2-S3	0.150	2.038	36.015	2.031	Surcharged
1.002	60 min Summer	32	2-S3	2-S4	0.154	2.295	44.973	0.316	OK
1.003	15 min Winter	13	2-S4	2-S5 TANK 2	0.225	1.421	62.317	0.568	OK
1.004	600 min Summer	729	2-S5 TANK 2	2-S11	0.225	0.052	2.204	0.020	OK
2.000	600 min Summer	558	2-S6	2-S9	0.225	0.884	7.397	0.106	OK
3.000	60 min Summer	60	2-S7	2-S8	0.225	0.733	8.735	0.239	OK
3.001	15 min Winter	10	2-S8	2-S9	0.225	0.633	11.714	0.320	OK
2.001	15 min Winter	9	2-S9	2-S10	0.300	0.962	64.484	0.824	Surcharged
2.002	15 min Winter	9	2-S10	2-S11	0.300	0.997	63.354	0.862	Surcharged
1.005	15 min Winter	6	2-S11	2-S18 HB	0.300	0.313	6.648	0.086	Surcharged
4.000	15 min Summer	9	2-S12	2-S13	0.143	1.368	23.809	1.362	OK
4.001	15 min Summer	9	2-S13	2-S14	0.160	1.491	44.193	0.826	OK
4.002	15 min Summer	10	2-S14	2-S15	0.169	2.391	71.572	0.842	OK
4.003	180 min Summer	126	2-S15	2-S18 HB	0.300	0.751	24.731	0.153	Surcharged
5.000	60 min Summer	28	2-S16 SWALE	2-S17	0.225	0.987	19.901	0.109	OK
5.001	120 min Winter	113	2-S17	2-S18 HB	0.150	0.467	5.271	0.113	Surcharged
1.006	720 min Winter	762	2-S18 HB	2-S19	0.150	0.630	2.384	0.165	Surcharged
1.007	15 min Winter	12	2-S19	2-S20	0.150	0.699	2.971	0.206	Surcharged
1.008	30 min Winter	16	2-S20	2-S24 HB	0.150	0.683	2.663	0.185	Surcharged
6.000	30 min Winter	23	2-S21	2-S22 TANK 3	0.225	0.913	16.284	0.385	OK
6.001	15 min Winter	15	2-S22 TANK 3	2-S23	0.225	0.711	8.538	0.202	OK
6.002	30 min Summer	17	2-S23	2-S24 HB	0.225	0.291	5.059	0.120	OK
1.009	600 min Summer	572	2-S24 HB	2-S25	0.045	0.656	2.904	0.201	OK
1.010	960 min Summer	642	2-S25	2-S26	0.044	0.674	2.904	0.201	OK
1.011	960 min Summer	642	2-S26	2-S27	0.043	0.468	2.904	0.047	OK
1.012	720 min Winter	583	2-S27	2-S28	0.043	0.470	2.904	0.047	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.013	600 min Summer	573	2-S28	MH 9904	0.041	0.498	2.904	0.047	OK

Return Period (yrs) + Climate Change (%):

100yr+40%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	9	124.200	0.545	17.755		Surcharged
2-S2	15 min Summer	9	124.045	0.563	53.828		Surcharged
2-S3	600 min Summer	597	123.826	0.469	0.922		Surcharged
2-S4	600 min Summer	597	123.826	1.563	0.913		Surcharged
2-S5 TANK 2	600 min Summer	597	123.826	1.604	1.349		Surcharged
2-S6	600 min Summer	597	123.826	0.925	0.742		Surcharged
2-S7	600 min Summer	597	123.826	1.338	0.182		Flood Risk
2-S8	600 min Summer	597	123.826	1.420	0.181		Surcharged
2-S9	600 min Summer	597	123.826	1.553	0.965		Surcharged
2-S10	600 min Summer	597	123.826	1.658	0.949		Surcharged
2-S11	600 min Summer	597	123.826	1.708	2.279		Surcharged
2-S12	15 min Summer	10	124.716	0.928	30.136		Surcharged
2-S13	15 min Summer	10	123.880	0.454	53.902		Surcharged
2-S14	600 min Summer	597	123.826	0.613	0.971		Surcharged
2-S15	600 min Summer	597	123.826	1.298	0.957		Flood Risk
2-S16 SWALE	120 min Winter	106	123.937	0.637	4.829		Flood Risk
2-S17	120 min Winter	106	123.936	1.238	4.862		Surcharged
2-S18 HB	600 min Summer	597	123.826	1.879	3.195		Surcharged
2-S19	600 min Summer	598	122.643	0.760	2.424		Surcharged
2-S20	600 min Summer	598	122.641	0.812	2.421		Surcharged
2-S21	600 min Summer	598	122.638	0.762	0.255		Surcharged
2-S22 TANK 3	600 min Summer	598	122.638	0.805	0.254		Surcharged
2-S23	600 min Summer	598	122.638	0.877	0.253		Surcharged
2-S24 HB	600 min Summer	598	122.638	0.917	2.670		Surcharged
2-S25	960 min Summer	1822	121.680	0.045	2.904		OK
2-S26	1440 min Summer	1603	121.473	0.043	2.904		OK
2-S27	1440 min Summer	1603	121.454	0.043	2.904		OK
2-S28	1440 min Winter	1593	121.426	0.043	2.904		OK
MH 9904	1440 min Winter	1593	121.394	0.040	2.904		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	10	2-S1	2-S2	0.150	0.915	16.174	0.912	Surcharged
1.001	15 min Winter	9	2-S2	2-S3	0.150	2.805	49.565	2.796	Surcharged
1.002	600 min Summer	513	2-S3	2-S4	0.225	1.117	13.053	0.092	OK
1.003	15 min Winter	10	2-S4	2-S5 TANK 2	0.225	1.483	85.287	0.778	OK
1.004	720 min Summer	562	2-S5 TANK 2	2-S11	0.225	0.039	3.337	0.031	OK
2.000	15 min Winter	9	2-S6	2-S9	0.225	1.790	69.982	1.002	OK
3.000	15 min Winter	7	2-S7	2-S8	0.225	0.778	16.739	0.458	OK
3.001	15 min Winter	9	2-S8	2-S9	0.225	0.640	15.589	0.426	OK
2.001	15 min Winter	9	2-S9	2-S10	0.300	1.249	88.273	1.129	Surcharged
2.002	15 min Winter	9	2-S10	2-S11	0.300	1.220	86.221	1.173	Surcharged
1.005	15 min Winter	5	2-S11	2-S18 HB	0.300	0.320	11.019	0.142	Surcharged
4.000	15 min Winter	10	2-S12	2-S13	0.150	1.622	28.666	1.640	Surcharged
4.001	15 min Winter	9	2-S13	2-S14	0.225	1.462	53.287	0.996	OK
4.002	30 min Summer	17	2-S14	2-S15	0.225	2.382	81.652	0.960	OK
4.003	15 min Winter	8	2-S15	2-S18 HB	0.300	1.202	78.940	0.487	Surcharged
5.000	30 min Summer	13	2-S16 SWALE	2-S17	0.225	0.925	19.892	0.109	OK
5.001	15 min Winter	13	2-S17	2-S18 HB	0.150	0.495	7.687	0.165	Surcharged
1.006	1440 min Winter	1299	2-S18 HB	2-S19	0.150	0.642	2.629	0.182	Surcharged
1.007	1440 min Winter	1312	2-S19	2-S20	0.150	0.621	2.632	0.182	Surcharged
1.008	30 min Winter	14	2-S20	2-S24 HB	0.150	0.594	2.934	0.203	Surcharged
6.000	15 min Winter	11	2-S21	2-S22 TANK 3	0.225	1.150	30.386	0.718	OK
6.001	15 min Winter	10	2-S22 TANK 3	2-S23	0.225	0.665	11.300	0.267	OK
6.002	30 min Summer	15	2-S23	2-S24 HB	0.225	0.319	6.378	0.151	OK
1.009	960 min Winter	1813	2-S24 HB	2-S25	0.045	0.656	2.904	0.201	OK
1.010	960 min Summer	1822	2-S25	2-S26	0.044	0.674	2.904	0.201	OK
1.011	1440 min Summer	1603	2-S26	2-S27	0.043	0.468	2.904	0.047	OK
1.012	1440 min Winter	1593	2-S27	2-S28	0.043	0.470	2.904	0.047	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.013	1440 min Winter	1593	2-S28	MH 9904	0.041	0.498	2.904	0.047	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
1-S1	0.111	1350	Type C	123.096	121.521	1.350	525919.687	200980.488
1-S2	0.000	1350	Type B	122.932	121.121	1.586	525912.340	200945.880
1-S3	0.021	1350	Type B	122.874	121.029	1.621	525907.852	200937.935
1-S4	0.046	1350	Type B	122.569	120.787	1.557	525894.198	200894.697
1-S5	0.049	1350	Type C	122.400	122.100	0.150	525891.826	200908.683
1-S6	0.000	1350	Type C	122.405	121.508	0.747	525895.132	200914.751
1-S8	0.000	1200	Type B	122.510	120.491	1.718	525901.747	200925.672
1-S9	0.007	1350	Type C	122.750	122.450	0.150	525928.936	200925.556
1-S10	0.000	1350	Type C	122.782	121.301	1.332	525931.322	200922.645
1-S11	0.000	1200	Type B	122.542	120.305	1.937	525928.375	200919.434
1-S16	0.011	1350	Type C	122.750	122.450	0.150	525935.709	200921.021
1-S17	0.000	1350	Type C	122.653	121.356	1.147	525932.701	200918.496
1-S100	0.000	1200	Type B	122.547	120.268	1.979	525931.889	200915.136
1-S18	0.000	1350	Type B	122.832	120.177	2.355	525939.555	200919.324
1-S12	0.011	1350	Type C	122.400	122.000	0.250	525935.687	200886.410
1-S13	0.000	1350	Type C	122.439	121.704	0.585	525931.175	200887.308
1-S14	0.060	1350	Type C	122.557	121.355	0.977	525930.231	200893.091
1-S15	0.000	1350	Type C	122.562	121.087	1.250	525933.137	200907.203
1-S19 TANK	0.000	1200	Type B	123.304	120.121	2.883	525944.649	200912.444
1-S24	0.013	1350	Type C	122.400	122.000	0.250	525956.289	200908.355
1-S25	0.000	1350	Type C	122.160	121.104	0.906	525954.529	200904.815
1-S20	0.055	1200	Type B	122.225	120.037	1.888	525951.710	200902.945
1-S21	0.102	1350	Type C	122.751	121.248	1.279	525967.973	200935.986
1-S26	0.027	1350	Type C	122.277	120.986	1.065	525962.828	200910.381
1-S27	0.000	1350	Type C	122.079	120.932	0.922	525961.777	200905.000
1-S28 HB	0.000	1350	Type B	122.098	120.015	1.933	525958.650	200900.405
1-S29	0.000	1350	Type B	122.097	119.870	2.077	525980.015	200895.529

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	1-S1	121.521	1-S2	121.121	Circ	225	35.380	88	0.600	1.350	1.586
1.001	1-S2	121.121	1-S3	121.029	Circ	225	9.125	99	0.600	1.586	1.621
1.002	1-S3	121.029	1-S8	120.566	Circ	225	13.699	30	0.600	1.621	1.718
2.000	1-S4	120.787	1-S8	120.586	Circ	225	31.882	159	0.600	1.557	1.699
3.000	1-S5	122.100	1-S6	121.508	Circ	150	6.910	12	0.600	0.150	0.747
3.001	1-S6	121.508	1-S8	121.426	Circ	150	12.769	155	0.600	0.747	0.934
1.003	1-S8	120.491	1-S11	120.305	Circ	300	27.349	147	0.600	1.718	1.937
4.000	1-S9	122.450	1-S10	121.301	Circ	150	3.764	3	0.600	0.150	1.332
4.001	1-S10	121.301	1-S11	120.455	Circ	150	4.359	5	0.600	1.332	1.937
1.004	1-S11	120.305	1-S100	120.268	Circ	300	5.551	150	0.600	1.937	1.979
5.000	1-S16	122.450	1-S17	121.356	Circ	150	3.928	4	0.600	0.150	1.147
5.001	1-S17	121.356	1-S100	120.418	Circ	150	3.456	4	0.600	1.147	1.979
1.005	1-S100	120.268	1-S18	120.177	Circ	300	8.735	96	0.600	1.979	2.355
1.006	1-S18	120.177	1-S19 TANK	120.121	Circ	300	8.561	153	0.600	2.355	2.883
6.000	1-S12	122.000	1-S13	121.704	Circ	150	4.600	16	0.600	0.250	0.585
6.001	1-S13	121.704	1-S14	121.430	Circ	150	5.860	21	0.600	0.585	0.977
6.002	1-S14	121.355	1-S15	121.162	Circ	225	14.408	75	0.600	0.977	1.175
6.003	1-S15	121.087	1-S19 TANK	120.196	Circ	225	12.649	14	0.600	1.250	2.883
1.007	1-S19 TANK	120.121	1-S20	120.037	Circ	300	11.835	140	0.600	2.883	1.888
7.000	1-S24	122.000	1-S25	121.104	Circ	150	3.954	4	0.600	0.250	0.906
7.001	1-S25	121.104	1-S20	120.187	Circ	150	3.383	4	0.600	0.906	1.888
1.008	1-S20	120.037	1-S28 HB	120.015	Circ	300	7.391	331	0.600	1.888	1.783
8.000	1-S21	121.248	1-S26	120.986	Circ	225	26.117	100	0.600	1.279	1.065
8.001	1-S26	120.986	1-S27	120.932	Circ	225	5.483	100	0.600	1.065	0.922
8.002	1-S27	120.932	1-S28 HB	120.090	Circ	225	5.558	7	0.600	0.922	1.783
1.009	1-S28 HB	120.015	1-S29	119.870	Circ	150	21.914	152	0.600	1.933	2.077

Outfall Details

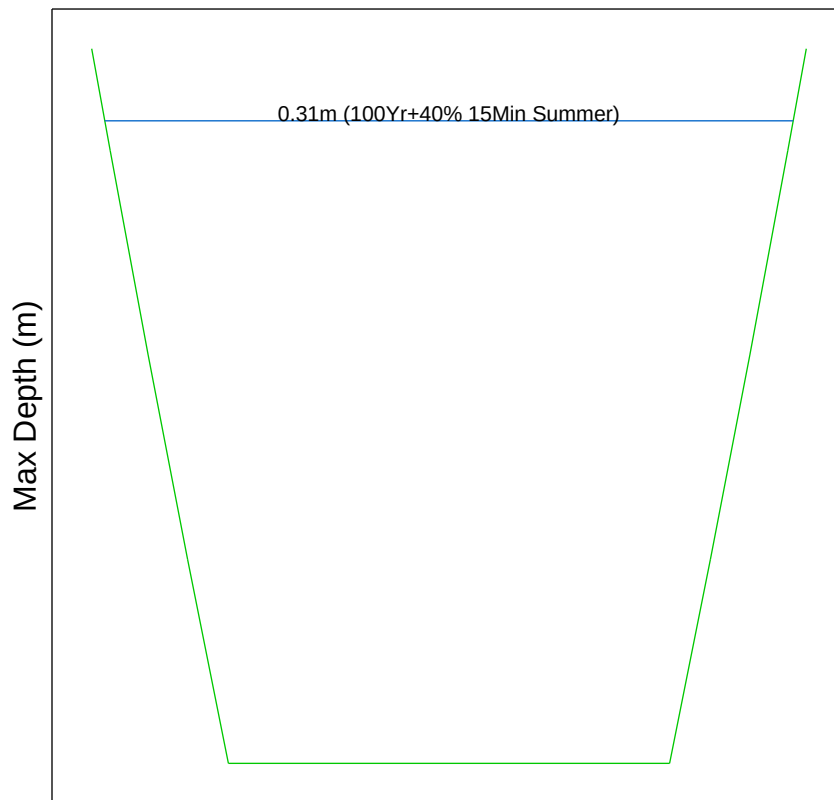
Outfall Manhole 1-S29 : Free Discharge

Flow Control Details

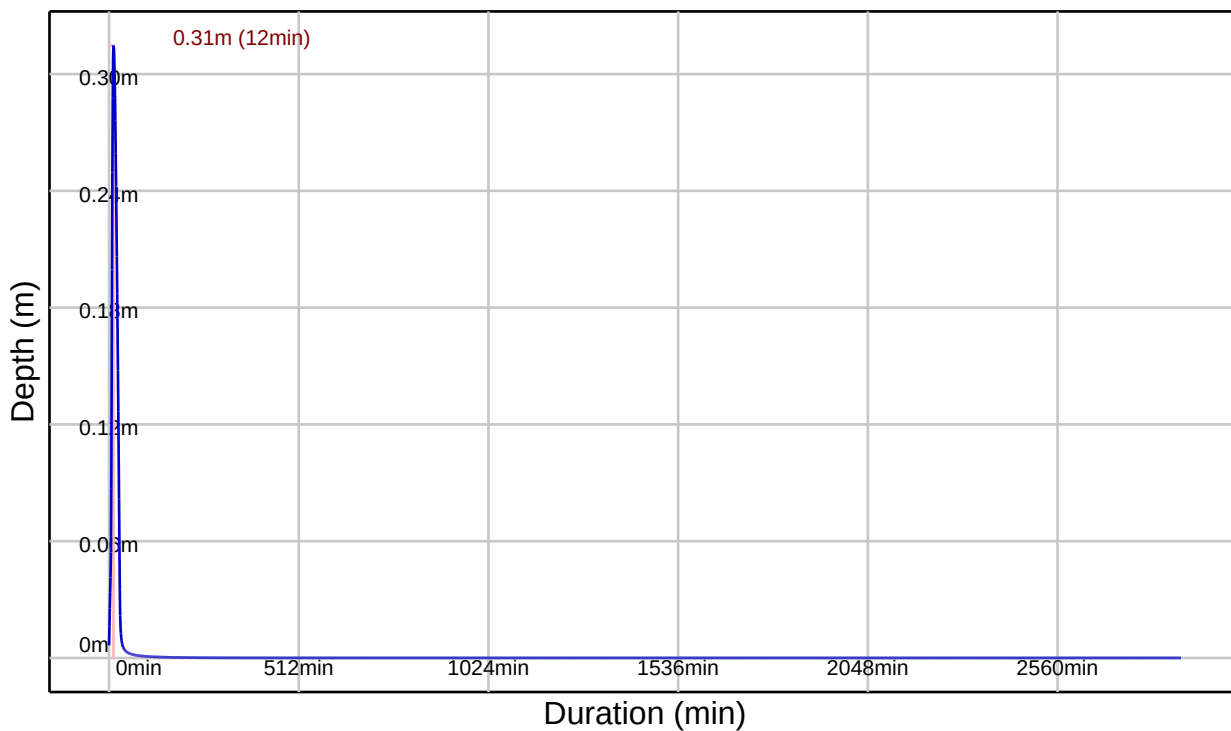
Pond Structure at Manhole 1-S5

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.100	0.350	11.064	122.450	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S5



Pond 2 at 1-S5 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S6

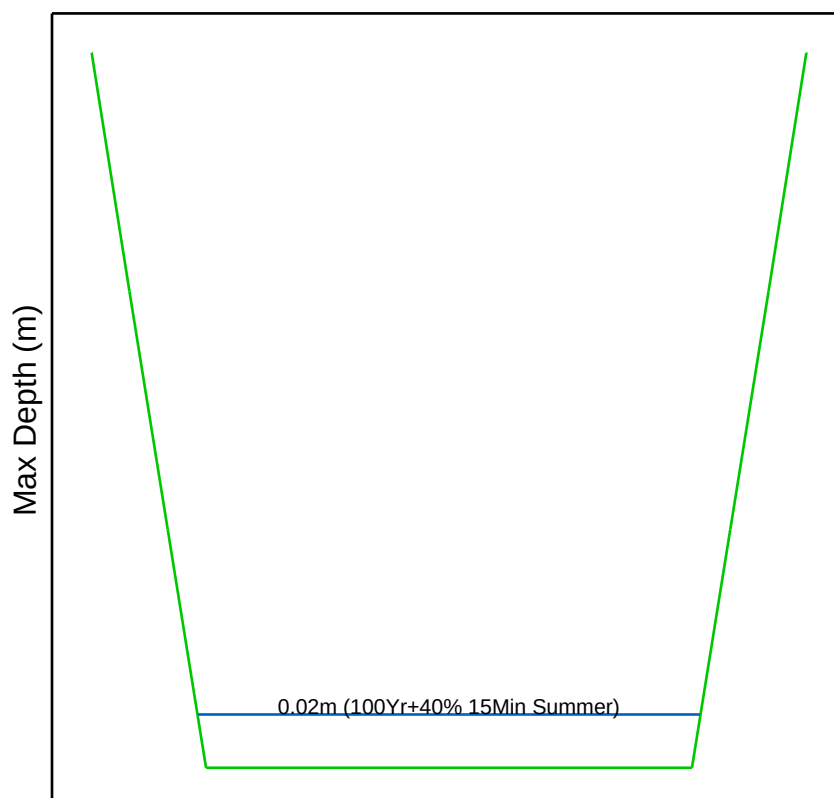
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.080	0.600

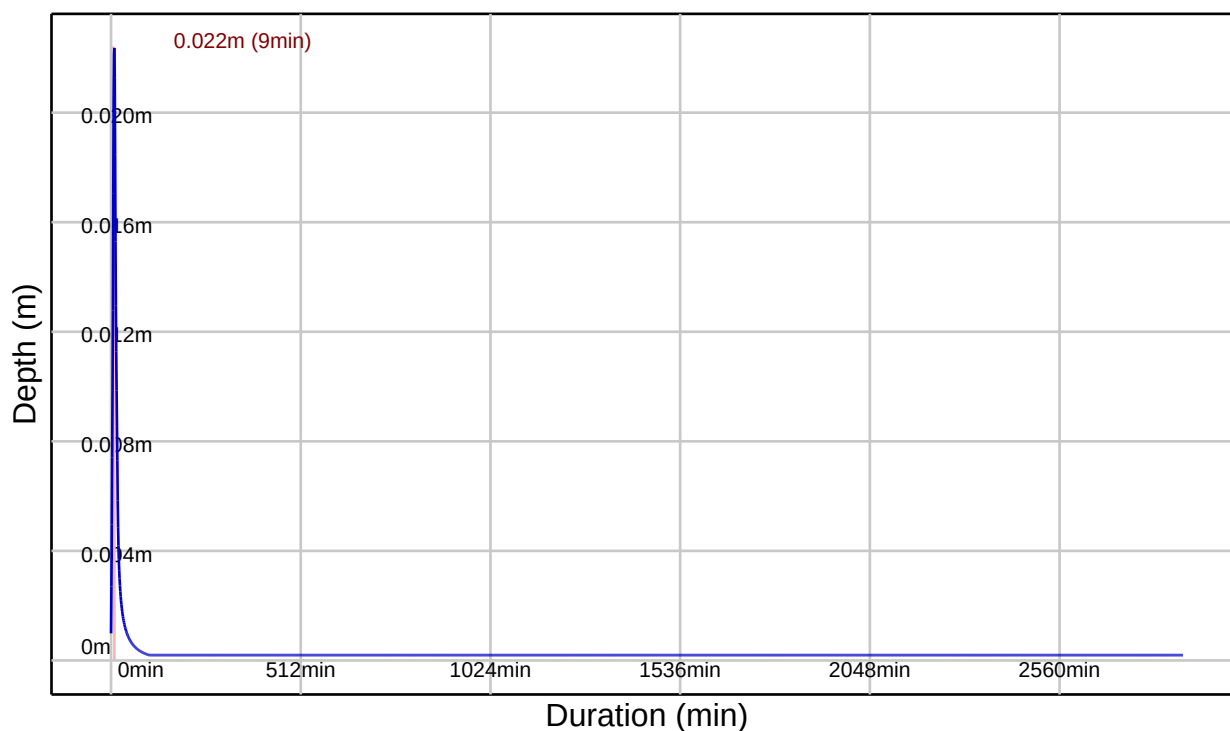
Pond Structure at Manhole 1-S9

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.450	0.300	8.280	122.750	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S9



Pond 6 at 1-S9 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S10

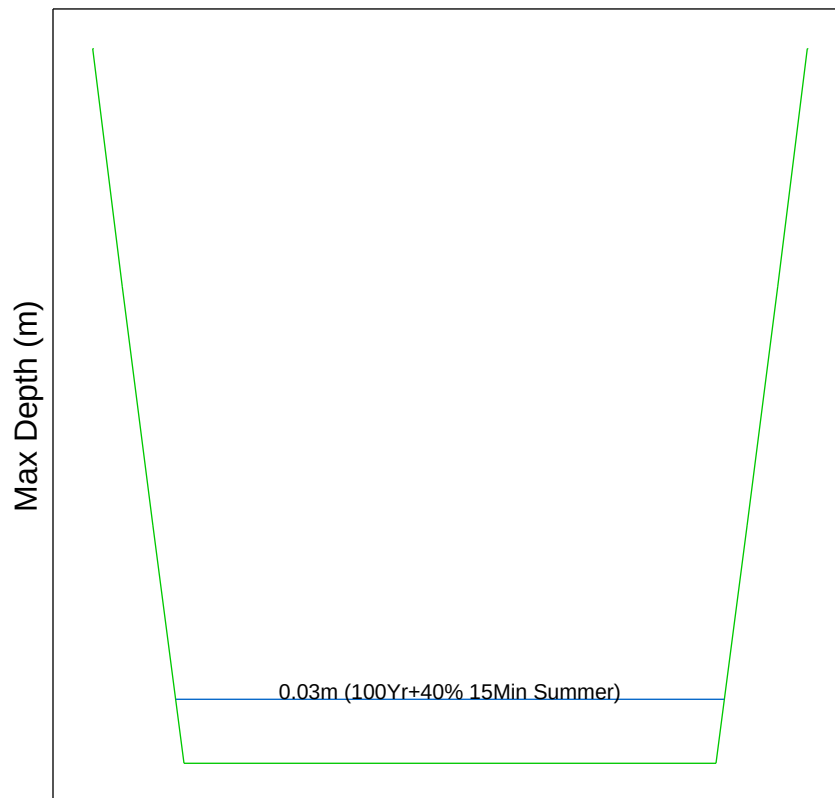
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

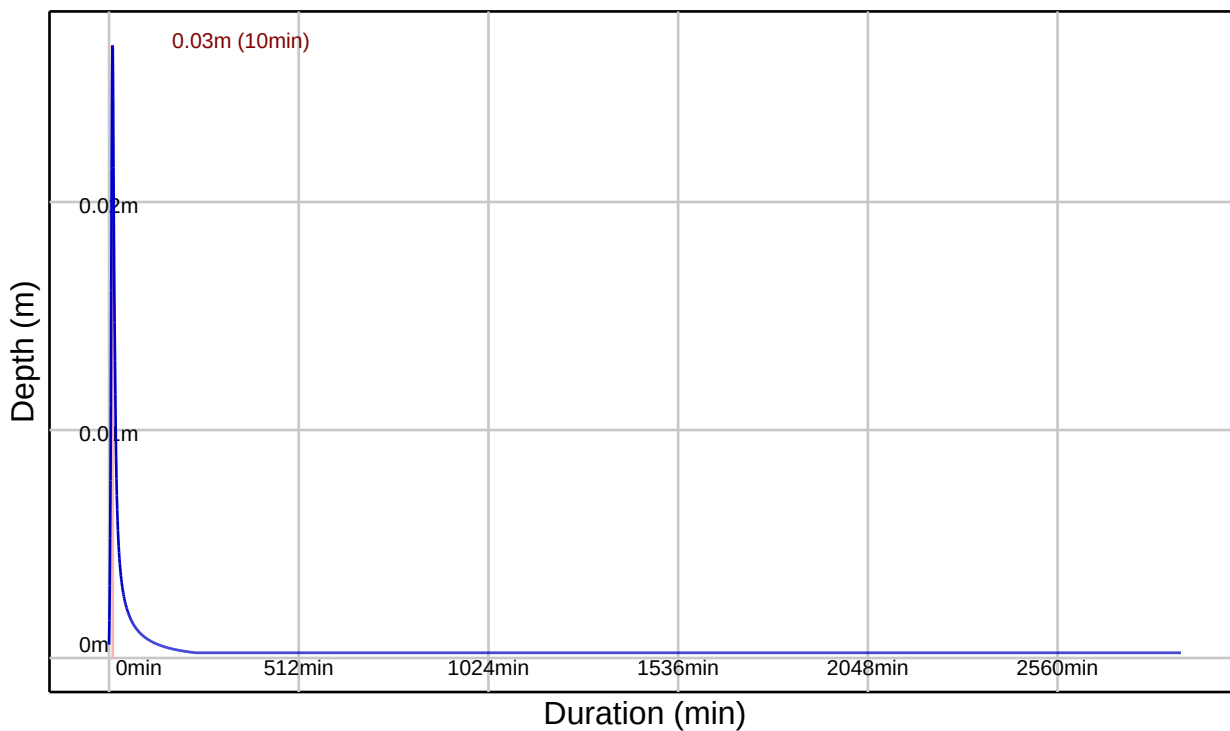
Pond Structure at Manhole 1-S16

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.450	0.300	18.961	122.750	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S16



Pond 5 at 1-S16 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S17

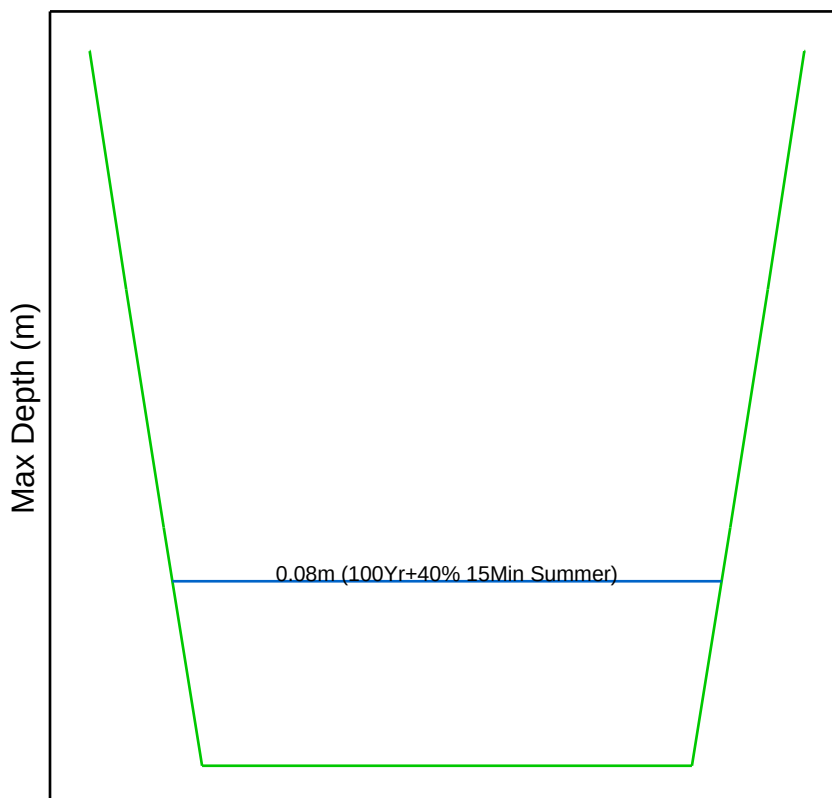
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

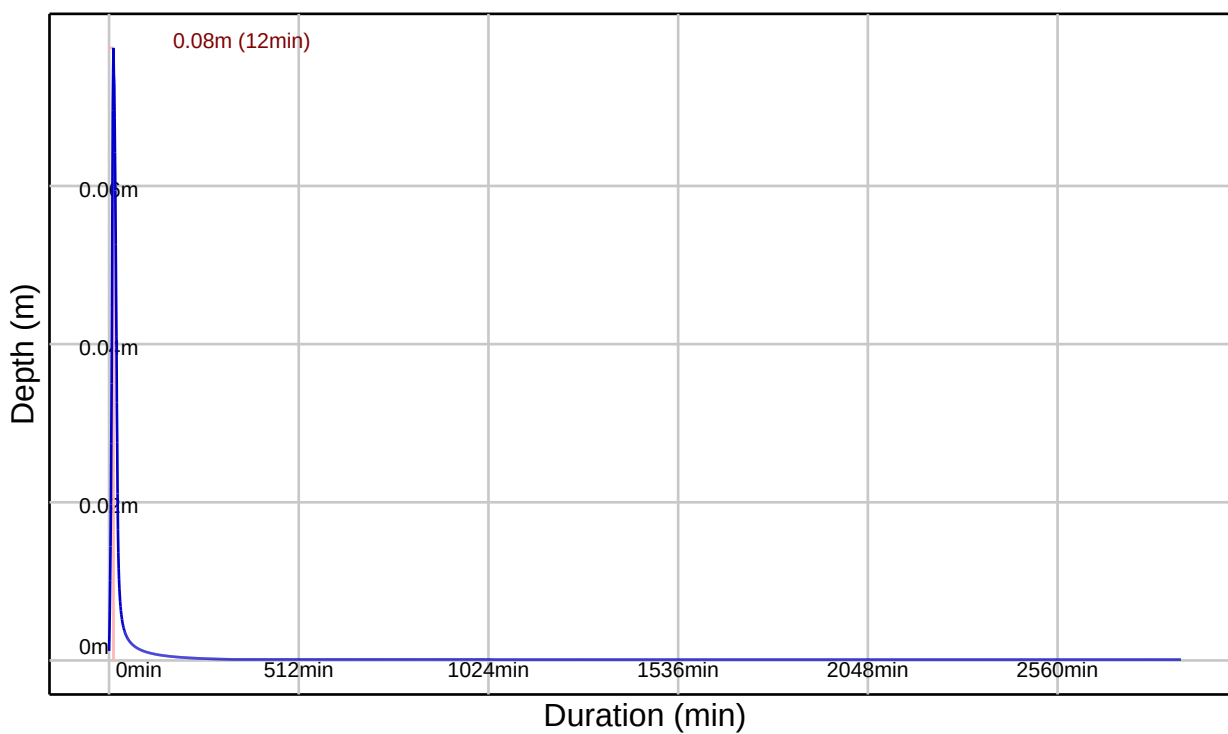
Pond Structure at Manhole 1-S12

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.000	0.300	10.384	122.300	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S12



Pond 7 at 1-S12 (100Yr+40% 15Min Summer)



Controls within Manhole 1-S13

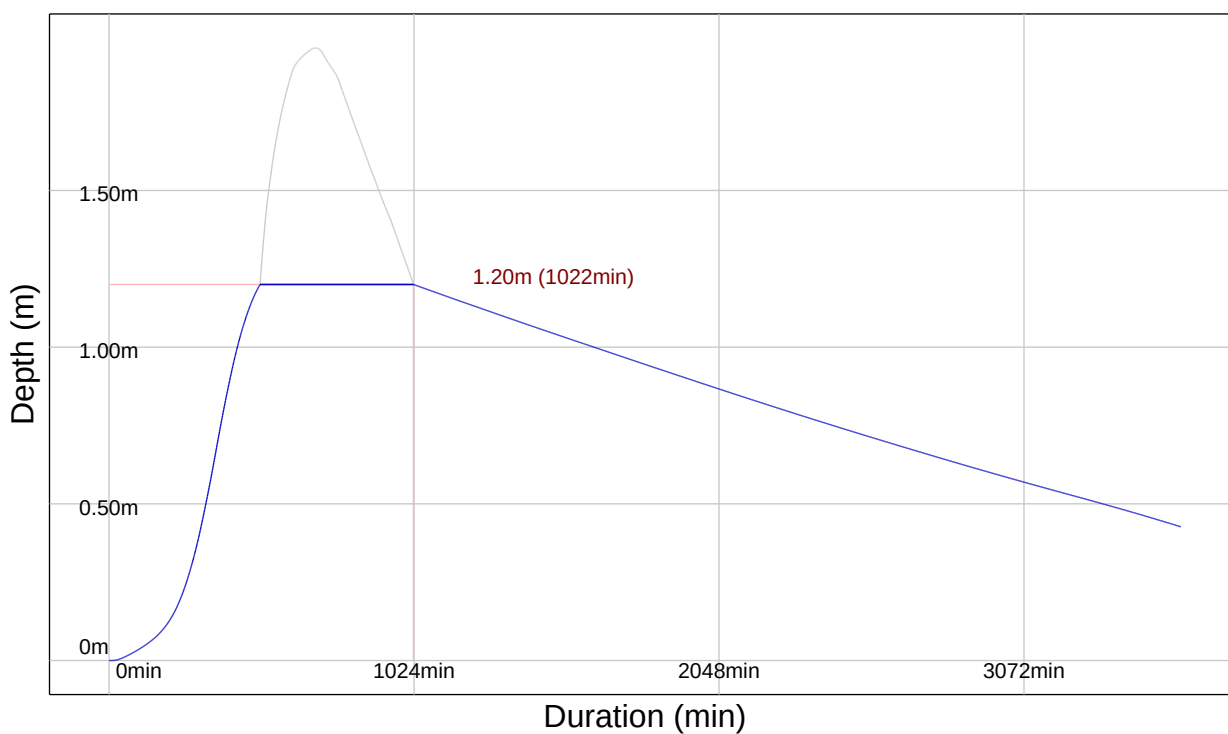
Orifice Control

Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Tank Structure at Manhole 1-S19 TANK

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
120.121	1.200	95.00	344.969	327.721	393.265	0.00000000	0.00000000	2.00

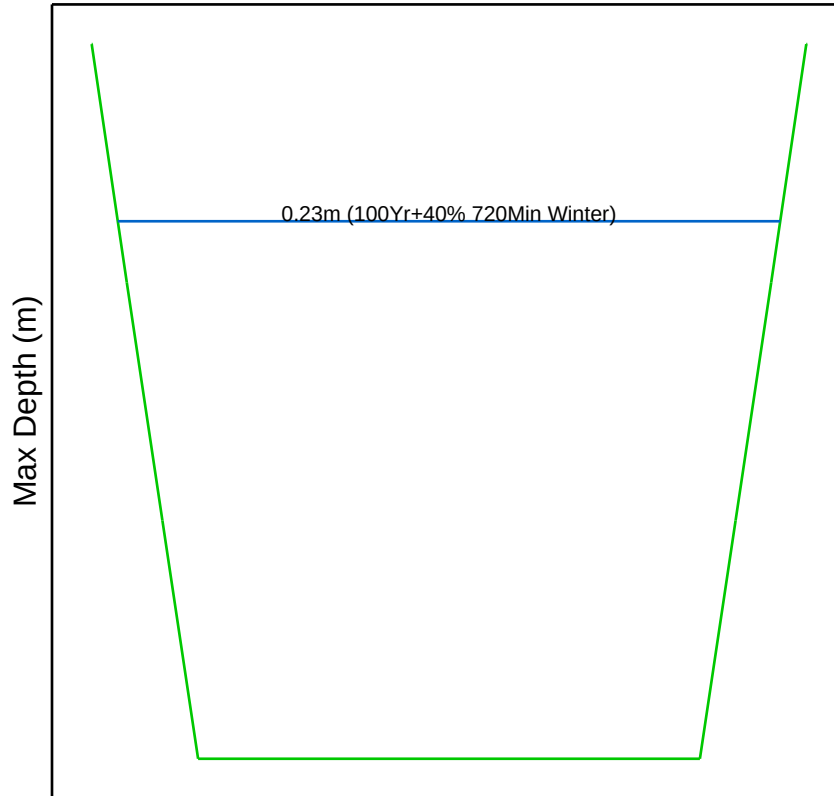
Tank 2 at 1-S19 TANK (100Yr+40% 720Min Winter)



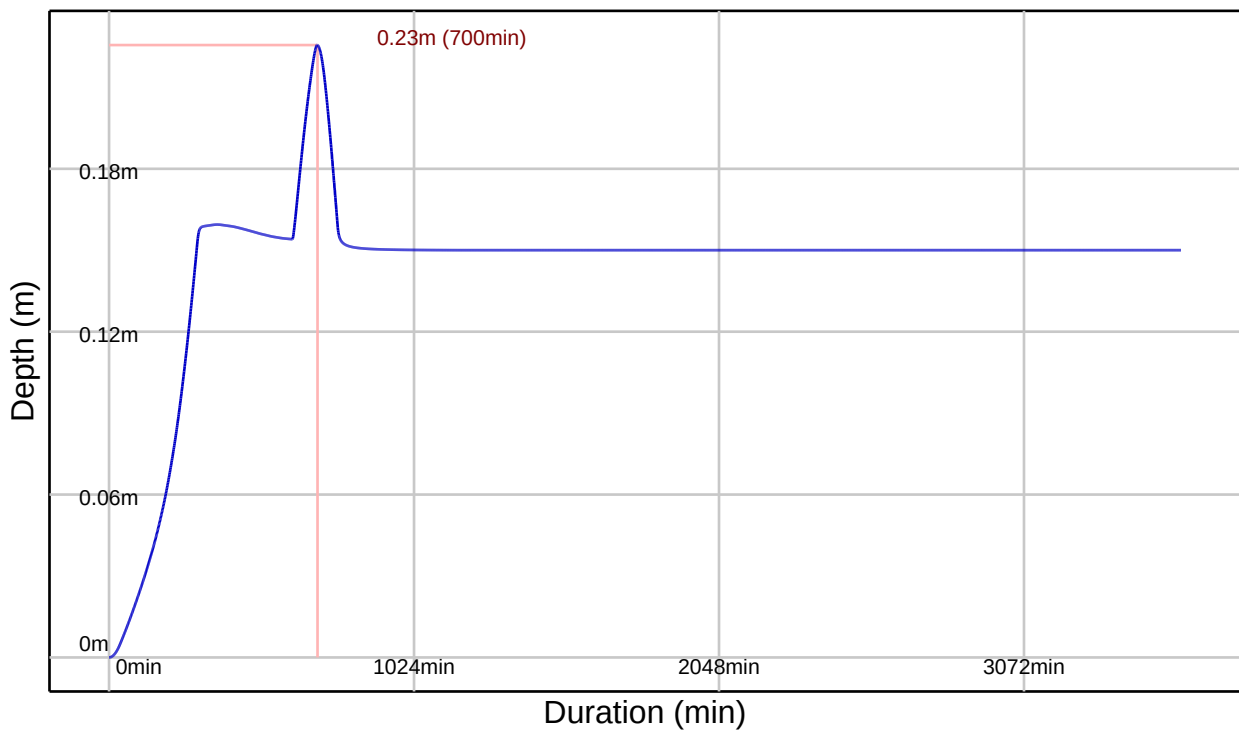
Pond Structure at Manhole 1-S24

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
121.850	0.300	10.085	122.150	0.000	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 1-S24



Pond 3 at 1-S24 (100Yr+40% 720Min Winter)



Controls within Manhole 1-S25

Orifice Control

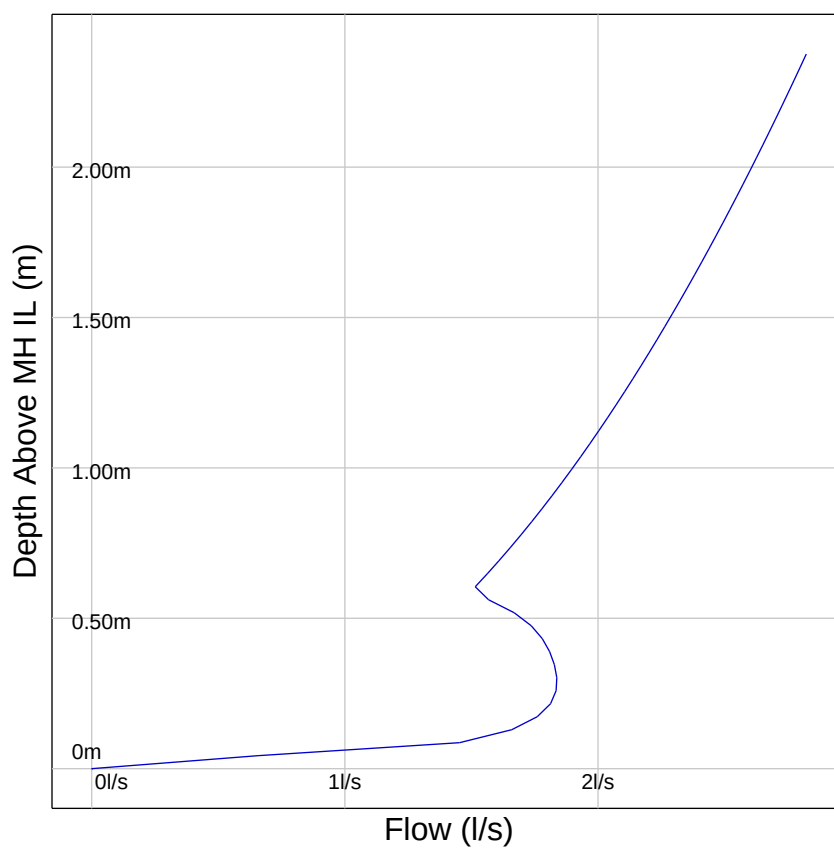
Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Controls within Manhole 1-S28 HB

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0065-2600-2000-2600	2.000	2.600	0.000	0.288	1.838	0.585	1.492

Hydro-Brake® Optimum Control from 1-S28 HB to 1-S29



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

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

Global Time of Entry: 5.0 mins

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

Return Periods (yrs) + Climate Change: (100, +40%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
100Yr+40% 15Min Winter	149.024	0.00	-0.23	100Yr+40% 480Min Summer	12.634	0.00	-0.29
100Yr+40% 15Min Summer	149.024	0.00	-0.30	100Yr+40% 480Min Winter	12.634	0.00	-0.34
100Yr+40% 30Min Winter	95.839	0.00	-0.29	100Yr+40% 600Min Summer	10.531	0.00	-0.27
100Yr+40% 30Min Summer	95.839	0.00	-0.33	100Yr+40% 600Min Winter	10.531	0.00	-0.28
100Yr+40% 60Min Winter	58.618	0.00	-0.18	100Yr+40% 720Min Summer	9.041	0.00	-0.23
100Yr+40% 60Min Summer	58.618	0.00	-0.21	100Yr+40% 720Min Winter	9.041	0.00	-0.26
100Yr+40% 120Min Summer	36.120	0.00	-0.13	100Yr+40% 960Min Summer	7.088	0.00	-0.20
100Yr+40% 120Min Winter	36.120	0.00	-0.11	100Yr+40% 960Min Winter	7.088	0.00	-0.21
100Yr+40% 180Min Summer	27.033	0.00	-0.07	100Yr+40% 1440Min Summer	5.005	0.00	-0.04
100Yr+40% 180Min Winter	27.033	0.00	-0.06	100Yr+40% 1440Min Winter	5.005	0.00	-0.17
100Yr+40% 240Min Summer	21.716	0.00	-0.01	100Yr+40% 2160Min Summer	3.516	0.00	-0.01
100Yr+40% 240Min Winter	21.716	0.00	-0.01	100Yr+40% 2160Min Winter	3.516	0.00	0.12
100Yr+40% 360Min Winter	15.861	0.00	-0.08	100Yr+40% 2880Min Winter	2.727	0.00	-0.01
100Yr+40% 360Min Summer	15.861	0.00	-0.07	100Yr+40% 2880Min Summer	2.727	0.00	-0.01

Simulation Results

Return Period (yrs) + Climate Change (%):

100yr+40%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
1-S1	15 min Summer	10	122.769	1.248	77.865		Surcharged
1-S2	720 min Winter	692	122.076	0.955	0.663		Surcharged
1-S3	720 min Winter	692	122.076	1.047	0.786		Surcharged
1-S4	720 min Winter	691	122.076	1.289	0.282		Surcharged
1-S5	15 min Summer	12	122.415	0.315	12.502		Surcharged
1-S6	15 min Summer	12	122.384	0.876	11.801		Flood Risk
1-S8	720 min Winter	692	122.076	1.585	1.384		Surcharged
1-S9	15 min Summer	9	122.472	0.022	6.001		OK
1-S10	720 min Winter	692	122.076	0.776	0.050		Surcharged
1-S11	720 min Winter	692	122.076	1.771	1.436		Surcharged
1-S16	15 min Summer	9	122.477	0.027	9.070		OK
1-S17	15 min Summer	12	122.206	0.851	5.278		Surcharged
1-S100	720 min Winter	692	122.076	1.808	1.484		Surcharged
1-S18	720 min Winter	692	122.076	1.899	1.485		Surcharged
1-S12	15 min Summer	12	122.077	0.077	2.810		OK
1-S13	15 min Winter	13	122.096	0.393	2.462		Surcharged
1-S14	720 min Winter	692	122.076	0.721	0.355		Surcharged
1-S15	720 min Winter	694	122.076	0.989	0.393		Surcharged
1-S19 TANK	720 min Winter	692	122.076	1.955	1.781		Surcharged
1-S24	720 min Winter	699	122.076	0.226	0.060		OK
1-S25	720 min Winter	699	122.076	0.972	0.072		Flood Risk
1-S20	720 min Winter	692	122.076	2.039	2.107		Flood Risk
1-S21	15 min Summer	9	122.124	0.877	85.915		Surcharged
1-S26	720 min Winter	692	122.076	1.090	0.771		Flood Risk
1-S27	720 min Winter	692	122.076	1.144	0.771		Flood Risk
1-S28 HB	720 min Winter	692	122.076	2.061	2.618		Flood Risk
1-S29	720 min Winter	692	119.912	0.042	2.618		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	9	1-S1	1-S2	0.225	2.143	85.201	1.542	OK
1.001	15 min Summer	10	1-S2	1-S3	0.225	1.970	78.332	1.502	OK
1.002	15 min Summer	10	1-S3	1-S8	0.225	2.268	90.168	0.940	OK
2.000	15 min Summer	8	1-S4	1-S8	0.225	0.955	34.366	0.836	OK
3.000	15 min Summer	8	1-S5	1-S6	0.150	1.129	15.120	0.289	Surcharged
3.001	480 min Summer	413	1-S6	1-S8	0.150	0.812	6.610	0.466	Surcharged
1.003	15 min Summer	10	1-S8	1-S11	0.300	1.804	127.488	1.395	Surcharged
4.000	15 min Summer	9	1-S9	1-S10	0.086	1.258	6.080	0.061	OK
4.001	360 min Summer	327	1-S10	1-S11	0.150	1.488	1.200	0.015	Surcharged
1.004	15 min Summer	10	1-S11	1-S100	0.300	1.813	128.139	1.416	Surcharged
5.000	15 min Summer	9	1-S16	1-S17	0.088	1.056	8.312	0.088	OK
5.001	360 min Summer	334	1-S17	1-S100	0.150	1.838	1.773	0.019	Surcharged
1.005	15 min Summer	10	1-S100	1-S18	0.300	1.845	130.408	1.152	Surcharged
1.006	15 min Summer	11	1-S18	1-S19 TANK	0.300	2.250	128.053	1.428	Surcharged
6.000	15 min Summer	16	1-S12	1-S13	0.114	0.847	8.274	0.182	OK
6.001	600 min Summer	522	1-S13	1-S14	0.150	1.081	1.237	0.032	Surcharged
6.002	360 min Summer	345	1-S14	1-S15	0.225	1.209	11.975	0.199	OK
6.003	360 min Summer	303	1-S15	1-S19 TANK	0.225	1.185	11.973	0.086	OK
1.007	30 min Winter	2149	1-S19 TANK	1-S20	0.300	0.295	5.649	0.060	Surcharged
7.000	720 min Winter	752	1-S24	1-S25	0.113	0.759	1.513	0.018	OK
7.001	360 min Summer	263	1-S25	1-S20	0.150	0.222	2.199	0.024	Surcharged
1.008	1440 min Winter	830	1-S20	1-S28 HB	0.300	0.131	5.035	0.083	Surcharged
8.000	15 min Summer	9	1-S21	1-S26	0.225	2.160	85.891	1.654	OK
8.001	240 min Summer	191	1-S26	1-S27	0.225	2.162	30.126	0.580	OK
8.002	240 min Summer	169	1-S27	1-S28 HB	0.225	1.844	30.097	0.148	OK
1.009	720 min Winter	692	1-S28 HB	1-S29	0.043	0.634	2.618	0.182	OK

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
2-S1	0.021	1350	Type C	125.005	123.655	1.200	525961.953	201077.756
2-S2	0.044	1350	Type C	125.002	123.482	1.370	525977.582	201070.470
2-S3	0.049	1350	Type C	124.963	123.357	1.381	525977.283	201065.463
2-S4	0.000	1200	Type B	124.883	122.263	2.394	525973.172	201051.298
2-S5 TANK 2	0.054	1350	Type B	125.155	122.222	2.708	525969.554	201043.861
2-S6	0.090	600	Unknown	124.316	122.902	1.189	525977.067	200987.002
2-S7	0.022	600	Unknown	123.835	122.489	1.122	526009.847	201018.286
2-S8	0.000	600	Type D	124.289	122.406	1.658	525994.886	201025.269
2-S9	0.007	1200	Type B	124.330	122.274	1.756	525989.999	201014.881
2-S10	0.000	1350	Type B	124.493	122.168	2.025	525970.820	201023.676
2-S11	0.000	1350	Type B	124.746	122.118	2.403	525959.510	201024.868
2-S12	0.043	1350	Type C	125.206	123.788	1.268	525945.412	201072.099
2-S13	0.034	1350	Type C	124.977	123.426	1.326	525933.585	201045.026
2-S14	0.045	1350	Type C	124.804	123.213	1.365	525929.007	201025.513
2-S15	0.000	1350	Type C	124.069	122.528	1.241	525920.651	201004.149
2-S16 SWALE	0.130	1350	Type C	124.000	123.275	0.500	525957.578	201001.927
2-S17	0.000	1350	Type C	124.328	122.698	1.480	525955.914	200997.514
2-S18 HB	0.000	1200	Type B	124.217	121.948	2.119	525945.792	200993.176
2-S19	0.000	1350	Type B	123.889	121.882	1.857	525952.856	200986.416
2-S20	0.000	1200	Unknown	123.470	121.829	1.491	525953.940	200978.456
2-S21	0.038	1350	Type C	122.945	121.876	0.844	525990.003	200963.524
2-S22 TANK 3	0.000	1350	Type C	123.010	121.833	0.952	525984.096	200966.031
2-S23	0.000	1350	Type C	122.998	121.762	1.011	525974.223	200970.221
2-S24 HB	0.000	1350	Type C	122.965	121.721	1.093	525968.254	200971.018
2-S25	0.000	1350	Type C	122.959	121.635	1.174	525966.036	200958.250
2-S26	0.000	1350	Type C	122.827	121.430	1.096	525973.864	200955.802
2-S27	0.000	1350	Type C	122.820	121.411	1.109	525979.810	200954.560
2-S28	0.000	1350	Type C	122.742	121.383	1.058	525988.291	200952.397
MH 9904	0.000	1500	Type C	122.705	121.355	1.050	525996.934	200949.755

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	2-S1	123.655	2-S2	123.482	Circ	150	17.244	100	0.600	1.200	1.370
1.001	2-S2	123.482	2-S3	123.432	Circ	150	5.016	100	0.600	1.370	1.381
1.002	2-S3	123.357	2-S4	122.263	Circ	225	14.749	13	0.600	1.381	2.394
1.003	2-S4	122.263	2-S5 TANK 2	122.222	Circ	3No. 225	8.271	200	0.600	2.394	2.708
1.004	2-S5 TANK 2	122.222	2-S11	122.118	Circ	3No. 225	21.485	207	0.600	2.708	2.403
2.000	2-S6	122.902	2-S9	122.349	Circ	225	30.733	56	0.600	1.189	1.756
3.000	2-S7	122.489	2-S8	122.406	Circ	225	16.510	200	0.600	1.122	1.658
3.001	2-S8	122.406	2-S9	122.349	Circ	225	11.480	200	0.600	1.658	1.756
2.001	2-S9	122.274	2-S10	122.168	Circ	300	21.099	200	0.600	1.756	2.025
2.002	2-S10	122.168	2-S11	122.118	Circ	300	11.372	226	0.600	2.025	2.328
1.005	2-S11	122.118	2-S18 HB	121.948	Circ	300	34.533	203	0.600	2.328	1.969
4.000	2-S12	123.788	2-S13	123.501	Circ	150	29.544	103	0.600	1.268	1.326
4.001	2-S13	123.426	2-S14	123.213	Circ	225	20.043	94	0.600	1.326	1.365
4.002	2-S14	123.213	2-S15	122.603	Circ	225	22.940	38	0.600	1.365	1.241
4.003	2-S15	122.528	2-S18 HB	121.948	Circ	300	27.431	47	0.600	1.241	1.969
5.000	2-S16 SWALE	123.275	2-S17	122.698	Circ	225	4.717	8	0.600	0.500	1.405
5.001	2-S17	122.698	2-S18 HB	121.948	Circ	150	11.011	15	0.600	1.480	2.119
1.006	2-S18 HB	121.948	2-S19	121.882	Circ	150	9.778	150	0.600	2.119	1.857
1.007	2-S19	121.882	2-S20	121.829	Circ	150	8.034	150	0.600	1.857	1.491
1.008	2-S20	121.829	2-S24 HB	121.721	Circ	150	16.131	150	0.600	1.491	1.093
6.000	2-S21	121.876	2-S22 TANK 3	121.833	Circ	225	6.416	150	0.600	0.844	0.952
6.001	2-S22 TANK 3	121.833	2-S23	121.762	Circ	225	10.726	150	0.600	0.952	1.011
6.002	2-S23	121.762	2-S24 HB	121.721	Circ	225	6.022	150	0.600	1.011	1.018
1.009	2-S24 HB	121.721	2-S25	121.635	Circ	150	12.959	150	0.600	1.093	1.174
1.010	2-S25	121.635	2-S26	121.580	Circ	150	8.201	150	0.600	1.174	1.096
1.011	2-S26	121.430	2-S27	121.411	Circ	300	6.074	315	0.600	1.096	1.109

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.012	2-S27	121.411	2-S28	121.383	Circ	300	8.753	315	0.600	1.109	1.058
1.013	2-S28	121.383	MH 9904	121.355	Circ	300	9.038	315	0.600	1.058	1.050

Outfall Details

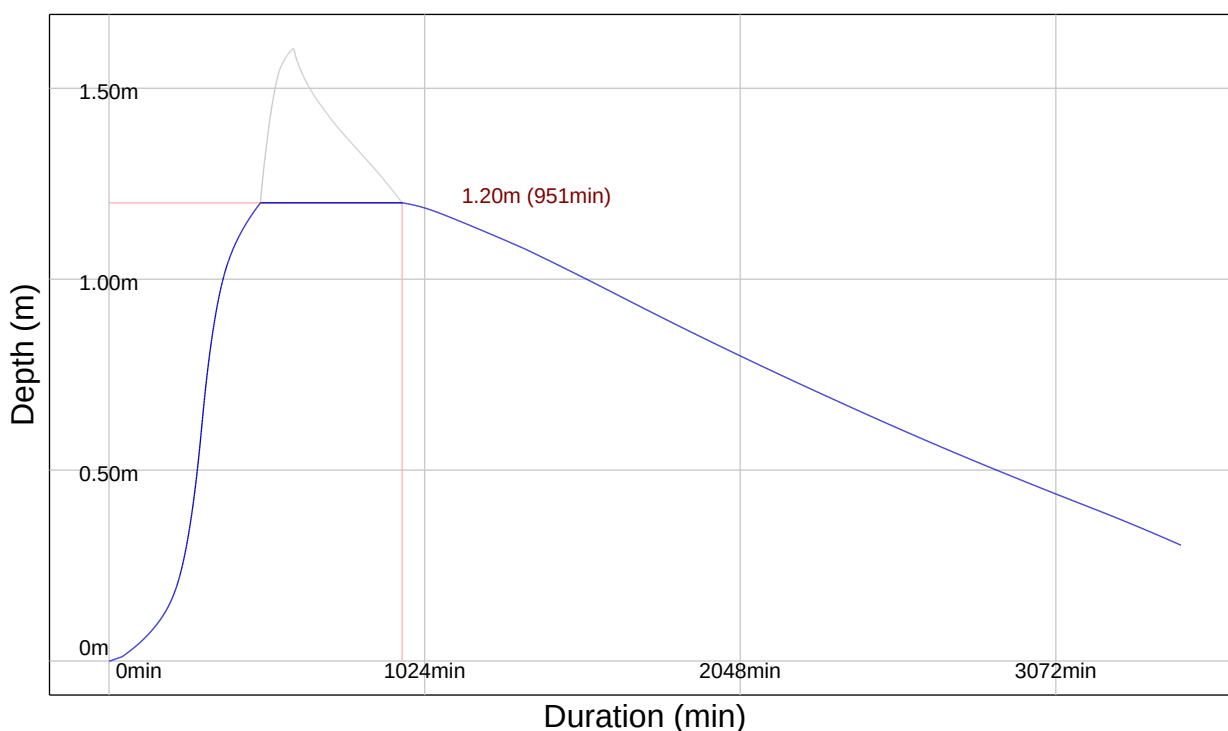
Outfall Manhole MH 9904 : Free Discharge

Flow Control Details

Tank Structure at Manhole 2-S5 TANK 2

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
122.222	1.200	95.00	331.577	314.998	377.997	0.00000000	0.00000000	2.00

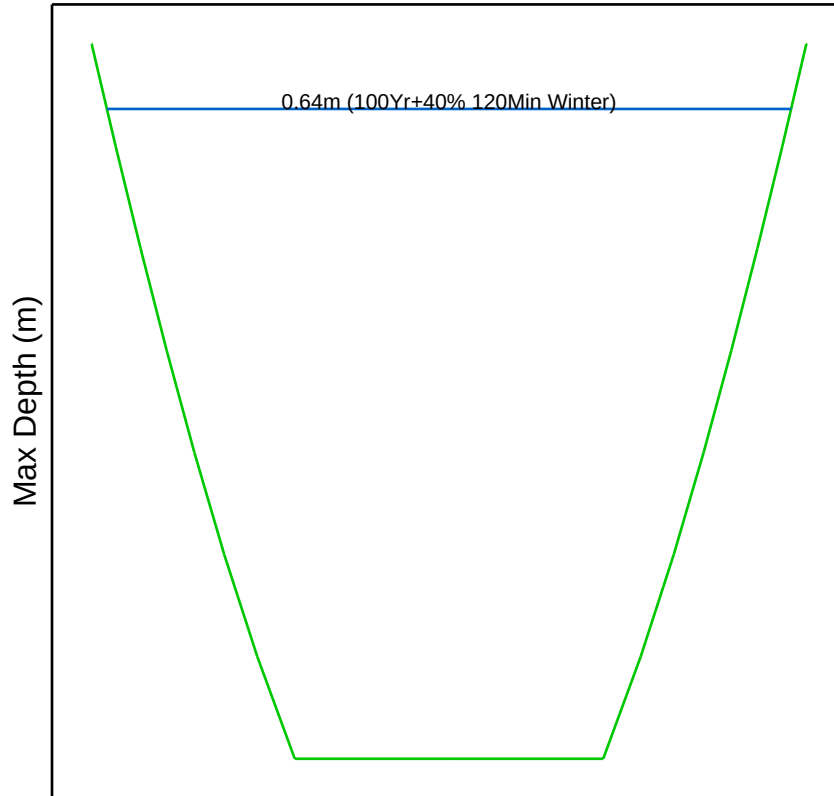
Tank 3 at 2-S5 TANK 2 (100Yr+40% 600Min Summer)



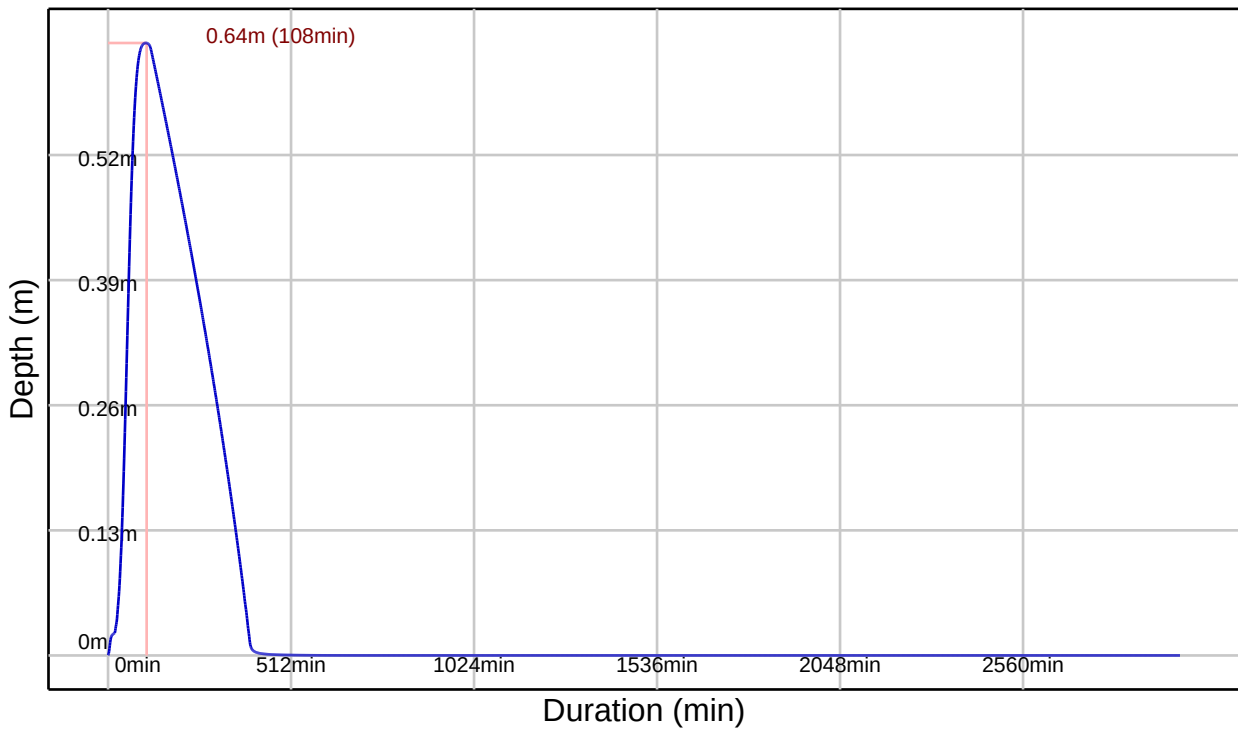
Pond Structure at Manhole 2-S16 SWALE

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
123.300	0.700	28.388	123.700	0.300	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at 2-S16 SWALE



Pond 1 at 2-S16 SWALE (100Yr+40% 120Min Winter)



Controls within Manhole 2-S17

Orifice Control

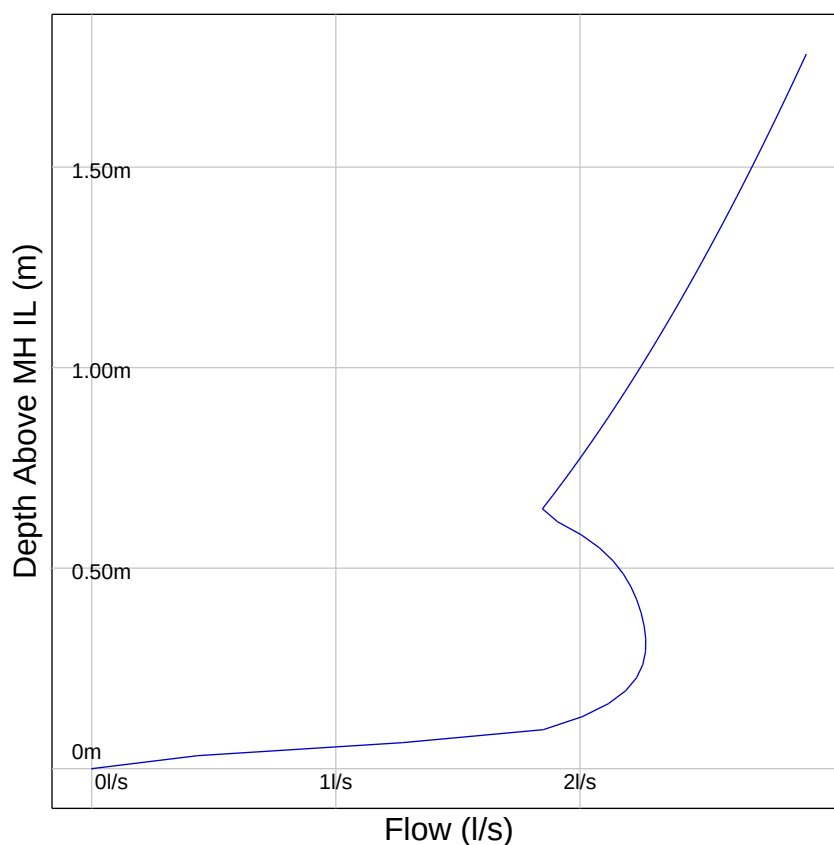
Invert Offset (m)	Orifice Diameter (m)	Discharge Coeff
0.000	0.050	0.600

Controls within Manhole 2-S18 HB

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0071-2700-1500-2700	1.500	2.700	0.000	0.310	2.270	0.636	1.831

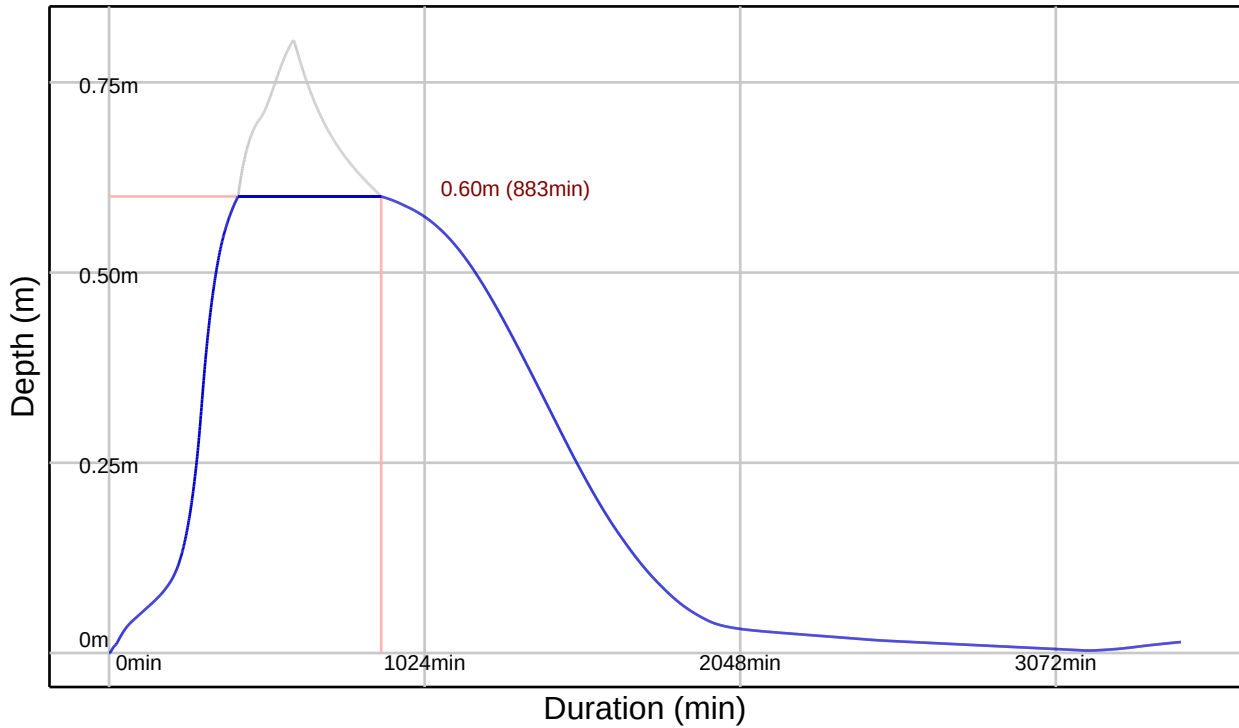
Hydro-Brake® Optimum Control from 2-S18 HB to 2-S19



Tank Structure at Manhole 2-S22 TANK 3

Tank Invert (m)	Tank Height (m)	Porosity Ratio (%)	Area (m2)	Effective Area (m2) Area x Porosity Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
121.833	0.600	95.00	30.756	29.218	17.531	0.00000000	0.00000000	2.00

Tank 4 at 2-S22 TANK 3 (100Yr+40% 600Min Summer)

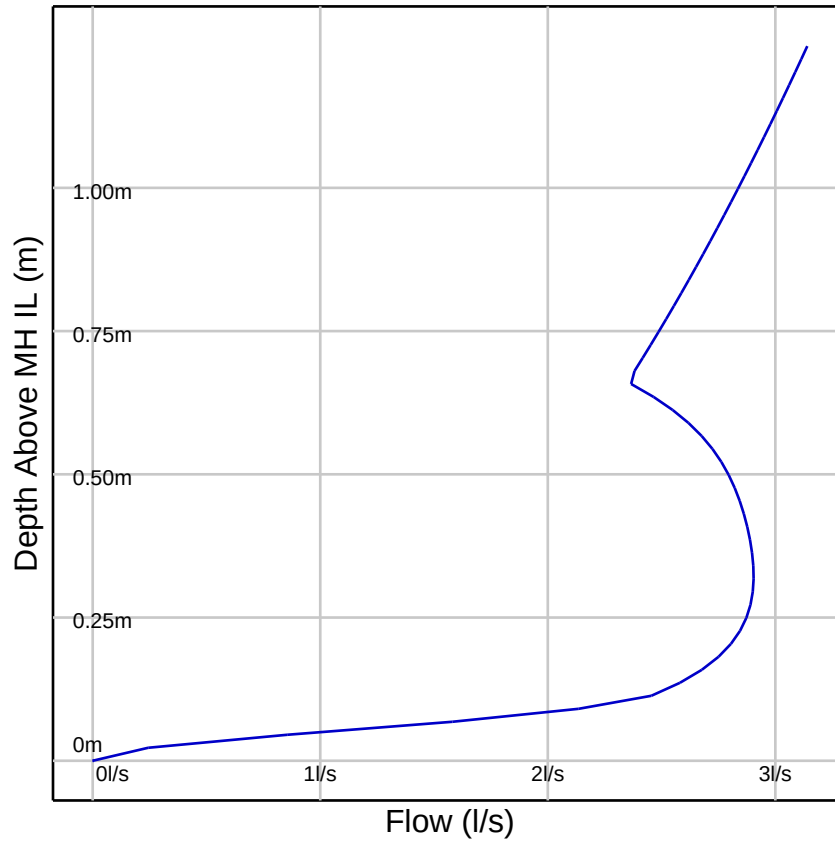


Controls within Manhole 2-S24 HB

Hydro-Brake® Optimum Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0080-2900-1050-2900	1.050	2.900	0.000	0.322	2.905	0.660	2.349

Hydro-Brake® Optimum Control from 2-S24 HB to 2-S25



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_525938_200950_v5_1_0.xml

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

Global Time of Entry: 5.0 mins

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

Return Periods (yrs) + Climate Change: (100, +40%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
100Yr+40% 15Min Winter	149.024	0.00	0.03	100Yr+40% 480Min Summer	12.634	0.00	0.39
100Yr+40% 15Min Summer	149.024	0.00	0.00	100Yr+40% 480Min Winter	12.634	0.00	0.38
100Yr+40% 30Min Winter	95.839	0.00	-0.07	100Yr+40% 600Min Summer	10.531	0.00	0.42
100Yr+40% 30Min Summer	95.839	0.00	-0.11	100Yr+40% 600Min Winter	10.531	0.00	0.42
100Yr+40% 60Min Winter	58.618	0.00	-0.08	100Yr+40% 720Min Summer	9.041	0.00	0.42
100Yr+40% 60Min Summer	58.618	0.00	-0.11	100Yr+40% 720Min Winter	9.041	0.00	0.42
100Yr+40% 120Min Summer	36.120	0.00	-0.10	100Yr+40% 960Min Summer	7.088	0.00	0.35
100Yr+40% 120Min Winter	36.120	0.00	-0.09	100Yr+40% 960Min Winter	7.088	0.00	0.34
100Yr+40% 180Min Summer	27.033	0.00	0.06	100Yr+40% 1440Min Summer	5.005	0.00	0.20
100Yr+40% 180Min Winter	27.033	0.00	0.06	100Yr+40% 1440Min Winter	5.005	0.00	0.23
100Yr+40% 240Min Summer	21.716	0.00	0.15	100Yr+40% 2160Min Summer	3.516	0.00	-0.01
100Yr+40% 240Min Winter	21.716	0.00	0.16	100Yr+40% 2160Min Winter	3.516	0.00	0.00
100Yr+40% 360Min Winter	15.861	0.00	0.30	100Yr+40% 2880Min Winter	2.727	0.00	-0.02
100Yr+40% 360Min Summer	15.861	0.00	0.30	100Yr+40% 2880Min Summer	2.727	0.00	-0.02

Simulation Results

Return Period (yrs) + Climate Change (%):

100yr+40%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
2-S1	15 min Summer	9	124.200	0.545	17.755		Surcharged
2-S2	15 min Summer	9	124.045	0.563	53.828		Surcharged
2-S3	600 min Summer	597	123.826	0.469	0.922		Surcharged
2-S4	600 min Summer	597	123.826	1.563	0.913		Surcharged
2-S5 TANK 2	600 min Summer	597	123.826	1.604	1.349		Surcharged
2-S6	600 min Summer	597	123.826	0.925	0.742		Surcharged
2-S7	600 min Summer	597	123.826	1.338	0.182		Flood Risk
2-S8	600 min Summer	597	123.826	1.420	0.181		Surcharged
2-S9	600 min Summer	597	123.826	1.553	0.965		Surcharged
2-S10	600 min Summer	597	123.826	1.658	0.949		Surcharged
2-S11	600 min Summer	597	123.826	1.708	2.279		Surcharged
2-S12	15 min Summer	10	124.716	0.928	30.136		Surcharged
2-S13	15 min Summer	10	123.880	0.454	53.902		Surcharged
2-S14	600 min Summer	597	123.826	0.613	0.971		Surcharged
2-S15	600 min Summer	597	123.826	1.298	0.957		Flood Risk
2-S16 SWALE	120 min Winter	106	123.937	0.637	4.829		Flood Risk
2-S17	120 min Winter	106	123.936	1.238	4.862		Surcharged
2-S18 HB	600 min Summer	597	123.826	1.879	3.195		Surcharged
2-S19	600 min Summer	598	122.643	0.760	2.424		Surcharged
2-S20	600 min Summer	598	122.641	0.812	2.421		Surcharged
2-S21	600 min Summer	598	122.638	0.762	0.255		Surcharged
2-S22 TANK 3	600 min Summer	598	122.638	0.805	0.254		Surcharged
2-S23	600 min Summer	598	122.638	0.877	0.253		Surcharged
2-S24 HB	600 min Summer	598	122.638	0.917	2.670		Surcharged
2-S25	2160 min Summer	1509	121.680	0.045	2.904		OK
2-S26	2160 min Summer	1509	121.473	0.043	2.904		OK
2-S27	2160 min Summer	1509	121.454	0.043	2.904		OK
2-S28	2160 min Summer	1510	121.426	0.043	2.904		OK
MH 9904	2160 min Summer	1510	121.394	0.040	2.904		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Summer	10	2-S1	2-S2	0.150	0.989	17.469	0.985	Surcharged
1.001	15 min Summer	9	2-S2	2-S3	0.150	3.020	53.362	3.010	Surcharged
1.002	600 min Summer	513	2-S3	2-S4	0.225	1.117	13.053	0.092	OK
1.003	15 min Summer	10	2-S4	2-S5 TANK 2	0.225	1.440	92.430	0.843	OK
1.004	720 min Summer	562	2-S5 TANK 2	2-S11	0.225	0.039	3.337	0.031	OK
2.000	15 min Summer	9	2-S6	2-S9	0.225	1.908	75.859	1.086	OK
3.000	15 min Summer	8	2-S7	2-S8	0.225	0.751	18.405	0.504	OK
3.001	15 min Summer	9	2-S8	2-S9	0.225	0.647	16.595	0.454	OK
2.001	15 min Summer	9	2-S9	2-S10	0.300	1.344	95.019	1.215	Surcharged
2.002	15 min Summer	9	2-S10	2-S11	0.300	1.309	92.559	1.259	Surcharged
1.005	15 min Summer	6	2-S11	2-S18 HB	0.300	0.335	11.886	0.153	Surcharged
4.000	15 min Summer	10	2-S12	2-S13	0.150	1.703	30.094	1.722	Surcharged
4.001	15 min Summer	10	2-S13	2-S14	0.225	1.463	53.613	1.002	OK
4.002	15 min Summer	9	2-S14	2-S15	0.225	2.384	85.256	1.003	OK
4.003	15 min Summer	9	2-S15	2-S18 HB	0.300	1.198	81.200	0.501	Surcharged
5.000	15 min Summer	7	2-S16 SWALE	2-S17	0.225	1.236	20.879	0.114	OK
5.001	15 min Summer	13	2-S17	2-S18 HB	0.150	0.520	7.073	0.152	Surcharged
1.006	1440 min Winter	1299	2-S18 HB	2-S19	0.150	0.642	2.629	0.182	Surcharged
1.007	1440 min Winter	1312	2-S19	2-S20	0.150	0.621	2.632	0.182	Surcharged
1.008	30 min Winter	14	2-S20	2-S24 HB	0.150	0.594	2.934	0.203	Surcharged
6.000	15 min Summer	10	2-S21	2-S22 TANK 3	0.225	1.174	32.698	0.773	OK
6.001	15 min Summer	10	2-S22 TANK 3	2-S23	0.225	0.656	10.481	0.248	OK
6.002	15 min Summer	8	2-S23	2-S24 HB	0.225	0.474	7.206	0.170	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.009	2160 min Summer	1509	2-S24 HB	2-S25	0.045	0.656	2.904	0.201	OK
1.010	2160 min Summer	1509	2-S25	2-S26	0.044	0.674	2.904	0.201	OK
1.011	2160 min Summer	1509	2-S26	2-S27	0.043	0.468	2.904	0.047	OK
1.012	2160 min Summer	1510	2-S27	2-S28	0.043	0.470	2.904	0.047	OK
1.013	2160 min Summer	1510	2-S28	MH 9904	0.041	0.498	2.904	0.047	OK

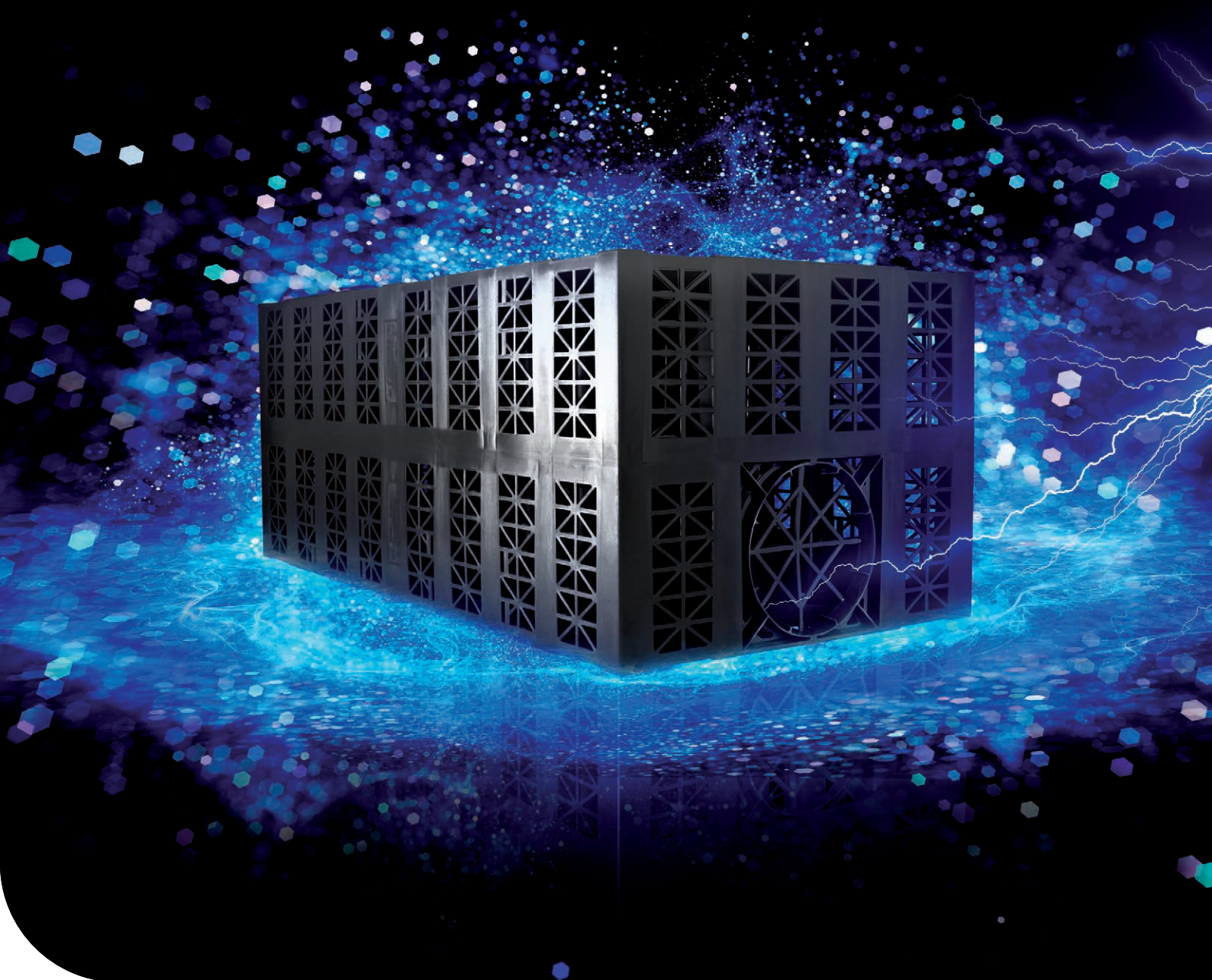
Appendix J

Attenuation Tank, Tree Root Cells, and Hydrobrake Maintenance Manuals

STORMWATER MANAGEMENT

AquaCell systems

Operation and maintenance guide



Storming performance

Thank you for choosing the AquaCell range of geocellular systems – the tried and tested solution to the effective management of excessive rainfall, whether through attenuation or infiltration.

All AquaCell units are engineered from reformulated, recycled material, so as concern grows over the effects of climate change and the challenges of increasing urbanisation, AquaCell continues to rain supreme as the cost-effective, proven and versatile stormwater solution.

The AquaCell range can be used as either a temporary storage tank or soakaway, and is suitable for applications including:

- ④ Landscaped areas
- ④ Parks
- ④ Domestic gardens
- ④ Residential developments
- ④ Car parks and roads
- ④ Industrial/Commercial areas

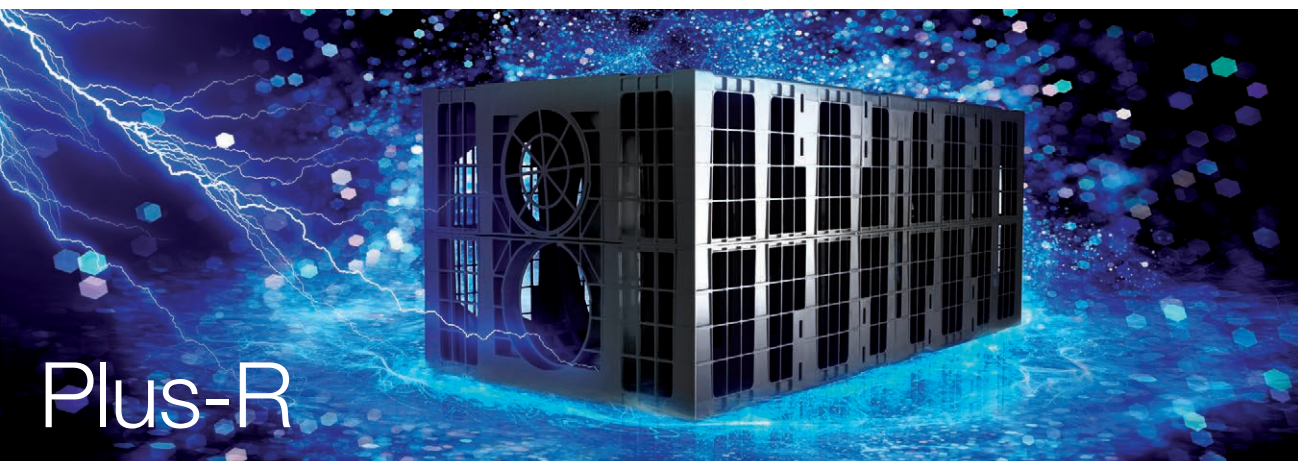
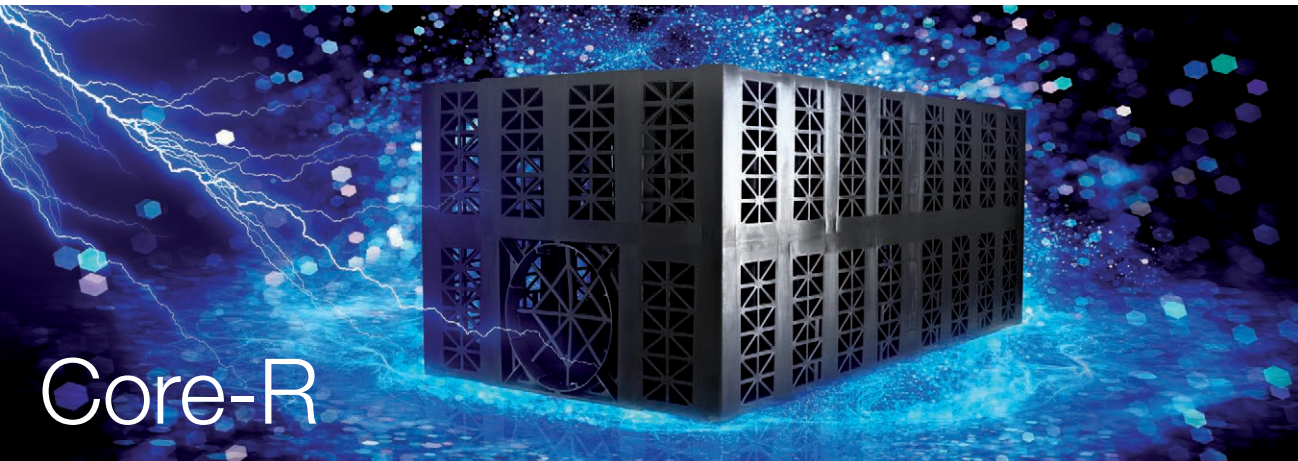
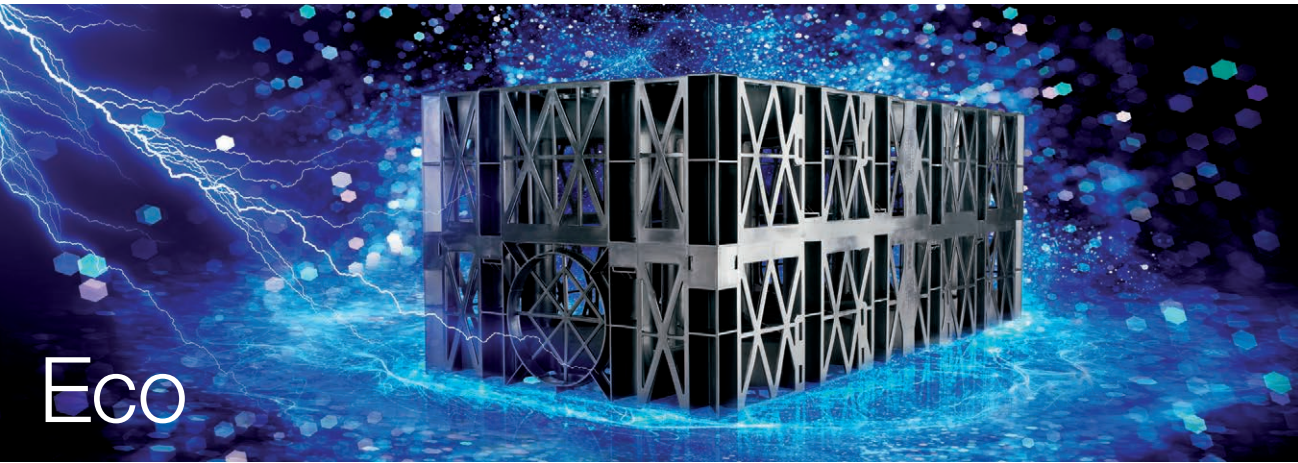
Each of the three AquaCell units can be used as a standalone system, or different unit types can be mixed and matched together in layers to value engineer the most cost effective solution.

All AquaCell units have identical dimensions (1m x 0.5m x 0.4m), but they are manufactured to perform differently. The type of unit, or combination of units required depends on factors such as the load application, overall installation depth and site conditions.

This guide provides information on typical installation methods and construction loads, as well as guidance on how to inspect and maintain your AquaCell tank to ensure its ongoing optimum performance.

Discover more online at: **wavin.co.uk/aquacell**

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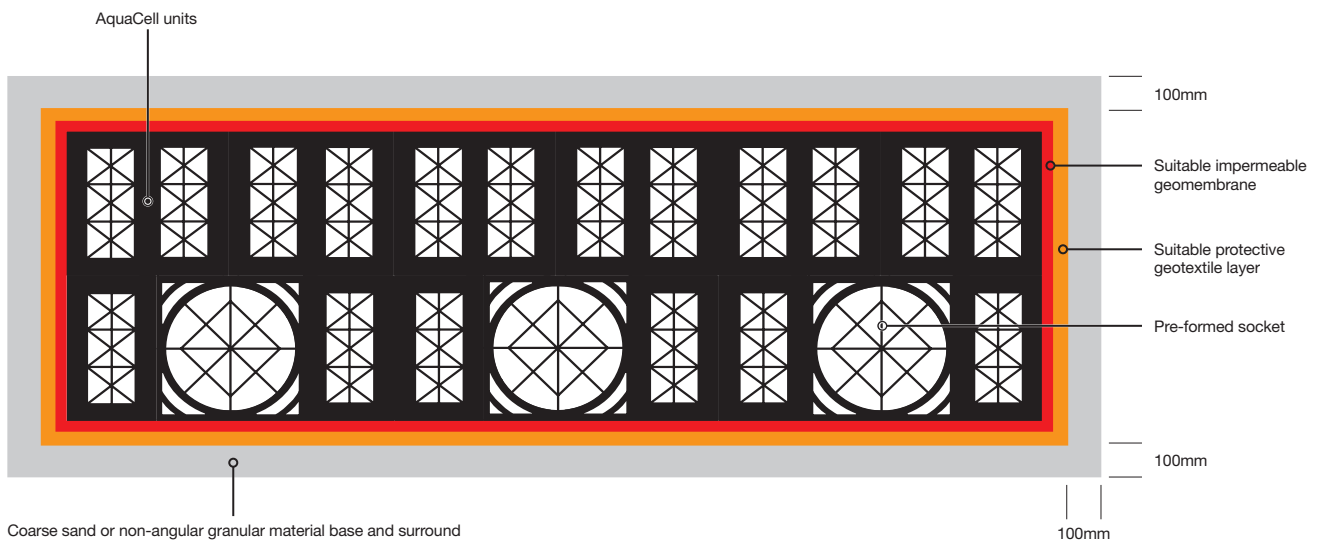
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Installation

Typical storage tank installation method

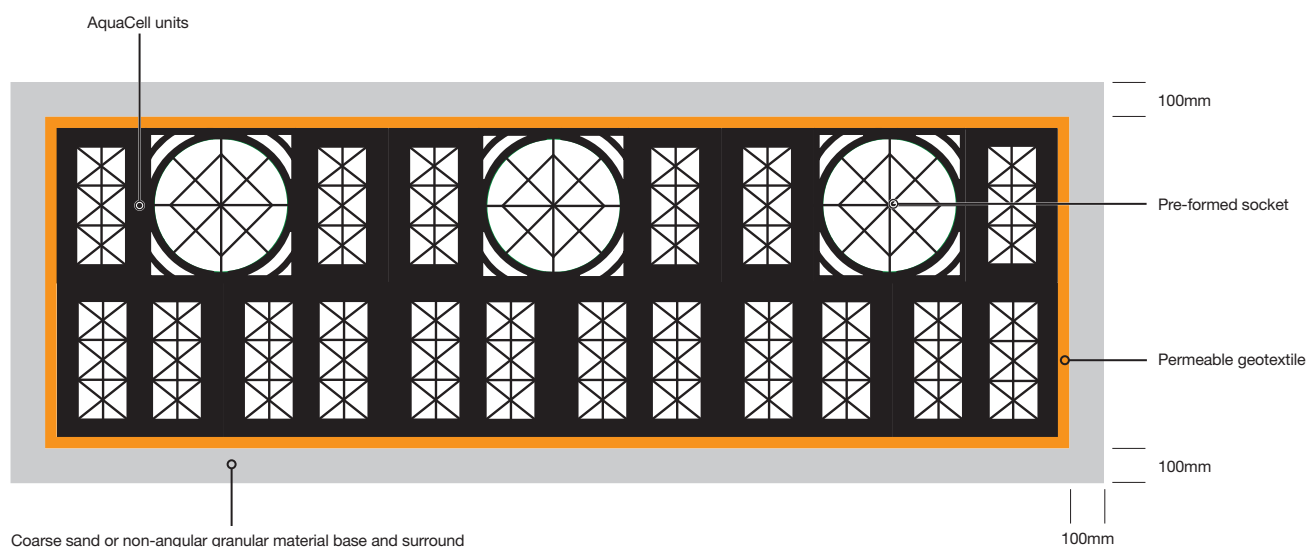
1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand or non-angular granular material, then level and compact.
3. Lay the geotextile over the base and up the sides of the trench.
4. Lay the geomembrane on top of the geotextile over the base and up the sides of the trench.
5. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below). For single layer applications use the AquaCell Clips, and for multiple layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
6. Wrap the geomembrane around the AquaCell structure and seal to manufacturer's recommendations.
7. If side connections into the AquaCell units are required, (other than the preformed socket), use the appropriate Flange Adaptor (6LB104 or 6LB106). Fix the flange adaptor to the unit using self-tapping screws. Drill a hole through the flange adaptor and connect the pipework. (6LB106 should not be used with AquaCell Eco).
8. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that a silt trap is installed prior to the inlet pipework.
9. Wrap and overlap the geotextile, covering the entire AquaCell structure to protect the geomembrane.
10. Lay 100mm of coarse sand or non-angular granular material between the trench walls and the AquaCell structure and compact.
11. Lay 100mm of coarse sand or non-angular granular material over the geotextile/geomembrane and compact.
12. Backfill with suitable material.

NB: A storage tank must be vented, and it is recommended that one 110mm diameter vent pipe is provided per 7,500m² of impermeable catchment area on site.



Typical soakaway installation method

1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand or non-angular granular material, then level and compact.
3. Lay the geotextile over the base and up the sides of the trench.
4. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below). For single layer applications use the AquaCell Clips, and for multiple layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
5. Fix the Adaptors to the AquaCell units as required and connect pipework.
6. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that a silt trap is installed prior to the inlet pipework.
7. Wrap and overlap the geotextile, covering the entire AquaCell structure.
8. Lay 100mm of coarse sand or non-angular granular material between the trench walls and the AquaCell structure and compact.
9. Lay 100mm of coarse sand or non-angular granular material over the geotextile and compact.
10. Backfill with suitable material.
11. Rainwater from roof areas may discharge directly into the soakaway, but rainwater from car parks must discharge through a catchpit manhole and/or a petrol interceptor.



Construction loads

AquaCell Core-R and Plus-R: Construction loads

Construction plant such as excavators can impose significant loads on any AquaCell unit. The following guidelines should be observed:

- ⦿ Tracked excavators (not exceeding 21 tonnes in weight) should be used to place fill over the AquaCell units when the geotextile or geomembrane wrapping has been completed.
- ⦿ At least 300mm of fill should be placed before the excavators or trucks delivering the backfill are allowed to traffic over the installed units.
- ⦿ Compaction plant used over the AquaCell units should not exceed 2,300kg/m width. This will allow the compaction of Type 1 sub-base in 150mm layers over the units in accordance with the Specification for Highways Works.
- ⦿ All other construction plant should be prevented from trafficking over the system once it is installed and surfacing completed, unless a site-specific assessment demonstrates that it is acceptable.
- ⦿ In particular, cranes should not be used, or place their outriggers, over the system.

AquaCell Eco: Construction loads

As AquaCell Eco is designed for landscaped and non-loaded applications, certain precautions are recommended on site to prevent damage to the units through excess loading.

Manual assembly

Whilst assembling the tank, it may be necessary to walk on top of previously laid AquaCell units. Therefore, care should be taken not to damage the edges of the units.

Backfilling

When backfilling AquaCell Eco installations:

- ⦿ Machines placing the material must be located OFF the units.
- ⦿ Only light compaction should be applied to the material.
- ⦿ Backfill with suitable, stone-free, as-dug material.
- ⦿ First layer should be 300mm thick before using any compaction plant.
- ⦿ NO vibratory mechanism should be used for compacting this first layer.
- ⦿ Compaction plant must not exceed 2,300kg/m width.

Construction traffic on site

Once backfilled, if construction plant (e.g. excavators or loaders) are likely to run over the installation, ensure that:

- ⦿ MINIMUM protective cover should be 500mm well-compacted granular material.
- ⦿ Only tracked excavators can be used and MUST NOT weigh more than 14 tonnes.
- ⦿ HGVs MUST NOT run over installed AquaCell Eco units.

Inspection and maintenance

AquaCell Plus-R: for inspectability

By aligning AquaCell Plus-R units end-to-end, full length viewing channels can be created – allowing for CCTV inspection, if required. These are created in the bottom layer of an AquaCell tank installation.

The units can be used in combination with AquaCell Core-R (and with Eco if there is at least one layer of AquaCell Core-R in between the Plus-R and Eco layer).

NOTE: For any AquaCell Plus-R units on the perimeter of a structure that are NOT required for inspection access, the open ends of the integral inspection tunnels should be fitted with the end caps provided.

Inspection chambers

An inspection chamber should precede the inlet pipework for the AquaCell structure.

A silt trap or hydro-dynamic separator prior to the inspection chamber is also recommended.

For on-line installations the following Chambers are recommended:

- ⦿ Down to 3m: Wavin Non-Entry Inspection Chambers
- ⦿ Down to 5m: Wavin Range 600 Inspection Chambers, or a traditional manhole*

**Where inlet pipework is replaced by AquaCell units acting as flow conduit.*

For off-line installations:

- ⦿ Manhole with in-built flow control

Recommendation: If installing any Wavin Non-Entry Inspection Chamber, deeper than 1.2m, ensure that the cover and frame includes a 350mm restrictor to prevent man entry.

Inspection and maintenance

CCTV inspection at every inspection point is recommended:

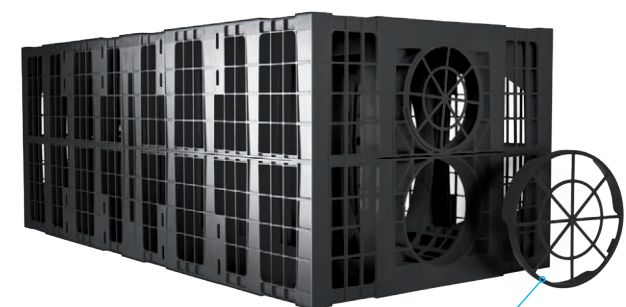
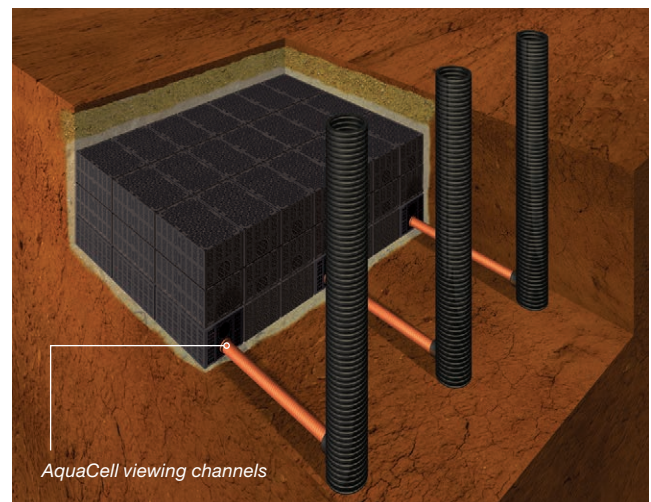
- ⦿ after every major storm
- ⦿ at regular intervals according to the specific maintenance plan for the site

Silt traps prior to inlet pipework should be routinely inspected and cleaned out to minimise debris reaching the tank. It is important to prevent construction silt from entering the AquaCell structure.

AquaCell Plus-R viewing channel



Tank installation with inspection chambers



End cap for when an inspection channel is not required

Maintenance schedule

The below guidance is taken from CIRIA C753: The SuDS Manual.

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground storage systems and soakaways. Maintenance responsibility for systems should be placed with a responsible organisation. The below tables provide guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive, and some actions may not always be required.

Maintenance plans and schedules should be developed during the design phase, and will be specific to the type of tank or soakaway that is adopted. Specific maintenance needs of the system should be monitored and maintenance schedules adjusted to suit requirements.

Operation and maintenance requirements for attenuation storage tanks

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

Operation and maintenance requirements for soakaways

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber.	Annually
	Cleaning of any gutters and filters on downpipes.	Annually, or as required
	Trimming any roots that may be causing blockages.	Annually, or as required
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber.	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void if performance deteriorates or failure occurs.	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway).	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring.	Annually

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

References: Woods Ballard, B., Wilson, S., Udale-Clarke, H., Illman, S., Scott, T., Ashley, R., Kellagher, R., CIRIA C753 (2015) The SuDs Manual, CIRIA, London, UK (ISBN: 978-0-86017-760-9)

Always on hand to help

If you have any questions about the inspection, maintenance or overall performance of your AquaCell tank during its lifetime, the Wavin Technical Team are always on hand during office hours to offer advice and guidance:

Technical Centre

T 0844 856 5165

E technical.design@wavin.co.uk

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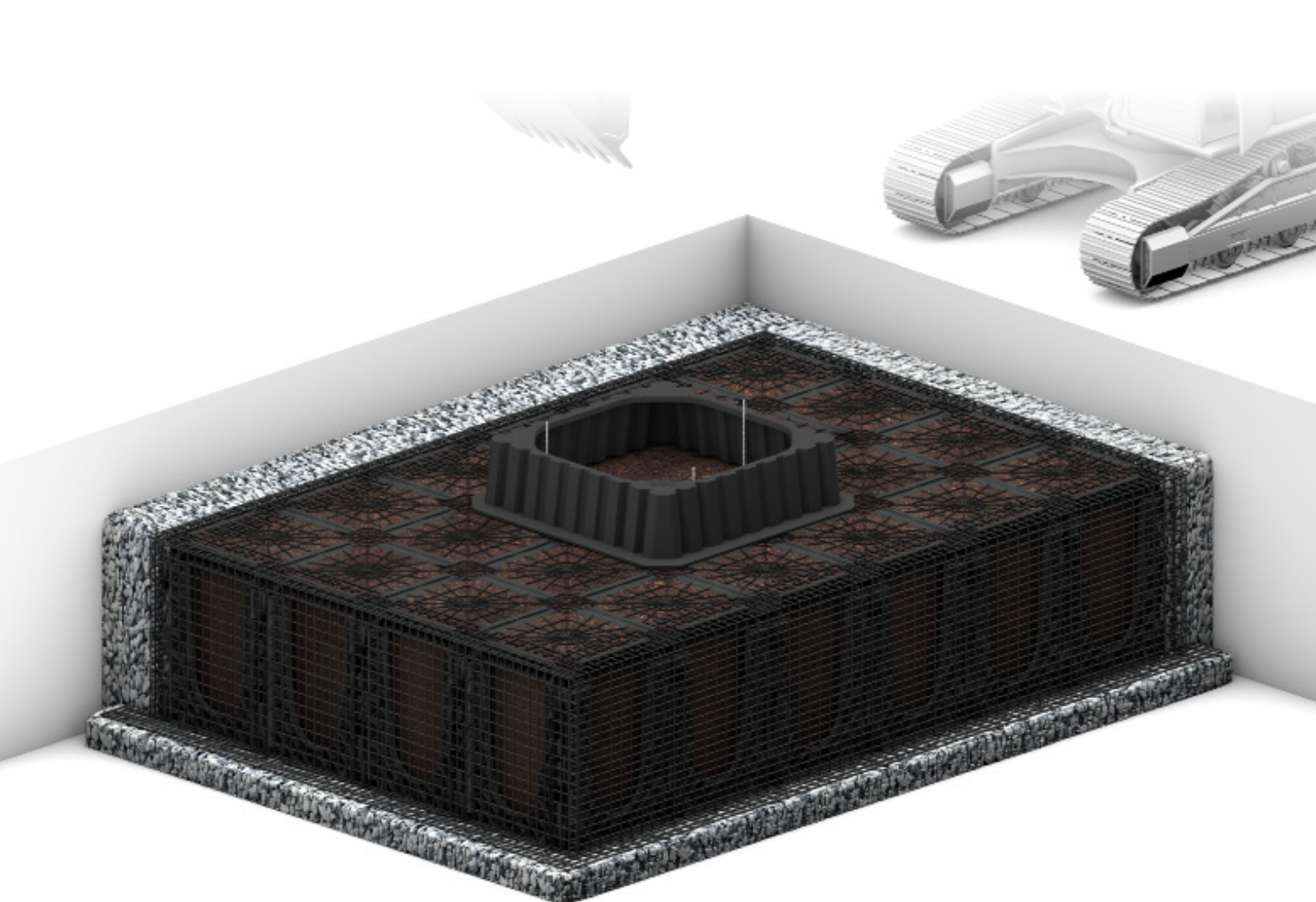
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Wavin Limited
Registered Office | Edlington Lane | Doncaster | DN12 1BY
Tel. 0844 856 5152 | www.wavin.co.uk | info@wavin.co.uk

RootSpace

Tree Pit Installation Guide



Health & Safety

- Works to be carried out under competent supervision.
- Lift safely using correct manual handling methods.
- Mechanical equipment to be used only by appropriately certificated persons.
- Recommend wearing full PPE including gloves, safety glasses, hard hats, safety boots, etc.
- Observe site rules and H&S requirements.
- GreenBlue Urban cannot be held responsible for any damage, loss or injury resulting from inappropriate handling, use or installation of GreenBlue products or tools or equipment used therewith.

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Construction Traffic

Restrict construction traffic until paving is complete.

Maximum load over RootSpace during construction and paving:

Vehicle Type	Light plant	Vibrating roller	Vibrating roller	Wheeled vehicle	Wheeled vehicle
Gross vehicle weight		1.8t	2.75t	up to 7.5t	over 7.5t
Drum width / Max. Axle load		950mm wide	1300mm wide	59 kN / Axle	113 kN / Axle
RootSpace + no cover	✓	✗	✗	✗	✗
+ 150mm Type 1	✓	✓	✗	✓	✗
+ 150mm Type 1 + 75mm DBM	✓	✓	✓	✓	✗
+ 150mm Type 1 + 150mm DBM	✓	✓	✓	✓	✓

Details of loadings such as Tracked vehicles, MEWPs or Crane wheel/outriggers to be submitted to GreenBlue Urban for evaluation. (Note that the table applies to single height G2 600 and G2 400 units. More calculations would be required for double and triple height units)

Tools / equipments

Rubber mallet



Spray paint



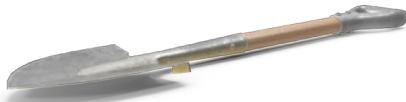
Knife



Tape measure



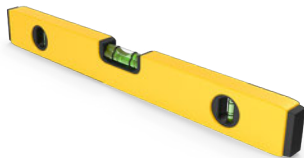
Shovel



Cable ties



Spirit level / surveyors' level



Straight edge



Compactor plate



Rake & Broom



Excavator

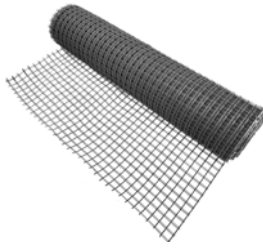


Combi drill



Components

GRN20 Netting



RootSpace Upright

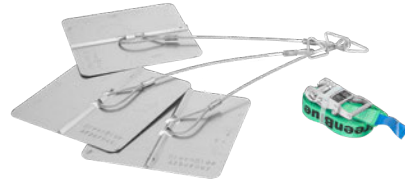


RootSpace Side Panel

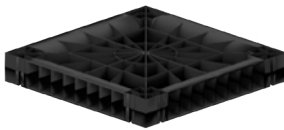


*optional component

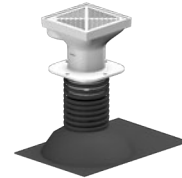
ArborGuy AnchorPlate



RootSpace Lid



ArborVent 150 - manifold/pipe/inlet

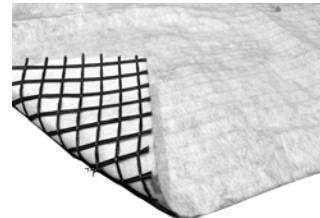


RootDirector



*Other options available

GLTWGNA Geonet



Tool kit - Install guide, zip ties, tape measure, knife, rubber mallet



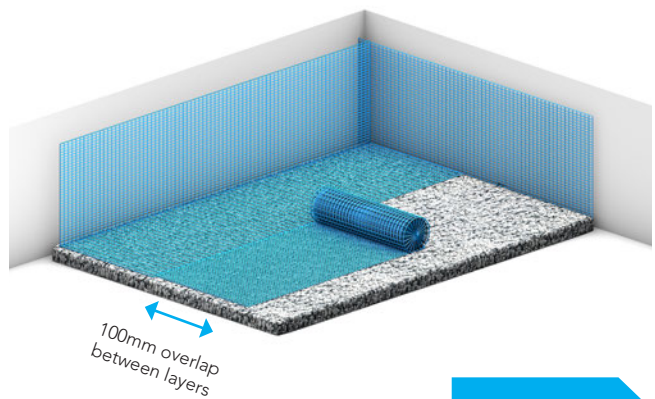
Quick Start Guide

1. Excavate tree pit, install and compact drainage stone flat and level.



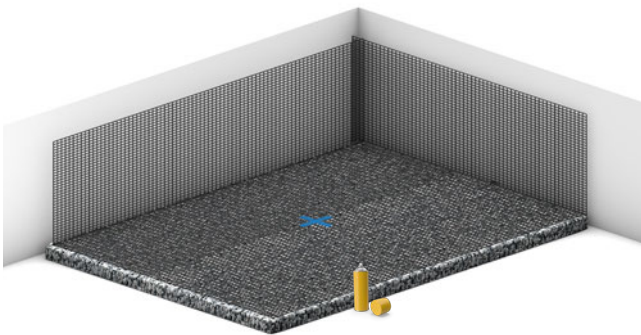
Step 1-5

2. Lay GRN20 Netting to base and up the sides.



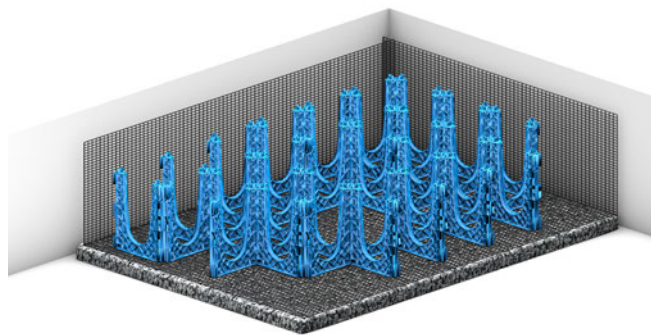
Step 9

3. Mark tree location.



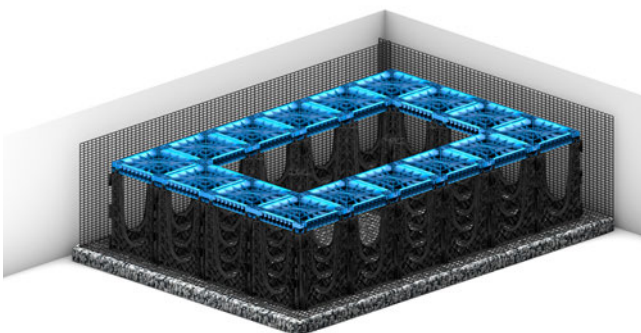
Step 10

4. Assemble RootSpace Uprights around tree location.



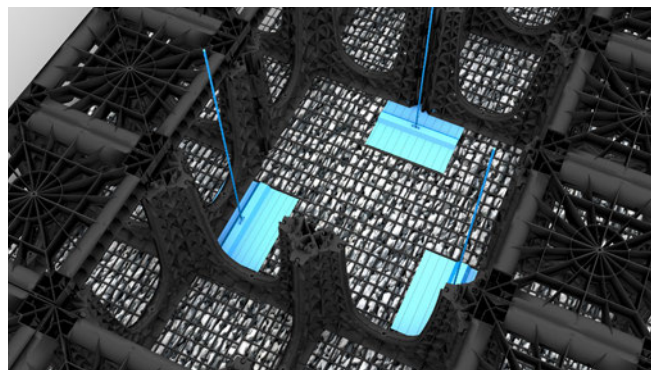
Step 11

5. Install RootSpace lids - leave 1mtr square gaps to ease soil filling.



Step 14

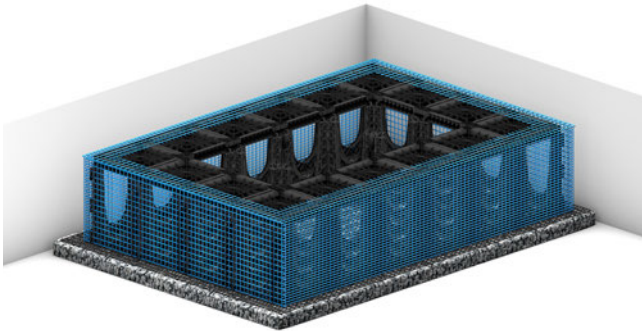
6. Position ArborGuy system as per product instructions.



Step 16

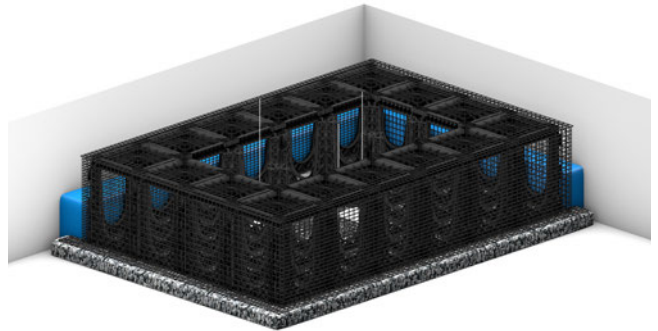
Quick Start Guide

7. Wrap GRN20 Netting around sides of RootSpace structure.



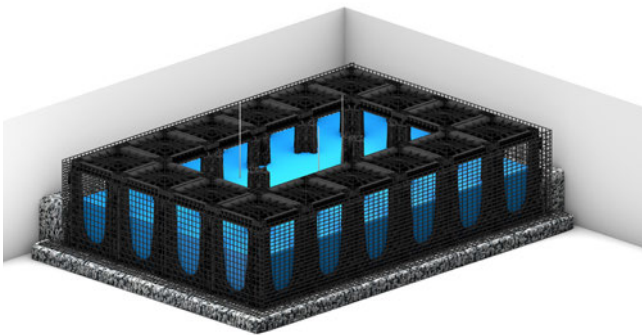
Step 15

8. Backfill perimeter with aggregate as specified.



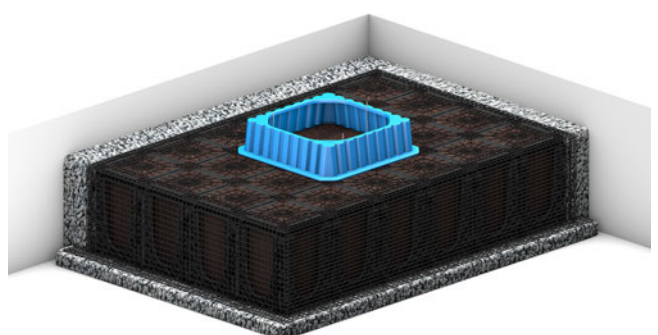
Step 17

9. Fill structure with soil, treading in thoroughly - install remaining RootSpace lids.



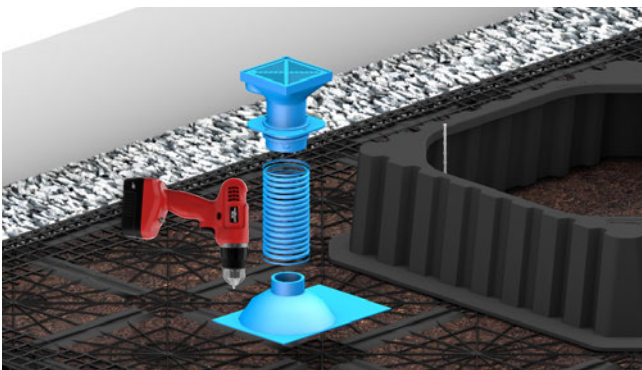
Step 18-21

10. Slot RootDirector into RootSpace tree location and fill with soil.



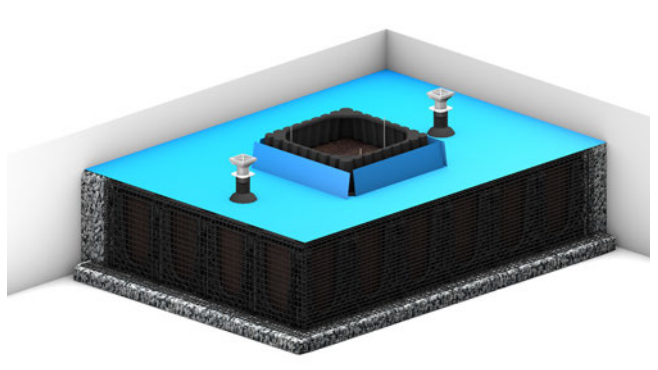
Page 17

11. Fit ArborVent aeration manifold as per product instructions.



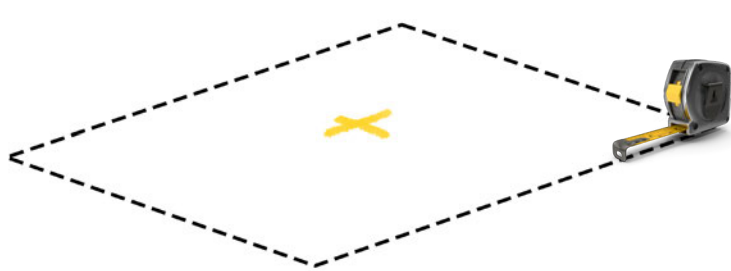
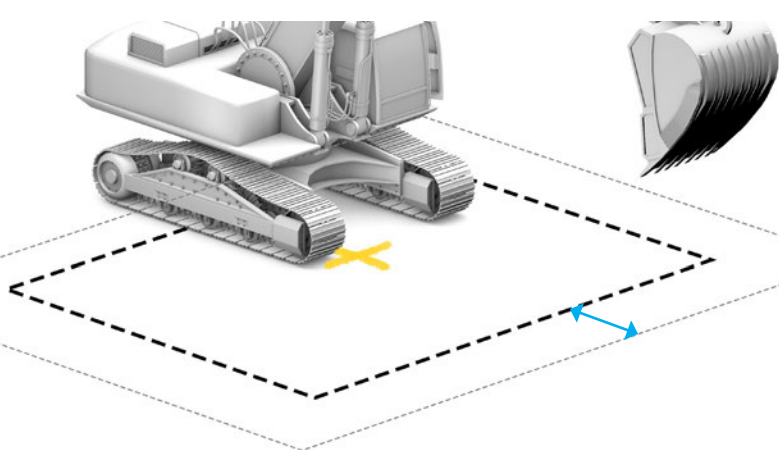
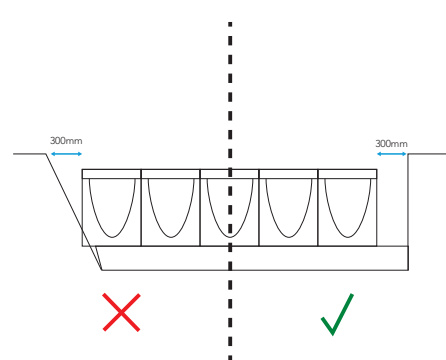
Step 23

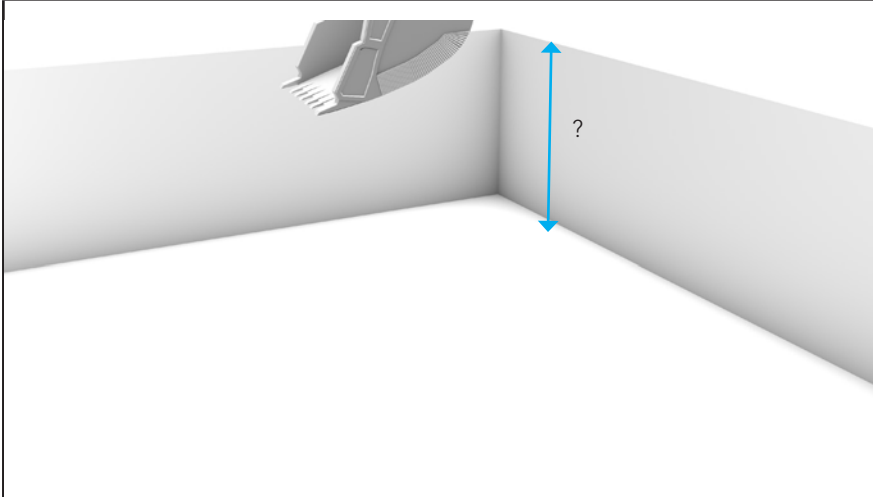
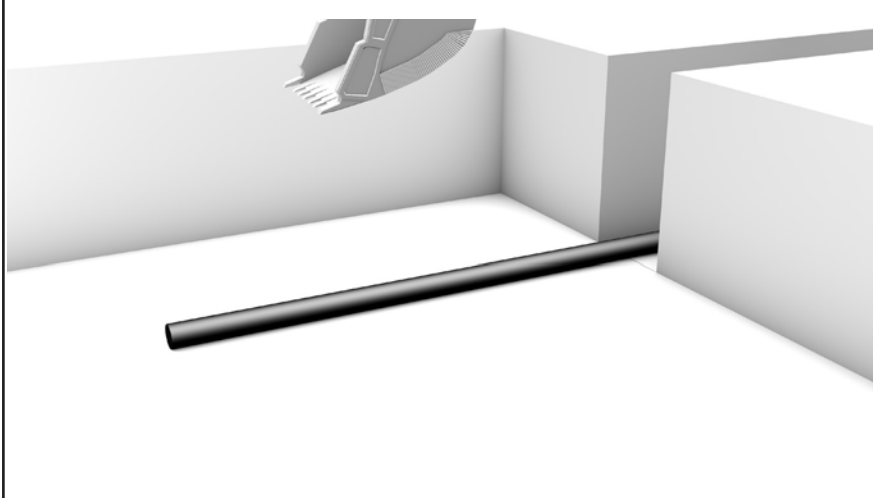
12. Lay GLTWGNA Geonet over RootSpace, RootDirector sides.

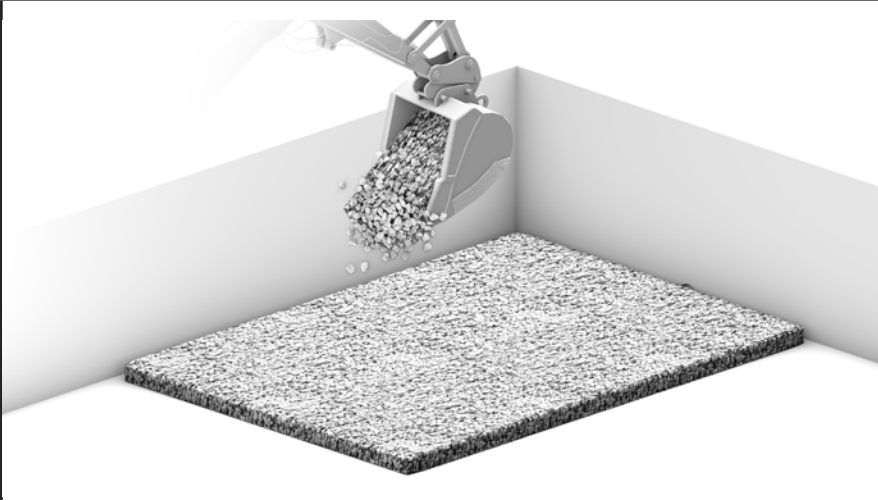
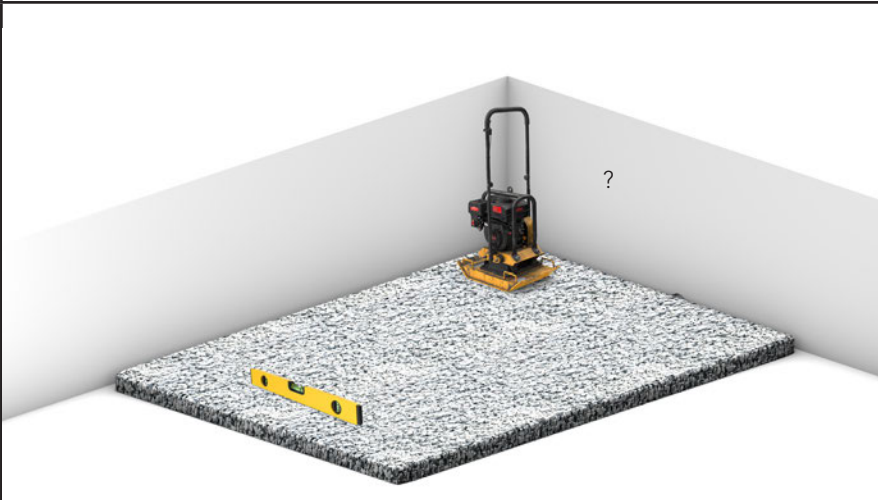
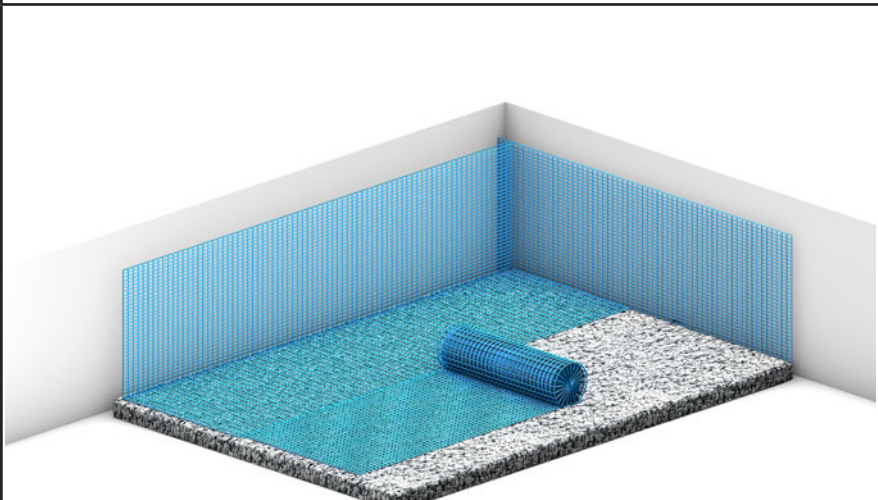


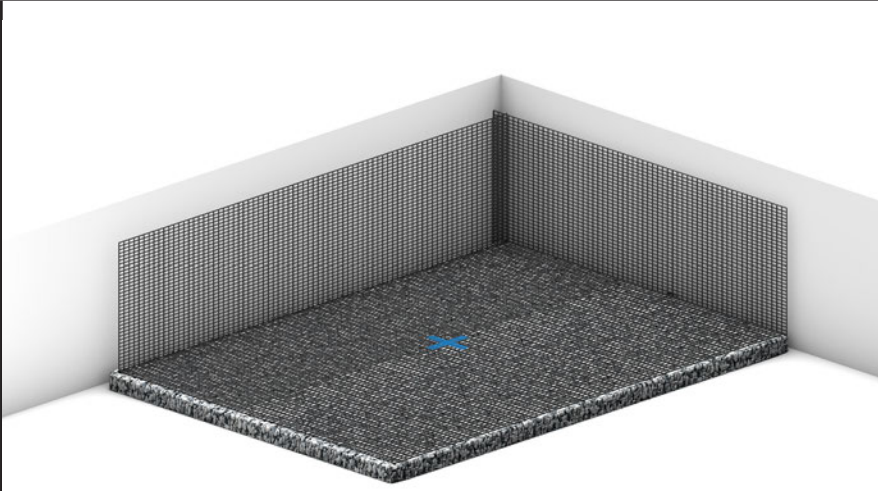
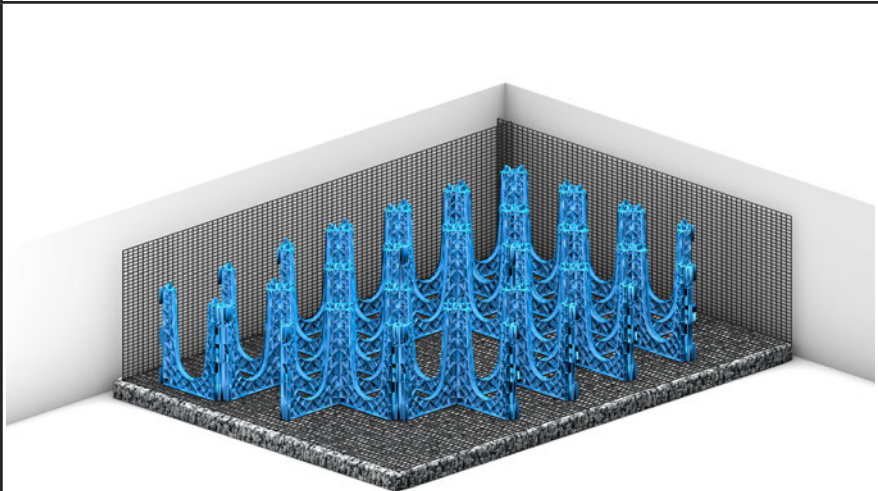
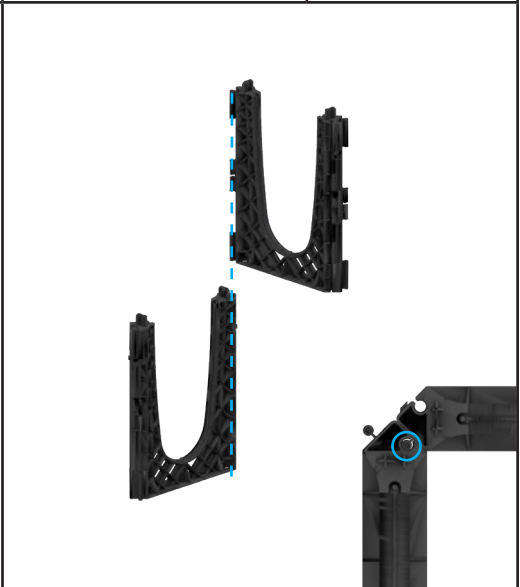
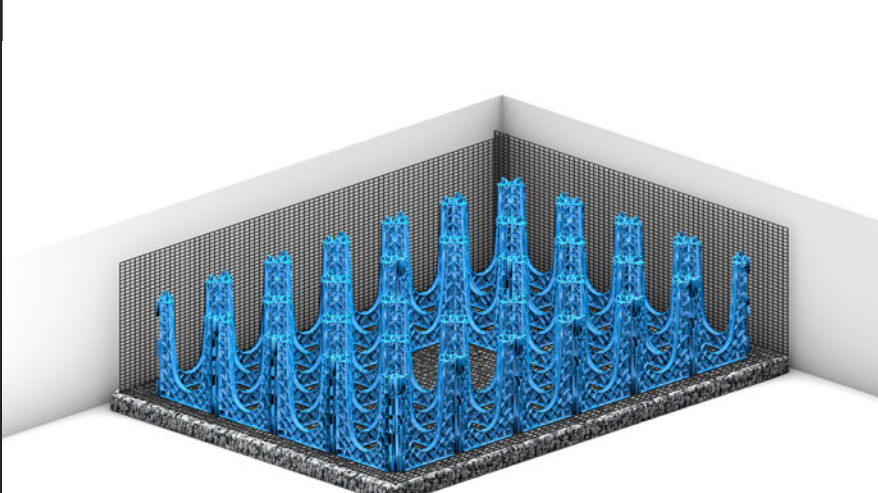
Step 24

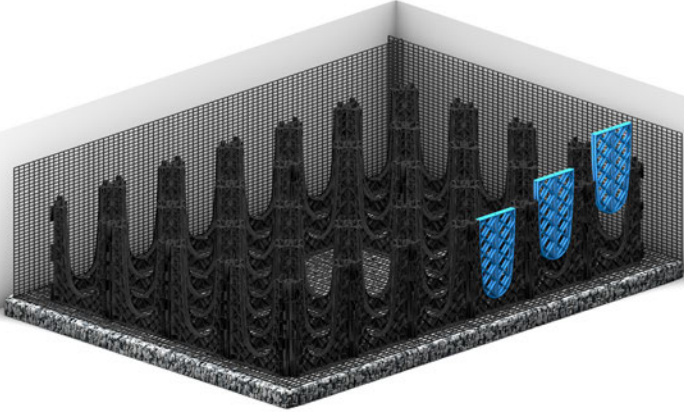
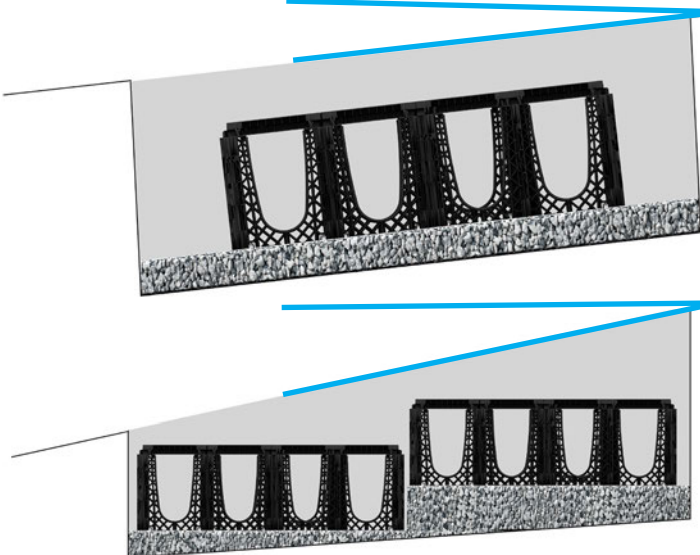
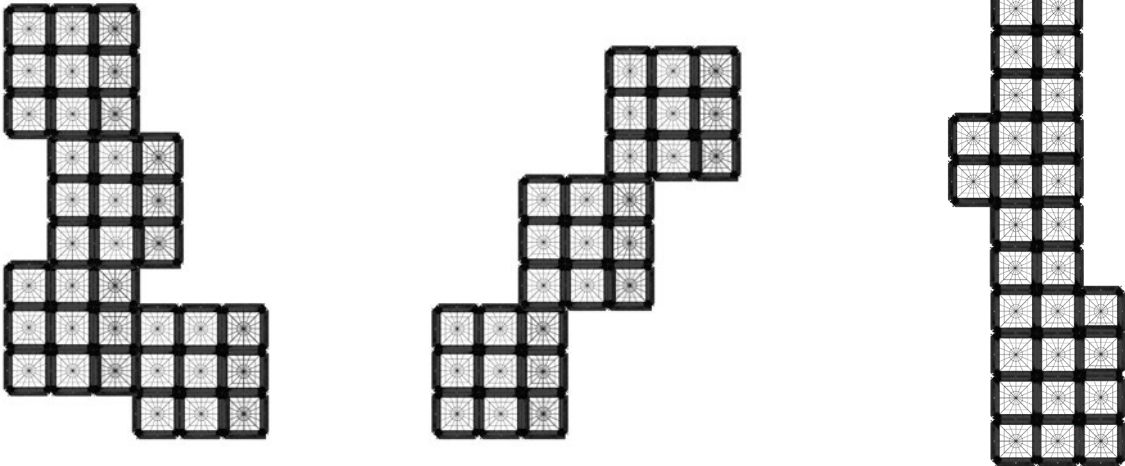
Detailed Guide

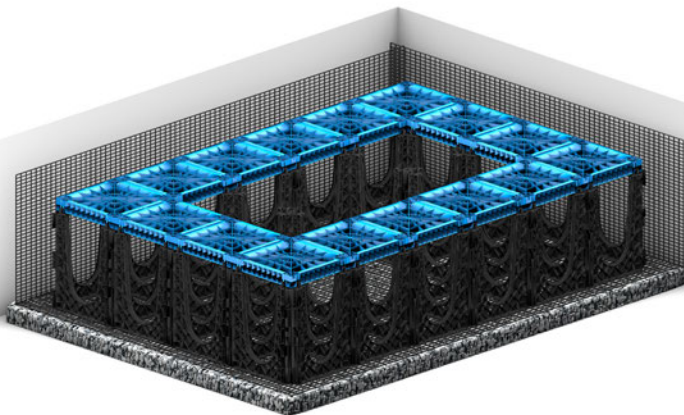
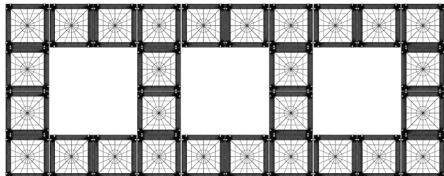
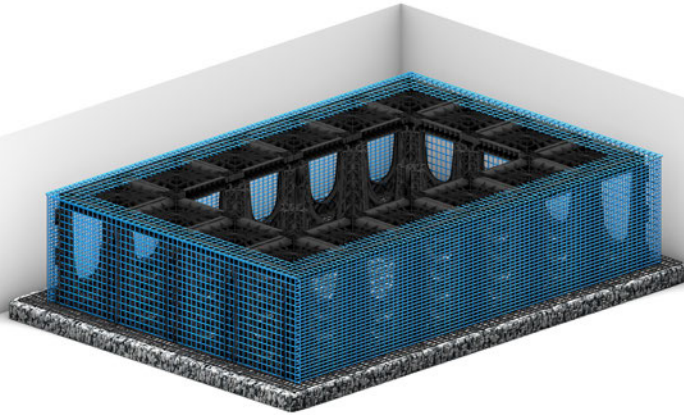
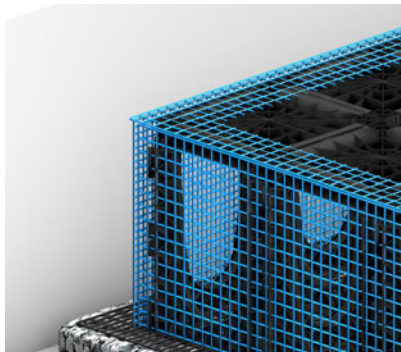
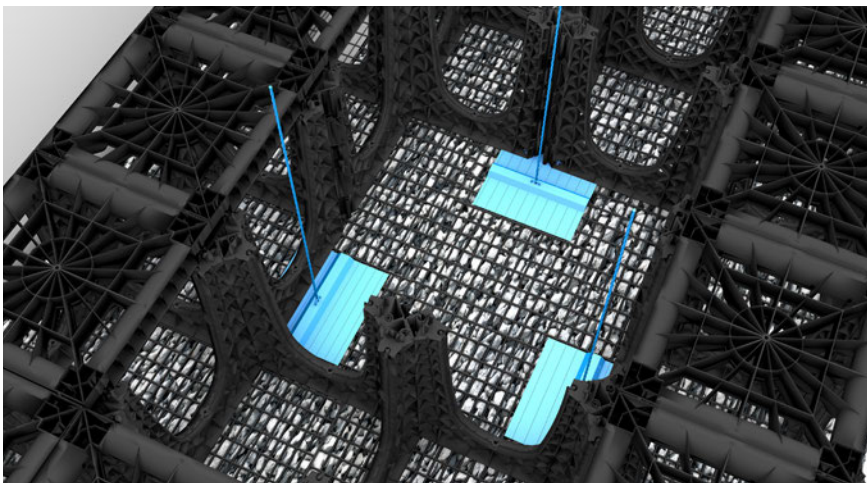
Main guidance	Advice	External ref
 1. Mark location of tree		Refer to engineers drawing
 2. Mark perimeter of RootSpace construction		Refer to engineers drawing
 3. Excavate 300mm beyond RootSpace perimeter	 Straight sides	

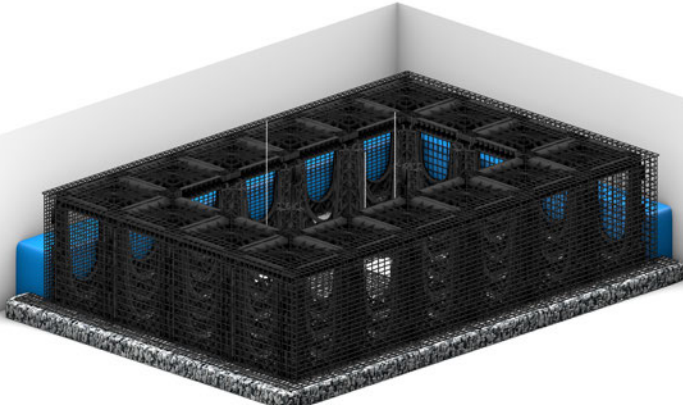
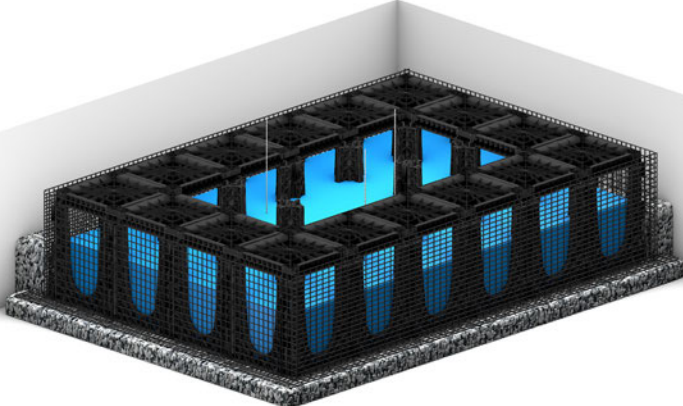
Main guidance	Advice	External ref										
 4. Excavate to correct depth from surface level	<table><tr><td>Tarmac</td><td>*m</td></tr><tr><td>Subbase</td><td>*m</td></tr><tr><td>RootSpace Lid</td><td>75mm</td></tr><tr><td>RootSpace Leg</td><td>600mm</td></tr><tr><td>Drainage layer</td><td>200mm</td></tr></table> Typical tree pit build up. *Refer to engineers drawing	Tarmac	*m	Subbase	*m	RootSpace Lid	75mm	RootSpace Leg	600mm	Drainage layer	200mm	
Tarmac	*m											
Subbase	*m											
RootSpace Lid	75mm											
RootSpace Leg	600mm											
Drainage layer	200mm											
 5. Check CBR of base of tree pit	Add twinwall geonet if CBR below 3% Engineer to approve if CBR below 2%	Refer to engineers drawing										
 6. Install drainage pipe if required	Essential for SuDS tree pits, may be required for standard tree pits	Refer to engineers drawing										

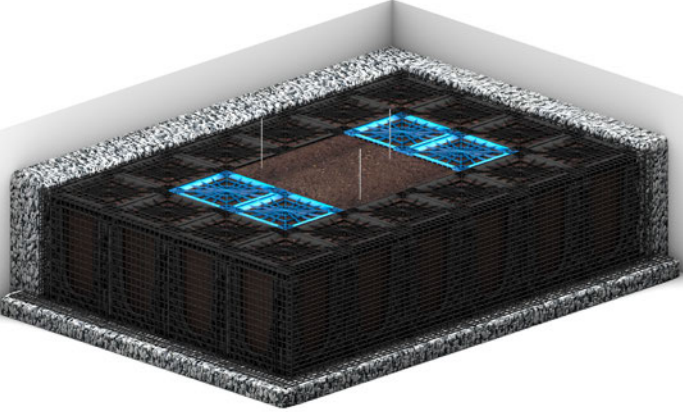
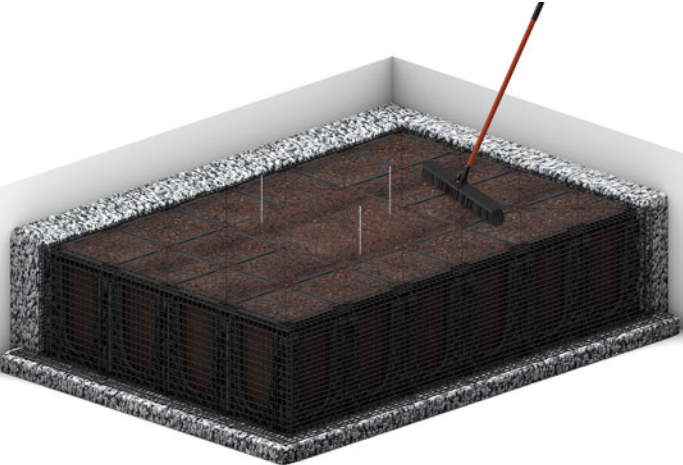
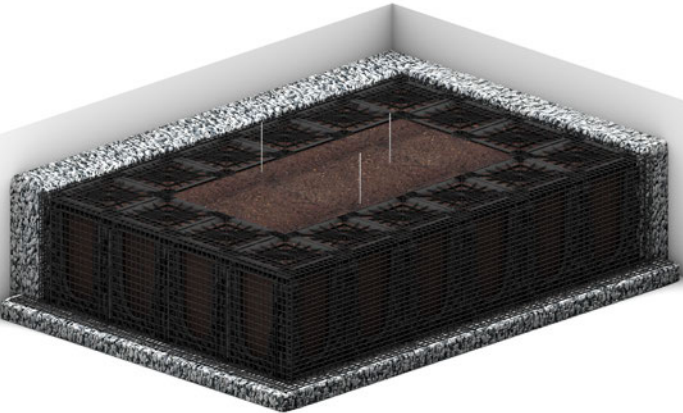
Main guidance	Advice	External ref
 7. Fill drainage stone	Drainage stone to base and sides of tree pit to be clean angular 20-40mm stone with no fines.	
 8. Carefully level and compact to correct depth		Refer to engineers drawing
 9. Lay GRN20 Netting to base and up the sides	Overlap layers of GRN20 by 100mm	

Main guidance	Advice	External ref
 10. Mark exact location of tree - square for space for rootball		Refer to engineers drawing
 11. Construct RootSpace Uprights around tree location		
 12. Complete RootSpace Upright assembly		

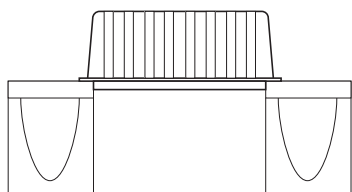
Main guidance	Advice	External ref
 13. Fit side panels	Only supplied if required by engineer	Refer to engineers drawing
Incline 	Suitable for gradients up to (1:20). Gradients greater than (1:20) to be approved by structural engineer. Suitable for any incline.	
Curves 		

Main guidance	Advice	External ref
 14. Fit RootSpace lids around perimeter and strips across tree pit	 Plan view For larger tree pits, ladder Rootspace lids before filling with soil	
 15. Wrap GRN20 Netting around sides of RootSpace structure and secure to RootSpace lids using cable ties	 Ensure GRN20 Netting is lapped over the shoulder of the RootSpace lids and secure with cable ties.	
 16. Install ArborGuy AnchorPlate. Secure wire to RootSpace lids using cable ties	 Real example of anchor plates in situ.	

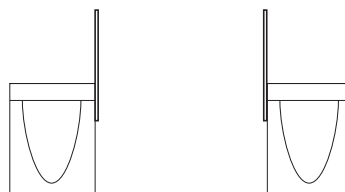
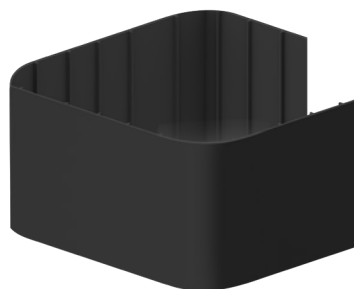
Main guidance	Advice	External ref
 17. Backfill stone around perimeter		
 18. Fill RootSpace with soil	If possible, counter balance back filling of stone with the filling of soil	
 19. Foot treading soil	No compactor plates just light foot treading	

Main guidance	Advice	External ref
 20. Fit remaining lids		
 21. Fill soil to top of lids	Essential due to soil settlement	
 22. Compact perimeter stone		Refer to engineers drawing

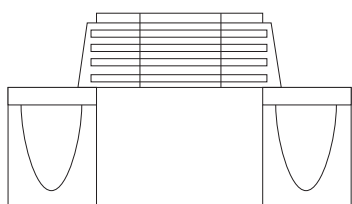
This is a range of optional products used for root control. Refer to engineers drawings to confirm selection.



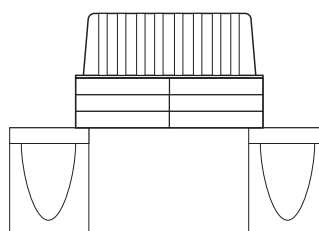
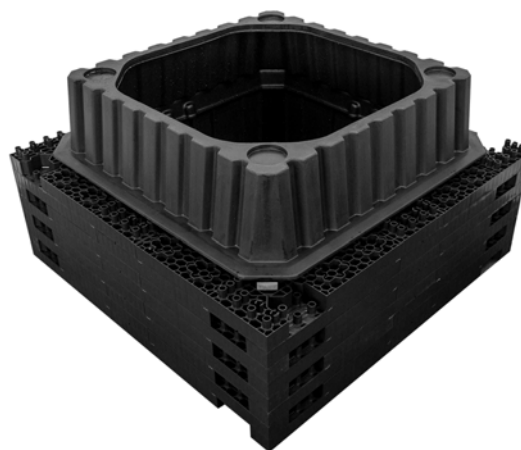
Root Director



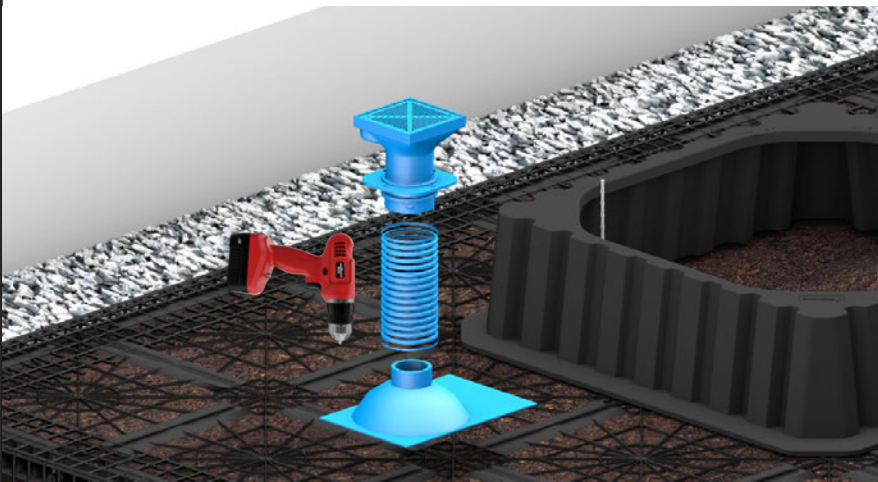
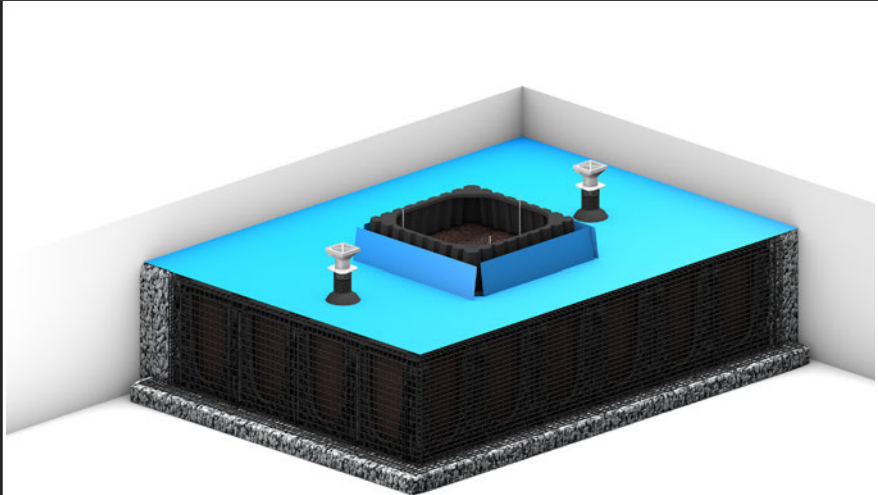
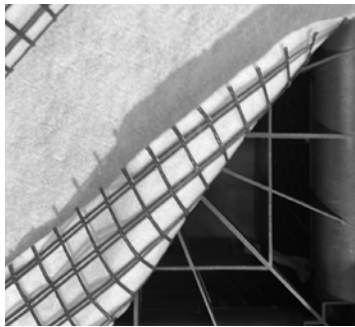
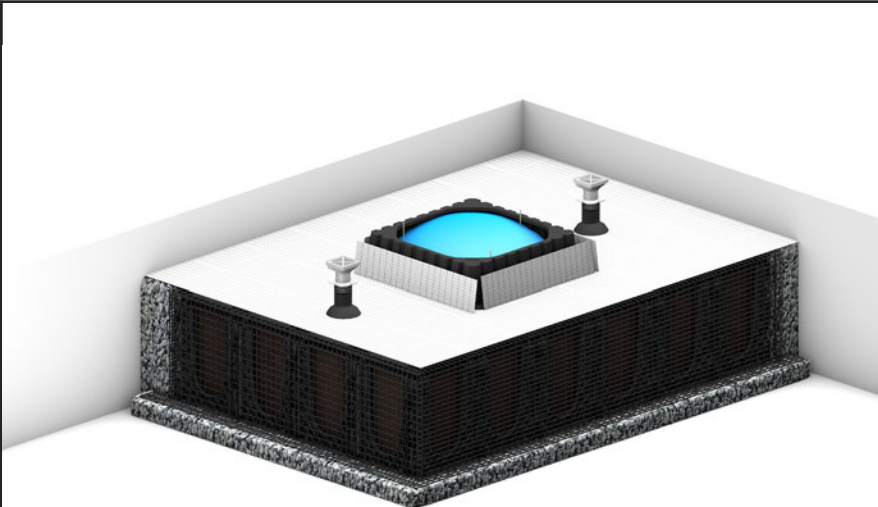
ReRoot Ribbed



RootForm



RootDirector Riser + Root Director

Main guidance	Advice	External ref
 23. Assemble and position ArborVent 150	Securing with screws is preferable	
 24. Lay GLTWGNA Geonet	 Install black side down. Lap up the sides of root directors by 200mm. Installed beyond the perimeter of the RootSpace structure by 300mm.	
 25. Fill RootDirector with soil	Light foot treading only. System now ready for paving to engineers' specification. Please note allowable construction traffic restrictions (refer to Page 3).	

Ongoing tree maintenance
2-4 Weeks after planting Check to see if anchor straps need re-tensioning. Check soil level.
6 months Maintain regular irrigation during growing seasons, frequency and water volume determined by climatic conditions. Visual inspection to check for pest and disease. Clear leaf litter in Autumn. Clear irrigation and aeration inlets with blue filter brush.
5 years Visual inspection to check for pest, disease, and damage. Formative pruning and crown lifting if necessary. Check suitability of grille and guard.
10 years + Check growth and remove guard/grille as required.

Hydro International Warranty, Maintenance and COSHH Statement

This statement covers all Hydro International Hydro-Brake® Optimum, Hydro-Brake® and S-Type Vortex Flow Control units (hereafter referred to as “Flow Control”).

Defects Liability Period Warranty

The standard Hydro International warranty covers products for one year from date of purchase and will only be considered for those defects or faults reported directly to Hydro International in writing. Warranties will not be considered for defects or faults caused by accident, acts of vandalism or unauthorised repair/rectification. Please Contact Hydro International for product specific details.

Maintenance

Normally, little maintenance is required as there are no moving parts within the Flow Control. Experience has shown that if blockages occur they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. The Flow Control (where applicable) is fitted with a pivoting bypass door, which allows the manhole chamber to be drained down should blockage occur. The smaller conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard.

Following installation of the Flow Control it is vitally important that any extraneous material i.e. building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced, please do not hesitate to contact the company so that an investigation may be made.

All Flow Control units are typically manufactured from grade 304 Stainless Steel, and if required they can also be manufactured in grade 316 Stainless Steel. Both materials have an estimated life span in excess of the design life of drainage systems.

COSHH

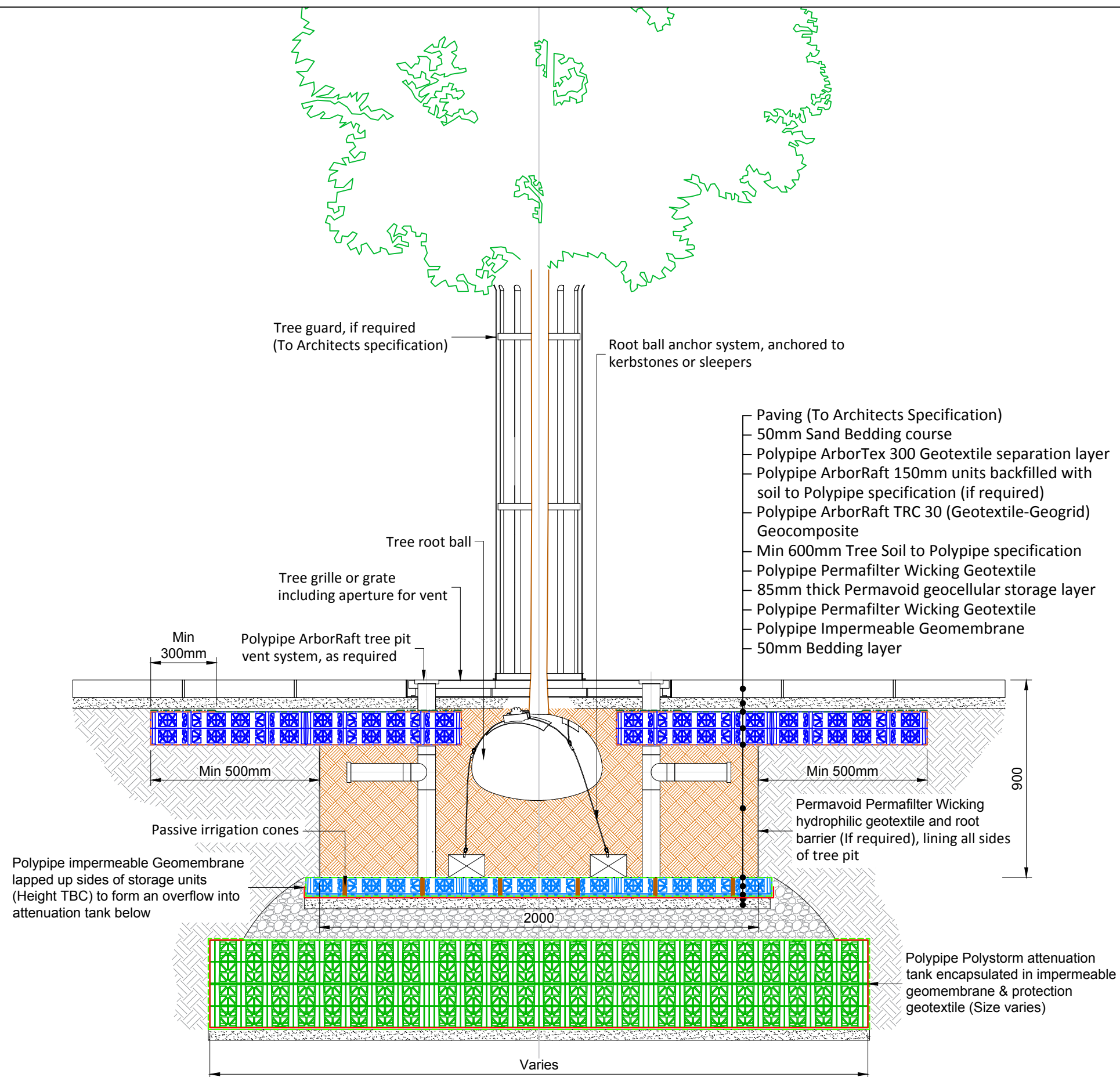
Flow Control units are manufactured from Stainless Steel, which is not regarded as hazardous to health and exhibits no chemical hazard when used under normal circumstances for the stated applications.

Manual Handling

The handling of Flow Control units should be in accordance with the current legislation and regulations:

- The Health and Safety at Work Act 1972
- The Management of Health and Safety at Work Regulations 1999
- The Manual Handling Operations Regulations 1992

All published and printed by the Health and Safety Executive.



Notes

REV	DESCRIPTION	DATE



PROJECT
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CLIENT
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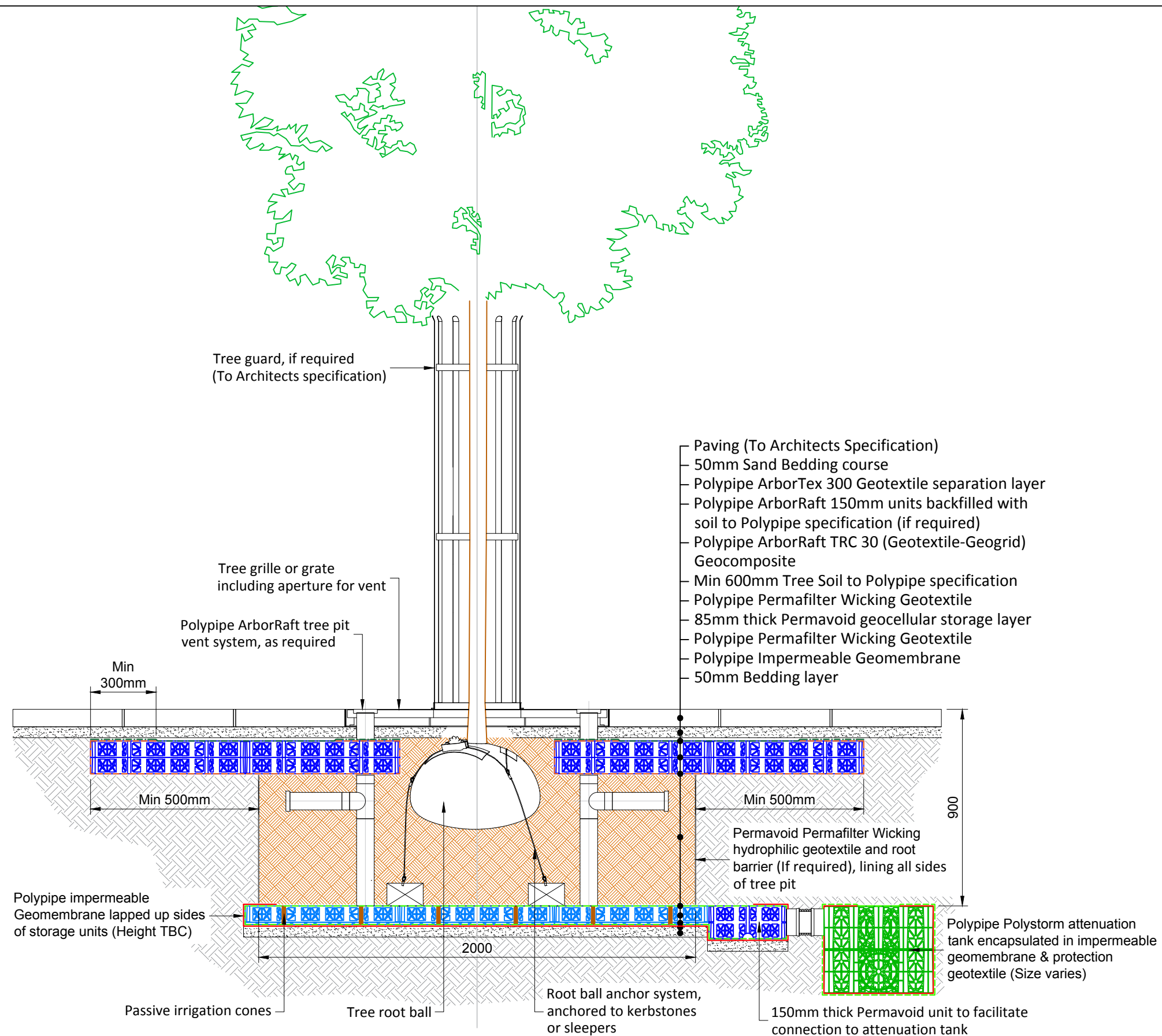
DRAWING TITLE
POLYPIPE ARBORRAFT TREE
PLANTING PIT WITH POLYSTORM
ATTENUATION TANK BELOW
SECTION 01

SCALE @A3 DATE
1:20 30/01/2020

DRAWN BY RAH	CHECKED BY PT	STATUS FOR INFORMATION
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DRAWING No TP-PP-ZZ-XX-DR-Y-0001-	REVISION P01
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TYPICAL SECTION - 01
Scale 1:20



Notes

REV	DESCRIPTION	DATE



PROJECT
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CLIENT
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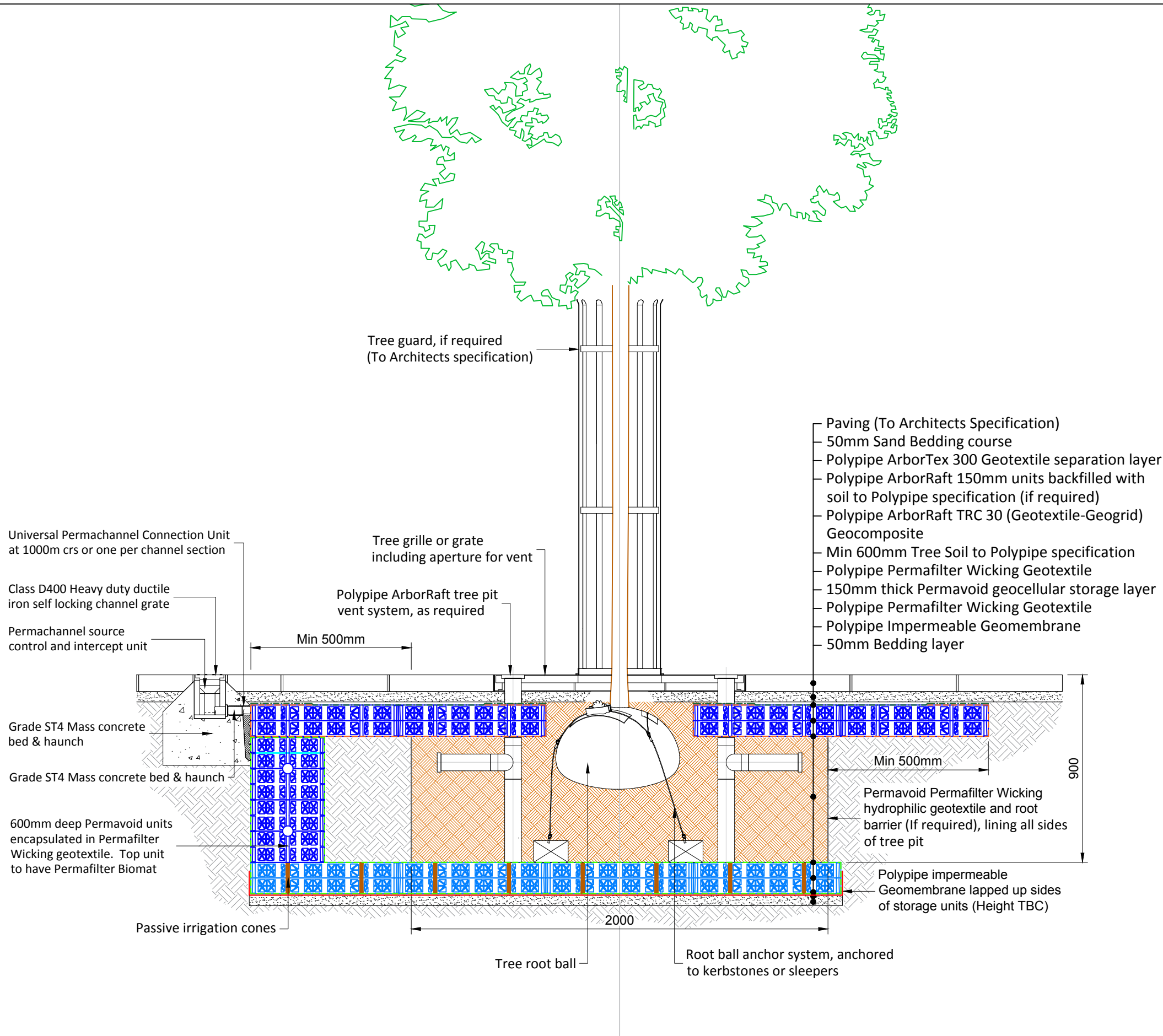
DRAWING TITLE
POLYPIPE ARBORRAFT TREE PLANTING PIT WITH CONNECTION TO ADJACENT POLYSTORM ATTENUATION TANK SECTION 02

SCALE	@A3	DATE
1:20		30/01/2020

DRAWN BY	CHECKED BY	STATUS
RAH	PT	FOR INFORMATION

DRAWING No	REVISION
TP-PP-ZZ-XX-DR-Y-0002-	P01

TYPICAL SECTION - 02
Scale 1:20



TYPICAL SECTION - 03

Scale 1:20

REV	DESCRIPTION	DATE

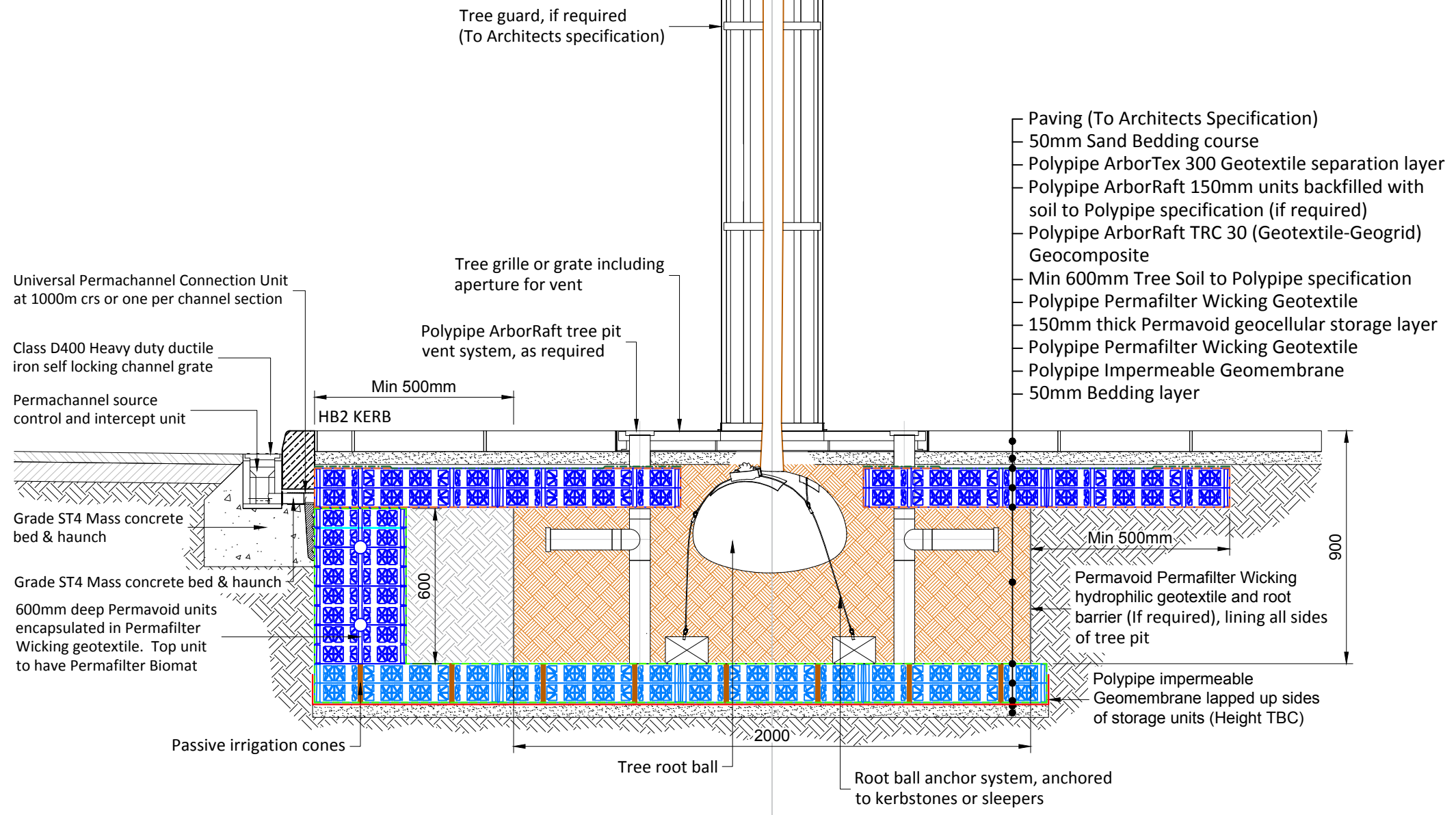
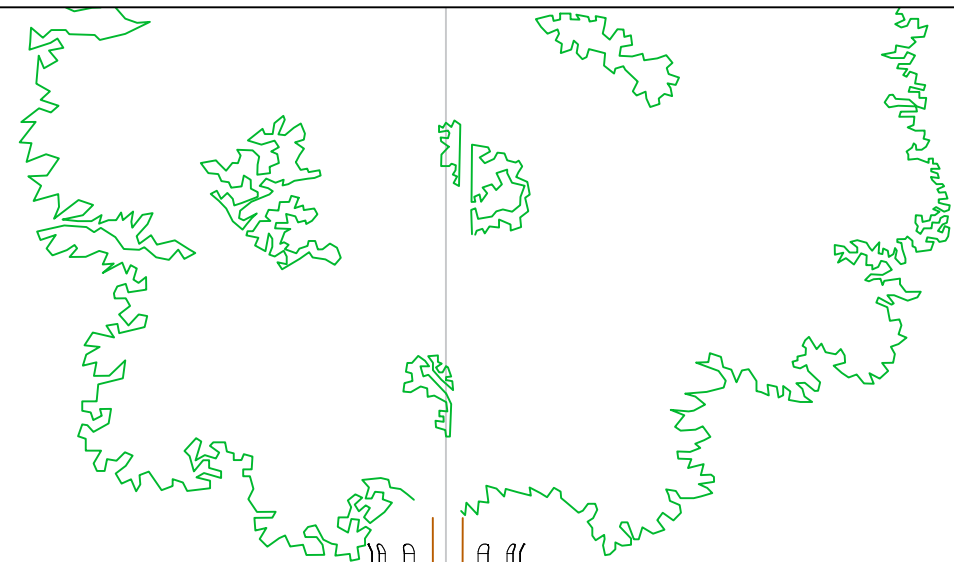


PROJECT
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CLIENT
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DRAWING TITLE
POLYPIPE ARBORRAFT TREE PLANTING PIT WITH CONNECTION FROM PERMACHANNEL SECTION 03

SCALE	@A3	DATE
1:20		30/01/2020
DRAWN BY	CHECKED BY	STATUS
RAH	PT	FOR INFORMATION
DRAWING No	REVISION	
TP-PP-ZZ-XX-DR-Y-0003-	P01	



Notes

REV	DESCRIPTION	DATE



PROJECT
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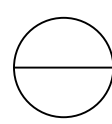
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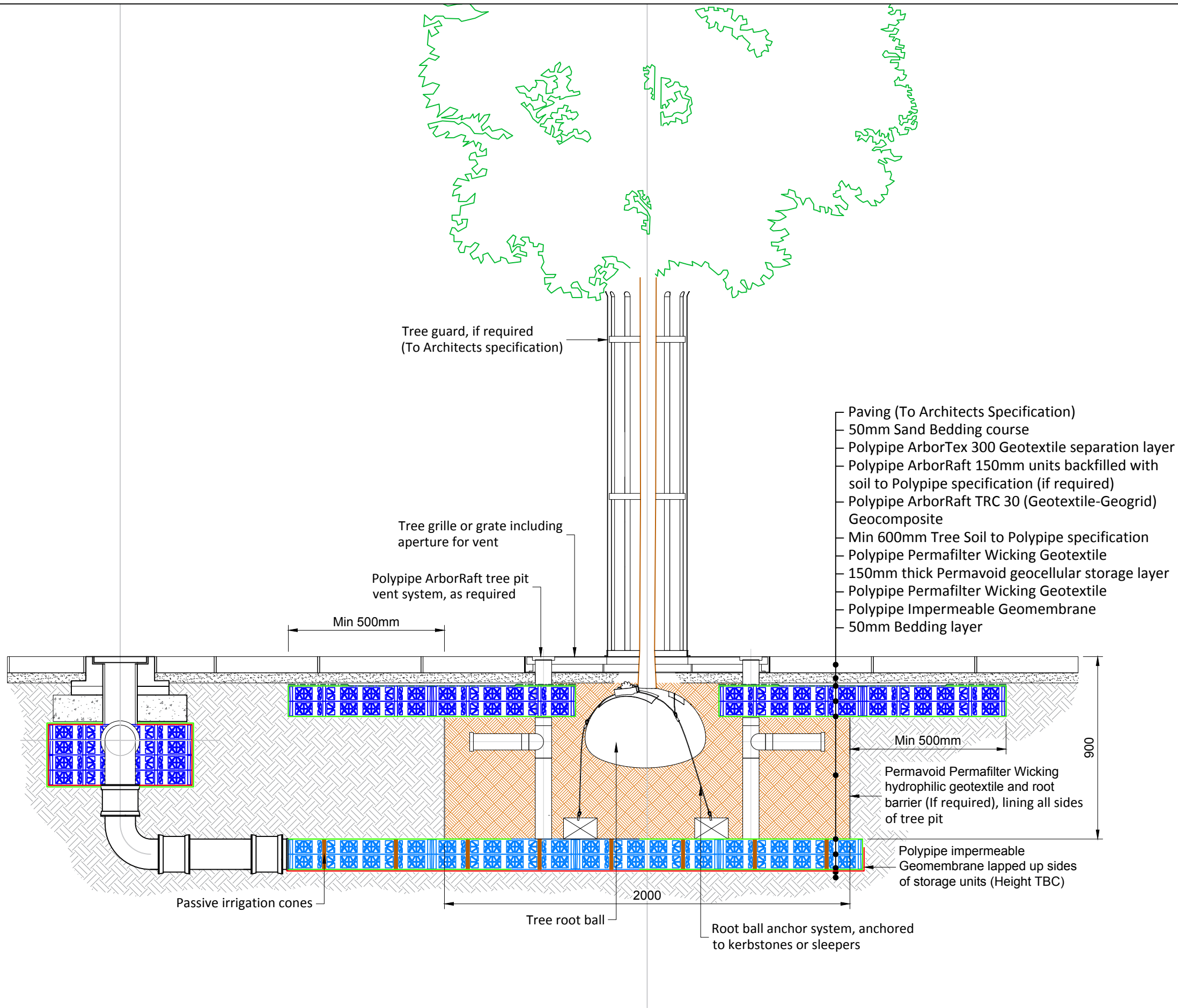
DRAWING TITLE
POLYPIPE ARBORRAFT TREE
PLANTING PIT WITH CONNECTION
FROM PERMACHANNEL
SECTION 04

SCALE 1:20	@A3 DATE 30/01/2020
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DRAWN BY RAH	CHECKED BY PT	STATUS FOR INFORMATION
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DRAWING No TP-PP-ZZ-XX-DR-Y-0004-	REVISION P01
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 **TYPICAL SECTION - 04**
Scale 1:20



REV	DESCRIPTION	DATE



PROJECT
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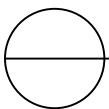
CLIENT
-

DRAWING TITLE
POLYPIPE ARBORRAFT TREE PLANTING PIT WITH CONNECTION FROM ROAD GULLY & GULLYSEPTOR SECTION 06

SCALE	@A3	DATE
1:20		30/01/2020

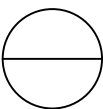
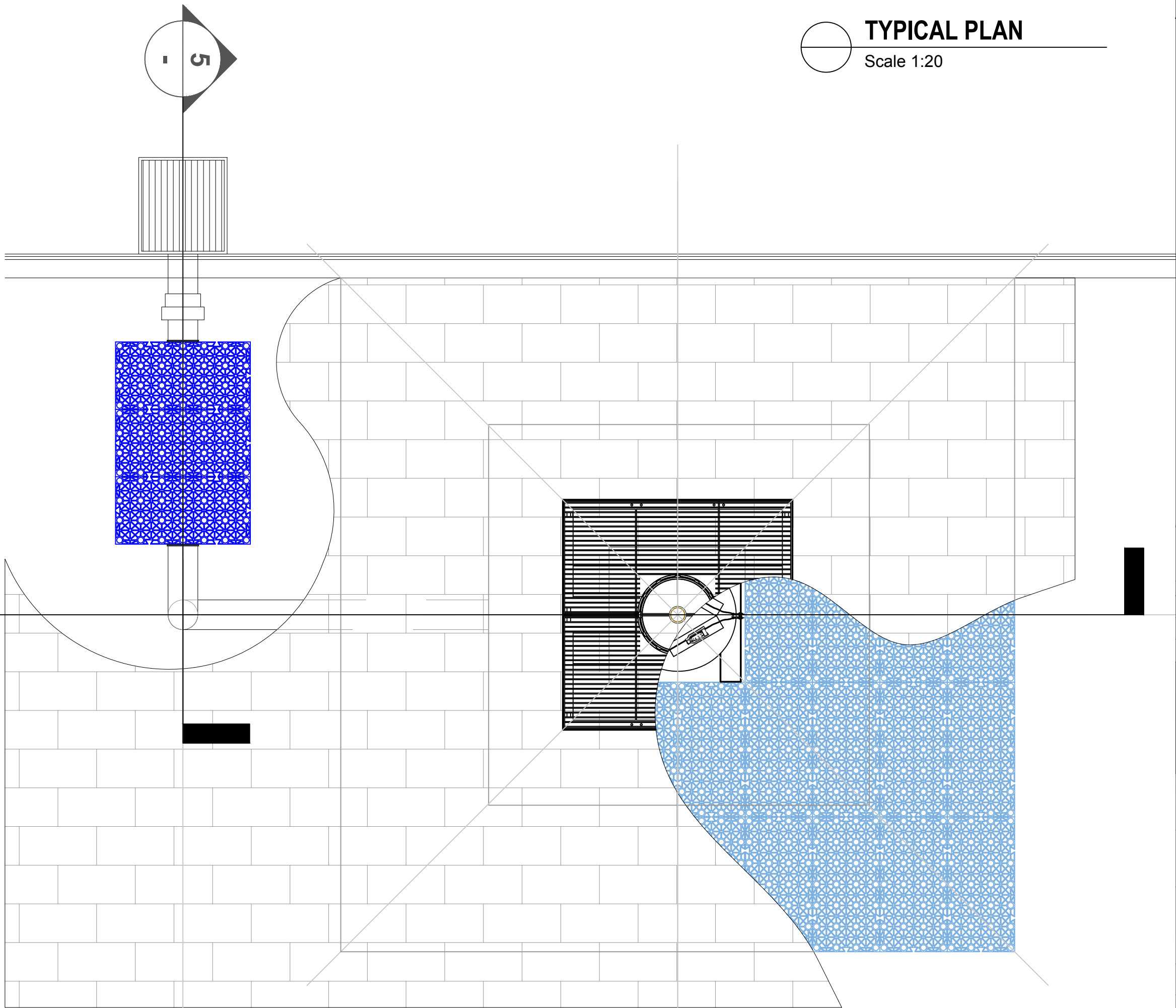
DRAWN BY	CHECKED BY	STATUS
RAH	PT	FOR INFORMATION

DRAWING No	REVISION
TP-PP-ZZ-XX-DR-Y-0006-	P01



TYPICAL SECTION - 06

Scale 1:20



TYPICAL PLAN

Scale 1:20

Notes

REV	DESCRIPTION	DATE



PROJECT
-

CLIENT
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DRAWING TITLE
POLYPIPE ARBORRAFT TREE PLANTING PIT WITH POLYSTORM ATTENUATION TANK BELOW PLAN

SCALE	@A3	DATE
1:20		30/01/2020

DRAWN BY	CHECKED BY	STATUS
RAH	PT	FOR INFORMATION

DRAWING No	REVISION
TP-PP-ZZ-XX-DR-Y-0007-	P01

Appendix K

Drainage and SuDS Checklist

CHECKLIST FOR SUBMISSION- Outline Drainage Design		
Ref.	Detail required	Supplied Y/N
1.	Demonstrate an understanding of the natural drainage characteristics within and adjoining the site.	Y - See Section 3 of FRA
2.	Provide an outline assessment of existing geology, ground conditions and permeability through desk-based research e.g. a review of geology maps and catchment information and site visit observations. Infiltration tests should be carried out at this stage wherever possible.	Y - See Section 3 of FRA
3.	Prepare a <u>Conceptual Drainage Plan</u> to show the above together with: a) The proposed 'management train' b) Indicative location and type of source control c) Site controls with storage locations d) Conveyance and exceedence routes e) The destination of runoff.	Y See DWGs Y in Appendix H- Y of the FRA Y Y
4.	Provide a <u>Conceptual SuDS Design Statement</u> describing: a) The SuDS Design Criteria applicable to the site b) Reasoning for inclusion of the selection of SuDS features c) Indicative runoff rate calculations and attenuation volumes for the lifetime of the development d) Integration with landscape design e) Any phasing plan for the development f) Management of health and safety risks g) Explanation of land use decision and how they impact drainage h) Proposed method of flow control i) Information regarding the proposed number of treatment stages to be applied to each element of the site j) Demonstration that surface water/groundwater entering the development from adjacent land has been taken into account.	Y Refer to Section Y 6 and 7 of the Y FRA Y Y Y Y Y Y Y



bdcgroup.co.uk

Billericay

Unit 5 – First Floor
Lake Meadows Business Park
Woodbrook Crescent,
Billericay, Essex
CM12 0EQ
T: +44 (0)1277 314 455

London

Tower Bridge Business Centre
Office.311
46-48 East Smithfield
London
E1W 1AW
T: +44 (0)207 871 7783