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Flood Risk and Surface Water Assessment Rev0

Land to the rear of 18 Denmark Street,
London,
N17 0JL

9 December 2022

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Appendices

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Prepared by	Checked by	Date
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This document has been prepared solely as a Flood Risk and SuDS Assessment for Atlas Property London. Base Energy accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

1. Introduction

This Flood Risk and SuDS Assessment has been prepared to support the planning application for the proposed residential development on a portion of land located to the rear of 18 Denmark Street.

Existing Site Description

The proposed site is currently enclosed backland.

Development Proposals

Proposals are for six residential dwellings with associated hard and soft landscaped areas. A copy of the proposed site layout plans is provided in **Appendix A**.

2. Planning Policy - Flood Risk and Surface Water Management

National Planning Policy Framework

The aim of the National Planning Policy Framework (NPPF) (and accompanying Planning Practice Guidance (PPG)) is to direct development away from areas at highest risk of flooding; where development is necessary, it should be made safe without increasing flood risk elsewhere.

The NPPF states that a Flood Risk Assessment (FRA) is required to support a planning application for developments that are:

- located in Flood Zone 2 and/or Flood Zone 3
- located in Flood Zone 1 and comprise 1ha or above

In some instances, for example where a site is located in Flood Zone 1 and comprises less than 1ha, an FRA may be required if the site is within an area which has critical drainage problems (i.e. a Critical Drainage Area - CDA) as notified to the Local Authority by the Environment Agency (EA).

In order to provide an indication of the flood zone classification of the site, and to ascertain whether an FRA is required, the starting point is the EA flood maps which are available on the EA website.

Environment Agency Flood Map

The EA flood maps show fluvial and tidal flood outlines based on the following:

- Flood Zone 1 - land assessed as having less than 1 in 1000 annual probability of river or sea flooding
- Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding, or between a 1 in 200 and 1 in 1000 annual probability of flooding from the sea
- Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding, or a 1 in 200 or greater annual probability of flooding from the sea

The flood maps available on the EA website indicate that parts of the site are located in Flood Zone 2 and therefore an FRA is required.

The London Plan 2021

Policy SI 12 Flood risk management

A Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

B Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.

C Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

D Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.

G Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat

Policy SI 13 Sustainable drainage:

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

- 1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
- 2) rainwater infiltration to ground at or close to source
- 3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
- 4) rainwater discharge direct to a watercourse (unless not appropriate)
- 5) controlled rainwater discharge to a surface water sewer or drain
- 6) controlled rainwater discharge to a combined sewer.

C Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

9.13.1 London is at particular risk from surface water flooding, mainly due to the large extent of impermeable surfaces. Lead Local Flood Authorities have responsibility for managing surface water drainage through the planning system, as well as ensuring that appropriate maintenance

arrangements are put in place. Local Flood Risk Management Strategies and Surface Water Management Plans should ensure they address flooding from multiple sources including surface water, groundwater and small watercourses that occurs as a result of heavy rainfall.

9.13.2 Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off. **Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems.** A blue roof is an attenuation tank at roof or podium level; the combination of a blue and green roof is particularly beneficial, as the attenuated water is used to irrigate the green roof.

9.13.3 For many sites, **it may be appropriate to use more than one form of drainage**, for example a proportion of rainwater can be managed by more sustainable methods, with residual rainwater managed lower down the hierarchy. In some cases, direct discharge into the watercourse is an appropriate approach, for example rainwater discharge into the tidal Thames or a dock. This should include suitable pollution prevention filtering measures, ideally by using soft engineering or green infrastructure.

In addition, if direct discharge is to a watercourse where the outfall is likely to be affected by tide-locking, suitable storage should be designed into the system. However, in other cases direct discharge will not be appropriate, for example discharge into a small stream at the headwaters of a catchment, which may cause flooding. This will need to be assessed on a case-by-case basis, taking into account the location, scale and quality of the discharge and the receiving watercourse. The maintenance of identified drainage measures should also be considered in development proposals.

9.13.4 The London Sustainable Drainage Action Plan complements this policy. It contains a series of actions to make the drainage system work in a more natural way with a particular emphasis on retrofitting

Haringey Council

Local SuDS Standards

Haringey Council Local SuDS Standards document states:

SuDS Principles

LS1a Sustainable drainage systems are to be designed to control surface water run off close to where it falls as rainfall and mimic natural drainage as closely as possible in accordance with National Planning Practice Policy.

LS1b Proposals for SuDS must result in capture for reuse, discharge into the ground, to a surface water body or, where these are demonstrated to be not achievable, to the storm sewer or combined sewer where no storm sewer is available. The destination of runoff for proposed SuDS must be justified using a methodology acceptable to Haringey.

LS1c Storage and treatment of surface runoff should be provided through provision of a management train.

Peak flow control

LS2a For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

LS2b The design of the drainage system accounts for the likely impacts of climate change and potential changes in impermeable area over the design life of the development.

LS3a For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

LS3b Where Greenfield rates cannot be achieved Haringey request that 50% of the Greenfield runoff rate attenuation volume be provided and outflows controlled to Greenfield runoff rates.

LS3c For developments which were previously developed, the design of the drainage system accounts for the likely impacts of climate change and potential changes in impermeable area over the design life of the development.

Volume control

LS4 To ensure no increase in flood risk elsewhere, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

LS5 To make provision for reduction in catchment floodrisk, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event. Haringey will seek to ensure that all means of volume reduction have been fully explored.

LS6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with **S4** or **S5** above, the runoff volume must be discharged at a rate that does not adversely affect flood risk. Haringey will request this rate to be a maximum discharge rate of Q_{bar} for the 1 in 100 year rainfall event with allowance made for climate change and application of urban creep where appropriate. Where development proposals do not meet these proposals Haringey will request that detailed hydraulic modelling be provided to demonstrate that there is no increased flood risk elsewhere in the receiving catchment.

Flood risk within the development

LS7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.

LS8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

LS9a The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.

LS9b SuDS design to ensure resilience to blockage and provide for exceedance. Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure, blockage of inlets or outlets, blockage of pipes, impediments along conveyance routes), and the associated flood risks reduced where possible.

LS9c Where development proposals do not meet these proposals Haringey will request that detailed hydraulic modelling be provided to demonstrate the risk of flooding within the development is manageable and that there is no increased flood risk elsewhere in the receiving catchment.

Structural integrity

LS10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

LS11 The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.

Designing for maintenance considerations

LS12 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity. Designs should ensure accordance with **S1a** before pumping is considered.

Construction

LS13 The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.

LS14 Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.

Water Quality

LS15 For greenfield developments, the frequency of runoff from the development to any highway drain, sewer or surface water body should not be increased. The surface water runoff should be managed to prevent any discharge of surface water from the site for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events. This should be achieved for the majority of all rainfall events that take throughout the year. S1a should be adhered to, otherwise the design should demonstrate that there is no runoff from 80% of rainfall events during summer events and 50% for winter rainfall events using time series rainfall hydraulic modelling analysis.

LS16 Where surface water is likely to be contaminated, effective management is required to reduce contaminant loads and concentrations in the runoff to acceptable levels, in order minimise the risk of pollution of receiving waterbodies and/or protect receiving sewers.

The London Plan 2021

Policy SI 13 Sustainable Drainage states:

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

- 1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
- 2) rainwater infiltration to ground at or close to source
- 3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
- 4) rainwater discharge direct to a watercourse (unless not appropriate)
- 5) controlled rainwater discharge to a surface water sewer or drain
- 6) controlled rainwater discharge to a combined sewer.

C Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

9.13.1 London is at particular risk from surface water flooding, mainly due to the large extent of impermeable surfaces. Lead Local Flood Authorities have responsibility for managing surface water drainage through the planning system, as well as ensuring that appropriate maintenance arrangements are put in place. Local Flood Risk Management Strategies and Surface Water Management Plans should ensure they address flooding from multiple sources including surface water, groundwater and small watercourses that occurs as a result of heavy rainfall.

9.13.2 Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off. **Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems.** A blue roof is an attenuation tank at roof or podium level; the combination of a blue and green roof is particularly beneficial, as the attenuated water is used to irrigate the green roof.

9.13.3 For many sites, **it may be appropriate to use more than one form of drainage**, for example a proportion of rainwater can be managed by more sustainable methods, with residual rainwater managed lower down the hierarchy. In some cases, direct discharge into the watercourse is an

appropriate approach, for example rainwater discharge into the tidal Thames or a dock. This should include suitable pollution prevention filtering measures, ideally by using soft engineering or green infrastructure.

In addition, if direct discharge is to a watercourse where the outfall is likely to be affected by tide-locking, suitable storage should be designed into the system. However, in other cases direct discharge will not be appropriate, for example discharge into a small stream at the headwaters of a catchment, which may cause flooding. This will need to be assessed on a case-by-case basis, taking into account the location, scale and quality of the discharge and the receiving watercourse. The maintenance of identified drainage measures should also be considered in development proposals.

9.13.4 *The London Sustainable Drainage Action Plan complements this policy. It contains a series of actions to make the drainage system work in a more natural way with a particular emphasis on retrofitting.*

Non-Statutory Technical Standards for SuDS

The Non-Statutory Technical Standards for SuDS, (and accompanying Local Authority SuDS Officer Organisation (LASOO) Practice Guidance) sets out the details which should be addressed within a SuDS Report, including:

- *Flood Risk Outside of the Development*
- *Peak Flow Control and Volume Control*
- *Flood Risk Within the Development*
- *Runoff Destinations*
- *Structural Integrity*
- *Designing for Maintenance Considerations*
- *Construction*

3. Sources of Flood Risk

Fluvial Flood Risk

The site is shown to be located largely within Flood Zone 2, with a small section in Flood Zone 1.

More detailed flood information has been obtained from the Environment Agency. A copy of the information is provided in **Appendix B**.

Detailed Flood Map

The more details flood map confirms that the site is within the 1 in 1000 year flood outline, with 2D levels of 10.05m AOD.

The EA has also provided an historic flood map for an event from 1947. The site is shown to have been flood free during this event.

Flood mitigation measure are outlined in the following section.

Groundwater Flooding

Groundwater flooding generally occurs during intense, long-duration rainfall events, when infiltration of rainwater into the ground raises the level of the water table until it exceeds ground levels. It is most common in low-lying areas overlain by permeable soils and permeable geology, or in areas with a naturally high water table.

Reference has also been made to the British Geological Survey geology maps; these indicate that the site is underlain by Enfield Silt Member (clay and silt). The underlying bedrock is comprised of London Clay.

Based on the above, the risk of groundwater flooding is considered to be low.

Surface Water Flooding

Surface water flooding results from rainfall generated overland flows, before the runoff reaches a watercourse/ drainage system, or where the watercourse/ drainage system is overwhelmed and unable to accept further runoff. Surface water runoff is usually associated with high intensity rainfall events but may also occur with lower intensity rainfall where the ground is saturated, developed or otherwise has low permeability resulting in overland flows and ponding within depressions in the topography.

The EA provide maps on their website which illustrate the risk of surface water flooding along with potential depths and velocities; the maps show that the site is at low to medium risk of surface water flooding with potential depths in the region of 300mm.

The surface water drainage strategy outlined in the following section will provide betterment when compared with the existing situation, and will sustainably manage flows over the lifetime of the development.



Figure 2 - Environment Agency Surface Water Flooding Map

Sewer Flooding

Sewer flooding occurs when the capacity of underground sewerage systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters.

There are no known records of surface water flooding at the site location.

4. Flood Mitigation Measures

Finished Floor Levels

Finished floor levels will be set above existing ground levels.

Flood Resilient Measures

Wherever feasible, flood resilient measures will be included in line with guidance provided in the Communities and Local Government Document, *Improving the Flood Performance of New Buildings: Flood Resilient Construction*¹. These could include:

- Where possible, all service entries will be sealed (e.g. with expanding foam or similar closed cell material).
- Pipework: Closed cell insulation
- Drainage services: Non-return valves in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging. Maintenance of these valves is important to ensure their continued effectiveness.
- Water, electricity and gas meters raised
- Electrical services: electrical sockets raised

¹ Improving the Flood Performance of New Buildings: Flood Resilient Construction. Department for Communities and Local Government. May 2007.

5. Surface Water and SuDS

The whole site comprises approximately 700m².

As previously noted, the site is currently enclosed backland.

The proposed site areas are broken down as follows:

- Roof areas - ~360m²
- Hardstanding (paving, parking areas, terraces etc) - ~200m²
- Landscaped areas - ~140m²

As previously noted, Policy 9.13.2 of the London Plan 2021 states: *Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off. Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems.*

As such, in the first instance the **ICP SuDS** method within Micro Drainage has been used to calculate flow rates from the total site (as detailed in **Appendix C** and shown in **Table 1**).

Table 1 – ICP SuDS – Total Site Greenfield Runoff Rates (l/s)

Return Period	Flow Rate from 700m ² (0.07ha) (l/s)
Qbar	0.1
1 in 30 year	0.2
1 in 100 year	0.3

The London Plan 2021 Hierarchy

The following outlines the most feasible ways to manage surface water runoff in line with the London Plan hierarchy.

1) Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)

There is the potential for simple rainwater harvesting. See the following section of this report.

2) Rainwater infiltration to ground at or close to source

At the time of writing, no site / ground investigation or infiltration testing (to BRE Digest 365) has been undertaken to confirm the underlying ground conditions.

As such, and as previously detailed, the British Geological Survey geology maps; these indicate that the site is underlain by Enfield Silt Member (clay and silt). The underlying bedrock is comprised of London Clay.

Reference has also been made to the BGS borehole records; a record is available for the nearby Manor Road, and this confirms the presence of London Clay (see **Appendix D**).

On this basis, and without further investigative works, we would not recommend full infiltration of surface water.

3) Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)

Some of the planted areas could act as rain gardens or conveyance routes for surface water flows.

4) Rainwater discharge direct to a watercourse (unless not appropriate)

There are no watercourse sin the immediate vicinity of the site.

5) Controlled rainwater discharge to a surface water sewer or drain

The most feasible option to manage the remainder of surface water from new hardstanding areas is through attenuation storage with a controlled outlet into the surface water sewer.

6) Controlled rainwater discharge to a combined sewer.

See above.

SuDS Options

SuDS aim to mimic natural drainage and can achieve multiple objectives such as removing pollutants from urban runoff at source, controlling surface water runoff from developments, ensuring that flood risk is not increased further downstream and combining water management with green space which can increase amenity and biodiversity value. When selecting SuDS, consideration needs to be given to a range of factors including the ground conditions, type of proposals, and the constraints of the site.

Based on the review of the London Plan 2021 drainage hierarchy, and recording the underlying ground conditions and constraints of the site, the following SuDS are proposed:

- Simple rainwater recycling (water butt)
- Attenuation storage with a controlled outlet into the public surface water sewer

Water Butts

In order to provide a level of rainwater recycling, water butts will be provided. Water butts afford the opportunity to reduce the impact on already stretched potable water supply by enabling future occupants to reuse water collected in the water butt, for example when watering the garden/or washing cars etc. If this supply is used frequently this may also ensure that some additional storage is available during an extreme rainfall event.

Attenuation Storage with Controlled Outlet

Attenuation storage with a controlled outlet into the public sewer system would be feasible, subject to agreement from Thames Water.

Micro Drainage has been used to calculate storage for surface water runoff from hardstanding areas (~560m²) in up to the 1 in 100 year plus 40% allowance for climate change.

Flows have been restricted to 0.3l/s; this is the existing 1 in 100 year greenfield rate of runoff (see **Table 1**).

As shown in **Appendix E**, a total storage volume of 36.1m³ will be required. The storage has been designed at a depth of 1.5m, filling to 1.0m and with a 0.5m freeboard provided, should any excess flows be received.

The storage could feasibly be provided beneath the parking areas.

SuDS Maintenance

Operation and maintenance schedules are provided below (taken from Ciria C753 The SuDS Manual): these, or similar schedules, will be adopted by the property owners.

Water Butt

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	<i>The water butt should be routinely checked for litter – leaves can become trapped in the water butt which could lead to blockage of the taps and overflow</i>	Monthly
	<i>Where appropriate, and if safe to do so, the water butt should be cleaned annually to prevent smells associated with stagnant water, and to remove any algae.</i>	Annually

Option 1 - Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface) Stabilise and mow contributing areas Removal of weeds or management using glyphosphate applied directly into the weeds	As required
Remedial Actions	Remediate any landscaping which through vegetation maintenance or soil slip has been raised to within 50mm of the level of the paving Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users	As required

Option 2 - Attenuation Storage

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 risks to performance)	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/ rehabilitate inlets, outlet, overflow, 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 five years, or as required

Pipe System

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 risks to performance)	Monthly

	Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
	Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid damage to system	Monthly or as required
Remedial Actions	Repair physical damage if necessary	As required
Monitoring	Inspect all inlets, outlets and vents to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

Hydrobrake

Hydro International Warranty, Maintenance Statement

The following has been provided by Hydro International:

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.

Timescales

The SuDS system will be given consideration at the earliest opportunity. In the first instance, Building Control will be consulted to discuss the strategy and to ensure that the SuDS will be appropriately installed.

6. Conclusions

This Flood Risk and SuDS Assessment has been prepared to support the planning application for the proposed residential development on a portion of land located to the rear of 18 Denmark Street.

The proposed site is currently enclosed backland.

Proposals are for six residential dwellings with associated hard and soft landscaped areas.

Flood Risk

The site is shown to be located largely within Flood Zone 2, with a small section in Flood Zone 1.

Based on the desktop study of underlying ground conditions, the risk of groundwater flooding is considered to be low.

The EA surface water flooding maps show that the site is at low to medium risk of surface water flooding with potential depths in the region of 300mm.

There are no known records of surface water flooding at the site location.

Flood Mitigation

Finished floor levels will be set above existing ground levels.

Wherever feasible, flood resilient measures will be included in line with guidance provided in the Communities and Local Government Document, *Improving the Flood Performance of New Buildings: Flood Resilient Construction*'.

Surface Water and SuDS

Based on the review of the London Plan 2021 drainage hierarchy, and recording the underlying ground conditions and constraints of the site, the following SuDS are proposed:

- Simple rainwater recycling (water butt)
- Attenuation storage with a controlled outlet into the public surface water sewer

Appendices

Appendix A - Proposed Site Layout Plans



GENERAL PLANNING NOTES

1. No dimensions to be scaled from this drawing.

2. All errors, omissions or inconsistencies to be reported to the architect immediately.

3. Use figured dimensions only. All dimensions to be checked on site prior to construction and/or fabrication.

01 Proposed First Floor
1:100 @ A1

PLANNING

Project No. 2210

Client Atlas Property London Ltd

Date

Scale 1:100 @ A3 / 1:200 @ A1

Project 18, Darnley Street, N17 0JL

Drawing Title: Proposed First Floor Plan

Drawing No. 10_10_11 Rev.

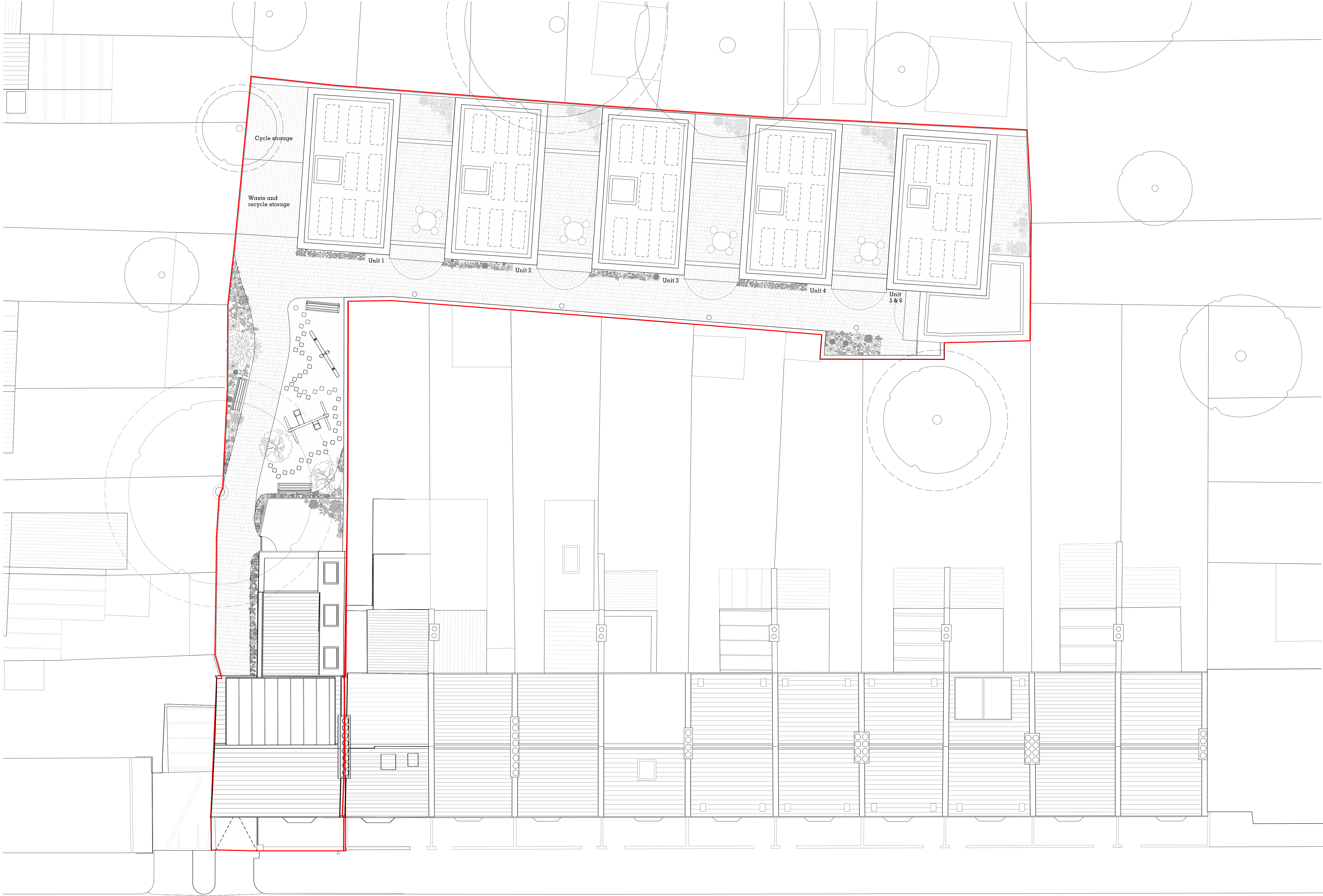
Drawn Approved Signed

Copyright Hill Patru Architects.

No implied license exists. This drawing should not be used to calculate areas for the purposes of valuation. All dimensions to be checked on site by the contractor and such dimensions to be their responsibility.

Do not scale drawings

All work must comply with relevant British Standards and Building Regulations requirements. Drawing errors and omissions to be reported to the architect.



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01 Proposed Site Plan
1:100 @ A1

PLANNING

Project No. 2210

Client Atlas Property London Ltd

Date 12/10/2020

Scale A3 / 1:100 @ A1

Project 18, Dagenham Street, N17 0JL

Drawing Title: Proposed Site Plan - Roof Plan

Drawing No. 2210_10_12 Rev.

Drawn Approved Signed

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No implied license exists. This drawing should not be used to calculate areas for the purposes of valuation. All dimensions to be checked on site by the contractor and such dimensions to be their responsibility.

Do not scale drawings

All work must comply with relevant British Standards and Building Regulations requirements. Drawing errors and omissions to be reported to the architect.

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GENERAL PLANNING NOTES	
1. No dimensions to be scaled from this drawing.	
2. All errors, omissions or inconsistencies to be reported to the architect immediately.	
3. Use figured dimensions only. All dimensions to be checked on site prior to construction and/or fabrication.	

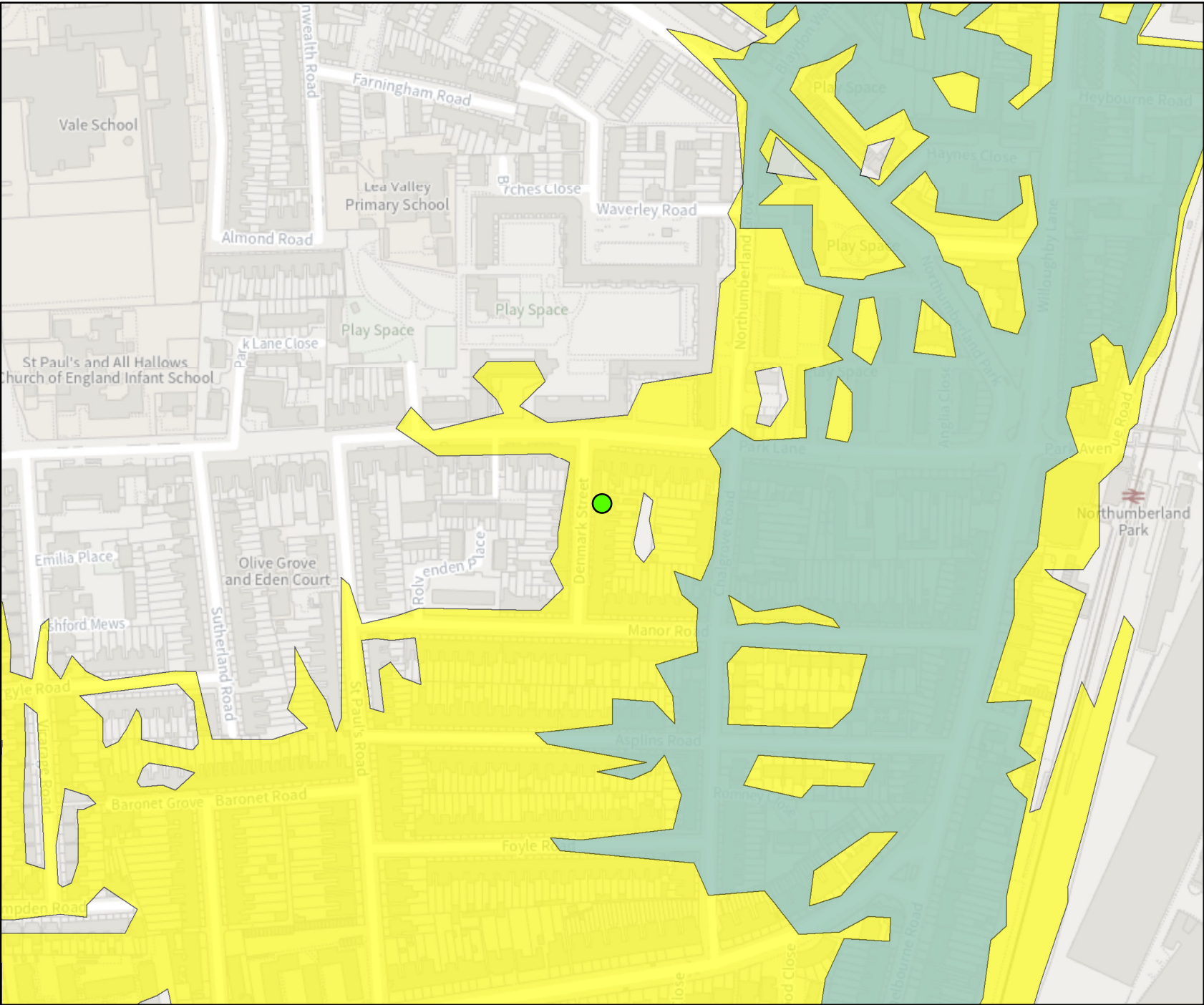
01 Proped Site Plan
1:100 @ A1

PLANNING	
Project No.	2210
Client	Atlas Property London Ltd
Date	15/10/2022
Scale	A3 / 1:100@A1
Project	18, Dagenham Street, N17 0JL
Drawing Title:	Proposed Site Plan
Drawing No.	2210_10_10
Rev.	
Drawn	Approved
	Signed

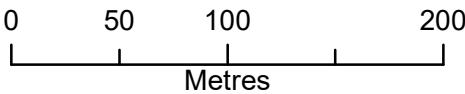
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Do not scale drawings
All work must comply with relevant British Standards and Building Regulations requirements. Drawing errors and omissions to be reported to the architect.

Appendix B - Detailed Environment Agency Information

Detailed FRA centred on: 13 Kenton Lane, Harrow, HA3 8TU- 21/11/2022 - HNL 288066 WD



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE



Legend

- Main Rivers
- Site location

Defended Flood Outlines

- 1 in 100+20% (CC) Defended
- 1 in 1000 (0.1%) Defended

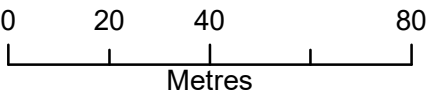
The data in this map has been extracted from the River Lee Modelling & Mapping Study (Halcrow, 2010). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences. Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: 13 Kenton Lane, Harrow, HA3 8TU- 21/11/2022 - HNL 288066 WD



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Hertfordshire,
AL7 1HE



Legend

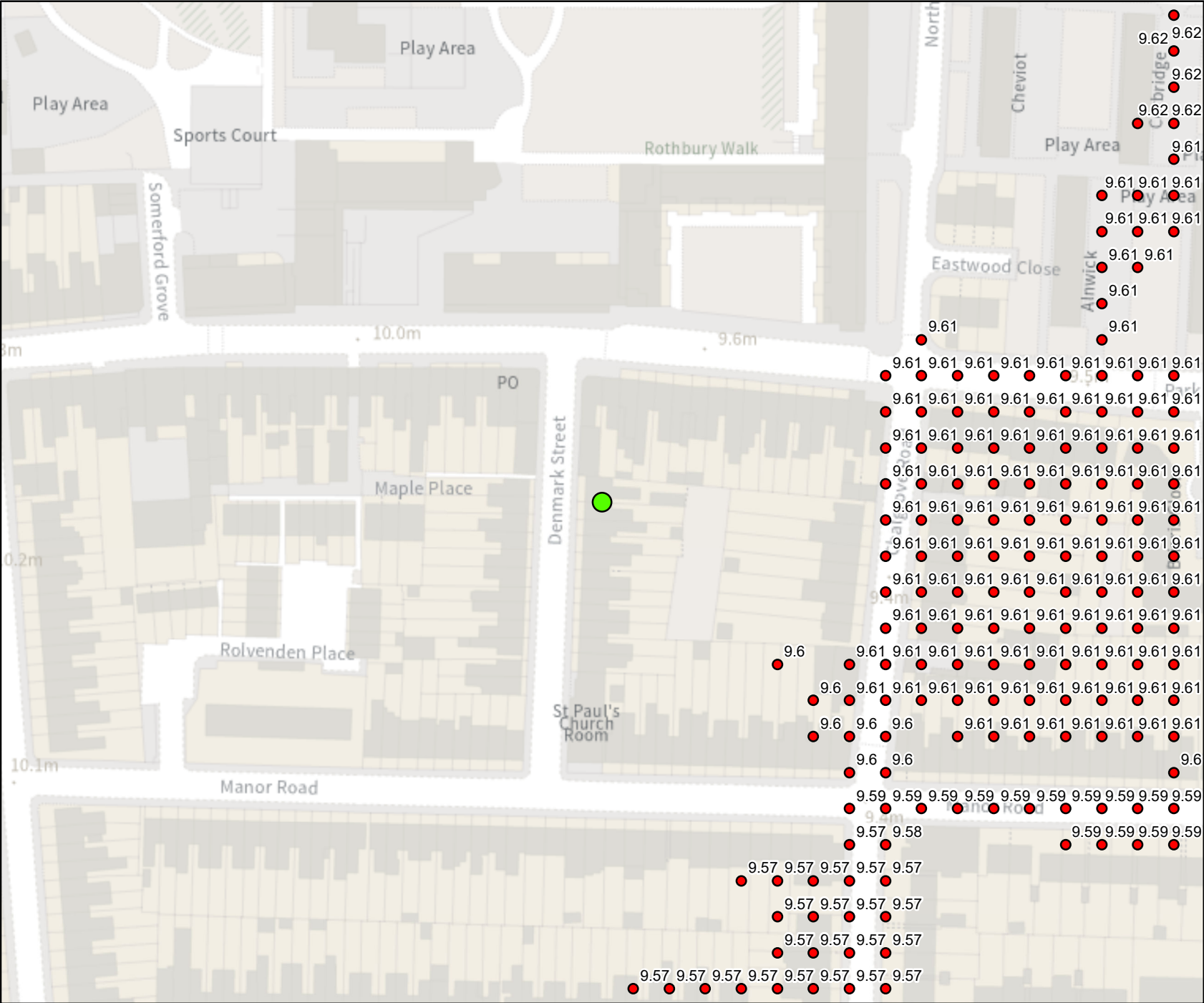
- Main Rivers
- Site location

2D Node Results: Heights

- 1 in 100+20% (CC) Defended

The data in this map has been extracted from the River Lee Modelling & Mapping Study (Halcrow, 2010). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences. Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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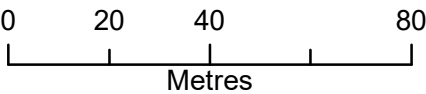


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Detailed FRA centred on: 13 Kenton Lane, Harrow, HA3 8TU- 21/11/2022 - HNL 288066 WD



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AL7 1HE

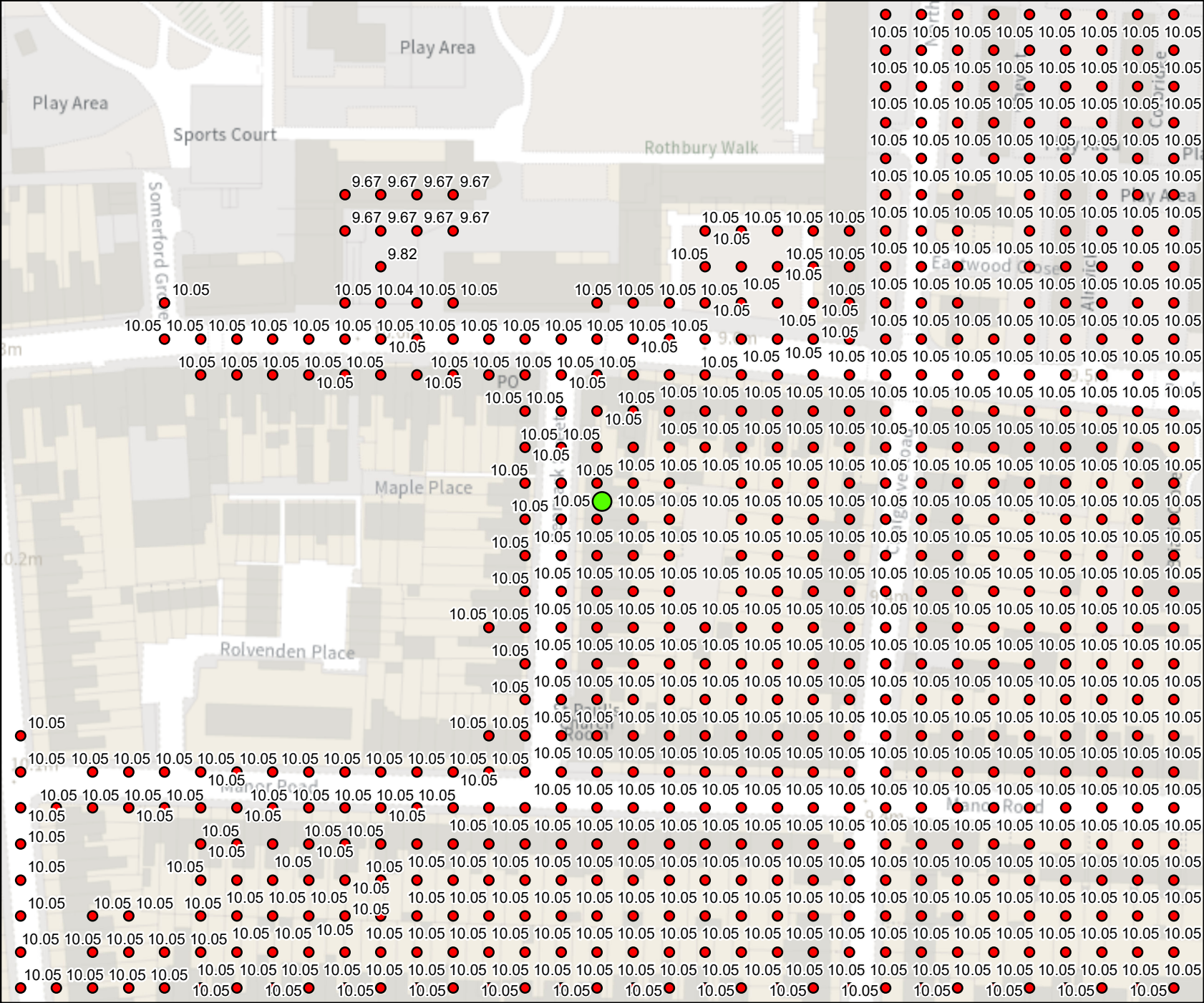


Legend

- Main Rivers
- Site location
- 2D Node Results: Heights**
 - 1 in 1000 (0.1%) Defended

The data in this map has been extracted from the River Lee Modelling & Mapping Study (Halcrow, 2010). This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences. Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

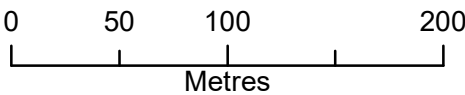
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Historic Flood Map centred on: 13 Kenton Lane, Harrow, HA3 8TU- 21/11/2022 - HNL 288066 WD



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AL7 1HE



Legend

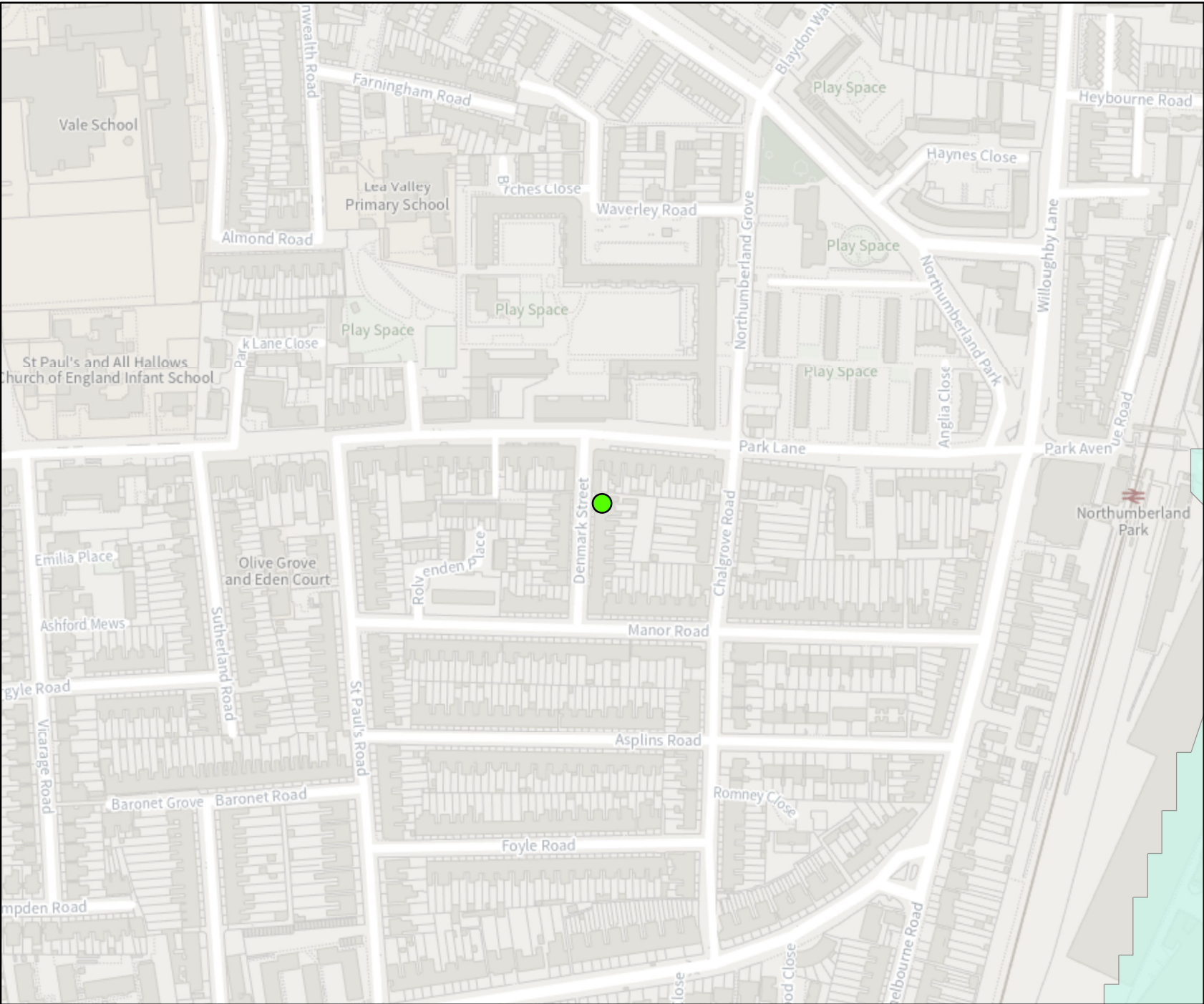
- Main Rivers
- Site location

Flood Event Outlines

1947

The historic flood event outlines are based on a combination of anecdotal evidence, Environment Agency staff observations and survey. Our historic flood event outlines do not provide a definitive record of flooding. It is possible that there will be an absence of data in places where we have not been able to record the extent of flooding. It is also possible for errors to occur in the digitisation of historic records of flooding.

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Appendix C - Greenfield Runoff Calculation

Appendix D - British Geological Society Borehole Record

Base Energy Services Limited		Page 1
44 Canal Street Bootle Liverpool L20 8QU	Denmark Total Greenfield	
Date 07/12/2022 File	Designed by CC Checked by PK	
Micro Drainage Source Control 2020.1.3		
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.300 Area (ha) 0.070 Urban 0.000 SAAR (mm) 600 Region Number Region 6 Results 1/s QBAR Rural 0.1 QBAR Urban 0.1 Q100 years 0.3 Q1 year 0.1 Q30 years 0.2 Q100 years 0.3		
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Appendix E - Micro Drainage Calculations

Base Energy Services Limited					Page 1	
44 Canal Street Bootle Liverpool L20 8QU			DenmarkStreet 100ys 40CC			
Date 07/12/2022 File E - Mirco.SRCX			Designed by CC Checked by PK			
Micro Drainage			Source Control 2020.1.3			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
	15 min Summer	0.357	0.357	0.2	15.0	O K
	30 min Summer	0.457	0.457	0.2	19.2	O K
	60 min Summer	0.553	0.553	0.2	23.2	O K
	120 min Summer	0.642	0.642	0.2	26.9	O K
	180 min Summer	0.686	0.686	0.3	28.8	O K
	240 min Summer	0.712	0.712	0.3	29.9	O K
	360 min Summer	0.737	0.737	0.3	31.0	O K
	480 min Summer	0.749	0.749	0.3	31.5	O K
	600 min Summer	0.751	0.751	0.3	31.6	O K
	720 min Summer	0.748	0.748	0.3	31.4	O K
	960 min Summer	0.732	0.732	0.3	30.8	O K
	1440 min Summer	0.700	0.700	0.3	29.4	O K
	2160 min Summer	0.654	0.654	0.2	27.5	O K
	2880 min Summer	0.613	0.613	0.2	25.8	O K
	4320 min Summer	0.542	0.542	0.2	22.8	O K
	5760 min Summer	0.481	0.481	0.2	20.2	O K
	7200 min Summer	0.428	0.428	0.2	18.0	O K
	8640 min Summer	0.380	0.380	0.2	15.9	O K
	10080 min Summer	0.337	0.337	0.2	14.1	O K
	15 min Winter	0.400	0.400	0.2	16.8	O K
	30 min Winter	0.512	0.512	0.2	21.5	O K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
	15 min Summer	144.742	0.0	14.5	26	
	30 min Summer	93.126	0.0	15.7	40	
	60 min Summer	57.005	0.0	23.8	68	
	120 min Summer	33.744	0.0	28.1	128	
	180 min Summer	24.534	0.0	30.6	186	
	240 min Summer	19.472	0.0	32.3	246	
	360 min Summer	13.984	0.0	34.2	364	
	480 min Summer	11.065	0.0	34.8	484	
	600 min Summer	9.221	0.0	35.1	602	
	720 min Summer	7.942	0.0	35.2	722	
	960 min Summer	6.271	0.0	35.2	896	
	1440 min Summer	4.489	0.0	35.0	1124	
	2160 min Summer	3.210	0.0	48.5	1516	
	2880 min Summer	2.528	0.0	50.9	1932	
	4320 min Summer	1.804	0.0	54.2	2764	
	5760 min Summer	1.418	0.0	57.2	3576	
	7200 min Summer	1.177	0.0	59.3	4392	
	8640 min Summer	1.010	0.0	61.0	5184	
	10080 min Summer	0.887	0.0	62.5	5952	
	15 min Winter	144.742	0.0	15.3	26	
	30 min Winter	93.126	0.0	16.2	39	
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Base Energy Services Limited				Page 2	
44 Canal Street Bootle Liverpool L20 8QU		DenmarkStreet 100ys 40CC			
Date 07/12/2022 File E - Mirco.SRCX		Designed by CC Checked by PK			
Micro Drainage		Source Control 2020.1.3			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.621	0.621	0.2	26.1	O K
120 min Winter	0.722	0.722	0.3	30.3	O K
180 min Winter	0.774	0.774	0.3	32.5	O K
240 min Winter	0.804	0.804	0.3	33.8	O K
360 min Winter	0.837	0.837	0.3	35.1	O K
480 min Winter	0.853	0.853	0.3	35.8	O K
600 min Winter	0.860	0.860	0.3	36.1	O K
720 min Winter	0.860	0.860	0.3	36.1	O K
960 min Winter	0.850	0.850	0.3	35.7	O K
1440 min Winter	0.809	0.809	0.3	34.0	O K
2160 min Winter	0.754	0.754	0.3	31.7	O K
2880 min Winter	0.699	0.699	0.3	29.3	O K
4320 min Winter	0.598	0.598	0.2	25.1	O K
5760 min Winter	0.511	0.511	0.2	21.5	O K
7200 min Winter	0.435	0.435	0.2	18.3	O K
8640 min Winter	0.369	0.369	0.2	15.5	O K
10080 min Winter	0.309	0.309	0.2	13.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	57.005	0.0	26.6	68	
120 min Winter	33.744	0.0	31.4	126	
180 min Winter	24.534	0.0	33.9	184	
240 min Winter	19.472	0.0	35.2	242	
360 min Winter	13.984	0.0	36.0	358	
480 min Winter	11.065	0.0	36.5	474	
600 min Winter	9.221	0.0	36.8	588	
720 min Winter	7.942	0.0	37.0	700	
960 min Winter	6.271	0.0	37.3	918	
1440 min Winter	4.489	0.0	37.2	1172	
2160 min Winter	3.210	0.0	54.3	1624	
2880 min Winter	2.528	0.0	56.9	2080	
4320 min Winter	1.804	0.0	59.9	2984	
5760 min Winter	1.418	0.0	64.0	3816	
7200 min Winter	1.177	0.0	66.4	4680	
8640 min Winter	1.010	0.0	68.4	5456	
10080 min Winter	0.887	0.0	70.0	6344	
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Base Energy Services Limited		Page 3
44 Canal Street Bootle Liverpool L20 8QU	DenmarkStreet 100ys 40CC	
Date 07/12/2022 File E - Mirco.SRCX	Designed by CC Checked by PK	
Micro Drainage Source Control 2020.1.3		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.100	Shortest Storm (mins)	15
Ratio R	0.450	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.056

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 0.025	4	8 0.025	8	12 0.006

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Base Energy Services Limited		Page 4
44 Canal Street Bootle Liverpool L20 8QU	Denmark Street 100ys 40CC	
Date 07/12/2022 File E - Mirco.SRCX	Designed by CC Checked by PK	
Micro Drainage Source Control 2020.1.3		

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	42.0	0.700	42.0	1.400	42.0	2.100	42.0
0.100	42.0	0.800	42.0	1.500	42.0	2.200	42.0
0.200	42.0	0.900	42.0	1.600	42.0	2.300	42.0
0.300	42.0	1.000	42.0	1.700	42.0	2.400	42.0
0.400	42.0	1.100	42.0	1.800	42.0	2.500	42.0
0.500	42.0	1.200	42.0	1.900	42.0		
0.600	42.0	1.300	42.0	2.000	42.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0024-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	0.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	24
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.3
Flush-Flo™	0.106	0.2
Kick-Flo®	0.218	0.2
Mean Flow over Head Range	-	0.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.3	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.5	8.000	0.7
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		

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