EUSTON TOWER

Drainage & SuDS Report Addendum

December 2024



ARUP

British Land Property Management Limited

Euston Tower

Drainage & SuDS Strategy Addendum

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04 | 10 December 2024

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1. Introduction

This Drainage & SuDS Strategy Addendum summarises the revisions made to the pending strategic application for Full Planning Permission (ref. 2023/5240/P), submitted in December 2023 for the Proposed Development at Euston Tower (286 Euston Road, London).

The Applicant has undertaken extensive consultation during both the pre-application and determination stages of the Proposed Development and has sought to respond positively to the responses received. The scheme has been revised in response to feedback from Officers, local stakeholders and residents, the Regents Park Conservation Area Advisory Committee and statutory consultees, including Historic England and The Greater London Authority.

This Addendum has been prepared detailing the revisions to the pending scheme (the "Proposed Development"). For the avoidance of doubt, the Drainage & SuDS Strategy report which accompanied the December 2023 Submission is considered as read and this Addendum deals only with the 2024 Revisions and any updates to assessments as a result of these revisions. This Addendum also clarifies and provides further details responding to consultation responses received since the original submission in December 2023 and March 2024. Save where varied or supplemented in this Addendum, the content of the Drainage & SuDS Strategy remains valid and up to date.

The Description of Development for the Proposed Development, in light of the 2024 Revisions, has been updated to the following (additions in bold):

"Redevelopment of Euston Tower comprising retention of parts of the existing building (including central core, basement and foundations) and erection of a new building incorporating these retained elements, to provide a 32-storey mixed-use building providing offices and research and development floorspace (Class E(g)) and office, retail, café and restaurant space (Class E) and Enterprise space (Class E/F) at ground and first, and associated external terraces; public realm enhancements, including new landscaping and provision of new publicly accessible steps and ramp; short and long stay cycle storage; servicing; refuse storage; plant and other ancillary and associated work."

2. Revised Surface Water Drainage Proposals

The revised drainage strategy included within this Addendum caters for surface water captured from within the building footprint and public realm (totalling approximately 0.79ha). The information below provides details of the estimated existing brownfield runoff rates, attenuation and discharge proposals and a review of appropriate SuDS that are considered viable based on the development proposals.

Public realm design, including provision of wetland and rain gardens, has been undertaken by DSDHA (Ref: Euston Tower – Landscape Statement). Proposals within this Drainage & SuDS Addendum have been prepared in line with public realm proposals by DSDHA however act independently and do not require any attenuation volume to be provided within public realm proposals.

2.1 Existing

2.1.1 Discharge Rates

Greenfield run off rates for this development have been calculated using FEH data and are detailed in the below table (calculations included within Appendix A). The greenfield runoff rates remain unchanged from the initial application and are provided for completeness only.

Table 1: Greenfield runoff rates

Rainfall Event	Greenfield Site Discharge Rate (I/s) (A=0.79ha)
1 in 1 Year	1.0
1 in 30 Year	2.8
1 in 100 Year	3.9
Qbar	1.2

Given this is a brownfield development, the modified rational method provides an estimate of existing surface water run-off rates from rainfall intensity.

Rainfall data has been obtained from Flood Estimation Handbook (FEH) online mapping to determine approximate existing discharge rates at the Site. The 60-minite storm durations were used within these calculations as typical duration storm events and the Rational Method applied:

Q = 2.78 CIA, where;

Q = flow (l/s);

C = runoff coefficient (1);

I = rainfall (mm/hr); and

A = catchment area (ha).

Rainfall Event	Intensity (mm/hr)	Total Existing Site Discharge Rate (I/s) (A=0.79ha)
1 in 1 Year	12.0	26.3
1 in 30 Year	37.3	81.9
1 in 100 Year	56.0	123.0

2.1.2 Point of Connection

A drainage survey has been undertaken by Plowman Craven in 2019 (Appendix B) which indicates a total of three connections into the existing TWUL combined sewers reaching the boundary of this application. Two are located along the east and are assumed to connect into Hampstead Road and one along the south which is assumed to connect within Euston Road.

2.2 Proposed

2.2.1 Surface Water Attenuation

A 380m³ attenuation tank is proposed to be provided within the basement which is a reduced amount compared to the previous application however due to proximity constraints within the basement this is the maximum volume of attenuation feasible here. The attenuation feature will cater for rainfall captured in the public realm and on the roof of the building. Other forms of attenuation have been considered however are not deemed suitable, as explained in Table 5.

2.2.2 Discharge rates

It is proposed that runoff from the building and public realm is drained towards the attenuation tank and discharged at restricted rates into the existing Thames Water network, offering significant betterment upon the existing scenario, as it is not possible to restrict fully to greenfield runoff rates (refer to Table 5).

Discharge rates have been calculated to maximise the available storage at each return period event (calculations provided in Appendix C). The below table shows discharge rates at each storm event.

Rainfall Event	Existing Site Discharge Rate (I/s)	Proposed Site Discharge Rate (I/s)	Betterment upon existing
1 in 1 Year	26.3	2.0	92%
1 in 30 Year	81.9	14.1	83%
1 in 100 Year +40% CC	123.0	39.0	68%

Table 3: Proposed discharge rates

Flows are proposed to be restricted by the use of a pump, or series of pumps, which provides a restricted discharge rate and optimises overall storage requirements during different storm events through the use of multiple or variable-rate pumps.

Discussions with Thames Water regarding the proposed discharge rates are ongoing, however it is envisaged that these rates will pose no issue as they are significantly lower than existing. The proposals exceed Camden Council guidance which states where it is not possible to restrict to greenfield run off rate, a minimum of 50% betterment must be provided.

2.2.3 Discharge volumes

As the development is keeping the existing basement below the proposed public realm, it is not possible to decrease the impermeable area, and therefore it is not possible to reduce overall volume. However, it should be noted that there will be marginal reduction in discharge volume due to increases in green areas and tree planting.

2.2.4 Climate Change

Current NPPF Guidance stipulates that to allow for the predicted impacts of climate change on surface water runoff, increases to peak rainfall intensity should be used.

Table 4 is an extract from the updated government guidance in relation to climate change allowances for the London Management Catchment for the 1% annual exceedance event. For development with a lifetime

beyond 2100 the upper end allowances should be assessed at both the 1% and 3.3% annual exceedance probability events for the 2070s epoch.

The development should be designed for the upper end allowance in the 1% annual exceedance probability event.

 Table 4: Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) (Source:

 Environment Agency Climate Change Guidance)

Annual Exceedance Probability Event	Allowance	Total potential change anticipated for the '2050s' (Development lifetime up to 2060)	Total potential change anticipated for the '2070s' (Development lifetime 2061 to 2125)
3.3%	Upper end	20%	35%
3.3%	Central	20%	40%
1%	Upper end	20%	40%
1%	Central	25%	40%

In line with Environment Agency guidance, an allowance of 40% for the effects of climate change to the year 2125 should be used to achieve the policy requirements for the proposed development.

As a result of including a 40% climate change allowance, the proposed surface water drainage strategy will serve to improve the resilience of the existing Site. This 40% increase in rainfall intensity has been applied to the calculations outlined in Table 3.

2.2.5 Opportunities for SuDS

Chapter 14 (paragraph 169) of the NPPF recommends that Sustainable Drainage Systems (SuDS) should be utilised, where possible, within all new drainage schemes. SuDS generally mimic the natural drainage patterns of an undeveloped site allowing infiltration into the ground (where feasible) and controlling outflow rates from the development. This reduces the impact and risk of flooding on downstream developments and can provide additional benefits such as pollution control, increased biodiversity and provision of water-based amenity space.

Table 5 below provides a detailed site-specific assessment of the suitability of a variety of SuDS considered within the proposed surface water drainage strategy.

Table 5: Detailed SuDS Suitability Appraisal for the building

SuDS Type	Site Suitability		
	A roof specifically intended and designed to store water. This can be via open water surfaces, storage within or beneath porous medium or modular surfaces, within shallow geo-cellular crates or below a raised decking/impermeable surface.		
Blue Roof	Advantages	Disadvantages	
	No additional land take making them effective within dense urban Sites and can contribute significantly to overall Site attenuation requirements.	Additional weight and cost to structure (compared to normal roof design). Damage to waterproof membrane can be critical. Does not always provide treatment dependent on system.	×
Site Suitability	Blue roofs are not considered feasible at the Site due to waterproofing concerns and the amount of mechanical plant.		

SuDS Type	Site Suitability		
	Multi-layered system that covers the roof of a building with vegetation/landscaping over a drainage layer. Designed to intercept and retain rainfall, reducing the volume of runoff and attenuating peak flows. Typically, either defined as intensive or extensive systems depending on the nature of the selected flora.		
Green Roof	Advantages	Disadvantages	
	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation. Damage to waterproof membrane can be critical.	*
Site Suitability	Green roofs are not considered feasible at the S design.	ite due to plant requirements and structural	
	The collection of rainwater (usually within underg buildings (treated), wash down facilities (commerc	round storage tanks) for later re-use in either cial) or irrigation.	
Rainwater Harvesting	Advantages	Disadvantages	-
	Can provide source control of storm water runoff, reduces demand on mains water.	Use is dependent on demand requirements, contributing surface area, and seasonal rainfall characteristics	~
Site Suitability	Rainwater harvesting is to be included within the proposals. Water harvested from the roof will be used to flush WCs within the building.		
	Any system which stores and discharges water dire soakaways, infiltration trenches, infiltration basins	ectly to the underlying soils. These are typically s or infiltration blankets.	
Infiltration	Advantages	Disadvantages	
Systems/ Soakaways	Provides groundwater recharge, ease of construction and can have minimal land take subject to design. Manages surface water at source.	Increased risk of groundwater ingress and pollution. Not suitable for poor draining soils or where infiltrating water may pit structural foundations at risk. Uncertainty over long term performance. Requires comprehensive geotechnical knowledge of underlying soils.	*
Site Suitability	Given the underlying geology and existing basement being kept beneath the building and public realm area, this is not a viable option.		
	Swales are linear vegetated drainage features in wheele and the signed to allow infiltration, where a	hich surface water can be stored or conveyed. appropriate.	
Swales	Advantages	Disadvantages	
	Can be incorporated into landscaping proposals, offers good removal of pollutants and reduces runoff rates and volumes. Relatively low cost.	Not suitable for steep areas and requires significant land take (not suitable for high density urban Sites). Not suitable in areas with roadside parking.	*
Site Suitability	Given the urban setting of the development and building and public realm area, the inclusion of	I the existing basement being kept beneath the swales is not viable or appropriate.	

SuDS Type	Site Suitability			
	Filter drains are shallow trenches filled with stone/gravel that accept runoff through sheet flow and provide temporary subsurface storage (typically provided adjacent to highways or as interception features). They can drain via infiltration or be lined and positively drained via a perforated collection pipe.			
Filter Drains	Advantages	Disadvantages		
	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into Site landscaping and fit well beside roads and car parks.	High clogging potential without effective pre- treatment, limited to small catchments, high cost of replacing filter material.	*	
Site Suitability	Given the urban setting of the development and building and public realm area, the inclusion of	l the existing basement being kept beneath the f filter drains is not viable or appropriate.		
	Shallow planted features, which receive runoff dir drained, surface water will infiltrate to the underly promote storage, plant up-take and filtration.	ectly from adjacent hardstanding. Typically under ing piped drainage system and in doing so		
Dia notantian	Advantages	Disadvantages		
Bio-retention Systems/Rain Gardens	Easily incorporated into soft landscaping, flexible shape and planting mix and provide good degree of storage (reducing the below ground requirement). High degree of pollutant removal and high biodiversity potential. Reduces need for surface drainage (gullies, channels etc) and low cost.	Requires considered use of water tolerant plant species and landscaping & management. Susceptible to clogging if poorly managed and not suitable for steeply sloping Sites.	~	
Site Suitability	Rain gardens features are proposed within the DSDHA public realm proposals. These features will provide surface water treatment before discharge into the basement tank. Due to the shallow depth between public realm and top of basement and the high density of existing and proposed utilities, the exact locations will need to be considered carefully.			
	Pavements that allow rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltrating the ground (unlined) or discharging to the sewerage system (lined).			
Permeable	Advantages	Disadvantages		
Pavements	Provides low-level treatment of highway- derived pollutants (as recognised by the EA) and reduces need for surface drainage (gullies, channels etc). Available in a range of surface types (not just block paving).	Often requires increased construction depth and not suitable for use with Type 1 sub-base. May not be applicable for heavy traffic loadings and irregular maintenance required in certain situations. Not suitable for utility routes.	*	
Site Suitability	Permeable paving does not provide a viable solution due to no opportunity for infiltration based drainage, due to the existing basement being kept beneath the building and public realm area.			
Detention Basins	Detention basins are surface storage basins that provide flow control through attenuation of storm water runoff. They facilitate settling of particulate pollutants. Typically dry, they can also offer multi-functional recreational use.			
	Advantages	Disadvantages		
	Can cater for a wide range of rainfall events, easy to maintain, potential for dual land use, can be incorporated in to landscaping proposals and low cost.	Not suitable for steep areas, significant land take and little reduction in runoff volume	×	
Site Suitability	Given the urban setting of the development and building and public realm area, detention basin	I the existing basement being kept beneath the as are not considered a suitable SuDS feature.		

SuDS Type	Site Suitability		
Ponds	Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline.		
	Advantages	Disadvantages	
	Good removal capability of urban pollutants, high potential ecological, aesthetic and amenity benefits, can cater for all storm events and good community acceptability.	No reduction in runoff volume; Anaerobic conditions can occur without regular inflow; Significantly land take; No suitable for steep Sites;	×
Site Suitability	Given the urban setting of the development and building and public realm area, ponds are not o	I the existing basement being kept beneath the considered a suitable SuDS feature.	
	Sub-surface storage provides an effective way of a and can be in multiple forms, such as geo-cellular	Sub-surface storage provides an effective way of attenuating storm water prior to offsite discharge and can be in multiple forms, such as geo-cellular or concrete tanks.	
Sub-Surface/Geo-	Advantages	Disadvantages	
cellular Storage	Modular and flexible, dual usage (infiltration/storage, high void ratios, can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	 ✓
Site Suitability	Attenuation tanks for surface water are proposed within the basement. Shallow attenuation (Permavoid or similar) has been considered above basement, however due to the extensive landscaping proposals and lack of available depth between existing basement roof and the finished public realm levels, it is concluded that these extensive landscaping proposals provide significant public amenity and should take precedence above basement.		
	Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.		
	Advantages	Disadvantages	
Rills/Canals	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	*
Site Suitability	Due to the shallow depth between public realm and top of basement and urban setting of the development, rills/canals do not provide a viable option.		

2.3 SuDS Selection Summary

Further to the assessment above, Table 5 provides a summary of SuDS that are considered viable within the context of the proposals, where opportunities to implement SuDS should be explored at detailed design stage and SuDS which are not appropriate for the proposals due to spatial constraints and existing ground conditions:

Table 6: SuDS Selection Summary

SuDS Type	Site Suitability		
	Suitable for consideration on Site	Further consideration to be carried out during detailed design	Not suitable for consideration on Site
Blue Roof			
Green Roof			
Rainwater Harvesting			

SuDS Type	Site Suitability				
	Suitable for consideration on Site	Further consideration to be carried out during detailed design	Not suitable for consideration on Site		
Infiltration Systems/Soakaways					
Swales					
Filter Drains					
Bio-retention Systems/Rain Gardens					
Permeable Pavements					
Detention Basins					
Ponds					
Sub-surface Storage					
Rills/Canals					

2.3.1 Compliance with London Plan

In accordance with the London Plan 2021 development proposals should 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.

In line with the above, Table 7 below demonstrates compliance with the drainage hierarchy.

Hierarchy	Surface Water Management	Considered Within Design?	Design Comments
1	Rainwater use as a resource	Yes	Rainwater harvesting has been included within the design
2	Rainwater infiltration to ground at or close to source	No	Not possible within building or public realm footprint due to existing basements
3	Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)	No	Blue roofs are not considered feasible at the Site due to waterproofing concerns and the amount of mechanical plant
4	Rainwater discharge direct to a watercourse (unless not appropriate)	No	No watercourses close to the Site
5	Controlled rainwater discharge to a surface water sewer or drain	No	No surface water sewers close to the Site
6	Controlled rainwater discharge to a combined sewer	Yes	The Site currently discharges to a combined public sewer and will continue to do so.

Table 7: London Plan Drainage Hierarchy

2.3.2 Exceedance Routes

In an exceedance level event where the drainage strategy is unable to accommodate rainfall effectively, it is anticipated that flows will follow the topography towards Hampstead Road and Euston Road. Existing levels across the development are very flat and therefore levels are to be designed in such a way to ensure flood waters are directed away from building thresholds.

2.3.3 SuDS Maintenance Schedules

It is the intention that the surface water drainage and SuDS features will be managed and maintained by the building management.

The following tables outline the minimum maintenance requirements for the different elements of the proposed strategy and are intended to form the basis of a final detailed operation and maintenance strategy document produced by the appointed private management company.

Maintenance requirements have been informed by the guidance outlined within CIRIA C753 and current best practice. The following information would also be supplemented by manufacturer's specifications and be dependent on the specific type of system/products used.

Table 8: Operation and Maintenance Requirements for Attenuation Tanks

Maintenance Schedule	Required Action	Frequency
	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
Regular Maintenance	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, overflows and vents.	As required
Manifarina	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
Monitoring	Survey inside of tank for sediment build up and remove if necessary.	Every 5 years or as required.
Health & Safety	In accordance with Table 36.2, management is considered Low Risk as minor injury or health effects are unlikely to occur, hence the design is accepted and no reasonable requirement to review proposals.	N/A

A. Greenfield Runoff Calculations



Calculated by:

Rob Belcher

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Feb 05 2024 12:40

Site Details

			-
Site name:	Euston Tower	Latitude:	51.52532° N
Site location:	Euston	Longitude:	0.13919° W
This is an estimatic criteria in line with developments" SC	on of the greenfield runoff rates that a Environment Agency guidance "Rainfa 030219 (2013) the SuDS Manual (2753 (are used to meet normal best practice Reference: Il runoff management for Ciria, 2015) and the pop-statutory	3774929550

standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis Date: for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

FEH Statistical

Site characteristics

0.79 Total site area (ha):

Methodology

Q_{MED} estimation method: Calculate from BFI and SAAR Specify BFI manually BFI and SPR method: N/A HOST class: 0.629 **BFI / BFIHOST:** Q_{MED} (I/s):

QBAR / QMED factor.

1.14

Hydrological characteristics	Default	Edited
SAAR (mm):	616	625
Hydrological region:	6	6
Growth curve factor 1 year.	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAB} < 2.0 l/s/ha?

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

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

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

(3) Is SPR/SPRHOST \leq 0.3?

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

Default

Q _{BAR} (I/s):	1.22	
1 in 1 year (l/s):	1.04	
1 in 30 years (l/s):	2.81	
1 in 100 year (l/s):	3.89	
1 in 200 years (l/s):	4.56	

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of 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, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

B. Existing Drainage Survey





		STANDARD ABBREVIATIONS
		A/C Air Conditioner IRF Iron Railing Fence AH Arch Height IRS Illuminated Road Sign AL Arch Level JB Junction Box ASH Arch Spring Height L Light ASL Arch Spring Level LB Litter Bin B Bollard L Lamp Post
		B Bollard LP Lamp Post BGP Break Glass Point Max Maximum BH Beam Height MH Manhole Br Brick Min Minimum BRW Brick Retaining Wall O/H Overhead BSL Beam Soffit Level OSBM Ordnance Survey Bench Mark
		BT British Telecom P Post BW Brick Wall PB Pillar Box CBF Close Boarded Fence PLt Pavement Light CCTV Closed Circuit Television PS Paving Stones Chy Chimney Rad Radiator
		CL Cover Level RDM Recessed Door Mat CLF Chain Link Fence RE Rodding Eye Col Column RS Road Sign Conc Concrete RSJ Rolled Steel Joist CPS Concrete Paving Slabs RWP Rain Water Pipe
		CTV Cable Television IC s spread Cup Cupboard S Window Sill Height/Level DH Door Head Height SBM Site Bench Mark DP Down Pipe SC Stop Cock DrC Drainage Channel SH Spring Height
		EIC Electrical Inspection Cover SL Sump Level EJB Electrical Junction Box Slt Skylight EM Electricity Meter SO Smoke Outlet ER Earthing Rod SP Sign Post ESG Flextrical Switchgear SS Security Sensor
		FA Fire Alarm SV Stop Valve FB Flower Bed T Telephone FE Fire Hydrant TBM Temporary Bench Mark
		FHR Fire Hose Reel TCB Telephone Call Box FL Floor Level TIC Telephone Inspection Cover Flt Floodlight TJB Telephone Junction Box g girth TL Traffic Light G Gully TLCB Traffic Light Control Box
		GC Gas Cock TLIC Traffic Light Inspection Cover GM Gas Meter TP Telephone Pole GV Gas Valve Typ Tylical H Window Head Height/Level V Vent h height VP Vent Pipe
		HB Hand Basin WH Water Heater HR Handrail WM Water Meter IC Inspection Cover WV Water Valve IL Invert Level
		Assumed Connection IL Invert Level (AR) Assumed Route L Level
		BdL Back Drop Level (NPV) No Pipes Visible CR Cable Riser Pd Depth to top of pipe DP Down Pipe Sd Sump Depth G Gully (UTL) Unable to Lift without damage HB Hatch Box (UTT) Unable to Trace
		HbL Hatch Box Level VP Vent Pipe SERVICE LEGEND
		SURFACE WATER DRAINAGE
		GAS
		UNKNOWN SERVICEUNDERGROUND CHAMBER
		 Underground services. The results are not infanible and the excavators must be carried out to confirm service identification, position and particularly depths. Although all reasonable effort has been made in searching available record drawings the completeness of the underground services information cannot be guaranteed. Unless otherwise stated, drainage pipes are 100mm diameter.
		LEGEND 2.70 Floor to celling height 2.70 Floor to false celling height 2.70 Celling level F22.70 False celling level
		This drawing has been extracted from a revit model (drawing no. 42746-002-PCL-02-ZZ-M3-G-0001_R2019-S0-P01) constructed to an accuracy consistent with a presentation scale of 1:100, the plan is typically taken at 1600mm above finished floor level - due to the revit extraction
	I	process, this may result in duplicate linework and missing detail - for any level/height information please refer to the original revit model Drawing units are metres
		CLIENT
		British Land Property Management Ltd
		10 South Crescent London WC1E7BD
H 23.78		
		Euston lower N1
		Basement Floor Plan
		PRESENTATION SCALE 1:100 @ A0
+ ^{23.82}	1000 77 78	DATE OF ORIGINAL SURVEYOctober 2019PC PROJECT No. 42746-002CHECKEDMDW
	23.78 [⊐] Enclosed pipe in chamber.	DRAWING No. ISSUE
	100mm	A Plowman Crovon
		Plowman Craven House 115 Southwark Bridge Road
	23.71	2 Lea Business Park London Lower Luton Road SE1 0AX Harpenden
+ ^{23.76}		Hertfordshire AL5 5EQ Tel: +44 (0)1582 765566Tel: +44 (0)207 490 7700
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	STANDARD AB	BREVIA	TIONS	
A/C	Air Conditioner	IRF	Iron Railing Fence	
AH AL ASH	Arch Height Arch Level Arch Spring Height	IRS JB L	Illuminated Road Sign Junction Box Light	
ASL	Arch Spring Level Bollard	LB LP	Litter Bin Lamp Post	
BGP BH Br	вreak Glass Point Beam Height Brick	Max MH Min	Maximum Manhole Minimum	
BRW BSL	Brick Retaining Wall Beam Soffit Level	O/H OSBM	Overhead Ordnance Survey Bench Mark	ĸ
BT BW CBF	British Telecom Brick Wall Close Boarded Fence	P PB PLt	Post Pillar Box Pavement Light	
CCTV Chy	Closed Circuit Television Chimney	PS Rad	Paving Stones Radiator	
CL CLF Col	Chain Link Fence Column	RE RS	Rodding Eye Road Sign	
Conc CPS CTV	Concrete Concrete Paving Slabs Cable Television IC	RSJ RWP s	Rolled Steel Joist Rain Water Pipe	
Cup DH	Cupboard Door Head Height	s S SBM	Spread Window Sill Height/Level Site Bench Mark	
DP DrC EIC	Down Pipe Drainage Channel Electrical Inspection Cover	SC SH SL	Stop Cock Spring Height Sump Level	
EJB	Electrical Junction Box Electricity Meter	Sit	Skylight Smoke Outlet	
ER ESG FA	Earthing Rod Electrical Switchgear Fire Alarm	SP SS SV	Sign Post Security Sensor Stop Valve	
FB FE	Flower Bed Fire Extinguisher	T Tac TRM	Telephone Tactile Paving	
FH FHR FL	Fire Hyarant Fire Hose Reel Floor Level	TCB TIC	Telephone Call Box Telephone Inspection Cover	
Fit g G	Floodlight girth Gully	TJB TL TLCB	Telephone Junction Box Traffic Light Traffic Light Control Box	
GC GM	Gas Cock Gas Meter	TLIC TP	Traffic Light Inspection Cover Telephone Pole	
GV H h	Gas Valve Window Head Height/Level height	Typ V VP	Typical Vent Vent Pipe	
HB HR	Hand Basin Handrail Inspection Cover	WH WM	Water Heater Water Meter	
IL	Invert Level	***	Water Valve	
(AC)	SERVICE ABBI	REVIATI ⊩	ONS Invert Level	
(AR) BdL	Assumed Route Back Drop Level	L (NPV)	Level No Pipes Visible	
CR DP G	Cable Riser Down Pipe Gully	Pd Sd (UTL)	Depth to top of pipe Sump Depth Unable to Lift without damage	
HB HbL	Hatch Box Hatch Box Level	(UTT) VP	Unable to Trace Vent Pipe	
			`	
	SERVICE	EGENL)	
SURF	ACE WATER DRAINAGE		>	
GAS	-11			
ELEC TELE	TRICITY -			
UNKN	IOWN SERVICE -			
UNDE	RGROUND CHAMBER	L		
Electro-o undergro	detection techniques have bee ound services. The results are	en used in t not infallib	he location of le and trial excavations	
must be particula	carried out to confirm service arly depths.	identificatio	on, position and	
record d	n all reasonable effort has bee lrawings the completeness of ion cannot be guaranteed	the undergr	ound services	
Unless of	otherwise stated, drainage pip	es are 100r	nm diameter.	
	LEGE	IND		
2.70	Floor to ceiling heigh	t		
(F2.70)	Floor to false ceiling	height		
22.70	Ceiling level			
	Folge geiling lovel			
[F22.70]	False ceiling level			
	Stair/step arrows poin	nt up		
1	Sloping ceiling arrow	s point up		
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C. Proposed Surface Water Calculations & Drawing

Ove Arup & Partners International Ltd		Page 1
The Arup Campus		
Blyth Gate		
Solihull B90 8AE		Micro
Date 09/12/2024 11:38	Designed by Robert.Belcher	
File 281835_TOTAL SITE 1YR (380M3	Checked by	Diamage
XP Solutions	Source Control 2020.1.3	

Summary of Results for 2 year Return Period (+40%)

Half Drain Time : 1072 minutes.

	Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m ³)	Status
15	min S	Summer	99.200	0.200	0.0	2.0	2.0	76.0	ОК
30	min S	Summer	99.250	0.250	0.0	2.0	2.0	94.9	ΟK
60	min S	Summer	99.297	0.297	0.0	2.0	2.0	112.9	ΟK
120	min S	Summer	99.421	0.421	0.0	2.0	2.0	159.9	ОК
180	min S	Summer	99.485	0.485	0.0	2.0	2.0	184.5	ОК
240	min S	Summer	99.524	0.524	0.0	2.0	2.0	199.3	ОК
360	min S	Summer	99.564	0.564	0.0	2.0	2.0	214.3	ОК
480	min S	Summer	99.579	0.579	0.0	2.0	2.0	220.1	ΟK
600	min S	Summer	99.583	0.583	0.0	2.0	2.0	221.6	ΟK
720	min S	Summer	99.580	0.580	0.0	2.0	2.0	220.5	ΟK
960	min S	Summer	99.565	0.565	0.0	2.0	2.0	214.9	ΟK
1440	min S	Summer	99.536	0.536	0.0	2.0	2.0	203.7	ΟK
2160	min S	Summer	99.498	0.498	0.0	2.0	2.0	189.4	ΟK
2880	min S	Summer	99.466	0.466	0.0	2.0	2.0	177.2	ΟK
4320	min S	Summer	99.415	0.415	0.0	2.0	2.0	157.9	ΟK
5760	min S	Summer	99.375	0.375	0.0	2.0	2.0	142.4	ΟK
7200	min S	Summer	99.341	0.341	0.0	2.0	2.0	129.5	ΟK
8640	min S	Summer	99.312	0.312	0.0	2.0	2.0	118.7	ΟK
10080	min S	Summer	99.288	0.288	0.0	2.0	2.0	109.5	ΟK
15	min W	Vinter	99.225	0.225	0.0	2.0	2.0	85.4	ΟK
30	min W	Vinter	99.280	0.280	0.0	2.0	2.0	106.6	ΟK
60	min W	Vinter	99.334	0.334	0.0	2.0	2.0	127.0	ΟK
120	min W	Vinter	99.474	0.474	0.0	2.0	2.0	180.3	ΟK
180	min W	Vinter	99.549	0.549	0.0	2.0	2.0	208.5	ΟK

	Stor	m	Rain	Flooded	Discharge	Time-Peak
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
15	min	Summer	52.681	0.0	76.8	26
30	min	Summer	33.099	0.0	96.0	41
60	min	Summer	20.007	0.0	118.4	70
120	min	Summer	14.450	0.0	171.0	130
180	min	Summer	11.342	0.0	201.2	188
240	min	Summer	9.376	0.0	221.6	248
360	min	Summer	7.002	0.0	247.5	366
480	min	Summer	5.618	0.0	263.9	484
600	min	Summer	4.712	0.0	275.6	602
720	min	Summer	4.072	0.0	284.4	720
960	min	Summer	3.223	0.0	296.3	858
1440	min	Summer	2.314	0.0	304.6	1090
2160	min	Summer	1.672	0.0	356.4	1480
2880	min	Summer	1.337	0.0	380.0	1900
4320	min	Summer	0.993	0.0	423.0	2720
5760	min	Summer	0.815	0.0	463.3	3512
7200	min	Summer	0.706	0.0	501.8	4264
8640	min	Summer	0.632	0.0	539.4	5024
10080	min	Summer	0.580	0.0	576.7	5760
15	min	Winter	52.681	0.0	85.9	26
30	min	Winter	33.099	0.0	107.0	40
60	min	Winter	20.007	0.0	132.6	70
120	min	Winter	14.450	0.0	191.5	128
180	min	Winter	11.342	0.0	225.1	186

Ove Arup & Partners International Ltd		Page 2
The Arup Campus		
Blyth Gate		
Solihull B90 8AE		Micro
Date 09/12/2024 11:38	Designed by Robert.Belcher	
File 281835_TOTAL SITE 1YR (380M3	Checked by	Dialindye
XP Solutions	Source Control 2020.1.3	1

Summary of Results for 2 year Return Period (+40%)	Summary	of	Results	for	2	year	Return	Period	(+40%)
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	Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
240	min W:	inter	99.594	0.594	0.0	2.0	2.0	225.8	ОК
360	min W:	inter	99.642	0.642	0.0	2.0	2.0	244.0	ΟK
480	min W	inter	99.663	0.663	0.0	2.0	2.0	251.9	ОК
600	min W	inter	99.671	0.671	0.0	2.0	2.0	254.8	ОК
720	min W	inter	99.671	0.671	0.0	2.0	2.0	254.9	ΟK
960	min W	inter	99.659	0.659	0.0	2.0	2.0	250.5	ΟK
1440	min W	inter	99.619	0.619	0.0	2.0	2.0	235.3	ΟK
2160	min W	inter	99.569	0.569	0.0	2.0	2.0	216.1	ΟK
2880	min W	inter	99.521	0.521	0.0	2.0	2.0	197.9	ΟK
4320	min W	inter	99.439	0.439	0.0	2.0	2.0	166.7	ΟK
5760	min W	inter	99.369	0.369	0.0	2.0	2.0	140.4	ΟK
7200	min W	inter	99.311	0.311	0.0	2.0	2.0	118.2	ΟK
8640	min W	inter	99.262	0.262	0.0	2.0	2.0	99.6	ΟK
10080	min W	inter	99.221	0.221	0.0	2.0	2.0	83.8	O K

	Stor: Even	m t	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
240	min	Winter	9.376	0.0	247.6	244
360	min	Winter	7.002	0.0	275.7	360
480	min	Winter	5.618	0.0	292.8	474
600	min	Winter	4.712	0.0	304.2	588
720	min	Winter	4.072	0.0	312.0	702
960	min	Winter	3.223	0.0	319.6	920
1440	min	Winter	2.314	0.0	312.4	1170
2160	min	Winter	1.672	0.0	399.2	1612
2880	min	Winter	1.337	0.0	425.7	2072
4320	min	Winter	0.993	0.0	473.2	2940
5760	min	Winter	0.815	0.0	518.9	3752
7200	min	Winter	0.706	0.0	562.0	4544
8640	min	Winter	0.632	0.0	604.2	5280
10080	min	Winter	0.580	0.0	645.9	6048

Ove Arup & Partners International Ltd		Page 3
The Arup Campus		
Blyth Gate		
Solihull B90 8AE		Mirro
Date 09/12/2024 11:38	Designed by Robert.Belcher	Drainage
File 281835_TOTAL SITE 1YR (380M3	Checked by	Diginage
XP Solutions	Source Control 2020.1.3	
<u>R</u>	ainfall Details	
Rainfall Model Return Period (years) FEH Rainfall Version Site Location GB 529047 : Data Type Summer Storms	FEH Winter Storms 2 Cv (Summer) 0. 2013 Cv (Winter) 0. 82363 TQ 29047 82363 Shortest Storm (mins) Point Longest Storm (mins) 10 Yes Climate Change %	Yes 750 840 15 080 +40
<u>Ti</u>	me Area Diagram	
То	al Area (ha) 0.790	
Time (mins) Area T From: To: (ha) F	ime (mins) Area Time (mins) Area rom: To: (ha) From: To: (ha)	
0 4 0.250	4 8 0.250 8 12 0.290	

Ove Arup & Partners International Lto	1				Pag	e 4			
The Arup Campus									
Blyth Gate									
Solihull B90 8AE						licco			
Date 09/12/2024 11:38	Designe	d by Robe	ert.Belch	er					
File 281835 TOTAL SITE 1YR (380M3	Checked	hv				rainage			
XP Solutions	Source	Control 2	2020.1.3						
Model Details									
Storage is Online Cover Level (m) 100.000									
<u>Cellular Storage Structure</u>									
Invert Level (m) 99.000 Safety Factor 2.0									
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00									
Infiltration Coefficient Side (m/hr) 0.00000									
Depth (m) Area (m^2) Inf	Donth (m) Apon (m^2) The Apon (m^2) Donth (m) Apon (m^2) The Apon (m^2)								
	mea (m)	Depth (m)	mea (m)	IIII. Area (m	,				
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<u><u>P</u></u>	ump Outflo	ow Contro	1						
		() 00 00	0						
1	nvert Level	(m) 99.00	0						
Depth (m) Flow (1/s) Depth (m) Flow (1/s)	Depth (m) H	[low (l/s)	Depth (m)	Flow (l/s) D	epth (m)	Flow (l/s)			
0.100 2.0000 0.800 2.0000	2.000	2.0000	4.000	2.0000	7.000	2.0000			
0.200 2.0000 1.000 2.0000	2.200	2.0000	4.500	2.0000	7.500	2.0000			
0.300 2.0000 1.200 2.0000	2.400	2.0000	5.000	2.0000	8.000	2.0000			
0.400 2.0000 1.400 2.0000	2.600	2.0000	5.500	2.0000	8.500	2.0000			
0.500 2.0000 1.600 2.0000	3.000	2.0000	6.000	2.0000	9.000	2.0000			
0.600 2.0000 1.800 2.0000	3.500	2.0000	6.500	2.0000	9.500	2.0000			

Ove Arup & Partners International Ltd		Page 1
The Arup Campus		
Blyth Gate		
Solihull B90 8AE		Micro
Date 09/12/2024 11:36	Designed by Robert.Belcher	
File 281835_TOTAL SITE 30YR (380M3	Checked by	Digitigh
XP Solutions	Source Control 2020.1.3	

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 226 minutes.

	Storm	ı	Max	Max	Max	Max	Max	Max	Stat	tus
	Event	:	Level	Depth	Infiltration	Control	Σ Outflow	Volume		
			(m)	(m)	(1/s)	(l/s)	(1/s)	(m³)		
15	min S	Summer	99.485	0.485	0.0	14.0	14.0	184.3		ОК
30	min S	Summer	99.606	0.606	0.0	14.0	14.0	230.2		ОК
60	min S	Summer	99.699	0.699	0.0	14.0	14.0	265.5		ОК
120	min S	Summer	99.817	0.817	0.0	14.0	14.0	310.3	Flood	Risk
180	min S	Summer	99.838	0.838	0.0	14.0	14.0	318.5	Flood	Risk
240	min S	Summer	99.828	0.828	0.0	14.0	14.0	314.5	Flood	Risk
360	min S	Summer	99.781	0.781	0.0	14.0	14.0	296.8	Flood	Risk
480	min S	Summer	99.726	0.726	0.0	14.0	14.0	276.0	Flood	Risk
600	min S	Summer	99.672	0.672	0.0	14.0	14.0	255.3		ОК
720	min S	Summer	99.619	0.619	0.0	14.0	14.0	235.4		ОК
960	min S	Summer	99.522	0.522	0.0	14.0	14.0	198.3		ОК
1440	min S	Summer	99.361	0.361	0.0	14.0	14.0	137.0		ОК
2160	min S	Summer	99.198	0.198	0.0	14.0	14.0	75.1		ΟK
2880	min S	Summer	99.115	0.115	0.0	14.0	14.0	43.6		ОК
4320	min S	Summer	99.079	0.079	0.0	11.1	11.1	30.2		ОК
5760	min S	Summer	99.064	0.064	0.0	8.9	8.9	24.3		ОК
7200	min S	Summer	99.054	0.054	0.0	7.6	7.6	20.6		ОК
8640	min S	Summer	99.048	0.048	0.0	6.7	6.7	18.1		ΟK
10080	min S	Summer	99.043	0.043	0.0	6.0	6.0	16.3		ΟK
15	min V	Winter	99.547	0.547	0.0	14.0	14.0	208.0		ΟK
30	min V	Winter	99.686	0.686	0.0	14.0	14.0	260.6		ΟK
60	min V	Winter	99.796	0.796	0.0	14.0	14.0	302.5	Flood	Risk
120	min V	Winter	99.942	0.942	0.0	14.0	14.0	358.0	Flood	Risk
180	min V	Winter	99.979	0.979	0.0	14.0	14.0	372.0	Flood	Risk

	Stor	m	Rain	Flooded	Discharge	Time-Peak
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
15	min	Summer	134.997	0.0	199.8	25
30	min	Summer	86.070	0.0	254.8	39
60	min	Summer	52.328	0.0	309.9	66
120	min	Summer	33.467	0.0	396.4	124
180	min	Summer	25.086	0.0	445.7	180
240	min	Summer	20.206	0.0	478.7	206
360	min	Summer	14.643	0.0	520.4	268
480	min	Summer	11.541	0.0	546.9	334
600	min	Summer	9.558	0.0	566.1	400
720	min	Summer	8.177	0.0	581.2	468
960	min	Summer	6.373	0.0	604.0	598
1440	min	Summer	4.477	0.0	636.4	846
2160	min	Summer	3.150	0.0	671.7	1192
2880	min	Summer	2.464	0.0	700.7	1504
4320	min	Summer	1.763	0.0	752.0	2208
5760	min	Summer	1.403	0.0	798.0	2936
7200	min	Summer	1.184	0.0	841.9	3672
8640	min	Summer	1.037	0.0	884.4	4408
10080	min	Summer	0.931	0.0	926.3	5136
15	min	Winter	134.997	0.0	223.8	25
30	min	Winter	86.070	0.0	285.4	39
60	min	Winter	52.328	0.0	347.1	66
120	min	Winter	33.467	0.0	444.0	122
180	min	Winter	25.086	0.0	499.2	178

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Solihull B90 8AE		Micco
Date 09/12/2024 11:36	Designed by Robert.Belcher	
File 281835_TOTAL SITE 30YR (380M3	Checked by	Dialitatje
XP Solutions	Source Control 2020.1.3	
Summary of Results	for 30 year Return Period (+40%)	

Storm

Max Max Max Max Max Status

Event		Level	Depth	Infiltration	Control	Σ Outflow	Volume					
				(m)	(m)	(1/s)	(1/s)	(1/s)	(m³)			
	240	min	Winter	99.970	0.970	0.0	14.0	14.0	368.6	Flood	Risk	
	360	min	Winter	99.907	0.907	0.0	14.0	14.0	344.7	Flood	Risk	
	480	min	Winter	99.834	0.834	0.0	14.0	14.0	316.8	Flood	Risk	
	600	min	Winter	99.756	0.756	0.0	14.0	14.0	287.4	Flood	Risk	
	720	min	Winter	99.680	0.680	0.0	14.0	14.0	258.3		ΟK	
	960	min	Winter	99.536	0.536	0.0	14.0	14.0	203.7		ΟK	
	1440	min	Winter	99.302	0.302	0.0	14.0	14.0	114.7		ΟK	
	2160	min	Winter	99.106	0.106	0.0	14.0	14.0	40.4		ΟK	
	2880	min	Winter	99.081	0.081	0.0	11.4	11.4	30.8		ΟK	
	4320	min	Winter	99.058	0.058	0.0	8.2	8.2	22.2		ΟK	
	5760	min	Winter	99.047	0.047	0.0	6.5	6.5	17.7		ΟK	
	7200	min	Winter	99.039	0.039	0.0	5.5	5.5	15.0		ΟK	
	8640	min	Winter	99.035	0.035	0.0	4.9	4.9	13.1		ΟK	
	10080	min	Winter	99.031	0.031	0.0	4.4	4.4	11.8		ΟK	

	Stor Even	m t	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
240	min	Winter	20.206	0.0	536.2	232
360	min	Winter	14.643	0.0	582.8	288
480	min	Winter	11.541	0.0	612.5	362
600	min	Winter	9.558	0.0	634.1	438
720	min	Winter	8.177	0.0	651.0	508
960	min	Winter	6.373	0.0	676.5	646
1440	min	Winter	4.477	0.0	712.8	888
2160	min	Winter	3.150	0.0	752.3	1152
2880	min	Winter	2.464	0.0	784.8	1476
4320	min	Winter	1.763	0.0	842.3	2212
5760	min	Winter	1.403	0.0	893.8	2896
7200	min	Winter	1.184	0.0	942.9	3680
8640	min	Winter	1.037	0.0	990.6	4392
10080	min	Winter	0.931	0.0	1037.5	5152

Ove Arup & Partners International Ltd			Page 3
The Arup Campus			
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Solihull B90 8AE			Micco
Date 09/12/2024 11:36	Designed by Rok	pert.Belcher	
File 281835_TOTAL SITE 30YR (380M3	Checked by		Diamage
XP Solutions	Source Control	2020.1.3	
<u>R</u>	ainfall Details		
Rainfall Model Return Period (years) FEH Rainfall Version Site Location GB 529047 Data Type Summer Storms	2 182363 TQ 29047 82 Po.	FEH Winter Storms Yes 30 Cv (Summer) 0.7 013 Cv (Winter) 0.8 363 Shortest Storm (mins) int Longest Storm (mins) 100 Yes Climate Change % -	řes 750 340 15 080 +40
<u>T:</u>	ime Area Diagram	<u>1</u>	
То	tal Area (ha) 0.79	0	
Time (mins) Area From: To: (ha) F	Time (mins) Area From: To: (ha)	Time (mins) Area From: To: (ha)	
0 4 0.250	4 8 0.250	8 12 0.290	
·		I	

Ove Arup & Partners	Internat	tional Lto	d				Pag	e 4	
The Arup Campus									
Blyth Gate									
Solihull B90 8AE							N	licco	
Date 09/12/2024 11:3	36		Design	ed by Robe	ert.Belch	ler			
File 281835 TOTAL SI	TE 30YR	(380M3	Checke	d bv				rainage	
 XP Solutions			Source	Control 2	2020.1.3				
Model Details									
		Storage is	Online Co	ver Level (m) 100.000				
<u>Cellular Storage Structure</u>									
		т	nvert Leve	1 (m) 99 0	00 Safety	Factor 20			
I	nfiltratio	on Coeffici	ent Base (1	m/hr) 0.000	00 Salecy 00 Po	rosity 1.00			
I	nfiltratio	on Coeffici	ent Side (1	m/hr) 0.000	00	1			
				1					
Depti	h (m) Area	a (m²) Inf.	Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)		
(0.000	380.0	0.0	1.000	380.0		0.0		
		<u>P</u> .	um <u>p</u> Outfl	<u>low Contro</u>	<u>)1</u>				
		-			<u>.</u>				
		Ţ	nvert Leve	1 (m) 99.00	0				
Depth (m) Flow (1/s) D	epth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	
0 100 14 0000	0 000	14 0000	2 000	14 0000	4 000	14 0000	7 000	14 0000	
0.200 14.0000	1.000	14.0000	2.200	14.0000	4.000	14.0000	7.500	14.0000	
0.300 14.0000	1.200	14.0000	2.400	14.0000	5.000	14.0000	8.000	14.0000	
0.400 14.0000	1.400	14.0000	2,600	14.0000	5.500	14.0000	8,500	14.0000	
0.500 14.0000	1.600	14.0000	3.000	14.0000	6.000	14.0000	9.000	14.0000	
0.600 14.0000	1.800	14.0000	3.500	14.0000	6.500	14.0000	9.500	14.0000	
		I			1		1		

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	Micro
Designed by Robert.Belcher	
Checked by	Diamage
Source Control 2020.1.3	1
	Designed by Robert.Belcher Checked by Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 82 minutes.

	Storm	L	Max	Max	Max	Max	Max	Max	Stat	tus
	Event		Level	Depth	Infiltration	Control	Σ Outflow	Volume		
			(m)	(m)	(1/s)	(l/s)	(l/s)	(m³)		
15	min S	Summer	99.587	0.587	0.0	39.0	39.0	223.2		ΟK
30	min S	Summer	99.724	0.724	0.0	39.0	39.0	275.0	Flood	Risk
60	min S	Summer	99.783	0.783	0.0	39.0	39.0	297.6	Flood	Risk
120	min S	Summer	99.838	0.838	0.0	39.0	39.0	318.6	Flood	Risk
180	min S	Summer	99.828	0.828	0.0	39.0	39.0	314.6	Flood	Risk
240	min S	Summer	99.793	0.793	0.0	39.0	39.0	301.5	Flood	Risk
360	min S	Summer	99.695	0.695	0.0	39.0	39.0	264.1		ΟK
480	min S	Summer	99.587	0.587	0.0	39.0	39.0	223.0		ΟK
600	min S	Summer	99.483	0.483	0.0	39.0	39.0	183.7		ΟK
720	min S	Summer	99.390	0.390	0.0	39.0	39.0	148.1		ΟK
960	min S	Summer	99.241	0.241	0.0	39.0	39.0	91.6		ΟK
1440	min S	Summer	99.101	0.101	0.0	39.0	39.0	38.3		ΟK
2160	min S	Summer	99.071	0.071	0.0	27.8	27.8	27.0		ΟK
2880	min S	Summer	99.055	0.055	0.0	21.5	21.5	21.0		ОК
4320	min S	Summer	99.039	0.039	0.0	15.1	15.1	14.6		ОК
5760	min S	Summer	99.030	0.030	0.0	11.8	11.8	11.4		ОК
7200	min S	Summer	99.025	0.025	0.0	9.7	9.7	9.5		ОК
8640	min S	Summer	99.022	0.022	0.0	8.5	8.5	8.2		ОК
10080	min S	Summer	99.019	0.019	0.0	7.5	7.5	7.2		ОК
15	min V	Winter	99.669	0.669	0.0	39.0	39.0	254.2		ОК
30	min V	Winter	99.828	0.828	0.0	39.0	39.0	314.6	Flood	Risk
60	min V	Winter	99.909	0.909	0.0	39.0	39.0	345.5	Flood	Risk
120	min V	Vinter	99.977	0.977	0.0	39.0	39.0	371.3	Flood	Risk
180	min V	Vinter	99.956	0.956	0.0	39.0	39.0	363.5	Flood	Risk

	Stor	m	Rain	Flooded	Discharge	Time-Peak
	Even	t	(mm/hr)	Volume	Volume	(mins)
				(m³)	(m³)	
15	min	Summer	179.466	0.0	265.6	23
30	min	Summer	115.404	0.0	341.7	36
60	min	Summer	70.357	0.0	416.7	62
120	min	Summer	45.255	0.0	536.1	98
180	min	Summer	34.318	0.0	609.8	132
240	min	Summer	27.902	0.0	661.1	166
360	min	Summer	20.470	0.0	727.5	234
480	min	Summer	16.234	0.0	769.3	298
600	min	Summer	13.482	0.0	798.6	362
720	min	Summer	11.546	0.0	820.7	420
960	min	Summer	8.990	0.0	852.1	534
1440	min	Summer	6.275	0.0	892.2	740
2160	min	Summer	4.352	0.0	928.0	1104
2880	min	Summer	3.356	0.0	954.2	1468
4320	min	Summer	2.335	0.0	996.0	2200
5760	min	Summer	1.814	0.0	1031.7	2936
7200	min	Summer	1.501	0.0	1066.9	3672
8640	min	Summer	1.291	0.0	1101.6	4344
10080	min	Summer	1.142	0.0	1136.3	5064
15	min	Winter	179.466	0.0	297.6	24
30	min	Winter	115.404	0.0	382.7	36
60	min	Winter	70.357	0.0	466.7	62
120	min	Winter	45.255	0.0	600.4	106
180	min	Winter	34.318	0.0	683.0	142

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Solihull B90 8AE		Micro
Date 09/12/2024 11:40	Designed by Robert.Belcher	
File 281835_TOTAL SITE 100YR +40%	Checked by	Dialitacje
XP Solutions	Source Control 2020.1.3	1

Summary of Results for 100 year Return Period (+40%)

:	Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Σ	Max Outflow (l/s)	Max Volume (m³)	Stat	us
240	min Win	ter	99.900	0.900	0.0	39.0		39.0	342.1	Flood	Risk
360	min Win	ter	99.746	0.746	0.0	39.0		39.0	283.4	Flood	Risk
480	min Win	ter	99.581	0.581	0.0	39.0		39.0	220.7		ОК
600	min Win	ter	99.427	0.427	0.0	39.0		39.0	162.4		ОК
720	min Win	ter	99.295	0.295	0.0	39.0		39.0	112.2		ΟK
960	min Win	ter	99.119	0.119	0.0	39.0		39.0	45.2		ОК
1440	min Win	ter	99.075	0.075	0.0	29.2		29.2	28.3		ОК
2160	min Win	ter	99.052	0.052	0.0	20.2		20.2	19.8		ОК
2880	min Win	ter	99.040	0.040	0.0	15.7		15.7	15.2		ОК
4320	min Win	ter	99.028	0.028	0.0	11.0		11.0	10.6		ОК
5760	min Win	ter	99.022	0.022	0.0	8.5		8.5	8.2		ОК
7200	min Win	ter	99.018	0.018	0.0	7.1		7.1	6.9		ОК
8640	min Win	ter	99.016	0.016	0.0	6.1		6.1	5.9		ОК
10080	min Win	ter	99.014	0.014	0.0	5.4		5.4	5.2		ОК

	Stor Even	m t	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
240	min	Winter	27.902	0.0	740.4	180
360	min	Winter	20.470	0.0	814.8	252
480	min	Winter	16.234	0.0	861.6	320
600	min	Winter	13.482	0.0	894.5	382
720	min	Winter	11.546	0.0	919.4	438
960	min	Winter	8.990	0.0	954.4	524
1440	min	Winter	6.275	0.0	999.2	738
2160	min	Winter	4.352	0.0	1039.4	1108
2880	min	Winter	3.356	0.0	1068.7	1452
4320	min	Winter	2.335	0.0	1115.5	2176
5760	min	Winter	1.814	0.0	1155.5	2928
7200	min	Winter	1.501	0.0	1195.0	3680
8640	min	Winter	1.291	0.0	1233.9	4312
10080	min	Winter	1.142	0.0	1272.6	5024

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The Arup Campus									
Blyth Gate									
Solihull B90 8AE		Micro							
Date 09/12/2024 11:40	Designed by Robert.Belcher	Drainago							
File 281835_TOTAL SITE 100YR +40%	Checked by	Diamage							
XP Solutions	Source Control 2020.1.3								
Rainfall Details									
Rainfall Model Return Period (years) FEH Rainfall Version Site Location GB 529047 Data Type Summer Storms	FEH Winter Storms M 100 Cv (Summer) 0.7 2013 Cv (Winter) 0.8 182363 TQ 29047 82363 Shortest Storm (mins) Point Longest Storm (mins) 100 Yes Climate Change %	Zes 750 340 15 080 +40							
T	<u>ime Area Diagram</u>								
Tc	otal Area (ha) 0.790								
Time (mins) Area From: To: (ha) I	Time (mins) Area Time (mins) Area From: To: (ha) From: To: (ha)								
	4 0 0 250 0 12 0 200								
0 4 0.250	4 8 0.250 8 12 0.290								

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Blyth Gate										
Solihull B90 8AE					N	licco				
Date 09/12/2024 11:40	Designed	d by Robe	ert.Belch	er						
File 281835 TOTAL SITE 100YR +40%	Checked	by				lalliaye				
XP Solutions	Source C	Control 2	2020.1.3							
<u>Model Details</u>										
Storage in	Online Corre	m Torrol (m) 100 000							
Storage IS	Unitine Cove	r Level (m) 100.000							
Cellular Storage Structure										
		-								
Ir	vert Level	(m) 99.0	00 Safety i	Factor 2.0						
Infiltration Coefficie	nt Base (m/l	hr) 0.000	00 Po: 00	rosity 1.00						
	nic side (m/n	III) 0.000	00							
Depth (m) Area (m²) Inf.	Area (m²) D	epth (m)	Area (m²)	Inf. Area (m	n²)					
0.000 380.0	0.0	1.000	380.0	C).0					
<u>P1</u>	.mp Outflow	w Contro	1							
_			<u>_</u>							
LI	vert Level	(m) 99.00	0							
Depth (m) Flow (1/s) Depth (m) Flow (1/s)	Depth (m) Fl	low (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)				
0.100 39.0000 0.800 39.0000	2.000	39.0000	4.000	39.0000	7.000	39.0000				
0.200 39.0000 1.000 39.0000	2.200	39.0000	4.500	39.0000	7.500	39.0000				
0.300 39.0000 1.200 39.0000	2.400	39.0000	5.000	39.0000	8.000	39.0000				
0.400 39.0000 1.400 39.0000	2.600	39.0000	5.500	39.0000	8.500	39.0000				
0.500 39.0000 1.600 39.0000	3.000	39.0000	6.000	39.0000	9.000	39.0000				
0.600 39.0000 1.800 39.0000	3.500	39.0000	6.500	39.0000	9.500	39.0000				

D. Camden SuDS Pro-forma

GREATER LONDON AUTHORITY

	Project / Site Name (including sub- catchment / stage / phase where appropriate)	Euston Tower	
tails	Address & post code	286 Euston Road, London, NW1 3DP	
	OS Grid ref. (Easting, Northing)	E 529192	
		N 182362	
	LPA reference (if applicable)		
1. Project & Site De	Brief description of proposed work	Major retrofit of Euston Tower including the partial retention (retention of existing core, foundations and basement), disassembly and re-use	
	Total site Area	7900 m ²	
	Total existing impervious area	7900 m ²	
	Total proposed impervious area	7900 m ²	
	Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	No	
	Existing drainage connection type and location	Connection into eixsting Thames Water combined sewer	
	Designer Name	Robert Belcher	
	Designer Position	Engineer	

	2a. Infiltration Feasibility			
	Superficial geology classification	Lynch Hill Gravel		
	Bedrock geology classification		London Clay	
	Site infiltration rate	0	m/s	
	Depth to groundwater level	Unknown m below ground le		w ground level
	Is infiltration feasible?	No		
	2b. Drainage Hierarchy			
כוובווו			Feasible (Y/N)	Proposed (Y/N)
201	1 store rainwater for later use		Y	Y
Toposed Discriminge Arris	2 use infiltration techniques, such as porous surfaces in non-clay areas		Ν	N
	3 attenuate rainwater in ponds or open water features for gradual release		Ν	N
	4 attenuate rainwater by storing in tanks or sealed water features for gradual release		Y	Y
i	5 discharge rainwater direct to a watercourse		Ν	Ν
	6 discharge rainwater to a surface water sewer/drain		Ν	N
	7 discharge rainwater to the combined sewer.		Y	Y
	2c. Proposed Discharge Details			
	Proposed discharge location	Euston Road (continue to use existing)		
	Has the owner/regulator of the discharge location been	Yes		

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	Designer Company	Arup
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consulted?

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	3a. Discharge Rates & Required Storage				
		Greenfield (GF) runoff rate (l/s)	Existing discharge rate (I/s)	Required storage for GF rate (m ³)	Proposed discharge rate (I/s)
	Qbar	1.2	\geq	\geq	$>\!$
	1 in 1	1	26.3		2
	1 in 30	2.8	81.9		14.1
	1 in 100	3.9	123		39
	1 in 100 + CC		\geq		
ategy	Climate change allowance used		40%		
	3b. Principal Method of Flow Control		Pump		
e St	3c. Proposed SuDS Measures				
rainag			Catchment area (m²)	Plan area (m²)	Storage vol. (m ³)
3. [Rainwater harvesting		0	$\left \right\rangle$	0
	Infiltration systems		0	\geq	0
	Green roofs		0	0	0
	Blue roofs		0	0	0
	Filter strips		0	0	0
	Filter drains		0	0	0
	Bioretention / tree pits		0	0	0
	Pervious pavements		0	0	0
	Swales		0	0	0
	Basins/ponds		0	0	0
	Attenuation tanks		7900	\geq	380
	Total		7900	0	380

	4a. Discharge & Drainage Strategy	Page/section of drainage report		
ting Information	Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	Not feasible due to underlying strata and existing basement which is to be retained (page 14, table 3) 281835-of ARP-XX-XX-RP-CD-0002- 05		
	Drainage hierarchy (2b)	Page 8, table 7 (Addendum)		
	Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Page 3 (Addendum)		
	Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Page 3 (Addendum)		
	Proposed SuDS measures & specifications (3b)	Page 5 (Addendum)		
por	4b. Other Supporting Details	Page/section of drainage report		
. Sup	Detailed Development Layout	Appendix		
4.	Detailed drainage design drawings, including exceedance flow routes	Appendix		
	Detailed landscaping plans	NA (see landscape document)		
	Maintenance strategy	Table 8 & 9		
	Demonstration of how the proposed SuDS measures improve:			
	a) water quality of the runoff?	Table 5		
	b) biodiversity?	Table 5		
	c) amenity?	Table 5		