

# **SAVILLE THEATRE** 135 SHAFTESBURY AVENUE

SUSTAINABLE URBAN DRAINAGE 105465-PEF-ZZ-XX-DR-CD-000001-S2-P04\_SDR

PELL FRISCHMANN

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### 1 Introduction & Report Context

#### 1.1 Context and Commission

- 1.1.1 Pell Frischmann has been commissioned to develop a Sustainable Drainage Strategy to support a planning application for the part demolition, restoration and refurbishment of the existing Grade II listed building, roof extension, and excavation of basement space, to provide a theatre at lower levels, with ancillary restaurant / bar space (Sui Generis) at ground floor level; and hotel (Class C1) at upper levels; provision of ancillary cycle parking, servicing and rooftop plant, and other associated works. This development shall hereafter be referred to as the Saville Theatre.
- 1.1.2 This Sustainable Drainage Report will (SDR) will set out the key principles of the proposed surface and foul water drainage strategies and demonstrate accordance with local and national guidance and best practice.
- 1.1.3 This includes justification of:
  - Outfall locations;
  - Discharge rates;
  - Volume of attenuation required on site;
  - Sustainable Drainage Systems to be included within proposals

#### 1.2 Information Consulted

- 1.2.1 A review of relevant information has been consulted to develop an appropriate drainage strategy for the development as follows:
  - > National Planning Policy Framework (NPPF), December 2023;
  - Planning Practice Guidance (PPG), August 2022;
  - > Non-statutory technical standards for sustainable drainage systems, March 2015;
  - Sewerage Sector Guidance, October 2019;
  - > The SuDS Manual C753 Version 6, 2015;
  - > Camden & Greater London Authority Sustainable Drainage Proforma;
  - > Approved Document H, Building Regulations;
  - > Camden Borough Council Strategic Flood Risk Assessment, 2014,
- 1.2.2 Pell Frischmann have been commissioned by YC Saville Theatre Limited to develop a sustainable drainage strategy to support an outline application. This document should be read in tandem with Pell Frischmann Flood Risk Assessment reference *105465-PEF-ZZ-XX-RP-YE-000010*.

### 2 Existing Site

### 2.1 Site Location and Existing Use

- 2.1.1 The footprint of the site, and thus the site boundary is approximately 800m<sup>2</sup> in size and is currently in use as a cinema.
- 2.1.2 The site is bound to the southwest by Stacey Street, the south east by Shaftesbury Avenue, the Northeast by St Giles Passage, and the Northwest by New Compton Street.
- 2.1.3 The site location can be seen below in **Figure** 2-1.

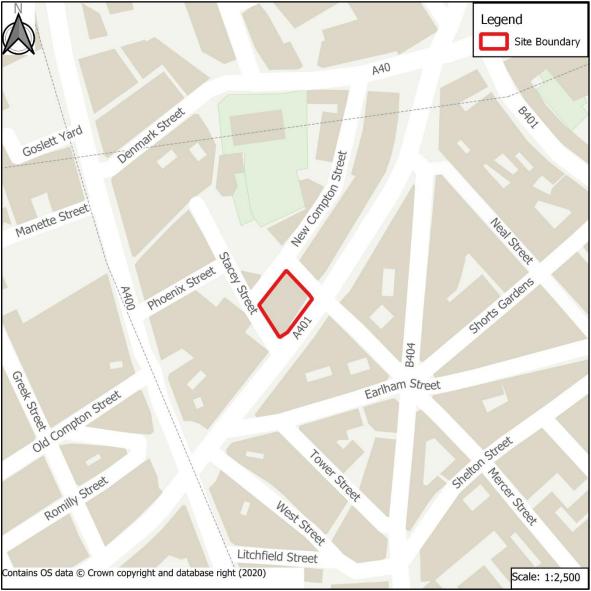


Figure 2-1 Site Location Plan

#### 2.2 Topography

- 2.2.1 As previously mentioned, the application area is entirely occupied by an existing building. This building is accessed from various points at different levels (as can be seen from the stepped access at the front of the building.
- 2.2.2 The wider topography of the area shows levels fall from North to South.
- 2.2.3 The topography as discussed above can be seen for the site and surrounding area in **Figure** 2-2.

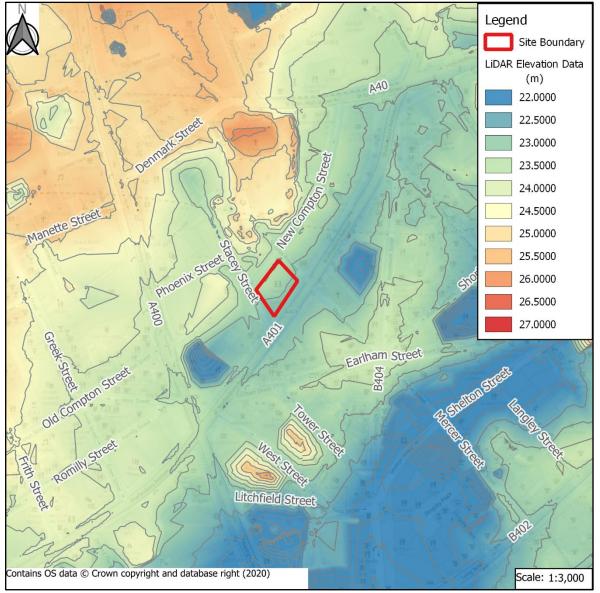
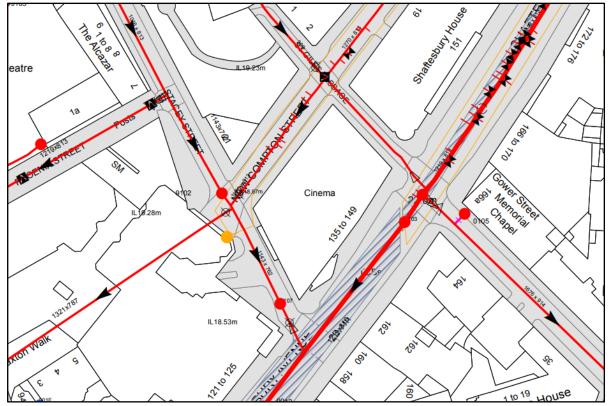


Figure 2-2 LiDAR Elevation Data

#### 2.3 Existing Drainage Regime

#### **Existing Surface Water Drainage Features**

- 2.3.1 Given the existing use of the site as a cinema, it is assumed that the existing building is served by a traditional drainage system above ground a system of gutters and down pipes convey roof runoff into the surrounding public sewerage network.
- 2.3.2 The interaction with the system serving the foul water generated by the building is unknown including the point at which the foul and surface water systems converge. This is discussed in **Section 4**.
- 2.3.3 An extract of the sewer records for the area can be seen below in Figure 2-3.



**Extract of Local Thames Water Sewer Network** Figure 2-3

#### **Existing runoff rate**

- The existing runoff rate has been assessed using a notional network model to calculate the peak runoff 2.3.4 generated by a 15-minute event on the footprint of the building for several key return periods.
- 2.3.5 The calculated existing runoff rates pertaining to the site are summarised below in Table 2-1. The calculations for the below can be seen in Appendix A.
- 2.3.6 The 100 year + 40% Climate Change event peak runoff rate of 81.3l/s can be conveyed by a 300mm pipe laid at 1:100. It is likely that the existing building has multiple connections to the public sewer network.

Table 2-1 Runoff Ra	ates for existing site
Return Period	Peak Runoff Rate (I/s)
2	16.8
30	43.9
100 (+40% Climate Change)	81.3

#### **Existing Runoff Volume**

In accordance with clause **S5** in Non-statutory technical standards for sustainable drainage systems; 2.3.7

S5 Where reasonably practicable, 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.

- 2.3.8 The greenfield runoff volume for the 360-minute, 100-year return period event is calculated at 12.1m<sup>3</sup>. The calculations for this event can be seen in Appendix B.
- 2.3.9 The runoff volume for the existing site for 360-minute, 100-year return period event calculated at 70m<sup>3</sup>. Calculations for this can be seen in **Appendix C**.

2.3.10 Detailed designs should therefore adhere to the requirements outlined above.

#### **Existing Surface Water Runoff Routing**

2.3.11 The existing runoff generated by the site will be naturally directed toward local low points should the drainage infrastructure fail or exceed inherent capacity. This will result in general direction of flow towards the low point within the A401 to the east of the site in accordance with Surface Water Flood Routing. This can be seen in **Figure** 2-4 below.

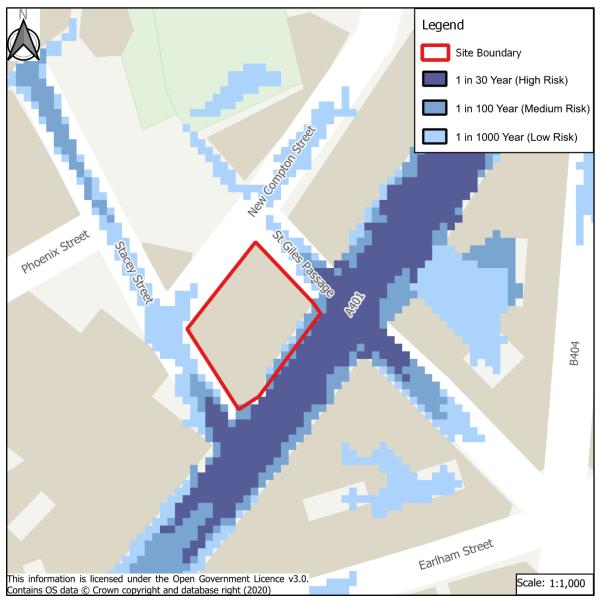


Figure 2-4 Risk of Flooding From Surface Water Mapping

#### 2.4 Groundwater

- 2.4.1 As discussed in the aforementioned Pell Frischmann Flood Risk Assessment, the overall risk of groundwater flooding to the site is classified as low due to the Camden Borough Council's SFRA suggesting that it lies within an area of deep groundwater.
- 2.4.2 This suggests that changes in the level of water table within the site have little impact on the current drainage of the site in its undeveloped state.

### 3 Proposed Surface Water Drainage Strategy

#### 3.1 Drainage Hierarchy Assessment

- 3.1.1 Prevailing local and national guidance (including being prescribed in Approved Document H of Building Regulations) dictates that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable;
  - Water reuse, where a need is identified;
  - > Into the ground (infiltration), where ground conditions permit;
  - > To a surface water body or watercourse;
  - > To a surface water sewer, highway drain, or another drainage system;
  - To a combined water sewer;
- 3.1.2 The overall aim of the drainage hierarchy is to manage surface water runoff close to where it falls and to mimic pre-existing drainage regimes.
- 3.1.3 A development-wide water reuse system should be considered within proposals to make use of runoff generated by the footprint of the building. This could include storage and greywater repurposing for e.g. irrigation for planting, laundry services etc.
- 3.1.4 It is likely to be unfeasible to manage the entire runoff via reuse, ergo an offsite discharge will be required.
- 3.1.5 The site is underlain by London Clay Formations, thus the potential use of infiltration as a means of surface water disposal is to be unlikely.
- 3.1.6 The next preferrable method for surface water disposal is a local waterbody or watercourse. The site's location, being far removed from any open watercourses, precludes this from being a feasible option.
- 3.1.7 The next most appropriate receptor for surface water should therefore be the public sewerage network. **Figure** 2-3 shows that a comprehensive combined sewer network serves the local area and therefore represents a feasible method of surface water disposal.
- 3.1.8 As discussed earlier in this report, it is assumed that surface water currently drains from the site into the public sewerage network and therefore the methodology outlined in this section follows existing drainage patterns.

#### 3.2 Outfall assessment

- 3.2.1 In order to prove the existing surface water sewer has capacity, Thames Water have been consulted on impacts of the development on the existing sewerage network. Results of this assessment for surface water are yet to be provided however it is considered that no impact will be made on the existing network due to the continuity of total impermeable area.
- 3.2.2 It is recommended that a survey is commissioned to better understand the existing drainage connections from the cinema into the public network.

#### 3.3 Runoff rate control

- 3.3.1 It is proposed that, because there are no external areas or possible locations for attenuation within the development, that there is no opportunity for runoff rate control within the drainage network serving the site.
- 3.3.2 Due to the continuity of an overall impermeable area, it is considered that the peak runoff rate and volume will not be altered and thus there will be no overall impact on the public sewerage network.

#### 3.4 Impermeable areas

3.4.1 The building footprint is approximately 800m<sup>2</sup>, representing no net change to existing conditions.

### 3.5 Principles of Maintenance and Adoption

- 3.5.1 For the proposed surface water drainage system to function correctly, it will need to be appropriately maintained. It is proposed that the drainage features on site are to be maintained by the operators of the building in its developed state.
- 3.5.2 The maintenance schedule adhered to for the network must be comprehensive and detail the specific maintenance requirements for each element of the drainage system.
- 3.5.3 For pipes, manholes and gullies, both general best practice and specific manufacturer maintenance protocols should be followed.

### 4 Proposed Foul Water Drainage Strategy

- 4.1.1 In its undeveloped state, the site has existing connection into the Thames Water sewer network.
- 4.1.2 It is proposed to reuse existing connections into the sewer network for the proposed site.
- 4.1.3 The peak flow rate to be generated by the development will be confirmed with Thames Water pending a detailed schedule of accommodation and commercial use within the building.

### 5 Summary

- 5.1.1 This report and supporting appendices demonstrate that an appropriate surface water drainage strategy has been developed for the site based on sustainable drainage principles in line with the relevant local and national policy and standards.
- 5.1.2 This Sustainable Drainage Report is intended to support a detailed planning application and as such the level of detail included is commensurate with the nature of the proposals. **Table** 5-1 provides a summary of key information.

Торіс	Existing Site		Proposed Development
Site Area (m <sup>2</sup> )	800		800
Impermeable Area (m <sup>2</sup> )	800		800
Number of Sub- Catchments	1		1
Outfall Location(s)	Combined Sewer	Network	Combined Sewer Network
	1 in 2-year	16.8	
	1 in 30-year	43.9	As Existing
Peak Runoff Rate (l/s)	1 in 100-year	81.3	
Proposed Storage Volume (m <sup>3</sup> )	-		-
SuDS Features	-		Improvement on planning submission strategy to be developed
Maintenance	Landowner		Landowner
Responsibilities			Operators

Table 5-1 Summary of	Key	Information
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Appendix A Existing Runoff Rate Calculations

Pell Frischmann							Pa	ge 1
5 Manchester Square								
London								
W1U 3PD							N/	icro
Date 16/01/2024 14:48	Designe	d by	HMcCo	oll				
File B - Existing Runoff	Checked	by						rainage
Innovyze	Network	2020	.1					
STORM SEWER DESIGN	by the M	lodifi	ed R	atio	nal I	Metho	<u>od</u>	
Design	Criteria	a for	Stor	<u>rm</u>				
Pipe Sizes ST	ANDARD Man	hole S:	izes S	STANDA	RD			
н Н	EH Rainfal	1 Mode	1					
Return Per:							100	
	all Version						2013	
Sit	te Location		28304 1	184308	3 TQ 2		84308 Point	
Maximum Rainfa	Data Type all (mm/hr)						50	
Maximum Time of Concentrat	tion (mins)						30	
	ge (l/s/ha)						0.000	
Volumetric Rur	noff Coeff. PIMP (%)						1.000	
Add Flow / Climate	. ,						100	
Minimum Backdrop	-						0.200	
Maximum Backdrop	-						1.500	
Min Design Depth for Optim: Min Vel for Auto Design							1.200	
Min Slope for Optimisa	-						500	
			C C I .					
Design	ned with Le	evel So	offits					
Design 				torm				
<u>Network I</u> PN Length Fall Slope I.Area T	Design Ta	ble f	for S k	HYD		Secti	ion Type	e Auto Design
<u>Network I</u> PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m S1.000 11.458 0.196 58.5 0.079	Design Ta P.E. Ban Mins) Flow 5.00	ble f se (1/s)	<u>k</u> (mm) 0.600	HYD SECT	<b>(mm)</b> 450	Pipe/	i <b>on Type</b> /Conduit /Conduit	Design
<u>Network I</u> PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m S1.000 11.458 0.196 58.5 0.079 S1.001 2.578 0.006 407.1 0.000	Design Ta P.E. Ban Mins) Flow 5.00	ble f se (1/s) 0.0 0.0	<u>k</u> (mm) 0.600 0.600	HYD SECT	<b>(mm)</b> 450	Pipe/	/Conduit	Design
<u>Network I</u> PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m S1.000 11.458 0.196 58.5 0.079 S1.001 2.578 0.006 407.1 0.000 <u>Netw</u> PN Rain T.C. US/IL E I.	Design Ta .E. Ba ins) Flow 5.00 0.00 ork Resu: .Area Σ B	ble f se (1/s) 0.0 0.0	<u>k</u> (mm) 0.600 0.600 <u>able</u> Foul	HYD SECT O Add	(mm) 450 450	Pipe/ Pipe/ <b>Vel</b>	/Conduit /Conduit	Design
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     S1.000   11.458   0.196   58.5   0.079     S1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E I.     (mm/hr)   (mins)   (m)   (h)	Design Ta .E. Ba ins) Flow 5.00 0.00 ork Resu: .Area Σ B	ble f se (1/s) 0.0 0.0 lts To ase	<u>k</u> (mm) 0.600 0.600 <u>able</u> Foul	HYD SECT O Add 1 (1/	(mm) 450 450 Flow 's)	Pipe/ Pipe/ Vel (m/s)	Conduit Conduit	Design
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     S1.000   11.458   0.196   58.5   0.079     S1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E     (mm/hr)   (mins)   (m)   (h	Design Ta .E. Ba ins) Flow 5.00 0.00 ork Resul .Area Σ B na) Flow	ble f se (1/s) 0.0 0.0 lts T Gase (1/s)	k (mm) 0.600 0.600 able Foul (1/s)	HYD SECT O Add	(mm) 450 450 Flow (s) 0.0	Pipe/ Pipe/ <b>Vel</b> (m/s) 2.66	/Conduit /Conduit Cap (l/s)	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     S1.000   11.458   0.196   58.5   0.079     S1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E     (mm/hr)   (mins)   (m)   (h	Design Ta .E. Ba hins) Flow 5.00 0.00 Cork Resul Area Σ B ha) Flow 0.079 0.079	ble f (1/s) 0.0 0.0 lts T (1/s) 0.0 0.0	k (mm) 0.600 0.600 able Foul (1/s) 0.0 0.0	HYD SECT O Add 1 (1/	(mm) 450 450 Flow 's) 0.0 0.0	Pipe/ Pipe/ <b>Vel</b> (m/s) 2.66	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E   I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   0utfall   0utfall   0utfall	Design Ta .E. Bas ins) Flow 5.00 0.00 Cork Resul Area 2 B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079	ble f se (1/s) 0.0 0.0 lts Tr (1/s) 0.0 0.0 Detai . Level	tor S k (mm) 0.600 0.600 able Foul (1/s) 0.0 0.0 0.0 1. M:	HYD SECT 0 Add 1 (1/ 0r S	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L	Pipe/ Pipe/ (m/s) 2.66 1.00	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   Free   Flowing   Free	Design Ta .E. Bas ins) Flow 5.00 0.00 Cork Resul Area E B ha) Flow 0.079 0.079 0.079 0.079	ble f se (1/s) 0.0 0.0 lts Tr (1/s) 0.0 0.0 0.0 Detai	k   (mm)   0.600   able   Foul   (1/s)   0.0   0.1s   f   M:   I M:   I. I.	HYD SECT 0 0 Add 1 (1/	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L	Pipe/ Pipe/ (m/s) 2.66 1.00	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
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Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E   I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   Outfall   Outfall   Outfall	Design Ta 2.E. Bas mins) Flow 5.00 0.00 cork Resul Area Σ B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 C. Level I (m)	ble f se (1/s) 0.0 0.0 lts T. (1/s) 0.0 0.0 Detai (m)	Eor S   k   (mm)   0.600   able   Foul   (1/s)   0.0   .ls f   I M:   I. I: (1/1)	HYD SECT O Add : (1/ Or S: in evel m)	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L (mm)	Pipe/ Pipe/ (m/s) 2.66 1.00 W (mm)	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:x)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E I.     (mm/hr)   (mins)   (m)   (fr     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free Flowing   Outfall   Outfall   Outfall   S     \$1.001   \$   \$   \$   \$   \$	Design Ta 2.E. Bas mins) Flow 5.00 0.00 cork Resul Area Σ B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 C. Level I (m)	ble f se (1/s) 0.0 0.0 lts T (1/s) 0.0 0.0 Detai (m) -0.202	Eor S k (mm) 0.600 0.600 able Foul (1/s) 0.0 0.0 0.0 1.1 1.1 (1 2.0	HYD SECT O Add : (1/ Or S: in evel m)	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L (mm)	Pipe/ Pipe/ (m/s) 2.66 1.00 W (mm)	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3

Pell Frischmann	1	Page 2
5 Manchester Square		
London		
W1U 3PD		Micro
Date 16/01/2024 14:48	Designed by HMcColl	
File B - Existing Runoff	Checked by	Drainage
Innovyze	Network 2020.1	1
Simulatio	on Criteria for Storm	
Volumetric Runoff Coeff	1.000 Additional Flow - % of Total Flo	ow 0.000
Areal Reduction Factor		
Hot Start (mins)		
HOT START LEVEL (MM) Manhole Headloss Coeff (Global)	0 Flow per Person per Day (1/per/day 0.500 Run Time (mins	
Foul Sewage per hectare (1/s)		
		-
	caphs 0 Number of Storage Structures 0	
	crols 0 Number of Time/Area Diagrams 0	
Number of Offline Cont	crols 0 Number of Real Time Controls 0	
Synthet	<u>ic Rainfall Details</u>	
Rainfall Mod	el FEH	
Rainiali Mod Return Period (year		
FEH Rainfall Versi	•	
Site Locati	on GB 528304 184308 TQ 28304 84308	
Data Ty	-	
Summer Stor		
Winter Stor		
Cv (Summe Cv (Winte	,	
Storm Duration (min	,	

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Runoff riod Summary Seduction Factor ot Start (mins) tart Level (mm) Coeff (Global) r hectare (l/s) of Input Hydrog r of Online Con of Offline Con of Offline Con of Offline Con Synth Rainfall Word Rainfall Versi Site Locati Data Ty Cv (Summe Cv (Winte for Flood Risk Analy Duratio Return Period Climate	Check Netwo <u>y of Cri</u> <u>1) for</u> <u>3imulation</u> 1.000 0 0.500 F 0.000 graphs 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 52 ype er) Warning ysis Time DTS St Profile on(s) (mi d(s) (yea	ed by rk 2020 itical Storm Additica Number of Number of Sadd 184 (mm) 300 estep F. catus (s) Summ ns) rs)	0.1 <u>Result</u> <u>ia</u> nal Flow D Factor Person p of Storag of Time/2 of Real : <u>etails</u> 1308 TQ 2 0.0 ine Iner ON	s by Ma. s by Ma. s * 10m³/h Inlet Coe per Day (1 ge Structu Area Diago Time Conto FF 202 28304 8430 Poin 1.00 1.00 DVD Statu ctia Statu	otal Flo a Storag ffiecier /per/day ures O cams O cols O EH 13 08 ht 00 00 s OFF	Drainag Level (Ran w 0.000 ge 2.000 nt 0.800
Runoff riod Summary Seduction Factor ot Start (mins) tart Level (mm) Coeff (Global) r hectare (l/s) of Input Hydrog r of Online Con of Offline Con of Offline Con of Offline Con Synth Rainfall Word Rainfall Versi Site Locati Data Ty Cv (Summe Cv (Winte for Flood Risk Analy Duratio Return Period Climate	Check Netwo <u>y of Cri</u> <u>1) for</u> <u>3imulation</u> 1.000 0 0.500 F 0.000 graphs 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 0 htrols 52 ype er) Warning ysis Time DTS St Profile on(s) (mi d(s) (yea	ed by rk 2020 itical Storm Additica Number of Number of Sadd 184 (mm) 300 estep F. catus (s) Summ ns) rs)	0.1 <u>Result</u> <u>ia</u> nal Flow D Factor Person p of Storag of Time/2 of Real : <u>etails</u> 1308 TQ 2 0.0 ine Iner ON	s by Ma. s by Ma. s * 10m³/h Inlet Coe per Day (1 ge Structu Area Diago Time Conto FF 202 28304 8430 Poin 1.00 1.00 DVD Statu ctia Statu	otal Flo a Storag ffiecier /per/day ures O cams O cols O EH 13 08 ht 00 00 s OFF	Drainag Level (Ran w 0.000 ge 2.000 nt 0.800
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<u>S:</u> eduction Factor bt Start (mins) cart Level (mm) Coeff (Global) r hectare (l/s) of Input Hydrog r of Online Con of Offline Con of Offline Con <u>Synth</u> Rainfall Mod Rainfall Versi Site Locati Data Ty Cv (Summe Cv (Winte for Flood Risk Analy Duratio Return Period Climate	1) for Simulation 1.000 0 0.500 F: 0.000 graphs 0 ntrols 0 ntrols 0 hetic Rai del ion ion GB 52 ype er) Warning ysis Time DTS St Profile on(s) (mi d(s) (yea	Storm Additio MAD low per Number of Number of Storm (s) Summ ns) rs)	ia nal Flow D Factor Person p of Storag of Time/ D Real 1 etails 1308 TQ 2 0.0 ine Iner ON	y - % of T r * 10m <sup>3</sup> /h Inlet Coe per Day (1 ge Structu Area Diago Time Conto Poin 1.00 DVD Statu tia Statu Winter	otal Flo a Storag ffiecier /per/day ures O cams O cols O EH 13 08 ht 00 00 s OFF	ow 0.000 je 2.000 ut 0.800
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for Flood Risk Analy Duratio Return Period Climate Return Clim	Warning ysis Time DTS St Profile on(s) (mi d(s) (yea	estep F. catus (s) Summ ns) rs)	ine Iner ON	DVD Statu tia Statu Winter	s OFF	
Analy Duratio Return Period Climate Return Cli	ysis Time DTS St Profile on(s) (mi d(s) (yea	estep F. catus (s) Summ ns) rs)	ine Iner ON	rtia Statu Winter		
Return Cli	e Change	(응)		360 100		
				0		
			First (Y) Flood	) First ( Overflo		
mmer 100	+0%					0.064
mmer 100	+0%					-0.102
harged Flooded	Flow / O	worflow		-		Level
(m) (m <sup>3</sup> )	Cap.	(1/s)			Status	
-0 386 0 000	0 05			12 3	OK	
-0.356 0.000	0.00					
m ha p (n	mer 100 arged Flooded Volume (m <sup>3</sup> ) 0.386 0.000	mer 100 +0% arged Flooded oth Volume Flow / O a) (m <sup>3</sup> ) Cap. 0.386 0.000 0.05	mer 100 +0% arged Flooded oth Volume Flow / Overflow a) (m <sup>3</sup> ) Cap. (l/s) 0.386 0.000 0.05	mer 100 +0% arged Flooded Half Dr bth Volume Flow / Overflow Time b) (m <sup>3</sup> ) Cap. (1/s) (mins 0.386 0.000 0.05	mer 100 +0% Arged Flooded Half Drain Pipe oth Volume Flow / Overflow Time Flow b) (m <sup>3</sup> ) Cap. (1/s) (mins) (1/s) 0.386 0.000 0.05 12.3	mer 100 +0% Arged Flooded Half Drain Pipe bth Volume Flow / Overflow Time Flow (m <sup>3</sup> ) Cap. (1/s) (mins) (1/s) Status 0.386 0.000 0.05 12.3 OK

Appendix B Greenfield Runoff Volume Calculations

Pell Frischmann			Page 1
5 Manchester Square			
London			
W1U 3PD			Micco
Date 16/01/2024 14:57	Designed by TSt	urtridge	Micro Drainage
File Greenfield Runoff Volume.SRCX	Checked by		Dialitatje
Innovyze	Source Control	2020.1	
Gre	enfield Runoff N	Volume	
	FSR Data		
Return P	Period (years)	100	
Storm Du	ration (mins)	360	
		and and Wales	
	M5-60 (mm)	20.600	
	Ratio R	0.437	
Areal Red	luction Factor Area (ha)	1.00 0.080	
	SAAR (mm)	600	
	CWI	87.000	
	Urban	0.000	
	SPR	30.000	
	Results		
	Percentage Runoff	(%) 24.41	
Greenfi	eld Runoff Volume (	(m³) 12.092	
	©1982-2020 Innov	yze	

Appendix C Existing Site Runoff Calculations

Pell Frischmann							Pa	ge 1
5 Manchester Square								
London								
W1U 3PD							N/	icro
Date 16/01/2024 14:48	Designe	d by	HMcCo	oll				
File B - Existing Runoff	Checked	by						rainage
Innovyze	Network	2020	.1					
STORM SEWER DESIGN	by the M	lodifi	ed R	atio	nal I	Metho	<u>od</u>	
Design	Criteria	a for	Stor	<u>rm</u>				
Pipe Sizes ST	ANDARD Man	hole S:	izes S	STANDA	RD			
н Н	EH Rainfal	1 Mode	1					
Return Per:							100	
	all Version						2013	
Sit	te Location		28304 1	184308	3 TQ 2		84308 Point	
Maximum Rainfa	Data Type all (mm/hr)						50	
Maximum Time of Concentrat	tion (mins)						30	
· · · · · · · · · · · · · · · · · · ·	ge (l/s/ha)						0.000	
Volumetric Rur	noff Coeff. PIMP (%)						1.000	
Add Flow / Climate	. ,						100	
Minimum Backdrop	-						0.200	
Maximum Backdrop	-						1.500	
Min Design Depth for Optim: Min Vel for Auto Design							1.200	
Min Slope for Optimisa	-						500	
			C C I .					
Design	ned with Le	evel So	offits					
Design 				torm				
<u>Network I</u> PN Length Fall Slope I.Area T	Design Ta	ble f	for S k	HYD		Secti	ion Type	e Auto Design
<u>Network I</u> PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m S1.000 11.458 0.196 58.5 0.079	Design Ta P.E. Ban Mins) Flow 5.00	ble f se (1/s)	<u>k</u> (mm) 0.600	HYD SECT	<b>(mm)</b> 450	Pipe/	i <b>on Type</b> /Conduit /Conduit	Design
<u>Network I</u> PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m S1.000 11.458 0.196 58.5 0.079 S1.001 2.578 0.006 407.1 0.000	Design Ta P.E. Ban Mins) Flow 5.00	ble f se (1/s) 0.0 0.0	<u>k</u> (mm) 0.600 0.600	HYD SECT	<b>(mm)</b> 450	Pipe/	/Conduit	Design
<u>Network I</u> PN Length Fall Slope I.Area T (m) (m) (1:X) (ha) (m S1.000 11.458 0.196 58.5 0.079 S1.001 2.578 0.006 407.1 0.000 <u>Netw</u> PN Rain T.C. US/IL E I.	Design Ta .E. Ba ins) Flow 5.00 0.00 ork Resul .Area Σ B	ble f se (1/s) 0.0 0.0	<u>k</u> (mm) 0.600 0.600 <u>able</u> Foul	HYD SECT O Add	(mm) 450 450	Pipe/ Pipe/ <b>Vel</b>	/Conduit /Conduit	Design
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     S1.000   11.458   0.196   58.5   0.079     S1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E I.     (mm/hr)   (mins)   (m)   (h)	Design Ta .E. Ba ins) Flow 5.00 0.00 ork Resul .Area Σ B	ble f se (1/s) 0.0 0.0 lts To ase	<u>k</u> (mm) 0.600 0.600 <u>able</u> Foul	HYD SECT O Add 1 (1/	(mm) 450 450 Flow 's)	Pipe/ Pipe/ Vel (m/s)	Conduit Conduit	Design
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     S1.000   11.458   0.196   58.5   0.079     S1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E     (mm/hr)   (mins)   (m)   (h	Design Ta .E. Ba ins) Flow 5.00 0.00 ork Resul .Area Σ B ha) Flow	ble f se (1/s) 0.0 0.0 lts T Gase (1/s)	k (mm) 0.600 0.600 able Foul (1/s)	HYD SECT O Add	(mm) 450 450 Flow (s) 0.0	Pipe/ Pipe/ <b>Vel</b> (m/s) 2.66	/Conduit /Conduit Cap (l/s)	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     S1.000   11.458   0.196   58.5   0.079     S1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E     (mm/hr)   (mins)   (m)   (h	Design Ta .E. Ba hins) Flow 5.00 0.00 Cork Resul Area Σ B ha) Flow 0.079 0.079	ble f (1/s) 0.0 0.0 lts T (1/s) 0.0 0.0	k (mm) 0.600 0.600 able Foul (1/s) 0.0 0.0	HYD SECT O Add 1 (1/	(mm) 450 450 Flow 's) 0.0 0.0	Pipe/ Pipe/ <b>Vel</b> (m/s) 2.66	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E   I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   0utfall   0utfall   0utfall	Design Ta .E. Bas ins) Flow 5.00 0.00 Cork Resul Area 2 B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079	ble f se (1/s) 0.0 0.0 lts Tr (1/s) 0.0 0.0 Detai . Level	tor S k (mm) 0.600 0.600 able Foul (1/s) 0.0 0.0 0.0 1. M:	HYD SECT 0 Add 1 (1/ 0r S	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L	Pipe/ Pipe/ (m/s) 2.66 1.00	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   Free   Flowing   Free	Design Ta .E. Bas ins) Flow 5.00 0.00 Cork Resul Area E B ha) Flow 0.079 0.079 0.079 0.079	ble f se (1/s) 0.0 0.0 lts Tr (1/s) 0.0 0.0 0.0 Detai	k   (mm)   0.600   able   Foul   (1/s)   0.0   0.1s   f   M:   I.   I.	HYD SECT 0 0 Add 1 (1/	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L	Pipe/ Pipe/ (m/s) 2.66 1.00	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E   I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   0utfall   0utfall   0utfall	Design Ta .E. Bas ins) Flow 5.00 0.00 Cork Resul Area 2 B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079 0.079	ble f se (1/s) 0.0 0.0 lts Tr (1/s) 0.0 0.0 Detai . Level	Eor S   k   (mm)   0.600   able   Foul   (1/s)   0.0   .ls f   I M:   I. I: (1/1)	HYD SECT O Add : (1/ Or S in sevel	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L	Pipe/ Pipe/ (m/s) 2.66 1.00	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:X)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E   I.     (mm/hr)   (mins)   (m)   (h     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free   Flowing   Outfall   Outfall   Outfall	Design Ta 2.E. Bas mins) Flow 5.00 0.00 cork Resul Area Σ B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 C. Level I (m)	ble f se (1/s) 0.0 0.0 lts T. (1/s) 0.0 0.0 Detai (m)	Eor S   k   (mm)   0.600   able   Foul   (1/s)   0.0   .ls f   I M:   I. I: (1/1)	HYD SECT O Add : (1/ Or S: in evel m)	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L (mm)	Pipe/ Pipe/ (m/s) 2.66 1.00 W (mm)	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3
Network I     PN   Length   Fall   Slope I.Area   T     (m)   (m)   (1:x)   (ha)   (m     \$1.000   11.458   0.196   58.5   0.079     \$1.001   2.578   0.006   407.1   0.000     Netw     PN   Rain   T.C.   US/IL   E I.     (mm/hr)   (mins)   (m)   (fr     \$1.000   50.00   5.07   0.000   0     \$1.001   50.00   5.07   0.000   0     \$1.001   50.00   5.11   -0.196   0     Free Flowing   Outfall   Outfall   Outfall   S     \$1.001   \$   \$   \$   \$   \$	Design Ta 2.E. Bas mins) Flow 5.00 0.00 cork Resul Area Σ B ha) Flow 0.079 0.079 0.079 0.079 0.079 0.079 C. Level I (m)	ble f se (1/s) 0.0 0.0 lts T (1/s) 0.0 0.0 Detai (m) -0.202	Eor S k (mm) 0.600 0.600 able Foul (1/s) 0.0 0.0 0.0 1.1 1.1 (1 2.0	HYD SECT O Add : (1/ Or S: in evel m)	(mm) 450 450 Flow ('s) 0.0 0.0 torm D,L (mm)	Pipe/ Pipe/ (m/s) 2.66 1.00 W (mm)	Conduit Conduit Cap (1/s) 423.5	Design t t f Flow (1/s) 14.3

Pell Frischmann		Page 2	
5 Manchester Square			
London			
W1U 3PD		Micro	
Date 16/01/2024 14:48	Designed by HMcColl		
File B - Existing Runoff	Checked by	Drainage	
Innovyze	Network 2020.1		
Simulatio	on Criteria for Storm		
	1.000 Additional Flow - % of Total Fl		
Areal Reduction Factor Hot Start (mins)			
	0 Flow per Person per Day (1/per/da		
Manhole Headloss Coeff (Global)		-	
Foul Sewage per hectare (l/s)		s) 1	
	caphs 0 Number of Storage Structures 0		
	crols 0 Number of Time/Area Diagrams 0 crols 0 Number of Real Time Controls 0		
Synthet	<u>ic Rainfall Details</u>		
Rainfall Mod	el FEH		
Return Period (year			
FEH Rainfall Version 2013			
Site Locati	on GB 528304 184308 TQ 28304 84308		
Data Ty	-		
Summer Stor			
Winter Stor			
Cv (Summe Cv (Winte	,		
Storm Duration (min	,		

Pell Frisch					Page 3
5 Mancheste	r Square				
london					
VIU 3PD					Micro
Date 16/01/	2024 14:48	De	esigned by	HMcColl	
File B - Ex	isting Runof	f Cł	necked by		Drainag
Innovyze		Ne	etwork 202	0.1	
<u>100 year R</u> (	eturn Period		<u>Critical</u> for Storm		imum Level (Ran
	Areal Reductio		<u>ation Criter</u> 00 Additio	<u>ia</u> nal Flow - % of Tc	otal Flow 0.000
	Hot Sta:	rt (mins)	0 MAD	D Factor * 10m³/ha	a Storage 2.000
	Hot Start Le	. ,	0		fiecient 0.800
	Headloss Coeff Sewage per hecta			Person per Day (1/	per/day) 0.000
	Number of C	nline Control	s 0 Number o	of Storage Structu of Time/Area Diagr of Real Time Contr	ams O
			c Rainfall De		
		nfall Model all Version		FE: 201	
			GB 528304 184	1308 TQ 28304 8430	
		Data Type		Poin	t
		Cv (Summer)		1.00	
		Cv (Winter)		1.00	0
	Retu	D	IS Status ofile(s) Sumr (mins)	ine Inertia Status ON mer and Winter 360 100	3 OFF
		Climate Cha	ange (%)	0	
US/ PN Nar		eturn Climate eriod Change		First (Y) First (Z Flood Overflow	
	S1 360 Summer S2 360 Summer	100 +09 100 +09			0.064 -0.102
	Surcharged S/MH Depth		v / Overflow	Half Drain Pipe Time Flow	Level
	Name (m)	(m <sup>3</sup> ) Car			Status Exceeded
<u>01</u> 000	0.200	0 000 0	0.5	10.0	077
S1.000 S1.001	s1 -0.386 s2 -0.356		.05 .10	12.3 12.3	OK OK
			2020 Innov		