LLFA COMMENT / QUERY TRACKER - 11.12.2019

INTRODUCTION

This tracker has been compiled to provide a detailed response to comments received by Camden Planning from the Lead Local Flood Authority in relation to the proposed development.

EXECUTIVE SUMMARY

The comments were discussed and informally resolved at a meeting between Coyle Kennedy, LBH and the LLFA on 26th November 2019. This tracker introduces the additional information being presented, which is in the form of a Response to Further information request by Coyle Kennedy issued on 9th December 2019 and an updated SuDS Proforma (to London Sustainable Drainage forum requirements) with associated updated supporting calculations.

The SuDS proposals for this development now deliver Greenfield run-off rates, in accordance with Camden Policy.

LLFA COMMENT / QUERY TRACKER

LLFA 2ND COMMENTS	APPLICANT RESPONSE	LLFA 3RD COMMENTS	LBH RESPONSE
Plan shows: • 50 m^3 surface water attenuation • 15 m^3 swale • 3 m^3 underground attenuation tank • Flow controlled rate from driveway 5 l/s Issue i: the indicated storage adds to 68 m3, a shortfall of 73.5 m3. Issue ii: No technical details indicated for the blue-green roofs (storage volume, area/depth, void %, flow controls, discharge rates etc.) Issue iii: no information on freeboard requirements	Issue i: There is a total storage volume of approximately of 141.5m3, which is made up as follows: • 15m^3 in the swale • 50m^3 in the attenuation tank • 76m^3 in green and blue roof storage Issue ii: The green/blue roofs will be designed by a specialist supplier/designer and it is unreasonable to request such details at this time as any specialist supplier/designer is unlikely to carry out a design without first receiving an order and deposit. Issue iii: The proposed house levels for the houses on the east side of the site are in excess of 1m above the level of Millfield Lane. From this it is clear there is more than ample freeboard provided.	Issue i: Noted. The blue-green roof storage information the Drainage Report. At least the Site Drainage Layout should be updated with the figures that make up the 76 m^3. Further action requested Issue ii: Adequate information should be submitted at planning stage, based on outline designs generated by the drainage consultant. This is to show the LPA/LLFA how the proposed drainage measures, rates and volumes could be achieved in the scheme. Final detailed design information is not expected at this stage; it is accepted details may change, but the potential to achieve the stated aims should be demonstrated. Further action requested Issue iii: This request related to the SuDS freeboards as per original comment: "Provide the maximum volume **each of the SuDS features can accommodate, as well as freeboard requirements** in order to verify if the 141.5 m3 of attenuation required can be accommodated and indicate the discharge rate from the impermeable driveway to the combined sewer. Further action requested	Issue i: *The roof designs will be undertaken by a specialist designer in due course.* *At this stage a conservative assumption might be made as follows:* *Assumed Approx. green/blue roof area* *Plots 1 to 3 - 80 m^2 each* *Plots 4 & 5 - 135 m^2 each* *Assumed equivalent depth water retained 150mm* *(3 x 80) + (2 x 135) = 510 m^2* *510 m^2 x .15m = 76.5 m^3* *NB. Coyle Kennedy have provided a further assessment (attached) based upon revised areas that suggests 125m^3 of blue/green roof storage to be potentially available.* Issue ii: *Coyle Kennedy have provided additional information (attached) to demonstrate how the drainage measures will be achieved.* Issue iii: *Coyle Kennedy have indicated a surplus storage capacity of some 50m^3. Given that there is no potential for freeboard within the filled swale and the attenuation tank this can be accommodated within the roof designs as a freeboard of some 60mm. (see attached CK detail)*

LLFA COMMENT / QUERY TRACKER

LLFA 2ND COMMENTS	APPLICANT RESPONSE	LLFA 3RD COMMENTS	LBH RESPONSE
The Micro Drainage tables show storm sewer design results and foul sewerage design. Issue iv: we should expect, for each return period: - summary of results - rainfall details / time area diagram - model details / storage structure / depth-flow relationship outflow control	The details of the storage structures are outlined in Coyle Kennedy's drawings to a level of detail which is reasonable for this stage of the planning/design.	We are seeking copies of the MicroDrainage calculations which will have been carried out by the consultant in order to generate the storage proposals. This is your evidence to support the proposed attenuation volumes and discharge rates. I can provide example copies on request from other schemes but the consultant would be aware of the items requested. Further action requested	Issue iv: *See attached updated LSD Proforma and calcs to demonstrate storage required to achieve* *A. Greenfield Rates - 161m^3* *B. 50% Betterment - 143m^3* *(it is noted that the previous estimate for 50% betterment was 141.5m^3, and also that the 190m^3 storage proposed by Coyle Kennedy will accommodate the Camden Policy to limit post development discharge to greenfield rates)*

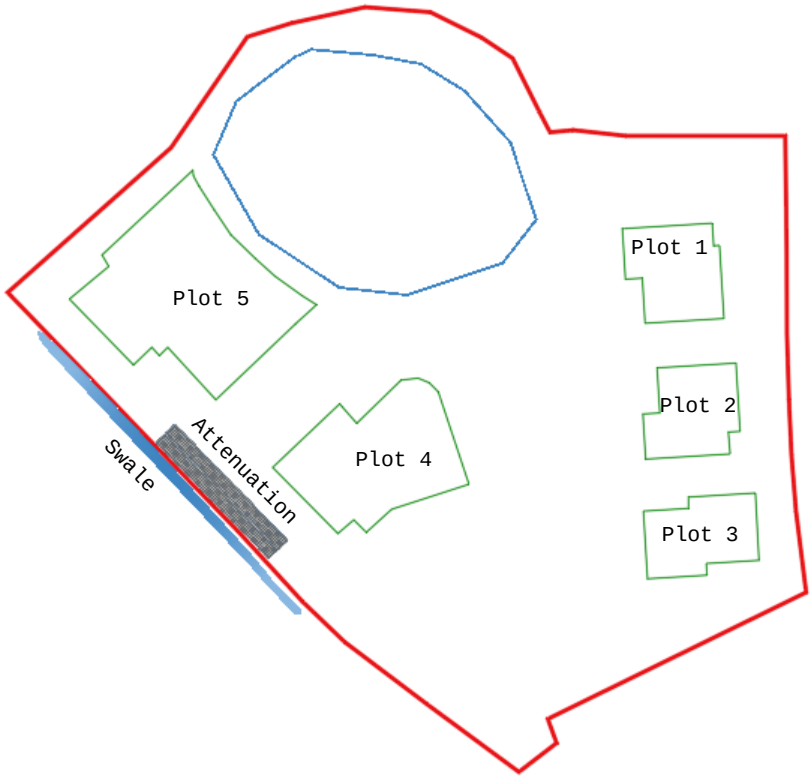
LLFA COMMENT / QUERY TRACKER			
LLFA 2ND COMMENTS	APPLICANT RESPONSE	LLFA 3RD COMMENTS	LBH RESPONSE
The reference states "….as agreed with Mr. Bob Warnock on site on the 10 May 2018." . Issue v: We should seek written confirmation from the landowner	*[Not addressed in 'Response to Further information request – 55 Fitzroy Park']*	Further action requested	Issue v: *We met on Bob Warnock of the City of London (and his then Hydrology advisor) on 1st May 2018 (not 10th May) and discussed how best to deal with the water that runs across Millfield Lane.* *I think we mistakenly understood at the time that the CoL were indicating a preference that they wished to see it removed and dealt with by means of a pipe installed under the carriageway of the lane.* *On 4th October 2018 we re-iterated to the CoL that we had no strong feelings on the matter but wished to accommodate whichever of the following options the CoL felt to be the most appropriate.1) Leave as is 2) Replace with a pipe or 3) Replace with a more formal surface stone/concrete "ford/channel".* *Unfortunately, the CoL were unable to provide any clarification but have since indicated that they have commissioned an independent hydrological consultant.* *On 26th October 2018 the CoL wrote that they would not support a request to discharge water onto the Heath, but again were unable to clarify what they wished to happen with the existing discharge. However, it would seem somewhat unlikely that the historic discharge of an ancient watercourse would require CoL permission to flow. (Not the least because the flow must be seen as an important contribution to the wetland area of the nature reserve, and, ultimately, to the Highgate Pond chain.)*

LLFA COMMENT / QUERY TRACKER			
LLFA 2ND COMMENTS	APPLICANT RESPONSE	LLFA 3RD COMMENTS	LBH RESPONSE
The reference states landscaping without providing further details. Issue vi: Final details may be conditioned, but we should ask for additional information to clarify the measures in outline.	*[Not addressed in 'Response to Further information request – 55 Fitzroy Park']*	Further action requested	Issue vi: *The landscaping details will be finalised in due course to provide the flood defence required. The required measures were outlined in the Hydrological & Hydrogeological assessment LBH4480 Ver 2.0 section 7.8 (page 31), where it was indicated that local landscaping would be used to direct any surface water flooding away from Plots 4& 5 and direct this to the designated overland flood route immediately to the north of Plot 5. (see attached additional information in the form of a plan and sketch sections by Coyle Kennedy)*

Response to Further information request – 55 Fitzroy Park

Issue I and Issue iii

There is a total storage volume of approximately of 141.5m^3, which is made up as follows:



Make up of attenuation volumes:

Swale 46m x 1.0m effective deptg filled with stone (33% voids)	= 15m^3
attenuation tank – 18 x 3 x 95% voids	= 50m^3
Blue and Green roof	
Plot 1 - 101m^2 of roof by 150mm deep	= 15.2m^3
Plot 2 - 98m^2 of roof by 150mm deep	= 14.7m^3
Plot 3 - 95m^2 of roof by 150mm deep	= 14.3m^3
Plot 4 - 214m^2 of roof by 150mm deep	= 32.1m^3
Plot 5 - 329m^2 of roof by 150mm deep	= 49.4m^3
Total	= 190 m^3

In relation to the storage volume there is a freeboard of 50m^3.

COYLE KENNEDY
Consulting Engineers

Third Floor
GW Business Centre
Great West House
Great West Road
Brentford TW8 9DF
England

Tel: +44 (0)203 393 1174
Fax: +44 (0)203 004 1234

website: www.coylekennedy.com
email: mail@coylekennedy.com

Irish Office:
GFSC
Moneenageisha Road
Galway
Ireland

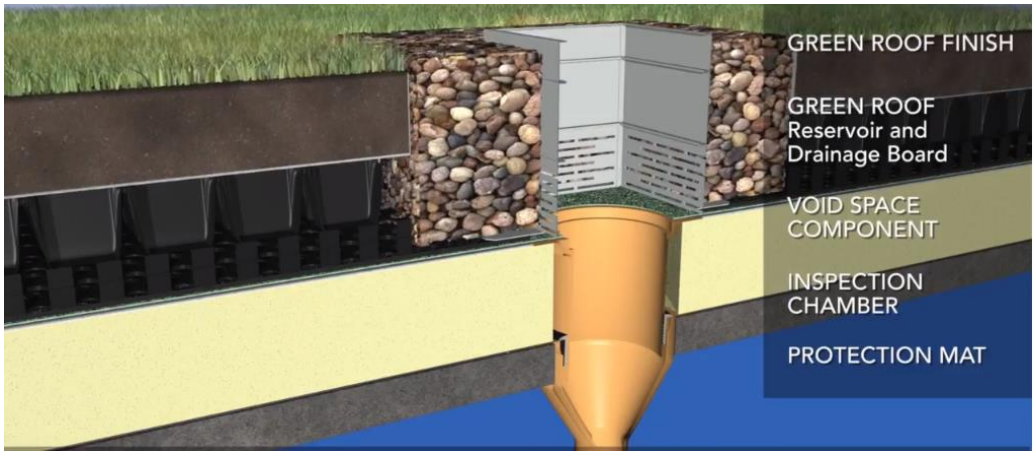
Tel: +353 (0)91 752000
Fax: +353 (0)91 753000

CKCE Limited
Registered in England 11566522

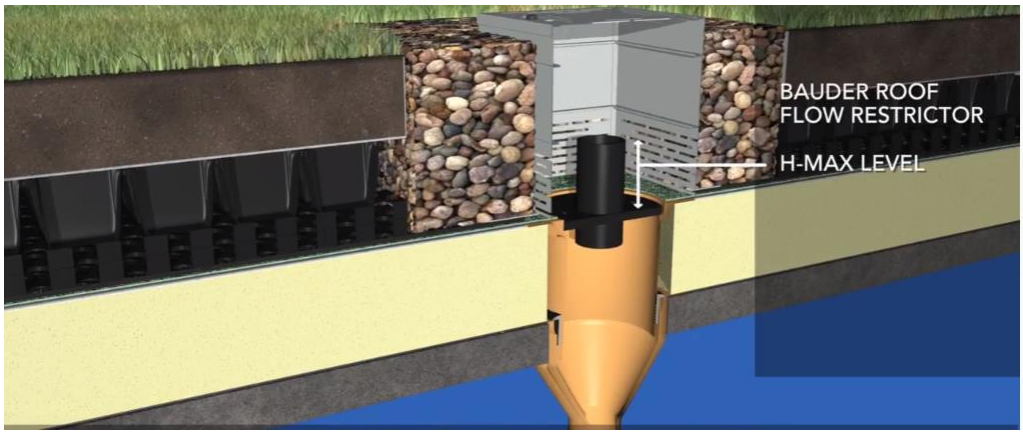
Directors:
Brian Coyle BE CEng MIEI MIStructE
Tadhg Kennedy BE MEngSc CEng MIEI MIStructE

Issue ii

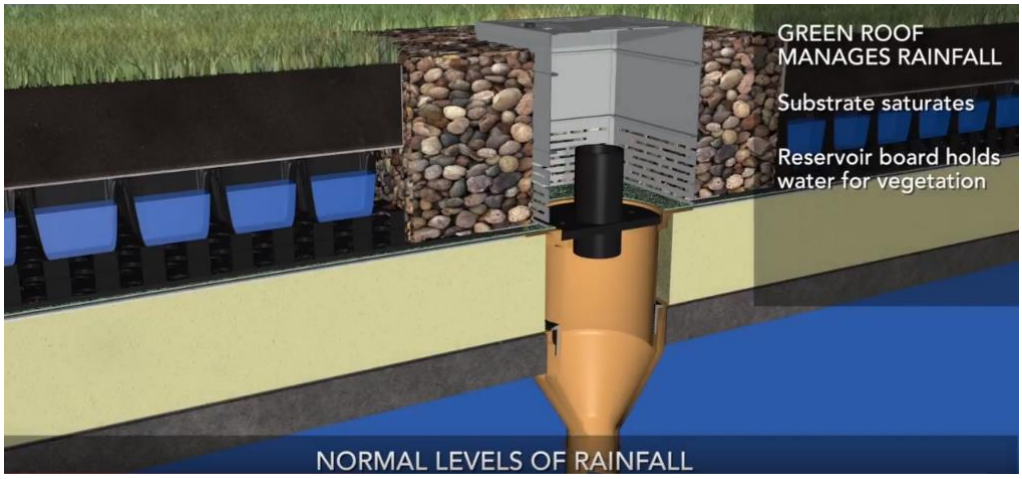
Blue and Green roof Process



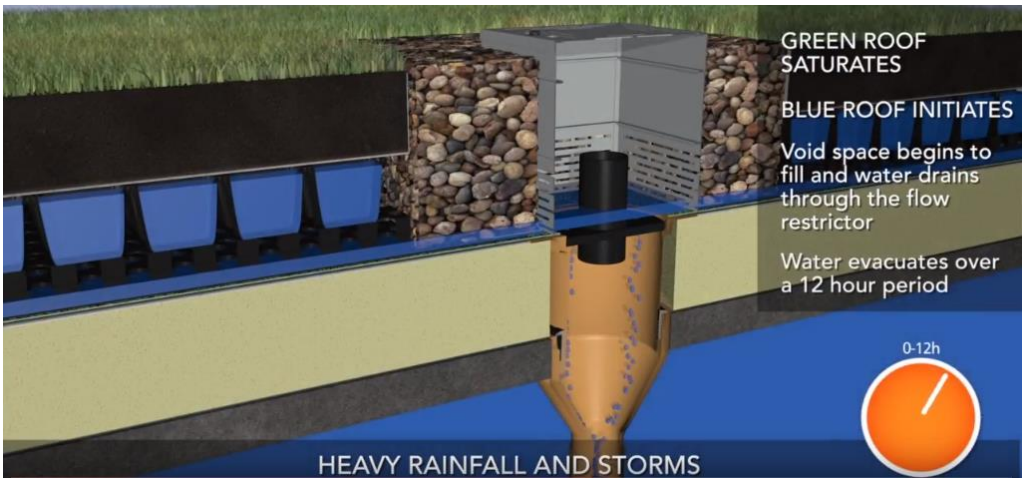
Green/Blue roof makeup



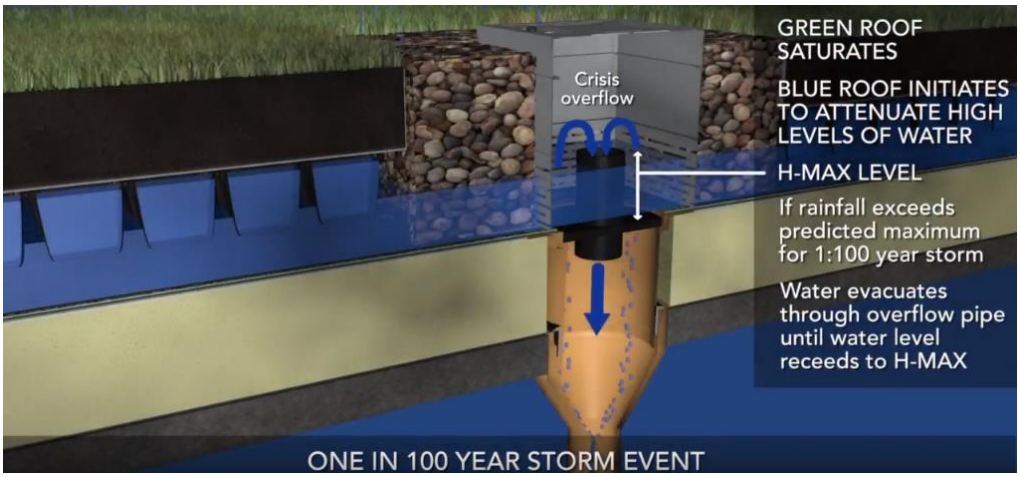
Maximum attenuation level



Normal levels of rainfall – sunstrate saturates, reservoir holds water for vegations – no discharge



Heavy rainfall – water overflows the storage cells into the void space and drains through the flow restricter attenauting the discharge

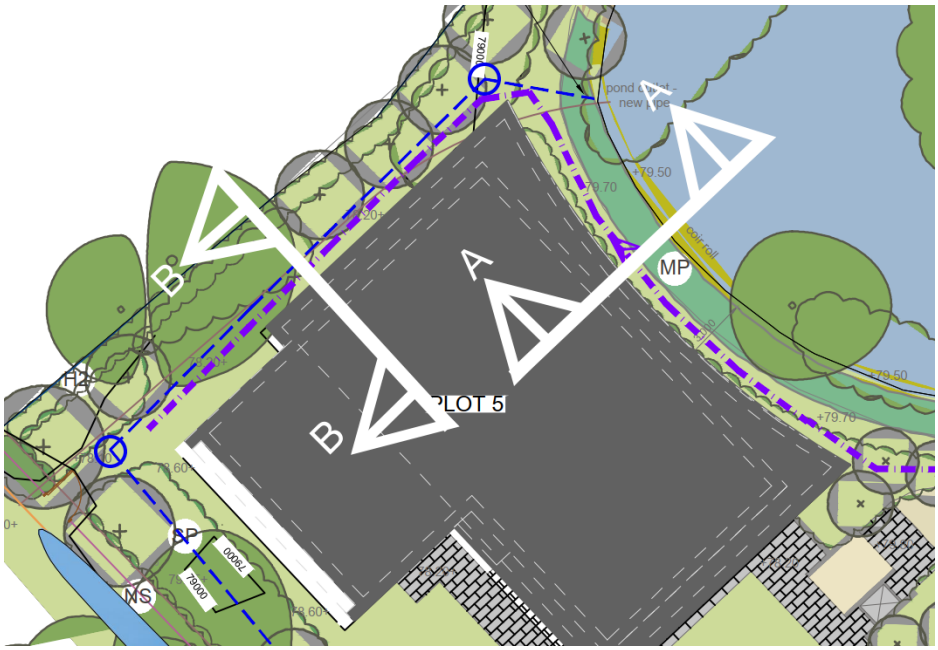


1:100 year event – if the rainfall exceeds the maximum 1:100 rainfall event the excess rainfall discharges the via the overflow pipe at high level – the remainder of the water is attenuted as normal.

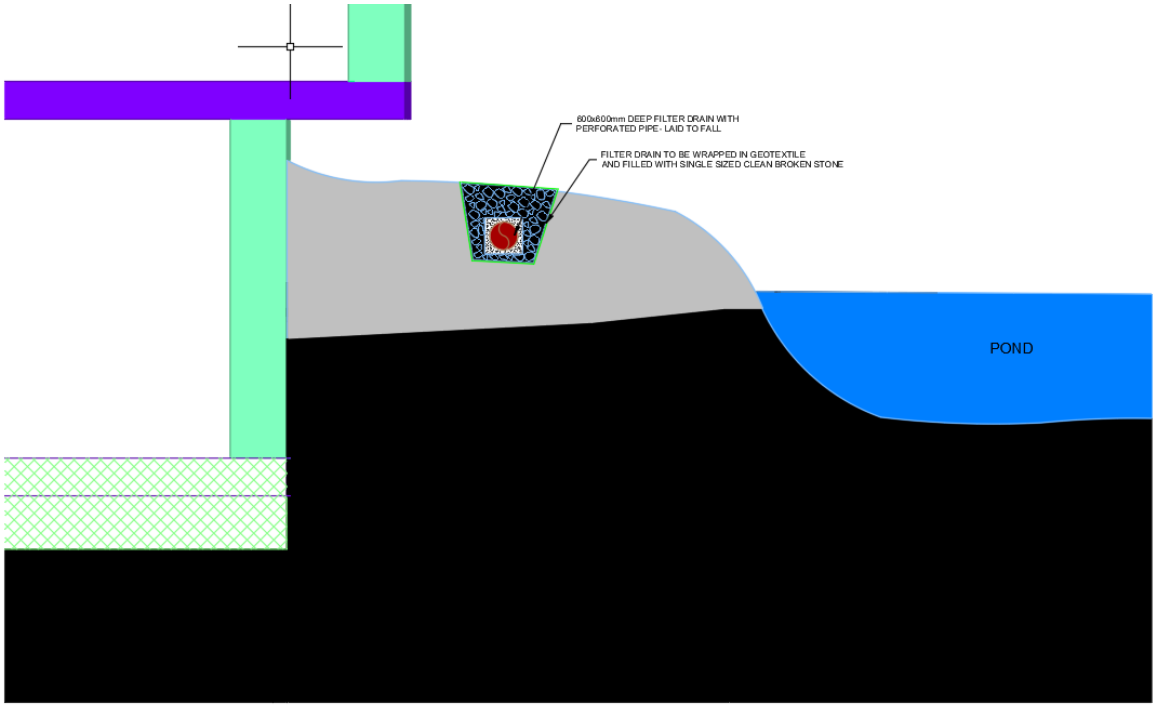
Issue Vi

Landscaping detail – typical detail shown adjacent to plot 5

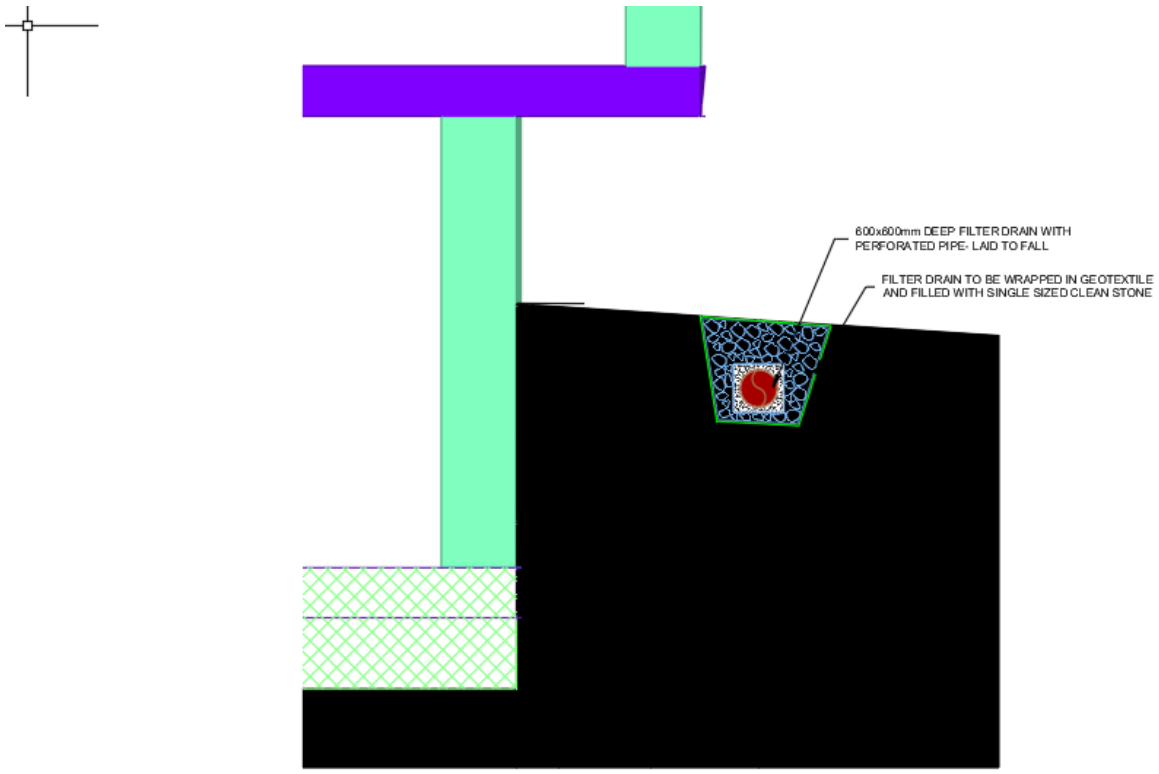
The details be low show the intent of the landscaping/drainage adjacent to divert the water away from the buildings to the attenuation/swale area.



Layout of plat 4



Section A-A



Section B-B

Tadhg Kennedy
COYLE KENNEDY
CHARTERED ENGINEERS

1. Project & Site Details	Project / Site Name (including sub-catchment / stage / phase where appropriate)	55 FITZROY PARK
	Address & post code	55 FITZROY PARK Camden N6 6JA
	OS Grid ref. (Easting, Northing)	E 527780
		N 186940
	LPA reference (if applicable)	
	Brief description of proposed work	Demolition of large house and construction of a five smaller houses
	Total site Area	5075 m^2
	Total existing impervious area	1092 m^2
	Total proposed impervious area	947 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	Combined Sewer beneath Fitzroy Park
	Designer Name	Tadhg Kennedy
	Designer Position	Consulting Engineer
	Designer Company	Coyle Kennedy

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	downwash
Bedrock geology classification	London Clay
Site infiltration rate	1.E-09 m/s
Depth to groundwater level	Varies
Is infiltration feasible?	No (Infiltration will be permitted but not relied upon)

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	Y
2 use infiltration techniques, such as porous surfaces in non-clay areas	No (Infiltration will be permitted but not relied upon)	
3 attenuate rainwater in ponds or open water features for gradual release	Y	Y
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	Y	Y
6 discharge rainwater to a surface water sewer/drain	N	N
7 discharge rainwater to the combined sewer.	Y	Y

2c. Proposed Discharge Details

Proposed discharge location	Combined Sewer beneath Fitzroy Park and pond /natural watercourse system
Has the owner/regulator of the discharge location been consulted?	Yes

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	2.20			
1 in 1	1.87	27.90	34.09	1.87
1 in 30	5.29	68.16	76.66	5.29
1 in 100	7.03	87.37	100.45	7.03
1 in 100 + CC			160.66	7.03
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Orifice		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	837	837	125.7
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements			0
Swales	103	46	15
Basins/ponds	1468	642	0
Attenuation tanks	2667		50
Total	5075	1525	190.7

4. Supporting Information	4a. Discharge & Drainage Strategy	*Page/section of drainage report*
	Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	Hydrological & Hydrogeological Impact Assessment LBH4480 Ver 2.0 July 2018
	Drainage hierarchy (2b)	Section 8.2 p32
	Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	TBN
	Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Appended
	Proposed SuDS measures & specifications (3b)	See Coyle Kennedy Drainage reports
	4b. Other Supporting Details	*Page/section of drainage report*
	Detailed Development Layout	See Coyle Kennedy Drainage reports
	Detailed drainage design drawings, including exceedance flow routes	See Coyle Kennedy Drainage reports
	Detailed landscaping plans	See Coyle Kennedy Drainage reports
	Maintenance strategy	TBN
	Demonstration of how the proposed SuDS measures improve:	Hydrological & Hydrogeological Impact Assessment LBH4480 Ver 2.0 July 2018
	a) water quality of the runoff?	Section 9 p37
	b) biodiversity?	
	c) amenity?	

GREENFIELD RUNOFF

Catchment Area: 5075sqm 0.508ha

PO Code : N6 6JA

Hydrological Region: 6 *From Wallingford on-line tool*

SAAR: 625mm *From Wallingford on-line tool*

SOIL type: 4 *From Wallingford on-line tool*

SPR: 0.47 *Derived as follows:*

SOIL	*Sand*	*Clayey Sand*	*Sandy Clay*	*Clay*	*Rock*
	1	*2*	*3*	*4*	*5*
SPR	*0.1*	*0.3*	*0.37*	*0.47*	*0.53*

From Wallingford on-line tool using IH 124 Method

Qbar: 216.97 *Calculated from SPR and SAAR*

Greenfield Peak Run-off Rate:

		Growth curve Factor
1 in 1	*184.4 l/sec*	*0.85*
1 in 30	*520.7 l/sec*	*2.40*
1 in 100	*692.1 l/sec*	*3.19*
1 in 200	*811.5 l/sec*	*3.74*

Qbar: 2.20 l/sec

Greenfield Peak Run-off Rate:

1 in 1	**1.87 l/sec**
1 in 30	**5.29 l/sec**
1 in 100	**7.03 l/sec**
1 in 200	**8.24 l/sec**

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

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

Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

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.

SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
GREENFIELD RUNOFF	
Sheet 1 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

RAINFALL PEAK INTENSITY (i)

M5-60 : 20 *From Wallingford Fig A1*

r: 0.42 *From Wallingford Fig A2*

D Duration		Z1	M5-D
5min	5min	0.38	7.6mm
10min	10min	0.55	11.0mm
15min	15min	0.65	13.0mm
30min	30min	0.75	15.0mm
1hr	60min	1.00	20.0mm
2hr	120min	1.20	24.0mm
4hr	240min	1.40	28.0mm
6hr	360min	1.60	32.0mm
10hr	600min	1.70	34.0mm
24hr	1440min	2.20	44.0mm
48hr	2880min	2.50	50.0mm

Z2

D Duration		M5-D	M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	7.6mm	0.62	0.79	0.89	0.97	1.02	1.19	1.36	1.43	1.79
10min	10min	11.0mm	0.61	0.79	0.90	0.97	1.03	1.22	1.41	1.49	1.91
15min	15min	13.0mm	0.61	0.79	0.90	0.97	1.03	1.22	1.41	1.49	1.91
30min	30min	15.0mm	0.62	0.81	0.90	0.97	1.03	1.24	1.44	1.53	1.99
1hr	60min	20.0mm	0.64	0.81	0.90	0.97	1.03	1.24	1.45	1.54	2.03
2hr	120min	24.0mm	0.64	0.81	0.90	0.97	1.03	1.24	1.45	1.54	2.03
4hr	240min	28.0mm	0.66	0.82	0.91	0.97	1.03	1.24	1.44	1.53	2.01
6hr	360min	32.0mm	0.68	0.83	0.91	0.97	1.03	1.22	1.42	1.51	1.97
10hr	600min	34.0mm	0.68	0.83	0.91	0.97	1.03	1.22	1.42	1.51	1.97
24hr	1440min	44.0mm	0.70	0.84	0.92	0.97	1.02	1.19	1.38	1.47	1.89
48hr	2880min	50.0mm	0.72	0.85	0.93	0.98	1.02	1.17	1.34	1.42	1.81

MT-D

D Duration		M5-D	M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	7.6mm	4.7mm	6.0mm	6.8mm	7.4mm	7.8mm	9.0mm	10.3mm	10.8mm	13.6mm
10min	10min	11.0mm	6.7mm	8.7mm	9.9mm	10.7mm	11.3mm	13.4mm	15.5mm	16.4mm	21.0mm
15min	15min	13.0mm	7.9mm	10.3mm	11.7mm	12.6mm	13.4mm	15.9mm	18.3mm	19.4mm	24.8mm
30min	30min	15.0mm	9.3mm	12.2mm	13.5mm	14.6mm	15.5mm	18.6mm	21.6mm	22.9mm	29.9mm
1hr	60min	20.0mm	12.8mm	16.2mm	18.0mm	19.4mm	20.6mm	24.8mm	29.0mm	30.9mm	40.6mm
2hr	120min	24.0mm	15.4mm	19.4mm	21.6mm	23.3mm	24.7mm	29.8mm	34.8mm	37.0mm	48.7mm
4hr	240min	28.0mm	18.5mm	23.0mm	25.5mm	27.2mm	28.8mm	34.7mm	40.3mm	42.9mm	56.3mm
6hr	360min	32.0mm	21.8mm	26.6mm	29.1mm	31.0mm	33.0mm	39.0mm	45.4mm	48.4mm	63.0mm
10hr	600min	34.0mm	23.1mm	28.2mm	30.9mm	33.0mm	35.0mm	41.5mm	48.3mm	51.5mm	67.0mm
24hr	1440min	44.0mm	30.8mm	37.0mm	40.5mm	42.7mm	44.9mm	52.4mm	60.7mm	64.5mm	83.2mm
48hr	2880min	50.0mm	36.0mm	42.5mm	46.5mm	49.0mm	51.0mm	58.5mm	67.0mm	71.0mm	90.5mm

Intensity i

D Duration			M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	56.5mm/hr	72.0mm/hr	81.2mm/hr	88.5mm/hr	93.0mm/hr	108.5mm/hr	124.0mm/hr	130.1mm/hr	163.2mm/hr
10min	10min	0.17hr	40.3mm/hr	52.1mm/hr	59.4mm/hr	64.0mm/hr	68.0mm/hr	80.5mm/hr	93.1mm/hr	98.3mm/hr	126.1mm/hr
15min	15min	0.25hr	31.7mm/hr	41.1mm/hr	46.8mm/hr	50.4mm/hr	53.6mm/hr	63.4mm/hr	73.3mm/hr	77.5mm/hr	99.3mm/hr
30min	30min	0.50hr	18.6mm/hr	24.3mm/hr	27.0mm/hr	29.1mm/hr	30.9mm/hr	37.2mm/hr	43.2mm/hr	45.8mm/hr	59.7mm/hr
1hr	60min	1.00hr	12.8mm/hr	16.2mm/hr	18.0mm/hr	19.4mm/hr	20.6mm/hr	24.8mm/hr	29.0mm/hr	30.9mm/hr	40.6mm/hr
2hr	120min	2.00hr	7.7mm/hr	9.7mm/hr	10.8mm/hr	11.6mm/hr	12.4mm/hr	14.9mm/hr	17.4mm/hr	18.5mm/hr	24.4mm/hr
4hr	240min	4.00hr	4.6mm/hr	5.7mm/hr	6.4mm/hr	6.8mm/hr	7.2mm/hr	8.7mm/hr	10.1mm/hr	10.7mm/hr	14.1mm/hr
6hr	360min	6.00hr	3.6mm/hr	4.4mm/hr	4.9mm/hr	5.2mm/hr	5.5mm/hr	6.5mm/hr	7.6mm/hr	8.1mm/hr	10.5mm/hr
10hr	600min	10.00hr	2.3mm/hr	2.8mm/hr	3.1mm/hr	3.3mm/hr	3.5mm/hr	4.1mm/hr	4.8mm/hr	5.1mm/hr	6.7mm/hr
24hr	1440min	24.00hr	1.3mm/hr	1.5mm/hr	1.7mm/hr	1.8mm/hr	1.9mm/hr	2.2mm/hr	2.5mm/hr	2.7mm/hr	3.5mm/hr
48hr	2880min	48.00hr	0.6mm/hr	0.8mm/hr	0.8mm/hr	0.9mm/hr	0.9mm/hr	1.1mm/hr	1.3mm/hr	1.3mm/hr	1.7mm/hr
48hr	2880min	48.00hr	0.8mm/hr	0.9mm/hr	1.0mm/hr	1.0mm/hr	1.1mm/hr	1.2mm/hr	1.4mm/hr	1.5mm/hr	1.9mm/hr

SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
RAINFALL PEAK INTENSITY	
Sheet 2 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

GREENFIELD PEAK RUNOFF

Hydrological Region: 6 *From Wallingford on-line tool* **Qbar: 2.20 l/sec**

Run-Off Q

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
10min	10min	0.17hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
15min	15min	0.25hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
30min	30min	0.50hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
1hr	60min	1.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
2hr	120min	2.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
4hr	240min	4.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
6hr	360min	6.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
10hr	600min	10.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
24hr	1440min	24.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec
48hr	2880min	48.00hr	1.87 l/sec	1.94 l/sec	2.23 l/sec	2.53 l/sec	2.82 l/sec	3.57 l/sec	4.33 l/sec	5.29 l/sec	7.03 l/sec

Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	0.6 m3	0.6 m3	0.7 m3	0.8 m3	0.8 m3	1.1 m3	1.3 m3	1.6 m3	2.1 m3
10min	10min	0.17hr	1.1 m3	1.2 m3	1.3 m3	1.5 m3	1.7 m3	2.1 m3	2.6 m3	3.2 m3	4.2 m3
15min	15min	0.25hr	1.7 m3	1.7 m3	2.0 m3	2.3 m3	2.5 m3	3.2 m3	3.9 m3	4.8 m3	6.3 m3
30min	30min	0.50hr	3.4 m3	3.5 m3	4.0 m3	4.5 m3	5.1 m3	6.4 m3	7.8 m3	9.5 m3	12.6 m3
1hr	60min	1.00hr	6.7 m3	7.0 m3	8.0 m3	9.1 m3	10.1 m3	12.8 m3	15.6 m3	19.0 m3	25.3 m3
2hr	120min	2.00hr	13.5 m3	14.0 m3	16.1 m3	18.2 m3	20.3 m3	25.7 m3	31.2 m3	38.1 m3	50.6 m3
4hr	240min	4.00hr	27.0 m3	27.9 m3	32.1 m3	36.4 m3	40.6 m3	51.4 m3	62.4 m3	76.1 m3	101.2 m3
6hr	360min	6.00hr	40.4 m3	41.9 m3	48.2 m3	54.5 m3	60.9 m3	77.1 m3	93.6 m3	114.2 m3	151.7 m3
10hr	600min	10.00hr	67.4 m3	69.8 m3	80.3 m3	90.9 m3	101.5 m3	128.4 m3	155.9 m3	190.3 m3	252.9 m3
24hr	1440min	24.00hr	161.7 m3	167.4 m3	192.8 m3	218.2 m3	243.6 m3	308.2 m3	374.2 m3	456.7 m3	607.0 m3
48hr	2880min	48.00hr	323.5 m3	334.9 m3	385.6 m3	436.4 m3	487.1 m3	616.5 m3	748.4 m3	913.3 m3	1213.9 m3

SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
GREENFIELD PEAK RUNOFF	
Sheet 3 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

EXISTING PEAK RUNOFF

C_V:	0.48	*Volumetric Run-Off Coefficient*
C_R:	1.3	*Routing Coefficient*

Run-Off Q

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	49.7 l/sec	63.4 l/sec	71.4 l/sec	77.8 l/sec	81.8 l/sec	95.5 l/sec	109.1 l/sec	114.5 l/sec	143.6 l/sec
10min	10min	0.17hr	35.4 l/sec	45.9 l/sec	52.3 l/sec	56.3 l/sec	59.8 l/sec	70.8 l/sec	81.9 l/sec	86.5 l/sec	110.9 l/sec
15min	15min	0.25hr	27.9 l/sec	36.1 l/sec	41.2 l/sec	44.4 l/sec	47.1 l/sec	55.8 l/sec	64.5 l/sec	68.2 l/sec	87.4 l/sec
30min	30min	0.50hr	16.4 l/sec	21.4 l/sec	23.8 l/sec	25.6 l/sec	27.2 l/sec	32.7 l/sec	38.0 l/sec	40.3 l/sec	52.5 l/sec
1hr	60min	1.00hr	11.3 l/sec	14.3 l/sec	15.8 l/sec	17.1 l/sec	18.1 l/sec	21.8 l/sec	25.5 l/sec	27.2 l/sec	35.7 l/sec
2hr	120min	2.00hr	6.8 l/sec	8.6 l/sec	9.5 l/sec	10.2 l/sec	10.9 l/sec	13.1 l/sec	15.3 l/sec	16.3 l/sec	21.4 l/sec
4hr	240min	4.00hr	4.1 l/sec	5.0 l/sec	5.6 l/sec	6.0 l/sec	6.3 l/sec	7.6 l/sec	8.9 l/sec	9.4 l/sec	12.4 l/sec
6hr	360min	6.00hr	3.2 l/sec	3.9 l/sec	4.3 l/sec	4.6 l/sec	4.8 l/sec	5.7 l/sec	6.7 l/sec	7.1 l/sec	9.2 l/sec
10hr	600min	10.00hr	2.0 l/sec	2.5 l/sec	2.7 l/sec	2.9 l/sec	3.1 l/sec	3.6 l/sec	4.2 l/sec	4.5 l/sec	5.9 l/sec
24hr	1440min	24.00hr	1.1 l/sec	1.4 l/sec	1.5 l/sec	1.6 l/sec	1.6 l/sec	1.9 l/sec	2.2 l/sec	2.4 l/sec	3.0 l/sec
48hr	2880min	48.00hr	0.7 l/sec	0.8 l/sec	0.9 l/sec	0.9 l/sec	0.9 l/sec	1.1 l/sec	1.2 l/sec	1.3 l/sec	1.7 l/sec

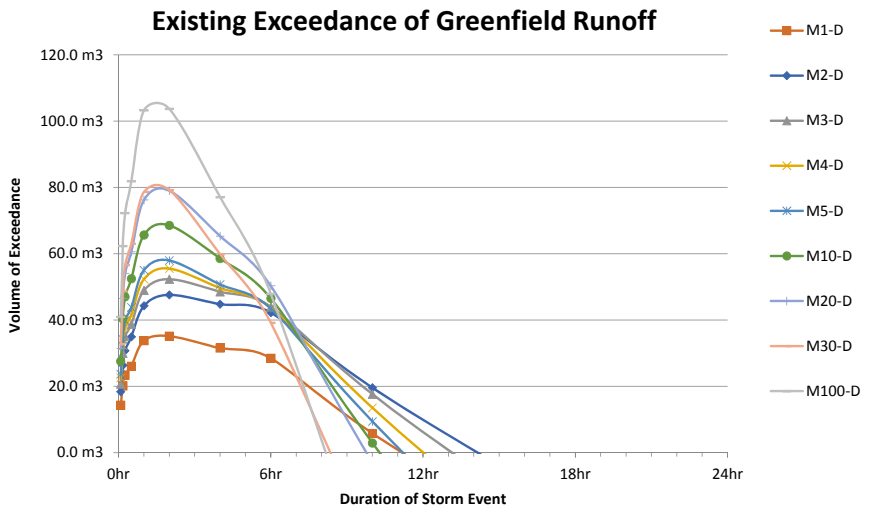
Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	14.9 m3	19.0 m3	21.4 m3	23.3 m3	24.5 m3	28.6 m3	32.7 m3	34.3 m3	43.1 m3
10min	10min	0.17hr	21.2 m3	27.5 m3	31.4 m3	33.8 m3	35.9 m3	42.5 m3	49.1 m3	51.9 m3	66.5 m3
15min	15min	0.25hr	25.1 m3	32.5 m3	37.1 m3	39.9 m3	42.4 m3	50.2 m3	58.0 m3	61.3 m3	78.6 m3
30min	30min	0.50hr	29.5 m3	38.5 m3	42.8 m3	46.1 m3	48.9 m3	58.9 m3	68.4 m3	72.5 m3	94.5 m3
1hr	60min	1.00hr	40.5 m3	51.3 m3	57.0 m3	61.4 m3	65.2 m3	78.5 m3	91.8 m3	97.7 m3	128.6 m3
2hr	120min	2.00hr	48.6 m3	61.6 m3	68.4 m3	73.7 m3	78.3 m3	94.2 m3	110.2 m3	117.3 m3	154.3 m3
4hr	240min	4.00hr	58.5 m3	72.7 m3	80.7 m3	86.0 m3	91.3 m3	110.0 m3	127.7 m3	136.0 m3	178.2 m3
6hr	360min	6.00hr	68.9 m3	84.1 m3	92.2 m3	98.3 m3	104.4 m3	123.6 m3	143.9 m3	153.4 m3	199.6 m3
10hr	600min	10.00hr	73.2 m3	89.4 m3	98.0 m3	104.4 m3	110.9 m3	131.4 m3	152.9 m3	162.9 m3	212.1 m3
24hr	1440min	24.00hr	97.5 m3	117.0 m3	128.2 m3	135.2 m3	142.1 m3	165.8 m3	192.3 m3	204.4 m3	263.3 m3
48hr	2880min	48.00hr	114.0 m3	134.6 m3	147.3 m3	155.2 m3	161.5 m3	185.3 m3	212.2 m3	224.8 m3	286.6 m3

Exceedance of Greenfield Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	14.4 m3	18.4 m3	20.8 m3	22.6 m3	23.7 m3	27.6 m3	31.4 m3	32.8 m3	41.0 m3
10min	10min	0.17hr	20.1 m3	26.4 m3	30.0 m3	32.3 m3	34.2 m3	40.4 m3	46.5 m3	48.7 m3	62.3 m3
15min	15min	0.25hr	23.4 m3	30.8 m3	35.0 m3	37.7 m3	39.9 m3	47.0 m3	54.1 m3	56.6 m3	72.3 m3
30min	30min	0.50hr	26.1 m3	35.0 m3	38.7 m3	41.5 m3	43.9 m3	52.5 m3	60.6 m3	63.0 m3	81.9 m3
1hr	60min	1.00hr	33.8 m3	44.3 m3	49.0 m3	52.3 m3	55.1 m3	65.7 m3	76.2 m3	78.7 m3	103.3 m3
2hr	120min	2.00hr	35.2 m3	47.6 m3	52.3 m3	55.5 m3	58.0 m3	68.6 m3	79.0 m3	79.2 m3	103.7 m3
4hr	240min	4.00hr	31.6 m3	44.8 m3	48.6 m3	49.6 m3	50.7 m3	58.6 m3	65.3 m3	59.9 m3	77.1 m3
6hr	360min	6.00hr	28.5 m3	42.2 m3	44.0 m3	43.8 m3	43.5 m3	46.6 m3	50.3 m3	39.2 m3	47.9 m3
10hr	600min	10.00hr	5.8 m3	19.6 m3	17.6 m3	13.5 m3	9.4 m3	2.9 m3	-3.0 m3	-27.3 m3	-40.8 m3
24hr	1440min	24.00hr	-64.2 m3	-50.4 m3	-64.6 m3	-83.0 m3	-101.4 m3	-142.4 m3	-181.9 m3	-252.3 m3	-343.6 m3
48hr	2880min	48.00hr	-209.5 m3	-200.3 m3	-238.4 m3	-281.2 m3	-325.6 m3	-431.2 m3	-536.2 m3	-688.5 m3	-927.4 m3

			C_V:
Catchment Area:	5075sqm	100%	
Permeable:	3983sqm	78%	0.40
Impermeable:	1092sqm	22%	0.77
			0.48



SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
EXISTING PEAK RUNOFF	
Sheet 4 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

POST- DEVELOPMENT PEAK RUNOFF

C_V: 0.47 *Volumetric Run-Off Coefficient* Climate Change Allowance: 0%

C_R: 1.3 *Routing Coefficient*

Run-Off Q

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	48.6 l/sec	62.0 l/sec	69.8 l/sec	76.1 l/sec	80.0 l/sec	93.4 l/sec	106.7 l/sec	111.9 l/sec	140.4 l/sec
10min	10min	0.17hr	34.6 l/sec	44.9 l/sec	51.1 l/sec	55.1 l/sec	58.5 l/sec	69.3 l/sec	80.1 l/sec	84.6 l/sec	108.4 l/sec
15min	15min	0.25hr	27.3 l/sec	35.3 l/sec	40.3 l/sec	43.4 l/sec	46.1 l/sec	54.6 l/sec	63.1 l/sec	66.7 l/sec	85.4 l/sec
30min	30min	0.50hr	16.0 l/sec	20.9 l/sec	23.2 l/sec	25.0 l/sec	26.6 l/sec	32.0 l/sec	37.2 l/sec	39.4 l/sec	51.4 l/sec
1hr	60min	1.00hr	11.0 l/sec	13.9 l/sec	15.5 l/sec	16.7 l/sec	17.7 l/sec	21.3 l/sec	24.9 l/sec	26.6 l/sec	34.9 l/sec
2hr	120min	2.00hr	6.6 l/sec	8.4 l/sec	9.3 l/sec	10.0 l/sec	10.6 l/sec	12.8 l/sec	15.0 l/sec	15.9 l/sec	21.0 l/sec
4hr	240min	4.00hr	4.0 l/sec	4.9 l/sec	5.5 l/sec	5.8 l/sec	6.2 l/sec	7.5 l/sec	8.7 l/sec	9.2 l/sec	12.1 l/sec
6hr	360min	6.00hr	3.1 l/sec	3.8 l/sec	4.2 l/sec	4.5 l/sec	4.7 l/sec	5.6 l/sec	6.5 l/sec	6.9 l/sec	9.0 l/sec
10hr	600min	10.00hr	2.0 l/sec	2.4 l/sec	2.7 l/sec	2.8 l/sec	3.0 l/sec	3.6 l/sec	4.2 l/sec	4.4 l/sec	5.8 l/sec
24hr	1440min	24.00hr	1.1 l/sec	1.3 l/sec	1.5 l/sec	1.5 l/sec	1.6 l/sec	1.9 l/sec	2.2 l/sec	2.3 l/sec	3.0 l/sec
48hr	2880min	48.00hr	0.6 l/sec	0.8 l/sec	0.8 l/sec	0.9 l/sec	0.9 l/sec	1.0 l/sec	1.2 l/sec	1.3 l/sec	1.6 l/sec

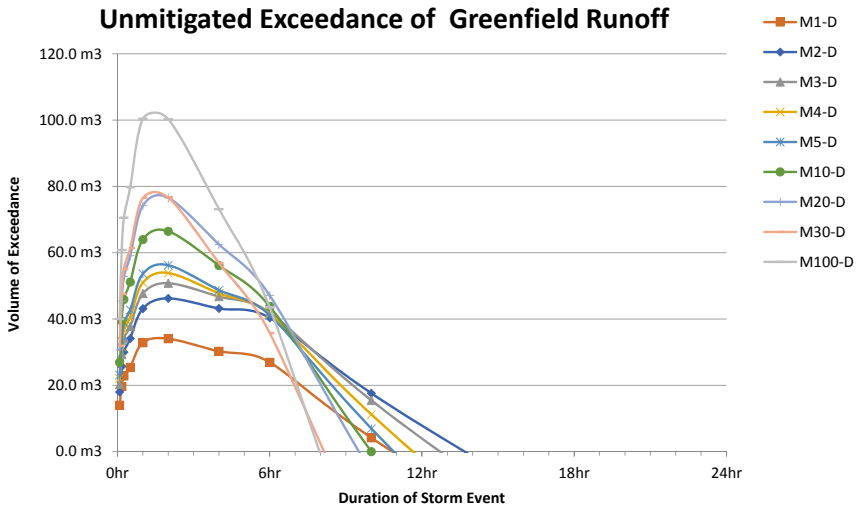
Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	14.6 m3	18.6 m3	20.9 m3	22.8 m3	24.0 m3	28.0 m3	32.0 m3	33.6 m3	42.1 m3
10min	10min	0.17hr	20.8 m3	26.9 m3	30.7 m3	33.0 m3	35.1 m3	41.6 m3	48.0 m3	50.8 m3	65.1 m3
15min	15min	0.25hr	24.6 m3	31.8 m3	36.2 m3	39.1 m3	41.5 m3	49.1 m3	56.8 m3	60.0 m3	76.9 m3
30min	30min	0.50hr	28.8 m3	37.6 m3	41.8 m3	45.1 m3	47.8 m3	57.6 m3	66.9 m3	70.9 m3	92.4 m3
1hr	60min	1.00hr	39.6 m3	50.2 m3	55.7 m3	60.1 m3	63.8 m3	76.8 m3	89.8 m3	95.6 m3	125.7 m3
2hr	120min	2.00hr	47.6 m3	60.2 m3	66.9 m3	72.1 m3	76.6 m3	92.2 m3	107.8 m3	114.7 m3	150.9 m3
4hr	240min	4.00hr	57.2 m3	71.1 m3	78.9 m3	84.1 m3	89.3 m3	107.5 m3	124.9 m3	133.0 m3	174.3 m3
6hr	360min	6.00hr	67.4 m3	82.3 m3	90.2 m3	96.1 m3	102.1 m3	120.9 m3	140.7 m3	150.0 m3	195.2 m3
10hr	600min	10.00hr	71.6 m3	87.4 m3	95.8 m3	102.1 m3	108.5 m3	128.5 m3	149.5 m3	159.4 m3	207.4 m3
24hr	1440min	24.00hr	95.4 m3	114.5 m3	125.4 m3	132.2 m3	139.0 m3	162.2 m3	188.0 m3	199.9 m3	257.5 m3
48hr	2880min	48.00hr	111.5 m3	131.6 m3	144.0 m3	151.8 m3	157.9 m3	181.2 m3	207.5 m3	219.9 m3	280.3 m3

Exceedance of Greenfield Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	14.0 m3	18.0 m3	20.3 m3	22.1 m3	23.2 m3	26.9 m3	30.7 m3	32.0 m3	40.0 m3
10min	10min	0.17hr	19.7 m3	25.7 m3	29.3 m3	31.5 m3	33.4 m3	39.4 m3	45.4 m3	47.6 m3	60.9 m3
15min	15min	0.25hr	22.9 m3	30.1 m3	34.2 m3	36.8 m3	38.9 m3	45.9 m3	52.9 m3	55.2 m3	70.6 m3
30min	30min	0.50hr	25.4 m3	34.1 m3	37.8 m3	40.5 m3	42.8 m3	51.2 m3	59.1 m3	61.4 m3	79.8 m3
1hr	60min	1.00hr	32.9 m3	43.2 m3	47.7 m3	51.0 m3	53.6 m3	64.0 m3	74.2 m3	76.6 m3	100.4 m3
2hr	120min	2.00hr	34.1 m3	46.3 m3	50.8 m3	53.9 m3	56.3 m3	66.5 m3	76.6 m3	76.7 m3	100.3 m3
4hr	240min	4.00hr	30.3 m3	43.2 m3	46.8 m3	47.8 m3	48.7 m3	56.2 m3	62.5 m3	56.9 m3	73.1 m3
6hr	360min	6.00hr	27.0 m3	40.4 m3	42.0 m3	41.6 m3	41.2 m3	43.8 m3	47.2 m3	35.8 m3	43.5 m3
10hr	600min	10.00hr	4.2 m3	17.6 m3	15.5 m3	11.2 m3	7.0 m3	0.0 m3	-6.4 m3	-30.9 m3	-45.5 m3
24hr	1440min	24.00hr	-66.3 m3	-53.0 m3	-67.4 m3	-86.0 m3	-104.6 m3	-146.1 m3	-186.2 m3	-256.8 m3	-349.4 m3
48hr	2880min	48.00hr	-212.0 m3	-203.3 m3	-241.6 m3	-284.6 m3	-329.2 m3	-435.3 m3	-540.9 m3	-693.4 m3	-933.7 m3
			34.1 m3							**76.7 m3**	**100.4 m3**

			C_V:
Catchment Area:	5075sqm	100%	
Permeable Garden	4128sqm	81%	0.40
Impermeable:	947sqm	19%	0.77
			0.47



SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
POST-DEV. PEAK RUNOFF	
Sheet 5 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

POST- DEVELOPMENT PEAK RUNOFF + CC

C_V: 0.47 *Volumetric Run-Off Coefficient* Climate Change Allowance: 40%

C_R: 1.3 *Routing Coefficient*

Run-Off Q

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	68.1 l/sec	86.8 l/sec	97.8 l/sec	106.5 l/sec	112.0 l/sec	130.7 l/sec	149.4 l/sec	156.7 l/sec	196.6 l/sec
10min	10min	0.17hr	48.5 l/sec	62.8 l/sec	71.5 l/sec	77.1 l/sec	81.9 l/sec	97.0 l/sec	112.1 l/sec	118.4 l/sec	151.8 l/sec
15min	15min	0.25hr	38.2 l/sec	49.5 l/sec	56.4 l/sec	60.7 l/sec	64.5 l/sec	76.4 l/sec	88.3 l/sec	93.3 l/sec	119.6 l/sec
30min	30min	0.50hr	22.4 l/sec	29.3 l/sec	32.5 l/sec	35.0 l/sec	37.2 l/sec	44.8 l/sec	52.0 l/sec	55.2 l/sec	71.9 l/sec
1hr	60min	1.00hr	15.4 l/sec	19.5 l/sec	21.7 l/sec	23.4 l/sec	24.8 l/sec	29.9 l/sec	34.9 l/sec	37.2 l/sec	48.9 l/sec
2hr	120min	2.00hr	9.2 l/sec	11.7 l/sec	13.0 l/sec	14.0 l/sec	14.9 l/sec	17.9 l/sec	21.0 l/sec	22.3 l/sec	29.3 l/sec
4hr	240min	4.00hr	5.6 l/sec	6.9 l/sec	7.7 l/sec	8.2 l/sec	8.7 l/sec	10.5 l/sec	12.1 l/sec	12.9 l/sec	16.9 l/sec
6hr	360min	6.00hr	4.4 l/sec	5.3 l/sec	5.8 l/sec	6.2 l/sec	6.6 l/sec	7.8 l/sec	9.1 l/sec	9.7 l/sec	12.7 l/sec
10hr	600min	10.00hr	2.8 l/sec	3.4 l/sec	3.7 l/sec	4.0 l/sec	4.2 l/sec	5.0 l/sec	5.8 l/sec	6.2 l/sec	8.1 l/sec
24hr	1440min	24.00hr	1.5 l/sec	1.9 l/sec	2.0 l/sec	2.1 l/sec	2.3 l/sec	2.6 l/sec	3.0 l/sec	3.2 l/sec	4.2 l/sec
48hr	2880min	48.00hr	0.9 l/sec	1.1 l/sec	1.2 l/sec	1.2 l/sec	1.3 l/sec	1.5 l/sec	1.7 l/sec	1.8 l/sec	2.3 l/sec

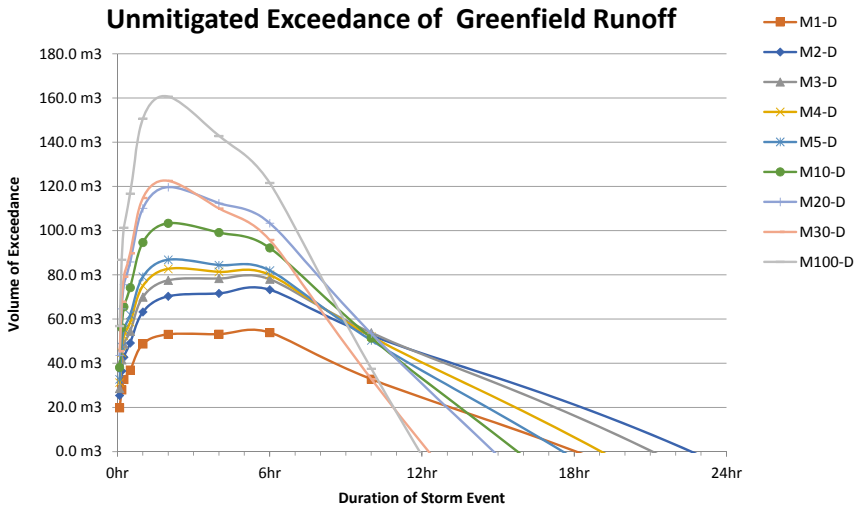
Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	20.4 m3	26.0 m3	29.3 m3	32.0 m3	33.6 m3	39.2 m3	44.8 m3	47.0 m3	59.0 m3
10min	10min	0.17hr	29.1 m3	37.7 m3	42.9 m3	46.3 m3	49.1 m3	58.2 m3	67.2 m3	71.1 m3	91.1 m3
15min	15min	0.25hr	34.4 m3	44.5 m3	50.7 m3	54.7 m3	58.1 m3	68.8 m3	79.5 m3	84.0 m3	107.7 m3
30min	30min	0.50hr	40.3 m3	52.7 m3	58.5 m3	63.1 m3	67.0 m3	80.6 m3	93.7 m3	99.3 m3	129.4 m3
1hr	60min	1.00hr	55.5 m3	70.2 m3	78.0 m3	84.1 m3	89.3 m3	107.5 m3	125.7 m3	133.8 m3	176.0 m3
2hr	120min	2.00hr	66.6 m3	84.3 m3	93.7 m3	100.9 m3	107.2 m3	129.0 m3	150.9 m3	160.6 m3	211.2 m3
4hr	240min	4.00hr	80.1 m3	99.5 m3	110.5 m3	117.8 m3	125.0 m3	150.5 m3	174.8 m3	186.1 m3	244.0 m3
6hr	360min	6.00hr	94.3 m3	115.2 m3	126.3 m3	134.6 m3	142.9 m3	169.3 m3	197.0 m3	210.0 m3	273.3 m3
10hr	600min	10.00hr	100.2 m3	122.4 m3	134.1 m3	143.0 m3	151.8 m3	179.8 m3	209.3 m3	223.1 m3	290.4 m3
24hr	1440min	24.00hr	133.5 m3	160.3 m3	175.5 m3	185.1 m3	194.6 m3	227.0 m3	263.3 m3	279.8 m3	360.6 m3
48hr	2880min	48.00hr	156.1 m3	184.3 m3	201.6 m3	212.5 m3	221.1 m3	253.6 m3	290.5 m3	307.8 m3	392.4 m3

Exceedance of Greenfield Run-Off Volume

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	19.9 m3	25.5 m3	28.7 m3	31.2 m3	32.8 m3	38.1 m3	43.5 m3	45.4 m3	56.9 m3
10min	10min	0.17hr	28.0 m3	36.5 m3	41.6 m3	44.7 m3	47.4 m3	56.0 m3	64.6 m3	67.9 m3	86.9 m3
15min	15min	0.25hr	32.7 m3	42.8 m3	48.7 m3	52.4 m3	55.5 m3	65.6 m3	75.6 m3	79.2 m3	101.3 m3
30min	30min	0.50hr	37.0 m3	49.2 m3	54.5 m3	58.5 m3	61.9 m3	74.2 m3	85.9 m3	89.8 m3	116.8 m3
1hr	60min	1.00hr	48.8 m3	63.3 m3	70.0 m3	75.0 m3	79.2 m3	94.7 m3	110.1 m3	114.8 m3	150.7 m3
2hr	120min	2.00hr	53.1 m3	70.3 m3	77.6 m3	82.8 m3	86.9 m3	103.3 m3	119.7 m3	122.5 m3	160.7 m3
4hr	240min	4.00hr	53.2 m3	71.6 m3	78.3 m3	81.4 m3	84.5 m3	99.2 m3	112.5 m3	110.0 m3	142.9 m3
6hr	360min	6.00hr	53.9 m3	73.3 m3	78.1 m3	80.0 m3	82.0 m3	92.2 m3	103.5 m3	95.8 m3	121.6 m3
10hr	600min	10.00hr	32.9 m3	52.6 m3	53.8 m3	52.1 m3	50.4 m3	51.4 m3	53.4 m3	32.8 m3	37.5 m3
24hr	1440min	24.00hr	-28.2 m3	-7.2 m3	-17.3 m3	-33.1 m3	-49.0 m3	-81.2 m3	-110.9 m3	-176.9 m3	-246.4 m3
48hr	2880min	48.00hr	-167.4 m3	-150.6 m3	-184.0 m3	-223.9 m3	-266.0 m3	-362.8 m3	-457.9 m3	-605.5 m3	-821.6 m3
											160.7 m3

			C_V:
Catchment Area:	5075sqm	100%	
Permeable Garden	4128sqm	81%	0.40
Impermeable:	947sqm	19%	0.77
			0.47



SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
POST-DEV. PEAK RUNOFF+CC	
Sheet 6 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

POST- DEVELOPMENT & SOURCE MITIGATION PEAK RUN-OFF + CC STORAGE

Proposed Discharge Rates: Greenfield x 1

INFLOW

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	20.4 m3	26.0 m3	29.3 m3	32.0 m3	33.6 m3	39.2 m3	44.8 m3	47.0 m3	59.0 m3
10min	10min	0.17hr	29.1 m3	37.7 m3	42.9 m3	46.3 m3	49.1 m3	58.2 m3	67.2 m3	71.1 m3	91.1 m3
15min	15min	0.25hr	34.4 m3	44.5 m3	50.7 m3	54.7 m3	58.1 m3	68.8 m3	79.5 m3	84.0 m3	107.7 m3
30min	30min	0.50hr	40.3 m3	52.7 m3	58.5 m3	63.1 m3	67.0 m3	80.6 m3	93.7 m3	99.3 m3	129.4 m3
1hr	60min	1.00hr	55.5 m3	70.2 m3	78.0 m3	84.1 m3	89.3 m3	107.5 m3	125.7 m3	133.8 m3	176.0 m3
2hr	120min	2.00hr	66.6 m3	84.3 m3	93.7 m3	100.9 m3	107.2 m3	129.0 m3	150.9 m3	160.6 m3	211.2 m3
4hr	240min	4.00hr	80.1 m3	99.5 m3	110.5 m3	117.8 m3	125.0 m3	150.5 m3	174.8 m3	186.1 m3	244.0 m3
6hr	360min	6.00hr	94.3 m3	115.2 m3	126.3 m3	134.6 m3	142.9 m3	169.3 m3	197.0 m3	210.0 m3	273.3 m3
10hr	600min	10.00hr	100.2 m3	122.4 m3	134.1 m3	143.0 m3	151.8 m3	179.8 m3	209.3 m3	223.1 m3	290.4 m3
24hr	1440min	24.00hr	133.5 m3	160.3 m3	175.5 m3	185.1 m3	194.6 m3	227.0 m3	263.3 m3	279.8 m3	360.6 m3
48hr	2880min	48.00hr	156.1 m3	184.3 m3	201.6 m3	212.5 m3	221.1 m3	253.6 m3	290.5 m3	307.8 m3	392.4 m3

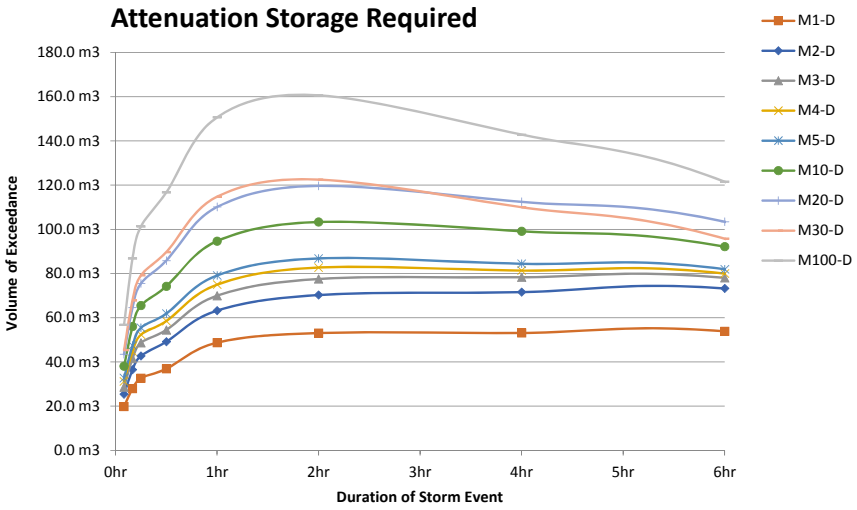
OUTFLOW

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	0.6 m3	0.6 m3	0.7 m3	0.8 m3	0.8 m3	1.1 m3	1.3 m3	1.6 m3	2.1 m3
10min	10min	0.17hr	1.1 m3	1.2 m3	1.3 m3	1.5 m3	1.7 m3	2.1 m3	2.6 m3	3.2 m3	4.2 m3
15min	15min	0.25hr	1.7 m3	1.7 m3	2.0 m3	2.3 m3	2.5 m3	3.2 m3	3.9 m3	4.8 m3	6.3 m3
30min	30min	0.50hr	3.4 m3	3.5 m3	4.0 m3	4.5 m3	5.1 m3	6.4 m3	7.8 m3	9.5 m3	12.6 m3
1hr	60min	1.00hr	6.7 m3	7.0 m3	8.0 m3	9.1 m3	10.1 m3	12.8 m3	15.6 m3	19.0 m3	25.3 m3
2hr	120min	2.00hr	13.5 m3	14.0 m3	16.1 m3	18.2 m3	20.3 m3	25.7 m3	31.2 m3	38.1 m3	50.6 m3
4hr	240min	4.00hr	27.0 m3	27.9 m3	32.1 m3	36.4 m3	40.6 m3	51.4 m3	62.4 m3	76.1 m3	101.2 m3
6hr	360min	6.00hr	40.4 m3	41.9 m3	48.2 m3	54.5 m3	60.9 m3	77.1 m3	93.6 m3	114.2 m3	151.7 m3
10hr	600min	10.00hr	67.4 m3	69.8 m3	80.3 m3	90.9 m3	101.5 m3	128.4 m3	155.9 m3	190.3 m3	252.9 m3
24hr	1440min	24.00hr	161.7 m3	167.4 m3	192.8 m3	218.2 m3	243.6 m3	308.2 m3	374.2 m3	456.7 m3	607.0 m3
48hr	2880min	48.00hr	323.5 m3	334.9 m3	385.6 m3	436.4 m3	487.1 m3	616.5 m3	748.4 m3	913.3 m3	1213.9 m3

ATTENUATION STORAGE REQUIRED TO MEET PROPOSED DISCHARGE RATE

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	19.9 m3	25.5 m3	28.7 m3	31.2 m3	32.8 m3	38.1 m3	43.5 m3	45.4 m3	56.9 m3
10min	10min	0.17hr	28.0 m3	36.5 m3	41.6 m3	44.7 m3	47.4 m3	56.0 m3	64.6 m3	67.9 m3	86.9 m3
15min	15min	0.25hr	32.7 m3	42.8 m3	48.7 m3	52.4 m3	55.5 m3	65.6 m3	75.6 m3	79.2 m3	101.3 m3
30min	30min	0.50hr	37.0 m3	49.2 m3	54.5 m3	58.5 m3	61.9 m3	74.2 m3	85.9 m3	89.8 m3	116.8 m3
1hr	60min	1.00hr	48.8 m3	63.3 m3	70.0 m3	75.0 m3	79.2 m3	94.7 m3	110.1 m3	114.8 m3	150.7 m3
2hr	120min	2.00hr	53.1 m3	70.3 m3	77.6 m3	82.8 m3	86.9 m3	103.3 m3	119.7 m3	122.5 m3	160.7 m3
4hr	240min	4.00hr	53.2 m3	71.6 m3	78.3 m3	81.4 m3	84.5 m3	99.2 m3	112.5 m3	110.0 m3	142.9 m3
6hr	360min	6.00hr	53.9 m3	73.3 m3	78.1 m3	80.0 m3	82.0 m3	92.2 m3	103.5 m3	95.8 m3	121.6 m3
10hr	600min	10.00hr	32.9 m3	52.6 m3	53.8 m3	52.1 m3	50.4 m3	51.4 m3	53.4 m3	32.8 m3	37.5 m3
24hr	1440min	24.00hr	-28.2 m3	-7.2 m3	-17.3 m3	-33.1 m3	-49.0 m3	-81.2 m3	-110.9 m3	-176.9 m3	-246.4 m3
48hr	2880min	48.00hr	-167.4 m3	-150.6 m3	-184.0 m3	-223.9 m3	-266.0 m3	-362.8 m3	-457.9 m3	-605.5 m3	-821.6 m3

ATTENUATION STORAGE REQUIRED:			**53.9 m3**	**73.3 m3**	**78.3 m3**	**82.8 m3**	**86.9 m3**	**103.3 m3**	**119.7 m3**	**122.5 m3**	**160.7 m3**



SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
STORAGE REQUIREMENTS	
Sheet 7 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO

POST- DEVELOPMENT & SOURCE MITIGATION PEAK RUN-OFF + CC STORAGE

Proposed Discharge Rate: **Existing x 50%** **(or greenfield where this is greater)**

INFLOW

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	20.4 m3	26.0 m3	29.3 m3	32.0 m3	33.6 m3	39.2 m3	44.8 m3	47.0 m3	59.0 m3
10min	10min	0.17hr	29.1 m3	37.7 m3	42.9 m3	46.3 m3	49.1 m3	58.2 m3	67.2 m3	71.1 m3	91.1 m3
15min	15min	0.25hr	34.4 m3	44.5 m3	50.7 m3	54.7 m3	58.1 m3	68.8 m3	79.5 m3	84.0 m3	107.7 m3
30min	30min	0.50hr	40.3 m3	52.7 m3	58.5 m3	63.1 m3	67.0 m3	80.6 m3	93.7 m3	99.3 m3	129.4 m3
1hr	60min	1.00hr	55.5 m3	70.2 m3	78.0 m3	84.1 m3	89.3 m3	107.5 m3	125.7 m3	133.8 m3	176.0 m3
2hr	120min	2.00hr	66.6 m3	84.3 m3	93.7 m3	100.9 m3	107.2 m3	129.0 m3	150.9 m3	160.6 m3	211.2 m3
4hr	240min	4.00hr	80.1 m3	99.5 m3	110.5 m3	117.8 m3	125.0 m3	150.5 m3	174.8 m3	186.1 m3	244.0 m3
6hr	360min	6.00hr	94.3 m3	115.2 m3	126.3 m3	134.6 m3	142.9 m3	169.3 m3	197.0 m3	210.0 m3	273.3 m3
10hr	600min	10.00hr	100.2 m3	122.4 m3	134.1 m3	143.0 m3	151.8 m3	179.8 m3	209.3 m3	223.1 m3	290.4 m3
24hr	1440min	24.00hr	133.5 m3	160.3 m3	175.5 m3	185.1 m3	194.6 m3	227.0 m3	263.3 m3	279.8 m3	360.6 m3
48hr	2880min	48.00hr	156.1 m3	184.3 m3	201.6 m3	212.5 m3	221.1 m3	253.6 m3	290.5 m3	307.8 m3	392.4 m3

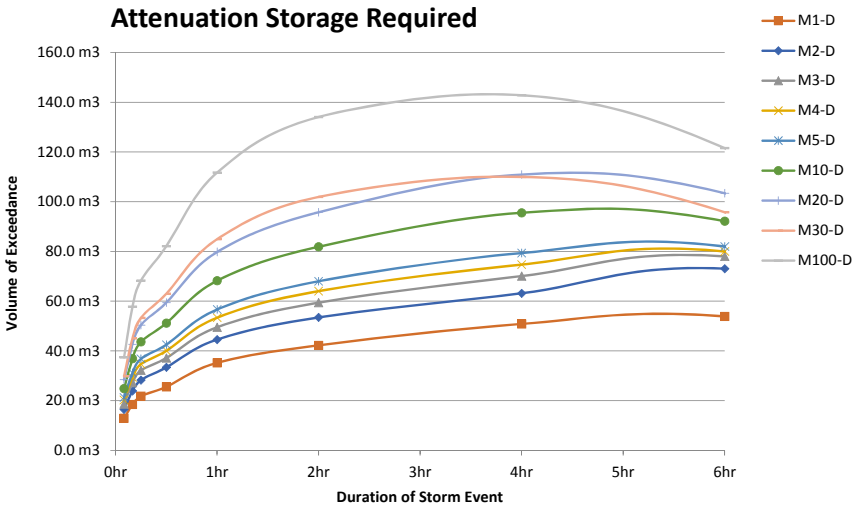
OUTFLOW

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	7.5 m3	9.5 m3	10.7 m3	11.7 m3	12.3 m3	14.3 m3	16.4 m3	17.2 m3	21.5 m3
10min	10min	0.17hr	10.6 m3	13.8 m3	15.7 m3	16.9 m3	17.9 m3	21.2 m3	24.6 m3	26.0 m3	33.3 m3
15min	15min	0.25hr	12.6 m3	16.3 m3	18.5 m3	20.0 m3	21.2 m3	25.1 m3	29.0 m3	30.7 m3	39.3 m3
30min	30min	0.50hr	14.7 m3	19.2 m3	21.4 m3	23.0 m3	24.5 m3	29.5 m3	34.2 m3	36.3 m3	47.3 m3
1hr	60min	1.00hr	20.3 m3	25.7 m3	28.5 m3	30.7 m3	32.6 m3	39.3 m3	45.9 m3	48.9 m3	64.3 m3
2hr	120min	2.00hr	24.3 m3	30.8 m3	34.2 m3	36.9 m3	39.1 m3	47.1 m3	55.1 m3	58.6 m3	77.1 m3
4hr	240min	4.00hr	29.3 m3	36.4 m3	40.3 m3	43.0 m3	45.7 m3	55.0 m3	63.8 m3	76.1 m3	101.2 m3
6hr	360min	6.00hr	40.4 m3	42.1 m3	48.2 m3	54.5 m3	60.9 m3	77.1 m3	93.6 m3	114.2 m3	151.7 m3
10hr	600min	10.00hr	67.4 m3	69.8 m3	80.3 m3	90.9 m3	101.5 m3	128.4 m3	155.9 m3	190.3 m3	252.9 m3
24hr	1440min	24.00hr	161.7 m3	167.4 m3	192.8 m3	218.2 m3	243.6 m3	308.2 m3	374.2 m3	456.7 m3	607.0 m3
48hr	2880min	48.00hr	323.5 m3	334.9 m3	385.6 m3	436.4 m3	487.1 m3	616.5 m3	748.4 m3	913.3 m3	1213.9 m3

ATTENUATION STORAGE REQUIRED TO MEET PROPOSED DISCHARGE RATE

	D Duration		M1-D	M2-D	M3-D	M4-D	M5-D	M10-D	M20-D	M30-D	M100-D
5min	5min	0.08hr	13.0 m3	16.5 m3	18.6 m3	20.3 m3	21.3 m3	24.9 m3	28.4 m3	29.8 m3	37.4 m3
10min	10min	0.17hr	18.5 m3	23.9 m3	27.2 m3	29.4 m3	31.2 m3	36.9 m3	42.7 m3	45.1 m3	57.8 m3
15min	15min	0.25hr	21.8 m3	28.3 m3	32.2 m3	34.7 m3	36.9 m3	43.7 m3	50.5 m3	53.3 m3	68.3 m3
30min	30min	0.50hr	25.6 m3	33.4 m3	37.2 m3	40.0 m3	42.5 m3	51.2 m3	59.5 m3	63.0 m3	82.2 m3
1hr	60min	1.00hr	35.2 m3	44.6 m3	49.5 m3	53.4 m3	56.7 m3	68.3 m3	79.8 m3	85.0 m3	111.7 m3
2hr	120min	2.00hr	42.3 m3	53.5 m3	59.5 m3	64.1 m3	68.0 m3	81.9 m3	95.8 m3	101.9 m3	134.1 m3
4hr	240min	4.00hr	50.9 m3	63.2 m3	70.1 m3	74.8 m3	79.4 m3	95.6 m3	111.0 m3	110.0 m3	142.9 m3
6hr	360min	6.00hr	53.9 m3	73.1 m3	78.1 m3	80.0 m3	82.0 m3	92.2 m3	103.5 m3	95.8 m3	121.6 m3
10hr	600min	10.00hr	32.9 m3	52.6 m3	53.8 m3	52.1 m3	50.4 m3	51.4 m3	53.4 m3	32.8 m3	37.5 m3
24hr	1440min	24.00hr	-28.2 m3	-7.2 m3	-17.3 m3	-33.1 m3	-49.0 m3	-81.2 m3	-110.9 m3	-176.9 m3	-246.4 m3
48hr	2880min	48.00hr	-167.4 m3	-150.6 m3	-184.0 m3	-223.9 m3	-266.0 m3	-362.8 m3	-457.9 m3	-605.5 m3	-821.6 m3

ATTENUATION STORAGE REQUIRED:	**53.9 m3**	**73.1 m3**	**78.1 m3**	**80.0 m3**	**82.0 m3**	**95.6 m3**	**111.0 m3**	**110.0 m3**	**142.9 m3**



SuDs CALCULATIONS	
Project: 55 FITZROY PARK	
STORAGE REQUIREMENTS	
Sheet 8 of 8	
Project Reference: LBH 4599	
Date: 13/12/2019	Rev: 1
Client: Turner Stokes / Springer	

LBHGEO