Title:	SuDS Strategy Summary	Date Approved:	26.02.2019
Discipline:	Civils	Author:	Will Hudson
Note Ref:	2190088 – 36 Avenue Road		

			Document Control				
revision:	P1	prepared by:	Will Hudson	checked by:	Tim Kenning	approved by:	Tim Kenning
date:	26.02.19	signature:	WHu	signature:	TKe	signature:	TKe

Technical Note Summary

This technical note has been prepared to discharge planning condition 6 on the 36 Avenue Road, Primrose Hill, London (London Borough of Camden Planning Application Ref: 2015/3328/P).

Planning Condition 6

Condition 6 is worded as follows:

Prior to commencement of development details of a sustainable urban drainage system shall be submitted to and approved in writing by the local planning authority. Such system shall be based on a ***1:100 year event with 30% provision for climate change*** *demonstrating* ***50% attenuation of all runoff****. The system shall be implemented as part of the development and thereafter retained and maintained.*

Planning Condition Response

Please refer to Appendix A for EW drawing C1000, which details the below ground drainage strategy for the development.

Surface Water Strategy:

Existing Drainage

A CCTV drainage survey of the existing on-site network was undertaken by GO Drainage Services Ltd in February 2015 which confirmed that the foul water and surface water flows from the site discharge to the Thames Water combined water sewer in Avenue Road.

The existing hardstanding drained area of the site has been calculated as 724m^2. Refer to Appendix B for area take off drawings showing the pre and post development areas.

Surface water runoff rates for the existing site have been calculated for the site using the Modified Rational Method equation shown below.

$$Q = 2.78C.i.A$$

Where Q = existing peak runoff (l/s), C = non-dimensional runoff coefficient = 1.3, i = rainfall intensity (mm/hr) and A = total catchment area being drainage = 0.0724ha

Return Period	Rainfall Intensity (mm/hr)	Existing Run-off (l/s)
1yr	33	8.6
30yr	82	21.3
100yr	107	27.8

Table 1 : Existing Surface Water Run-off rates

Note that the rainfall intensities used in the above calculations have been based on average rainfall intensities for a 15-minute storm using Micro Drainage software.

Proposed Drainage

The proposed site has a slight reduction in hardstanding drained area from 724m^2 to 666m^2 (approximately 8% reduction). In order to comply with the guidance outlined by the London Borough of Camden, it is proposed to restrict surface water runoff from the site through the use of a vortex flow control device in the final surface water manhole.

The flow control device has been designed to limit the peak surface water runoff from the site to a maximum of 5l/s for all rainfall events up to and including the 100-year return + 30% allowance for climate change. Using Micro Drainage software, the volume of attenuation required to restrict to a maximum run-off of 5l/s has been calculated to be 15m^3. This attenuation will be provided in the form of below ground geocellular attenuation crates located beneath the front driveway.

Table 2 provides a summary of the percentage reduction in surface water run-off between the existing and proposed sites. The proposed run-off rates have been taken from the Micro Drainage network calculation results which can be found in Appendix C.

Return Period	Existing Run-off (l/s)	Proposed Run-off (l/s)	Run-off Reduction
1yr	8.6	4.2	51%
30yr	21.3	4.3	80%
100yr	27.8	5.0	82%
100yr + 30% CC	N/A	5.0	>82%

Table 2 : Existing and Proposed Surface Water Run-off reduction

As can be seen in Table 2, the proposed development will restrict to greater than 50% of the existing run-off rate in the 1-year return period and provide over 80% reduction in flow rate for the 30-year and 100-year + 30% climate change allowance events. Therefore, the requirements of Condition 6 have been met.

Maintenance Strategy:

The proposed drainage system will be entirely within the extents of the development ownership boundary and will therefore be maintained by the property owners / a dedicated maintenance company for the lifetime of the development. The below table details the maintenance regime which will be required to ensure efficient operation.

All SuDS will be maintained in accordance with the 2015 SuDS Manual, maintenance requirements are summarised below:

Modular Systems – Geo-cellular Storage Crates:

Maintenance Schedule	Required Action	Recommended Frequency
Regular	Inspect and identify any areas that are not operating correctly. If required take remedial action. Debris removal from catchment surface (where may cause risks to performance) Remove sediment from pre-treatment structures including catch pits	Monthly for 3 months, then six monthly Monthly 6 monthly, or as required
Remedial actions	Repair/rehabilitation of inlets, outlets, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms. Include CCTV survey for perforated pipe if excessive silts found in chambers.

Gullies:

Inspection and removal of debris from silt trap once a year; preferably after leaf fall in the autumn.

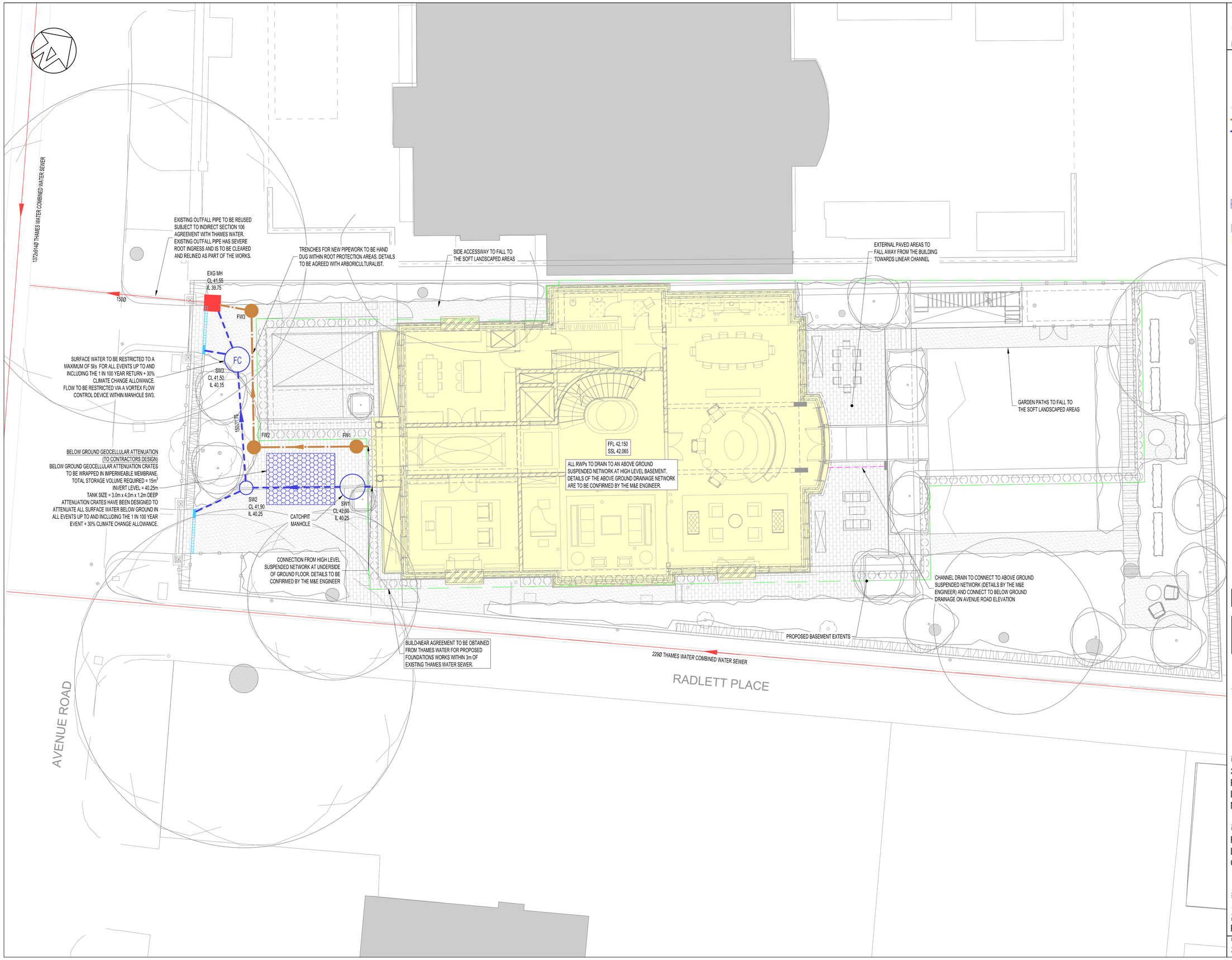
Drainage pipes, manholes & silt traps:

Inspect manholes & silt traps for build-up of silt and general debris (once a year, preferably after leaf fall in the autumn). If silt/debris is building up then clean with jetting lorry / gully sucker and inspect pipe – repeat cleaning if required. If the pipes to be jetted are plastic then a high flow, low pressure setting should be used so that the pipes are not damaged. NOTE: Manhole covers can be heavy and suitable lifting equipment / procedures should be used. Where possible, personnel should not enter manholes to carry out maintenance.

Unusual / unresolved problems:

If the drainage system is still holding water following cleaning with a jetter, or the jetting of the system removes excessive amounts of debris this may indicate greater issues within the system. A CCTV survey is likely to be required and further advice should be sought from a drainage engineer.

Appendix A – Below Ground Drainage Drawing



This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

LEGEND

- COMBINED WATER MANHOLE
- FOUL WATER MANHOLE
- SURFACE WATER MANHOLE
- EXISTING COMBINED WATER
- PROPOSED FOUL WATER
- PROPOSED SURFACE WATER
- PROPOSED LINEAR CHANNEL WITH HEELGUARD GRATING
- PROPOSED THRESHOLD DRAIN WITH BRICK SLOT UPSTAND
- FOUL DROP POINT
- RWP RAIN WATER PIPE
- GEOCELLULAR SURFACE WATER ATTENUATION
- FC FLOW CONTROL CHAMBER
- EXISTING BUILDING
- PROPOSED BUILDING

NOT FOR CONSTRUCTION

rev	date	by	chk	description
P2	26.02.19	WHu	TKe	Revised to co-ordinate with latest above ground drainage arrangement
P1	22.02.19	WHu	TKe	Issued for information

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Project

36 Avenue Road
Primrose Hill
London
NW8 6HS

Drawing title

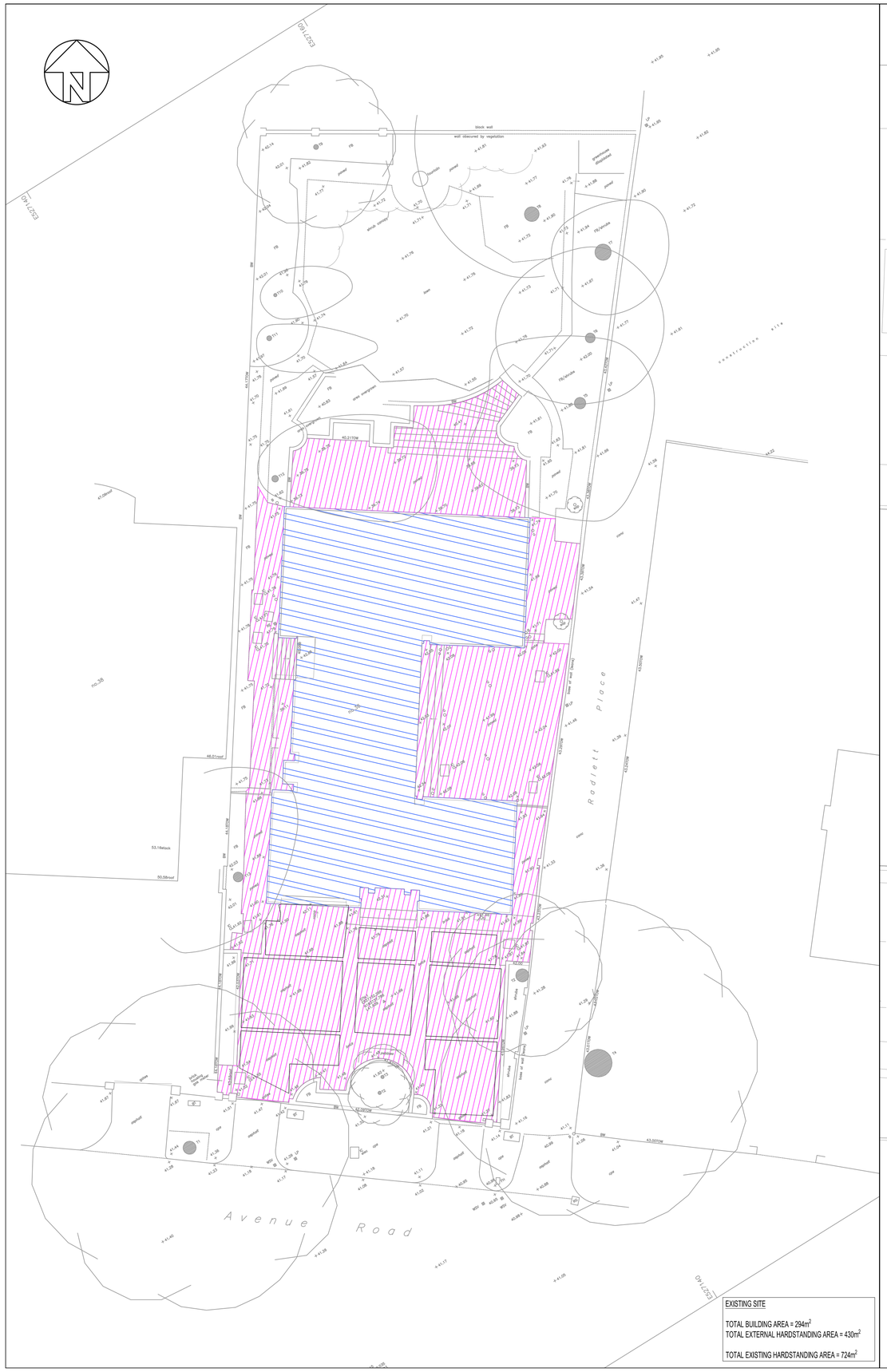
Proposed Below Ground Drainage Layout
Ground Floor

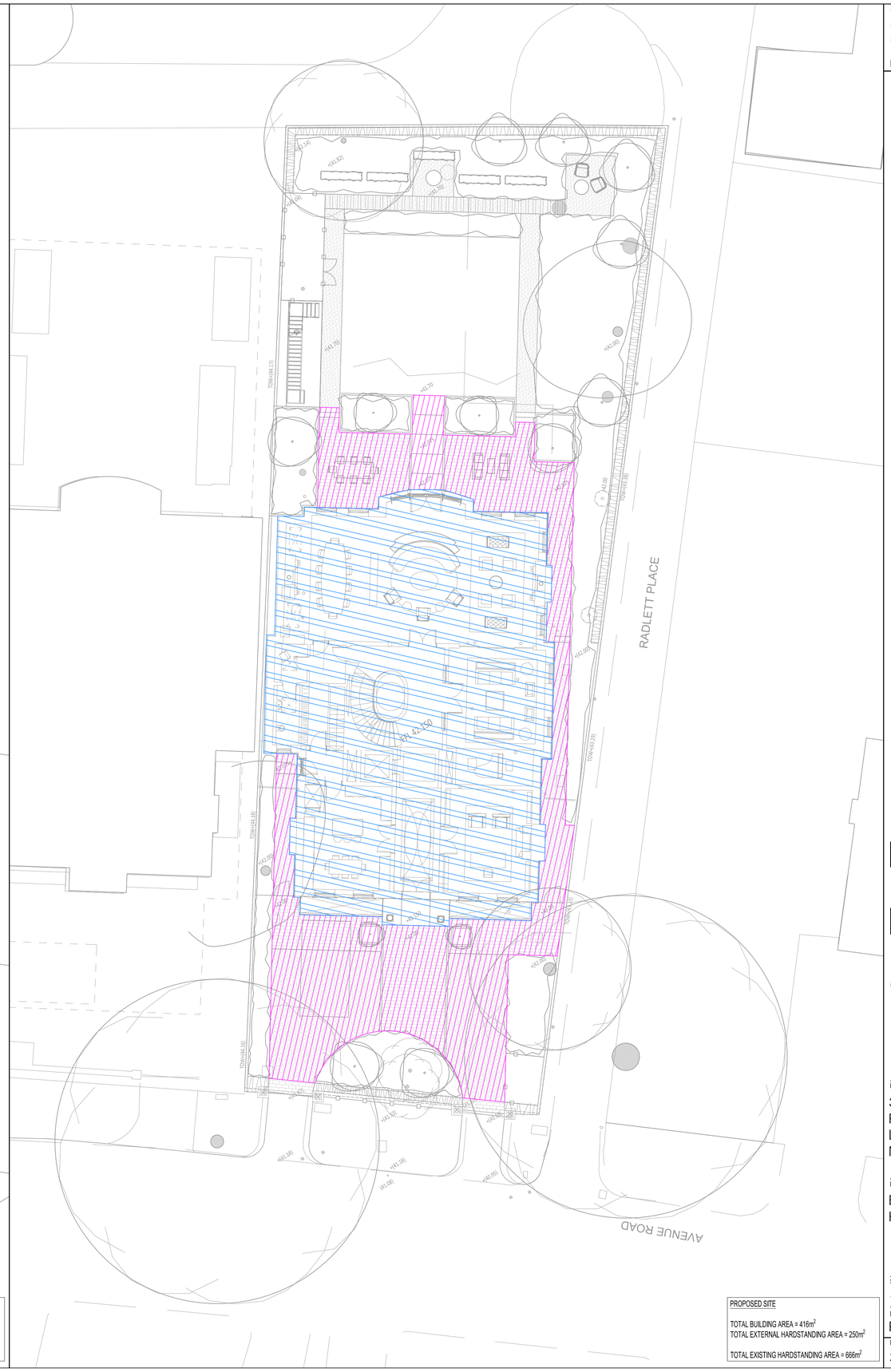
Scale (s)	Date	Drawn
1:100@ A1; 1:200@ A3	February 2019	WHu

Drawing status	Status	Revision
Preliminary	S2	P2

Project no.	Originator	Zone	Level	Type	Role	drg no.
2190088	EWP	ZZ	00	DR	C	1000

Appendix B – Existing and Proposed Hardstanding Areas





This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.

Do not scale from this drawing.

LEGEND

BUILDING AREA

HARDSTANDING AREA

NOT FOR CONSTRUCTION

rev	date	by	chk	description
P1	22.02.19	WHu	TKe	Issued for information

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Project

36 Avenue Road
Primrose Hill
London
NW8 6HS

Drawing title

Existing and Proposed Hardstanding Areas

Scale (s)	Date	Drawn
1:150@ A1; 1:300@ A3	February 2019	WHu

Drawing status	Status	Revision
Preliminary	S2	P1

Project no.	Originator	Zone	Level	Type	Role	drg no.
2190088	EWP	ZZ	00	DR	C	5000

Appendix C – MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	21.000	Add Flow / Climate Change (%)	0
Ratio R	0.437	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.050	4-8	0.016

Total Area Contributing (ha) = 0.066

Total Pipe Volume (m³) = 1.085

Network Design Table for Storm

- Indicates pipe length does not match coordinates

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	25.992	0.640	40.6	0.017	6.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	5.755	0.310	18.6	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	12.007	0.100	120.1	0.007	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	15.869	1.350	11.8	0.022	6.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	1.750#	0.400	4.4	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.27	41.200	0.017	0.0	0.0	0.0	1.58	28.0	2.3
1.001	50.00	6.31	40.560	0.028	0.0	0.0	0.0	2.35	41.5	3.8
1.002	50.00	6.53	40.250	0.035	0.0	0.0	0.0	0.92	16.2	4.7
2.000	50.00	6.09	41.500	0.022	0.0	0.0	0.0	2.96	52.2	3.0
1.003	50.00	6.54	40.150	0.066	0.0	0.0	0.0	4.85	85.7	8.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
MH1	42.075	0.875	Open Manhole	450	1.000	41.200	150				
MH2	42.000	1.440	Open Manhole	450	1.001	40.560	150	1.000	40.560	150	
MH3	42.000	1.750	Open Manhole	1200	1.002	40.250	150	1.001	40.250	150	
MH4	42.075	0.575	Open Manhole	450	2.000	41.500	150				
MH5	41.500	1.350	Open Manhole	1200	1.003	40.150	150	1.002	40.150	150	
								2.000	40.150	150	
OUTFALL	41.500	1.750	Open Manhole	1200		OUTFALL		1.003	39.750	150	

PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	MH1	42.075	41.200	0.725	Open Manhole	450
1.001	o	150	MH2	42.000	40.560	1.290	Open Manhole	450
1.002	o	150	MH3	42.000	40.250	1.600	Open Manhole	1200
2.000	o	150	MH4	42.075	41.500	0.425	Open Manhole	450
1.003	o	150	MH5	41.500	40.150	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	25.992	40.6	MH2	42.000	40.560	1.290	Open Manhole	450
1.001	5.755	18.6	MH3	42.000	40.250	1.600	Open Manhole	1200
1.002	12.007	120.1	MH5	41.500	40.150	1.200	Open Manhole	1200
2.000	15.869	11.8	MH5	41.500	40.150	1.200	Open Manhole	1200
1.003	1.750#	4.4	OUTFALL	41.500	39.750	1.600	Open Manhole	1200

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.017	0.017	0.017
1.001	-	-	100	0.011	0.011	0.011
1.002	-	-	100	0.007	0.007	0.007
2.000	-	-	100	0.022	0.022	0.022
1.003	-	-	100	0.009	0.009	0.009
				Total	Total	Total
				0.066	0.066	0.066

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	OUTFALL	41.500	39.750	0.000	1200	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: MH5, DS/PN: 1.003, Volume (m³): 2.0

Unit Reference	MD-SHE-0100-4500-1000-4500	Sump Available	Yes
Design Head (m)	1.000	Diameter (mm)	100
Design Flow (l/s)	4.5	Invert Level (m)	40.150
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.5	Kick-Flo®	0.630	3.6
Flush-Flo™	0.292	4.5	Mean Flow over Head Range	-	3.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.1	2.000	6.2	4.000	8.6	7.000	11.2
0.200	4.4	1.000	4.5	2.200	6.5	4.500	9.1	7.500	11.6
0.300	4.5	1.200	4.9	2.400	6.8	5.000	9.6	8.000	12.0
0.400	4.4	1.400	5.3	2.600	7.0	5.500	10.0	8.500	12.3
0.500	4.2	1.600	5.6	3.000	7.5	6.000	10.4	9.000	12.7
0.600	3.8	1.800	5.9	3.500	8.1	6.500	10.8	9.500	13.0

Storage Structures for Storm

Cellular Storage Manhole: MH3, DS/PN: 1.002

Invert Level (m) 40.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.0	0.0	1.200	12.0	0.0	1.201	0.0	0.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 21.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.438 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	MH1	15 Winter	1	+0%	100/30 Winter				41.230	-0.120	0.000	0.09
1.001	MH2	15 Winter	1	+0%	30/15 Winter				40.593	-0.117	0.000	0.11
1.002	MH3	15 Winter	1	+0%	30/15 Summer				40.370	-0.030	0.000	0.23
2.000	MH4	15 Winter	1	+0%					41.524	-0.126	0.000	0.06
1.003	MH5	15 Winter	1	+0%	1/15 Summer				40.362	0.062	0.000	0.11

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	MH1		2.4	OK	
1.001	MH2		3.8	OK	
1.002	MH3		3.4	OK	
2.000	MH4		3.1	OK	
1.003	MH5		4.2	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 21.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.438	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	MH1	15 Winter	30	+0%	100/30 Winter				41.247	-0.103	0.000	0.22
1.001	MH2	30 Winter	30	+0%	30/15 Winter				40.829	0.119	0.000	0.23
1.002	MH3	30 Winter	30	+0%	30/15 Summer				40.825	0.425	0.000	0.27
2.000	MH4	15 Winter	30	+0%					41.539	-0.111	0.000	0.16
1.003	MH5	30 Winter	30	+0%	1/15 Summer				40.818	0.518	0.000	0.11

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	MH1		5.8	OK	
1.001	MH2		7.8	SURCHARGED	
1.002	MH3		3.9	SURCHARGED	
2.000	MH4		7.5	OK	
1.003	MH5		4.3	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 21.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.438	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
1.000	MH1	30 Winter	100	+30%	100/30 Winter				41.422	0.072	0.000	0.30
1.001	MH2	30 Winter	100	+30%	30/15 Winter				41.414	0.704	0.000	0.33
1.002	MH3	30 Winter	100	+30%	30/15 Summer				41.409	1.009	0.000	0.30
2.000	MH4	15 Winter	100	+30%					41.552	-0.098	0.000	0.26
1.003	MH5	30 Winter	100	+30%	1/15 Summer				41.400	1.100	0.000	0.13

PN	US/MH Name	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	MH1		8.0	SURCHARGED	
1.001	MH2		11.4	SURCHARGED	
1.002	MH3		4.3	SURCHARGED	
2.000	MH4		12.8	OK	
1.003	MH5		5.0	FLOOD RISK	