elliottwood

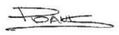
King's House School
Richmond

Sustainable Drainage Strategy

engineering a better **society**

elliottwood | engineering a better society

elliottwood | engineering a better society

		Remarks:	**Issued for Planning**				
Revision	P1	Prepared by:	Will Hudson MEng (Hons)	Checked by:	Paul Davis BEng (Hons) MSc CEng MICE	Approved by:	Paul Davis BEng (Hons) MSc CEng MICE
Date:	12/01/2021	Signature:		Signature:		Signature:	

Contents

Appendices

One

Introduction

1.1

Elliott Wood Partnership Ltd have been appointed to provide a Sustainable Drainage Strategy to support a detailed planning application for the proposed development at King's House School, 68 Kings Road, Richmond TW10 6ES.

1.2

The purpose of this report is to explain the approach taken with regards to the below ground drainage strategy. It evaluates the selection of SuDS devices and highlights how the drainage disposal hierarchy has been followed.

1.3

This report has been prepared in accordance with the GOV.UK *Sustainable Drainage Systems: Non-statutory Technical Standards*, and the London Borough of Richmond upon Thames (LBRT) *Planning Guidance Document: Delivering SuDS in Richmond.*

1.4

The scheme detailed in this report follows the same principles as the original strategy proposed as part of the approved planning application for the site (ref: 16/2129/FUL). The strategy has been updated to suit the latest proposals, and achieves the same outcome from the drainage strategy as the original scheme.

Two

Existing Site

2.1

The site is located on Kings Road, approximately 700m south east of Richmond railway station. The site is bounded by Kings Road to the west, and residential properties on all three other sides.

2.2

The total site area equates to approximately 4500m^2. The site has a mixture of hardstanding areas and soft landscape. The total drained area of the site is approximately 2790m^2, which equates to around 62% of the site.

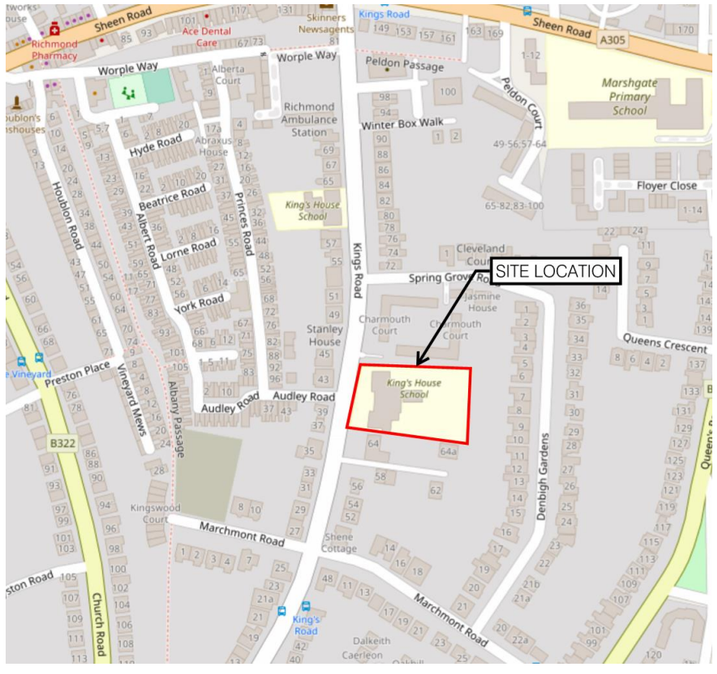


Figure 1: Site Location

2.3

A topographic survey of the site was completed by CPB Surveys in April 2015. Survey indicates that there is a gradual fall from south to north across the width of the site, with the northern boundary at approximately at approximately 22.10m AOD, and the southern boundary at 23.50m AOD. The site has minimal rise from front to back (west to east), with approximately 300mm fall from the east of the site to the west.

The topographic survey has been included in **Appendix A.**

Three

Underlying Geology

3.1

A Geotechnical Investigation was carried out by Site Analytical Services Ltd in October 2018. Two boreholes were drilled to 15m depth to determine the geology of the site. The boreholes revealed that the ground conditions on site comprised made ground up to 1.1m thickness overlying sands and gravels to depths of approximately 6.0m. The water table was struck at approximately 4.0m below ground level.

Four

Existing Drainage

4.1

Public sewer records have been obtained from Thames Water. An extract of the asset plan is shown in Figure 2 below. Refer to **Appendix B** for the full records.

Figure 2: Extract from Thames Water sewer records

4.2

The Thames Water records show a 300mm diameter foul water sewer and 225mm diameter surface water sewer running from south to north in Kings Road. The records do not indicate any sewers within or near the proposed building

4.3

A CCTV Drainage survey was undertaken by Novum Surveys Ltd in August 2018. The survey confirmed that the onsite drainage is generally combined (foul and surface water) and connects to the sewer in Kings Road via a 100mm diameter pipe. A copy of the CCTV drainage survey has been included within **Appendix C**.

4.4

The surface water runoff rates for the existing site have been calculated using the Modified Rational Method equation below (based on CIRIA C697) and are shown in **Table 1**:

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

Where:

Q = Existing peak runoff (l/s),

C = non-dimensional runoff coefficient=1.0,

i = Rainfall intensity (see table 1); and

A = total catchment area being drained =0.279ha

Table 1 Existing Surface Water Run-off rates

Return Period	Rainfall Intensity (mm/hr)	Existing run-off (l/s)
1yr	20.3	15.8
30yr	49.8	38.6
100yr	65.1	50.5

Note that the rainfall intensities used in the above calculations have been based on average rainfall intensities for a 30-minute storm using Micro Drainage software.

Five

Proposed Development

5.1

The proposed development involves the demolition of some areas of the existing buildings, and the construction of a new classroom block at the rear of the site. The proposals involve modifications to the existing sports hall, and the creation of a new central "quad" area.

The total development area which will be affected by the works is approximately 895m^2. The total increase in impermeable equates to approximately 345m^2.

.

Six

Proposed Drainage

6.1

The surface water drainage system has been designed in accordance with the requirements of National Planning Practice Guidance (NPPG) and the CIRIA SuDS Manual. The following drainage hierarchy has therefore been considered:

1) Store rainwater for later use
2) Use infiltration techniques, such as porous surfaces in non-clay areas
3) Attenuate rainwater in ponds or open water features for gradual release
4) attenuate rainwater by storing in tanks or sealed water features for gradual release
5) Discharge rainwater direct to a watercourse
6) Discharge rainwater to a surface water sewer/drain
7) Discharge rainwater to the combined sewer.

6.2 Appraising the use of Rainwater Harvesting

It is not proposed to use rainwater harvesting techniques for the scheme due to the required space for an appropriately sized tank, and the additional complexity involved with the routing of mains water supply within the proposed building.

The demand on the potable water supply will be reduced as much as possible through the use of low flow appliances within the new development.

6.3 Appraising the use of Infiltration Techniques

In order to comply with building regulations, infiltration techniques such as traditional soakaways must not be installed within 5m of a building or highway. As there are large root protection "no-dig" zones along the northern boundary of the site, it is not possible to achieve a 5m offset from the buildings without encroaching on these root zones.

It is therefore not considered feasible to use soakaways on the site.

6.4 Appraising the use of Open Water Features

Due to the nature of the development in an urban school environment with limited external space, it is not deemed feasible to make use of open water features (such as ponds and basins) due to the associated health and safety risks to the students, and land uptake which would be required.

6.5 Appraising the use of above and below-ground attenuation

The surface water runoff from the new development area of the site will be attenuated using below ground geocellular attenuation tanks. The tanks will be located to the north of the new quad area and will be sized to accommodate all rainfall up to an including the 1 in 100-year return + 40% allowance for climate change.

Green roofs are proposed for use on the flat roof area of the new classroom block and sports hall roof. Although the green roof does not provide surface water attenuation, it will help reduce the peak discharge rate from this area of roof by slowing down rainfall which falls on this area of the roof. The green roof will also help improve the biodiversity of the existing site and improve the quality of the water runoff from the roof.

6.6 Appraisal of discharging to watercourse/surface water sewer

There are no nearby accessible watercourses, therefore surface water generated from site areas of the development will discharge at a restricted rate to the sewer located in Kings Road via the existing outfall.

6.7

A summary of our SuDS evaluation is presented in **Table 2**:

Table 2 Evaluation of SuDS techniques

SuDS Technique	Y/N	Comment
Rainwater reuse	N	Rainwater reuse is not proposed for the scheme as it is proposed to reduce water usage rather than recycle rainwater.
Open Water features	N	The nature of the development makes open water features unfeasible.
Infiltration devices (i.e. Soakaways)	N	Soakaways are not deemed feasible for this site due to restricted space on site not allowing a minimum of 5m from buildings or roads without encroaching on the root protection zones.
Green Roofs	**Y**	**Green roofs are proposed on some of the flat roof areas to help improve biodiversity, water quality and slow the rate at which surface water reaches the below ground network.**
Tanked systems	**Y**	**The runoff from the new development areas of the site will be restricted and then attenuated using below ground geocellular a attenuation tank.**

6.8 Proposed Discharge Rate

As the works proposed as part of the new development do not affect the majority of the buildings on the site, it is proposed to minimise the impact to the existing drainage network by only directing the new build areas of the site, and the new quad (a total of 980m^2) to the below ground attenuation tank. It is proposed to discharge the new areas to a peak discharge rate of 2.5l/s for all return periods up to and including the 1 in 100-year return period include a 40% allowance for climate change.

6.9

A breakdown of the site areas has been provided in **Table 3**.

Table 3 Proposed Site areas

	Total Area (m^2)
Total Site Area	4500
Total pre-development drained area	2790
Total post-development drained area	3135
Total area to drain via attenuation tank	895
Remaining drained area (unrestricted)	2240

6.10

Using Micro Drainage, a Network model has been used to confirm the size of the attenuation tank required to restrict the development area to 2.5l/s. Approximately 34m^3 of geocellular attenuation is required to achieve a reduction to 2.5l/s in the 100 year return + 40% climate change allowance. The Network calculation results have been included in **Appendix D**.

6.11

The total peak runoff rate from the proposed development, and the percentage improvement over the existing total runoff from the site is presented **Table 4**.

Table 4 Total proposed runoff

Return Period	**Existing Area Runoff Rate (l/s)**	**Development Area Runoff Rate (l/s)**	**Total Runoff (l/s)**	**Existing run-off (l/s)**	**Percentage betterment on existing (%)**
1 in 1 year	12.6	2.0	14.6	15.8	7.5%
1 in 30 years	31.0	2.5	33.5	38.6	13%
1 in 100 years	40.5	2.5	43.0	50.5	15%
1 in 100 years + 40% Climate Change	53.5	2.5	56.0	66.6	15%

6.12

In conclusion, although it is not possible to achieve a significant overall reduction in runoff from the total site, as can be seen in **Table 4**, a restriction of the development area to 2.5l/s provides a 15% improvement in the 1 in 100-year return period + 40% climate change allowance for the site as a whole.

The proposed drainage strategy allows for an improvement on the existing runoff despite the overall impermeable area associated with the site increasing by approximately 12.5%. The strategy also minimises the impact on the existing drainage associated with the buildings which are not being modified during the works and will be kept functional during the construction period.

Please see **Appendix E** for the proposed below ground drainage layout.

The London Borough or Richmond upon Thames Drainage Proforma has been completed and provided in **Appendix F**.

Seven

Maintenance Requirements

7.1

All SuDS will be maintained by the school for the lifetime of the development in accordance with the SuDS Manual as summarised below. Maintenance requirements for the green roof will be supplied by the specialist designer.

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.

Green Roofs:

Maintenance Schedule	Required Action	Recommended Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Eight

Flood Risk

8.1

The existing site is located within Flood Zone 1 and is considered to be at low risk of flooding from fluvial and tidal sources. The development site area is less than 1 hectare in plan area, and not located in an identified Critical Drainage Area. As a result, in accordance with Paragraph 103 footnote 20 of the NPPF, a site-specific flood risk assessment is not required for planning.

Nine

Conclusion

9.1

In summary, following the advice and guidance provided by the London Borough of Richmond upon Thames, a SuDS strategy has been produced for the planning application associated with King' House School, Richmond.

9.2

The SuDS Hierarchy has been followed in order to employ the most suitable and practicable SuDS techniques to improve surface water run off rates from the site, whilst minimising the impact to the existing building.

The proposed development will restrict surface water run off from the new development area to the public sewer to a peak discharge of 2.5l/s for the site. This provides a betterment on the existing runoff from the total site area of over 15% for the 1 in 100-year event + 40% climate change event, despite a 12.5% increase in impermeable area.

9.3

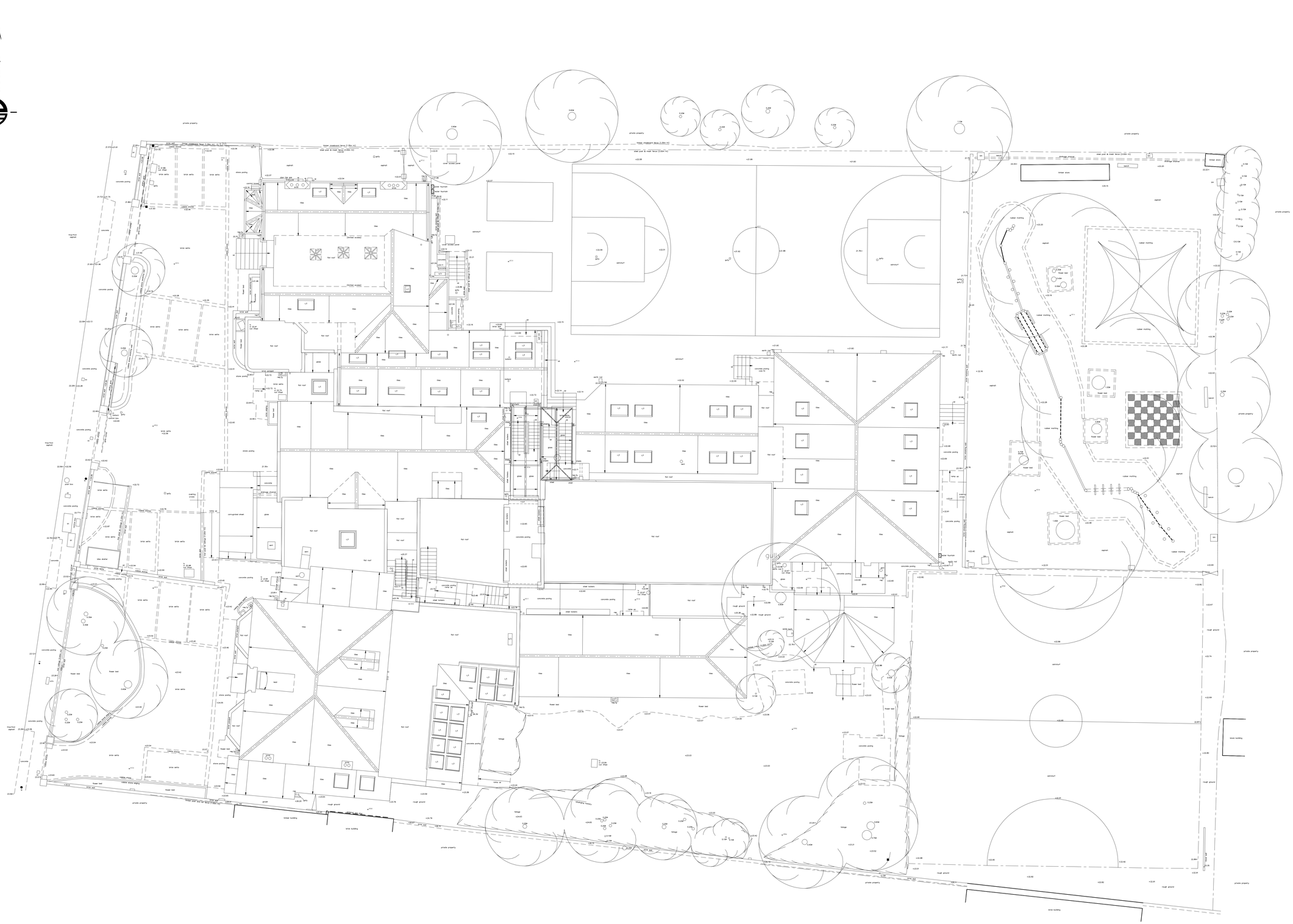
Through the use of SuDS techniques, the surface water management of the proposed site will see a notable betterment from the existing surface water runoff rate.

elliottwood

Appendices

engineering a better society

A Topographic Survey



Notes

This plot has been prepared with a scaling accuracy for a plot at a scale of 1/100.

All levels are in metres and related to GPS.

The co-ordinate grid is based on GPS values.

All tree heights and spreads are approximate.

We have tried to identify tree types, however if tree species are critical specialist advice should be gained.

Drainage pipe sizes have been measured from the surface, chamber access has not been gained for safety reasons, therefore sizes should be regarded as approximate.

Station	Easting	Northing	Level
ST02	518721.790	174740.717	23.045
ST03	518689.649	174734.643	23.641
ST04	518721.017	174732.709	23.370
ST05	518692.779	174750.208	27.521
ST06	518700.970	174764.280	28.808
ST07	518720.807	174749.133	22.900
ST08	518737.556	174751.499	22.837
ST09	518722.850	174752.071	22.672
ST10	518740.171	174758.795	22.386
ST11	518742.827	174772.061	22.244
ST12	518693.571	174783.737	21.995
ST13	518719.035	174778.730	21.941
ST14	518705.309	174768.559	22.119
ST15	518700.292	174776.140	22.158
ST16	518701.537	174760.553	22.638
ST17	518701.470	174750.535	22.649
ST18	518709.899	174750.522	22.660
ST19	518693.323	174751.422	23.756
ST20	518678.612	174763.840	22.065
ST21	518674.995	174775.954	22.165
ST22	518673.386	174763.671	22.557
ST23	518673.398	174751.409	23.244
ST24	518671.589	174737.731	23.598
ST25	518657.636	174757.517	22.727
ST26	518659.164	174766.258	22.404
ST27	518661.434	174780.364	21.866
ST28	518672.425	174796.930	21.225

bl	bed level
cl	cover level
il	invert level
tl	threshold level
u/l	unable to lift
wl	water level
wfc	water filled chamber
sh	sill to head height
fs	floor to sill height
u/s	underside height
t/s	topside height
fb	floorboard direction
conc	concrete
rl	roof light
cup'd	cupboard
fp	fireplace
sd	sliding door
svp	soil and vent pipe
rwp	rain water pipe
C	carpet
3.17	room height

roof slope

radiator

0.5 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

Scale = 1 : 100

CBH/PBH/FM

A0

JOB

Kings House School
66 - 68 Kings Road
Richmond
TW10 6ES

CLIENT

Redmond Ivie Architects

TITLE

Land Survey / Roof Plan

DWG No

2915/01

SCALE

1/100 @ A0

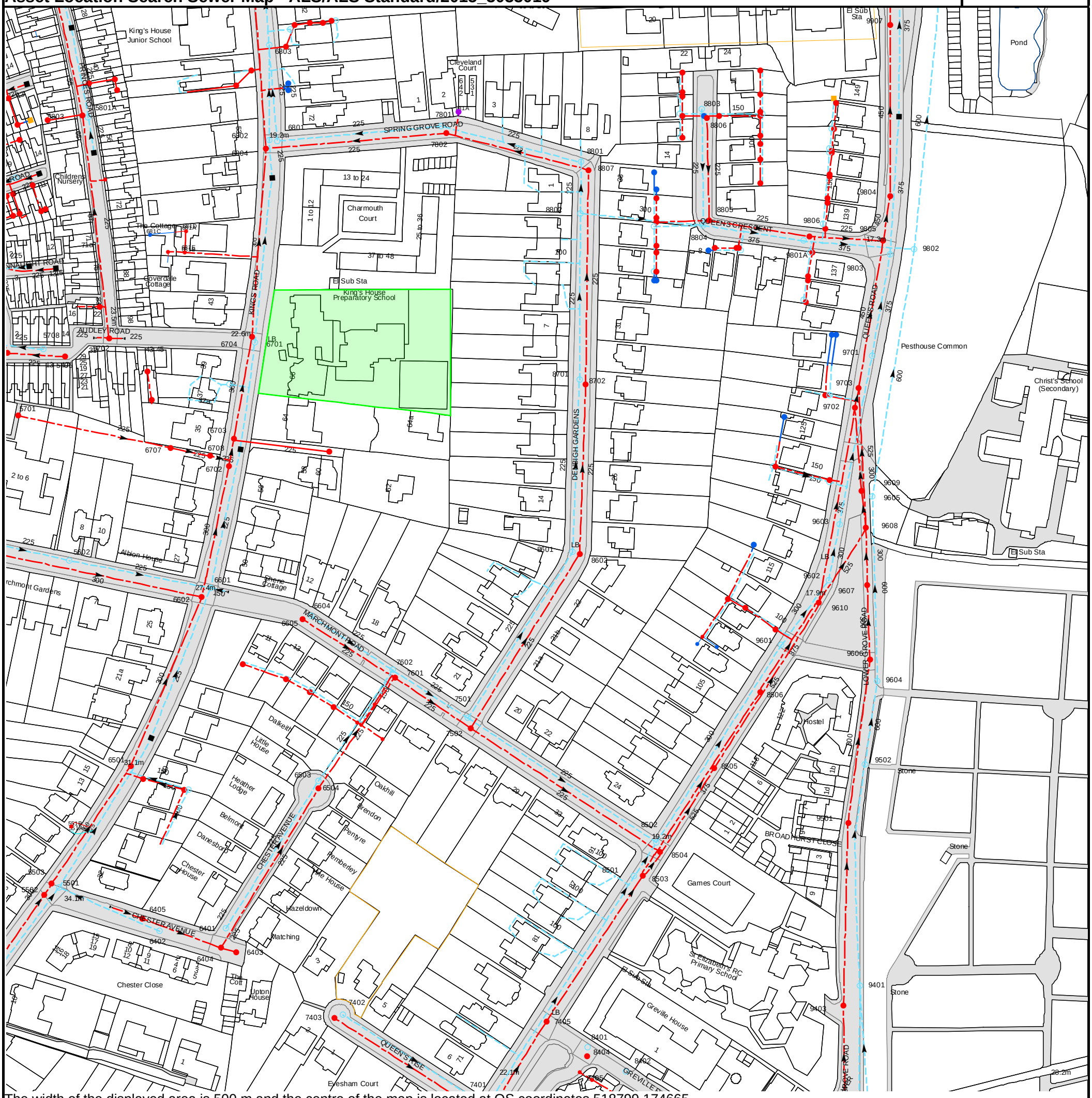
DATE

April 2015

CPB Surveys
TOPOGRAPHICAL AND MEASURED BUILDING SURVEYORS
PO Box 4256, Leamington Spa, CV31 9BZ
TEL: 01926 429565 FAX: 01926 429565
E-MAIL: info@cpbsurveys.com

B Thames Water Asset Records

Asset Location Search Sewer Map - ALS/ALS Standard/2015_3033019



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 518799,174665

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
88XQ	n/a	n/a
9907	15.38	10.96
9610	17.76	14.64
9602	17.72	14.64
9403	n/a	n/a
9501	19.61	16.19
9401	n/a	n/a
9502	19.28	16.69
9607	17.57	14.83
9606	18.16	15.11
9604	18.39	12.83
58SQ	n/a	n/a
58QP	n/a	n/a
6802	19.1	16.76
7802	18.5	16.67
7801	18.46	17.27
781A	n/a	n/a
68XW	n/a	n/a
68YR	n/a	n/a
68ZR	n/a	n/a
68YT	n/a	n/a
58QQ	n/a	n/a
68ZQ	n/a	n/a
68YP	n/a	n/a
6803	17.43	16.08
69YS	n/a	n/a
69YV	n/a	n/a
69YW	n/a	n/a
69YT	n/a	n/a
79ZX	n/a	n/a
69YX	n/a	n/a
58ZY	n/a	n/a
58YW	n/a	n/a
58ZQ	n/a	n/a
58ZW	n/a	n/a
5809	20.45	19.54
58XX	n/a	n/a
58SR	n/a	n/a
58QT	n/a	n/a
5801A	19	17.63
5803	19.01	17.76
88VP	n/a	n/a
9801A	18.12	14.87
9805	17.26	12.44
9806	18.08	14.85
98XS	n/a	n/a
98YS	n/a	n/a
98XT	n/a	n/a
98XV	n/a	n/a
9804	17.04	12.17
88XZ	n/a	n/a
98XW	n/a	n/a
98XX	n/a	n/a
88XX	n/a	n/a
98XY	n/a	n/a
98YT	n/a	n/a
98XZ	n/a	n/a
98YV	n/a	n/a
88XW	n/a	n/a
88XV	n/a	n/a
98YP	n/a	n/a
98YW	n/a	n/a
88XT	n/a	n/a
88XS	n/a	n/a
88WW	n/a	n/a
88WZ	n/a	n/a
98YQ	n/a	n/a
88XP	n/a	n/a
88ZT	n/a	n/a
87YX	n/a	n/a
87YW	n/a	n/a
88ZS	n/a	n/a
88YZ	n/a	n/a
88YQ	n/a	n/a
88YR	n/a	n/a
88YV	n/a	n/a
88YT	n/a	n/a
87YV	n/a	n/a
87YT	n/a	n/a
88WS	n/a	n/a
88WR	n/a	n/a
88WQ	n/a	n/a
88VW	n/a	n/a
88VX	n/a	n/a
88WP	n/a	n/a
88VZ	n/a	n/a
88VY	n/a	n/a
8803	17.99	15.93
8804	18.12	15.61
88XR	n/a	n/a
8806	18	15.92

Manhole Reference	Manhole Cover Level	Manhole Invert Level
88VV	n/a	n/a
8805	18.61	15.61
88VQ	n/a	n/a
86YV	n/a	n/a
9608	17.17	14.2
9603	17.72	10.49
9605	17.22	14.89
9609	17.02	14.27
96ZT	n/a	n/a
96ZR	n/a	n/a
97ZV	n/a	n/a
97ZR	n/a	n/a
97ZS	n/a	n/a
9702	17.7	13.06
97YS	n/a	n/a
97YZ	n/a	n/a
9703	17.76	15.53
9701	17.6	15.53
97YX	n/a	n/a
97YV	n/a	n/a
97YQ	n/a	n/a
97XY	n/a	n/a
97YP	n/a	n/a
97XZ	n/a	n/a
9803	17.28	15.15
98ZR	n/a	n/a
98ZP	n/a	n/a
88VS	n/a	n/a
9802	16.93	13.98
88TZ	n/a	n/a
8602	22.87	20.97
8601	22.81	21.44
6702	24.99	22.18
6708	n/a	n/a
67YV	n/a	n/a
6707	n/a	n/a
6703	23.94	19.56
67ZX	n/a	n/a
67YY	n/a	n/a
8702	21.19	19.13
8701	21.09	19.64
67ZY	n/a	n/a
6701	22.62	21.15
5702	23.31	21.36
6704	22.53	19.56
57YW	n/a	n/a
681B	n/a	n/a
681F	n/a	n/a
681C	n/a	n/a
681A	n/a	n/a
88ZR	n/a	n/a
8802	19.25	18.13
581B	n/a	n/a
8807	18.8	16.89
8801	18.73	17.47
6804	19.17	16.08
6801	18.99	16.73
5706	23.8	21.44
58YX	n/a	n/a
5701	24.68	23.65
58ZR	n/a	n/a
58ZX	n/a	n/a
5708	23.78	22.79
5705	23.94	n/a
5602	27.34	25.92
66ZS	n/a	n/a
66ZR	n/a	n/a
6605	27.34	25.34
65ZQ	n/a	n/a
6604	27.2	25.78
66YY	n/a	n/a
6503	29.62	26.88
6504	29.64	26.51
75ZV	n/a	n/a
75ZT	n/a	n/a
751C	n/a	n/a
751B	n/a	n/a
751A	n/a	n/a
7602	25.85	24.45
7601	25.95	23.95
7501	24.61	22.96
7502	24.6	22.59
8503	19.73	19.17
8502	19.31	18.04
8504	19.35	16.05
86YZ	n/a	n/a
861A	n/a	n/a
8505	18.55	15.62
861B	n/a	n/a
86YX	n/a	n/a
86YW	n/a	n/a
8506	18.01	14.89
96ZX	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9601	18.01	16.46
6403	32.22	30.62
6404	32.66	29.94
6402	33.27	30.5
6401	32.4	29.73
6405	33.26	31.86
5502	34.26	30.73
5501	n/a	n/a
5503	34.06	30.45
551A	n/a	n/a
551B	n/a	n/a
65YX	n/a	n/a
65YS	n/a	n/a
65YW	n/a	n/a
6501	30.98	28.75
6602	27.73	24.66
6601	27.6	25.35
841E	n/a	n/a
8405	n/a	n/a
8402	n/a	n/a
8404	n/a	n/a
8401	n/a	n/a
7405	n/a	n/a
7403	28.33	26.25
7402	28.43	26.6
8501	19.73	18.43

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

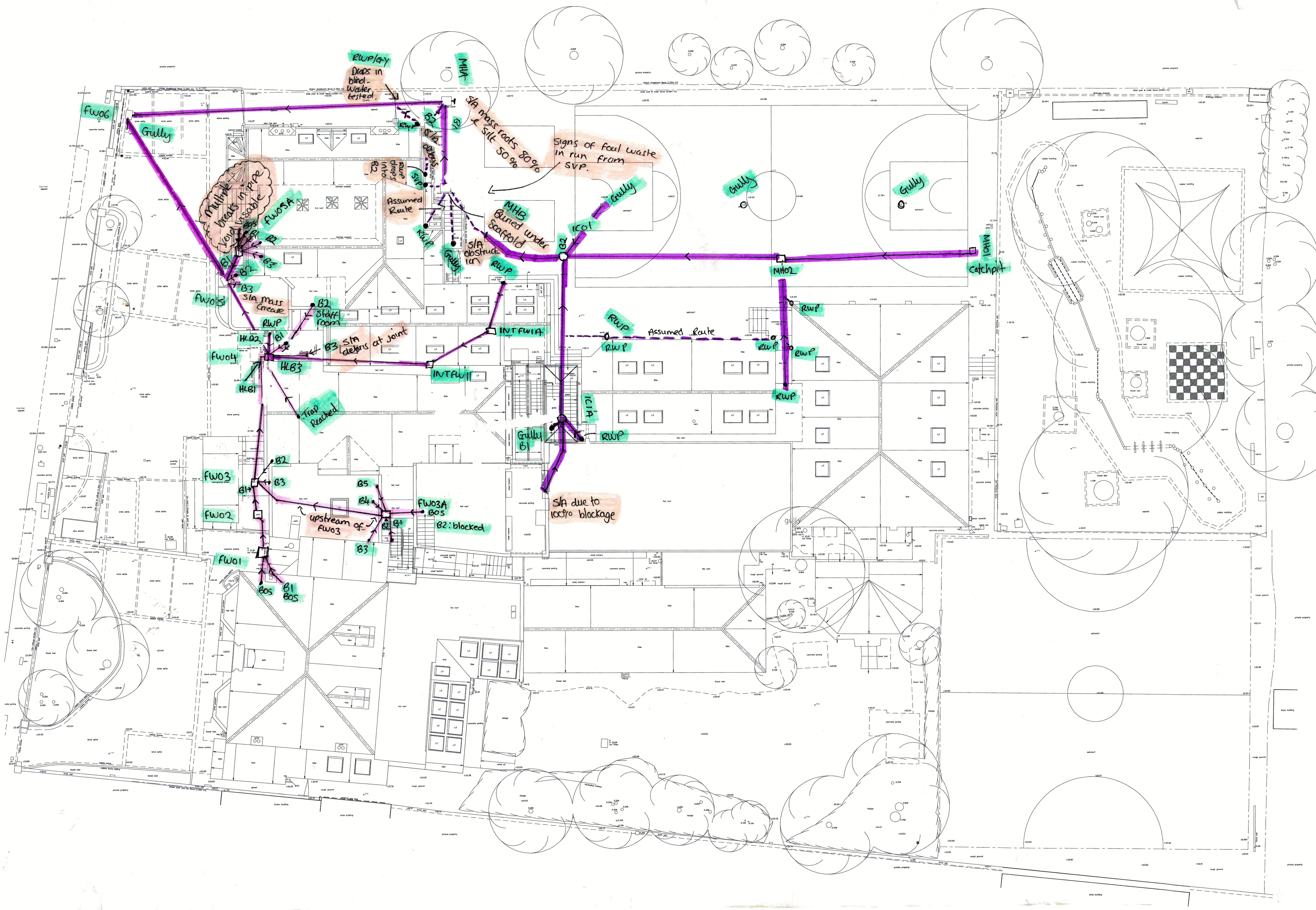
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

C CCTV Drainage Survey


FW06
Gully
RWP/G-Y
Drops in blind. Water tested.
MHA
RWP
S/A mass roots 80% & silt 50%
Signs of foul waste in run from SVP.
SVP
Multiple breaks in pipe. Void visible
FW05A
B1
B2
B3
Assumed Route
MHB Buried under Scaffold
S/A obstruct
Gully
ICO1
Gully
Gully
MH1 Catchpit
MH02
FW05
S/A mass grease
B2 Staff room
RWP
HLB2
B1
B3 S/A debris at joint
INTFW1A
Assumed Route
RWP
FW04
HLB3
HLB1
INTFW1
Trap Reached
ICIA
Gully B1
RWP
S/A due to 100% blockage
FW03
B2
B3
FW02
B5
B4
FW03A BOS
upstream of FW03
B2: blocked
B3
FW01
BOS
B1 BOS

D Micro Drainage Network 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)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.410	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	0.062	4-8	0.028

Total Area Contributing (ha) = 0.090

Total Pipe Volume (m³) = 2.158

Network Design Table for Storm

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	30.458	0.310	98.3	0.025	6.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	15.453	0.160	96.6	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	5.140	0.050	102.8	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	14.514	0.100	145.1	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	3.929	0.005	785.8	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	3.547	0.005	709.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	2.574	0.020	128.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	15.075	0.145	104.0	0.000	0.00	0.0	0.600	o	225	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	6.50	21.690	0.025	0.0	0.0	0.0	1.01	17.9	3.3
1.001	50.00	6.75	21.380	0.039	0.0	0.0	0.0	1.02	18.1	5.3
1.002	50.00	6.84	21.220	0.050	0.0	0.0	0.0	0.99	17.5	6.8
1.003	50.00	7.13	21.170	0.077	0.0	0.0	0.0	0.83	14.7	10.4
1.004	50.00	7.27	20.995	0.090	0.0	0.0	0.0	0.46	18.2	12.2
1.005	50.00	7.39	20.990	0.090	0.0	0.0	0.0	0.48	19.2	12.2
1.006	50.00	7.43	20.985	0.090	0.0	0.0	0.0	1.15	45.8	12.2
1.007	50.00	7.63	20.965	0.090	0.0	0.0	0.0	1.28	51.0	12.2

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)
SW1	22.750	1.060	Open Manhole	1200	1.000	21.690	150				
SW2	22.750	1.370	Open Manhole	1200	1.001	21.380	150	1.000	21.380	150	
SW3	23.080	1.860	Open Manhole	1200	1.002	21.220	150	1.001	21.220	150	
SW4	22.500	1.330	Open Manhole	1200	1.003	21.170	150	1.002	21.170	150	
SW5	22.300	1.305	Open Manhole	1200	1.004	20.995	225	1.003	21.070	150	
TANK	22.300	1.310	Junction		1.005	20.990	225	1.004	20.990	225	
SW7	22.300	1.315	Open Manhole	1200	1.006	20.985	225	1.005	20.985	225	
SW8	22.300	1.335	Open Manhole	1200	1.007	20.965	225	1.006	20.965	225	
OUTFALL	22.000	1.180	Open Manhole	0		OUTFALL		1.007	20.820	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SW1	518751.098	174735.163	518751.098	174735.163	Required	
SW2	518720.652	174736.036	518720.652	174736.036	Required	
SW3	518720.052	174751.477	518720.052	174751.477	Required	
SW4	518716.942	174755.569	518716.942	174755.569	Required	
SW5	518716.833	174770.082	518716.833	174770.082	Required	
TANK	518712.904	174770.137			No Entry	
SW7	518709.358	174770.137	518709.358	174770.137	Required	
SW8	518706.793	174770.355	518706.793	174770.355	Required	
OUTFALL	518696.809	174781.649			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

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	SW1	22.750	21.690	0.910	Open Manhole	1200
1.001	o	150	SW2	22.750	21.380	1.220	Open Manhole	1200
1.002	o	150	SW3	23.080	21.220	1.710	Open Manhole	1200
1.003	o	150	SW4	22.500	21.170	1.180	Open Manhole	1200
1.004	o	225	SW5	22.300	20.995	1.080	Open Manhole	1200
1.005	o	225	TANK	22.300	20.990	1.085	Junction	
1.006	o	225	SW7	22.300	20.985	1.090	Open Manhole	1200
1.007	o	225	SW8	22.300	20.965	1.110	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	30.458	98.3	SW2	22.750	21.380	1.220	Open Manhole	1200
1.001	15.453	96.6	SW3	23.080	21.220	1.710	Open Manhole	1200
1.002	5.140	102.8	SW4	22.500	21.170	1.180	Open Manhole	1200
1.003	14.514	145.1	SW5	22.300	21.070	1.080	Open Manhole	1200
1.004	3.929	785.8	TANK	22.300	20.990	1.085	Junction	
1.005	3.547	709.3	SW7	22.300	20.985	1.090	Open Manhole	1200
1.006	2.574	128.7	SW8	22.300	20.965	1.110	Open Manhole	1200
1.007	15.075	104.0	OUTFALL	22.000	20.820	0.955	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.025	0.025	0.025
1.001	User	-	100	0.015	0.015	0.015
1.002	User	-	100	0.011	0.011	0.011
1.003	User	-	100	0.027	0.027	0.027
1.004	User	-	100	0.013	0.013	0.013
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.090	0.090	0.090

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)
1.007	OUTFALL	22.000	20.820	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW7, DS/PN: 1.006, Volume (m³): 1.6

Unit Reference	MD-SHE-0075-2500-1000-2500	Sump Available	Yes
Design Head (m)	1.000	Diameter (mm)	75
Design Flow (l/s)	2.5	Invert Level (m)	20.985
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	100
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	2.5	Kick-Flo®	0.627	2.0
Flush-Flo™	0.307	2.5	Mean Flow over Head Range	-	2.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.3	2.000	3.4	4.000	4.7	7.000	6.2
0.200	2.4	1.000	2.5	2.200	3.6	4.500	5.0	7.500	6.4
0.300	2.5	1.200	2.7	2.400	3.7	5.000	5.3	8.000	6.6
0.400	2.5	1.400	2.9	2.600	3.9	5.500	5.5	8.500	6.8
0.500	2.4	1.600	3.1	3.000	4.1	6.000	5.7	9.000	7.0
0.600	2.1	1.800	3.3	3.500	4.5	6.500	6.0	9.500	7.1

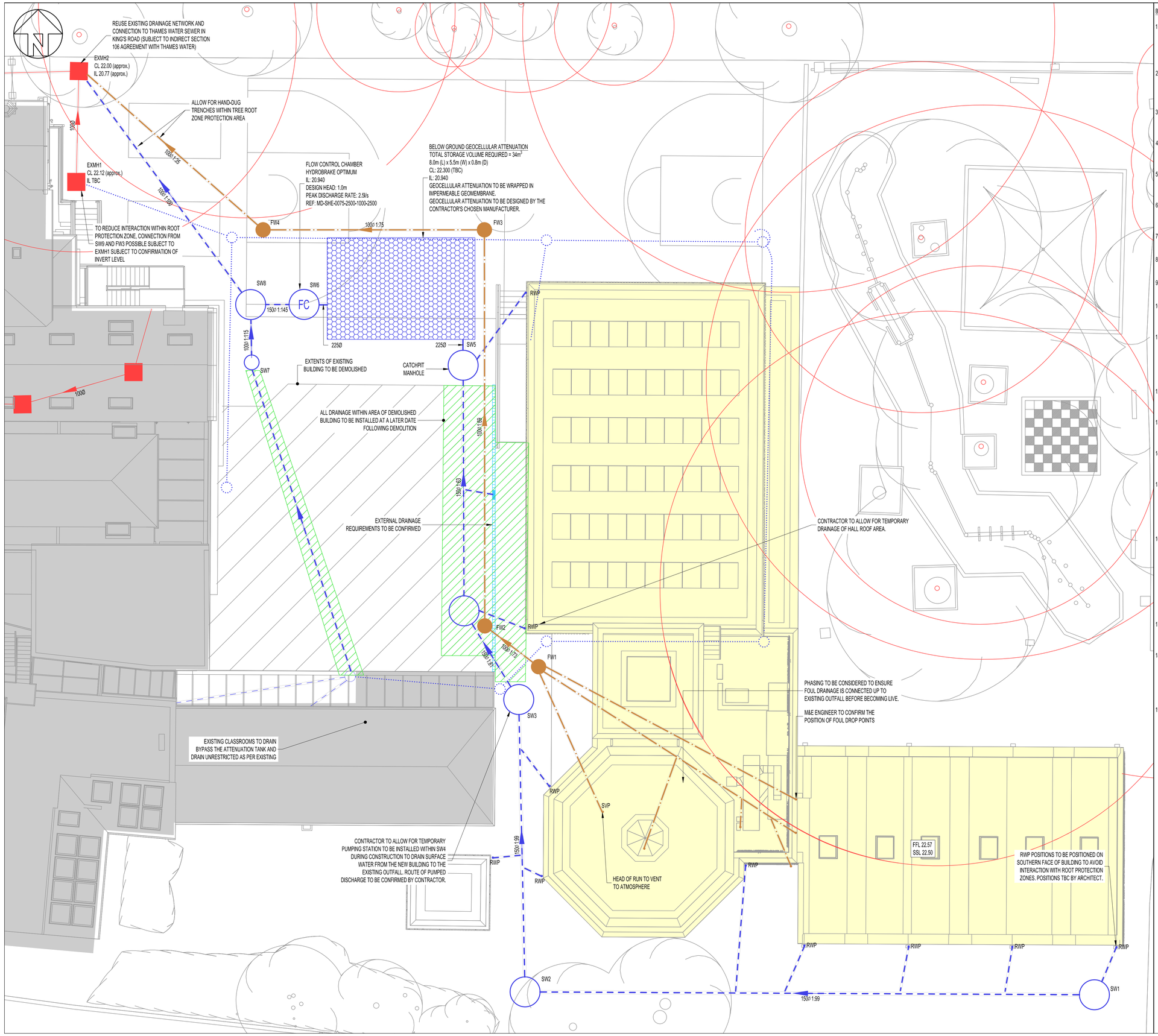
Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.005

Invert Level (m) 20.940 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	44.0	0.0	0.800	44.0	0.0	0.801	0.0	0.0

E Proposed Below Ground Drainage Layout



BELOW GROUND DRAINAGE NOTES

1. THE LOCATION AND LEVEL OF EXISTING DRAINAGE CONNECTIONS AND EXISTING SERVICES IS TO BE CHECKED PRIOR TO COMMENCEMENT OF DRAINAGE WORKS. ANY VARIANCE TO THE DETAILS ON THIS DRAWING AND THE SCHEDULE IS TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
2. THE DESIGN IS BASED ON THE INFORMATION AVAILABLE ON THE DATE OF ISSUE FROM OTHER PARTIES (EG. ARCHITECT AND M & E ENGINEER). IT IS SUBJECT TO CHANGE RESULTING FROM UPDATES TO THE AVAILABLE INFORMATION FROM OTHERS.
3. THE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE NBS SPECIFICATIONS, ASSOCIATED MANHOLE SCHEDULE AND STANDARD DRAINAGE DETAIL DRAWINGS WHERE APPLICABLE.
4. THE POSITIONS OF FOUL AND SURFACE WATER DRAINAGE POINTS ARE INDICATIVE ONLY, REFER TO THE ARCHITECTS DRAWINGS FOR SETTING OUT DETAILS.
5. PRIVATE FOUL AND SURFACE WATER DRAINAGE IS TO BE CONSTRUCTED IN ACCORDANCE WITH BUILDING REGULATIONS PART H, BS EN752 AND BS EN12056.
6. DRAINS AT GROUND LEVEL ARE TO BE CONSTRUCTED USING VITRIFIED CLAY PIPES TO BS EN 295-1 SUPER STRENGTH SPECIFICATION (HEPWORTH SUPERSLEVE) OR SIMILAR APPROVED.
7. ALL SOIL CONNECTIONS UNDER BUILDINGS TO BE 100mm DIA LAID AT A MINIMUM GRADIENT OF 1/40 UNLESS NOTED OTHERWISE.
8. ALL SURFACE WATER CONNECTIONS TO BE 150mm DIAMETER AND TO BE LAID AT A MINIMUM GRADIENT OF 1/80 UNLESS NOTED OTHERWISE .
9. ALL SOIL CONNECTIONS AND RAINWATER PIPES SHOULD BE RODDABLE FROM GROUND LEVEL.
10. RAINWATER DOWN PIPES ARE TO CONNECT TO A DRAIN VIA A REST BEND. WHERE DRAINAGE IS COMBINED A 'P' TRAP MUST ALSO BE PROVIDED.
11. IN CASES OF IN SITU CONCRETE FLOOR SLABS, DRAINS ARE TO BE CAST INTEGRAL WITH THE SLAB WHERE PIPE COVER TO THE CROWN IS LESS THAN 300mm. - NOTE SPECIAL PROVISIONS APPLY TO BASEMENT FLOOR SLABS - SEE DETAILED DRAINAGE AND STRUCTURAL DRAWINGS. CONCRETE ENCASEMENT TO BE REINFORCED AS PER DRAINAGE DETAIL.
12. IN CASES OF SUSPENDED FLOORS WHERE A VOID OF 300mm OR MORE EXISTS BELOW FLOOR DRAINS ARE TO BE SUSPENDED USING A PROPRIETARY HANGER SYSTEM OR CAST INTEGRAL WITH THE FLOOR.
13. WHERE DRAINS PASS THROUGH FOUNDATIONS OR OTHER RIGID STRUCTURES A LINTEL OR SLEEVE IS TO BE USED AND PROVISION FOR FLEXIBILITY IS TO BE MADE USING ROCKER PIPES.
14. BACKFILLING OF DRAIN TRENCHES ADJACENT TO BUILDING OR OTHER STRUCTURES IS TO BE IN ACCORDANCE WITH DIAGRAM 8 OF THE BUILDING REGULATIONS.
15. EXISTING FOUNDATIONS AND RETAINING WALLS MUST NOT BE UNDERMINED BY NEW DRAINAGE RUNS UNLESS AGREED IN WRITING WITH THE STRUCTURAL ENGINEER. CONTRACTOR TO SUBMIT METHOD STATEMENTS AND TEMPORARY WORKS PROPOSALS TO THE STRUCTURAL ENGINEER FOR COMMENT PRIOR TO COMMENCEMENT OF WORKS.
16. ALL DRAINAGE EXCAVATIONS SHOULD BE RISK ASSESSED BY THE CONTRACTOR TO ENSURE TRENCH SAFETY / STABILISATION MEASURES ARE CONSIDERED DURING THE CONSTRUCTION PERIOD. ANY EXCAVATIONS LEFT EXPOSED SHOULD BE INSPECTED BY A COMPETENT PERSON ON A DAILY BASIS. GROUND CONDITIONS SHOULD BE MONITORED AND TOOL BOX TALKS SHOULD INCLUDE SITE INVESTIGATION INFORMATION TO AID THE CONTRACTORS ONGOING RISK ASSESSMENT AND METHOD OF EXCAVATION. ALL EXCAVATIONS SHOULD BE ASSESSED BY A COMPETENT PERSON FOR CONFINED SPACES REQUIREMENTS.
17. THE CONTRACTOR IS TO CONSIDER PHASING OF THE DRAINAGE INSTALLATION AND ARE TO PROVIDE TEMPORARY DRAINAGE MEASURES THEY DETERMINE ARE REQUIRED.
18. SuDS ARE TO BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS MADE WITHIN THE CIRIA SUDS MANUAL C753 (WITH PARTICULAR ATTENTION DRAWN TO CHAPTER 31) AND CIRIA GUIDANCE ON THE CONSTRUCTION OF SuDS C768. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONSIDER CONSTRUCTION PROGRAMME OF SuDS.
19. DETAILED DESIGN OF GEOCELLLULAR ATTENUATION CRATES IS A CDP ITEM AND SHOULD BE BASED ON LEVEL, LAYOUT AND VOLUME DETAILS SHOWN. DETAILED SHOULD BE PROVIDED TO THE ELLIOTT WOOD TO PASS COMMENT.

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
- EXISTING SURFACE WATER
- PROPOSED FOUL WATER
- PROPOSED SURFACE WATER
- SURFACE WATER PIPE ABANDONED
- PROPOSED LINEAR CHANNEL WITH HEELGUARD GRATING
- FOUL DROP POINT
- SVP SOIL VENT PIPE
- RWP RAIN WATER PIPE
- GEOCELLULAR SURFACE WATER ATTENUATION (TO CONTRACTOR DESIGN)
- FC FLOW CONTROL CHAMBER
- EXISTING BUILDING
- PROPOSED BUILDING
- DENOTES DRAINAGE TO BE INSTALLED FOLLOWING DEMOLITION OF EXISTING CLASSROOM BLOCK

NOT FOR CONSTRUCTION

P2	18.12.20	WHu	PDa	Updated to new building layout
P1	12.07.19	WHu	TKe	Issued for Stage 3
rev	date	by	chk	description

elliottwood | engineering a better society

Elliott Wood Partnership Ltd
Central London • Wimbledon • Nottingham
Consulting Structural and Civil Engineers
(020) 7499 5888 • elliottwood.co.uk

Project

King's House School,
68 King's Road,
Richmond TW10 6ES

Drawing title

Proposed Below Ground Drainage

Scale (s)	Date	Drawn
1:100@ A1; 1:200@ A3	December 2020	WHu

Drawing status: Preliminary — Status S2 — Revision P2

Project no.	Originator	Zone	Level	Type	Role	drg no.
2180308	EWP	ZZ	00	DR	C	1000

F London Borough of Richmond upon Thames Drainage Proforma

LONDON BOROUGH OF RICHMOND UPON THAMES

GREATER**LONDON**AUTHORITY

LoDEG

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	King's House School, 66 - 68 Kings Road Richmond TW10 6ES
Address & post code	66 - 68 Kings Road Richmond TW10 6ES
OS Grid ref. (Easting, Northing)	E 518688
	N 174757
LPA reference (if applicable)	
Brief description of proposed work	Demolition of a number of existing school buildings and erection of buildings including new classrooms; extension of existing sports hall; and associated hard and soft landscaping.
Total site Area	4500 m^2
Total existing impervious area	2790 m^2
Total proposed impervious area	3135 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	To the existing Thames Water sewer in Kings Road
Designer Name	William Hudson
Designer Position	Senior Civil Engineer
Designer Company	Elliott Wood Partnership Ltd

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Sands and Gravels
Bedrock geology classification	London Clay Formation
Site infiltration rate	N/A m/s
Depth to groundwater level	4 m below ground level
Is infiltration feasible?	No

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	N
2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
3 attenuate rainwater in ponds or open water features for gradual release	N	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	N	N
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	Reuse existing connection to Kings Road
Has the owner/regulator of the discharge location been consulted?	No. An indirect S106 app will be submitted

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	0.68			
1 in 1	0.58	15.8	81	14.6
1 in 30	1.57	38.6	159	33.5
1 in 100	2.18	50	216	43
1 in 100 + CC			326	56
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Vortex Flow Control		

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	0	0	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	980		34
Total	**980**	**0**	**34**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	Section 3
Drainage hierarchy (2b)	Section 6
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Section 6
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Section 6
Proposed SuDS measures & specifications (3b)	Section 6

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix E
Detailed drainage design drawings, including exceedance flow routes	Appendix E
Detailed landscaping plans	-
Maintenance strategy	Section 7
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	Section 6
b) biodiversity?	Section 6
c) amenity?	Section 6

elliottwood | engineering a better **society**

London
55 Whitfield Street
Fitzrovia
W1T 4AH
+44 207 499 5888

Wimbledon
241 The Broadway
London
SW19 1SD
+44 208 544 0033

Nottingham
1 Sampsons Yard
Halifax Place
Nottingham
NG1 1QN
+44 870 460 0061

www.elliottwood.co.uk