Pell Frischmann

excellence through innovation

Space House

May 2019

Drainage Strategy Report

101478-PF-ZZ-XX-RPT-D-0001

Submitted by Pell Frischmann

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Contents

Executive Summary

This document sets out the drainage and SuDS strategy to support the application for planning permission and listed building consent for the proposed refurbishment scheme of Space House at 1 Kemble Street and 43-59 Kingsway, London.

The development comprises of the removal of existing roof plant equipment at 1 Kemble Street and erection of a single storey facsimile floor plus one setback floor; removal of roof plant from 43-59 Kingsway and erection of a single storey set-back extension; enclosure of the southern external stair at ground floor level on Kingsway with slimline glazing replacement windows and new glazing at ground floor level across the site; enclosing the redundant petrol filling station area with slimline glazing; façade cleaning; new landscaping and public realm works and internal alterations to both buildings in connection with their refurbishment and change of use from Class B1 offices to Class A1/A3 and flexible Class B1/B1 and events space (sui generis) at part ground and basement levels.

The existing development consists of hard landscaping throughout, with no attenuation of any kind. The proposed development is likely to be looked at as a refurbishment by LLFA (Lead Local Flood Authority) and as such use of SuDS is to be maximised with justification for where it can't be achieved.

The proposed development seeks to incorporate soft landscaping where possible, and a free standing $30m^3$ GRP attenuation tank in the basement. Using these measures, we aim to reduce the 100 year plus climate change surface water discharge rates into the system by 20%.

The drainage strategy for the development is to utilise as much of the existing underground drainage as possible to avoid alterations to the existing raft foundation (which is upto 1.83m deep) to install new drainage runs. The existing foul and surface water drainage runs and connection to the existing combined sewer will be retained.

This report, along with the enclosed calculations demonstrates that the proposed development can be adequately provided with all necessary surface and foul water infrastructure. These achievements align with the aims and objectives for the required legislative guidelines.

1. Introduction

This document outlines the strategy for the proposed foul and surface water drainage that is to be provided as part the Space House refurbishment.

The strategy has been prepared to support the planning permission and listed building consent applications. It will also be submitted to Thames Water as part of the consultation and Statutory Approvals process.

1.1 PLANNING LAYOUT REFERENCE

This drainage strategy is based on the preliminary proposed site layout drawings provided by the architects Squire and Partners, and the landscaping plan provided by landscape architects Gustafson Porter + Bowman, submitted as part of this planning permission and listed building consent application submission.

Refer to drawing reference: GP-360-P-00-1000 – GA Landscape Plan

The following adopted national, regional and local planning policies have been assessed;

- National Planning Policy Framework 2019 (NPPF);
- The London Plan 2016;
- Camden Local Plan 2017 (Policies CC1, CC2, CC3);
- Camden Planning Practice Documents (CPG Water and Flooding 2019);

2. Description of Site

The following site description is based upon a review of currently available information.

The site is located in the southern end of the London Borough of Camden, with the centre of the site roughly at grid reference TQ305812. The lead local flood authority (LLFA) for Space House is the London Borough of Camden.

The site is an island site surrounded by roads on all sides; to the east by Kingsway, the south by Kemble Street and Wild Street and to the north by Keeley Street. The site is grade II listed. The existing tower building comprises ground plus 16 storeys with the Kingsway block comprising ground plus seven storeys, both sharing 2 levels of basement.

The closest watercourse to the site is the River Thames located approximately 550m to the south. The primary flood defence being the Thames barrier and the secondary tidal flood defences along the Thames frontage. Environmental agency records show that no flooding has occurred historically around the vicinity of the site.

The site location and aerial images are provided below in Figure 2.1 and Figure 2.2

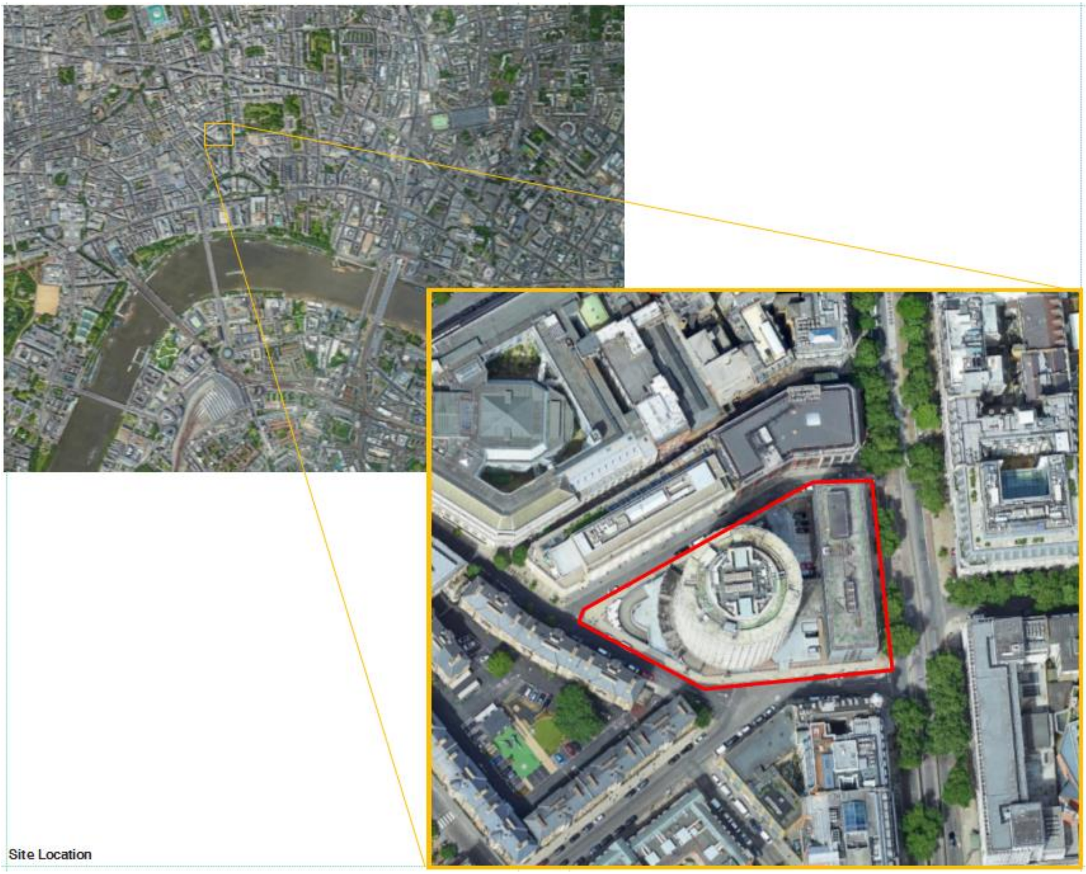


Figure 2.1: Approximate Space House site location

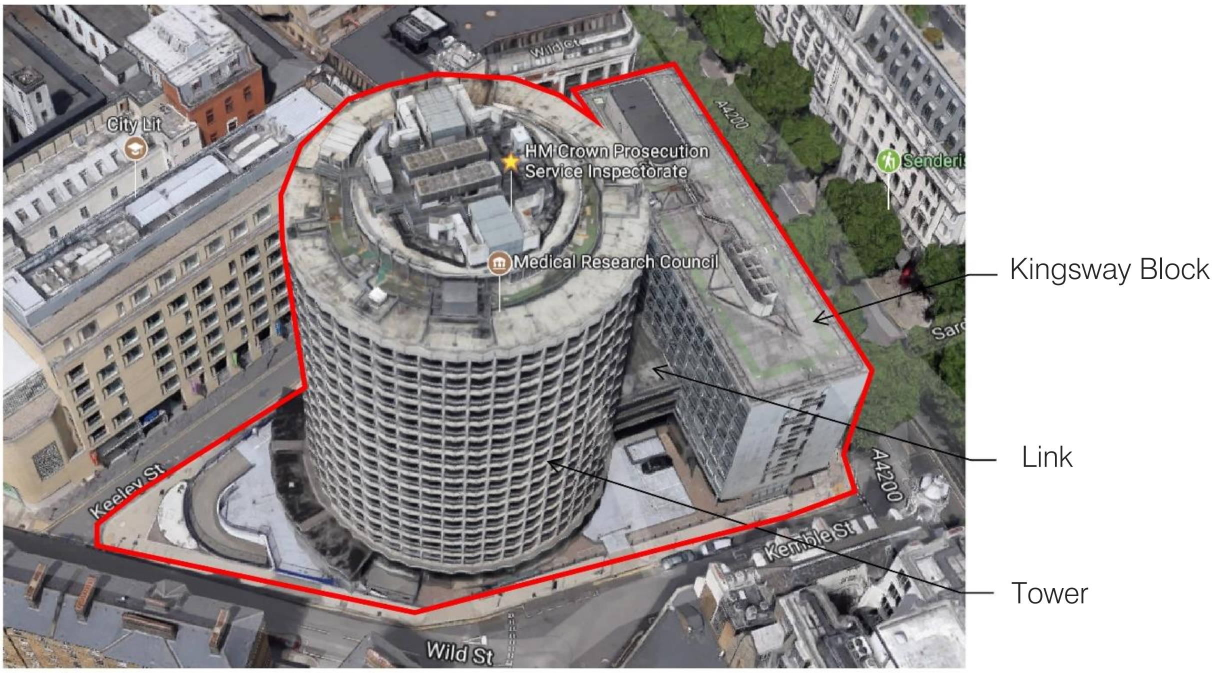


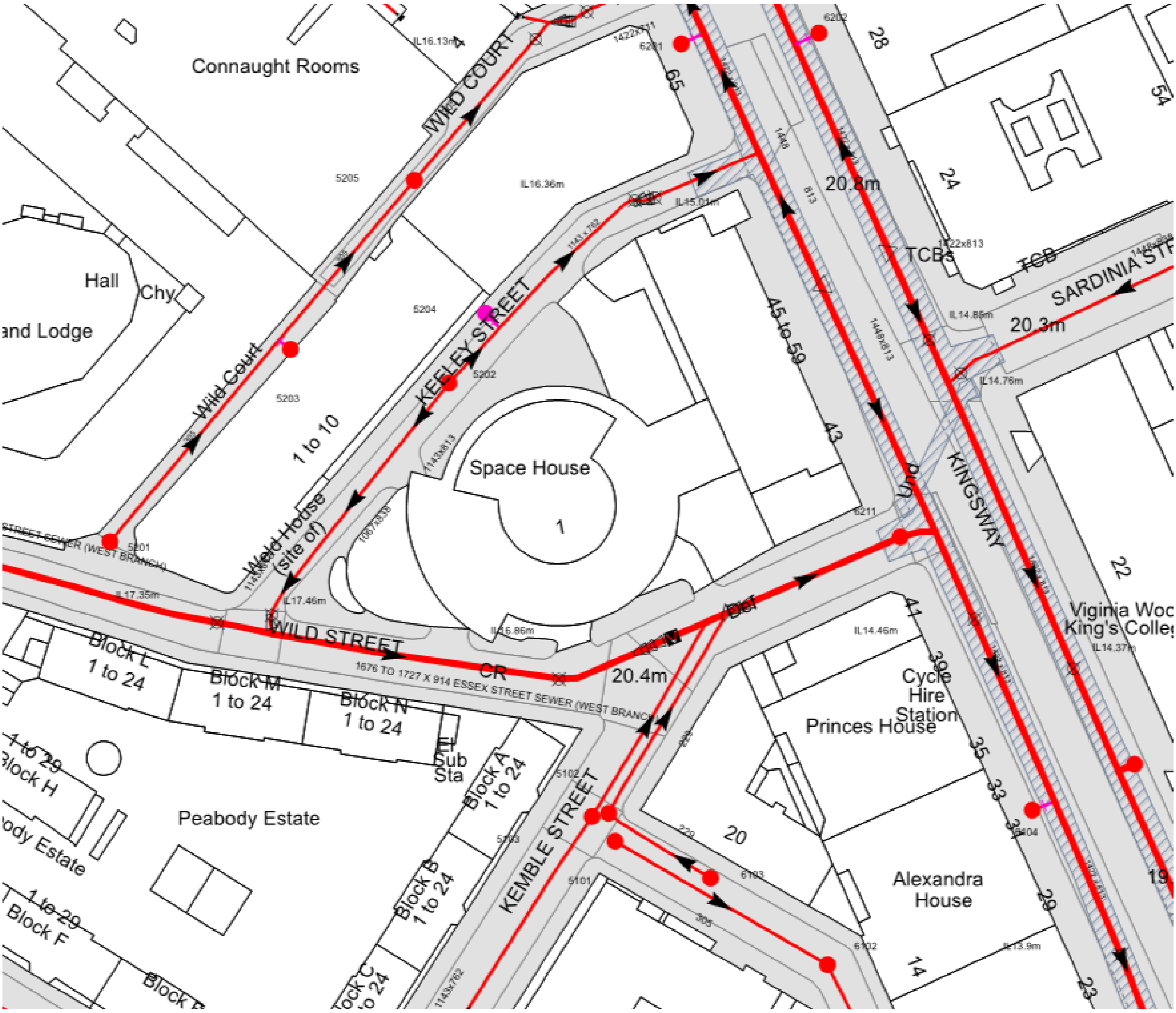
Figure 2.2: Aerial image

2.1 Existing Surface Water Drainage Arrangements

A Thames Water asset search for the site and its vicinity has been conducted and is shown in figure 2.3. The findings show that the site is surrounded on each side by combined water public sewers. The public sewers within Kingsway Road to the east are located within an underground tunnel/culvert suggesting they are running close to full bore.

The sewer within Keeley Street is approximately 4m deep whilst information on the other sewer depths is not available. The current strategy for the development is to utilise as much of the existing underground drainage as possible to avoid alterations to the existing raft foundation to install new drainage runs. The existing foul and surface water drainage runs and connection to the existing combined sewer will be retained.

At present there is no information currently available about any existing localised drainage on site serving the buildings. To understand this and the existing site connections to the public sewer a CCTV/Drainage Survey will be required.



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

Figure 2.3: Thames Water Asset Search
(Source: Thames Water)

3. Proposed Development

The following is a description of the proposed works for the development for which planning permission and listed building consent are sought:

“Removal of existing roof plant equipment at 1 Kemble Street and erection of a single storey facsimile floor plus one setback floor; removal of roof plant from 43-59 Kingsway and erection of a single storey set-back extension; enclosure of the southern external stair at ground floor level on Kingsway with slimline glazing replacement windows and new glazing at ground floor level across the site; enclosing the redundant petrol filling station area with slimline glazing; façade cleaning; new landscaping and public realm works and internal alterations to both buildings in connection with their refurbishment and change of use from Class B1 offices to Class A1/A3 and flexible Class B1/B1 and events space (sui generis) at part ground and basement levels.”

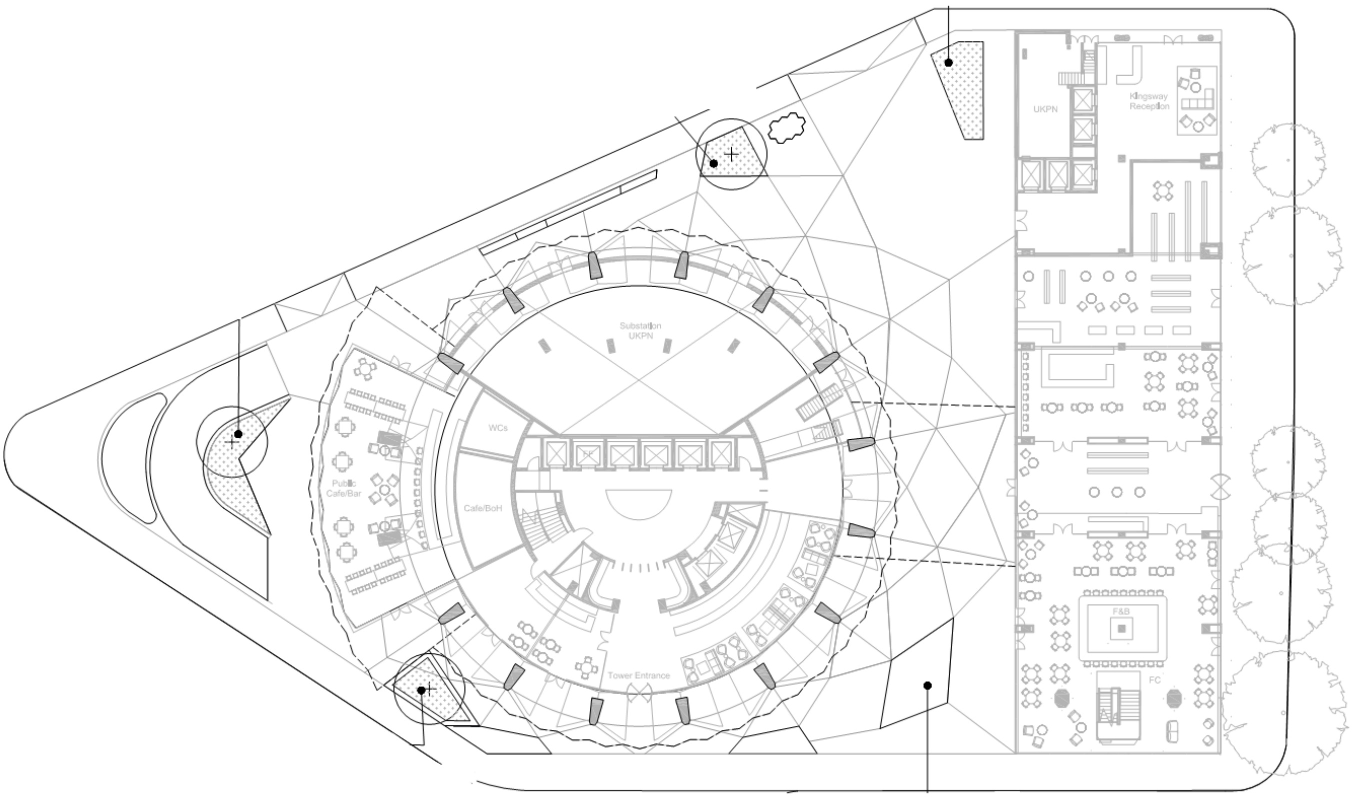


Figure 3.1: Indicative Site Development Plan with Indicative Landscaping and Tree Pits

4. General Drainage Design Proposals

It is proposed to provide the following drainage infrastructure as part of the new development:

- Sustainable Urban Drainage System (SuDS) to be incorporated into the design of the site, to improve attenuation, water treatement and reduce runoff.
- The existing combined sewer will be utilised for both the surface and foul water, subject to Thames Water Approval. No alterations are necessary; however, a survey is required to understand the condition of the localised sewer network at the next design stage.

The following design guidance will be adhered to for the proposed foul and surface water drainage system serving the proposed site.

- Building Regulations Part H;
- National Planning Policy Framework 2019 (NPPF);
- Sewers for Adoption 7th Edition (for adopted connections);
- BS EN 752:20017, Drainage & Sewer Systems Outside Buildings;
- BS EN 12056-2:2000, Gravity Drainage Inside Buildings;

Specific design criteria for the system includes:

- Piped system design is to prevent flooding in any part of the site for the critical duration, 1:100-year return storm event. Including an allowance of 40% for climate change (sewers can surcharge during this return period);
- Surface water drainage will convey the runoff that cannot be soaked away from roofs, roads and other hard-standing areas to the public sewer at a controlled rate;
- Check design for the 1 in 100+40% year to ensure properties on and off site are not subject to flooding;
- Design event rainfall based on the use of the most recent version of the ‘Flood Estimation Handbook’ with an enhancement of 40% to account for climate change;
- Design surface water attenuation to accommodate the above modelled events using agreed discharge rates.
- Foul drainage will be conveyed by a traditional piped system to the nearby existing sewer.

4.1 PLANNING POLICY REQUIREMENTS

NPPF (National Planning Policy Framework 2019) specifies that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development. Opportunities to reduce the flood risk to the site itself and elsewhere, taking climate change into account, should be investigated. The drainage proposals within this strategy have been prepared to meet planning policy requirements including CPG Water and Flooding 2019 and Camden Local Plan Policy 2017 (policies CC1, CC2 and CC3). The proposed development is likely to be looked at as a refurbishment by LLFA (Lead Local Flood Authority) and as such justification should be provided for viable attenuation volumes. Nevertheless, the developer should provide evidence to show how the proposed development has maximised the use of sustainable drainage systems (SuDS) across the site.

4.2 DRAINAGE PRINCIPLES

Ground infiltration is normally the most suitable method of discharging surface water runoff from a proposed development and should be used wherever feasible to mimic the existing diffuse discharge to ground. Ground conditions at the site are unsuitable for infiltration drainage such as soakaways. Interception, attenuation and connection to the existing sewer is considered to be the only viable drainage option for the development.

The main options considered to drain surface water from the proposed development are:

- *Ground infiltration within the site* – this is **not** considered practical for the development site due to ground conditions as:
    - The general geology of the site is that it is underlain by the London Clay Formation. Infiltration is not viable due to the fact that the site is located entirely above an existing basement. London has a high proportion of impermeable surfaces, which prevent water from soaking into the ground. In addition to this, London's Clay soils reduce the rate of infiltration, which results in more water at the surface. Infiltration devices should not be built within 5m of a building, road or areas of unstable land. The ground is unlikely to have sufficient permeability to discharge a meaningful quantity of runoff through infiltration. Due to the fact that the site is located entirely above an existing basement, ground infiltration methods and soakaways are not suitable.

- *Large scale attenuation and connection to existing watercourses* – this is not considered practical for the development site due to the relatively small scale changes to the existing infrastructure and main building structure, limited ground floor build-up and the limited space within the existing basement.

- *Management of land drainage providing interception and storage* – surface water on site will be partially intercepted and stored before discharging at a controlled rate into the existing sewer.

- *Provision of localised storage features* – 'on-site' small storage will be provided for schematically by landscaped areas in the public realm at ground floor level (subject to further design development). Attenuation for the site will also be increased through a free standing $30m^3$ tank that will be located in the basement, the final position will be according to the M&E engineers drawings. Due to space restrictions in the existing basement, the free standing $30m^3$ tank is the largest viable size that can be accommodated.

- *Green/Blue Roofs* – The use of green roofing would not be in keeping with the brutalist nature of the existing grade II listed building. The additional build-up for green and blue roofs would increase the building height which is not desirable as this will have an impact on strategic and local views. In addition, the risk of leakage of blue rooves would pose an unacceptable waterproofing risk for the development, given the use of HAC (high alumina cement) concrete within the building, that should be kept dry at all times. Therefore the use of green/blue roofing is not considered viable for the development.

- *Connection to existing surface water sewer* – this is the proposed solution.

Thames Water will be contacted to ascertain the discharge points and rate which can be catered for by the adjacent public sewer network.

4.3 SURFACE WATER DRAINAGE STRATEGY

The proposed surface water drainage strategy layout and techniques used are included in Appendix B.

The principles employed in the drainage strategy are to provide measures to improve the quality of the run-off with the use of suitable SuDS source control, as well as to provide small-scale attenuation. This will improve the situation of proposed refurbishment over the existing development by reducing surface water discharge rates for the 100 year event by 20%.

SuDS are water sensitive drainage systems which mimic natural catchment processes to manage urban runoff. A "treatment train" of various SuDS is required to capture, detain, convey and discharge water from an urban environment. The treatment train concept is fundamental to designing a successful SuDS strategy.

The treatment train philosophy uses drainage techniques to systematically control the three elements of runoff: pollution, flow rates and volumes. This is achieved in three main steps: Source Control, Conveyance Control and Discharge Control (see Figure 4.1 below). Source control is preferred to those further down the train as they lead to the retention of pollutants and control of water before it enters the proposed or existing drainage network or watercourse. All of the methods suggested are recommended controls considered for SuDS and will be utilised where practical.

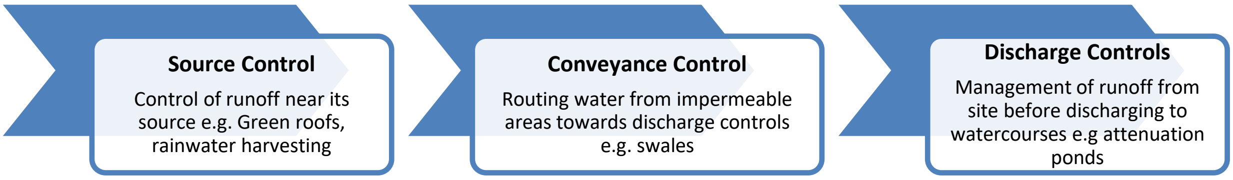


Figure 4.1 SuDS Treatment Train

To comply with the current best practice, the proposed drainage system at the proposed development will:

- Manage runoff at or close to its source;
- Manage runoff at the surface;
- Integrate with public open space areas and contribute towards meeting the objectives of the urban plan;
- Be cost-effective to operate and maintain.
- Ensure that:
  - Natural hydrological processes are protected through maintaining interception of an initial depth of rainfall and prioritising infiltration;
  - Flood risk is managed through the control of runoff peak flow rates and volumes discharged from the site;
  - Storm water runoff is treated to prevent detrimental impacts to the receiving water body as a result of urban contaminants.

4.4 DRAINAGE DESIGN CONSIDERATIONS

SuDS components integrated into the system reflect the desirability to have a mix of SuDS components across the site as different components have different capacities for treatment of individual pollutants.

4.5 LEVELS OF SERVICE, DETENTION STORAGE AND OVERLAND FLOW PATHS

The NPPF and Sewers for Adoption requires that surface water drainage systems are provided for new development sites should be designed to retain all runoff for events up to the 100-year rainfall event where possible, with an appropriate allowance for climate change. This is to prevent downstream flooding. As this development is not a new development, it would not be possible to attenuate and reduce runoff to greenfield rates, however the use of SuDS has been maximised and justified accordingly. This will improve the situation of proposed refurbishment over the existing development by reducing discharge rates, providing an overall betterment to the existing situation.

The SuDS features discharging directly to piped systems and storage are designed to provide a level of service to ensure that surface water is discharged safely away from property to a suitable drainage feature via overland flow paths along exceedance routes (where applicable).

Open space design and drainage management will ensure natural flow paths are not intercepted by new development infrastructure.

Fences, walls and other potential obstructions should make provision to allow exceedance flows to continue above the ground unhindered during extreme rainfall events. This will be addressed during the detailed design stage.

5. Proposed Drainage

Existing drainage records are contained within Appendix A of this report, which has been used to inform this Drainage Strategy.

The design of a surface water drainage system to serve the development considers both water treatment and on-site attenuation for the proposed development in accordance with CIRIA 753 The SuDS Manual.

The SuDS components aim to emulate the natural drainage system of the site through attenuation of flows and natural percolation. This has the added benefit of alleviating water quality issues associated with urban drainage runoff.

In addition, The Environment Agency provides a hierarchy for the disposal of surface water, in order of preference, as follows:

1. *Site Infiltration Techniques* – Not possible due to level of impermeability and compact nature of the site.
2. *Outfall to Watercourse* - not possible in this case due to the site's proximity to a suitable receiving body of water. The closest surface water feature identified by aerial images is understood to be the River Thames.
3. *Use of existing connections to Existing Sewer* – the designed solution. Being a connection to the combined sewer that is surrounding the site.

The SuDS measures are being incorporated within the design of Space House are soft landscaping in the public realm areas, and a free standing $30m^3$ attenuation tank in the basement. All will aid in reducing runoff across the site, improving attenuation, improving building performance and adding ecological value. Further details to their performance and location can be found in Section 6 and Appendix B.

5.1 PROPOSED SURFACE WATER FLOWS AND DISCHARGE RATES

The development size of Space House is 0.389ha. The proposed development which adds elements of permeability through soft landscaping, tree pits; has reduced the impermeable area by approximately 0.011ha, to a total of approximately 0.378ha.

Surface water runoff rates for both the existing and proposed were calculated for this site (Appendix C). An annual runoff of 704.5mm is obtained through Met Office data for the London borough of Camden. The storm event was looked at over a duration of 15 minutes. M5-60 and R values were collated using Micro Drainage.

Discharge rates are calculated with an enhancement of 40% to account for climate change. The table below demonstrates the discharge rates for the required return periods.

Return Period	Existing Discharge Rates (l/s)
Q1	46.8
Q2	60.5
Q30	115.1
Q100	149.7
Q100 + CC	209.6

Figure 5.1: Existing discharge rates

The introduction of soft landscaping and a 30m^3 attenuation tank in the basement will reduce runoff rates for the Q100 + CC to approximately 162.4 l/s providing a 22.5% betterment on existing rates. This shows that the proposed refurbishment provides a betterment over the existing situation as required by LLFA (Lead Local Flood Authority) guidance.

As the overall discharge rates of the proposed refurbishment will be less than the existing, therefore the risk to the approval of the Thames Water application will be negligible as a betterment is being provided.

5.2 FOUL WATER

All foul water will be collected in the combined public sewers that surround the site. The sewers within Kingsway Road to the east are located within an underground tunnel/culvert suggesting they are running close to full bore. The sewers at Keeley Street are approximately 4m deep, however depths of the sewers across the entire site is unknown. A CCTV Survey will be required to gain further information on the characteristics and condition of the sewers to determine whether work is needed to upgrade or repair them.

The proposed development scheme is consistent with the land use of the surrounding area, and the loadings will be able to be accommodated within the existing foul sewer system. Any alteration in the foul water variables will be agreed upon with Thames Water.

The anticipated foul water peak discharge rate for the site into the surrounding network will increase marginally over the existing scheme, however this will be more than offset by the reduction in surface water discharge, providing an overall betterment.

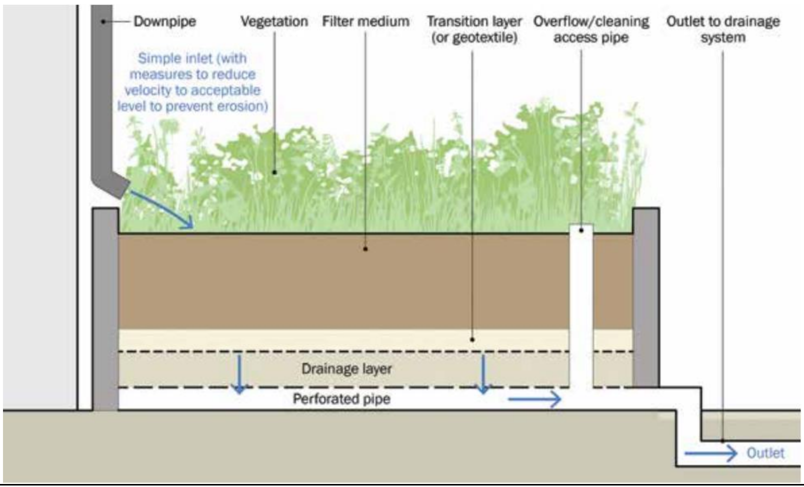
The appointed contractor will submit their proposals for the control of any temporary foul or surface water to Thames Water and must seek and obtain their approval prior to commencement of any site work or temporary connection into their existing system.

6. Site-Specific Use of SuDS Components

A review has been undertaken of the suitability of various SuDS treatments for the site conditions. A summary of the performance of each treatment device is contained within Appendix D.

With the exception of the $30m^3$ free standing attenuation tank in the basement, other SuDS components cannot be relied on for storage of large scale storm events under saturated conditions. However, during the summer months, where ground conditions are not saturated, SuDS components can contribute to the requirements for Interception (see Appendix D), i.e. there should normally be no runoff from the site for an initial depth of rainfall - usually 5mm.

The following devices are proposed to be incorporated as part of the proposed development.

SuDS	***DESCRIPTION***
Raised Planters  	Raised planters with trees are being used as part of the soft landscaping in the public realm areas within the development. ***Location and Use on Site:*** Raised platers with trees will be included within the development. Refer to the latest landscape architect drawing GP-360-P-00-1000.

7. Adoption and Maintenance

For the SuDS features/structures within the curtilage of the proposed development it is envisaged that the landowner will assume responsibility for the maintenance and upkeep of all the SuDS attenuation features. A private maintenance company could manage shared facilities on the site, with occupiers paying a maintenance fee.

7.1 TYPICAL SUDS MAINTENANCE SCHEDULE

7.1.1 Landscaping

The following table outlines the general maintenance principles for landscaped area.
The maintenance schedule below is indicative and taken CIRIA Report C753, a site specific maintenance plan will be required at the later stages of the project and not all of the items outlined may be required.

Table 7.4: Landscaping Maintenance (Source: CIRIA report C753 – The SuDS Manual v6, 2015)

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspection silt accumulation rates and establish appropriate removal frequencies	Half Yearly

7.1.2 Attenuation Storage Tank

The following table outlines the general maintenance principles for attenuation storage tank. The maintenance schedule below is indicative and taken CIRIA Report C753, a site specific maintenance plan will be required at the later stages of the project and not all of the items outlined may be required.

Table 21.3: Attenuation storage tank (Source: CIRIA report C753 – The SuDS Manual v6, 2015)

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial Maintenance	Repair/rehabilitation of inlets, outlet, 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
	Survey inside of tank for sediment build up and remove if necessary	Every 5 years or as required

7.2 CONSULTATIONS

As the overall discharge rates of the proposed refurbishment will be less than the existing, the risk to the approval of the Thames Water application will be negligible. A pre-development enquiry will be made in the next stage and is subject to further applicable submissions during later stages of the design development. As part of this, details of the site's connection will be agreed with Thames Water. As a betterment is being provided, no capacity concerns are envisaged.

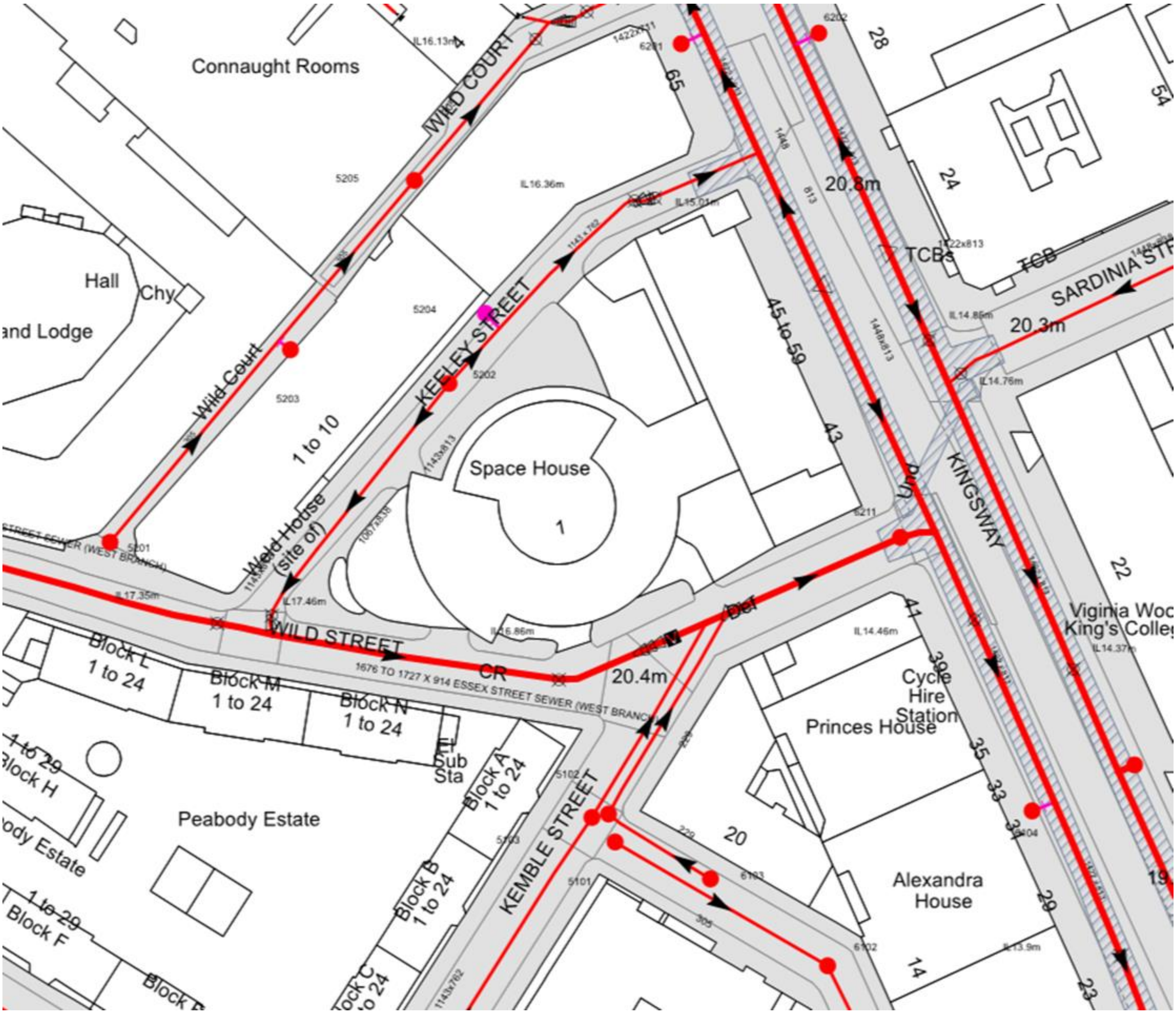
8. Conclusion

This document has set out a viable drainage strategy for the proposed refurbishment scheme. This report has demonstrated that the proposed refurbishment can be adequately provided with all necessary surface and foul water infrastructure, providing an overall betterment to the existing building.

Through the use of soft landscaping and small scale attenuation, the proposed development will attenuate surface water flows, provide water quality treatment and prevent downstream flooding and reduce overall discharge rates, overall providing a betterment to the existing building. These achievements comply and align with the aims and objectives of the Local Authorities and other legislative guidelines set out in section 1.1 of this report, including The National Planning Policy Framework 2019 (NPPF), The London Plan, Camden Local Plan (CC1, CC2 & CC3) and Camden Planning Practice Documents (CPG Water and Flooding 2019).

9. Appendix A

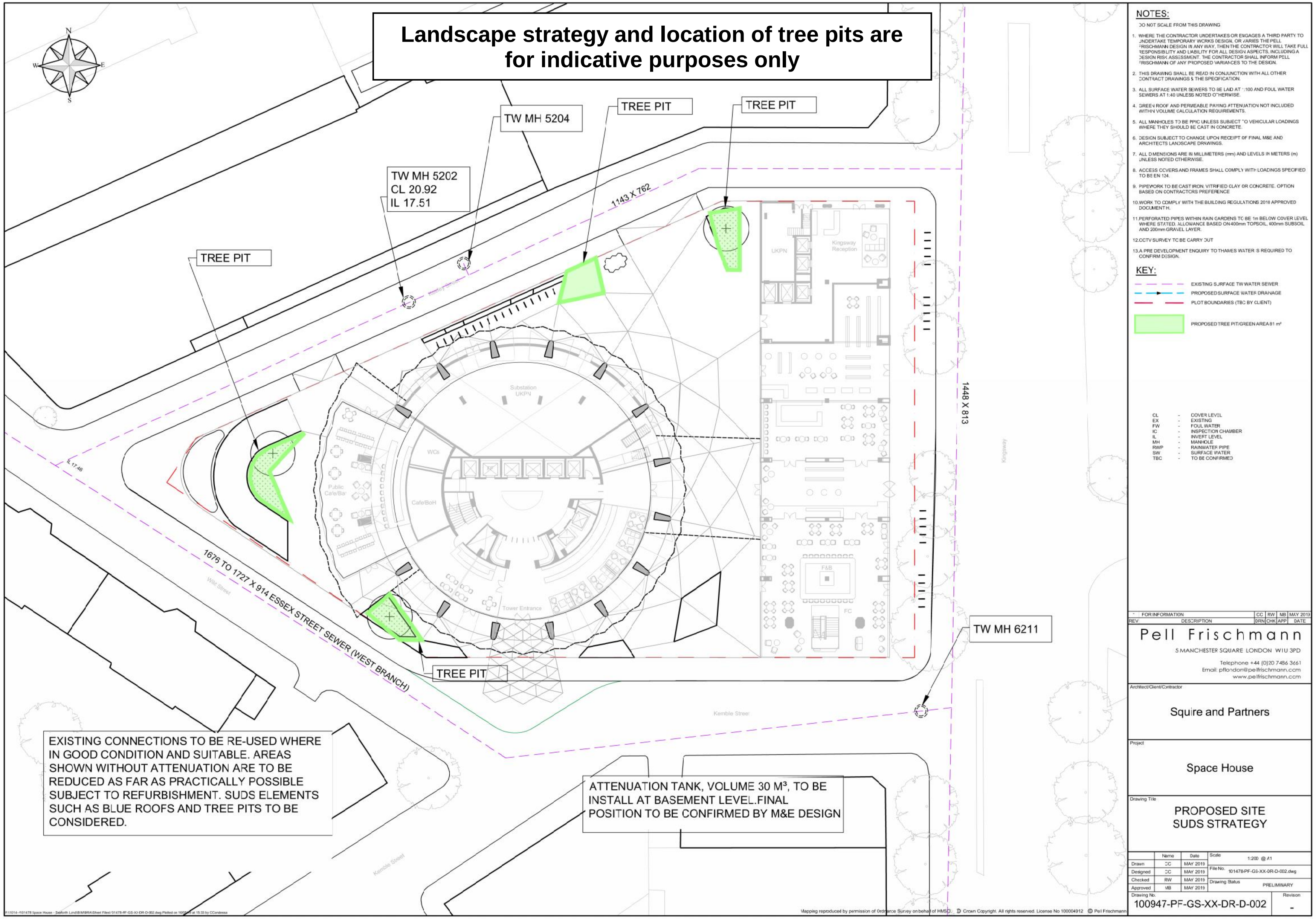
Existing Drainage Records (TW Asset Search)



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

10. Appendix B

Site Wide Drainage Strategy Drawing


Landscape strategy and location of tree pits are for indicative purposes only
TW MH 5204
TREE PIT
TREE PIT
TW MH 5202
CL 20.92
IL 17.51
1143 X 762
TREE PIT
1448 X 813
1676 TO 1727 X 914 ESSEX STREET SEWER (WEST BRANCH)
TREE PIT
TW MH 6211
EXISTING CONNECTIONS TO BE RE-USED WHERE IN GOOD CONDITION AND SUITABLE. AREAS SHOWN WITHOUT ATTENUATION ARE TO BE REDUCED AS FAR AS PRACTICALLY POSSIBLE SUBJECT TO REFURBISHMENT. SUDS ELEMENTS SUCH AS BLUE ROOFS AND TREE PITS TO BE CONSIDERED.
ATTENUATION TANK, VOLUME 30 M³, TO BE INSTALL AT BASEMENT LEVEL.FINAL POSITION TO BE CONFIRMED BY M&E DESIGN
NOTES:
DO NOT SCALE FROM THIS DRAWING
1. WHERE THE CONTRACTOR UNDERTAKES OR ENGAGES A THIRD PARTY TO UNDERTAKE TEMPORARY WORKS DESIGN, OR VARIES THE PELL FRISCHMANN DESIGN IN ANY WAY, THEN THE CONTRACTOR WILL TAKE FULL RESPONSIBILITY AND LIABILITY FOR ALL DESIGN ASPECTS, INCLUDING A DESIGN RISK ASSESSMENT. THE CONTRACTOR SHALL INFORM PELL FRISCHMANN OF ANY PROPOSED VARIANCES TO THE DESIGN.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS & THE SPECIFICATION.
3. ALL SURFACE WATER SEWERS TO BE LAID AT 1:100 AND FOUL WATER SEWERS AT 1:40 UNLESS NOTED OTHERWISE.
4. GREEN ROOF AND PERMEABLE PAVING ATTENUATION NOT INCLUDED WITHIN VOLUME CALCULATION REQUIREMENTS.
5. ALL MANHOLES TO BE PPIC UNLESS SUBJECT TO VEHICULAR LOADINGS WHERE THEY SHOULD BE CAST IN CONCRETE.
6. DESIGN SUBJECT TO CHANGE UPON RECEIPT OF FINAL M&E AND ARCHITECTS LANDSCAPE DRAWINGS.
7. ALL DIMENSIONS ARE IN MILLIMETERS (mm) AND LEVELS IN METERS (m) UNLESS NOTED OTHERWISE.
8. ACCESS COVERS AND FRAMES SHALL COMPLY WITH LOADINGS SPECIFIED TO BS EN 124.
9. PIPEWORK TO BE CAST IRON, VITRIFIED CLAY OR CONCRETE. OPTION BASED ON CONTRACTORS PREFERENCE
10. WORK TO COMPLY WITH THE BUILDING REGULATIONS 2010 APPROVED DOCUMENT H.
11. PERFORATED PIPES WITHIN RAIN GARDENS TO BE 1m BELOW COVER LEVEL WHERE STATED. ALLOWANCE BASED ON 400mm TOPSOIL, 400mm SUBSOIL AND 200mm GRAVEL LAYER.
12. CCTV SURVEY TO BE CARRY OUT
13. A PRE DEVELOPMENT ENQUIRY TO THAMES WATER IS REQUIRED TO CONFIRM DESIGN.
KEY:
EXISTING SURFACE TW WATER SEWER
PROPOSED SURFACE WATER DRAINAGE
PLOT BOUNDARIES (TBC BY CLIENT)
PROPOSED TREE PIT/GREEN AREA 81 m²
CL - COVER LEVEL
EX - EXISTING
FW - FOUL WATER
IC - INSPECTION CHAMBER
IL - INVERT LEVEL
MH - MANHOLE
RWP - RAINWATER PIPE
SW - SURFACE WATER
TBC - TO BE CONFIRMED
Pell Frischmann
5 MANCHESTER SQUARE LONDON W1U 3PD
Squire and Partners
Space House
PROPOSED SITE SUDS STRATEGY
100947-PF-GS-XX-DR-D-002

11. Appendix C
Existing and Proposed Calculation Sheets

Pell Frischmann

CALCULATIONS	Project: Space House	Calc No.: 100029/DC01	Location:
Subject: Exisitng Surface Water Runoff		Date: 07/05/2019	By / Chkd: SM / RW

Notes / Output

M5-60	20.8	Hydrological Region	6	CV	1
R	0.44	Soil Type	3	CR	1.3

Annual Rainfal (SAAR)	704.5	Development Size (Ha)	0.389
Soil Runoff Coefficient (SPR)	0.3	Impermeable Area (Ha)	0.389

Part 1 — Rainfall Intensities

Storm Duration (mins)	15	Intesity Type	Average

1 Year Return Period	33.323	*mm/hr*
2 Year Return Period	43.045	*mm/hr*
30 Year Return Period	81.845	*mm/hr*
100 Year Return Period	106.492	*mm/hr*

Part 2 — Greenfield Analysis

Development under 50ha, therefore interpolate linerally.

QBAR50 = 1.08(A/100)^0.89x**SAAR**^1.17x**SPR**^2.17

Calculate Q by return period. Growth curve value for region 10 (GC)

GC 1	0.85	GC 30	2.3	GC 100	3.19

Output	
QBAR 50 (l/s)	91.8
QBAR (l/s)	0.7
Q1yr (l/s)	0.6
Q30yr (l/s)	1.6
Q100yr (l/s)	2.3

Part 3 — Discharge Rates

Climate Change Co-efficieint	1.4

Surface water flows calculated based on rainfall intensities in part 1.

Data Set Used	FSR

Output	
Q1 (l/s)	46.8
Q2 (l/s)	60.5
Q30 (l/s)	115.1
Q100 (l/s)	149.7
Q100+CC (l/s)	209.6

Part 4 — Additional Information

Pell Frischmann		Page 1
5 Manchester Square London W1U 3PD		Micro Drainage
Date 16/05/2019 15:23 File Storage Calculations.srcx	Designed by CCondessa Checked by	
Innovyze	Source Control 2018.1.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	2.753	2.753	162.8	27.5	O K
30 min Summer	1.830	1.830	162.8	18.3	O K
60 min Summer	0.604	0.604	151.8	6.0	O K
120 min Summer	0.344	0.344	103.5	3.5	O K
180 min Summer	0.284	0.284	77.3	2.8	O K
240 min Summer	0.249	0.249	62.1	2.5	O K
360 min Summer	0.206	0.206	44.9	2.1	O K
480 min Summer	0.181	0.181	35.6	1.8	O K
600 min Summer	0.164	0.164	29.8	1.6	O K
720 min Summer	0.152	0.152	25.7	1.5	O K
960 min Summer	0.133	0.133	20.2	1.3	O K
1440 min Summer	0.112	0.112	14.5	1.1	O K
2160 min Summer	0.094	0.094	10.5	0.9	O K
2880 min Summer	0.083	0.083	8.2	0.8	O K
4320 min Summer	0.070	0.070	5.9	0.7	O K
5760 min Summer	0.062	0.062	4.7	0.6	O K
7200 min Summer	0.056	0.056	3.8	0.6	O K
8640 min Summer	0.052	0.052	3.3	0.5	O K
10080 min Summer	0.049	0.049	2.9	0.5	O K
15 min Winter	3.167	3.167	162.4	30.0	O K
30 min Winter	1.395	1.395	162.7	13.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	149.088	0.0	105.7	12
30 min Summer	96.210	0.0	136.4	19
60 min Summer	59.033	0.0	167.4	34
120 min Summer	34.986	0.0	198.4	62
180 min Summer	25.433	0.0	216.3	92
240 min Summer	20.173	0.0	228.8	122
360 min Summer	14.531	0.0	247.2	182
480 min Summer	11.510	0.0	261.0	244
600 min Summer	9.600	0.0	272.2	306
720 min Summer	8.274	0.0	281.5	362
960 min Summer	6.540	0.0	296.6	488
1440 min Summer	4.688	0.0	319.0	712
2160 min Summer	3.356	0.0	342.5	1100
2880 min Summer	2.645	0.0	360.0	1420
4320 min Summer	1.889	0.0	385.7	2188
5760 min Summer	1.487	0.0	404.7	2872
7200 min Summer	1.234	0.0	419.9	3672
8640 min Summer	1.060	0.0	432.6	4248
10080 min Summer	0.931	0.0	443.6	5112
15 min Winter	149.088	0.0	118.3	12
30 min Winter	96.210	0.0	152.7	20

Model Details

Storage is Online Cover Level (m) 4.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	10.0	3.000	10.0	3.010	0.0	4.000	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0443-1630-4000-1630
Design Head (m)	4.000
Design Flow (l/s)	163.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	443
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	Site Specific Design (Contact Hydro International)
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	4.000	162.8
Flush-Flo™	1.152	162.8
Kick-Flo®	2.497	129.4
Mean Flow over Head Range	-	141.0

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)
0.100	11.7	1.200	162.8	3.000	141.5	7.000	214.0
0.200	42.5	1.400	161.7	3.500	152.6	7.500	221.4
0.300	84.2	1.600	159.7	4.000	162.8	8.000	228.5
0.400	125.0	1.800	156.8	4.500	172.5	8.500	235.4
0.500	145.4	2.000	152.6	5.000	181.6	9.000	242.1
0.600	151.6	2.200	146.1	5.500	190.2	9.500	248.6
0.800	159.1	2.400	136.2	6.000	198.5		
1.000	162.3	2.600	132.0	6.500	206.4		

12. Appendix D

SUDS Components Performance

The effectiveness of SuDS components in improving development surface water run-off quality for this site is summarised in Appendix D, Table 1 below. Combinations of treatments can be used to reduce potential pollutants from reaching the receiving course.

Appendix D, Table 1: SuDS Treatment Train

	Interception	Peak flow control: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydrocarbons/ PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Pervious Pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Var
Filter Strips	Y	N	N	N	N	Y	N	Y	Y	Var
Swales	Y	Y	S	Y (*)	N	Y	Y (+)	Y	Y	Y (-)
Trenches	Y	Y	S	Y (*)	N	N	N	Y	Y	Y (-)
Detention Basins	Y	Y	Y	N	Y	Y	Y (+)	Y	Y	Var
Ponds	N	Y	Y	N	Y	N (~)	Y	Limited	Y	Var
Wetlands	N	Y	S	N	Y	N (~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bioretention Systems	Y	Y	S	Y (*)	N	N (~)	Y	Y	Y	Y
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y (!)	Y (!)	Y (!)
Subsurface Storage	N	Y	Y	N	Y	N (~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N (~)	N	N	N	N

Notes:

- S: Not normally with standard designs, but possible where space is available and designs mitigate impact of high flow rates.
- Y (*): Where infiltration is facilitated by the design.
- N (~): Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
- Y (+): Where designs minimise the risk of fine sediment mobilisation during larger events.
- Y (!): Where designs specifically promote the trapping and breakdown of soils and PAH based constituents.
- Y ("): Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
- Var: The nutrient removal performance is variable, and can be negative in some situations.
- Y (~): Good nutrient removal performance where subsurface bio-filtration system with a permanently saturated zone included within the design.

13. Hydraulic Design Criteria

Best practice criteria for hydraulic control required interception, runoff rate control and volume control.

Interception

To fulfil the requirements for Interception, there should normally be no runoff from the site for an initial depth of rainfall - usually 5mm. This is achieved through the use of infiltration, evapotranspiration, or rainwater harvesting.

Flow and Volume Control

Discharge rates are to be managed to current Greenfield run-off rates or 5 l/s minimum flow. The sites are to be considered Greenfield development, therefore runoff from the site needs to be constrained to the equivalent Greenfield rates and volumes.

Attenuation and hydraulic controls will be used to manage flow rates

Rainwater harvesting, or the use of Long Term Storage can be used to achieve Greenfield runoff volume control. Where volume control is not practicable, flows discharged from the site will be constrained to QBAR or 5 l/s/ (whichever is the greater).

Water Quality Design Criteria

Current best practice takes a risk-based approach to managing discharges of surface runoff to the receiving environment. The following text provides guidance on the extent of water quality management likely to be appropriate for the site.

Hazard Classification

Runoff from clean roof surfaces (i.e. not metal roofs, roofs close to polluted atmospheric discharges, or roofs close to populations of flocking birds) is classified as Low in terms of hazard status.

Runoff from roads, parking and other areas of residential, commercial and industrial sites (that are not contaminated with waste, high levels of hydrocarbons, or other chemicals) is classified as Medium in terms of hazard status.

Treatment requirements for disposal to surface water systems

Roof runoff will require 1 treatment stage prior to discharge. Runoff from other parts of this site such as roads, parking and other areas will require ideally 3 treatment stages prior to discharge.