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RADA Studios, 16 Chenies Street, London

Sustainable Drainage Strategy

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STRUCTURES GEOMETRICS SUSTAINABILITY INFRASTRUCTURE

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1 The Site

The site is located within the London Borough of Camden on the south-east side of Chenies Street. The site currently comprises two buildings, both with basement levels, an access road and a small car park area. Access for vehicles is currently available from Ridgmount Street. The site area is approximately 0.13 hectares and the average ground level is approximately 27.200m AOD.

The site has approximate OS coordinates of 529669/181851 at Grid Reference TQ296818, and the postcode is WC1E 7EX.

Figure 1.1: Existing Development

2 Proposed Development

The proposals involve the demolition and reconstruction of part of the existing building as well as refurbishment works on both buildings. The site will be redeveloped for education use, providing student accommodation, a theatre, a Library, a cafe and student communal areas.

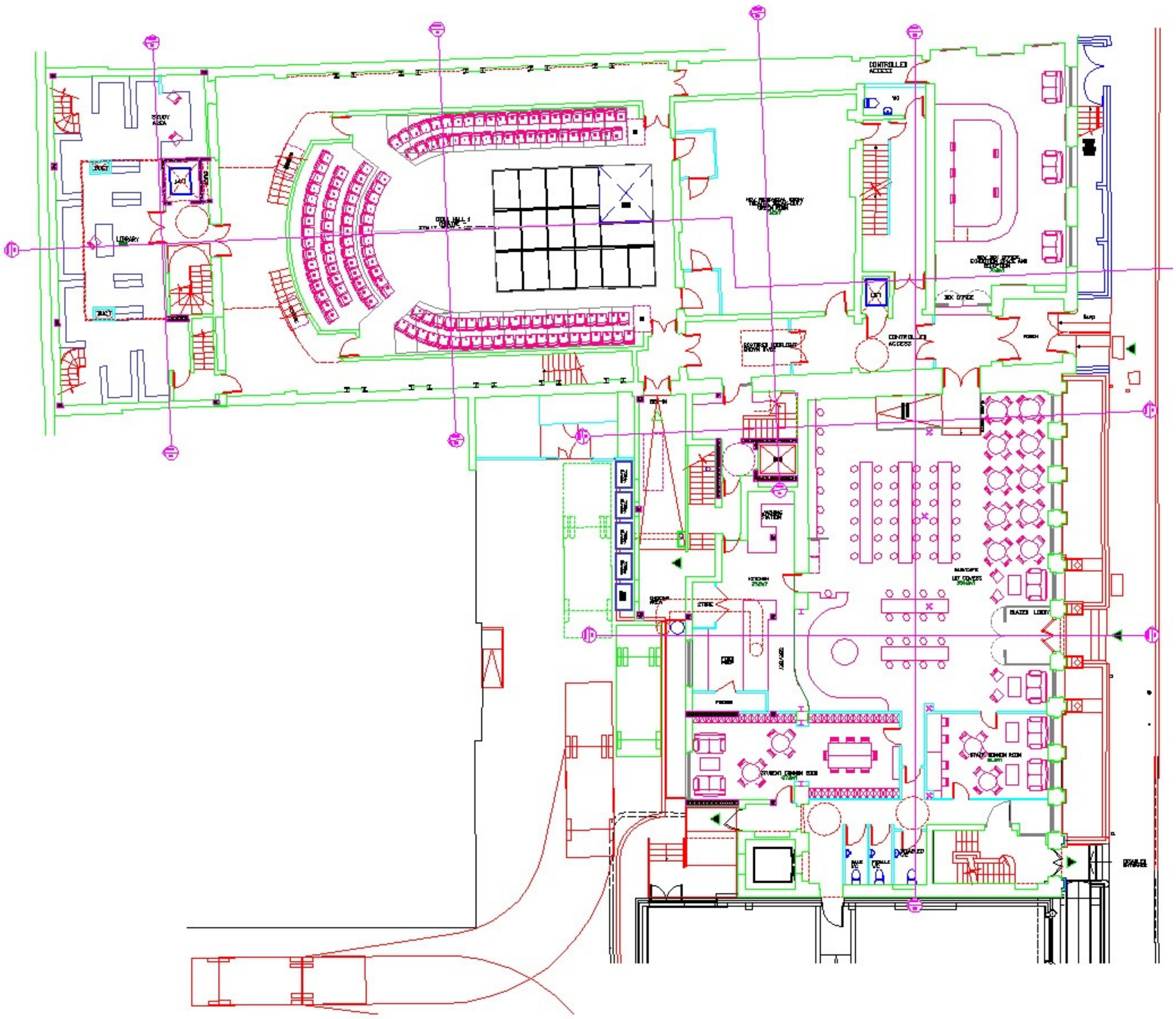


Figure 2.1: Proposed Development

3 Existing Drainage

Survey information for the existing drainage arrangements on site was not available at the time of writing this report. As such, it has been assumed that foul and surface water from the existing development currently drains to the combined sewers in Chenies Street.

Hardstanding and roof areas currently occupy the entire site area. The existing peak run-off rates were calculated for the annual, 1 in 30 and 1 in 100 year storm events, using the modified rational method. Q = 2.78 x A x i (where 'A' is the catchment area in hectares and 'i' is the rainfall intensity in mm/hr). Q_1 = 2.78 x 0.13 x 33.5 = 12.11 l/sec, Q_{30} = 2.78 x 0.13 x 82.2 = 29.71 l/sec,

Q_{100} = 2.78 x 0.13 x 107 = 38.67 l/sec

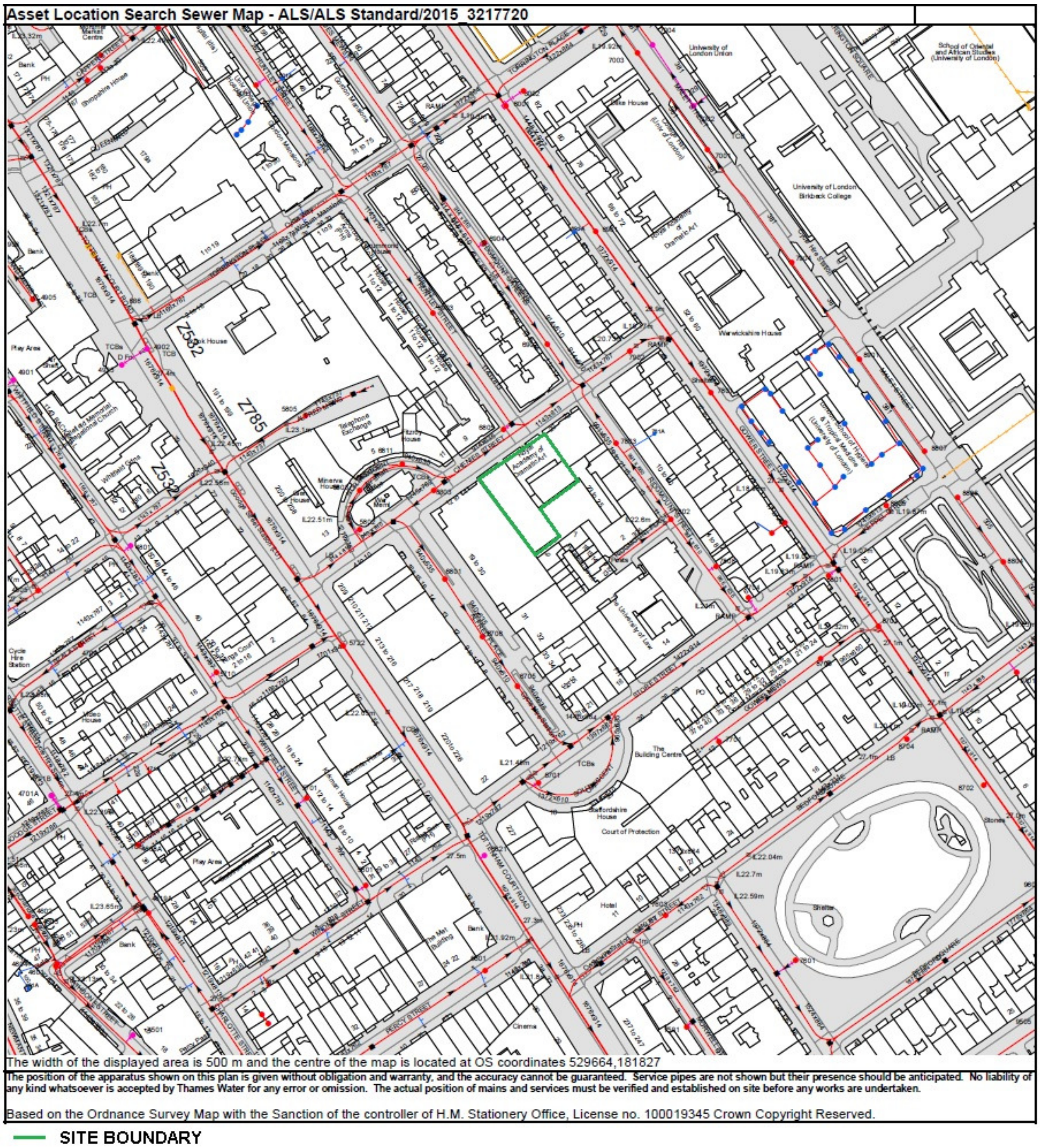


Figure 3.1: Thames Water's Sewer Records

4 Proposed Drainage

4.1 Surface Water

In accordance with the London Plan, Environment Agency (EA) guidelines, Building Regulations and Water Authority's advice the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable Drainage Systems (SUDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharge of groundwater in a manner that mimics natural conditions. If drainage to an infiltration system proved to be an unsuitable option for the site then drainage to a watercourse will be assessed. Drainage to the public sewers can be considered only when all other options are proven unsuitable.

Published information shows that the ground conditions could be suitable for infiltration techniques. Furthermore, a site specific ground investigation report, prepared by Geotechnical & Environmental Associates in October 2015, confirms that below a significant thickness of made ground, Lynch Hill Gravel is present over London Clay. The made ground generally comprised brownish grey clay with fragments of brick, concrete, mortar and ash and extended to depths of 3.30 m and 5.00 m below ground level. This restricts the use of infiltration techniques, as no infiltration systems can be constructed within the made ground. There is a risk of contaminating the ground water without knowing the content of materials that forms the made ground. Infiltration systems can increase the flood risk on site, as there can be major variation in the infiltration properties of made ground, considering that it is not a consistent natural ground. Furthermore, infiltration systems must be constructed at least 5m away from buildings in order to avoid any potential damage to the foundations. The site layout drawing shows that this is not achievable.

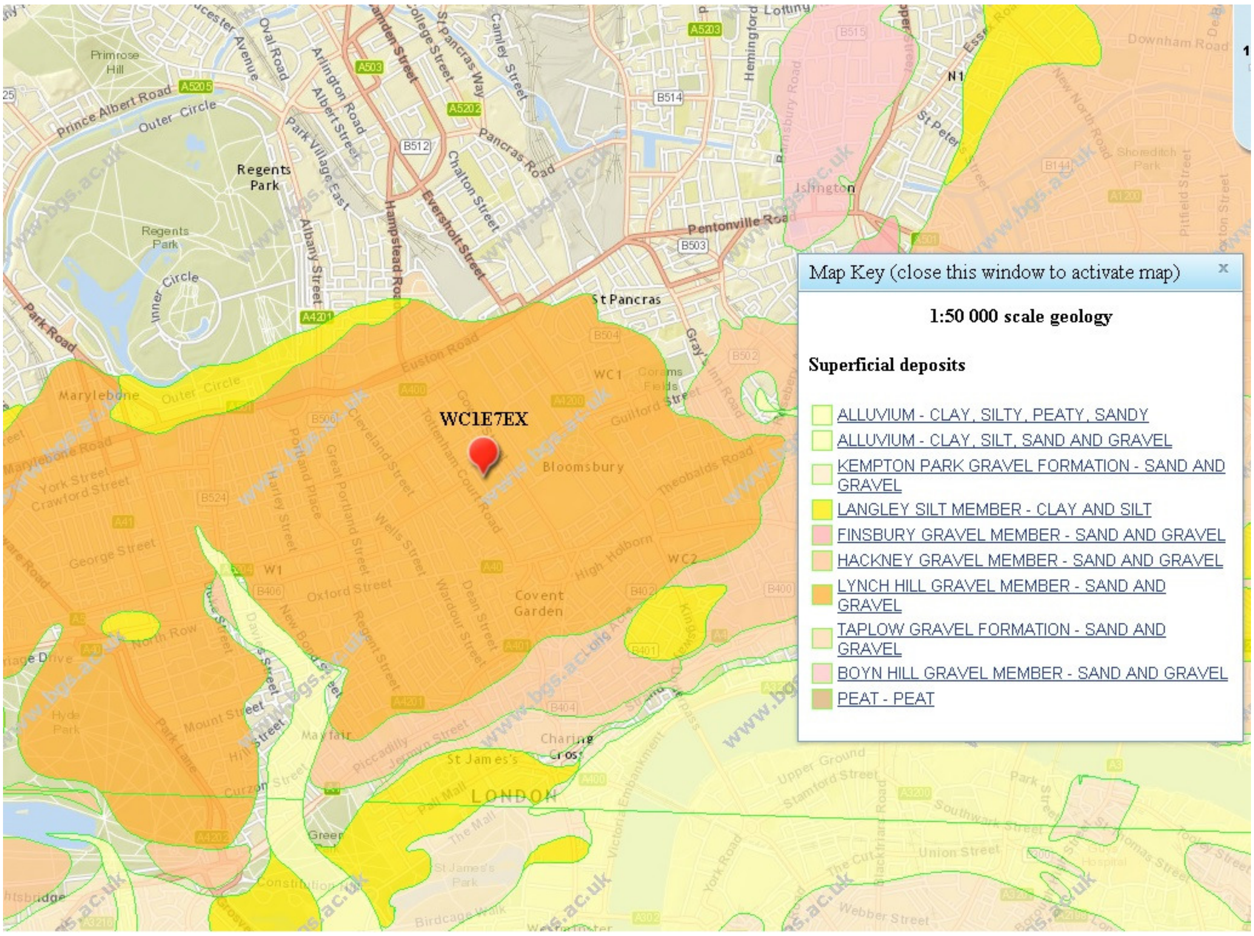


Figure 4.1: British Geological Survey Map (Superficial Deposits)

The London Plan requires attenuation to Greenfield run-off rates from new developments. The Greenfield run-off rate was calculated based on the FEH method (Appendix A). These calculations showed that the Q_{bar} for 1 hectare area is 1.56 l/sec. Therefore, the site area generates a Q_{bar} of 0.20 l/sec (0.13ha x 1.56 l/sec). The Q_{bar} must be multiplied by a growth curve factor or 3.19 (as Appendix A shows) in order to calculate the site's Greenfield run-off rate for the 1 in 100 year storm event. Therefore, the site's Greenfield run-off rate in the 1 in 100 year storm event is 0.65 l/sec. Best practice guidelines state that surface water should not be attenuated to less than 5 l/sec as this would require small diameter flow control devices which are more prone to blockages. Therefore, surface water from the site could be attenuated to the minimum practical flow rate of 5 l/sec.

The London Plan, Policy 5.13 "Sustainable Drainage" sets the parameters for new development as follow:

Development should utilise SUDS unless there are practical reasons for not doing so, and should aim to achieve Greenfield run-off rates, also ensuring that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. Store rainwater for later use: This can be achieved by connecting rainwater pipes from the roof to the rainwater harvesting system. While rainwater harvesting can be full with water prior to a storm event, providing no attenuation benefits, these systems reduce the water demand and therefore must be considered in the design. The capacity in the rainwater harvesting tank depends on water use within the buildings that it serves. If there is no activity in the building during a rainfall event, the tank will be filled providing no attenuation benefits for a subsequent storm event.
2. Use infiltration techniques: Soakaways, ponds, swales, permeable pavement, porous asphalt and gravel trenches. These systems are all external and must be located away from buildings. The site layout drawing shows that it is not practical to accommodate these systems on site.
3. Attenuate rainwater in ponds or open water features: The site layout confirms that there is no available external space for such systems. However, a green roof can be considered for the new library. The SUDS Manual (CIRIA 697) states that "the hydraulic performance of green roofs during extreme events tends to be fairly similar to standard roofs. So the hydraulic design of green roof drainage should follow the advice in BS EN 12056-3:2000 (although the standard relates to the design of normal roof drainage)". This means that green roofs will reduce the run-off rates in small storm events such as the annual and the 1 in 2 year events which are not responsible for surface and sewer flooding. However, these systems provide no attenuation benefits in high storm events such as the 1 in 30 and 1 in 100 year when flooding occur.

   The architectural drawings show that a parapet will be provided around the new library's roof. This will provide an opportunity for attenuation. While the green roof will be unable to absorb the water volumes in high storm events the proposed parapet will contain the water within the roof's perimeter providing attenuation. The roof area is approximately 105 m^2, generating 3.1 l/sec run-off in the 1 in 100 year storm event. This run-off rate will be increased to 4 l/sec in the future due to the climate change. Therefore, flow control systems (such as hydrobrakes) cannot be used for attenuation, considering that the minimum recommended attenuation rate is 5 l/sec. It is difficult to calculate the attenuated rates for various storm events, as the green roofs soil will control the run-off rate.

   In conclusion, while it is difficult to calculate the magnitude of the benefits this system will provide, it is accepted that a green roof will provide some form of attenuation and will treat the surface water before draining to the sewers. The effective area of the green roof will be $60m^2$ allowing for the lower plant area, lift override and roof light.

4. **Attenuate rainwater by storing it in tanks or sealed water features**: Only a small part of the site will be reconstructed. The rest will be refurbished and therefore the drainage arrangements that serve the roof areas will be maintained. Therefore, it is not practical to disconnect and divert the entire drainage system to a single point for attenuation. Furthermore, attenuation tanks can be located at basement level only. This means that surface water must be pumped, if an attenuation tank is constructed below basement level. This is against the Building Regulations Part H which states that pumping must be avoided where gravity drainage is achievable. Pumping surface water is not sustainable and will increase the flood risk on site from pump failures.
5. **Discharge rainwater direct to a watercourse**: There are no watercourses at this location.
6. **Discharge surface water to a surface water sewer drain**: There are no surface water public sewers at this location
7. **Discharge rainwater to the combined sewer**: Surface water will discharge to the public sewers via the existing site connections.

The SUDS assessment concludes that there is no available space for infiltration systems and pumping will be required if attenuation tanks are installed below the basement level. Pumping surface water will increase the flood risk from surface water on site and therefore is not considered a sustainable option, since surface water from the site currently drains to the public sewers by gravity. Furthermore, the proposed development will not increase the flood risk elsewhere, as there will be no increase in the impermeable areas on site. A rainwater harvesting tank can be considered in the design. This tank can collect surface water from the small new build. While in the worst case scenario this system will provide no surface water attenuation benefits, as it can be full with water prior to a storm event, it provides other sustainability benefits by reducing the water demand. Design details of the rainwater harvesting system are not provided in this report, as the water consumption requirements will dictate the size and use which falls outside the scope of this study. A green roof will be constructed on the new library providing further attenuation benefits.

4.2 Foul Water

It is proposed that the foul water flows from the site will drain to the public sewer using one or more of the existing connections. Foul water pumping must be avoided if possible.

5 Conclusions

- Existing foul and surface water from the site currently drains to the public sewers.

- Published information shows that the site is underlain by superficial deposits which should be suitable for infiltration techniques. However, the site layout arrangements and the existing thick layer of made ground indicate that infiltration techniques are not suitable for this development.

- The proposed development will not increase the impermeable areas and, subsequently, will not increase the run-off rates.

- The SUDS assessment concludes that a rainwater harvesting tank and a green roof will be considered in the design, aiming to reduce the development's water demands and run-off rate.

- Foul water from the site will drain by gravity to the public sewers via the existing connections.

Appendix A – Greenfield Run-off Calculations

HR Wallingford
Working with water

Greenfield runoff estimation for sites

Site name:	16 Chenies Street
Site location:	

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude:	51.52074° N
Longitude:	0.13257° W
Reference:	gcpvhgp6nfh9 / 1
Date:	16 Dec 2015

Site characteristics

Total site area	1	ha
Significant public open space	0	ha
Area positively drained	1	ha

Methodology

Greenfield runoff method	FEH

Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Specify BFI manually	
HOST class	N/A	
BFI / BFIHOST	0.65	
Qmed	1.195	l/s
Qbar / Qmed Conversion Factor	1.136	

Hydrological characteristics

	Default	Edited	
SAAR	613	613	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.74	0.74	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	1.36	1.36	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

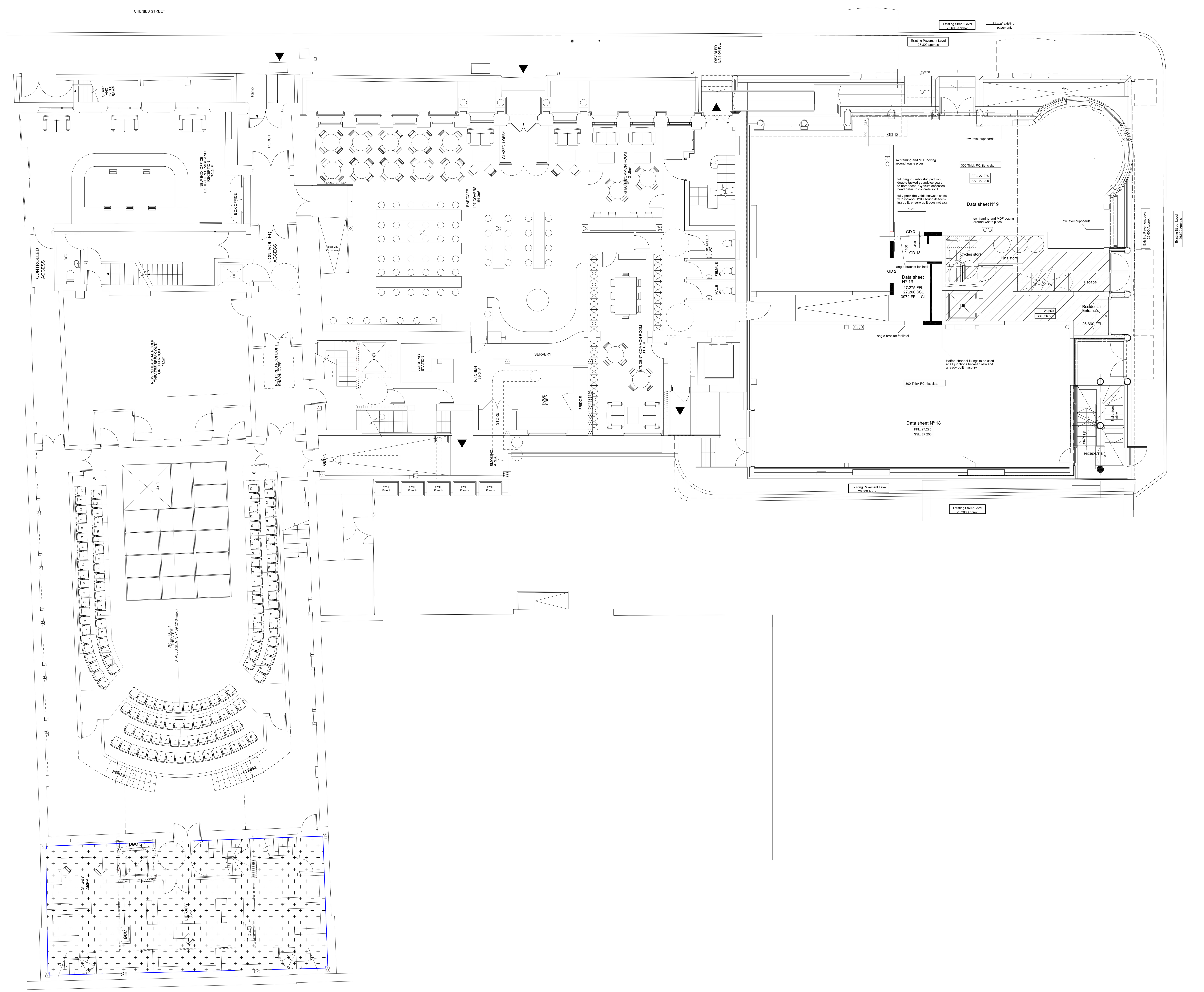
Please note that a minimum flow of 5 l/s applies to any site

Appendix B – Green Roof Management & Maintenance Plan

The maintenance and management plan for the green roof must be developed in accordance with the manufacturer's specification. All roofs require a minimum of two inspections a year to ensure that the outlets and all other components of the system are maintained, regardless of the type of green roof. The following procedures should be developed further in liaison with the manufacturer, once a specific product is selected for the project:

- Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed when working at roof level. It is advised that the contractor should always seek proof of current maintenance for any man-safe roof access systems prior to proceeding with the work on site.
- Remove all dead vegetation and debris from the roof surface, taking particular care to ensure that all chute outlets, gutters and downpipes are clear. Please note that roofs in the vicinity of taller trees will need more frequent maintenance. Dead leaves should be removed during the spring and again in the autumn, to ensure that they do not damage the roof vegetation.
- Remove the lids of all Inspection chambers, ensure that all rainwater outlets and downpipes are free from blockages and that water can flow freely away.
- Ensure that any protective metal flashings and termination bars remain securely fixed in place. Advise the client of the need to repair or renew as necessary.
- Examine all mastic sealant and mortar pointing for signs of degradation. Advise the client of the need to repair or renew as necessary.
- Check that all promenade tiles and paving slabs are securely fixed to the roof surface and in good condition.
- Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing.
- The Building owner should keep a record of all inspections and maintenance carried out on the roof. Any signs of damage or degradation to the waterproofing should be reported to the manufacturer immediately, in order that arrangements can be made for remedial work to be carried out if necessary.
- When carrying out maintenance to adjoining areas, care must be taken not to damage either the landscaping or the waterproofing system.

Appendix C – SUDS Layout



Notes :

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety :
All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. For general notes refer to Drawing No. ....

DRAINAGE LEGEND

Green Roof

Ver	Date	Drawn	Eng	Amendment
2	11/01/16	DLin	DLin	Issued for planning
1	16/12/15	DLin	DLin	Issued for information

RADA 16-18 CHENIES ST.
LONDON

SUDS Strategy

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn DLin Eng DLin
Scales 1:100 at A1 1:200 at A3
Drawing No 21361/SK600 Ver 2

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