Colt Data Centre Services

London 4, Hayes

Sustainable Urban Drainage Strategy

DCS20109-ARUP-DC-XX-XX-RP-C-52001

P05 | 22 August 2022

Job number 281528

Ove Arup & Partners Ltd
Central Square
Forth Street
Newcastle upon Tyne NE1 3PL
United Kingdom
www.arup.com

ARUP

Contents

Tables

Figures

Appendices

Existing Drainage

Appendix C

Proposed Site Plans

Appendix D

Greenfield and Brownfield Calculations

Appendix E

Thames Water PPE Response

Appendix F

SuDS Management and Maintenance

Appendix G

Proposed Drainage Layout and Details

Appendix H

MicroDrainage

Appendix I

Water Cycle Strategy

1 Introduction

Ove Arup & Partners Limited (Arup) has been commissioned by Colt Data Centre Services (COLT DCS) to provide Civil and Structural Engineering (CSE) design services for the proposed London 4, Hayes Data Centre. Arup's scope includes the production of a Drainage Strategy in support of the planning application.

This report should be read in conjunction with the Arup Flood Risk Assessment (FRA) DCS20109-ARUP-DC-XX-XX-RP-C-00012.

The drainage design has been developed following the principles set out in the Hillingdon SuDS Design and Evaluation Guide[1]. A copy of The London Sustainable Drainage Proforma has been completed to accompany this application. Refer to Appendix A.

Following the planning submission, London Borough of Hillingdon provided a pre-commencement condition (No. 14) related to sustainable water management. This condition is outlined below, along with an associated table which directs the reader to the appropriate section of this report that demonstrates compliance with the condition.

Condition 14 - Sustainable Water Management
Prior to the commencement of development (excluding demolition and site clearance), a scheme for the provision of sustainable water management in line with the approved document reference 'DCS20109-ARUP-DC-XX-XX-RP-C-52001 Rev. P02 Sustainable Urban Drainage Strategy (Dated 24th March 2022)' shall be submitted to, and approved in writing by the Local Planning Authority. The scheme shall clearly demonstrate how it manages water and demonstrate ways of controlling the surface water on site by providing information on:

[1] London Borough of Hillingdon SuDS Design and Evaluation Guide, 2018

Condition	Section confirming compliance
a) Sustainable Drainage features:	
i. Surface water discharge - the submitted drainage strategy must identify the proposed method and location of discharging collected surface water from the site in accordance with the hierarchy set out in Policy SI 13 of the London Plan (2021). Where the proposal does not utilise the most sustainable solution, justification must be provided. Any proposal that includes a connection to a private sewer network should provide details of the condition and ownership of the entire drainage route to a public sewer or ordinary watercourse.	Refer to Section 3.1. The point of discharge has not been changed. The subsequent findings of the soakaway tests confirmed infiltration not to be viable. The drainage will connect into the Thames Water sewer.
ii. SuDS - the submitted drainage strategy should incorporate Sustainable Drainage System (SuDS) elements that are embedded, where practicable, within the landscaping plan for the development. Preference should be given to above-ground SuDS elements that control water at source and provide wider biodiversity, water quality and amenity benefits.	Refer to Section 3.3. A full SUDS suitability review has been carried out detailing the reasoning behind each SUDS system being or not being incorporated.
iii. Runoff rates - surface water discharge from the site must be no greater than greenfield runoff rates at a variety of return periods including 1 in 1 year, 1 in 30, 1 in 100, and 1 in 100 plus 40% climate change.	Refer to Section 3.4.1. A table of greenfield rates and proposed flow rates has been included.
iv. Drainage calculations - include calculations to demonstrate that the volume of storage and size of drainage features provided is adequate to control surface water for a range of storm duration and rainfall intensities for events up to and including the critical 1 in 100 plus 40% climate change rainfall event.	Refer to Section 3.4.1 and Appendix H.
v. Exceedance routes - provide a plan showing the route surface water will take through the development for rainfall events exceeding the 1 in 100 year event. Where it is intended to store water on the ground surface, the maximum extent of overland flooding should be mapped and include details on flow paths, depths and velocities. Safe access and egress for the site must be demonstrated.	Refer to Appendix G for the flood route drawing. Exceedance drainage has been added in strategic places to provide additional flood resilience in failure of permeable surfaces or in exceedance of the below ground drainage system.

b) Long-term management and maintenance of the drainage system.	
i. Provide a Management and Maintenance Plan for the drainage system that includes clear plans showing all the drainage network above and below ground, and identifies the responsibility of different parties for each component of the drainage network.	Refer to Appendix F for SuDS Management and Maintenance plan and Appendix G for drainage drawings. All drainage within the site boundary except for the Thames Water Sewer is to be maintained by Colt.
ii. Include details of the necessary inspection regimes and maintenance frequencies.	Refer to Appendix F.
c) Minimise water use.	
i. incorporate water saving measures and equipment.	Refer to Section 5 and the Water Cycle Strategy produced by the M&E Engineer in Appendix I. Confirmation that the design of water saving measures and equipment (designed by the M&E engineer) is included within the scheme.
ii. provide details of how rain and/or grey water will be recycled and reused in the development.	Refer to Section 5. Confirmation that a 35m3 rainwater harvesting tank (internal to the building and designed by the M&E engineer) has been designed to be dedicated to meet 100% of the WC flushing requirements of the building 1 under normal seasonal conditions.

Note: Revision P03 has been updated with further information as the design has progressed. Minor amendments have been made to the text in the body of the report to reflect consultation responses, GI findings and minor strategy updates. Design drawings in Appendix G have been updated to reflect further design development of the scheme and the drainage strategy, which has also been reflected in the drainage hydraulic modelling.

2 Project and Site Details

2.1 Location

The site is located off Beaconsfield Road, Hayes, UB4 0SL in the London Borough of Hillingdon (LBH). It is situated in the Brook Industrial Estate. The site is currently occupied by the Optimum Data Centre, Tudor Works and Veetec Motor Group Facility shown in Figure 1 below.

The site is approximately 2.12 hectares (ha) and is bounded by Yeading Brook to the east, Beaconsfield Road and Hayes and Yeading Football Club to the south, Express Reinforcements and other commercial buildings to the west and industrial warehouses/structures to the north.

The approximate National Grid reference of the site is TQ116 801.

Figure 1 Existing Site Plan

2.2 Existing Topography

A topographical survey was undertaken by Catsurveys between May and July 2021.

The ground levels within the site are generally flat.8 The highest elevations are on the western boundary at circa 30m falling to circa 29m AOD at the south-eastern boundary.

2.3 Existing Drainage

A Ground Penetrating Radar (GPR) survey was undertaken by Catsurveys between May and July 2021. Figure 3 illustrates the drainage shown on the GPR survey.

Arup have also obtained historic drainage records for the Optimum Data Centre site and Thames Water (TW) asset records for the area. Refer to Appendix B for existing drainage information.

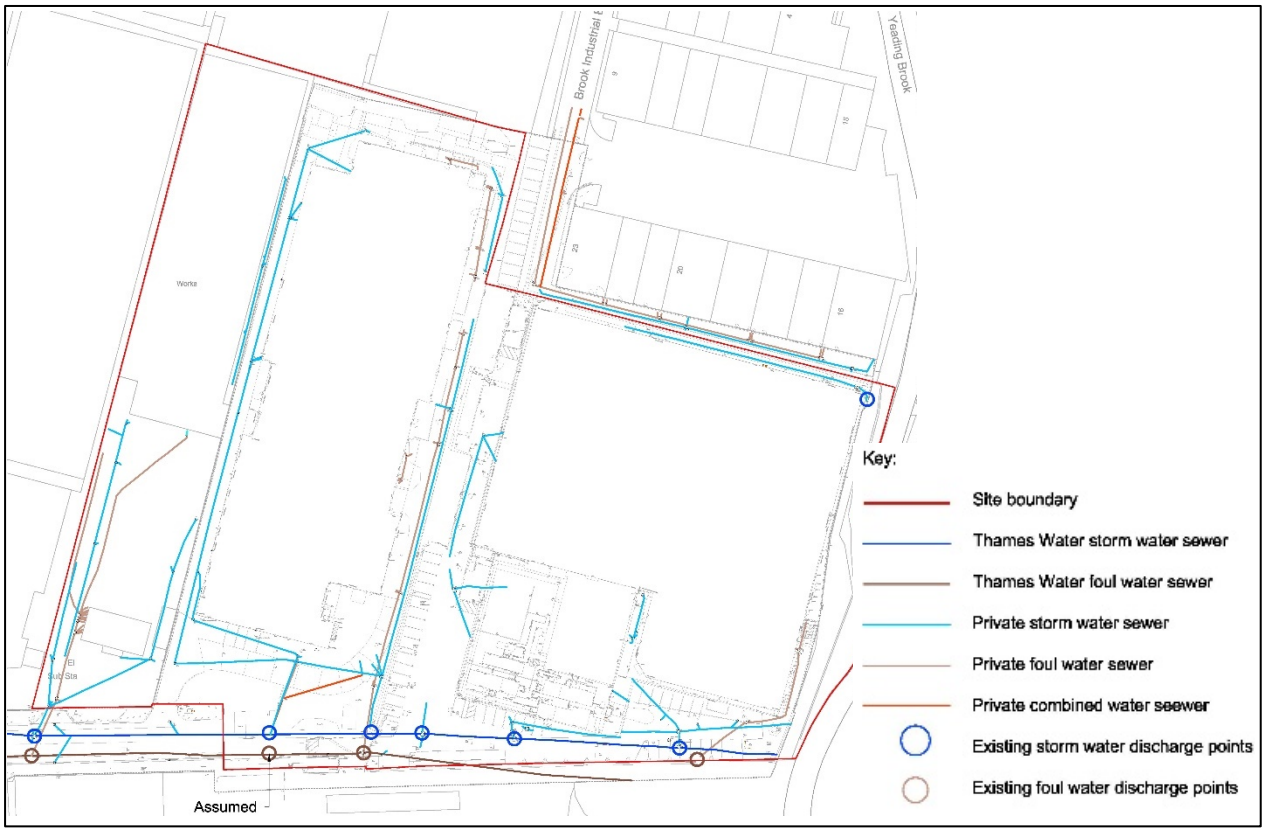

Figure 2 Existing Discharge Points Based on GPR Survey

2.3.1 Public System

The drainage records and GPR survey illustrate that a 525mm diameter TW storm water sewer crosses the site to the south, running from Beaconsfield Road to an outfall into Yeading Brook.

The records also show a 225mm diameter TW foul water sewer running east to west through the southern corner of the Optimum Data Centre plot.

As part of the legal searches for the site, TW have confirmed there are no current wayleave/easement agreements for these sewers.

2.3.2 Private System

2.3.2.1 Surface Water

The GPR and drainage records illustrate the site to be fully drained.

The Optimum Data Centre, Tudor Work and Veetec Motor Group Facility predominantly discharge to the TW storm water sewer in the south of the site. The following connections to the TW site are shown on the GPR survey:

- Optimum Data Centre
  - Two 300mm diameter connections within the site
  - Two 150mm diameter connections within the site (assumed only to pick up singular gullies)
- Tudor Work
  - 150mm diameter connection within the site
  - 100mm diameter connection within the site

The survey information has not picked up manholes in these areas, it is possible the chambers are buried, or the connection has been formed using “T” junctions.

- Veetec Motor Group Facility 225mm diameter connection to a manhole in Beaconsfield Road

A small area to the northeast of the Optimum Data Centre is shown to discharge directly to the Yeading Brook via a 225mm diameter outfall.

Oil interceptors are only known to be present upstream of the two connections from the Optimum Data Centre to the TW sewer and there are no known flow controls.

2.3.2.2 Foul Water

Foul water from the Tudor works, Optimum Data Centre and Veetec Motor Group Facility are shown on the GPR to each discharge to the TW foul sewer to the south of the site via three separate 150mm diameter connections.

The GPR survey of the Tudor work also highlighted the presence of a 100mm diameter foul sewer which followed the alignment of the 100mm storm water connection. It is assumed that the foul drain continues to connect to the TW foul water sewer and is not connected into the surface water system however this has not been proven by the survey.

2.4 Proposed Development

2.4.1 Masterplan

Colt DCS propose to redevelop the existing brownfield site to deliver a new data centre campus including: two data centre buildings; associated energy and electricity infrastructure, buildings, and plant; security gatehouse, systems and enclosures; works to the highway, car parking and cycle parking; hard and soft landscaping; as well as associated infrastructure, ancillary office use, and associated external works.

The masterplan is shown in Figure 3. Refer to Appendix C for Detailed Development Layout and Landscaping Plans.

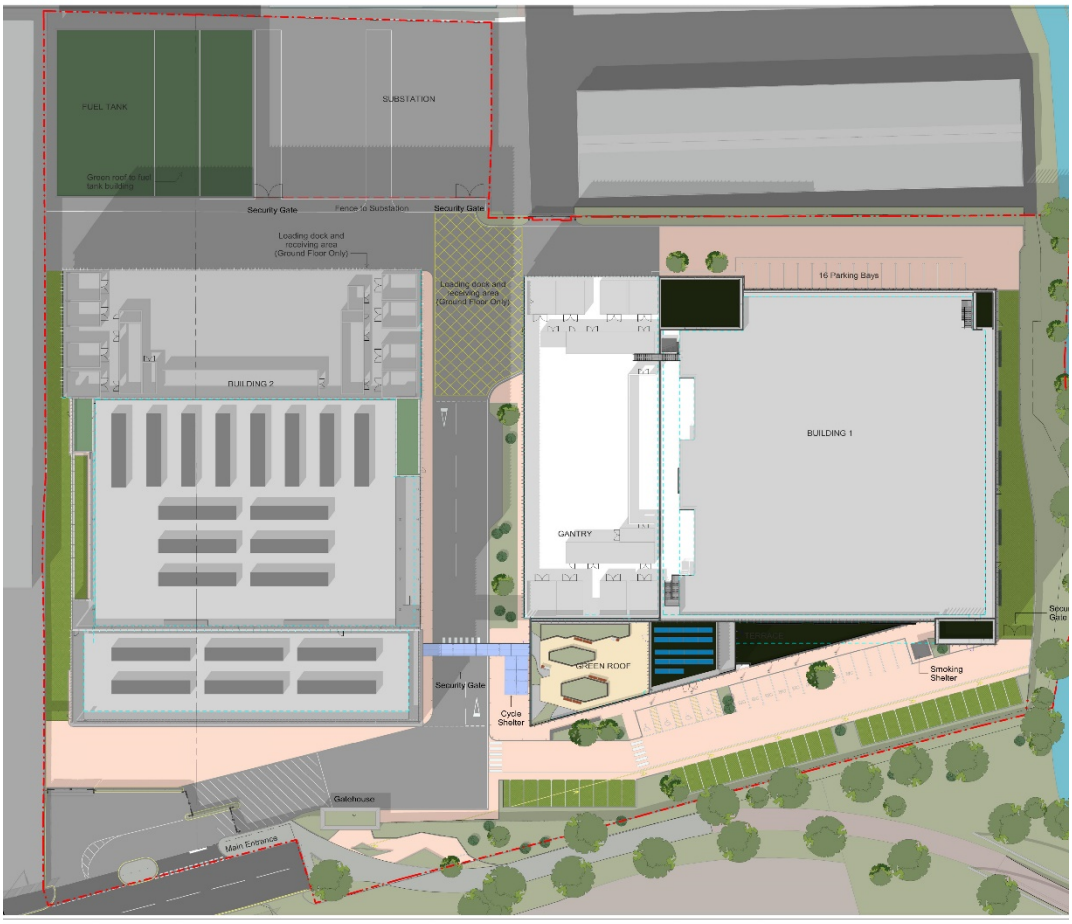

Figure 3 Proposed Development

A pre-planning application was issued to LBH in June 2021 and subsequent discussions have been held with the planning officers around the masterplan and design strategies.

2.4.2 Site Selection and Design

The site meets the wider technical and logistical requirements for the construction and operation of a data centre (access to infrastructure and services).

The footprint of the data centre buildings and external areas shown in the development plan have been reviewed during the design stages to ensure space planning has been carried out efficiently and the minimum footprints are shown for a viable data centre on this site. Whilst there is significant plant and associated logistical space required to support this type of development (i.e., offices, logistics, parking, maintenance etc.), the areas shown for the inclusion Sustainable Drainage Systems have been maximised in line with the required constraints this type of development presents.

3 Proposed Storm Water Drainage

The principles of the drainage strategy have been set out in accordance with national and local planning guidance.

In advance of the full planning application consultation has been undertaken with Victoria Boorman, the Lead Local Flood Authority (LLFA) officer for LBH to review the suitability of the drainage principles.

3.1 Drainage Hierarchy

In accordance with the CIRIA SuDS Manual (C753)[2] and National Planning Practice Guidance[3] stormwater disposal should follow the hierarchy of discharge.

1st. Discharge to the ground

2nd. Discharge to a watercourse

3rd. Discharge to a surface water sewer/drain

4th. Discharge to a combined sewer

Geotechnical investigations (GI) were carried out during late 2021.

The site sits above London Clay which is present at varying depths of circa 2-12m Below Ground Level (BGL). The site investigation suggests variable geology on site, with the presence of a possible drift filled hollow identified due to an increased presence of superficial deposits identified in the northwest corner of the site. In addition to this, water seepage has also been identified throughout the London Clay. This poses the risk of hydraulic continuity between the upper and lower aquifer which is to be confirmed by the outstanding groundwater monitoring.

It is considered that due to variable water levels, infiltration rates and potential contamination, it is not deemed appropriate to discharge storm water via infiltration.

The existing storm water outfall to the Yeading Brook at the north of the site is insufficiently sized and too shallow to serve the proposed development.

It is thus proposed that the site discharge indirectly to the Yeading Brook via one of the existing 300mm diameter TW sewer connections. This will limit disruption to the river and adjacent planting, while utilising existing infrastructure and creating a single controlled point of discharge for the whole development.

[2] The SuDS Manual (C753), CIRIA, December 2015
[3] National Planning Policy Framework, Ministry of Housing, Communities & Local Government, July 2021

3.2 Discharge Restrictions

3.2.1 Planning Policy

LBH Local Plan Part 2[4] Policy DMEI 10 states that:

"All major new build developments, as well as minor developments in Critical Drainage Areas or an area identified at risk from surface water flooding must be designed to reduce surface water run-off rates to no higher than the pre-development greenfield run-off rate in a 1:100-year storm scenario, plus an appropriate allowance for climate change for the worst storm duration. The assessment is required regardless of the changes in impermeable areas and the fact that a site has an existing high run-off rate will not constitute justification"

As a development with a site boundary exceeding 1 hectare London 4 is considered a Major Development in line with NPPF[5] and must be restricted to Greenfield discharge in line with DMEI 10.

3.2.2 Predevelopment Flow Rates

The greenfield equivalent runoff rates for the site are summarised in Table 1. The greenfield rates have been calculated using the IH124 method tool on the HR Wallingford's UK SuDS website[6]. The tool is based on the Institute of Hydrology Report 124[7], flood estimation for small catchments.

Restricting the site to greenfield equivalent provides a significant betterment on existing brownfield discharge rates which have also been summarised in Table 1. The existing brownfield rates for the site have been estimated using a simple MicroDrainage model based on the available Ground Penetrating Radar Survey of the existing site. Where required conservative assumptions have been made.

Of the existing 2.2 ha site boundary, 2.1 ha is currently fully drained hardstanding with no known flow control devices. The remaining area forms the densely vegetated embankment falling into the Yielding Brook, which will remain undeveloped. This area has been discounted from the calculations.

[4] London Borough of Hillingdon A Vision For 2026 Local Plan: Part 1 Strategic Policies, November 2012
[5] National Planning Policy Framework, Ministry of Housing, Communities & Local Government, July 2021
[6] https://www.uksuds.com/drainage-calculation-tools/greenfield-runoff-rate-estimation accessed July 2021
[7] Report No.124 Flood Estimation for Small Catchments, Institute of Hydrology, June 1994

Return Period	Brownfield (l/s)	Greenfield Flow (l/s)	Betterment
Area (ha)	2.122		
Qbar		8.8	
1 in 1 year	165.5	7.5	95%
1 in 30 year	326.6	20.3	94%
1 in 100 year	367.4	28.2	92%

Table 1 Brownfield and Greenfield Flow Rates

Copies of these calculations are included within in Appendix D

In line with Approach 1 set out in the Hillingdon SuDS Design and Evaluation Guide. Arup propose to utilise a complex flow control. This will allow the discharge from the site to vary between the allowable 1-year and 30-year greenfield flow rates set out in Table 1. This allows the site to better mimic the greenfield equivalent rates for each respective storm and minimise storage requirements. This is covered in further detail in Section 3.4.1.

3.2.3 Thames Water Capacity

A Pre-Planning Enquiry has been made to TW to ensure that the drainage strategy is acceptable in principle prior to the planning application.

TW's response (DS6085964) is included in Appendix E confirming there are no objections to discharging the site to the TW sewer at the greenfield rates set out in Table 1. This was also confirmed as part of the planning consultation process.

3.3 SuDS Measures

In line with the National Planning Policy Framework[8]:

"major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate".

The drainage strategy has been developed in conjunction with the masterplan and a comprehensive multidisciplinary review has been undertaken to identify where sustainable drainage features have the potential to be implemented. Table 2 below provides a summary of this review.

3.3.1 SuDS Suitability

SuDS Feature	Suitability	Pollution Reduction	Storage Provided	Comment
Building features				
Rainwater harvesting	✓	x	x	A rainwater harvesting (RWH) strategy is being developed by the M&E Engineer. Rainwater harvesting from the entire roof area of Building 1(excluding the gantry) is collected in a 35m³ RWH tank at ground floor with associated distribution pump. The rainwater harvesting tank for building 1 is dedicated to meet 100% WC flushing requirements under normal seasonal conditions.
Green roof or blue roof	✓ (Limited)	✓	✓	Intensive/ extensive green roof area has been proposed above the stair/lift cores of both buildings, the office space of building one, above the lowered portion of building 2, in addition to the fuel tank building (area of which is still under development). Additional planted areas will also be provided on the office roof terrace Application of green roof space in other areas of the buildings is limited due to the high quantity of mechanical plant required at roof level which will be spread over two levels. The location of the plant on the roof has been determined based on the plant replacement strategy and Computational Fluid Dynamics (CFD) calculations. This results in the mechanical plant being spread across the whole of the gantry and data hall roof area. Green or blue roofs are thus unsuitable above these areas.

[8] National Planning Policy Framework, Ministry of Housing, Communities & Local Government, July 2021

SuDS Feature	Suitability	Pollution Reduction	Storage Provided	Comment
Green wall	✓	x	x	Green walls are proposed to the southern and eastern elevations of Building 1. They will be incorporated into the building drainage system designed by the M&E engineer.
Soft or permeable landscaping features				
Filter drain	✓	✓	Low	Filter drains have been included to capture runoff from permeable paving areas.
Filter strip	x	✓	✓	Due to the size of the vehicles and cranes which will need to access the site and the extent of their vehicular movements, the site will need to be predominantly hard surfaced leaving limited room for filter strips or swales.
Swale	x	✓	✓	
Rainwater Garden/ Bioretention	x	✓	✓	The limited areas to the north of the site which are free from vehicular movements and may be soft landscaped are constrained by the number of existing and proposed utilities in these areas and their depth requirements. This includes Thames's Water assets which they have communicated should not be located close to trees/bushes/shrubs etc. Rain Gardens are thus not considered to be suitable in these areas.
Permeable Paving	✓	✓	✓	Permeable paving has been considered for areas other than those areas frequently used by HGVs. The pavement design has been considered in line with vehicular loading and the design levels of utilities.
Detention basin	x	✓	✓	There is insufficient space for basins, ponds, or wetlands within the site. The only amenable space is to the north western corner which is at the furthest point from the site outfall and will be adjacent to the proposed substation and potential fuel storage This area is therefore unsuitable.
Pond	x	✓	✓	
Wetland	x	✓	✓	
Hard landscaping features				
Kerb Drains, Rills and Channels	✓	x	x	The design incorporates channel drains as the primary capture for areas not drained by permeable paving. They will also be included in areas of permeable paving to provide resilience in the event of exceedance events or drainage failures.
Below-ground features				
Storage Tank	✓	x	✓	To meet the greenfield flow restrictions set out in Table 1 storm water storage has been utilised. Due to spatial availability within the site the only means of achieving this will be through storage tanks.

SuDS Feature	Suitability	Pollution Reduction	Storage Provided	Comment
Hydrocarbon Separators	✓	✓	x	A full retention Class 1 oil interceptor will be incorporated at the downstream extent of the network and in the area of refuelling to the north of Building 2.

Table 2 Suitability of SuDS Features

3.3.2 Contamination Risks

The following contamination risks are present within the site:

- Glycol

  The chilled water system will have 20% glycol. Handling units will be located on the main roof area. The M&E engineer has confirmed under normal use and operation glycol will not enter the surface water system. The rainwater harvesting system used for the main roof will however include a glycol alarm. As this would only occur under failure of the plant this event is considered unlikely and has not been considered further within the design.

- Fuel

  Fuel storage will be required within the site to power backup generators serving the data centre. These Tanks are being designed by the M&E engineer in consultation with the Environment Agency. The fuel tanks are proposed to be in the northeast corner of the site. The tanks will be within a framed structure preventing rainwater egress and risk of rainwater contamination. The structure will be bunded and a separator will be provided locally to provide containment of any potential spillages.

3.3.3 Site Improvements Through SUDS

3.3.3.1 Water quality

The previous industrial usages within the site present many possible sources of water contamination. This includes the following:

- Multiple large above and below ground fuel tanks. Some are not bunded and show evidence of spillages.
- Potential Asbestos containing materials (ACMs) within the Tudor Works and Veetec Motor roofs, drainpipes, and guttering.
- Fly tipped materials of unknown origin in addition to bins and waste materials included wooden pallets, tyres, paint cans, empty oil drums and possible ACMs.
- The site housed multiple industrial units including vehicle servicing and maintenance shops, housing degreasers, paint booths and compressors.

The only known level of water treatment within the three sites is hydrocarbon separators located within the existing data centre. The classification for the separators is unknown.

The development of the London 4 data centre will ensure that all high-risk areas will be appropriately contained and managed. This will include the use of at source capture and separation of potential fuel spills around the fuelling points.

Most of the site area will be at low risk of contamination. Water capture will predominantly occur on the commercial roofs or within the low trafficked areas.

Permeable paving is proposed across low trafficked areas which is effective at removing suspended solids, metals, and hydrocarbons.

The use of green roof spaces above the areas described in section 3.3 will also be effective at removing any potential contaminants in this area.

To provide an additional level of treatment a Class 1 full retention separator with an overflow alarm has been proposed at the downstream extent of the network, as well as an additional localised interceptor at the refuelling point to the north of building 2.

It is considered that the development will have a significant benefit to water quality against the existing scenario.

3.3.3.2 Biodiversity

Due to the nature of the site and the required vehicular and crane movements, there is limited opportunity to implement large areas of ground level greening. London 4 will however include green walls to the southern elevations of buildings and a number of green roofs.

Along the eastern and western boundaries of the site cellular grassed paving is proposed to provide some greening. Although these areas will not be used often, they must remain accessible for fire tenders.

Small, grassed areas and above ground / movable planters are also proposed in the areas surrounding the carparking to the south of the site and between the two buildings. Movable planters are also proposed to the north. These areas have been constrained by the proposed utilities, existing Thames Water sewer and HGV/crane requirements.

Through these measures it is considered the development will have a benefit to biodiversity against the existing scenario.

3.3.3.3 Amenity

The green walls and green roofs will be dominant aspects on the frontage of the buildings and recreational area of the office. These large SuDS will have a significant impact on the wellbeing of staff, visitors, and neighbours, softening the appearance of the building and connecting people to water and biodiversity.

The use of permeable paving where possible throughout the site and appropriate design of the below ground storage will also ensure a pleasant and safe environment for users preventing existing surface water flooding.

It is considered that the development will have a benefit to amenity.

3.3.4 SuDS Maintenance

To sustain functionality of the drainage systems and suitably safeguard water quality, biodiversity, and amenity all drainage systems must be appropriately maintained.

The maintenance and management of all surface water drainage will be the responsibility of the appointed Contractor during the construction phase and maintenance period and the responsibility of Colt Data Centre Services thereafter.

Maintenance responsibilities have been set out in Appendix F for both parties.

3.4 Proposed Drainage Design and Evaluation

The surface water drainage system has been designed in accordance with the recommendations set out in:

- BS EN 752:2017 - *Drain and sewer systems outside buildings - Sewer system management*, and
- The Building Regulations 2010, Approved Document H – *Drainage and waste disposal*.

Proposed drainage layouts and details showing the proposed surface water strategy for the development are included in Appendix G.

Drainage within the substation area is to be developed by a specialist contractor. Performance requirements will be placed on the contractor to ensure that all surfaces are suitably graded to ensure that surface water is conveyed to the drainage system, the drainage systems are designed to adequately convey the flows entering the system and features shall be designed to meet self-cleansing velocities.

The contractor will also be required to install a full retention oil interceptor for the substation area, in line with Environment Agency policy document PPG 3 and ensure that the substation drainage is designed and constructed to ensure that contaminates are intercepted, both during construction and operations, and prevented from entering surrounding watercourses and ground water systems.

3.4.1 Drainage Network Modelling

The drainage has been modelled using MicroDrainage. Refer to Appendix H for summary of results.

The following constraints /conservative assumptions have been applied:

- Paved external surfaces and the building roofs have been modelled as 100% impermeable.
- Cellular grassed paving areas have also been modelled as 100% impermeable to develop conservative storage requirements.
- The summer and winter volumetric runoff coefficients have been modelled as 1.
- Storage within the permeable paving, green roof and rainwater harvesting have not been included within the model.
- An additional 40% rainfall intensity has been incorporated in line with climate change allowances set out in the National Planning Policy Framework [9].

[9] National Planning Policy Framework, Ministry of Housing, Communities & Local Government, July 2021