NORTHUMBERLAND DEVELOPMENT PROJECT **HOTEL**

S73 APPLICATION

DRAINAGE STRATEGY

BURO HAPPOLD

Northumberland Development Project Hotel S73 Application

Drainage Strategy

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Glossary

Term	Definition
EA	Environment Agency
NPPF	National Planning Policy Framework
LBH	London Borough of Haringey
NDP	Northumberland Development Project
SuDS	Sustainable urban Drainage System
THFC	Tottenham Hotspur Football Club
TW	Thames Water

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Executive Summary

This Drainage Strategy report has been prepared by Buro Happold on behalf of Tottenham Hotspur Property Company Limited ("THFC") ("the Applicant") in support of an application for minor material amendments to the London Borough of Haringey ("LBH") made under Section 73 ("S73") ("S73 Application") of the Town and Country Planning Act 1990 (as amended)
The S73 Site is currently occupied by a basement car park, and public realm area around the THFC stadium which was constructed as part of the Northumberland Development Project (NDP).
This application is to bring forward revised proposals for the hotel building (originally approved in full). The revisions are intended to enhance the deliverability of the proposals and help them to better respond to the revised future context in the local area.
The estimated cumulative foul discharge for the hotel development is 10.94 l/s which would be an increase to the current foul discharges given the current uses of the site. The majority of foul water from the hotel is to discharge to the existing 1000mm TW sewer in Park Lane at manhole 0001E, with a small proportion of foul water which is generated in the basement is to discharge to the existing foul pumping station located at the north of the site.
As part of the original drainage strategy for NDP, final design drawings indicate a proposed sewer to connect to TW MH9006 (Outfall 05), this sewer has a maximum allowable discharge rate of 4.4l/s to serve the hotel as agreed as part of the planning application submitted for the THFC Stadium and NDP development. The existing podium area and ground level area which falls within the S73 red line boundary drains to existing TW manhole 0001 (Outfall 06).
Material changes to the locations of the ACO drainage channels to pick up the surface water runoff in these areas are to be altered in order to accommodate the hotel development and floor gullys are proposed to pick up surface runoff in the new podium area at the south of the site onto Park Lane above the existing stairs. Despite the changes to the ACO linear drainage channels and inclusion of floor gullys to collects surface runoff, the fundamental impermeable catchment area (podium and ground level) and discharge location to Outfall 06 remain unchanged.
It is proposed for the hotel catchment to discharge at the previously agreed discharge rate of 4.4l/s to the TW network whilst making additional allowance for attenuation to accommodate the 1 in 100 year + 40% climate change storm event. Upstream of Outfall 05, 51m^3 of attenuation and flow control device are proposed to capture runoff from the hotel. The hard landscaped areas at podium level L01 and ground level L00 are to continue to discharge to Outfall 06 as they do currently.

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1 Introduction

1.1 Background

This Drainage Strategy report has been prepared by Buro Happold on behalf of Tottenham Hotspur Property Company Limited ("THFC") ("the Applicant") in support of an application for minor material amendments to the London Borough of Haringey ("LBH") made under Section 73 ("S73") ("S73 Application") of the Town and Country Planning Act 1990 (as amended), following the grant of planning permission for the Northumberland Development Project ("NDP") ("the Site") on 15 April 2016 (LPA ref HGY/2015/3000). This report will review and discuss the following:

- Review of the existing external sewer network
- Surface water drainage strategy
- Foul water drainage strategy.

This report is informed by the following data:

- Thames Water Asset records
- Proposed development plans produced by F3 Architects
- External landscape plan produced by Arup
- Flood Risk Assessment prepared by Buro Happold.

This report sets out the anticipated measures that could be incorporated into the detailed design stage in order to control both the quantity and quality of foul and surface water discharge from the site. Details of the foul and surface water drainage design are expected to be submitted to the local planning authority, the London Borough of Haringey (LBH), prior to the commencement of each relevant stage of the development, following consultation with relevant stakeholders as necessary. This will ensure that the foul and surface water drainage details are appropriately designed and controlled.

1.2 Site Description

The proposed development is located within the London Borough of Haringey (LBH) and is formed of the following site, hereafter referred to as 'the Site',

- Tottenham Hotspur Stadium, 748 High Road, Tottenham, London, N17 0AP

The Site is currently occupied by a basement car park, and public realm area around the THFC stadium which was constructed as part of the NDP. The nearest watercourse is the River Moselle, 50m west of the site. This watercourse is classified as a Main River, which is understood to flow below ground in a culvert, from west to east along the alignment of White Hart Lane and then south along High Road. According to the British Geological Survey, nearby historic boreholes suggest that the underlying ground conditions consist of London Clay.

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1.3 Proposed Development

Planning Permission was granted for the NDP on 15 April 2016 (LPA ref HGY/2015/3000). This 'Hybrid Consent' gave full planning permission for Plot 1 (The Stadium), Plot 2 (The Tottenham Experience) and Plot 3 (Hotel) and outline planning permission for Plot 4 (The Extreme Sports Building), Plot 5 (The Residential Buildings and Flexible B1/D1 Space) and Plot 6 (The Community Health Building).

Plots 1 and 2 have been built out and various reserved matters have been approved for other plots.

This application is to bring forward revised proposals for the hotel building (originally approved in full). The revisions are intended to enhance the deliverability of the proposals and help them to better respond to the revised future context in the local area.

Application under Section 73 of the Town and Country Planning Act for variations to Condition A4 (Approved Plans) and (Condition A7) of the hybrid planning permission HGY/2015/3000 (as amended) for the proposed demolition and comprehensive redevelopment of the Northumberland Development Project (the amendments consist of revisions to the design, height and maximum floorspace at Plot 3 Hotel and other changes)'.

Site location and summary of the development is provided in Figure 1-1 and Table 1-1 below.

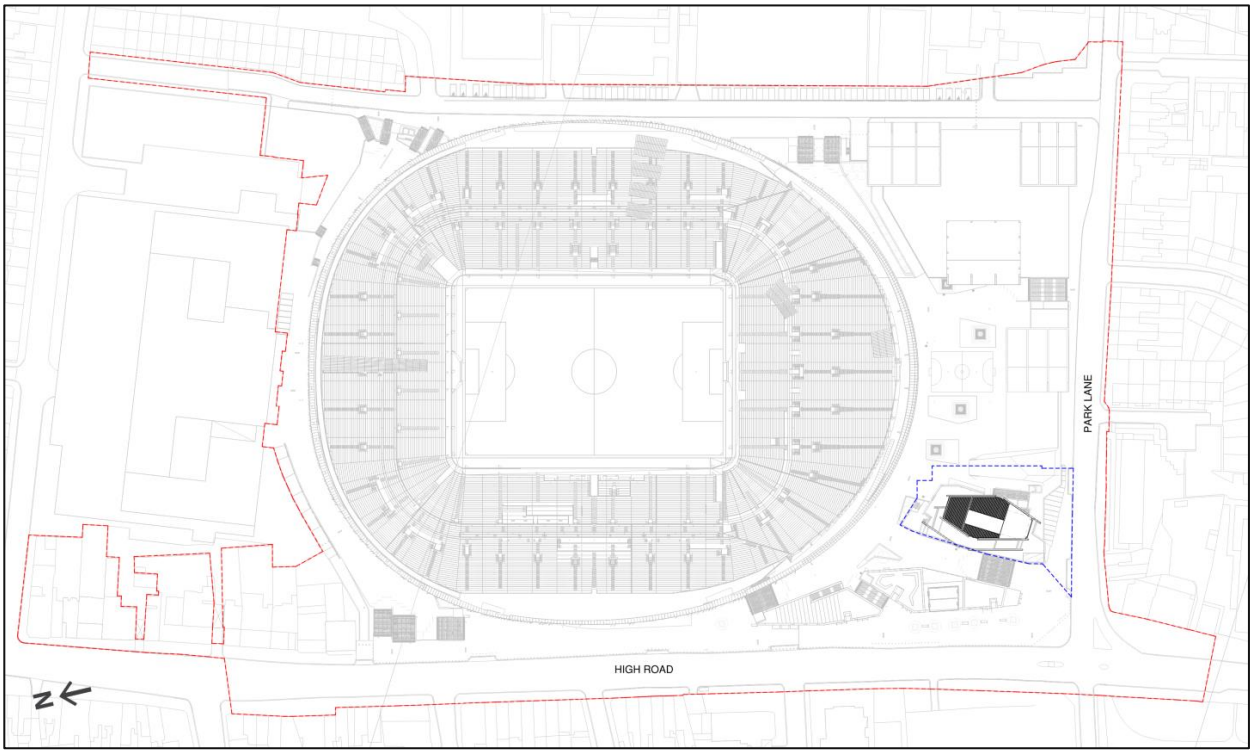

Figure 1-1: Site Plan (NDP Application boundary in red, NDP Hotel Application boundary in blue)

Table 1-1: Summary of Proposed Development

Use	Floorspace (m^2) (GIA)	Hotel Rooms / Units
Hotel	16,132 (incl Commercial)	180
Commercial (Bar, Restaurant, Club)	2,652	-
Residential	11,246	49

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2 Foul Drainage Strategy

2.1 Relevant Policy & Guidance

Building Regulations Part H states:

- *H1. (1) An adequate system of drainage shall be provided to carry foul water from appliances within the building to one of the following, listed in order of priority:*
    - *a public sewer; or, where that is not reasonably practicable,*
    - *a private sewer communicating with a public sewer; or, where that is not reasonably practicable,*
    - *either a septic tank which has an appropriate form of secondary treatment or another wastewater treatment system; or, where that is not reasonably practicable,*
    - *a cesspool*
- *(2) In this Part 'foul water' means wastewater which comprises or includes:*
    - *waste from a sanitary convenience, bidet or appliance used for washing receptacles for foul water; or*
    - *water which has been used for food preparation, cooking or washing.*

For connections to the local public sewer system, Thames Water (TW) must be consulted regarding capacity of the existing system and means of connection.

2.2 Existing Foul Sewer Network

Existing foul drainage infrastructure includes a 1000mm diameter TW sewer which runs from west to east along Park Lane and a further 225mm diameter TW sewer which starts from the southeast corner of the site outside Concord House running east.

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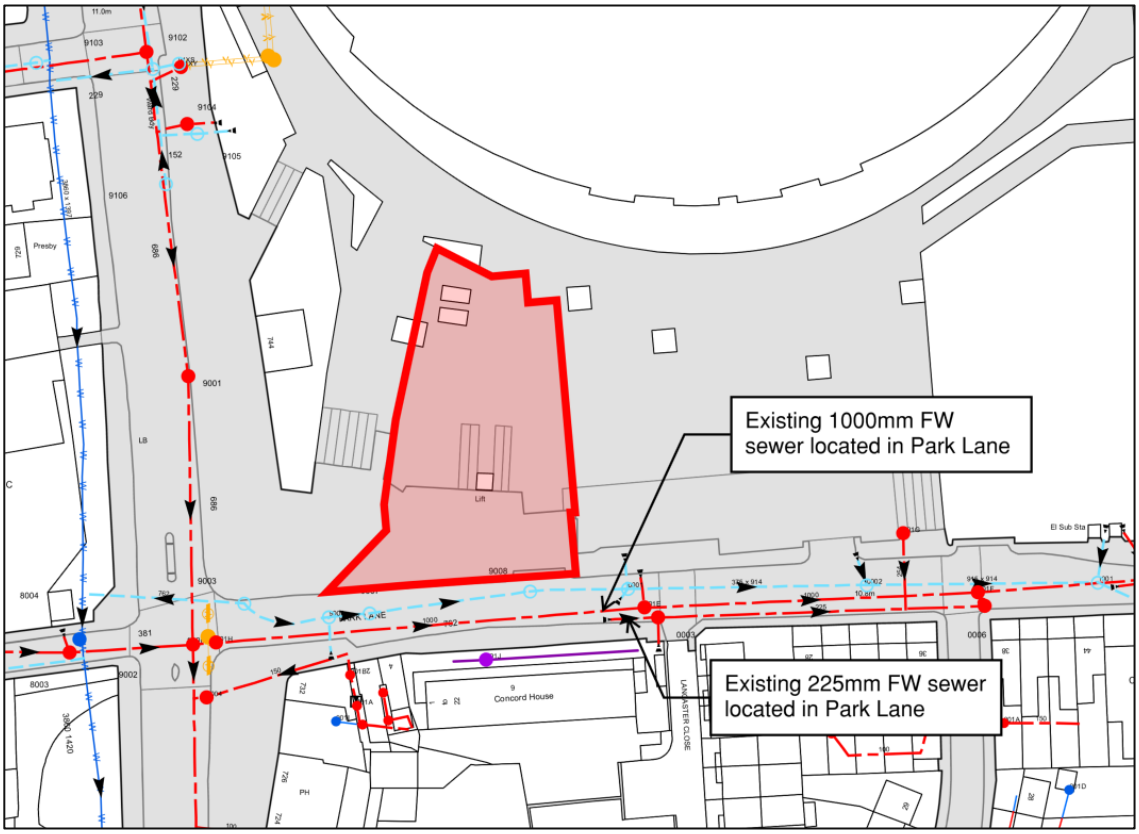

Figure 2-1: Existing foul drainage arrangements

The existing hotel site consists of a basement car park and public realm area around the THFC stadium which was constructed as part of the NDP. The basement area currently drains to a foul pumping station located to the north of the basement which discharges to the existing gravity sewer located the High Road. This pumping station also currently collects the surface water runoff that enters the hotel site.

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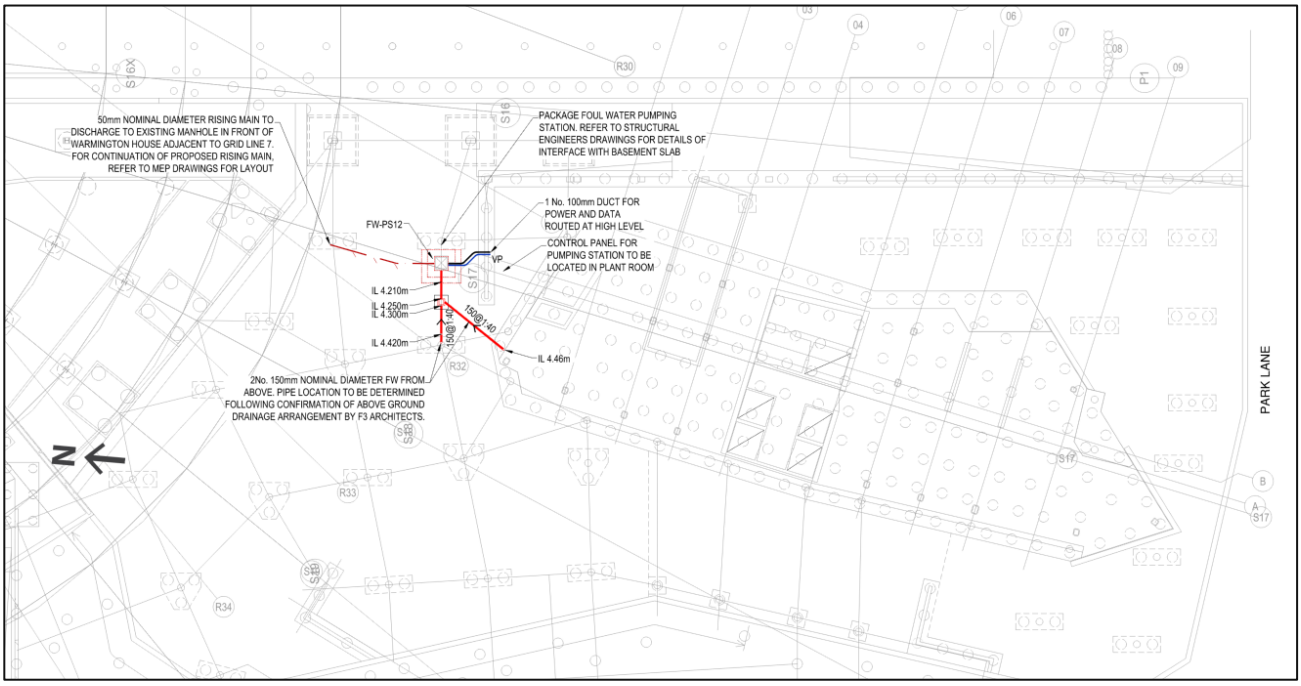

Figure 2-2: Existing foul pumping station

2.3 Proposed Foul Drainage Strategy

2.3.1 Estimated Foul Loading

An initial assessment of the foul water discharge rates for the hotel (commercial) and residential units in the THFC Hotel development are given in

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Table 2-1. This has been made using the following assumptions:

- Foul discharges for the residential units have been calculated based on the highest estimated number of residential units and residential foul water generated at a peak rate of 4,000 litres/unit/day in line with the latest Water UK Sewerage Sector Guidance (SSG, Appendix C, version 2.1).

$$Peak\ Foul\ Flow\ Rate\ = \frac{Units\ \times 4{,}000\, litres/unit\ /day}{24\ \times 60\ \times 60}$$

- Foul discharges for commercial units have been calculated based on non-residential floorspace, 0.6 l/s/ha for domestic use and 0.7 l/s/ha for trade effluent (SSG, Appendix C, version 2.1).

$$Peak\ Foul\ Flow\ Rate\ =\ Floorspace\ \times 1.3\, litres/second\ /hectare$$

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Table 2-1: Summary of estimated peak foul water discharge rates from the NDP Hotel

Building Use	Number of Units	Floorspace (GIA) (ha)	Peak Foul Flow Rate (l/s)	Discharge Locations
Hotel	180	1.37	8.33	1000mm – Park Lane via 150mm sewer
Commercial	-	0.26	0.34	
Residential	49	1.12	2.27	
Total		**2.75**	**10.94**	

Based on the existing hotel site not having a foul discharge, there will be an increase of 10.94 l/s in the foul water discharge as a result of the proposed development.

2.3.2 Discharge location

As part of the NDP design a 150mm diameter sewer with a capped stub connection for the future hotel was designed to serve this plot.

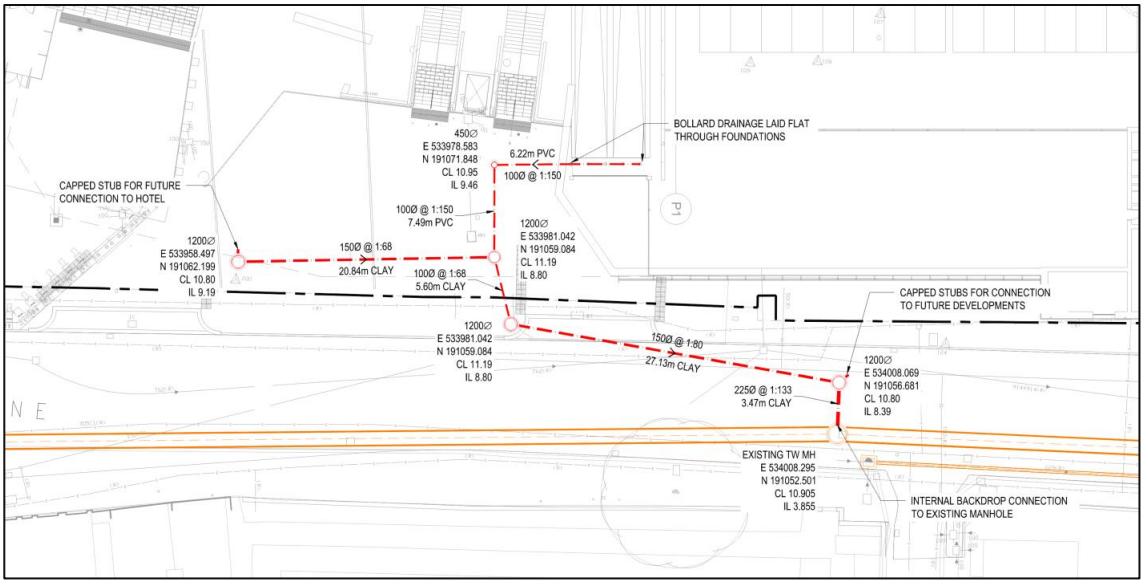

Figure 2-3: Existing approved foul drainage arrangements

This existing approved drainage arrangement was designed to run along the southern perimeter of the hotel along Park Lane with an invert level of 9.19m AOD suitable for connection at L00.

The 150mm diameter sewer with a capped end proposed to serve the future hotel was not installed as part of the wider Northumberland Development Project in 2018 as the sewer was not required at the time. This private sewer is proposed to discharge to the 1000mm diameter TW sewer located in Park Lane at manhole MH0001E.

As part of the S73 application, the hotel development is proposed to discharge to the same point of connection to the TW network at manhole MH0001E however it is intended for the upstream arrangement to be adjusted to suit the updated scheme. This drainage arrangement is as detailed in

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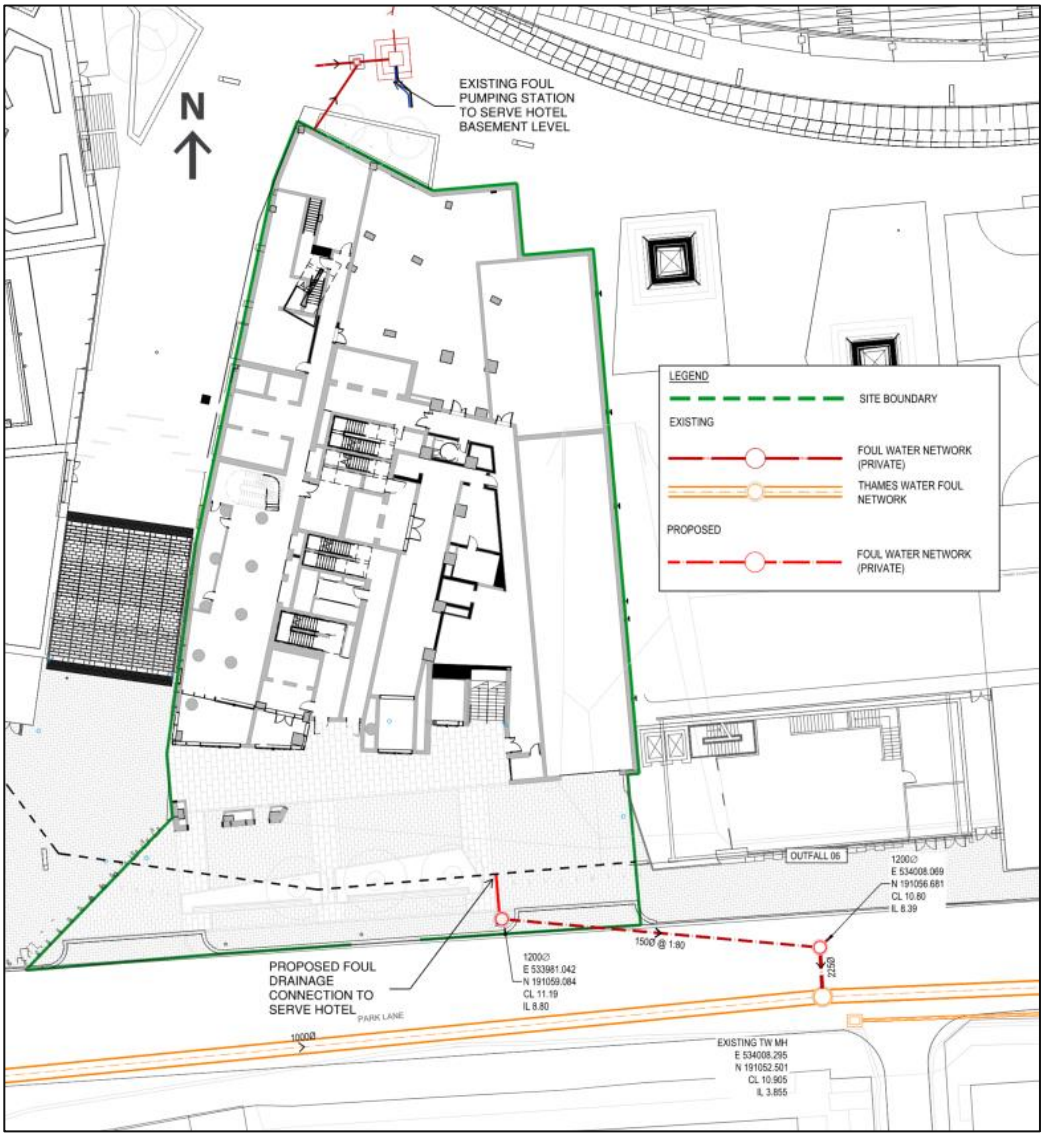

Figure 2-4:

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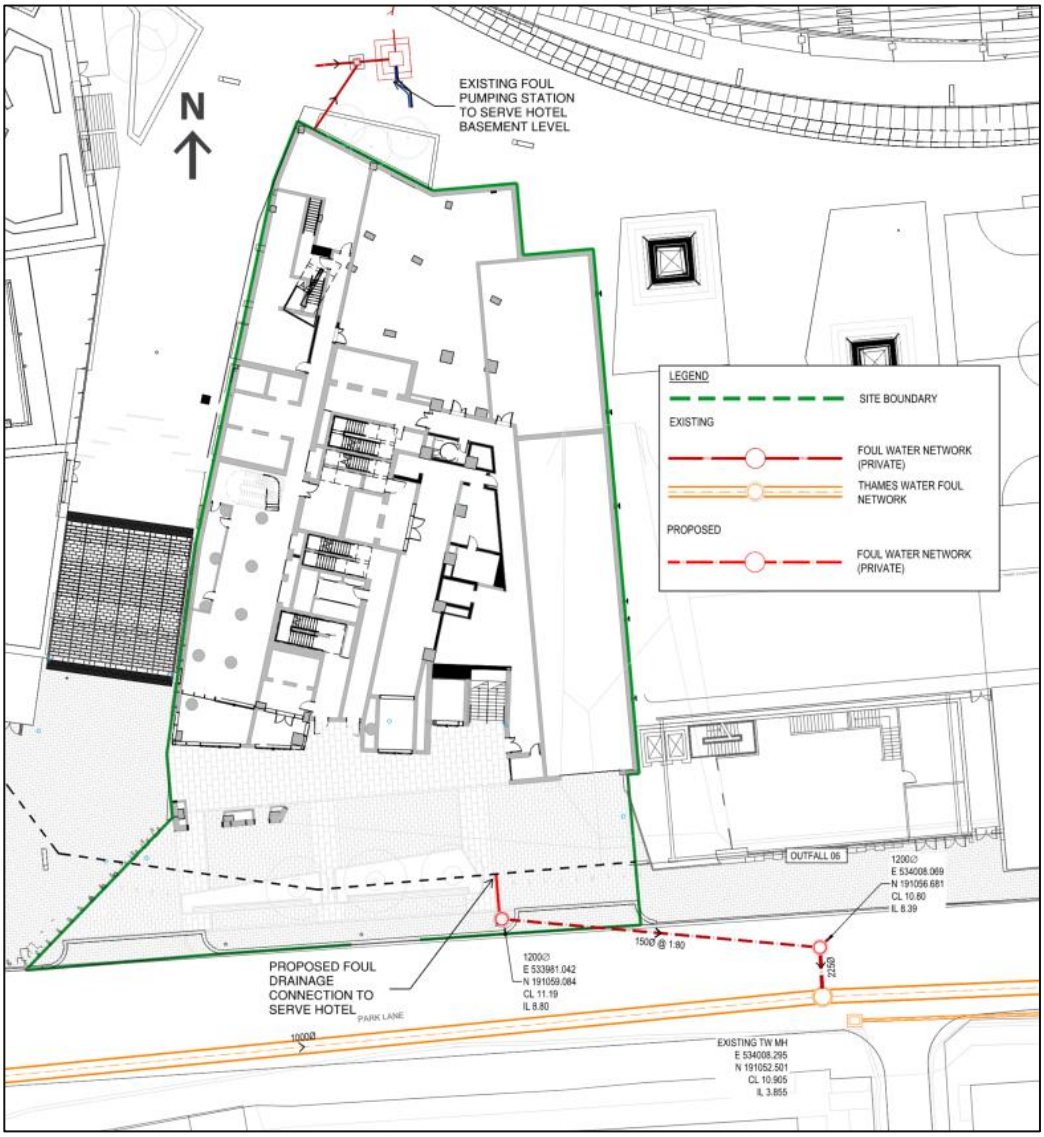

Figure 2-4: Proposed foul drainage arrangement

2.4 Thames Water Consultation

The foul water flows anticipated to be generated from the site represent an increase from the estimated foul water discharged to the TW sewer network from the existing development. TW were consulted as part of the wider NDP which accounted for foul discharge from the future hotel construction at this location as part of the original drainage strategy. A pre-development enquiry has been submitted to TW in order to present the proposed drainage strategy and to understand the potential impact of the foul water flows on the existing TW network.

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3 Surface Water Drainage Strategy

3.1 Relevant Policy & Guidance

The National Planning Policy Framework[1] (NPPF) provides national policy for dealing with surface water, with a focus on sustainable development. NPPF requires that developments incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate and to include mitigation for the anticipated impacts of climate change.

In accordance with the NPPF (2021), the London Plan[2] (2021), LBH Strategic Policies[3] 2013 (with alterations adopted July 2017) ("SP"), LBH Development Management DPD (adopted July 2017) ("DM DPD"), Site Allocations DPD (adopted July 2017) ("SA DPD") and Tottenham Area Action Plan (adopted July 2017) ("TAAP"), consideration of suitable sustainable drainage systems for the Proposed Development is required. Policy and guidance that has influenced the design of the proposed drainage networks are summarised below.

3.1.1 National Standards – Non-statutory technical standards for sustainable drainage systems (SuDS)

The CIRIA C698 technical standards for SuDS are referenced in the Haringey local guidance for surface water design (ref: "Principles of SuDS"). These standards include the following relevant criteria:

Peak flow control

- *S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

Volume Control

- *S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.*
- *S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 [or S5] above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.*

Flood risk within the development

- *S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.*
- *S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*
- *S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property."*

[1] Ministry of Housing, Communities and Local Government (2021). *National Planning Policy Framework*.
[2] Greater London Authority (2021). *The London Plan: The Spatial Development Strategy for Greater London, March 2021*.
[3] London Borough of Haringey (2017). *Haringey's Local Plan: Strategic Policies 2013* (with alterations adopted July 2017).

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3.1.2 The London Plan

The London Plan, Policy SI 13 Sustainable drainage:

A. Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B. Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1. Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2. Rainwater infiltration to ground at or close to source
3. Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4. Rainwater discharge direct to a watercourse (unless not appropriate)
5. Controlled rainwater discharge to a surface water sewer or drain
6. Controlled rainwater discharge to a combined sewer.

C. Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D. Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

3.1.3 Haringey's Local Plan

The London Borough of Haringey, Development Management Development Plan Document (DPD)[4], Policy DM25 Sustainable Urban Drainage Systems:

A. All proposals for new development must seek to manage surface water as close to its source as possible in line with the London Plan drainage hierarchy.

B. The Council will require Sustainable Drainage Systems (SuDS) to be sensitively incorporated into new development by way of site layout and design, having regard to the following requirements:

a. All major development proposals will be required to reduce surface water flows to a greenfield run-off rate for a 1 in 100 year critical storm event;

b. All minor development proposals should aim to achieve a greenfield run-off rate and, at a minimum, achieve a 50 per cent reduction on existing site run-off rates;

[4] London Borough of Haringey (2017). *Development Management DPD*.

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c. All other development should seek to achieve a greenfield run-off rate and include at least one 'at source' SuDS measure resulting in a net improvement in water quantity or quality discharging to a sewer; and

d. For all development where a greenfield runoff rate cannot be achieved justification must be provided to demonstrate that the run-off rate has been reduced as much as possible.

C. Where Sustainable Drainage Systems are implemented they will be expected to:

e. Meet the requirements set out in the Council's relevant local standards and guidance, or national standards where agreed;

f. Incorporate measures identified in the Surface Water Management Plan;

g. Be designed to maximise biodiversity and local amenity benefits, and where appropriate, ensure that SuDS techniques provide for clean and safe water at the surface;

h. Improve water quality; and

i. Function effectively over the lifespan of the development.

Where SuDS cannot be implemented due to site constraints (such as land contamination or space limitations) robust justification must be provided along with proposed alternative sustainable approaches to surface water management.

The London Borough of Haringey, Strategic Policies 2013, Policy SP5 Water Management and Flooding:

The Council will require all development in Haringey to be water efficient during construction and operation and to reduce all forms of flood risk. All development shall:

- *Improve the water environment, water quality and drainage systems;*
- *Minimise water use and illustrate how development would contribute to general and flash flooding;*
- *Take account of flood risk vulnerability classification as set out in paragraph 100 of the NPPF and will apply the NPPF Sequential Test and Exception Test;*
- *Implement measures to prevent (or mitigate as last resort) local surface water and downstream flooding;*
- *Implement Sustainable Drainage Systems from strategic to individual site level to improve water attenuation, quality and amenity;*
- *Restore and enhance the Blue Ribbon Network including Pymmes Brook, Moselle Brook, the River Lee and its tributaries, deculverting wherever feasible, to improve water quality and amenity of these waterways and to help reduce flood risk (in line with London River Action Plan); and*
- *Require higher resilience and levels of flood protection for critical infrastructure to ensure the protection of essential services such as water and power.*

3.2 Existing Surface Water Sewer Network

Existing surface water drainage infrastructure includes a 225mm diameter TW sewer which runs from west to east along Park Lane and increases to a 375mm diameter sewer from Lancaster Close onwards.

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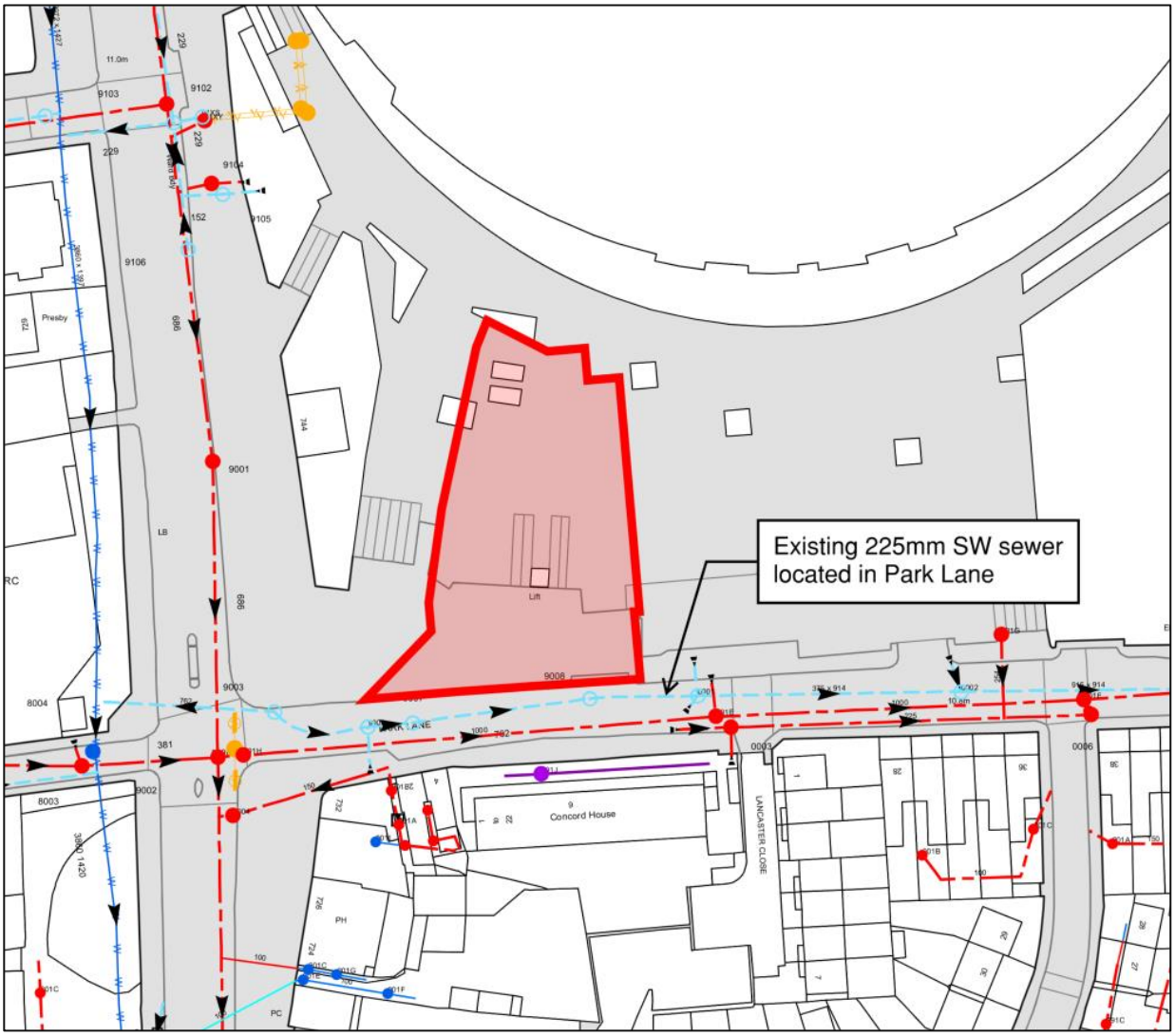

Figure 3-1: Existing surface water drainage arrangements

Existing surface water drainage in the hotel basement area currently discharges to an existing foul pumping station at the north of the site. The surface water drainage will need to be disconnected from this pumping station on completion of the hotel development when the proposed surface water drainage network is in place.

3.3 Climate Change

The climate change allowances are based on Table 3-1 Peak Rainfall Intensity Allowance in Small Catchments (less than 5km^2) or Urban Drainage Catchments (based on a 1961 to 1990 baseline), produced by the Environment Agency[5] (EA).

[5] Environment Agency (2020). *Flood risk assessments: climate change allowances*. [online] Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. [Accessed 12 May 2021].

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Table 3-1: Peak Rainfall Intensity Allowance in Small Catchments (less than 5km^2) or Urban Drainage Catchments (based on a 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

For the proposed development, the site is considered at the upper end and the design life of the building is more than 50 years. From the table, the potential change in the peak rainfall intensity allowance anticipated is 40%.

It is worth noting that for the original NDP development a climate change allowance of 20% was used in line with planning policy and guidance at the time. The revised THFC Hotel development will need to allow for 40% climate change allowance in line with current legislation.

3.4 Sustainable Urban Drainage Systems (SuDS)

The proposed development considers the use of sustainable drainage techniques in accordance with the NPPF, the London Plan 2021 and the Haringey Planning Policy. The London Plan 2021 contains a hierarchy of sustainable methods of capturing and storing rainwater in a descending order: from drainage into the ground to recharging water resources. Where infiltration is not possible, surface water should be stored on site in open water features and then released at a controlled rate. The final option is to store surface water in tanks or cellular storage.

The purpose of SuDS is to mimic the natural run off characteristics of the site and remove pollutants from the urban run off at source.

A summary of the drainage options identified within these drainage hierarchies and the application of these to the proposed development is given in Table 3-2.

Table 3-2: **Summary of proposed surface water drainage options in accordance with the London Plan drainage hierarchy**

Drainage Option	Proposed Development
Rainwater use as a resource (rainwater harvesting, blue roofs for irrigation)	The collection and storage of rainwater for later use within the building and across the site will be developed at detailed design stage for each of the buildings. For the purposes of this report, it is assumed that there will be no reuse of rainwater, as this represents the most conservative scenario.
Rainwater infiltration to ground or close to source	According to the British Geological Survey, nearby historic boreholes suggest that the underlying ground conditions consist of impermeable London Clay. It is therefore considered that infiltration SuDS techniques are not suitable for the site.
Attenuation within green infrastructure for gradual release (green roofs, rain gardens, etc.)	Below ground attenuation with bioretention areas from the raised planters have been proposed to the south of the development in the entrance area to attenuate surface water in order to reduce the peak flow rate of surface water being discharged to the local sewer network.
Discharge directly to a watercourse	Nearest watercourse is the Moselle River (culverted) located in High Road approximately 50m to the west of the development. It is not feasible to discharge to this watercourse as it is not in close proximity to the site
Discharge to a surface water sewer	The surface water from the THFC Hotel development is proposed to discharge to the existing TW surface water sewer located in Park Lane via attenuation and a flow restriction device. This attenuation will limit the flow rate of surface water entering the surface water network.
Discharge to combined sewer	Not applicable

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3.4.1 SuDS Techniques for the Proposed Development

Given the site is partially developed there are few opportunities for the implementation of SuDS features in this parcel of land.

Bioretention Systems

Bioretention systems are small landscaped depressions that can reduce runoff rates and volumes, whilst providing a form of treatment by filtering the run off through engineered soils and vegetation. Planted areas and tree pits across the site can be utilised as bioretention systems.

Geocellular storage crates provide an underground storage structure with a high void ratio that is suitable for attenuating surface water flows. The flows can be released either into the in-situ ground through infiltration (if ground conditions permit), or into the public sewer drainage system via flow control devices.

Due to the restricted external space for other SuDS, underground storage structures will form part of a series of attenuation features which will contribute to attenuating the 1:30 and 1:100 year storm events.

Bioretention attenuation is proposed at front of the hotel on Park Lane.

3.5 Catchment Analysis

The areas that contribute to surface water runoff have been calculated using the runoff coefficients for the proposed surfacing types.

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Figure 3-2: Surface water catchments

A summary of the contributing areas for the development are detailed in Table 3-3 below:

Table 3-3: Contributing Areas

Land Use	Area (ha)	Runoff Coefficient	Effective Area (ha)
Hard Landscaping	0.129	0.9	0.116
Impermeable Roof	0.104	0.95	0.098
Total	0.233	-	0.214

3.6 Pollution Control

Each of the attenuation systems deployed on the network contributes to pollution control. The process of infiltration, which is a key principle in permeable surfaces, and tree pits, removes silt and pollutants from run-off, and prevents the egress of wind-borne debris into the network. Silt traps and permeable geo-textiles will be deployed on the cellular storage systems to a similar effect.

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3.7 Maintenance of SuDS

Regular maintenance of the sustainable urban drainage system is essential to maintain its performance for the entire lifespan of the development and to avoid failure of the mechanical/electrical components.

It is anticipated that the maintenance of the SuDS features particularly the geocellular storage will be undertaken by an experienced contractor. The suppliers of SuDS products will normally offer a maintenance contract for periodic inspections to check for blockages and flushing of the system to remove silt and debris that has built up in the system over time.

For the planted areas, early maintenance should involve regular inspection, removal of invasive vegetation and possibly irrigation during long dry periods, particularly in soils with high void ratios. Appropriate irrigation schedules should be developed with the expertise of an arboriculturist/landscape architect with local knowledge.

An agreed maintenance regime and programme is to be developed in accordance with the equipment manufacturers recommendations. See Appendix E for SuDS Maintenance Plan for further details.

3.8 Discharge Rate

The surface water drainage strategy for NDP is based on an allowable discharge of 150l/s/ha totalling 1260l/s for the entire 8.4ha development site. This has been agreed in principle with the Environment Agency. Thames Water has stipulated that discharge will be restricted to the capacity of the existing connections.

The podium and ground level catchments (G3) were transferred from Outfall 05 to Outfall 06 (planning application flow rate 7.4 l/s) and Outfall 05 has been left to address the surface water discharges from the hotel only (planning application discharge rate 4.4 l/s):

Table 3-4: Surface water discharges to Park Lane sewer from Building Control report

Outfall Reference	Catchment Reference	Catchment Area (ha)	Planning Application Flow Rate (l/s)	Design Flow Rate (l/s)	Storage Volume (m3)	Comments
Outfall 05	D (Hotel)	0.07	4.4	4.4	-	
	G3 (Ground Level)	-	7.6	0	-	G3 catchment omitted from Outfall 05 and included into Outfall 06 catchment
Outfall 06	E (Residential Roof)	0.147	10	10	-	
	G3 (Ground level) + Area 6_0 (Podium Level)	0.117	0	7.4	17	7.4 l/s Design flow transferred from Outfall 05 (Planning application flow rate)

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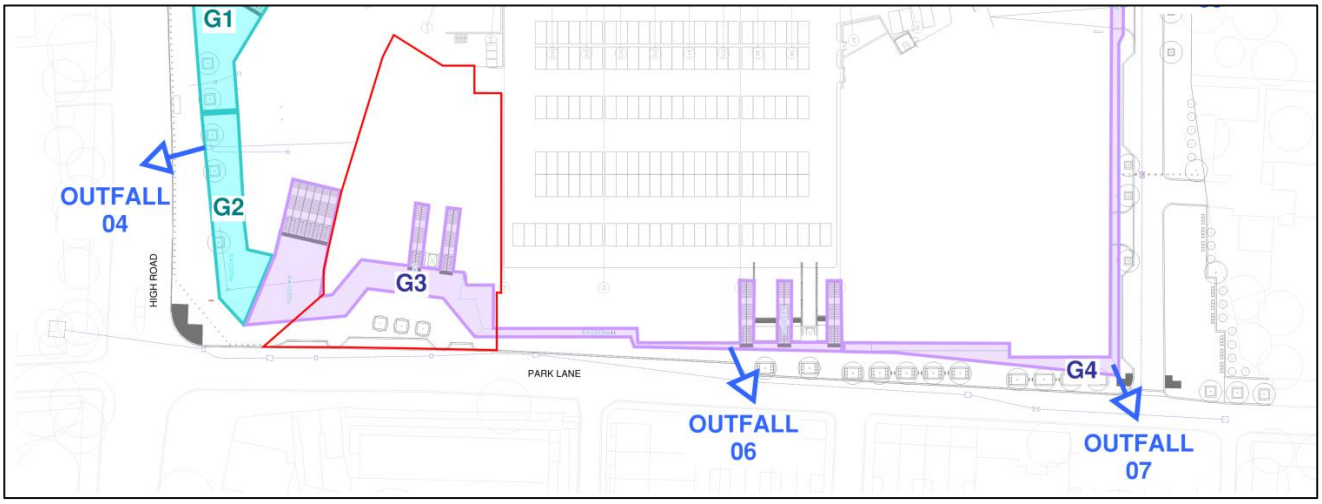

Figure 3-3: Surface water catchments ground level 00

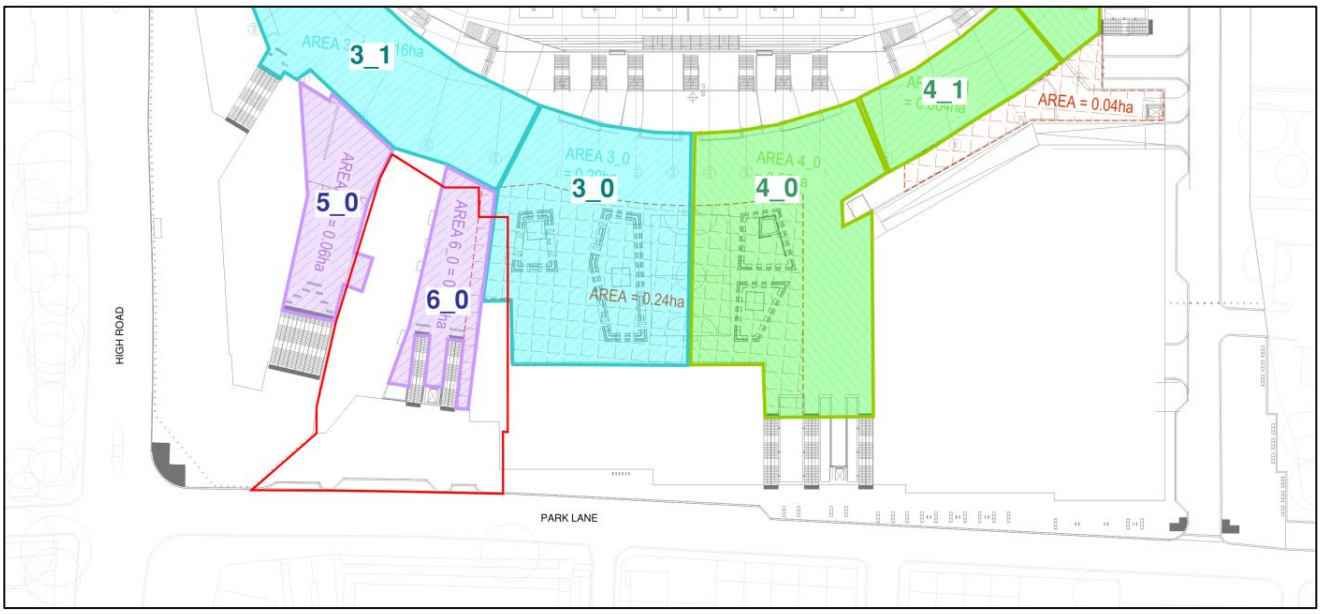

Figure 3-4: Surface water catchments podium level 01

The S73 amendments to the scheme within the hotel development site do not fundamentally change the drainage strategy for the podium and ground level hard landscaped surfaces from those proposed under the original planning submission (ref: HGY/2015/3000). These areas are to discharge to Outfall 06 as they are currently.

The hotel area is to discharge to Outfall 05 at 4.4 l/s.

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3.10 Proposed Surface Water Drainage Strategy

As part of the original drainage strategy for NDP, final design drawings indicate a proposed sewer to connect to TW MH9006 (Outfall 05), this sewer has a maximum allowable discharge rate of 4.4l/s to serve the hotel as agreed as part of the planning application submitted for the THFC Stadium and NDP development. The existing podium area and ground level area which falls within the S73 red line boundary drains to existing TW manhole 0001 via S11. Figure 3-6 and Figure 3-6 detail Outfall 05 and the existing podium drainage relevant to the proposed hotel development:

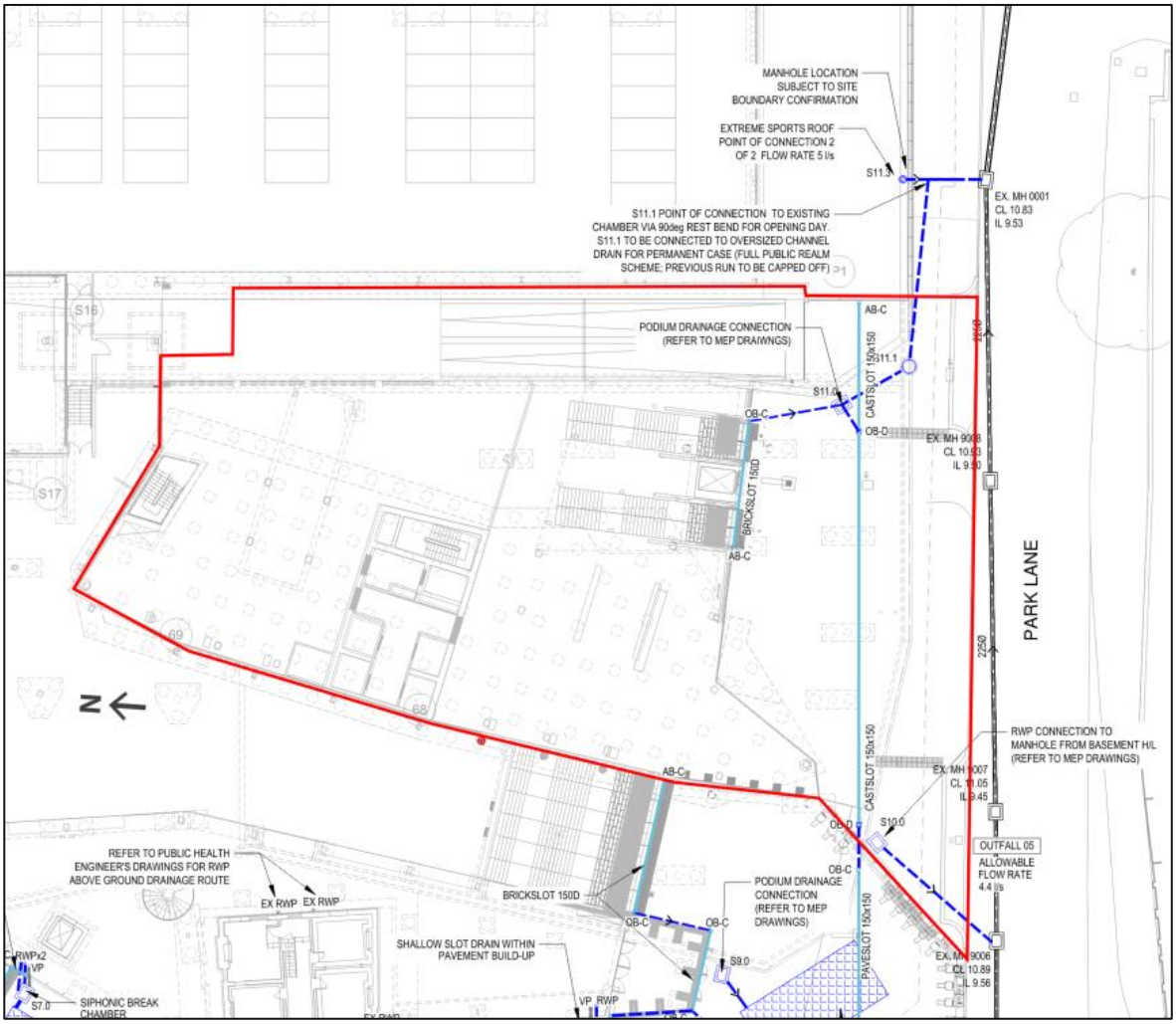

Figure 3-5: Existing approved surface water drainage arrangements L00

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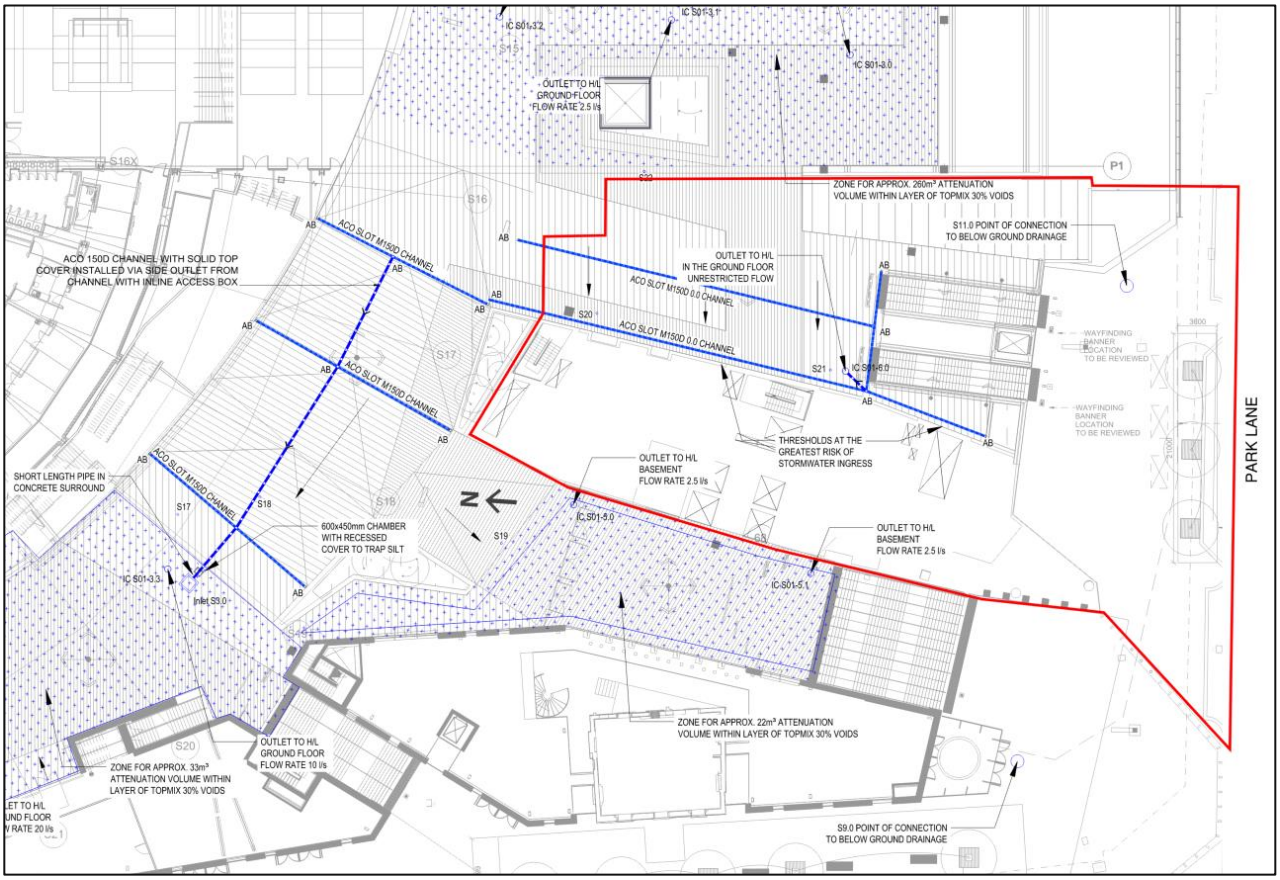

Figure 3-6: Existing approved surface water drainage arrangements L01

Records indicate that the S10 surface water drainage run to serve the hotel has not been installed during the earlier phases of the NDP development.

Within the boundary of the S73 variation for the hotel, the surface water drainage strategy for the hard landscaped areas on the ground level 00 and podium level 01 remains unchanged with these areas proposed to drain via a series of ACO linear drainage channels at podium level prior to discharging to the network at ground level and then finally discharge to the 225mm TW sewer in Park Lane at Outfall 06.

Material changes to the locations of the ACO drainage channels to pick up the surface water runoff in these areas are to be altered in order to accommodate the hotel development and floor gullys are proposed to pick up surface runoff in the new podium area at the south of the site onto Park Lane above the existing stairs. Despite the changes to the ACO linear drainage channels and inclusion of floor gullys to collects surface runoff, the fundamental impermeable

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catchment area (podium and ground level) and discharge location to Outfall 06 remain unchanged.

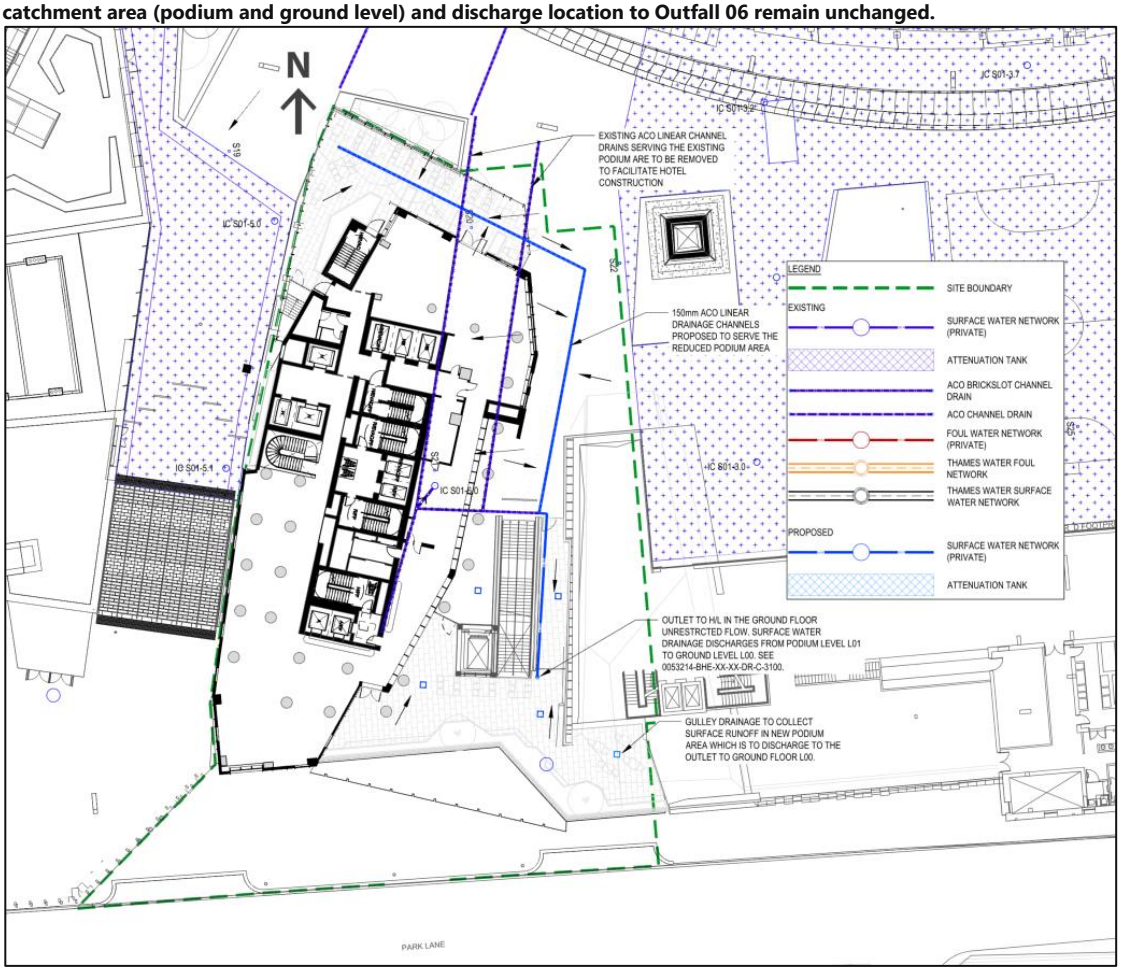

Figure 3-7 below details the proposed amendment to the podium drainage to accommodate the new footprint for the hotel.

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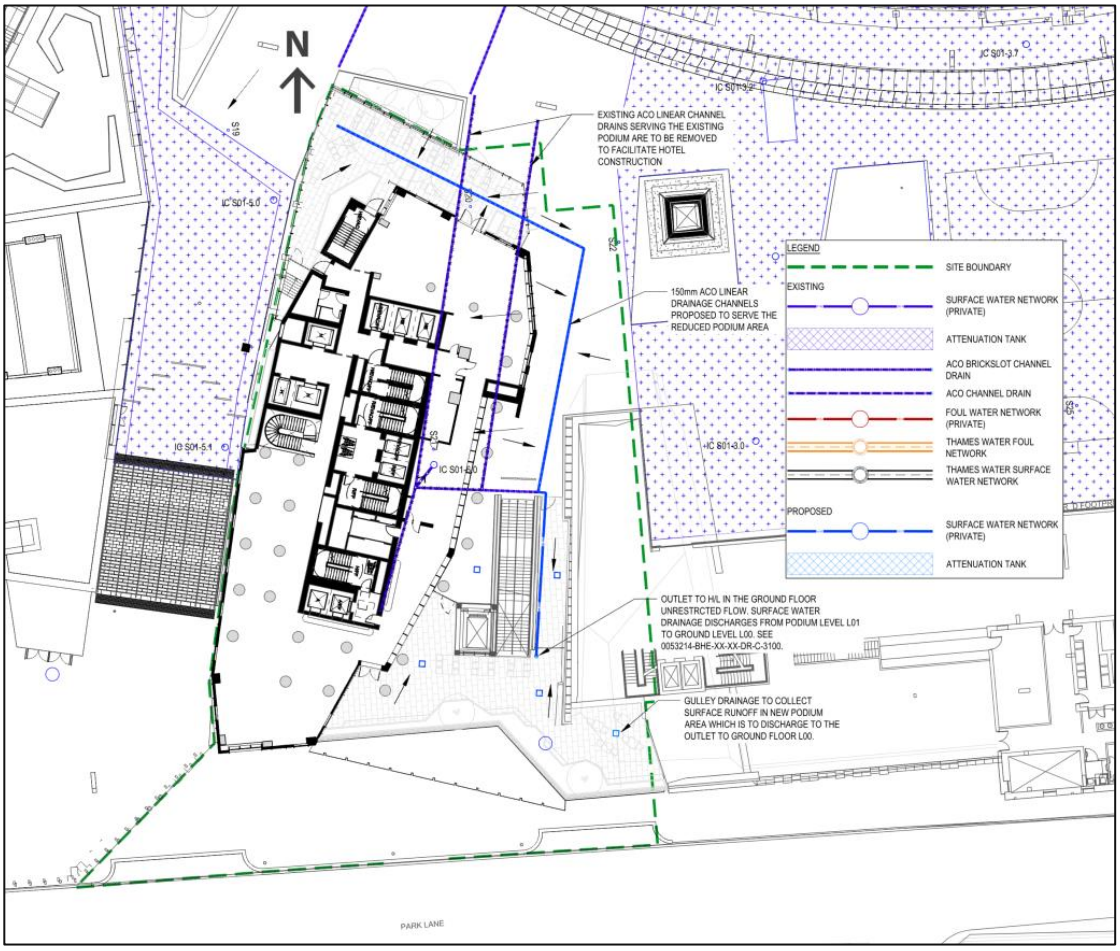

Figure 3-7: Proposed surface water drainage podium level L01

Regarding the hotel area, this has increased from the area in the original submission (0.07ha to 0.10ha) and therefore the catchment area of the hard landscaped areas at ground level 00 and podium level 01 have reduced.

It is proposed for the hotel to discharge at the previously agreed discharge rate of 4.4l/s to the TW network whilst making additional allowance for attenuation to accommodate the 1 in 100 year + 40% climate change storm event.

Microdrainage Quickstorage estimate was carried out based on a 4.4l/s restriction and the hotel catchment area which indicates that approximately 42 to 61m^3 of attenuation is required to restrict surface water from the hotel development site to 4.4l/s.

Upstream of Outfall 05, 51m^3 of attenuation and flow control device are proposed to capture runoff from the hotel and the hard landscaped areas at podium level L01 and ground level L00 are to continue to discharge to Outfall 06 as they do currently.

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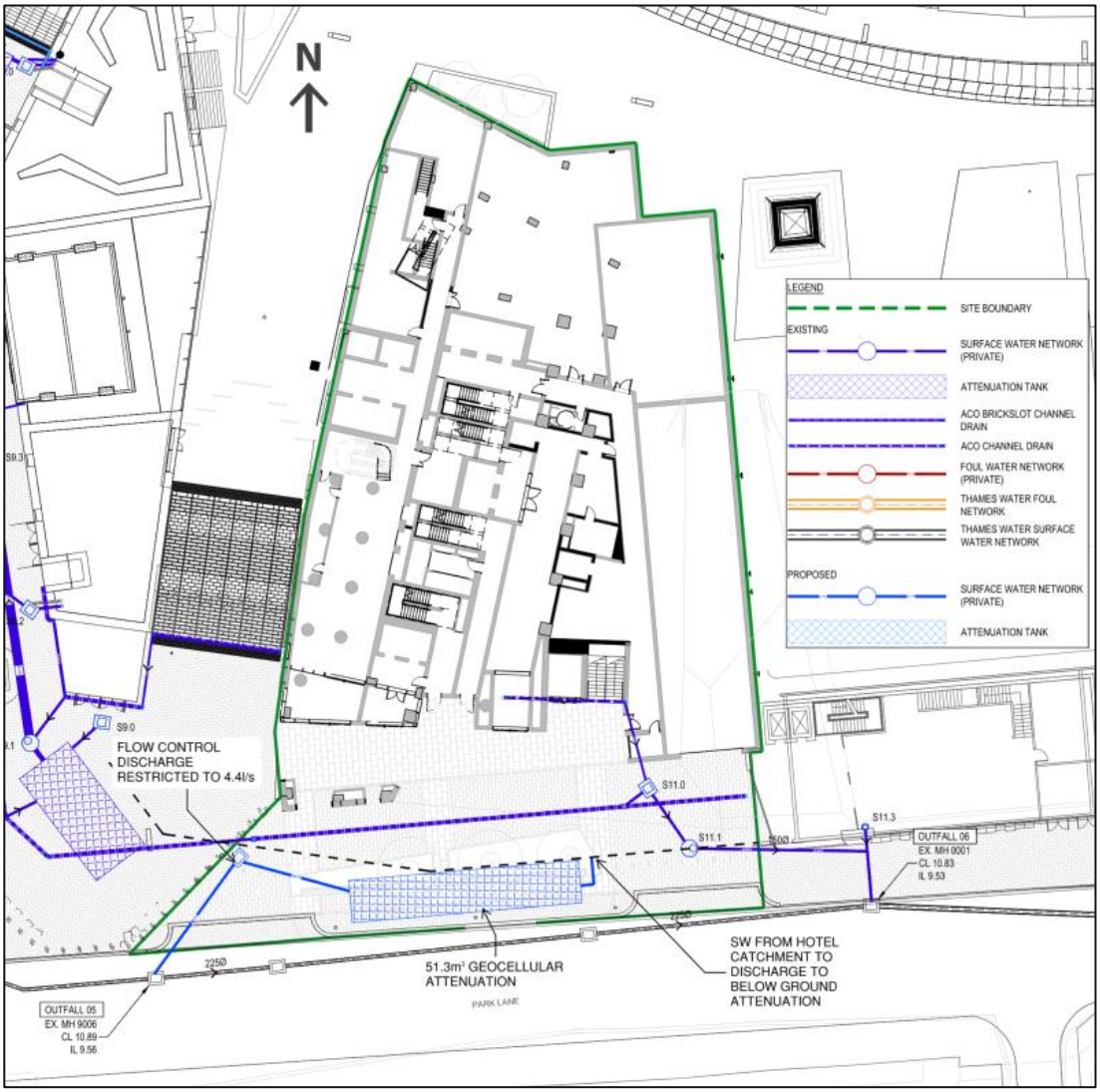

Figure 3-8: Proposed surface water drainage at ground level L00

3.11 Exceedance Flows

The development site has marginal falls to the south towards Park Lane. Much of the podium levels are existing to be retained and drain from a high point of 17.07m southwards. At ground level there are high points of 10.90m and 10.88m either side of a central linear drainage channel which is existing and to be replaced with the proposed resurfacing associated with the hotel development.

All levels fall away from building entrance thresholds.

Should one of the drainage features in the podium or ground floor areas fail and result in surface water to overflow, the surface water should run along the surface to the next drainage feature. The attenuation for the hotel catchment has been sized to prevent flooding for the 1 in 100 year rainfall event with a 40% allowance for climate change.

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3.12 Thames Water Consultation

TW were consulted as part of the wider NDP which accounted for surface water discharge from the future hotel construction at this location as part of the original drainage strategy. A pre-development enquiry has been submitted to TW in order to present the proposed drainage strategy and to understand the potential impact of the surface water flows on the existing TW network.

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4 Summary

The proposed surface water discharge rate for the development has been reduced to 4.4 l/s which is in line with the agreed discharge rate for the hotel as part of the original NDP development scheme. The hotel development is proposed to discharge to the existing 225mm sewer (MH 9006) via bioretention attenuation to the south of the development adjacent to Park Lane.

The surface water drainage strategy has been developed in accordance with the drainage hierarchy set out in the London Plan. The surface water strategy has been developed to attenuate surface water in a combination of below ground drainage systems in the form of below ground geocellular storage / tree pit attenuation. The implementation of SuDS features will help to attenuate and reduce the surface water discharge rate from the proposed development.

The proposed peak foul water discharge rate for THFC Hotel is 10.94 l/s which is proposed to discharge to the existing 1000mm foul sewer located on Park Lane via TW manhole 0001E.

Consultation with TW has been carried out as part of a pre-development enquiry for the proposed development. We are currently awaiting response from TW to confirm whether they have any objection to the proposed drainage strategy.

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Appendix A Thames Water Asset Map

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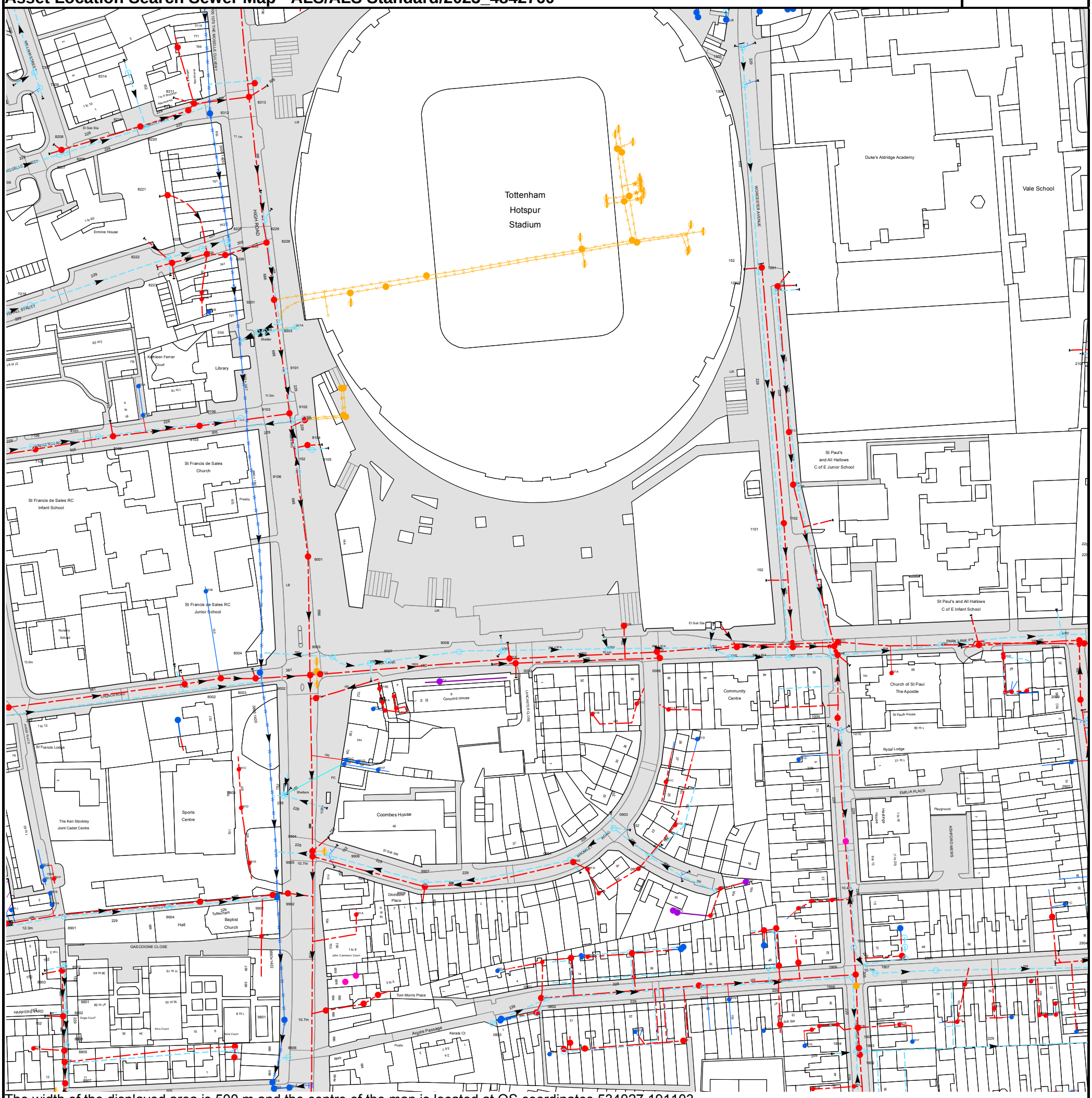
Asset Location Search Sewer Map - ALS/ALS Standard/2023_4842760



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 534027,191103

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.

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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
2101	11.01	10.39
13XS	n/a	n/a
13XW	n/a	n/a
211A	n/a	n/a
2001	10.71	9.21
201E	10.41	8.41
20TX	n/a	n/a
201D	n/a	n/a
20VQ	n/a	n/a
20TY	n/a	n/a
20TZ	n/a	n/a
20VP	n/a	n/a
2003	10.55	9.16
201C	n/a	n/a
2002	10.18	7.62
2009	10.01	8.98
201F	10.13	3.22
2004	10.19	9.34
2902	10.15	8.78
191D	n/a	n/a
091E	n/a	n/a
0904	10.31	9.44
1903	10.45	9.05
091J	n/a	n/a
091D	n/a	n/a
091C	n/a	n/a
101G	n/a	n/a
001D	n/a	n/a
1010	10.51	9.73
1009	10.55	8.87
001A	n/a	n/a
101A	n/a	n/a
0006	10.71	9
1002	10.58	9.34
101E	10.71	9.09
101F	10.66	8.98
101B	10.61	8.63
001F	10.81	3.81
1001	10.78	9.16
101D	10.63	8.67
1004	10.72	8.17
1008	10.61	7.19
101C	10.57	3.44
1101	10.9	9.67
1102	10.9	9.3
111B	11.02	9.19
111A	11.04	7.68
281A	n/a	n/a
281B	n/a	n/a
281D	n/a	n/a
281C	n/a	n/a
29VX	n/a	n/a
291C	n/a	n/a
1909	n/a	n/a
191A	n/a	n/a
181G	n/a	n/a
191B	n/a	n/a
1817	n/a	n/a
181K	n/a	n/a
181A	n/a	n/a
191C	n/a	n/a
181C	n/a	n/a
1906	10.36	8.89
1904	10.34	9.42
181L	n/a	n/a
1905	10.36	8.67
1804	10.24	8.84
181B	n/a	n/a
1801	10.24	8.5
1802	10.2	8.52
1803	10.2	8.83
1907	10.39	9.33
181E	n/a	n/a
0809	n/a	n/a
081C	n/a	n/a
181O	n/a	n/a
1816	n/a	n/a
181N	n/a	n/a
0906	10.16	8.97
0905	10.17	9.04
09WP	n/a	n/a
09XP	n/a	n/a
19VX	n/a	n/a
19VY	n/a	n/a
19WR	n/a	n/a
09WQ	n/a	n/a
09WW	n/a	n/a
09VY	n/a	n/a
09WV	n/a	n/a
19WV	n/a	n/a
19VZ	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
19YV	n/a	n/a
19WS	n/a	n/a
191F	n/a	n/a
091I	n/a	n/a
091H	n/a	n/a
191G	n/a	n/a
191E	n/a	n/a
19XY	n/a	n/a
19XW	n/a	n/a
19XT	n/a	n/a
19XS	n/a	n/a
19XR	n/a	n/a
181F	n/a	n/a
2901	10.32	9.01
281L	n/a	n/a
291B	n/a	n/a
281N	n/a	n/a
281O	n/a	n/a
291A	n/a	n/a
281P	n/a	n/a
281M	n/a	n/a
281Q	n/a	n/a
081P	n/a	n/a
0812	n/a	n/a
0811	n/a	n/a
0808	n/a	n/a
0810	n/a	n/a
0803	10.54	9.6
08YW	n/a	n/a
08YR	n/a	n/a
08YT	n/a	n/a
08YP	n/a	n/a
9812	n/a	n/a
0802	10.35	9.06
0801	10.38	9.45
9813	n/a	n/a
9927	n/a	n/a
091A	n/a	n/a
09TS	n/a	n/a
09TV	n/a	n/a
09WS	n/a	n/a
091B	n/a	n/a
09WY	n/a	n/a
991A	n/a	n/a
091F	n/a	n/a
9908	10.96	8.39
9906	10.66	9.02
9003	10.94	9.56
901E	n/a	n/a
901C	n/a	n/a
901G	n/a	n/a
9006	11.09	9.32
901I	n/a	n/a
901F	n/a	n/a
901B	n/a	n/a
901A	n/a	n/a
9020	n/a	n/a
9007	11.05	9.45
9018	n/a	n/a
9019	n/a	n/a
9907	10.99	8.85
901J	n/a	n/a
9008	10.93	9.5
0001	10.89	9.45
001E	10.88	3.99
0003	10.77	9.74
0901	10.58	9.33
0902	10.56	8.62
091G	n/a	n/a
001B	n/a	n/a
0002	10.78	9.34
0903	10.45	9.42
001G	n/a	n/a
001C	n/a	n/a
8313	11.03	8.57
8333	n/a	n/a
8233	10.77	9.57
8332	n/a	n/a
8229	10.85	10.05
821D	10.85	9
8228	10.86	8.47
9201	10.89	8.35
9203	10.82	9.77
9101	10.74	9.91
9102	10.77	8.25
9103	10.72	9.63
921A	11.14	9.97
91XS	n/a	n/a
91XY	n/a	n/a
03ZX	n/a	n/a
03ZT	n/a	n/a
13WQ	n/a	n/a
13WT	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1303	11.84	11.18
1304	11.82	10.98
1202	11.84	10.38
13WY	n/a	n/a
1201	11.82	9.99
121B	11.81	9.55
121A	11.81	8.45
111C	11.02	7.84
781B	n/a	n/a
791B	n/a	n/a
791A	n/a	n/a
8903	12.35	11.07
8802	12.43	10.94
8901	12.07	11.12
8804	12.38	10.09
8902	12.35	10.49
8806	12.36	10.84
8807	12.18	10.82
8801	12.42	10.11
8803	12.38	10.2
8805	12.34	10.01
8904	11.89	10.82
891F	n/a	n/a
8820	n/a	n/a
8818	n/a	n/a
8819	n/a	n/a
891A	n/a	n/a
8810	10.98	9.01
891G	10.65	8.94
9802	10.95	8.93
9901	10.74	9.12
9801	10.74	9.12
9902	10.65	8.89
9806	10.68	9.52
9803	10.64	9.01
9811	n/a	n/a
9926	n/a	n/a
7106	12.3	9.63
7107	12.29	8.76
791D	n/a	n/a
791C	n/a	n/a
791E	n/a	n/a
791F	n/a	n/a
8101	12.35	9.58
8102	12.37	8.57
80YQ	n/a	n/a
8001	11.85	8.49
801B	n/a	n/a
8002	11.58	8.43
801C	n/a	n/a
891D	n/a	n/a
891E	n/a	n/a
8003	11.18	8.38
8004	11.12	9.27
9903	10.68	9.26
9106	10.65	9.37
9104	10.93	8.68
9001	10.55	8.11
9002	10.81	7.99
9105	10.86	9.57
9904	10.55	7.84
9905	10.54	7.83
9004	10.72	8.86
901H	10.8	4.62
7218	12.72	11.2
7307	12.12	10.95
7306	12.12	11.23
8207	12.22	11.26
8208	12.23	10.64
8209	12.23	10.63
8314	n/a	n/a
811A	n/a	n/a
8219	11.58	10.33
811B	n/a	n/a
8220	11.56	10.3
8221	11.91	10.1
8222	11.86	10.55
8223	11.86	10.06
8331	n/a	n/a
8310	11.3	10.15
8311	11.36	10.09
8103	12.23	8.47
8225	11.41	10.38
821A	n/a	n/a
821C	n/a	n/a
8224	11.37	9.87
821B	n/a	n/a
8312	11.12	9.41
8226	11.08	n/a
8227	11.06	9.33
8106	11.41	9.45
7902	12.25	10.29
7003	12.86	8.84

Manhole Reference	Manhole Cover Level	Manhole Invert Level
791J	n/a	n/a

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.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

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

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

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

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
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- 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.

- Inlet
- Outfall
- Undefined End

Other Symbols

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

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the 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 indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. 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, please contact Property Searches on 0800 009 4540.

Appendix B Proposed Drainage Plan

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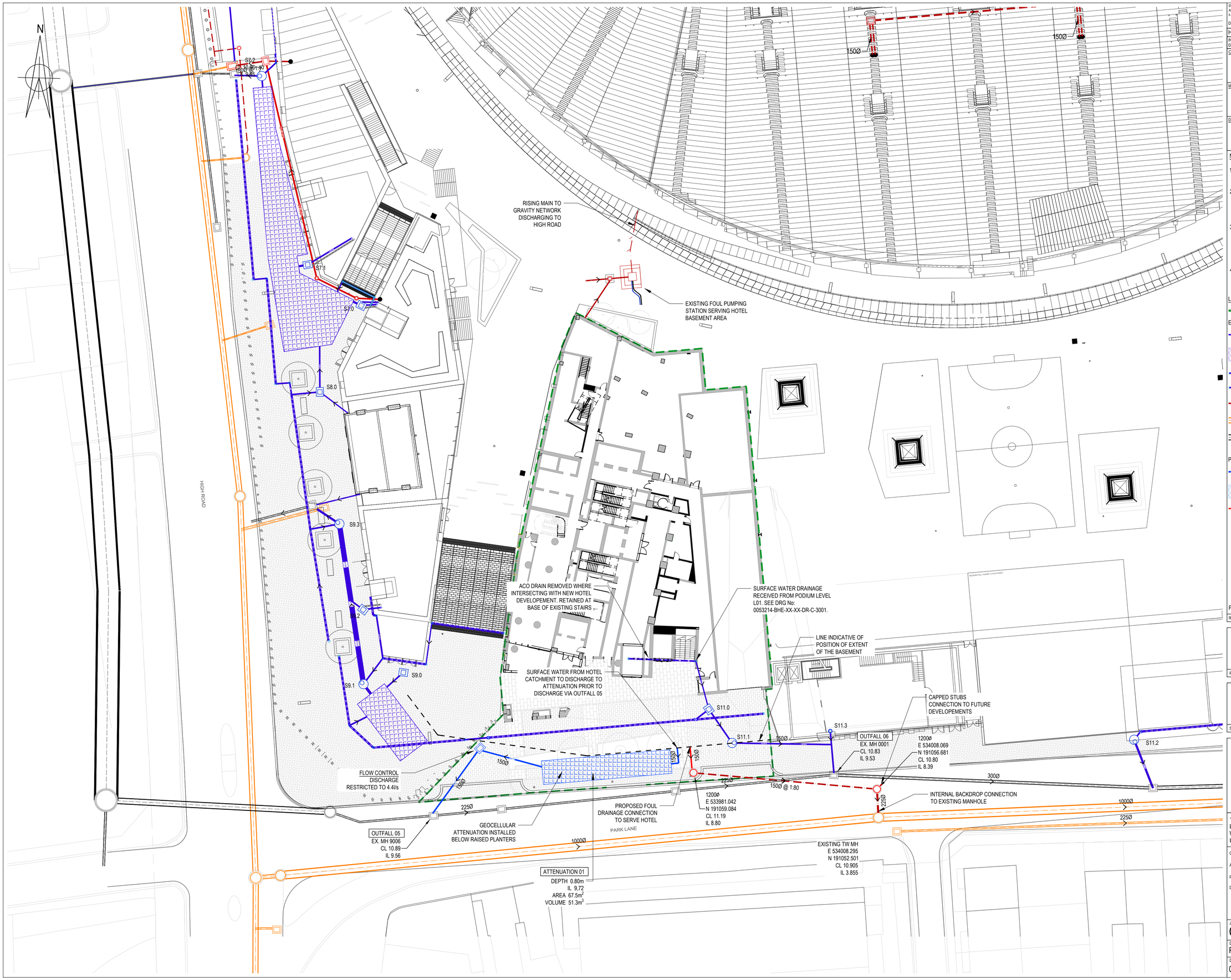

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CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. DRAWING BASED ON THE FOLLOWING BACKGROUND INFORMATION:
   - 27888002-ARP-00-DR-L-1501 LEVEL L00 PLAN RECEIVED 19/07/2023.
3. DRAINAGE LAYOUT BASED ON PREVIOUS BH (BATH) FINAL DRAWINGS:
   - THFC-BHE-XX-L00-DR-CI-4114 (SW)
   - THFC-BHE-XX-L00-DR-CI-3117 (FW)
   - THFC-BHE-XX-L01-DR-CI-4124 (SW)
4. FOR LEVEL L01 DRAINAGE INFORMATION SEE DRAWING No:
   - 0053214-BHE-XX-XX-DR-C-3101.

LEGEND

SITE BOUNDARY

EXISTING

SURFACE WATER NETWORK (PRIVATE)

ATTENUATION TANK

ACO BRICKSLOT CHANNEL DRAIN

ACO CHANNEL DRAIN

FOUL WATER NETWORK (PRIVATE)

THAMES WATER FOUL NETWORK

THAMES WATER SURFACE WATER NETWORK

PROPOSED

SURFACE WATER NETWORK (PRIVATE)

ATTENUATION TANK

FOUL WATER NETWORK (PRIVATE)

Rev	Description	Date	Iss'd	Rev'd	App'd
P01	ISSUED FOR PLANNING	26.07.2023	P.M.	M.J.	L.J.

PLANNING

Project Stage

FOR INFORMATION

Status of Drawing

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Client: THFC

Architect: F3

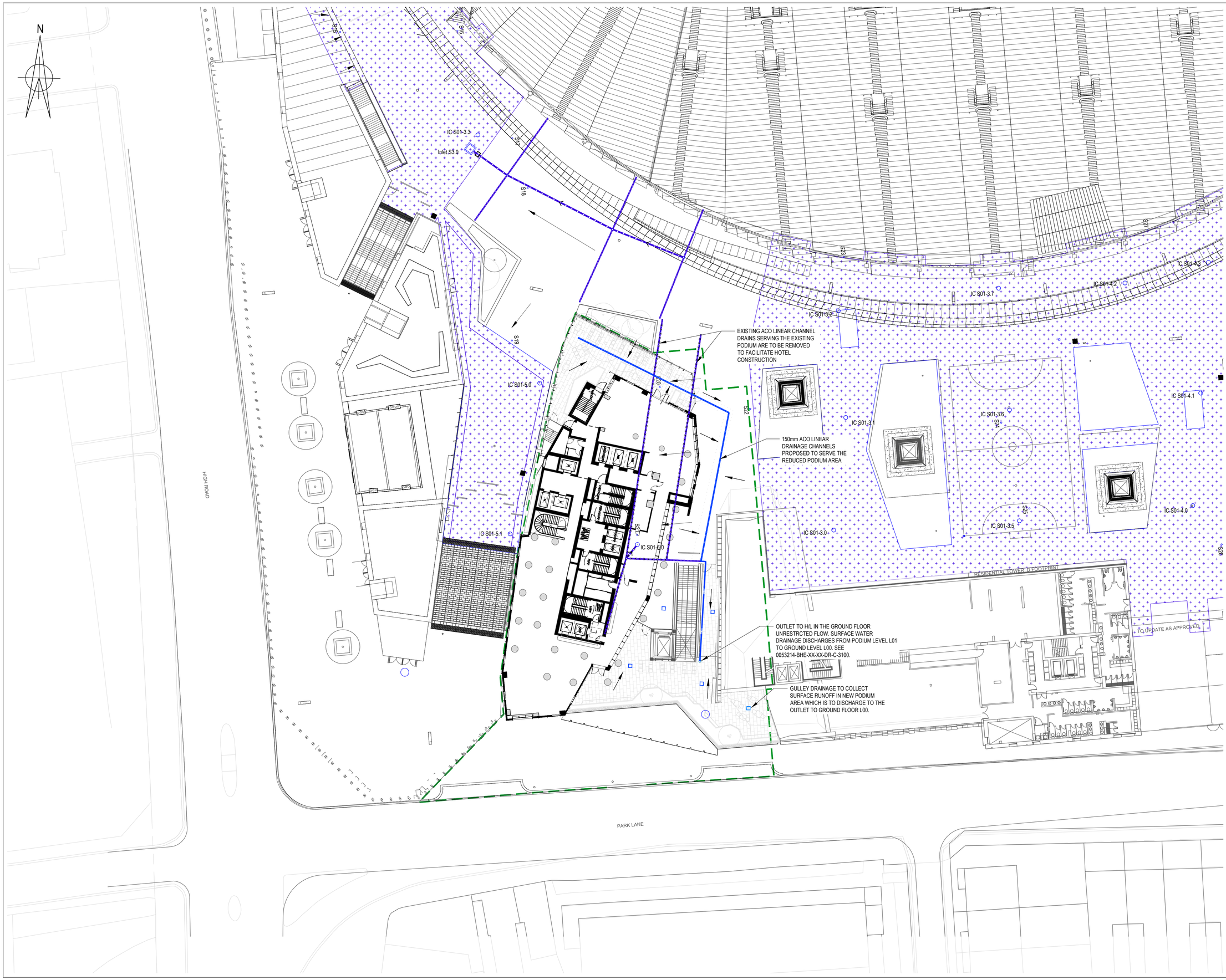
Project: **THFC Hotel**

Drg Title: DRAINAGE PLAN LEVEL 00

Job No.	Scale@A1
0053214	1:250

Drawn/Designed By.	Checked By.	Approved By.
P.McGahan	M.Jones	L.Johnson

Drawing No.	Revision
0053214-BHE-XX-XX-DR-C-3100	P01



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NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. DRAWING BASED ON THE FOLLOWING BACKGROUND INFORMATION:
   - 27888002-ARP-00-DR-L-1502 LEVEL L01 PLAN RECEIVED 19/07/2023.
3. DRAINAGE LAYOUT BASED ON PREVIOUS BH (BATH) FINAL DRAWING:
   - THFC-BHE-XX-L01-DR-CI-4124 (SW)
4. FOR LEVEL L01 DRAINAGE INFORMATION SEE DRAWING No:
   - 0053214-BHE-XX-XX-DR-C-3100.

LEGEND

SITE BOUNDARY

EXISTING

ACO CHANNEL DRAIN (PRIVATE)

ACO SLOT DRAIN (PRIVATE)

PERMEABLE SUB BASE LAYER

PROPOSED

ACO SLOT DRAIN TO BE REMOVED

ACO SLOT DRAIN (PRIVATE)

PROPOSED PIPE (PRIVATE)

FLOW DIRECTION ARROW

PROPOSED GULLEY

Rev	Description	Date	Iss'd	Rev'd	App'd
P01	ISSUED FOR PLANNING	26.07.2023	P.M.	M.J.	L.J.

PLANNING

Project Stage

FOR INFORMATION

Status of Drawing

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Client: *THFC*

Architect: *F3*

Project: **THFC Hotel**

Drg Title: DRAINAGE PLAN LEVEL 01

Job No.	Scale@A1
0053214	1:250

Drawn/Designed By.	Checked By.	Approved By.
P.McGahan	M.Jones	L.Johnson

Drawing No.	Revision
0053214-BHE-XX-XX-DR-C-3101	P01

Appendix C Hydraulic Modelling

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
S1.000	9.858	0.074	133.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	15.495	0.094	164.0	0.091	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	13.217	0.092	144.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.19	9.871	0.000	0.0	0.0	0.0	0.87	15.4	0.0
S1.001	50.00	5.52	9.797	0.091	0.0	0.0	0.0	0.78	13.8	12.3
S1.002	50.00	5.78	9.703	0.091	0.0	0.0	0.0	0.83	14.8	12.3

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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)
S3	11.000	1.129	Open Manhole	1200	S1.000	9.871	150				
S10	11.000	1.203	Open Manhole	1200	S1.001	9.797	150	S1.000	9.797	150	
S10	11.000	1.297	Open Manhole	1200	S1.002	9.703	150	S1.001	9.703	150	
SMH9006	10.890	1.279	Open Manhole	0		OUTFALL		S1.002	9.611	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S3	533976.321	191060.377	533976.321	191060.377	Required	
S10	533966.499	191059.527	533966.499	191059.527	Required	
S10	533951.828	191064.510	533951.828	191064.510	Required	
SMH9006	533944.876	191053.269			No Entry	

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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)
S1.000	o	150	S3	11.000	9.871	0.979	Open Manhole	1200
S1.001	o	150	S10	11.000	9.797	1.053	Open Manhole	1200
S1.002	o	150	S10	11.000	9.703	1.147	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)
S1.000	9.858	133.2	S10	11.000	9.797	1.053	Open Manhole	1200
S1.001	15.495	164.0	S10	11.000	9.703	1.147	Open Manhole	1200
S1.002	13.217	144.2	SMH9006	10.890	9.611	1.129	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	Classification	Roof	95	0.095	0.091	0.091
1.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.095	0.091	0.091

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)
S1.002	SMH9006	10.890	9.611	9.560	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S10, DS/PN: S1.002, Volume (m³): 1.7

Unit Reference	MD-SHE-0096-4400-1200-4400
Design Head (m)	1.200
Design Flow (l/s)	4.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	9.703
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	4.4
Flush-Flo™	0.357	4.4
Kick-Flo®	0.744	3.5
Mean Flow over Head Range	-	3.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.4	3.000	6.7	7.000	10.1
0.200	4.2	1.400	4.7	3.500	7.3	7.500	10.4
0.300	4.4	1.600	5.0	4.000	7.7	8.000	10.7
0.400	4.4	1.800	5.3	4.500	8.2	8.500	11.0
0.500	4.3	2.000	5.6	5.000	8.6	9.000	11.4
0.600	4.1	2.200	5.8	5.500	9.0	9.500	11.7
0.800	3.6	2.400	6.1	6.000	9.4		
1.000	4.0	2.600	6.3	6.500	9.7		

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Storage Structures for Storm

Cellular Storage Manhole: S10, DS/PN: S1.001

Invert Level (m) 9.671 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)
0.000	67.5	0.0	0.801	0.0	0.0
0.800	67.5	0.0			

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FEH
FEH Rainfall Version 2013
Site Location GB 533705 191591 TQ 33705 91591
Data Type Point
Cv (Summer) 0.950
Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S3	15 Summer	2	+0%	30/120 Summer				9.871
S1.001	S10	240 Summer	2	+0%	30/30 Summer				9.856
S1.002	S10	240 Summer	2	+0%	30/15 Summer				9.831

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S3	-0.150	0.000	0.00			0.0	OK	
S1.001	S10	-0.091	0.000	0.30			3.9	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	S10	-0.021	0.000	0.28			3.7	OK	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FEH
FEH Rainfall Version 2013
Site Location GB 533705 191591 TQ 33705 91591
Data Type Point
Cv (Summer) 0.950
Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S3	180 Summer	30	+0%	30/120 Summer				10.045
S1.001	S10	180 Summer	30	+0%	30/30 Summer				10.045
S1.002	S10	180 Summer	30	+0%	30/15 Summer				10.031

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S3	0.024	0.000	0.00			0.1	SURCHARGED	
S1.001	S10	0.098	0.000	0.36		83	4.6	SURCHARGED	
S1.002	S10	0.179	0.000	0.32			4.4	SURCHARGED	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Cv (Summer)	0.950
Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S3	180 Summer	100	+0%	30/120 Summer				10.199
S1.001	S10	180 Summer	100	+0%	30/30 Summer				10.200
S1.002	S10	180 Summer	100	+0%	30/15 Summer				10.201

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S3	0.178	0.000	0.01			0.1	SURCHARGED	
S1.001	S10	0.253	0.000	0.37		106	4.7	SURCHARGED	
S1.002	S10	0.348	0.000	0.32			4.4	SURCHARGED	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 533705 191591 TQ 33705 91591
Data Type	Point
Cv (Summer)	0.950
Cv (Winter)	0.950

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S3	180 Summer	100	+40%	100/15 Summer				10.563
S1.001	S10	180 Summer	100	+40%	100/15 Summer				10.563
S1.002	S10	180 Summer	100	+40%	100/15 Summer				10.547

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S3	0.542	0.000	0.01			0.1	SURCHARGED	
S1.001	S10	0.616	0.000	0.38		149	4.8	SURCHARGED	
S1.002	S10	0.695	0.000	0.32			4.4	SURCHARGED	

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Appendix D SuDS Maintenance Plan

SUDS COMPONENT:	BIORETENTION AND TREE PITS	
MAINTENANCE	**ACTION**	**FREQUENCY**
REGULAR MAINTENANCE	- LITTER AND DEBRIS REMOVAL	MONTHLY
	- INSPECT AND CLEAR INLETS, OUTLETS AND OVERFLOWS	
	- PRUNING, TRIMMING AND GENERAL LANDSCAPE CARE	
OCCASIONAL TASKS	- REMOVAL OF SILT FROM PRE-TREATMENT STRUCTURE	AS REQUIRED
	- SURFACE REINSTATEMENT BY FORKING OR SCARIFYING	
	- REPLACEMENT OF MULCH WITH SHREDDED PRUNINGS FROM SITE OR COMPOSTED BARK	
REMEDIAL WORK	LEVEL REINSTATEMENT DUE TO EROSION OR DAMAGE	AS REQUIRED
	REPAIR OR REPLACE INLETS, OUTLETS OR OVERFLOW STRUCTURES	

SUDS COMPONENT:	GEOCELLS ATTENUATION TANKS	
MAINTENANCE	**ACTION**	**FREQUENCY**
REGULAR MAINTENANCE	- CHECK INLETS, OUTLETS, CONTROL STRUCTURES AND OVERFLOWS	MONTHLY OR ANNUALLY AS REQUIRED
OCCASIONAL TASKS	- JETTING AND SUCTION WHERE SILT HAS SETTLED	AS REQUIRED
REMEDIAL WORK	- REINSTATE	AS REQUIRED

SUDS COMPONENT:	KEY DESIGN STANDARDS FOR ADOPTION INLETS, OUTLETS AND CONNECTIONS	
MAINTENANCE	**ACTION**	**FREQUENCY**
REGULAR MAINTENANCE	- LITTER AND DEBRIS REMOVAL	MONTHLY
	- GRASS CUT AROUND STRUCTURE 1m AT 50mm WHERE NECESSARY	MONTHLY
	- REMOVE SILT FROM FOREBAYS, APRONS OR OTHER STRUCTURES IF PRESENT	MONTHLY OR AS REQUIRED
	- INSPECT AND CLEAR INLETS, OUTLETS, CONTROL STRUCTURES AND OVERFLOWS	MONTHLY OR AS REQUIRED
OCCASIONAL TASKS	- REMOVAL OF TREE OR SHRUB GROWTH WITHIN 5m OF POND EDGE	AS REQUIRED

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Appendix E Haringey LLFA Pro-Forma

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1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Northumberland Development Project Hotel
Address & post code	Tottenham Hotspur Stadium, 748 High Road, Tottenham, London, N17 0AP
OS Grid ref. (Easting, Northing)	E 533967
	N 191100
LPA reference (if applicable)	
Brief description of proposed work	Section 73 of the Town and Country Planning Act for variations to approved plans. Site currently consists of a basement car park, which is to be developed into a hotel
Total site Area	2330 m^2
Total existing impervious area	2330 m^2
Total proposed impervious area	2330 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	Local area defined as Critical Drainage Area (CDA)
Existing drainage connection type and location	Brownfield Site to Storm Sewer
Designer Name	Marc Jones
Designer Position	Senior Infrastructure Engineer
Designer Company	Buro Happold

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Border betweek Taplow Gravel Member and the Kempton Park Gravel Member
Bedrock geology classification	London Clay Formation
Site infiltration rate	m/s
Depth to groundwater level	m below ground level
Is infiltration feasible?	No

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	N	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	Y	Y
7 discharge rainwater to the combined sewer.	N	N

2c. Proposed Discharge Details

Proposed discharge location	225mm TW Sewer Park Lane (MH9006)
Has the owner/regulator of the discharge location been consulted?	Yes. Pre-planning application 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	0.41			
1 in 1	0.35			4.4
1 in 30	0.98		92	4.4
1 in 100	1.32		117	4.4
1 in 100 + CC			176	4.4
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Hydrobrake		

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	1034	67.5	51.3
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
Total	**1034**	**67.5**	**51.3**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	
Drainage hierarchy (2b)	Section 3.4
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Thames Water Asset Map - Appendix A
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Microdrainage Model - Appendix D
Proposed SuDS measures & specifications (3b)	Section 3

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix C
Detailed drainage design drawings, including exceedance flow routes	Sections 3.8, 3.9, 3.10 & Appendix C
Detailed landscaping plans	Arup Landscape Architect
Maintenance strategy	Appendix E
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	

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