Working in partnership

CONSTRUCTION SKILLS CENTRE & SITE ACCOMMODATION AT FORMER MARIA FIDELIS SCHOOL SITE FLOOD RISK ASSESSMENT

August 2021

1CP01-MDS_ARP-EV-REP-SS08_SL23-990007 – C01

Revision Key:
P =Preliminary Documents/Drawings – P01, P02, P03
C = Contractual Documents/Drawings – C01, C02, C03
X = As Built Mark-Up Drawings – X01, X02, X03
Z = As Built Record Drawings – Z01, Z02, Z03

Revision	Author	Checked By	Approved By	Date Approved **/**/****	Reason for Revision
C01	JAF	AP	SB	03/08/2021	Revised following comments
	---	---	---	---	Revised following comments
	---	---	---	---	

1 Introduction

1.1 Purpose

1.1.1 This report has been produced by the Mace Dragados Joint Venture (MDjv) on behalf of High Speed 2 Ltd (HS2 Ltd), to support a full planning application for a Construction Skills Centre and Site Accommodation at the former Maria Fidelis School site (the 'Proposed Development').

1.1.2 The Proposed Development would provide:

- a Construction Skills Centre (CSC) on behalf of London Borough of Camden (LBC), for which a similar scheme was previously granted planning permission under LBC application reference 2019/3091/P; and
- a Site Accommodation facility to accommodate approximately 2,500 site operatives and management staff, including office space, ancillary rooms, WCs, showers and changing rooms, and on-site catering. This is required as part of the High Speed Two (HS2) railway project and will facilitate the construction of HS2 Euston Station.

1.1.3 The Proposed Development is required for a temporary period of 10 years and will be removed following the construction of HS2 Euston.

1.1.4 A summary of the application and how this report fits into the suite of documents can be found in the Planning Statement.

1.1.5 Although the Proposed Development does not fall under the HS2 Act it is proposed to undertake a Flood Risk Assessment (FRA) in accordance with all relevant national and local policies.

1.1.6 Relevant FRAs have been undertaken in connection with:

- HS2 Euston station proposals.
- UK Power Networks (UKPN) proposals to construct a new substation at the rear of Exmouth Arms (located at the NW boundary to the Proposed Development site (the 'UKPN substation – near Exmouth Arms').
- A recent proposal to develop the whole of the Maria Fidelis site which was granted Planning Permission (LBC ref: 2019/3091/P) in 2019 (the 'Maria Fidelis Lower School Development'). The Proposed Development only occupies the northern part of the whole Maria Fidelis site.

1.1.7 Associated findings from relevant FRAs will be used to inform the requisite FRA for the Proposed Development.

1.1.8 This report provides the requisite FRA for the Proposed Development.

1.2 Location and Description of the Proposed Development

1.2.1 The site is located in the northern part of the former Maria Fidelis Catholic School in the London Borough of Camden. The site is currently vacant but had most recently been used as outdoor play space associated with the school and a two-storey ancillary school building, constructed in the 1990s, remains onsite.

1.2.2 The land immediately to the south of the site is occupied by the five-storey former school building, which was constructed in the interwar period. Planning consent was granted (subject to completion of s.106 agreement) in October 2020 for the mixed-use redevelopment of the former school building.

1.2.3 The surrounding area is a mix of residential and commercial uses, with Euston Station located to the north east. To the north of the site is the HS2 Euston Station construction site, which was formerly St. James's Gardens'.

1.2.4 The site is accessed via North Gower Street to the west and via Cobourg Street to the east. Starcross Street is located to the south of the wider Maria Fidelis site and connects North Gower Street and Cobourg Street. Hampstead Road is located beyond North Gower Street to the west of the site. There are no Listed buildings onsite and the application site is not within a Conservation Area. The buildings on the eastern (no's 190-204) and western (no's 211-229) North Gower Street, located approximately 100 metres to the south of the site, are Grade II Listed. 108 Hampstead Road, located 20 metres to the north east of the application site, is Locally Listed.

1.2.5 The draft description of the Proposed Development is as follows:

- Erection of a six-storey combined CSC (Class F1(a) - Education) and Site Accommodation (Class E(g)(i) – Offices) to facilitate the construction of HS2 Euston station, as meanwhile uses for a period of up to 10 years from occupation.
- The Proposed Development would provide 1,378sqm of CSC floorspace and 5,747sqm of Site Accommodation floorspace. The overall site area is 0.24ha. The maximum height of the building would be 22.4m and the building would be 77m wide and 18m deep.
- The building would utilise modular construction, using modern methods of construction and assembly on-site to the form described above.
- Vehicular access to the Site Accommodation would be delivered via a combination of the existing HS2 worksite to the north and Cobourg Street. Vehicular access arrangements for the Site Accommodation would change throughout the construction and operational period to accommodate wider HS2 works to the north of the site. Vehicular access for the CSC would remain

as previously approved with infrequent servicing use of North Gower Street (consented under extant permission 2019/3091/P).
- Pedestrian access to the Site Accommodation would only be from Hampstead Road and through the existing HS2 worksite to the north.

1.2.6 The location and layout for the Proposed Development is shown in Appendix 1.

1.3 Background Information

1.3.1 This FRA is informed by Flood Risk and/or Drainage Assessment reports undertaken for HS2 proposals at Euston as listed in Table 1-1 below:

Table 1-1 List of HS2 Euston Flood Risk and Drainage Reports informing this Appraisal

Reference Identity	Report Title	Date
Ref 1	Euston Station Flood and Drainage Strategy	Dec 2017
Ref 2	Euston Station Flood Risk Assessment Technical Note	Jul 2019
Ref 3	Euston Station Highways and Drainage Scheme Design Report	Dec 2019
Ref 4	LU Flood Risk Assessment – DN1000 Water Main Burst Study	Oct 2020

1.3.2 In addition to the above FRA reports undertaken for HS2 Euston Station, this FRA is also informed by information provided to the MDjv Maria Fidelis Project team by the HS2 Euston Station team with relevant details concerning the Drainage Strategy for HS2 Euston including:

- Updates to attenuation proposals which now form part of the updated/agreed Drainage Strategy.
- Agreements with TWUL on storm drainage discharge rates to combined sewers and requisite consenting for making such discharges.

1.3.3 This FRA is further informed by Flood Risk and/or Drainage Assessment reports undertaken for other relevant projects in the vicinity as listed in Table 1-2 below:

Table 1-2 List of other related and proximal Flood Risk Assessments and Drainage Reports informing this Appraisal

Reference Identity	Report Title	Date
Ref 5	UKPN Substations Level 2 Flood Risk Assessment	Apr 2021
Ref 6	Maria Fidelis School Flood Risk Assessment and Drainage Strategy *Compiled by Conisbee for Camden Council*	Apr 2019

1.3.4 Government and NPPF advice indicate an FRA is not ordinarily required for a development that is less than 1 ha located in flood zone 1 (as applies here; see Section 4.2) unless it:

- Could be significantly affected by flood types/sources other than fluvial/tidal.
- Falls in, or affects, an area subject to critical drainage problems.
- Provides a key utility function highly vulnerable to flooding.

1.4 Relevant National and Local Policy

National Planning Policy Framework (NPPF), July 2021

1.4.1 The NPPF was revised on 20th July 2021 and sets out the government's planning policies for England and how these are expected to be applied. This revised Framework replaces the previous National Planning Policy Framework published in March 2012, revised in July 2018 and updated in February 2019.

1.4.2 One of the overarching objectives of the NPPF is the encouragement of growth and acknowledgement that decision-makers should adopt a presumption in favour of sustainable development. Paragraph 11 of the document states:

"Plans and decisions should apply a presumption in favour of sustainable development…

For decision-taking this means:

- *approving development proposals that accord with an up-to-date development plan without delay; or*
- *where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:*
    - *the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or*
    - *any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole."*

1.4.3 Paragraph 167 of the NPPF states that:

"When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- *within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- *the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- *it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- *any residual risk can be safely managed; and*
- *safe access and escape routes are included where appropriate, as part of an agreed emergency plan."*

London Borough of Camden Strategic Flood Risk Assessment (SFRA), July 2014

1.4.4 The NPPF and accompanying Technical Guidance emphasise the responsibility of Local Planning Authorities (LPAs) to ensure that flood risk is understood and managed effectively using a risk-based approach throughout all stages of the planning process. As such, LPAs are required to undertake Strategic Flood Risk Assessments (SFRAs) to support the preparation of their Local Plan.

1.4.5 The aim of the SFRA is to collate and analyse the most up-to-date flood risk information from all sources, to provide an overview of flood risk across the borough. The resulting report and mapping were intended to be used to inform the preparation of a Local Plan, ensuring flood risk is taken into account when considering development options and in the preparation of strategic land use policies.

1.4.6 For the preparation of site specific FRAs key takeaways from the SFRA includes an overview of the key flood risk issues within the borough, guidance on the application of sequential and exception testing, and guidance for preparing site-specific FRAs.

Camden Planning Guidance (CPG) Water and Flooding, March 2019

1.4.7 The Council has prepared the CPG on Water and Flooding to support the policies in the Camden Local Plan 2017. This guidance is consistent with the Local Plan and forms a Supplementary Planning Document (SPD) which is an additional material consideration in planning decisions.

1.4.8 Relevant information to this FRA within the CPG includes the council's policies relating to climate change mitigation, assessment of flood risk, and drainage system design and modelling requirements.

The London Plan, March 2021

1.4.9 The London Plan is the overall strategic plan for London and sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years.

1.4.10 Key relevant policies to this FRA within The London Plan include Policy SI 12 'Flood Risk Management' and Policy SI 13 'Sustainable Drainage'. A summary of these policies is provided in the extracts below:

SI 12 Flood Risk Management

A. "Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

B. Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks…

C. Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed…

…

E. Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

…

G. Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat."

SI 13 Sustainable Drainage

"…

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:

- Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation).
- Rainwater infiltration to ground at or close to source.
- Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens).
- Rainwater discharge direct to a watercourse (unless not appropriate).

- Controlled rainwater discharge to a surface water sewer or drain.
- 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.

2 Clarifications ideally required on Key findings from Existing Reports

2.1 Summary of clarifications required

2.1.1 A summary of key clarifications ideally required in relation to the outline review from existing reports given in Appendix 2 is provided in Table 2-1 below.

Table 2-1 - Summary of key Flood Risk and Drainage matters clarifications

Ref. Id.	Report Title	Key Content	Key Clarifications Required	Key Clarifications Obtained	Comment
Ref 1	Euston Station Flood and Drainage Strategy	Provides overall strategy and considers pluvial flood risk from a Q1000 event for the RIBA2 land-form.	Drainage strategy based on deployment of attenuation tanks – has this been updated? The design event adopted for the strategy was the Q100 + 40% climate change uplift. What prorata inflow rate has been agreed – 27 l/s/ha, 54 l/s/ha or something else? What consenting is required from TWUL for discharges to their combined sewers?	Where possible deployment of underground attenuation tanks has been superseded by proposed use of blue roofs at the station and the MDP/OSD strategy and these alternatives provide more sustainable/alternative solutions. Proposed blue roofs account for 1.13 ha of the total area drained and the area served by proposed by the MDP/OSD strategy is significant but not stated. The design event adopted for the strategy being the Q100 + 40% climate change uplift has been confirmed. A prorata inflow rate of 54 l/s/ha was agreed with TWUL in a meeting on 25 June 2020. Groundwater drainage is not to be conveyed directly to combined sewer – it is now proposed to use this source of water for flush WC usage at the proposed station meaning it will alternatively enter the combined sewers as a foul water component.	The type of attenuation deployment should be spatially confirmed across the whole site.
Ref 2	Euston Station Flood Risk Assessment Technical Note	Provides qualitative update to pluvial flood risk given in Ref 1	Ref 1 indicated an updated version of TWUL hydraulic model for the combined sewer system should be used – remains outstanding. Updated RIBA3 land-form only considered qualitatively against Ref 1 modelled results. What scope for further pluvial flood risk assessment work is planned?	An updated pluvial flood risk assessment has been undertaken, however this has not yet been approved for use. The updated model takes into account: - the RIBA3 land-form - the updated attenuation concepts applied to proposals for Euston Station as outlined with regards to Ref 1 Based upon this the RIBA3 model predicts lower flood levels than the RIBA2 model, thus the RIBA2 data used within this assessment is considered conservative and remains the adopted output until the RIBA3 model outputs are verified and adopted.	Updated RIBA3 pluvial flood risk modelling/ assessment required.

Ref 3	Euston Station Highways and Drainage Scheme Design Report	Provides qualitative update to drainage strategy given in Ref 1	No mention is given here on varying the form of attenuation suggested in Ref 1. Confirms the design basis remains the Q100 + 40% climate change uplift. Suggests a prorata inflow rate to combined sewer of 54 l/s/ha is being discussed with TWUL.	As for Ref 2 ensuring all aspects of Drainage Strategy are set out /confirmed.	As for Ref 2.
Ref 4	LU Flood Risk Assessment – DN1000 Water Main Burst Study	Very conservatively models burst water main flood risk for RIBA3 land-form	Has TWUL endorsed this flood risk assessment? HS2 has not yet approved this assessment. LU is yet to decide if it will act on this assessment. Have flood risk mitigation measures required to protect for pluvial flood risk and burst water main flood risk been fully harmonised where relevant?		Seek TWUL endorsement / comment on assessment undertaken if not already done. Ensure harmonisation with pluvial flood risk mitigation measures where relevant.
Ref 5	UKPN Substations Level 2 Flood Risk Assessment	Provides details of flood risk to UKPN Substation and mitigation measures	Groundwater levels to be confirmed Confirm suitability of burst water main flooding assessment undertaken for substation against levels on-site	Groundwater levels at the UKPN substation found to be slightly deeper than previously indicated at 3.0mBGL (approx. 21.00mAOD). Burst water main review deemed acceptable however is being considered as very conservative.	Tank depth and appropriate lining to be considered in relation to groundwater levels.

Ref 6	Maria Fidelis School - Flood Risk Assessment and Drainage Strategy	Provides overview of flood risk to wider Maria Fidelis School site along with outline drainage strategy details and considerations	100yr +30%CC used in attenuation calculation – this likely should be 40% and will need checking against LLFA guidance Discharge rates reduced to 1.0 l/s – is this still considered an acceptable approach by TWUL and the LLFA? Which existing sewers are being discharged to?	London Borough of Camden LLFA have stated within their Water and Flooding Planning Guidance (March 2019) that surface water discharge from the site should be managed to greenfield rates where possible, and attenuation should be provided for up to the 1 in 100yr +20%CC storm with a sensitivity check for +40%CC. Thames Water have also indicated that a reduction in surface water discharge to greenfield rates should be achieved where possible. Multiple sewers were used as outfalls including the existing combined sewer passing through the site, as well as the combined sewer within Starcross Street to the south.	Rates to be reduced to QBAR greenfield where feasible to appease both the LLFA and Thames Water.

2.2 Summary of residual clarifications ideally required

2.2.1 The pluvial flood risk assessment has been updated to accommodate;

- Amendments to the Drainage Strategy; and
- The RIBA3 land-form.

2.2.2 However, this updated model is not yet approved for use but is considered to produce less conservative flood level predictions than the RIBA2 model. Predicted flood levels from the updated model should be considered once approved for use.

2.2.3 The updated pluvial flood risk assessment should be harmonised with mitigation requirements to address flood risk issues associated with both pluvial and burst water main risks where appropriate to do so.

3 Summary of Flood Risks to the Proposed Development

3.1 Sources of Flooding

3.1.1 The following sources of flooding have been assessed as part of this FRA:

- Fluvial and Tidal
- Surface Water
- Sewers
- Groundwater
- Artificial Sources (water main breach, canals, reservoir breach)

3.2 Fluvial and Tidal Flooding

3.2.1 The EA Flood Map for Planning indicates that the entire site falls within Flood Zone 1 (FZ1) which means that the site is at a lower than 1 in 1,000 annual probability of river or sea flooding.

3.2.2 No tidal watercourses are located near the site with the nearest tidal watercourse (River Thames) being located approximately 2.5km south of the site. The Thames is protected by defences for combined tidal and fluvial flooding up to the 1 in 1,000 year event. Based on the EA Flood Map for Planning the site is located outside of the residual flood extent resulting from a potential breach of the defences.

3.2.3 It should also be noted that the site is situated at an approximate average level of 25mAOD which is significantly higher than any potential tidal flood level.

3.2.4 Based on the available information the site is considered to be at a low risk of fluvial and tidal flooding.

3.3 Surface Water Flooding

3.3.1 The EA Long Term Flood Risk Maps indicates that the site falls entirely within an area considered to be at a very low risk of surface water flooding (less than a 1 in 1,000 annual probability). An extract of this mapping for the site location is presented within figure 4.1 below.

3.3.2 The RIBA2 pluvial model has been reviewed as part of the UKPN Substation Level 2 FRA (Ref 5) which has indicated a flood level for a Q1000-60min event at the Exmouth Arms Pub southeast of the site of 24.68mAOD. This level is lower than the existing levels within the site with the exception of some smaller areas along the northern boundary. The proposed FFL of the new on-site building of 25.08m is 0.4m above this level.

3.3.3 It should be noted that the RIBA2 pluvial model is using a coarse ground model and does not take into account any storm drainage attenuation proposed as part of HS2 Euston Station. The new RIBA3 model has been produced but is not yet approved for use. This new model uses a much finer ground model and now accounts for proposed HS2 Euston Station attenuation and drainage. As a result, the RIBA2 model is considered to predict conservative/higher flood levels compared to those predicted by the RIBA3 model which appear to be lower (subject to verification/approval).

3.3.4 It is likely that any proposed new development and associated drainage infrastructure would further reduce the surface water flood risk on-site.

3.3.5 Based on the available information the site is considered to be at a very low risk of surface water flooding.

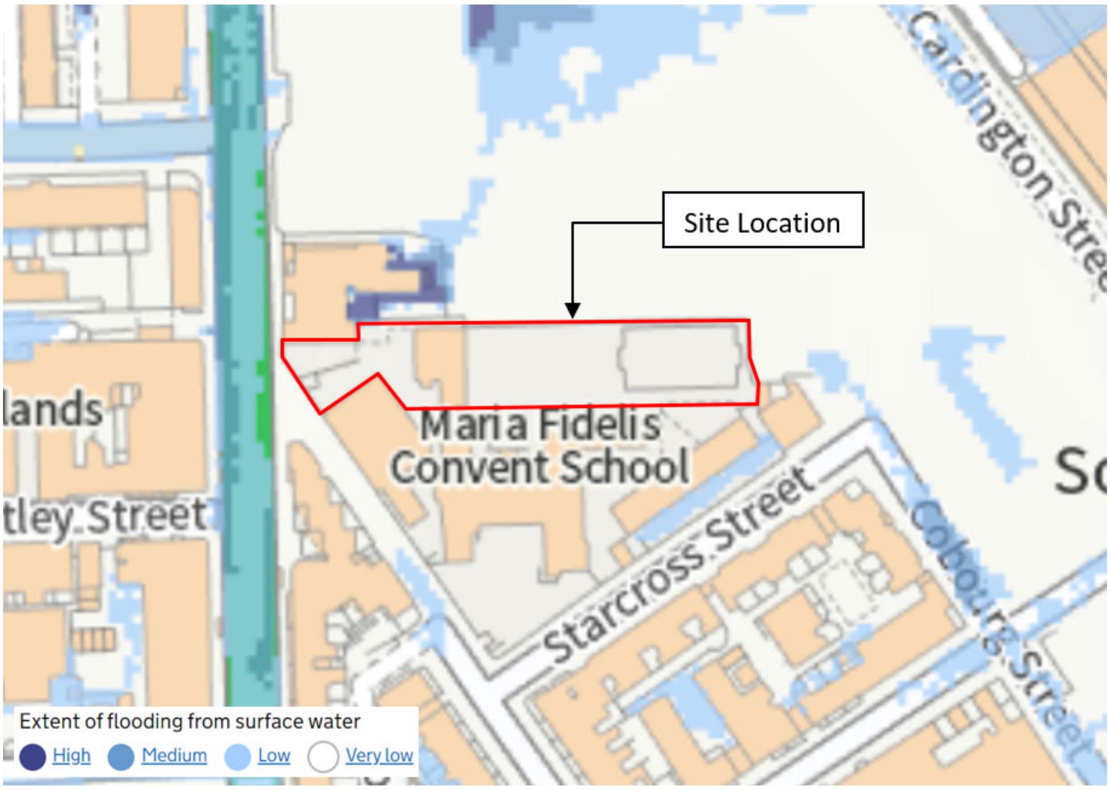


Figure 4.1 - EA Flood Risk from Surface Water 'Extent of Flooding'

3.4 Sewer Flooding

3.4.1 The London Borough of Camden SFRA (2014) indicates that no internal or external sewer flooding events have been recorded within the site boundary or surrounding areas, with the nearest recorded incidents having been identified at least 1.3km north of the site.

3.4.2 As stated within the 2019 Maria Fidelis FRA and Drainage Strategy (Ref 6 – see section 2.2.7 for further details) the majority of the sewer networks within and around the site are built to outdated standards, hence they are likely to be overwhelmed by storms of significantly lower intensity than those which modern systems are now designed for (i.e. 1 in 100 year plus climate change events).

3.4.3 Based on the available information the site is considered to be at a low risk of sewer flooding, with the proposed site drainage strategy providing a net betterment over the existing situation.

3.5 Groundwater Flooding

3.5.1 The London Borough of Camden SFRA (2014) indicates that the site falls partially within an area considered to be at an increased susceptibility to elevated groundwater (potential for groundwater to rise to within 2m of the surface following periods of higher than average recharge). Three EA groundwater incidents are also noted as having occurred within a 1km radius of the site, the nearest being approximately 800m southeast.

3.5.2 No basements are proposed within the development; however, a high groundwater level may impact upon subsurface structures such as any potential cellular storage tanks used for surface water attenuation. Ideally 1.0m minimum standoff is maintained between the invert of tanks and the peak groundwater level, however in instances where this is not possible, tanks may need to be lined and/or weighted to avoid groundwater ingress and/or floatation.

3.5.3 Interpreted ground model data (Appendix 3) has indicated a groundwater level of approximately 21.0mAOD which is approximately 4.0mBGL within the site.

3.5.4 Based on the available information the site is considered to be at a low risk of groundwater flooding occurring at the surface, however there is a moderate risk that groundwater could affect subsurface structures such as attenuation tanks without suitable mitigation.

3.6 Artificial Sources of Flooding

Burst Water Main

3.6.1 A burst water main assessment was undertaken for the main HS2 Euston Station as described in Ref 4 within Section 2 of this report. The nearest point at which a modelled flood level was taken (HS2 Drummond St Entrance) indicates a flood level of 24.70mAOD. Based upon levels as indicated within the topographical survey found within the 2019 Maria Fidelis FRA (Ref 6), this flood level is generally 0.0-0.3m lower than the existing site levels, with the exception of smaller areas around the northern boundary of the site which fall to around 24.50mAOD. The proposed new building also has an FFL indicated as 25.08mAOD which is 0.38m above the modelled burst water main flood level.

3.6.2 It should however be noted that the modelling was undertaken using a worse-case scenario. In terms of flood risk, the analyses considered inundation effects from a burst of the proposed 1m diam. water main without allowing for any probable, and significant, losses to the road drainage network or possible, though less significant, loss to infiltration.

3.6.3 Based on the available information, the site is considered to be at a low risk of flooding as a result of a burst water main.

Canals

3.6.4 The nearest canal is the Regents Canal which is located 1.05km east of the site at its nearest point. As stated within the Euston Station RIBA 2 Flood and Drainage Strategy report (Ref 1), the volume of water escaping from the canal in the event of a major breach could be significant, however, the water levels within the canal are actively controlled by the Canal and River Trust. Given the significant distance between the site and the canal and that the water levels are actively managed, the Regents Canal is considered to pose a minimal risk of flooding to the site.

Reservoirs

3.6.5 The Environment Agency Flood Risk from Reservoirs Map shows that the site is located 1.1km away from the nearest area identified as being at a residual risk of flooding from a reservoir breach. The site is therefore not considered to be at risk of flooding resulting from a reservoir breach.

4 Drainage Strategy and Flood Protection for the Proposed Development

4.1 Existing Drainage Regime

4.1.1 The existing site is predominantly made up of hardstanding areas which are drained by an existing sewer network.

4.1.2 As indicated within Section 3.7 of the 2019 Maria Fidelis FRA (Ref 6), a topographic survey and CCTV survey of the existing drainage systems was carried out for the wider site (including the site area covered by this report) in 2018. These surveys indicated that the surface and foul water drainage from the site is collected by a private combined sewer network. The wider site discharges at three locations including south to Starcross Street, west to North Gower Street, and the sewer passing through the site east to west.

4.1.3 The existing 1168x787mm combined sewer within the site occurs at a depth of approximately 4.0m (20.5mAOD). Consultations have previously been held with Thames Water as part of the 2019 FRA whereby Thames Water has stated that a class 3 Build Over is required for the CSC as the sewer is over 375mm in diameter.

4.2 Design Criteria for the Requisite Drainage Strategy

Drainage Hierarchy

4.2.1 Planning guidance requires surface water discharge methods to be considered in line with the following hierarchy:

1. Re-use of surface water at source (most preferred)
2. Infiltration into underlying geology
3. Discharge to a watercourse
4. Discharge to a surface water sewer
5. Discharge to a combined sewer (least preferred)

4.2.2 In the case of the proposed site the demand for the harvesting of rainwater is limited, the underlying geology has been identified as not being suitable for infiltration (as stated within section 8.1.9 of Ref 1 which identifies the abundance of London Clay based upon the findings within Euston Station RIBA 2 Geotechnical Design Development Report), and no watercourses or surface water sewers are located nearby. A combined sewer is known to be located within the site boundary therefore this has been identified as the most preferential available surface water discharge option for the proposed site.

Discharge Rates

4.2.3 On-site attenuation volumes are directly impacted by the peak rate at which water is discharged off-site. Allowable discharge rates are mandated by key stakeholders including the local sewerage undertaker and LLFA, which in the case of the proposed Maria Fidelis CSC and Site Accommodation is Thames Water and Camden London Borough Council respectively. Details of each of their requirements for the discharge of surface water is set out below.

London Borough of Camden LLFA

4.2.4 The Water and Flooding chapter of the Camden Planning Guidance (March 2019) states that:

> *"The Council will expect developments to achieve a greenfield surface water run-off rate where feasible once SuDS have been installed."*

4.2.5 To meet this requirement, it is likely that discharge of surface water is restricted to a peak of the QBAR greenfield runoff rate. Based on a site impermeable area of 0.232 ha a peak discharge rate for all events up to the critical 1 in 100yr plus 40% climate change event of 1.0 l/s would be considered acceptable by the LLFA (QBAR, calculated using IH124 methodology).

Thames Water

4.2.6 As outlined within the November 2018 pre-development enquiry contained within the 2019 Maria Fidelis School FRA (Ref 6), Thames Water have indicated that ideally flows would be restricted to greenfield rates. Where this is not considered practicable and the site is less than 1.0ha in size (which the current site is), restricting discharge to 95% of existing flows is also considered acceptable.

4.2.7 Restricting flows to 1.0 l/s is considered to satisfy the requirements of both the LLFA and Thames Water.

4.2.8 As the existing site is predominantly impermeable and flows are not currently restricted, the reduction in discharge from the site to a peak rate of 1.0 l/s presents a significant betterment over the existing scenario.

4.2.9 Table 4-1 below sets out the estimated existing peak runoff rates from the site, greenfield rates, the proposed runoff rates, and the percentage reduction of the proposed rates compared to existing.

Table 4-1 – Summary of existing, greenfield, and proposed surface water discharge rates

Return Period	Existing Peak Runoff Rate (l/s) [1]	Greenfield Runoff Rate (l/s) [2]	Proposed Discharge Rate (l/s)	Percentage Betterment (%) [3]
1 in 1yr	13.0	0.82	1.0	92.3%
1 in 30yr	31.9	2.22	1.0	96.9%
1 in 100yr	41.8	3.08	1.0	97.6%
1 in 100yr (+40% CC)	58.4	n/a	1.0	98.3%

[1] Determined by the Modified Rational Method with a storm duration of 30 minutes; volumetric runoff coefficient of 1 for impermeable areas and 0 for permeable.
[2] Calculated based on IH124 methodology – see Appendix 4.
[3] Percentage difference between existing peak runoff rate and proposed discharge rate.

4.3 The Proposed Drainage Strategy

Proposed Drainage

4.3.1 In accordance with the NPPF, London Plan, Camden Planning Guidance, and Camden Local Plan, the Proposed Development is to incorporate SuDS features where possible in order to provide source control, attenuation, and treatment of surface water on-site.

4.3.2 The SuDS strategy for the Proposed Development has been derived using the principles outlined within the CIRIA C753 SuDS Design Manual along with BS 8582:2013 – Code of Practice for Surface Water management for Development Sites.

4.3.3 The Proposed Development drainage arrangement for the site will look to hold water at the surface where viable through the use of SuDS such as permeable paving, with the primary means of surface water attenuation being provided in the form of a cellular storage tank beneath the ground.

4.3.4 The site will be drained via a new drainage network designed to modern standards, with all surface water ultimately directed into the proposed cellular storage tank. Surface water will be discharged from the site at 1.0 l/s (Qbar greenfield runoff rate) into the Thames Water combined sewer within the site.

4.3.5 Surface water attenuation is to be provided on-site with capacity for up to the 1 in 100 year storm event plus a 40% allowance for climate change (considered to be a worst-case scenario in line with LLFA guidance). MicroDrainage modelling (see Appendix 5) has indicated that 198m^3 of attenuation will be required on-site. This volume is to be provided in the form of a cellular storage tank (10.2m long, 3.5m wide, 2.0m deep, 0.95 porosity) providing 67.8m^3 of storage, which is supplemented by permeable paving (725m^2, 0.5m deep type 3 granular sub base with 0.3 porosity) throughout the site which is estimated to provide an additional 96.5m^3 of attenuation. The remaining 34m^3 of storage is provided within the proposed pipe network and associated manholes.

4.3.6 Figure 5.1 below provides details of the cellular storage and permeable paving including their proposed locations.

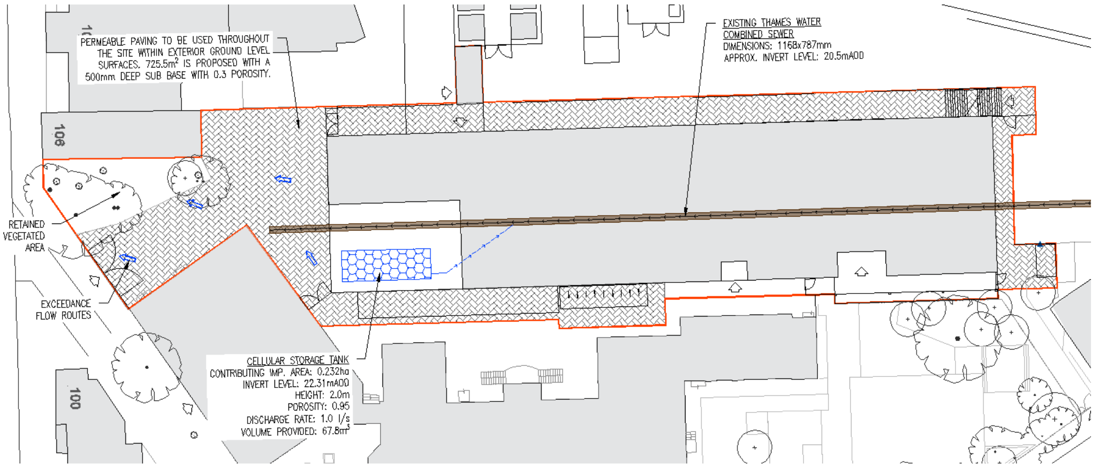


Figure 5.1 – Proposed surface water attenuation strategy

4.3.7 To ensure the effectiveness of the proposed drainage network a robust maintenance regime in accordance with CIRIA 753 'The SuDS Manual' Part D should be put in place which will be implemented to ensure future performance of all SuDS and drainage components. This will include regular cleaning of SuDS devices located on communal areas and is likely to be procured through a private management company. The management of health and safety risks related to SuDS design is subject to CDM.

Design and Modelling Criteria and Assumptions

4.3.8 FSR rainfall has been used in line with the consented 2019 Maria Fidelis School FRA (Ref 6) with the following parameters:

- M5_60min = 20
- Ratio R = 0.4

4.3.9 The site has a total impermeable area of 0.232ha which has been used for the purpose of calculating attenuation requirements. Overall catchment factors (Cv) of 1 have been used for both winter and summer storms.

4.3.10 Attenuation calculations have been run for up to the 1 in 100 year storm event plus a 40% allowance for climate change (considered a worst-case scenario in line with LLFA guidance) with storm durations varying from 15 minutes up to 7 days.

4.3.11 An allowance has been made for the inclusion of upstream permeable paving and storage within the proposed pipe network and manholes. No allowance has been made for any rainwater harvesting.

Water Quality

4.3.12 The majority of the site is made up of non-trafficked areas including pedestrian walkways and the building roof, with only a small area in the west of the site likely to be infrequently trafficked for deliveries.

4.3.13 Non-trafficked areas within the site, such as pedestrian walkways and the building roof, will require minimal levels of surface water pre-treatment prior to discharge. This will be provided in the form of catchpit manholes and SuDS including permeable paving. These will provide an additional element of surface water pre-treatment to the water that passes through them. The use of permeable paving within the lightly trafficked area in the west is considered to provide sufficient levels of surface water pre-treatment as per Chapter 26 of BRE Digest 365 'The SuDS Manual' 2015.

Foul Water Drainage

4.3.14 The proposed foul water drainage strategy for the Proposed Development will be to convey flows to the existing combined sewer that passes beneath the site.

4.3.15 Based on the development proposals of 7,125m^2 of floor space (assumed as office space for the purpose of calculation), a peak foul water discharge rate of 4.1 l/s is anticipated.

4.3.16 As stated within section 4.10 of the 2019 Maria Fidelis FRA, Thames Water has previously confirmed there is sufficient capacity within the existing 1168x787mm combined sewer which passes through the middle of the site to support the uplift in foul flows generated by the Proposed Development.

4.3.17 While foul flows will be increasing relative to the existing situation, the integrated discharge from the site to the combined sewer will be significantly reduced as a result of surface water being attenuated on-site to 1.0 l/s.

4.4 Flood Protection Requirements

4.4.1 Based upon the flood risk review undertaken for this site it is anticipated that minimal flood protection will be required.

4.4.2 The site falls entirely within EA Flood Zone 1, and as indicated within the UKPN Substations Level 2 FRA (Ref 5) the HS2 Euston Station RIBA2 peak pluvial flood level is not expected to impact the proposed site. The updated, but not yet approved, RIBA 3 flood model predictions suggest RIBA2 predictions are conservative.

4.4.3 The burst water main assessment for HS2 Euston (Ref 4) does indicate a peak flood level close to the existing and proposed site levels, however as previously discussed, this modelling is considered to be very conservative with the actual peak flood level likely being lower than what is currently suggested, thus no flood protection requirements are proposed to mitigate this risk.

4.4.4 Based on the available groundwater information (Appendix 3) the invert of any tanks should be set at a minimum of 22.0mAOD in order to avoid the need for lining. This is due to a minimum of 1.0m needing to be provided between the tank invert and peak groundwater level in order to minimise the risk of groundwater ingress as well as minimising the risk of uplift/floatation of the tank.

5 Conclusions and Recommendations

5.1 Conclusions

5.1.1 Based upon the information provided within this report, it is concluded that:

- The development site is located entirely within EA Flood Zone 1;
- The site is at negligible or low risk of flooding from all identified sources with the exception of groundwater which may impact upon subsurface structures such as attenuation tanks without suitable mitigation;
- The Proposed Development drainage arrangement will comprise of SuDS to provide source control and water quality treatment prior to discharge to an existing Thames Water combined sewer via a cellular storage tank;
- Surface water runoff will be attenuated on-site for up to the 1 in 100yr +40%CC rainfall event (considered to be a worst-case scenario) in line with LLFA guidance and Thames Water requirements;
- Attenuation is proposed to be primarily provided within an on-site cellular storage tank and permeable paving. The requisite total attenuation volume to be provided on site is $198m^3$;
- Foul water from the site is to be discharged to the existing combined sewer within the site for which Thames Water has confirmed receptor capacity;
- The combined surface and foul water discharge from the site is predicted to significantly decrease compared to the existing situation as a result of surface water being attenuated to greenfield rates.
- This report has been reviewed against LLFA requirements as set out in the proforma found in Appendix 6.

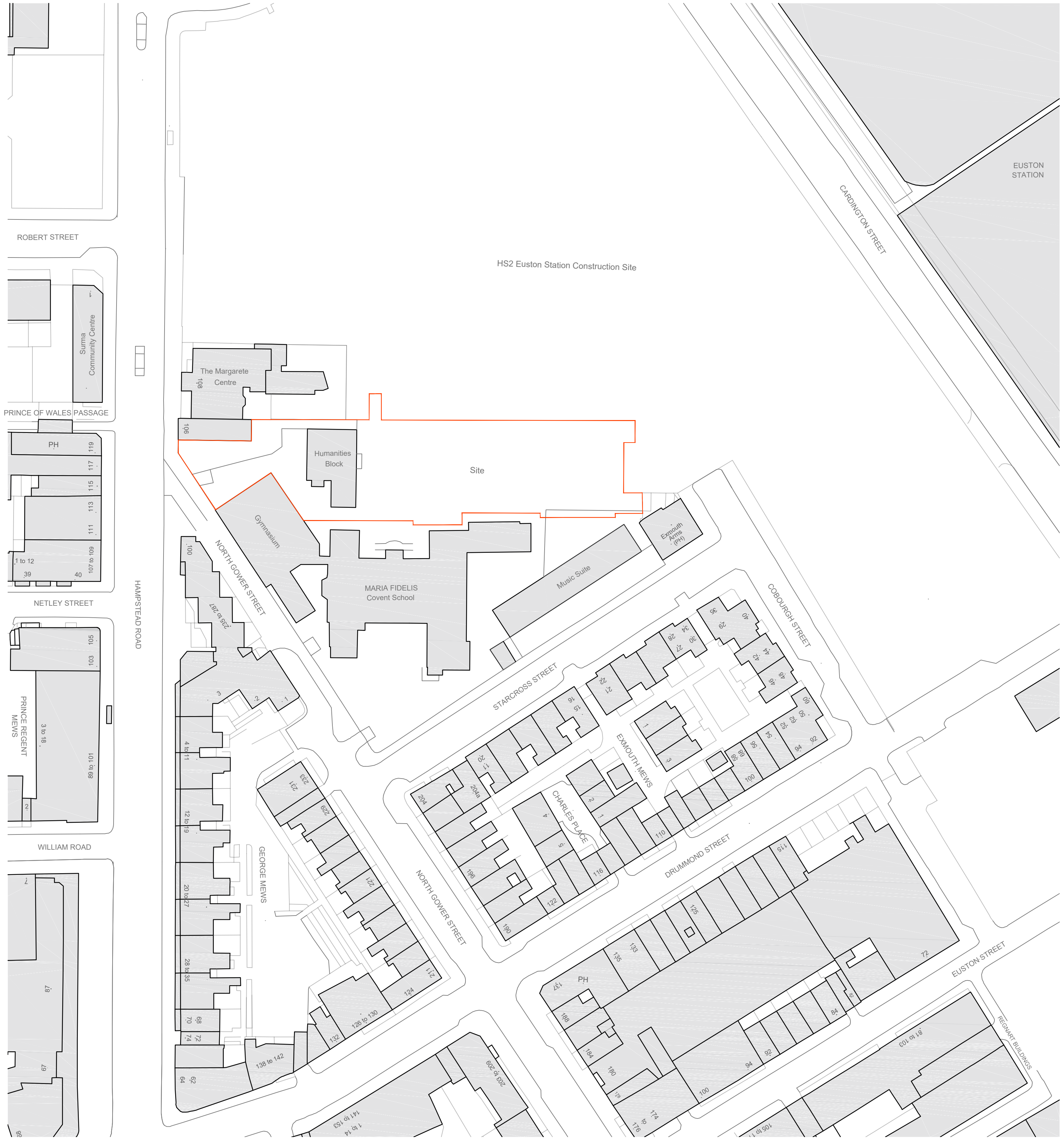
5.2 Recommendations

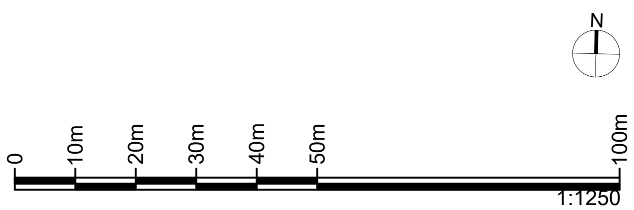
5.2.1 Based upon the findings of this assessment, the following is recommended:

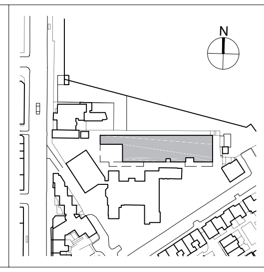
- The HS2 Euston RIBA3 pluvial flood model predictions should be reviewed with respect to the proposed site once approved for use.
- Discussions should be held with Thames Water regarding a class 3 Build Over for the CSC and Site Accommodation building with respect to the existing combined sewer within the site boundary.

APPENDIX 1

Site Location Plan and Proposed Site Plan







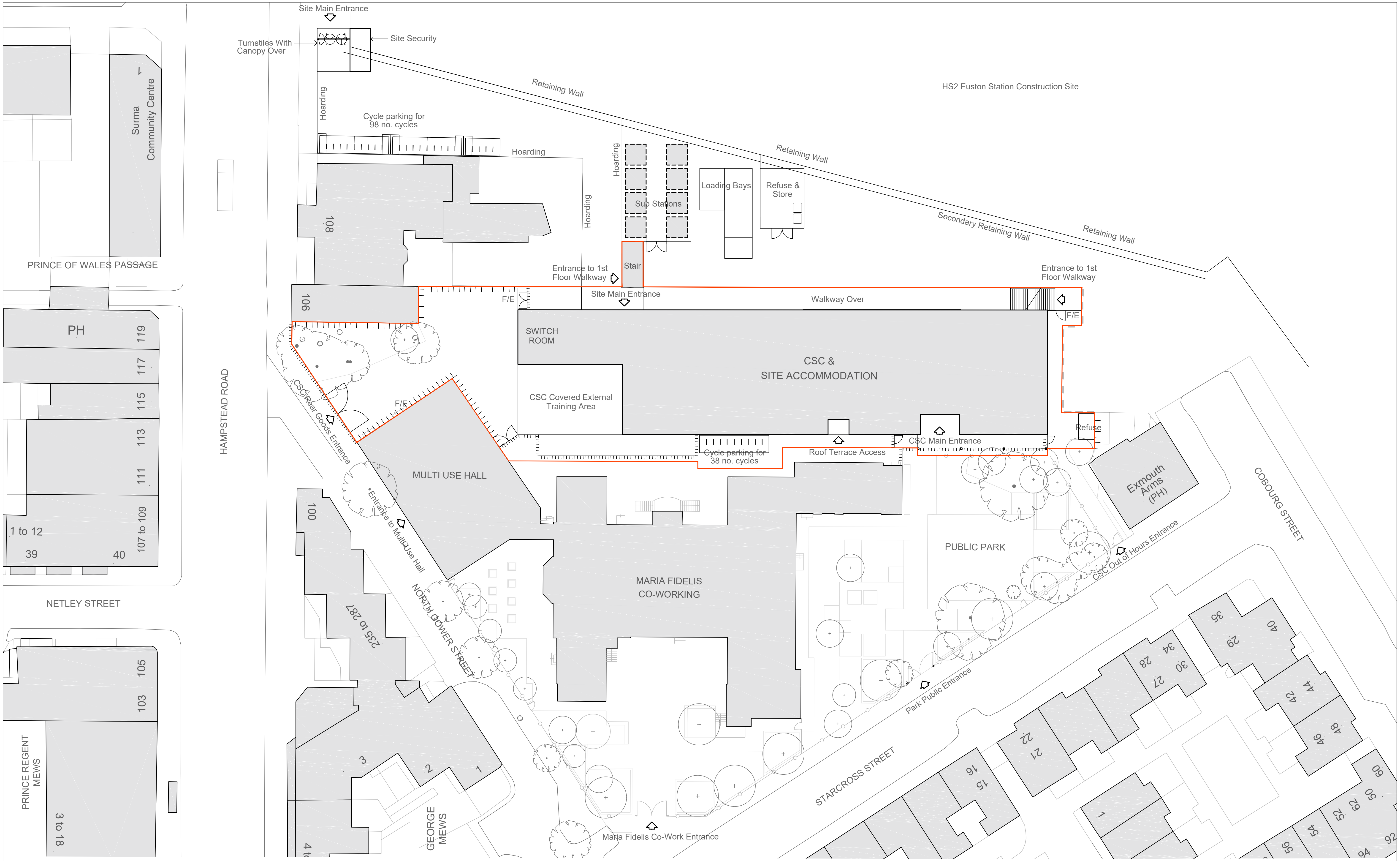
Rev	Description	Drawn	Checked	Approved	Con App
P1.2	Site boundary amended. OS extract extended to the south	GR	JSN	APB	
P1.1	Initial Issue	GR	JSN	APB	

Legends/Notes:

OFFICIAL

Registered in England
Registration No. 06791686
Registered office:
2 Snow Hill, Queensway,
Birmingham, B4 6GA

Project/Contract: 1CP01		Creator/Originator: MDS	Sub-Originator: FBM
Zone: SS08	Work Package Description: SL23	Discipline/Function: AR	System Description: DSP
Drawing Title: Site Location Plan - Existing		Drawn by: GR; Checked by: JSN	Approved by: APB; Date: 15/07/2021
		Scale: 1:1250; Size: A3	Stage: 2; Suitability: P
		Drawing No.: 1CP01-MDS_FBM-AR-DSP-SS08_SL23_GF-000002	Rev.: P1.2



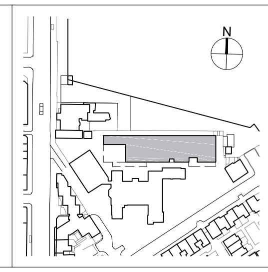
						HS2 accepts no responsibility for any circumstances which arise from the reproduction of this document after alteration, amendment or abbreviation or if it is issued in part or issued incompletely in any way.
C1.2	Fences / Hoarding updated	GR	JSN	APB		
C1.1	Contract Issue	GR	JSN	APB		
P1.2	Site location amended Cycle parking relocated Scale bar and North added to legend.	GR	JSN	APB		This material was last updated on 2020 and may not be copied, distributed, sold or published without the formal permission of Land Registry. Only an official copy of a title plan or register obtained from the Land Registry may be used for legal or other official purposes.
P1.1	Initial Issue	GR	JSN	APB		
Rev	Description	Drawn	Checked	Approved	Con App	Scale with caution as distortion can occur.

Legends/Notes:

- New boundary fences
- Existing boundary
- Hoarding / Constuction site varies over phase/ time

N

0 2m 4m 6m 8m 10m 20m
1:500



OFFICIAL

Registered in England
Registration No. 06791686
Registered office:
2 Snow Hill, Queensway,
Birmingham, B4 6GA

Project/Contract: Proposed Maria Fidelis CSC & Site Accommodation, London. NW1 2HR 1CP01		Creator/Originator: MDS	Sub-Originator: FBM
Zone: SS08	Work Package Description: SL23	Discipline/Function: AR	System Description: DSP
Drawing Title: Proposed Site Plan		Drawn by: GR / Checked by: JSN	Approved by: APB / Date: 29/07/2021
		Scale: 1:500 / Size: A3	Stage: 3 / Suitability: C
		Drawing No.: 1CP01-MDS_FBM-AR-DSP-SS08_SL23_GF-000004	Rev.: C1.2

APPENDIX 2

Key Findings from Existing Reports

1 Key Findings from Existing Flood Risk Assessment and Drainage Strategy Reports

1.1.1 The key findings from the existing reports used to inform Flood Risk/Drainage related matters associated with HS2 Euston proposals are summarised in Table 1-1 and other relevant/proximal proposals listed in Table 1-2.

1.2 Ref 1 - Euston Station RIBA2 – Flood and Drainage Strategy

1.2.1 This report (Ref 1) includes strategically assessed flood risks for Camden which may be pertinent to Euston Station. These were extracted from the North London Strategic Flood Risk Assessment (August 2008) and are summarised in Table 1-1 below.

Table 1 -1 Summary of Flood Risk Sources-Pathways-Receptors pertinent to Camden and possibly to Euston

Flood Source	Flood pathway	Receptor	Potential risk / consequence in Camden
Fluvial R. Lee & tributaries	Inundation of floodplains/overtopping or breaching of flood defences	Properties and infrastructure in flood plain or along/proximal to pathway	n/a
Fluvial R. Brent tributaries	Inundation of floodplains/overtopping or breaching of flood defences	Properties and infrastructure in flood plain or along/proximal to pathway	n/a
Tidal R. Lee	Overtopping or breaching of flood defences Wave action Ponding of surface water behind defences	Properties and infrastructure in flood plain or along/proximal to pathway	n/a
Surface water/combined sewer Flooding/overland flow	Exceedance of Sewer Capacity Blockage of sewer networks Tide-locking of outfalls	Properties and infrastructure along/proximal to pathway	Medium
Groundwater flooding	Rising groundwater	Developments in low lying areas or with basements. Underground infrastructure/tube stations	Very small

Water infrastructure failure - Reservoirs - Canals (incl. New River) - Blocked sewers - Burst water mains	Overtopping or breach/failure of water infrastructure	Watercourse, property and infrastructure downstream of overtopped/breached/failed water infrastructure item	Medium

1.2.2 This reveals there is no significant fluvial or tidal flood risk associated with Camden or indeed Euston.

1.2.3 Ref 1 goes on to consider potential flood risk to Euston in more detail from other sources summarised in Table 2-1 and the outcome is summarised in Table 2-2 below.

Table 1-2 - Summary of Flood Risks to Euston Station

Flood Source		Potential risk to Euston Station	Further Action
Type	Origin		
Fluvial	R. Lee & tributaries	All assessed as negligible being in Flood Zone 1 Risk is < 1 in 1000 years	None Flood Zone 1
	R. Brent tributaries		
Tidal	R. Lee		
Surface water/combined sewer	Exceedance of Sewer Capacity from extreme pluvial events (proximal to station)	Possible	Further investigate
Groundwater flooding	Failure of basement waterproofing Low lying land relative to perched groundwater	Possible	Further consider
Water infrastructure failure	Reservoirs Highgate/Hampstead pond reservoirs	Negligible	None
	Canals (Regents Canal)	Negligible	
	Blocked sewers	Negligible*	
	Burst water mains (proximal to station)	Possible	Further investigate

* Although this risk is assessed as negligible (see Table 4 in Ref 1) there is no explanation as to how this assessment/conclusion is arrived at

1.2.4 Drainage from proposed developments at Euston station will enter combined sewers operated by Thames Water Utilities Ltd (TWUL). It is proposed to attenuate surface water runoff rates, but direct foul drainage unattenuated from Euston station into the combined sewer network.

1.2.5 The peak foul flow discharge rate to the combined sewer network is predicted to rise from 75.12 l/s (the existing Euston station) to 182.0 l/s (the proposed Euston station) giving an increase of 106.88 l/s.

1.2.6 It was assumed the main attenuation of surface water runoff from Euston station will be achieved by means of deploying storage tanks in the drainage networks. Possible use of green/blue roofs as a means of attenuation was discounted at this stage though such concepts were earmarked to be reviewed again at RIBA3 (see Section 3.1.2 and Table 3-2). Requisite attenuation will be effective up to the Q100 with a 40% uplift to allow for Climate Change. The permissible prorata discharge rate for surface water runoff into the combined sewer network was calculated as 27 l/s/ha using the Rational method which for RIBA2 was taken as 50% of the peak rate calculated for the entire HS2 Euston station works area (including station and tracks) resulting from a Q30 storm event of 120 minutes duration. This was the value used for the AP03 Hybrid Bill. However, subsequent assessments alternatively use a permissible discharge rate of 54 l/s/ha taken as the actual peak rate calculated for a Q30 storm event of 120 minutes duration.

1.2.7 A summary of the surface water runoff attenuation volumes required for proposed developments at Euston station in accordance with the above design constraints are summarised in Table 2-3 below.

Table 1 -3 - Summary of surface water attenuation requirements for proposed Euston station developments

Proposed Development	Location	Catchment Area (ha)	Attenuation Volume (m^3) – at 27 l/s/ha	Attenuation Volume (m^3) – at 54 l/s/ha	TWUL Combined Sewer Discharge Receptor
HS2 station box & Level Deck Slab	Station Basement	2.91	1,810	1,500	Coburg St. P
	Station Basement	2.84	1,770	1,460	Coburg St. P
Over Site Development (OSD)	Station Basement	1.29	810	670	Coburg St. P
	Station Basement	0.16	100	85	Coburg St. P
Wolfson House	Basement	0.04	32	28	Coburg St. P
Taxi Rank	Below taxi rank	0.145	95	80	Coburg St. P
Coburg St	HS2 Plaza#	0.802	75	56	Coburg St. P
Euston Sq. Gardens	Below Gardens	1.073*	300	220	Euston Rd. P
Total	n/a	9.26	4,992	4,089	n/a

P drainage systems requiring pumping (all systems proposed)

* of which 0.55 ha is impermeable

located between Stage A station & Royal College of General Practitioners

1.2.8 Regarding consenting for the proposed surface water discharges to TWUL combined sewers referred to Table 2-3 Ref 1 indicates Regulatory Consent is required from TWUL under Sections 104 and 106 of the Water Industry Act 1991.

1.2.9 Pluvial flood risk modelling was undertaken using TWUL 2013 hydraulic model for the Q1000 storm event against the proposed and attenuated drainage system previously outlined. Sensitivity analyses revealed a 60 minute storm duration as being most critical in terms of flood risk. Simulation of the Q1000-60 minute storm event indicates that the main station concourse, LU assets (the Gordon St. entrances) and Wolfsen House require flood mitigation with the area around the Triangle Basement being at the greatest risk. Predicted flood depths are given in Figure 5 of Ref 1 though higher resolution plots of predicted flood depths and details on predicted flood elevations are given within Appendix D of the same document. The mitigation proposed entails self-raising flood barriers for at risk areas and these should provide 300mm free board above predicted Q1000 flood levels.

1.2.10 The HS2 tracks are to be protected from possible overland flow originating from the NR tracks. The latter is constructed to a higher elevation but lower drainage standard. A retaining wall is proposed between both systems to keep respective drainage systems separate.

1.2.11 The report indicated TWUL were undertaking further survey work to inform recalibration of their hydraulic model and this should be used in any future RIBA3 assessments.

1.2.12 Groundwater was identified a possible flood risk. A perched water system, within made ground and/or River Terrace Deposits, occurs ~2m bgl and groundwater management including sub-surface water proofing is required to prevent groundwater flood risk to the station box. Any sub-surface water proofing should be suitably elevated above baseline groundwater levels though extensive groundworks forming HS2 station development, along with associated drainage, are predicted to provide a local cone of depression to surrounding groundwater levels from Stage A and Stage B1 works.

1.2.13 The predicted depression to groundwater levels may be further accentuated on a temporary basis by the groundworks proposed post Stage A and B1.

1.2.14 Ref 1 indicates any groundwater discharges from the Proposed Development, whether permanent or temporary (associated with underground construction works), alternatively require Trade Effluent Consents under the same Act to allow their discharge into TWUL combined sewer network. Any groundwater discharge rate is expected to be low owing to the low permeability of strata which may be encountered. However, groundwater may potentially be contaminated and hence the need to seek a Trade Effluent Consent to permit such discharges. When the Ref 1 Flood and Drainage Strategy was formulated three main areas of groundwater drainage were identified:

- Below the structural raft slab and below the track slab to the north of the basement box.
- Below the lowest basement slab for the main basement box.
- Below the structural raft slab and below the track slab to the south of the basement box.

1.2.15 Separate/subsequent review of the ground model used to inform this assessment shows it to be relatively low resolution compared to the ground model now being used to inform RIBA3 based assessments and this should be borne in mind.

1.3 Ref 2 - Euston Station Flood Risk Assessment Technical Note

1.3.1 This Technical Note provides an update to the flood risk component of Ref 1.

1.3.2 The only significant point of note in this update is that road levels were raised around the proposed underground structure meaning:

- Associated flood inundation levels around the proposed underground structure would be reduced for an extreme Q1000 pluvial event, likely remain within the road cross section and virtually no inundation is predicted.
- Flood waters would tend to be diverted away from the proposed underground structure.

1.3.3 There is no suggestion that this review was informed by:

- The proposed update of the TWUL hydraulic model indicated for Ref 1 (Section 2.1.10).
- Application of the RIBA3 updated landform in any hydraulic modelling.

1.3.4 This update indicated a flow rate to sewer of 54 l/s/ha was proposed at RIBA3 in contrast to RIBA2 (Ref 1) but highlights this remains to be agreed with TWUL.

1.4 Ref 3 - Highways and Drainage Scheme Design Report

1.4.1 This report considered outcomes concerning highways and external drainage assessments relevant for HS2 Euston station under WP1 and does not cover WP2 concerning the retaining walls.

1.4.2 The proposed HS2 Euston station development requires modifications and upgrades adjacent or proximal to the development. Additionally, it is proposed to route some peripheral areas associated with the proposed station to the modified/upgraded drainage system.

1.4.3 This report indicated:

- Attenuation was being designed for the Q100 plus 40% uplift for Climate Change (as previously stated Ref 1).
- Ongoing discussions concerning a flow rate to sewer of 54 l/s/ha were being held with TWUL (as previously indicated in Ref 2 succeeding earlier assumptions and AP03 Hybrid Bill values referred to in Ref 1).
- Corresponding attenuation volumes were given in Table 2-3 (from Ref 1) for the higher pro-rata flow rate being proposed.

1.5 Ref 4 - LU Flood Risk Assessment – DN1000 Water Main Burst Study

1.5.1 Ref 4 was informed by a preceding scoping document setting out the background and scope for undertaking a flood risk assessment involving a major burst from a water main proximal to the proposed HS2 Euston station.

1.5.2 The assessment considers the threat of flood risk from a burst on the 1m diam. (DN 1000) water main diversion/replacement to the proposed HS2 station entrances at Euston. Accordingly, the Stage B1 entrance layout was used for assessment purposes.

1.5.3 As a worse-case scenario, in terms of flood risk, the analyses considered inundation effects from a burst of the proposed 1m diam. water main without allowing for any probable, and significant, losses to the road drainage network or possible, though less significant, loss to infiltration.

1.5.4 Additionally, Transport for London/London Underground (TfL/LU) were concerned that the same poses a possible threat to the LU station and requested consideration of flood risk at:

- LU Euston station entrances.

- The proposed 'Sugar cube' LU traction sub-station (on the corner Cobourg St and Stephenson Way).

1.5.5 The assessments also considered the possibility of flood pathways to the above via:

- Vent shafts to the LU station.
- Disused entrances to the LU station.
- Possible connectivity to the LU station via entrances to the Network Rail (NR) station concourse.

1.5.6 The modelling undertaken assumes:

- An extreme outflow rate of 707l/s from the burst water main. Taken as the peak flow rate predicted in 2045 and the maximum possible outflow that could be sustained for any significant length of time.
- A five-hour period to isolate the main and a further one hour of ponding with trickle inflow of 1 l/s.

1.5.7 Sensitivity analyses indicated no significant variation to outcomes when different burst locations were assessed.

1.5.8 Modelling was undertaken using Micro Drainage with a 2m grid discretisation and a 5 minute time interval.

1.5.9 The assumption was made that at any entrance or other potential inflow point temporary barriers would be put in place allowing flood inundation of the modelled area to continue unchecked.

1.5.10 The landform used to inform the model assessment is similar to that used to inform Ref 3 (RIBA3).

1.5.11 Modelled flood depths and water level elevations for each locational/flow scenario modelled are shown within Ref4 in:

- Tabular form (in the Model Results Overview section).
- Figure format (in Appendix B).

1.5.12 Maximum flood depths and elevations modelled at each location considered are summarised in Table 2-4 below

Table 1-4 - Summary of modelled flood depths and elevations from Water Main burst study

Assessed feature/location			Max Flood Depth (m)	Max Flood Elevation (m AOD)
Feature	Map Ref	Location		
HS2 station Entrances	H1	HS2 North Entrance	-	-
	H2	HS2 West Entrance	0.13	24.63
	H3	HS2 Drummond St Entrance	0.20	24.70
	H4	HS2 South Entrance	0.21	24.71
LU station Entrances	L1	LU Southern Entrance	0.07	24.57
	L2	LU Gordon St Entrance	-	-
	L3	#170 (top of esc) – within NR station	-	-
	L4	#3009 (top of stairs) – within NR station	-	-
NR station Entrances	R1	Euston station East (North)	0.03	21.69
	R2	Euston station East (South)	0.09	21.95
Disused Entrances	D1	#153 (Door 2)	-	-
	D2	#154 (Door 3)	-	-
	D3	#155 (Door 4)	-	-
	D4	#26006 (Grill)	-	-
Vent Shaft Entrances	S1	#377 (Door 2)	0.19	24.60
	S2	#378 (Door 1)	0.12	24.66
	S3	#378 (Entrance 1)	-	-
	S3	#380 (Unnamed)	-	-
	S3	#381 (Door 3)	-	-
	S3	#382 (Door 4)	-	-
	S4	#383 (Door 5)	0.44	24.69
	S3	#384 (Unnamed)	-	-
	E1	Sugar Cube (North façade)	0.38	24.68

1.5.13 It should be noted that at the time of this report HS2 has not approved Ref 4 and LU are still to decide how they propose to act on Ref 4 findings.

1.6 Ref 5 - UKPN Substations Level 2 Flood Risk Assessment

1.6.1 This report (Ref 5) sets out the flood risks associated with the relocation of a UKPN substation to the rear of the Exmouth Arms (alongside the western boundary to the Maria Fidelis School).

1.6.2 Flood risk expressed in terms of elevations at the proposed UKPN substation is summarised in Table 2-5 below.

Table 1-5 – Predicted Flood Elevations at the proposed UKPN substation

UKPN substation		Predicted Flood Elevations (m AOD)		Substation Elevations (m AOD)		
Location	Component	Pluvial Q1000 – 60 minute	Burst Water Main (location 3)	Surrounding Ground Level	Base Level	Base Trench (min)
Rear Exmouth Arms	Underground	24.68[1]	24.63[2] & 24.70[3]	~24.50	20.40	19.90

[1] This prediction is at the proposed Exmouth Arms substation.
[2] This prediction is at H2 (HS2 West Entrance) located NW of the proposed Exmouth Arms substation.
[3] This prediction is at H3 (HS2 Drummond St Entrance) located SW of the proposed Exmouth Arms substation.
~ = This is an approx. min. elevation

1.6.3 The predicted flood level for the permanent UKPN substation location was found to be marginally higher for the burst water main assessment. All predictions were found to be very similar at the Exmouth Arms, however a conservative approach was taken to adopt the value given for the burst water main event at H3 (the HS2 Drummond Street Entrance) which is marginally higher than for the pluvial event.

1.6.4 As and when pluvial flood risk modelling/assessment for HS2 Euston station is updated the above findings have been recommended to be reviewed.

- A qualitative review of Ref 1 findings was undertaken which suggested no significant changes in terms of predicted flood risk outcomes though the coarseness of the RIBA2 land-form model used should be noted.
- Ref 5 is ultimately informed by Ref 4 (Flood risk from a Water Main Burst) which gives the highest flood level predictions and any update to the pluvial flood risk assessment is unlikely to change this.

1.6.5 Correspondingly, predicted flood depths have been found to equate to:

- 0.20m at Exmouth Arms.
- The predicted flood depths for the fluvial event at Exmouth Arms are only marginally (0.02m) less than those for the corresponding burst water main flood.

1.6.6 Where a flood risk is predicted, a flood barrier in accordance with UKPN - Engineering Design Standard EDS 07-0106 has been stated as being required. Accordingly, flood barrier requirements at the proposed UKPN substation are set out in Table 2-6 below.

1.6.7 For burst water main mediated flood events the following has been noted:

- No Climate Change uplift is applied (it is not considered appropriate).
- No freeboard uplift is applied (the flood predictions are extremely conservative as no allowance is made for loss to the road drainage system etc.).

1.6.8 For a pluvial flood event if the predicted flood depth plus Climate Change uplift is less than 0.30m then the freeboard uplift is capped to predicted flood depth plus Climate Change uplift as applies for the proposed underground component at Exmouth Arms.

Table 1-6 - Flood Barrier Mitigation at UKPN substation

UKPN substation	Flood Source	Surround-ing Ground Level (m AOD)	Predicted flood depth (m)	20% Climate Change uplift (m)	Free-board uplift (m)	Flood Barrier	
Location						Height (m)	Cap Elevation (m AOD)
Rear Exmouth Arms	Water Main	~24.50	0.20	N/A	N/A	0.20	24.70
	Fluvial		0.18	0.04	0.22	0.44	24.94

[1] Arguably no flood barrier mitigation is required here but low-level provision is recommended for consistency and added assurance.

1.6.9 The assessment identifies a flood barrier with a cap elevation of 24.94m AOD around the whole substation is required.

1.7 Ref 6 - Maria Fidelis School - Flood Risk Assessment and Drainage Strategy

1.7.1 This report (Ref 6) was produced as part of the recent proposal to develop the whole of the Maria Fidelis site which received resolution to grant, subject to a S106 agreement in October 2020 (the 'Maria Fidelis Lower School Development').

1.7.2 Ref 6 was produced by Conisbee and provides a review of flood risk associated with the wider Maria Fidelis Lower School Development along with a proposed development and drainage strategy in line with relevant local and national planning requirements including, but not limited to, the NPPF (2018) and Camden Local Plan (2017).

1.7.3 The 2019 FRA indicates that the site is located wholly within Flood Zone 1 (less than a 1 in 1,000 annual probability of river or sea flooding) and that the Proposed Development, considered as commercial use, is classified as 'Less Vulnerable' as per Table 2 of the NPPF Flood Risk and Coastal Change chapter. As a result, the use case of the site is considered acceptable as per Table 3 of the NPPF Flood Risk and Coastal Change chapter, thus the exception test is not required. The site is also not required to pass the sequential test.

1.7.4 Flood risk from a range of sources has been considered as part of the 2019 FRA. A summary of each risk is provided in Table 2-7.

Table 1-7 – Site Flood Risk Summary

Flood Risk Source	Identified Risk
Fluvial	Not at risk
Surface Water	Very low risk
Sewers	Very low risk
Groundwater	Very low risk
Artificial Sources	Not at risk
Tidal	Not at risk

1.7.5 The drainage strategy as proposed within Ref 6 indicates that a significant portion of the drainage network serving the buildings (particularly school buildings) within the site will be retained from the existing site, with pipes that are deemed to be in poor condition being repaired/replaced and manholes/RWP/SVPs moved where necessary. Drainage which is made redundant by the Proposed Development is proposed to be abandoned and properly decommissioned. No additional attenuation has been proposed for these areas with flows allowed to discharge as per existing.

1.7.6 The area largely consisting of the new CSC is proposed to be drained via an entirely new drainage network designed to modern standards. This system is proposed to discharge at a controlled rate to the local combined sewers with attenuation provided in the form of cellular storage and permeable paving.

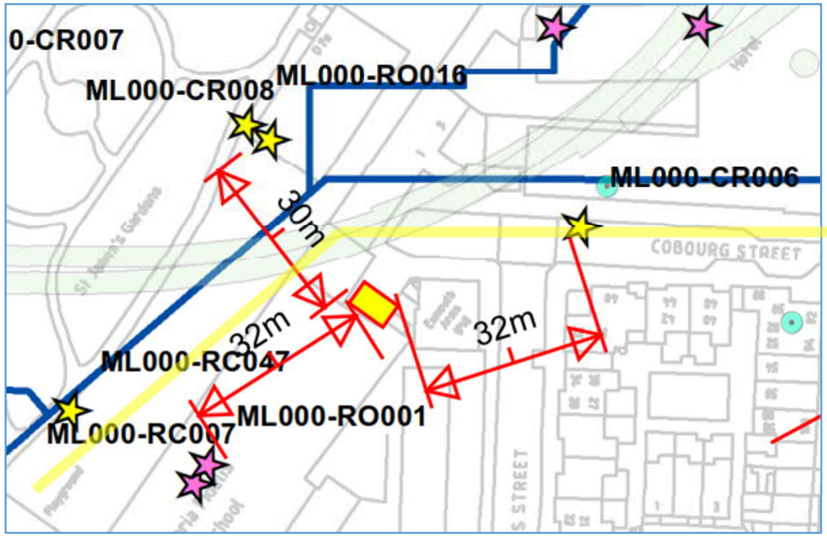
1.7.7 Where controlled, surface water is proposed to discharge at the QBAR greenfield runoff rate, though not lower than 1.0 l/s.

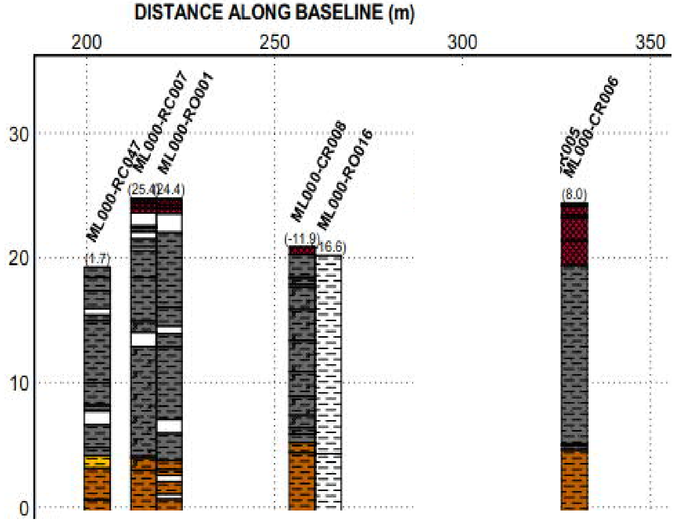
1.7.8 Attenuation is indicated as being provided for up to the 1 in 100yr storm +30% climate change event which is stated as complying with the ‘Upper Limit’ in DEFRA guidance. It has been assumed that the site is 75% impermeable (PIMP) while using an overall catchment factor (Cv) of 1.

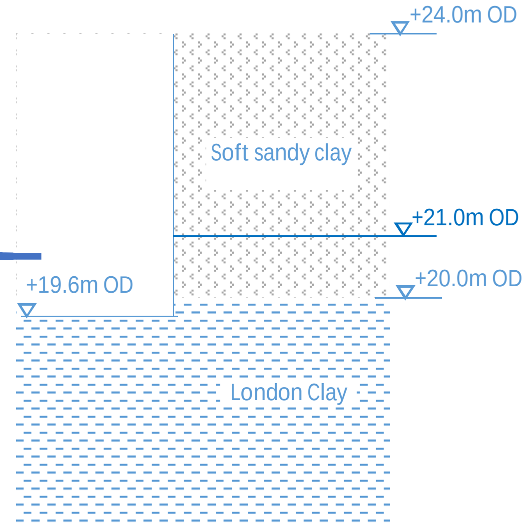
APPENDIX 3

Interpreted Ground Model Extract

Ground model







Borehole	Encountered Made Ground		
ML000-RC007	0-0.1m: Tarmac 0.1-0.75m: Fine to coarse sand 0.75-1.2m: Soft clay 1.2-2.2m: Assumed Zone of Core Loss 2.2-2.4m: Soft clay	ML000-CR008	0-0.6m: Backfilled material (Clay) in St James Garden exhumation area.
ML000-RO001	0-0.1m: Tarmac 0.1-0.75m: Fine to coarse sand 0.75-1.2m: Soft clay 1.2-2.7m: Assumed Zone of Core Loss	ML000-CR006	0-1.2m: Silty sand and gravel 1.2-3.0m: Firm gravelly clay 3.0-5.0m V stiff high plasticity clay

APPENDIX 4

Greenfield Runoff Rate Calculation

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	James Forsdyke
Site name:	Former Maria Fidelis School Site
Site location:	London Borough of Camden

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.52801° N
Longitude:	0.13756° W
Reference:	3223906969
Date:	Aug 03 2021 11:21

Runoff estimation approach: IH124

Site characteristics

Total site area (ha): 0.232

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	616	616
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.96	0.96
1 in 1 year (l/s):	0.82	0.82
1 in 30 years (l/s):	2.22	2.22
1 in 100 year (l/s):	3.08	3.08
1 in 200 years (l/s):	3.61	3.61

APPENDIX 5

Microdrainage Attenuation Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.222	4-8	0.010

Total Area Contributing (ha) = 0.232

Total Pipe Volume (m³) = 8.360

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	21.600#	0.144	150.0	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	
1.001	84.000#	0.560	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
1.002	14.600#	0.097	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
1.003	14.100#	0.094	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.36	23.294	0.000	0.0	0.0	0.0	0.99	31.0	0.0
1.001	50.00	6.78	23.150	0.000	0.0	0.0	0.0	0.99	31.0	0.0
1.002	50.00	7.03	22.590	0.000	0.0	0.0	0.0	0.99	31.0	0.0
1.003	50.00	7.27	22.493	0.000	0.0	0.0	0.0	0.99	31.0	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	7.400#	0.049	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
1.005	5.900#	0.039	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
2.000	13.500#	0.090	150.0	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	
2.001	11.000#	0.073	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
3.000	25.800#	0.172	150.0	0.000	5.00	0.0	0.600	o	200	Pipe/Conduit	
3.001	25.800#	0.172	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
3.002	14.400#	0.096	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
3.003	14.500#	0.097	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
3.004	3.500#	0.023	150.0	0.000	0.00	0.0	0.600	o	200	Pipe/Conduit	
1.006	10.000#	0.067	149.3	0.232	0.00	0.0	0.600	o	200	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	50.00	7.39	22.399	0.000	0.0	0.0	0.0	0.99	31.0	0.0
1.005	50.00	7.49	22.349	0.000	0.0	0.0	0.0	0.99	31.0	0.0
2.000	50.00	5.23	23.618	0.000	0.0	0.0	0.0	0.99	31.0	0.0
2.001	50.00	5.41	23.528	0.000	0.0	0.0	0.0	0.99	31.0	0.0
3.000	50.00	5.44	24.150	0.000	0.0	0.0	0.0	0.99	31.0	0.0
3.001	50.00	5.87	23.978	0.000	0.0	0.0	0.0	0.99	31.0	0.0
3.002	50.00	6.11	23.806	0.000	0.0	0.0	0.0	0.99	31.0	0.0
3.003	50.00	6.36	23.710	0.000	0.0	0.0	0.0	0.99	31.0	0.0
3.004	50.00	6.42	23.613	0.000	0.0	0.0	0.0	0.99	31.0	0.0
1.006	50.00	7.66	22.310	0.232	0.0	0.0	0.0	0.99	31.1«	31.4

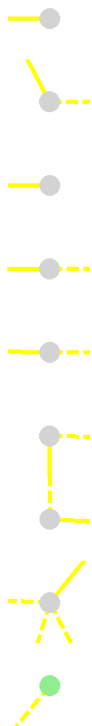
Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	25.000	1.706	Open Manhole	1200	1.000	23.294	200				
2	25.000	1.850	Open Manhole	1200	1.001	23.150	200	1.000	23.150	200	
3	25.000	2.410	Open Manhole	1200	1.002	22.590	200	1.001	22.590	200	
4	25.000	2.507	Open Manhole	1200	1.003	22.493	200	1.002	22.493	200	
5	25.000	2.601	Open Manhole	1200	1.004	22.399	200	1.003	22.399	200	
6	25.000	2.651	Open Manhole	1200	1.005	22.349	200	1.004	22.349	200	
7	25.000	1.382	Open Manhole	1200	2.000	23.618	200				
8	25.000	1.472	Open Manhole	1200	2.001	23.528	200	2.000	23.528	200	
9	25.000	0.850	Open Manhole	1200	3.000	24.150	200				
10	25.000	1.022	Open Manhole	1200	3.001	23.978	200	3.000	23.978	200	
10	25.000	1.194	Open Manhole	1200	3.002	23.806	200	3.001	23.806	200	
11	25.000	1.290	Open Manhole	1200	3.003	23.710	200	3.002	23.710	200	
12	25.000	1.387	Open Manhole	1200	3.004	23.613	200	3.003	23.613	200	
7	25.000	2.690	Open Manhole	1200	1.006	22.310	200	1.005	22.310	200	
								2.001	23.455	200	1145
								3.004	23.590	200	1280
	25.000	2.757	Open Manhole	0		OUTFALL		1.006	22.243	200	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	344.563	30.078	344.563	30.078	Required	
2	341.375	80.281	341.375	80.281	Required	
3	183.594	81.875	183.594	81.875	Required	
4	184.125	52.656	184.125	52.656	Required	
5	206.438	30.344	206.438	30.344	Required	
6	231.406	30.344	231.406	30.344	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
7	275.500	29.016	275.500	29.016	Required	
8	246.016	29.016	246.016	29.016	Required	
9	305.709	73.954	305.709	73.954	Required	
10	263.596	74.356	263.596	74.356	Required	
10	221.483	74.758	221.483	74.758	Required	
11	198.303	75.102	198.303	75.102	Required	
12	198.533	48.939	198.533	48.939	Required	
7	236.453	47.078	236.453	47.078	Required	
	247.609	60.625			No Entry	



PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	200	1	25.000	23.294	1.506	Open Manhole	1200
1.001	o	200	2	25.000	23.150	1.650	Open Manhole	1200
1.002	o	200	3	25.000	22.590	2.210	Open Manhole	1200
1.003	o	200	4	25.000	22.493	2.307	Open Manhole	1200
1.004	o	200	5	25.000	22.399	2.401	Open Manhole	1200
1.005	o	200	6	25.000	22.349	2.451	Open Manhole	1200
2.000	o	200	7	25.000	23.618	1.182	Open Manhole	1200
2.001	o	200	8	25.000	23.528	1.272	Open Manhole	1200
3.000	o	200	9	25.000	24.150	0.650	Open Manhole	1200
3.001	o	200	10	25.000	23.978	0.822	Open Manhole	1200
3.002	o	200	10	25.000	23.806	0.994	Open Manhole	1200
3.003	o	200	11	25.000	23.710	1.090	Open Manhole	1200
3.004	o	200	12	25.000	23.613	1.187	Open Manhole	1200
1.006	o	200	7	25.000	22.310	2.490	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	21.600#	150.0	2	25.000	23.150	1.650	Open Manhole	1200
1.001	84.000#	150.0	3	25.000	22.590	2.210	Open Manhole	1200
1.002	14.600#	150.0	4	25.000	22.493	2.307	Open Manhole	1200
1.003	14.100#	150.0	5	25.000	22.399	2.401	Open Manhole	1200
1.004	7.400#	150.0	6	25.000	22.349	2.451	Open Manhole	1200
1.005	5.900#	150.0	7	25.000	22.310	2.490	Open Manhole	1200
2.000	13.500#	150.0	8	25.000	23.528	1.272	Open Manhole	1200
2.001	11.000#	150.0	7	25.000	23.455	1.345	Open Manhole	1200
3.000	25.800#	150.0	10	25.000	23.978	0.822	Open Manhole	1200
3.001	25.800#	150.0	10	25.000	23.806	0.994	Open Manhole	1200
3.002	14.400#	150.0	11	25.000	23.710	1.090	Open Manhole	1200
3.003	14.500#	150.0	12	25.000	23.613	1.187	Open Manhole	1200
3.004	3.500#	150.0	7	25.000	23.590	1.210	Open Manhole	1200
1.006	10.000#	149.3		25.000	22.243	2.557	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
3.003	-	-	100	0.000	0.000	0.000
3.004	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.232	0.232	0.232
				Total	Total	Total
				0.232	0.232	0.232

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006		25.000	22.243	0.000	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	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.006, Volume (m³): 3.6

Unit Reference	MD-SHE-0037-1000-2590-1000
Design Head (m)	2.590
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	37
Invert Level (m)	22.310
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	2.590	1.0	Kick-Flo®	0.334	0.4
Flush-Flo™	0.164	0.5	Mean Flow over Head Range	-	0.7

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	0.5	1.200	0.7	3.000	1.1	7.000	1.6
0.200	0.5	1.400	0.8	3.500	1.1	7.500	1.6
0.300	0.4	1.600	0.8	4.000	1.2	8.000	1.7
0.400	0.4	1.800	0.8	4.500	1.3	8.500	1.7
0.500	0.5	2.000	0.9	5.000	1.3	9.000	1.8
0.600	0.5	2.200	0.9	5.500	1.4	9.500	1.8
0.800	0.6	2.400	1.0	6.000	1.5		
1.000	0.7	2.600	1.0	6.500	1.5		

Storage Structures for Storm

Complex Manhole: 7, DS/PN: 1.006

Cellular Storage

Invert Level (m) 22.310 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	35.7	0.0	2.001	0.0	0.0
2.000	35.7	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	25.0
Membrane Percolation (mm/hr)	1000	Length (m)	29.0
Max Percolation (l/s)	201.4	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	24.400	Cap Volume Depth (m)	0.500

1 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 FSR Ratio R 0.400
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 20.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS 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) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Winter	1	+0%	30/60 Summer				23.294
1.001	2	960 Summer	1	+0%	30/30 Summer				23.205
1.002	3	960 Summer	1	+0%	1/60 Summer				23.205
1.003	4	960 Summer	1	+0%	1/30 Summer				23.205
1.004	5	960 Summer	1	+0%	1/15 Summer				23.205
1.005	6	960 Summer	1	+0%	1/15 Summer				23.205
2.000	7	360 Winter	1	+0%	30/120 Summer				23.618
2.001	8	360 Winter	1	+0%	30/60 Summer				23.528
3.000	9	360 Winter	1	+0%	30/480 Summer				24.150
3.001	10	360 Winter	1	+0%	30/240 Summer				23.978
3.002	10	360 Winter	1	+0%	30/180 Summer				23.806
3.003	11	360 Winter	1	+0%	30/120 Summer				23.710
3.004	12	360 Winter	1	+0%	30/120 Summer				23.613
1.006	7	960 Summer	1	+0%	1/15 Summer				23.205

1 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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.200	0.000	0.00		0.0	OK	
1.001	2	-0.145	0.000	0.00		0.0	OK	
1.002	3	0.415	0.000	-0.02		-0.5	SURCHARGED	
1.003	4	0.513	0.000	-0.02		-0.6	SURCHARGED	
1.004	5	0.607	0.000	-0.03		-0.7	SURCHARGED	
1.005	6	0.656	0.000	-0.03		-0.8	SURCHARGED	
2.000	7	-0.200	0.000	0.00		0.0	OK	
2.001	8	-0.200	0.000	0.00		0.0	OK	
3.000	9	-0.200	0.000	0.00		0.0	OK	
3.001	10	-0.200	0.000	0.00		0.0	OK	
3.002	10	-0.200	0.000	0.00		0.0	OK	
3.003	11	-0.200	0.000	0.00		0.0	OK	
3.004	12	-0.200	0.000	0.00		0.0	OK	
1.006	7	0.695	0.000	0.02		0.6	SURCHARGED	

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	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	20.000	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS 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)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	720 Winter	30	+0%	30/60 Summer				24.457
1.001	2	720 Winter	30	+0%	30/30 Summer				24.457
1.002	3	720 Winter	30	+0%	1/60 Summer				24.458
1.003	4	720 Winter	30	+0%	1/30 Summer				24.458
1.004	5	720 Winter	30	+0%	1/15 Summer				24.458
1.005	6	720 Winter	30	+0%	1/15 Summer				24.458
2.000	7	720 Winter	30	+0%	30/120 Summer				24.458
2.001	8	720 Winter	30	+0%	30/60 Summer				24.458
3.000	9	720 Winter	30	+0%	30/480 Summer				24.458
3.001	10	720 Winter	30	+0%	30/240 Summer				24.458
3.002	10	720 Winter	30	+0%	30/180 Summer				24.458
3.003	11	720 Winter	30	+0%	30/120 Summer				24.458
3.004	12	720 Winter	30	+0%	30/120 Summer				24.458
1.006	7	720 Winter	30	+0%	1/15 Summer				24.458

30 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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.963	0.000	-0.01		-0.2	SURCHARGED	
1.001	2	1.107	0.000	-0.02		-0.7	SURCHARGED	
1.002	3	1.668	0.000	-0.03		-0.9	SURCHARGED	
1.003	4	1.765	0.000	-0.04		-1.1	SURCHARGED	
1.004	5	1.859	0.000	-0.05		-1.2	SURCHARGED	
1.005	6	1.909	0.000	-0.06		-1.4	SURCHARGED	
2.000	7	0.640	0.000	-0.01		-0.1	SURCHARGED	
2.001	8	0.730	0.000	-0.02		-0.5	SURCHARGED	
3.000	9	0.108	0.000	0.00		-0.1	SURCHARGED	
3.001	10	0.280	0.000	-0.01		-0.3	SURCHARGED	
3.002	10	0.452	0.000	-0.02		-0.5	SURCHARGED	
3.003	11	0.548	0.000	-0.02		-0.6	SURCHARGED	
3.004	12	0.645	0.000	-0.04		-0.8	SURCHARGED	
1.006	7	1.948	0.000	0.03		0.9	SURCHARGED	

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 FSR Ratio R 0.400
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 20.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS 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) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	1440 Winter	100	+40%	30/60 Summer				24.994
1.001	2	1440 Winter	100	+40%	30/30 Summer				24.994
1.002	3	1440 Winter	100	+40%	1/60 Summer				24.994
1.003	4	1440 Winter	100	+40%	1/30 Summer				24.994
1.004	5	1440 Winter	100	+40%	1/15 Summer				24.994
1.005	6	1440 Winter	100	+40%	1/15 Summer				24.994
2.000	7	1440 Winter	100	+40%	30/120 Summer				24.994
2.001	8	1440 Winter	100	+40%	30/60 Summer				24.994
3.000	9	1440 Winter	100	+40%	30/480 Summer				24.994
3.001	10	1440 Winter	100	+40%	30/240 Summer				24.994
3.002	10	1440 Winter	100	+40%	30/180 Summer				24.994
3.003	11	1440 Winter	100	+40%	30/120 Summer				24.994
3.004	12	1440 Winter	100	+40%	30/120 Summer				24.994
1.006	7	1440 Winter	100	+40%	1/15 Summer				24.994

100 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)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	1.500	0.000	-0.01		-0.2	FLOOD RISK	
1.001	2	1.644	0.000	-0.01		-0.4	FLOOD RISK	
1.002	3	2.204	0.000	-0.02		-0.6	FLOOD RISK	
1.003	4	2.301	0.000	-0.03		-0.8	FLOOD RISK	
1.004	5	2.395	0.000	-0.04		-1.0	FLOOD RISK	
1.005	6	2.445	0.000	-0.05		-1.2	FLOOD RISK	
2.000	7	1.176	0.000	-0.01		-0.2	FLOOD RISK	
2.001	8	1.266	0.000	-0.01		-0.4	FLOOD RISK	
3.000	9	0.644	0.000	-0.01		-0.2	FLOOD RISK	
3.001	10	0.816	0.000	-0.02		-0.6	FLOOD RISK	
3.002	10	0.988	0.000	-0.03		-0.9	FLOOD RISK	
3.003	11	1.084	0.000	-0.04		-1.1	FLOOD RISK	
3.004	12	1.181	0.000	-0.06		-1.3	FLOOD RISK	
1.006	7	2.484	0.000	0.04		1.0	FLOOD RISK	

APPENDIX 6

Camden LLFA SuDS Proforma

Pro-forma for any schemes in flood risk areas & all major development - Camden LLFA

All yellow boxes **must** be completed on this and all relevant tabs
Complete peach cells with source document and section/page references, required to support/justify responses
Do not edit grey cells
Please note guidelines / notes in column M
Complete all relevant tabs

Introduction: This Proforma is intended to help you understand the Sustainable Drainage and Flood Risk considerations that the Lead Local Flood Authority (LLFA) and Local Planning Authority (LPA) will take into account when considering an application in Camden, as well as helping us to consider the application. This does not replace the need also to provide where required a Drainage Statement, Flood Risk Assessment, and GLA-Camden SuDS Pro-forma, and observe the detailed guidance in ' Camden Planning Guidance (CPG) Water & Flooding'. Any information provided should be referenced to the relevant section of submitted supporting documents. This summary page will help provide key details on the application. Note that certain cells on this and other tabs will be populated automatically from previous answers given.

A. Application details

Planning reference (if known)				
Scheme name	Maria Fidelis Construction Skills Centre and Site Accomodation			
Scheme address	Maria Fidelis Convent School, North Gower Street, Euston Road, London			
Postcode	NW1 2LY			
Scale of development as registered	Major			
Scale - policy subcategory		Residential parts	Major - other	Non-residential parts
Type(s) of development	Non-residential	New/re-build		
Site area, hectares	0.2446	*100%*		
Of which total permeable area, to nearest 0.0001 ha	0.0122	5%		
of which total impermeable area, to nearest 0.0001 ha	0.2324	95%		

	Existing	Proposed				
	TOTAL pre-development	For demolition	New-build incl. infills, re-build, extensions	Retained (refurbished or change of use)	TOTAL post-development	Net UPLIFT post-development
Total floor area of development (GIA)	0	0	7125	0	7125	7125
of which residential			0	0	0	0
of which non- residential	0	0	7125	0	7125	7125
Number of residential units	0	0	0	0	0	
List all use class(es)	D1	B1(a)				

Drainage Statement document details	
Flood Risk Assessment document details	1CP01-MDS_ARP-EV-REP-SS08_SL23-990007, James Forsdyke, 03/08/2021, C01

B. Flood Risk and SuDS - Policy & Documents Filter

Recommendation (Council to complete)			
	Site area 1 hectare or greater?	*No*	
	Major application?	*Yes*	
	In Critical Drainage Area?	Yes	
	In or bordering (<50m) Local Flood Risk Zone(s)?	No	
	Name of LFRZ(s):	n/a	
	On Historically Flooded Street 1975 or 2002?	No	
	Name of HFS(s):	n/a	
	Area at risk of flooding (surface water)?	*No*	
	Elevated groundwater susceptibility or <50m of GW i	Yes	
	In area with recorded sewer flooding incident?	No	
	In street with historical underground watercourse?	No	
	Area at risk of flooding (other relevant types)?	*Yes*	
	Basement proposed - new, enlarged or change of use	No	
	IF YES, list proposed basement uses (all spaces):		
Approve/Condition/Refuse	*IF YES, are habitable or vulnerable use(s) included?*		
Approve/Condition/Refuse	*IF NO, is other (non-basement) vulnerable developme*	No	
	Vulnerable development in flood-prone area?	*CHECK SITE DETAILS*	
	Site-specific Flood Risk Assessment (FRA) required?	*CHECK SITE DETAILS*	
Approve/Condition/Refuse	Site-specific FRA submitted?	Yes	**If Yes, go to Flood Risk Proposals tab**
	Drainage Statement (DS) required?	*No*	
Approve/Condition/Refuse	DS submitted?	No	**If Yes, go to Flood Risk Proposals tab**
	Sustainable drainage (SuDS) proposals required?	*CHECK SITE DETAILS*	
Approve/Condition/Refuse	SuDS proposals submitted?	Yes	**If Yes, go to SuDS Proposals tab**
	FRA/DS/SuDS supporting evidence required?	*CHECK SITE DETAILS*	
Approve/Condition/Refuse	Supporting evidence submitted?	Yes	**If Yes, go to Flood Risk Proposals &/or SuDS Proposals t**

Flood Risk Assessment, Proposals & Evidence

Recommendation (Council to complete)	**Assessments**	Required?	Document submitted?	Document title	Page/ section reference	**Guidelines / notes**
	Site-specific Flood Risk Assessment	*CHECK SITE DETAILS*	*Yes*	Maria Fidelis Flood Risk Assessment		Policy CC3 c. consider the impact of development in areas at risk of flooding (including drainage) & d. incorporate flood resilient measures in areas prone to flooding; Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.
	Drainage Statement	*No*	*No*			Policy CC3 c. consider the impact of development in areas at risk of flooding
	SuDS Proposals tab completed	*No*	No			(including drainage);
	SuDS Proposals	*CHECK SITE DETAILS*	Yes			Policy CC3 b. avoid harm to the water environment and improve water quality
	SuDS Proposals tab completed	*CHECK SITE DETAILS*	Yes			& e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible

Recommendation (Council to complete)	**Policy compliance**	Required?	Requirement met?	Document title	Page/ section reference	
	Assessments address local, regional & national policies	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment		*including Local Plan CC3, CPG, new London Plan, National Planning Policy Framework*
	include suitable research & quantification of site flood risks	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Sections 2 & 3 & Appendix 2	*including Strategic Flood Risk Assessment, Update LFRZ Map & EA Mapping*
	address cumulative impact of developments	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Section 3	Policy CC3 c. consider the impact of development in areas at risk of flooding
	propose suitable flood ingress internal coping measures	*CHECK SITE DETAILS*	No	Site set above peak flood levels		Policy CC3 d. incorporate flood resilient measures in areas prone to flooding;
	propose suitable flood risk mitigation measures	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Sections 3 & 4	Policy CC3 d. incorporate flood resilient measures in areas prone to flooding;
	Internal water consumption target 105 l/p/d (residential)	*No*	n/a			Policy CC3 a. incorporate water efficiency measures
	External water consumption target 5 l/p/d (residential)	*No*	n/a			Policy CC3 a. incorporate water efficiency measures
	BREEAM Excellent water consumption target (non-resi >500m2)	*Yes*	n/a			Policy CC3 a. incorporate water efficiency measures
	Will not locate vulnerable development in flood-prone area	*Yes*	*No*			Policy CC3 f. not locate vulnerable development in flood-prone areas.
	Scheme does not increase flood risk on & off site	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Section 4	Policy CC3 The Council will seek to ensure that development does not increase flood risk
	Scheme reduces on&off-site flood risk where possible	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Section 4	Policy CC3 The Council will seek to ensure that development...reduces the risk of flooding where possible

Recommendation (Council to complete)	**Evidence supporting Assessments & Proposals**	Required?	Evidence submitted?	Document title	Page/ section reference	
	Drawings showing site-specific flood risk up to 100yr+40%	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Section 3 & 4	*allowing 300mm freeboard to potential water ingress points*
	Drawings showing proposed internal coping measures	*CHECK SITE DETAILS*	No	Site set above peak flood levels		
	Drawings showing proposed flood mitigation measures	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Section 4	
	Drawings showing proposed basement/ground floor uses	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Appendix 1	
	Building flood risk emergency evacuation plan		No			
	Drawings showing on&off-site overland exceedance flows	*CHECK SITE DETAILS*	Yes	Maria Fidelis Flood Risk Assessment	Section 4	
	Internal water calculations & proposals (resi)	*No*	n/a			Policy CC3 a. incorporate water efficiency measures
	External water calculations & proposals (resi)	*No*	n/a			Policy CC3 a. incorporate water efficiency measures
	BREEAM water calculations & proposals (non-resi >500m2)	*Yes*	n/a			Policy CC3 a. incorporate water efficiency measures

Sustainable Drainage (SuDS) Assessment, Evidence and Proposals

Recommendation (Council to complete)	Assessments	Document submitted?	Document title	Page/ section reference	Guidelines / notes
	Drainage Statement (DS)	*No*			Policy CC3 c. consider the impact of development in areas at risk of flooding (including drainage);
	GLA-Camden SuDS Pro-forma (fully completed)	Yes	Camden Flood-SuDS Proforma v1_Maria Fidelis FRA		Download from www.london.gov.uk/what-we-do/environment/climate-change/surface-

Recommendation (Council to complete)	Policy compliance	Requirement met?	Document title	Page/ section reference	Guidelines / notes
	DS must include identification of flood risk	Yes	Maria Fidelis Flood Risk Assessment	Section 3	Policy CC3 e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible & Policy CC3 supporting text §8.67
	DS must include assessment of existing, greenfield & proposed runoff rates	Yes	Maria Fidelis Flood Risk Assessment	Section 4 Table 4-1	
	DS must include identification of measures, in line with the drainage hierarchy, to reduce runoff rates	Yes	Maria Fidelis Flood Risk Assessment	Section 4	
	Achieve greenfield runoff rates wherever feasible, or as close as possible	Yes	Maria Fidelis Flood Risk Assessment	Section 4	Policy CC3 e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible & Policy CC3 supporting text §8.66
	Constrain runoff volumes to greenfield for 100yr 6hr event where feasible	Yes	Maria Fidelis Flood Risk Assessment	Section 4	
	Backstop target for unaltered buildings: >50% reduction in existing run-off	n/a			
	Developments must include SuDS unless inappropriate	Yes	Maria Fidelis Flood Risk Assessment	Section 4	Policy CC3 e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible & Policy CC3 supporting text §8.68
	Development should follow the detailed London Plan drainage hierarchy	Yes	Maria Fidelis Flood Risk Assessment	Section 4	
	EA climate change factor applied: 2080s upper rainfall intensity allowance (40%)	Yes	Maria Fidelis Flood Risk Assessment	Section 4	

Recommendation (Council to complete)	Evidence supporting Assessments & Proposals	Evidence submitted?	Document title	Page/ section reference
	Drawings detailing SuDS extent & position (incl. outfalls, control points, levels)	Yes	Maria Fidelis Flood Risk Assessment	Section 4 & Figure 4.1
	Blue-green roof details with area & minimum 150mm substrate for storage	No		
	Results of cross-site infiltration rate or similar tests to show soil (in)compatibility	Yes	Maria Fidelis Flood Risk Assessment	Section 4
	Professional run-off calculations supporting rates & volumes reported in DS	Yes	Maria Fidelis Flood Risk Assessment	Section 4 & Appendix 4
	Drawings showing on&off-site overland exceedance flows	Yes	Maria Fidelis Flood Risk Assessment	Figure 4.1
	Evidence of site surveys and investigations relating to drainage	Yes	Maria Fidelis Flood Risk Assessment	See Appendix 2 and Section 4
	Lifetime maintenance and adoption arrangements (and maintenance owner)	Yes	Maria Fidelis Flood Risk Assessment	Section 1 and 4
	Management of health & safety risks related to SuDS design	Yes	Maria Fidelis Flood Risk Assessment	Section 4
	Confirmation of discharge capacity (or correspondence) from relevant body eg TW	Yes	Maria Fidelis Flood Risk Assessment	See Appendix 2 and Section 4