# Flood Risk Assessment and Drainage Strategy Report

J2889 Toddler Lab, 32 Torrington Square

Ref: J2889-C-RP-0002
Revision: 00
Status: S3

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**GENERAL NOTES**



**REVISION HISTORY**

| Revision | Status | Date | Author | Reviewer | Approver |
|---|---|---|---|---|---|
| 00 | For Information | 20/07/2017 | AP | GP-D | TW |
| 01 | Stage 3 Issue | 21/07/17 | GP-D | GP-D | TW |

# 1 INTRODUCTION

Webb Yates Engineers have been appointed by Birkbeck University of London to undertake the civil and structural engineering design services for the proposed redevelopment of the existing building situated at 32 Torrington Square and the proposed annex to the land north of 32 Torrington Square.

The project consists of a full refurbishment of existing 32 Torrington Square and a new build five-storey annex in the empty site between 32 Torrington Square and The Warburg Institute.

This site-specific Flood Risk Assessment (FRA) and Drainage Strategy Report has been prepared on behalf of Birkbeck University of London in respect to this development and as part of its BREEAM assessment. The site is located in Flood Zone 1 and as such an exception or sequential test is not required.

This study considers the issues relating to flood risk and drainage associated with the development proposals. The purpose of this assessment is to assess how the development proposal affects flood risk both to the site and the surrounding areas and ensure the development will be safe for its lifetime taking into account the vulnerability of its users. This will be in accordance with national guidance.

This Document has been prepared with reference to:

- National Planning Policy Framework (NPPF) March 2012
- National Planning Practice Guidance (NPPG) March 2014
- Environment Agency (EA) Flood Maps (http://maps.environment-agency.gov.uk/)
- London Borough of Camden Strategic Flood Risk Assessment (SFRA) July 2014.
- Sustainable Drainage Systems: Non Statutory technical standards for sustainable drainage systems March 2015
- Sewers for adoption 7th Edition October 2012
- Camden Core Strategy November 2010
- The London Plan (www.london.gov.uk) 2011.
- The London Supplementary Planning Guidance (SPG) – Sustainable Design and Construction (www.london.gov.uk) 2014.
- SuDS Manual, Ciria 2015.
- Rainfall Runnoff Management for Developments Report – SC030219, Environment Agency 2013

## 2 GENERAL DESCRIPTION OF SITE

The proposed development includes the refurbishment of the existing 32 Torrington Square, and a new five-storey annex in the vacant plot between 32 Torrington Square and The Warburg Institute. 32 Torrington Square is the last building in a row of terraced houses. The building was awarded Grade II listed status in 1969. The site is found south east of Regents Park, approximately 1.5km north west of the River Thames. The site is in the Borough of Camden approximately 500m south east of Euston railway stations.

The immediate peripheries of the proposed new annex include hardstanding to the east of the site, Torrington Square to the West, 32 Torrington Square and a row of terraced properties to the South, and The Warburg Institute to the North. The site's postcode is WC1E 7JL. The approximate national grid reference is TQ 29808 82110 and the latitude/longitude coordinates are approximately 51.522997/-0.130343. Figure 1 shows the site geographical location and Figure 2 shows an aerial view of the site.

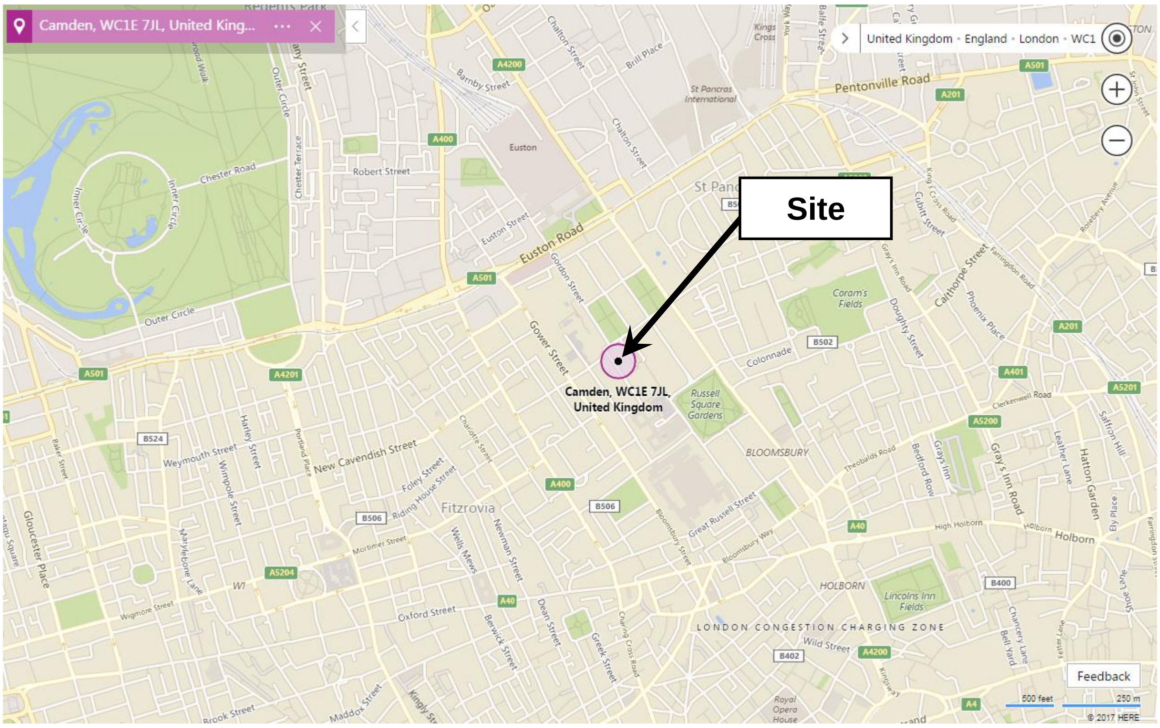



Figure 1: Maps of Local Area with site marked with arrow.

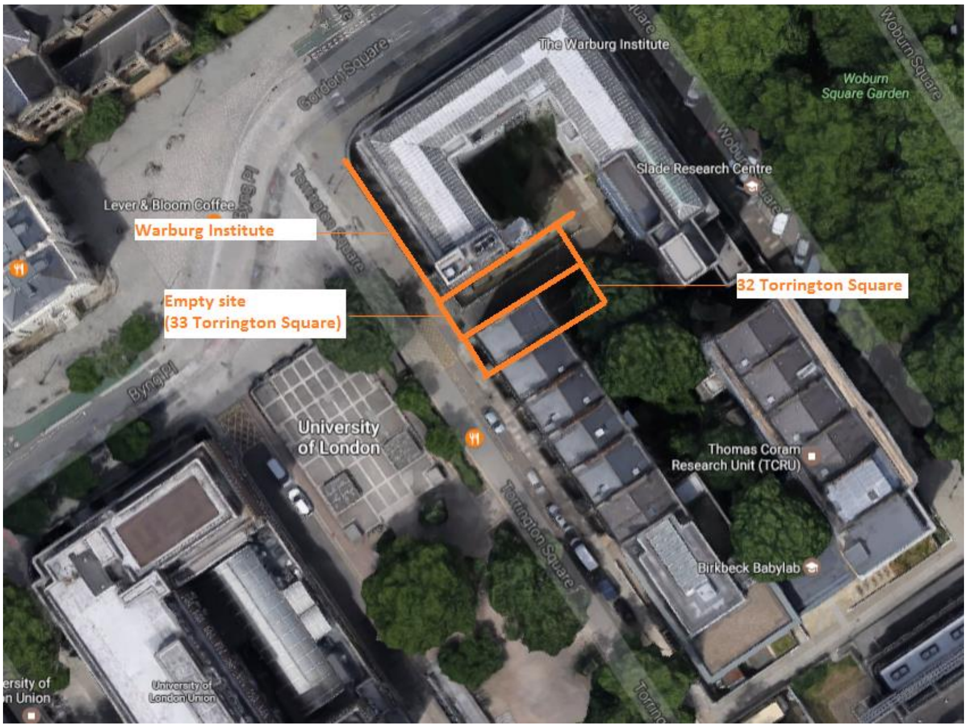



Figure 2: Site aerial view [source: Google Maps Top, Bing Maps Bottom]

# 3 SITE CONTEXT

## 3.1 TOPOGRAPHY

The site topography is relatively flat, with a shallow gradient falling away from Torrington Square, from a level roughly 25.90 mAOD at the site boundary adjacent to Torrington Square. The centre of the Torrington Square carriageway at 25.72 mAOD; showing the site lies on slightly higher ground.

## 3.2 GEOLOGY

A Site Investigation has been undertaken for the proposed development, and a report, BRD Environmental Limited *Geo-Environmental Site Investigation (BRD2903-OR2-A)* provided.

The report indicates that the site is underlain by superficial deposits comprising the Lynch Hill Gravel Member. The shallowest bedrock unit is shown to be London Clay Formation.

The above findings are similar to that shown on the British Geological Society bedrock and superficial deposit maps, which indicate Lynch Hill Gravel Member - Sand and Gravel deposits overlying London Clay.

## 3.3 HYDROGEOLOGY

The site is situated upon superficial deposits designated a Secondary A Aquifer. The underlying bedrock geology is designated as Unproductive Strata.

The site is not located within a groundwater Source Protection Zone.

## 3.4 HYDROLOGY

The River Thames lies approximately 1.6km to the south of the site. The nearest surface water feature to the site is a culvert, located approximately 400m to the east of the site. The culvert is likely to be a section of the River Fleet, a tributary of the River Thames.

## 3.5 EXISTING DRAINAGE

A Thames Water combined sewer passes within the Torrington Square access road. It is likely all foul and surface water drainage is taken into the combined sewer

# 4 PROPOSED DEVELOPMENT

## 4.1 BUILDING PROPOSAL PURPOSE

The project consists of a full refurbishment of existing 32 Torrington Square and a new build five storey annex in the empty site between 32 Torrington Square and The Warburg Institute.

The existing building is of traditional construction utilising masonry vertical elements and timber floor structures with a basement enclosed on three sides and part submerged to the rear of the property. The existing basement is to be lowered by a depth of approximately 1metre.

The new annex on the empty site between 32 Torrington Square and the Warburg Institute is proposed as a 5 storey annex with a basement which will link through to the basement of 32 Torrington Square. The existing ramp which provides access to the rear courtyard of The Warburg Institute is to be reinstated following construction of the new building, running through the proposed development at ground floor level.

Figures 3 and 4 show the proposed ground floor and basement plan layouts. Appendix A shows the proposed site layout.

## 4.2 FLOOD RISK VULNERABILITY CLASSIFICATION

NPPF sets out the Flood Risk and Flood Vulnerability Tables to decide whether development is appropriate depending on the vulnerability type of the development. The development proposed is considered 'non-residential uses for health services, nurseries and educational establishments'. Table 2: Flood Risk Vulnerability Classifications found within the NPPF Technical Guidance Document classifies this type of development as "More Vulnerable". The site solely within Flood Zone 1 so the NPPF finds the development proposal satisfactory; this is in accordance with Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' (extract below).

| Flood Zones | Flood Risk Vulnerability Classification | | | | |
|---|---|---|---|---|---|
| | Essential infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water compatible |
| Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Zone 2 | ✓ | Exception Test required | ✓ | ✓ | ✓ |
| Zone 3a † | Exception Test required † | ✗ | Exception Test required | ✓ | ✓ |
| Zone 3b * | Exception Test required * | ✗ | ✗ | ✗ | ✓* |

**Key:**

✓ Development is appropriate

✗ Development should not be permitted.

Table 1: Flood Risk Vulnerability and Flood Zone 'Compatibility

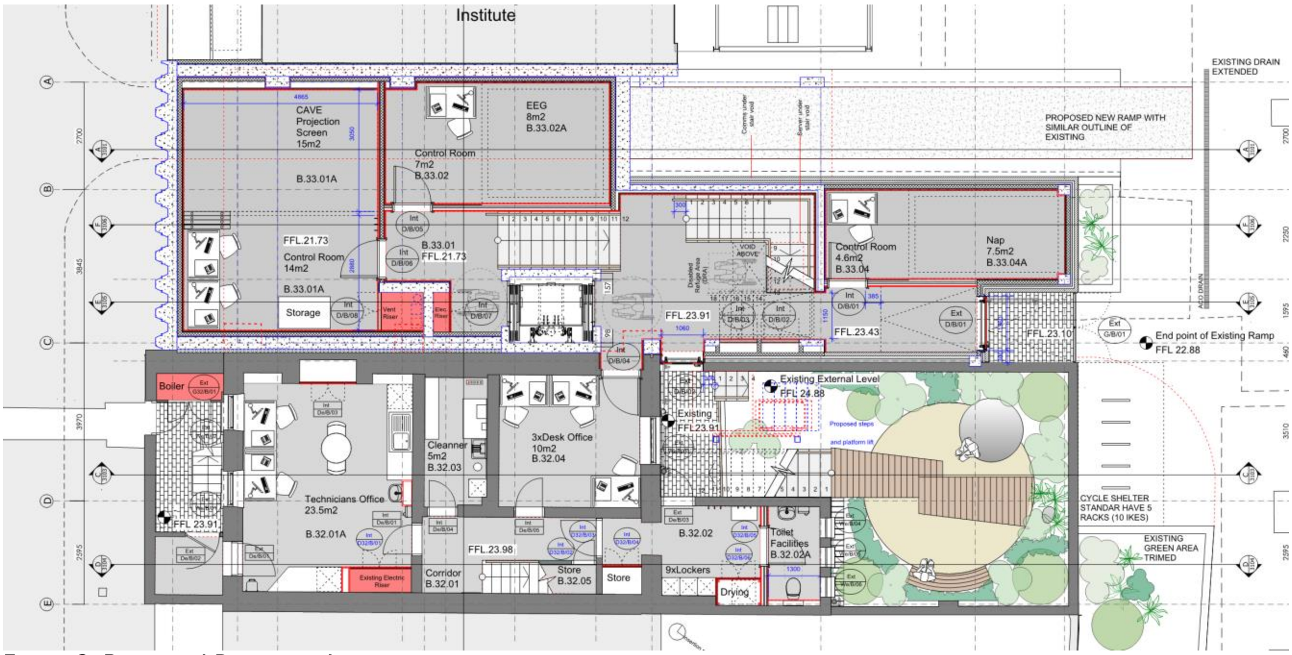



Figure 3: Proposed Basement Layout

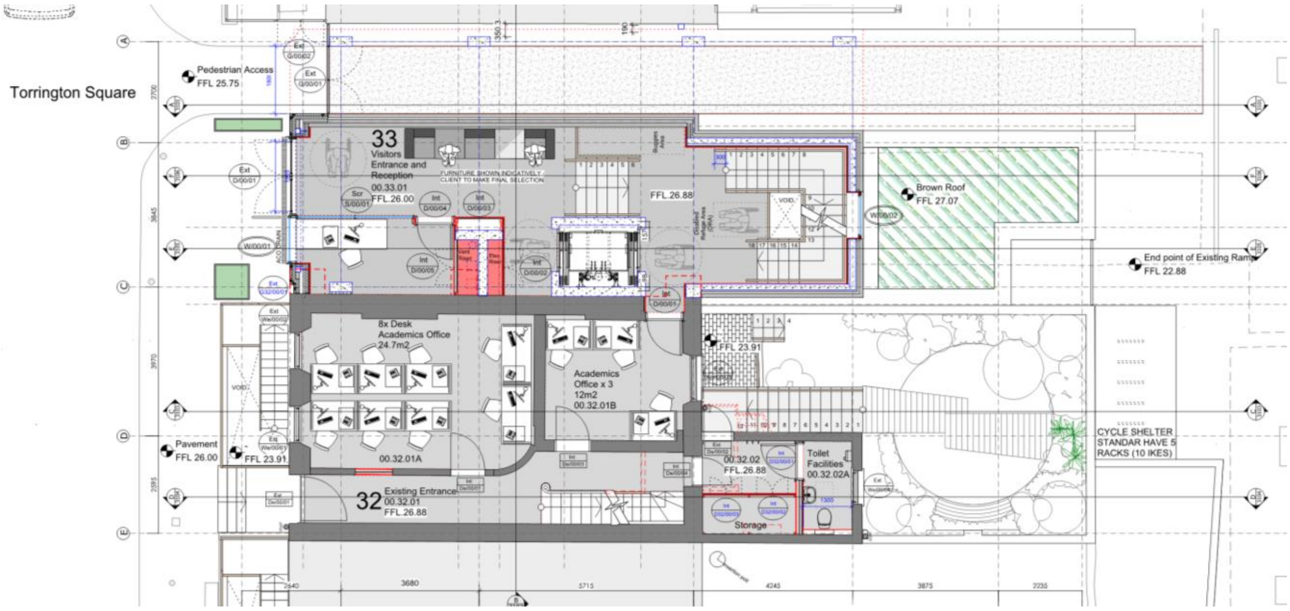



Figure 4: Proposed Ground Floor Layout

# 5 POTENTIAL SOURCES OF FLOODING

## 5.1 FLOODING FROM RIVERS AND SEAS

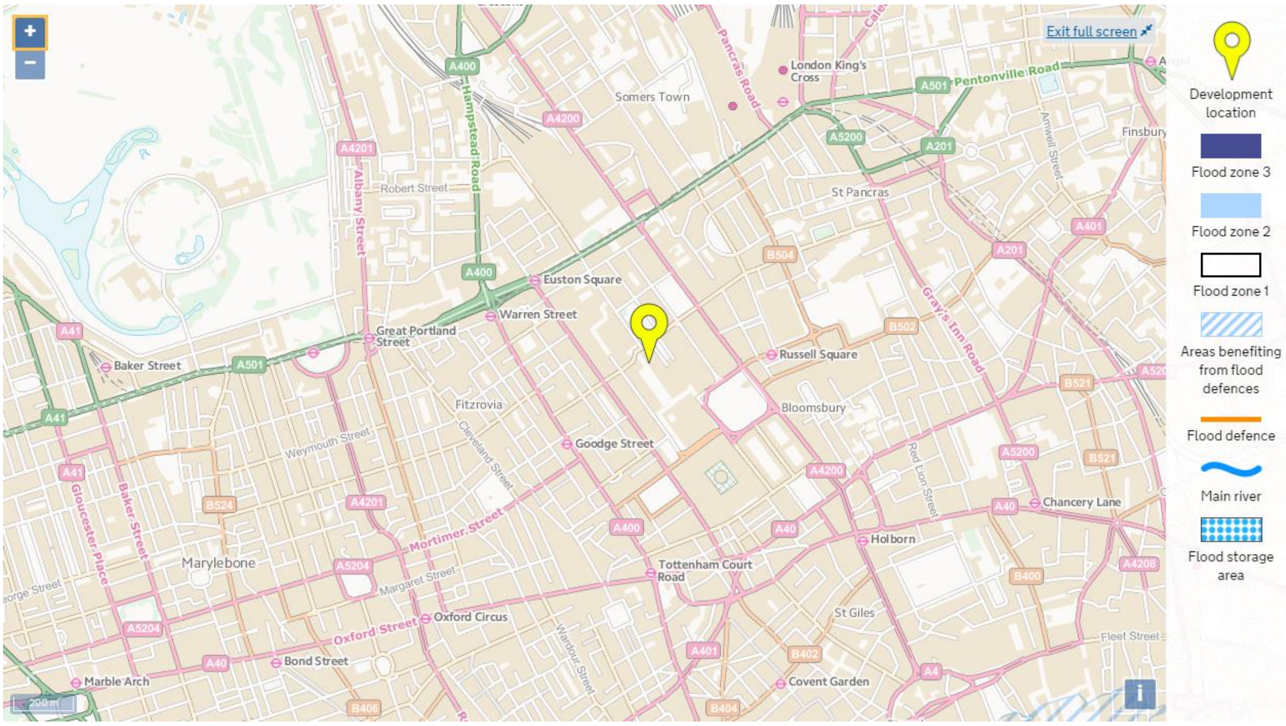



Figure 5: EA Online Flood Map from Sea and Rivers (Source: https://flood-map-for-planning.service.gov.uk)

The Environment Agency Online Flood Map from Sea and Rivers, Figure 5, indicate that the site lies within Flood Zone 1. Land within Flood Zone 1 is considered to be at a low risk of probability of river and sea flooding, with an annual probability of less than 1 in 1,000 annual probability of river and sea flooding. This probability ignores the presence of any flood defences.

## 5.2 FLOODING FROM SURFACE WATER

Flooding from surface water maps provided by the Environment Agency have been used to assess the effects of flooding from pluvial effects. The model raises building footprints by an average of 0.3 m to represent how the average building would not flood internally until water outside is 0.3 m deep. At that depth, the model allows water to flow slowly though the building. Roads have been lowered by 0.125 m, so that the model would reflect how surface water often flows along roads.

There are four levels of risk as defined by the Environment Agency:

- High – each year, the area has a chance of flooding of greater than 1 in 30 (3.3%)
- Medium – each year, the area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%)
- Low – Each year, the area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%)
- Very low – each year, the area has a chance of flooding of less than 1 in 1000 (0.1%)

Analysis of the surface water flood maps identifies that surface water flooding is generally contained within the courtyard, garden area to the rear of the development, and around the perimeter of The Warburg Institute at lower level.(Figure 6). Surface water flooding within these areas is low risk.

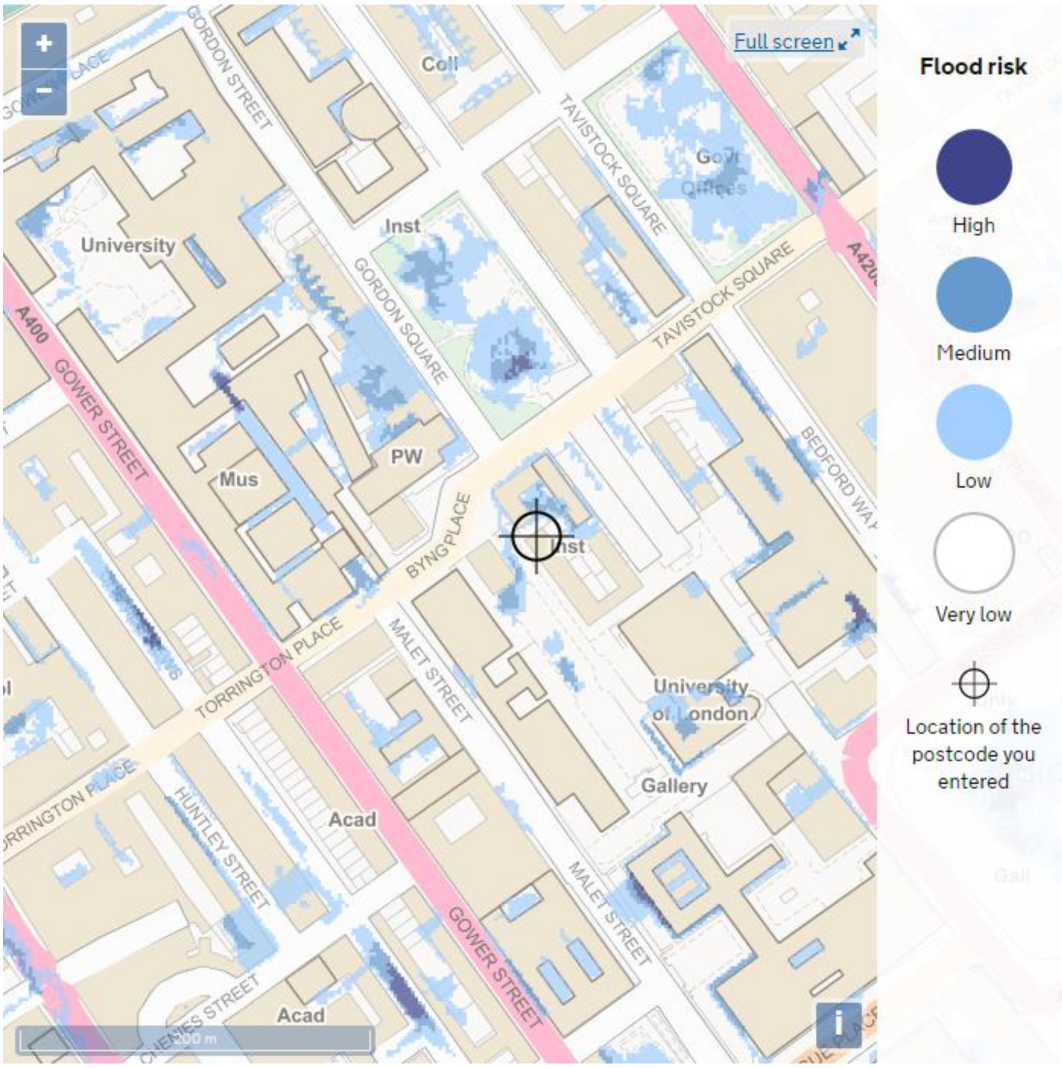



Figure 6: EA Online Surface Water Flood Map (Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/)

## 5.3 FLOODING FROM SEWERS

The Level 1 SFRA highlights that sewer flooding can be an issue with surcharged drains and inadequate drainage systems. These are identified as related to inadequate maintenance of the sewer infrastructure leading to blockages or systems being overwhelmed by the quantity of discharge. However often the source of flooding in incidents of this nature is very unclear, based purely upon anecdotal evidence provided by local resident. Furthermore many incidents and issues are likely to have gone unrecorded. Sewer flooding is spatially highly unpredictable, hence there is not enough validation to prevent future developments based on historic artificial flooding records. As the proposed site will be connected to a formal sewer system, there is a unlikely possibility that flooding from sewers may occur.

## 5.4 FLOODING FROM GROUNDWATER

As previously mentioned within the "Site Context" Section, the site lies within the influence zone of the River Thames, with the surface geology of the site consisting of River Terrace Deposits underlain by London Clay. The order of this geological formation allows for the ability for a perched aquifer to form within the River Terrace Deposits

The primary control of groundwater flooding distribution and timing are down to:

- Spatial and temporal distribution of rainfall
- Spatial distribution of aquifer properties
- Recharge mechanisms
- Spatial distribution of geological structures
- Efficiency of the surface drainage network.

As the site is located within the influence zone of the River Thames the groundwater levels will most likely fluctuate with river stage. Therefore, the basement may be at risk of groundwater flooding.

## 5.5 FLOODING FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

The development site is not within an area at risk of flooding from reservoirs, canals and other artificial sources, as indicated by Figure 7, Environment Agency Online Reservoir Flood Map.

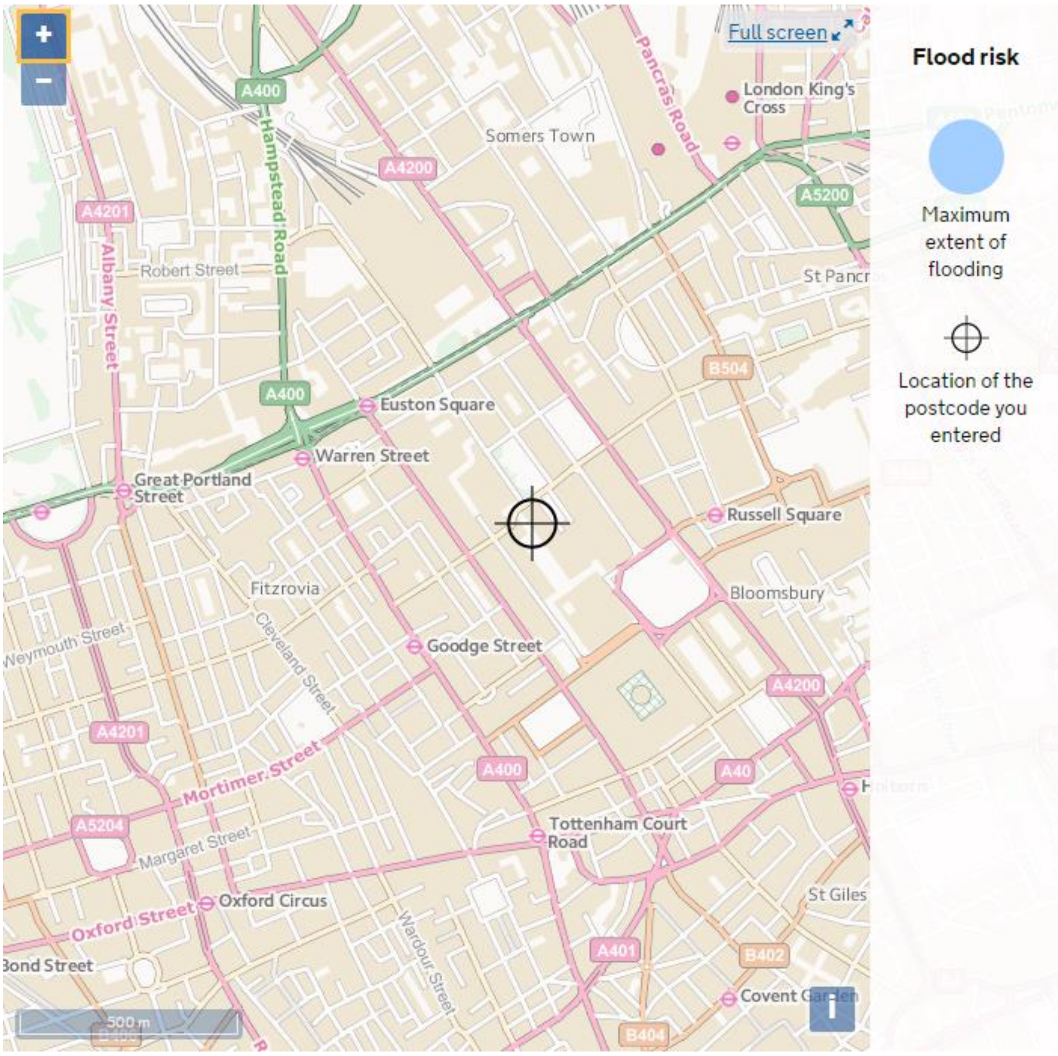



*Figure 7: EA Online Reservoir Flood Map (Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/).*

## 6 DESIGN ASSUMPTIONS, CONSTRAINTS AND PARAMETERS

### 6.1 SPATIAL CONSTRAINTS

Onsite above ground drainage storage options such as swales, ponds and detention basins are not considered a viable solution due to spatial constraints inhibiting for open water features with sufficient capacity.

### 6.2 CLIMATE CHANGE EFFECTS

In accordance with the National Planning Policy Framework (NPPF) 2012, the effects of climate change are included within the assessment to reduce future flood risk. Following the recommended contingency allowances from the 19th February 2016, the following allowances should be made for the proposed development:

- **Peak Rainfall Intensity**: +40% (Upper End Allowance) for 2070 to 2115
- **Peak Rainfall Intensity**: +20% (Central Allowance) for 2070 to 2115

The new surface water drainage systems for the site will include SUDS and will be designed to accommodate increases in peak rainfall intensity.

## 6.3 ASSUMED IMPERMEABLE AREAS

The table below identifies the total area of the site and the respective surface areas belonging to hard and soft landscaping.

*Table 1: Table of impermeable areas for 32 Torrington Square*

| | | Existing Area ($m^2$) | Proposed Area ($m^2$) | Difference ($m^2$) |
|---|---|---|---|---|
| **Hard Landscaping** | Building Footprint | 94 | 94 | 0 |
| | External Hardstanding | 45 | 45 | 0 |
| | Total | **149** | **149** | **0** |
| **Soft Landscaping** | Total | **9** | **9** | **0** |
| **Site Area** | Total | **158** | **158** | **0** |

*Table 2: Table of impermeable areas for the new Annex*

| | | Existing Area ($m^2$) | Proposed Area ($m^2$) | Difference ($m^2$) |
|---|---|---|---|---|
| **Hard Landscaping** | Building Footprint | 0 | 100 | +100 |
| | External Hardstanding | 177 | 77 | -100 |
| | Total | **177** | **177** | **0** |
| **Soft Landscaping** | Total | **0** | **0** | **0** |
| **Site Area** | Total | **177** | **177** | **0** |

On both sites there is no increase in impermeable areas.

## 6.4 INFILTRATION RATES

The BRD desktop study has identified that infiltration techniques maybe feasible on site but due to the close proximity of neighbouring buildings and the space constraints on site soakaways and other infiltration approaches are not likely to be appropriate or sustainable methods to drain surface water runoff from the site.

## 6.5 HYDROLOGICAL PARAMETERS

The drainage design has assumed the following hydrological parameters found in table 3.

*Table 3: Hydrological Parameters*

| Hydrological Character | Parameter | Unit | Value |
|---|---|---|---|
| **Rainfall Model** | | | FSR Rainfall |
| **Hydrological Region** | | - | 6 |
| **M5-60** | | mm | 20 |
| **Ration** | R | R | 0.45 |
| **Rainfall intensity** | $M_1$ , $Z_2$ | mm , - | 12.8 , 0.64 |
| | $M_{30}$ , $Z_2$ | mm , - | 30.8 , 1.54 |
| | $M_{100}$ , $Z_2$ | mm , - | 40.6 , 2.03 |
| **Summer Volumetric Run-off Coefficient** | - | - | 0.750 |
| **Winter Volumetric Run-off Coefficient** | - | - | 0.840 |

# 7 DRAINAGE DESIGN CRITERIA AND PRINCIPLES FOR 32 TORRINGTON SQUARE

## 7.1 PROPOSED DRAINAGE SYSTEM DESIGN

As this is an internal refurbishment of a listed building changes to the existing drainage system will be kept to a minimum and existing drainage connections will be reused where possible.

## 7.2 SURFACE WATER DESIGN

The surface water disposal system has been designed to ensure the drainage hierarchy has been implemented in the most practical and viable approach to benefit to the site; as per the SuDS Manual 2015. Furthermore, the design has considered the Non Statutory Technical standards for sustainable drainage systems, and ensured these standards have been addressed.

As this is an internal refurbishment of a listed building which is drained via a combined sewer there is no scope to provide a 50% betterment of the existing surface water runoff from the site. It is proposed to reuse the existing drainage connections which connect to the Thames Water public sewer at the front of the building. Please refer to table 4.

*Table 4: Discharge Rates for 32 Torrington Square*

| Return Period | Greenfield Runoff (l/s) | Existing Rates (l/s) | Proposed Unmitigated Rates (l/s) | Proposed Mitigated Rates (l/s) | Difference (l/s) (Proposed Mitigated – Existing) |
|---|---|---|---|---|---|
| **Greenfield QBAR** | 0.02 | N/A | N/A | N/A | N/A |
| **1 in 1** | 0.02 | 2.27 | 2.27 | 2.27 | 0 |
| **1 in 30** | 0.06 | 5.49 | 5.49 | 5.49 | 0 |
| **1 in 100** | 0.08 | 6.84 | 6.84 | 6.84 | 0 |
| **1 in 100 plus Climate change (20%)** | N/A | N/A | 8.21 | 8.21 | 0 |
| **1 in 100 plus Climate change (40%)** | N/A | N/A | 9.57 | 9.57 | 0 |

*Table 5: Additional Volumes and Storage Capacities for 32 Torrington Square*

| Return period | Existing Volume ($M^3$) | Proposed Volume ($M^3$) | Long term and Attenuation Storage Capacity ($M^3$) |
|---|---|---|---|
| **100 year 6 hour event** | 4.70 | 4.70 | 0 |

As there is no change in hardstanding areas on the site there will be no change to long term storage on the site.

An infiltration based system and surface water control bodies have not be considered due to the sites spatial limitations and the existing building being Grade 11 listed.

## 7.3 FOUL WATER DESIGN

It is proposed that the new foul drainage reuses existing connections to the the existing Thames Water combined sewer at the front of the building.

The peak foul flowrate has been calculated using the formula stated in BS EN 12056-2 (2000).

$$Q = K \cdot \sqrt{\sum DU}$$

Where:

Q = Peak Flow (l/s)

K = Frequency Factor

DU = Discharge Units (l/s)

*Table 6: Appliances and Discharge Units per Floor*

| Floor | Appliance | Discharge Units per appliance (l/s) | Total Discharge Units (l/s) |
|---|---|---|---|
| **Basement** | 2 x Sinks | 1.3 | 10.5 |
| | 1 x Toilet | 1.8 | |
| | 2 x Wash Basins | 0.3 | |
| **Ground Floor** | 1 x Toilet | 1.8 | |
| | 1 x Wash Basin | 0.3 | |
| **First Floor** | 1 x Sink | 1.3 | |
| | 1 x Toilet | 1.8 | |
| | 1 x Wash Basin | 0.3 | |
| **Second Floor** | | | |
| **Third Floor** | | | |

1. Frequency factor is assumed to be 0.5
2. Discharge Units are based on the values for a system 111 in table 2 from BS EN 12056-2 (2000)

$$Q = 0.5 \cdot \sqrt{\sum 10.5}$$
$$Q = 1.62 \mathrm{l/s}$$

# 8 DRAINAGE DESIGN CRITERIA AND PRINCIPLES FOR THE NEW ANNEX

## 8.1 PROPOSED DRAINAGE SYSTEM DESIGN

The above ground drainage will drain to the basement level as separate foul and surface water systems. These will then drain via gravity and combine at a demarcation manhole at the rear of the building before reusing an existing connection to the Combined Sewer. The surface water system has been designed to have a maximum flowate of 5l/s which will be achieved through a flowcontrol with the excess water volume being attenuated onsite. The brown roof will also increase the interception storage available for the site via increased evapotranspiration.

## 8.2 SURFACE WATER DESIGN

The surface water disposal system has been designed to ensure the drainage hierarchy has been implemented in the most practical and viable approach to benefit to the site; as per the SuDS Manual 2015. Furthermore, the design has considered the Non Statutory Technical standards for sustainable drainage systems, and ensured these standards have been addressed.

It is proposed to reuse an existing combined drainage connection which runs along the rear of the property and for the new surface water drainage to be kept separate from the new foul drainage up to the point of connection where they will combine in a demarcation chamber before discharging into the existing combined drain.

The new proposed development will have a maximum flow rate of 5l/s for all return periods upto and including the 100 year event plus 40% climate change (as per CN3.10 of POL 3- Surface Water run-off of the BREEAM guide). This flow rate will be controlled by a flow control and is as reasonable practicable to the Greenfield runoff rate due to mechanical malfunctions of most flow controls under 5l/s. Please refer to table 6.

*Table 7: Discharge Rates for the new Annex*

| Return Period | Greenfield Runoff (l/s) | Existing Rates (l/s) | Proposed Unmitigated Rates (l/s) | Proposed Mitigated Rates (l/s) | Difference (l/s) (Proposed Mitigated – Existing) |
|---|---|---|---|---|---|
| **Greenfield QBAR** | 0.03 | N/A | N/A | N/A | N/A |
| **1 in 1** | 0.02 | 2.72 | 2.72 | 2.72 | 0 |
| **1 in 30** | 0.06 | 6.57 | 6.57 | 5 | -1.57 |
| **1 in 100** | 0.08 | 8.18 | 8.18 | 5 | -3.18 |
| **1 in 100 plus Climate change (20%)** | N/A | N/A | 9.82 | 5 | -4.82 |
| **1 in 100 plus Climate change (40%)** | N/A | N/A | 11.45 | 5 | -6.45 |

Excess volume of water from the site will be attenuated upstream of the flow control unit. This will be provided in an oversized pipe which will have sufficient storage for the additional volume of water leaving the site upto a 1 in 100 year plus climate change event; as per the London Borough of Camden Drainage Statement pro-forma (table 3).

*Table 8: Additional Volumes and Storage Capacities for the new Annex*

| Return period | Existing Volume ($M^3$) | Proposed Volume ($M^3$) | Long term and Attenuation Storage Capacity ($M^3$) |
|---|---|---|---|
| **100 year 6 hour event** | 5.58 | 5.58 | 0 |

An infiltration based system and surface water control bodies have not be considered due to the sites spatial limitations.

### 8.3 FLOOD ROUTING ANAYLSIS

In the unlikely event that the surface water system fails then any flood water would be diverted out towards Woburn square. This would not cause any detrimental effects to emergency services.

### 8.4 FOUL WATER DESIGN

It is proposed that the new foul drainage connects to the existing combined sewer. Similarly to the surface water system, the foul system will drain to the combined sewer at the rear of the building and will be kept separate from the surface water drainage before combining at the demarcation chamber. The demarcation chamber will be fitted with a non-return valve to prevent the downstream sewer backing up into the drainage within the basement.

The peak foul flowrate has been calculated using the formula stated in BS EN 12056-2 (2000).

$$Q = K \cdot \sqrt{\sum DU}$$

Where:

Q = Peak Flow (l/s)

K = Frequency Factor

DU = Discharge Units (l/s)

*Table 9: Appliances and Discharge Units per Floor*

| Floor | Appliance | Discharge Units per appliance (l/s) | Total Discharge Units (l/s) |
|---|---|---|---|
| **Basement** | | | 7.7 |
| **Ground Floor** | | | |
| **First Floor** | 1 x Sink | 1.3 | |
| | 1 x Toilet | 1.8 | |
| | 1 x Wash Basin | 0.3 | |
| | 1 x Shower | 0.4 | |
| **Second Floor** | 1 x Sink | 1.3 | |
| **Third Floor** | 1 x Sink | 1.3 | |
| | 2 x Toilets | 1.8 | |
| | 3 x Wash Basins | 0.3 | |

1. Frequency factor is assumed to be 0.5
2. Discharge Units are based on the values for a system 111 in table 2 from BS EN 12056-2 (2000)

$$Q = 0.5 \cdot \sqrt{\sum 7.7}$$

$$Q = 1.39\text{l/s}$$

# 9 BREEAM CREDITS

For the purposes of BREEAM the existing 32 Torrington Square building and the new annex are to be assessed separately. Below is a summary of the credits achieved for each criteria.

## 9.1 32 TORRINGTON SQUARE

### 9.1.1 FLOOD RISK (2 CREDITS)

The site is located in Flood Zone 1 and is therefore at little risk of flooding which has been confirmed by this Flood Risk Assessment.

### 9.1.2 SURFACE WATER RUN-OFF (1 CREDIT)

There is no increase in hardstanding area between what is proposed and what is existing.

## 9.2 THE NEW ANNEX

### 9.2.1 FLOOD RISK (2 CREDITS)

The site is located in Flood Zone 1 and is therefore at little risk of flooding which has been confirmed by this Flood Risk Assessment.

### 9.2.2 SURFACE WATER RUN-OFF (2 CREDITS)

There is no increase in hardstanding area between what is proposed and what is existing. The existing surface water discharge from the site has also been reduced to 5l/s for all rainfall events up to the 1 in 100 year return period plus 40% climate change.

### 9.2.3 MINIMISING WATERCOURSE POLLUTION (1 CREDIT)

The site is at a low risk source of watercourse pollution and the surface water runoff from the site is treated with an appropriate level of pollution prevention treatment such as gully pots and brown roofs. A maintenance schedule will also be in place to ensure all the SuDS features operate as they should.

# 10 MAINTENANCE

The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The private storm and foul drains, below ground attenuation tank, and flow control chamber will be maintained by Birkbeck University of London to the manufacturer's recommendations as part of their property maintenance programme. The downstream public sewer will be maintained by Thames Water as part of their maintenance works.

## 10.1 BELOW GROUND DRAINAGE PIPED SYSTEMS

The below ground piped system (based on assessed flood risk) should be inspected every 10 years as a minimum and repaired and cleansed where necessary.

### 10.2 GULLIES AND CHANNEL DRAINS

Gullies and channel drains should be cleaned out very six months or when required.

## 11 DESIGN STANDARDS AND REFERENCES

The works are to be designed to the requirements of the following British Standards and documents:

- BS EN 752:2008 Drain and Sewer Systems Outside Buildings
- The Wallingford Procedure: Design and Analysis of Urban Storm Drainage
- Building Regulations 2010 Part H: Drainage and Waste Disposal.
- CIRIA Report C697: The SUDS Manual
- National Planning Policy Framework
- Volume 7 of Design Manual for Roads and Bridges.
- BS EN 1997 Eurocode 7- Geotechnical Design of Structures
- Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems April 2015.

## 12 DRAINAGE DRAWINGS

Refer to Appendix A for the drawings.

## 13 CONCLUSION

To conclude, the proposed development includes the refurbishment of the existing 32 Torrington Square, and a new five-storey annex in the vacant plot between 32 Torrington Square and The Warburg Institute. 32 Torrington Square is the last building in a row of terraced houses. The proposed development is classified as more vulnerable as per the NPPF Flood Risk Vulnerability and Flood Zone 'Compatibility table.

The site is located in Flood Zone 1 so is at low risk from surface water flooding from rivers and seas. The courtyard at the rear of the property is a natural low point. However the risk of surface water flooding from this area into the new proposed basement as a result of surcharging of nearby drains is low and highly unpredictable and there is not validation to prevent future developments based on this.

To mitigate the low risk of flooding a new drainage system to deal with any surface water runoff from and around the building will be installed and any drainage connecting directly to the public sewer from the new proposed basement will be fitted with non-return valves to prevent any surcharge from the public sewer backing up into the building drainage. There will also be a building maintenance schedule put in place for the below ground drainage system. Surrounding proposed ground levels will also be made to slope away from the building to prevent surface water flows entering into the building as a result of the unlikely event of the drainage system failing.

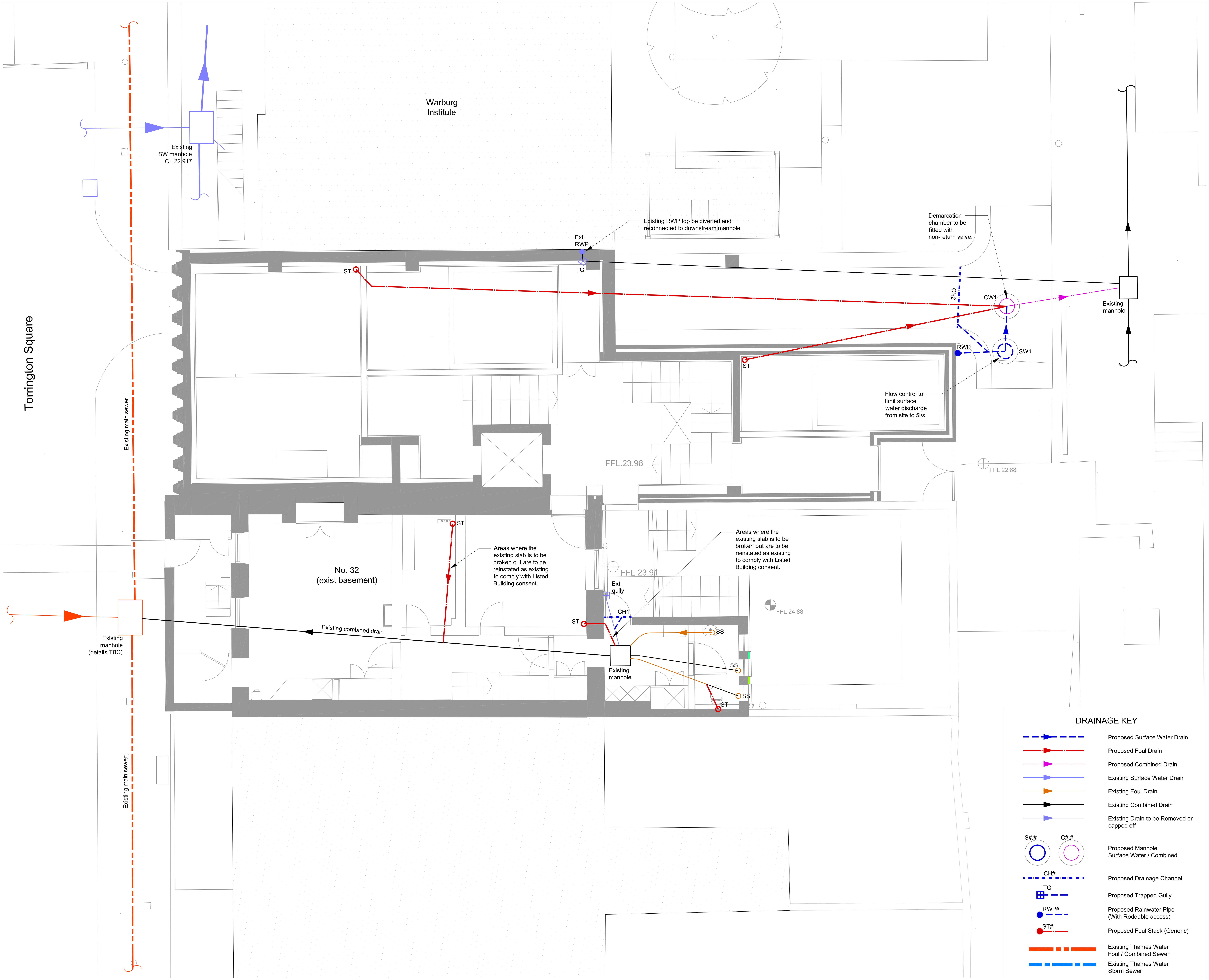
As 32 Torrington Square is a listed building and is an internal refurbishment changes to the existing below ground drainage system will be kept to a minimum and existing drainage connections will be reused where possible.

For the new Annex the surface water and foul drainage networks from the building will be kept separate until the point of connection into the existing combined sewer. The surface water discharge from the site will be controlled to 5l/s via the use of a flow control.

# 14 APPENDIX A – PROPOSED DRAINAGE LAYOUT

Notes

1. Do not scale the drawing
2. All dimensions are in millimetres unless noted otherwise
3. Any discrepancies between structural and architectural setting out dimensions must be brought to the attention of the Architect and Engineers

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| 00 | 21.07.17 | Stage 3 Issue. | GP-D | GP-D |

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Project
Toddler Lab, 32 Torrington Square

Drawing Title
Basement Level Below Ground Drainage Layout

Drawing Status
Developed Design

| Drawn by | Checked by | Sheet size | Scale | Rev status |
|---|---|---|---|---|
| GP-D | GP-D | A1 | 1:50 | S3 |

| Drawing Number | Revision |
|---|---|
| J2889-C-GA-0100 | 00 |