Brent Local Plan Level 2 Strategic Flood Risk Assessment

March 2020

Contents

1 Introduction

1.0 The Strategic Flood Risk Assessment (SFRA) is a planning tool that enables the Local Planning Authority through the development of the Local Plan to select and develop sustainable site allocations with respect to flood risk. This SFRA is supporting the draft Brent Local Plan that was published in October 2019 and which will be submitted for examination in March 2020.

1.1 Where decision-makers are unable to allocate all proposed development and infrastructure in accordance with the Sequential Test (i.e. steer development to areas of lowest risk of flooding), it is necessary to increase the scope of the Level 1 SFRA to provide information necessary for application of the Exception Test through the process of a Level 2 SFRA.

1.2 The Level 2 SFRA will provide more detail on the nature of flood risk in development allocations located in Flood Zones 2 or 3 (FZ2 or FZ3) where Sequential & Exception Tests are needed. The Level 2 focuses on sites where fluvial or pluvial FZ3 > 20% of site (and will therefore be regarded as a significant constraint on development) or if the site is currently less than 20% in FZ3, but will be more than 20% under a selected climate change scenario. For the purposes of this Level 2, this includes scenarios up to 100yr +70% where more vulnerable uses such as residential are proposed. This detailed flood risk information will enable the London Borough of Brent to apply the Sequential and Exception Tests within Flood Zones where there is development pressure in areas at medium or high flood risk. The sequential and exceptions test is undertaken in a separate document which considers all sites that are within fluvial or pluvial zone 3, regardless of their extent.

1.3 The Level 2 SFRA should be read in conjunction with the West London SFRA. The consultants Metis were appointed to produce the West London SFRA on behalf of the London Boroughs of Ealing, Brent, Barnet, Hillingdon and Hounslow. This provided a detailed analysis of all sources of flooding across the study area and the impacts of climate change, and provides the context for the Level 2 SFRA.

1.4 The objectives of the Level 2 SFRA are to:

- provide information needed to apply the Sequential Test within specific development proposals sites at medium or high flood risk in line with the principles of National Planning Practice Guidance (NPPG);
- allow the flood risk for specific development proposal sites to be assessed, to ensure that development in such areas satisfies the requirements of the Exception Test;
- consider the detailed nature of the flood hazard, taking into account the presence of flood risk management measures such as flood defences; and
- inform planning policy for site allocations.

1.5 The Council has identified the site allocations. For the intensification corridors, it has sought to identify parts of the corridor that have similar characteristics from a flooding perspective and parcel them together. The Council has taken account the West London SFRA Level 1 information contained within a Geographical Information System containing flood risk sources (fluvial including climate change scenarios +25%, 35% and 70%, surface water, sewer, ground water, elevated ground water, critical drainage areas, reservoir breach and historic flood events) to identify the flooding risks of that site. This has been supplemented with information from the West London SFRA Level 1 website which provides greater detail on some matters, such as surface water depths. In addition use has been made of the Environment Agency's site specific 'Flood Map for Planning' information where available. This includes Flood Map Flood Zones Detailed FRA setting out flood heights for the whole range of non-climate and climate change scenarios, extents and volumes of flow for the areas and at locations along the river corridor, Historic Flood Maps, Structures and Defences protection and quality information. Additional information has also been taken from the previous Brent Level 2 SFRA that supported the core strategy, site specific allocations and Wembley Area Action Plan for individual sites and site specific FRAs supporting planning applications. In addition the Environment Agency's webpages 'Learn More About This Area's Flood Risk provides more detailed information on surface water and reservoir flood depths, speeds and directions of flow.

Document Structure

1.6 Sites where a Level 2 SFRA have been undertaken are set out in two separate following sections. The first section deals with sites where there is a significant fluvial risk (other flood risks may also be apparent). This section is initially ordered by Place as set out in the draft Local Plan and then by site allocation reference. Following this, it addresses areas that the draft Brent Local Plan has identified as Intensification Corridors, ordered by Place. The second section addresses sites which are in wholly in Fluvial Zone 1 but which have a significant element of pluvial risk. They are ordered in the same manner as that in the preceding section.

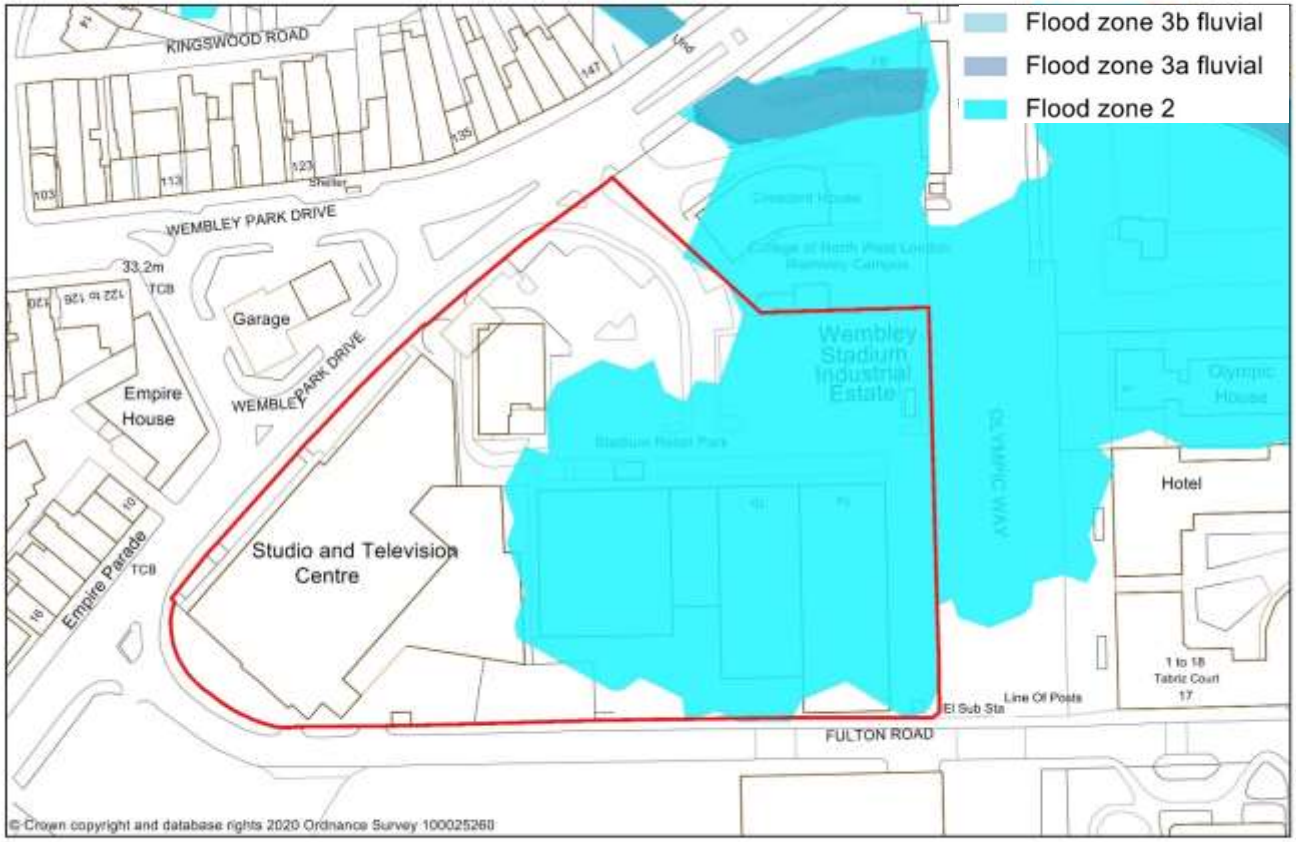
1.7 For each site information is provided on the percentage of the site within each fluvial flood zone and where the site contains flood zone 2 or 3 the predicted flood heights for a 1:20 year, 1 in 100 year and 1 in 100 year plus the relevant climate change scenario related to the vulnerability of the use. The site's minimum and maximum current ground height are also identified and the likely level of flood at the lowest point on the site for each of the flood events. The section then indicates the depth/ speed of floodwaters and indication of danger to life. It identifies the period of inundation and whether the site benefits from any flood defences.

1.8 Turning to surface water it identifies the extent of site in Zone 3, whether the site is subject to surface water flooding in a 1 in 30 year event and the range of depths of flooding for a 1 in 100 year event. The section looks at how climate change will affect the site in terms of fluvial risk. It then identifies the sites groundwater susceptibility and other sources of flood risk such as sewer, reservoir and canal.

1.9 Finally, it sets out recommendations for site layout and design, surface water matters, finished floor levels, resilience and resistance measures, access and egress, emergency planning, Lead Local Flood Authority Consultation and what a site-specific flood risk assessment should address. It then has a high-level summary for the site.

Fluvial and Surface Water Risk Sites

Stadium Retail Park and Fountain Studios BCSA2

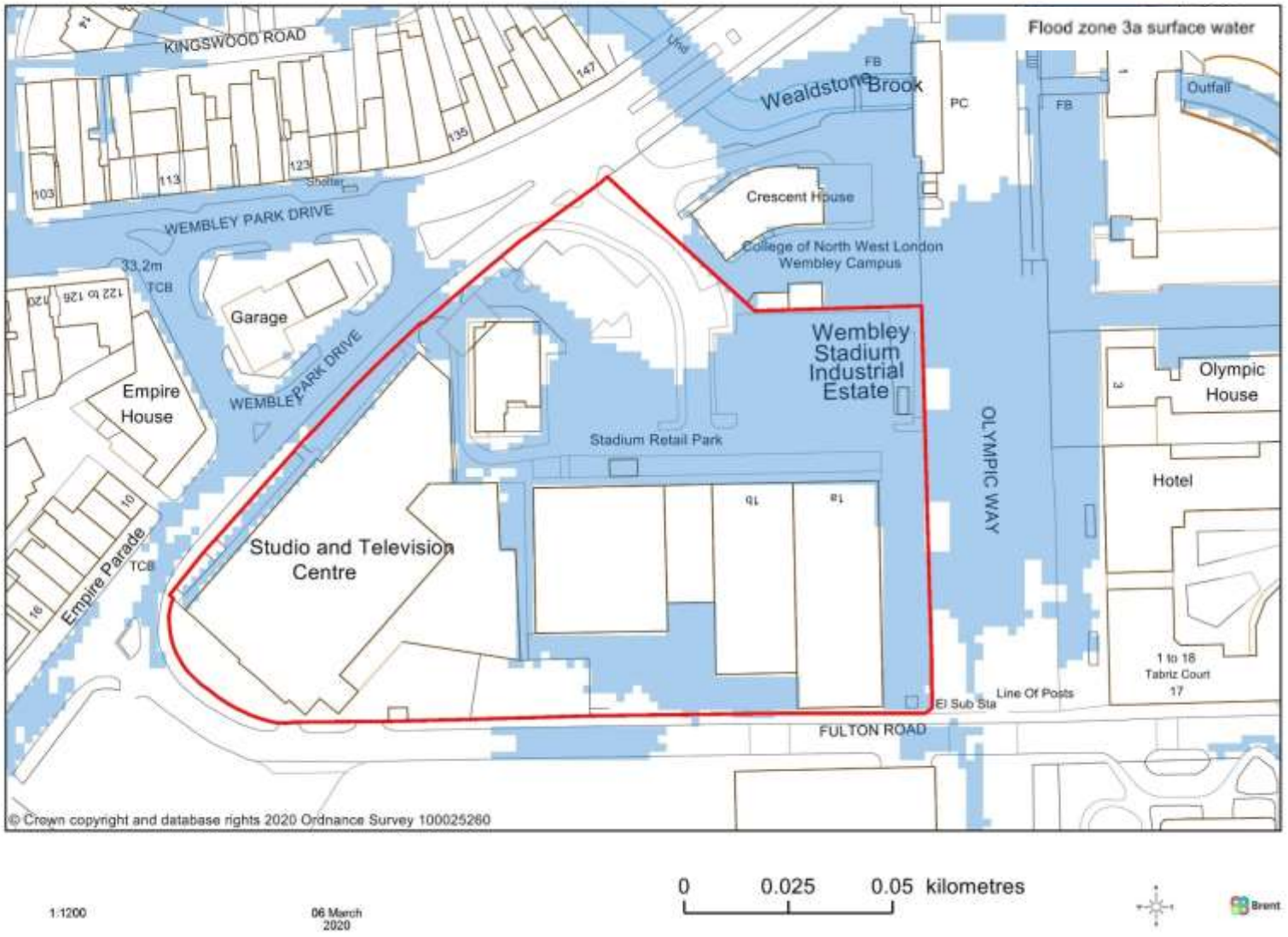


Site Name:	Stadium Retail Park & Fountain Studios	Site Allocation Ref:	BCSA2
Location:	Wembley Park Drive, HA9 8TS	Site Area:	1.67
Proposed Use:	Residential and commercial	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
49%	0%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.98m	31.92m	32.67	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
33.6m		32m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design =	Zone 3a +70% climate change =	
0m	0m	0.67m	

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.5 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site relatively quickly for a short period, not exceeding 6 hours for a 1:100.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.


Flood zone 3a surface water
KINGSWOOD ROAD
WEMBLEY PARK DRIVE
Wealdstone Brook
Crescent House
College of North West London
Wembley Campus
Garage
33.2m
TCB
Empire House
Wembley Stadium Industrial Estate
Stadium Retail Park
Studio and Television Centre
OLYMPIC WAY
Olympic House
Hotel
Empire Parade
FULTON ROAD
Outfall
PC
FB
Shelter
El Sub Sta
Line Of Posts
1 to 18 Tabriz Court
© Crown copyright and database rights 2020 Ordnance Survey 100025260
0
0.025
0.05 kilometres
1:1200
06 March 2020
Brent

Surface water flooding	
Flood zone 3a	37%
Surface water ponding is predicted in the centre of the site during the 1 in 30-year pluvial event or greater. An overland flow path is observed along the surrounding road network. The majority of the ground coverage in the site is impermeable as it is heavily urbanised. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 90cm on the site during the 1% annual chance. The majority is within the 30-60cm range. An overland flow runs from Wembley Park Road across the site to Olympic Way. In some parts the speed is over 0.25m/s, whilst in areas not part of the overland route, the flow is reduced to below 0.25m/s.	

Climate Change	
Main River 70% Climate Change	45% of site
The extent of flood zone 3a will extend to encompass properties currently within the site as a result of climate change. As a result of the more vulnerable uses proposed on site this will require consideration in the design and layout.	
Geology and Groundwater	
Groundwater susceptibility	<25%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location less than 25%. The site is in a Critical Drainage Area and the north eastern corner of the site has increased potential for elevated groundwater.	
Other Sources	
Sewer	77% site
Reservoir	90% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a	

rapid inundation. The extent of the flood indicates that its depths will be well above those of the fluvial +70% climate change, in the region of up to 2 metres.

Recommendations

Site Layout and Design

The majority of the site lies within Fluvial Flood Zone 2. Taking account of the proposed residential use of the site, factoring in climate change of +70% a large part of the site would become flood zone 3. Sequentially, whilst the more vulnerable development should be preferably situated in Flood Zone 1, given its town centre location, the site is in any case likely to be less vulnerable commercial use at ground flood, with residential on uppers. Taking account of the climate change scenario, if development is necessary within Flood Zones 2 or 3a, then all residential accommodation should ideally be located in the first floor level or above. Zone 1 provides the opportunity for more ground floor buildings/volumes than currently. The location of the existing building within the likely extent of flood zone 3a +70% means that no overall increase in ground floor volume within the boundary of Zone 3+ climate change should occur, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need careful consideration if located on this site in terms of its location and extent, to resist water ingress and also provide safe egress via internal stairway in times of flood from fluvial events and reservoir flooding.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Ideally building ground floors for the commercial uses would be above fluvial climate change levels 35% + 30cm freeboard. If this cannot be achieved development should seek to be flood resilient in design at ground floor level. Internal access to higher floors is required for safety purposes during floods.

Resilience and Resistant Measures

If it is not possible to locate all ground floors above the Zone 3+ climate change levels. A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. The west of the site towards Wembley Park Drive and to the south Fulton Road provides the best potential for moving away from flood areas and risk.

Emergency Planning

The majority of the site is in an EA flood warning area. Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

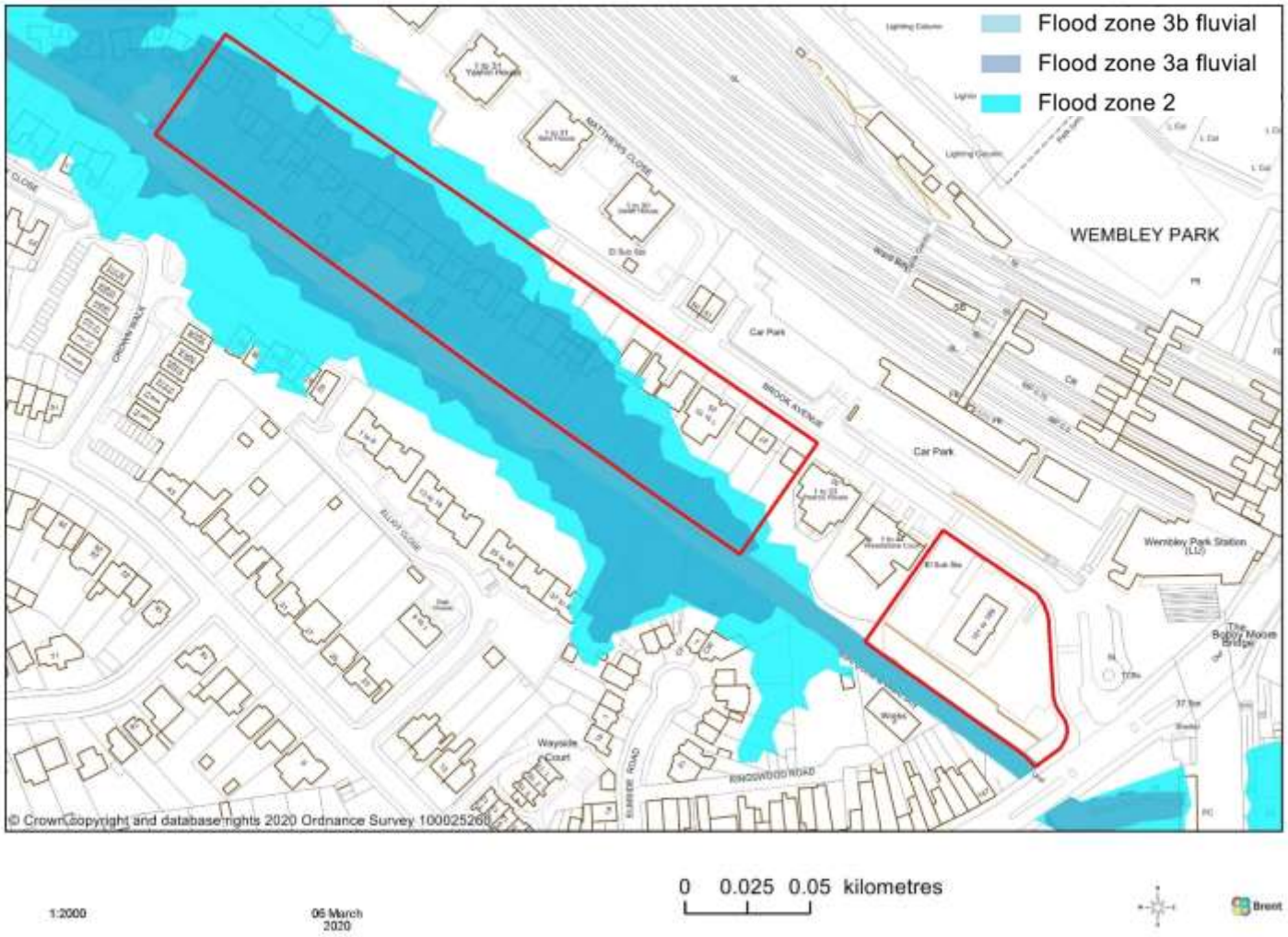
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has some limited risk associated with fluvial flooding with part being in Zone 2. A large part (45%) is subject to Zone 3a when taking account of climate change +70%. A sequential approach would prioritise development to the west. The ground heights/ footprint of development within flood zone 3a should not be greater than existing to not increase flood risk elsewhere. More vulnerable development if within flood zone 3 +70% should be on upper floors, or at the least above flood levels. Surface water flooding should be addressed through suitable ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Floor heights should if possible be above Zone 3+ 35% climate change + 30cm flood heights and if this is not possible dealt with through flood resilience. Safe egress and access should be provided in times of flood, with evacuation points being to the west and south of the site to be agreed with the Council's emergency planning team.

Brook Avenue - BCSA3



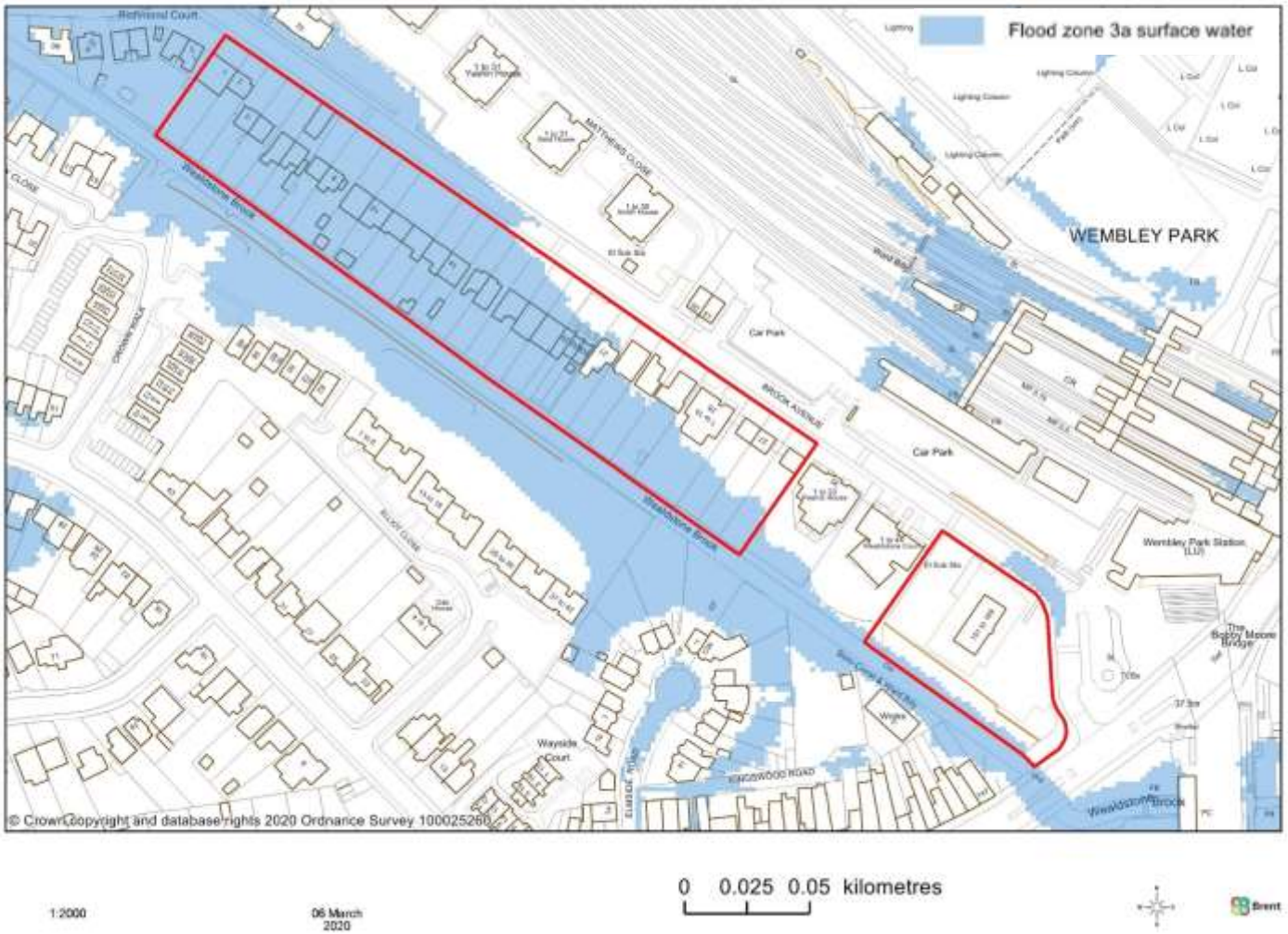
Site Name:	Brook Avenue	Site Allocation Ref:	BCSA3
Location:	Wembley, HA9	Site Area:	1.5
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
58%	55%	2%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
31.7m	32.4m	33.2	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
33.0m		31.4m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0.3m	1.0m	1.8m	

The Wealdstone Brook runs in a culvert to the north west of the site and is a source of flooding. The majority of the site is within flood zone 3a due to fluvial flooding, and nearly all of the site is in flood zone 2. The culverted river channel is functional floodplain and within the site a few low-lying garden areas adjoining are also within it.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	65%
Surface water ponding is predicted on the eastern portion of the site during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths on approximately 50% of the site that is predicted to flood in excess of 1200mm during the 1% annual chance. An overland flow path is observed through the site. Flows are at over 0.25 m/s on parts towards the western end of Brook Avenue, where water flows from Forty Avenue towards the Weadstone Brook. Elsewhere the majority of flows are below 0.25 m/s. Whilst rear gardens contain soft landscaping front gardens largely comprise hard standing. This can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. Surface water flooding follows the location of the fluvial flood zones.	

Climate Change	
Main River 70% Climate Change	63% of site
The extent of flood zone 3a will extend adding a couple of additional dwellings in the site as a result of climate change.	
Geology and Groundwater	
Groundwater susceptibility	>25%<50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area. The southern edges towards the Brook has increased potential for elevated groundwater.	
Other Sources	
Sewer	100% site
Reservoir	70% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres along and adjacent to most of the river channel and between 0.3 and up to 2 metres elsewhere.	

Recommendations

Site Layout and Design

A small amount of the site is within 3b, with the most significant proportion within Fluvial Flood Zone 3a, with the majority in flood zone 3. Some of the site is within Zone 1 and Zone 2. Taking account of the proposed residential use of the site, factoring in climate change of +70% a large part (63%) of the site would become flood zone 3. Sequentially more vulnerable development should be preferably situated in Flood Zone 1 which the site allows in part. Many of the existing residential properties are within flood zone 3 and in a 1:100 event will get flooded. New dwellings can replace them and be suitably designed to reflect the flood risk, reducing danger to occupants and property. New residential within Zone 3 should be brought closer to Brook Avenue to reduce the flood depth the properties are within. The location of existing buildings within the likely extent of flood zone 3a +70% means that no overall increase in ground floor volume within the boundary of Zone 3+ climate change should occur, so as not to increase flood risk elsewhere. To reduce flood risk residential floors should be elevated, which if necessary can create space for other functions such as parking. Highly vulnerable development should be avoided within the Zone 3+ 70% climate change parts of the site. Encroachment into Functional Floodplain will not be permitted.

Basement for servicing/ vehicle parking is unlikely to be acceptable in Zone 3 climate change.

Consistent with the need to move development towards Brook Avenue, development should be create more space for water near the Wealdstone Brook (well beyond the Environment Agency 8metre zone) and flow routes for fluvial water should not be obstructed.

Surface Water

This site has surface water depths consistent with those of fluvial levels. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above fluvial climate change levels +70% +freeboard.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. For floods of 1 in 100 year or less, Brook Avenue to the north of the site provides the best potential for moving away from flood areas and risk. For events that start to take account of climate change, e.g. from +25%, Brook Avenue starts to be flooded towards its western end. The placing of residential accommodation above the flood zone 3 +70% flood heights allows for safe refuge until the area is no longer flooded.

Emergency Planning

The majority of the site is in an EA flood warning area, with the exception of 24-28 and The Premier Inn. Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

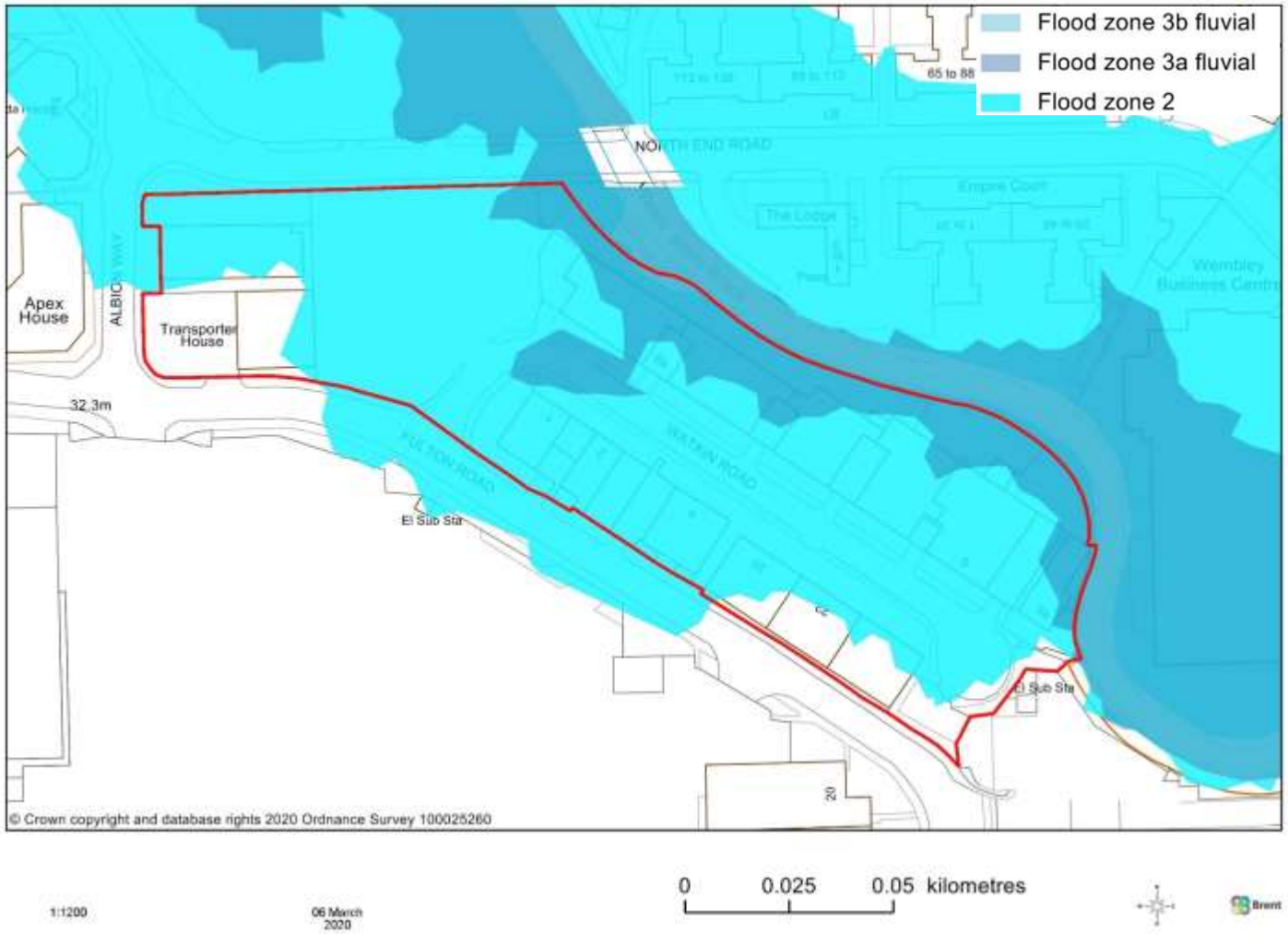
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding, a small part is within fluvial zone 3b, with most in Zone 3a. When taking account of climate change +70% a larger part of the site falls within 3a. A sequential approach would prioritise development to the east in zone 3. Elsewhere, more vulnerable (i.e. residential accommodation) in Zone 3 should not be provided at ground level, with space under this potentially acceptable for other ancillary uses (such as parking) if required. The footprint of development within flood zone 3a should not be greater than existing (unless compensated for) to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements will not be appropriate in Zone 3 locations. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood, with evacuation processes and points being to the north of the site to Brook Avenue, or locations within the buildings if routes cannot be delivered to be agreed with the Council's emergency planning team.

Watkin Road BCSA6

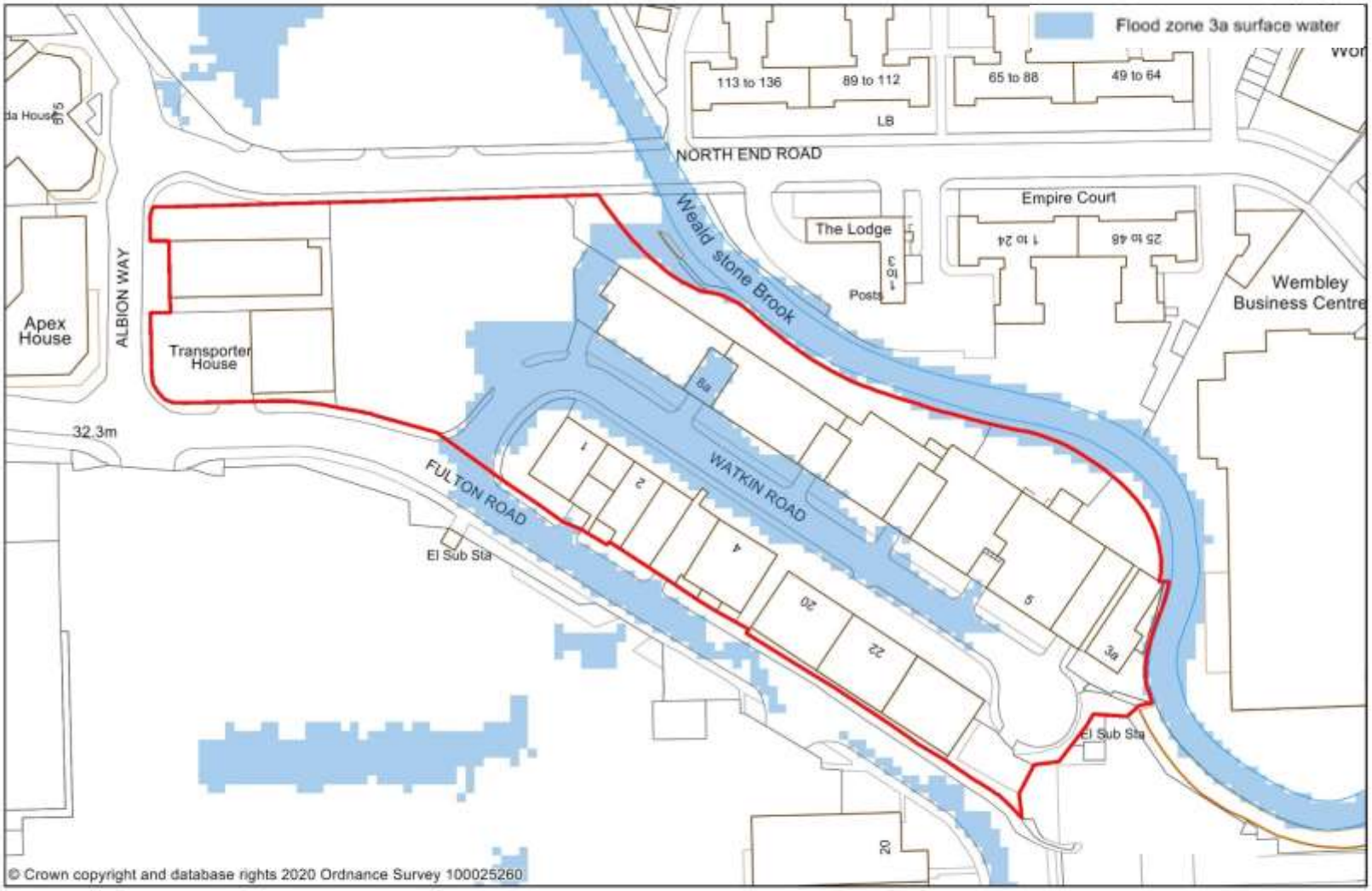


Site Name:	Watkin Road	Site Allocation Ref:	BCSA6
Location:	Wembley, HA9 0NL	Site Area:	1.41
Proposed Use:	Residential and industrial	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
88%	17%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
29.79m	30.64m	31.61	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
32.1m		29.9m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design =	Zone 3a +70% climate change =	
0m	0.74m	1.71m	

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the water course water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



1:1200

06 March 2020

0 0.025 0.05 kilometres

Brent

Surface water flooding	
Flood zone 3a	18%
Surface water ponding is predicted on Watkin Road during the 1 in 30-year pluvial event or greater. An overland flow path is observed along the surrounding road network. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 90cm on the site during the 1% annual chance. The majority is in the 30-60cm range. The majority of the velocity of water at this event is below 0.25m/s, with a small amount over 0.25m/s on a flow path running from Fulton Road to the Wealdstone Brook via the entrance to Watkin Road. The majority of the ground coverage in the site is impermeable. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	85% of site
The extent of flood zone 3a will extend to encompass properties currently within the site as a result of climate change. As a result of the more vulnerable uses proposed on site this will require consideration in the design and layout.	
Geology and Groundwater	
Groundwater susceptibility	>25%<50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is in a Critical Drainage Area. There is increased potential for elevated groundwater to the north of the site.	
Other Sources	
Sewer	97% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. There are no records of historic sewer flooding on the site. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths will be over 2 metres for nearly all the site.	

Recommendations

Site Layout and Design

A small proportion of the site currently lies within Fluvial Flood Zone 3, with the majority in flood zone 2. Taking account of the proposed residential use of the site, factoring in climate change of +70% a large part (85%) of the site would become flood zone 3. Whilst the more vulnerable development should be preferably situated in Flood Zone 1, the site's current use for industrial purposes will require a re-provision of at least the same amount of space and possibly more. This is likely to result in less vulnerable commercial use at ground level, with no space being available for residential accommodation at ground floor. Taking account of the climate change scenario, all residential accommodation outside Flood Zone 1 should ideally be located in the first floor level or above. The location of existing buildings within the likely extent of flood zone 3a +70% means that no overall increase in ground floor volume within the boundary of Zone 3+ climate change should occur (unless compensated for), so as not to increase flood risk elsewhere. Highly vulnerable development should be avoided within this site. Encroachment into Functional Floodplain will not be permitted.

Basement for servicing/ vehicle parking is unlikely to be acceptable in most of this location. Where proposed it will need careful consideration to resist water ingress and also provide safe egress via internal stairway in times of flood from fluvial events and reservoir flooding.

The development should be set back from the Wealdstone Brook (Environment Agency seeks a 8metre zone) and flow routes for fluvial water should not be obstructed.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for non-residential should be above fluvial climate change levels 35% + 30cm freeboard. If this cannot be achieved development should seek to be flood resilient in design at ground floor level. Internal access to higher floors for refuge is required for safety purposes during floods.

Resilience and Resistant Measures

If it is not possible to locate all ground floors above the Zone 3+ 35% climate change levels + freeboard. A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. The west of the site and the south along Fulton Road provides the best potential for moving away from flood areas and risk.

Emergency Planning

The majority of the site is in an EA flood warning area. Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

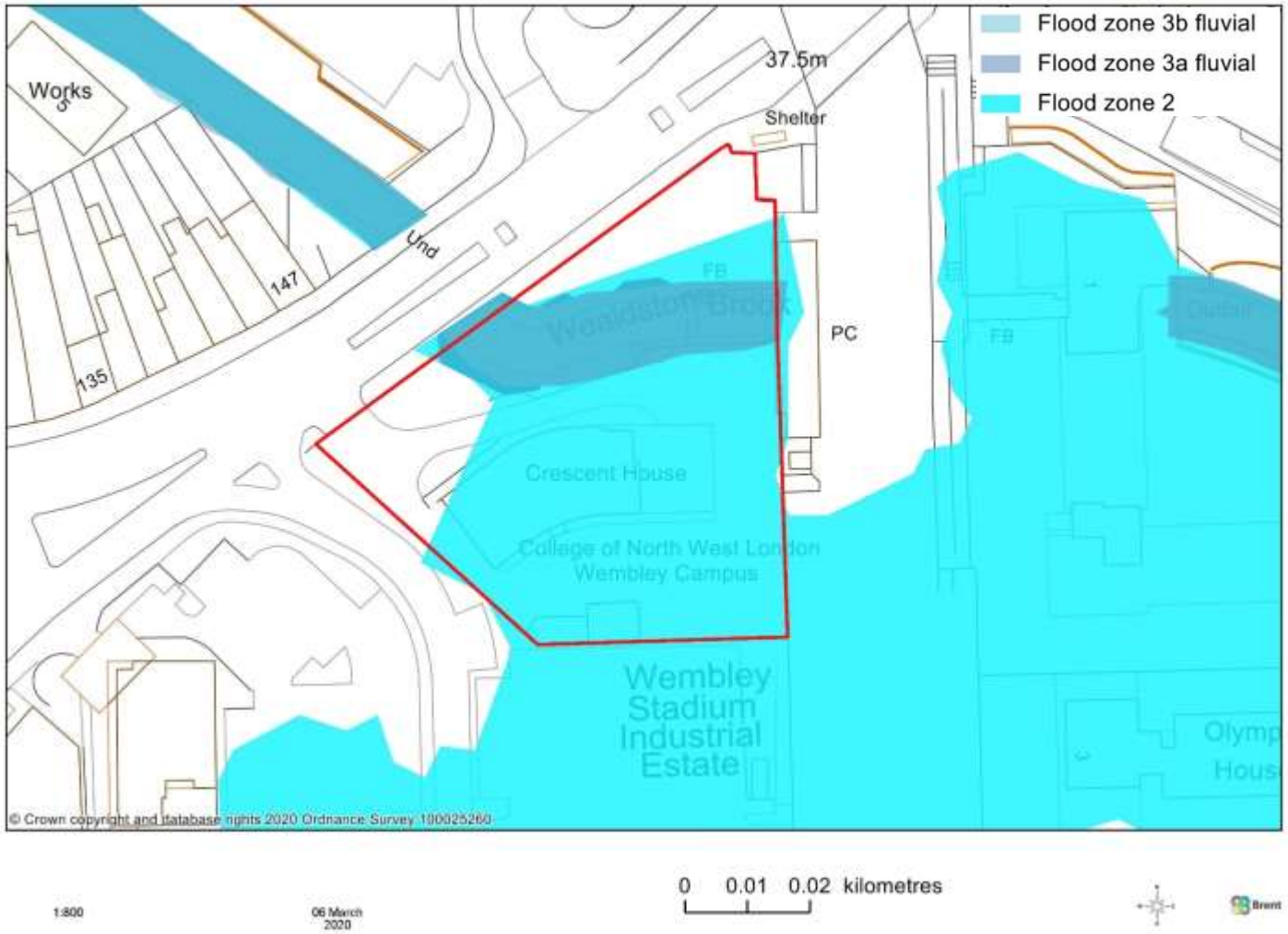
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has some limited risk associated with fluvial flooding, currently a small part is within fluvial zone 3, with most in Zone 2. When taking account of climate change +70% a significant part of the site falls within 3a. A sequential approach would prioritise development to the west in zone 1. Elsewhere, more vulnerable (i.e. residential accommodation) should be avoided at ground level, where the space should be used for less vulnerable (industrial) uses. The ground heights/ footprint of development within flood zone 3a should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. The appropriateness of basements will need careful consideration. Ground floor heights of buildings should if possible be above predicted flood heights and if this is not possible dealt with through flood resilience. Safe egress and access should be provided in times of flood, with evacuation processes and points being to the west and south of the site to be agreed with the Council's emergency planning team.

College of North West London Wembley - BCSA11



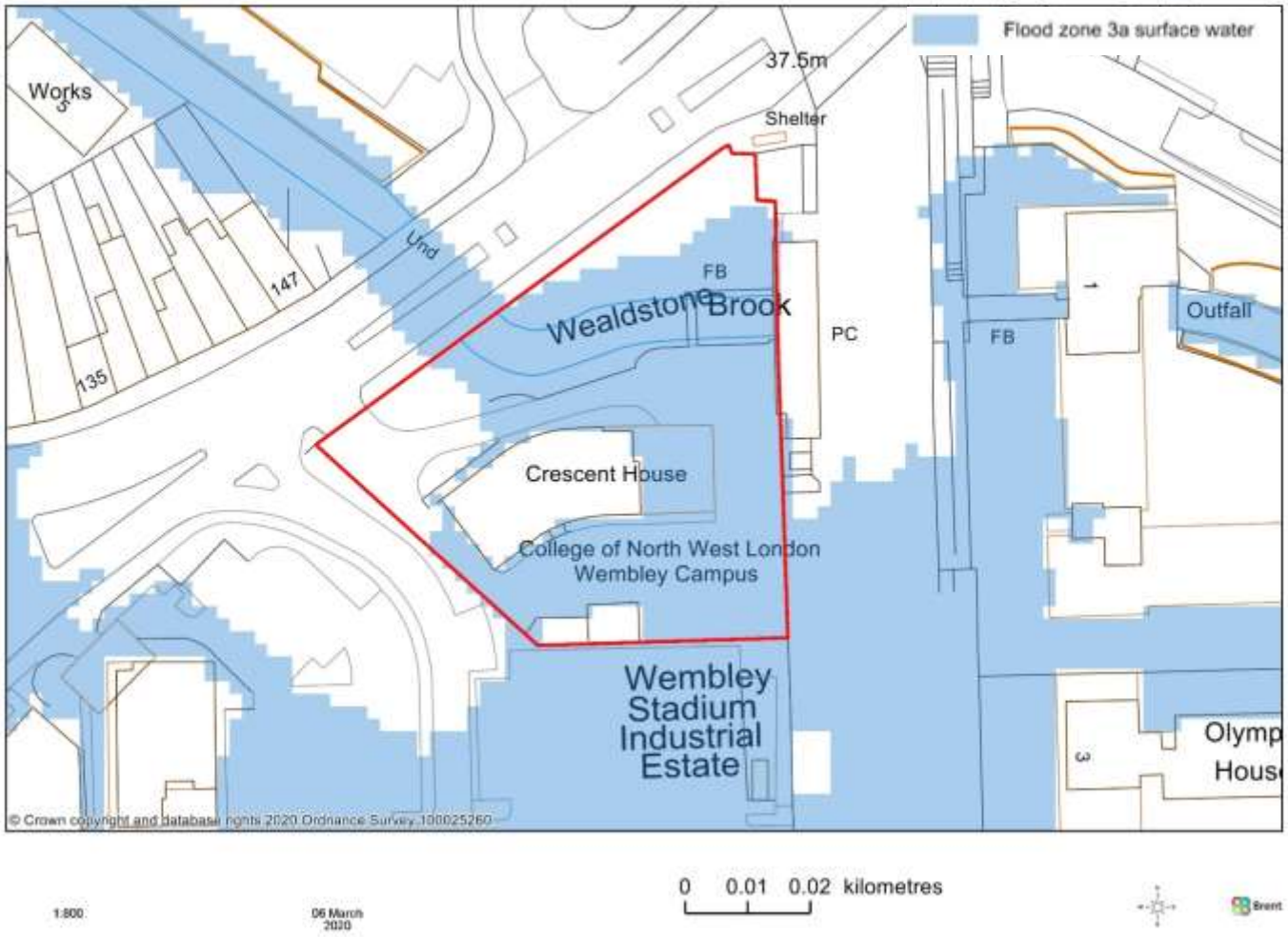
Site Name:	College of North West London Wembley	Site Allocation Ref:	BCSA11
Location:	Wembley, HA9	Site Area:	0.37
Proposed Use:	Mixed-use	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
78%	17%	16%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.98m	31.92m	32.67	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
34.3m		31.4m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design =	Zone 3a +70% climate change =	
0m	0.52m	1.27m	

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.5 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services where water is 40cm or more.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the water course water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site quickly for a short period, not exceeding 12 hours for a normal 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.

The Wealdstone Brook runs in a culvert to the north of the site and is a source of flooding. The majority of the site is in flood zone 2. The low lying areas adjoining the river is functional floodplain.



Surface water flooding	
Flood zone 3a	68%
Surface water ponding is predicted on the eastern portion of the site during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths in excess of 120cm on the site during the 1% annual chance. This is however within the river channel. Elsewhere on-site the majority is within 30-60cm and 60-90cm ranges. An overland flow path is observed through the site along the Wealdstone Brook and around the college building. The building is surrounded by hardstanding which can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. Surface water flooding follows the location of the fluvial flood zones. For the 1:100 event approximately half flows at over 0.25m per second, in the area between Crescent House and Olympic Way which forms a flow path, whilst the remainder travels at less than 0.25 m/s.	

Climate Change	
Main River 70% Climate Change	79% of site
The extent of flood zone 3a will extend to encompass properties currently within the site as a result of climate change. As a result of the more vulnerable uses proposed on site this will require consideration in the design and layout.	
Geology and Groundwater	
Groundwater susceptibility	<25%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as less than 25%. The site has increased potential for elevated groundwater.	
Other Sources	
Sewer	21% site
Reservoir	80% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. There are no records of historic sewer flooding on the site. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid	

inundation with potentially little warning. Its depths for the majority of the site are identified between 0.3 and 2 metres. Its speed between 0.5-2m per second on much of the site and below 0.5m per second on the remainder.

Recommendations

Site Layout and Design

The majority of the site lies within Fluvial Flood Zone 2, with about 17% in Flood Zone 3 currently, including and adjacent to the Wealdstone Brook channel. A small part to the site, principally to the west is located within Zone 1. Taking account of the proposed residential use of the site, factoring in climate change of +70% a significant part of the site would become flood zone 3. Whilst the more vulnerable development should be preferably situated in Flood Zone 1, given its town centre location, the site is in any case likely to have a significant amount of commercial use at ground flood, whilst residential accommodation should be on the uppers. Taking account of the climate change scenario, if development is necessary within Flood Zones 2 or 3a, then all residential accommodation should ideally be located in the first floor level or above. Lower vulnerability uses including landscaped open space or gardens should be prioritised in flood zone 3a. Encroachment into functional floodplain adjacent the site boundary will not be permitted. Flow routes adjacent to the river and potentially across the site to the east where both fluvial and surface waters could flow over Olympic Way should not be obstructed. Zone 1 provides the opportunity for more ground floor buildings/volumes, whilst the location of the existing building within the likely extent of flood zone 3a +70% means that no overall increase in ground floor volume within the boundary of Zone 3+ climate change should occur, unless compensatory measures can be shown so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need careful consideration if located on this site in terms of its location and extent, to resist water ingress and also provide safe egress via internal stairway in times of flood.

The development should contribute to flood alleviation and if possible re-naturalisation to Wealdstone Brook.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Set-back Distance

An 8m wide undeveloped buffer strip should be retained along main rivers to provide access for maintenance.

Finished Floor Levels

Building ground floors should be above fluvial climate change levels 35% + 30cm freeboard. Nevertheless, given the commercial nature of the site and its town centre location, it is recognised that this might not be possible, as it would require adjacent ground levels around buildings to be heightened to provide level access, thus impacting on site fluvial flood storage, potentially increasing risk downstream. If this is the case development should seek to be flood resilient in design at ground floor level. Internal access to higher floors is required for safety purposes during floods.

Resilience and Resistant Measures

As identified, it might not be possible to locate all ground floors above the Zone 3+ climate change levels. A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. The west of the site towards Wembley Park Drive provides the best potential for moving away from flood areas and risk.

Emergency Planning

The majority of the site is in an EA flood warning area. Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has some limited risk associated with fluvial flooding, with parts subject to Zone 3a within and adjacent to the Wealdstone Brook channel. The area becomes more extensive when taking account of climate change +70%, with about 70% being covered. A sequential approach would prioritise development to the west. The ground heights/ footprint of development within flood zone 3a should not be greater than existing to not increase flood risk elsewhere. More vulnerable development if within flood zone 3a+70% should be on upper floors. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Floor heights should if possible be above predicted flood heights and if this is not possible dealt with through flood resilience. Safe egress and access and refuge areas above flood levels should be provided, with evacuation points being to the west of the site to be agreed with the Council's emergency planning team.

Coombe Road - BESA1

Site Name:	Coombe Road	Site Allocation Ref:	BESA1
Location:	Land at Coombe Road	Site Area:	1.35
Proposed Use:	Industrial, commercial and residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	25%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.43m	31.98m	32.47	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
32.4m		31.6m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design =	Zone 3a +70% climate change =	
0m	0.38m	0.87m	

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. No data is available for fluvial flows for the 0.1% event. For the breach of the reservoir, which is greater in extent than the 0.1 % flood event, the overland flow peak velocity is between 0.3 and 2 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the water course water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site relatively quickly for a short period, not exceeding 12 hours for a 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.

Surface water flooding	
Flood zone 3a	0%
No surface water flood risk has been identified using The Environment Agency's surface water depth modelling.	

Climate Change	
Main River 70% Climate Change	100% of site
The extent of flood zone 3a will extend to encompass properties currently within the site as a result of climate change. As a result of the more vulnerable uses proposed on site this will require consideration in the design and layout.	
Geology and Groundwater	
Groundwater susceptibility	>25%<50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site has potential for elevated groundwater.	
Other Sources	
Sewer	94% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. They hold no records of historic sewer flooding instances within this site as of 2017. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The extent of the flood indicates that its depths will be over 2 metres across the whole site.	

Recommendations

Site Layout and Design

The majority of the site lies within Fluvial Flood Zone 2. Nevertheless, it is effectively an island as it is surrounded by Zone 3. Taking account of the proposed residential use of the site, factoring in climate change of +70% all of the site would become flood zone 3. Indeed it all becomes Zone 3 when taking account of climate change +20%. On a sequential basis, development should be located away from the existing Zone 3. More vulnerable uses should be located in areas currently outside Zone 3. The site will need to re-provide the existing/ industrial/ commercial uses which will take up the majority of the ground floor and possibly some first floor. Taking account of this and climate change, the more vulnerable residential accommodation should be located in the first floor level or above. The location of the existing buildings within the likely extent of flood zone 3a + climate change means that no overall increase in ground floor volume on site should occur unless compensated for elsewhere, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need careful consideration if located on this site in terms of its location and extent, to resist water ingress and also provide safe egress via internal stairway in times of flood from fluvial events and reservoir flooding. Development should contribute to the restoration of the River Brent and naturalisation of waterways, providing an appropriate landscaped set-back.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood.

Set-back Distance
An 8m wide undeveloped buffer strip should be retained along main rivers to provide access for maintenance.

Finished Floor Levels

Building ground floors should be above fluvial climate change levels 35% + 30mm freeboard. If this cannot be achieved, development should seek to be flood resilient in design at ground floor level. Internal access to higher floors for the ground floor uses is required for safety purposes during floods.

Resilience and Resistant Measures

If it is not possible to locate all ground floors above the Zone 3+ climate change levels. A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. Currently whilst Coombe Road highway land would not flood in a 1 in 100 year event, Blackbird Hill is identified as flooding. This in addition to potentially the whole site being subject to flooding in climate change scenarios, means safe refuge should be provided in upper floors for building occupants to remain in situ, unless flood waters recede or evacuation can be supported by emergency services.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Particular regard should be given to procedures in the event of reservoir failure. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

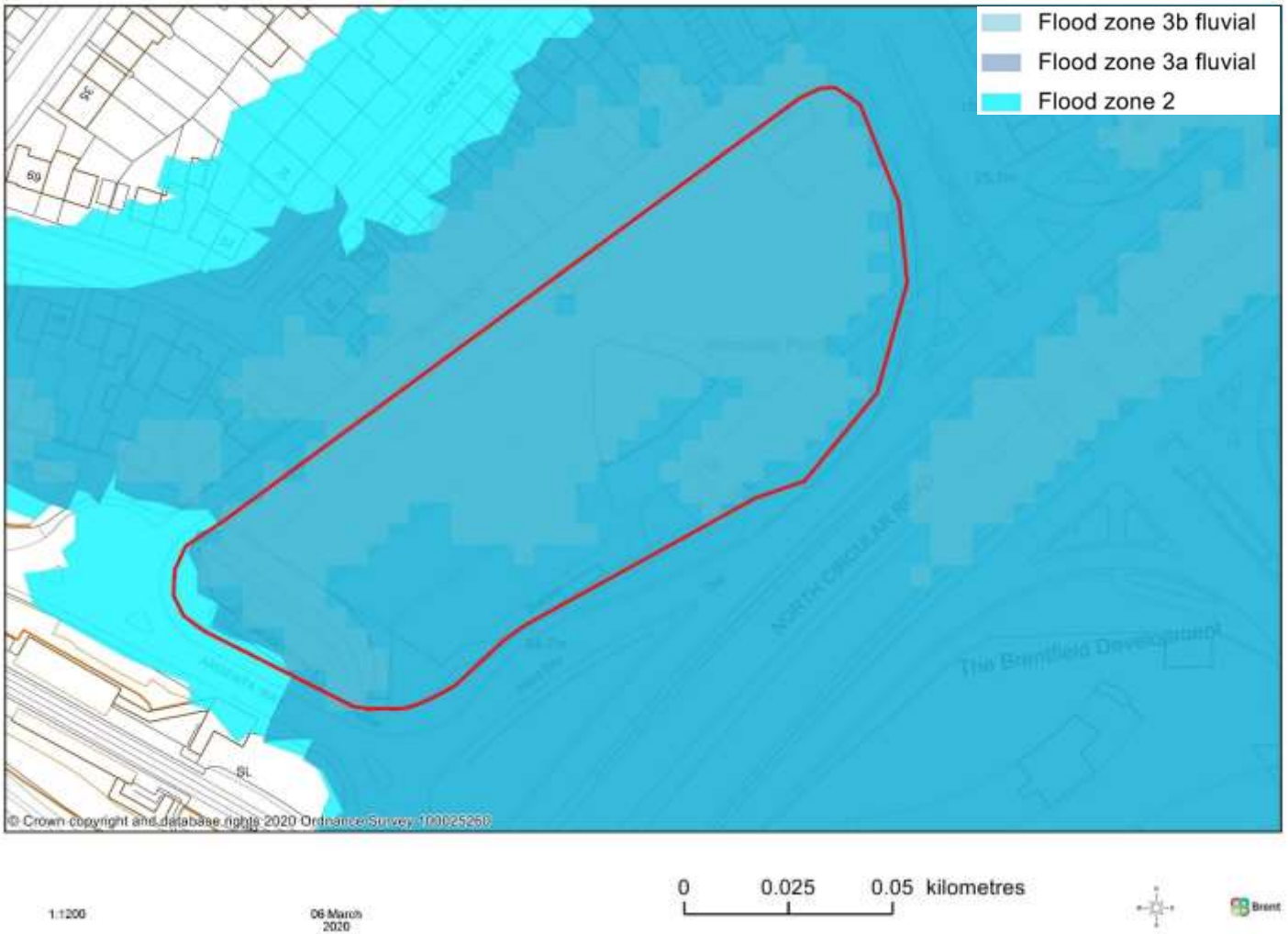
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has some limited risk associated with fluvial flooding, with some (26%) subject to Zone 3. When taking account of climate change the flood risk rises, with all the site falling within Zone 3 +70%. A sequential approach would prioritise development towards the centre of the site adjacent to Coombe Road. The footprint of development within the site should not be greater than existing, unless compensated for to not increase flood risk elsewhere. More vulnerable development should be on upper floors. The site has no current identified risk of surface water flooding, management of this issue should be addressed through ground levels, building placement, and a drainage strategy to remove potential for ponding and reduce off-site flows. Floor heights should if possible be above predicted flood heights and if this is not possible dealt with through flood resilience. Suitable refuge places should be provided for times of flood, with existing ground floor uses requiring access to refuge on upper floors, until the site is safe to evacuate if required by the emergency services, with a Plan to be agreed with the Council's emergency planning team.

Argenta House and Wembley Point – BSSA6



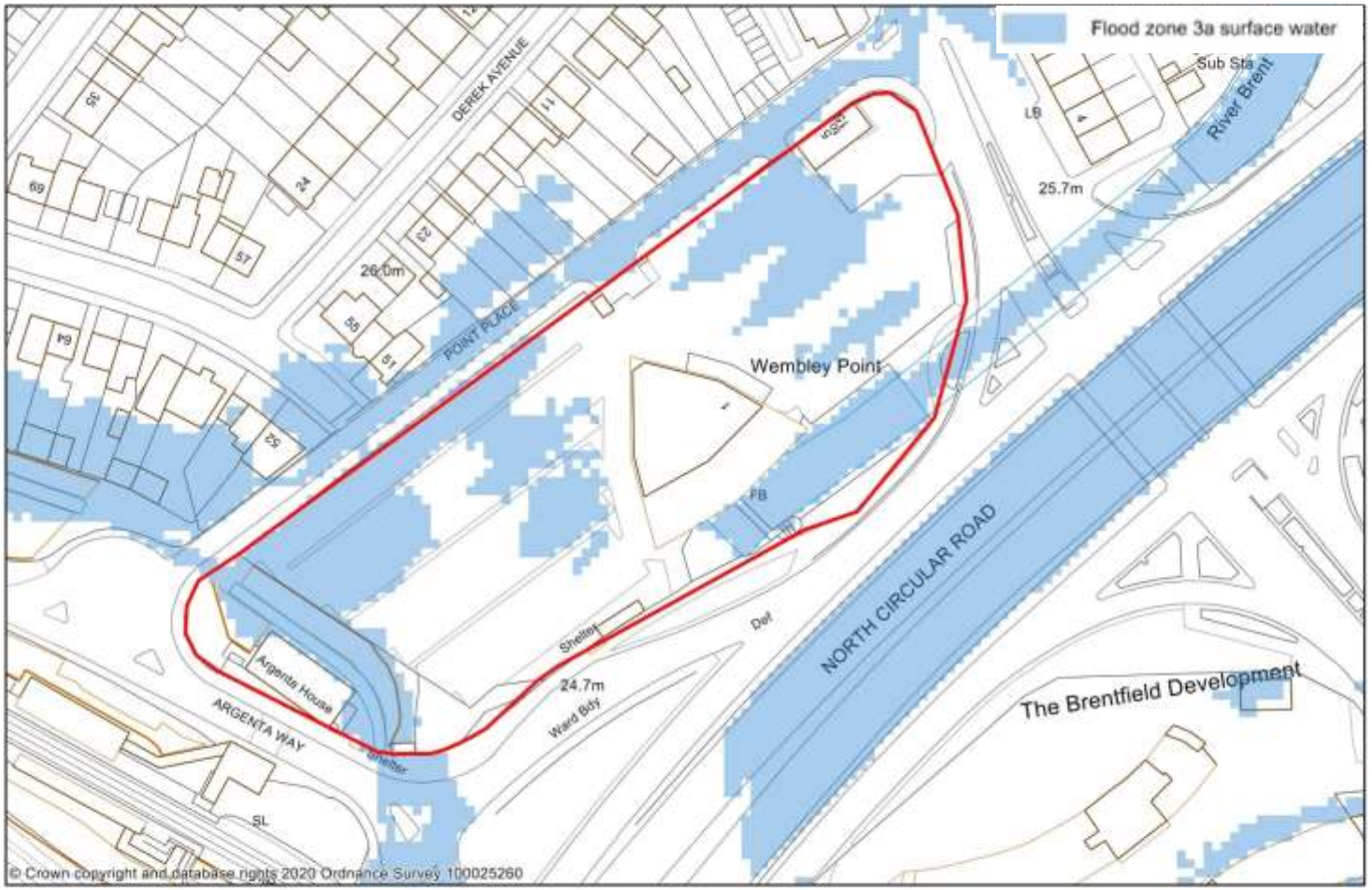
Site Name:	Argenta House & Wembley Point	Site Allocation Ref:	BSSA7
Location:	Argenta Way, NW10 0AZ	Site Area:	1.2
Proposed Use:	Residential and employment	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	99%	72%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
25.6m	26.2m	26.8m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
25.6m		24.4m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
1.2m	1.8m	2.4m	

The River Brent runs in a culvert to the south of the site and is a source of flooding. The site is within flood zone 3b and 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity reaches 3 m/s* Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a period of about 24 hours for a 0.1% event.

Flood Defences
The site is offered protection in part from raised formal defences to the south east of Wembley Point. The River Brent is accommodated in a concrete channel.


Flood zone 3a surface water
DEREK AVENUE
POINT PLACE
Wembley Point
River Brent
Sub Sta
LB
25.7m
26.0m
FB
NORTH CIRCULAR ROAD
The Brentfield Development
Argenta House
ARGENTA WAY
Shelter
24.7m
Ward Bdy
Def
SL
© Crown copyright and database rights 2020 Ordnance Survey 100025260
1:1200
06 March 2020
0
0.025
0.05 kilometres
Brent

Surface water flooding	
Flood zone 3a	36%
Surface water ponding is predicted along the Brook during the 1 in 30-year pluvial event or greater. An overland flow path is observed along the Brook connection to the surrounding road network. The majority of the ground coverage in the site and its surroundings is impermeable, and lacks soft landscaping. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 120cm on land surrounding the Brook during the 1% annual chance, about 60% is in the 0-30cm range, with the remainder essentially in the 30-60cm range, except for the Brent River channel which goes up to the 120cm range. Flows are generally below 0.25 m/s, with the exception of the river channel where they are above 0.25 m/s.	

Climate Change	
Main River 70% Climate Change	100% of site
This event extends Flood Zone 3 across the remainder of the site and increases flood depths on existing parts of Zone 3.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is in a Critical Drainage Area with increased potential for elevated groundwater.	
Other Sources	
Sewer	87% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres on the majority of the site, with the remainder 0.3 - up to 2 metres. Water speeds are mostly between 0.5 and 2m/s, with part below 0.5m/s.	

Recommendations

Site Layout and Design

The site is essentially wholly within flood zone 3. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site will be subject to further depths of flooding. The site's location wholly within Zone 3 limits options in terms of the sequential location of uses. Current EA modelling indicates that a significant part of the site is within functional floodplain being surface car parking and therefore inappropriate for non-water compatible uses. The existing Zone 3 extent also potentially limits new buildings, as there should be no overall increase in ground floor building volume within the site unless this can be adequately compensated for, so as not to increase flood risk elsewhere. If a site specific SFRA shows that development can be accommodated on site, without increasing flood risk elsewhere, given predicted flood heights, low vulnerability uses should be on the lower floors with more vulnerable uses such as residential should be on upper floors.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Set-back Distance

An undeveloped buffer strip should be retained along main rivers to provide access for maintenance. Generally, this should be 8m wide, however, given the scale of the site the size of the buffer should be informed by detailed discussions with the Environment Agency.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3 (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for low vulnerability uses should be above fluvial climate change levels + 35% + 30cm freeboard.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability surface water and fluvial flood events. In this case the lifetime of the property is 100 years. The height of flood waters for the 1 in 100 year event, plus depths of water in adjacent areas and movements corridors such as the North Circular or Point Place means that dry access in and out of the site is only likely in a 1:100 event on to Argenta Way. However the wider movement network (apart from the elevated underground line) is likely to be closed due to flooding. In +70% climate change scenario all routes are inaccessible. As occupants will have to remain on site and the buildings must contain safe/dry access to refuge points for those on lower floors if below 1:100 +35% + 30cm until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding being with the exception of one small part wholly within Zone 3, with a large proportion identified through current modelling as functional floodplain (3b). No development should take place within what is identified as functional floodplain. An exception to this might be possible for the Argenta House part of the site where existing structures in the floodplain if amended could reduce flood risk, through for example reducing river flow potentially being blocked by debris, if not increasing the volume of structures within what would be classed as functional floodplain. The depth of flooding for the 1:100 event brings significant risks. Given the mixed-use status of the site, less vulnerable uses should be put on lower floors and more vulnerable uses on the upper floors. If the ground floors of buildings are designed to be above fluvial level 3 + 70% + 30cm then this is likely to create space underneath for other ancillary uses (such as parking) if required. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are included to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements will not be appropriate in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

Bridge Park & Unisys – BSSA7

Site Name:	Bridge Park & Unisys	Site Allocation Ref:	BSSA7
Location:	Brentfield, Stonebridge, NW10 0RG	Site Area:	2.7
Proposed Use:	Leisure centre, office and residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	100%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
25.7m	26.0m	26.7m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
24.9m		24.5m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	1.5m	2.2m	

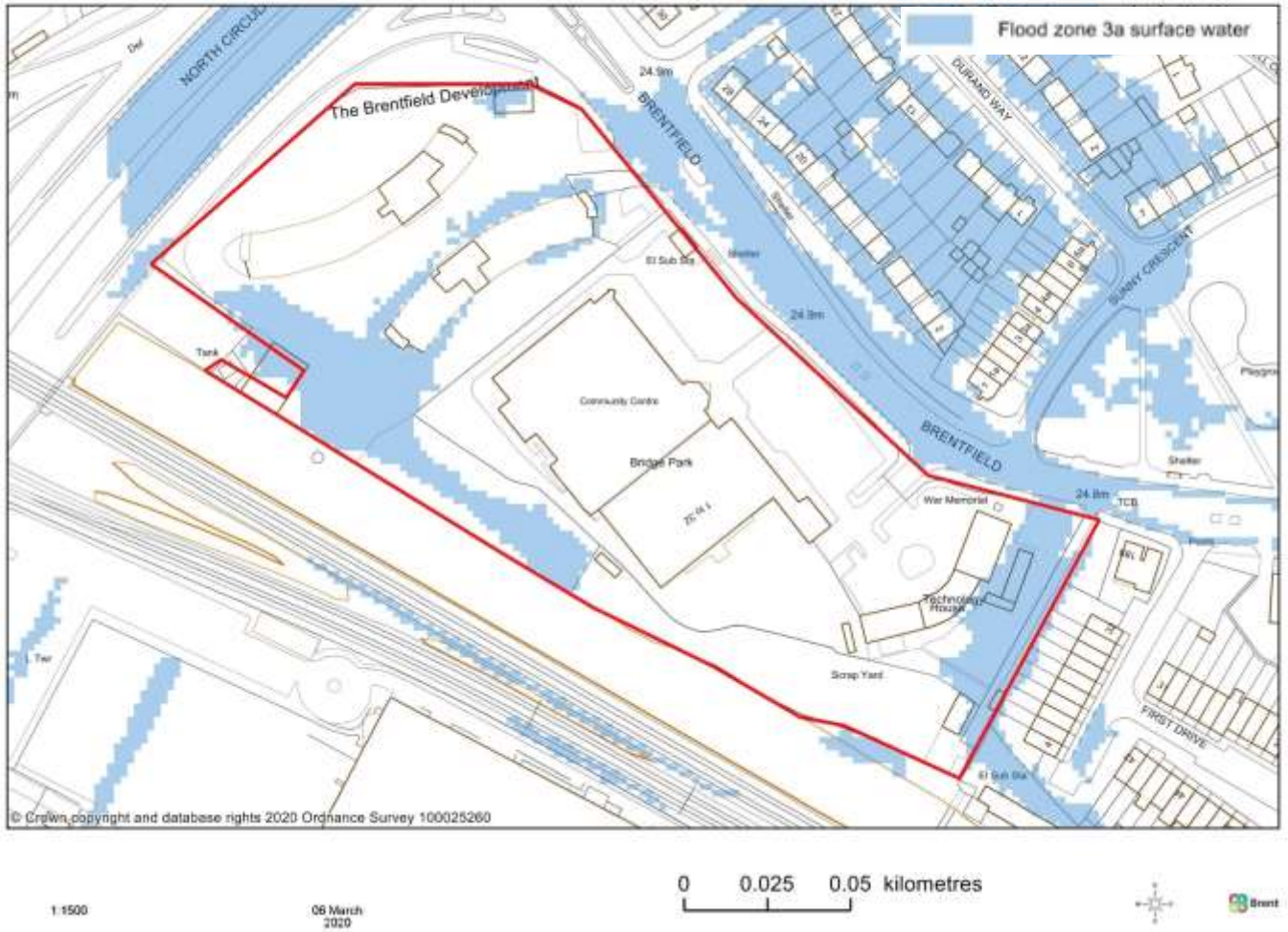
The River Brent runs in a culvert to the north of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity reaches 3 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a period of about 24 hours for a 1:1000 year event.

Flood Defences

The site is offered some protection from raised formal defences on the north and south of the River Brent, although the design standard appears to be only up to a 1 in 20 year standard. The River Brent is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	15%
Surface water ponding is predicted on hard standing to the south east of the site and to the west of the Unisys buildings during the 1 in 30-year pluvial event or greater. An overland flow path is observed along the surrounding road network connecting to the railway embankment. The majority of the ground coverage in the site is impermeable. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 60cm on the site during the 1% annual chance, about 50% is in the 30-60cm range, with the remainder split between the 0-15 and 15-30cm ranges. Flows are below 0.25 m/s.	

Climate Change	
Main River 70% Climate Change	100% of site
The site is already Flood Zone 3, but depths will increase.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is in a Critical Drainage Area and has increased potential for elevated groundwater.	
Other Sources	
Sewer	57% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Thames Water have recorded incidents of sewer flooding surrounding to the south on land encompassing Technology House and the scrap yard, and to the north on land surrounding the Unisys Buildings. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water.	

The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres on nearly all the site, with the remainder 0.3 - up to 2 metres.

Recommendations

Site Layout and Design

The site is in flood zone 3. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site will be subject to further depths of flooding. The site's location wholly within Zone 3 limits options in terms of the sequential location of uses. Given predicted flood heights, low vulnerability uses should be on the lower floors with more vulnerable uses such as residential should be on upper floors. There should be no overall increase in ground floor volume within the site, unless it can be suitably compensated for so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3 (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for low vulnerability uses should be above fluvial climate change levels + 35% + 30cm freeboard.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability surface water and fluvial flood events. In this case the lifetime of the property is 100 years. The height of flood waters for the 1 in 100 year event, plus depths of water in adjacent areas and movements corridors such as Brentfield means that dry access in and out of the site is unlikely to be possible through built structures. The buildings must contain safe/dry access to refuge points for those on lower floors if below 1:100 +35% + 30cm until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

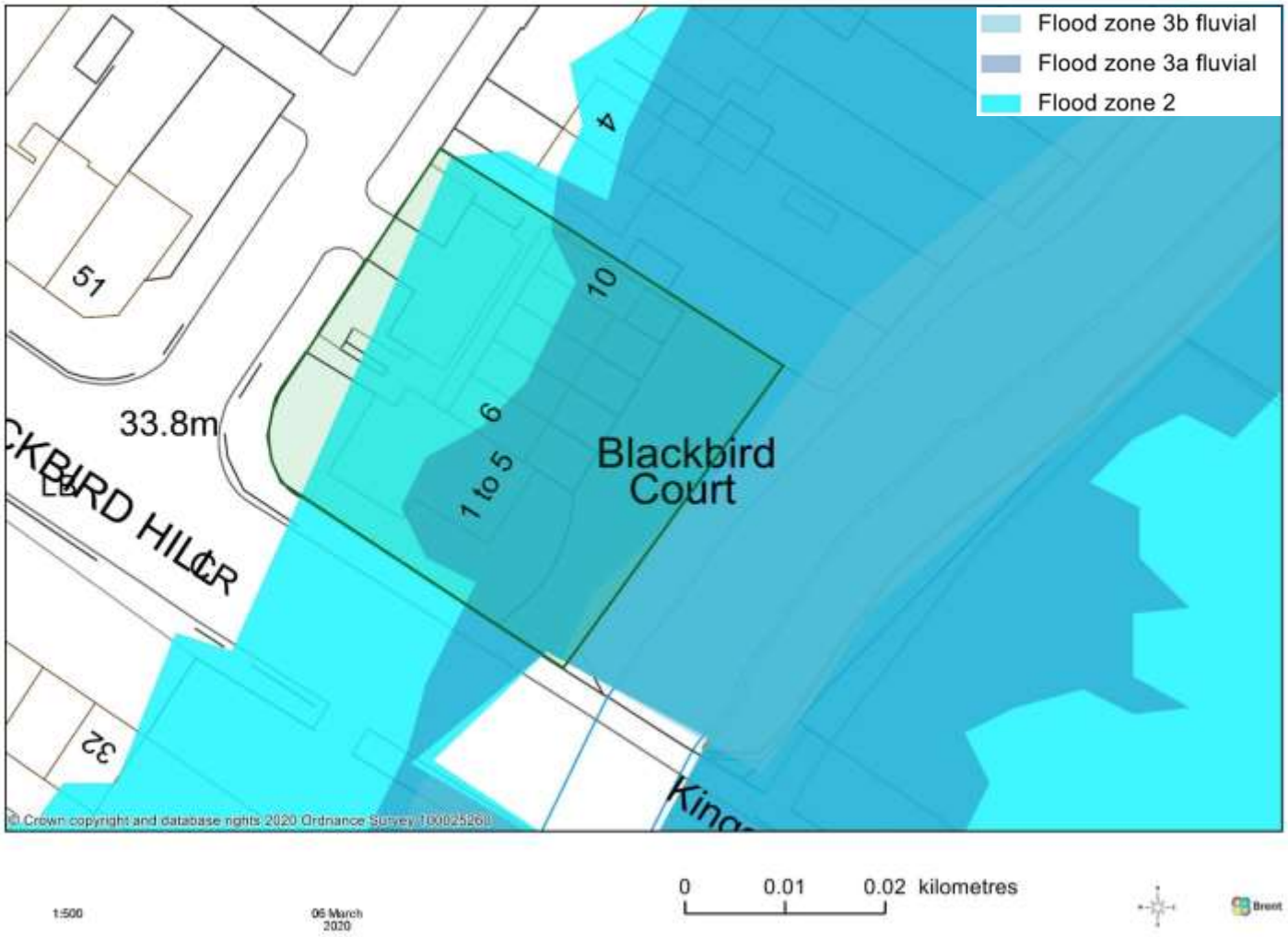
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding being wholly within Zone 3a. The depth of flooding for the 1:100 event brings significant risks. Given the mixed use status of the site, less vulnerable uses should be put on lower floors and more vulnerable uses on the upper floors. If the ground floors of buildings are designed to be above fluvial level 3 + 70% + 30cm then this is likely to create space underneath for other ancillary uses (such as parking) if required. The footprint of development within flood zone 3 should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements will not be appropriate in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

Blackbird Court, Blackbird Hill Intensification Corridor – BD2



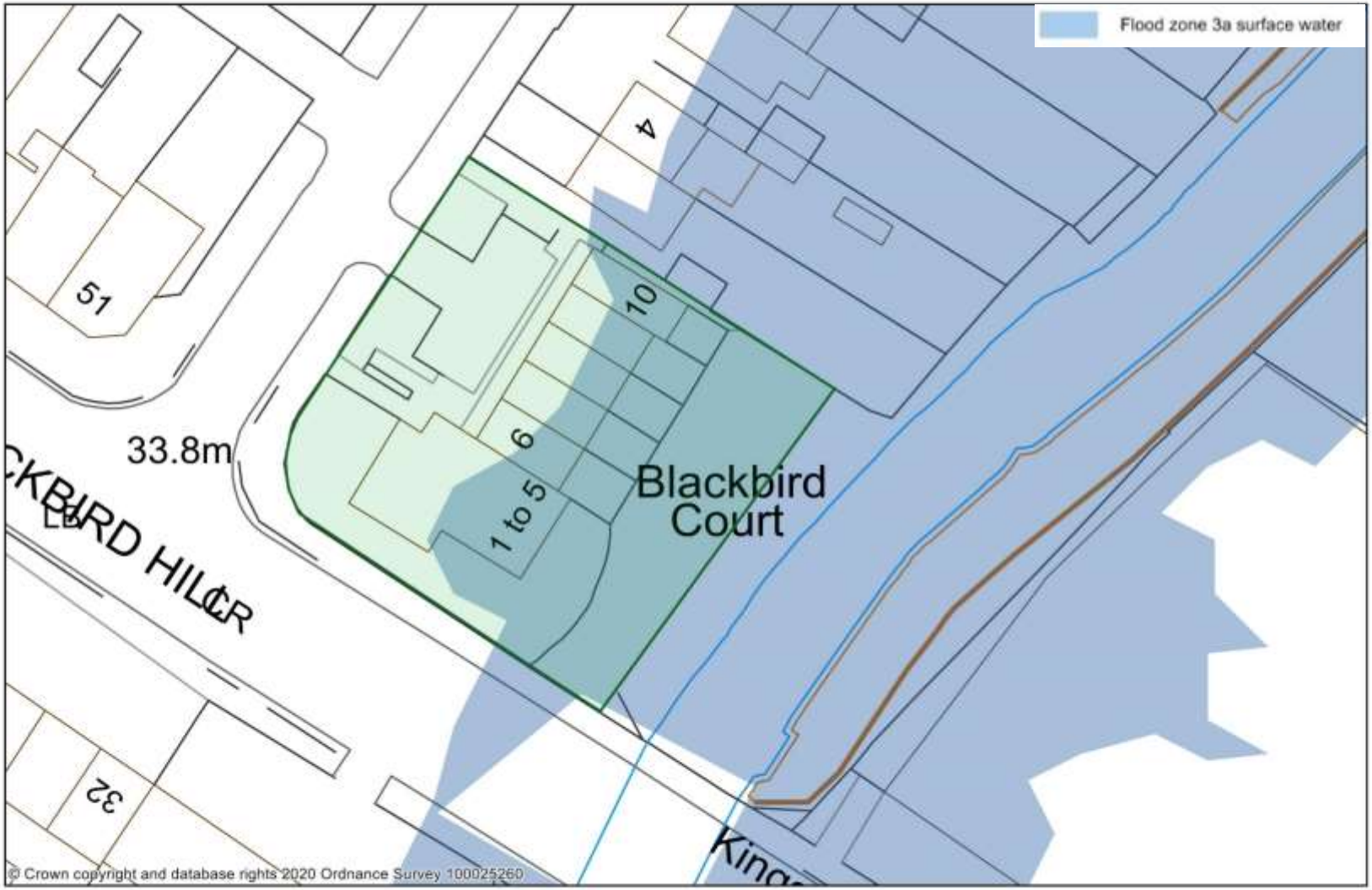
Site Name:	1-10 Blackbird Court	Site Allocation Ref:	No allocation – part of priority areas for intensification
Location:	NW9 8SA	Site Area:	0.01
Proposed Use:	Residential and commercial	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
89%	54%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.3m	31.8m	32.8m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
33.5m		30.3m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	1.5m	2.5m	

The River Brent runs in a culvert to the east of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity will be over 2.5 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a period of no more than 24 hours for a 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



1:500

06 March 2020

0 0.01 0.02 kilometres

Brent

Surface water flooding	
Flood zone 3a	1%
Surface water ponding is predicted adjacent to the Brook during the 1 in 100-year pluvial event or greater. A large proportion of the ground coverage in the site and its surroundings is impermeable, and lacks soft landscaping. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 30 – 60cm on land adjacent to the Brook during the 1% annual chance. Flows are over 0.25 m/s.	

Climate Change	
Main River 70% Climate Change	89% of site
This event extends Flood Zone 3 across most of the site and increases flood depths on existing parts of Zone 3.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is adjacent to a Critical Drainage Area with increased potential for elevated groundwater.	
Other Sources	
Sewer	0% site
Reservoir	100% site
Canal	0
The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres on the majority of the site, with the remainder 0.3 - up to 2 metres. Water speeds are mostly between 0.5 and 2m/s, with part adjacent to the Brook at over 2.5m/s.	

Recommendations

Site Layout and Design

The majority of the site is in flood zone 3. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site will be subject to further coverage by Zone 3 and increased depths of flooding. The existing buildings are within the Zone 3 floodplain. Sequentially development should be located more to the west where the site rises out of Zone 3. The more vulnerable residential uses should

ideally be raised above the 1 in 100 year plus 70% climate change. There should be no overall increase in ground floor building volume within Zone 3, unless adequate compensation is provided for so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Set-back Distance

An undeveloped buffer strip should be retained along main rivers to provide access for maintenance. Generally, this should be 8m wide, however, given the scale of the site the size of the buffer should be informed by detailed discussions with the Environment Agency.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood.

Finished Floor Levels

Building ground floors for residential accommodation should be above fluvial climate change levels + 70%.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 70% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability fluvial flood events. In this case the lifetime of the property is 100 years. The height of floodwaters for the 1 in 100 year event+ climate change means that dry access in and out of the site is only likely to be possible on Birchen Grove.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding with the majority being within Zone 3a, this envelopes current buildings. The depth of flooding for the 1:100 event brings significant risks on lower parts of the site. Redevelopment of the site has the potential to reduce the risk associated with existing apartment dwellings with ground floor living accommodation located within the floodplain (existing and + climate change). Locating the development on higher ground and increasing floor levels has the potential to reduce flood risk. If the ground floors of buildings are designed to be above fluvial level 3 + 70% + 30cm then this could create space underneath for other ancillary uses (such as parking) if required. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are

included to not increase flood risk elsewhere. The current risk of surface water flooding is located adjacent to the river channel away from the dwellings. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements will not be appropriate in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places in the development should be provided for times of flood, with dry access and egress to Birchen Grove and evacuation processes and points agreed with the Council's emergency planning team.

494-502 Neasden Lane Intensification Corridor – BD2

Site Name:	494-502 Neasden Lane	Site Allocation Ref:	No allocation – part of priority areas for intensification
Location:	NW10 0EA	Site Area:	0.09
Proposed Use:	Residential and commercial	Vulnerability Classification	More vulnerable/less vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	96%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.3m	31.7m	32.8m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
31.5m		31.2m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0.5m	2.5m	

The River Brent runs in a culvert to the west of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity will be over 2.5 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a period of less than 24 hours for a 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The River Brent is accommodated in a concrete channel.


Flood zone 3a surface water
Shelter
El Sub Sta
2
504
494
31.4m
1
KELLY
490
492
488
486
409
1
© Crown copyright and database rights 2020 Ordnance Survey 100025260
1:500
06 March 2020
0
0.01
0.02 kilometres
Brent

Surface water flooding	
Flood zone 3a	0%
A large proportion of the ground coverage in the site and its surroundings is impermeable, and lacks soft landscaping. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas.	

Climate Change	
Main River 70% Climate Change	100% of site
This event extends Flood Zone 3 across the site and increases flood depths on existing parts of Zone 3.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is adjacent to a Critical Drainage Area with increased potential for elevated groundwater.	
Other Sources	
Sewer	0% site
Reservoir	100% site
Canal	0
The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres with water speeds between 0.5 and 2m/s.	

Recommendations

Site Layout and Design

The majority of the site is in flood zone 3. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site will be subject to further coverage by Zone 3 and increased depths of flooding. The existing buildings are within the Zone 3 floodplain. Sequentially development should be located more to the rear of the site west where the site rises out of Zone 3. The site will be required to accommodate replacement of the existing commercial, which as a less vulnerable use should be accommodated at ground floor. The more vulnerable residential accommodation should be raised above the 1 in 100 year plus 70% climate change. This makes it appropriate on the upper floors. There should be no overall increase in ground floor building volume within Zone 3, unless adequately compensated for, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood.

Finished Floor Levels

Building ground floors for commercial uses should be above fluvial climate change levels + 35% +30cm freeboard, with residential above the climate change +70%. For the commercial premises however level access requirements could make lifting floor heights above this level without increasing ground heights within the floodplain difficult. As such, buildings might require incorporation of resilience/resistant measures as an alternative.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability fluvial flood events. In this case the lifetime of the property is 100 years. The height of floodwaters for the 1 in 100 year event+ climate change means that dry access in and out of the site to other areas will not be possible as the existing highway network for some distance will be flooded. As such dry access to safe refuge points on site will be required to accommodate users on floors below the +70% climate change.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

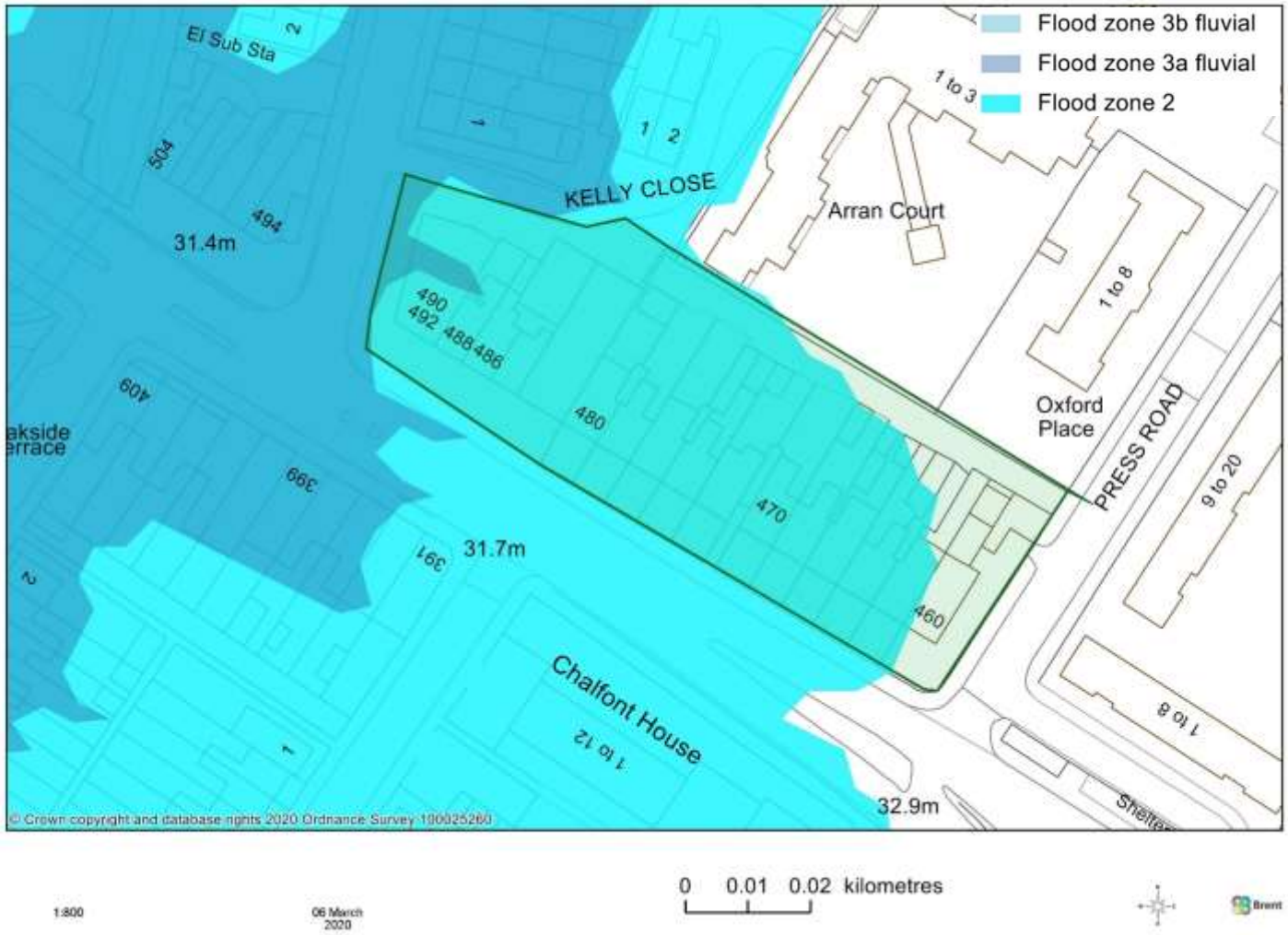
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding with the majority being within Zone 3a, this envelopes current buildings. Redevelopment of the site has the potential to reduce the risk of the existing commercial premises. Increasing floor heights/ incorporating flood resistant/resilient design has the potential to reduce flood risk. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are included to not increase flood risk elsewhere. Surface water flooding potential on and off-site should be addressed through a drainage strategy. Basements will not be appropriate in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places in the development should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

460-492 Neasden Lane Intensification Corridor – BD2



Site Name:	460-492 Neasden Lane	Site Allocation Ref:	No allocation – part of priority areas for intensification
Location:	NW10 0EA	Site Area:	0.4
Proposed Use:	Residential and commercial	Vulnerability Classification	More vulnerable/less vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
82%	3%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.3m	31.7m	32.8m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
33.0m		31.5m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0.2m	1.3m	

The River Brent runs in a culvert to the west of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity will be over 2.5 m/s. For a 1 in 100 year event, this would bring danger for some, including children ,the elderly and the infirm. Where floodwaters reach the maximum depth and speed on site associated with climate change +70%, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a period of less than 12 hours for a 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The River Brent is accommodated in a concrete channel.

Surface water flooding	
Flood zone 3a	27%
A proportion of the ground coverage in the site and its surroundings is impermeable, and lacks soft landscaping. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. The Environment Agency's surface water depth modelling for a 1 in 100 year event identifies the potential for depths of 30 – 60cm for about 50%, with the remainder split evenly between the 0-15cm and 15-30 cm ranges. Flows are over 0.25 m/s. Ponding occurs to the rear gardens, gravitating towards the centre. On the front it moves towards the highway.	

Climate Change	
Main River 70% Climate Change	92% of site
This event extends Flood Zone 3 across the site and increases flood depths on existing parts of Zone 3.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is adjacent to a an area with increased potential for elevated groundwater.	
Other Sources	
Sewer	0% site
Reservoir	100% site
Canal	0
The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres for nearly all the site and 0.3-2 metres on the remainder with water speeds between 0.5 and 2m/s on most, with below 0.5m/s on areas with lower water levels.	

Recommendations

Site Layout and Design

A small part of the site is in flood zone 3. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site will be subject to further coverage by Zone 3 and increased depths of flooding. The existing buildings are within the Zone 3 floodplain. Sequentially development should be located more to the east of the site where it rises out of current Zone 3. The site will be required to accommodate replacement of the existing commercial, which as a less vulnerable use should be accommodated at ground floor. The more

vulnerable residential accommodation should be raised above the 1 in 100 year plus 70% climate change. This makes it appropriate on the upper floors for parts with commercial buildings. There should be no overall increase in ground floor building volume within Zone 3, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking needs careful consideration with regards to water ingress in times of flood, although given the likely level of floors sought to be above flood levels, undercroft areas are more likely.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood.

Finished Floor Levels

Building ground floors for commercial uses should be above fluvial climate change levels + 35% +30cm freeboard, with residential above the climate change +70%. For the commercial premises however level access requirements could make lifting floor heights above this level without increasing ground heights within the floodplain difficult. As such, buildings might require incorporation of resilience/resistant measures as an alternative.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability fluvial flood events. In this case the lifetime of the property is 100 years. The height of floodwaters for the 1 in 100 year event+ climate change means that dry access in and out of the site to other areas will not be possible as the existing highway network for some distance will be flooded. As such dry access to safe refuge points on site will be required to accommodate users on floors below the +70% climate change. If basements are provided, dry safe passage should be provided to refuges on upper floors.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

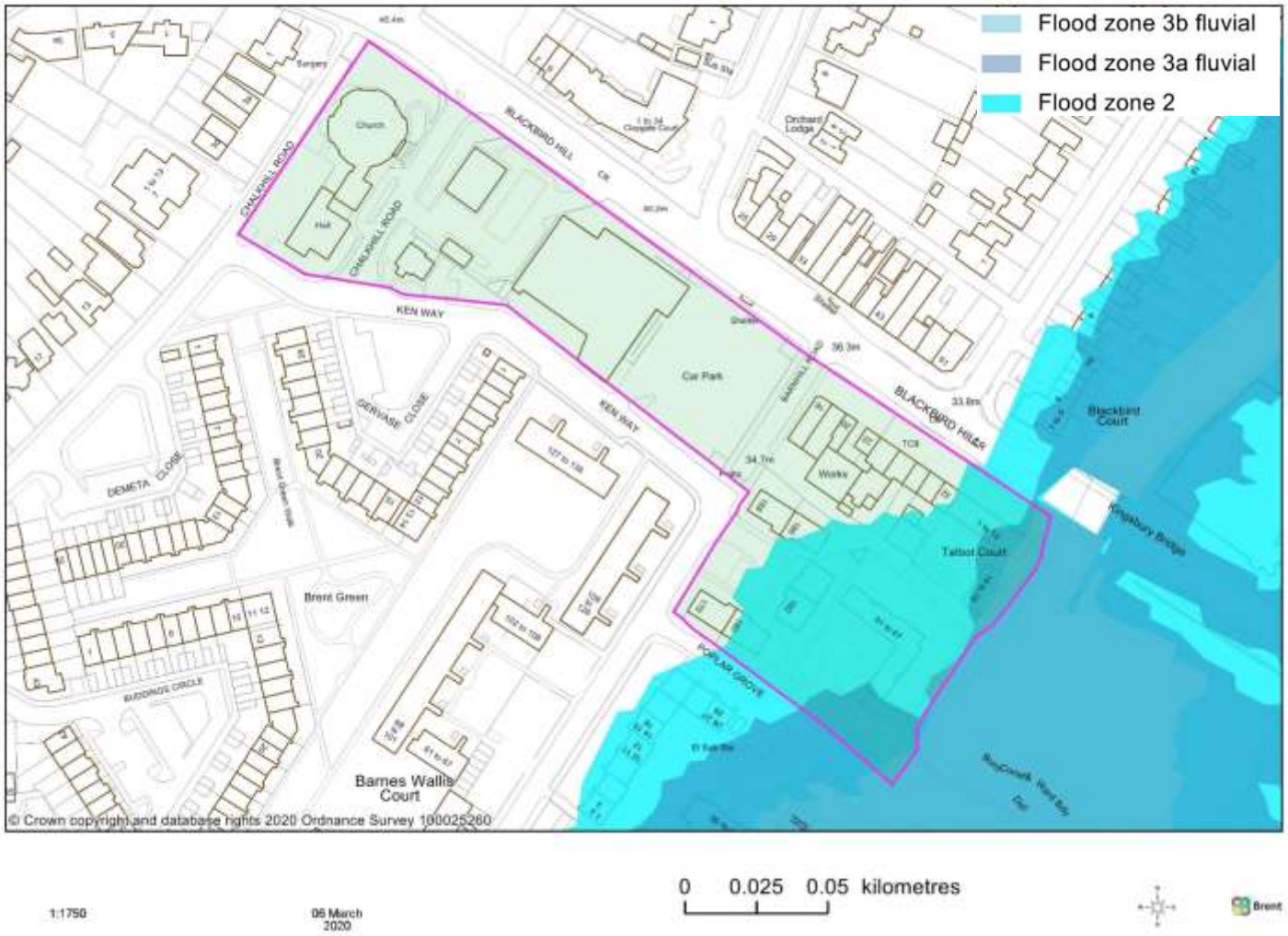
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding with a small part being within Zone 3a. The extent increases significantly when taking account of climate change +70%. Redevelopment of the site has the potential to reduce the future risk of properties through increasing floor heights/ incorporating flood resistant/resilient design. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are included to not increase flood risk elsewhere. Surface water flooding potential on and off-site should be

addressed through a drainage strategy. Basements need careful consideration in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places in the development should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

Talbot Court to English Martyrs RC Church Blackbird Hill Intensification Corridor – BD2



Site Name:	Talbot Court to English Martyrs RC Church Blackbird Hill	Site Allocation Ref:	No allocation – part of priority areas for intensification
Location:	NW9 8SD	Site Area:	2.15
Proposed Use:	Residential and commercial	Vulnerability Classification	More vulnerable/less vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
30%	4%	2%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
30.1m	31.3m	32.8m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
45.7m		29.4m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0.7m	1.3m	2.4m	

The River Brent runs in a culvert to the east of the site and is a source of flooding. The site is within flood zones 3b, 3a and 2 due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity will be over 2.5 m/s. Where floodwaters reach the maximum depth and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a period of less than 12 hours for a 1:100 year event.

Flood Defences

The site is not offered any form of protection from raised formal defences. The River Brent is accommodated in a concrete channel.

Surface water flooding	
Flood zone 3a	0%
A proportion of the ground coverage in the site and its surroundings is impermeable, and lacks soft landscaping. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas.	

Climate Change	
Main River 70% Climate Change	31% of site
This event extends Flood Zone 3 across more of the site and increases flood depths on existing parts of Zone 3.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site has some area with increased potential for elevated groundwater towards the river.	
Other Sources	
Sewer	33% site
Reservoir	49% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are over 2 metres for nearly all the area at risk, with a small element of 0.3-2 metres and an even smaller part under 0.3 metres, with water speeds between 0.5 and 2m/s on most, with below 0.5m/s on areas with lower water levels and adjacent to the river over 2m/s.	

Recommendations

Site Layout and Design

A small part of the site is in flood zone 3b and 3a fluvial, this includes some apartments where living accommodation floor levels are below the 1:100 year event. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site will be subject to further coverage by Zone 3 and increased depths of flooding. Sequentially development should be located more to the west of the site where it rises out of current Zone 3. The site will be required to accommodate replacement of the existing commercial, which as a less vulnerable use should be accommodated at ground floor. However if replaced on a current like for like basis on the site, this is already outside the extent of Zone 3+70%. The more vulnerable residential accommodation should be raised above the 1 in 100 year plus 70% climate change. There should be no overall increase in ground floor building volume within Zone 3, without suitable compensation elsewhere so as not to increase flood risk off site.

Basement for servicing/ vehicle parking needs careful consideration with regards to water ingress in times of flood on sites that fall within Zone 3 (+climate change), although given the likely level of floors sought to be above flood levels, undercroft areas are more likely in areas towards the south of the site.

Development should be create more space for water near the River Brent (as a minimum the Environment Agency 8metre zone) and flow routes for fluvial water should not be obstructed.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood.

Finished Floor Levels

Building ground floors for commercial uses should be above fluvial climate change levels + 35% +30cm freeboard, with residential above the climate change +70%.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. This should also be considered for potential reservoir flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability fluvial flood events. In this case the lifetime of the property is 100 years. The height of floodwaters for the 1 in 100 year event+ climate change means that dry access in and out of the site to other areas will not be possible on parts of Blackbird Hill and Poplar Grove as the existing highway network will be flooded, as such passage to higher up Blackbird Road or Ken Way should be considered. Dry access to safe refuge points on site will be required if floor levels are below +70% climate change. If basements are provided, dry safe passage should be provided to refuges on upper floors.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding with a small part including buildings currently being within Zone 3a. The extent increases significantly when taking account of climate change +70%. Redevelopment of the site has the potential to reduce the future risk of properties, which if remaining the same would otherwise flood, through increasing floor heights/ incorporating flood resistant/resilient design. Buildings should be moved away from the existing Zone 3. If this is not possible, the footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are included to not increase flood risk elsewhere. Surface water flooding potential on and off-site should be addressed through a drainage strategy. Basements need careful consideration in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places in the development should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

2-4 North Circular Road, 2-32 Brentfield and 1-3a Sunny Crescent – BD2

Site Name:	2-4 North Circular Road, 2-32 Brentfield and 1-3a Sunny Crescent	Site Allocation Ref:	BD2
Location:	NW10 0RG	Site Area:	0.47
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	100%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
25.7m	26.0m	26.7m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
24.9m		24.4m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	1.6m	2.3m	

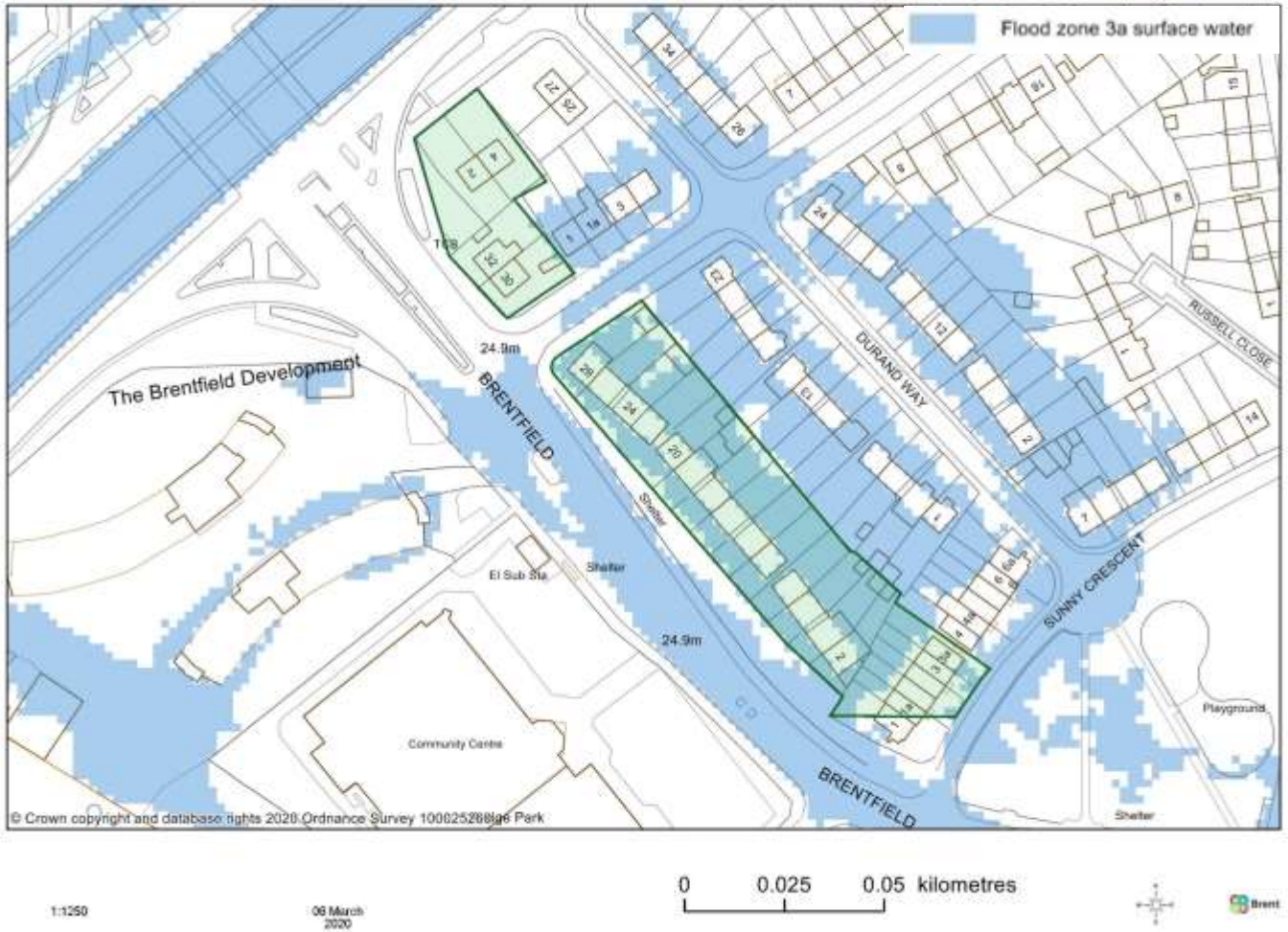
The River Brent runs in a culvert to the north of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity reaches 3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site quickly for a period of about 24 hours for a 1:1000 year event.

Flood Defences

The site is offered some form of protection from raised formal defences which mean it is not regarded as functional floodplain. The River Brent is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	26%
Surface water ponding is predicted on front and rear gardens on properties in the southern half of Brentfield during the 1 in 30-year pluvial event or greater. There are no obvious overland flows. Ground coverage in the site is a mixture of permeable and impermeable. The impermeable can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 60cm on the site during the 1% annual chance, about 60% is in the 30-60cm range, with the remainder mostly in the 15-30cm range. Flows are below 0.25 m/s.	

Climate Change	
Main River 70% Climate Change	100% of site
The site is already Flood Zone 3, but depths will increase.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is in a Critical Drainage Area and has increased potential for elevated groundwater.	
Other Sources	
Sewer	95% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Thames Water have recorded incidents of sewer flooding surrounding to the south on land encompassing Technology House and the scrap yard, and to the north on land surrounding the Unisys Buildings. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water.	

The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation with speeds between 0.5 and 2 m/s. The depths are over 2 metres on nearly all the site, with the remainder 0.3 - up to 2 metres (near the upper end given the limited variation in topography).

Recommendations

Site Layout and Design

The site is in flood zone 3. Existing properties will flood in the region of 1.5 metres for a 1 in 100 year event. Taking account of the proposed residential use of the site, factoring in climate change of +70%, the site will be subject to further depths of flooding of over 2 metres. Given predicted flood heights, residential accommodation floor heights should be designed to be above the 1 in 100 year event + 70% climate change. There should be no overall increase in ground floor volume within the site unless this can be compensated for on site, or through compensation elsewhere, so as not to increase flood risk off site.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3 (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for more vulnerable uses should be above fluvial climate change levels + 70%.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 70% climate change a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for higher probability surface water events. In this case the lifetime of the property is 100 years. The height of flood waters for the 1 in 100 year event, plus depths of water in adjacent areas and movements corridors such as Brentfield means that dry access in and out of the site is unlikely to be possible through built structures. Location of living accommodation above 1 in 100 + 70% climate change will allow safe refuge until evacuation can occur (if required). If non-sleeping accommodation is below these points, dry access/ refuse must be provided until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor as dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

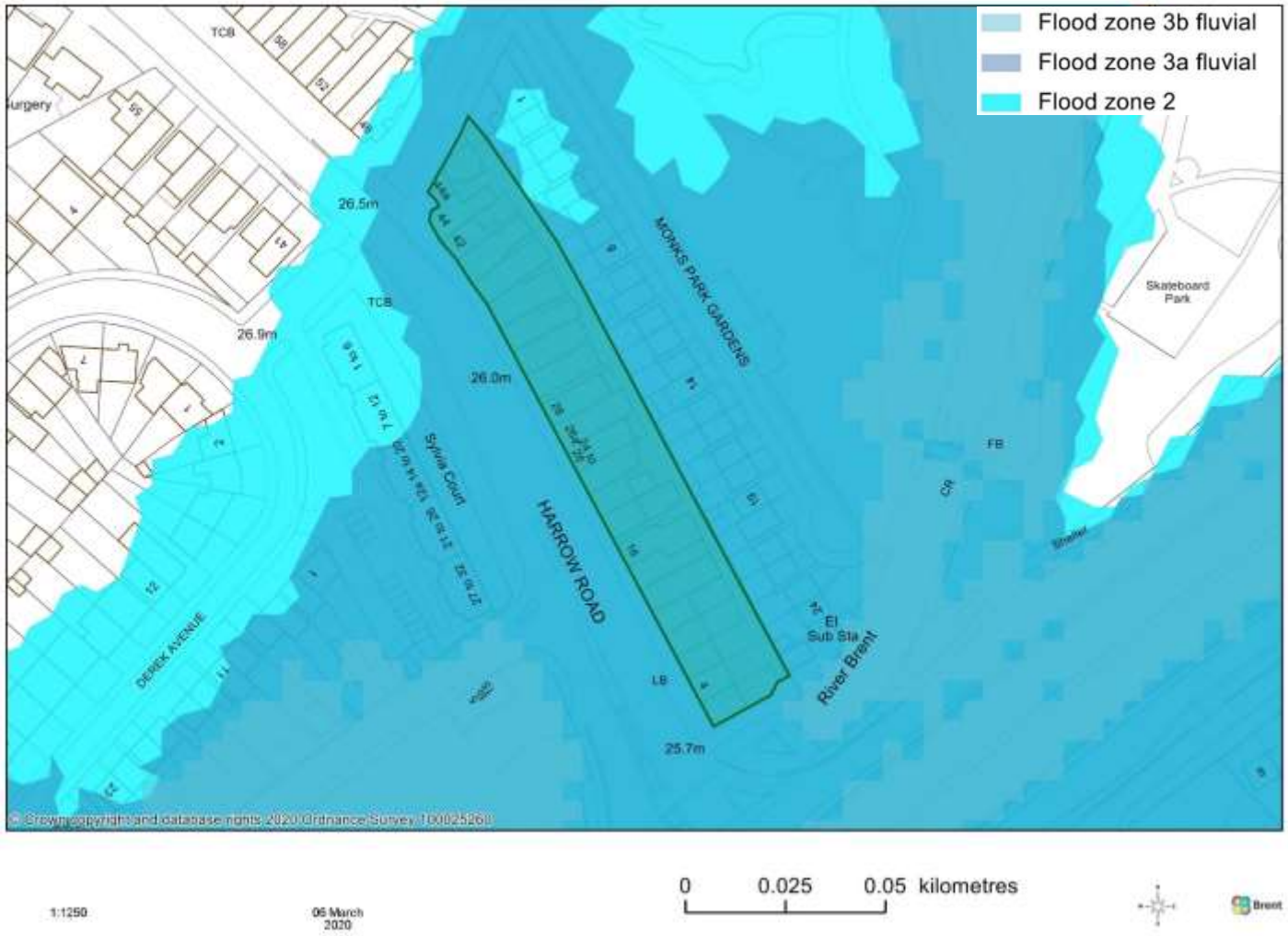
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding being wholly within Zone 3a. The depth of flooding for the 1:100 event brings significant risks. If the ground floors of buildings are designed to be above fluvial level 3 + 70% then this is likely to create space underneath for other ancillary uses (such as parking) if required. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are included to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements will not be appropriate in this location. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Access to safe refuge places should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

2-44a Harrow Road – BD2



Site Name:	2-44a Harrow Road	Site Allocation Ref:	BD2
Location:	HA9 6PG	Site Area:	0.35
Proposed Use:	Residential and commercial	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	100%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
25.7m	26.2m	26.7m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
26.2m		25.8m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0.4m	0.9m	

The River Brent runs in a culvert to the south of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity reaches 3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site quickly for a period of about 24 hours for a 1:1000 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The River Brent is accommodated in a concrete channel.

1:1250

06 March 2020

0 0.025 0.05 kilometres

Brent

Surface water flooding	
Flood zone 3a	0%
Surface water ponding is predicted in the highway on Harrow Road. Ground coverage in the site is a mixture of permeable and impermeable. The impermeable can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 60cm in the Harrow Road adjacent to the site during the 1% annual chance, about 50% is in the 15-30cm range, with the remainder in the 0-15cm range. Flows are above 0.25 m/s, draining to Point Place.	

Climate Change	
Main River 70% Climate Change	100% of site
The site is already Flood Zone 3, but depths will increase.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is in a Critical Drainage Area and has increased potential for elevated groundwater.	
Other Sources	
Sewer	100% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation with speeds between 0.5 and 2 m/s. The depths are between 0.3 - up to 2 metres (about 1 metre if using the 1:1000 fluvial which has a similar flood extent).	

Recommendations

Site Layout and Design

The site is in flood zone 3. Existing properties will flood in the region of 0.4 metres for a 1 in 100 year event. Taking account of the proposed residential use of the site, factoring in climate change of +70%, the site will be subject to further depths of flooding of about 0.9 metres. Given predicted flood heights, residential accommodation floor heights should be designed to be above the 1 in 100 year event + climate change. The site will have to accommodate existing commercial uses, so these less vulnerable uses should be at ground floor. There should be no overall increase in ground floor volume within the site unless this can be compensated for on site, or through compensation elsewhere, so as not to increase flood risk off site.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3 (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for less vulnerable uses should be above fluvial climate change levels + 35% + 30cm freeboard. It is however, recognised that this might be difficult given the need for level access to the commercial premises at ground floor, without increasing surrounding ground heights and thus reducing floodplain capacity. As such resilience and resistant measures might be the preferred strategy.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change + freeboard a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level

- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

It is unlikely that dry access to and from the site can be provided for higher probability surface water events due to the extent of flood waters in adjacent areas. In this case the lifetime of the property is 100 years. Location of living accommodation above 1 in 100 + 70% climate change will allow safe refuge until evacuation can occur (if required). For ground floor premises, if below flood levels, dry access/ refuge must be provided until the area is no longer flooded/ emergency services evacuation can occur if required.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor as dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

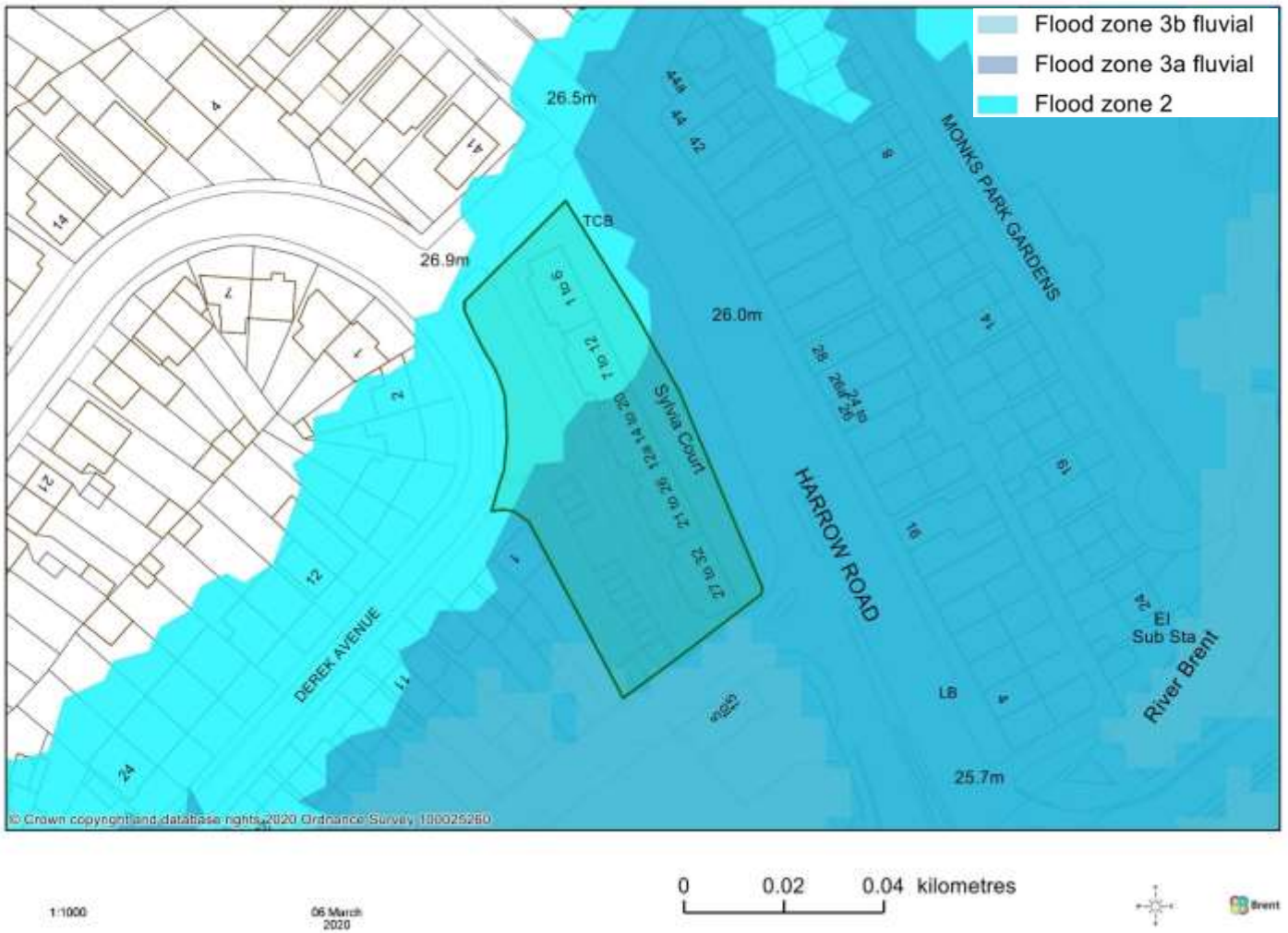
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding being wholly within Zone 3a. Existing buildings are likely to flood in a 1 in 100 year event. Lower vulnerability uses should be located at ground floor, ideally with floor levels above the 1 in 100 year +35% + freeboard. Alternatively, resilience/ resistance measures will be required for properties at risk of flooding. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are provided to not increase flood risk elsewhere. Basements are unlikely to be appropriate in this location. Access to safe refuge places should be provided for times of flood, with evacuation processes and points agreed with the Council's emergency planning team.

Sylvia Court Harrow Road – BD2



Site Name:	Sylvia Court Harrow Road	Site Allocation Ref:	BD2
Location:	HA9 6PG	Site Area:	0.29
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	60%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
25.7m	26.2m	26.7m	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
26.6m		25.7m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0.5m	1.0m	

The River Brent runs in a culvert to the south of the site and is a source of flooding. The site is within flood zone 3a due to fluvial flooding.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent River Brent. In the 0.1 % flood event, the overland flow peak velocity reaches 3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The River Brent catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site quickly for a period of about 24 hours for a 1:1000 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The River Brent is accommodated in a concrete channel.

0 0.02 0.04 kilometres

1:1000

06 March 2020

Brent

Surface water flooding	
Flood zone 3a	0%
Surface water ponding is predicted in the highway on Point Road and Harrow Road. Ground coverage in the site is a mixture of permeable and impermeable. The impermeable can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 60cm in the Harrow Road adjacent to the site during the 1% annual chance, about 50% is in the 15-30cm range, with the remainder in the 0-15cm range. Flows are above 0.25 m/s, draining to Point Place.	

Climate Change	
Main River 70% Climate Change	100% of site
The site is already Flood Zone 3, but depths will increase.	
Geology and Groundwater	
Groundwater susceptibility	25%-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is in a Critical Drainage Area and has increased potential for elevated groundwater.	
Other Sources	
Sewer	100% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation with speeds between 0.5 and 2 m/s. The depths are between 0.3 - up to 2 metres (about 1 metre if using the 1:1000 fluvial which has a similar flood extent).	

Recommendations

Site Layout and Design

The site is in flood zone 3. Existing properties appear to have a floor height about 30cm above external ground levels and will flood in the region of 0.3 metres for a 1 in 100 year event. Taking account of the proposed residential use of the site, factoring in climate change of +70%, the site will be subject to further depths of flooding of about 0.6 metres. Given predicted flood heights, new residential accommodation floor heights in a redevelopment should be designed to be above the 1 in 100 year event + climate change. As the existing properties are flats with sleeping accommodation at ground floor, if these properties remain these would be replaced with less vulnerable commercial uses. There should be no overall increase in ground floor volume within the site unless this can be compensated for on site, or through compensation elsewhere, so as not to increase flood risk off site.

Basement for servicing/ vehicle parking is unlikely to be acceptable, although given the likely level of floors sought to be above flood levels undercroft areas are more likely.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3 (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for less vulnerable uses should be above fluvial climate change levels + 35% + 30cm freeboard, for residential above +70% climate change.

Resilience and Resistant Measures

For building structures below the 1 in 100 year event + 35% climate change + freeboard a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level

- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

It is unlikely that dry access to and from the site can be provided for higher probability surface water events due to the extent of flood waters in adjacent areas. In this case the lifetime of the property is 100 years. Location of living accommodation above 1 in 100 + 70% climate change will allow safe refuge until evacuation can occur (if required). Flood waters on the northern half of the site only occur in +climate change events and are likely to be shallow. For ground floor premises, if below flood levels, dry access/ refuge must be provided until the area is no longer flooded/ emergency services evacuation can occur if required.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor as dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

LLFA Consultation

It is recommended that potential developers contact the Environment Agency and Brent Council as the LLFA for further information prior to taking forward site specific plans.

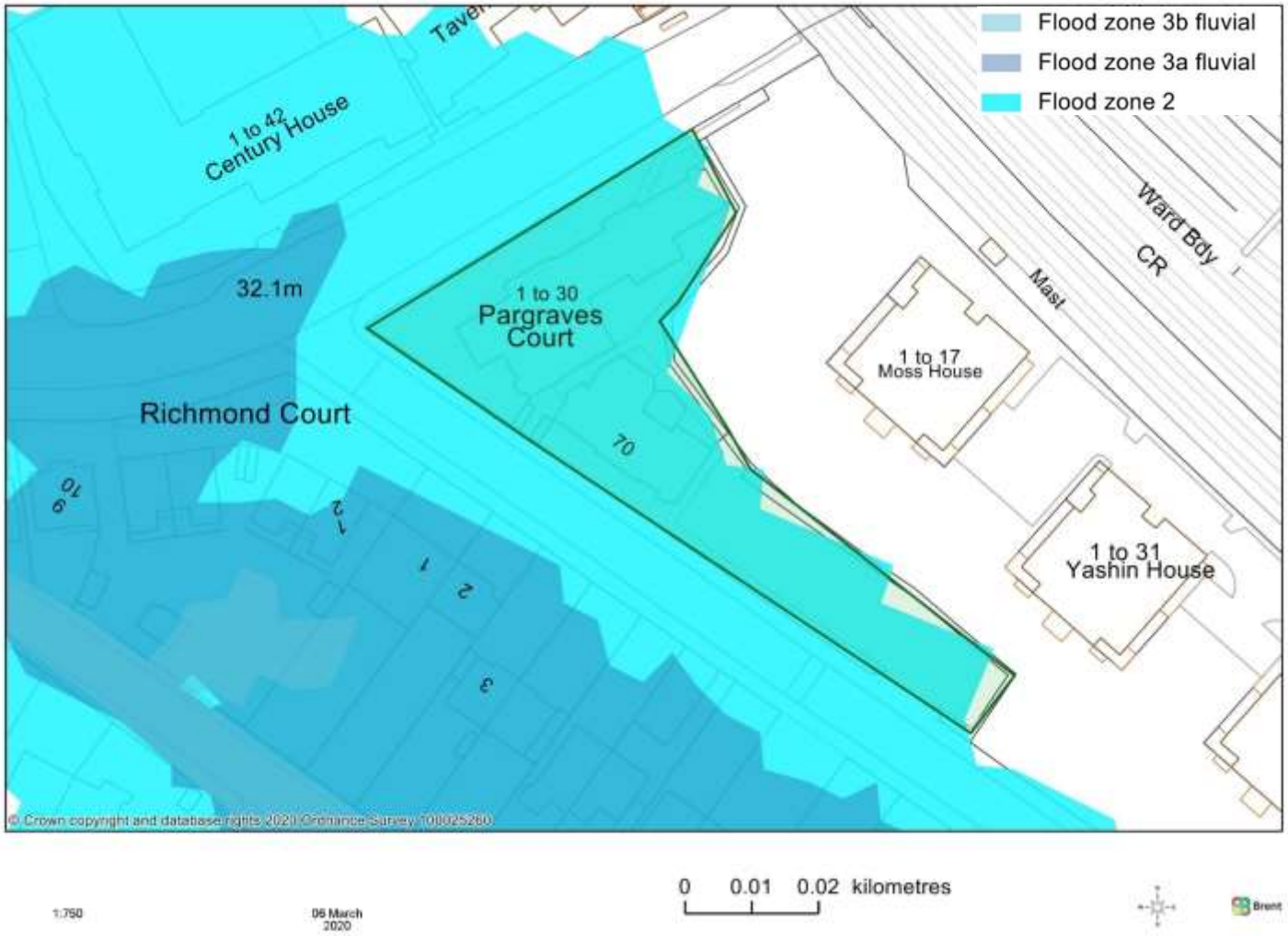
Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with fluvial flooding as 60% is within Zone 3a. Some existing residential apartments with ground floor bedrooms within the Zone 3 are likely to flood. Ideally lower vulnerability uses should be located at ground floor, with floor levels above the 1 in 100 year +35% + freeboard. Alternatively, if change of use/redevelopment does not occur, resilience/ resistance measures will be required for existing residential accommodation at risk of flooding. The footprint of development within flood zone 3 should not be greater than existing, unless compensatory measures are undertaken to not increase flood risk elsewhere. Basements are unlikely to be appropriate in this location and if provided will need to prevent water ingress and ensure that dray/safe access to upper floors for safe refuge is possible. Access to safe refuge places should be provided for times of flood for those in ground floor properties that might be at risk of inundation, with evacuation processes and points agreed with the Council's emergency planning team.

Pargreaves Court, 70 Brooke Avenue – BD2



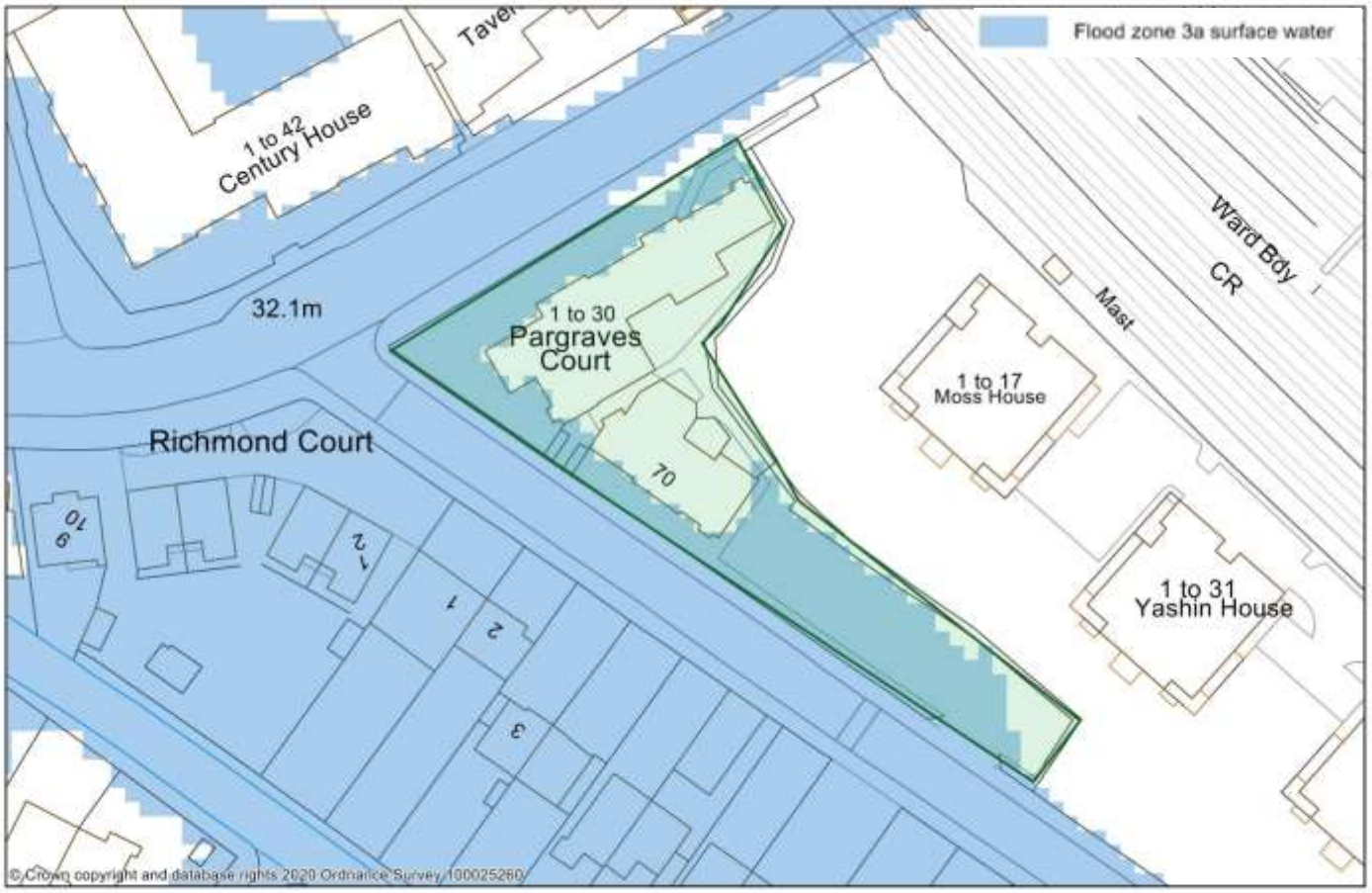
Site Name:	Pargreaves Court, 70 Brooke Avenue	Site Allocation Ref:	BD2
Location:	Wembley, HA9 8PG	Site Area:	0.2
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
97%	0%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
31.7m	32.3m	33.0	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
32.9m		32.5m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0.0m	0.5m	

The Wealdstone Brook runs in a culvert to the south of the site and is a source of flooding. All of the site is in flood zone 2, for a 1 in 100 year event + 70% climate change it all falls within Zone 3.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach over 30cm in the climate change event, due to speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year event + climate change.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	50%
Surface water ponding is predicted on highway adjacent to the site during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths on approximately 50% of the site that is predicted to flood in up to 60cm during the 1% annual chance on the areas in front of the main frontages of the buildings plus the adjacent surface level car park to the east. The majority is within the 30-60cm range, essentially on the car park, with the land in front of the buildings in the 15-30cm range. An overland flow path is observed adjacent along highway. Flows on site are at over 0.25 m/s on edges of the highway, elsewhere flows are below 0.25 m/s. The gardens largely contain soft landscaping. The car park is extensive and hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	100% of site
The extent of flood zone 3a will extend incorporating all of the site as a result of climate change, likely to lead to shallow ground floor flooding of the current buildings.	
Geology and Groundwater	
Groundwater susceptibility	>25%<50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	100% site
Reservoir	80% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are between 0.3 and up to 2 metres, with flow below 0.5 m/s.	

Recommendations

Site Layout and Design

Currently the site is within Flood Zone 2. Taking account of the proposed residential use of the site, factoring in climate change of +70% all the site would become flood zone 3. Redevelopment with new dwellings can allow for homes to be suitably designed to reflect the flood risk, reducing danger to occupants and property. The location of existing buildings within the likely extent of flood zone 3a +70% means that no overall increase in ground floor volume should occur, unless this can be appropriately addressed by creating replacement capacity on site, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need careful consideration to prevent water ingress.

Surface Water

This site has surface water depths consistent with those of fluvial levels. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above fluvial climate change levels 70%.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. For floods below 1 in 100 year +70% climate change, Forty Avenue to the north east the site provides the best potential for moving away from flood areas and risk. For the +70% event, the placing of residential accommodation floors above this height allows for safe refuge until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

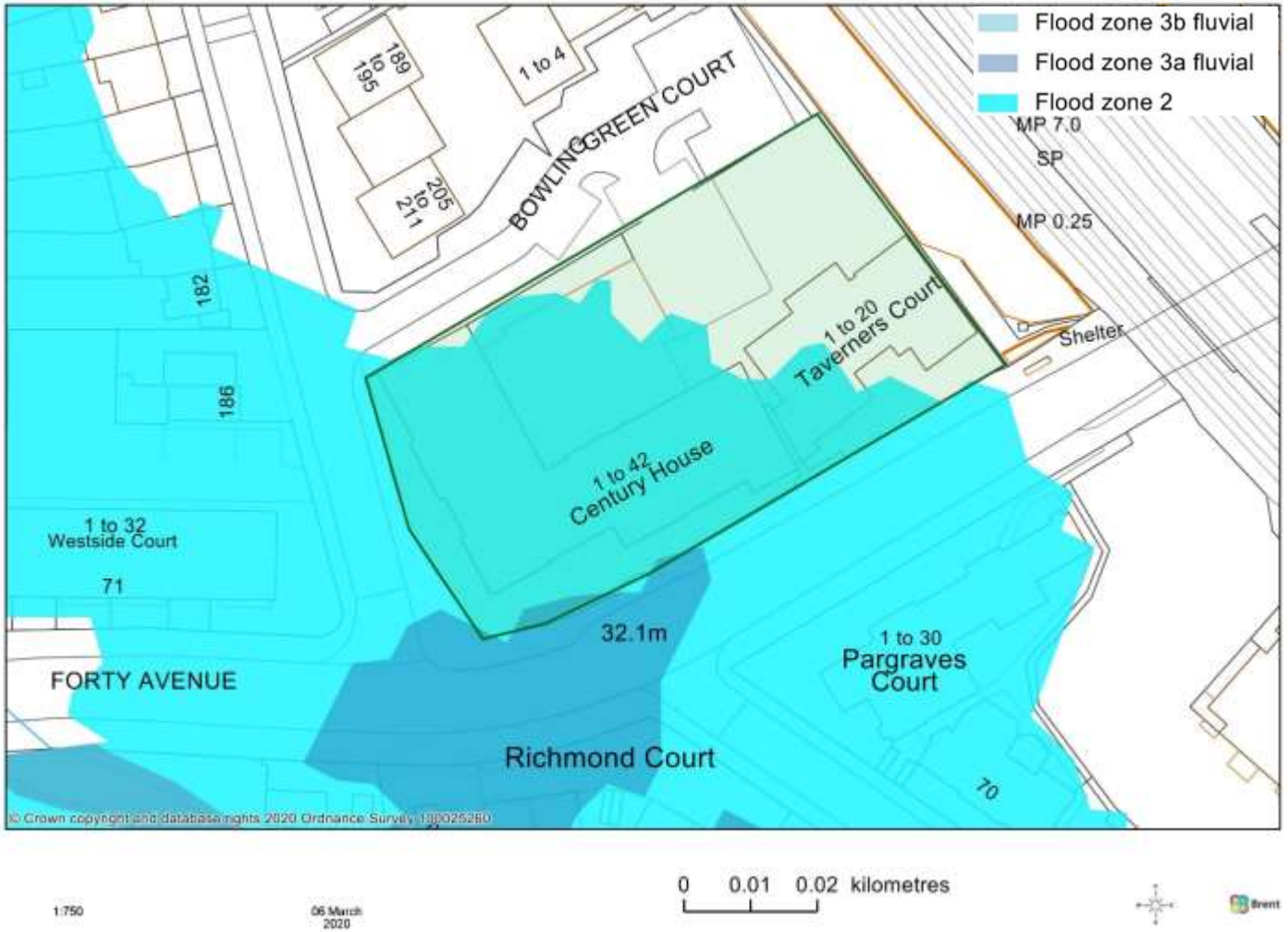
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with surface water flooding, with about 50% within fluvial zone 3. When taking account of climate change +70% the site becomes subject to Fluvial Zone 3. A sequential approach would prioritise development in the current location of buildings. The footprint of development, unless compensatory measures can be delivered on site should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements in this location will need consideration to prevent the ingress of water. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should

be provided in times of flood, with evacuation processes and points being for all but the most extreme event along Forty Avenue, or locations within the buildings in the most extreme event to be agreed with the Council's emergency planning team.

Century House and Taverners Court, Forty Avenue – BD2



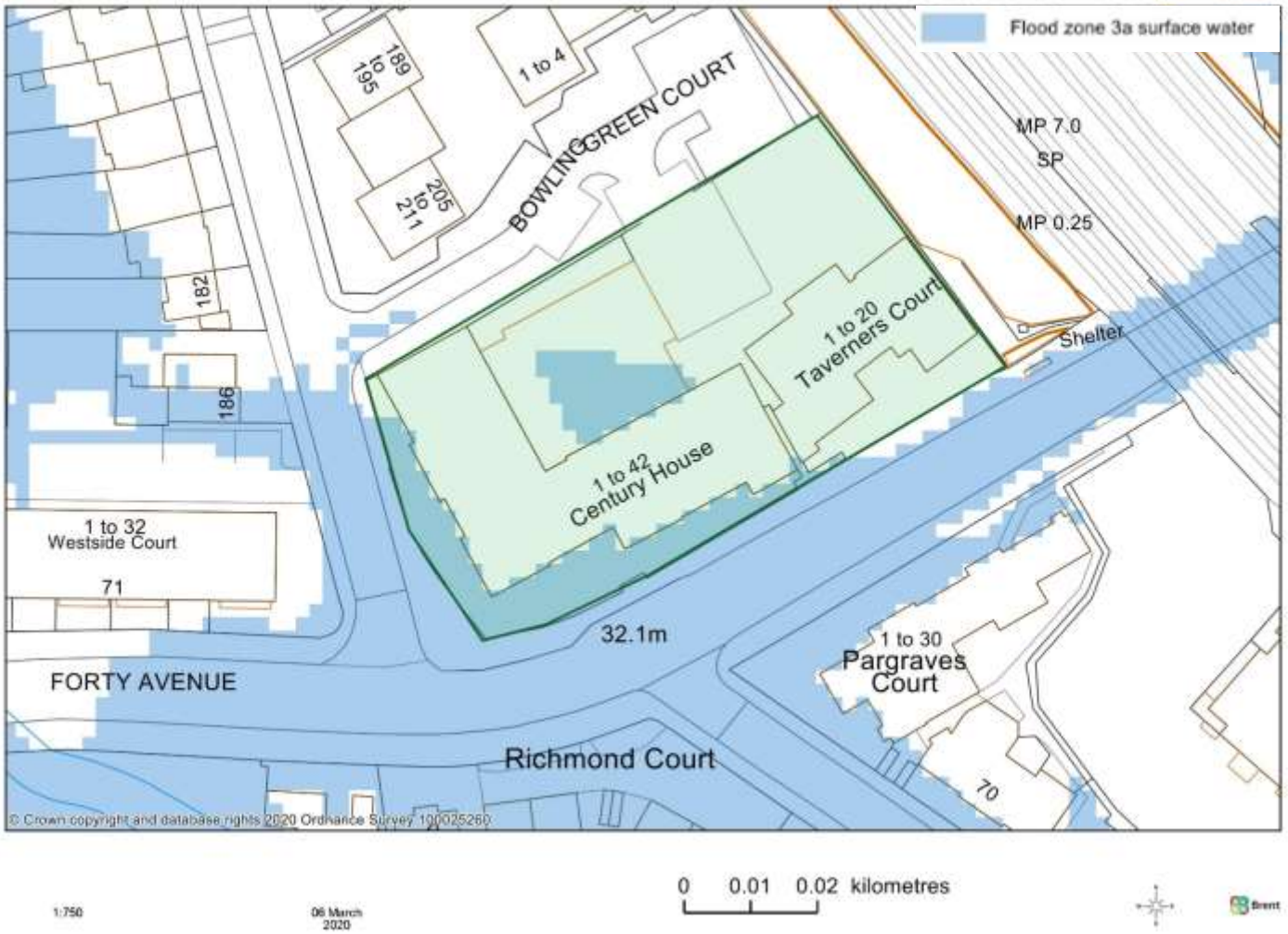
Site Name:	Century House and Taverners Court, Forty Avenue	Site Allocation Ref:	BD2
Location:	Wembley, HA9 8RU	Site Area:	0.4
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
60%	2%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
31.7m	32.3m	33.0	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
33.4m		32.2m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0.1m	0.7m	

The Wealdstone Brook runs in a culvert to the south of the site and is a source of flooding. Nearly all of the site, with the exception of some garden on Forty Avenue is in flood zone 2. For a 1 in 100 year event + 70% climate change, 64% of the site falls within Zone 3.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach over 30cm in association with a climate change event, given the speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year event + climate change.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	15%
Surface water ponding is predicted on land at the south west corner of the site and adjacent highway adjacent to the site during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths of up to 90cm on part of the site. This is split evenly within the ranges, 15-30cm, 30-60cm and 60-90cm, with the highest depths being near the highway. Surface water flooding occurs to the front on landscaping and in the rear car park. An overland flow path is observed adjacent along highway. Flows on site are at over 0.25 m/s on edges of the highway, elsewhere flows are below 0.25 m/s. The gardens largely contain soft landscaping. The rear car park is extensive and hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	64% of site For a 1 in 100 year event + 70% climate change.
The extent of flood zone 3a will extend incorporating much of the site as a result of climate change, likely to lead to shallow ground floor flooding of some of the current buildings.	
Geology and Groundwater	
Groundwater susceptibility	<25%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	100% site
Reservoir	65% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are between 0.3 and up to 2 metres, for 2/3rd of the area affected, with below 0.3 metres on the rest, with flow below 0.5 m/s.	

Recommendations

Site Layout and Design

Currently the site is within Flood Zone 2. Taking account of the proposed residential use of the site, factoring in climate change of +70% much the site would become flood zone 3. Redevelopment with new dwellings can allow for homes to be suitably designed to reflect the flood risk, reducing danger to occupants and property. The location of existing buildings within the likely extent of flood zone 3a +70% means that no overall increase in ground floor volume should occur, unless this can be appropriately addressed by creating replacement capacity on site, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need careful consideration to prevent water ingress.

Surface Water

This site has varying surface water depths, split between the ranges 15-30cm 30-60am and 60-90cm. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above fluvial climate change levels 70%.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. For floods below 1 in 100 year +70% climate change, Forty Avenue to the south east the site provides the best potential for moving away from flood areas and risk. For the +70% event, the placing of residential accommodation floors above this height allows for safe refuge until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

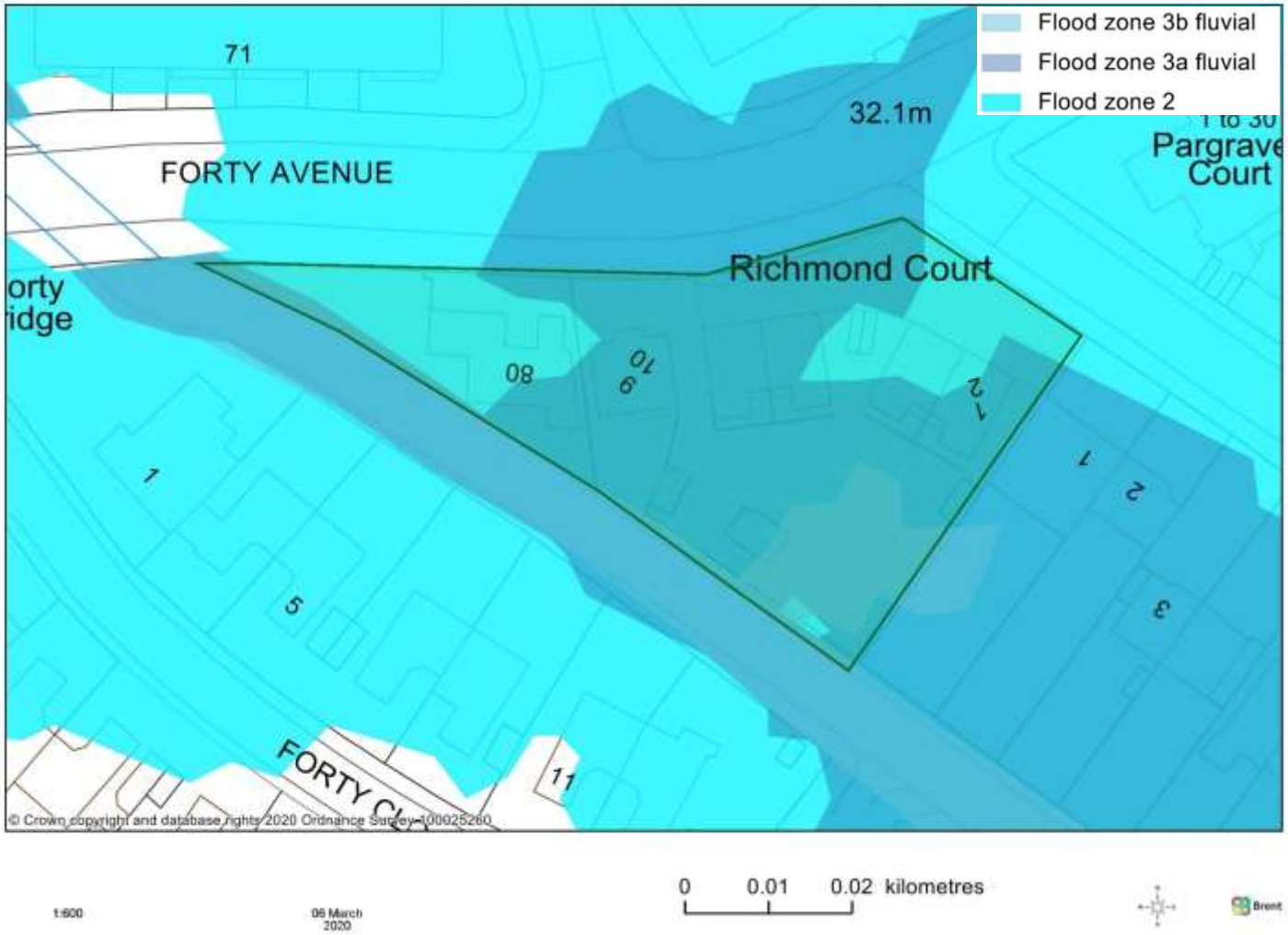
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with surface water flooding, with about 15% within fluvial zone 3. When taking account of climate change +70% the site becomes subject to Fluvial Zone 3. A sequential approach would prioritise development away from Forty Avenue. The footprint of development, unless compensatory measures can be delivered on site should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements in this location will need consideration to prevent the ingress of water. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should

be provided in times of flood, with evacuation processes and points being for all but the most extreme event along Forty Avenue, or locations within the buildings in the most extreme event to be agreed with the Council's emergency planning team.

1-10 Richmond Court and 80b Forty Avenue – BD2



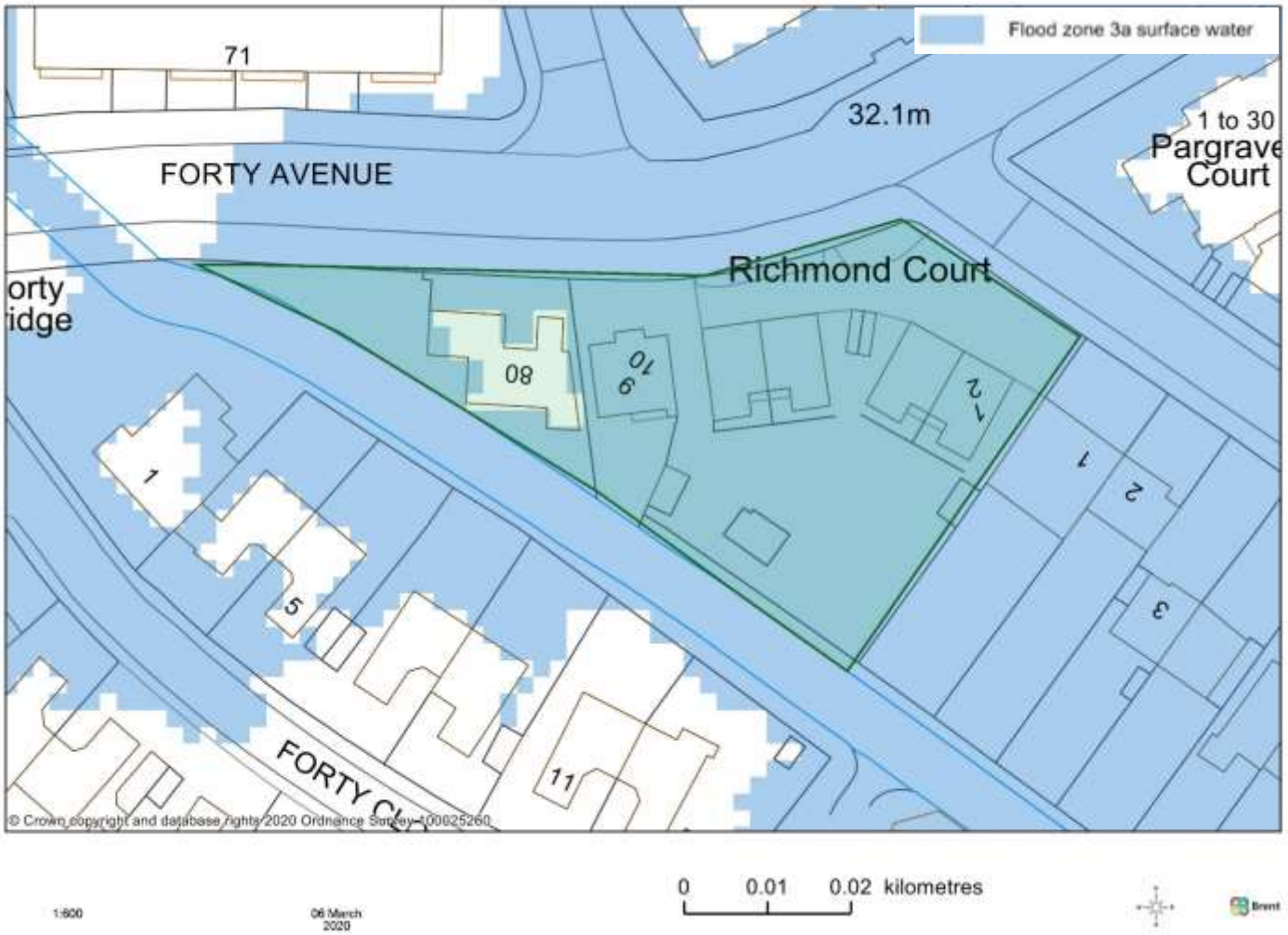
Site Name:	1-10 Richmond Court and 80b Forty Avenue	Site Allocation Ref:	BD2
Location:	Wembley, HA9 8LN	Site Area:	0.25
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
100%	70%	16%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
31.7m	32.3m	33.0	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
32.3m		31.3m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	1.0m	1.7m	

The Wealdstone Brook runs in a culvert to the west of the site and is a source of flooding. 70% of the site is in flood zone 3, with a small proportion . For a 1 in 100 year event + 70% climate change, 64% of the site falls within Zone 3 and some of the rear gardens of 1-4 is in Zone 3b.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	71%
Surface water ponding is predicted on most of the site that is not buildings during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths of >120cm on part of the site adjacent to the Brook. Flood depths are 50% in the >120cm range, with the remainder split evenly within the ranges 60-90cm and 90-120cm ranges. An overland flow path is observed from the highway to the brook. Flows on site are at over 0.25 m/s on most of the site. The rear gardens largely contain soft landscaping, car parking to the front is extensive and hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	64% Zone 3
The extent of flood zone 3a will extend incorporating much of the site as a result of climate change, likely to lead to +50cm deep ground floor flooding in the current buildings.	
Geology and Groundwater	
Groundwater susceptibility	>25%<50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	100% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. There are no records of historic sewer flooding on the site. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are between 0.3 and up to 2 metres, with flow below 0.5 m/s on most, with deeper parts over 2.5m/s.	

Recommendations

Site Layout and Design

Currently the majority of the site is within Flood Zone 3a and 3b. Sequentially Zone 2 should be prioritised for development. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site would be subject to greater levels of flooding. In Richmond Court this is significant as sleeping accommodation is on the ground floors. Redevelopment with new dwellings can allow for homes to be suitably designed to reflect the flood risk, reducing danger to occupants and property. No development should take place in fluvial Zone 3b. The location of existing buildings within the flood zone 3 means that no overall increase in ground floor volume should occur, unless this can be appropriately addressed by creating replacement capacity on site, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking is unlikely to be appropriate in this location.

Surface Water

This site has varying surface water depths, with some significant depths (>120cm) on site. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above fluvial climate change levels 70%.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. For floods below 1 in 100 year not taking account of climate change dry paths are available along Brook Avenue and Forty Avenue. For the +25% event and above, dry access and egress is no longer available on the highway and the placing of residential accommodation floors above this height allows for safe refuge until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

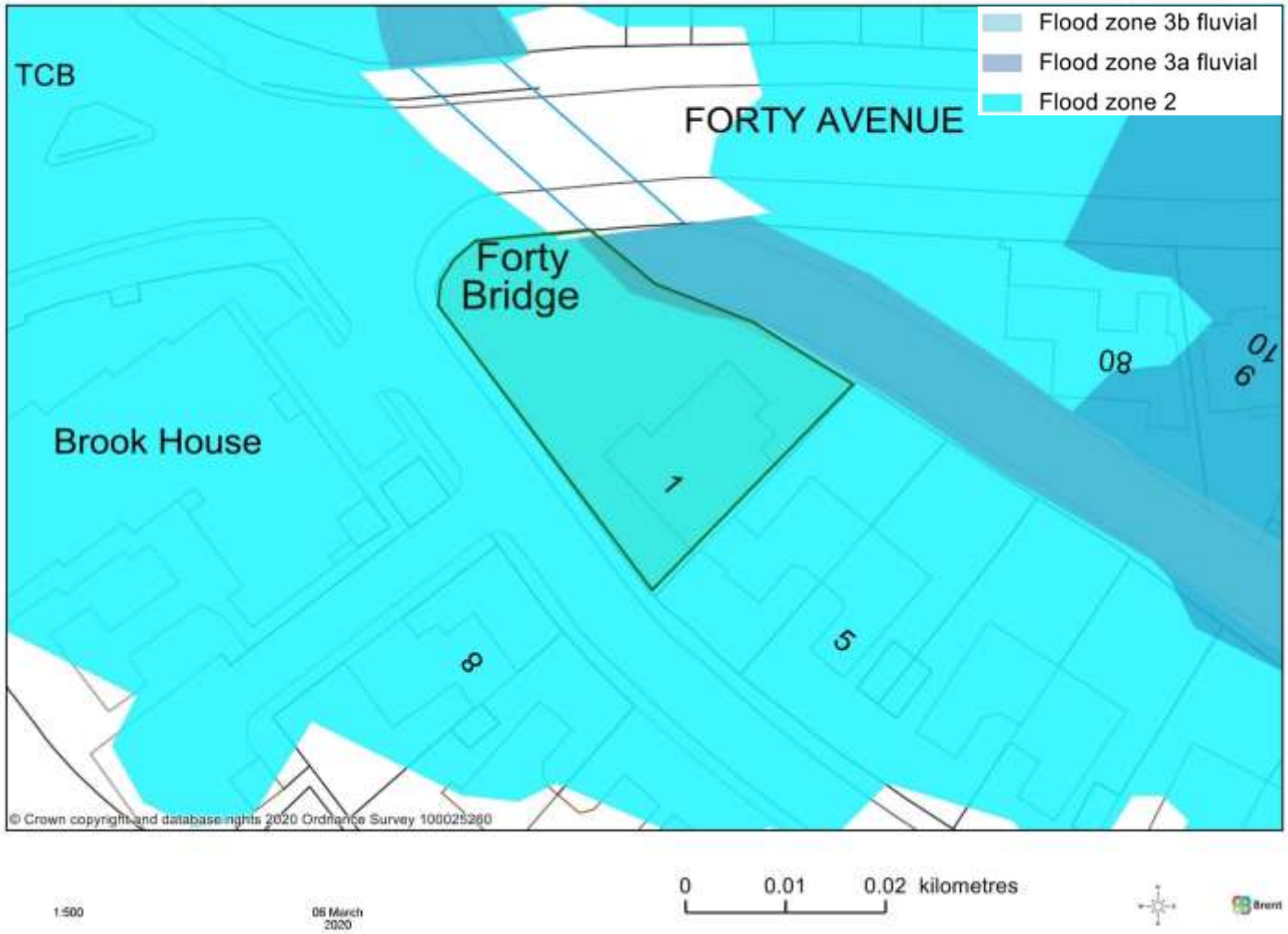
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with both surface water flooding, and fluvial flooding, with both forming the majority of zone 3. When taking account of climate change +70% the site becomes fully inundated in Fluvial Zone 3. A sequential approach would prioritise development on current Zone 2. Floor levels should be above climate change + 70%. The footprint of development, unless compensatory measures can be delivered on site should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements in this location are unlikely to be acceptable. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood, with evacuation processes and points being for all but for events

taking into account climate change along Forty Avenue and Brook Avenue, or locations within the buildings in events of +25% climate change or more to be agreed with the Council's emergency planning team.

1 Forty Close and Meeting Room Forty Avenue – BD2



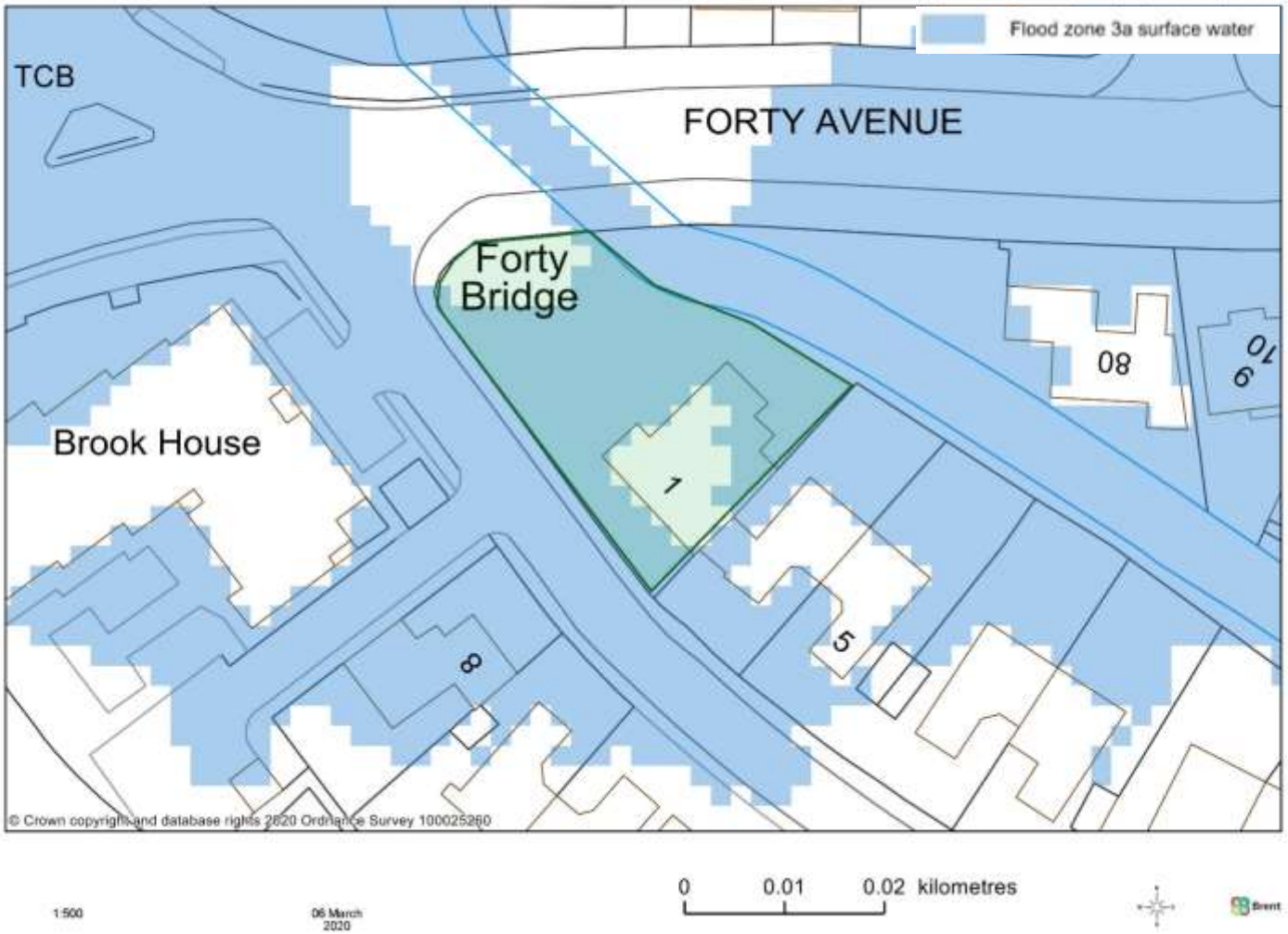
Site Name:	1 Forty Close and Meeting Room Forty Avenue	Site Allocation Ref:	BD2
Location:	Wembley, HA9 8LX	Site Area:	0.15
Proposed Use:	Residential and community space	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
97%	3%	3%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
31.7m	32.3m	33.0	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
33.2m		32.2m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	1.0m	1.7m	

The Wealdstone Brook runs in a culvert to the east of the sites and is a source of flooding. 3% of the site is in flood zone 3a/b. For a 1 in 100 year event + 70% climate change, 97% of the site falls within Zone 3.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	71%
No surface water ponding is predicted on the site during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths of up to 90cm on part of the site adjacent to Brook Close. 70% of the site is subject to surface water flooding, all outside the footprint of the existing buildings. Flood depths are 50% in the 60-90cm range, with the remainder split evenly within the ranges 30-60 and 15-30cm ranges. An overland flow path is observed from the highway to the brook. Flows on site are at over 0.25 m/s on most of the site. The gardens of 1 Brook Close largely contain soft landscaping, whilst car parking for the meeting room is extensive and hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	95% Zone 3.
The extent of flood zone 3a will extend incorporating much of the site as a result of climate change.	
Geology and Groundwater	
Groundwater susceptibility	>25% and <50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	100% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are between 0.3 and up to 2 metres on nearly all of the site and below 0.3 metres on part, with flow between 0.5-2m/s and below 0.5 m/s on parts.	

Recommendations

Site Layout and Design

Currently the majority of the site is within Flood Zone 2 fluvial. Sequentially Zone 2 should be prioritised for development. Taking account of the proposed residential use of the site, factoring in climate change of +70% the site would be subject to fluvial flooding. In Forty Close this is significant as sleeping accommodation is on the ground floors. Redevelopment on this part of the site with new dwellings can allow for homes to be suitably designed to reflect the flood risk, reducing danger to occupants and property. On the meeting room site, less vulnerable uses through the re-provision of the community hall can be at ground level with residential on the upper floors. No development should take place in current fluvial Zone 3a and 3b. The location of existing buildings within the flood zone 3 + climate change means that no overall increase in ground floor volume should occur, unless this can be appropriately addressed by creating replacement capacity on site, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need consideration in this area of how to avoid ingress of water in this location.

Surface Water

This site has varying surface water depths, with 50% in the 60-90cm range on site. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above fluvial climate change levels 70%.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level

- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. For floods below 1 in 100 year not taking account of climate change, dry paths are available along Forty Avenue, Forty Close and Carlton Avenue East. For the +70% event, dry access and egress is no longer available on highway away from the wider area and the placing of residential accommodation floors above this height allows for safe refuge until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

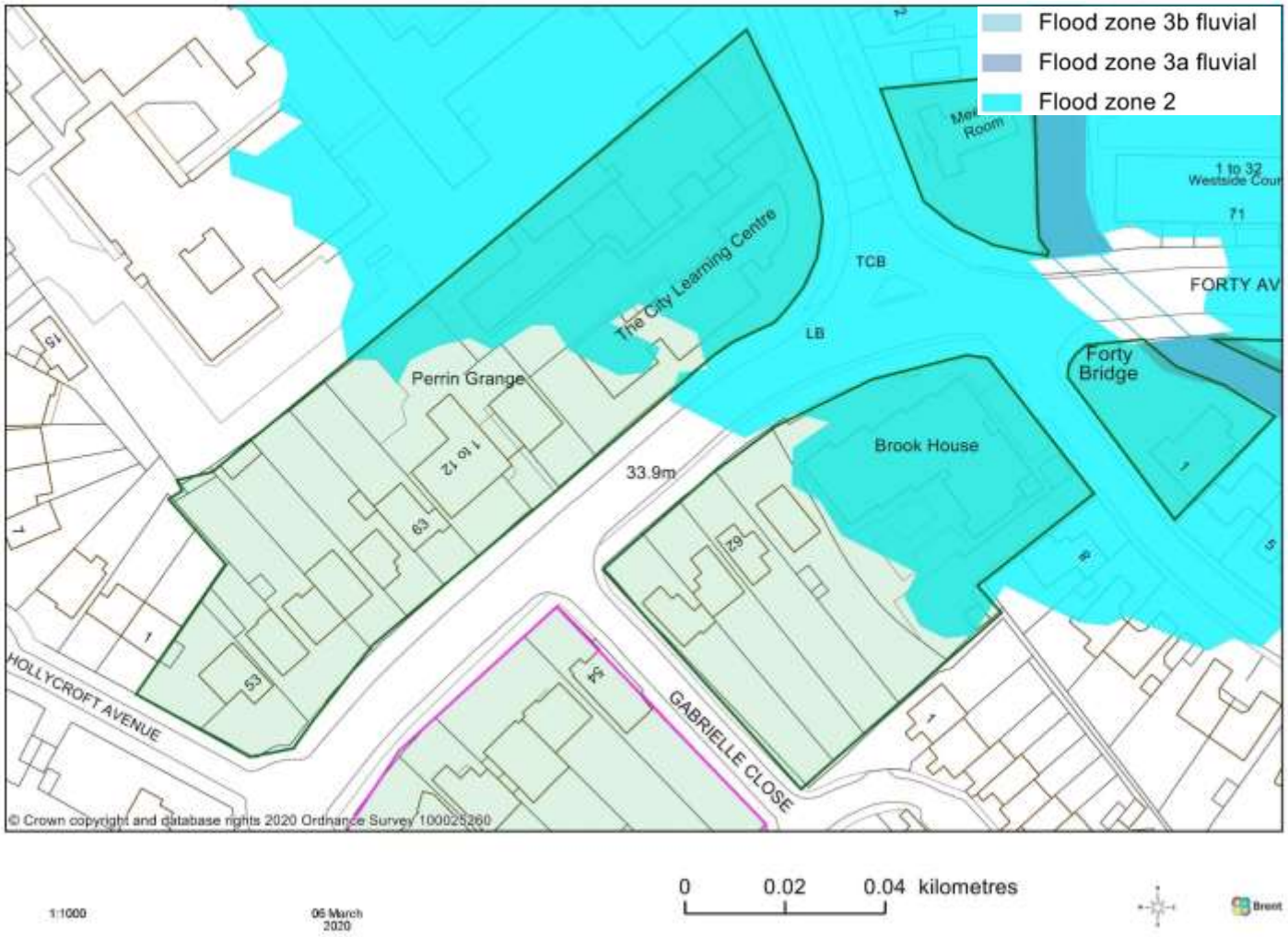
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with surface water flooding on about 71%, and a very small extent of fluvial flooding within Zone 3. When taking account of climate change +70% the site becomes fully inundated in Fluvial Zone 3. A sequential approach would prioritise development on current Zone 2. Floor levels should be above climate change + 70%. The footprint of development, unless compensatory measures can be

delivered on site should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements in this location will need to consider how to prevent water ingress. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood, with evacuation processes and points being for all but for events taking into account climate change along the adjacent highway network, or locations within the buildings in events of +25% climate change or more to be agreed with the Council's emergency planning team.

53-63 Forty Avenue, Perrin Grange, the City Learning Centre and Brook House and 58-64 Forty Avenue – BD2



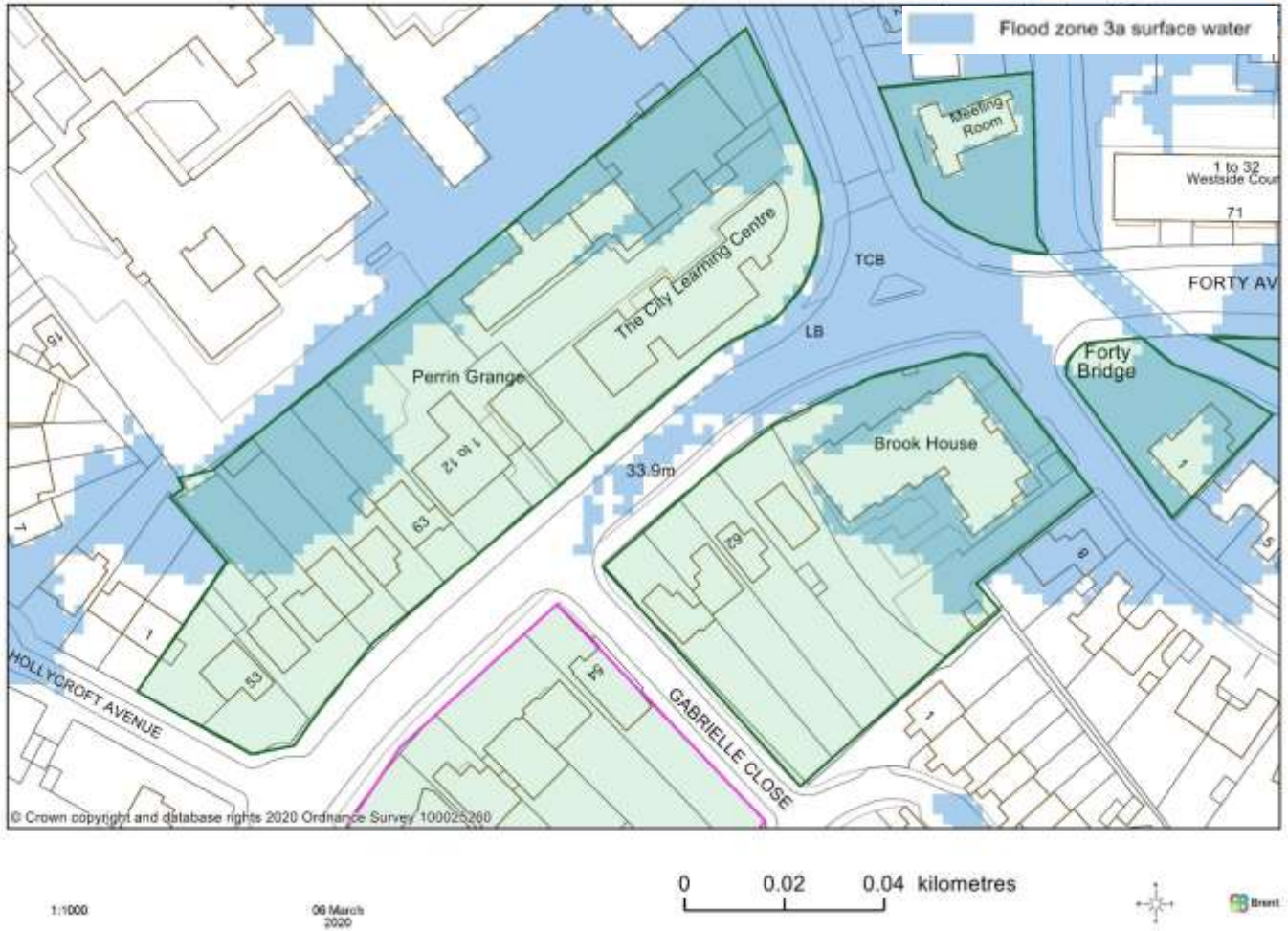
Site Name:	53-63 Forty Avenue, Perrin Grange, the City Learning Centre and Brook House and 58-64 Forty Avenue	Site Allocation Ref:	BD2
Location:	Wembley, HA9 8LQ	Site Area:	1.5
Proposed Use:	Residential and education	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 2	Flood Zone 3a	Flood Zone 3b	
31%	0%	0%	
Peak flood level in a 1 in 20yr flood event (AOD)	Peak flood level in a 1 in 100yr flood event (AOD)	Peak flood level in a 1in 100 yr flood event +70% climate change	
31.7m	32.3m	33.0	
Maximum Ground Level within the floodplain (AOD)		Minimum Ground Level within the floodplain	
35.0m		32.5m	
Approximate (Maximum) Flood Depth(m)			
Zone 3b Functional Floodplain 5% (1:20 design event)	Zone 3a High Probability 1% (1 in 100) Design	Zone 3a +70% climate change =	
0m	0m	0.5m	

The Wealdstone Brook runs in a culvert to the east of the sites and is a source of flooding. 31% of the site is in flood zone 2. For a 1 in 100 year event + 70% climate change, 29% of the site falls within Zone 3.

Speed of Floodwaters
Overland flow that has exceeded the capacity of the adjacent Wealdstone Brook. In the 0.1 % flood event, the overland flow peak velocity reaches 2.3 m/s. Where floodwaters reach the maximum depth (indeed over 30cm) and speed on site, this would represent a danger to all including the emergency services.

Period of Inundation
The Wealdstone Brook catchment is relatively small, and response times (i.e. the period between which rainfall is observed in the catchment, and the watercourse water levels rise) are relatively short. For this reason it is reasonable to assume that floodwaters will inundate the site for a short period, not exceeding 12 hours for a normal 1:100 year +70% event.

Flood Defences
The site is not offered any form of protection from raised formal defences. The Wealdstone Brook is accommodated in a concrete channel.



Surface water flooding	
Flood zone 3a	12%
Surface water ponding is predicted on the site during the 1 in 30-year pluvial event or greater to the rear of properties on the northern side of Forty Avenue, with deeper water in 63-73's rear gardens. The Environment Agency's surface water depth modelling identifies the potential for depths of >120cm. 12% of the site is subject to 1 in 100 year event surface water flooding, all outside the footprint of the existing buildings. Flood depths are evenly split across the ranges from 0-15 up to >120cm. An overland flow path is observed from Hollycroft Avenue to the rear gardens and from the northern site to towards Carlton Avenue on the east with flows to Forty Close on the south eastern side. Flows on site are at over 0.25 m/s on the deeper parts adjacent to the highway, elsewhere below 0.25m/s. The rear gardens largely contain soft landscaping, whilst car parking on the fronts of properties is extensive and hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	29% Zone 3
The extent of flood zone 3a extends east-west from the areas closer to the Brook as a result of climate change.	
Geology and Groundwater	
Groundwater susceptibility	>25% <50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	100% site
Reservoir	16% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are between 0.3 and up to 2 metres on nearly all of the southern site affected site below 0.3 metres on the northern side of Forty Avenue, with flow below 0.5 m/s.	

Recommendations

Site Layout and Design

Currently the majority of the site is within Flood Zone 1, with some in Flood Zone 2 fluvial. Sequentially Zone 1 should be prioritised for development. Taking account of the proposed residential use of the site, factoring in climate change of +70% part of the site would be subject to fluvial flooding. In Brook House this is significant as it is an old people's home and sleeping accommodation is on the ground floors. Redevelopment on this part of the site with new dwellings can allow for homes to be suitably designed to reflect the flood risk, reducing danger to occupants and property. On the education site, more vulnerable uses should have floor levels above flood heights. The location of existing buildings within the flood zone 3 + climate change means that no overall increase in ground floor volume should occur, unless this can be appropriately addressed by creating replacement capacity on site, so as not to increase flood risk elsewhere.

Basement for servicing/ vehicle parking will need consideration of how to avoid ingress of water in this location.

Surface Water

This site has varying surface water depths, with some significant depths >120cm predicted in lower lying gardens to the north west which are surrounded by higher ground from which surface water runs into that area. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above fluvial climate change levels 70%. For non-residential it should be +35% + 30cm freeboard.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. For floods below 1 in 100 year not taking account of climate change, dry paths are available along Forty Avenue. For the +70% event, dry access and egress is available for those areas outside the flood extend along Forty Avenue, but for those areas of the site subject to the +70% event, the placing of accommodation on floors above this height, or dry access to places above flood levels allows for safe refuge until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. Developments will be required to sign up to the Environment Agency flood warning system. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with surface water flooding on about 12%. When taking account of climate change +70% the site has parts (29%) in Fluvial Zone 3. A sequential approach would prioritise development on current Zone 1. As the site does however have existing

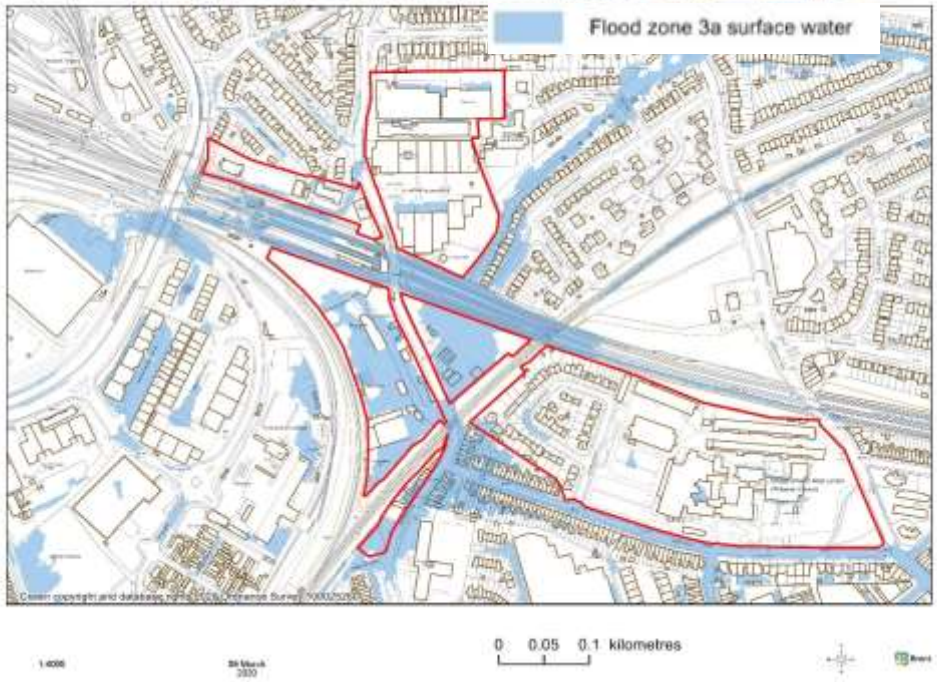
properties in Zone 2, if development here is necessary, floor levels should be above climate change + 70% for residential. The footprint of development, unless compensatory measures can be delivered on site should not be greater than existing to not increase flood risk elsewhere. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements in this location will need to consider how to prevent water ingress. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood, with evacuation processes and points being for all but for events taking into account climate change along the adjacent highway network. For more extreme events safe refuse within the buildings in events of +70% climate change or more should be agreed with the Council's emergency planning team.

Sites within Flood Zone 1 - Surface Water Flood Zone 3

Neasden Stations Growth Area – BEGA1

Site Name:	Neasden Stations Growth Area	Site Allocation Ref:	BEGA1
Location:	Neasden Lane NW10 1PH	Site Area:	11.7
Proposed Use:	Residential, industrial, transport infrastructure, social infrastructure	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1			
100%			

The site has no risk of fluvial flooding.



Surface water flooding	
Flood zone 3a	15%
Surface water ponding is predicted on the site during the 1 in 30-year pluvial event or greater. This is for the most part concentrated on the sites to the south of the Metropolitan line, either side of Neasden Lane. The Environment Agency's surface water depth modelling identifies the potential for depths of 90-120cm to the west of Neasden Lane. 15% of the whole Growth Area is subject to 1 in 100 year event surface water flooding. Flood depths are predominantly in the 30-60cm range on the sites adjacent to Neasden Lane, with other parts evenly spread in the 15-30cm and 60-90cm ranges. A very small part is within the 90-120cm. These two sites are located on much lower ground than Neasden Lane highway. Elsewhere in the Growth Area, surface water drainage issues are essentially associated with ponding on sites of 15-30cm and 30-60cm, with similar levels also shown on adjacent highways. Flows on site are predominantly under 0.25 m/s, although parts are above 0.25m/s. Flow paths are along adjacent highways, but for the Growth Area sites themselves are relatively self contained on individual sites. The areas with highest levels of surface water risk are almost wholly hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	0%
The site is not at threat of being within fluvial Zone3 as a result of climate change.	
Geology and Groundwater	
Groundwater susceptibility	None
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify no susceptibility to increased ground water flooding in this location. The majority of the site is within a Critical Drainage Area.	
Other Sources	
Sewer	60% site
Reservoir	6% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are below 0.3metres for most of the susceptible areas to the west of Neasden Lane with a very small piece	

between 0.3-2 metres, with flow mostly below 0.5 m/s, with some between 0.5 and 2m/s on deeper parts towards the North Circular/ Metropolitan Line.

Recommendations

Site Layout and Design

Currently the site is within fluvial Flood Zone 1 and this does not change with predicted climate change. The main risk is from surface water flooding which for the central part either side of Neasden Lane is extensive, with some significant depths on site. In this part, in terms of land uses, the ground floor should be prioritised for lower vulnerability uses such as the industrial which already exists and will need replacing.

Basement for servicing/ vehicle parking will need consideration of how to avoid ingress of water in this location.

Surface Water

This site has varying surface water depths, with some significant depths 90-120cm on a very small part where the ground gets lower. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site. The extent of potential flooding on this site, combined with the extent of development is likely to require underground storage capacity if floor levels are increased to remove the potential for flooding.

Finished Floor Levels

Building ground floors for residential living accommodation should be above predicted surface flooding levels. Much of the site currently at most risk is used for materials grading as part of recycling processes and vehicle storage. Given the need to intensify use of the site, ground floors could be raised to remove flood risk, if this is not sufficiently addressed through for example avoiding risk by providing underground storage capacity to which waters can be diverted.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. Neasden Lane highway due to its elevated nature in the areas most at risk of surface water flooding is likely to remain a dry area. The placing of accommodation on floors above flood height, or dry access to places above flood levels allows for safe refuge until the area is no longer flooded will be needed.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with surface water flooding on about 15%. Sequentially development should be prioritised in locations outside Zone3, nevertheless in the central area there will be limited scope to do this, due to the extensive area covered. A surface water management plan can address the on-site risks. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Solutions may be to divert water to storage areas underground to store water than runs into the site, reducing above ground ponding and/ or raise floor levels. More vulnerable uses can be located on the upper floors, or potentially with floor levels raised above predicted surface water flooding levels plus an element of freeboard. Basements in this location will need to consider how to prevent water ingress. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood, with evacuation processes and points being for all but for events taking into account climate change along the adjacent highway network. These should be agreed with the Council's emergency planning team.

Site NW04 Wembley Masterplan – BCSA16

Site Name:	NW04 Wembley Masterplan	Site Allocation Ref:	BCSA16
Location:	NW10 0DA	Site Area:	0.4
Proposed Use:	Commercial and residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1: 100%			

Surface water flooding	
Flood zone 3a	27%
Surface water ponding is predicted on 5% of site during the 1 in 30-year pluvial event or greater, adjoining the adjacent highway. For the 1% annual chance the site is subject to an overland flows from adjacent highway into the site. Formerly a car park, the site is in meanwhile use as public realm. The ground coverage on the site is currently porous pavement. It is subject to controlled off-site surface water flows as part of the wider Wembley masterplan drainage strategy. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 30cm on the site during the 1% annual chance. The majority is in the 0-15cm range, with a small part near Engineers Way within the 15-30cm range. Speed of water higher at 0.25m/s where water enters the site and further away from Engineers Way is under 0.25m/s.	

Climate Change	
Main River 70% Climate Change	0% of site
No risk of increased fluvial flooding	
Geology and Groundwater	
Groundwater susceptibility	<25%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as under 25%.	
Other Sources	
Sewer	35% site
Reservoir	0% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water.	

Recommendations

Site Layout and Design

The principal risk results from surface water flooding, this is related to overland flows generated from highway that runs down a gradient towards the site which then flows into the site and ponds in depressed areas. It is not clear if this actually reflects events as all this area has been subject to a surface water drainage strategy that will reduce run-off to the highway compared to a typical impermeable area. Nevertheless, a surface water strategy can deal with the issue of overland flows, either placing buildings outside these zones or diverting the flow elsewhere in the site and ensuring floor heights outside the limits of risk and providing dry access and egress from buildings to areas not likely to flood. A drainage strategy to properly deal with surface water generated by the site can also ensure reduced run-off from the site compared to an impervious hard surface. This can be through for example retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground, and if necessary also accommodating some of the current flows into the site to not increase flood risk elsewhere.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

In the unlikely event residential development cannot be avoided within the flood extent, finished floor levels should be set at least 300mm freeboard above the 1 in 100 flood level.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by EA data on flood depth, speed and direction.

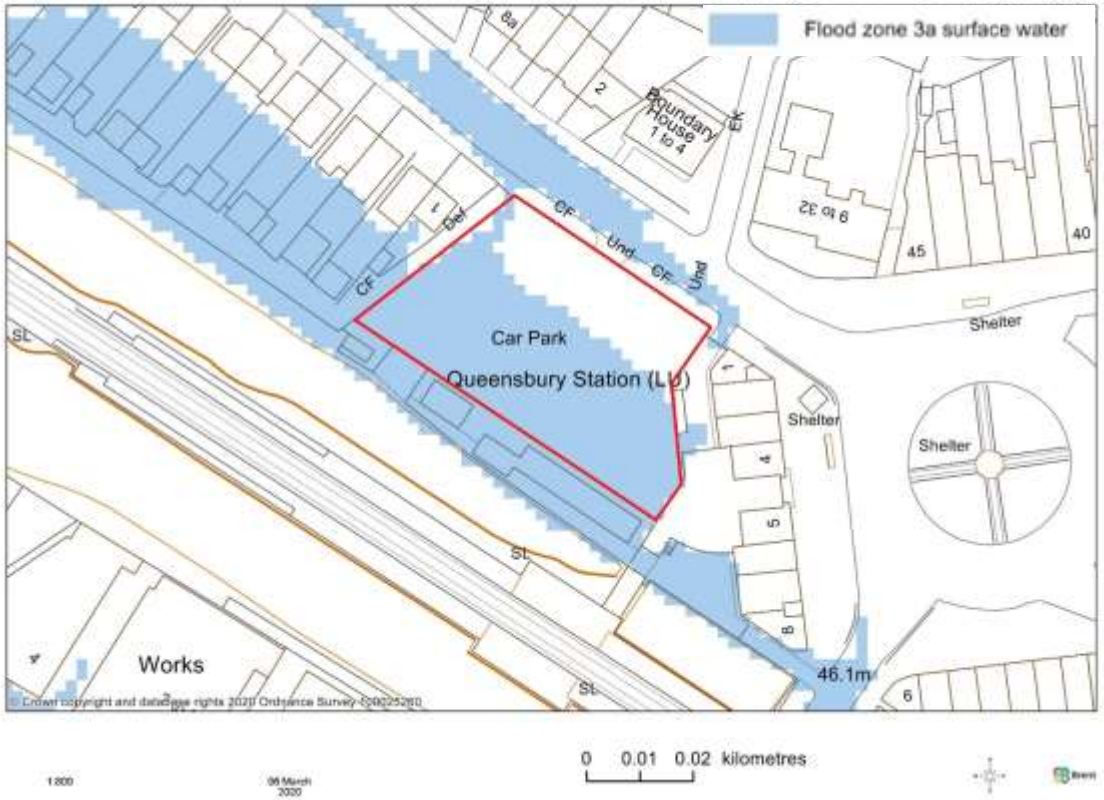
Summary

The site currently has risk associated with surface water flooding. Surface water issues are resulting from overland flows from highway on higher ground to the south of the site which ponds in the site. Suitable redesign of the site, together with a surface water drainage strategy can ensure that risk is reduced for people and property. This will be by placing buildings in areas away from flows through the site from highway water and providing suitable on site storage/ attenuation above or below ground for surface water generated on site. A drainage strategy will reduce off-site flows compared to impermeable surfaces, thus reducing flood risk elsewhere. Overall, with the appropriate solutions redevelopment of the site is likely to reduce flood risk to people and property on and off-site.

Queensbury Station Car Park – BNSA8

Site Name:	Queensbury Station Car Park	Site Allocation Ref:	BNSA8
Location:	Turner Road, HA8 5NP	Site Area:	0.2
Proposed Use:	Residential and car parking	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1			
100%			

The site has no risk of fluvial flooding.



Surface water flooding	
Flood zone 3a	71%
Surface water ponding is predicted on the site during the 1 in 30-year pluvial event or greater moving closer towards the railway from the highway. The Environment Agency's surface water depth modelling identifies the potential for depths of 90-120cm. 71% of the site is subject to 1 in 100 year event surface water flooding. Flood depths are evenly split across the ranges from 15-30cm, 30-60cm, 60-90cm and 90-120cm. An overland flow path appears to run across the site from adjacent rear gardens to the site's south east. Flows on site are at over 0.25 m/s on part and elsewhere below 0.25m/s. The area is almost wholly hardstanding, this can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas.	

Climate Change	
Main River 70% Climate Change	0%
The site is not at threat of being within fluvial Zone3 as a result of climate change.	
Geology and Groundwater	
Groundwater susceptibility	<25%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as less than 25%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	25% site
Reservoir	0% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water.	

Recommendations

Site Layout and Design

Currently the site is within fluvial Flood Zone 1 and this does not change with predicted climate change. The main risk is from surface water flooding which is extensive, with some significant depths on site. In terms of land uses, the ground floor should be prioritised for lower vulnerability uses.

Basement for servicing/ vehicle parking will need consideration of how to avoid ingress of water in this location.

Surface Water

This site has varying surface water depths, with some significant depths 90-120cm predicted where the ground gets lower. A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site. The extent of potential flooding on this site, combined with the extent of development is likely to require underground storage capacity if floor levels are increased to remove the potential for flooding.

Finished Floor Levels

Building ground floors for residential living accommodation should be above predicted surface flooding levels. As the site is currently a car park, whilst ground floors could be raised to remove flood risk, it might be considered appropriate for existing ground floors to remain as is with measures to avoid its use in times of predicted flood.

Resilience and Resistant Measures

For building structures below residential ground floor level a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. The highway is likely to remain a dry area. The placing of accommodation on floors above this height, or dry access to places above flood levels allows for safe refuge until the area is no longer flooded.

Emergency Planning

Details will be required on the flood related risks that will remain once the proposed mitigation measures have been implemented, and how the risks will be managed over the development's lifetime. Flood warnings and/ or flood alerts need to be considered along with the emergency evacuation procedures in the design and layout of the proposed development. The Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety.

Details will be required on flood warning and emergency evacuation procedures as well as details regarding safe refuge areas above ground floor if dry egress routes for evacuation cannot be guaranteed. This should consider the safety of people within the building and also the safety of people around the building and in adjacent areas, including those who are less mobile.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

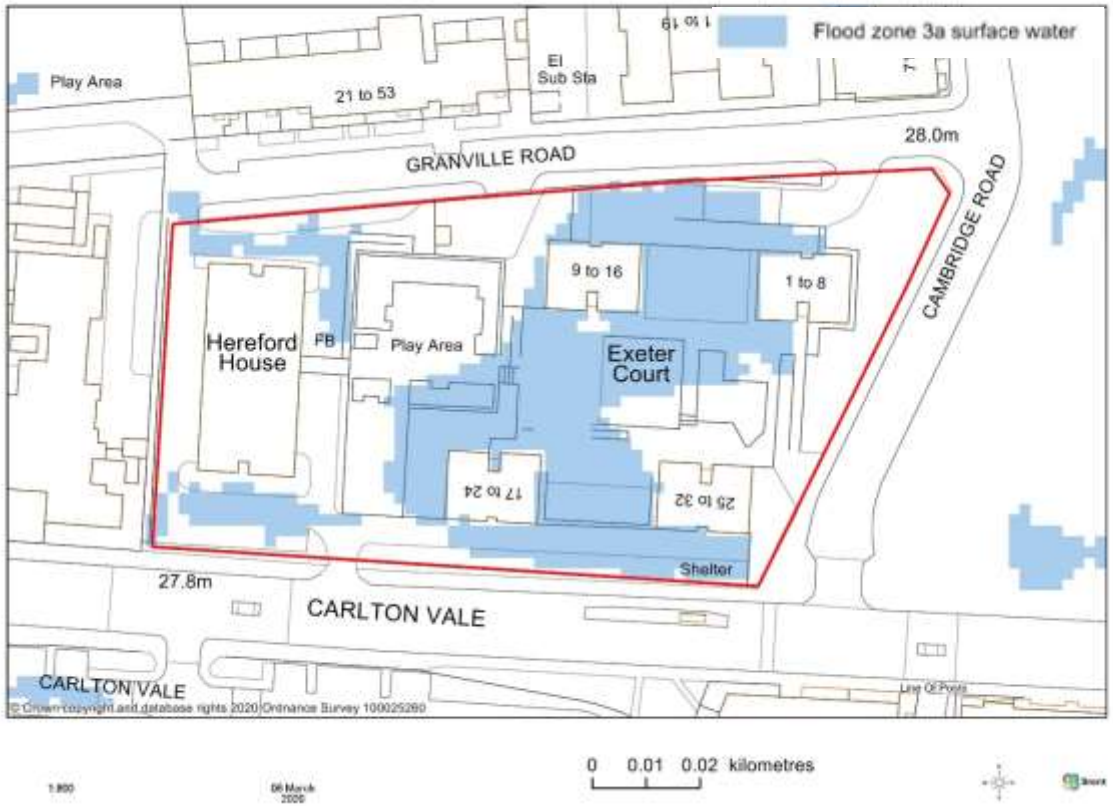
Summary

The site currently has risk associated with surface water flooding on about 71%. Sequentially development should be prioritised in locations outside Zone 3. A surface water management plan can address the on-site risks. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Solutions may be to divert water to storage areas underground to store water that runs into the site, reducing above ground ponding and/ or raise floor levels. More vulnerable uses can be located on the upper floors, or potentially with floor levels raised above predicted surface water flooding levels plus an element of freeboard. Basements in this location will need to consider how to prevent water ingress. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood, with

evacuation processes and points being for all but for events taking into account climate change along the adjacent highway network. These should be agreed with the Council's emergency planning team.

Hereford House & Exeter Court – BSESA8

Site Name:	Hereford House & Exeter Court	Site Allocation Ref:	BSESA8
Location:	Carlton Vale	Site Area:	0.8
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1: 100%			



Surface water flooding	
Flood zone 3a	36%
Surface water ponding is predicted on around the building footprint on impermeable surfaces such as car parking and the highway during the 1 in 30-year pluvial event or greater. The majority of the ground coverage in the site is impermeable as it is heavily urbanised. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The age of the site means that it is unlikely to control off-site surface water flows, thus depositing run-off rapidly into the combined sewer network. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 90cm on the site during the 1% annual chance. The majority is in the 30-60cm range.	

Climate Change	
Main River 70% Climate Change	0% of site
No risk of increased fluvial flooding	
Geology and Groundwater	
Groundwater susceptibility	0%
Other Sources	
Sewer	86% site
Reservoir	0
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Thames Water have recorded instances of sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. Reduction in surface water flows into the combined network may assist in reducing sewer flooding risk.	

Recommendations

Site Layout and Design

The principal risk results from surface water flooding. This is likely to be as a result of the site's excavation below the surrounding ground levels and the highway network, resulting in rainfall ponding as it is unable to divert overland to other sites and is probably added to by run-off into the site from the surrounding highway network flow path from Carlton Vale. As with other developments in this area that have removed this

deck access type property, a design solution to address this issue is required. A drainage strategy to properly deal with surface water generated by the site can adequately deal with this issue. This can be through for example retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground, and if necessary also accommodating current flows into the site to not increase flood risk elsewhere.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

In the unlikely event residential development cannot be avoided within the flood extent, finished floor levels should be set at least 300mm freeboard above the 1 in 100 flood level plus an appropriate freeboard.

Resilience and Resistant Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years.

Emergency Planning

Not considered necessary given that suitable surface water management should eradicate risk.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

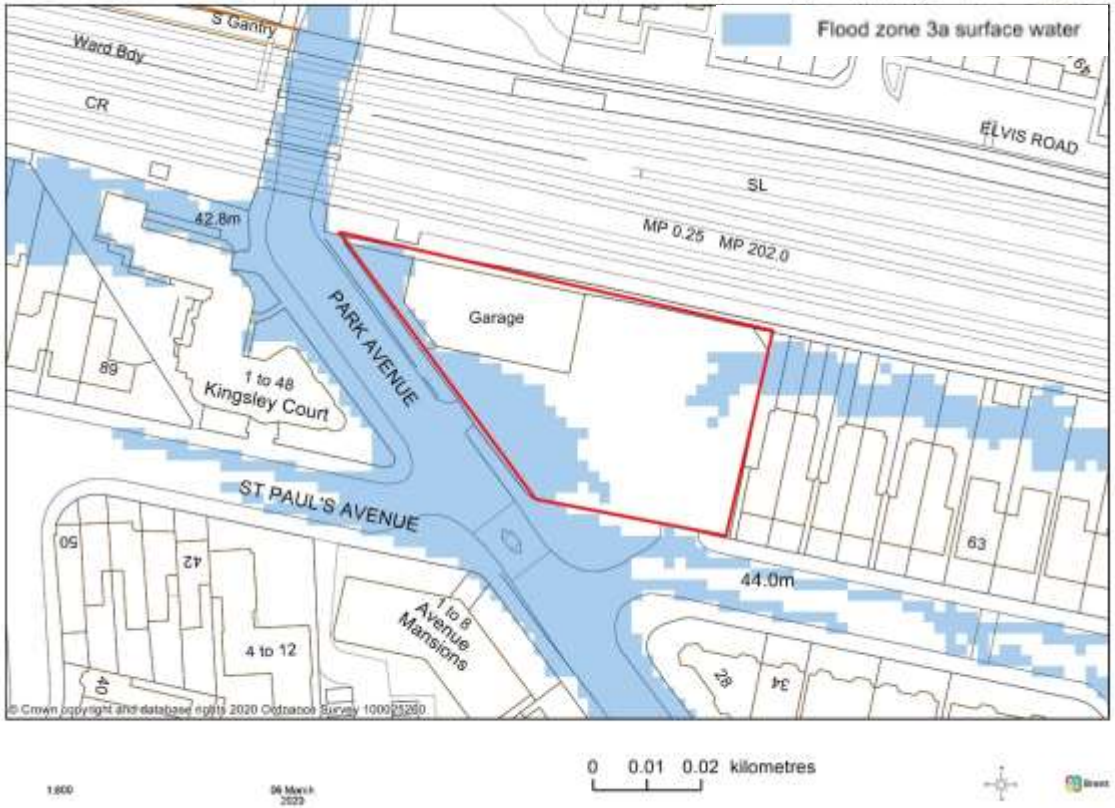
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by EA data on flood depth, speed and direction.

Summary

The site currently has risk associated with surface water flooding. This is related to its excavated extent, which means it is below the ground level of the surrounding area. This restricts free movement of surface water off the site and makes it a receptacle for flows from the adjacent highway network. Suitable redesign of the site, together with a surface water drainage strategy can ensure that risk is removed from people and property. This will be by providing suitable on site storage/ attenuation above or below ground for surface water generated on site. If necessary it can also accommodate surface water which is currently predicted to enter the site, if not doing so would cause unacceptable flood risk elsewhere. Current outfall from the extensive hard surfacing on site to the combined sewerage network is unlikely to be restricted. A drainage strategy will reduce off-site flows, thus is likely to increase capacity in the network off-site, reducing flood risk elsewhere. Overall, with the appropriate solutions redevelopment of the site is likely to reduce flood risk to people and property on and off-site.

Park Avenue Garage – BSESA25

Site Name:	Park Avenue Garage	Site Allocation Ref:	BSESA25
Location:	St Paul's Avenue, NW2 5TG	Site Area:	0.23
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1: 100%			



Surface water flooding	
Flood zone 3a	25%
Surface water ponding is predicted on the western boundary and eastern corner of the site during the 1 in 30-year pluvial event or greater. An overland flow path is observed along the surrounding road network and along adjacent rear gardens to the site. The majority of the ground coverage in the site is impermeable as it is heavily urbanised, covered in hard surfacing and buildings. This can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 90cm on the site during the 1% annual chance. This is split evenly between the 0-15cm, 15-30cm, 30-60cm and 60-90cm ranges. The speed of the flow is over 0.25m/s.	

Climate Change	
Main River 70% Climate Change	0% of site
No risk of increased fluvial flooding	
Geology and Groundwater	
Groundwater susceptibility	0%
Other Sources	
Sewer	54% site
Reservoir	0
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Thames Water hold no records of incidents of sewer flooding on this site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. Reduction in surface water flows into the combined network may assist in reducing sewer-flooding risk.	

Recommendations

Site Layout and Design

The principal risk results from surface water flooding. This is likely to be as a result of the site being slightly lower than the adjacent highway network, resulting in rainfall ponding/flow over the site as there is a surface water flow route along Park Avenue in times of surface water flood. Buildings should be located in areas out of risk, or through diverting and retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the 1 in 100 flood level. Basements design will need to pay attention to now allowing water ingress during in flood events.

Resilience and Resistant Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. Access should be to St Paul's Avenue to provide a flood free route to and from the site that fits into the wider highway network as Park Avenue is unlikely to have dry pavements in a 1:100 year event.

Emergency Planning

Not considered necessary given that suitable surface water management should eradicate risk.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by EA data on flood depth, speed and direction.

Summary

The principal risk results from surface water flooding. This is likely to be as a result of the site being slightly lower than the adjacent highway network, resulting in rainfall ponding/flow over the site as there is a surface water flow route along Park Avenue in times of surface water flood. Buildings should be located in areas out of risk, or through diverting and retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground. Current outfall from the extensive hard surfacing on site to the combined sewerage network is unlikely to be restricted. A drainage strategy will reduce off-site flows, thus is likely to increase capacity in the network off-site, reducing flood risk elsewhere. Overall, with the appropriate solutions redevelopment of the site is likely to reduce flood risk to people and property on and off-site.

Turpin's Yard – BSESA31

Site Name:	Turpin's Yard	Site Allocation Ref:	BSESA31
Location:	Oakland Road, NW2 6LL	Site Area:	0.4
Proposed Use:	Residential and industrial	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1: 100%			

Surface water flooding	
Flood zone 3a	25%
Surface water ponding is predicted on hard standing in the centre of the site during the 1 in 30-year pluvial event or greater. An overland flow path is observed along the surrounding road network. Surface water flooding occurs as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or a watercourse. The majority of the ground coverage in the site is impermeable car parking or storage. This area is subject to ponding. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 60cm on the site during the 1% annual chance. This is predominantly in 15-30cm range with the rest within the 0-15cm, and 30-60cm ranges. The speed of the flow is less than 0.25m/s.	

Climate Change	
Main River 70% Climate Change	0% of site
No risk of increased fluvial flooding	
Geology and Groundwater	
Groundwater susceptibility	0%
Other Sources	
Sewer	87% site
Reservoir	0
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Thames Water hold no records of incidents of sewer flooding on this site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. Reduction in surface water flows into the combined network may assist in reducing sewer-flooding risk.	

Recommendations

Site Layout and Design

The principal risk results from surface water flooding. This is likely to be as a result of the site being slightly lower than the adjacent highway network, resulting in rainfall ponding/flow over the site as there is a surface water flow route along Park Avenue in times of surface water flood.

Buildings should be located in areas out of risk, or through diverting and retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the 1 in 100 flood level. Basements design will need to pay attention to now allowing water ingress during in flood events.

Resilience and Resistant Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. Access should be to Oaklands Road to provide a flood free route to and from the site that fits into the wider highway network.

Emergency Planning

Not considered necessary given that suitable surface water management should eradicate risk.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by EA data on flood depth, speed and direction.

Summary

The principal risk results from surface water flooding. This is likely to be as a result of the site being slightly lower than the adjacent highway network, resulting in rainfall ponding/flow over the site from Oaklands Road in times of surface water flood. Buildings should be located in areas out of risk, or through diverting and retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground. Current outfall from the extensive hard surfacing on site to the combined sewerage network is unlikely to be restricted. A drainage strategy will reduce off-site flows, thus is likely to increase capacity in the network off-site, reducing flood risk elsewhere. Overall, with the appropriate solutions redevelopment of the site is likely to reduce flood risk to people and property on and off-site.

84-98 Wembley Park Drive – BD2

Site Name:	84-98 Wembley Park Drive	Site Allocation Ref:	BD2
Location:	Wembley, HA9 8HW	Site Area:	0.5
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1			
100%			

Surface water flooding	
Flood zone 3a	30%
Surface water ponding is predicted on the south eastern portion of the site during the 1 in 30-year pluvial event or greater. The Environment Agency's surface water depth modelling identifies the potential for depths. Approximately 30% of the site is predicted to flood, in the range 0-60cm during the 1% annual chance. The majority is within 15-30cm, with a small part 30-60cm. An overland flow path is observed from adjacent highway to rear gardens on the site. Flows are predominantly less than 0.25 m/s with the rate over 0.25 on the narrow strip that flow from the highway towards the rear gardens. Whilst rear gardens contain soft landscaping front gardens largely comprise hard standing. This can compound surface water flooding. Less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. Surface water flooding follows the location of the fluvial flood zones.	

Climate Change	
Main River 70% Climate Change	0% of site
N/A	
Geology and Groundwater	
Groundwater susceptibility	>25% <50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%. The site is within a Critical Drainage Area.	
Other Sources	
Sewer	100% site
Reservoir	0% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water.	

Recommendations

Site Layout and Design

About 30% of the site is within 3a surface water flood zones. This is in depressed rear garden areas to the rear of 92-98. Sequentially more vulnerable development should be situated outside this area which the site allows. To reduce flood risk residential floors should be elevated in those parts adjacent to areas at risk of flooding.

Basement for servicing/ vehicle parking will need careful consideration to prevent water ingress.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Building ground floors for residential living accommodation should be above Zone 3 levels + 30cm freeboard.

Resilience and Resistant Measures

For building structures which may be at risk of flooding a number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. Wembley Park Drive pavement appears unlikely to flood, unlike the main carriageway in a 1 in 100 year surface water event. The placing of residential accommodation above the 3 flood zone +30 cm freeboard allows for safe refuge until the area is no longer flooded.

Emergency Planning

Risk if the scheme is designed to avoid areas of Zone 3 surface water and include resilience measures, as such no specific emergency planning is recommended.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

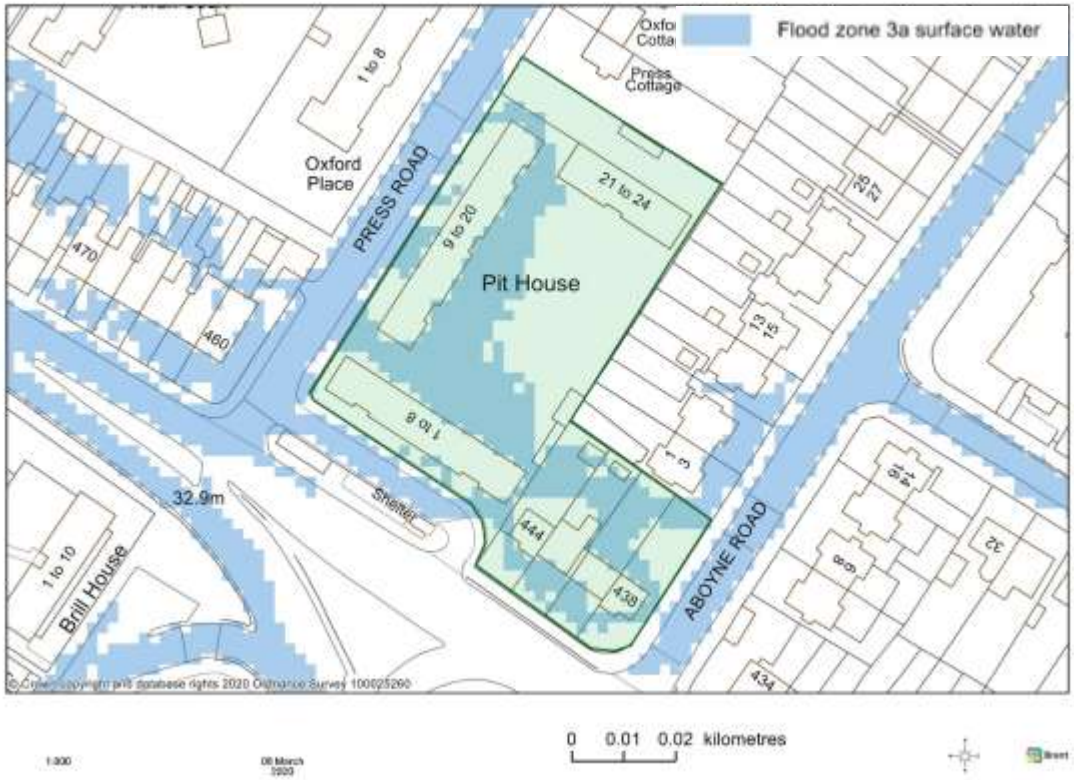
A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by modelling to assess the flood frequency, depth, velocity and speed of onset.

Summary

The site currently has risk associated with surface water flooding with 30% of the site within Zone 3. A sequential approach should prioritise development away from land to the rear of 92-98. Surface water flooding should be addressed through ground levels, building placement, and a drainage strategy to reduce ponding, reduce off-site flows and keep buildings away from flood risk. Basements will not need consideration to prevent water ingress. Flood resilience should be built into building structures that will potentially be exposed to flood waters. Safe egress and access should be provided in times of flood to Wembley Park Drive.

438-444 Neasden Lane and Pitt House – BD2

Site Name:	438-444 Neasden Lane and Pitt House	Site Allocation Ref:	BD2
Location:	NW10 0DA	Site Area:	0.4
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1: 100%			



Surface water flooding	
Flood zone 3a	40%
No surface water ponding is predicted on site during the 1 in 30-year pluvial event or greater. It is predicted on the adjacent highway. For the 1% annual chance the site is subject to an overland flows from adjacent highway to the front and rear of properties facing Neasden Lane, whilst some ponding is within areas of hardstanding to the rear of properties on Press Road. The ground coverage in the site is split evenly between impermeable (buildings/ hardstanding) and soft landscaping. The hard surfaces can compound surface water flooding as the runoff rate is greater on impermeable grounds compared to permeable areas. In addition, less water is able to drain away through infiltration, which increases the surface water flood risk in these areas. The age of the site means that it is unlikely to control off-site surface water flows, thus depositing run-off rapidly into the surface water drainage network/ into the River Brent. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 30cm on the site during the 1% annual chance. It is split evenly between the 0-15cm and 15-30cm ranges. Speed of water is mostly above 0.25m/s, although where there are no highway flows, just ponding this reduces to under 0.25m/s.	

Climate Change	
Main River 70% Climate Change	0% of site
No risk of increased fluvial flooding	
Geology and Groundwater	
Groundwater susceptibility	25-50%
The site is underlain by Thames Group (also referred to as London Clay) bedrock, a composition of silty clay/mudstone, sandy silts and sandy clayey silts of marine origin. Thames Group generally has a low hydraulic conductivity which means water does not easily move through it. However, because of this characteristic and poor drainage, ponding can occur if London Clay is downhill of aquifer outcrops. The Environment Agency identify the susceptibility of ground water flooding in this location as between 25 and 50%.	
Other Sources	
Sewer	100% site
Reservoir	100% site
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. There are no records of historic sewer flooding on the site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site is at risk in the remote possibility of a significant failure of the Brent Reservoir. This is likely to be a rapid inundation. The depths are 0.3-2 metres for all the area at risk with water speeds between 0.5 and 2m/s on some nearer Press Road, with below 0.5m/s on most.	

Recommendations

Site Layout and Design

The principal risk results from surface water flooding. This is likely to be as a result of local topography with the site slightly depressed compared to its surroundings and being on a small gradient, resulting in overland flows from highway on higher ground east west to the front and rear of properties on Neasden Lane and some ponding of this flow on lower ground. A surface water strategy can deal with the issue of overland flows, placing buildings outside these zones and ensuring floor heights and providing dry access and egress from buildings to areas not likely to flood. A drainage strategy to properly deal with surface water generated by the site can also ensure run-off from the site. This can be through for example retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground, and if necessary also accommodating some of the current flows into the site to not increase flood risk elsewhere.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

In the unlikely event residential development cannot be avoided within the flood extent, finished floor levels should be set at least 300mm freeboard above the 1 in 100 flood level.

Resilience and Resistant Measures

The site is at risk of reservoir flooding. A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height

- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years.

Emergency Planning

Although extremely remote, the risk of reservoir failure exists, as such the Council's Emergency Planning Team should agree the necessary measures to ensure occupants' safety for this type of event.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by EA data on flood depth, speed and direction. Consider necessity for surface water under 1 hectare.

Summary

The site currently has risk associated with surface water flooding and failure of the Brent reservoir. Surface water issues are resulting from overland flows from highway on higher ground east west to the front and rear of properties on Neasden Lane and some ponding of this flow on lower ground. Suitable redesign of the site, together with a surface water drainage strategy can ensure that risk is reduced for people and property. This will be by placing buildings in areas away from flows through the site from highway water and providing suitable on site storage/ attenuation above or below ground for surface water generated on site. A drainage strategy will reduce off-site flows below those currently existing, thus reducing flood risk elsewhere. Overall, with the appropriate solutions redevelopment of the site is likely to reduce flood risk to people and property on and off-site.

Springhill House, Willesden Lane – BD2

Site Name:	Springhill House	Site Allocation Ref:	BD2
Location:	Willesden Lane NW2 5DG	Site Area:	0.24
Proposed Use:	Residential	Vulnerability Classification	More vulnerable
Fluvial Flooding			
Flood Zone 1: 100%			

Surface water flooding	
Flood zone 3a	21%
Surface water ponding is predicted on hard standing to the south of the building on site during the 1 in 30-year pluvial event or greater. Surface water flooding occurs as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or a watercourse. This site has been cut into a hill and is subject to ponding. No flow paths are identified, but it is likely that movement would be to lower highway to the north. The Environment Agency's surface water depth modelling identifies the potential for depths of 0 – 60cm on the site during the 1% annual chance. This is predominantly in 15-30cm range with some within the 0-15cm range. The speed of the flow is less than 0.25m/s on part of the site and above on others.	

Climate Change	
Main River 70% Climate Change	0% of site
No risk of increased fluvial flooding	
Geology and Groundwater	
Groundwater susceptibility	0%
Other Sources	
Sewer	63% site
Reservoir	0
Canal	0
Sewer flooding can occur due to sewer infrastructure failure or due to an increased flow and volume of water entering a sewer system which exceeds its hydraulic capacity, causing the system to surcharge. If sewer outfall points are either blocked or submerged due to high water levels, water can back up in a sewer system and cause flooding. These issues can result in water overflowing from gullies and drainage inspection holes, causing flooding in the local area. The south of the borough has a combined sewer, leading to increased environmental risks where flooding occurs. Thames Water Utilities Ltd provide surface water, foul and combined sewer systems in the borough. Thames Water hold no records of incidents of sewer flooding on this site. Additional capacity for sewerage on and off-site will need to be agreed with Thames Water. The site has recently been redeveloped, so is likely to have reduced outfall from surface water as part of its drainage strategy.	

Recommendations

Site Layout and Design

The principal risk results from surface water flooding. This is likely to be as a result of the site being cut into a hillside, resulting in rainfall ponding/flow over the site to lower areas. Buildings should be located in areas out of risk, or through diverting and retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground.

Surface Water

A drainage strategy will be required which accords with the Drainage Strategy Submission Checklist included in the Level 1 SFRA. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of Sustainable Drainage Systems (SuDS). SuDS should aim to achieve greenfield run off rates, providing management and attenuation features that ensure that surface water runoff is managed as close to the source as possible in accordance with the London Plan drainage hierarchy.

Permeable surfaces should be increased, and open space maximised to ensure space for water to flow during times of flood. Within flood zone 3a (surface water), flood plain compensation must account for predicted flood depths for the 1 in 30yr and 1 in 100yr Risk of Flooding from Surface Water mapping or depth predicted for the site.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the 1 in 100 flood level. Basements design will need to pay attention to now allowing water ingress during in flood events.

Resilience and Resistant Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. These could include:

- installing electrical equipment above flood level
- installing flood doors and barriers, to ensure water stays out of a property to a given height
- providing adequate flood risk management infrastructure. Space should be left in developments for flood risk management infrastructure to be maintained and enhanced.

Access/Egress

Safe dry access to and from the site should be provided for the lifetime of the property, factoring in the impacts of climate change. In this case the lifetime of the property is 100 years. Willesden Lane is likely to be subject to low level (0-15cm) surface water flooding for a 1 in 100 year event. It will be for residents to undertake their own risk assessment on whether dry routes are available to use.

Emergency Planning

Not considered necessary given that suitable surface water management should eradicate risk.

LLFA Consultation

It is recommended that potential developers contact Brent Council as the LLFA for further information prior to taking forward site specific plans.

Site Specific FRA

A Site Specific Flood Risk Assessment will be required which meets the requirements of the Flood Risk Assessment Submission Checklist in the Level 1 SFRA. The Site Specific FRA should be informed by EA data on flood depth, speed and direction.

Summary

The principal risk results from surface water flooding. This is likely to be as a result of the site being cut into a hillside, resulting in rainfall ponding/flow over the site in times of surface water flood. Buildings should be located in areas out of risk, or through diverting and retaining water in planned locations on site, where it can be of no risk to people or property, either above or below ground. The site has recently been redeveloped, as such it is likely to incorporate measures to reduce surface water flows off site already, thus betterment to reduce flood risk elsewhere may be limited. Overall, with the appropriate solutions redevelopment of the site is likely to ensure acceptable levels of risk to people and property on and off-site.