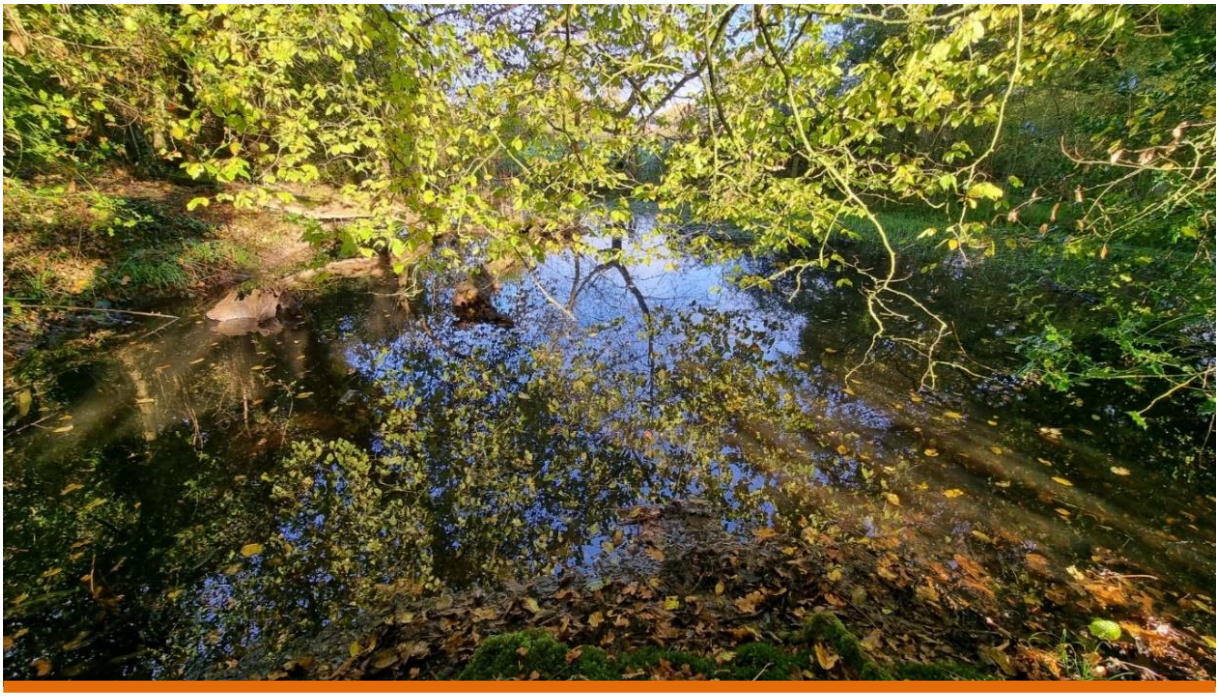

Flood Risk Assessment

The John Crank Site Redevelopment, Brunel University Kingston Lane, Uxbridge UB8 3PH

Client

Brunel University London

PO Box 496

Central Park

Telford TF2 2HF

Ref: 12365

Date: March 2023

Consulting Engineers

GTA Civils & Transport Limited

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192-198 London Road

Burgess Hill

West Sussex

RH15 9RD

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Schedule of Appendices

Issue	Issue date	Compiled	Checked
Preliminary Issue	02 March 2022	JP	MR
2nd Preliminary Issue	08 March 2022	JP	MR

1 Introduction

1.1 This FRA report has been prepared for the Applicant, Brunel University in relation to the proposed works at the site of the former John Crank Building, Brunel University, Kingston Lane, Uxbridge UB8 3PH. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.

1.2 GTA Civils & Transport Ltd was appointed by the client to provide a Flood Risk Assessment (FRA) as required by the Environment Agency and Hillingdon London Borough Council in order to achieve Planning Approval.

1.3 This report will take the form of a formal Flood Risk Assessment in accordance with the 2021 National Planning Policy Framework (NPPF) and the 2022 Planning Practice Guidance (PPG).

2 Existing Site & Flood Risk Profile

2.1 The application site, measuring 0.235ha, comprises a vacant area within the University's campus where the former John Crank Building stood. The site lies in the area administered by Hillingdon London Borough Council (HLBC). A site location plan and aerial photo are shown in Appendix A.

2.2 Hydrology: the River Pinn flows broadly southwards some 45m east of the site at its closest. This discharges into the River Frays/Colne at Yiewsley, approximately 1.8km to the south.

2.3 Topography: a topographic survey is shown in Appendix C. Ambient levels range between 33.31m AOD (NW corner) and 32.66m AOD (near the SW corner).

2.4 The topographic survey includes a surface water drain run close to the SW corner. This runs broadly southeast discharging into the Pinn close by.

2.5 Geology: the BGS online map shows this site's solid geology is London Clay Formation (clay and silt) with Langley Silt Member (clay, silt) overlying. GTA Civils and Transport have extensive experience of various projects on this campus. Soil soakage testing has shown nil results in early projects: infiltration features are not viable here.

2.6 The greenfield runoff rate for the site has been calculated for this area – refer to the first sheet in Appendix C. The Qbar rate is 0.3l/s.

2.7 Fluvial Flooding: The Environment Agency's Rivers and Seas Flood map (in Appendix B) shows the centre of the site and the north, east and south boundaries are located in Flood Zone 2 (FZ2). Inland sites in FZ2 have an Annual Exceedance Probability of flooding greater than 1 in 1000 years but less than 1 in 100 years (0.1%> but <1%), on average.

2.8 The EA's modelled data is shown in Appendix B. This confirms the site lying in FZ2 – the 5th map shows this area inundated in the 1000yrs event. This area benefits from defences – protecting up to the 250yrs scenario.

2.9 The 1 in 100yrs (1%) level nearby is 32.42m AOD and the 1% + 20% CC flood level is 32.50m AOD.

2.10 Climate change: the EA's web page relating to Climate Change Allowances states that for a development whose predicted lifetime is 20-45 years, the higher of the 2020s and 2050s epochs should be considered. The proposal is – effectively – water compatible. Referring to the London Management Catchment peak river flow allowances table, the correct allowance of CC is 17%. The critical 1% + CC flood level is therefore **32.50m AOD**. As the lowest level is 32.66m AOD the site is

outside this floodplain.

2.11 Surface water flooding: occurs when excess rainwater does not infiltrate into the ground, or is not intercepted by urban drainage systems, and instead flows across the surface. The EA's surface water flood map in a 'Low Risk Scenario' ('1 in 1000 years' storm event) in Appendix B shows an isolated central area and section on the northern boundary are liable to surface water flooding, depth up to 300mm. These originate within the site and so any such precipitation will be intercepted by the site's drainage – and can be ignored as a threat.

2.12 Artificial Sources: flooding from reservoirs, canals and docks. The EA's reservoir flooding map (in Appendix B) shows the site is at risk from flooding from this source 'when there is also flooding from rivers.'

2.13 Historical flooding: according to DEFRA's Online 'Historical Flooding' Map, the site has not been affected by flooding in the past.

2.14 Groundwater Flooding: the EA's Groundwater Vulnerability Zone Map (in Appendix B) shows the site overlies an 'Unproductive' Aquifer. According to the EA's Groundwater Source Protection Zones Map the site is removed from all Groundwater Source Protection Zones.

2.15 Conclusion: the site is susceptible to fluvial flooding – but only in the extreme storm (1000yrs). It is also liable to flood from reservoir failure flooding when combined with river (fluvial) flooding.

3 Proposed Development

3.1 The proposed development is to build a marquee and contemporary outdoor student amenity space. The proposed site layout is shown in Appendix C.

3.2 As summarised in section 2.5 the site is liable to flood only in the extreme storm from fluvial sources – and following a catastrophic reservoir failure when combined with fluvial flooding. Given that no buildings are proposed, it is contended that no flood mitigation is needed. The site can flood without any detriment to the University –in terms of both 'occupants' and 'property'.

3.3 The change in vulnerability as a result of this development is minimal, as this vacant area will remain clear of buildings. "Annex 3: Flood risk vulnerability classification" of the NPPF includes lists of development types, but there is no mention of tents or marquees in the 4 classifications. There will be no sleeping accommodation as the marquee will be for day and evening use only. Any flood water passing through the marquee would be able to flow, if not completely unimpeded, sufficiently smoothly. It is contended that a marquee, being a temporary structure, would be classed as "water compatible", for these reasons. Water compatible uses are permitted in FZ2.

3.4 Safe access to dry land: this area will not be occupied as such – the marquee is not habitable accommodation, of course. During any inclement weather this area would be free of occupants – so no need to consider a route to dry land.

4 SuDS

4.1 The SuDS Hierarchy (infiltration, watercourses, public sewers, private sewers) was considered and given the Clay soil type (refer to section 2.5 above), the only route to discharge runoff is into the River Pinn - this being the second option in the SuDS hierarchy.

4.2 The drainage hierarchy as set out in Policy SI 13 of The London Plan was considered. Storing rainwater for reuse is the first item. This was considered to be unduly impractical on this site.

4.3 2nd item: "rainwater infiltration to ground at or close to source" Due to the soil's high clay content, infiltration techniques – ie discharge to ground - have been discounted.

4.4 3rd item: "rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)". The landscaped areas have been designed as rain gardens.

4.5 4th item: "rainwater discharge direct to a watercourse." The runoff will be routed into the River.

4.6 The 5th and 6th items – routing to sewers – are not pertinent here as the above options have been chosen.

4.7 The development's surface water will be routed offsite into the river. The runoff rate will be restricted to 1.0l/s, this being the practical minimum limit of screened orifices/vortex controls (the greenfield runoff rate for the contributing area of 0.187ha is less than this – refer to section 2.6 above).

4.8 The permeable paving will slow down the flow rate and provide a treatment stage. The filtration through the granular fill sub-base provides a total mitigation that exceeds the pollution indices for such a non-industrial development.

4.9 The surface water network has been modelled with Micro Drainage Source Control. These show that the storage volume needed in the critical 100yrs + 40% CC storm (Winter 600 minutes duration) is 150.7m^3. The total storage volume provided is 220m^3.

4.10 The half drain time in the critical 100yrs + 40% CC storm of 1384 minutes complies with Building Regulations.

4.11 Exceedance flows: the landscaped areas will provide some volume in an exceedance event. If the orifice plate were to get clogged up the resultant overland flow would be generally east-southeast to the River Pinn.

4.12 Maintenance of the SuDS network will remain the responsibility of the Applicant. A SuDS Management and Maintenance Plan has been drafted with reference to the relevant sections within CIRIA's SuDS Manual (C753).

4.13 The inclusion of permeable paving and rain gardens complies fully with sections B, C & D of Policy SI 13 of the London Plan (March '21).

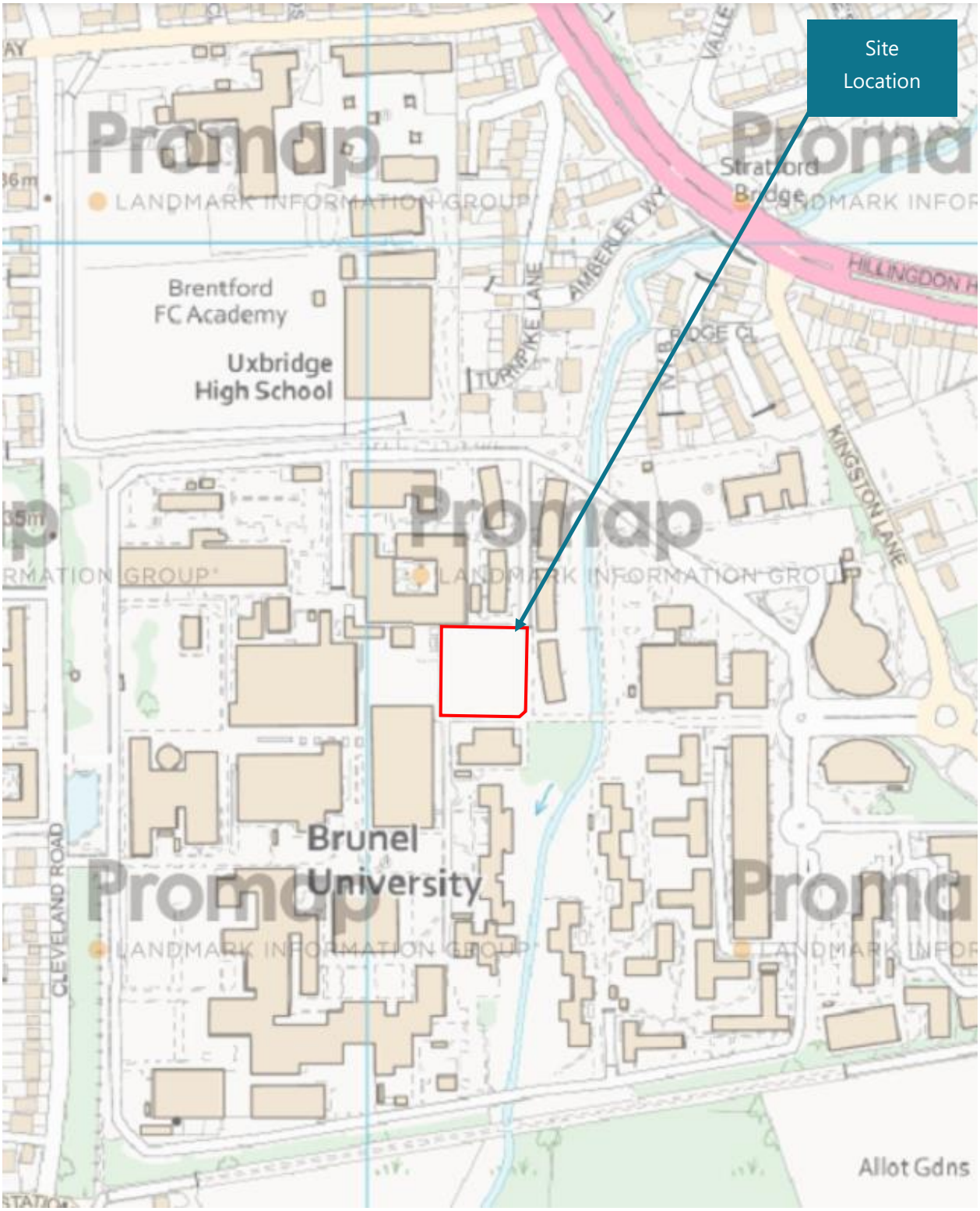
4.14 It is contended that the proposed storm network is 100% sustainable.

Conclusion: the proposed development complies fully with the 2021 NPPF/2022 NPPG.

- End of Report -

Appendix A

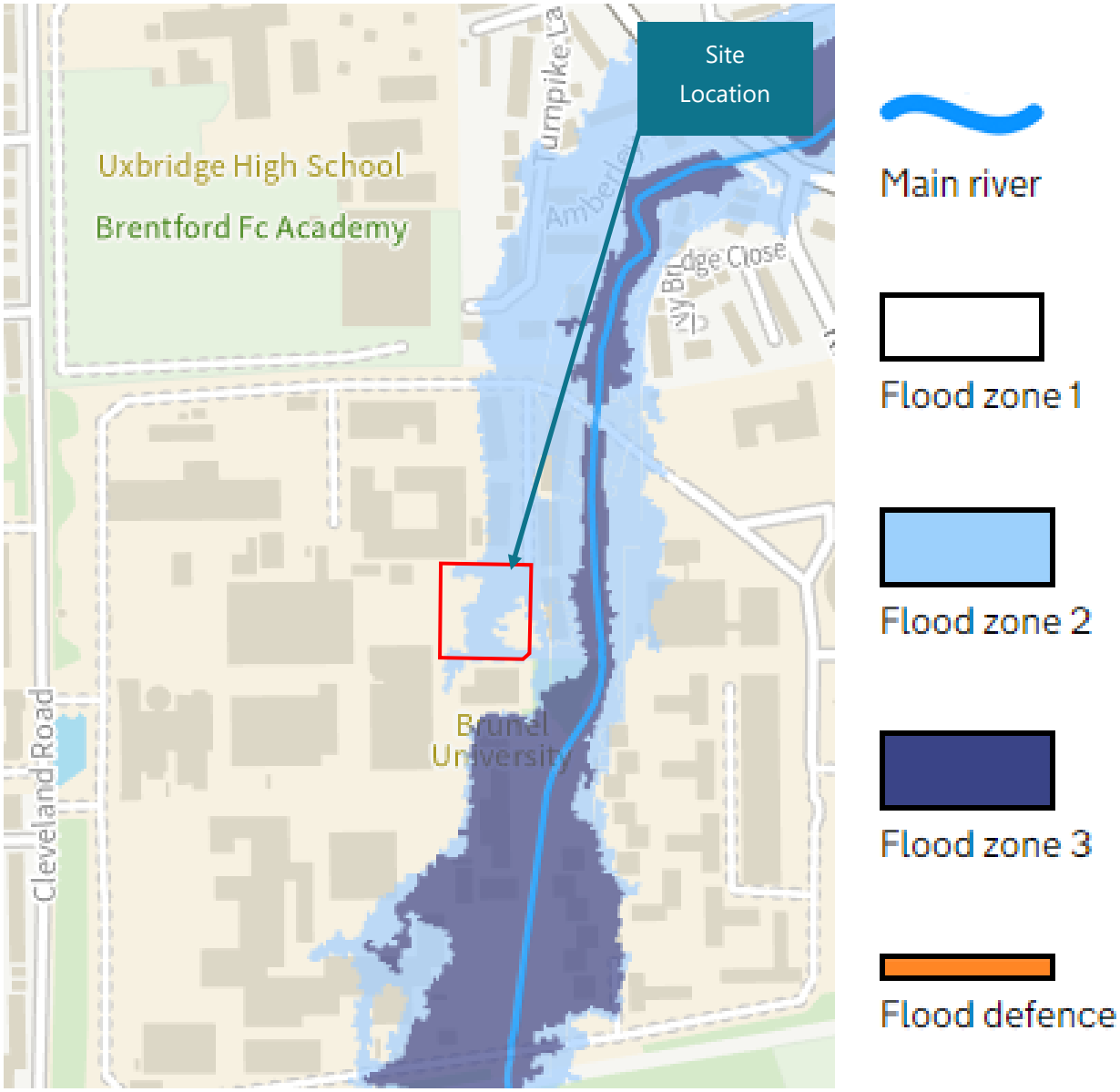
Site Location Map & Aerial Photo




Site
Location

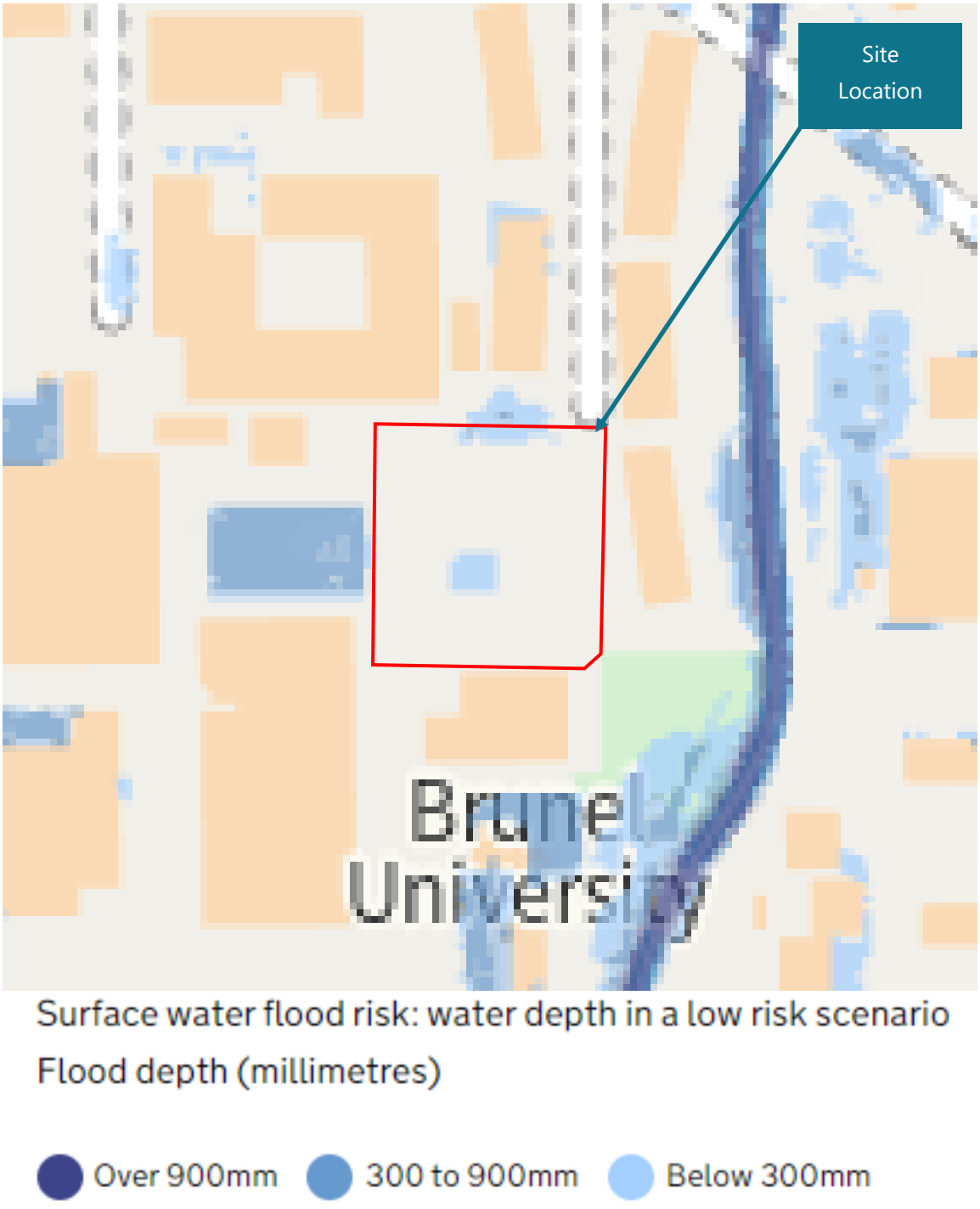
Appendix B

Environment Agency Flood Data & Groundwater Maps



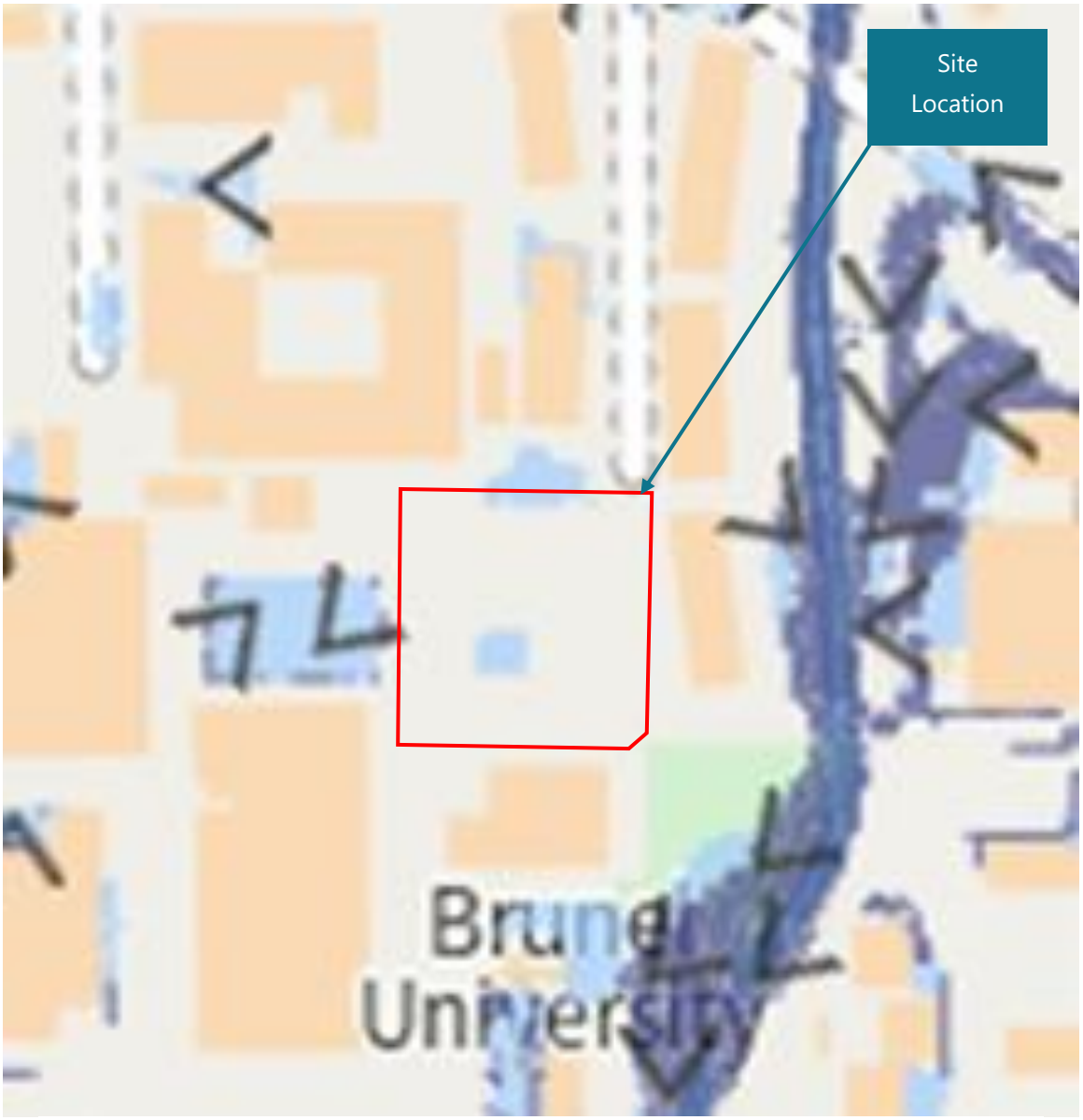
EA's Online Flood Map for Planning (Rivers and Seas)

The centre of the site plus the north, east and south boundaries are located in Flood Zone 2 (FZ2)



EA's Online Surface Water Flood Depth Map in a 'Low Risk Scenario'
(1 in 1000 years storm event)

An isolated central area and section on the northern boundary are liable to surface water flooding - below 300mm. One small pocket on the northern boundary is susceptible to flooding between 300mm and 900mm



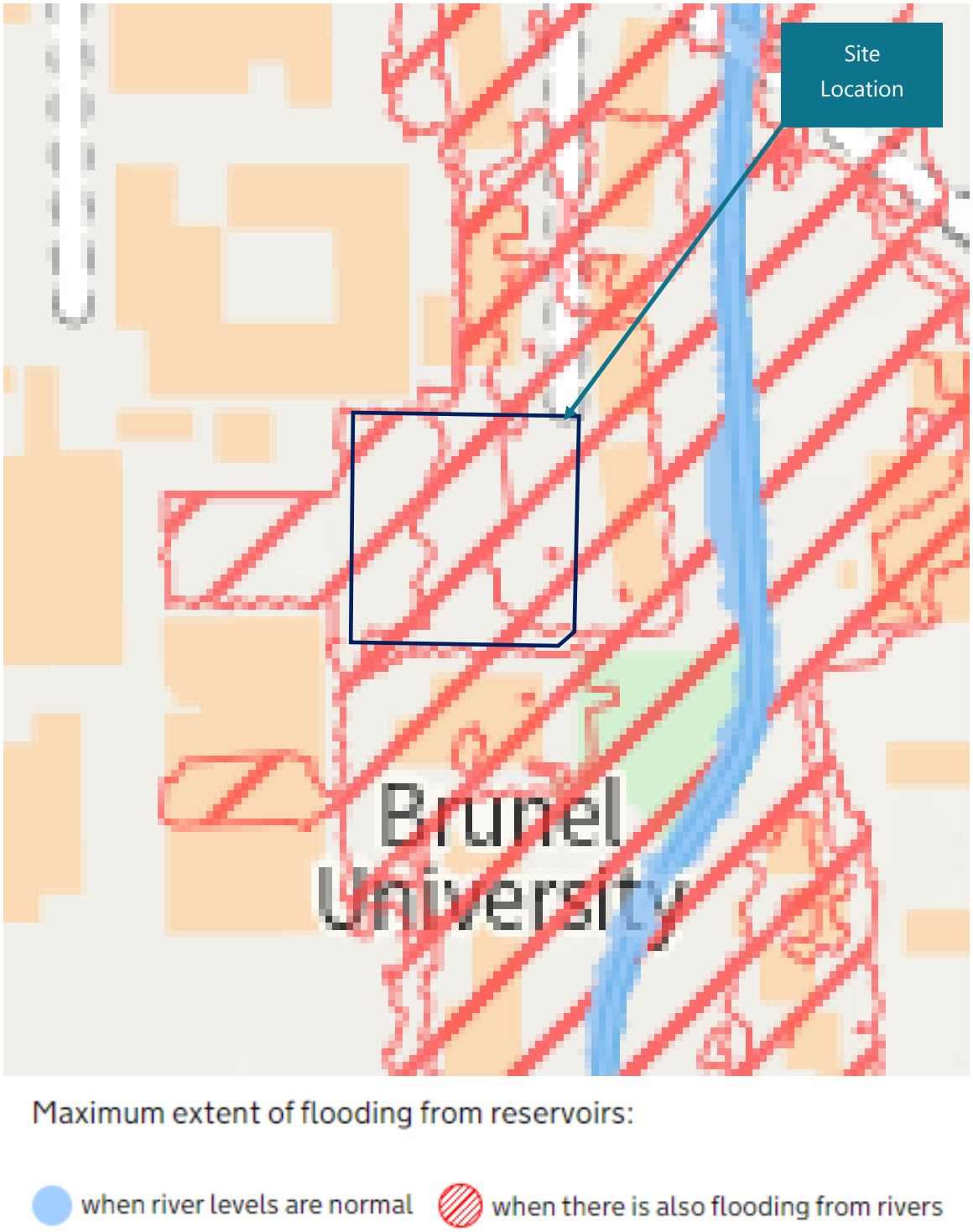
Surface water flood risk: water velocity in a low risk scenario

Flood velocity (metres/second)

Over 0.25 m/s Less than 0.25 m/s Direction of water flow

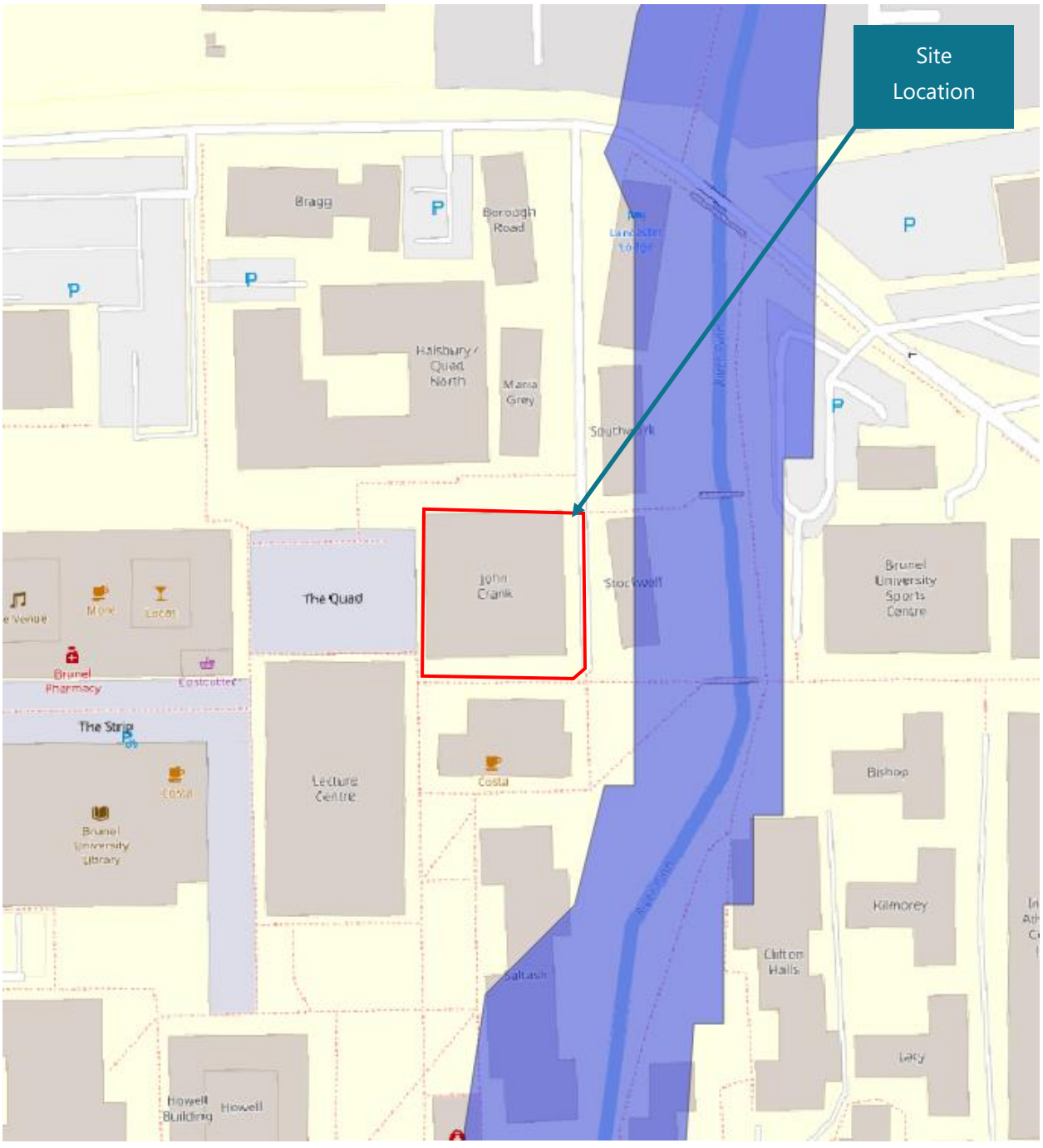
EA's Online Surface Water Flood Velocity Map in a 'Low Risk Scenario'
(1 in 1000 years storm event)

Surface water in the centre of the site and on the northern boundary flow at a velocity of less than 0.25m/s



EA's Online Flood Risk of 'Flooding from Reservoirs' Map

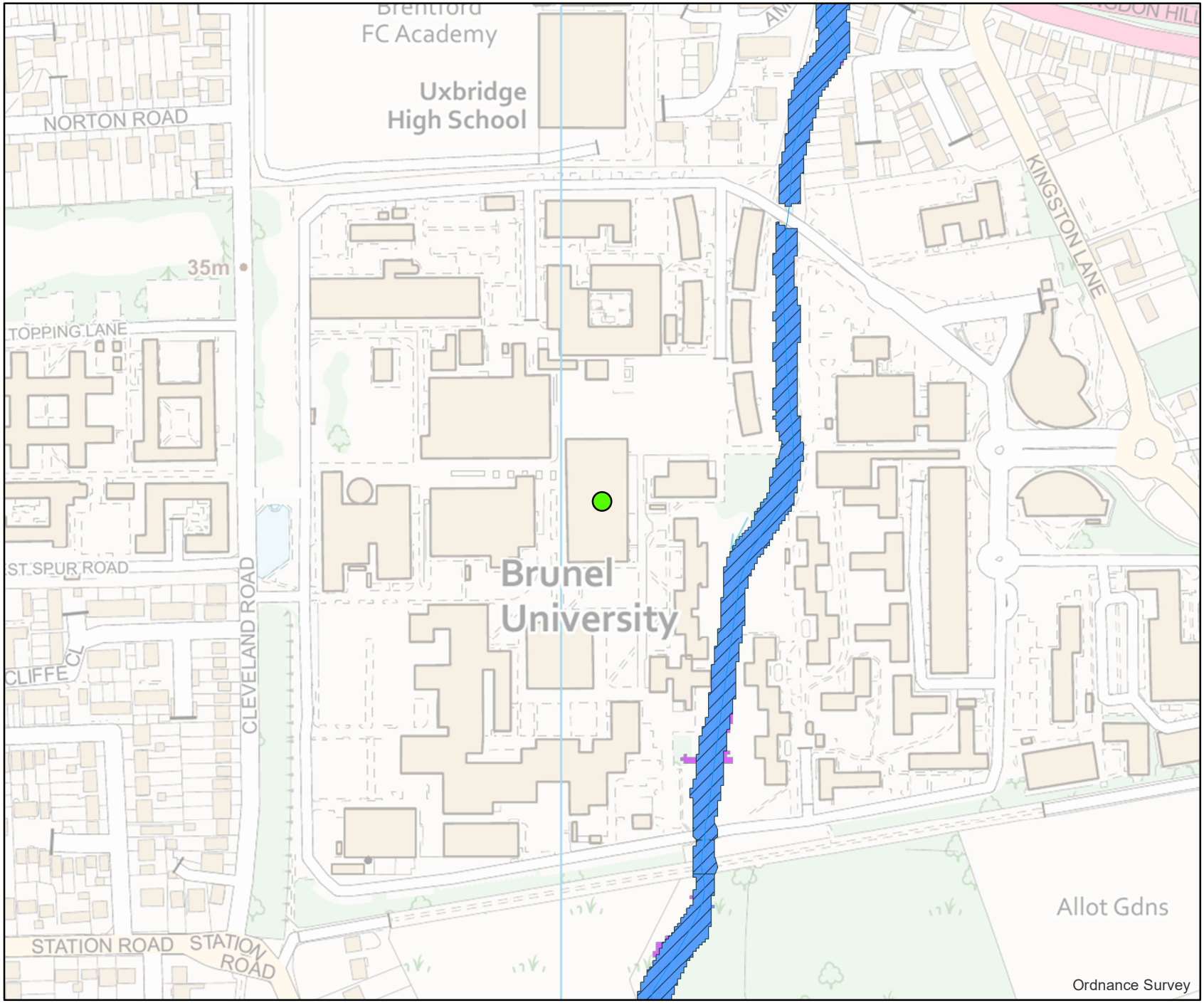
The site is at risk from flooding from this source 'when there is also flooding from rivers'



DEFRA's Online 'Historical Flooding' Map

The site has not been affected by flooding in the past

Detailed FRA centred on: Brunel University, Kingston Lane, Uxbridge, UB8 3PH - 02/03/2023 - HNL 301043 WD



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

- Statutory Main Rivers
- Site location

Defended Flood Outlines

- 1 in 2 year (50%) Defended
- 1 in 5 year (20%) Defended
- 1 in 10 year (10%) Defended

The data in this map has been extracted from the River Pinn Mapping Study (JBA, 2015).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment.
Modelled outlines take into account catchment wide defences.
Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

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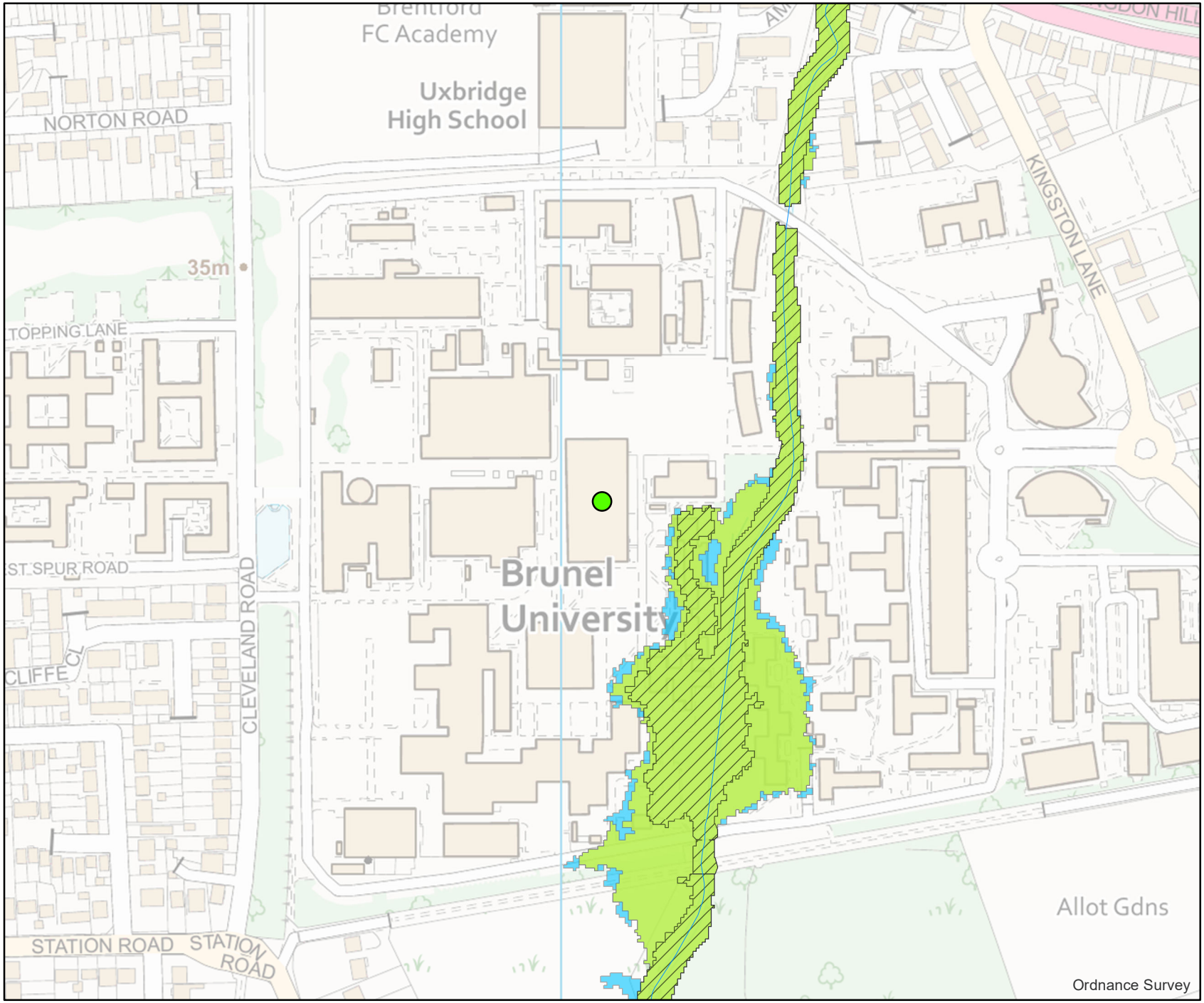

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AL7 1HE

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Metres

Legend

- Statutory Main Rivers
- Site location

Defended Flood Outlines

- 1 in 20 year (5%) Defended
- 1 in 30 year (3.33%) Defended
- 1 in 50 year (2%) Defended

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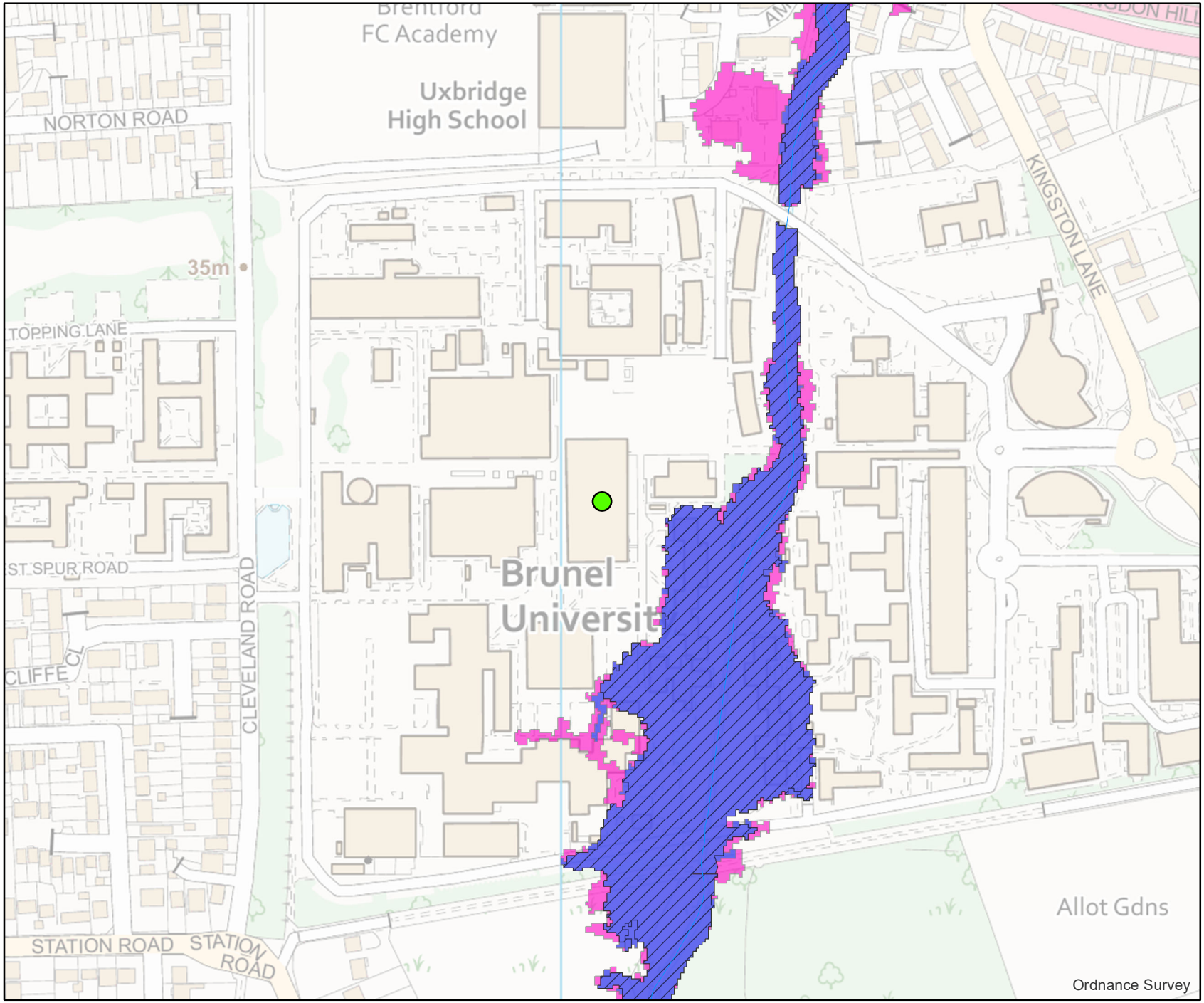

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Metres

Legend

- Statutory Main Rivers
- Site location

Defended Flood Outlines

- 1 in 75 year (1.33%) Defended
- 1 in 100 year (1%) Defended
- 1 in 100 year + 20% (*CC) Defended

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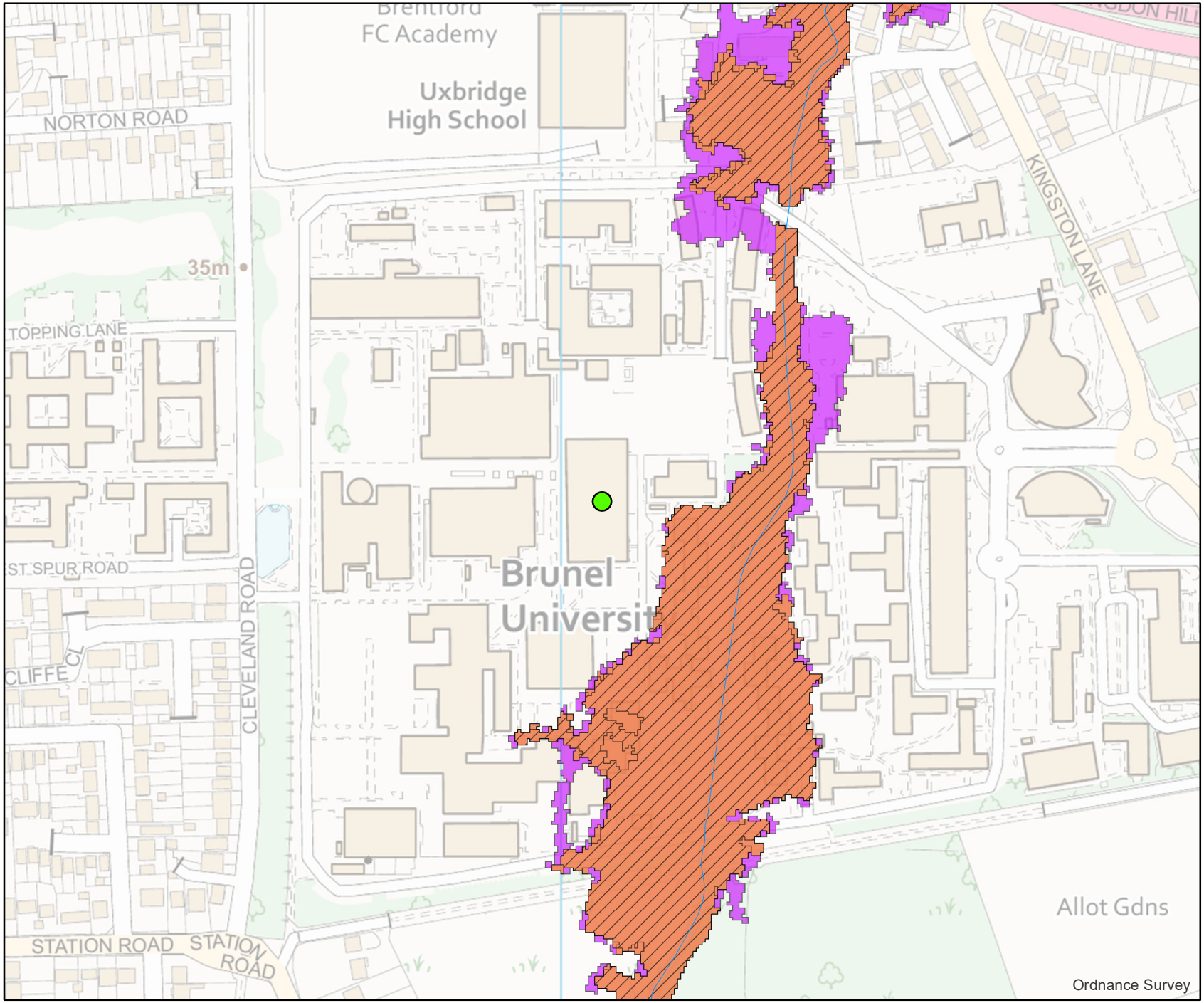

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0 50 100 200

Metres

Legend

- Statutory Main Rivers
- Site location

Defended Flood Outlines

- 1 in 100 year + 25% (*CC) Defended
- 1 in 100 year + 35% (*CC) Defended
- 1 in 100 year + 70% (*CC) Defended

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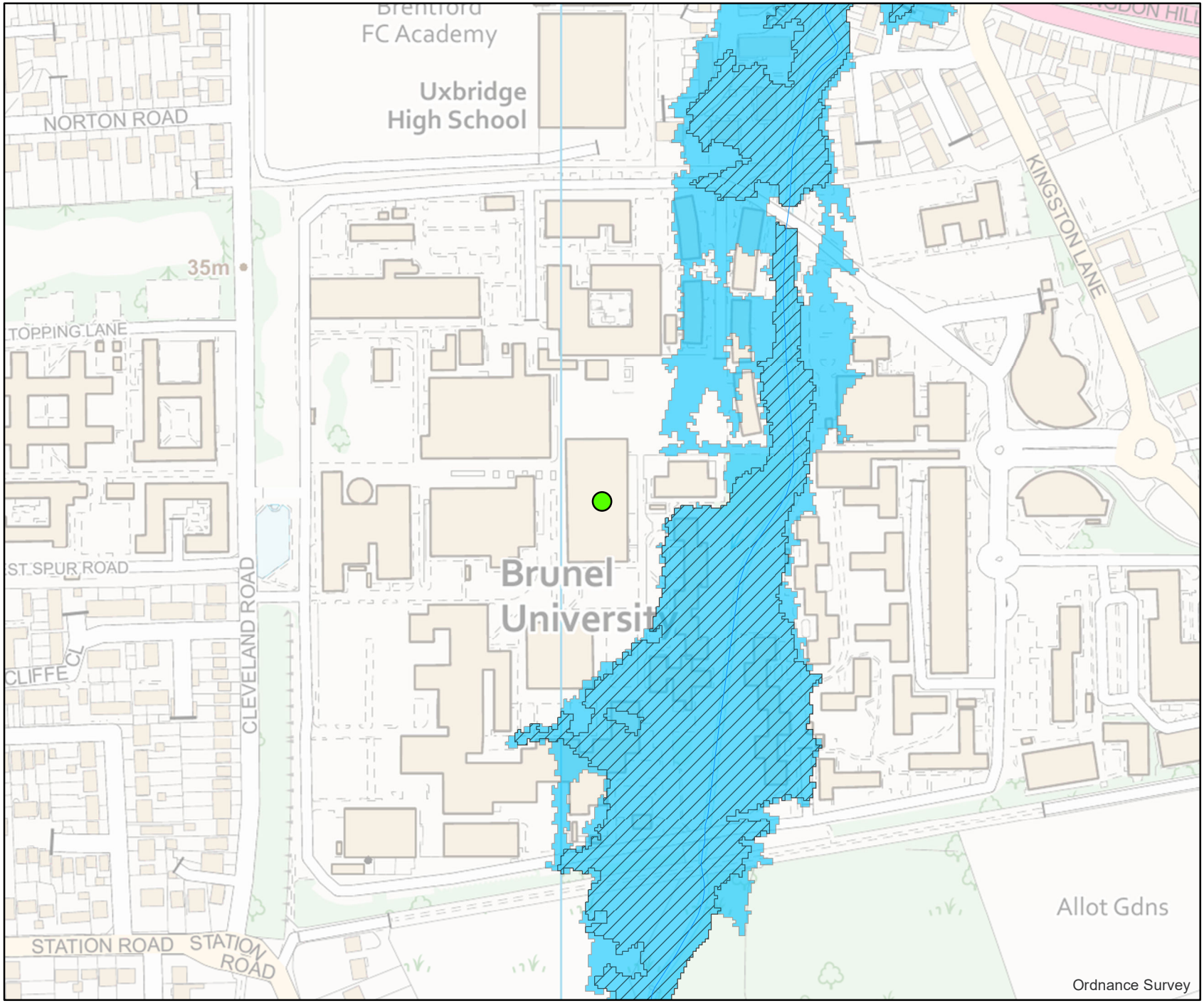

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Metres

Legend

- Statutory Main Rivers
- Site location

Defended Flood Outlines

- 1 in 250 year (0.4%) Defended
- 1 in 1000 year (0.1%) Defended

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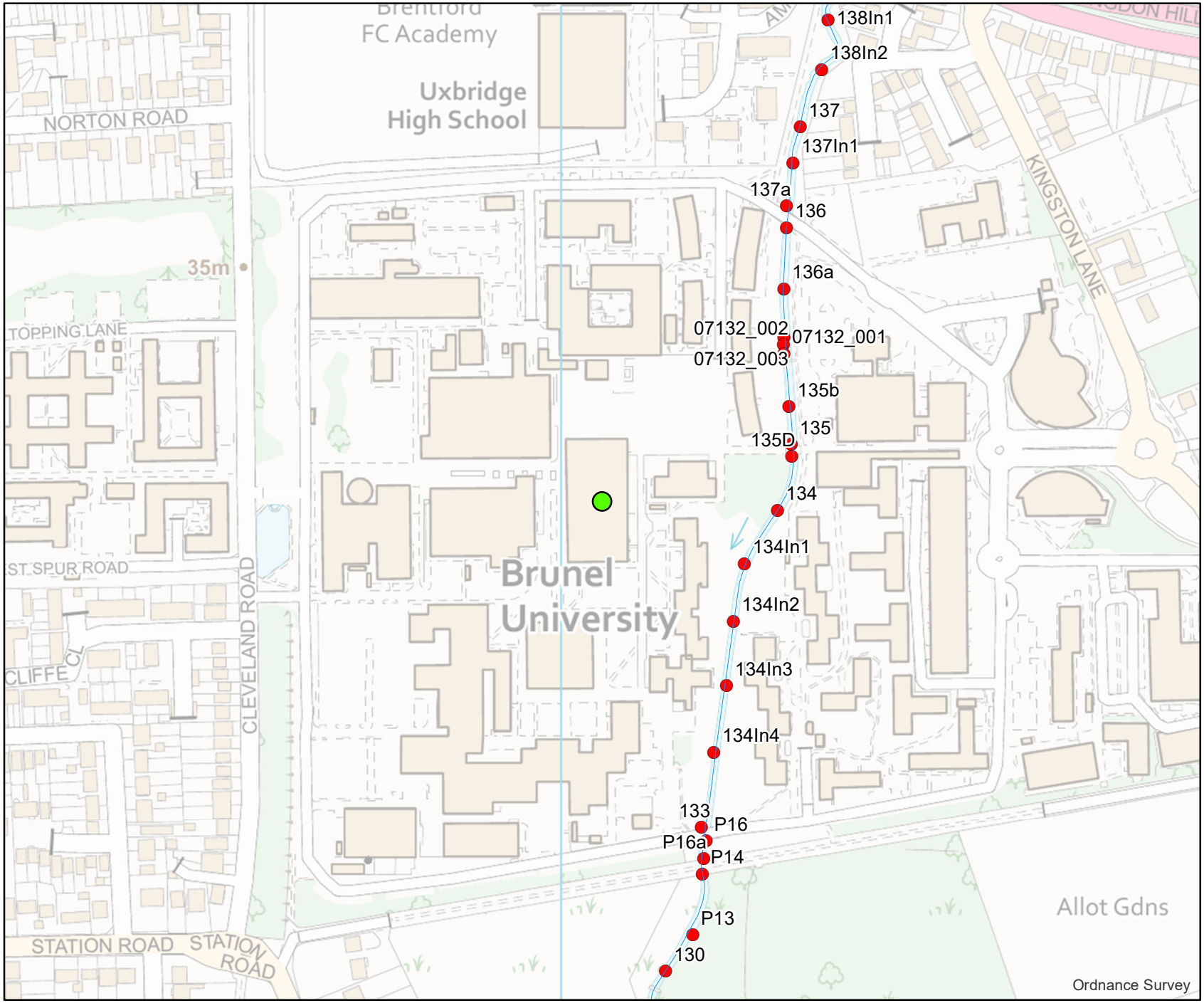

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Metres

Legend

- Statutory Main Rivers
- Site location

1D Node Results

- Nodes

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Environment Agency ref: HNL 301043 WD

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https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Caution:
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites across the entire catchment.

All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

MODELLED FLOOD LEVEL

				Return Period												
Node Label	Easting	Northing	2 yr	5 yr	10 yr	20 yr	30 yr	50 yr	75 yr	100 yr	100yr + 20%	100yr + 25%	100yr + 35%	100yr + 70%	250 yr	1000yr
138ln1	506174	182967	32.00	32.15	32.24	32.40	32.55	32.66	32.74	32.79	32.93	32.96	33.01	33.19	32.98	33.33
138ln2	506170	182935	31.93	32.07	32.17	32.33	32.50	32.62	32.70	32.75	32.89	32.92	32.98	33.17	32.95	33.32
137	506156	182898	31.84	31.99	32.09	32.26	32.46	32.57	32.65	32.71	32.86	32.89	32.95	33.16	32.92	33.31
137ln1	506151	182874	31.80	31.95	32.06	32.24	32.44	32.56	32.63	32.69	32.84	32.88	32.94	33.15	32.91	33.30
137a	506147	182846	31.78	31.93	32.04	32.23	32.43	32.54	32.62	32.68	32.83	32.86	32.92	33.12	32.89	33.26
136	506147	182832	31.74	31.90	32.00	32.18	32.38	32.47	32.52	32.55	32.64	32.66	32.70	32.81	32.68	32.90
136a	506145	182792	31.56	31.70	31.80	32.02	32.26	32.34	32.38	32.41	32.47	32.49	32.52	32.60	32.50	32.64
07132_003	506145	182761	31.54	31.70	31.81	32.03	32.27	32.35	32.39	32.42	32.49	32.51	32.54	32.63	32.52	32.69
07132_002	506145	182756	31.55	31.71	31.81	32.03	32.27	32.35	32.39	32.42	32.48	32.50	32.53	32.60	32.51	32.65
07132_001	506145	182750	31.54	31.69	31.80	32.02	32.27	32.35	32.39	32.42	32.49	32.51	32.54	32.62	32.52	32.67
135b	506149	182716	31.53	31.70	31.81	32.04	32.28	32.36	32.40	32.43	32.50	32.52	32.55	32.64	32.53	32.70
135	506150	182691	31.47	31.64	31.75	32.00	32.25	32.33	32.38	32.40	32.47	32.49	32.52	32.61	32.50	32.68
135D	506150	182683	31.47	31.64	31.75	31.99	32.23	32.31	32.35	32.37	32.42	32.43	32.45	32.51	32.44	32.56
134	506141	182648	31.38	31.58	31.70	31.96	32.22	32.30	32.34	32.36	32.41	32.42	32.44	32.50	32.43	32.54
134ln1	506119	182614	31.31	31.53	31.66	31.94	32.21	32.29	32.33	32.35	32.40	32.41	32.43	32.49	32.42	32.53
134ln2	506112	182576	31.25	31.49	31.63	31.92	32.20	32.28	32.32	32.34	32.38	32.39	32.41	32.46	32.40	32.49
134ln3	506108	182534	31.21	31.47	31.61	31.90	32.19	32.28	32.32	32.34	32.39	32.40	32.43	32.49	32.41	32.53
134ln4	506100	182491	31.18	31.44	31.59	31.90	32.19	32.27	32.31	32.33	32.36	32.37	32.39	32.42	32.38	32.44
133	506092	182442	31.16	31.43	31.57	31.88	32.18	32.27	32.31	32.34	32.40	32.41	32.43	32.50	32.42	32.55
P16	506095	182433	31.03	31.23	31.32	31.52	31.75	31.82	31.88	31.92	32.03	32.05	32.08	32.16	32.06	32.21
P16a	506093	182422	30.93	31.12	31.19	31.38	31.64	31.72	31.78	31.83	31.95	31.98	32.02	32.13	32.00	32.20
P14	506092	182412	30.93	31.11	31.18	31.23	31.28	31.35	31.40	31.43	31.54	31.57	31.63	31.77	31.60	31.87
P13	506086	182372	30.91	31.11	31.18	31.25	31.29	31.34	31.38	31.41	31.50	31.52	31.57	31.69	31.55	31.78
130	506068	182348	30.86	31.05	31.13	31.19	31.22	31.26	31.29	31.31	31.36	31.38	31.41	31.48	31.39	31.55