GRANDPONT HOUSE
ABINGDON ROAD, OXFORD

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

NETHERHALL EDUCATIONAL ASSOCIATION

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Authorisation and Version Control

Water Environment was commissioned by Netherhall Educational Association to investigate the risks and assess the consequences of flooding on the site at Grandpont House.

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EXECUTIVE SUMMARY

Grandpont House is used for educational, religious and cultural activities for students, as well as a small university residence. Proposals are to extend the existing facilities through refurbishment and infill of the existing buildings, as well as a boathouse, to provide crucial modernisation of the accommodation and secure the long-term viability of the Grade II* listed building. Although the site lies within Flood Zone 3 of the River Thames, there are no suitable alternative sites for the proposals, which must be within the grounds and therefore the Sequential Test is passed. The proposal includes enhancement of an existing habitat area close to the river and an area of wet woodland. These benefits, together with a sustainable design that ensures the proposed development will be safe throughout a flood event without increasing flood risk elsewhere, secure compliance with the flood risk Exception Test. The proposal complies with the sequential approach to the location of proposed uses on the highest parts of the site.

Extensive consultation has been undertaken with both Oxford City Council (OCC) and the Environment Agency (EA) over a period of years, particularly in relation to flood risk. Several agreements have been secured in relation to the principle of development and the design of the proposals.

Part of the grounds lie within the modelled extent of Flood Zone 3b. However, the proposed extensions to Grandpont House are located wholly within the part of the site that lies outside the extent of functional floodplain, and also outside the area at risk in the design 100 year return period flood event including 26% allowance for climate change. This is except for the proposed boathouse which may potentially located within the functional floodplain as defined in the Strategic Flood Risk Assessment (SFRA) (it is not clear from the resolution of the maps in the SFRA), however, this is water compatible development and therefore acceptable within Flood Zone 3b.

Finished floor levels will be set to match the existing floor level in Grandpont House, and therefore flood resistant construction is required, including an assessment, and reinforcement if required, of the existing building structures along the north boundary of the site. Flood resistance will be designed to a minimum level of 56.59m AOD, incorporating a 300mm freeboard into the design.

The proposed development will not occupy flood storage, since the extension and all associated structures will be built entirely within the part of the site that does not flood in the design event, as well as within the existing building curtilage. The proposed boathouse that will be built in the grounds will be a raised structure with ground floor levels above the modelled design flood water level of 56.29m AOD. This will allow water to flow freely underneath the structure in the event of a flood, and not adversely impact flooding elsewhere. Surface water will be collected and attenuated via a green roof on the proposed boathouse and discharged to the pond, which will be designed to accommodate the additional 0.6 m^3 of volume required.

ABBREVIATIONS

Acronym	Definition
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Survey
DEFRA	Department for Environment Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
OCC	Oxford City Council
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

1 INTRODUCTION

General Information

1.1 Netherhall Educational Association owns Grandpont House, at the northern end of Abingdon Road, near Folly Bridge in Oxford. The house is currently used by the Charity for educational and religious purposes that include accommodation for its staff and for a limited number of students. The facilities are inadequate for the Association's long-running activities serving people throughout southern and central England, and the accommodation is badly in need of upgrading and modernisation.

1.2 The site lies within Flood Zone 3 of the River Thames (Isis) as shown on the Environment Agency's latest flood maps, and a full Flood Risk Assessment (FRA) has therefore been prepared to accompany a planning application for the development. The FRA incorporates a Drainage Statement and details of Sustainable Drainage Systems (SuDS).

1.3 The proposed development has been the subject of extensive consultation with both Oxford City Council (OCC) and the Environment Agency (EA) in relation to the principle and specifics of the proposed development. Agreements have been reached with OCC and the EA over a period of years regarding the methodology for the assessment of flood risk which has been adhered to and is discussed within the following assessment report.

1.4 The latest EA hydraulic model of the River Thames through Oxford has been used to inform the FRA[1].

Scope of Study

1.5 The main objectives of this study are to:

Determine the acceptability of the principle of development on the land at Grandpont House for the purposes proposed by establishing the position of the proposals relative to the "functional" floodplain (Flood Zone 3b);

Assess the risk and implications of flooding on the site during the design (1 in 100 annual exceedance probability) fluvial flood event prior to and following development, including relevant allowances for climate change according to current practice, and to demonstrate that the proposals will not adversely affect flood risk elsewhere;

Consider the risks of flooding from other sources including surface water, groundwater and artificial waterbodies;

Provide advice on the site layout and design elements that will ensure safe operation of the site in an extreme flood event; and

Provide a flood risk assessment of the site, compliant with the guidelines set out in the revised National Planning Policy Framework (NPPF)[2] and accompanying Planning Practice Guidance (PPG) [3], to accompany an application for planning permission.

[1] Environment Agency, Thames (Eynsham to Sandford) 2018 Oxford Flood Alleviation Scheme, March 2018
[2] Department for Levelling Up, Housing and Communities, National Planning Policy Framework, September 2023
[3] Department for Levelling Up, Housing and Communities, Planning Practice Guidance Flood risk and coastal change, https://www.gov.uk/guidance/flood-risk-and-coastal-change, August 2022

2 SITE DESCRIPTION

Location

2.1 Grandpont House is located on Abingdon Road in Oxford, next to Folly Bridge and is adjacent to the River Thames. The Hogacre ditch flows through the site. The site lies within the jurisdiction of OCC. The location of the site relative to surrounding water and geographical features is presented in Figure 1.

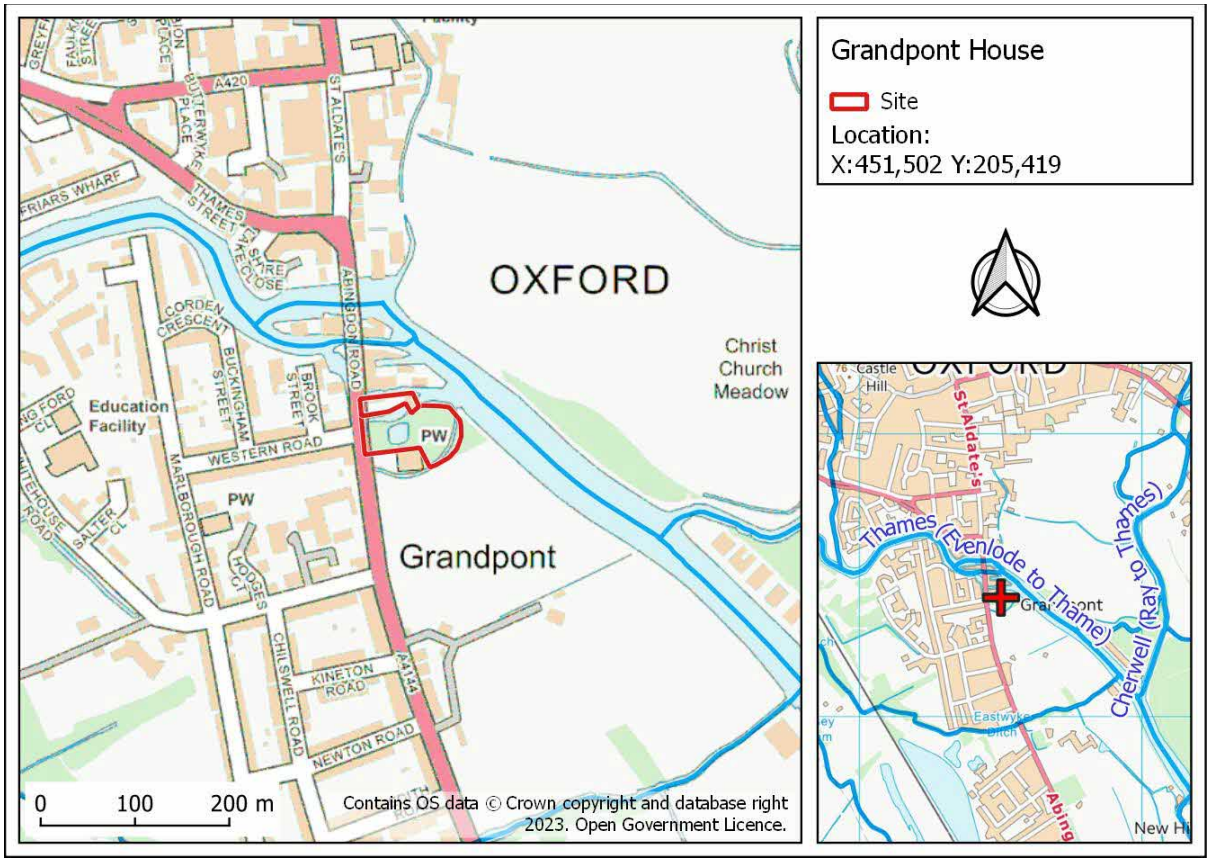

Figure 1: Location of proposed development site

Topographic Survey

2.2 A topographic survey of the site was undertaken by On Centre Surveys Ltd. in October 1988, and referenced to Ordnance Survey datum. Additional GPS survey was undertaken by Oxford Geospatial in September 2017.

2.3 The topographic survey of the site shows that there is a continuous line of high land along the northern edge of the watercourse through the site. This is the main pedestrian footway from Abingdon Road to the rear entrance of Grandpont House, which steps down from the road level of 57.41m AOD to 56.42m AOD. This pathway is then maintained at a level between 56.39m AOD and 56.42m AOD along its entire length, with a minimum level of 56.38m AOD close to Grandpont House, at a gate which allows access to a raised walkway alongside the river, set at 56.52m AOD. The minimum level within the area north of the watercourse is 55.83m AOD (excluding localised depressed drainage gullys).

2.4 The topographic survey indicates that the ground levels in the grounds to the south of the watercourse range from 55.5m AOD to 56.2m AOD to the west, with land at a general level of

56.0m AOD. Ground levels fall from west to east, before a bank down to a low-lying marshy area alongside the watercourse at around 54.3m AOD. The top of bank of the watercourse through the site is 55.1m AOD on the south bank.

Existing Development

2.5 Grandpont House is an existing Grade II* listed building was built in 1785 and is currently used by the Charity for educational and religious purposes, including accommodation for staff and students. The facilities are no longer adequate for the Association's activities, and the building is also in need of repair and restoration.

2.6 The site boundaries are formed by the River Thames to the north, the towpath to the east, the Brasenose College Recreation Ground and Holy Rood Catholic Church to the south and Abingdon Road to the west. The current building occupies the north eastern corner of the site, and is built on brick arches over a branch of the river that passes through the site.

2.7 The current listed building houses a lounge and visitor room at ground floor, office and chapel at first floor and eleven accommodation rooms from ground to second floor. There are a number of brick buildings along the northern boundary of the site which are currently in ancillary uses.

2.8 There are a number of small buildings along the northern boundary of the site which are currently in ancillary use and would be refurbished as part of the proposals to provide domestic services.

2.9 Surface water runoff from the site currently drains directly to the local watercourses. Thames Water has confirmed that there are no surface water connections to the public sewer. Foul water from the site currently drains to the public sewer in Abingdon Road.

Proposed Development

2.10 Proposed internal and external refurbishment of Grandpont House is to include:

internal and external refurbishment to main Grade II* listed building including partial demolition, reinstatement and restoration of original features, rendering and framing; retrofit to building fabric and installation of new ventilation and heating;

internal and external refurbishment of existing stable block to create new accommodation, including alterations to roof, formation of mezzanine and new fenestration;

Erection of extensions to listed building to create new accommodation and chapel; single story glazed link entrance; boathouse and garden room.

2.11 The existing building is in residential use and is therefore classified in flood risk terms as 'more vulnerable'. The majority of the proposed development lies within the existing building footprint, and will not increase the vulnerability classification. The boathouse will be located on the high land south of the watercourse close to Abingdon Road. This is water compatible development[4].

[4] National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK (www.gov.uk)

3 PLANNING POLICY

National Planning Policy Framework

3.1 The NPPF was released in March 2012 and sets out the Governments' planning policies for England and how these are expected to be applied. The NPPF has been updated several times, the most recently available consolidated version is dated December 2023. The NPPF states that:

> *"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere."*

This is implemented through the Sequential and Exception Test.

3.2 In this instance the application is for an extension of the existing use and expansion of existing facilities, and as a result there are no available sites that would be sequentially acceptable for the development in flood risk terms. The sequential approach to development has been applied, with the proposed development located on the highest part of the site. No vulnerable uses located within Flood Zone 3b, which would constitute inappropriate development in the floodplain. However, all other development, where Flood Zone 3b is avoided, would be acceptable subject to the application of the Exception Test. Note that OCC allows development in Flood Zone 3b subject to certain conditions, as discussed below.

3.3 Notwithstanding the above, it remains necessary under the NPPF for a site-specific FRA to demonstrate that there is no adverse impact on the risk of flooding elsewhere as a result of the development, and that development will be safe, specifically that:

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

3.4 Part a) is complied with by locating the proposed new building area on the highest part of the site closest to Abingdon Road, which provides dry escape access to Oxford City Centre.

3.5 Part b) will be complied with through the inclusion of flood resilient design, as appropriate, specified within this FRA.

3.6 Parts c) d) and e) will be addressed within this FRA.

3.7 In terms of the overall requirement that there be no adverse impact on the risk of flooding elsewhere, this is achieved by ensuring no built volume within the floodplain apart from the proposed boathouse. It is also committed that there would be no increase in surface water runoff rates as a result of the development.

Oxford City Council

3.8 As the local planning authority, it is the responsibility of Oxford City Council (OCC) to set policy in relation to flood risk, and to determine the flood risk implications of all minor development. OCC policy is defined by the Adopted Local Plan[5] policy and the Strategic Flood Risk Assessment (SFRA)[6].

3.9 The Local Plan acknowledges that certain areas of Oxford lie within the defined Functional Floodplain (Flood Zone 3b) for historic reasons and as a result it is sustainable to allow development on sites that lie within Flood Zone 3b, subject to certain conditions:

> *The Local Plan policy approach is to allow very careful re-development of existing brownfield sites in Flood Zone 3b to make the best use of existing sites in sustainable locations.*

3.10 The proposed development has been located on high land to the north of the watercourse crossing the site, and outside the extent of Flood Zone 3b. The main development therefore does not fall within Flood Zone 3b. However, a boathouse is defined on the south side of the watercourse, albeit on high land relative to the rest of the grounds associated with the property. Parts of the grounds, in particular the low-lying marshy area alongside the watercourse channel are within the extent of the site could be defined as Flood Zone 3b.

3.11 The situation of the site is very similar to allocated land at St Catherine's college, (policy SP30), which lies partially within Flood Zone 3b. The Local Plan document indicates that the flood zone allocation is "FZ3b but FZ1 for sequential test". This is based on the location of the proposed development rather than the site boundary.

3.12 Whilst the proposed development at Grandpont House is located in Flood Zone 3a, Policy RE3: Flood Risk Management covering the requirements for development in Flood Zone 3b is recited here for completeness:

> *Planning permission will not be granted for development in Flood Zone 3b except [..] where it is on previously developed land and it will represent an improvement for the existing situation in terms of flood risk. All of the following criteria must be met:*
>
> *a) It will not lead to a net increase in the built footprint [in Flood Zone 3b];*
>
> *b) It will not lead to a reduction in flood storage and where possible increase flood storage;*
>
> *c) It will not lead to increased risk of flooding elsewhere; and*
>
> *d) It will not put any future occupants of the development at risk*

3.13 The proposed development will improve the existing situation in respect of flood risk by facilitating the relocation of sleeping accommodation to the higher part of the site and close to the dry access route away from the site. Additionally, excess flood storage will be provided in the expanded ecological pond (condition b), and surface water runoff rates will be controlled in accordance with local policy. By constructing the extended facilities on the high land, there will be no increase in built footprint in Flood Zone 3b (condition a). This FRA will assess parts c and d.

[5] Oxford City Council (June 2020) Adopted Oxford Local Plan 2036
[6] Wallingford Hydrosolutions on behalf of Oxford City Council (November 2023) Level 1 Strategic Flood Risk Assessment

3.14 Further guidance is included within Policy RE3 relating to all planning applications within areas of flood risk with additional conditions as follows:

> *e) The proposed development will not increase flood risk on site or off site;*
>
> *f) Safe access and egress in the event of a flood can be provided; and*
>
> *g) Details of the necessary mitigation measures to be implemented have been provided.*

3.15 All conditions listed above will be covered by this FRA.

3.16 OCC Policy RE4 deals with drainage management and requires compliance with the sustainable drainage discharge hierarchy. *All development proposals will be required to manage surface water through SuDS or techniques to limit run-off and reduce the existing rate of run-off on previously developed sites.* SuDS details should be submitted as part of the FRA. Additional restrictions are placed on development within groundwater catchments for the Lye Valley and Oxford Meadows. The site does not fall within these areas.

3.17 Guidance on SuDS is provided in the OCC joint council document "Sustainable Drainage Design & Evaluation Guide"[7]. The guide indicates that the site lies within an area with "Loamy and clayey floodplain soils with naturally high groundwater" which is generally unsuited for discharge by infiltration. The design guide is principally aimed at major development, but does set out the fundamental principles of drainage management for proposed development, which mirror national best practice. The guide does not stipulate any specific policy requirements.

3.18 Further guidance on FRA requirements is provided within specific Planning Application Guidance for flooding[8]- however this guidance pre-dates the 2020 adopted local plan and policy references and requirements are out of date. Nevertheless, it provides a useful checklist for FRA requirements.

Oxford City Council draft Local Plan 2040

3.19 The draft Local Plan 2040 is currently out for consultation until January 2024. Policies contained in the draft plan are not in force until the plan is adopted, however they do provide a useful level of guidance on expectations for development proposals. Subject to the outcome of further work, flood risk will be covered by Policy G7. The proposed policy retains the requirements of adopted policy RE3, and sets out a hierarchy of flood risk management principles for minor extensions. Policy G8 covers drainage management and SuDS and reiterates the requirements detailed above. Policy G9 is designed to promote resilience to climate change in proposal design and construction, and includes recommendations to implement flood risk reduction, resistance and resilience measures in all developments at risk of flooding both now and in the future.

Oxfordshire County Council

3.20 Oxfordshire County Council fulfils the role of Lead Local Flood Authority (LLFA) and SuDS approval body for the site. However, since the application is not for "major development", the function of the LLFA as a statutory consultee is removed.

3.21 Whilst the proposed development will be assessed under OCC policy, the information contained within LLFA documents, including the Preliminary Flood Risk Assessment (PFRA)[9] and Local Flood

[7] McCloy Consulting & Robert Bray Associates on behalf of Oxford City Council (2018) Sustainable Drainage Design & Evaluation Guide
[8] Oxford City Council (undated) Planning Application Guidance Flooding https://www.oxford.gov.uk/downloads/file/3815/planning_application_guidance_-_flooding
[9] JBA on behalf of Oxfordshire County Council (June 2011) Preliminary Flood Risk Assessment Report

Risk Management Strategy (LFRMS)[10] are used as evidence to inform the assessment of flood risk within this FRA.

3.22 In addition to the flood risk evidence base provided by the LLFA, the LLFA SuDS guidance for major development[11] provides a useful starting point for best practice design of surface water drainage.

Environmental Permits

3.23 Due to the proximity of the site to the River Thames, environmental permits will be required for all proposed works within the site. Additionally, Oxfordshire County Council as LLFA will be consulted in relation to all ditches on or adjacent to the site that are not designated as part of the River Thames main river, such as the ditch on the southern site boundary. These permits can be applied for post-planning.

[10] Oxfordshire County Council (August 2021) Local flood risk management strategy
[11] Oxfordshire County Council (November 2018) Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire

4 POTENTIAL FLOODING ON SITE

Historical Records of Flooding

4.1 The EA holds records of historic flood events in Oxford in 1947, 1979, 1977, 1992, 1993, 1998, 2000, 2003, 2007 and 2014. According to the estimated flood extents for these events provided by the EA, the site and access routes did not flood in any event except the 2003, 2007 and 2014 events. Anecdotal evidence from staff members and the Grandpont House records suggest that the building did not flood in any of these three events, and that access was available to the site throughout. Furthermore, the grounds of the site did not flood, with only the pond/marshy area filling with water. The EA records for the site are therefore inaccurate. There are no records in the archives held at Grandpont House that suggest the building has flooded since it was built in the late 18th century.

4.2 There are records of groundwater flooding having occurred within 1km of the Grandpont House site. These coincide with fluvial flood events, and there are no reports of isolated groundwater flooding occurring. It is understood that the open land next to the River Thames east from the site floods in winter, the source of which is believed to be groundwater. The pond/marshy area also fills to a few hundred millimetres in winter.

Flooding from Rivers and the Sea

4.3 The GOV.UK Flood Zone maps represent the latest existing data for identifying zones of low, medium and high probability of flooding from rivers and the sea. The Flood Zone map for the site is presented in Figure 2. The floodplain indicated in dark blue is the area that may be affected by the fluvial flooding event with a chance of 1% or greater of occurring in any year (1% AEP event), neglecting the influence of any flood defences in the area. This is categorised by the Environment Agency as 'Flood Zone 3'. The light blue colour shows the additional extent of an extreme flood (land affected during the 1% AEP to 0.1% AEP tidal or fluvial flooding event) and is categorised as 'Flood Zone 2'. Finally, the areas that are not highlighted indicate that the annual probability of the site flooding from rivers and tides is less than 0.1% AEP, and these zones are categorised as 'Flood Zone 1'.

4.4 The Flood Zone maps are based on a nationwide study of flood risk for all surface catchments of 3km^2 or greater, and those areas with a known historical risk from rivers or the sea. In this instance, the flood zone mapping is based on the results of the detailed River Thames hydraulic modelling study, and supplemented by the historic flood outlines described above. The site is shown to lie within Flood Zone 2 and 3. The SFRA maps which present the result of an update to the River Thames hydraulic model show that the grounds are at risk of flooding in the 3.3% annual exceedance probability (30 year return period) event, and as such, falls potentially within Flood Zone 3b. However, the extent of Flood Zone 3b is confined to the area south of the watercourse crossing the site. The extent of Flood Zone 3b from the SFRA has mapping has been superimposed onto Figure 2.

4.5 Since there is a risk of flooding from rivers on the site, there is also a risk of the proposals creating or adversely affecting areas of flood risk elsewhere. Therefore, the risk of fluvial flooding to the site, and the potential for off-site impacts, is assessed in detail in the following chapters.

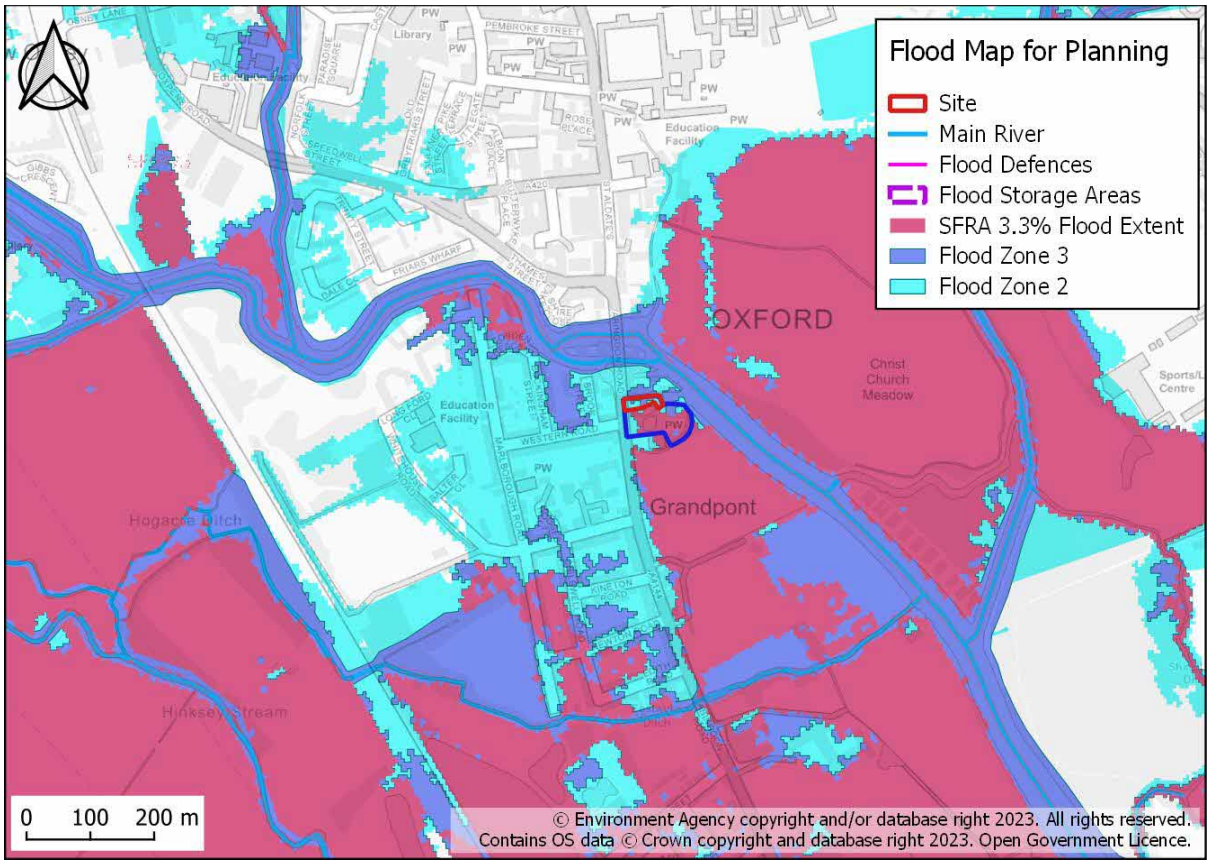

Figure 2: Flood Map for Planning

Flooding from Surface Water

4.6 Flooding from surface water arises during intense rainfall events when floodwater is unable to infiltrate into the ground or discharge into local ditches or artificial drainage infrastructures. In an urban environment, the risk of flooding from surface water and from overloaded sewer is closely related. Flooding events are typically of short duration (unless there is a drainage system blockage) but can be severe.

4.7 The GOV.UK online mapping for surface water indicates the likely extent of overland flooding in the area and highlights natural flow paths. The surface water map for the area surrounding the site is shown in Figure 3. The dark blue areas represent areas of 'High' surface water flood risk that have a 3.3% AEP (30 year event) chance of flooding. The lighter blue areas are of 'Medium' risk of surface water flooding which have a 1% AEP chance of flooding and the pale blue areas are of 'Low' risk surface water flooding with a 0.1% to 1% AEP chance of occurring. Areas that are not highlighted are classified as 'Very low' risk of surface water flooding with a less than 0.1% AEP chance of occurring.

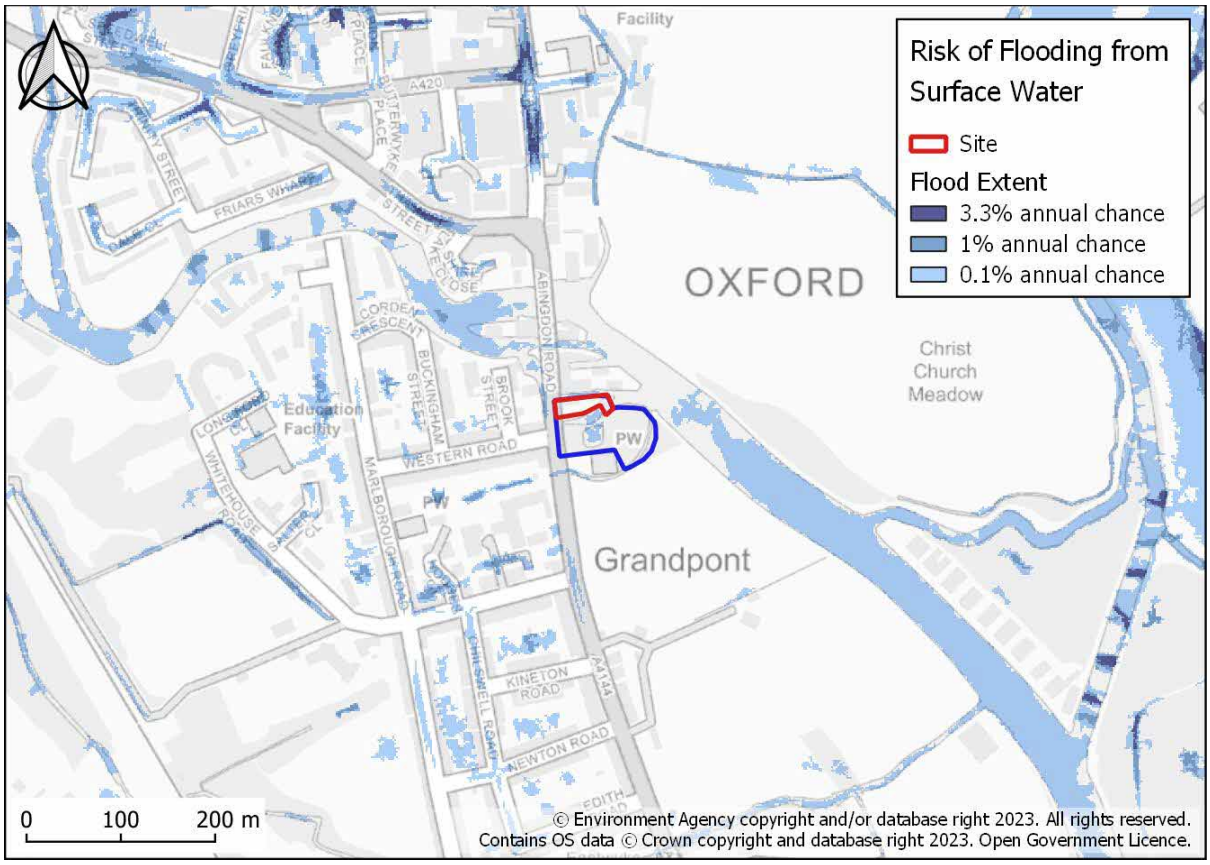

Figure 3: Risk of Flooding from Surface Water Map

4.8 Figure 3 indicates that the site is not at risk of flooding as a result of surface water runoff.

Flooding from Groundwater

4.9 There are records of instances of groundwater flooding within 1km from the site. Aquifer mapping shows that the bedrock at the site is non-aquifer, however the superficial deposits are classified as a Secondary A aquifer and of 'High' vulnerability. Superficial aquifers of this type within river basins are usually the result of historic river deposits.

4.10 According to British Geological Survey (BGS) data, the site is located on Northmoor Sand and Gravel over Oxford Clay. Local boreholes at Brook Street (published by the BGS) dated June 1986 indicate that the gravels do contain substantial groundwater, with water strikes at or above the top of the gravel layer (beneath made ground), and that the groundwater is under slight pressure (rest level was higher than the strike level). The same was encountered at 2-6 Abingdon Road, in June 1984, although two separate water strikes were recorded in one borehole- in alluvium overlying the gravels as well as within the gravels themselves. All four boreholes indicate a level around 2m below ground, settling to around 1.5m below ground.

4.11 The available evidence suggests that there is likely to be groundwater within the superficial deposits underlying the site. However, due to the proximity of the site to the river, it is very unlikely that groundwater in the overlying superficial gravels will cause an isolated source of flooding. Any groundwater flooding that does occur at the site will likely be dominated by associated fluvial flooding. No basements are proposed, and flood risk mitigation measures designed to alleviate the fluvial flood risk at the site will be ample to protect against groundwater flooding. Consequently, the risk of groundwater flooding of the proposals, independent from, and in the context of the fluvial flood risk is considered insignificant.

Flooding from Sewers

4.12 The Thames Water sewer plans show separate foul and surface water sewers present on Abingdon Road flowing under gravity in a southerly direction. The surface water sewer starts close to the southern boundary of the site, and any overloading of this sewer system would flow south, flooding lower lying areas away from the site.

4.13 Thames Water has confirmed that the site is recorded as not being at risk of internal flooding from overloaded sewers.

Flooding from Other Sources

4.14 Although the Oxford Canal lies within 1km of the site, at this location it forms part of the River Thames network and is included within the hydraulic model. All artificial waterbodies in the area are similarly included and therefore all are accounted for in the assessment of flooding from the River Thames.

4.15 There are several raised reservoirs upstream of Oxford which pose a risk of reservoir flooding within the general area. The gov.uk reservoir flood risk map is presented in Figure 4, and though there are risks of flooding due to reservoir failure along the Thames corridor through Oxford and downstream to Abingdon arising from impounded water bodies at Farmoor, Worton, Blenheim and Eynsham, the area of risk in the absence of fluvial flooding is contained within lower land, covering an extent equivalent to approximately the 20% annual exceedance probability fluvial flood (5 year return period). As a result the site lies outside the risk area.

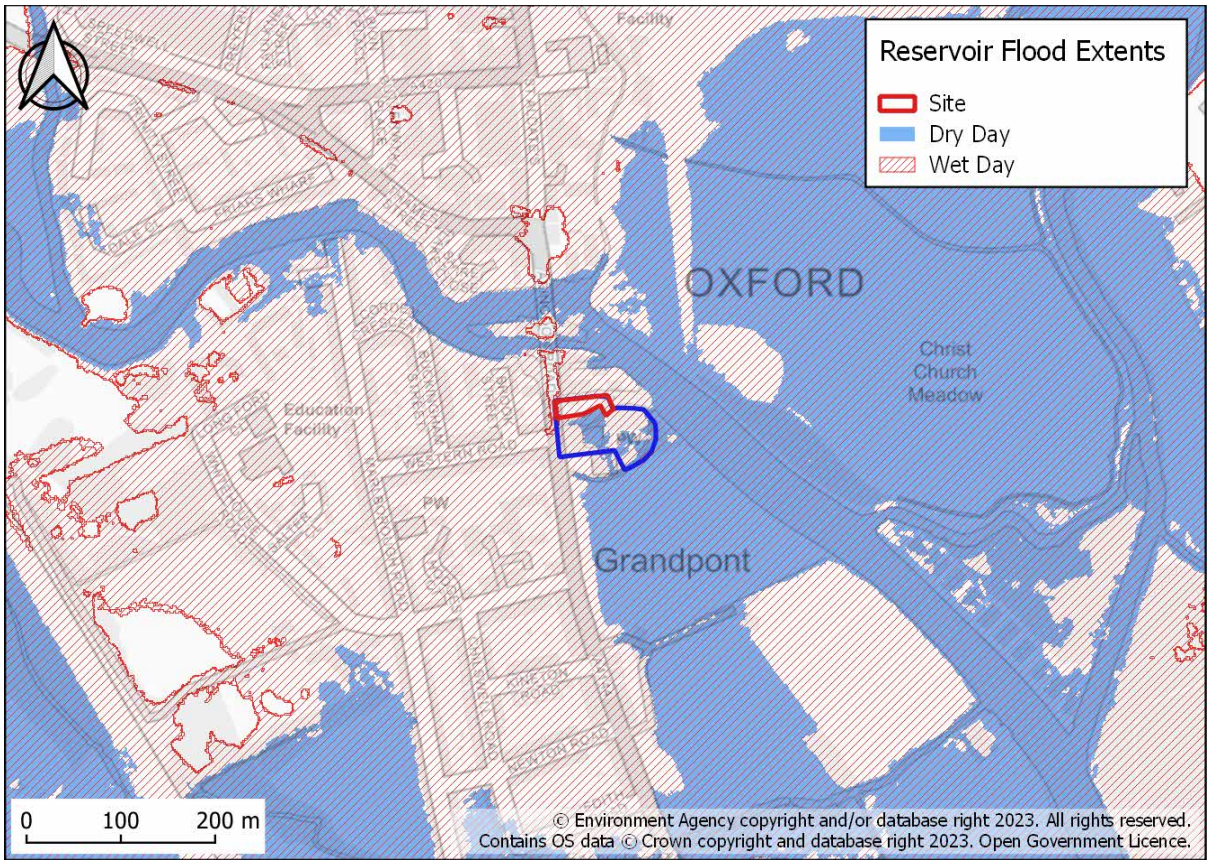

Figure 4: Gov.UK Reservoir Flood Risk Map

4.16 The risk of flooding from reservoirs dataset includes mapping showing the expected extent of reservoir flooding if this were to occur in combination with a 1% fluvial flood. The extent of risk covers an area substantially in excess of the 0.1% annual exceedance probability fluvial flood.

4.17 The EA is the enforcement authority for the Reservoirs Act 1975 in England, and ensures that reservoirs are inspected regularly, and essential safety work is carried out. All reservoirs must be inspected and supervised by reservoir panel engineers. There has been no loss of life in the UK from reservoir flooding since 1925. Further, the extents and depths of flooding are less than those predicted for fluvial flooding and therefore mitigation designed for fluvial flooding will also be ample to protect against flooding from this source.

4.18 Consequently, the risk of flooding from other sources is insignificant.

Structures which may Influence Local Hydraulics

4.19 The major structure affecting the local hydraulics at Grandpont House is Folly Bridge and the raised approach on Abingdon Road. The site lies downstream of the bridge on the southern (right) extent of the river. The bridge spans the two main channels of the River Thames approximately 65m and 100m north of the site. The northern span is supported by three stone archways, whilst the southern span consists of a single arch. Approximately 15m upstream of the bridge, there is an off-take to the south (right bank) which passes beneath a footbridge and forms a lagoon upstream of Abingdon Road. Abingdon Road is raised at the level of the bridge past this lagoon, with three small arch culverts conveying water beneath the bridge from the lagoon to each of three subsidiary channels, one of which passes through the former Boat House site north of Grandpont House, the remainder being those bordering and bisecting the site as shown in the topographic survey and development plans.

4.20 The bridge and embankment are the dominant structural controls at this location on the River Thames. The two main spans are of sufficient capacity that Abingdon Road has not been overtopped by the River Thames in any of the flood events on record for the area. Modelling performed by Atkins for the West End area action plan SFRA shows that the 100 year flood event (including an allowance for climate change) will overtop onto adjacent land to the north of the bridge, whilst remaining in bank to the south, consistent with these observations.

4.21 Assuming that Abingdon Road does not overtop in the simulated 100 year flood, the limiting capacity of the culverts is sufficient that water in the three subsidiary channels downstream of the bridge will remain in bank. Any flooding of the site in such an event must therefore arise from high water levels in the river downstream of Folly Bridge.

Flood Defences

4.22 There are currently no formal flood defences in place to protect the site from flooding related to any source. The EA is currently investigating possible schemes to provide flood protection to the Oxford area in the form of storage reservoirs upstream. A number of smaller schemes are also under consideration to provide more immediate relief to the area.

4.23 Local schemes improving the capacity of the channel by removing obstructions and improving maintenance have been carried out. The full scale flood relief scheme is also being considered[12]. At this stage it is unclear how significant the impact of either scale of scheme will be on flood risk at the subject site, however flood risk is expected to reduce in the future by virtue of the schemes.

[12] https://www.gov.uk/government/publications/oxford-flood-scheme/oxford-flood-scheme

5 CONSULTATION HISTORY

Planning Applications and Pre-application Advice

5.1 There has been considerable history of consultation and agreement with both the EA and OCC regarding flood risk and development of the site over the past 2 decades. Agreement was reached with the EA in 2014 regarding the principle of development at the site and the form and design of flood mitigation measures. This was supported by hydraulic modelling undertaken prior to compilation of a planning application in 2014. Key planning milestones are set out below.

2010 Hydraulic Modelling Report

5.2 As part of the proposed development design evolvement between 2007 and 2010 pre-application discussions were held with OCC and the EA regarding flood risk. Hydraulic modelling was undertaken by refining the most recent EA hydraulic model to provide refined flood water levels on the site as well as assess the impact of development on the site with regards to flood risk.

5.3 As well as refining the EA hydraulic model, the work included pre- and post-development hydraulic modelling, incorporating the proposed extension as a solid block within the site as well as proposed flood storage mitigation in the form of on-site lowered ground on a volume basis.

5.4 The EA was formally consulted on this work and agreed to the outcomes. The planning and development control consultation responses dated 21 April 2009[13] and 22nd November 2010[14] confirms the agreement with the EA that the site is not in the functional floodplain. On this basis, detailed work on the layout of the proposed development continued with a view to submitting a planning application.

2014 Flood Risk Assessment Report

5.5 A detailed FRA was prepared to support a proposed development of the site and a planning application. Due to reasons not related to flood risk, a planning application was not ultimately submitted however a pre-application enquiry was undertaken with the EA as part of the preparation.

5.6 The FRA included an analysis of the extent of the functional floodplain, as well as the outcomes of the hydraulic modelling exercise, alongside an assessment of the risks to people and the impact on flood risk arising from the proposals.

5.7 The EA reviewed the Flood Risk Assessment and provided a response which confirmed that "*We are aware that there has been significant consultation on this proposed development over a number of years. We have previously accepted the general approach to ensuring the development remains safe over its lifetime and does not increase risk elsewhere and confirm that we do not have significant concerns with the proposals in their current form.*" And "*The use of volumetric compensatory floodplain storage has been discussed and agreed, in conjunction with the implementation of a voided building design.*" [15]

2016 Pre-application Enquiry

5.8 Due to reasons unrelated to flood risk, the project took a change in direction over the next two years and a different scheme was developed for the site. Coincidentally the EA updated the hydraulic model of the River Thames in 2014. A pre-application enquiry was submitted to OCC

[13] Environment Agency letter dated 21 April 2009 which states "We would agree sufficient evidence has been submitted to show that the site is not within Flood Zone 3b (functional flood plain)"
[14] Environment Agency letter dated 22 November 2010 which states "We have previously accepted that the site is not in Flood Zone 3b, the functional Floodplain."
[15] Environment Agency letter dated 24 January 2014

in mid-2016. A response was received regarding Flood Risk and Drainage which, amongst other considerations, raised concerns regarding Flood Zone 3b (functional floodplain) in the context of the revised EA modelling[16].

5.9 Further work was therefore undertaken regarding Flood Zone 3b. It was determined that the Flood Risk and Drainage comments had been prepared without the benefit of previous correspondence with the EA which confirmed that the site was not in the functional floodplain as well as the detailed 2014 FRA. This information was submitted to Mathew Bunn, the flood risk officer at OCC, and updated comments were received, recommending that further advice be sought from the EA.[17]

5.10 A further pre-application enquiry was therefore submitted to the EA in March 2017. A round of correspondence followed during which a detailed report, drawings, historical flood maps, photographs and witness statements were submitted to OCC and the EA. The key to the ultimate agreement with the EA was the 2014 historic flood event, which the EA estimated to have been a 25 year return period flood, during which the site was not flooded except for the low-lying marshy area. The estimated peak water level for this event at the site is between 55.73m AOD and 55.74m AOD, based on on-site observations. On this basis, it was agreed that the extent of the functional floodplain should be mapped by applying a flood level of 55.73m AOD to 55.74m AOD across the site. This was confirmed by the EA by email and letter- indicating that the area of the site proposed for development is not in the functional floodplain.[18]

2019 Pre-application Enquiry

5.11 Following receipt of this confirmation from the EA, further detailed work on the proposals was undertaken and a revised pre-application enquiry was submitted to OCC on the 30 November 2018 seeking opinion on flooding and tree issues only. The response[19] was detailed and confirmed that "*The general principle of the approach taken to manage flood risk is acceptable*" and went on to discuss that the EA hydraulic model has been updated and the latest available data should be considered. A further pre-application enquiry with the EA was therefore undertaken.

5.12 In 2018 the EA hydraulic model was again updated, with revised hydrology, improved calibration, and the inclusion of climate change allowances that were adjusted in policy in 2016. The revised modelling resulted in a reduction in 20 year return period flood water levels at the site relative to the previous modelling, from 55.99m AOD to 55.94m AOD, and therefore the modelled extent of Flood Zone 3b was reduced.

5.13 Although the agreement regarding the functional floodplain extents in 2017 took into account all available information including historical flood events as well as predictive modelling, the modelled flood water level has reduced since the date of the agreement. Therefore, the latest hydraulic model does not change the principles of the agreement with the EA.

5.14 The revised proposals included several improvements to the proposed scheme. Crucially, the revised proposal includes moving the building to the higher part of the site closer to Abingdon Road, and thus, further out of the floodplain. Consequently, the revised proposals, in combination with the reduction in predicted flood risk indicated by the revised model, improves the situation with regards to flood risk relative to the previously agreed scheme.

[16] Oxford City Council Flood Risk and Drainage Planning application response dated 17 October 2016 (Application reference 16/01978/PAC)
[17] Oxford City Council Flood Risk and Drainage Planning application response dated 9 January 2017 (Application reference 16/01978/PAC)
[18] Environment Agency letter dated 17 July 2017
[19] Oxford City Council Planning and Regulatory Services letter dated 19 March 2019 (Ref: 18-03132-LBPAC)

5.15 However, the EA response to the revised enquiry indicated that the revision to the model should be considered to provide the best available information, due to improved calibration, and should therefore be used to define Flood Zone 3b even though previous "on-the-ground" data was used to define Flood Zone 3b, and the model revision resulted in a reduction in the extent of the floodplain. Further information was requested by the EA including an analysis of the revised modelling and the historical information used previously.

5.16 A further technical note was therefore submitted to the EA[20] detailing the changes to the model calibration and concluding that the calibration in the Oxford City area was insufficient to improve confidence in the definition of the functional floodplain- indeed the calibration of the model against the 2007 flood event is clearly shown in the model report to overestimate flood water levels in the Abingdon Road area by 170mm to 420mm.

5.17 A response was received[21] to the technical note and letter which acknowledged the validity of the concerns regarding over-estimation of the flood risk within the hydraulic model. However, it recommended that the analysis be expanded to determine whether the 2007 event can be analysed to extract a more exact return period to improve confidence in the analysis.

5.18 The technical note also discusses the extent of flooding experienced on site during the 2007 and 2014 flood events in the River Thames. Photographic evidence was used to support an estimate of the maximum flood water levels between 55.74m AOD and 55.76m AOD.

5.19 The EA response agreed that, subject to further work demonstrating that the return period of the 2007 event is above 20 years, that the 55.76m AOD level could be used to define Flood Zone 3b. This FRA will seek to address this element of the analysis. The response went on to suggest that the extent of Flood Zone 3b must not coincide with land within the red line boundary- however this would be contrary to OCC policy, allocated sites and case law related to the application of flood zones, and in this particular case is impossible to achieve due to the channel within the site. Nevertheless, the EA response does state "we must see clear evidence that none of your red line boundary or built footprint is impacted by this event" and it is assumed, based on planning precedence in general, and within the OCC development plan in particular, that the emphasis in this statement is intended to relate to the built-development, rather than the entire red line boundary.

5.20 In addition to the agreement regarding the extent of Flood Zone 3b, the EA response indicates that the FRA must demonstrate that the development does not increase flood risk, including the expectation that finished floor levels be set about the 1 in 100 AEP flood water level including a 35% allowance for climate change. These requirements echo the detail contained in the pre-app response from OCC in March 2019. However, the OCC response went a stage further, indicating that the use of floodable space beneath the building, to ensure no loss of floodplain storage, would be accepted if it can be shown that the development does not increase off-site flood risk. It is noted that the required allowance for climate change has reduced since this correspondence, and is now 26%.

2021 Pre-application Enquiry

5.21 An FRA[22] was submitted to the EA for further advice and comment on revised proposals in October 2021. This scheme involved construction of a building on the south side of the watercourse, but on the high land closest to Abingdon Road. The building was proposed to be built to be open to flooding up to the design flood water level.

[20] Water Environment Ltd (3rd June 2021) 2007 flood event assessment
[21] Environment Agency letter dated 24 June 2021 (Reference ENVPAC/WTHAMS/00504/WA/2021/128674/02-L01)
[22] Water Environment Ltd (October 2021) Flood Risk Assessment reference 17014-FRA-RP-01 P02

5.22 The initial formal response in November 2021[23] indicated that the EA was satisfied with the analysis presented therein that indicated the proposed development does not lie within Flood Zone 3b. The EA also confirmed that the use of void space beneath a building is an acceptable means of maintaining flood storage capacity in this instance.

5.23 The EA indicated that the 26% climate change allowance should be applied, rather than the 25% used in the FRA submitted as part of the pre-app. This results in an increase in flood water level of 10mm. The FRA was updated throughout to comply with this.

5.24 One outstanding query in the EA response of November 2021 related to the provision of level-for-level floodplain compensation for structural supports within the floodplain. Further negotiation on this point was focussed on the scale of any likely volume losses in the context of the catchment-wide storage in the River Thames, as well as the over-provision of volumetric flood storage within the site as a whole. The EA ultimately agreed that the mitigation proposed, in the form of over-provision of volumetric storage, was sufficient in this instance, subject to demonstration of the actual calculated loss in floodplain storage at each level being negligible. Therefore, the volume lost to structural supports was additionally covered within the FRA.

Planning Application – April 2022

5.25 The application for planning was subsequently submitted, along with the final FRA[24]. An initial objection from the EA was lodged on two main points. Firstly, due to the extent of the agreed Flood Zone 3b not being superimposed clearly enough to show that the building was not in the functional floodplain. Secondly, further clarifications on previously agreed points were requested to be included in the FRA, as follows:

> Details of the calculation demonstrating the agreed 26% flood water level;
>
> Further clarifications on the proposed ground floor finished floor levels;
>
> Further details on the building design (to ensure free flooding) and structure piles, including a calculation of flood storage volumes following an agreement with the EA that less than 10m3 of storage lost would be considered negligible;
>
> Further detail on the calculations provided in the FRA based on total loss of floodplain storage if the building voids were to be compromised which showed free-draining water volume to increase at all levels;
>
> A request for information on further development that was not included in the application, i.e. the EA had misinterpreted the proposed plans; and
>
> Further information on the proposed access bridge structures (these had previously been agreed).

5.26 A statement was prepared covering these elements, all of which were either already covered in the FRA and thus were carefully explained, or were the result of a misunderstanding of the proposed development. However, the application was withdrawn prior to further consultation with the Environment Agency.

Pre-application Enquiry – January 2023

5.27 An alternative scheme was drawn up following the withdrawal of the planning application, with proposals revised to avoid creating any new structures by refurbishing the existing buildings. A

[23] Environment Agency letter dated 02 November 2021 (Reference ENVPAC/WTHAMS/00504/WA/2021/128674/03-L01)
[24] Water Environment Limited (March 2022) Flood Risk Assessment Reference 17014-FRA-RP-01 C01

statement on Flood Risk[25] was submitted alongside a pre-application enquiry to OCC. The pre-application response included the following observation:

> *The FRA to be submitted with the application should be based on the EA's 2018 hydraulic model*

5.28 Note that all work since the 2019 pre-application enquiry, including the detailed discussions with the EA related to the definition of the functional floodplain and Flood Zone 3b, was based on the 2018 version of the hydraulic model.

5.29 In addition, the following recommendations were made:

> *There should be no increase in flood risk on site – i.e. floor levels should be raised about the 1 in 100 + 35% climate change uplift modelled flood level etc.*
>
> *There should be no increase in flood risk off site – flood compensation should be provided. Ideally this will be level for level where possible, but if this is not feasible, Oxford City Council have accepted floodable voids in the past, if in line with EA guidance.*
>
> *Safe access and egress should be demonstrated, as per DEFRA/EA criteria*
>
> *Flood resilience and resistance measures should be included in the design, as per DEFRA/EA and DCLG guidance*
>
> *Structures affecting the watercourse (as referred to in the EA pre-app) would still fall within 3b, therefore would be subject to objections*
>
> *A sustainable drainage strategy should be included in order to manage surface water from the new development.*

5.30 All of these elements have been addressed in the proposed scheme.

Principle of Development – Flood Zone 3b

5.31 This proposed development, excluding water compatible development, is located entirely to the north of the watercourse crossing the site. This is shown in the SFRA to be Flood Zone 3, with Flood Zone 3b only extending across the grounds from the south as far as the watercourse. Consequently, the proposed development is within Flood Zone 3a. However, the proximity of Flood Zone 3b has been the subject of concern from the EA in the past and therefore this is discussed further here.

5.32 It was previously agreed with the EA that the site, with the exception of the watercourse itself and the marshy/pond area, did not fall within the extent of Flood Zone 3b (functional floodplain). This was based on extensive negotiation related to records of historic flooding, comparisons of modelled flood extents, and a detailed statistical analysis of data available for the 2007 flood event, for which an estimated flood water level was extracted using photographic evidence. A detailed statistical analysis was undertaken, and it was determined that the 2007 flood event had a return period, based on the combined upstream gauged catchments, of no less than 17 years on the Thames, 82 years on the Cherwell and 75 years on the Evenlode, with the resulting overall return period in the region of between approximately 55 years and 500 years. The EA estimated the 2007 event to have between 10 and 50 year return period, however the 2014 event, which resulted in slightly less flooding on the site than in 2007 according to the available photographic

[25] Water Environment Limited (February 2023) Pre-application Flood Risk Statement reference 17014-FRA-TN-01 P01

archives, was described as a 25 year return period flood. Therefore, it was considered acceptable to use the 2007 event, and estimated flood level of 55.76m AOD, to define Flood Zone 3b.

5.33 However, national guidance was updated in August 2022 to consider the 30 year return period event as the starting point for Flood Zone 3b, rather than the 20 year return period event. This change was rolled into the OCC SFRA in November 2023. Although there has been no change in the technical definition of Flood Zone 3b, which is based on flooding mechanisms and essential flow pathways, the previous agreements, which were based on the starting point of the 20 year return period event, have been superseded by new national guidance. Clearly, the morphology of the watercourse and floodplain has not changed in this period, and therefore the extent of functional floodplain has not changed. Nevertheless, the theoretical basis has altered by guidance, and the previous arguments, whilst still valid, would need to be reconsidered.

5.34 The revised scheme places all vulnerable development on the north side of the watercourse crossing of the site. Although shown in Flood Zone 3 on national scale flood zone mapping, this area does not flood in the modelled the 1% annual probability flood event, including climate change, and therefore it may confidently be concluded that the proposed development lies outside Flood Zone 3b. This is except for the proposed boathouse which is potentially located within the functional floodplain as defined in the SFRA (it is not clear from the resolution of the maps in the SFRA), however, the boathouse is water compatible development and therefore compatible with Flood Zone 3b.

Flood Risk Mitigation Principles

5.35 It has previously been established that it is not possible to provide level-for-level flood storage compensation on the site due to the topography. However, it was previously agreed by the EA that so long as all storage is available at a low enough level, provision of full volumetric storage is sufficient to offset losses in floodplain storage and prevent displacement of flood water, so long as storage is freely floodable.

5.36 In addition, OCC has indicated that where it is not possible to provide level-for-level flood storage compensation, floodable space beneath the building may be considered acceptable floodplain storage, subject to specific safeguarding and conditions.

5.37 Therefore, this FRA demonstrates that the proposals would not increase flood risk elsewhere through the hydraulic model- by comparing pre- and post-development scenarios, coupled with provision of excess volumetric flood storage compensation.

6 ASSESSMENT OF FLUVIAL FLOOD RISK

Flood Zone Allocation

6.1 The Oxford SFRA identifies Flood Zone 3b "Functional Floodplain" as areas subject to flooding in events up to (and including) the 3.3% AEP design event. Areas that are previously developed are defined as Flood Zone 3b Developed. The results of the updated River Thames hydraulic model in the SFRA show that parts of the wider site (within the blue line) is at risk of flooding in the 3.3% annual exceedance probability (30 year return period) event, and as such, falls potentially within Flood Zone 3b.

6.2 As part of the extensive pre-application consultation with the EA, it was agreed that, based on evidence of historic flood extents provided by Grandpont House staff, and in consideration of there being a permanent waterbody crossing the grounds, only those areas that flooded in the 2007 event need be classified as Flood Zone 3b. This was based on a hydrological analysis demonstrating that the 2007 event return period exceeded 20 years. It was further agreed that, where development was proposed that did not overlap with the extent of flooding in the 2007 event (based on an agreed flood water level), the development would not be considered as lying within Flood Zone 3b.

6.3 Since the definition of Flood Zone 3b was agreed with the Environment Agency, the SFRA has been updated and the extent of Flood Zone 3b is now taken to be the 3.3% annual exceedance probability 30 year return period flood.

6.4 The proposed development takes place within the area north of the watercourse crossing of the site, on land that lies outside the modelled extent of the 30 year return period flood according to the SFRA mapping. As will be discussed later, this area is outside the modelled extent of flooding in the 1% AEP event including climate change, with full dry access to Oxford city centre, and therefore the development is located in Flood Zone 2. The only exception to this is the proposed boat house, which is located in the grounds, south of the watercourse crossing. This area of the site is designated as Flood Zone 3. Due to the nature of the boat house, and its design, this is acceptable.

6.5 The new flood water levels from the SFRA model were not made available for this study. Consequently, previously agreed flood water levels for the 1% annual exceedance probability event including the latest climate change allowance are used to assess flood risk. These were provided by the Environment Agency from the latest (2018) version of the hydraulic model, which is the same hydraulic model as was used in the SFRA.

Modelled Flood Water Levels

6.6 Flood water levels have been extracted from the hydraulic model of the River Thames, and are presented in Table 1. The 1D levels at the upstream node 47.079 are also presented, and are 20mm to 30mm higher than the site levels. This is because the 1D node is upstream of the site.

Table 1: Modelled maximum flood water levels

	5% AEP Flood Zone 3b	1% AEP – Flood Zone 3a			0.1% AEP Flood Zone 2
		Present Day	25% CC	35% CC	
47.079 (us)	55.97	56.16	56.31	56.41	56.43
Min on grounds	55.94	56.13	56.28	56.39	56.41
Max on grounds	55.94	56.14	56.29	56.40	56.42

6.7 The recommended allowances for climate change are based on River Management catchments. For all assessments, the central allowance should be applied over the lifetime of the proposed development. For Grandpont House, which lies within the "Gloucestershire and the Vale" management catchment, the central allowance to the 2080s (maximum allowance) is 26%. The EA has previously confirmed that it is acceptable to use a design flood water level of 56.29m AOD, please see written correspondence ENVPAC/WTHAMS/00504/WA/2021/128674/03-L01 dated 2nd November 2021 as follows:

> *"The modelled flood extents that impact this site as solely from the River Thames. The appropriate level to use in this location is therefore the 1 in 100 plus 26% level. Given that there is only a difference of 1% between the 25% and 26% we are satisfied with you using a conservative interpolation approach.*
>
> *In this location, the 1 in 100 plus 25% level is 56.28 metres (AOD) and the 1 in 100 plus 35% level is 56.38 metres AOD. Therefore, if you applied a conservative interpolation approach it would give you a 1 in 100 plus 26% flood level of 56.29 metres AOD."*

6.8 The topographic survey of the site shows that there is a continuous line of high land along the northern edge of the watercourse that prevents the development area from flooding up to a level of 56.38m AOD (approximately 100mm above the design flood water level). This is shown in Figure 5, which is an extract from the topographic survey with the 56.29m AOD contour marked as well as the extent of the 1 in 100 plus 26% flood based on ground levels.

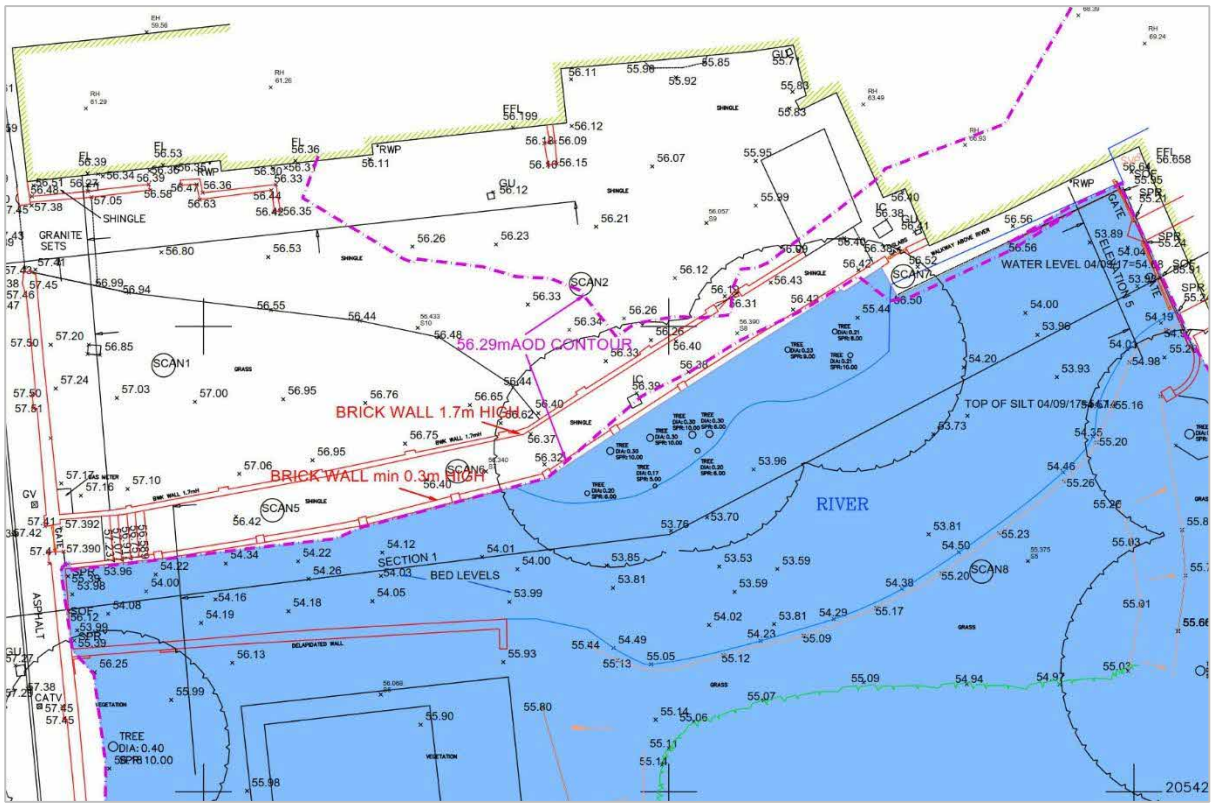

Figure 5: Topographic Survey and Flood Levels

6.9 The area of high land is the main pedestrian footway from Abingdon Road to the rear entrance of Grandpont House, which steps down from the road level of 57.41m AOD to 56.42m AOD. This pathway is then maintained at a level between 56.39m AOD and 56.42m AOD along its entire length, with a minimum level of 56.38m AOD close to Grandpont House, at a gate which allows

access to a raised walkway alongside the river, set at 56.52m AOD. This analysis of levels does not account for the 1.7m high brick walls that enclose the path on both sides- the inner (northern) side is 1.7m high, while the outer (southern) side varies in height, but is a minimum of 300mm. Although it cannot be assumed these walls have been structurally designed to withstand hydrostatic pressures, since the ground level is above the modelled water level, it is reasonable to assume that they are sufficient to prevent any flooding onto the site due to wind or spray causing flooding to exceed the design water level, and to prevent flooding at the lowest locations in the 1% plus 35% climate change events which could otherwise amount to up to 20mm.

6.10 The continuous building line along the northern boundary prevents flooding of the site from a northerly direction. Therefore, no flooding is expected within the development area in the 1% AEP plus climate change flood event. This includes the entire site, as well as access to Abingdon Road, both pedestrian and via the vehicular entrance, where ground levels are a minimum of 57.41m AOD, more than 1m above the design flood water level. Consequently, neither the site, nor the full extent of access north to Oxford city centre is expected to flood in the design event.

Assessment of Flood Risk

6.11 The modelled 100 year return period event including a 26% allowance for climate change is used to assess the risk of flooding. The design flood water level is 56.29m AOD.

6.12 TUFLOW has the capability to explicitly model flood hazard during the simulation. This is crucial, because flood hazard is a combination of water depths and flow velocity, described by the following formula as defined in the DEFRA UK "Flood Risks to People" guidance[26]:

$$Flood\ Hazard = d(v + 0.5) + DF$$

where d is the depth of flow, v is the velocity and DF is a debris factor between 0 and 1, varying depending on the likelihood of debris being present, and the potential for such debris to cause a hazard. In the default TUFLOW 2D engine, the debris factor is set to the "conservative" value from Table 3.1 of the Technical Report (TR1)[27], i.e. 0.5 for all flood depths up to 250mm, and 1 for all other flood depths. The TUFLOW control file for this model does not override this setting.

6.13 It is important to use the modelled flood hazard output to determine the spatial hazard, as opposed to simply multiplying maximum depth and velocity outputs, because the maximum depth and velocity do not necessarily occur simultaneously, and any calculation that relies on maximum depth and velocity results in isolation may over-estimate the actual flood hazard.

[26] DEFRA/Environment Agency Flood and Coastal Defence R&D Programme "Flood Risks to People" Phase 2: Guidance Document (FD2321/TR2), March 2006
[27] DEFRA/Environment Agency Flood and Coastal Defence R&D Programme "Flood Risks to People" Phase 2: Technical Report (FD2321/TR1), March 2006

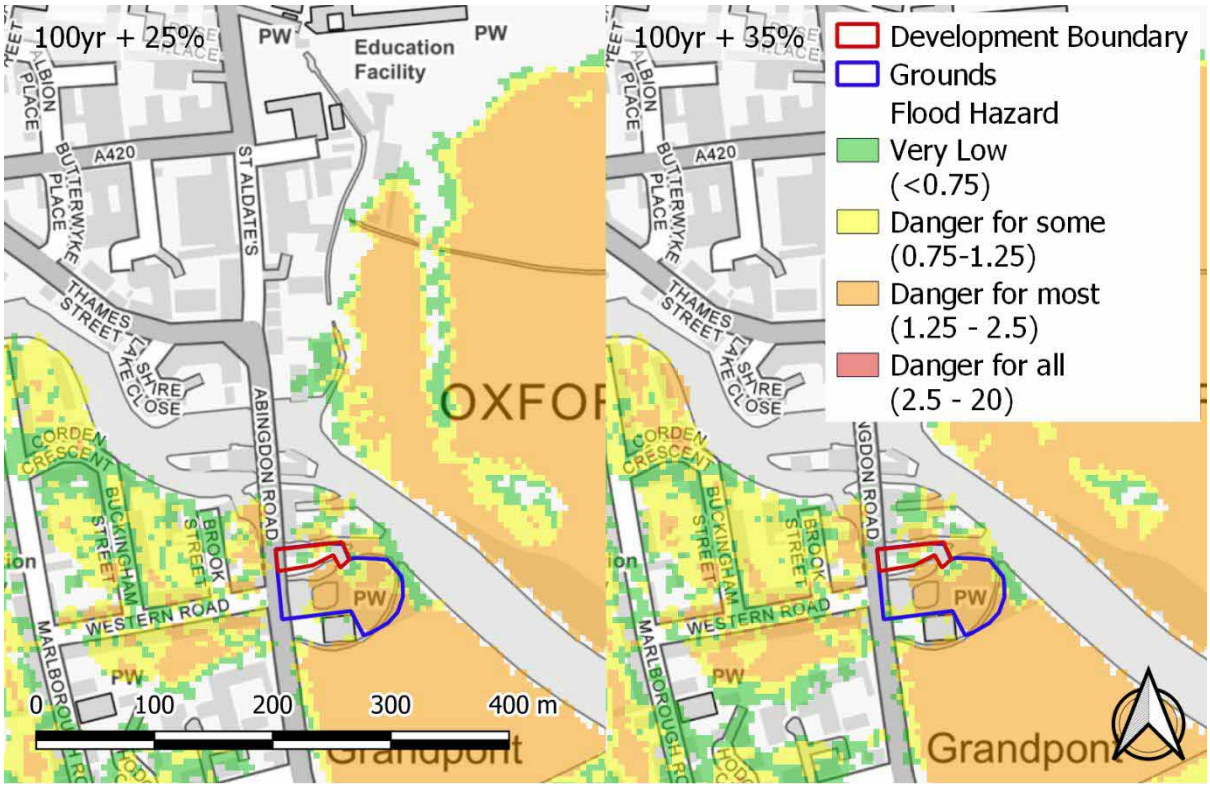

Figure 6: Modelled Flood Hazard

6.14 The hydraulic model indicates that the flood hazard rating for the site is negligible, including the entire area north of the on-site channel, access route to Abingdon Road, and Abingdon Road itself north into Oxford where essential services and evacuation centres can be accessed. Although areas of flooding are shown within the red line boundary, it has previously been demonstrated that this area does not flood. In terms of the access route and crossing of the River Thames, the hydraulic model shows that flood water does not overtop Folly Bridge, and therefore this access route remains safe.

Finished Floor Levels

6.15 It is noted that although the entire site is protected from flooding by surrounding high land and structures, there are some areas of the site that lie below the modelled design flood water level. The minimum level within the development area is 55.83m AOD (excluding localised depressed drainage gullys), which is 460mm below the anticipated flood level. Although the site is not expected to flood, flood mitigation should be incorporated into the design of the proposed development.

6.16 The existing ground floor level in the rear wing of Grandpont House is 55.95m AOD, and the ground floor finished floor level in the refurbished northern buildings will match this level. This is in accordance with EA Standing Advice, however, since floor levels will be below the modelled design flood water level, flood resilience should be incorporated into the design of these buildings to a level of 56.59m AOD (i.e. up to 600mm). A full structural survey will be required and where necessary, remedial works to any walls that are anticipated to withstand the hydraulic pressure on the north side must be completed as part of the proposal. Flood proof doors and glazing, along with other flood proof construction measures such as raised utilities, airbrick covers and flood proof construction materials are also recommended where these measures would not conflict with the heritage constraints of the listed building. The minimum ground floor finished floor level in the front wing of Grandpont House is 56.72m AOD.

6.17 Detailed flood resistance measures should be designed following planning approval as they will depend on the final detailed design of the building and can dealt with via a suitably worded planning condition. Measures will be designed in accordance with the latest CIRIA code of practice for property flood resilience (C790).

6.18 The proposed boathouse is water compatible development. The boathouse will be raised with respect to the design flood water level of 56.29m AOD. Flood water will be able to flow underneath, such that the development will not adversely affect flooding elsewhere. In order for this to be achieved, the soffit level of the ground floor slab will need to be raised to a minimum of 56.29m AOD, which is 370mm above the existing ground levels shown in the boathouse section drawings. These drawings are included in the appendix.

Impact on Flood Risk On Site

6.19 The design of the proposed extension and refurbishment will result in an increase in the number of bedrooms, however the building will be better configured and all bedrooms will have internal access onto the higher parts of the site. The number of bedrooms at ground floor will remain the same.

Impact on Flood Risk Off Ste

6.20 The increase in building volume on the existing house is not anticipated to result in a reduction in floodplain storage since the development area is not currently expected to flood. As a result, there will be no displacement of flood storage and no obstruction of flood flows.

6.21 The boathouse will be constructed to be open on all four sides in accordance with EA guidelines. Void openings will extend from existing ground level to at least 56.29m AOD. The boat house will be open plan. Any boat racks or storage areas will be raised at least 410mm above the ground to ensure there is no loss in floodplain storage within the building. Floor levels in the boat house will be at existing ground levels or lowered where it is necessary to level the ground floor. These measures will ensure that flood storage is not lost as a result of the boathouse, and increased between the levels of 55.88m AOD and 56.29m AOD.

6.22 The proposal will not result in any new areas of hard-standing across the proposed footprint at adjacent to the existing house which is all currently either roof or hard standing ground. The existing driveway will be repaved, and the extent increased. In addition, the new boathouse roof and surrounding areas will be hard surfaces. The proposed sustainable drainage strategy will ensure there is no impact offsite as a result of the introduction of new hard surfaces on the site.

Safe Access and Egress

6.23 As discussed above, safe access is available north from the site on Abingdon Road to Oxford City Centre. This area is not modelled to flood in any event up to and including the 0.1% AEP flood event, which includes the 1% AEP flood events including 35% and 70% climate change. This access is therefore completely dry, and affords routes for both pedestrians and vehicles in both directions.

6.24 Within the site, all vulnerable development is located north of the watercourse that crosses that site. As discussed, this area is entirely surrounded by high land plus brick walls, and will therefore also remain dry. Further, there is internal access from all rooms to the entrances at the west of the former service wing, where ground levels are around 56.31m AOD. Consequently, there is continuous access from all parts of the building onto land at a level above the design flood water level, from where Abingdon Road, at a level of 57.43m AOD, may be reached.

Structures Affecting the Watercourse

6.25 There are no new structures proposed that will affect the watercourse.

7 SURFACE WATER MANAGEMENT

Policy

7.1 The proposed development is not "major development", however, OCC policy does require the inclusion, where possible, of SuDS as a means of managing surface water drainage.

7.2 For non-major development, the policy requirements related to surface water management are substantially reduced, in that LLFA policy and the Technical Standards do not apply. Nevertheless, through OCC policy and in accordance with the NPPF, it is necessary to demonstrate that surface water runoff rates and volumes do not increase as a result of development.

7.3 Within the OCC area, adopted local plan policy RE4 specifically requires for all development proposals: *proposals will be required to manage surface water through SuDS or techniques to limit run-off and reduce the existing rate of run-off on previously developed sites*.

7.4 Consequently, OCC policy requires surface water runoff rates to managed such that the rate of runoff is reduced.

Existing Site Runoff Characteristics and Drainage

7.5 The site covers an area totalling 0.536ha, and is currently occupied by Grandpont House, comprising the existing house (study, lounge and dining areas at ground floor) and former stables refurbished for study, dining and laundry. The driveway is partly permeable shingle but formally drained through a series of gullys as indicated on the topographic survey. The ground cover in the area proposed for the boathouse building is grass and vegetation.

7.6 According to Thames Water there is no formal connection to the public surface water sewer in Abingdon Road, the head of which is close to the southern boundary of the site. It is understood that surface water runoff currently discharges from the existing roofs and hardstanding areas, including the driveway, directly to the River Thames. The remainder of the undeveloped parts of the site is predominantly flat and it is likely that rainfall collects on site before discharging to the river at Greenfield rates or infiltrating into the ground.

7.7 In order to assist with the development of the new outbuilding, greenfield runoff rates for the site have been calculated using the UK SuDS online tool[28] through the use of the IH 124 estimation method and a total site area of 0.536 ha. The greenfield runoff rates for the 1 year, 30 year, and 100-year rainfall event have been calculated as 0.74 l/s, 1.99 l/s and 2.76 l/s respectively. A copy of this Microdrainage calculation spreadsheet is included in the appendix.

Post-development Runoff Characteristics

7.8 The proposed development will result in a gross increase in roof area on the site due to the introduction of the extension building, however the extension is located over an existing section of driveway which is already drained and the roof runoff from the extension will be connected into the existing drainage system with no increase in rate or volume. New path and driveways will be constructed from permeable materials, thus maintaining the current infiltration patterns on the remainder of the site.

7.9 The philosophy of the drainage design (which will be undertaken at the detailed design stage of planning), will be to maintain the existing conditions wherever possible. Thus, drainage on areas of the site where no external alterations are proposed (such as refurbishment of the Grade II* listed building) will remain as existing in terms of drainage infrastructure.

[28] https://www.uksuds.com/tools/greenfield-runoff-rate-estimation (accessed 15/12/2023)

7.10 The total new boathouse development area is 134.3m^2, which includes timber decking and a new boathouse. The decking area which will be placed on top of gravel and as such can be considered permeable. The total impermeable area is therefore the footprint of the boathouse, which is 60.5 m^2, approximately 0.006 ha. This is 1.12% of the total site area, which means that the equivalent greenfield runoff rate is 0.003 l/s. This greenfield rate is far too low to be attenuated to, as such a rate of 2 l/s will be used.

Discharge Hierarchy

7.11 SuDS best practice and national guidance recommends that the ultimate discharge of surface water from a site should follow the discharge hierarchy, which seeks to discharge first to ground (thus reducing "runoff" to zero), then to local watercourses and finally to public sewers, with surface water sewers preferred over combined or foul infrastructure. The discharge hierarchy should also be considered, the Planning Practice Guidance states:

> *"Generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:*
>
> 1. *Into the ground (infiltration)*
> 2. *To a surface water body;*
> 3. *To a surface water sewer, highway drain or another drainage system;*
> 4. *To a combined sewer."*

7.12 In this case, although it would be notionally possible to discharge to ground, the proximity to the river is such that the level of the groundwater within the permeable superficial deposits at the site will be at or close to the ground surface. As such, the use of infiltration devices to dispose of groundwater would not be technically possible whilst maintaining the required depth to groundwater.

7.13 Since discharge by infiltration is not possible, new drained areas (specifically the proposed new building) will be collected and discharged to the pond which will be connected to the River Thames at an attenuated rate, in accordance with the discharge hierarchy, set out in Table 2.

Table 2: Summary of Discharge Hierarchy

Outfall	Practicable	Proposed	Notes
Into the ground (infiltration)	×	×	Shallow groundwater and the proximity of the river means that it is not technically feasible to discharge to ground.
To a surface water body			Discharge to the River Thames is the most viable option.
To a surface water sewer		×	Not required
To a combined sewer	×	×	Not required

Sustainable Drainage Systems (SuDS)

7.14 The aim of SuDS is to emulate natural drainage processes such that watercourses and storage areas receive the hydrological profiles under which they evolved, and that water quality in local ecosystems is protected or improved. The best practice guide[29] states that SuDS will:

Reduce the impact of additional urbanisation on the frequency and size of floods;
Protect or enhance river and groundwater quality;
Be sympathetic to the needs of the local environment and community; and
Encourage natural groundwater recharge.

Table 3: SuDS Hierarchy[30]

	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
Most Sustainable	Green roofs (source control)			
	Basins and ponds 1. Constructed wetlands 2. Balancing ponds 3. Detention basins 4. Retention ponds			
	Filter strips and swales			
	Infiltration devices 5. Soakaways 6. Infiltration trenches and basins			
	Permeable surfaces and filter drains 7. Gravelled areas 8. Solid paving blocks 9. Porous paviors			
Least Sustainable	Tanked systems 10. Over-sized pipes/tanks 11. Box storage systems			

7.15 SuDS design for development should always fit within the overall runoff control framework (known as the SuDS Management Train) and prioritise those elements that fall as close to the source as possible. In order of priority:

Source control – including storage for re-use, recreation and irrigation and the use of permeable surfaces to reduce initial runoff such as gravel, porous paving and soft landscaping;
Site control – reducing rates of runoff on a site-by-site or sub-catchment basis using flow-through storage features, particularly those that promote infiltration, evapotranspiration and evaporation prior to discharge into a wider control system, using flow limiting devices if necessary; and
Regional control – reducing the final discharge from a surface water management area using a controlled final outfall and associated upstream storage structures.

[29] CIRIA (2001), *CIRIA C523:* Sustainable Drainage Systems – Best practice.
[30] http://www.sustainabledrainagecentre.co.uk/suds-hierarchy_c2236.aspx Retrieved 02/11/2016

7.16 In this case, the areas of runoff are small, and source control is therefore the preferred management method.

7.17 Table 3 shows the hierarchy of specific SuDS components for site and regional control elements of the SuDS management train. The SuDS components that are proposed to manage surface water for the development will be discussed in relation to this hierarchy.

7.18 In order to attenuate surface water runoff, green roofs will be implemented, subject to conservation and structural constraints.

7.19 Basins, filter strips and swales are not suitable due to a lack of available space, and the proposal does not include additional hard surfaces aside from the roofs- though it is recommended that any refreshed or re-laid paving is of permeable construction.

7.20 Infiltration is not viable for the site due to anticipated high groundwater levels, as indicated in the Oxfordshire Council SuDS guidance document.

7.21 Surface water from the roof will be attenuated prior to discharge at a restricted rate to the River Thames (subject to the necessary approvals from the Environment Agency for discharge to a Main River).

Table 4: Summary of Proposed SuDS Relative to SuDS Hierarchy

SUDS Technique	Practicable	Proposed	Notes
Green roofs, Blue roofs, rainwater collection systems, Bioretention areas, Tree pits			Rainwater collection will be incorporated into the roof water collection system where practicable.
Basins and ponds			Marshy/pond area will provide additional storage below the flood storage level for surface water if required.
Filter strips and swales	×	×	Insufficient space available on the site
Infiltration devices	×	×	Insufficient depth to groundwater and proximity to river
Permeable surfaces and filter drains			Any replacement paving should be of permeable construction
Tanked systems			Where insufficient storage can be located within the site

7.22 Surface water runoff will be attenuated to the lowest practicable rate, to comply with local policies and ensure no detrimental impact on the frequency and extent of flooding elsewhere because of the development.

Proposed Surface Water Drainage System

7.23 The only development proposal which could increase surface water runoff is the boathouse.

7.24 Since the site of the boathouse is located within the floodplain, there is little space available for surface based runoff attenuation features, although water will be discharged to the low-lying marshy area on the site which will be formalised as part of the proposals to form a pond. Further,

due to the relatively flat nature of the site and high groundwater levels in the area, sub-surface attenuation features are likely to be difficult to implement.

7.25 The proposed drainage design shows that surface water would be collected and discharged to the pond.

7.26 Calculations were carried out in Microdrainage (available in the appendix) and showed if the runoff from the proposed boathouse flows into the onsite pond without restriction, a volume of only 0.6 m^3 would be required to achieve the theoretical minimum practicable rate of 2l/s. There is sufficient space in the pond to accommodate this.

7.27 The detailed design of the drainage system should ensure no increase in runoff rates at any return period up to and including the 100 year return period flood plus a 40% allowance for climate change.

Drainage Exceedance

7.28 Exceedance of the onsite drainage system will not create a risk of flooding on the site or elsewhere since it will discharge directly to the pond. Exceedance flows will be extremely small in the context of overall flood volumes.

Effect on Flood Risk Elsewhere

7.29 Subject to attenuation of surface water runoff in the pond, accounting for the impact of climate change, there will be no change in the rates or volumes of surface water runoff and there will be no impact on the risk of flooding elsewhere due to surface water.

SuDS Management and Maintenance

7.30 Management and maintenance of the drainage will be the responsibility of the occupier. Management and maintenance agreements and plans will be arranged prior to completion of development. The SuDS Manual provides details for maintaining SuDS with requirements set out for each type of SuDS component.

7.31 The CIRIA guidelines are generic and provide advice only. Management and maintenance of the drainage should be carried out in accordance with the guidance and specification provided by the supplier of each SuDS component.

8 FOUL WATER MANAGEMENT

Existing Foul Drainage System

8.1 There is an existing connection from the site to the existing Thames Water foul sewer on Abingdon Road. The Thames Water asset plans are shown in the appendix.

Proposed Foul Drainage System

8.2 The development is an extension and will result in only minor amendments to private drainage. There will be no change to the existing connection to the public sewer in Abingdon Road.

8.3 The boat house includes two WC's and two wash-hand basins. Subject to agreement with Thames Water post-planning, it is proposed to connect wastewater from the boathouse to the public sewer in Abingdon Road via a new connection.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 The 0.5ha site occupied by Grandpont House, an 18th century building, and associated ancillary use buildings and grounds is located within Flood Zone 3 of the River Thames and is at potential risk of fluvial flooding. A minor channel of the River Thames, as well as the Hogacre Ditch, form significant features within the site. There is no significant risk of flooding from other sources independent of the fluvial flood risk.

9.2 Grandpont House is used for educational, religious and cultural activities for students and as a small university residence, and proposals are to expand the existing facilities by constructing an extension building on the western part of the site close to Abingdon Road. Provision of modern accommodation, as well as enhanced facilities, is crucial to ensuring long-term viability of the Grade II* listed building which is to be suitably refurbished as an integral part of a single sustainable project. The proposed scheme is focussed on refurbishment and minor infill extension of the existing buildings to provide these facilities.

9.3 The proposals have been the subject of extensive consultation with the Environment Agency (EA) and Oxford City Council (OCC). Consequently the proposals have been designed specifically to be sympathetic to the watercourses and associated habitats on the site, and particularly with reference to the risk of flooding. This includes the enlargement of an existing area of low-lying marshy ground towards the centre of the site alongside the channel through the site to enhance the ecology of this area and to provide additional flood storage.

9.4 The latest EA hydraulic model shows the grounds of Grandpont House, south of the watercourse, to lie within the extent of the 20 year return period flood. An update for the SFRA shows this area to also lie in the 30 year return period flood extent. In accordance with the National Planning Policy Framework (NPPF), observations on site have been used to supplement the understanding of the functional floodplain, and it was agreed with the EA that the extent of Flood Zone 3b was limited to the extent of the historic 2007 flood. However, national policy, incorporated into the latest SFRA for Oxford, revised the starting point for assessing Flood Zone 3b from the 20 year to 30 year flood. Although there has been no change in the morphology of the watercourse, this does affect the basis for the agreement.

9.5 Although the area south of the watercourse is designated by the SFRA mapping as Flood Zone 3b, the area north of the watercourse does not flood even in the 100 year return period flood including climate change. The proposed refurbishment and extensions take place entirely within this area, which also has dry access to Oxford city centre and out of the floodplain via Abingdon Road throughout the design flood event. This area is officially designated as Flood Zone 3, however comparison of site levels with modelled flood levels show that this area does not lie within the 100 year flood used to define Flood Zone 3.

9.6 Guidance on climate change allowances and their application in planning and building design have recently been revised, and the required allowance for climate change for the site is 26%. The hydraulic modelling uses the previous allowances of 25% and 35%, and the EA has agreed to a linear analysis to determine the 26% allowance, with the design flood water level agreed to be 56.29m AOD. Since there is no essential infrastructure at risk of flooding in hydraulic continuity with the site, the 26% allowance is also used to assess impact.

9.7 The proposed development is located on land that will not flood in the design 100 year return period flood event plus 26% climate change allowance. Finished floor levels will be set to match the existing floor level in Grandpont House, and therefore flood resistant construction is required, including an assessment, and reinforcement if required, of the existing building structures along the north boundary of the site. Flood resistance will be designed to a minimum level of 56.59m AOD, incorporating a 300mm freeboard into the design.

9.8 The proposed development will not occupy flood storage, since the extension and all associated structures will be built entirely within the part of the site that does not flood in the design event, as well as within the existing building curtilage. The proposed boathouse that will be built in the grounds will be a raised structure with ground floor levels above the modelled design flood water level of 56.29m AOD.

9.9 Surface water will be collected from the roof of the boathouse and discharged to the pond, which is designed to be able to accommodate the additional 0.6 m^3 of volume required.

9.10 Subject to the measures included within the design and described in this report, the proposed extension will be safe, without increasing the risk of flooding elsewhere.