APPENDIX B: CORRESPONDANCE

Environment Agency letter dated 21 April 2009

Environment Agency letter dated 22 November 2010

Environment Agency letter dated 24 January 2014

Oxford City Council Flood Risk and Drainage Planning application response dated 17 October 2016 (Application reference 16/01978/PAC)

Oxford City Council Flood Risk and Drainage Planning application response dated 9 January 2017 (Application reference 16/01978/PAC)

Environment Agency letter dated 17 July 2017

Oxford City Council Planning and Regulatory Services letter dated 19 March 2019 (Ref: 18-03132-LBPAC)

Water Environment Ltd (3rd June 2021) 2007 flood event assessment

Environment Agency letter dated 24 June 2021 (Reference ENVPAC/WTHAMS/00504/WA/2021/128674/02-L01)

Water Environment Ltd (October 2021) Flood Risk Assessment reference 17014-FRA-RP-01 P02

Environment Agency letter dated 02 November 2021 (Reference ENVPAC/WTHAMS/00504/WA/2021/128674/03-L01)

Water Environment Limited (March 2022) Flood Risk Assessment Reference 17014-FRA-RP-01 C01

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

Mr Guy Laister
Water Environment Ltd
165 The Broadway
London
SW19 1NE

Our ref: WA/2008/104132/03-L01
Your ref: -

Date: 21 April 2009

Dear Mr Laister

EXTENSION OF EXISTING GRANDPONT HOUSE BUILDING TO PROVIDE LIBRARY, CHAPEL, SEMINAR AND STUDY ROOMS, TOGETHER WITH ACCOMMODATION FOR NEA STAFF AND STUDENTS.
GRANDPONT HOUSE, OXFORD.

Thank you for your consultation, which we received on 1 April 2009.

Environment Agency position
We have reviewed the submitted information and find it to be unsatisfactory. We would like to comment as follows.

If we were to receive this information from the Local Planning Authority as part of a planning application we would **maintain our objection** to the proposed development.

For clarity I will divide my response into the following headings:

- Drainage and Flood Risk
- Waterways
- Groundwater and Contaminated Land

Drainage and Flood Risk
We would agree sufficient evidence has been submitted to show that the site is not within Flood Zone 3b (functional flood plain). However we still consider the site to lie within Flood Zone 3a. As such it must be demonstrated that the development will not increase flood risk elsewhere in accordance with Planning Policy Statement 25: 'Development and Flood Risk' (PS25). It has been confirmed previously and again in this email that level for level compensation, required by the Environment Agency to ensure the development will not increase flood risk, can not be provided. The raising of a section of the building up to first floor level does not remove the need for this area to be compensated for as the area may be infilled in future or used for storage, removing

the area from the flood plain.

While it is recognised that you have made considerable efforts to overcome this objection, without level for level compensation or evidence that the scheme would reduce overall flood risk in the area this proposal is still contrary to PPS25.

Waterways
There is a Right of Navigation wherever Thames Water flows. We will only support this proposed development if the existing railings blocking the culverts under Grandpont House are removed in order to allow canoeists to use this backwater. Any new areas over which Thames Water is flowing will carry similar Rights of Navigation which must be recognised and accepted without inhibition.

Groundwater and Contaminated Land
If soakaways are proposed for drainage from the car parking areas then this surface water should be passed through a suitable type of oil/grit separator, the design of which shall be to the satisfaction of the Environment Agency.

Yours sincerely

Miss Juliane Hedel
Planning Officer

Direct dial 01491 828 486
Direct fax 01491 834 703
Direct e-mail [redacted]

End

Mr Guy Laister
Water Environment Ltd
165 The Broadway
London
SW19 1NE

Our ref: WA/2008/104132/05-L01
Your ref: -

Date: 22 November 2010

Dear Mr Laister

EXTENSION OF EXISTING GRANDPONT HOUSE BUILDING TO PROVIDE LIBARY, CHAPEL, SEMINAR AND STUDY ROOMS, TOGETHER WITH ACCOMMODATION FOR NEA STAFF AND STUDENTS.
GRANDPONT HOUSE, OXFORD.

We have assessed the findings of the approved modelling report by Water Environment dated July 2010.

The key conclusions of the modelling report are:
· The 1 in 100 year flood level with an allowance for climate change (the design flood level) has been refined to be 56.44mAOD, 190mm lower than the Environment Agency's previous 1 in 200 year flood level (in the absence of a modelled 1 in 100 year flood level with an allowance for climate change, the 1 in 200 year level has been used as a substitute for this).
· The proposed development would have a negligible impact on flood levels. This was the case even when the building was represented as a solid wall across the floodplain in the model, ignoring flow routes through the floodable voids and the flow route around the south of the building.

We have previously accepted that the site is not in Flood Zone 3b, the functional floodplain.

The flood substitution/mitigation measures proposed as part of the development are:
· Volume-for-volume flood storage compensation for the entire ground floor footprint of the building.
· Floodable voids up to the design flood level.

We are generally opposed to the use of floodable voids to mitigate losses in flood water storage due to their tendency to become blocked over the lifetime of developments and cease to operate as designed. For this reason, we would be opposed to the reliance on floodable voids to mitigate losses in flood water storage.

Where there is a loss of flood water storage, level-for-level compensation is normally required. This is the replacement of volumes lost from the flood plain through development with new flood plain volume, by reducing nearby ground levels. The compensatory volume must be at the same level (within reasonable working limits) as the lost storage.

For this development, volume-for-volume flood compensation is proposed to substitute the storage lost from the footprint of the new building (ignoring the floodable voids). Volume for volume storage replaces the lost volume, but not necessarily at the same topographic level. Providing low level compensation to match high level development or vice versa affects how the compensatory flood plain operates relative to the pre-development condition of the site, and therefore doesn't replicate the natural behaviour of the flood plain. For this reason we are usually opposed to the use of volume-for-volume flood storage compensation.

Although we are normally opposed to the use of floodable voids or volume-for-volume compensation to mitigate losses in flood water storage, we are inclined to accept the principle of a combination of both of these mitigation techniques in this instance for the following reasons:
· If the voided flood storage performs as designed (does not become blocked) over the lifetime of the development, there will be a flood risk benefit because the volume of flood storage taken up by the proposed building has also been compensated for through the lowering of land on the site.
· Detailed hydraulic modelling has been carried out to demonstrate that even if the voids become completely blocked, the development (with volume-for-volume compensation) will have negligible impact on flood levels in the surrounding area.
· The hydraulic modelling has redefined the design flood level in the Environment Agency model to be 190mm lower, meaning that the depth of water that would inundate the footprint of the building is considerably lower than previously accepted.

Overall, we are confident that the mitigation measures proposed (if correctly designed) will ensure that the development will not increase flood risk.

Considering the improvements to the Environment Agency's hydraulic model have now been signed off, we find no reason for the redefined flood levels from the model not to be used in the design of the proposed development.

Your email, dated 02 November 2010, outlines that the wing of the building to the east, raised on stilts to first floor level in the current plans, is likely revert back to ground floor level now that the entire footprint can be compensated for. We would prefer this wing to remain at first floor level because the flood storage available underneath is far less likely to become blocked than if the wing is dropped to first floor level and voided.

In summary, we are in agreement over the principle of the proposed flood risk mitigation measures and see a positive way forward with this development that will not increase flood risk.

A PPS25 compliant flood risk assessment should now be submitted which develops the proposed mitigation measures to a more detailed. The FRA should include details of:
· the detail of voids (we can provided guidance on this).
· the volume-for-volume compensatory storage.

Cont/d..

· the finished floor levels of the buildings.

Yours sincerely

Mrs Cathy Harrison
Planning Liaison Officer

Direct dial 01491 828515
Direct e-mail [redacted]

End

Mr Guy Laister
Water Environment Ltd
165 The Broadway
London
SW19 1NE

Our ref: WA/2008/104132/06-L01

Date: 24 January 2014

Dear Mr Laister

PROPOSAL TO EXTEND THE CURRENT FACILITIES TO INCLUDE A LIBRARY, CHAPEL, STUDY ROOMS AND ACCOMMODATION FOR STAFF AND STUDENTS. (MODEL PREVIOUSLY SUBMITTED)
GRANDPONT HOUSE, OXFORD.

Thank you for consulting us on this matter. We received your letter and FRA (CD) on 23 December 2013 and we are now in a position to respond.

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. I'm also aware that you have discussed the submitted report with my colleague Nick Read on 24 January 2014. The key points of that discussion are outlined below:

The use of volumetric compensatory floodplain storage has been discussed and agreed, in conjunction with the implementation of a voided building design. Please can you confirm that the Ground Lowering shown on the plans within Appendix B is formal compensatory storage areas and that this provides the volume required to offset the potential lost storage associated with built development within the design flood extent. We understand that this has been considered but the final design of these areas has not yet been implemented - we appreciate the final design and landscaping of these features could be undertaken at a later stage in the design process but the FRA will need to confirm that the proposals are achievable.

The elevations shown on the Oxford Architects plans in Appendix B provide details of openings into the under floor void beneath the building. There is no standard design for void openings as such but we understand that around a 20% opening along each side of the building is proposed in this instance. If it is feasible we would recommend that additional openings are provided to reduce the impact of flood flows within the site. The LPA will need to be consulted to ensure they are willing to accept the inclusion of voids within the design of the building.

The Local Authority will need to be consulted to confirm whether they are willing to impose and enforce a planning condition to ensure the voids remain open over the lifetime of the development. We recommend the applicant develops a maintenance plan to ensure the voids remain open for the life time of the development.

You should note that we are currently undertaking new hydraulic modelling in this area which may affect flood levels locally. Updated information should be requested from our Customers and Engagement team on WTEnquiries@environment-agency.gov.uk We would not anticipate that additional modelling work would be required to establish accurate flood mechanisms across the site as this work has previously been undertaken.

Yours sincerely,

Mr Jack Moeran
Planning Advisor

Direct dial 01491 828367
Direct e-mail planning-wallingford@environment-agency.gov.uk

cc Water Environment Ltd

Please note that the view expressed in this letter by the Environment Agency is a response to a pre application enquiry only and does not represent our final view in relation to any future planning application made in relation to this site. We reserve the right to change our position in relation to any such application.

You should seek your own expert advice in relation to technical matters relevant to any planning application before submission

End

Planning and Regulatory Services
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E-mail: heritage@oxford.gov.uk

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109 St Aldate's
Oxford OX1 1DS

www.oxford.gov.uk
OXFORD CITY COUNCIL

Netherhall Educational Association
C/o Stephen Tsang
31 Stewart's Grove
London
SW3 6PH

Date: 19th March 2019
Your ref:
My ref: 18-03132-LBPAC
Please ask for: Gill Butter
Telephone: [redacted]
Email:

Dear Mr. Tsang

APPLICATION: 18/03132/LBPAC

PROPOSAL: Extension to Grandpont House, Abingdon Road

AT: Grandpont House, Abingdon Road

Thank you for your letter and plans received on 30th November 2018 which seek an informal opinion **solely on flooding and tree issues** on the above-mentioned work to a listed building. The submission fails to include any supporting information on the historic environment and I am therefore unable to comment on this matter. Previous pre-application submissions have omitted to seek both heritage and design advice both of which are fundamental matters in consideration of any development on this very important site. Grandpont House itself is listed grade II* and is a distinctive late C18 building sited in a visually prominent location both from Abingdon Road but also significantly from The River Thames and Christchurch Meadow on the northern bank of the river. The building also falls into the setting of Folly Bridge, importantly one of the key river crossings into the city, identified as a Saxon causeway and which forms part of a scheduled ancient monument with archaeological significance.

I am therefore unable to stress sufficiently how important it is that you seek both heritage, including archaeological and design advice from the decision making authority prior to making applications for planning permission and listed building consent for any extension to Grandpont House.

The advice contained in this letter purely relates to issues of flooding and trees as you have requested. I am simply forwarding the advice received from the appropriate consultants but you should bear in mind they form only two of very many issues that would need to be weighed in the balance when reaching a decision on an application as suggested and there are other issues that are likely, given current case law to have considerably greater weight. I have included a more comprehensive list of planning policies and statutory instruments together with emerging SPD's that will also be important to consider in your design development.

Policy considerations

Any proposal submitted for consideration and determination by the Local Planning Authority would be assessed in accordance with the statutory duties and planning policy obligations set out in the following documents:

Planning (Listed Buildings and Conservation Areas) Act 1990
National Planning Policy Framework (NPPF)
Oxford Local Plan 2001-2016
Oxford Core Strategy 2026
Sites and Housing Plan 2026
Emerging Local Plan 2036
Central (City and University) Conservation Area Appraisal – consultation draft

In this particular case the relevant policies set out in the planning policy documents would be:

- NPPF: paragraphs 38-50, 124-132, 189 - 202
- Oxford Local Plan 2001-2016:
  - HE.2 Archaeology
  - HE.3 Listed Buildings and their Setting
  - HE.4 Archaeological remains within Listed Buildings
  - HE.5 Fire Safety in Listed Buildings
  - HE.7 Conservation Areas
  - HE.8 Important Parks and Gardens
  - HE.11 Architectural Lighting
  - CP.1 Development Proposals
  - CP.6 Efficient use of land and density
  - CP.8 Designing development to relate to its context
  - CP.9 Creating Successful New Places
  - CP.10 Siting of Development to meet functional needs
  - CP.11 Landscape Design
  - CP.20 Lighting
  - NE.15
  - NE.16
- Oxford Core Strategy 2026:
- CS2 Previously developed and greenfield land
- CS9 Energy and natural resources
- CS10 Waste and recycling
- CS11 Flooding
- CS12 Biodiversity
- CS14 Supporting city-wide movement
- CS17 Infrastructure and developer contributions
  - CS18 Urban design, townscape character and the historic environment
  - CS19 Community safety
  - CS25 Student accommodation

The new emerging Local Plan 2032 is currently out to public consultation with a view to submitting for examination in March 2019. Policies DH1 and DH3 are a material

consideration in this case and show a direction of travel for the Council in terms of heritage.
There are also emerging policies in terms of trees, flooding and design that will need to be taken into consideration in determining applications should they be submitted.

- Oxford Local Plan 2036 – Proposed Submission Draft:
  - DH1 High quality design and placemaking
  - DH3 Designated heritage assets

In preparing documents to support an application for listed building consent it is particularly important for an applicant and or those acting on their behalf to bear in mind the requirements of applicants set out in paragraph 189 of the NPPF.

All of these documents can be viewed online and I recommend that you view those related to the NPPF and Oxford's Local Plan at the following addresses:

http://planningguidance.communities.gov.uk/blog/policy/
http://www.oxford.gov.uk/PageRender/decP/Planning_Policy_occw.htm

Flooding Issues
The general principle of the approach taken to manage flood risk is acceptable, however there is one slight issue in that since the previous pre-app was undertaken, the Environment Agency have updated the Thames in Oxford Flood Model. In fact it has been updated twice since, in 2016 (released 2017), and I believe the 2018 model data has recently been released.
The flood risk assessment to be submitted with the application should obtain the latest model data from the EA, and demonstrate using this that the site is not within Flood zone 3b. These levels should also be used for calculations re: flood compensation as per the points below. The updated EA model contains more data than the 2014 model – so hopefully this should mean less detailed work will be needed to demonstrate the site is outside flood zone 3b.
It would also be recommended to seek an updated pre-app with the EA using the most recent model data to seek their approval.
Assuming the above be demonstrated, then then the other advice given in pre-app responses from both Oxford City Council and the EA would still apply. In particular:
- 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 (attached).
- 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, as linked to below:
https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zones-2-and-3#extra-flood-resistance-and-resilience-measures
https://www.gov.uk/government/publications/flood-resilient-construction-of-new-buildings
- 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. Requirements can be found in Oxford City Council SuDS Design Guide, which is available at www.oxford.gov.uk/floodriskforplanning

Void Design Info.pdf

Arboricultural issues

I am concerned that the foot-print of this proposed build will conflict with retained trees; in particular, trees along the western, Abingdon Road, boundary.
However I am unable to make a detailed assessment at this point because,
(1) the tree report drawing or schedule do not include information of the crown spreads of the trees at their cardinal points,
(2) the tree report drawing does not include information of the Root Protection Areas in all instances.
These are survey data as required in accordance with BS.5837;2012- Trees in relation to design, demolition and construction- Recommendations.
A separate Tree Constraints Plan drawing (with proposed built-form layer) is necessary.

Other considerations

Archaeology

As the site is within the city centre archaeological area / an area of archaeological interest and your proposals would involve significant breaking of the ground, an archaeological assessment of the area would be required as part of a formal application. For more information please see policy HE.2 of the Oxford Local Plan: http://www.oxford.gov.uk/PageRender/decP/Planning_Policy_occw.htm.

Historic Parks and Gardens

As your proposals would affect a *nationally / locally* registered historic park and garden *(insert name)*, you are advised to contact the Oxfordshire Gardens Trust for further advice and information: http://ogt.org.uk/planning.

Conclusion

In summary, officers are unlikely to be able to support your proposal without amendments/further information as set out in the comments relating to the two topics for which you have requested advice.

I hope that this information will be of assistance to you. This advice is for guidance only and does not bind the formal consideration of any listed building consent application by the Local Planning Authority.

Yours faithfully,

Gill Butter
Conservation and Urban Design Officer
For and on behalf of
ADRIAN ARNOLD
Acting Head of Planning Services
Please quote reference number in all communications

INVESTORS IN PEOPLE | Gold

Flood Risk and Drainage

Planning application response

Planning Reference: 16/01978/PAC

Location: Grandpont House, Abingdon Road, Oxford

Description: Student halls of residence

Technical Officer: M. Bunn

Response Type: Comments

Case Officer: Kieran Amery

Date of Response: 09/01/2017

Technical Officer Comments:

Further Submitted Details

- Topographic Survey prepared by Oxford Architects, unreferenced, rev Perlim – dated 22/09/08.
- Product 4 Data for Grandpont House, Folly Bridge prepared by the Environment Agency, Ref OX_1256_01.
- Letter titled Extension of Existing Grandpont Bouse Building to Provide Library, Chapel, Seminar and Study Rooms, Together with Accommodation for nea Staff and Students prepared by the Environment Agency, Ref WA/2008/104132/03-L01, dated 21/04/2009.

Flood Risk

The site is shown to lie within Flood Zone 3 based on the EA National Flood Maps. Reviewing Appendix J of the Oxford Strategic Flood Risk Assessment, Oxford City Council have designated this area as Flood Zone 3b (functional floodplain) for planning purposes.

It is note that the site levels range from 57m to 55m according to the above referenced survey. It is noted that the survey information has not been stated to a specific datum, a survey which has been provided to Ordnance Datum (OD) will need to confirm the levels across the site with any future assessment.

It is also noted that the Product 4 Data (referenced above) reports that the 1 in 20 year (or 5% AEP) flood levels range from 56.06 to 55.99mAOD. Comparing the levels within the topographic survey to the 1 in 20 (or 5% AEP) flood levels suggests that a large portion will be affected by this flood event.

Council’s SFRA states that any development within and up to the 1 in 25 year (4% AEP) flood extent will be classified as Flood Zone 3b. Given the site is affected by the 1 in 20 year (or 5% AEP), the subject site is considered to be partly within Flood Zone 3b, 3a and 2.

The proposal is for the provision of accommodation units with the intention to be used as student residence. From Table 2 (Flood Risk Vulnerability Classification) from the NPPG the proposal is classified as a More Vulnerable use (student halls of residence). Table 3 (Flood risk vulnerability and flood zone ‘compatibility’) from the NPPG states that More Vulnerable uses are not permitted within Flood Zone 3b as well as sating that More Vulnerable development need to pass the Exception Test. Given this information it is suggested that the proposal is not acceptable in terms of National Planning Policy within Flood Zone 3b. Given this, any proposed development will be required to be located within Flood Zone 3a if the requirements of the Exception Test have been meet.

From review of the proposed building layout it is suggested that part of the proposal is located within Flood Zone 3b, 3a and 2.

Any application will need to include details of the modelled 1 in 25 year (4% AEP) flood extent for the development and a site plan which details the expected outline of the modelled 1 in 25 year (4% AEP) flood event based on topographic survey. Furthermore the applicant will need to demonstrate that a sequential approach to design of the new building has taken place, which ensures that the proposed building is not located within Flood Zone 3b and is whole located within Flood Zones 3a and 2.

It is noted that letter has been produced from the Environment Agency (dated 21/04/2009), which stated the following;

> *“We would agree sufficient evidence has been submitted to show that the site is not within Flood Zone 3b (functional flood plain). However we still consider the site to lie within Flood Zone 3a.”*

Based on the information presented it is not agreed that this is site does not contain Flood Zone 3b, given the topography and the Environment Agency’s Product 4 data. **Given this, it is recommended that the applicant seeks pre-application advice from the Environment Agency prior to submitting any proposal.**

Any flood risk assessment will then need to demonstrate the following:

- Updated plans which ensure the proposal is not located within Flood Zone 3b
- No loss of flood storage and impedance of flood flows to ensure no increase in flood risk to the site and the surrounding area
- Identify opportunities to reduce and improve flood risk to the site and the surrounding area
- Demonstrate there is a safe pedestrian access route to a safe haven
- Appropriate flood resilience and flood management measures to ensure the development will be safe for its lifetime

- Opportunities to enhance the river corridor with regards to biodiversity and amenity
- Any loss of flood storage will be required to be compensated through creating flood storage compensation on a level for level and volume for volume basis
- Sequential approach in placing development in lower risk areas within the site

Surface Water Management

Oxford City Councils Policy CS11 requires all developments to implement sustainable drainage measures. The proposal will be required to ensure surface water can be managed for the lifetime of the development for all rainfall events up to and including the 1 in 100 year + climate change event.

To ensure the most optimum SuDS scheme, certain assessments and key principles should be established before and during the early stages of the design of the site. It is not best practice to design the site and 'fit' SuDS into the development as an afterthought.

By keeping the surface water on surface and as shallow as possible, this will reduce the need for maintenance, cost of materials/excavation, reduce the risk of flooding and allow full interaction with the water cycle as it passes through the site, using water in an innovative way whilst providing mitigation against flooding, biodiversity enhancement and water quality prior to discharge either to ground or to the nearest water course. By following this management and treatment train approach, where there are a minimum of 3 stages, this will slow down the rates of flows, reduce the volume of water, protect against any failure or pollution within the system and reduce the cost of maintaining larger systems.

This approach will also enable the applicant to meet other policy objectives as part of the Oxford City Core Strategy towards providing a sustainable development.
The following should be included within the FRA:

- Establish the existing condition of the existing drainage
- Provide plans, details and calculations which demonstrate that the proposal will not match or decrease the surface water runoff for the proposal for all rainfall events up to and including the 1 in 100 year + climate change event
- Establish where the existing drainage outfalls and at what rate for all rainfall events
- Seek to reduce the existing run-off rates and volumes to pre-development greenfield run-off rates for other hardstand and built areas within the site
- Provide a narrative and justification for the implementation of SuDS having established the existing ground conditions, existing overland flows routes, topography of the site and opportunities to dual purpose space i.e. using permeable paving on car parking areas, rain gardens within landscaped areas etc.
- The applicant should be ensuring a hierarchy approach to SuDS selection, considering those methods that provide other environmental benefits such as water quality, biodiversity and amenity.

There are many useful reference documents to assist in the design and development of the surface water drainage scheme which the applicant should refer to:

Non-statutory SuDS standards- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

LASOO- non-statutory SuDS standards guidance- http://www.susdrain.org/resources/

Oxford Local Plan relevant policies in relation to the implementation of SuDS- Policy CS11 Flooding, Policy CS12 Biodiversity https://www.oxford.gov.uk/downloads/file/1450/oxford_core_strategy

Lead Local Flood Risk Management Strategy- Oxfordshire- https://www.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/flooding/OxfordshireFloodRiskManagementStrategy.pdf

Other comments

It is noted that the proposal show the provision of a structure which will spans across a section of the exiting waterbody (shown as the River Thames within the plans). If the application is to include the constructions of a bridge structure or modification of the watercourse the appropriate authority should be consulted to determine if a Land Drainage Consent is required.

creating a better place

Environment Agency

Mr Guy Laister
Water Environment Ltd
165 The Broadway
London
SW19 1NE

Our ref: ENVPAC/WTHAMS/00405
WA/2017/123710/03-L03

Date: 17 July 2017

Dear Mr Laister

Proposal to extend the current facilities to include a library, chapel, study rooms and accommodation for staff and students.

Grandpont House, Oxford.

We have reviewed the evidence you have provided in your email dated 19 June 2017.

We are willing to accept that the information you have provided demonstrates that the majority of the site where you are proposing to site the new building (as shown in the plans you submitted to us in March 2017) is not within the functional flood plain.

You can include this evidence as part of any future detailed FRA you submit in support of development proposals at this site.

Please note, we still have concerns about the plans which show the new building bridging the river. The river is considered functional floodplain (FZ3B). As stated in our previous letters, we are unlikely to be supportive of this approach unless it is clearly demonstrated that the structure complies with national policy and does not negatively impact on flood risk or ecology of the watercourse.

Yours sincerely,

Mr Jack Moeran
Planning Specialist

Direct dial 02030259655
Direct e-mail planning-wallingford@environment-agency.gov.uk

End

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OXFORD CITY COUNCIL

Netherhall Educational Association
C/o Stephen Tsang
31 Stewart's Grove
London
SW3 6PH

Date: 19th March 2019
Your ref:
My ref: 18-03132-LBPAC
Please ask for: Gill Butter
Telephone: [redacted]
Email:

Dear Mr. Tsang

APPLICATION: 18/03132/LBPAC

PROPOSAL: Extension to Grandpont House, Abingdon Road

AT: Grandpont House, Abingdon Road

Thank you for your letter and plans received on 30th November 2018 which seek an informal opinion **solely on flooding and tree issues** on the above-mentioned work to a listed building. The submission fails to include any supporting information on the historic environment and I am therefore unable to comment on this matter. Previous pre-application submissions have omitted to seek both heritage and design advice both of which are fundamental matters in consideration of any development on this very important site. Grandpont House itself is listed grade II* and is a distinctive late C18 building sited in a visually prominent location both from Abingdon Road but also significantly from The River Thames and Christchurch Meadow on the northern bank of the river. The building also falls into the setting of Folly Bridge, importantly one of the key river crossings into the city, identified as a Saxon causeway and which forms part of a scheduled ancient monument with archaeological significance.

I am therefore unable to stress sufficiently how important it is that you seek both heritage, including archaeological and design advice from the decision making authority prior to making applications for planning permission and listed building consent for any extension to Grandpont House.

The advice contained in this letter purely relates to issues of flooding and trees as you have requested. I am simply forwarding the advice received from the appropriate consultants but you should bear in mind they form only two of very many issues that would need to be weighed in the balance when reaching a decision on an application as suggested and there are other issues that are likely, given current case law to have considerably greater weight. I have included a more comprehensive list of planning policies and statutory instruments together with emerging SPD's that will also be important to consider in your design development.

Policy considerations

Any proposal submitted for consideration and determination by the Local Planning Authority would be assessed in accordance with the statutory duties and planning policy obligations set out in the following documents:

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National Planning Policy Framework (NPPF)
Oxford Local Plan 2001-2016
Oxford Core Strategy 2026
Sites and Housing Plan 2026
Emerging Local Plan 2036
Central (City and University) Conservation Area Appraisal – consultation draft

In this particular case the relevant policies set out in the planning policy documents would be:

- NPPF: paragraphs 38-50, 124-132, 189 - 202
- Oxford Local Plan 2001-2016:
    - HE.2 Archaeology
    - HE.3 Listed Buildings and their Setting
    - HE.4 Archaeological remains within Listed Buildings
    - HE.5 Fire Safety in Listed Buildings
    - HE.7 Conservation Areas
    - HE.8 Important Parks and Gardens
    - HE.11 Architectural Lighting
    - CP.1 Development Proposals
    - CP.6 Efficient use of land and density
    - CP.8 Designing development to relate to its context
    - CP.9 Creating Successful New Places
    - CP.10 Siting of Development to meet functional needs
    - CP.11 Landscape Design
    - CP.20 Lighting
    - NE.15
    - NE.16
- Oxford Core Strategy 2026:
- CS2 Previously developed and greenfield land
- CS9 Energy and natural resources
- CS10 Waste and recycling
- CS11 Flooding
- CS12 Biodiversity
- CS14 Supporting city-wide movement
- CS17 Infrastructure and developer contributions
    - CS18 Urban design, townscape character and the historic environment
    - CS19 Community safety
    - CS25 Student accommodation

The new emerging Local Plan 2032 is currently out to public consultation with a view to submitting for examination in March 2019. Policies DH1 and DH3 are a material

consideration in this case and show a direction of travel for the Council in terms of heritage.
There are also emerging policies in terms of trees, flooding and design that will need to be taken into consideration in determining applications should they be submitted.

- Oxford Local Plan 2036 – Proposed Submission Draft:
  - DH1 High quality design and placemaking
  - DH3 Designated heritage assets

In preparing documents to support an application for listed building consent it is particularly important for an applicant and or those acting on their behalf to bear in mind the requirements of applicants set out in paragraph 189 of the NPPF.

All of these documents can be viewed online and I recommend that you view those related to the NPPF and Oxford's Local Plan at the following addresses:

http://planningguidance.communities.gov.uk/blog/policy/
http://www.oxford.gov.uk/PageRender/decP/Planning_Policy_occw.htm

Flooding Issues
The general principle of the approach taken to manage flood risk is acceptable, however there is one slight issue in that since the previous pre-app was undertaken, the Environment Agency have updated the Thames in Oxford Flood Model. In fact it has been updated twice since, in 2016 (released 2017), and I believe the 2018 model data has recently been released.
The flood risk assessment to be submitted with the application should obtain the latest model data from the EA, and demonstrate using this that the site is not within Flood zone 3b. These levels should also be used for calculations re: flood compensation as per the points below. The updated EA model contains more data than the 2014 model – so hopefully this should mean less detailed work will be needed to demonstrate the site is outside flood zone 3b.
It would also be recommended to seek an updated pre-app with the EA using the most recent model data to seek their approval.
Assuming the above be demonstrated, then then the other advice given in pre-app responses from both Oxford City Council and the EA would still apply. In particular:
- 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 (attached).
- 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, as linked to below:
https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zones-2-and-3#extra-flood-resistance-and-resilience-measures
https://www.gov.uk/government/publications/flood-resilient-construction-of-new-buildings
- 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. Requirements can be found in Oxford City Council SuDS Design Guide, which is available at www.oxford.gov.uk/floodriskforplanning

Void Design Info.pdf

Arboricultural issues

I am concerned that the foot-print of this proposed build will conflict with retained trees; in particular, trees along the western, Abingdon Road, boundary.
However I am unable to make a detailed assessment at this point because,
(1) the tree report drawing or schedule do not include information of the crown spreads of the trees at their cardinal points,
(2) the tree report drawing does not include information of the Root Protection Areas in all instances.
These are survey data as required in accordance with BS.5837;2012- Trees in relation to design, demolition and construction- Recommendations.
A separate Tree Constraints Plan drawing (with proposed built-form layer) is necessary.

Other considerations

Archaeology

As the site is within the city centre archaeological area / an area of archaeological interest and your proposals would involve significant breaking of the ground, an archaeological assessment of the area would be required as part of a formal application. For more information please see policy HE.2 of the Oxford Local Plan: http://www.oxford.gov.uk/PageRender/decP/Planning_Policy_occw.htm.

Historic Parks and Gardens

As your proposals would affect a *nationally / locally* registered historic park and garden *(insert name)*, you are advised to contact the Oxfordshire Gardens Trust for further advice and information: http://ogt.org.uk/planning.

Conclusion

In summary, officers are unlikely to be able to support your proposal without amendments/further information as set out in the comments relating to the two topics for which you have requested advice.

I hope that this information will be of assistance to you. This advice is for guidance only and does not bind the formal consideration of any listed building consent application by the Local Planning Authority.

Yours faithfully,

Gill Butter
Conservation and Urban Design Officer
For and on behalf of
ADRIAN ARNOLD
Acting Head of Planning Services
Please quote reference number in all communications

Project Name	Grandpont House			Reference	17014
Location	Oxford				
Client	Netherhall Educational Association				
Document Title	2007 flood event assessment			Date	3rd June 2021
Revision	-	Amendment	-	Rev Date	-
Author	GL	Checker	FdM	Approver	GL

Introduction

In 2017 pre-application advice was sought from the Environment Agency (EA) regarding the proposed development at Grandpont House, Oxford. A key consideration for development of the site related to the definition of Flood Zone 3b, the functional floodplain. To this end, we exchanged significant correspondence with the EA in the period March to July 2017. The discussion commenced when we submitted a set of updated development plans on the 27th March 2017, which showed the proposed development restricted to the part of the site where ground levels are highest, i.e. immediately adjacent to Abingdon Road on the western side of the site. This was a significant improvement in flood risk terms from the proposals previously agreed with the EA in 2014 through a full Flood Risk Assessment submitted with a planning application which ultimately did not receive consent (due to reasons unrelated to flood risk).

The EA responded with concerns regarding the functional floodplain (7th April 2017). We prepared and submitted a report in May 2017 for review which justified that the area of the site proposed for development was not in the functional floodplain. The EA review (1st June 2017) highlighted concerns and requested additional information which we provided in a few separate emails over the course of the following 3 weeks. The key to our agreement in the end was the 2014 historic flood event, which the EA estimated to have been a 25 year return period flood. We estimated this event to have a peak water level at the site of between 55.73m AOD and 55.74m AOD, based on on-site observations. It was on this basis that we agreed 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 in an email of the 17th July 2017 and in a letter dated 13th August 2018.

Part of the discussion regarding the functional floodplain related to the modelled 20 year flood water level. There were several hydraulic models in circulation at the time, including the 'Wolvercote' model used in the Oxford City Council (OCC) Strategic Flood Risk Assessment (SFRA), the 'Water Environment' model which refined the Wolvercote model in the proximity of the site with more detailed level information, and the updated EA model from 2014. All provided slightly different flood water levels, but importantly it was considered that all models overestimated the extents of the 20 year floodplain based on observed historical evidence of flooding around the site. For reference, the three models provided the following levels relevant to the discussion regarding the functional floodplain:

Wolvercote: (25 year return period) 56.04m AOD
WEL model (25 year return period) 55.87m AOD
EA 2014 model (20 year return period) 55.99m AOD

The EA model has been further updated since our correspondence in 2017.

We can confirm that there have not been any flooding events on the site since the 2017 report and on that basis there is no change to the basis for the agreement that the area proposed for development on the site is not in the functional floodplain, based on a detailed assessment of the 2014 event. For completeness, we have requested the latest data from the updated EA model and the 20 year flood water level is 55.94m AOD. This is a further 50mm lower than the 2014 modelled level. Therefore, 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.

We have resubmitted a pre-application enquiry to the EA in 2021 to seek advice on minor changes to the proposed layout issued to the EA in 2017. The EA responded by stating that the latest hydraulic model is more detailed than the data held at the time of the 2017 agreement and that the latest 20 year flood water level of 55.94m AOD should be used to define the functional floodplain.

Although the model has been refined, predominantly with the aim of attempting to better represent historic flood events, it has not, in terms of the evidence used to derive the 2017 agreement, been sufficiently updated to accurately represent the flood mechanisms and extents shown through multiple flood events in the catchment to be the situation on the ground. The model on its own is therefore an insufficient base for determining the functional floodplain, as indicated in the Planning Practice Guidance: Flood Risk and Coastal Change, which confirms the following:

> The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

The EA have also stated that the model has been calibrated which should, in theory, improve confidence. However, the EA confirmed previously "that the 2014 event was the 25 year flood event (functional floodplain) for Oxford." The flood water level for this event on the site was accurately measured as 55.73 to 55.74m AOD. Therefore the model calibration cannot be robust in the location of the site, since the model predicts a 20 year flood water level on the site as 55.93m AOD around 200mm higher than the observed 25 year flood water level. This is not unusual for a model of this scale, since it is not reasonably possible to calibrate the model to match observed results at every location- and in this instance the available datasets do not include measured flow rates that allow correct calibration of the mechanisms through Oxford itself in particular at a sufficiently high flow rate i.e. in flood conditions.

Through further discussions with the EA it has therefore been agreed that modelling data is only the starting point for assessing the functional floodplain, and the EA have recommended also assessing the 2007 event as this was used in the calibration in the model.

We have completed a detailed review of the latest hydraulic model, as well as the accompanying reports. We have also collated as much anecdotal information on the 2007 event as possible. We can report as follows.

<u>Historical records</u>

The EA 2007 recorded flood outline is presented below. Note that the record very clearly shows Abingdon Road as not flooding, and no flooding onto the Grandpont site from the riverside. Flooding from the north is clearly shown to remain on the north side of the line of buildings on the north boundary of the site. On the site itself, the map suggests that water was observed in the existing pond area and along the channel through the site. This coincides with what would be expected due to the presence of Abingdon Road, and the evidence indicating that flooding does not come from the River Thames from the north or east. High water levels in the channel through the site and overtopping into the pond area has been confirmed by the occupants at Grandpont House.

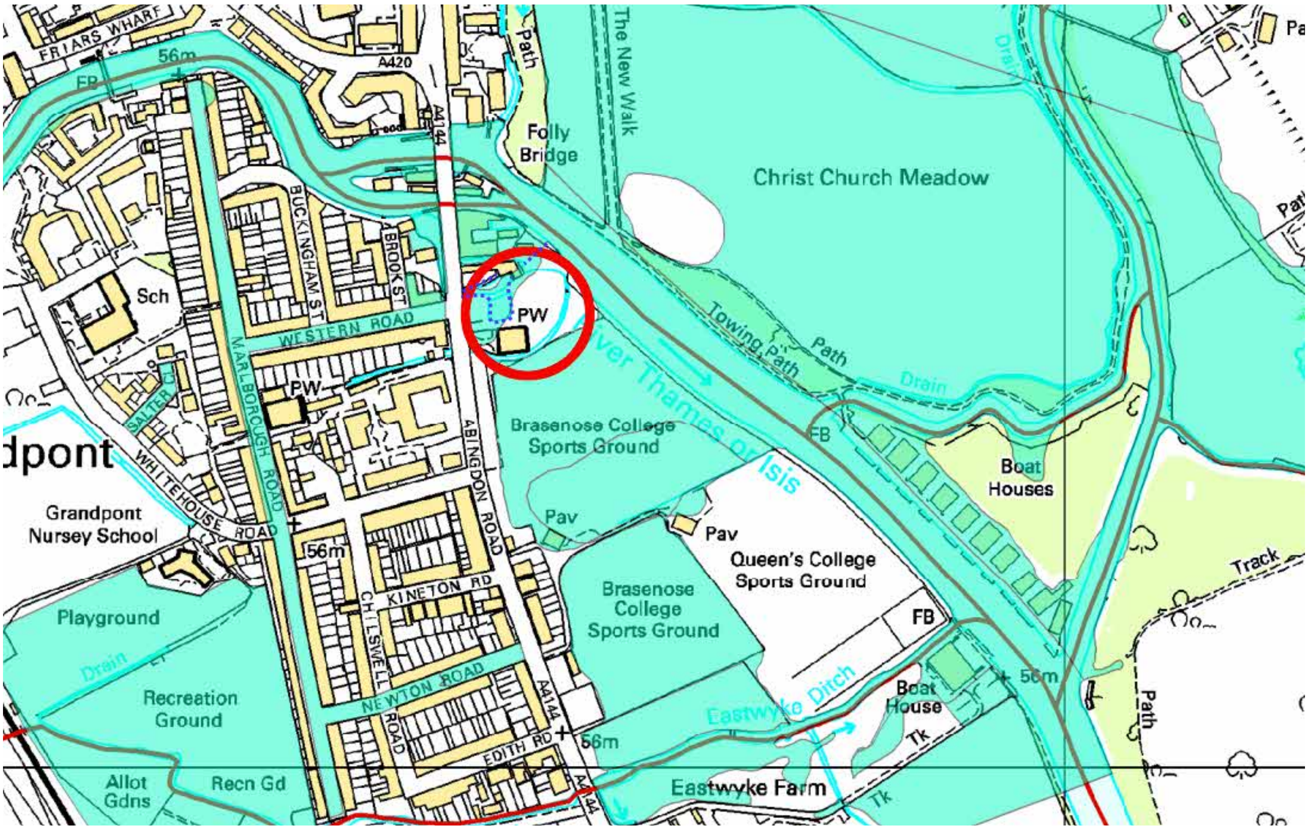


Figure 1: Environment Agency historical flood outline for the 2007 flood event (as provided in a Product 4)

The drawn extent in the EA historical map also suggests the area proposed for development flooded in 2007, but this is incorrect. The topography and mechanism do not support this, the only "flooding" observed was along the channel and into the pond area only, without extending onto the higher ground proposed for development, as shown by the dotted blue line.

The main part of the garden east of the pond is not shown as having flooded. From a practical perspective the ground levels in this area are relatively consistent at 55.70 – 55.75m AOD. These levels are 250mm – 500mm lower than the levels on the area proposed for development. Therefore if flooding on the site was caused from either the main Thames or the stream through the site from water backing up behind the culvert beneath the house, the main garden area would flood before the area proposed for development. Therefore the anecdotal evidence used to plot the historical map below cannot be correct.

Below are photos taken of the 2007 flood event. These photos were taken from the access path leading from Abingdon Road towards Grandpont House (i.e. view in an easterly direction). The photos show the high water levels in the channel through the site at approximately 6inches below the soffit level of the culverts beneath the house. The photos also show the flooding of the pond area but not the garden area behind.

Figure 2: Photos of the flooding at Grandpont House in 2007.

We understand from the occupants at Grandpont House that these photos were taken at the peak of the flood event, when the water levels were at the highest on the site. The topographic survey of the site (enclosed) recorded the sprung arch levels of the culverts at 55.21m AOD – 55.24m AOD and the top of bank along the channel varies between 54.97 and 55.26m AOD. The sprung arch levels and the bank have clearly been breached and so the water level is higher than 55.26m AOD. The soffit level of the two culverts beneath the house are 55.91m AOD and 55.95m AOD. Both soffits can be seen in the photos and thus the water level is not as high as 55.91m AOD. The water level has been estimated as approximately 6inches below the soffit level, which equates to 150mm and a water level of 55.76m AOD. Looking to the right of the house (east), the gravel path in the garden can be seen as not flooded. The topographic survey includes a spot level on the bank side of the path as 55.83m AOD. With the bank in front of the path clearly visible, the water level cannot be as high as 55.83m AOD. A tree is visible in the fourth photo below, with the trunk visible to ground level and not submerged. The topographic survey recorded a spot level for the top of bank of the pond in this vicinity as 55.66m AOD, although the ground level at the base of the tree was not recorded. It is, however, reasonable given levels across the site that the water is at this level, or not much higher, otherwise the tree would be submerged. Therefore, the peak water level on the site in the 2007 event was in the range of >55.66m AOD and <55.83m AOD, and most likely in the order of 55.76m AOD.A water level of 55.76m AOD, or even as high as 55.83m AOD, would not flood the area of the site proposed for development.

In addition, historical records of the 2007 flood event clearly show Abingdon Road flooding (http://www.oxfordhistory.org.uk/floods/index.html), contrary to the EA map, and therefore there is low confidence in the EA historical map. There are several photos in the above archive which compare the flooding on Abingdon Road in the 2007 and 2014 events. On the basis of this evidence the 2014 event resulted in greater flooding on Abingdon Road, and still did not flood the development area on the site.

Hydraulic modelling

We have downloaded the model files and model report. Specific observations are related to the calibration as discussed, and do not change our opinion that the known outlines of historic events, rather than modelled simulations of the flows at the gauges (which are relatively hydraulically distant from the site), should be used to define the functional floodplain. This is in large part due to the inability to verify the performance of the model at the location specified, due to a lack of available information with which to secure a robust understanding and representation of the floodplain interactions created both by the railway embankment, which bifurcates the floodplain, and, immediately upstream of the site, the raised Abingdon Road as it approaches Folly Bridge, which constricts flows. This is in accordance with the conventional wisdom that true observed data should always be used in preference to mathematically idealised, and therefore approximate, data where discrepancies exist. It is also in accordance with the Planning Practice Guidance on defining the extent of Flood Zone 3b.

The calibration undertaken on the latest model issue does not comprise full model calibration, but rather, an adjustment to the previously calibrated model. According to the figures and tables in the hydraulic modelling report, he model is shown to overestimate flood water levels and extents for the 2007 event in the area between Abingdon Road and the River Thames. Therefore, it is reasonable to conclude that the modelled flood levels and extents are over-estimated at all return periods and certainly for those return periods that are of a similar scale to the 2007 event. Therefore, the actual recorded outline should be used in preference to the modelled data.

Calibration and verification shows reasonable agreement at gauges, however, there is an absence of gauges along the central Oxford reach, and as noted in prior discussions, it is extremely difficult therefore to determine whether or not the model is representing flooding in this extremely complicated area correctly. Observed floodplain levels are provided in the Hinksey and Botley areas, however these are not close to the Folly Bridge area of interest. It is however telling to note that, for the 2007 (main calibration) event, modelled flood levels at Botley (upstream of the railway line) are predominantly underestimates compared to the observed level, whilst at Hinksey (downstream of the railway line), levels are overestimated. The closest point hydraulically, to Grandpont House, point no. 5 (as shown below), overestimates levels by 170mm relative to the measured flood level. Point no. 2, another hydraulically similar location, overestimates by 420mm. The only points in the area presented in Figure 28 that underestimate the flood water level do so by no more than 3mm and lie either on the upstream side of the railway line (points 36 and 37) or immediately downstream on one of the braided channels returning flow to the main floodplain (point 10).

SECTION 6 – MODEL CALIBRATION

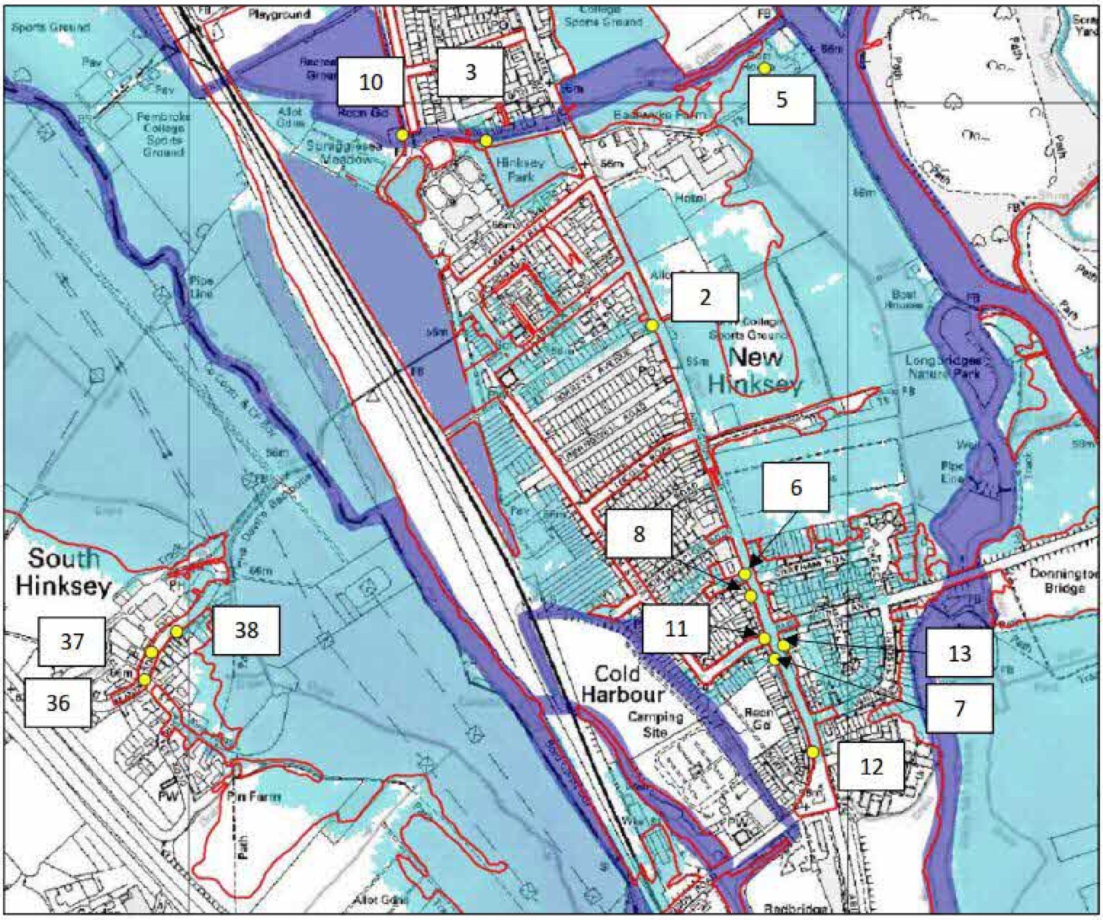


Figure 28: Comparison of 2007 observed and modelled flood extents (Hinksey Area)

It is noted that minor edits were undertaken to the model to correct instability and reversing flows at Osney, together with validation of spot gauged results in this area- this approach would generally be expected to significantly improve the understanding of the bifurcation in the floodplain around the Botley/Osney area which causes the discrepancies noted above. However, this work was undertaken on in-bank flows (and indeed, is run without the TUFLOW element present) and unfortunately does not therefore provide any meaningful validation of the flooded scenario, in particular the role of the railway line in altering the proportion of flow that passes down the Hinksey side to the west, thus bypassing central Oxford entirely. Therefore due to the lack of available gauged data on the individual channels and structures in observed flood events, the calibration through Oxford is unfortunately impossible to correctly achieve.

Although a lot of work has gone into the calibration and verification of the model, which is, in general, extremely robust, there are clearly still shortcomings, which arise solely out of the difficulties of attempting to adjust a model of this scale to fit local hydraulics – this is through no fault of the modellers, it is simply the nature of the beast. When we have known data, this should always take precedence over derived data where discrepancies exist- after all: the model is always adjusted to fit the data, not the other way around.

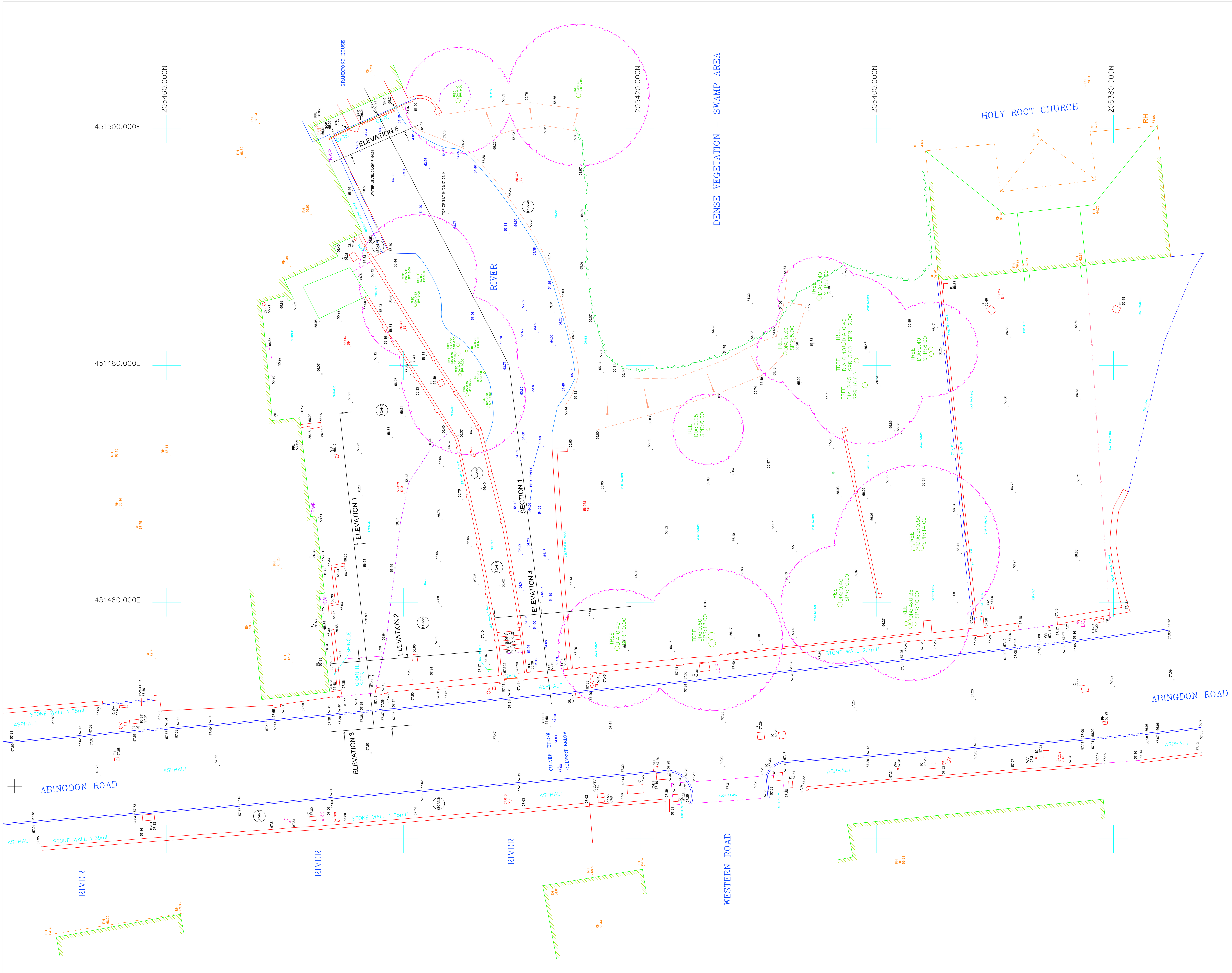
Summary

The area of the site at Grandpont House proposed for development did not flood in either 2007 nor 2014. The EA has estimated the return period of the 2007 event as between 10 and 50 year. The EA has estimated the return period of the 2014 event as 25 years. Photographic records of the site during both events are available and have been assessed. The water level peaked at very similar levels in both events with an estimated peak water level of 55.76m AOD in 2007 and 55.73-55.74m AOD in 2014. The records onsite therefore collate and are consistent with the EA return period estimates. The EA historical flood maps are incorrect for both these events as they show the area proposed for development as having flooded, however this is not possible based on the topography and flood extents in the grounds of Grandpont House. The hydraulic model estimates the 20 year flood water levels on the site as 55.93m AOD. However, this is inconsistent with historical records as the maximum water level reached in any flood event in the living memory of those onsite (since 1959) was in 2007 and 2014. The calibration of the hydraulic model confirms that the model overestimates the 2007 water level on the reach of the Thames downstream of Folly Bridge and Grandpont by between 170mm – 420mm.

Given all the evidence, it can be deduced that the model is overestimating flood water levels on the site in events of similar magnitude to 2007 and 2014 and as the area proposed for development has not flooded in at least 40 years (based on witness statements of occupants still present at Grandpont House), including 2007 and 2014, that the area proposed for development is not in the functional floodplain.

Encl

Topographic survey – Oxford Geospatial (13.09.2017) Grandpont House, Oxford Topographical survey OGL_17043_Topo_Rev01



INDICATIVE ONLY

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker
BH	Borehole	MT	Mercury Telecom Cover
BOL	Bollard	OHC	Overhead Cable
BT	British Telecom Cover	OHP	Overhead Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
BWK	Brickwork	PB	Post Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker
CB	Close Boarded Fence	PR	Post & Rail Fence
CCTV	Closed Circuit TV	PW	Post & Wire Fence
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence
CHPL	Chestnut Paling Fence	RE	Rodding Eye
CL	Cover Level	RG	Road Gully
CM	Cable Marker	RN	Road Name
CP	Catch Pit	RS	Road Sign
CPL	Catch Pit Base Level	RW	Retaining Wall
DIA	Diameter	RWP	Rain Water Pipe
DK	Drop Kerb	SAP	Sapling
DP	Down Pipe	SC	Stop Cock
EJB	Electricity Junction Box	SPR	Spread
EC	Electricity Cover	STA	Traverse Station
EP	Electricity Pole	SV	Stop Valve
ER	Earthing Rod	SVP	Soil Vent Pipe
FH	Fire Hydrant	SW	Storm Water
FIG	Feed Into Ground	TB	Telephone Box
FW	Foul Water	TBM	Temporary Bench Mark
G	Gully	TFR	Taken From Records
GV	Gas Valve	TJB	Telephone Junction Box
HT	Height	TPT	Trial Pit
IC	Inspection Cover	TL	Traffic Light
IL	Invert Level	TP	Telephone Pole
IR	Iron Railing Fence	UTL	Unable To Lift
KO	Kerb Outlet	UTT	Unable To Trace
LB	Litter Bin	VP	Vent Pipe
LC	Lamp Column	WKH	Water Key Hole
LP	Lamp Post	WM	Water Meter
MH	Manhole	WV	Water Valve

Legend

——F——	Foul Water Pipe	— —S— —	Surface Water Pipe
— · —O— · —	Overhead Cable	——T——	Telephone Cable
——E——	Electricity Cable	——W——	Water Pipe
——G——	Gas Pipe	- - -U- - -	Unidentified Service

Survey Station Information

STA No.	Easting	Northing	Level	Type
STA005	451495.444	205429.920	55.375	PEG/NAIL
STA006	451467.617	205424.187	56.068	PEG/NAIL
STA007	451472.142	205433.773	56.340	PK NAIL
STA008	451482.942	205439.711	56.390	PK NAIL
STA009	451481.618	205444.443	56.057	PK NAIL
STA010	451469.213	205439.939	56.433	PK NAIL
STA011	451441.813	205446.016	57.780	PK NAIL
STA012	451443.215	205430.832	57.613	PK NAIL
STA013	451446.597	205384.820	57.232	PK NAIL
STA014	451485.505	205389.169	56.526	PK NAIL

Notes

The Grid is related to OS using GPS
All Levels are related to OS datum using GPS

Rev	QA Initials	Description	Date
01	dw	First Complete Issue	13.09.2017

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SURVEYED	DW	Stephen Tsbag Designs
DRAWN	DW	
SCALE	1:100	

GRANDPONT HOUSE, OXFORD

TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
17043	OGL_17043_Topo_Rev01

A0 Sheet - 1189mm x 841mm

creating a better place

Environment Agency

Mr Guy Laister
Water Environment Ltd
165 The Broadway
London
SW19 1NE

Our ref: ENVPAC/WTHAMS/00504 WA/2021/128674/02-L01

Date: 24 June 2021

Dear Mr Laister

Proposal to extend the current facilities to include a library, chapel, study rooms and accommodation for staff and students.

Grandpont House, Oxford.

Thank you for consulting us. We have reviewed the following documents:

- Email from Guy Laister (Water Environment), dated 03 June 2021
- Flood Risk Technical Note (2007 Flood Event Assessment) produced by Water Environment, dated 03 June 2021

As stated in our previous correspondence (dated 16 February 2021) the most up to date modelled flood data for this site is the Thames (Eynsham to Sandford 2018) model.

This modelling shows your site to be impacted by the 1 in 20 year flood extent (Flood Zone 3b). This could potentially result in an objection 'in principle' from ourselves as the development proposed would be deemed to be inappropriate within Flood Zone 3b in line with both national and local flood risk policy.

In February 2021, we advised that you might consider making a comparison between the flood model data and known historic flood return periods to establish whether the model was accurately reflecting the 1 in 20 year flood extent on site.
The Flood Risk Technical Note you have submitted has examined the flood modelling data in detail and specifically looked at recent historic flood events and how these have been used to calibrate the flood modelling.

The 2007 flood event, which is considered in Oxford to have a return period of between 10-50 years, is the most recent significant flood event used to inform the modelling. Unfortunately, the Technical Note confirms that the more recent significant flood event 2013/2014 was not used to inform the 2018 modelling. The Technical Note has examined how the 2007 event was used as part of the modelling.

In summary, the Technical Note confirms that the 2007 event is a useful event to help us determine the Flood Zone 3b extent in this location. However, it has looked in detail at the modelling and in this location and has highlighted some perceived shortcomings

Cont/d..

with how flood risk data has been represented. This is likely to have led to an overestimation of the 2007 flood extent in this location.

We would recommend that this element of the Technical Note is developed further and includes some further analysis which establishes a more accurate 2007 event level is in this location. We would also welcome some further analysis into whether the 2007 event in this location can be refined into a more exact return period within the 10-50 year range. This would give greater confidence in the evidence submitted. This could all be collated into a detailed FRA.

The Technical Note also provides detailed anecdotal evidence that this site did not flood during the 2007 and 2014 events. This is supported by photographs. The photographs indicate that maximum flood levels in this location were around 55.76 metres AOD in 2007 and 55.74 metres AOD in 2014. These photographs are really useful and combined with the above will provide a useful evidence base to include within a detailed FRA.

If the further work we have recommended is carried out and supports the view that the 2007 event was above the 1 in 20 year event then we would be reasonably satisfied with the anecdotally confirmed level of 55.76 metres AOD being used as the Flood Zone 3b level in this location.

However, if this level (55.76 metres AOD) is being used to establish the Flood Zone 3b level then we must see clear evidence that none of your red line boundary or built footprint is impacted by this event. At present, the topographic drawing provided as part of the Technical Note, does not include an overlay showing exactly where the red line boundary and built development is to be located. This needs to be included.
As stated previously, if the ‘in principle’ objection is overcome then you will still need to demonstrate within a detailed Flood risk Assessment (FRA) that this development does NOT increase flood risk. We would not support development that led to any loss of flood storage. Any loss of storage caused by built development or land raising must be compensated for on a level for level basis up to the 100 plus 35% flood level.

In addition, the FRA must demonstrate that future users of the site are safe. We would expect Finished Floor Levels (FFLs) to be set above the 1 in 100 plus 35% flood level.

Safe access/egress and the Sequential Test is the responsibility of the Local Planning Authority (LPA). Surface water and groundwater flood risk is the responsibility of the Lead Local Flood authority (LLFA)

Yours sincerely

Mr Jack Moeran
Planning Specialist

Direct dial 02030259655
Direct e-mail planning-wallingford@environment-agency.gov.uk

Disclaimer
Please note that the views expressed in this report by the Environment Agency, is a response to a pre-application enquiry only and **does not represent our final view in relation to any future statutory consultations made in relation to this site**. We reserve the right to change our position in relation to any such application. You should seek your own expert advice in relation to technical matters relevant to any conditions before submission.

End

GRANDPONT HOUSE
ABINGDON ROAD, OXFORD

FLOOD RISK ASSESSMENT

NETHERHALL
EDUCATIONAL ASSOCIATION

DOCUMENT REFERENCE:

17014-FRA-RP-01 | P02

WATER | ENVIRONMENT

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Authorization 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 as well as to develop a Sustainable Drainage Strategy for the proposed development.

Author:	**Fiona de Mauny** MA MEng (Cantab) C.WEM MCIWEM	[redacted]
Checker:	**Guy Laister** MSc Eng BSc Eng (Civil) CEng CEnv C.WEM MCIWEM	[redacted]
Approver:	**Guy Laister** Director	[redacted]

for and on behalf of Water Environment Limited

Document Version History

Rev	Date	Comments	Auth	Chck	Appr
P01	07/10/2021	Issue to Netherhall for comment	FdM	GL	GL
P02	13/10/2021	Issue to Environment Agency for comment	FdM	GL	GL

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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 to provide crucial modernisation of the accommodation and secure the long-term viability of the Grade II* listed building through provision of a new extension building and to enable refurbishment. Although the site lies within Flood Zone 3 of the River Thames, there are no suitable alternative sites for the proposals, which will provide vital facilities which must be within the grounds and therefore the Sequential Test is passed. The proposal for an extension building is accompanied by both refurbishment plans and the enhancement of an existing habitat area close to the river. These benefits, together with a 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 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.

A minor channel of the River Thames, as well as the Hogacre Ditch, form an integral part of the site. Part of the site lies within the functional floodplain of the River Thames (Flood Zone 3b). In order to ensure that no inappropriate development occurs within the functional floodplain, the extent of the floodplain has been determined by using a historical flood water level derived from site evidence and data from the 2007 and 2014 flood events. These events have been demonstrated through statistical analysis of gauges in the upstream catchments to have a return period in excess of 20 years. The proposed extension is located outside the extent of functional floodplain on the site.

The building will be raised so that the underside of the floor structure is above the 100 year return period flood water level including an allowance for climate change of 25%, which represents a conservative application of the revised climate change allowances released in July 2021. As a result of this construction, the ground floor finished floor level will be above the 100 year return period flood water level including an allowance for climate change of 35% which is used as a sensitivity test. Full dry access to the building is available entirely above the 100 year return period flood water level including a 35% allowance for climate change to Abingdon Road and then to high land on the north side of Folly Bridge.

The proposed building will not occupy flood storage due to the clear span construction above the 100 year return period flood including a 25% allowance for climate change. However, the proposed improvements to the ecological area will result in an increase in freely floodable and draining flood storage which is greater than the volume of storage within the building footprint at all levels to the 100 year return period including a 35% allowance for climate change, with a total increase in storage of 195m^3. As a sensitivity test, assuming the entire area under the building were filled in, there would still be a total increase in storage of 33m^3. The hydraulic model was used to demonstrate that the proposed development does not affect flood risk elsewhere. The ground model was modified to represent the existing and proposed buildings on the site and on the site to the north to ensure flow mechanisms were adequately represented. There was no change in either flood levels or the extents of flooding at any return period.

Surface water will be collected from the roof of the proposed extension and discharged to the ecological area. The SuDS strategy will be designed to attenuate runoff to greenfield rates, and is anticipated to use a combination of source control measures to minimise runoff- including replacing existing hard-paved surfaces with permeable surfacing.

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.

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.

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)[1] and accompanying Planning Practice Guidance (PPG)[2], to accompany an application for planning permission.

[1] Ministry of Housing, Communities & Local Government, revised National Planning Policy Framework, July 2021
[2] Ministry of Housing, Communities & Local Government, Planning Practice Guidance Flood risk and coastal change, https://www.gov.uk/guidance/flood-risk-and-coastal-change, August 2021

2 DESCRIPTION OF PROPOSED DEVELOPMENT

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.

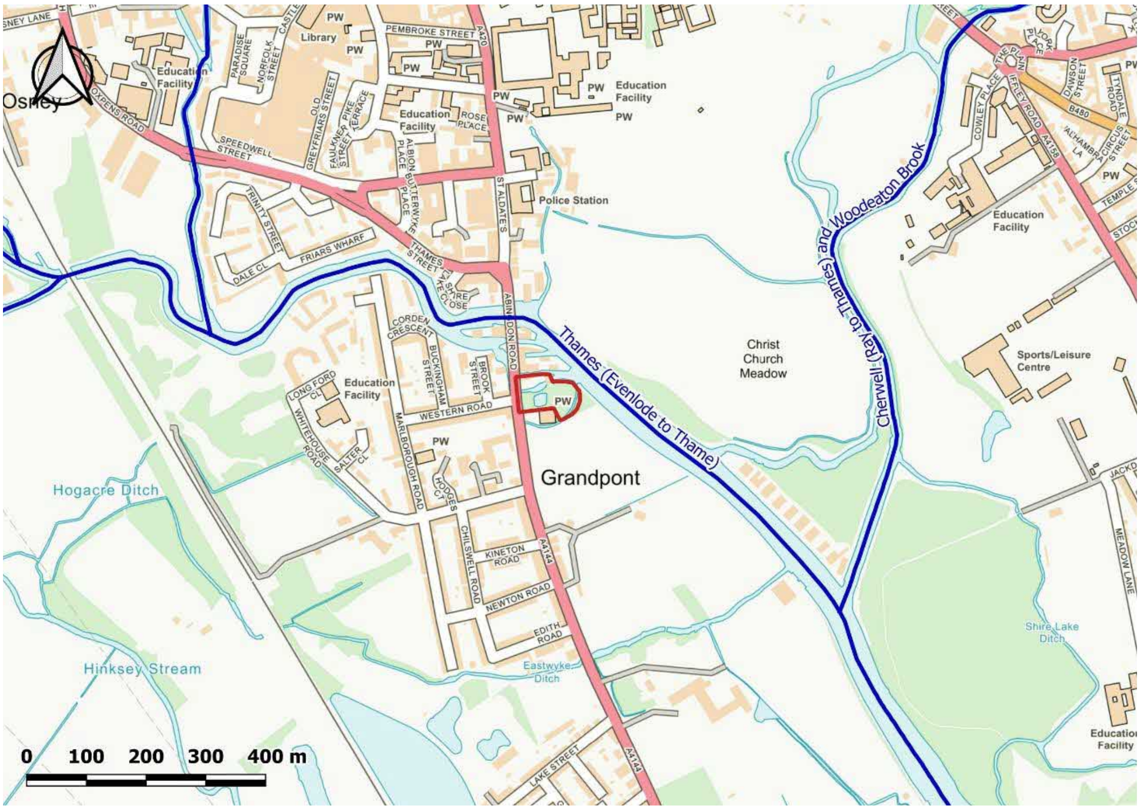

Figure 1: Location of proposed development site[3]

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 indicates that the ground levels in the area of the proposed development range from 55.5m AOD to 56.2m AOD. The area is at a general level of 56.0m AOD. Ground levels fall from west to east across the development area, with the eastern boundary of the area at the top of a bank down to a low-lying marshy area at around 54.3m AOD. The top of bank of the watercourse through the site is 55.1m AOD on the south bank.

2.4 The current access road falls from 57.4m AOD at Abingdon Road to a minimum level of 56.1m AOD at the entrance to Grandpont House. Access is also available along a pedestrian walkway, the minimum level of which is 56.4m AOD. Abingdon Road rises to the north over Folly Bridge.

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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. 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.

2.7 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; however, according to Thames Water records a charge is currently payable for surface water drainage. It is recommended that the institution apply to have this charge waived in the absence of any surface water connections at the site. Foul water from the site currently drains to the public sewer in Abingdon Road.

Proposed Development

2.8 Proposals are to extend the current facilities, and include a library, office, chapel, lounge, dining room, study rooms and accommodation for staff and students. Provision of modern accommodation, as well as enhanced facilities, in the new-built extension 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 ancillary buildings along the northern boundary of the site would be refurbished to provide domestic services and a multi-purpose hall. This part of the development includes some demolition and rebuild. Certain internal refurbishments of the existing main building are included in the plans.

2.9 Proposals include increasing the number of residents on site from 11 to 21. Four of these will be in the refurbished main house, four will be in the refurbished wing, and thirteen in the new extension at first and second level. The remainder of the rooms will be study rooms, visitors' rooms, dining room, a new library and book stores, and a new chapel. Ground floor uses in the proposed new building are restricted to "less vulnerable" classifications.

2.10 The proposed development is part of an ongoing development plan to broaden the scope of the educational institution to make the venture viable, allowing renovation of the existing Grade II* listed building.

2.11 Proposals include landscaping to enlarge the low-lying marshy area by the river by excavating between the river channel through the site and the existing depression which will be over-excavated to form a pond, thus providing an improved ecosystem in the marshland, and providing an additional area of free draining flood storage.

2.12 The proposed building would be accessed directly from the pedestrian access from Abingdon Road via a bridge over the channel through the site, designed to be clear span with the underside set above the design flood water level. Part of the proposed building will additionally span the channel on a clear span structure.

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 July 2021. 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 through the provision of compensatory floodplain storage, and confirmed through hydraulic modelling. 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[4] policy and the Strategic Flood Risk Assessment (SFRA)[5].

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 is located on high land and not within the extent of Flood Zone 3b. However, due to the low-lying marshy area in the gardens and adjacent to the channel that crosses the site, part of the site can 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 close to the dry access route away from the site. Additionally, excess flood storage will be provided (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.

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;*

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[4] Oxford City Council (June 2020) Adopted Oxford Local Plan 2036
[5] Wallingford Hydrosolutions on behalf of Oxford City Council (November 2017) Level 1 Strategic Flood Risk Assessment

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"[6]. 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[7]- 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.

3.19 The SFRA was released in November 2017. The SFRA pre-dates the Local Plan, and therefore policy recommendations contained within it have been rolled into the Local Plan. The SFRA introduces the concept of separate Flood Zone 3b designation for developed land and paves the way for the provisions included in OCC Policy RE3. In addition, the SFRA re-iterates the requirements of the "Living on the Edge" 5th ed[8]. which covers the maintenance and management responsibilities of the landowner and should be considered an integral part of all proposed development on the site.

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 consultee is removed.

3.21 Since the LLFA has no remit to advise on proposed development that is not deemed "major", the proposed development must be considered under OCC policy only. However, the information contained within LLFA documents, including the Preliminary Flood Risk Assessment (PFRA)[9] and Local Flood Risk Management Strategy (LFRMS)[10] are used as evidence to inform the assessment of flood risk within this FRA.

[6] McCloy Consulting & Robert Bray Associates on behalf of Oxford City Council (2018) Sustainable Drainage Design & Evaluation Guide
[7] Oxford City Council (undated) Planning Application Guidance Flooding https://www.oxford.gov.uk/downloads/file/3815/planning_application_guidance_-_flooding
[8] Environment Agency (October 2014) Living on the Edge 5th edition
[9] JBA on behalf of Oxfordshire County Council (June 2011) Preliminary Flood Risk Assessment Report
[10] Oxfordshire County Council (August 2021) Local flood risk management strategy

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.

[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 18^{th} 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 east of the River Thames 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. The site is shown to lie within Flood Zone 2 and 3. The results of the River Thames hydraulic model show that the site is at risk of flooding in the 5% annual exceedance probability (20 year return period) event, and as such, falls potentially within Flood Zone 3b.

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 using the results of the hydraulic model.

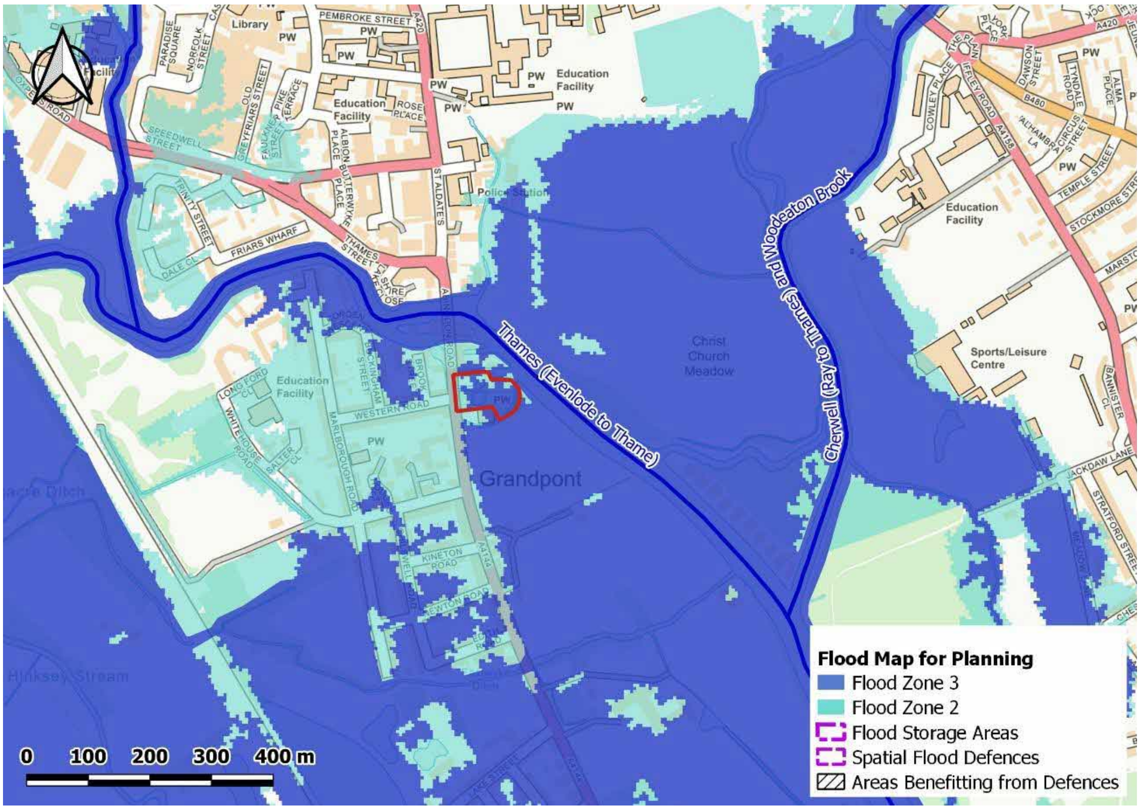

Figure 2: Flood map for planning[12]

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.

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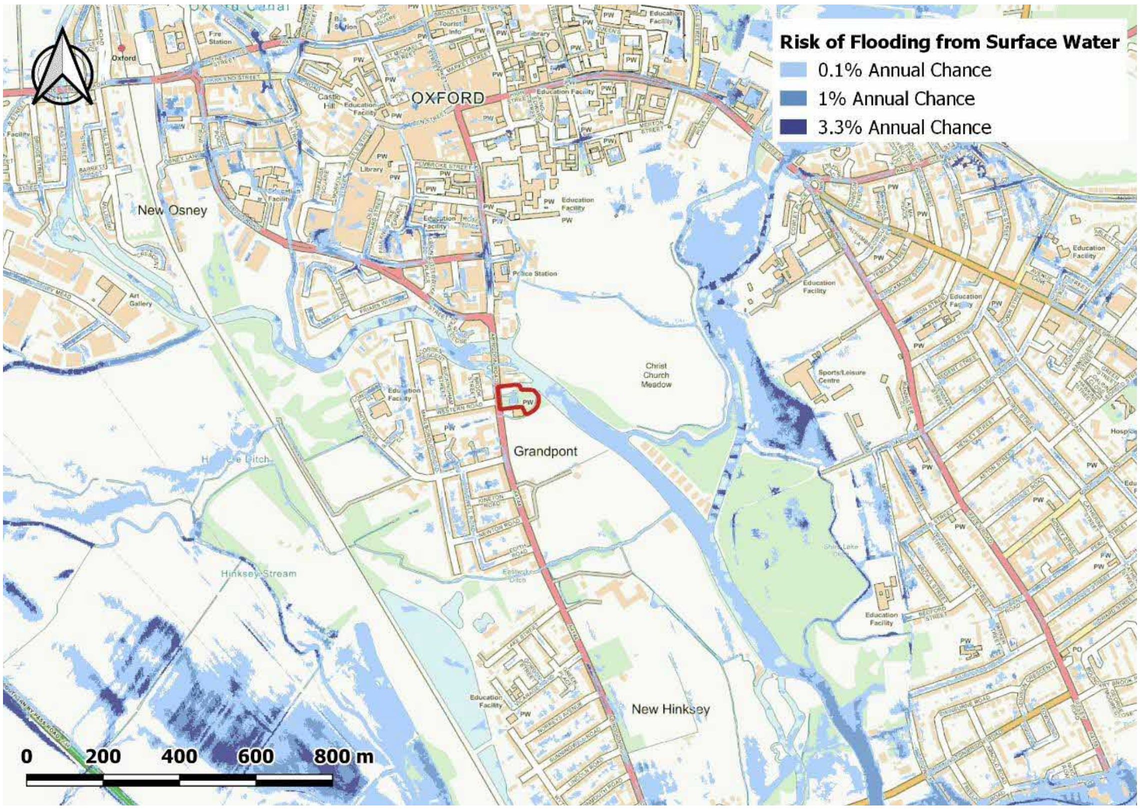

Figure 3: Surface Water Flood Risk Map[13]

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

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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, Eynsham, the area of risk is contained within lower land, and covers a lesser extent than the fluvial risk. As a result the site lies just outside the risk area.

4.16 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.

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

Figure 4: Reservoir Flood Risk Map[14]

Structures which may Influence Local Hydraulics

4.18 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.

4.19 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.

4.20 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

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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

4.21 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.

4.22 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[15]. 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.

Hydraulic Models

4.23 In order to assess the impact of the proposed extension, the latest EA model was obtained. The model was trimmed upstream to improve run times- however the trimmed model was able to replicate exactly the results of the original model at all return periods.

4.24 The trimmed model was amended by including existing and proposed digital terrain models (DTMs) generated using the topographic survey and proposed plans. The proposed extension extent was modelled by raising the entire building area by 3m, while the proposed excavation area was applied directly from the proposed drawings. The DTMs were read directly into the model DTM to generate existing and proposed case results grids.

4.25 Comparison of the results grids indicated that there were no changes to modelled flood water levels off-site that exceed model tolerances of 1mm. The only difference between the two modelled scenarios was a reduction in floodplain extent (the raised building area does not flood in the model) and reductions in flood level at four grid squares at the very edge of the floodplain extent due to the reduced ground levels in the low-lying marshy area where the proposed excavation and ecological enhancement will take place. All non-negligible changes in flood extent and level arise entirely within the site boundary.

[15] 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[16] and 22nd November 2010[17] 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.*" [18]

2016 Pre-application Enquiry

5.8 Due to reasons unrelated to flood risk, the project took at a change in direction over the next two years and a different scheme was developed for the site. Coincidentally the EA updated the

[16] 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)"
[17] Environment Agency letter dated 22 November 2010 which stats "We have previously accepted that the site is not in Flood Zone 3b, the functional
Floodplain."
[18] Environment Agency letter dated 24 January 2014

hydraulic model of the River Thames in 2014. A pre-application enquiry was submitted to OCC 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[19].

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.[20]

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.[21]

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[22] 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.

[19] Oxford City Council Flood Risk and Drainage Planning application response dated 17 October 2016 (Application reference 16/01978/PAC)
[20] Oxford City Council Flood Risk and Drainage Planning application response dated 9 January 2017 (Application reference 16/01978/PAC)
[21] Environment Agency letter dated 17 July 2017
[22] 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[23] 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[24] 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%.

Principle of Development – Flood Zone 3b

5.21 The EA has agreed to using the estimated on-site flood level for the 2007 flood event to define the extent of Flood Zone 3b- subject to further analysis to demonstrate that the 2007 flood event can reasonably be considered to have a return period in excess of 20 years.

5.22 The Planning Practice Guidance: Flood Risk and Coastal Change confirms the following:

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[23] Water Environment Ltd (3rd June 2021) 2007 flood event assessment
[24] Environment Agency letter dated 24 June 2021 (Reference ENVPAC/WTHAMS/00504 WA/2021/128674/02-L01)

> *The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.*

5.23 Thus, although this FRA will attempt to define the return period of the 2007 event, it is worth noting that the site has not flooded except on the marshy low-lying area next to the channel that passes through the site (which effectively forms part of the river), at any time since the current occupancy (1959). A 20 year return period event would have been expected to occur approximately 3 times in this period, and though the low-lying area was flooded in 2003, 2007 and 2014, water did not extend onto the main part of the site at any time. There are no designated flood storage assets on the site. Therefore although the modelled 20 year flood event extents may be used as a starting point for defining the functional floodplain, the evidence suggests that in reality, aside from the low-lying marshy area, the site does not lie within the functional floodplain.

5.24 Nevertheless, this assessment will attempt to determine the return period of the 2007 flood to corroborate this observation.

Flood Risk Mitigation Principles

5.25 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 has been agreed 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.

5.26 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.

5.27 Therefore, in accordance with previous agreements, it will be demonstrated in this FRA 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 on a level-by-level basis.

6 FLOOD ZONE ALLOCATION

Background

6.1 As discussed in Chapter 4, it has been necessary over the course of several consultations to demonstrate that the site does not lie within Flood Zone 3b, designated as functional floodplain. It was agreed in the past that the 2014 event could be used to define the extent of Flood Zone 3b since the return period was estimated to be 25 years for this event. However, the EA position has since changed, and the 2007 historic event has been agreed, subject to establishing with reasonable confidence that the 2007 event has a return period in excess of 20 years.

6.2 These agreements have been the subject of many reports, and the key points, as well as new analysis, are set out within the following chapter. The initial part of the chapter discusses the likely return period of the 2007 event through statistical analysis of flow records and hydrology for the contributing rivers. The following part of the chapter presents the evidence, already submitted and agreed, that shows the site to lie outside the extent of the 2007 flood.

Methodology

6.3 Peak river flow data were used in the WINFAP-FEH v5 software as a single-site (historical flood) analysis to determine estimates of return period flows for nearby gauges. Data were obtained from the National River Flow Archive (NRFA), and only those stations were considered that form part of the Peak Flow v10 (HiFlows) dataset.

6.4 There are no gauges in a similar hydraulic location to the site, however, it should be possible to estimate the return period of the 2007 event by considering the relevant nearby gauges. The nearest downstream flow gauges on the River Thames are at Sutton Courtenay and Days Weir, however both of these lie downstream of significant tributary inflows and therefore could result in misleading results. Therefore, it is better to analyse the upstream catchments.

6.5 Data were obtained for the following three stations, the locations of which are presented in Figure 5:

39008 River Thames at Eynsham – a dataset of 26 years of record, suitable for enhanced single site analysis;
39021 River Cherwell at Enslow Mill – a dataset of 54 years of record, suitable for single site analysis to determine return periods up to 27 years; and
39034 River Evenlode at Cassington Mill – a dataset of 50 years of record, suitable for single site analysis to determine return periods up to 25 years.

6.6 Unfortunately there are no peak flow gauging stations on the River Ray, which joins the Cherwell downstream of Enslow Mill, however the similarity between the Ray, Cherwell and Evenlode catchments are such that the return periods estimated for these rivers should be equally applicable to the combined Ray and Cherwell catchment.

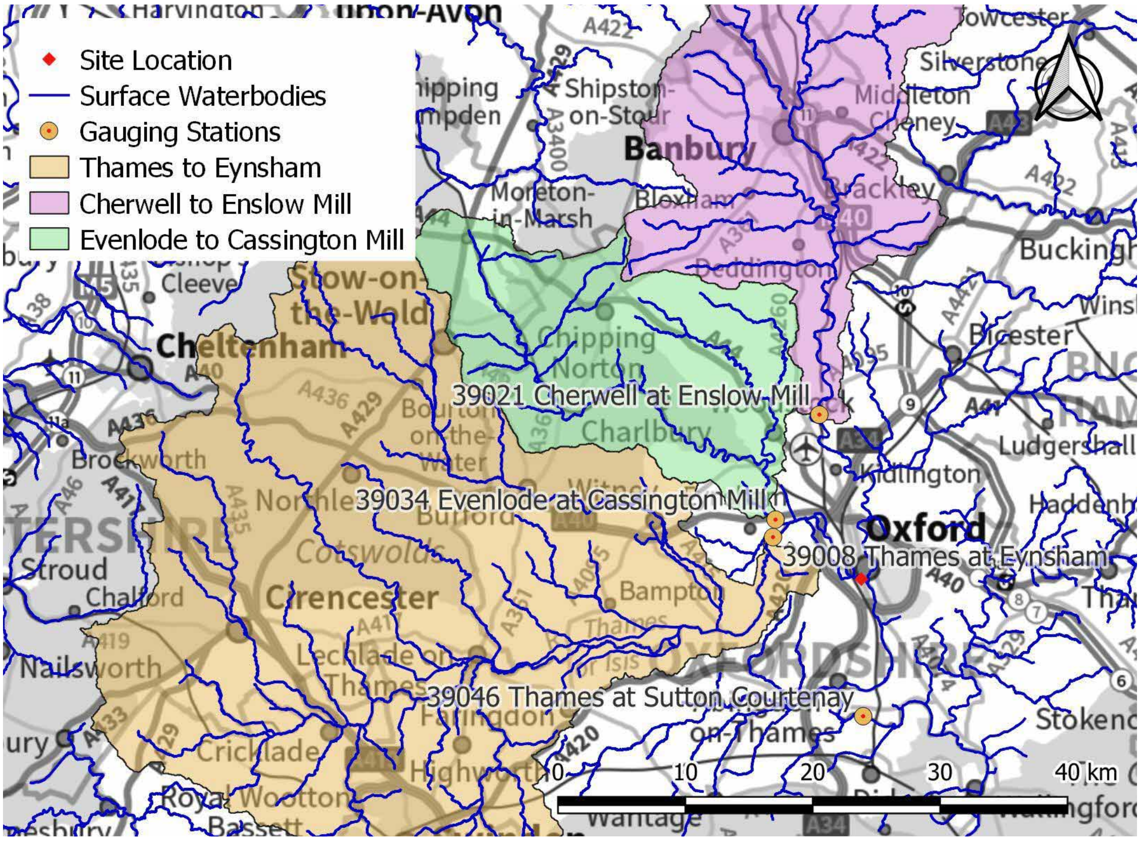

Figure 5: Location of gauging stations relative to the site

6.7 Each station was imported directly into WINFAP-FEH and the systematic historical analysis and/or single site or enhanced single site statistical analyses used to obtain flows for each return period based on the data.

Thames at Eynsham

6.8 The flow in the River Thames on 24th July 2007 was 102.0m^3/s. The length of record for this station is insufficient to rely on estimates of return period in excess of 13 years and therefore an enhanced single site analysis has been undertaken on this gauge. An initial pooling group was derived comprising 13 gauges, and at-site data was included. Stations were rejected for the following reasons:

Data record of less than 20 years - 27099;
Significantly differing hydrological area - 203010;
High rainfall (SAAR>850) - 43007, 27009;
Small catchment less than 50% of subject area - 33034; and
Sites with high L-SKEW (subject catchment has FARL=0.946 and low L-SKEW) – 27041.

6.9 The station 25009 was retained in the pooling group in spite of having a high SAAR value due to the low FARL value and similarity to the site growth curve, to enhance the homogeneity of the group. The resulting pooling group had a record length of 469 years (the required minimum length for 20 year assessment is 100 years) and a H2 value of 1.12 (acceptable homogeneous).

6.10 The pooling group showed the strongest fit to the Generelised Extreme Value (GEV) and Pearson Type 3 (P3) distributions. As shown in Table 1, the estimated 20 year return period flow is 103.2m^3/s using the systematic historical analysis, and up to 107.0m^3/s for the maximum pooled estimate. Therefore the recorded flow in 2007 is between 99% and 95% of the estimated 20 year return period flow.

Table 1: Systematic Historical and Enhanced Single Site Assessment Output for Station 39008

	2 years	5 years	10 years	20 years	25 years
Historical	71.98	87.15	95.61	103.16	105.47
Single Site GEV	71.63	88.78	97.19	103.59	105.33
Pooled GEV	71.80	89.67	99.23	107.00	109.22
Pooled P3	71.80	89.19	98.67	106.71	109.09

6.11 The WINFAP flood statistics calculator calculates a return period for the 2007 event in the River Thames of 17 years using the GEV distribution and 17 years using the P3 distribution. The recorded 2007 flow is within 1% of the computed historical 20 year event, and within 5% of the maximum flow estimated using the pooled statistical analysis.

Cherwell at Enslow Mill

6.12 The flow in the River Cherwell on 22nd July 2007 was 85.5m^3/s. The systematic historical calculator was unable to determine confidence limits for this data, so the single-site statistical analysis was also undertaken.

6.13 According to the calculated growth curve, the 2007 flow equates to a return period of between 75 years and 100 years, however, confidence is low in these estimates for return periods over 27 years. Nevertheless, as shown in Table 2, the estimated 20 year return period flow is 37.2m^3/s using the systematic historical analysis, and up to 46.6m^3/s for the maximum single-site estimate. Therefore the recorded flow in 2007 is between 1.8 times and 2.3 times the 20 year return period flow.

Table 2: Systematic Historical and Single Site Assessment Output for Station 39021

	2 years	5 years	10 years	20 years	25 years
Historical	19.74	26.35	31.44	37.17	39.19
Single Site GL	19.30	26.89	34.71	45.60	49.98
Single Site GEV	19.30	27.13	35.33	46.62	51.13
Single Site KAP3	19.30	26.92	34.88	45.95	50.40

6.14 The WINFAP flood statistics calculator calculates a return period for the 2007 event in the River Cherwell of 85 years using the Generalised Logistic distribution, 83 years using the Kappa 3 distribution, and 82 years using the Generalised Extreme Value distribution.

Evenlode at Cassington Mill

6.15 The Evenlode presents the simplest information in that the record length is sufficient to estimate return periods flows for up to 25 years with a high degree of confidence, and the recorded data is suitable for the historical analysis.

6.16 The flow in the River Evenlode on 21st July 2007 was 75.5m^3/s. According to the calculated growth curve, this equates to a return period of between 200 years and 500 years (using the maximum confidence limits), however, confidence is low in these estimates for return periods over 25 years.

6.17 Nevertheless, as shown in Table 3, the estimated 20 year return period flow is 32.2m^3/s (upper confidence limit of 37.2m^3/s, and therefore the recorded flow in 2007 is between 2 times and 2.5 times the 20 year return period flow.

Table 3: Systematic Historical Assessment Output for Station 39034

	2 years	5 years	10 years	20 years	25 years
Magnitude	19.98	24.95	28.46	32.17	33.44
Confidence	±8%	±9%	±12%	±16%	±17%

6.18 The 2007 event in the River Evenlode may therefore be considered to be substantially in excess of the 20 year return period flood. The WINFAP flood statistics calculator calculates a return period for the 2007 event in the River Evenlode of 660 years using the Generalised Logistic distribution, although using the upper confidence limit curve the return period could be as low as 75.

Return Period Assessment

6.19 Statistical analysis of both the Cherwell and Evenlode catchments indicates that the return period of the 2007 event for these rivers is substantially in excess of 20 years. As shown in Table 4, the proportion of flow in 2007 from the Thames, which recorded a lower return period flow, was less than 40% into the study area, and therefore, using a simplistic representation of flow mechanisms, the return period of the full event downstream of the full confluence of flows would tend towards the higher estimated return periods, regardless of flood mechanism, since a total of 61% of the 2007 flow was contributed by the Cherwell and Evenlode catchments.

Table 4: Relative importance of catchments

	2007 Flow	Proportion	Return Period
Thames	102m^3/s	39%	17 - 25
Cherwell	86m^3/s	33%	75 - 100
Evenlode	76m^3/s	29%	75 - 500

6.20 However, the site is located in an area where flow from the Thames and Evenlode is substantially reduced, especially at lower return periods, due to the separation of flow routes which carries the majority of flood water down the western side of the railway embankment, bypassing Oxford entirely, and only returning to the Thames downstream of Grandpont House. This mechanism can be clearly seen in Figure 6, which shows the modelled 20 year return period floodplain. This shows that only in-bank flow passes along the River Thames, with the natural floodplain falling west of the railway embankment. Indeed, Figure 6 shows Grandpont House to fall on the Cherwell side of the watershed which is created by the raised railway embankment and high land towards Oxford city centre. The result is that the flood risk at this location is dominated heavily by the River Cherwell.

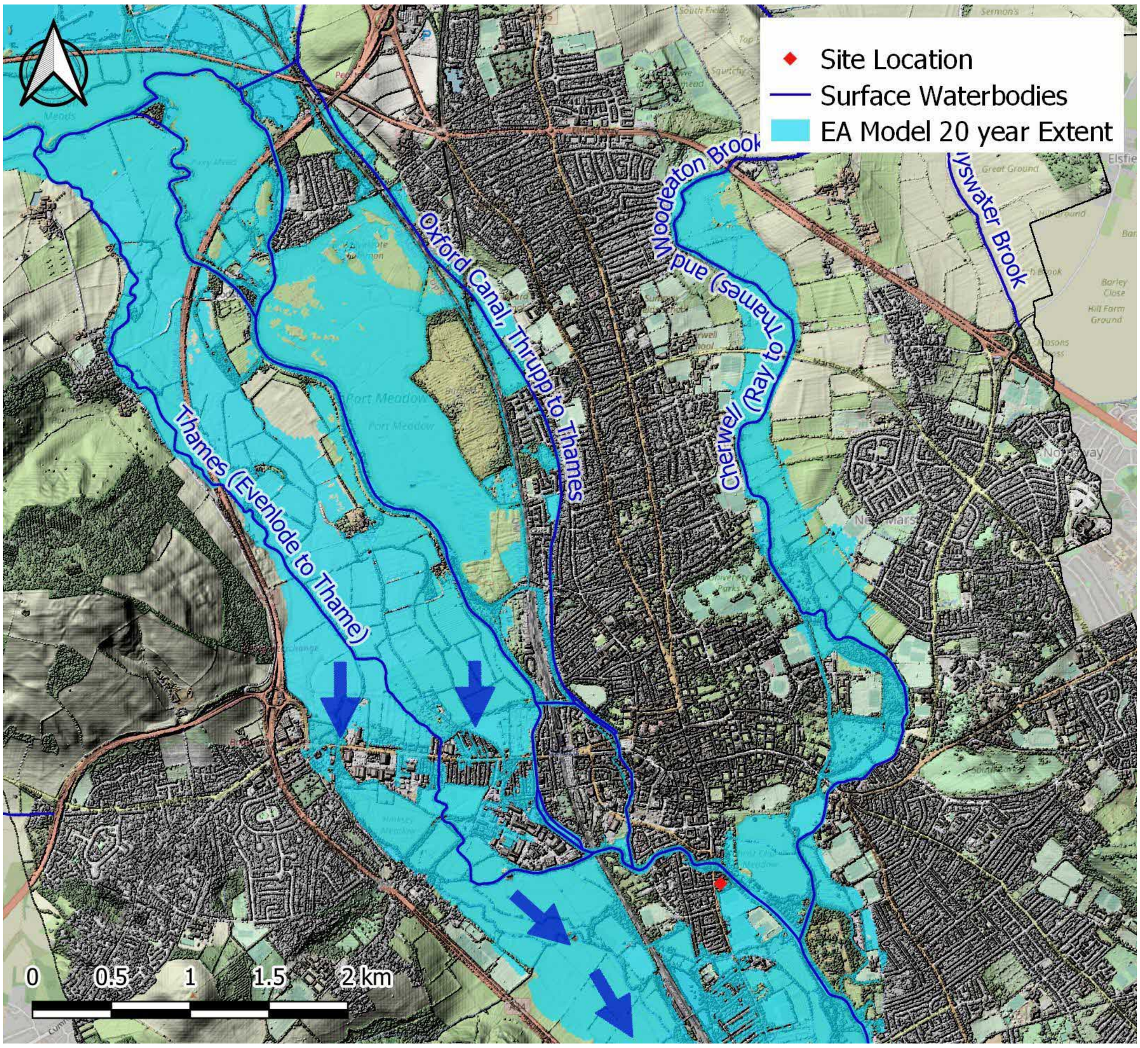

Figure 6: Flood flow mechanisms

6.21 This can also be seen when comparing the outlines for flood risk from rivers and the outlines for flood risk from failure of impounded reservoirs, as shown in Figure 7. This is a useful comparison because the outlines denoting the area at risk from reservoirs along the Thames valley at Oxford specifically compare very well with the area of fluvial flood risk as denoted by Flood Zone 3- however, there are no impounded reservoirs within the Cherwell catchment.

6.22 While the outlines showing the areas at risk differ only imperceptibly on the western side of the railway line and downstream of Eastwyke Ditch, the areas of risk to the east of the railway line, and through Oxford in particular are substantially lower for the reservoir scenario. This demonstrates that this part of Oxford is far more heavily at risk due to flooding in the Cherwell than in the Thames.

6.23 Having established that the Cherwell is the dominant source of flooding, it is also worth noting that, as shown in Figure 8, the higher return period flows in 2007 were observed in the northern catchments, which indicates a possible link to variable weather conditions.

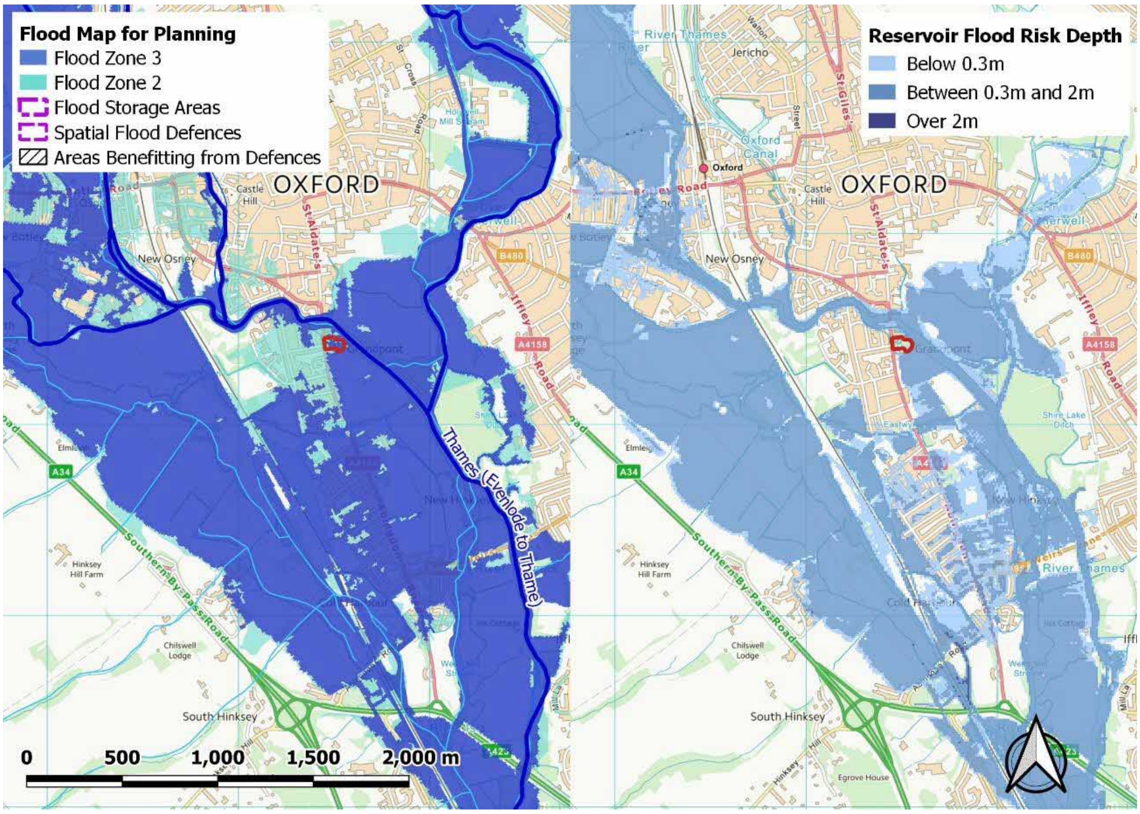

Figure 7: Comparison of fluvial and reservoir flood risk in Oxford

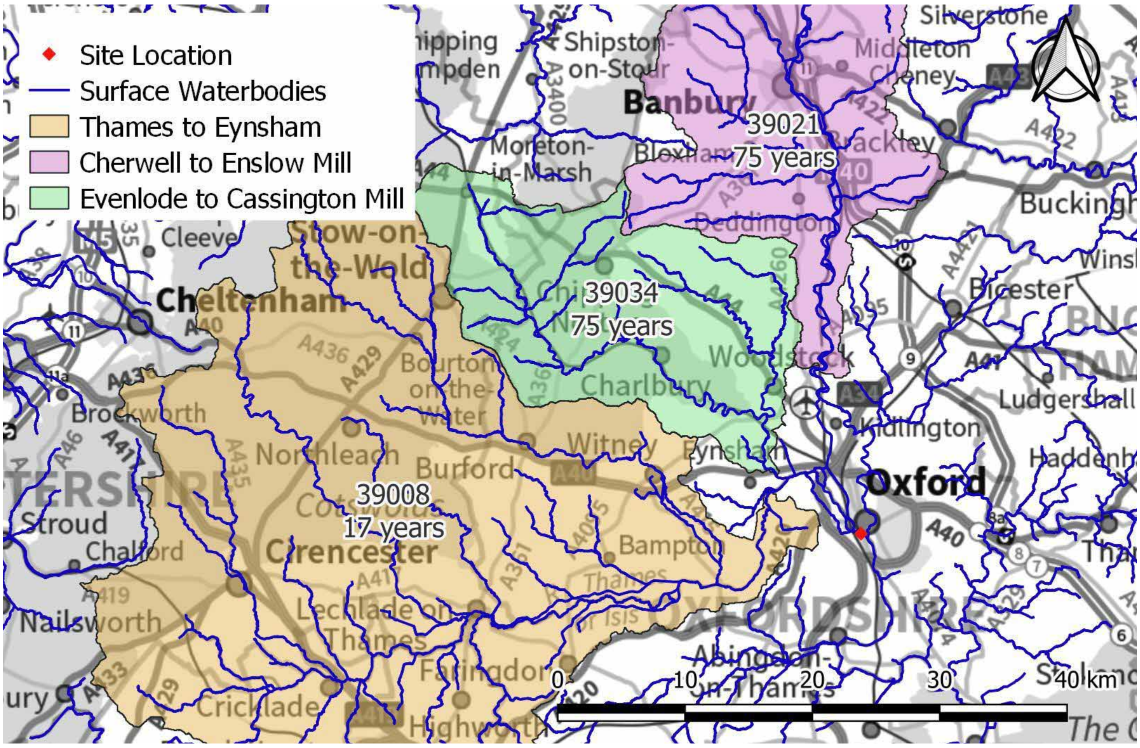

Figure 8: Catchment return periods for the 2007 event

6.24 On the basis that the Evenlode and Cherwell catchment return periods are estimated to be in excess of 75 years, the overall flood return period of the 2007 event is considered to be substantially in excess of 20 years.

2007 Flood Event at Grandpont House

6.25 The EA 2007 recorded flood outline is presented in Figure 9. Note that the record very clearly shows Abingdon Road as not flooding, and no flooding onto the Grandpont House site from the riverside. Flooding from the north is clearly shown to remain on the north side of the line of buildings on the north boundary of the site. On the site itself, the map suggests that water was observed in the existing pond area and along the channel through the site. This coincides with what would be expected due to the presence of Abingdon Road, and the evidence indicating that flooding does not come from the River Thames from the north or east. High water levels in the channel through the site and overtopping into the pond area has been confirmed by the occupants at Grandpont House.

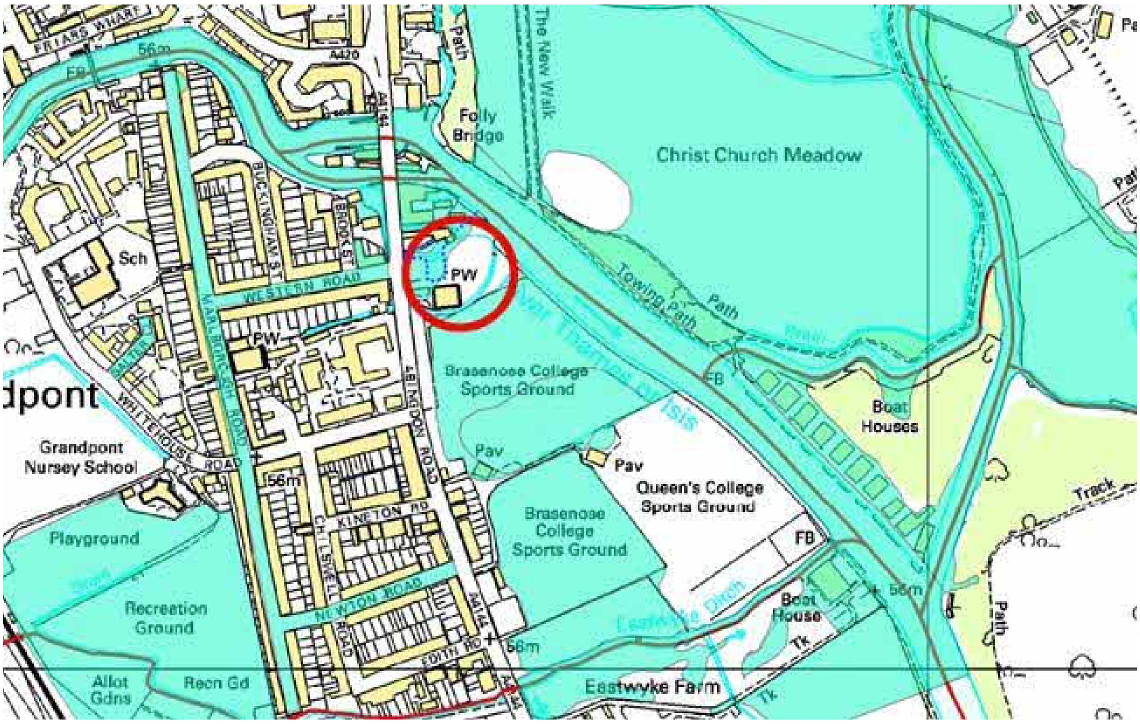

Figure 9: Environment Agency flood outline for the 2007 flood event (as provided in a Product 4)

6.26 The drawn extent in the EA historical map also suggests the area proposed for development flooded in 2007, but this is incorrect. The topography and mechanism do not support this, the only observation on site was rising water levels in the channel and into the low-lying marshy area only, without extending onto the higher ground proposed for development, as shown by the dotted blue line.

6.27 The main part of the garden east of the pond is not shown as having flooded. From a practical perspective the ground levels in this area are relatively consistent at 55.70m AOD to 55.75m AOD. These levels are 250mm – 500mm lower than the levels on the area proposed for development. Therefore if flooding on the site was caused from either the main Thames or the stream through the site from water backing up behind the culvert beneath the house, the main garden area would flood before the area proposed for development. Therefore the anecdotal evidence used to plot the historical map below cannot be correct.

6.28 Photos taken of the 2007 flood event are presented in Figure 10. These photos were taken from the access path leading from Abingdon Road towards Grandpont House (i.e. view in an easterly direction). The photos show the high water levels in the channel through the site at approximately 6 inches below the soffit level of the culverts beneath the house. The photos also show the flooding of the pond area but not the garden area behind.

Figure 10: Photos of the flooding at Grandpont House in 2007.

6.29 It is understood from the occupants at Grandpont House that these photos were taken at the peak of the flood event, when the water levels were at the highest on the site. The topographic survey of the site records the sprung arch levels of the culverts at 55.21m AOD to 55.24m AOD and the top of bank along the channel varies between 54.97m AOD and 55.26m AOD. The sprung arch levels and the bank have clearly been breached and so the water level is higher than 55.26m AOD. The soffit level of the two culverts beneath the house are 55.91m AOD and 55.95m AOD. Both soffits can be seen in the photos and thus the water level is not as high as 55.91m AOD. The water level has been estimated as approximately 6inches below the soffit level, which equates to 150mm and a water level of 55.76m AOD. Looking to the right of the house (east), the gravel path in the garden can be seen as not flooded. The topographic survey includes a spot level on the bank side of the path as 55.83m AOD. With the bank in front of the path clearly visible, the water level cannot be as high as 55.83m AOD. A tree is visible in the fourth photo below, with the trunk visible to ground level and not submerged. The topographic survey recorded a spot level for the top of bank of the pond in this vicinity as 55.66m AOD, although the ground level at the base of the tree was not recorded. It is, however, reasonable given levels across the site that the water is at this level, or not much higher, otherwise the tree would be submerged. Therefore, the peak water level on the site in the 2007 event was in the range of between 55.66m AOD and 55.83m AOD, and most likely in the order of 55.76m AOD. A water level of 55.76m AOD, or even as high as 55.83m AOD, would not flood the area of the site proposed for development.

Hydraulic Model Calibration

6.30 The EA requested that the calibration of the hydraulic model be considered in addition to purely relying on the historic observations. Specific observations detailed below are related to the calibration as discussed, and do not change our opinion that the known outlines of historic events, rather than modelled simulations should be used to define the functional floodplain, especially when reliable anecdotal information is available over a long period of time. This is in large part due to the inability to verify the performance of the model at the location specified, due to a lack of available information with which to secure a robust understanding and representation of the floodplain interactions created both by the railway embankment, which bifurcates the floodplain, and, immediately upstream of the site, the raised Abingdon Road as it approaches Folly Bridge, which constricts flows. This is in accordance with the conventional wisdom that true observed data should always be used in preference to mathematically idealised, and therefore approximate, data where discrepancies exist. It is also in accordance with the Planning Practice Guidance on defining the extent of Flood Zone 3b.

6.31 The calibration undertaken on the latest model issue does not comprise full model calibration, but rather, an adjustment to the previously calibrated model. According to the figures and tables in the hydraulic modelling report, the model is shown to overestimate flood water levels and extents for the 2007 event in the area between Abingdon Road and the River Thames. Therefore, it is reasonable to conclude that the modelled flood levels and extents are over-estimated at all return periods and certainly for those return periods that are of a similar scale to the 2007 event. Therefore, the actual recorded outline should be used in preference to the modelled data.

6.32 Calibration and verification shows reasonable agreement at gauges, however, there is an absence of gauges along the central Oxford reach, and as noted in prior discussions, it is extremely difficult therefore to determine whether or not the model is representing flooding in this extremely complicated area correctly. Observed floodplain levels are provided in the Hinksey and Botley areas, however these are not close to the Folly Bridge area of interest. It is however telling to note that, for the 2007 (main calibration) event, modelled flood levels at Botley (upstream of the railway line) are predominantly underestimates compared to the observed level, whilst at Hinksey (downstream of the railway line), levels are overestimated. The closest point hydraulically, to Grandpont House, point no. 5 (presented in Figure 11), overestimates levels by 170mm relative to the measured flood level. Point no. 2, another hydraulically similar location, overestimates by 420mm. The only points in the area presented in Figure 28 that underestimate the flood water level do so by no more than 3mm and lie either on the upstream side of the railway line (points 36 and 37) or immediately downstream on one of the braided channels returning flow to the main floodplain (point 10).

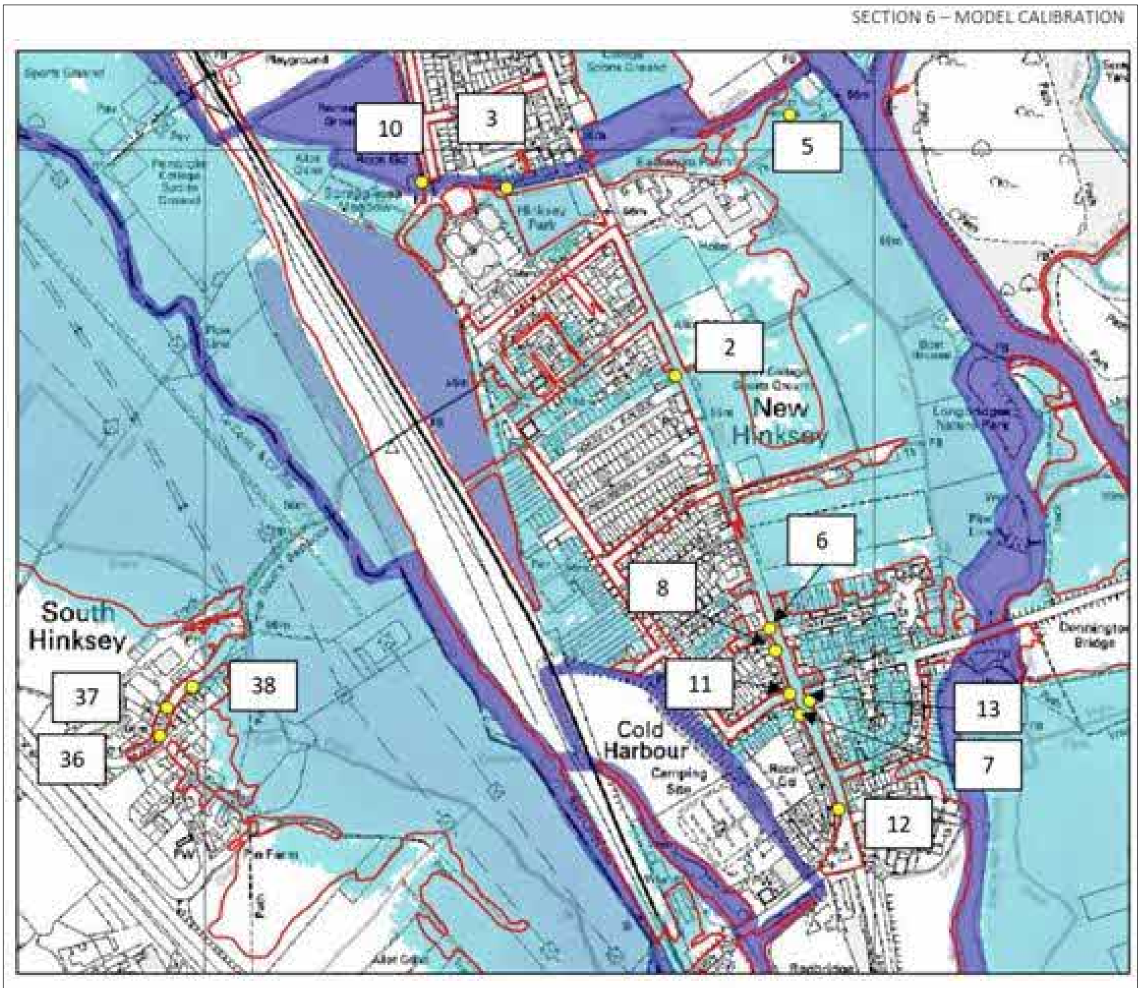

Figure 28: Comparison of 2007 observed and modelled flood extents (Hinksey Area)

Figure 11: Extract from EA hydraulic modelling report

6.33 It is noted that minor edits were undertaken to the model to correct instability and reversing flows at Osney, together with validation of spot gauged results in this area- this approach would generally be expected to significantly improve the understanding of the bifurcation in the floodplain around the Botley/Osney area which causes the discrepancies noted above. However, this work was undertaken on in-bank flows (and indeed, is run without the TUFLOW element present) and unfortunately does not therefore provide any meaningful validation of the flooded scenario, in particular the role of the railway line in altering the proportion of flow that passes down the Hinksey side to the west, thus bypassing central Oxford entirely. Therefore due to the lack of available gauged data on the individual channels and structures in observed flood events, the calibration through Oxford is unfortunately impossible to correctly achieve.

6.34 Although a lot of work has gone into the calibration and verification of the model, which is, in general, robust, there are clearly still shortcomings, which arise solely out of the difficulties of attempting to adjust a model of this scale to fit local hydraulics – this is through no fault of the modellers, it is simply the reality of the complexity in the area. When we have known data, this should always take precedence over derived data where discrepancies exist- the model should always be adjusted to fit the data, not the other way around.

Conclusion and Flood Zone Allocation

6.35 The area of the site at Grandpont House proposed for development did not flood in either 2007 or 2014. Initial EA estimates of the return period for the 2007 event put the return period between 10 and 50 years, while the 2014 event is estimated to have a return period of 25 years. This assessment has determined with a high level of confidence that the 2007 flood event had a return period in excess of 20 years when considering all inflow locations.

6.36 Photographic records of the site during both events have been provided to the EA and have been assessed. The water level peaked at very similar levels in both events with an estimated peak water level of 55.76m AOD in 2007 and 55.74m AOD in 2014. The EA historical flood maps are incorrect for both these events as they show the area proposed for development as having flooded, however this is not possible based on the topography and flood extents in the grounds of Grandpont House.

6.37 The hydraulic model estimates the 20 year flood water levels on the site as 55.93m AOD. However, this is inconsistent with historical records as the maximum water level reached in any flood event in the living memory of those onsite (since 1959) was in 2007 and 2014. The calibration of the hydraulic model confirms that the model overestimates the 2007 water level on the reach of the Thames downstream of Folly Bridge and Grandpont by between 170mm and 420mm.

6.38 Given all the evidence, it can be deduced that the model is overestimating flood water levels on the site in events of similar magnitude to 2007 and 2014 and as the area proposed for development has not flooded in at least 40 years (based on witness statements of occupants still present at Grandpont House, but actual record likely to be longer than 40 years), including 2007 and 2014, that the area proposed for development is not in the functional floodplain.

6.39 In the most recent letter from the EA, a closing comment is noted that:

> *We must see clear evidence that none of your red line boundary or built footprint is impacted by this [55.76m AOD flood level] event. [...] An overlay showing exactly where the red line boundary and built development is to be located [...] needs to be included.*

6.40 The exact text of the comment above is slightly ambiguous as to whether the red line boundary or the built footprint is to be used in determining the principle of development. Since a minor channel of the River Thames passes through the site, and there is an existing low-lying marsh within the site boundary, this is a material consideration, since it is not possible to exclude these areas from the flood event.

6.41 However, there is previous appeal case law in this matter, as set out in Thackard Ltd vs Teignbridge District Council (appeal reference APP/P1133/A/13/2209715). The inspector's view of policy is as follows:

> *The Council's approach in this case confuses the location of application sites (as defined by the 'site edged red') with the location of vulnerable development. This approach could readily be circumvented by the technicality of simply excluding areas within Flood Zones 2 and 3 from the site boundary, but in practical terms that would achieve little other than to prevent appropriate treatment of such land by excluding it from the purview of any resultant planning permission. The fundamental policy intention is to prevent vulnerable categories of development from actually being built on land susceptible to flooding and application sites routinely encompass land in more than one flood zone. The important object is to*

design or condition schemes so as to meet that policy intention and that would be perfectly possible in this instance.

6.42 The building has been located in such a way as to avoid development within the land designated as Flood Zone 3b using the 55.76m AOD level, and is wholly accessible at the upper level. The proposed vulnerable development therefore is located outside Flood Zone 3b except where Flood Zone 3b coincides with the existing water feature (river channel) on the site, where it will be crossed, internally and externally, on clear span bridges above the 100 year water level. Therefore, the principle of development is acceptable.

7 HYDRAULIC MODELLING

Availability of Hydraulic Models

7.1 The EA has provided the River Thames – Eynsham to Sandford 2018 hydraulic model for use in the study. The model was checked and evaluated, and aside from the shortcomings relating to model calibration and hydrology, which cannot readily be overcome, is deemed fit for purpose.

Technical Alterations

7.2 In order to minimise costs and ensure the assessment scope is reasonable given the scale of the proposals (in accordance with the NPPF), no technical alterations to the base model were undertaken. This is to ensure there is no need for a costly Flood Map Challenge or model verification process.

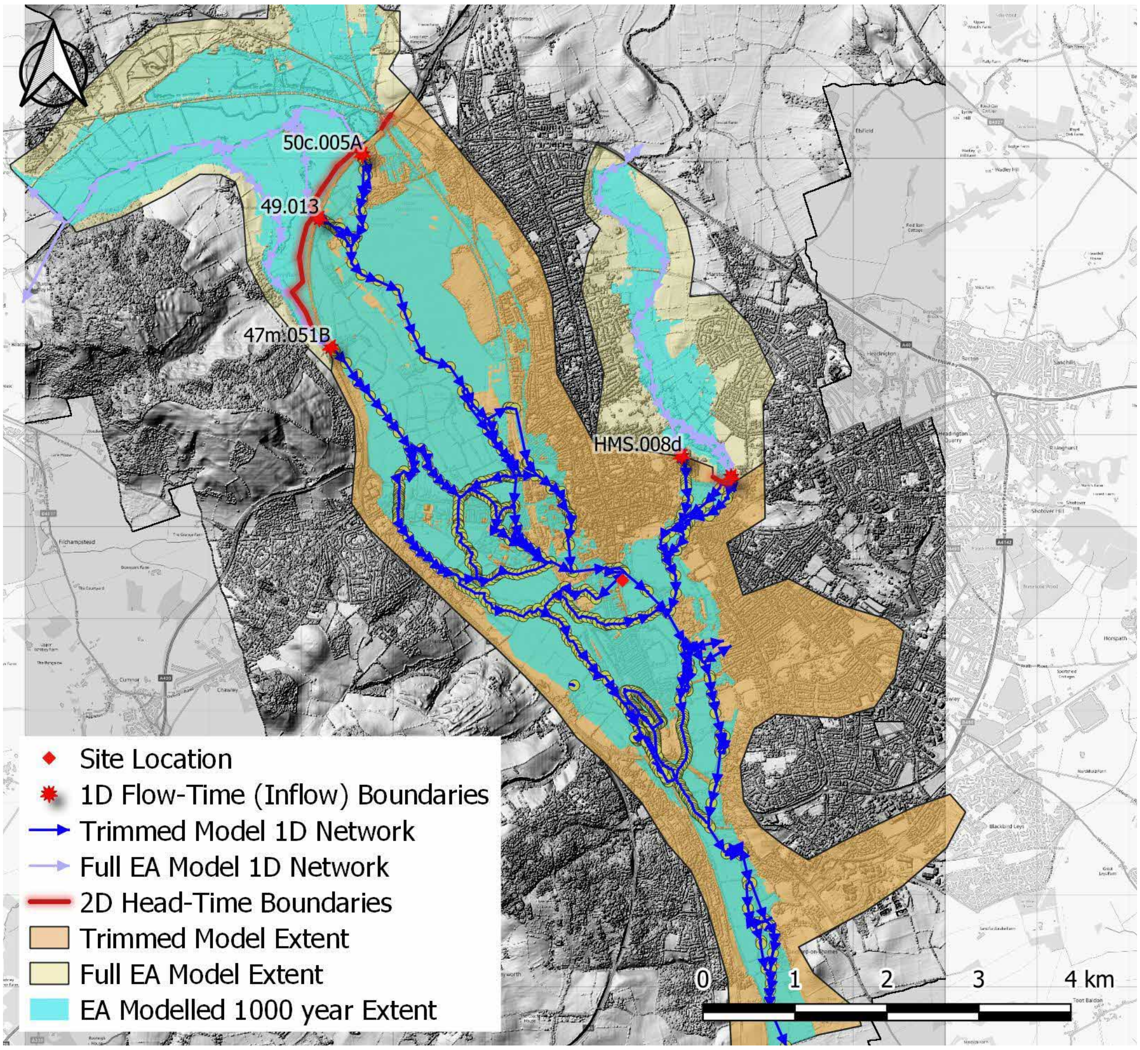

Figure 12: Model schematic showing trimmed section

7.3 The model was trimmed upstream to shorten run times and enable the model to be run within a limited node licence by removing the 1D sections upstream of the A34 on the River Thames, and upstream of the High Street bridge on the River Cherwell, as shown in Figure 12. The 1D inflows at the A34 were obtained by extracting flow-time results from the full model results for each node, and 2D boundaries were applied upstream of each culvert or floodplain inflow location using extracted head-time results from the 2D.

7.4 As can be seen in the figure, both locations create full barriers to flow and therefore form robust hydraulic boundaries for the model- the locations and boundaries were refined until there was no difference (±0.001m) in the 2D results grids for the 100 year return period event including 25% allowance for climate change on the downstream side of either the A34 or the High Street. This ensures that the trimmed model replicates the results of the existing EA model, i.e. it is identical. No technical changes were made to the model except to replace the 2D grid at the site by updating the DTM.

Scenarios

7.5 The model was run for the provided 2 year, 5 year, 20 year, 100 year, 100 year plus 25%, 100 year plus 35% and 1000 year flows. Each return period was run for the following scenarios:

EA model build with DTM at Grandpont House replaced with a grid compiled from the 3d topographic survey (including buildings); and

As above, with the proposed scheme elements included in the DTM, as described below.

7.6 The proposed scheme DTM was built using the survey DTM as the basis. The outline of the proposed building was raised to 60m AOD, around 4m higher than the surrounding ground, and the area of proposed lowering (to form volume-for-volume compensation) was included as an area of lowered ground, to 54.5m AOD. The output model check file grids are presented in Figure 13 and show the proposed scheme to be correctly represented within the 2D model.

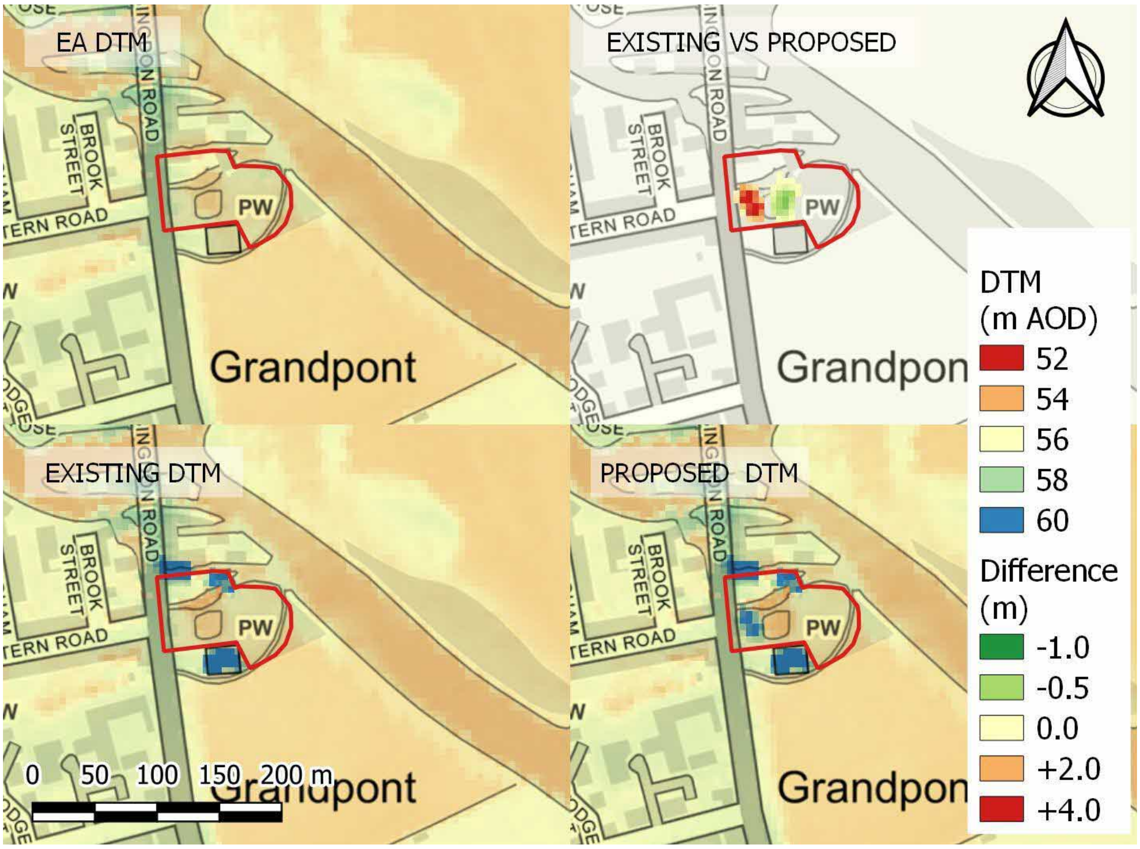

Figure 13: Comparison of 2D model grids

8 ASSESSMENT OF FLUVIAL FLOOD RISK

Modelled Flood Risk

8.1 The maximum water level grid output by TUFLOW was interrogated to obtain the maximum water levels for design, which are presented in Table 5. 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 5: Modelled maximum flood water levels

	2yr	5yr	20yr	100yr	100yr + 25%	100yr + 35%	1000yr
47.079 (u/s)	55.52	55.73	55.97	56.16	56.31	56.41	56.43
Max on-site	n/a	n/a	55.94	56.13	56.28	56.39	56.41
Min on-site	n/a	n/a	55.94	56.14	56.29	56.40	56.42

8.2 The modelled flood event outlines are presented in Figure 14.

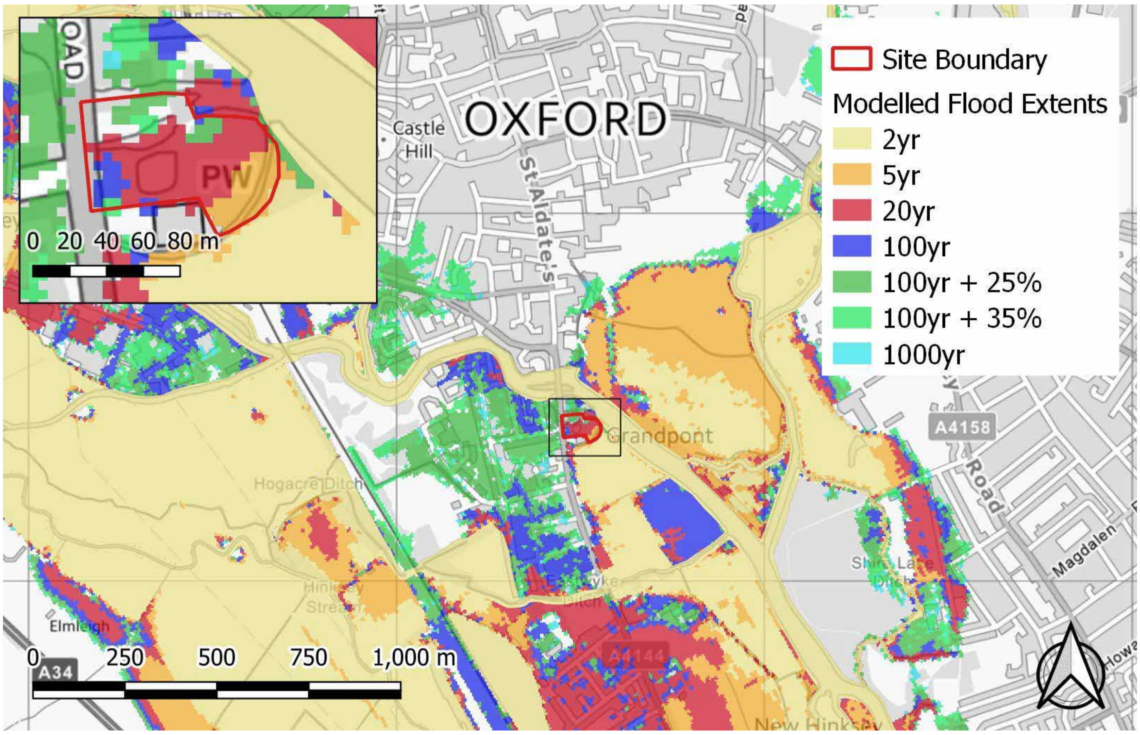

Figure 14: Modelled flood event outlines

Climate Change

8.3 The recommended allowances for climate change were updated on 21st July 2021, and revised estimates, based on River Management Catchments, have been released[25]. In addition the guidance has changed such that all assessment should use the central allowance except for Essential Infrastructure in the floodplain[26].

[25] https://www.gov.uk/government/publications/peak-river-flow-climate-change-allowances-by-management-catchment
[26] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-river-flow-allowances

8.4 The new allowances for Oxford are complicated by the differing catchments. The 'Central' allowance to the 2080s for the River Cherwell catchment is 15%, with the sensitivity allowance (Higher Central) set at 25%. For the Thames, the "Cotswolds" catchment has a 'Central' allowance of 30%, however, the "Gloucestershire and the Vale" management catchment requires only 26%. The site lies within the "Gloucestershire and the Vale" management catchment extent, however very little of the flow passing the site comes from this catchment area. The downstream catchment "Thames and South Chilterns", which includes all the relevant inflows at the site, but does additionally include substantial additional tributary inflows, requires an allowance of 31%.

8.5 As discussed above, the River Cherwell is the dominant flood source at the site. This would require a design climate change allowance of 15%. However, the model has been run for 25% and 35% climate change scenarios. The 25% model coincides with the 'Central' allowance that is specific to the site based on location, and is a significant increase relative to the required allowance for the River Cherwell which is the dominant flood source. The 35% allowance is higher than any of the possible required allowances and therefore is used as a sensitivity test.

8.6 For determination of off-site impacts, since there are no "Essential Infrastructure" uses (defined as essential transport i.e. mass evacuation routes, wind turbines or essential utility infrastructure) within the floodplain near the site, the 'Central' allowance should be used, and therefore the 25% allowance is used in design. The 35% allowance is used as a sensitivity test.

Assessment of Flood Risk

8.7 The modelled 100 year return period event including a 25% allowance for climate change is used to assess the risk of flooding. The design flood water level is 56.29m AOD.

8.8 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[27]:

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

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)[28], 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.

8.9 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.

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

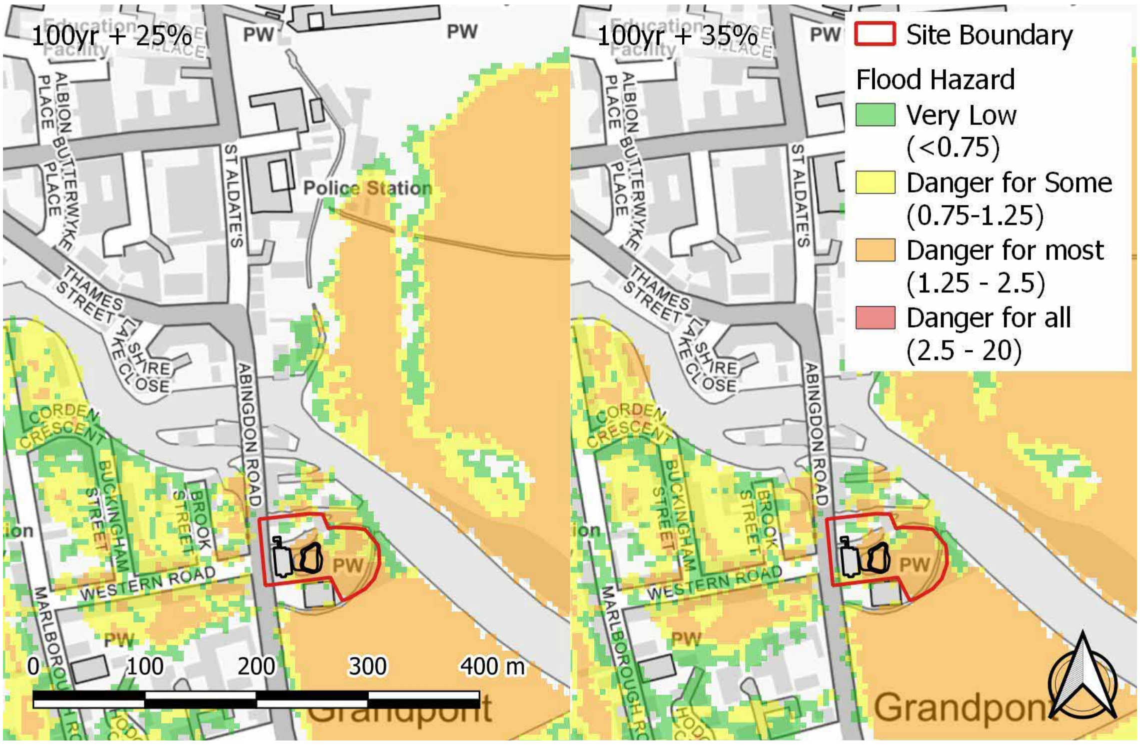

Figure 15: Modelled flood hazard – proposed development scenario

8.10 The hydraulic modelling indicates that the flood hazard rating for the area of the site where the building is to be situated is negligible, including the 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. Flood water does not overtop Folly Bridge and therefore this access route remains safe.

Design Response to Flood Risk

8.11 Ground floor finished floor levels in the proposed new building will be set no lower than the sensitivity flood water level of 56.40m AOD. In addition, the underside of the ground floor slab will be set above the modelled on-site flood level for the 100 year return period event including 25% allowance for climate change (the required design level) of 56.29m AOD, and water will be allowed to flood freely beneath the building.

8.12 The proposed development will increase the number of residential units on the site. There will be no ground floor sleeping accommodation in the proposed new building. Residents will be able to reach the new building and exit the property throughout a 100 year return period event, including both the required allowance for climate change and the sensitivity level, and there will be internal access to higher floors in the event of flooding on the existing access routes as a result of more severe events. It is noted that Abingdon Road, and the higher areas of the site to the west, are not expected to flood even in the 1000 year return period event.

Flood Management and Personal Flood Plan

8.13 It has been established that the proposed development would be dry and fully accessible throughout the design 100 year return period event with climate change included. However, it is prudent to devise and maintain flood management, action and evacuation plans, which will equally apply to the existing development, to ensure rapid recovery following any flood event.

8.14 The Environment Agency has prepared a template document for compilation of a "personal flood plan", which is available at www.gov.uk/government/publications/personal-flood-plan, and is equally applicable for this residential scenario. The document enables the occupier and residents to record the contact details of critical services and information providers for future reference, as well is emergency contacts and locations of cut-off points for services.

8.15 The second part of the flood plan recommends several actions to take when a flood is expected to safeguard personal possessions and prepare for removal to an upstairs location should an extreme event be forecast.

Floodplain Storage and Compensation

8.16 The proposed building is to be raised on stilts with suspended ground floor slab supported on columns and the underside of the structure will be above the design flood water level. Water will flow freely underneath and egress naturally once water levels recede, without impacting on the flooding mechanisms described in preceding chapters. The development would therefore not result in loss of flood storage or obstruction of flood flows.

8.17 Under floor space will be designed in accordance with latest best-practice provided by the EA in terms of the width and number of openings, access protection and grills. A maintenance plan will be prepared and adhered to by the Grandpont House staff to ensure the space is kept open and clear of debris, with regular inspections and clearance as required.

8.18 Therefore, the actual impact of the proposed building, as proposed, is negligible, since it will not occupy any floodplain storage.

8.19 As a sensitivity test, the model was used to assess the impact if the open space beneath the building is solid and does not provide any floodplain storage or conveyance of flow, should the overhangs or voids become obstructed. The hydraulic modelling shows that changes in flood storage on the site do not have any offsite impact. However, additional flood storage will be provided in the form of excavation between the low-lying marshy area and the channel through the site.

8.20 Usually, such compensatory storage would be provided at the same level as the storage removed. However, in this case, due to the lack of available high land, this is not possible. Instead, compensatory storage will be provided to the same volume, but at the lower level. This means that storage is over-provided for during smaller return period events, but remains sufficient at the maximum event. This was previously agreed with the EA and the same principle applies to this development. Thus, the total volume available at each 100mm increment remains higher than in the undeveloped scenario.

8.21 The hydraulic modelling exercise undertaken as part of this Flood Risk Assessment showed that the development did not have any negative impact on the flood risk elsewhere by increasing flood water levels. The proposed extension was represented as a solid barrier to flood flow. The compensatory flood storage was included in the model by flattening the area of the proposed ecological area to the minimum ground level.

8.22 Consequently, although the proposed extension does not reduce flood storage on the site, and compensatory flood storage is not required- additional storage is nevertheless provided, in sufficient volume to fully offset the loss should the area beneath the building be considered solid, within the low-lying marshy area.

Effect on the Risk of Flooding Elsewhere

8.23 By altering the hydraulic model, it is possible to assess the impact of the proposed extension on flood risk. It is noted that, by excluding the proposed building from the floodplain entirely, any calculated impacts are conservatively over-estimated, since there is no allowance for the free-flooding design of the building.

8.24 Comparison of the modelled flood level results grids was undertaken by subtracting the pre-scheme (baseline) maximum flood level grid from the post-scheme maximum flood level grid. This produces a grid showing the change in flood water level across the entire model area.

8.25 The model results showed that the proposals do not have any impact on flood water levels away from the site that do not fall within model tolerances (±1mm), for any return period modelled from 2 years to 1000 years and including climate change. The "greatest" impacts were modelled at the 20 year return period event, and arise due to fluctuations in critical model calculations.

8.26 Figure 16, presents the change in flood water levels for the 20 year return period event. Changes in water level of no more than 1mm are modelled on Christ Church Meadows, with no effect on modelled flood extents. Changes in modelled levels of 1mm are well within model tolerances and the conclusion is that there is no change in model results arising due to the proposed development.

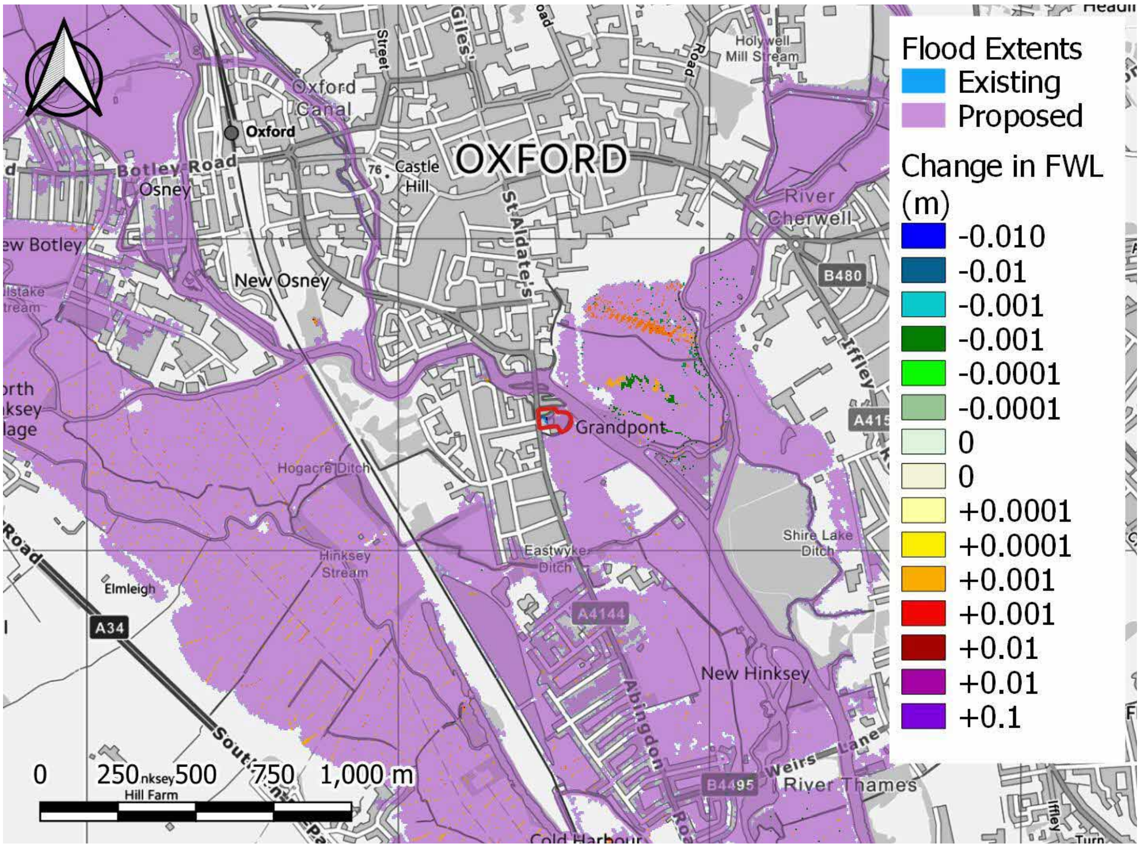

Figure 16: Modelled impact of the proposals on the 20 year flood event

8.27 A closer view, including remaining return periods, is presented in Figure 17. This shows that minor reductions in flood water level of the order of 10mm are modelled on site. Since these fall at the edge of the floodplain, these are likely to arise purely as a result of changes in wetting and drying for these cells and do not necessarily indicate that flood risk on the site will be reduced. The extents of flooding are clearly reduced in the proposed case model, showing that the model is working correctly.

8.28 It may be concluded, therefore, that the proposed development will not have any adverse impacts on flood risk.

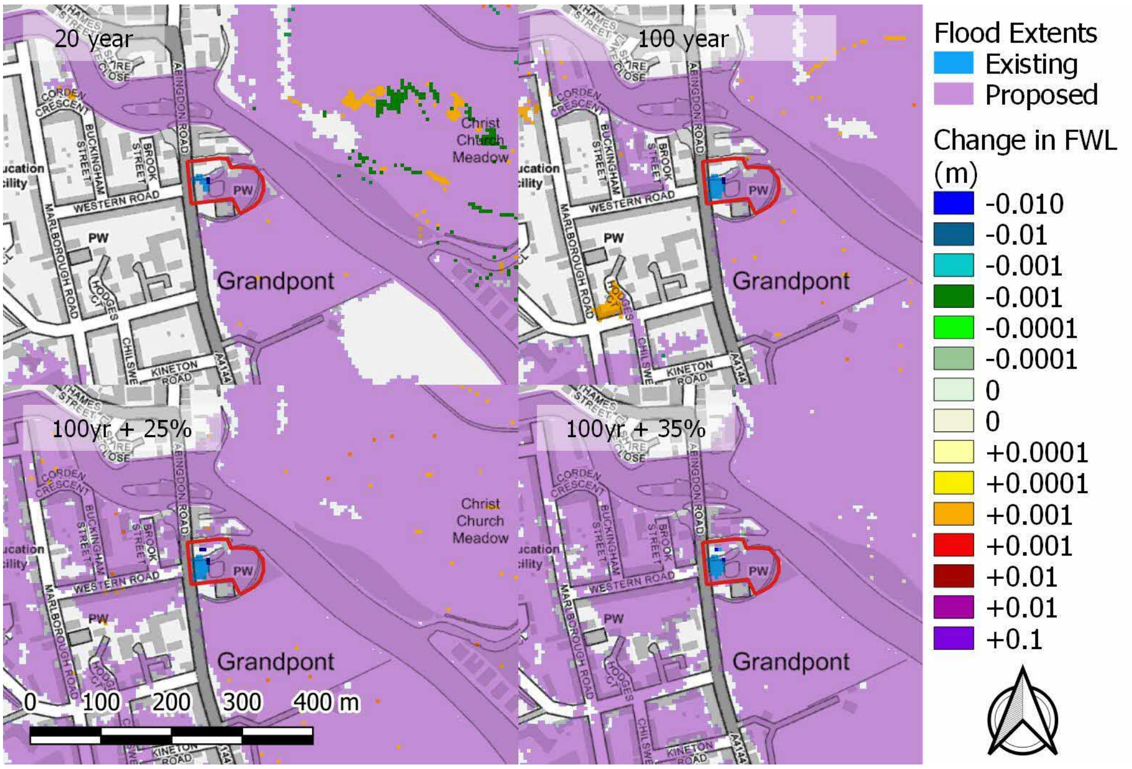

Figure 17: Impact figures for remaining return periods illustrating the reduced effect

Flood Storage Calculations

8.29 The under-floor void design outlined above, though effectively removing the majority of built structure in the floodplain and thus preventing loss in floodplain storage capacity, could become blocked. Although it has been shown that the proposed development does not affect flood risk, it is prudent as a precautionary measure that compensation be provided.

8.30 The 3d topographic survey model was used to perform a cut and fill exercise for the proposed development. The footprint of the proposed building was raised to the 100 year return period level including a 25% allowance for climate change of 56.29m AOD. The required fill to achieve this level is 124.4m^3. The minimum ground level within the building footprint is 55.10m AOD (according to the 3d model) and therefore all storage must be calculated from this level.

8.31 The minimum spill height for free draining of the marshy area is 55.10m AOD, so this is the lowest level at which storage can be compensated. This coincides with the minimum level at which storage is lost and therefore is acceptable.

8.32 Storage is provided by flattening in the marshy area to create a level base to the pond, which has been set at 54.50m AOD for the purposes of design and to enable free flooding from the existing marshy area into the proposed new pond zone. The minimum level in this area is 54.28m AOD and therefore the entire excavated volume is considered to contribute as floodplain storage, since the resting water level is expected to be no higher than 54.28m AOD.

8.33 The total volume provided in the compensation area is 195m^3. This is an increase of 57% compared with the design standard flood event. A comparison of the net change in storage within the pond area with the storage lost at each 100mm level is presented in Table 6. All excavation takes place at or below 56.0m AOD, and therefore the storage compensation provided above this level remains the same for all increments at 195m^3.

Table 6: Calculated storage change at each 100mm level (all m³)

Level m AOD	Built Footprint (Loss)	Existing Pond Area	Proposed Pond Area	Pond Storage Gained	Net Flood Storage
55.2	1	51	209	158	+157
55.3	1	77	245	168	+167
55.4	2	107	282	175	+173
55.5	3	138	320	182	+179
55.6	5	170	359	189	+184
55.7	6	206	399	193	+187
55.8	7	245	439	194	+187
55.9	23	285	479	195	+172
56.0	27	325	520	195	+168
56.1	59	366	560	195	+136
56.2	93	406	601	195	+102
56.3	128	447	642	195	+67 (52%)
56.4	162	488	682	195	+33 (20%)

8.34 The calculations show that there is an increase in available flood storage at all levels from the minimum level lost to the 100 year return period event including 35% allowance for climate change (sensitivity event). For all calculation levels presented above, the pond is freely floodable and draining, with no change in the mechanism of flooding to the pond area.

Residual Risk

8.35 There is a minor risk that any blockage of the culverts under the existing building will result in additional flooding from the reach of the river that bisects the site. In extreme events, this is unlikely to have a significant impact on site, since the dominant flooding mechanism is from downstream of the culvert, but may increase the duration of residual flooding when the Thames recedes, due to the reduced capacity of the drainage pathway. The site is also located downstream of the Abingdon Road culverts, which would trap debris prior to it reaching the site, further reducing the probability of such an event. Blockage of any of the culverts on site would therefore tend to reduce the risk of flooding at the site, by reducing the possible pathways for floodwater to reach the site.

8.36 The modelled flood mechanisms clearly show that blockage of the culverts on site would not result in an increase in the risk of flooding and therefore no additional residual risk on the site.

Consequences of Flooding on Site

8.37 The site has been designed to remain safe in the 100 year return period event including an allowance for climate change. The building would remain dry and accessible. Therefore the consequences of flooding on site are minimal.

Exception Test

8.38 The site lies in Flood Zone 3 and additional residential units are proposed. Therefore the development needs to pass the Exception Test.

8.39 Development of this site will enable essential maintenance work to be completed on the existing Grade II* listed building on the site. It will improve the amenity of the space by providing enhanced educational facilities, and employ sustainable techniques for water usage and surface water management. Further, due to the compensatory storage areas, and the ecological works at the site, the proposals will have a net beneficial effect in relation to both flood risk and biodiversity.

8.40 This FRA demonstrates that the development will be safe during a 100 year return period flood, including allowances for climate change, and does not increase flood risk elsewhere. The FRA has identified each source of flooding, and although the risk to the site is low, the design incorporates measures to protect residents from flooding. The site satisfies the Exception Test, and is appropriate for the proposed development.

9 SURFACE WATER MANAGEMENT

Policy

9.1 The proposed development is not "major development" and therefore there is no requirement to undertake a detailed SuDS strategy for the development. However, OCC policy does require the inclusion, where possible, of SuDS as a means of managing surface water drainage.

9.2 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.

9.3 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*.

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

Existing Site Runoff Characteristics and Drainage

9.5 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 gravel. The ground cover in the area proposed for the new building is grass and vegetation.

9.6 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. Surface water runoff currently discharges from the existing roofs and hardstanding areas directly to the River Thames. The remainder 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.

Post-development Runoff Characteristics

9.7 The proposed development will result in a gross increase in impermeable area on the site due to the introduction of the extension building. Path and driveways will be constructed from permeable materials, thus maintaining the current infiltration patterns on the remainder of the site.

9.8 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.

9.9 The only alteration to the runoff characteristics will therefore result from construction of the extension. The introduction of this impermeable area will result in a net increase in surface water runoff, which should be attenuated to existing Greenfield rates to avoid potentially causing an adverse impact on flood risk elsewhere.

Discharge Hierarchy

9.10 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."*

9.11 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.

9.12 Since discharge by infiltration is not possible, new drained areas (specifically the proposed new building) will be collected and discharged directly to the River Thames at an attenuated rate where feasible, in accordance with the discharge hierarchy, set out in Table 7.

Table 7: 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)

9.13 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.

[29] CIRIA (2001), *CIRIA C523:* Sustainable Drainage Systems – Best practice.

9.14 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.

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

9.16 Table 8 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.

Table 8: 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			

9.17 In order to provide source control and retain rainwater on site for reuse, it is recommended that rainwater is collected into a storage tank (blue roof) or water butts in the first instance, to be re-used as irrigation, and for non-potable water use. Green roofs may also be considered subject to conservation and structural constraints. However, in a conservative approach to the calculation, rainwater collection is not considered within the calculations.

[30] http://www.sustainabledrainagecentre.co.uk/suds-hierarchy_c2236.aspx Retrieved 02/11/2016

9.18 Basins, ponds, 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.

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

9.20 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 9: 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 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

9.21 Surface water runoff will be attenuated to Greenfield rates, if feasible, 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

9.22 Since the site 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. 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.

9.23 In order to attenuate to Greenfield rates without utilising surface or sub-surface attenuation features at ground level, surface runoff from the roof areas could be collected at roof level and discharged to a storage tank located within the building. This tank could form part of a rainwater harvesting system that additionally promotes sustainable water usage where mains potable water is not required, such as in toilets and washing machines. Any tank would be designed to attenuate the 100 year storm including an allowance for climate change, releasing water to the River Thames at Greenfield rates.

Drainage Exceedance

9.24 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 existing on-site watercourses. Exceedance flows will be extremely small in the context of overall flood volumes.

Effect on Flood Risk Elsewhere

9.25 Due to the implementation of a suitable SuDS strategy, 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

9.26 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.

9.27 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.

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 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.

10.2 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, in the new-built extension 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 new building will contain a chapel, library, study rooms and part of the total study-bedroom accommodation.

10.3 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.

10.4 The latest EA hydraulic model shows the site to lie within the extent of the 20 year return period flood. As such, the site is designated as functional floodplain (Flood Zone 3b). However, in accordance with the National Planning Policy Framework (NPPF), observations on site have been used to supplement the understanding of the functional floodplain. The functional floodplain is defined as land where water flows or is stored in times of flood- in the former case this refers to dynamic flow paths, and in the latter, areas that are intended to flood and known to provide a flood alleviation benefit. The NPPF indicates that the natural 1 in 20 annual probability floodplain should be used as a starting point, but should not be rigidly used to define Flood Zone 3b.

10.5 Although significant flood events have been observed in the River Thames in Oxford, with ten events on record since 1947, the site is only known to have flooded to a level sufficient to affect the building or access route in any of these events. However, it is acknowledged that the low-lying marshy area on the site floods during moderate events, and it is therefore necessary to define the extent of the functional floodplain by estimating a flood level. Photographic evidence has been used to estimate a maximum flood level in the 2007 and 2014 flood events. It has been agreed with the EA that this level can be used to define Flood Zone 3b subject to confirmation that the 2007 flood event had a return period greater than 20 years.

10.6 Statistical analysis of the nearest flow gauges indicates that the flow through Oxford in the 2007 flood event was at least 75 years on the Cherwell and Evenlode catchments, and at least 17 years in the upstream Thames catchment, which forms 40% of the overall flow through Oxford, including the bypass route to the west of the railway line. Considering both the relative contributions of the catchments to flood risk in Oxford, and the return periods for each catchment, the return period of the event can be confidently assessed to be at least 20 years. This supports the evidence of the historical record, which indicates that the site has not flooded for at least 40 years according to witness statements, and at least 60 years according to EA records.

10.7 The 2007 event is used to define Flood Zone 3b. The estimated flood level of 55.74m AOD is used to define Flood Zone 3b. The proposed building is located on land above this level, with free access to Flood Zone 1 and thus lies outside Flood Zone 3b. Although the watercourse itself and the low-lying marshy area form part of Flood Zone 3b, these are not proposed for vulnerable uses and OCC policy allows for this.

10.8 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 varies between 15% and 26%. The hydraulic modelling uses the previous allowances of 25% and 35%, and therefore the 25% allowance is used to set design levels. Since there is no essential infrastructure at risk of flooding in hydraulic continuity with the site, the 25% allowance is also used to assess impact. The 35% allowance is applied as a sensitivity test.

10.9 In accordance with national policy and EA and OCC consultation responses, the proposed building will be set on the highest part of the site, and constructed to be fully open to the under-side of ground floor construction, which will be set above the 100 year modelled flood water level including the required allowance for climate change of 56.28m AOD. Consequently, ground floor finished floor levels will be set at well above the sensitivity (35%) climate change level, which is only 110mm higher than the 25% level. The proposed extension has access to the main entrance to the site from Abingdon Road via footbridges to land wholly above both design flood levels. Abingdon Road and Folly Bridge are not modelled to flood in either event, and therefore full dry access for both pedestrians and vehicles is available. Flood resilient construction is encouraged within the proposed building, to be determined as part of the detailed design.

10.10 The proposed development will not occupy flood storage, since the extension will be built entirely above the modelled flood water level for the 100 year return period event including climate change. However, since the proposed construction is for the building to lie above the floodplain, there is a minor risk of blockage, and therefore an analysis of flood storage is undertaken to demonstrate that no adverse impacts on flood risk will result.

10.11 The hydraulic model was used to show that the proposed development does not affect flood risk in the River Thames for any return period, even assuming that the area beneath the building was entirely enclosed (100% blocked). In addition, the additional flood storage (accounting only for free-flooding and free-draining volume) which will be created in the ecological area will return a greater volume of storage to the floodplain than would be lost should the entire underside of the structure be blocked. This is true at every level from the lowest level within the proposed building footprint up to the 100 year flood level including the sensitivity (35%) climate change level.

10.12 Surface water will be collected from the roof of the proposed extension and discharged to the ecological area. The SuDS strategy will be designed to attenuate runoff to greenfield rates, and is anticipated to use a combination of source control measures to minimise runoff- including replacing existing hard-paved surfaces with permeable surfacing.

10.13 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.

creating a better place

Environment Agency

Mr Guy Laister
Water Environment Ltd
165 The Broadway
London
SW19 1NE

Our ref: ENVPAC/WTHAMS/00504
WA/2021/128674/03-L01

Date: 02 November 2021

Dear Mr Laister

Proposal to extend the current facilities to include a library, chapel, study rooms and accommodation for staff and students.

Grandpont House, Oxford.

Thank you for consulting us. We have reviewed the following documents:

- Email from Guy Laister (Water Environment), dated 13 October 2021
- Flood Risk Assessment (FRA) (Ref: 17014-FRA-RP-01 P02)

The FRA confirms that the red line boundary is impacted during the 1 in 20 year event (Flood Zone 3b). Oxford City Council are responsible for the Sequential Test and they will need to make a judgment as to whether they deem the proposed development in this location as acceptable 'in principle'.

The FRA states that the area that is being developed is shown by the topographic survey to be above the 1 in 20 year (Flood Zone 3b) level. This conclusion is based on a detailed comparison between known flood events return periods and recorded anecdotal evidence of flood risk on this site.

In our previous discussions you have confirmed that the area of the site earmarked for built development did not flood in the 2007 event in Oxford. The 2007 flood event, is considered in Oxford to have a return period of between 10-50 years and was used to help inform the 2018 modelling. In our previous correspondence (24 June 2021), we requested that further evidence is submitted which provides certainty that the 2007 modelling was above the 20 year event.

The FRA includes a detailed assessment of potential return period for the 2007 event. We agree that the confluence of the River Cherwell is likely to have had a significant impact on the River Thames flood levels in this location during the 2007 event. The FRA confirms that the River Cherwell Catchment had a return period for the 2007 event which was significantly in excess of the 1 in 20 year event. Therefore, we agree that when you consider the upstream River Thames and River Cherwell flow data evidence together it suggests that the 2007 event on the Thames in this location was most likely above the 1 in 20 year event.

Cont/d..

The FRA then provides further detailed evidence that the areas of the site identified for built development were NOT impacted in the 2007 flood event. We are therefore satisfied that the proposed areas of the site identified for built development are NOT located in the 1 in 20 year flood extent.

If Oxford City Council raise no policy concerns with the undeveloped areas of the site being impacted by the 1 in 20 year extent then it's unlikely that the Environment Agency will have any 'in principle' objection to the proposed development.

However, as stated in our previous correspondence the FRA musty also clearly demonstrate that:

1. Any loss of storage caused by built development or land is compensated for on a level for level basis up to the 100 plus CC flood level.
2. Finished Floor Levels (FFLs) are set above the 1 in 100 plus CC flood level.

We are pleased to see that the FRA includes an assessment of climate change. However, we note that you have used the 1 in 100 plus 25% as your design flood level. You have stated that you have used this level because the flooding is influenced by the River Cherwell in this location. I can confirm that flood extents from the River Cherwell do NOT directly impact this site.

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.

<u>Flood Compensation</u>

We have no objection to the use of voids to mitigate for the increase in built footprint on site. However, we would expect that compensation be provided for the stilts and access points associated with the design of the building. You have stated that flood compensation is being provided. However, no design drawings have been submitted which clearly show where compensation is to be located and how the void design functions. As stated previously, any loss of storage caused by built development or land raising must be compensated for on a level for level basis up to the 100 plus CC flood level. At present, our understanding of the FRA is that volumetric storage is being proposed which would not be acceptable. However, we would welcome design drawings showing level for level compensation if we have misunderstood the detail within the FRA.

<u>Finished Floor Levels</u>

We would welcome the commitment to set FFLs above the 1 in 100 plus 26% flood level. However, we need to see design drawings which clearly show how the building functions and the FFLs in place.

<u>Final Advice</u>

You have stated in the FRA that there was no flooding on Abingdon Road in the 2007 event based on historic flood maps you received from ourselves as part of a product 4 request. Please note that our historic maps aren't always 100% accurate. They are often based on aerial photography which may not have picked up everything. There are news reports online from the 2007 event which did show flooding on the Abingdon road. We recommend that your FRA is updated accordingly with this evidence.

Safe access/egress and the Sequential Test is the responsibility of the Local Planning Authority (LPA). Surface water and groundwater flood risk is the responsibility of the Lead Local Flood authority (LLFA).

Yours sincerely,

Mr Jack Moeran
Planning Specialist

Direct dial 02030259655
Direct e-mail planning-wallingford@environment-agency.gov.uk

Disclaimer
Please note that the views expressed in this report by the Environment Agency, is a response to a pre-application enquiry only and **does not represent our final view in relation to any future statutory consultations made in relation to this site**. We reserve the right to change our position in relation to any such application. You should seek your own expert advice in relation to technical matters relevant to any conditions before submission.

GRANDPONT HOUSE

ABINGDON ROAD, OXFORD

FLOOD RISK ASSESSMENT

NETHERHALL
EDUCATIONAL ASSOCIATION

DOCUMENT REFERENCE:

17014-FRA-RP-01 | C01

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Authorization 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 as well as to develop a Sustainable Drainage Strategy for the proposed development.

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Document Version History

Rev	Date	Comments	Auth	Chck	Appr
P01	07/10/2021	Issue to Netherhall for comment	FdM	GL	GL
P02	13/10/2021	Issue to Environment Agency for comment	FdM	GL	GL
P03	23/03/2022	Planning version issue to Netherhall for comment	FdM	GL	GL
C01	30/03/2022	Final issue for planning	FdM	GL	GL

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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 to provide crucial modernisation of the accommodation and secure the long-term viability of the Grade II* listed building through provision of a new extension building and to enable refurbishment. Although the site lies within Flood Zone 3 of the River Thames, there are no suitable alternative sites for the proposals, which will provide vital facilities which must be within the grounds and therefore the Sequential Test is passed. The proposal for an extension building is accompanied by both refurbishment plans and the enhancement of an existing habitat area close to the river. These benefits, together with a 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 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.

A minor channel of the River Thames, as well as the Hogacre Ditch, form an integral part of the site. Part of the site lies within the functional floodplain of the River Thames (Flood Zone 3b). In order to ensure that no inappropriate development occurs within the functional floodplain, the extent of the floodplain has been determined by using a historical flood water level derived from site evidence and data from the 2007 and 2014 flood events, in consultation with the EA. These events have been demonstrated through statistical analysis of gauges in the upstream catchments to have a return period in excess of 20 years. The proposed extension is located outside the extent of functional floodplain on the site.

The building will be raised so that the underside of the floor structure is above the 100 year return period flood water level including an allowance for climate change of 26% (56.29m AOD, as agreed with the EA), which represents a conservative application of the revised climate change allowances released in July 2021. The ground floor finished floor level will be at least 56.60m AOD, 200mm above the 100 year return period flood water level including an allowance for climate change of 35% which is used as a sensitivity test, and 180mm above the modelled 1,000 year return period flood water level. Full dry access to the building is available entirely above the 100 year return period flood water level including a 35% allowance for climate change, and above the 1,000 year return period flood water level, within the site to Abingdon Road and then to high land on the north side of Folly Bridge.

The proposed building will not occupy flood storage due to the clear span construction above the 100 year return period flood including a 26% allowance for climate change. The maximum calculated storage required for structural piles has been assessed to be negligible (<10m^3). However, the proposed improvements to the ecological area will result in an increase in freely floodable and draining flood storage which is greater than the volume of storage within the building footprint at all levels to the 100 year return period including a 35% allowance for climate change, with a total increase in storage of 195m^3. As a sensitivity test, assuming the entire area under the building were filled in, there would still be a total volumetric increase in flood storage of 33m^3. The hydraulic model was used to confirm that the proposed development does not affect flood risk elsewhere.

Surface water will be collected from the roof of the proposed extension and discharged to the ecological area. The SuDS strategy (undertaken by others) should be designed to attenuate runoff to greenfield rates, and is anticipated to use a combination of source control measures to minimise runoff- including replacing existing hard-paved surfaces with permeable surfacing.

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.

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.

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)[1] and accompanying Planning Practice Guidance (PPG)[2], to accompany an application for planning permission.

[1] Ministry of Housing, Communities & Local Government, revised National Planning Policy Framework, July 2021
[2] Ministry of Housing, Communities & Local Government, Planning Practice Guidance Flood risk and coastal change, https://www.gov.uk/guidance/flood-risk-and-coastal-change, August 2021

2 DESCRIPTION OF PROPOSED DEVELOPMENT

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.

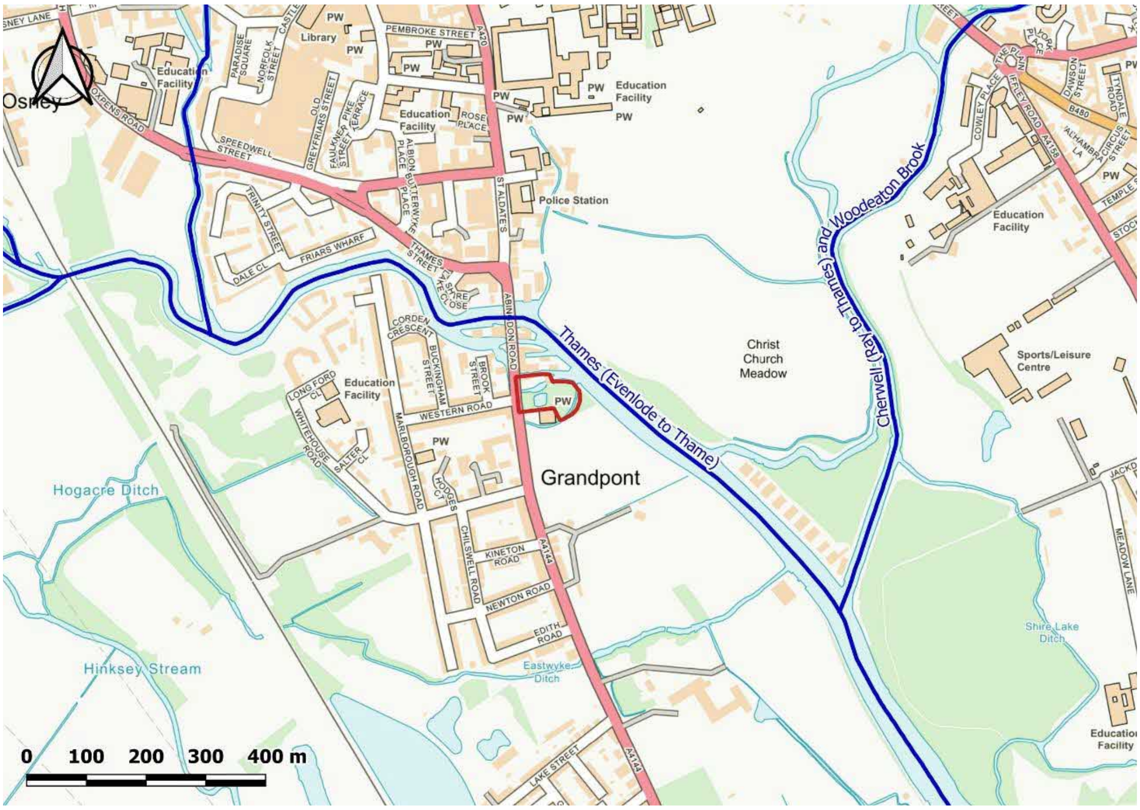

Figure 1: Location of proposed development site[3]

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 indicates that the ground levels in the area of the proposed development range from 55.5m AOD to 56.2m AOD. The area is at a general level of 56.0m AOD. Ground levels fall from west to east across the development area, with the eastern boundary of the area at the top of a bank down to a low-lying marshy area at around 54.3m AOD. The top of bank of the watercourse through the site is 55.1m AOD on the south bank.

2.4 The current access road falls from 57.4m AOD at Abingdon Road to a minimum level of 56.1m AOD at the entrance to Grandpont House. Access is also available along a pedestrian walkway, the minimum level of which is 56.4m AOD. Abingdon Road rises to the north over Folly Bridge.

[3] © Ordnance Survey Crown copyright. All rights reserved.
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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. 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.

2.7 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; however, according to Thames Water records a charge is currently payable for surface water drainage. It is recommended that the institution apply to have this charge waived in the absence of any surface water connections at the site. Foul water from the site currently drains to the public sewer in Abingdon Road.

Proposed Development

2.8 Proposals are to extend the current facilities, and include a library, office, chapel, lounge, dining room, study rooms and accommodation for staff and students. Provision of modern accommodation, as well as enhanced facilities, in the new-built extension 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 ancillary buildings along the northern boundary of the site would be refurbished to provide domestic services and a multi-purpose hall. This part of the development includes some demolition and rebuild. Certain internal refurbishments of the existing main building are included in the plans.

2.9 Proposals include increasing the number of residents on site from 11 to 21. Four of these will be in the refurbished main house, four will be in the refurbished wing, and thirteen in the new extension at first and second level. The remainder of the rooms will be study rooms, visitors' rooms, dining room, a new library and book stores, and a new chapel. Ground floor uses in the proposed new building are restricted to "less vulnerable" classifications.

2.10 The proposed development is part of an ongoing development plan to broaden the scope of the educational institution to make the venture viable, allowing renovation of the existing Grade II* listed building.

2.11 Proposals include landscaping to enlarge the low-lying marshy area by the river by excavating between the river channel through the site and the existing depression which will be over-excavated to form a pond, thus providing an improved ecosystem in the marshland, and providing an additional area of free draining flood storage.

2.12 The proposed building would be accessed directly from the pedestrian access from Abingdon Road via a bridge over the channel through the site, designed to be clear span with the underside set above the design flood water level. Part of the proposed building will additionally span the channel on a clear span structure.

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 July 2021. 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 through the provision of compensatory floodplain storage, and confirmed through hydraulic modelling. 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[4] policy and the Strategic Flood Risk Assessment (SFRA)[5].

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 is located on high land and not within the extent of Flood Zone 3b. However, due to the low-lying marshy area in the gardens and adjacent to the channel that crosses the site, part of the site can 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 close to the dry access route away from the site. Additionally, excess flood storage will be provided (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.

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;*

[4] Oxford City Council (June 2020) Adopted Oxford Local Plan 2036
[5] Wallingford Hydrosolutions on behalf of Oxford City Council (November 2017) Level 1 Strategic Flood Risk Assessment

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"[6]. 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[7]- 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.

3.19 The SFRA was released in November 2017. The SFRA pre-dates the Local Plan, and therefore policy recommendations contained within it have been rolled into the Local Plan. The SFRA introduces the concept of separate Flood Zone 3b designation for developed land and paves the way for the provisions included in OCC Policy RE3. In addition, the SFRA re-iterates the requirements of the "Living on the Edge" 5th ed[8]. which covers the maintenance and management responsibilities of the landowner and should be considered an integral part of all proposed development on the site.

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 consultee is removed.

3.21 Since the LLFA has no remit to advise on proposed development that is not deemed "major", the proposed development must be considered under OCC policy only. However, the information contained within LLFA documents, including the Preliminary Flood Risk Assessment (PFRA)[9] and Local Flood Risk Management Strategy (LFRMS)[10] are used as evidence to inform the assessment of flood risk within this FRA.

[6] McCloy Consulting & Robert Bray Associates on behalf of Oxford City Council (2018) Sustainable Drainage Design & Evaluation Guide
[7] Oxford City Council (undated) Planning Application Guidance Flooding https://www.oxford.gov.uk/downloads/file/3815/planning_application_guidance_-_flooding
[8] Environment Agency (October 2014) Living on the Edge 5th edition
[9] JBA on behalf of Oxfordshire County Council (June 2011) Preliminary Flood Risk Assessment Report
[10] Oxfordshire County Council (August 2021) Local flood risk management strategy

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.

[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 east of the River Thames 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. The site is shown to lie within Flood Zone 2 and 3. The results of the River Thames hydraulic model show that the site is at risk of flooding in the 5% annual exceedance probability (20 year return period) event, and as such, falls potentially within Flood Zone 3b.

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 using the results of the hydraulic model.

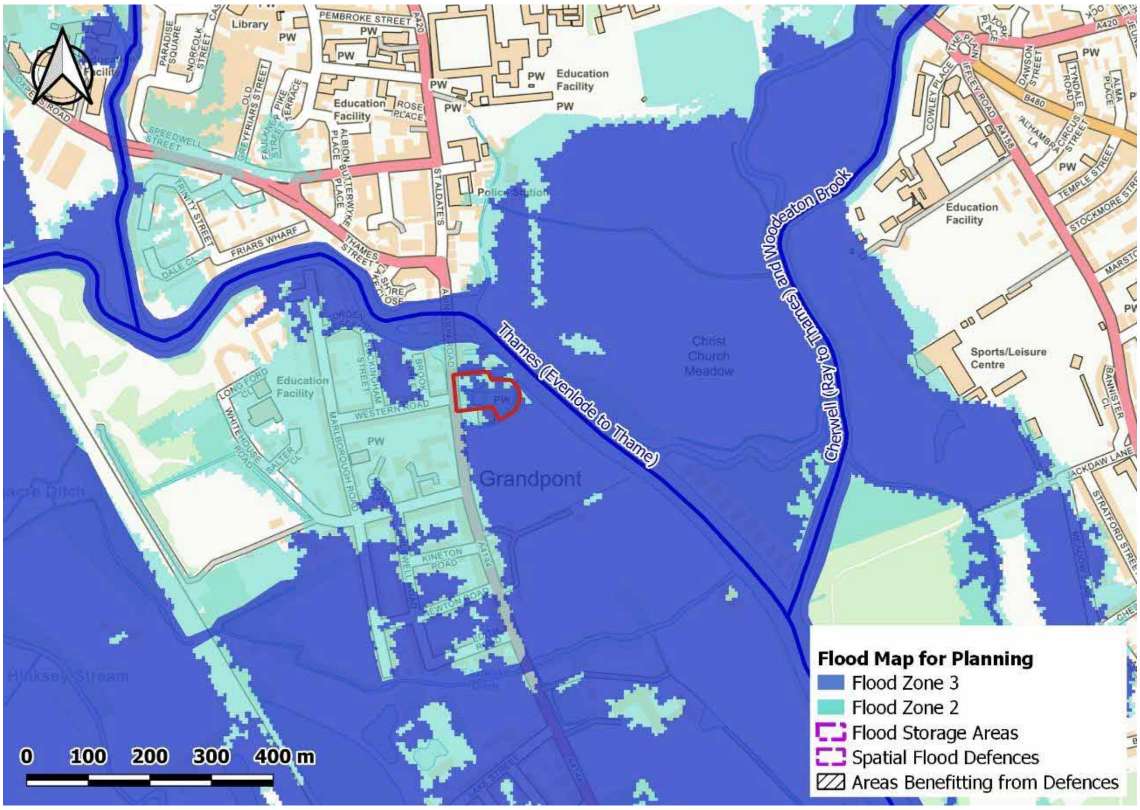

Figure 2: Flood map for planning[12]

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.

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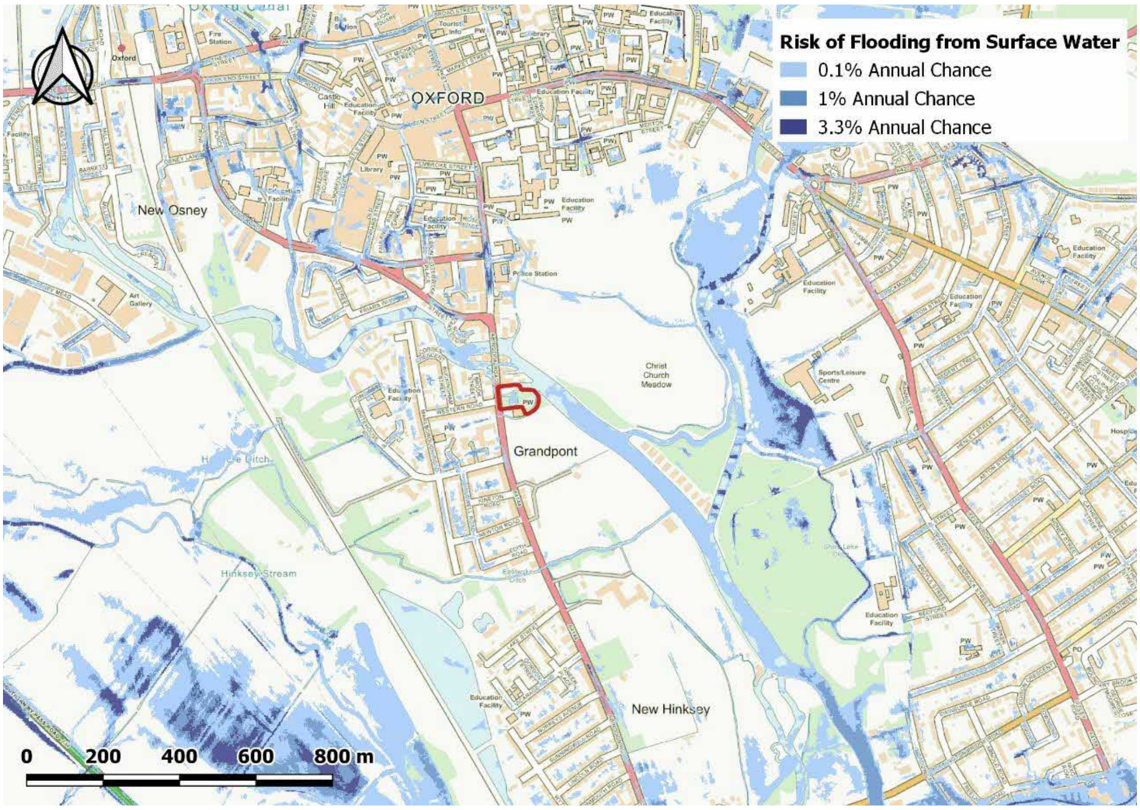

Figure 3: Surface Water Flood Risk Map[13]

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

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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, Eynsham, the area of risk is contained within lower land, and covers a lesser extent than the fluvial risk. As a result the site lies just outside the risk area.

4.16 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.

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

Figure 4: Reservoir Flood Risk Map[14]

Structures which may Influence Local Hydraulics

4.18 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.

4.19 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.

4.20 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

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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

4.21 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.

4.22 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[15]. 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.

Hydraulic Models

4.23 In order to assess the impact of the proposed extension, the latest EA model was obtained. The model was trimmed upstream to improve run times- however the trimmed model was able to replicate exactly the results of the original model at all return periods.

4.24 The trimmed model was amended by including existing and proposed digital terrain models (DTMs) generated using the topographic survey and proposed plans. The proposed extension extent was modelled by raising the entire building area by 3m, while the proposed excavation area was applied directly from the proposed drawings. The DTMs were read directly into the model DTM to generate existing and proposed case results grids.

4.25 Comparison of the results grids indicated that there were no changes to modelled flood water levels off-site that exceed model tolerances of 1mm. The only difference between the two modelled scenarios was a reduction in floodplain extent (the raised building area does not flood in the model) and reductions in flood level at four grid squares at the very edge of the floodplain extent due to the reduced ground levels in the low-lying marshy area where the proposed excavation and ecological enhancement will take place. All non-negligible changes in flood extent and level arise entirely within the site boundary.

[15] 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[16] and 22nd November 2010[17] 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.*" [18]

2016 Pre-application Enquiry

5.8 Due to reasons unrelated to flood risk, the project took at a change in direction over the next two years and a different scheme was developed for the site. Coincidentally the EA updated the

[16] 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)"
[17] Environment Agency letter dated 22 November 2010 which stats "We have previously accepted that the site is not in Flood Zone 3b, the functional
Floodplain."
[18] Environment Agency letter dated 24 January 2014

hydraulic model of the River Thames in 2014. A pre-application enquiry was submitted to OCC 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[19].

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.[20]

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.[21]

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[22] 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.

[19] Oxford City Council Flood Risk and Drainage Planning application response dated 17 October 2016 (Application reference 16/01978/PAC)
[20] Oxford City Council Flood Risk and Drainage Planning application response dated 9 January 2017 (Application reference 16/01978/PAC)
[21] Environment Agency letter dated 17 July 2017
[22] 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[23] 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[24] 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 This FRA was submitted to the EA for further advice and comment on the latest proposals in October 2021. The initial formal response in November 2021[25] indicated that the EA was satisfied with the analysis presented herein that indicates the proposed development does not lie within Flood Zone 3b. The EA also confirmed that the use of void space beneath the building is an acceptable means of maintaining flood storage capacity in this instance.

[23] Water Environment Ltd (3rd June 2021) 2007 flood event assessment
[24] Environment Agency letter dated 24 June 2021 (Reference ENVPAC/WTHAMS/00504/WA/2021/128674/02-L01)
[25] Environment Agency letter dated 02 November 2021 (Reference ENVPAC/WTHAMS/00504/WA/2021/128674/03-L01)

5.22 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 has been updated throughout to comply with this.

5.23 One outstanding query in the EA response of November 2021 relates 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 agreed that the mitigation proposed, in the form of over-provision of volumetric storage, is 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 is additionally covered within the FRA.

Principle of Development – Flood Zone 3b

5.24 The EA has agreed to using the estimated on-site flood level for the 2007 flood event to define the extent of Flood Zone 3b- subject to further analysis to demonstrate that the 2007 flood event can reasonably be considered to have a return period in excess of 20 years.

5.25 The Planning Practice Guidance: Flood Risk and Coastal Change confirms the following:

> *The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.*

5.26 Thus, although this FRA will attempt to define the return period of the 2007 event, it is worth noting that the site has not flooded except on the marshy low-lying area next to the channel that passes through the site (which effectively forms part of the river), at any time since the current occupancy (1959). A 20 year return period event would have been expected to occur approximately 3 times in this period, and though the low-lying area was flooded in 2003, 2007 and 2014, water did not extend onto the main part of the site at any time. There are no designated flood storage assets on the site. Therefore although the modelled 20 year flood event extents may be used as a starting point for defining the functional floodplain, the evidence suggests that in reality, aside from the low-lying marshy area, the site does not lie within the functional floodplain.

5.27 The assessment determines the return period of the 2007 flood to corroborate this observation, and the EA has accepted this analysis as confirmed in the letter dated 02 November 2021.

Flood Risk Mitigation Principles

5.28 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.

5.29 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.

5.30 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.

5.31 Following the November 2021 EA response, the FRA additionally presents an analysis of the total volume of storage lost due to structural support beneath the building, to demonstrate that the volume of flood storage occupied would be insignificant in the context of the catchment-wide flood storage, as agreed with the EA.

6 FLOOD ZONE ALLOCATION

Background

6.1 As discussed in Chapter 4, it has been necessary over the course of several consultations to demonstrate that the site does not lie within Flood Zone 3b, designated as functional floodplain. It was agreed in the past that the 2014 event could be used to define the extent of Flood Zone 3b since the return period was estimated to be 25 years for this event. However, the EA position has since changed, and the 2007 historic event has been agreed, subject to establishing with reasonable confidence that the 2007 event has a return period in excess of 20 years.

6.2 These agreements have been the subject of many reports, and the key points, as well as new analysis, are set out within the following chapter. The initial part of the chapter discusses the likely return period of the 2007 event through statistical analysis of flow records and hydrology for the contributing rivers. The following part of the chapter presents the evidence, already submitted and agreed, that shows the site to lie outside the extent of the 2007 flood.

Methodology

6.3 Peak river flow data were used in the WINFAP-FEH v5 software as a single-site (historical flood) analysis to determine estimates of return period flows for nearby gauges. Data were obtained from the National River Flow Archive (NRFA), and only those stations were considered that form part of the Peak Flow v10 (HiFlows) dataset.

6.4 There are no gauges in a similar hydraulic location to the site, however, it should be possible to estimate the return period of the 2007 event by considering the relevant nearby gauges. The nearest downstream flow gauges on the River Thames are at Sutton Courtenay and Days Weir, however both of these lie downstream of significant tributary inflows and therefore could result in misleading results. Therefore, it is better to analyse the upstream catchments.

6.5 Data were obtained for the following three stations, the locations of which are presented in Figure 5:

39008 River Thames at Eynsham – a dataset of 26 years of record, suitable for enhanced single site analysis;
39021 River Cherwell at Enslow Mill – a dataset of 54 years of record, suitable for single site analysis to determine return periods up to 27 years; and
39034 River Evenlode at Cassington Mill – a dataset of 50 years of record, suitable for single site analysis to determine return periods up to 25 years.

6.6 Unfortunately there are no peak flow gauging stations on the River Ray, which joins the Cherwell downstream of Enslow Mill, however the similarity between the Ray, Cherwell and Evenlode catchments are such that the return periods estimated for these rivers should be equally applicable to the combined Ray and Cherwell catchment.

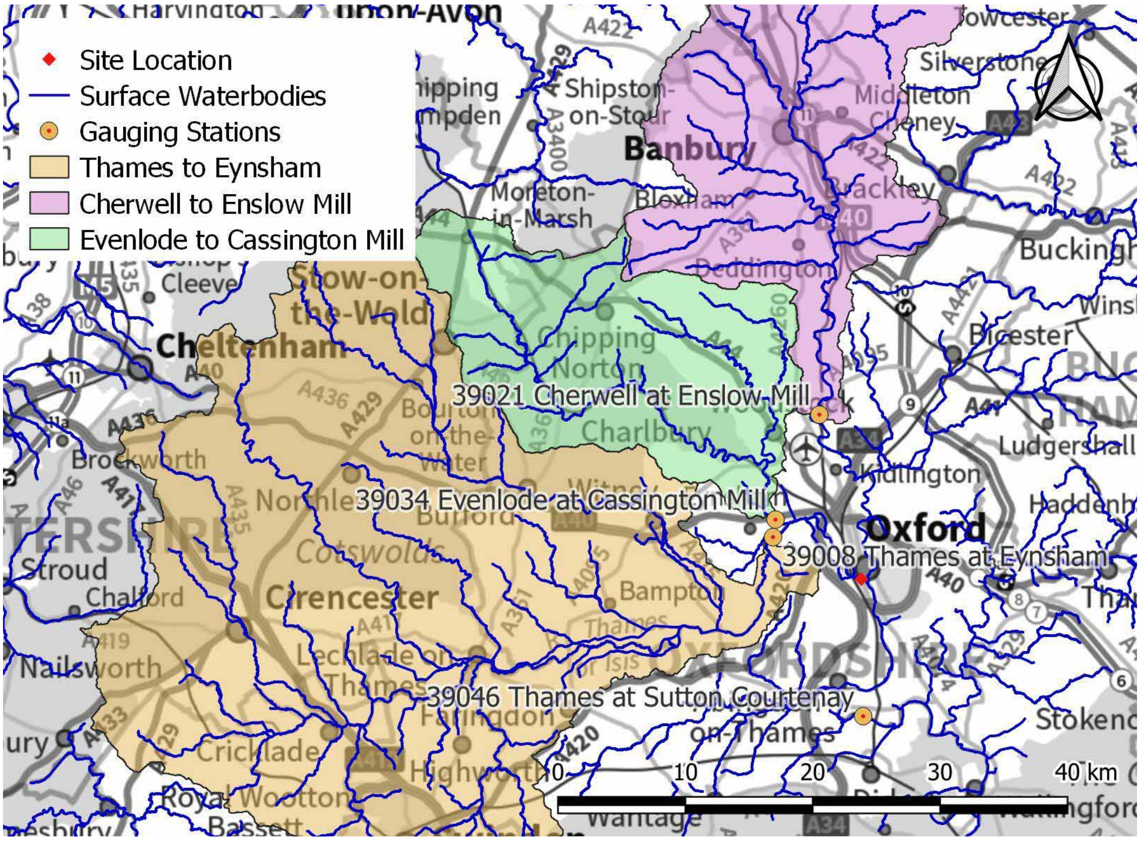

Figure 5: Location of gauging stations relative to the site

6.7 Each station was imported directly into WINFAP-FEH and the systematic historical analysis and/or single site or enhanced single site statistical analyses used to obtain flows for each return period based on the data.

Thames at Eynsham

6.8 The flow in the River Thames on 24th July 2007 was 102.0m^3/s. The length of record for this station is insufficient to rely on estimates of return period in excess of 13 years and therefore an enhanced single site analysis has been undertaken on this gauge. An initial pooling group was derived comprising 13 gauges, and at-site data was included. Stations were rejected for the following reasons:

Data record of less than 20 years - 27099;
Significantly differing hydrological area - 203010;
High rainfall (SAAR>850) - 43007, 27009;
Small catchment less than 50% of subject area - 33034; and
Sites with high L-SKEW (subject catchment has FARL=0.946 and low L-SKEW) – 27041.

6.9 The station 25009 was retained in the pooling group in spite of having a high SAAR value due to the low FARL value and similarity to the site growth curve, to enhance the homogeneity of the group. The resulting pooling group had a record length of 469 years (the required minimum length for 20 year assessment is 100 years) and a H2 value of 1.12 (acceptable homogeneous).

6.10 The pooling group showed the strongest fit to the Generelised Extreme Value (GEV) and Pearson Type 3 (P3) distributions. As shown in Table 1, the estimated 20 year return period flow is 103.2m^3/s using the systematic historical analysis, and up to 107.0m^3/s for the maximum pooled estimate. Therefore the recorded flow in 2007 is between 99% and 95% of the estimated 20 year return period flow.

Table 1: Systematic Historical and Enhanced Single Site Assessment Output for Station 39008

	2 years	5 years	10 years	20 years	25 years
Historical	71.98	87.15	95.61	103.16	105.47
Single Site GEV	71.63	88.78	97.19	103.59	105.33
Pooled GEV	71.80	89.67	99.23	107.00	109.22
Pooled P3	71.80	89.19	98.67	106.71	109.09

6.11 The WINFAP flood statistics calculator calculates a return period for the 2007 event in the River Thames of 17 years using the GEV distribution and 17 years using the P3 distribution. The recorded 2007 flow is within 1% of the computed historical 20 year event, and within 5% of the maximum flow estimated using the pooled statistical analysis.

Cherwell at Enslow Mill

6.12 The flow in the River Cherwell on 22nd July 2007 was 85.5m^3/s. The systematic historical calculator was unable to determine confidence limits for this data, so the single-site statistical analysis was also undertaken.

6.13 According to the calculated growth curve, the 2007 flow equates to a return period of between 75 years and 100 years, however, confidence is low in these estimates for return periods over 27 years. Nevertheless, as shown in Table 2, the estimated 20 year return period flow is 37.2m^3/s using the systematic historical analysis, and up to 46.6m^3/s for the maximum single-site estimate. Therefore the recorded flow in 2007 is between 1.8 times and 2.3 times the 20 year return period flow.

Table 2: Systematic Historical and Single Site Assessment Output for Station 39021

	2 years	5 years	10 years	20 years	25 years
Historical	19.74	26.35	31.44	37.17	39.19
Single Site GL	19.30	26.89	34.71	45.60	49.98
Single Site GEV	19.30	27.13	35.33	46.62	51.13
Single Site KAP3	19.30	26.92	34.88	45.95	50.40

6.14 The WINFAP flood statistics calculator calculates a return period for the 2007 event in the River Cherwell of 85 years using the Generalised Logistic distribution, 83 years using the Kappa 3 distribution, and 82 years using the Generalised Extreme Value distribution.

Evenlode at Cassington Mill

6.15 The Evenlode presents the simplest information in that the record length is sufficient to estimate return periods flows for up to 25 years with a high degree of confidence, and the recorded data is suitable for the historical analysis.

6.16 The flow in the River Evenlode on 21st July 2007 was 75.5m^3/s. According to the calculated growth curve, this equates to a return period of between 200 years and 500 years (using the maximum confidence limits), however, confidence is low in these estimates for return periods over 25 years.

6.17 Nevertheless, as shown in Table 3, the estimated 20 year return period flow is 32.2m^3/s (upper confidence limit of 37.2m^3/s, and therefore the recorded flow in 2007 is between 2 times and 2.5 times the 20 year return period flow.

Table 3: Systematic Historical Assessment Output for Station 39034

	2 years	5 years	10 years	20 years	25 years
Magnitude	19.98	24.95	28.46	32.17	33.44
Confidence	±8%	±9%	±12%	±16%	±17%

6.18 The 2007 event in the River Evenlode may therefore be considered to be substantially in excess of the 20 year return period flood. The WINFAP flood statistics calculator calculates a return period for the 2007 event in the River Evenlode of 660 years using the Generalised Logistic distribution, although using the upper confidence limit curve the return period could be as low as 75.

Return Period Assessment

6.19 Statistical analysis of both the Cherwell and Evenlode catchments indicates that the return period of the 2007 event for these rivers is substantially in excess of 20 years. As shown in Table 4, the proportion of flow in 2007 from the Thames, which recorded a lower return period flow, was less than 40% into the study area, and therefore, using a simplistic representation of flow mechanisms, the return period of the full event downstream of the full confluence of flows would tend towards the higher estimated return periods, regardless of flood mechanism, since a total of 61% of the 2007 flow was contributed by the Cherwell and Evenlode catchments.

Table 4: Relative importance of catchments

	2007 Flow	Proportion	Return Period
Thames	102m^3/s	39%	17 - 25
Cherwell	86m^3/s	33%	75 - 100
Evenlode	76m^3/s	29%	75 - 500

6.20 However, the site is located in an area where flow from the Thames and Evenlode is substantially reduced, especially at lower return periods, due to the separation of flow routes which carries the majority of flood water down the western side of the railway embankment, bypassing Oxford entirely, and only returning to the Thames downstream of Grandpont House. This mechanism can be clearly seen in Figure 6, which shows the modelled 20 year return period floodplain. This shows that only in-bank flow passes along the River Thames, with the natural floodplain falling west of the railway embankment. Indeed, Figure 6 shows Grandpont House to fall on the Cherwell side of the watershed which is created by the raised railway embankment and high land towards Oxford city centre. The result is that the flood risk at this location is dominated heavily by the River Cherwell.

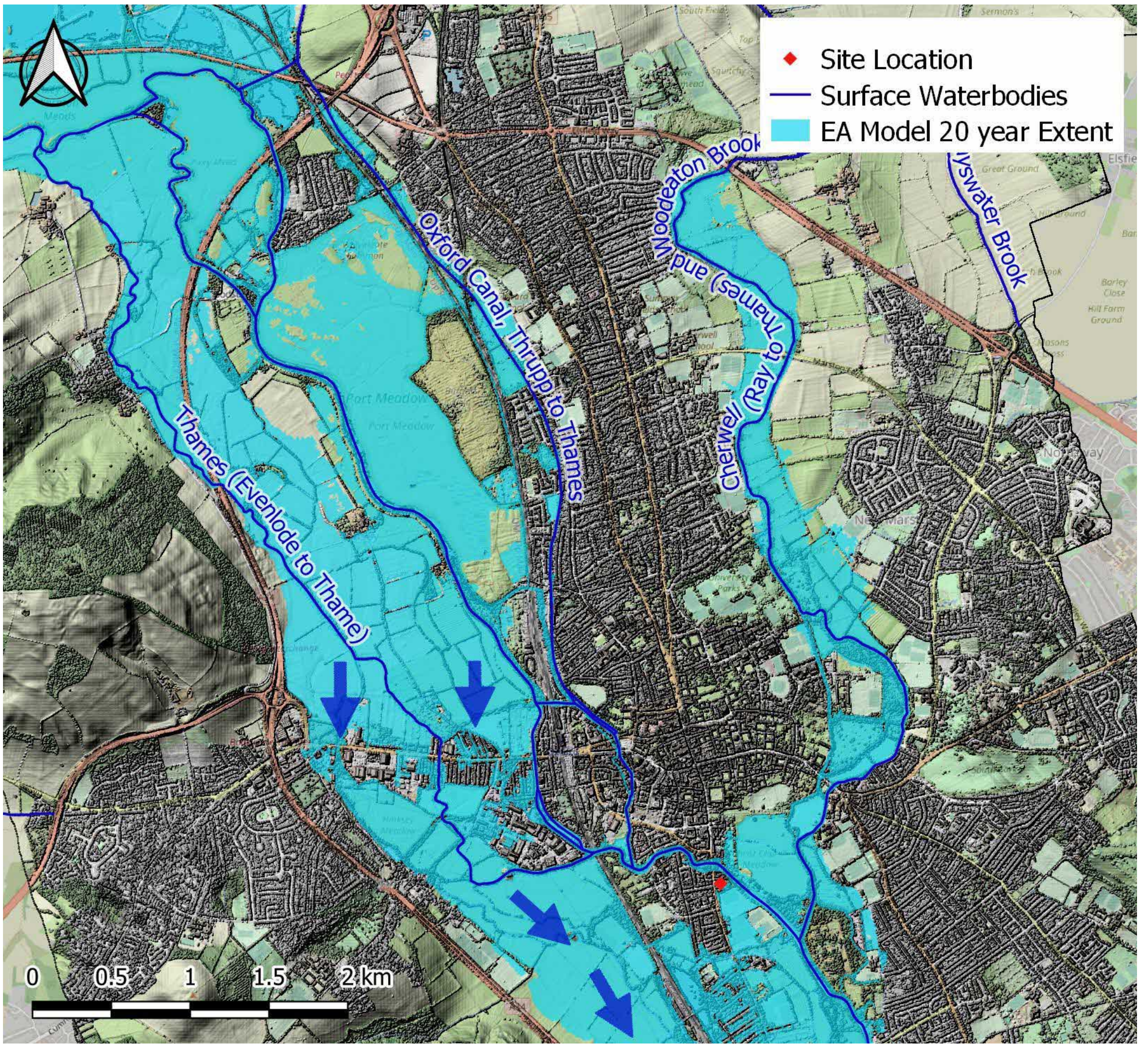

Figure 6: Flood flow mechanisms

6.21 This can also be seen when comparing the outlines for flood risk from rivers and the outlines for flood risk from failure of impounded reservoirs, as shown in Figure 7. This is a useful comparison because the outlines denoting the area at risk from reservoirs along the Thames valley at Oxford specifically compare very well with the area of fluvial flood risk as denoted by Flood Zone 3- however, there are no impounded reservoirs within the Cherwell catchment.

6.22 While the outlines showing the areas at risk differ only imperceptibly on the western side of the railway line and downstream of Eastwyke Ditch, the areas of risk to the east of the railway line, and through Oxford in particular are substantially lower for the reservoir scenario. This demonstrates that this part of Oxford is far more heavily at risk due to flooding in the Cherwell than in the Thames.

6.23 Having established that the Cherwell is the dominant source of flooding, it is also worth noting that, as shown in Figure 8, the higher return period flows in 2007 were observed in the northern catchments, which indicates a possible link to variable weather conditions.

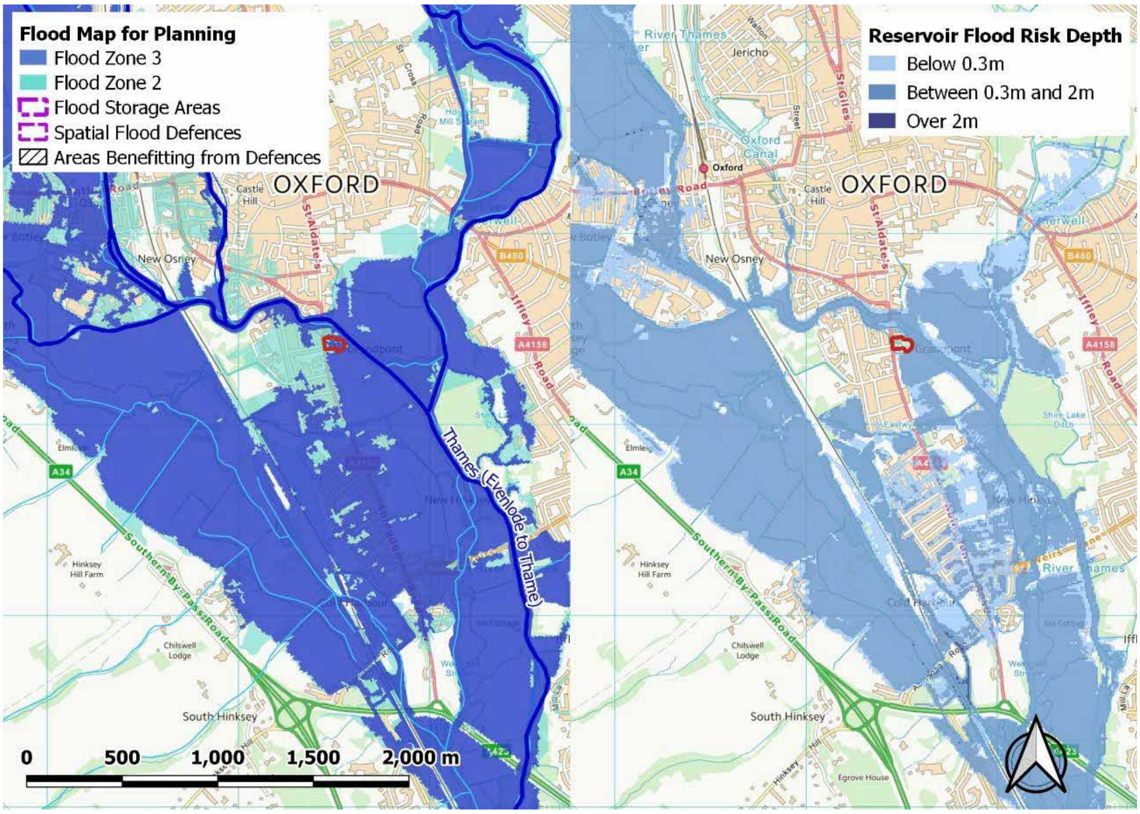

Figure 7: Comparison of fluvial and reservoir flood risk in Oxford

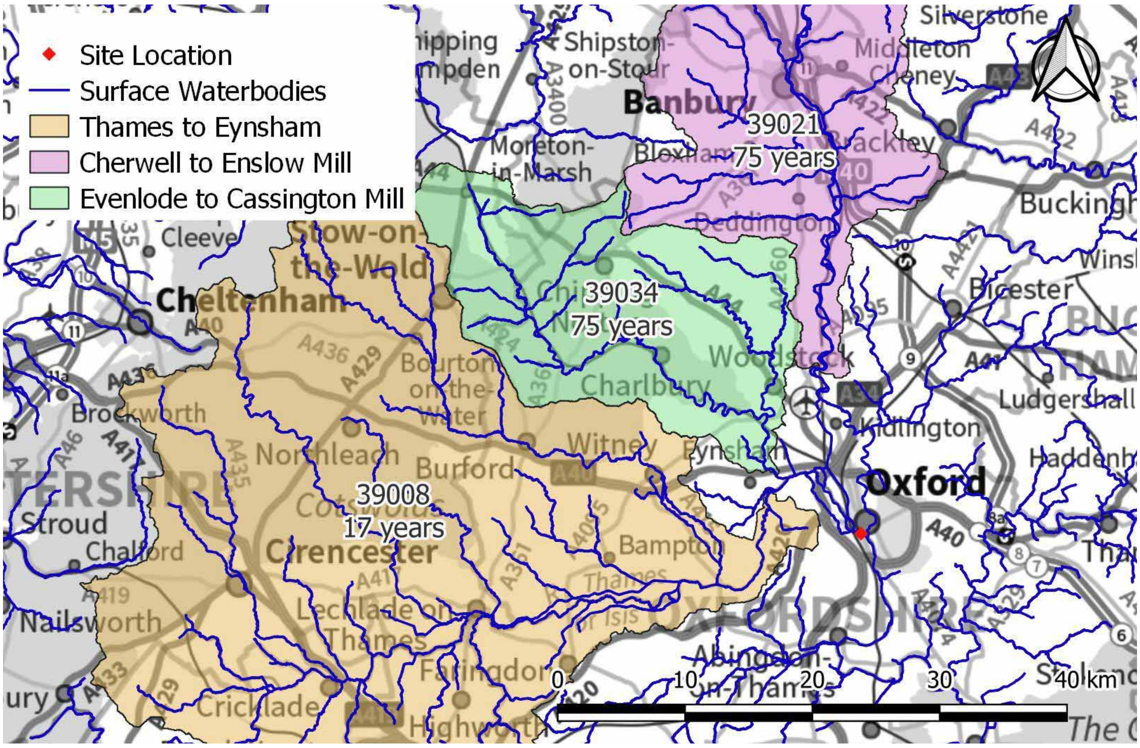

Figure 8: Catchment return periods for the 2007 event

6.24 On the basis that the Evenlode and Cherwell catchment return periods are estimated to be in excess of 75 years, the overall flood return period of the 2007 event is considered to be substantially in excess of 20 years.

2007 Flood Event at Grandpont House

6.25 The EA 2007 recorded flood outline is presented in Figure 9. Note that the record very clearly shows Abingdon Road as not flooding, and no flooding onto the Grandpont House site from the riverside. Although news reports at the time of the 2007 event indicate that Abingdon Road was flooded, the accompanying photographs clearly show this flooding to be constrained to the area south of Eastwyke Ditch, with Abingdon Road dry as far south as the junction with Vicarage Road, 800m south of the site (and south of the mapped extent shown in Figure 9). The testimony of the residents of Grandpont House who were present during the flood confirms that Abingdon Road was not flooded in past the site or across Folly Bridge.

6.26 Flooding from the north is clearly shown to remain on the north side of the line of buildings on the north boundary of the site. On the site itself, the map suggests that water was observed in the existing pond area and along the channel through the site. This coincides with what would be expected due to the presence of Abingdon Road, and the evidence indicating that flooding does not come from the River Thames from the north or east. High water levels in the channel through the site and overtopping into the pond area has been confirmed by the occupants at Grandpont House.

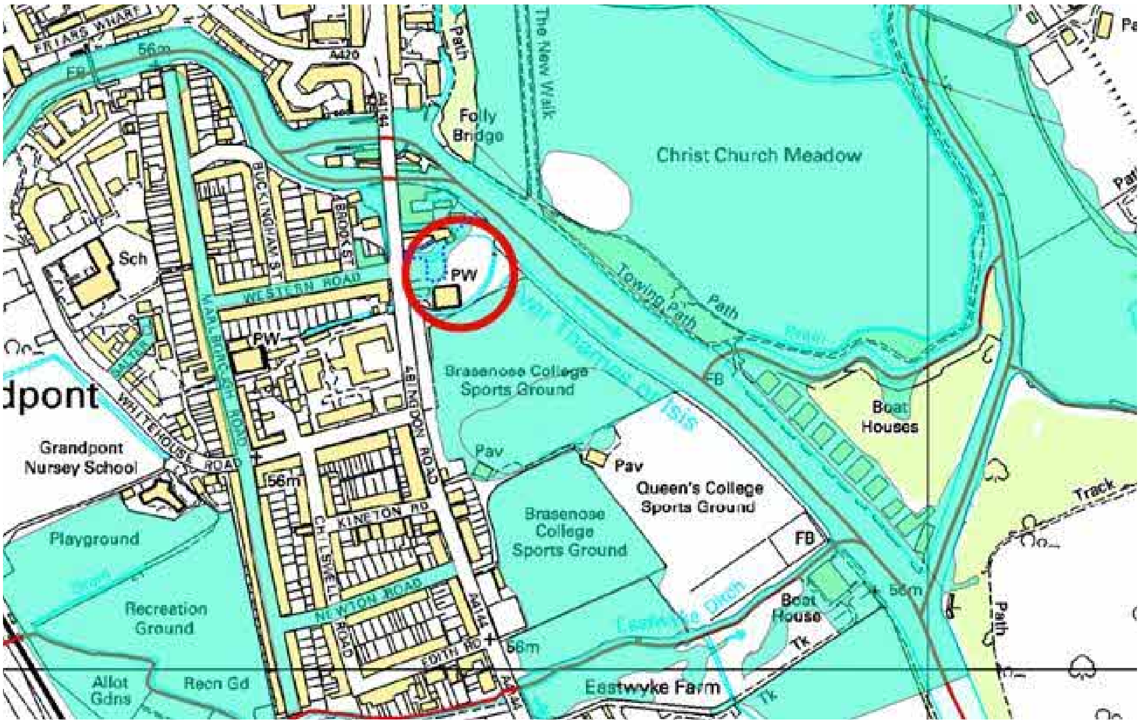

Figure 9: Environment Agency flood outline for the 2007 flood event (as provided in a Product 4)

6.27 The drawn extent in the EA historical map also suggests the area proposed for development flooded in 2007, but this is incorrect. The topography and mechanism do not support this, the only observation on site was rising water levels in the channel and into the low-lying marshy area only, without extending onto the higher ground proposed for development, as shown by the dotted blue line.

6.28 The main part of the garden east of the pond is not shown as having flooded. From a practical perspective the ground levels in this area are relatively consistent at 55.70m AOD to 55.75m AOD. These levels are 250mm – 500mm lower than the levels on the area proposed for development. Therefore if flooding on the site was caused from either the main Thames or the stream through the site from water backing up behind the culvert beneath the house, the main garden area would flood before the area proposed for development. Therefore the anecdotal evidence used to plot the historical map below cannot be correct.

6.29 Photos taken of the 2007 flood event are presented in Figure 10. These photos were taken from the access path leading from Abingdon Road towards Grandpont House (i.e. view in an easterly direction). The photos show the high water levels in the channel through the site at approximately 6 inches below the soffit level of the culverts beneath the house. The photos also show the flooding of the pond area but not the garden area behind.

Figure 10: Photos of the flooding at Grandpont House in 2007.

6.30 It is understood from the occupants at Grandpont House that these photos were taken at the peak of the flood event, when the water levels were at the highest on the site. The topographic survey of the site records the sprung arch levels of the culverts at 55.21m AOD to 55.24m AOD and the top of bank along the channel varies between 54.97m AOD and 55.26m AOD. The sprung arch levels and the bank have clearly been breached and so the water level is higher than 55.26m AOD. The soffit level of the two culverts beneath the house are 55.91m AOD and 55.95m AOD. Both soffits can be seen in the photos and thus the water level is not as high as 55.91m AOD. The water level has been estimated as approximately 6inches below the soffit level, which equates to 150mm and a water level of 55.76m AOD. Looking to the right of the house (east), the gravel path in the garden can be seen as not flooded. The topographic survey includes a spot level on the bank side of the path as 55.83m AOD. With the bank in front of the path clearly visible, the water level cannot be as high as 55.83m AOD. A tree is visible in the fourth photo below, with the trunk visible to ground level and not submerged. The topographic survey recorded a spot level for the top of bank of the pond in this vicinity as 55.66m AOD, although the ground level at the base of the tree was not recorded. It is, however, reasonable given levels across the site that the water is at this level, or not much higher, otherwise the tree would be submerged. Therefore, the peak water level on the site in the 2007 event was in the range of between 55.66m AOD and 55.83m AOD, and most likely in the order of 55.76m AOD. A water level of 55.76m AOD, or even as high as 55.83m AOD, would not flood the area of the site proposed for development.

Hydraulic Model Calibration

6.31 The EA requested that the calibration of the hydraulic model be considered in addition to purely relying on the historic observations. Specific observations detailed below are related to the calibration as discussed, and do not change our opinion that the known outlines of historic events, rather than modelled simulations should be used to define the functional floodplain, especially when reliable anecdotal information is available over a long period of time. This is in large part due to the inability to verify the performance of the model at the location specified, due to a lack of available information with which to secure a robust understanding and representation of the floodplain interactions created both by the railway embankment, which bifurcates the floodplain, and, immediately upstream of the site, the raised Abingdon Road as it approaches Folly Bridge, which constricts flows. This is in accordance with the conventional wisdom that true observed data should always be used in preference to mathematically idealised, and therefore approximate, data where discrepancies exist. It is also in accordance with the Planning Practice Guidance on defining the extent of Flood Zone 3b.

6.32 The calibration undertaken on the latest model issue does not comprise full model calibration, but rather, an adjustment to the previously calibrated model. According to the figures and tables in the hydraulic modelling report, the model is shown to overestimate flood water levels and extents for the 2007 event in the area between Abingdon Road and the River Thames. Therefore, it is reasonable to conclude that the modelled flood levels and extents are over-estimated at all return periods and certainly for those return periods that are of a similar scale to the 2007 event. Therefore, the actual recorded outline should be used in preference to the modelled data.

6.33 Calibration and verification shows reasonable agreement at gauges, however, there is an absence of gauges along the central Oxford reach, and as noted in prior discussions, it is extremely difficult therefore to determine whether or not the model is representing flooding in this extremely complicated area correctly. Observed floodplain levels are provided in the Hinksey and Botley areas, however these are not close to the Folly Bridge area of interest. It is however telling to note that, for the 2007 (main calibration) event, modelled flood levels at Botley (upstream of the railway line) are predominantly underestimates compared to the observed level, whilst at Hinksey (downstream of the railway line), levels are overestimated. The closest point hydraulically, to Grandpont House, point no. 5 (presented in Figure 11), overestimates levels by 170mm relative to the measured flood level. Point no. 2, another hydraulically similar location, overestimates by 420mm. The only points in the area presented in Figure 28 that underestimate the flood water level do so by no more than 3mm and lie either on the upstream side of the railway line (points 36 and 37) or immediately downstream on one of the braided channels returning flow to the main floodplain (point 10).

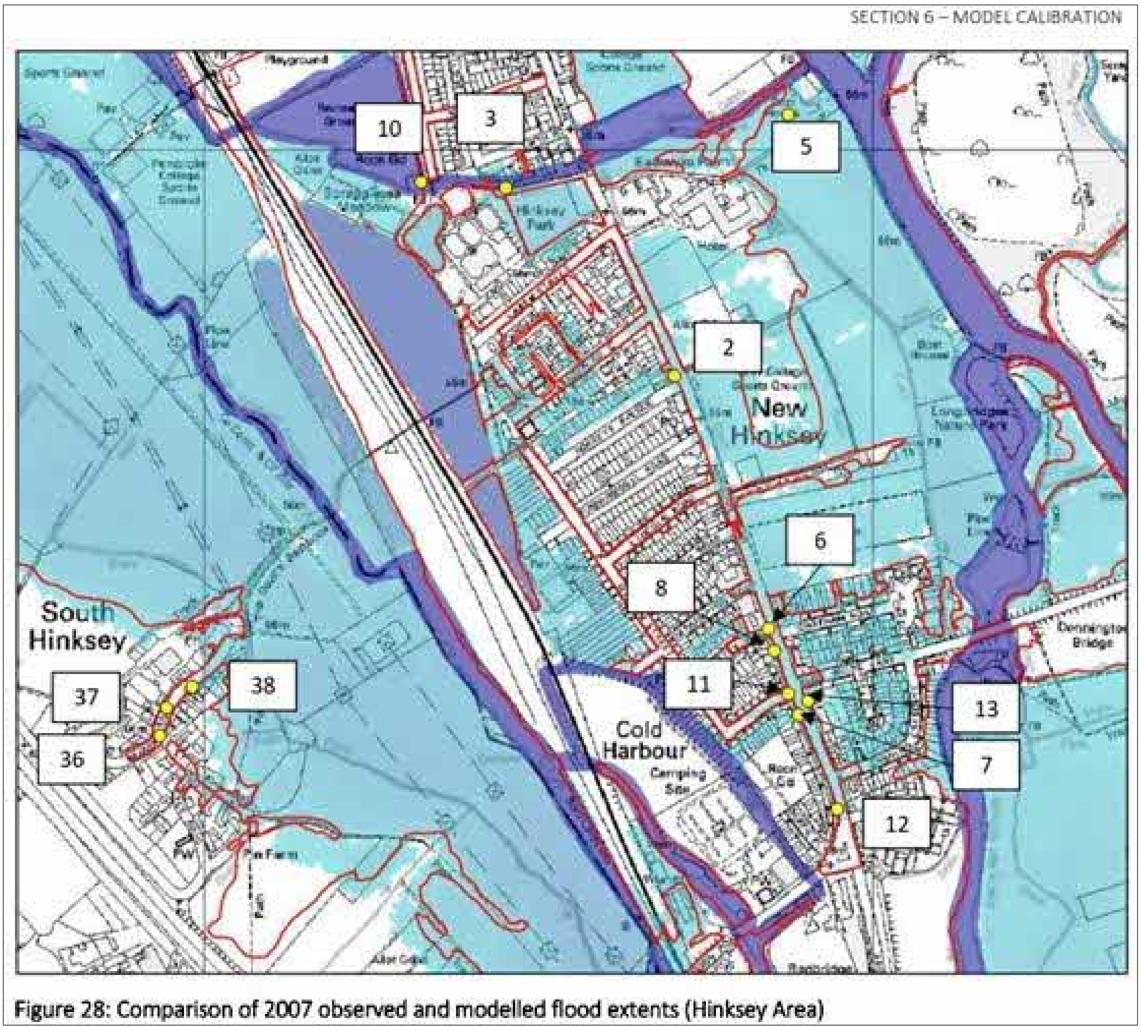

Figure 11: Extract from EA hydraulic modelling report

6.34 It is noted that minor edits were undertaken to the model to correct instability and reversing flows at Osney, together with validation of spot gauged results in this area- this approach would generally be expected to significantly improve the understanding of the bifurcation in the floodplain around the Botley/Osney area which causes the discrepancies noted above. However, this work was undertaken on in-bank flows (and indeed, is run without the TUFLOW element present) and unfortunately does not therefore provide any meaningful validation of the flooded scenario, in particular the role of the railway line in altering the proportion of flow that passes down the Hinksey side to the west, thus bypassing central Oxford entirely. Therefore due to the lack of available gauged data on the individual channels and structures in observed flood events, the calibration through Oxford is unfortunately impossible to correctly achieve.

6.35 Although a lot of work has gone into the calibration and verification of the model, which is, in general, robust, there are clearly still shortcomings, which arise solely out of the difficulties of attempting to adjust a model of this scale to fit local hydraulics – this is through no fault of the modellers, it is simply the reality of the complexity in the area. When we have known data, this should always take precedence over derived data where discrepancies exist- the model should always be adjusted to fit the data, not the other way around.

Conclusion and Flood Zone Allocation

6.36 The area of the site at Grandpont House proposed for development did not flood in either 2007 or 2014. Initial EA estimates of the return period for the 2007 event put the return period between 10 and 50 years, while the 2014 event is estimated to have a return period of 25 years. This assessment has determined with a high level of confidence that the 2007 flood event had a return period in excess of 20 years when considering all inflow locations.

6.37 Photographic records of the site during both events have been provided to the EA and have been assessed. The water level peaked at very similar levels in both events with an estimated peak water level of 55.76m AOD in 2007 and 55.74m AOD in 2014. The EA historical flood maps are incorrect for both these events as they show the area proposed for development as having flooded, however this is not possible based on the topography and flood extents in the grounds of Grandpont House.

6.38 The hydraulic model estimates the 20 year flood water levels on the site as 55.93m AOD. However, this is inconsistent with historical records as the maximum water level reached in any flood event in the living memory of those onsite (since 1959) was in 2007 and 2014. The calibration of the hydraulic model confirms that the model overestimates the 2007 water level on the reach of the Thames downstream of Folly Bridge and Grandpont by between 170mm and 420mm.

6.39 Given all the evidence, it can be deduced that the model is overestimating flood water levels on the site in events of similar magnitude to 2007 and 2014 and as the area proposed for development has not flooded in at least 40 years (based on witness statements of occupants still present at Grandpont House, but actual record likely to be longer than 40 years), including 2007 and 2014, that the area proposed for development is not in the functional floodplain.

6.40 In the most recent letter from the EA, a closing comment is noted that:

> *We must see clear evidence that none of your red line boundary or built footprint is impacted by this [55.76m AOD flood level] event. [...] An overlay showing exactly where the red line boundary and built development is to be located [...] needs to be included.*

6.41 The exact text of the comment above is slightly ambiguous as to whether the red line boundary or the built footprint is to be used in determining the principle of development. Since a minor channel of the River Thames passes through the site, and there is an existing low-lying marsh within the site boundary, this is a material consideration, since it is not possible to exclude these areas from the flood event.

6.42 However, there is previous appeal case law in this matter, as set out in Thackard Ltd vs Teignbridge District Council (appeal reference APP/P1133/A/13/2209715). The inspector's view of policy is as follows:

> *The Council's approach in this case confuses the location of application sites (as defined by the 'site edged red') with the location of vulnerable development. This approach could readily be circumvented by the technicality of simply excluding areas within Flood Zones 2 and 3 from the site boundary, but in practical terms that would achieve little other than to prevent appropriate treatment of such land by excluding it from the purview of any resultant planning permission. The fundamental policy intention is to prevent vulnerable categories of development from actually being built on land susceptible to flooding and application sites routinely encompass land in more than one flood zone. The important object is to*

design or condition schemes so as to meet that policy intention and that would be perfectly possible in this instance.

6.43 The building has been located in such a way as to avoid development within the land designated as Flood Zone 3b using the 55.76m AOD level, and is wholly accessible at the upper level. The proposed vulnerable development therefore is located outside Flood Zone 3b except where Flood Zone 3b coincides with the existing water feature (river channel) on the site, where it will be crossed, internally and externally, on clear span bridges above the 100 year water level. Therefore, the principle of development is acceptable.

7 HYDRAULIC MODELLING

Availability of Hydraulic Models

7.1 The EA has provided the River Thames – Eynsham to Sandford 2018 hydraulic model for use in the study. The model was checked and evaluated, and aside from the shortcomings relating to model calibration and hydrology, which cannot readily be overcome, is deemed fit for purpose.

Technical Alterations

7.2 In order to minimise costs and ensure the assessment scope is reasonable given the scale of the proposals (in accordance with the NPPF), no technical alterations to the base model were undertaken. This is to ensure there is no need for a costly Flood Map Challenge or model verification process.

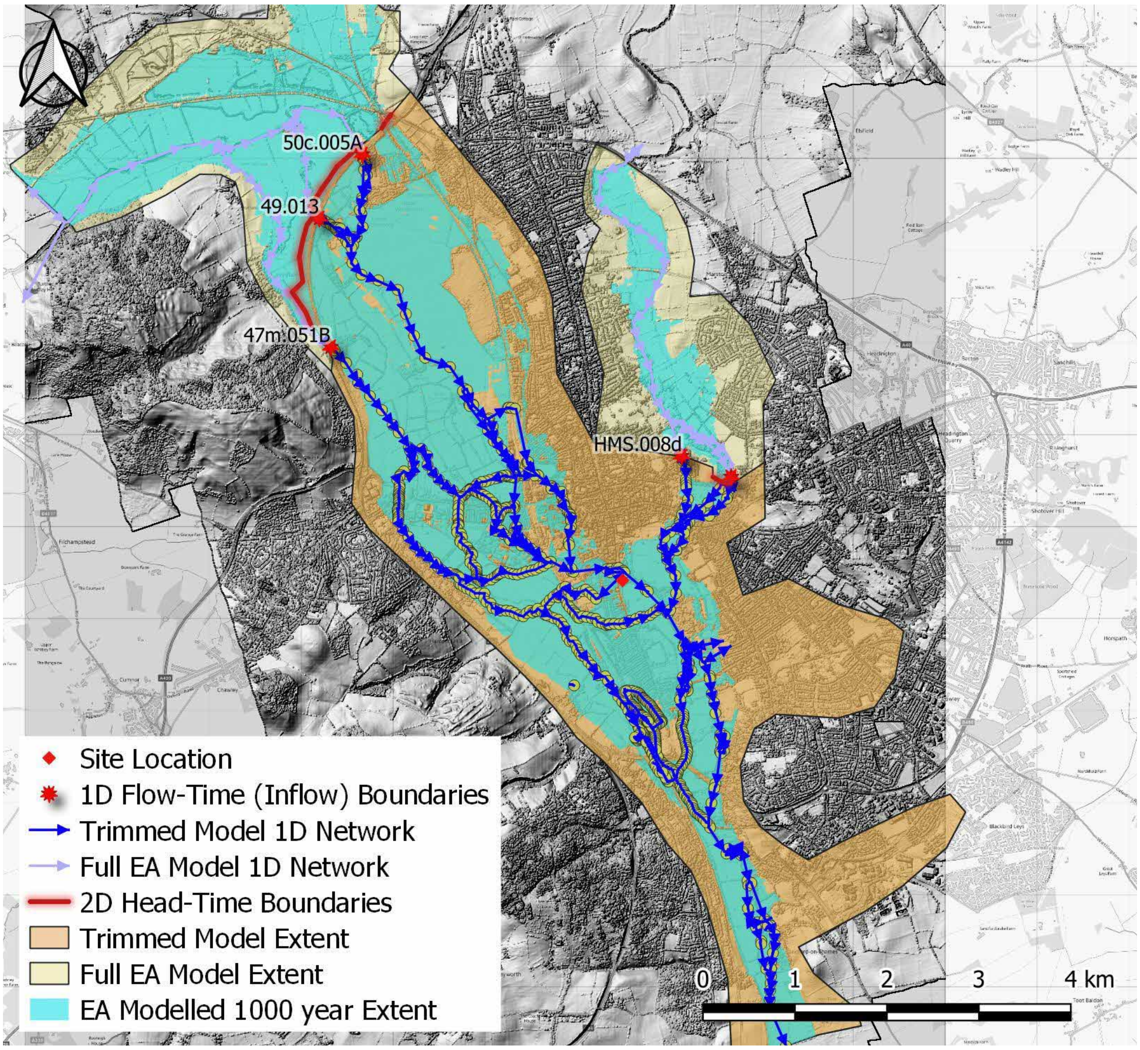

Figure 12: Model schematic showing trimmed section

7.3 The model was trimmed upstream to shorten run times and enable the model to be run within a limited node licence by removing the 1D sections upstream of the A34 on the River Thames, and upstream of the High Street bridge on the River Cherwell, as shown in Figure 12. The 1D inflows at the A34 were obtained by extracting flow-time results from the full model results for each node, and 2D boundaries were applied upstream of each culvert or floodplain inflow location using extracted head-time results from the 2D.

7.4 As can be seen in the figure, both locations create full barriers to flow and therefore form robust hydraulic boundaries for the model- the locations and boundaries were refined until there was no difference (±0.001m) in the 2D results grids for the 100 year return period event including 25% allowance for climate change on the downstream side of either the A34 or the High Street. This ensures that the trimmed model replicates the results of the existing EA model, i.e. it is identical. No technical changes were made to the model except to replace the 2D grid at the site by updating the DTM.

Scenarios

7.5 The model was run for the provided 2 year, 5 year, 20 year, 100 year, 100 year plus 25%, 100 year plus 35% and 1000 year flows. Each return period was run for the following scenarios:

EA model build with DTM at Grandpont House replaced with a grid compiled from the 3d topographic survey (including buildings); and
As above, with the proposed scheme elements included in the DTM, as described below.

7.6 The proposed scheme DTM was built using the survey DTM as the basis. The outline of the proposed building was raised to 60m AOD, around 4m higher than the surrounding ground, and the area of proposed lowering (to form volume-for-volume compensation) was included as an area of lowered ground, to 54.5m AOD. The output model check file grids are presented in Figure 13 and show the proposed scheme to be correctly represented within the 2D model.

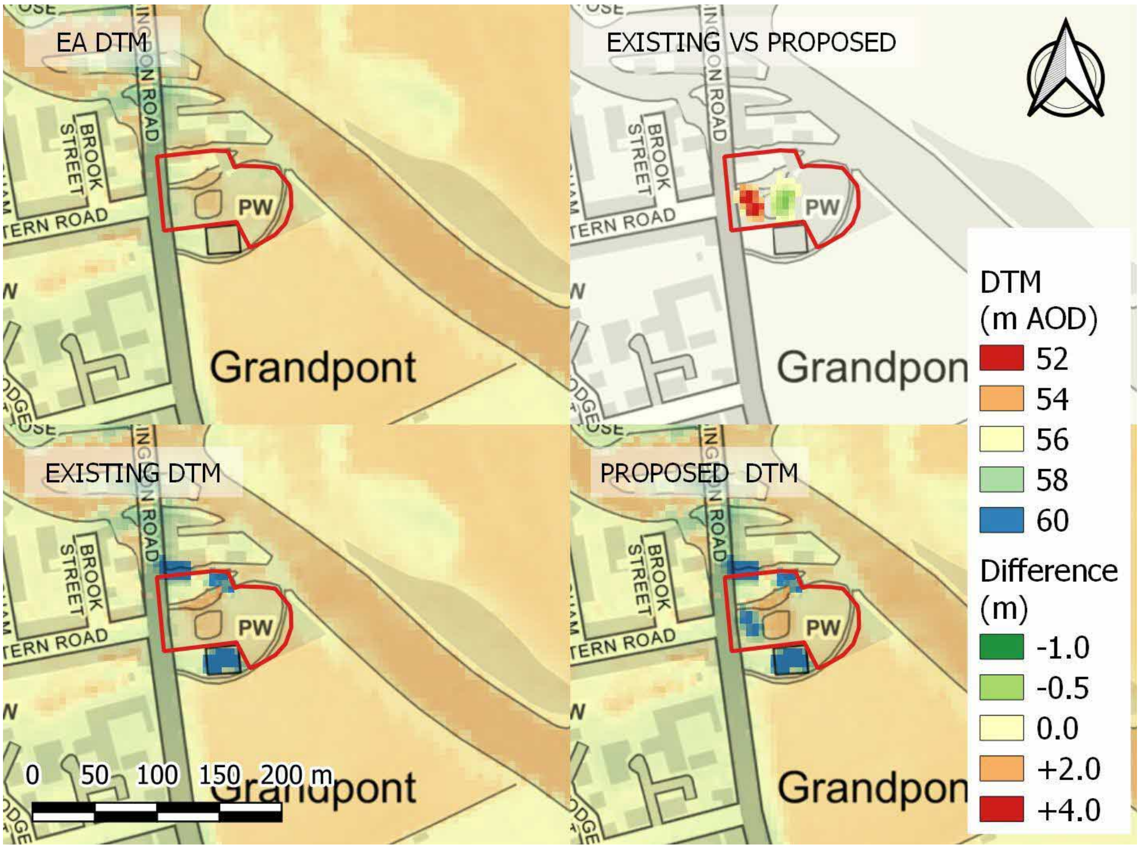

Figure 13: Comparison of 2D model grids

8 ASSESSMENT OF FLUVIAL FLOOD RISK

Modelled Flood Risk

8.1 The maximum water level grid output by TUFLOW was interrogated to obtain the maximum water levels for design, which are presented in Table 5. 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 5: Modelled maximum flood water levels

	2yr	5yr	20yr	100yr	100yr + 25%	100yr + 35%	1000yr
47.079 (u/s)	55.52	55.73	55.97	56.16	56.31	56.41	56.43
Min on-site	n/a	n/a	55.94	56.13	56.28	56.39	56.41
Max on-site	n/a	n/a	55.94	56.14	56.29	56.40	56.42

8.2 The modelled flood event outlines are presented in Figure 14.

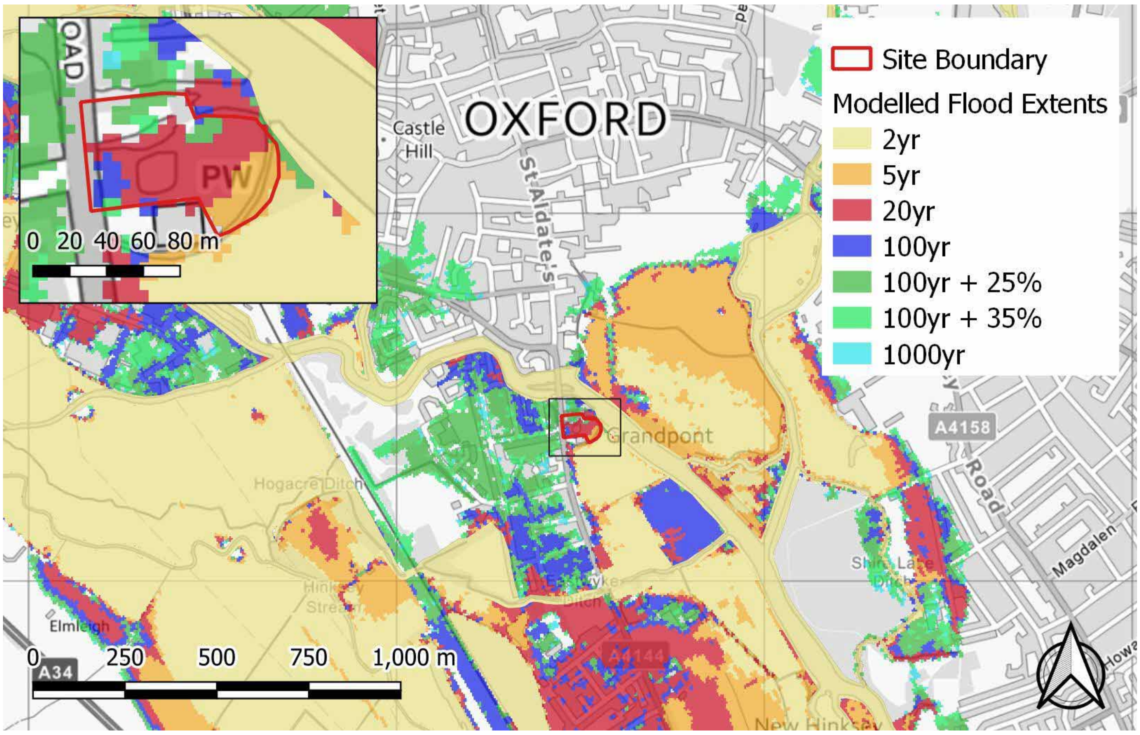

Figure 14: Modelled flood event outlines

Climate Change

8.3 The recommended allowances for climate change were updated on 21st July 2021, and revised estimates, based on River Management Catchments, have been released[26]. In addition the guidance has changed such that all assessment should use the central allowance except for Essential Infrastructure in the floodplain[27].

[26] https://www.gov.uk/government/publications/peak-river-flow-climate-change-allowances-by-management-catchment
[27] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-river-flow-allowances

8.4 The new allowances for Oxford are complicated by the differing catchments. The 'Central' allowance to the 2080s for the River Cherwell catchment is 15%, with the sensitivity allowance (Higher Central) set at 25%. For the Thames, the "Gloucestershire and the Vale" management catchment requires 26% for the 'Central' allowance. The site lies within the "Gloucestershire and the Vale" management catchment extent. The EA has confirmed in pre-application discussion that the 26% allowance should be used for the design, and has agreed to a design flood water level of 56.29m AOD obtained through interpolation. The 35% allowance, used in the hydraulic modelling, is higher than any of the possible required allowances.

8.5 For determination of off-site impacts, since there are no "Essential Infrastructure" uses (defined as essential transport i.e. mass evacuation routes, wind turbines or essential utility infrastructure) within the floodplain near the site, the 'Central' allowance should be used, and therefore the 26% allowance is used in design. The 35% allowance is used as a sensitivity test.

Assessment of Flood Risk

8.6 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.

8.7 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[28]:

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

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)[29], 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.

8.8 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.

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

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

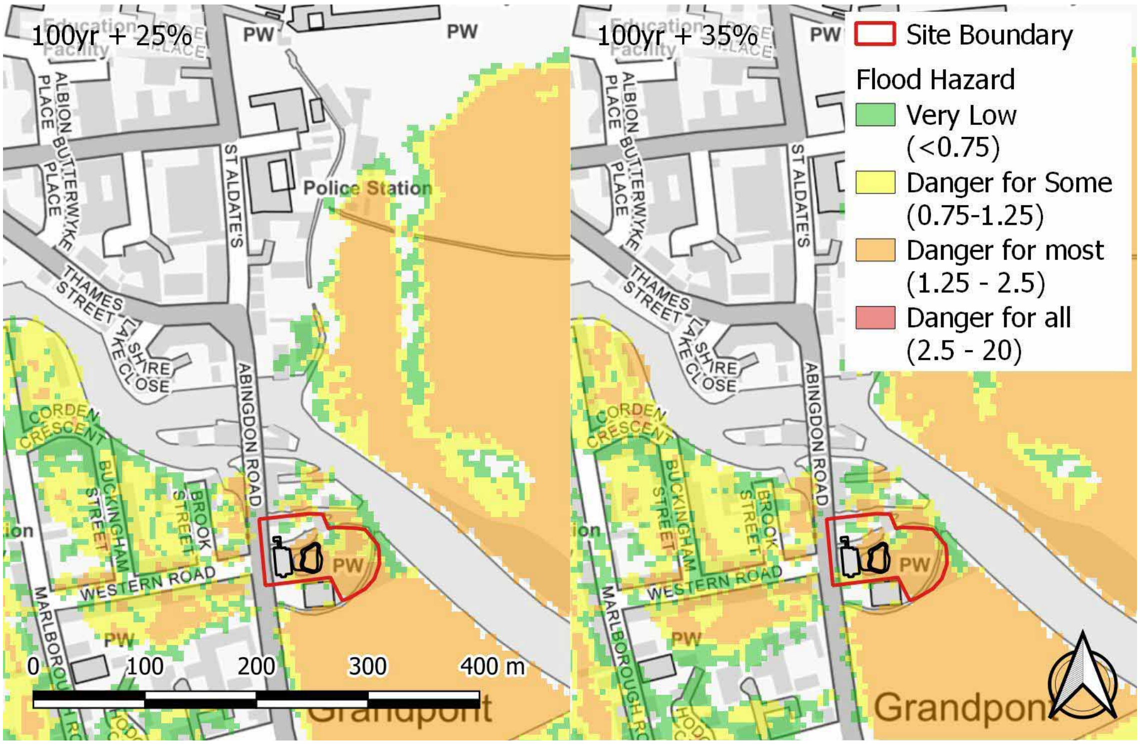

Figure 15: Modelled flood hazard – proposed development scenario

8.9 The hydraulic modelling indicates that the flood hazard rating for the area of the site where the building is to be situated is negligible, including the 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. Flood water does not overtop Folly Bridge and therefore this access route remains safe.

Design Response to Flood Risk

8.10 Ground floor finished floor levels in the proposed new building will be set at 56.60m AOD, which is 310mm above the design flood water level of 56.29m AOD and 200mm above the sensitivity flood water level of 56.40m AOD. In addition, the underside of the ground floor slab will be set above the modelled on-site flood level for the 100 year return period event including 26% allowance for climate change (the required design level) of 56.29m AOD, and water will be allowed to flood freely beneath the building.

8.11 The proposed development will increase the number of residential units on the site. There will be no ground floor sleeping accommodation in the proposed new building. Residents will be able to reach the new building and exit the property throughout a 100 year return period event, including both the required allowance for climate change and the sensitivity level, and there will be internal access to higher floors in the event of flooding on the existing access routes as a result of more severe events. It is noted that Abingdon Road, and the higher areas of the site to the west, are not expected to flood even in the 1000 year return period event.

Flood Management and Personal Flood Plan

8.12 It has been established that the proposed development would be dry and fully accessible throughout the design 100 year return period event with climate change included. However, it is prudent to devise and maintain flood management, action and evacuation plans, which will equally apply to the existing development, to ensure rapid recovery following any flood event.

8.13 The Environment Agency has prepared a template document for compilation of a "personal flood plan", which is available at www.gov.uk/government/publications/personal-flood-plan, and is equally applicable for this residential scenario. The document enables the occupier and residents to record the contact details of critical services and information providers for future reference, as well is emergency contacts and locations of cut-off points for services.

8.14 The second part of the flood plan recommends several actions to take when a flood is expected to safeguard personal possessions and prepare for removal to an upstairs location should an extreme event be forecast.

Floodplain Storage and Compensation

8.15 The proposed building is to be raised on stilts with suspended ground floor slab supported on columns and the underside of the structure will be above the design flood water level. Water will flow freely underneath and egress naturally once water levels recede, without impacting on the flooding mechanisms described in preceding chapters. The development would therefore not result in loss of flood storage or obstruction of flood flows.

8.16 Under floor space will be designed in accordance with latest best-practice provided by the EA in terms of access protection and grills. A maintenance plan will be prepared and adhered to by the Grandpont House staff to ensure the space is kept open and clear of debris, with regular inspections and clearance as required.

8.17 Since the entire structure (including the access bridge and internal bridge) will be constructed with the underside above the design flood water level, the only potential losses in floodplain storage would occur due to the supporting piles and pile caps. The structural design (included in Appendix A) currently shows 81 piles, with the maximum dimension of the pile capping being 600mm in diameter. The depth from ground to design flood water level beneath the structure is 300mm, which equates to a total volume of 6.9m^3. The EA has agreed that a volume of less than 10m^3 is negligible in the context of catchment flood storage. Therefore, the actual impact of the proposed building, as proposed, is negligible, since it will not occupy any significant floodplain storage.

8.18 As a sensitivity test, the model was used to assess the impact if the open space beneath the building is solid and does not provide any floodplain storage or conveyance of flow, should the overhangs or voids become obstructed. The hydraulic modelling shows that changes in flood storage on the site do not have any offsite impact as discussed below. However, additional flood storage will be provided in the form of excavation between the low-lying marshy area and the channel through the site.

8.19 Usually, such compensatory storage would be provided at the same level as the storage removed. However, in this case, due to the lack of available high land, this is not possible. Instead, compensatory storage will be provided to the same volume, but at the lower level. This means that storage is over-provided for during smaller return period events, but remains sufficient at the maximum event. This was previously agreed with the EA and the same principle applies to this development. Thus, the total volume available at each 100mm increment remains higher than in the undeveloped scenario.

8.20 The hydraulic modelling exercise undertaken as part of this Flood Risk Assessment showed that the development did not have any negative impact on the flood risk elsewhere by increasing flood water levels. The proposed extension was represented as a solid barrier to flood flow. The compensatory flood storage was included in the model by flattening the area of the proposed ecological area to the minimum ground level (rather than modelling any excavation).

8.21 Consequently, although the proposed extension does not reduce flood storage on the site, and compensatory flood storage is not required- additional storage is nevertheless provided, in sufficient volume to fully offset the loss should the area beneath the building be considered solid, within the low-lying marshy area.

Effect on the Risk of Flooding Elsewhere

8.22 By altering the hydraulic model, it is possible to assess the impact of the proposed extension on flood risk. It is noted that, by excluding the proposed building from the floodplain entirely, any calculated impacts are conservatively over-estimated, since there is no allowance for the free-flooding design of the building.

8.23 Comparison of the modelled flood level results grids was undertaken by subtracting the pre-scheme (baseline) maximum flood level grid from the post-scheme maximum flood level grid. This produces a grid showing the change in flood water level across the entire model area.

8.24 The model results showed that the proposals do not have any impact on flood water levels away from the site that do not fall within model tolerances (±1mm), for any return period modelled from 2 years to 1000 years and including climate change. The "greatest" impacts were modelled at the 20 year return period event, and arise due to fluctuations in critical model calculations.

8.25 Figure 16, presents the change in flood water levels for the 20 year return period event. Changes in water level of no more than 1mm are modelled on Christ Church Meadows, with no effect on modelled flood extents. Changes in modelled levels of 1mm are well within model tolerances and the conclusion is that there is no change in model results arising due to the proposed development.

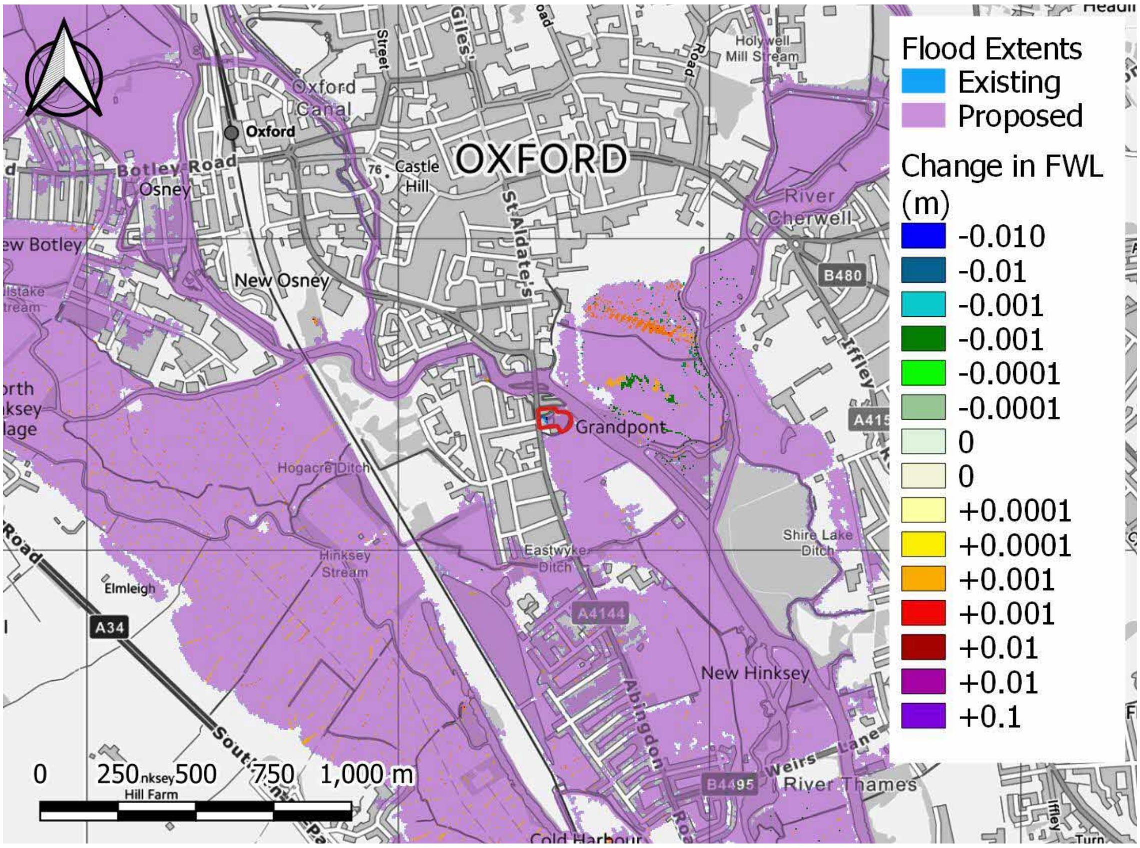

Figure 16: Modelled impact of the proposals on the 20 year flood event

8.26 A closer view, including remaining return periods, is presented in Figure 17. This shows that minor reductions in flood water level of the order of 10mm are modelled on site. Since these fall at the edge of the floodplain, these are likely to arise purely as a result of changes in wetting and drying for these cells and do not necessarily indicate that flood risk on the site will be reduced. The extents of flooding are clearly reduced in the proposed case model, showing that the model is working correctly.

8.27 It may be concluded, therefore, that the proposed development will not have any adverse impacts on flood risk.

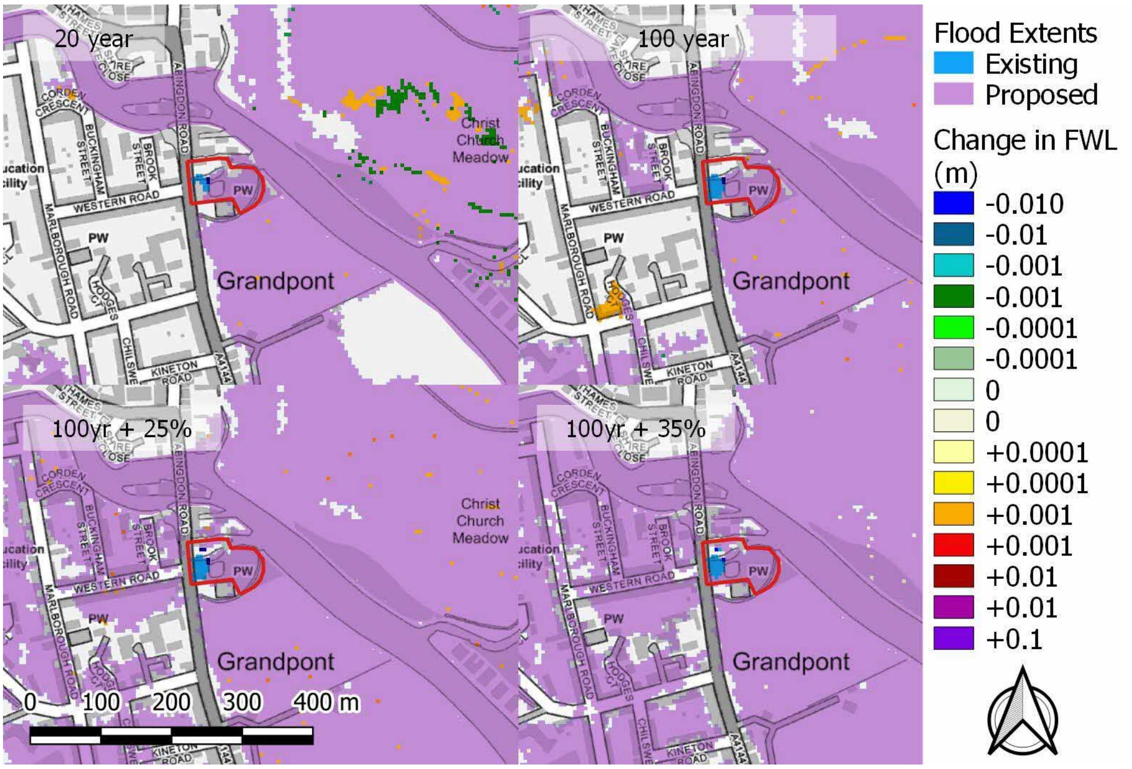

Figure 17: Impact figures for remaining return periods illustrating the reduced effect

Flood Storage Calculations

8.28 The under-floor void design outlined above, though effectively removing the majority of built structure in the floodplain and thus preventing loss in floodplain storage capacity, could become blocked. Although it has been shown that the proposed development does not affect flood risk, it is prudent as a precautionary measure that compensation be provided.

8.29 The 3d topographic survey model was used to perform a cut and fill exercise for the proposed development. The footprint of the proposed building was raised to the 100 year return period level including a 25% allowance for climate change of 56.29m AOD. The required fill to achieve this level is 124.4m^3. The minimum ground level within the building footprint is 55.10m AOD (according to the 3d model) and therefore all storage must be calculated from this level.

8.30 The minimum spill height for free draining of the marshy area is 55.10m AOD, so this is the lowest level at which storage can be compensated. This coincides with the minimum level at which storage is lost and therefore is acceptable.

8.31 Storage is provided by flattening in the marshy area to create a level base to the pond, which has been set at 54.50m AOD for the purposes of design and to enable free flooding from the existing marshy area into the proposed new pond zone. The minimum level in this area is 54.28m AOD and therefore the entire excavated volume is considered to contribute as floodplain storage, since the resting water level is expected to be no higher than 54.28m AOD.

8.32 The total volume provided in the compensation area is 195m^3. This is an increase of 57% compared with the design standard flood event. A comparison of the net change in storage within the pond area with the storage lost at each 100mm level is presented in Table 6. All excavation takes place at or below 56.0m AOD, and therefore the storage compensation provided above this level remains the same for all increments at 195m^3.

Table 6: Calculated storage change at each 100mm level (all m^3)

Level m AOD	Built Footprint (Loss)	Existing Pond Area	Proposed Pond Area	Pond Storage Gained	Net Flood Storage
55.2	1	51	209	158	+157
55.3	1	77	245	168	+167
55.4	2	107	282	175	+173
55.5	3	138	320	182	+179
55.6	5	170	359	189	+184
55.7	6	206	399	193	+187
55.8	7	245	439	194	+187
55.9	23	285	479	195	+172
56.0	27	325	520	195	+168
56.1	59	366	560	195	+136
56.2	93	406	601	195	+102
56.3	128	447	642	195	+67 (52%)
56.4	162	488	682	195	+33 (20%)

8.33 The calculations show that there is an increase in available flood storage at all levels from the minimum level lost to the 100 year return period event including 35% allowance for climate change (sensitivity event). For all calculation levels presented above, the pond is freely floodable and draining, with no change in the mechanism of flooding to the pond area.

Residual Risk

8.34 There is a minor risk that any blockage of the culverts under the existing building will result in additional flooding from the reach of the river that bisects the site. In extreme events, this is unlikely to have a significant impact on site, since the dominant flooding mechanism is from downstream of the culvert, but may increase the duration of residual flooding when the Thames recedes, due to the reduced capacity of the drainage pathway. The site is also located downstream of the Abingdon Road culverts, which would trap debris prior to it reaching the site, further reducing the probability of such an event. Blockage of any of the culverts on site would therefore tend to reduce the risk of flooding at the site, by reducing the possible pathways for floodwater to reach the site.

8.35 The modelled flood mechanisms clearly show that blockage of the culverts on site would not result in an increase in the risk of flooding and therefore no additional residual risk on the site.

Consequences of Flooding on Site

8.36 The site has been designed to remain safe in the 100 year return period event including an allowance for climate change. The building would remain dry and accessible. Therefore the consequences of flooding on site are minimal.

Exception Test

8.37 The site lies in Flood Zone 3 and additional residential units are proposed. Therefore the development needs to pass the Exception Test.

8.38 Development of this site will enable essential maintenance work to be completed on the existing Grade II* listed building on the site. It will improve the amenity of the space by providing enhanced educational facilities, and employ sustainable techniques for water usage and surface water management. Further, due to the compensatory storage areas, and the ecological works at the site, the proposals will have a net beneficial effect in relation to both flood risk and biodiversity.

8.39 This FRA demonstrates that the development will be safe during a 100 year return period flood, including allowances for climate change, and does not increase flood risk elsewhere. The FRA has identified each source of flooding, and although the risk to the site is low, the design incorporates measures to protect residents from flooding. The site satisfies the Exception Test, and is appropriate for the proposed development.

9 SURFACE WATER MANAGEMENT

Policy

9.1 The proposed development is not "major development" and therefore there is no requirement to undertake a detailed SuDS strategy for the development. However, OCC policy does require the inclusion, where possible, of SuDS as a means of managing surface water drainage.

9.2 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.

9.3 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*.

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

Existing Site Runoff Characteristics and Drainage

9.5 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 gravel. The ground cover in the area proposed for the new building is grass and vegetation.

9.6 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. Surface water runoff currently discharges from the existing roofs and hardstanding areas directly to the River Thames. The remainder 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.

Post-development Runoff Characteristics

9.7 The proposed development will result in a gross increase in impermeable area on the site due to the introduction of the extension building. Path and driveways will be constructed from permeable materials, thus maintaining the current infiltration patterns on the remainder of the site.

9.8 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.

9.9 The only alteration to the runoff characteristics will therefore result from construction of the extension. The introduction of this impermeable area will result in a net increase in surface water runoff, which should be attenuated to existing Greenfield rates to avoid potentially causing an adverse impact on flood risk elsewhere.

Discharge Hierarchy

9.10 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."*

9.11 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.

9.12 Since discharge by infiltration is not possible, new drained areas (specifically the proposed new building) will be collected and discharged directly to the River Thames at an attenuated rate where feasible, in accordance with the discharge hierarchy, set out in Table 7.

Table 7: 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)

9.13 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[30] 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.

[30] CIRIA (2001), *CIRIA C523:* Sustainable Drainage Systems – Best practice.

9.14 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.

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

9.16 Table 8 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.

Table 8: SuDS Hierarchy[31]

	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			

9.17 In order to provide source control and retain rainwater on site for reuse, it is recommended that rainwater is collected into a storage tank (blue roof) or water butts in the first instance, to be re-used as irrigation, and for non-potable water use. Green roofs may also be considered subject to conservation and structural constraints.

[31] http://www.sustainabledrainagecentre.co.uk/suds-hierarchy_c2236.aspx Retrieved 02/11/2016

9.18 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.

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

9.20 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 9: 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 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

9.21 Surface water runoff will be attenuated to Greenfield rates, if feasible, 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

9.22 Since the site 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. 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.

9.23 The proposed drainage design (undertaken by others) shows that surface water would be collected and discharged to the on-site pond. A restricted outfall is proposed from the pond into the channel of the River Thames at the site, and includes specification of a non-return valve.

9.24 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

9.25 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 existing on-site watercourses. Exceedance flows will be extremely small in the context of overall flood volumes.

Effect on Flood Risk Elsewhere

9.26 Subject to attenuation of surface water runoff to Greenfield runoff rates, 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

9.27 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.

9.28 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.

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 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.

10.2 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, in the new-built extension 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 new building will contain a chapel, library, study rooms and part of the total study-bedroom accommodation.

10.3 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.

10.4 The latest EA hydraulic model shows the site to lie within the extent of the 20 year return period flood. As such, the site is designated as functional floodplain (Flood Zone 3b). However, in accordance with the National Planning Policy Framework (NPPF), observations on site have been used to supplement the understanding of the functional floodplain. The functional floodplain is defined as land where water flows or is stored in times of flood- in the former case this refers to dynamic flow paths, and in the latter, areas that are intended to flood and known to provide a flood alleviation benefit. The NPPF indicates that the natural 1 in 20 annual probability floodplain should be used as a starting point, but should not be rigidly used to define Flood Zone 3b.

10.5 Although significant flood events have been observed in the River Thames in Oxford, with ten events on record since 1947, the site is only known to have flooded to a level sufficient to affect the building or access route in any of these events. However, it is acknowledged that the low-lying marshy area on the site floods during moderate events, and it is therefore necessary to define the extent of the functional floodplain by estimating a flood level. Photographic evidence has been used to estimate a maximum flood level in the 2007 and 2014 flood events. It has been agreed with the EA that this level can be used to define Flood Zone 3b subject to confirmation that the 2007 flood event had a return period greater than 20 years.

10.6 Statistical analysis of the nearest flow gauges indicates that the flow through Oxford in the 2007 flood event was at least 75 years on the Cherwell and Evenlode catchments, and at least 17 years in the upstream Thames catchment, which forms 40% of the overall flow through Oxford, including the bypass route to the west of the railway line. Considering both the relative contributions of the catchments to flood risk in Oxford, and the return periods for each catchment, the return period of the event can be confidently assessed to be at least 20 years. This supports the evidence of the historical record, which indicates that the site has not flooded for at least 40 years according to witness statements, and at least 60 years according to EA records.

10.7 The 2007 event is used to define Flood Zone 3b. The estimated flood level of 55.74m AOD is used to define Flood Zone 3b. The proposed building is located on land above this level, with free access to Flood Zone 1 and thus lies outside Flood Zone 3b. Although the watercourse itself and the low-lying marshy area form part of Flood Zone 3b, these are not proposed for vulnerable uses and OCC policy allows for this.

10.8 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, which is used to set design levels. 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. The 35% allowance is applied as a sensitivity test.

10.9 In accordance with national policy and EA and OCC consultation responses, the proposed building will be set on the highest part of the site, and constructed to be fully open to the under-side of ground floor construction, which will be set above the 100 year modelled flood water level including the required allowance for climate change of 56.29m AOD. Consequently, ground floor finished floor levels will be set at well above the sensitivity (35%) climate change level, which is only 110mm higher than the 25% level. The proposed extension has access to the main entrance to the site from Abingdon Road via footbridges to land wholly above both design flood levels. Abingdon Road and Folly Bridge are not modelled to flood in either event, and therefore full dry access for both pedestrians and vehicles is available. Flood resilient construction is encouraged within the proposed building, to be determined as part of the detailed design.

10.10 The proposed development will not occupy flood storage, since the extension and all associated structures will be built entirely above the modelled flood water level for the 100 year return period event including climate change. The only structures that could occupy flood storage are therefore the piles and pile caps that support the building. The maximum total volume occupied is less than $7m^3$, which the EA has agreed to be negligible in the context of flooding in the Thames catchment.

10.11 The hydraulic model was used to show that the proposed development does not affect flood risk in the River Thames for any return period, even assuming that the area beneath the building was entirely enclosed (100% blocked). In addition, the additional flood storage (accounting only for free-flooding and free-draining volume, i.e. assuming the pond area were pre-filled to the top-of-bank height) which will be created in the ecological area will return a greater volume of storage to the floodplain than would be lost should the entire underside of the structure be blocked. This is true at every level from the lowest level within the proposed building footprint up to the 100 year flood level including the sensitivity (35%) climate change level.

10.12 Surface water will be collected from the roof of the proposed extension and discharged to the ecological area. The SuDS strategy (undertaken by others)should be designed to attenuate runoff to greenfield rates, and is anticipated to use a combination of source control measures to minimise runoff- including replacing existing hard-paved surfaces with permeable surfacing.

10.13 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.

APPENDIX A: DRAWINGS

The following drawings are referenced within the body of this report:

Topographic Survey – Oxford Geospatial Drawing No 17043/OGL_17043_Topo_Rev01 (Aug 2017)

Site Plan (Ground Floor) – Stephen Tsang Designs Drawing No 077/43 (Feb 2022)

Structural Section Showing Floor Slab – TZG Partnership Drawing No 6915/PL02/A (Mar 2022)

Piling Plan – TGZ Partnership Drawing No 6915/PL01/A (April 2021)

Drainage Layout – TGZ Partnership Drawing No 6915/D001 (Mar 2022)

These are included within this Appendix in the order they are referenced.

APPENDIX B: STATUTORY INFORMATION

The following data for the site and surrounding area have been obtained from public providers:

- Environment Agency Product 4 data

TECHNICAL NOTE

Water Environment Limited
6 Coppergate Mews
Brighton Road
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London
KT6 5NE

Tel: 020 8545 9720

www.WaterEnvironment.co.uk

PROJECT	Grandpont House Abingdon Road, Oxford		CLIENT	Netherhall Educational Association			
TITLE	Pre-application Flood Risk Statement		REFERENCE	17014-FRA-TN-01			P01
AUTHOR		CHECKER		APPROVER			
Fiona de Mauny MA MEng (Cantab) C.WEM MCIWEM		Guy Laister MSc Eng, BSc Eng, (Civil) CEng, CEnv, C.WEM MCIWEM		Guy Laister Director			
REV	COMMENTS			DATE	AUTH	CHKR	APPR
P01	First issue			07/02/2023	FdM	GL	GL

1 Introduction

1.1 Development is proposed at Grandpont House, Abingdon Road, Oxford, including a new chapel, meeting and seminar rooms, and additional student bedrooms.

1.2 The project has been in development for over 10 years and in that time, Water Environment has undertaken several studies in relation to flood risk, including several reviews and amendments to Environment Agency hydraulic modelling, as well as agreeing the principles of the development with the Environment Agency on a number of occasions.

1.3 The Environment Agency has been consulted regularly and frequently throughout this process and although the position has changed on several occasions (mostly due to the large variation in predicted flooding from changes to flood hydrology and the hydraulic model), the proposal has been developed, at all stages, to be consistent with the advice provided at the time.

1.4 The latest proposal differs from previous proposals, largely in that the location of proposed development is contained entirely within the area that is already occupied by buildings, on the north side of the watercourse that flows through the site. This area is primarily classified as Flood Zone 2 and not predicted to flood in the 100 year return period flood including an allowance for climate change over the lifetime of the proposed development.

2 Proposed Development

2.1 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. The current building occupies the north eastern corner of the site, and is built on brick arches over a branch of the River Thames that flows through the grounds.

2.2 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.

2.3 Proposals are to extend the current facilities by repairing and refurbishing the buildings along the northern boundary, and through minor extensions to infill and partially expand the existing building footprint. Grandpont House would also be refurbished. The majority of the proposed development lies within the existing building footprint.

2.4 As a result of the proposals the existing accommodations would be expanded to include a new enlarged chapel and priest's office at ground floor, with the existing visitor room and lounge to be retained. A new director's office and bedroom would occupy the space to the west of Grandpont House (away from the river), where bedrooms were previously located. The ground floor of the outbuildings would be converted to contain a visitor room and seminar room, flexible dining room/lecture room with associated kitchen and pantry, and a laundry room. There would also be an accessible bedroom at ground floor in this area.

2.5 The existing mezzanine level to the rear of Grandpont House would be refurbished to provide two bedrooms with en-suites in place of the present allowance of three bedrooms. At the same level, the upper storeys of the outbuildings would provide six further bedrooms. At first floor in Grandpont House, the existing chapel would be converted to a library, while the office would be repurposed as a seminar room. The area to the rear would remain as two bedrooms. At third floor, the existing four bedrooms would be refurbished and converted into three bedrooms.

2.6 As a result of the proposed developments, the number of bedrooms would increase from eleven to fifteen (an increase of four). The number of bedrooms at ground floor would remain two.

3 Risk of Flooding

Historic Flooding

3.1 Grandpont House has extensive archives and there are no records to suggest any internal flooding of the existing building since it was built in the late 18th century. Environment Agency (EA) records indicate the grounds as having flooded in 2003, 2007 and 2014, however anecdotal evidence from staff members indicates that although the lowest parts of the grounds adjacent to the watercourse flooded, the building and grounds on the north side of the watercourse channel remained dry, with dry access to Oxford city centre throughout all three events.

3.2 According to the Strategic Flood Risk Assessment[1] (SFRA), 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 east of the River Thames 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.

Risk of Flooding from Rivers

Flood Zone Allocation

3.3 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 1. The development area lies primarily in Flood Zone 2, and partially within Flood Zone 3. Note that the map does not account for the raised roadway at Folly Bridge, which is shown as Flood Zone 3. The entire bridge and thus the access to Oxford city centre does not flood, and therefore the Grandpont area does not lie on a "dry island".

[1] Wallingford Hydrosolutions on behalf of Oxford City Council (November 2017) Level 1 Strategic Flood Risk Assessment

3.4 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. The site is shown to lie within Flood Zone 2 and 3.

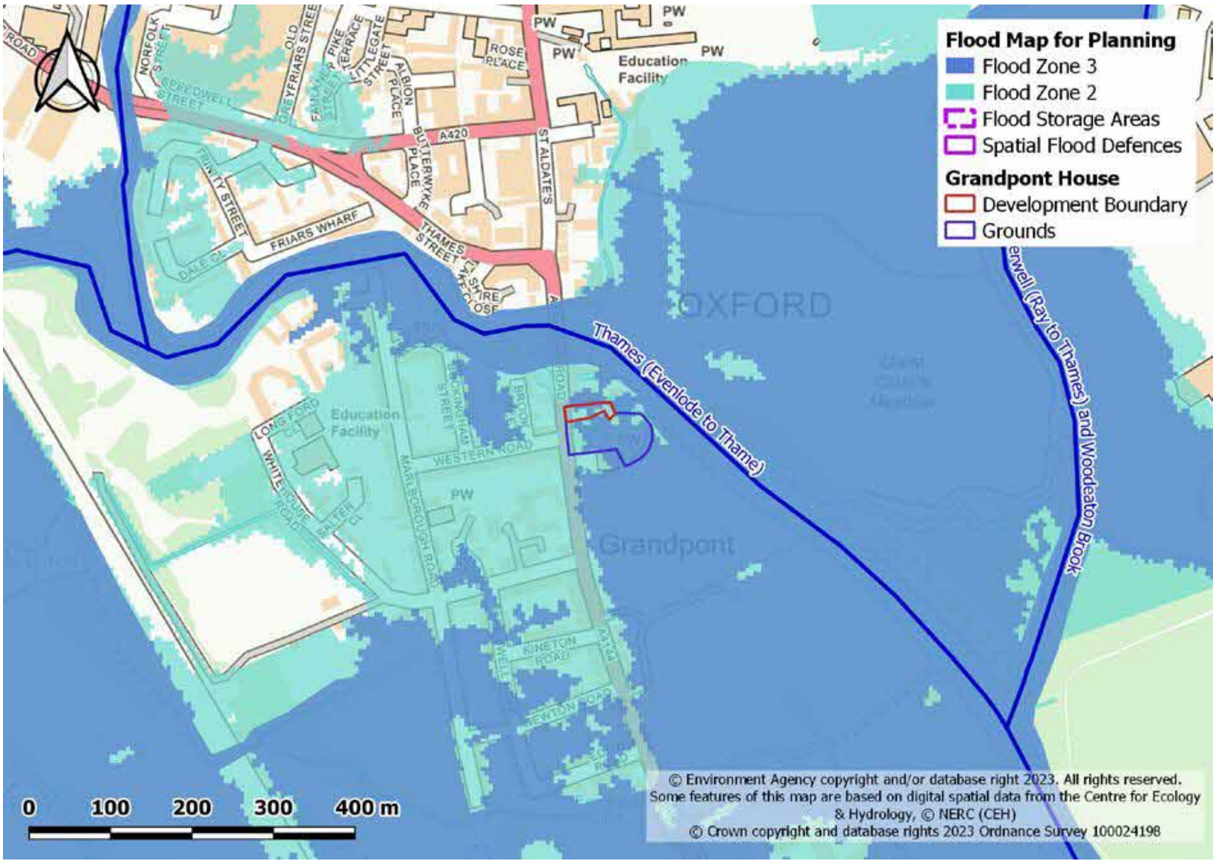

Figure 1: Gov.UK Flood Zone map

3.5 The Oxford SFRA identifies Flood Zone 3b "Functional Floodplain" as areas subject to flooding in events up to (and including) the 5% AEP design event. Areas that are previously developed are defined as Flood Zone 3b Developed. The results of the River Thames hydraulic model show that parts of the wider site (within the blue line) is at risk of flooding in the 5% annual exceedance probability (20 year return period) event, and as such, falls potentially within Flood Zone 3b.

3.6 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.

3.7 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.

3.8 The proposed development takes place entirely within the area north of the watercourse crossing of the site, on land that lies above the agreed water level for the 2007 flood event. As will be discussed later, this area also lies 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.

Flood Levels in Relation to Proposed Development

3.9 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

3.10 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.

3.11 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. 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. This analysis of levels does not account for the 1.7m heigh brick walls that enclose the path on both sides. 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 may be assumed that these walls 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.

3.12 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.

Design Response to Flood Risk

3.13 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, it would be prudent to incorporate flood mitigation into the design of the proposed development.

3.14 The existing ground floor level in the rear wing of Grandpont House is 55.95m AOD, and it is understood that the ground level in the refurbished northern buildings will match this level. This is in accordance with EA Standing Advice, however, it is recommended that flood resilience is incorporated into the design of these buildings. This could be accomplished by raising the ground floor finished floor level, and/or including flood proof doors and glazing. These fittings are highly customisable and can be made to best match existing heritage features. Other flood proof construction measures such as raised utilities, airbrick covers and flood proof construction materials are also recommended.

3.15 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.

3.16 The increase in building volume is not anticipated to result in a reduction in floodplain storage since the development area is not currently expected to flood.

3.17 The proposed development is therefore expected to be safe in the design event including climate change in the River Thames, without increasing flood risk elsewhere.

4 Other Flood Sources

4.1 According to the EA Risk of Flooding from Surface Water (RoFSW) mapping, the site is not at risk of flooding from surface water. Due to the location immediately adjacent to the River Thames, groundwater flooding, particularly of the elevated development area, is not considered to be a risk in the absence of flooding from the River Thames.

4.2 Thames Water has confirmed that Grandpont House is not recorded as being at risk of internal flooding from overloaded sewers, and the risk of flooding as a result of reservoir failure is not significant.

4.3 There is no significant risk of flooding from other sources.

5 Conclusions

5.1 The proposed development at Grandpont House would take place entirely within the area north of the watercourse that crosses the grounds. The proposal involves minor extensions that expand the existing buildings and result in an increase in the number of bedrooms from eleven to fifteen.

5.2 Although the development area lies partially within Flood Zone 3a of the River Thames according to the gov.uk Flood Zone Maps, comparison of ground levels with modelled design levels indicates that the development area, together with access routes for both pedestrians and vehicles to Oxford city centre, do not flood in the design 1% AEP plus 26% climate change event. The proposed development is not located within Flood Zone 3b and not within 3a either.

5.3 As the development is an extension of the existing buildings, ground floor levels are partly dictated by existing floor levels in Grandpont House. Although floor levels may be below the predicted flood water level, water cannot reach the development area and consequently the buildings are not expected to flood. However, flood resilient construction is recommended where practicable and where in agreement on heritage matters.

5.4 The risk of flooding from other sources is negligible in comparison to the risk from the River Thames.

5.5 The proposed development would be safe from all sources of flooding without increasing flood risk elsewhere in accordance with paragraph 159 of the NPPF.

5.6 This report outlines they key principles regarding flood risk and drainage. A full Flood Risk Assessment will be prepared and submitted with the planning application.