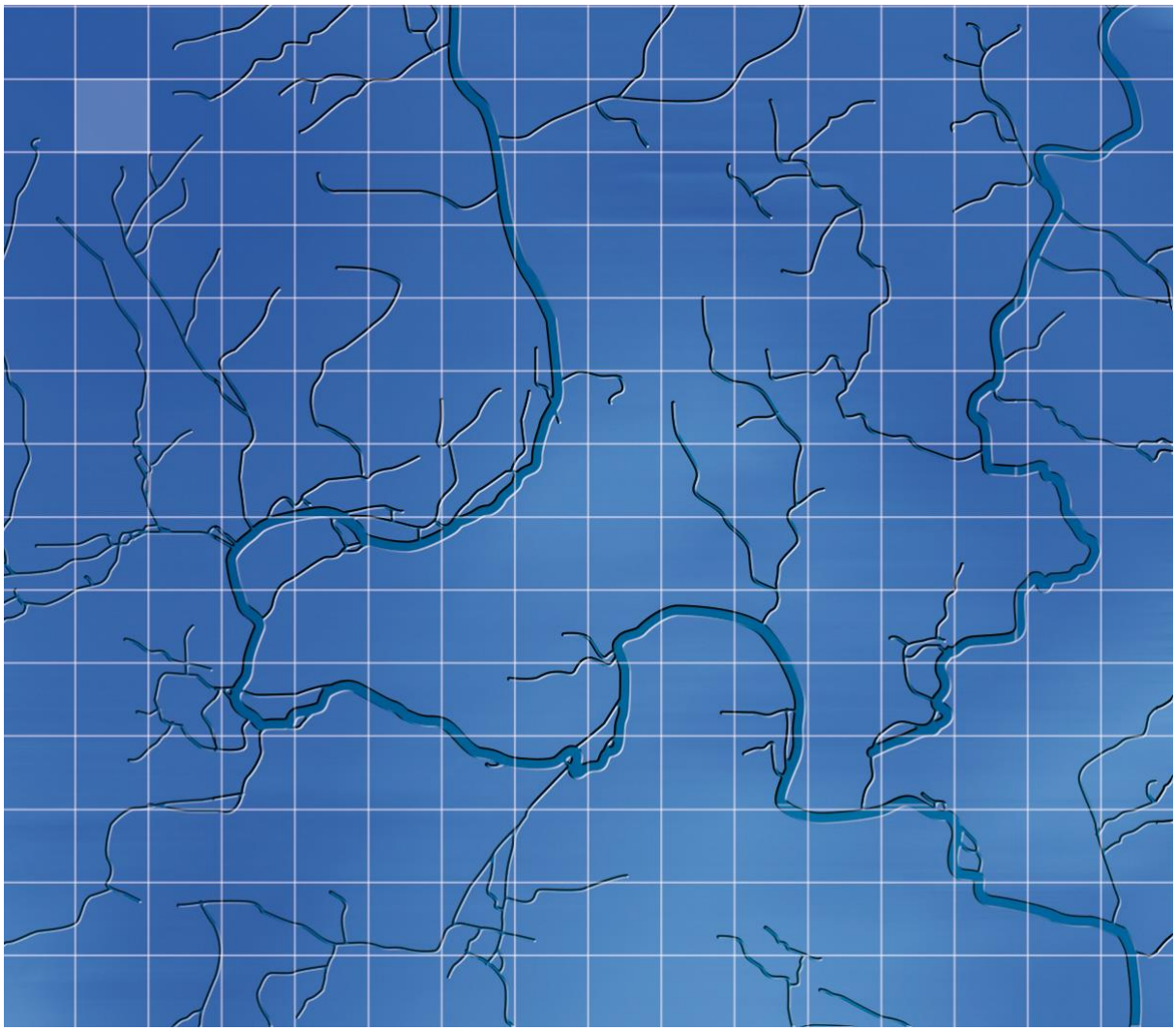
Oxford City Council

November 2023

Oxford City Level 2 Strategic Flood Risk Assessment



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1.1	29/08/2023	Draft	Alyssa Jones (*Consultant*)	Daniel Hamilton (*Principal Consultant*)
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For and on behalf of Wallingford HydroSolutions Ltd.

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1 Introduction

Wallingford HydroSolutions (WHS) Ltd has been commissioned by Oxford City Council (OCC) to undertake a Level 2 Strategic Flood Risk Assessment (SFRA) in accordance with the National Planning Policy Framework (NPPF)[1], Planning Practice Guidance (PPG)[2] and associated guidance from the Environment Agency (EA).

Oxford City Council has carried out a sequential test of sites within its administrative area. The results of which show that a number of sites may need to be located in Flood Zone 2, Flood Zone 3a and Flood Zone 3b. The site locations are displayed in Figure 1, with their full names and proposed uses summarised in Table 1.

This Level 2 SFRA includes a detailed assessment of flooding at each of the sites based on available model data, flood defence information, surface water flood mapping and historical flood data. The assessments also include guidance for the preparation of site-specific Flood Risk Assessments (FRAs), including information about the use of SuDS and the need for mitigation measures. From this information the appropriateness of development on the sites and likelihood of passing the Exception Test has been determined.

This document details the methodology applied, the specific site assessments are provided in Appendix 1 which include the results of the flood risk analysis along with the conclusions and recommendations reached for each of the sites.

[1] Ministry of Housing Communities & Local government (2021) National Planning Policy Framework https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

[2] UK Government (2022) Planning practice guidance- Flood risk and coastal change https://www.gov.uk/guidance/flood-risk-and-coastal-change

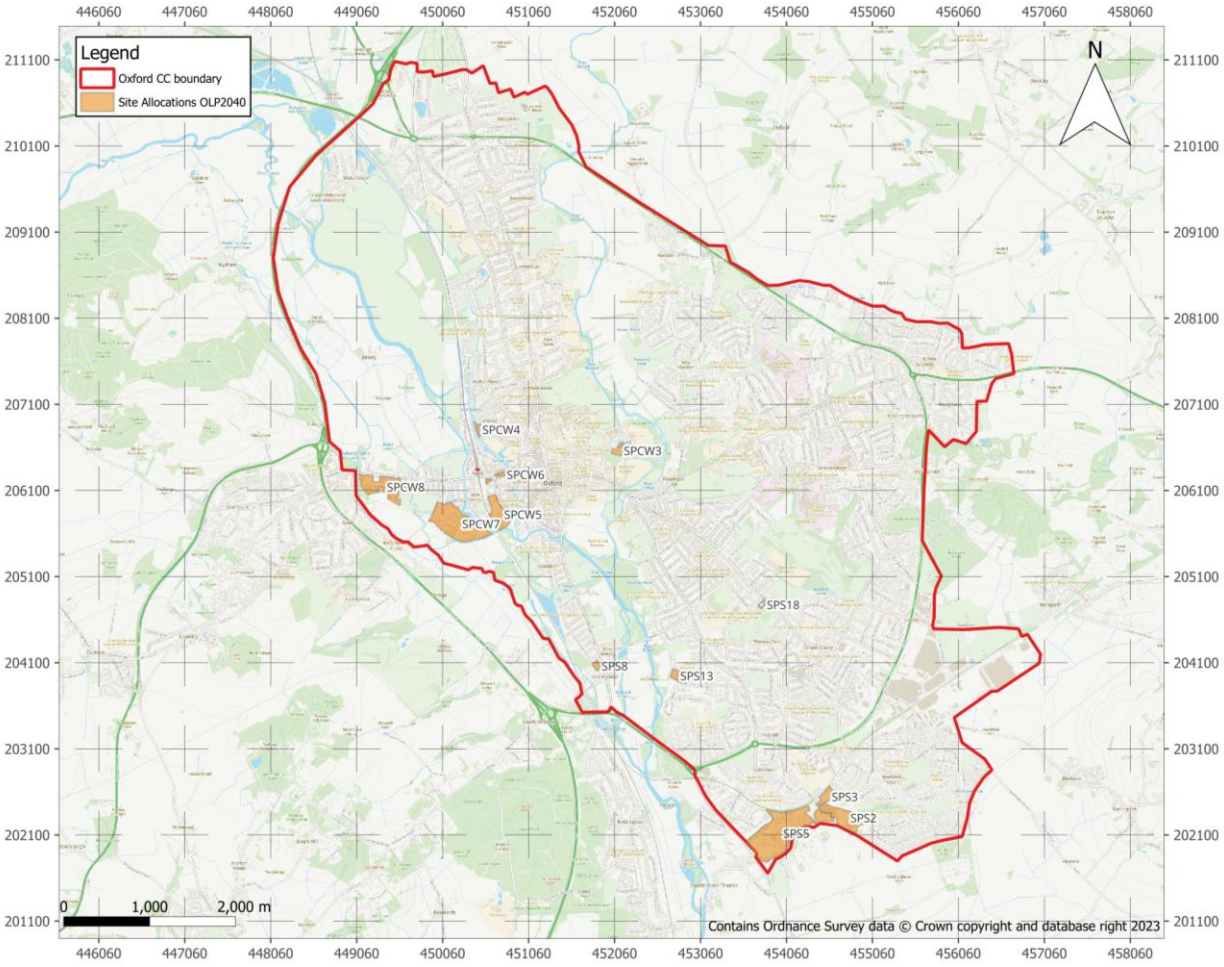

Figure 1- Site Locations Plan

Table 1- Site Names & Proposed Uses

Site Code	Site Name
Residential	
SPS3	Overflow Car Park, Kassam Stadium
SPS8	Bertie Place Recreation Ground
SPS13	Land at Meadow Lane
SPS18	474 Cowley Road (Former Powells Timber Yard)
SPCW3	Manor Place
Employment	
SPS5	Oxford Science Park
SPCW8	Botley Road Retail Park
Mixed	
SPS2	Kassam Stadium and Ozone Leisure Park
SPCW4	Canalside Land, Jericho
SPCW5	Oxpens
SPCW6	Nuffield Sites
SPCW7	Osney Mead

2 Methodology

2.1 Sources of Data

This Level 2 SFRA presents an assessment of the risk of flooding from all sources at each of the sites. To inform this, existing information and model data have been identified and collated for different sources of flooding. The latest model data for the Thames catchment through Oxford have been incorporated into the site-specific assessments, along with details on flood defences, surface water flooding and groundwater conditions.

The main sources of data used to inform this SFRA include;

- Hydraulic modelling data for the River Thames and tributaries (2018[3], 2021[4]) – to assess fluvial flood risk at the following sites: SPS8, SPS13, SPCW3, SPCW4 SPCW5, SPCW6, SPCW7 and SPCW8
- Hydraulic modelling data from the Northfield and Littlemore Brook (2011[5]) – to assess fluvial flood risk at the sites SPS2, SPS3 and SPS5
- Hydraulic modelling data for the Boundary Brook (2010[6]) – to assess fluvial flood risk at site SPS18
- EA Surface Water Flood Maps[7] – to quantify the pluvial flood risk and flood risk from ordinary watercourses where appropriate
- EA Historical Flood Map[8] and Recorded Flood Outlines[9] – to review historical flood events
- Flooding incident data provided by OCC[10] – to provide information on local and historical flooding from surface water flooding across the study area
- EA flood defence structures[11] – to assess existing formal and informal flood defences present
- British Geological Survey (BGS) geoviewer[12] – To determine local bedrock and its expected permeability informing assessment of groundwater flood risk
- Soilscapes map[13] – To determine local soil and its expected permeability informing assessment of groundwater flood risk

2.2 Updates to Hydraulic Models

As part of the level 1 SFRA, the inputs to the hydraulic model for the River Thames and tributaries was updated. This exercise was undertaken to provide results for i) the 3.3% AEP event and ii). a range of updated climate change scenarios.

This update was necessary following a revision of Flood Zone 3b in the latest NPPF. Whereby Flood Zone 3b was redefined as the 3.3% Annual Exceedance Probability (AEP) extent, formally being the

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[3] CH2M (2018) *Oxford Baseline Hydraulic Modelling*
[4] Jacobs (2022) *Oxford Flood Alleviation Scheme Modelling*
[5] EA (2011) *Northfield & Littlemore Brook Hydraulic Model*
[6] EA (2010) *Boundary Brook Hydraulic Model*
[7] EA (2023) *Risk of surface water flooding* https://environment.data.gov.uk/DefraDataDownload/?Mode=rofsw
[8] EA (2023) *Recorded Flood Outlines,* https://www.data.gov.uk/dataset/16e32c53-35a6-4d54-a111-ca09031eaaaf/recorded-flood-outlines
[9] EA (2023) *Historic Flood Map,* https://www.data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map
[10] Oxfordshire County Council (2023) *Flood incidents- Oxford City*
[11] EA(2023) AIMS Spatial Flood Defences (inc. standardised attributes) https://www.data.gov.uk/dataset/cc76738e-fc17-49f9-a216-977c61858dda/aims-spatial-flood-defences-inc-standardised-attributes
[12] BGS (2023) *BGS Geology Viewer*, https://geologyviewer.bgs.ac.uk/
[13] Cranfield Soil and Agrifood Institute (2023) *Soilscapes map*, http://www.landis.org.uk/soilscapes/

5.0% AEP extent. The existing Thames model pre-dated this redefinition and did not have results for the 3.3% AEP event.

In terms of climate change scenarios the existing model used allowances for the Cotswolds management catchment. The majority of Oxford City lies in the Gloucestershire and the Vale management catchment. Therefore, it was necessary to re-run the model considering the allowances relevant to this catchment. The latest central (26%), higher central (41%) and upper end (84%) allowances for the 2080s epoch were applied.

As a result of these updates the hydraulic model was re-run for the following scenarios:

- 3.3% AEP Event
- 3.3% AEP (plus 26% Climate Change) Event
- 3.3% AEP (plus 41% Climate Change) Event
- 3.3% AEP (plus 84% Climate Change) Event
- 1.0% AEP (plus 26% Climate Change) Event
- 1.0% AEP (plus 41% Climate Change) Event
- 1.0% AEP (plus 84% Climate Change) Event

Based on the latest NPPF and PPG, the central allowance is to be applied to more vulnerable infrastructure and less vulnerable infrastructure which covers the development proposed across all of sites. In this regard the 1.0% AEP (plus 26% Climate Change) Event is considered to be the design event.

The majority of sites identified by OCC are located in the updated flood extents from the Thames model. However, the Kassam Stadium and Ozone Leisure Park (SPS2), Overflow Car Park, Kassam (SPS3) and Oxford Science Park (SPS5) are all located in the flood extents for the 2011 Northfield and Littlemore Brook model. Parts of the sites lie within Flood Zone 3 and are at significant risk. In this regard the Northfield and Littlemore Brook hydraulic model was also re-run for the events listed above.

One site, 474 Cowley Road (Former Powells Timber Yard) lies close to the Boundary Brook however it lies a significant distance outside of Flood Zone 3. In this regard an update to the Boundary Brook model was not undertaken at this stage. To assess climate change at this site, the model results for the 1.0% AEP (plus 20% Climate Change) Event and 0.1% AEP Event were used. The 20% allowance is the old blanket allowance applied pre-2016. As the model is 1D only, no depth data was available for these events, therefore flood levels have been inferred based on the highest contour the flood extents reach in the vicinity of the site.

2.3 Assessment of Flood Risk

For the sites, a detailed assessment of the nature of flood hazard was undertaken. This included using the relevant fluvial modelling data to assess:

- The proportion of the site inundated for a range of return periods
- The speed of onset
- Flood Depth
- Flood Velocity
- Overall Flood Hazard (ZUK0) and potential impacts

The sites were assessed against a range of return periods, however the design event, the 100-year (plus 26% climate change) event, was considered most important for planning purposes.

In addition to the analysis of modelling data, the location, standard and condition of existing flood defences was assessed. Other sources of flooding were also reviewed at each site. This included an

assessment of surface water flooding and an assessment of groundwater flooding based on available hydrogeological information. Potential access/egress routes were identified with respect to the risk posed from all sources of flooding.

Following a review of flood risk, flood defences and the identification of access/egress routes, an assessment was made on whether it is likely that a future site-specific FRA would be able to show that the site can be allocated for development. The assessment also takes into account the NPPF's flood risk vulnerability and flood zone compatibility classifications along with any requirements for the Exception Test (see section 2.4).

In this respect guidance is provided for the preparation of FRAs, including information about the use of SuDS, and requirements to consider at the planning application stage including any layout and ground raising considerations.

2.4 Exception Test

The NPPF outlines the use of the Exception Test for determining whether a particular development is suitable within areas vulnerable to flooding. The Exception Test is required if a development is:

- Highly vulnerable and in Flood Zone 2
- Essential infrastructure in Flood Zone 3a or 3b
- More vulnerable in Flood Zone 3a

The Exception Test comprises the following two requirements, which the NPPF states must be passed for development to go ahead:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk.
- It must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.

This Level 2 SFRA provides a high-level assessment of the likelihood of each site passing the second part of the test. A site-specific FRA will need to undertake a more detailed assessment of flood risk and design mitigation measures where required to apply the test and ensure that the development is safe for its lifetime.

3 Flood Risk Review

Flood risk has been assessed for each of the level 2 sites. This has included identifying the risk associated with all relevant sources including fluvial (main rivers), surface water, groundwater, and reservoir.

The assessment of flood risk at each site is collated in Table 2. It should be noted that the risk levels are indicative at this stage, a site-specific FRA should include a detailed assessment of each source of flooding and make use of further data where this is available. Reservoir flooding is not classified due to the rarity of a reservoir flood event.

Following the assessment of flood risk, an assessment was made on how developable each site was and the likelihood of passing the Exception Test. A traffic light system has been used, with the three categories defined as follows:

- Red - Proposed development is not appropriate and is unlikely to pass the Exception Test
- Amber - Proposed development is appropriate but may require significant mitigation and/or analysis to demonstrate compliance with the Exception Test
- Green - Proposed development is appropriate and likely to be justified in a site-specific FRA

The table below summarises this assessment, the individual site assessments in Appendix 1 provide more detail on the flood risk from each source and a more detailed commentary on suitability.

Table 2- Flood Risk Summary

Site Name	Fluvial	Pluvial	Groundwater	Reservoir	Developable
Residential					
SPS3	Low	Low	Moderate	No	Proposed development is appropriate and likely to be justified in a site-specific FRA
SPS8	Moderate	Low	Moderate	**Yes**	Proposed development is appropriate and likely to be justified in a site-specific FRA
SPS13	Low	Low	Low	**Yes**	Proposed development is appropriate and likely to be justified in a site-specific FRA
SPS18	Moderate	Low	Low	No	Proposed development is appropriate and likely to be justified in a site-specific FRA. However, confidence in assessment is low due to the data available.
SPCW3	Low	Low	Moderate	**Yes**	Proposed development is appropriate and likely to be justified in a site-specific FRA
Employment					
SPS5	Moderate	Low	Moderate	No	Proposed development is appropriate and likely to be justified in a site-specific FRA
SPCW8	High	Low	Moderate	**Yes**	Proposed development is appropriate but may require mitigation and/or analysis to show compliance with the Exception Test
Mixed					
SPS2	Low	Low	Moderate	No	Proposed development is appropriate and likely to be justified in a site-specific FRA
SPCW4	Moderate	Low	Moderate	**Yes**	Proposed development is appropriate and likely to be justified in a site-specific FRA
SPCW5	Moderate	Low	Moderate	No	Proposed development is appropriate but may require mitigation and/or analysis to show compliance with the Exception Test
SPCW6	Moderate	Low	Moderate	**Yes**	Proposed development is appropriate but may require mitigation and/or analysis to show compliance with the Exception Test
SPCW7	High	Low	Moderate	**Yes**	Proposed development is appropriate but may require mitigation and/or analysis to show compliance with the Exception Test

As can be seen above five of the sites, 474 Cowley Road (Former Powells Timber Yard) (SPS18), Oxpens (SPCW5), Nuffield Sites (SPCW6), Osney Mead (SPCW7) and Botley Road Retail Park (SPCW8) were classed as amber in terms of how developable they are. For these sites care should be taken in locating different development vulnerability types. Based on the flood vulnerability classification only water compatible infrastructure can be sited in Flood Zone 3b, development is permitted in Flood Zone 3a for less vulnerable infrastructure, however an Exception Test needs to be applied for more vulnerable infrastructure in this zone. For these sites ground raising may be required to raise finished floor levels above the design flood level. If ground raising is required, compensatory storage may need to be considered and mitigation modelling will be required to demonstrate that the development does not increase flood risk elsewhere.

Seven of the sites, Manor Place (SPCW3), Canalside Land, Jericho (SPCW4), Kassam Stadium and Ozone Leisure Park (SPS2), Overflow Car Park, Kassam Stadium (SPS3), Oxford Science Park (SPS5), Bertie Place Recreation Ground (SPS8) and Land at Meadow Lane (SPS13) were classed as green for how developable they are. Development at these sites should be possible as most of their land is flood free in the design flood event and safe access and egress is available. No Exception Test should be required for these sites, provided more vulnerable infrastructure is located outside of Flood Zone 3a.

As all of the sites lie partially within Flood Zone 2 and/or Flood Zone 3 all of the sites trigger the requirement for a site-specific FRA.

4 Summary

4.1 Conclusions and Recommendations

4.1.1 OCC identified a total of 12 sites to be included in the Level 2 SFRA. For these sites a detailed assessment of flood risk needed to be undertaken.

4.1.2 The detailed site assessments showed 8 of the 12 sites to be at risk of fluvial flood risk, and none of the 12 sites to be at risk from pluvial flooding.

4.1.3 Following a review of flood risk from all relevant sources in respect to site access/egress, development type and access/egress, a high-level review of the Exception Test was undertaken.

4.1.4 For 7 of the 12 sites development is considered appropriate and is likely to be justified in a site-specific FRA; an Exception Test should not be required provided development is located outside of the small at-risk areas.

4.1.5 For 5 of the sites development is considered appropriate however mitigation measures may be required and/or analysis to demonstrate compliance with the Exception Test.

4.1.6 For none of the sites is the proposed development completely inappropriate and unlikely to pass the Exception Test unless the development type is changed.

4.1.7 A site-specific FRA will need to be undertaken at each of the sites, these will need to take into account the latest SuDS guidance, and where an Exception Test is required, show that i). the sustainability benefits of the development to the community outweigh flood risk, and ii). show that the development will be safe for its lifetime; detailing mitigation measures where required.

A Living Document

This SFRA has been developed with reference to existing data and knowledge with respect to flood risk within Oxford City. The flood maps informing this SFRA are regularly updated with new information and modelling software. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the City. Subsequently, the predicted flood extents may be altered in some locations. Furthermore, future amendments to the NPPF are anticipated. Given that this is the case, a periodic review should be undertaken of both the Oxford City Level 1 and 2 SFRA.

Appendix 1 – Site Specific Assessments