Flood Risk Assessment
& Drainage Strategy

Begbroke Science Park

Jubb

PREPARED BY:	FOR:	DATE:	REFERENCE:
Jubb Consulting Engineers Ltd.	University of Oxford	May 2018	18143-FRA-01 v3

Contents

1 Project Information

1.1 Project Information

Client	University of Oxford

1.2 Project Details

Project Name	Begbroke Science Park
Location	Begbroke, Oxfordshire
Jubb Project Number	18143

1.3 Report Details

Version	V3
Status	Planning Issue
Date	03-05-2018

1.4 Project Authorisation

ISSUE HISTORY:

AUTHORISATION:

Version	Date	Detail	Prepared By	Approved By
V1	21/03/18	First Draft	MB	LE
V2	03/04/18	Second Draft	MB	DG
V3	03/05/18	Planning Issue	MB	DG

2 Introduction

2.1 Commission

2.1.1 This Flood Risk Assessment and Drainage Strategy has been commissioned on behalf of the Chancellor, Masters and Scholars of the University of Oxford ("the University of Oxford"), the Applicant and owners of the Science Park (UoO) to support a planning application for the proposed development of Begbroke Science Park, Oxfordshire.

2.1.2 This report is for the private and confidential use of UoO (to whom alone is owed a duty of care) and their professional advisors and consultants in connection with the current development proposals for the site.

2.1.3 This report may not be relied upon or reproduced by any third party for any use without the written agreement of Jubb Consulting Engineers Ltd.

2.2 Brief

2.2.1 This flood risk assessment is prepared in accordance with the requirements of the National Planning Policy Framework (NPPF) published by the Department of Communities and Local Government. Section 10 of the NPPF and the associated Planning Practice Guidance sets out the framework for planning decisions made by the local, regional and national government and the Environment Agency (EA). In order for planning authorities to make informed decisions on the development of sites in areas at risk of flooding, NPPF requires the developer to carry out an assessment of flood risk.

This report addresses the requirements set out in Section 10 of the NPPF and other issues, which are deemed relevant to flood risk. These requirements include the following:

- Assessment of the magnitude and severity of flood risk to the site
- Assess suitability of the site and development through the use of the Sequential Test & Exception Test (if required)
- Consider flood risk due to overtopping of existing flood defences
- Assess the impact of the proposed development on flood risk to adjacent developments
- Determine the ability of existing and proposed drainage to accommodate development flows with respect to surface flooding
- Demonstrate the appropriate mitigation measure have been taken to prevent flooding
- Demonstrate the appropriate emergency situations have been considered e.g. overland flow paths and evacuation routes

2.2.2 This report also considers the disposal of wastewater generated by the proposed development. Existing infrastructure will be reviewed to identify potential options for the disposal of foul and surface water run-off. A strategy will be presented for the preferred option.

3 Existing Site

3.1 Location

3.1.1 The proposed site is located at Begbroke Science Park which is an established and renowned hub of high tech research facilities, which is owned by the University of Oxford. The site is located to the east of Woodstock Road (A44), between the settlements of Begbroke, Yarnton and Kidlington. The proposed site is approximately 5.54 Ha in area, with a National Grid Reference (NGR) of 447848E, 213530N.

3.1.2 The site boundaries are formed predominantly by densely vegetated hedgerows, with the site surrounded by agricultural land.

3.1.3 Within the site the proposed additional floor space will be located within the north east and north west corners of the site, in which these areas are currently predominantly tarmacked. The north east corner of the site in which development will occur is 0.47ha, while the north west corner is 0.52ha. Within the Framework Plan these areas are respectively referred to as Zones B and C.

3.1.4 The site can be accessed by vehicle via Woodstock Road (A44) and by pedestrians/cyclists via Sandy Lane to the west and south respectively.

A location plan is included in Appendix A.

3.2 Current Land Use

3.2.1 The proposed site is currently predominantly occupied by several large buildings, which are used for high tech and scientific research facilities.

3.2.2 The Begbroke Science Park site has been subject to a previous planning permission to expand the floorspace within it, which expired on the 1st of May 2017. The application was for 21,236m^2 of additional floorspace, with circa 9,900m^2 of this area not being implemented within the expected time frame. Consequently the site is now being subject to a new planning permission for up to 12,500m^2 of floorspace to meet current demand.

3.3 Site Topography

3.3.1 There is currently no detailed topographical survey for the proposed development sites within Zones B and C.

3.3.2 A detailed topographical survey has been undertaken on part of the existing Begbroke Science Park for the previous development of the Centre for Innovation & Enterprise. This survey gives an indication of the topography of the existing site and the proposed development areas.

3.3.3 The existing survey indicates that the Begbroke Science Park is relatively flat in nature with ground levels of approximately 68.50mAOD, due to the developed nature of the site.

3.3.4 The proposed developable areas are predominantly tarmacked and are therefore expected to have a very similar topography and levels to the rest of the site.

A copy of the topographical survey extract is included in Appendix B.

3.4 Site Geology

Geology

3.4.1 The geology beneath the site has been established as comprising of two geological units of the Jurassic age, including Oxford Clay Formation and West Walton Formation.

3.4.2 Superficial deposits have been indicated beneath the site and are shown to comprise of Summertown-Radley Sand and Gravel Member.

Hydrogeology

3.4.3 The solid geology beneath the site is identified as being a Secondary (undifferentiated) aquifer.

3.4.4 Secondary undifferentiated aquifers are described as assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

3.4.5 The Environment Agency Source Protection Zone map indicates that the subject site is not located within a groundwater source protection zone.

Hydrology

3.4.6 There are no watercourses located within the proposed site.

3.4.7 The nearest watercourse to the site is Rowel Brook, located approximately 250m to the north of the site at the closest point. This watercourse runs to the east before joining up with the Oxford Canal approximately 500m downstream to the east.

3.5 Existing Drainage

3.5.1 The existing local public foul and surface water sewer network currently serving the Begbroke and wider Oxfordshire area is owned and maintained by Thames Water.

3.5.2 The existing Begbroke Science Park is served by a private network of foul, chemical drainage and surface water sewers.

3.5.3 The existing foul sewer system which currently serves the existing Science Park buildings appears to convey flows to a private pumping station located in the north-west of the site, within the north-eastern region of Zone C of the proposed site. This pumping station discharges flows to the existing Thames Water Sewer network.

3.5.4 Chemical drainage is conveyed within a separate network before discharging into the private foul network and pumping station, before discharging into the existing public sewer network under an agreement with Thames Water.

3.5.5 Areas of the existing site, including the recently developed Centre for Innovation and Enterprise, drain surface water to onsite soakaways that disperse the water via infiltration into the ground within the site.

4 Flood Risk to the Existing Site

This section explores the primary sources of flooding to the site.

4.1 Tidal & Fluvial Flooding

4.1.1 The proposed site is identified as lying outside of the fluvial and tidal flood risk zone according to the Environment Agency's published floodplain map (refer to Figure 1). This estimate of the extent of flooding is based on the absence or failure of all existing flood defences currently protecting the site.

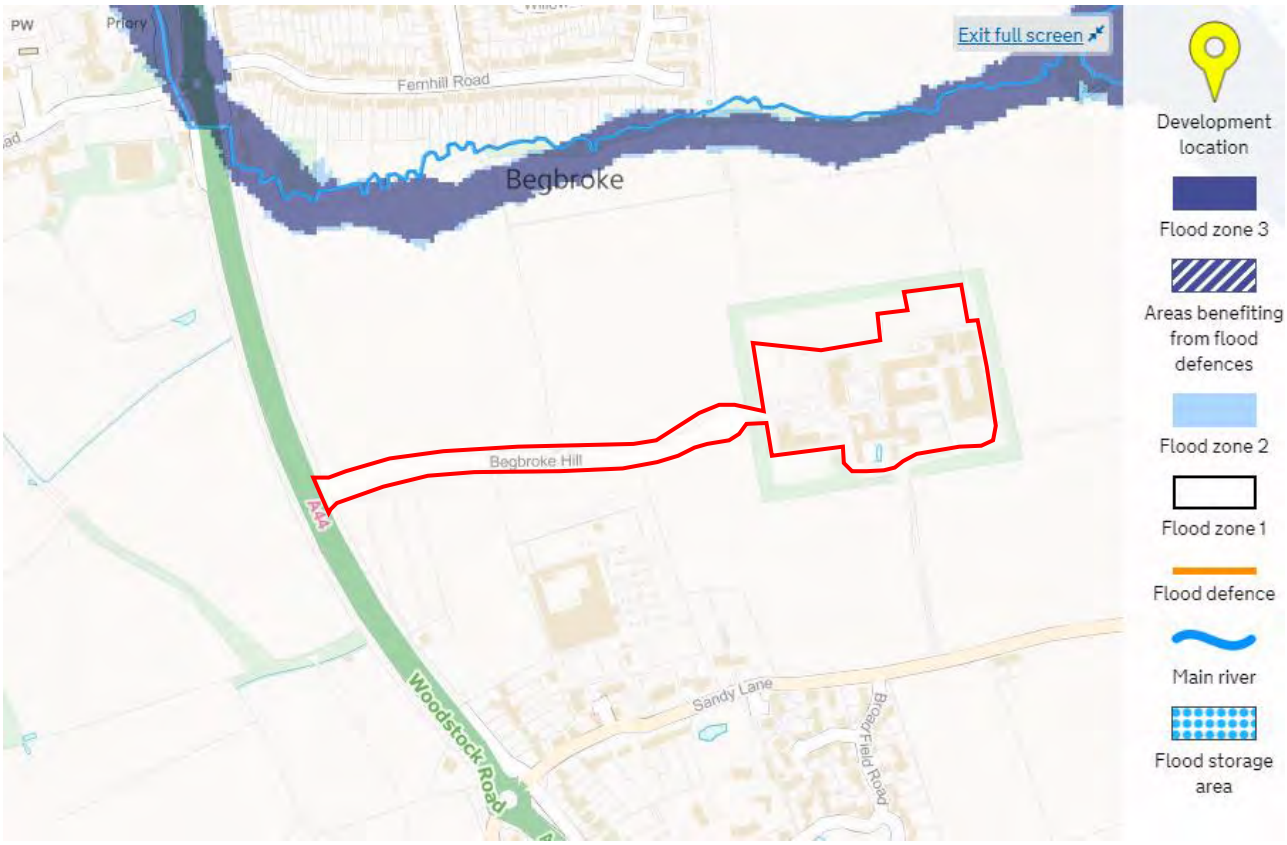

Figure 1 – Extract from Environment Agency Flood Map for Planning

4.1.2 The EA floodplain map indicates that the level of flood risk to the site corresponds to a Flood Zone 1 – Low Probability in Table 1 of the NPPF Planning Practice Guidance.

4.1.3 This zone has less than a 1 in 1000-year annual probability of flooding.

4.1.4 The NPPF Planning Practice Guidance states that all types of development are suitable for this flood zone.

4.2 Overland / Surface Water Flooding

4.2.1 As shown on the EA risk of flooding from surface water map (refer to Figure 2), the proposed site is identified as an area at very low risk of overland and surface water flooding.

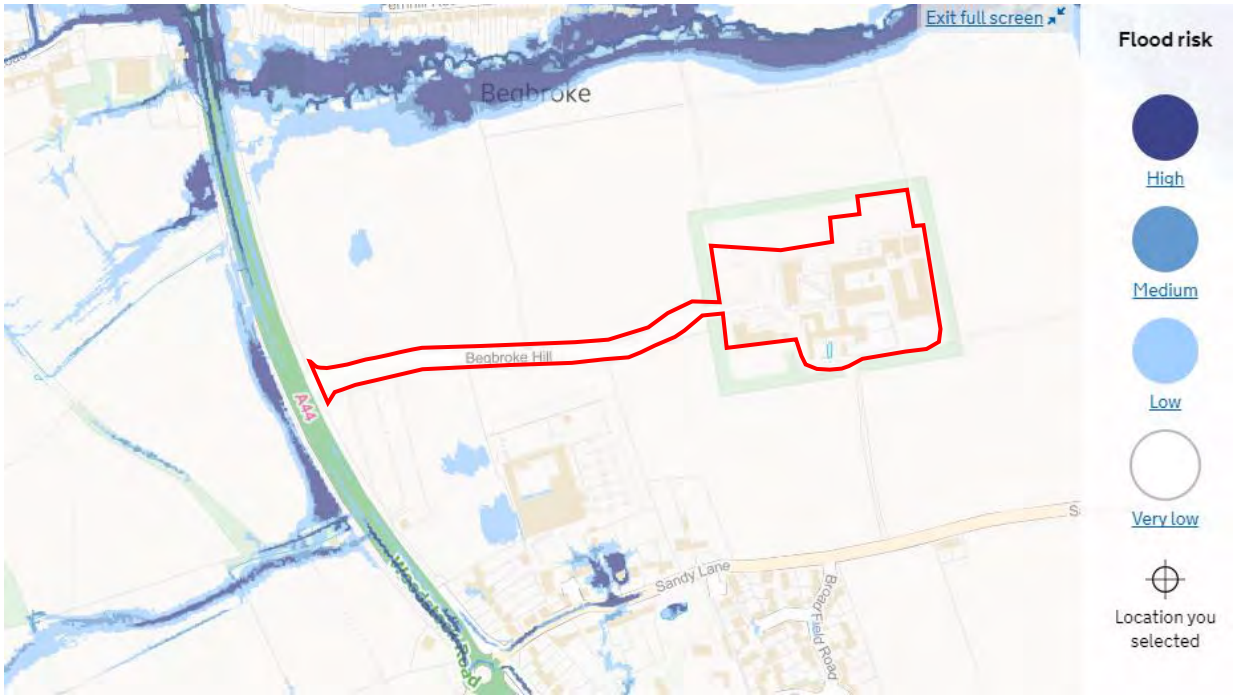

Figure 2 – Extract from Environment Agency Flood Risk from Surface Water Map

4.2.2 The proposed site is protected from overland flows from the surrounding area due to the existing topography and permeable nature of the surrounding agricultural land.

4.2.3 The land to the north, east and south of the proposed site falls away from the site, with the A44 and existing drainage network to the west preventing flows from the surrounding area impacting upon the proposed site.

4.2.4 There are no records of previous overland or surface water flooding events affecting the proposed site. Based on this and the factors described above, the proposed site is not considered to be at risk from overland or surface water flooding.

4.3 Flooding from Sewers

4.3.1 The proposed site is currently positively drained with private foul, chemical drainage and surface water networks currently serving the site.

4.3.2 Existing survey information appears to show all foul flows being conveyed into the Thames Water network via a privately owned pumping station, whilst surface water discharges into soakaways within the site.

4.3.3 There are no records of historical flooding caused by the local sewer infrastructure, within the site or in the surrounding area, impacting upon the site.

4.3.4 Consequently, it is not considered that flooding from sewers poses a significant risk of flooding to the proposed development.

4.4 Flooding from Groundwater

4.4.1 The underlying geology beneath the proposed site has been identified as mudstone of the Oxford Clay formation and West Walton formation, which is rated as having secondary (undifferentiated) aquifer properties.

4.4.2 It is difficult to undertake a quantified assessment of the risk of groundwater flooding on the proposed site. This is due to a lack of groundwater levels records, the variability in geological conditions and the lack of predictive tools that can be used to make assessments of groundwater flow and risk of groundwater flooding following rainfall events.

4.4.3 No detailed on-site geotechnical investigation works has been undertaken on the proposed site. It is therefore difficult to estimate the potential impact of groundwater levels on the proposed site.

4.4.4 However, there are no historic records of groundwater flooding events on the site and therefore it is considered that flooding from groundwater does not pose a significant risk to the site.

4.5 Flooding from Artificial Sources

4.5.1 There are no artificial bodies of water located within or near the proposed site. As a result, it is not considered that flooding from artificial sources poses a risk of flooding to the site.

5 Proposed Development

5.1 Development Description

5.1.1 The development will consist of up to 12,500m^2 of additional floor space within the existing Begbroke Science Park site, which will be used for B1a/B1b/B1c and D1 uses. The additional floorspace will be provided within two development zones, Zone B & C, as shown on the development framework plan. Zones B & C incorporate 9,900m^2 of developable land.

A Framework Plan is included in Appendix C.

5.1.2 The development will consist of no more than 20% of the space being used for office purposes (B1a) with the remaining space being used for research and development and light industrial and ancillary (B1b/B1c/D1).

5.1.3 Access to the site will be provided via the existing access road that connects the site to Woodstock Road.

5.2 Development Suitability

5.2.1 The NPPF aims to direct developments to suitable areas with low probability of flooding. The table below illustrates the acceptable classification of development within each flood zone.

Flood Risk Vulnerability Classification	**Essential Infrastructure**	**Water Compatible**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**
Flood Zone 1 **(<1 in 1000)**	✓	✓	✓	✓	✓
Flood Zone 2 **(up to 1 in 1000)**	✓	✓	Exception Test	✓	✓
Flood Zone 3a **(1 in 100 fluvial)** **(1 in 200 tidal)**	Exception Test	✓	X	Exception Test	✓
Flood Zone 3b **(functional floodplain)**	Exception Test	✓	X	X	X

5.2.2 The proposed development type is considered to be classified as a 'less vulnerable' development under Table 2 of the NPPF.

5.2.3 As the site is in Flood Zone 1, all vulnerability classes are suitable and thus the proposed scheme is deemed acceptable.

5.2.4 The site will not require to be subjected to a sequential test by the Local Planning Authority (LPA) in respect of its allocation and appropriateness for the proposed development of this location, as the proposals are within flood zone 1.

6 Development Drainage

6.1 Foul/ Chemical Drainage

6.1.1 The existing Begbroke Science Park site is currently served by a private network of foul and chemical drainage sewers that collect and convey flows to a private pumping station which discharges into the public Thames Water sewer network.

6.1.2 A new foul and chemical drainage network will be required to service the new development. It is proposed to connect the new drainage into the existing foul and chemical networks.

6.1.3 The proposed development will result in an increase of foul flows discharged to the public sewerage system.

6.1.4 Based on the development proposals of an additional 12,500m^2 of floorspace for B1a/B1b/B1c and D1 usage, an anticipated peak flow rate of 0.87 l/s will be generated by the new development.

6.1.5 Confirmation of the additional foul flows discharged from the development will be required at a detailed design stage. Discussions with Thames Water will be required to confirm sufficient capacity is available within the existing public network to accommodate the additional flows from the development.

6.1.6 Due to the size and proposed usage of the proposed development, only a small increase is flows is anticipated as a result of the Science Park development. Consequently, it is anticipated that sufficient capacity will be available within the public network to accommodate the development.

6.1.7 It is understood that the existing onsite pumping station has been designed with additional capacity to accommodate future developments. Further investigation and assessment of the existing network and pumping station is required prior to connection of the proposed development. Depending on the discussions with Thames Water the pumps can be uprated to accommodate the relatively small increase in flows or the storage within the pumping station can be altered to maintain peak flow and adjust pump starts and timings.

6.1.8 The new foul sewerage network will be designed to accommodate the anticipated peak development flows without flooding.

6.2 Surface Water Drainage

6.2.1 Current legislation and guidance requires developers to manage surface run-off from new development to mitigate flood risk to the site and the surrounding area, and also to provide a sustainable means of disposing of run-off from impermeable areas.

6.2.2 Off-site surface water discharge from the site must be managed to ensure that it does not exceed the predevelopment flow rate. Sustainable drainage systems should be utilised to attenuate flows and ensure that run-off from the new hardstanding areas receives the appropriate level of treatment to improve water quality.

6.2.3 Parts of the existing Begbroke Science Park currently use infiltration methods to discharge surface water flows from the site. This suggests that the site has favourable ground conditions for the use of infiltration sustainable drainage techniques. However, it is recommended that additional infiltration testing is carried out on site in accordance with BRE365 to confirm the viability of SUDS infiltration techniques.

6.2.4 A range of sustainable infiltration drainage options have been considered for the discharge of flows from the new development. This includes infiltration basins, cellular soakaways, permeable paving and an infiltration trenches.

6.2.5 It has been assumed that the proposed development will have an impermeable area of 85% of the total proposed site, due to the proposed building uses of the development.

6.2.6 Due to the existing ground conditions, discharge from the site via infiltration has been assessed using an assumed infiltration rate of 1×10^{-5} m/s.

6.2.7 Assuming this rate of infiltration, an assessment of the 100-year event plus 40% climate change scenario requires a cellular soakaway with a volume of $475m^3$ for Zone C and $418m^3$ for Zone B.

6.2.8 A variety of infiltration options could be utilised across the development. Following the results of onsite ground investigation and confirmed site layout plans, a detailed sustainable drainage strategy will be designed for the proposed development.

7 Sustainable Drainage Systems & Water Quality

7.1.1 The surface water management should incorporate sustainable drainage techniques to restrict surface water discharge from the site and improve water quality of the run-off. There are a wide range of techniques that can be applied including source control, online systems and outlet controls. Ciria have published a SuDS manual, which details a number of systems along with guidance on their application and design.

7.1.2 SuDS systems typically rely on either infiltration or attenuation to reduce peak flows and volume discharge and filtration systems to remove pollutants or solids from the effluent.

7.1.3 The existing site subgrade suggests ground conditions are likely to provide a suitable rate of infiltration.

7.1.4 Following the results of onsite ground investigation works, additional sustainable drainage techniques such as permeable paving will be considered, which will provide pollutant removal and flow restriction benefits.

8 Development Flood Risk & Mitigation

8.1 Tidal & Fluvial Flooding

8.1.1 The proposed site is not at risk of tidal or fluvial flooding and lies within flood zone 1 on the EA flood maps. The development proposals do not increase the flood risk to the site or the surrounding area from tidal or fluvial sources.

8.1.2 The proposed use of the site is considered as 'less vulnerable' under the NPPF. This type of development is acceptable for a low flood risk site.

8.2 Overland / Surface Water Flooding

8.2.1 As discussed in section 4.2 the proposed site is not at risk of flooding from overland flows. A proposed drainage strategy will be designed to accommodate all surface water flows from the new hardstanding areas of the development. This network will be designed to accommodate flows for a range of storm events without flooding.

8.2.2 Consequently, the proposed development will not have a significant impact on flood risk to the site or the surrounding area.

8.3 Flooding from Sewers

8.3.1 There is no current flood risk to the site from existing sewers. A new surface water drainage network will be constructed to service the proposed development. However, the new sewer network will not pose a risk of flooding to the site or the surrounding area, as the network will be designed to prevent surface flooding in the 1 in 100-year storm event with an allowance for climate change.

8.3.2 A new foul drainage network will also be constructed to service the site. This network will be designed to accommodate the anticipated peak flows with no flooding.

8.4 Groundwater Flooding

8.4.1 There are no historic records of groundwater flooding on the site or in the surrounding area, which suggests that groundwater re-emergence has not caused significant flooding issues in the past.

8.4.2 It is proposed to discharge surface water flows via infiltration solutions. The proposals are not expected to affect the groundwater table and consequently will not increase the risk of flooding from groundwater sources.

8.5 Flooding from Artificial Sources

8.5.1 As discussed in section 4.5 there is no flood risk to the site from artificial sources. The development proposals do not impact the risk posed to the site or the surrounding area.

9 Conclusions & Recommendations

It is considered that this assessment represents a comprehensive and robust analysis of the flood impact of the development upon other adjacent properties and of existing flood mechanisms on the development itself. It demonstrates that the proposed development is sustainable in terms of flood risk and can be summarised as follows;

Subject	Conclusions
Tidal and Fluvial Flood Risk	The development is located in Flood Zone 1 – low probability for tidal and fluvial flooding on the Environment Agency flood maps.
Flood Risk from Other Sources	No flood risk to the site from overland flows, groundwater, sewers or artificial water bodies was identified.
Development Suitability	The development use is considered suitable for the site, which lies within Flood Zone 1 – low probability under Table 3 of the NPPF Planning Practice Guidance.
Existing Drainage	The existing site is positively drained with onsite foul and chemical drainage being conveyed into the Thames Water network via the private pumping station. It appears that surface water flows are discharged via infiltration, with a number of soakaways located across the site.
Proposed Drainage	New surface and foul water sewer networks will be constructed to service the proposed development. Surface water flows will be discharged via a sustainable drainage solution. The preferred method is to discharge flows via infiltration methods. Foul and chemical drainage flows will be discharged to the existing public and chemical drainage sewer network.
Surface Water Management	Existing ground conditions and the current use of soakaways on the site suggest discharge of flows via infiltration methods will be a suitable option for the development. A variety of sustainable infiltration drainage options could be utilised within the development including soakaway, infiltration basins and permeable paving.
Foul Water Disposal	The development will increase foul loadings from the site, with an anticipated additional peak discharge rate of 0.87 l/s. Discussions with Thames Water will be required to confirm sufficient capacity is available within the existing public sewer to accommodate the additional flows, however the existing pumping station can be altered to maintain existing peak flow if required.

Based on the findings of this report, it is considered that there are no grounds for objecting to the proposed development in terms of flood risk.

Appendix A: Location Plan

Site Area (5.54ha)

Other Land Under the Control of the Applicant

Begbroke

Begbroke Science Park

Begbroke Hill

Yarnton

Rev	Description	Date

Client:

University of Oxford

Begbroke Science Park

Location Plan

Scale@A1 :	Drawn:	Designed:	Approved:
1:5,000	**ADW**	**DC**	**---**

0m — 200m

Drawing Number:	Revision:	Date:
UNO001/001	**---**	**02.03.18**

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David Lock Associates
Town Planning and Urban Design

Appendix B: Topographical Survey Extract

OS NORTH

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
GU	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

Survey Station Information

STN No.	Easting	Northing	Level	Type
STN1	447898.60	213505.98	68.48	Nail
STN2	447883.81	213579.34	69.01	Nail
STN3	447813.31	213577.65	69.01	Nail
STN4	447818.29	213500.74	68.43	Nail

Notes

The Grid is Related to OS using GPS

All Levels are related to OS using GPS

Rev	QA Check	Description	Date
5	-	-	-
4	-	-	-
3	-	-	-
2	-	-	-
1	-	-	-
0	BF	First Complete Issue	05/03/2015
Prelim	-	Preliminary - Not Complete	-

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SURVEYED	FA	Ridge & Partners LLP
DRAWN	FA	
SCALE	1: 200	

University of Oxford
Begbroke Science Park

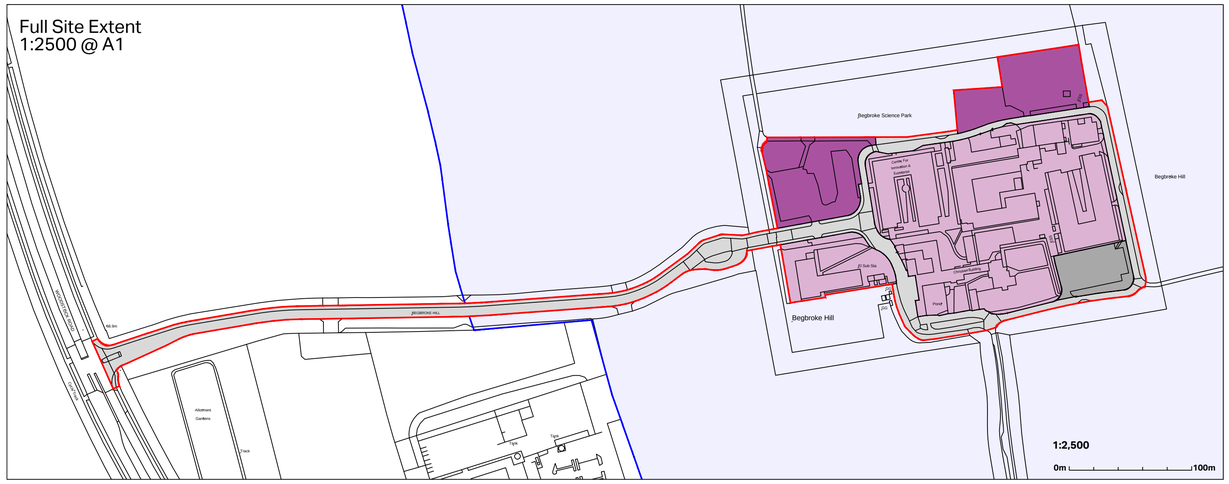
TOPOGRAPHICAL SURVEY WITH OS BACKDROP

JOB No	DRAWING NUMBER
S715/0552	S715/0552/P/0002

A0 Sheet - 1,189mm X 841mm

Appendix C: Framework Plan

Full Site Extent
1:2500 @ A1



Site Area (5.54ha)

Other Land Under the Control of the Applicant

Existing Built Development

Proposed Employment Area

Existing Infrastructure

Proposed Parking

NOTE:
All building heights up to 12.6m above existing ground level (excluding point features and plant)

Park

B

Zone B
0.47ha

ESS

Zone C
0.52ha

Centre For Innovation & Enterprise

Zone A
2.47ha

ESS

Zone A
0.38ha

El Sub Sta

Christian Building

Zone D
0.22ha

GG

GG

Pond

Begbroke Hill

Rev	Description	Date

Client:
University of Oxford

Land at Begbroke

Framework Plan

Scale@A1 :	Drawn:	Designed:	Approved:
1:500	**ADW**	**DC**	**---**

0m 20m

Drawing Number:	Revision:	Date:
TRI001/015	**A**	**27.02.18**

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