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Flood Risk Assessment
for
The Barn, Duck End, Graveley

for:

Mr & Mrs Wheeler

Date	Issued	Revision
25 May 2023	Issued for Comments	A

Reference: 63834 - 01

Prepared by:

[redacted]

Student Engineer

Approved by:

[redacted]

Senior Civil Engineer

CONTENTS Page

APPENDICES

1. EXECUTIVE SUMMARY

1.1 This flood risk assessment has been prepared on the instruction of Mr and Mrs Wheeler to address the flooding risk for the proposed development at Duck End, Offord Road, Graveley. At the time of writing this report, the site was occupied by a garage and outbuilding.

1.2 The site lies in fluvial flood zone 1. As such, the proposed development is not at risk of flooding from any nearby watercourse during a 1:1000-year flooding event. The risk from all flooding is considered negligible or very low.

1.3 Site levels to the South and West are higher than the proposed development. Levels to the North are unknown, however. During periods of heavy rainfall, it is likely that surface water runoff will flow towards from the site from the Southwest, hence there is a medium to low risk of overland flooding. However, the existing culverted watercourse located on the Southwest of site is to be reinstated as an open channel, to collect these overland flows, mitigating flood risk from overland flows.

1.4 The proposed redevelopment is classified as a more vulnerable development by the Flood Risk Vulnerability Classification (table 2) in the National Planning Policy Framework (NPPF). Therefore, in line with the flood risk vulnerability and flood zone compatibility table (table 3) in the NPPF, the development is appropriate in flood zone 1, with no requirement for a sequential or exception test.

1.5 The proposed development should utilise a sustainable drainage (SuDS) design in accordance with the NPPF. The hierarchy of SuDS designs to be considered:

- Discharge rainwater into a soakaway
- Attenuate rainwater by storing in tanks and releasing gradually over time
- Discharge rainwater directly into nearby watercourses
- Discharge rainwater into surface water sewers
- Discharge rainwater into combined sewers

2. INTRODUCTION

2.1 This flood risk assessment has been prepared on the instruction of Mr and Mrs Wheeler to address the flooding risk for the proposed development at Duck End, Offord Road, Graveley.

2.2 The purpose of the report is to establish the level of risk that exists for a flooding event to affect the site. Any increased flood risks to the surrounding area following the construction of the proposed development will be identified. The report will also outline measures that can reasonably be put in place to reduce the effects, should flooding occur, to acceptable levels based on the identified risk.

2.3 This assessment generally follows the principles as laid down in the NPPF and PPS25. Although PPS25 has been superseded by the NPPF, it still contains measures that are recognised as needing to be followed.

2.4 The general conditions contained in appendix V are applied to this report and it should be read and construed accordingly.

2.5 Appendices to the report are as follows:

Appendix I	Location Plan
Appendix II	Topographical Survey
Appendix III	Site Layout
Appendix IV	Environment Agency Flood Maps
Appendix V	General Conditions

3. SITE DESCRIPTION AND LOCATION

3.1 The site is located to along Offord Road, north of the Cambridgeshire village of Graveley. Grid reference easting: 524565, northing: 264314 denotes the approximate centre of the site. At the time of writing the flood risk assessment the site is currently occupied by a garage and outbuilding.

3.2 A location plan is included in appendix I.

3.3 The site is elongated in shape, and occupies an area of approximately 0.12ha. The surrounding area is made up of predominantly agricultural land / open fields and dense trees. The site falls approximately 1m from the Southwest to the Northeast. To the Southwest, levels were approximately 44m AOD whereas to the north, levels were approximately of 43m AOD.

3.4 Summary details of the site boundaries and adjacent land use are:

Boundary	Construction	Adjacent Land Use	Proximal Land Use
North	Fence	Open field	Agricultural
East	Fence	Offord Road	Residential
South	Fence	Woodland area	Agricultural
West	Fence	Open field	Agricultural

3.5 A topographical survey is included in appendix II.

4. DEVELOPMENT

4.1 It is proposed to convert an existing barn structure into a two-storey dwelling in the Northeast region of the site, with an associated driveway / parking area. A proposed site plan is included within appendix III.

4.2 As the purpose of the development is for residential use, the development will be classified as a ‘more vulnerable’ development by the Flood Risk Vulnerability Classification (Table 2) in the NPPF.

4.3 The proposed site layout is shown in appendix III.

5. SEQUENTIAL AND EXCEPTION TESTS

5.1 The whole of the site lies in a flood zone 1 area as shown on the appended Environment Agency (EA) flood maps (appendix IV). The site is also located in an area categorised as at medium to low risk of pluvial flooding, which will be mitigated through the drainage design. Additionally, the site is unlikely to experience flooding from reservoirs. The risk to the site from all aspects of flooding is considered medium or low. In view of the above, the application of the sequential test is not required.

5.2 The exception test is not required as the development lies in an area designated as flood zone 1.

6. ANALYSIS OF RISK

6.1 Introduction

6.1.1 The source pathway receptor model will be used to analyse the likely risk of flooding affecting the site and the development.

6.1.2 The sources will be investigated and their risk of affecting the development assessed. Those that have a low or negligible risk of affecting the site will not need to be considered further.

6.1.3 Sources with a medium or high risk of affecting the site will be considered further in terms of their pathway to the site. Where possible the pathway risk to the receptors will be reduced from medium or high risk to low or negligible risk.

6.1.4 The residual medium or high risks to the receptors will be managed to ensure that the users of the development and their possessions and property are not at a greater than a low risk of being affected.

6.2 Sources of Flooding

6.2.1 Possible sources of flooding in mainland England are generally taken to be:

- Fluvial (rivers)
- Tidal (sea or estuary)
- Groundwater
- Sewers
- Infrastructure failure
- Pluvial (surface water flooding)
- Overland flooding

6.2.2 Fluvial Flooding

Fluvial flooding from the on-site watercourse needs to be considered. The culvert which runs through site is located approximately 18m (at its closest point) to the South of the proposed barn, and flows from West to East. Additionally, another culverted watercourse exists East of the site and along Offord Road. It is located approximately 24m to the East of the barn. With reference to the appended EA fluvial flood map (appendix IV), the site is located within flood zone 1. In view of this, even allowing for climate change, the risk of fluvial flooding affecting the site is very low.

6.2.3 Tidal Flooding

The site is approximately 68 kilometres from the sea, with the site level being approximately 43-44m above sea level. The risk of tidal flooding affecting the site is therefore negligible.

6.2.4 Groundwater Flooding

The EA map has no results for groundwater flooding; therefore, this cannot be assessed and is taken as being low risk.

6.2.5 Surface Water Runoff (Pluvial Flooding)

With reference to the EA surface water flood maps (appendix IV), the risk of surface water flooding affecting the site is medium to low. This risk can be attributed to the on-site levels and the proximity to watercourses. These risks will be mitigated through adequate drainage design, such as the use of collector pipes to redirect surface water to the adjacent watercourses and away from the barn. The overall risk of surface water runoff flooding is assessed as low, given the plans in place to mitigate this risk.

6.2.6 Overland Flooding

Ground levels to the Southwest of the site are approximately 1m above the site; any overland flows generated Southwest will travel towards the existing watercourse. The watercourse is currently a culvert, but will be reinstated to an open channel. This will allow all overland flows from this region to fall into the watercourse and be transported away from site. The levels to the north of the site are unknown, however are to be assumed similar to those of the site. Given the points raised above the risk of overland flooding has been assessed as low, given the plans in place to mitigate this risk.

6.2.7 Infrastructure

Burst water mains are unlikely to affect the site as the water will be channelled away from the site via Offord Road. Given the topography of the site and the surrounding area, it is likely that land to the north of the site will flood before the site is affected. With reference to the map for reservoir flooding (appendix IV), the site is located outside the maximum extent of flooding from reservoirs. Therefore, the risk from reservoir flooding is negligible.

6.3 Pathways

After analysing the above flooding sources, pluvial and overland flooding have been identified as being the most probable cause of flooding. These sources are currently seen as medium to low risk however, after the implementation of an adequate drainage strategy, these sources can be considered low or very low risk. The possible pathways for flooding affecting the site need not be considered further.

6.4 Receptors

The receptors will include users of the site and the property on the opposite side of Offord Road. Given that it has been demonstrated that the risk of flooding from all sources is low (apart from overland flows which will be mitigated) it is unlikely that the redevelopment will affect the risk of flooding to any of these receptors, as the site is already developed and no additional external developments are taking place.

6.5 Outcome of Risk Analysis

Source	Risk	Population at Risk	Mitigation Measures	Residual Risk
Fluvial	Very low	Site users	None required	Very low
Tidal	Negligible	N/A	None required	Negligible
Groundwater	Low	Site users	Levels design to direct water away from buildings to provide a safe dry egress route.	Very low
Surface water runoff (pluvial flooding)	Medium to Low	Site users	Design of Drainage System to accommodate the 100Yr with Climate Change allowance storm event.	Low
Infrastructure	Very low	Site users	None required	Very low
Overland flooding	Medium to Low	Site users	Reinstatement of culverted watercourse to an open channel	Low

7. SURFACE WATER DRAINAGE SYSTEM

7.1 The proposed development should utilise a SuDS design in accordance with the NPPF. The hierarchy of SuDS designs to be considered is as follows:

- Discharge rainwater into a soakaway
- Attenuate rainwater by storing in tanks and releasing gradually over time
- Discharge rainwater directly into nearby watercourses
- Discharge rainwater into surface water sewers
- Discharge rainwater into combined sewers

7.2 Flood exceedance would flow towards the north east running in a south west to north east direction to the north east of the site. The flood exceedance would flow east, into the surface water drainage systems installed across the development designed to be in areas of driveway and parking. Therefore, flood exceedance will have no adverse effect on neighbouring properties.

8. GEOLOGY

8.1 Within the accuracy of the available geological information (British Geological Survey Geology of Britain at a scale of 1:50,000) the solid geology beneath the site is indicated to be the Oxford Clay Formation, a silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules.

8.2 The fine nature of the underlying stratum may render infiltration on the site to be unviable. At time of writing this report a full site investigation and onsite infiltration testing have not taken place. These should be completed and infiltration confirmed prior to commencement of construction works on site.

9. CONCLUSIONS

9.1 The site is situated in EA flood zone 1. The site is therefore not likely to be subjected to fluvial or tidal flooding in a 1:1000 year plus climate change flood event. The risk of flooding from tidal, fluvial and infrastructure sources have been determined to be very low / negligible. Groundwater , pluvial and overland flooding has been determined as a low risk, considering the drainage strategy.

9.2 A sequential and exception test are not required as the site is located in flood zone 1.

9.3 To reduce the risk from overland flooding it is recommended that a combination of careful consideration of levels in the detailed design coupled with providing appropriate land drainage facilities is fully explored. Additionally, the culverted watercourse to the West of the site will be reinstated to an open channel. This will allow all overland flows from this region to fall into the watercourse and be transported away from site.

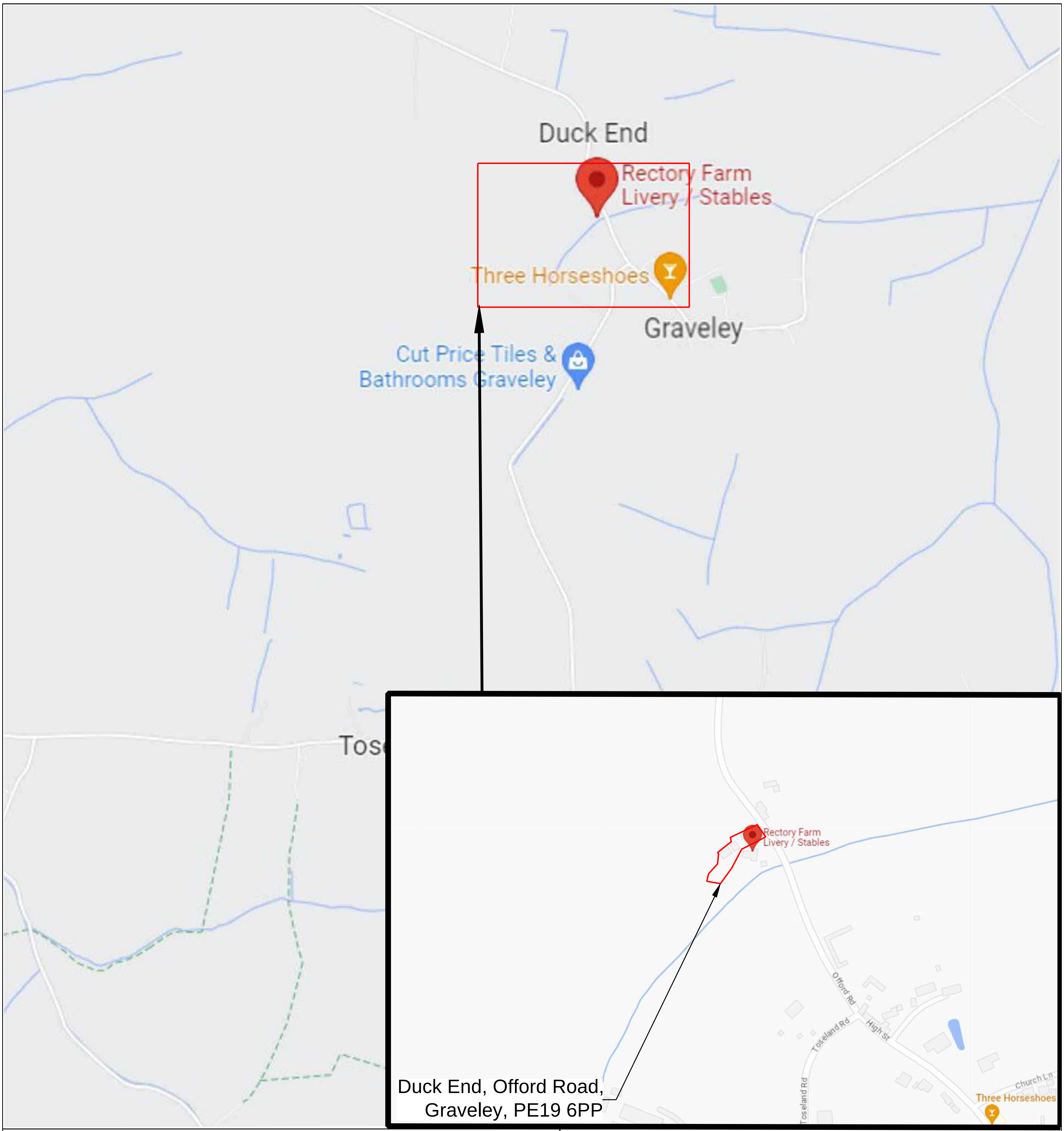
9.4 The proposed development should utilise a SuDS design in accordance with the NPPF. Some examples of SuDS designs are below.

- Attenuates rainwater by storing in tanks and releasing gradually over time
- Discharge rainwater directly into a nearby watercourse
- Discharge rainwater into surface water sewers
- Discharge rainwater into combined sewers

9.5 Provided the above are fully taken into account in the detailed design, the development should be allowed to proceed.

APPENDIX I

LOCATION PLAN



Project:

The Barn, Duck End, Offord Road, Graveley, PE19 6PP

Title:

Site Location Plan

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consulting engineers & surveyors

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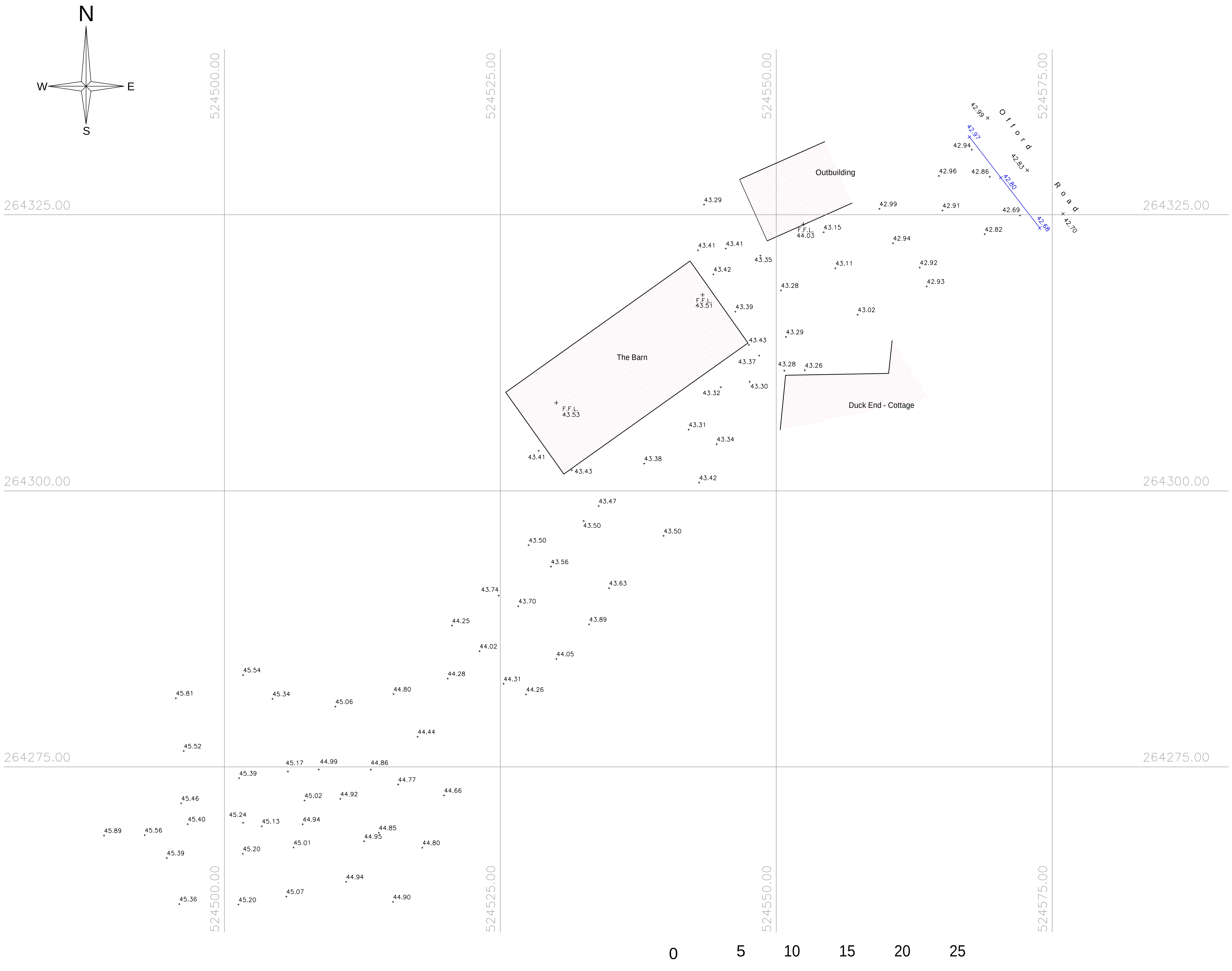
Status:

FOR INFORMATION

Engineer:	MAS	Date:	May 2023
Drawn:	DB	Scales @ A4:	NTS
Checked:	MAS		
Project No:	63834	Drg No: SK01	Rev: -

APPENDIX II

TOPOGRAPHICAL SURVEY



SCALE BAR: 1:250

TOPOGRAPHIC KEY

	FENCE
BF	BOARDED
CLF	CHAIN LINK
CF	CHESTNUT
BWF	BARBED WIRE
EF	ELECTRIC
PRF	POST & RAIL
PWF	POST & WIRE
GP	GATEPOST
PF	PANEL
IR	IRON RAILING
	GATE
PT	POST
TK	TRACK
	ROAD EDGE (NO KERB)
	FOOTPATH
DK	DROP KERB
KO	KERB OUTLET
7.621	KERB
BW	BRICK WALL
BG	BUILDING
SW	STONE WALL
CW	CONCRETE WALL
BLW	BLOCK WALL
RW	RETAINING WALL
	SHED
	STRUCTURE
5.55	GROUND LEVEL IS 5.55M
BM	BENCHMARK
STN	SURVEY STATION
MHS MHT MHC	MANHOLES
CP CP	CATCH PIT
DP	DOWNPIPE
VP	VENT PIPE
RE	RODDING EYE
CL CL	COVER LEVEL
SL SL	SOFFIT LEVEL
IL IL	INVERT LEVEL
G 7.564	GULLY
123.45	ABOVE GROUND OBJECT LEVEL

INDICATIVE BUILDING SECTION
HEIGHT MEASUREMENT LOCATIONS

RIDGE
EAVE POINT
FASCIA
SOFFIT
WALL

LP	LAMPPOST
	NAME SIGN/PLATE
MS	MILE STONE
TS	TRAFFIC SIGNAL
RS	ROAD SIGN
BCN	BELISHA BEACON
BD	BOLLARD
HR	HAND RAIL
CB	CRASH BARRIER
BENCH	BENCH
BS	BUS STOP
CB	BT CALL BOX
BTBX	BT ABOVE GROUND BOX
BTMH	BT MANHOLE
TP	BT TELEGRAPH POLE
CATV	CABLE TELEVISION
EP	ELECTRICITY POLE
ELMH	GASCTRICITY MANHOLE
ER	EARTH ROD
GAS	
FH	FIRE HYDRANT
FHMP	FIRE HYDRANT M/POST
WM	WATER METER
WSV	WATER STOP VALVE
SV	STOP VALVE
SVMP	STOP VALVE M/POST
MTR	METER
US	UNIDENTIFIED SERVICE
TSCB	TRAFFIC SIGNAL CNTL BOX
	HEDGE
	FOLIAGE OUTLINE
	BANKING

G1.10
S3.50
H8.00

G	TRUNK GIRTH (CIRCUMFERENCE)
S	CANOPY SPREAD (RADIUS)
H	TREE HEIGHT (APPROXIMATE)

SAPLING

SITE SURVEY NOTES:

The depiction of a wall, fence or hedge does not necessarily represent a legal boundary. It is the clients responsibility to confirm legal boundaries with the vendor.

All drawing units, levels and dimensions are in metres, unless otherwise stated.

The computation of the horizontal and vertical survey control was recorded using our survey grade GNSS receivers.
This data was provided by Leica Geosystems Smartnet RTK correction service.

Primary survey control was established on control station 1 and referenced to station 2. A scale factor of 1 has been applied to this survey although based on OSGB36(15)

Plotting on paper may lead to a variety of scaling risks/errors due to paper stretching or inaccurate plotter settings etc.
Therefore we do not recommend scaling from a paper version. Any dimensions scaled from a paper reproduction of this survey should be treated with caution.

This drawing must be used in conjunction with all other relevant documentation.

Please contact us with any questions or if any errors or inaccuracies have been identified.

SITE FOCUS SURVEYS
TOPO·ENG·MBS·3DH DS
·sitefocussurveys.co.uk
·info@sfsurveys.co.uk
·01480 354508
·07446 138947
·Cambridgeshire

Title/Address:
The Barn, Duck End, Offord Rd,
Graveley, PE19 6PP

Details:
Level Survey

Client:
Mr & Mrs Wheeler

Size & Scale:	Surveyed:	Drawing Id:
A2 @ 1:250	20/05/2022	DF

Drawing id:
SFS-356SWH-1

APPENDIX III

PROPOSED SITE LAYOUT

NOTE: Overland flows from neighbouring properties causing flood risk to the proposed development have been mitigated by re opening the watercourse to its original condition, therefore finish floor level of the proposed building shall be 150mm above average external levels.

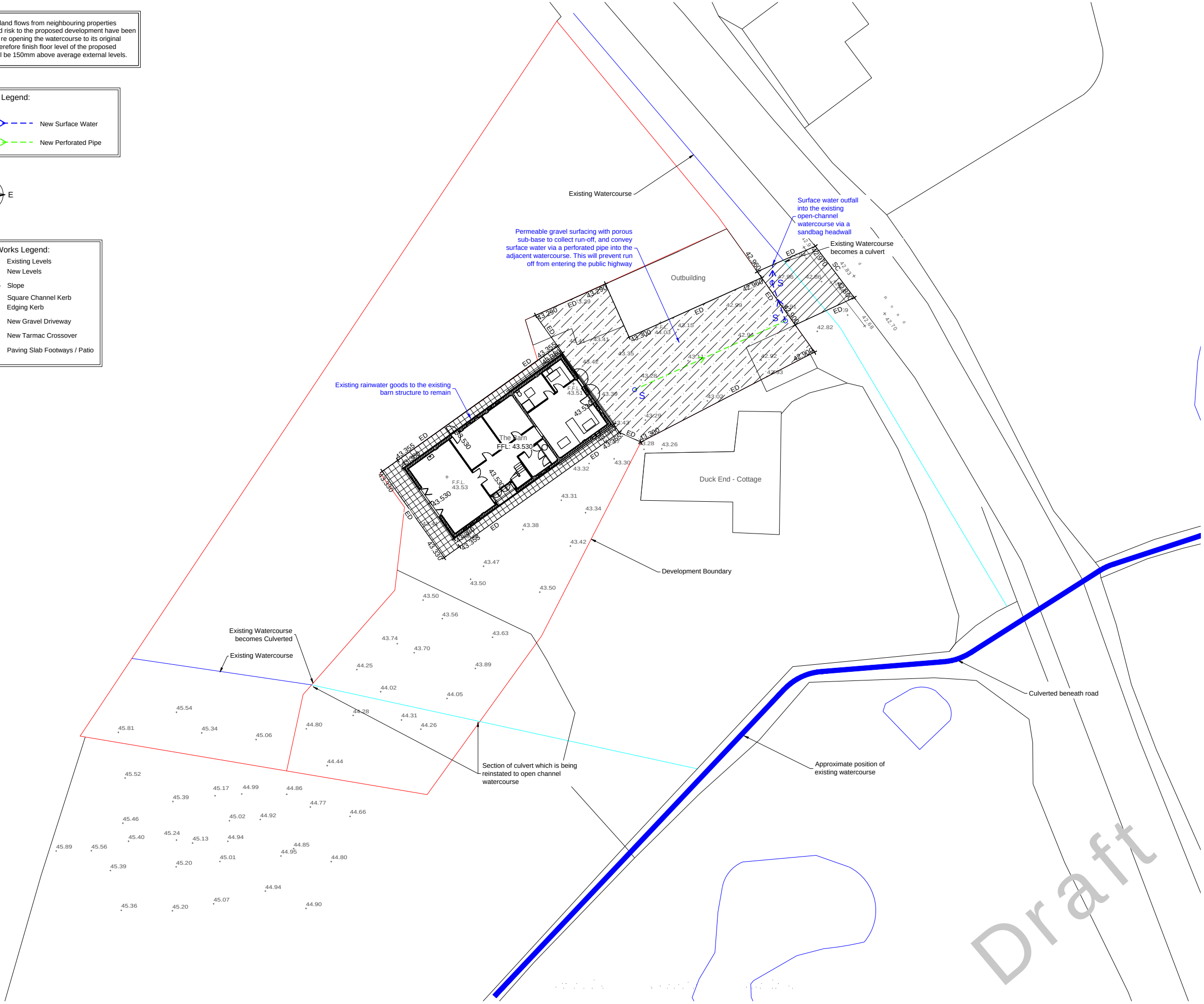
Drainage Legend:

○ S - - -> - - -	New Surface Water
○ S - - -> - - -	New Perforated Pipe

N
W E
S

External Works Legend:

+100.00	Existing Levels
+100.000	New Levels
1/X →	Slope
SC	Square Channel Kerb
ED	Edging Kerb
▨	New Gravel Driveway
▨	New Tarmac Crossover
▦	Paving Slab Footways / Patio



P1	25/05/2023	Issued for comments	DB / MAS
Rev	Date	Description	By / Chk

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Client:
Mr & Mrs Wheeler

Architect:
Architecture & Building Design: Cambridge

Project:
The Barn, Duck End,
Offord Road, Graveley

Title:
Drainage & External Works Layout

Status:
PRELIMINARY

Engineer:	MAS	Date:	May 2023
Drawn:	DB	Scales @ A1:	
Checked:	MAS		1:200
Project No:	63834	Drg No: 002	Rev: P1

APPENDIX IV

ENVIRONMENT AGENCY FLOOD MAPS

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**524542/264308**	**24 May 2023 15:09**

Your selected location is in flood zone 1, an area with a low probability of flooding.

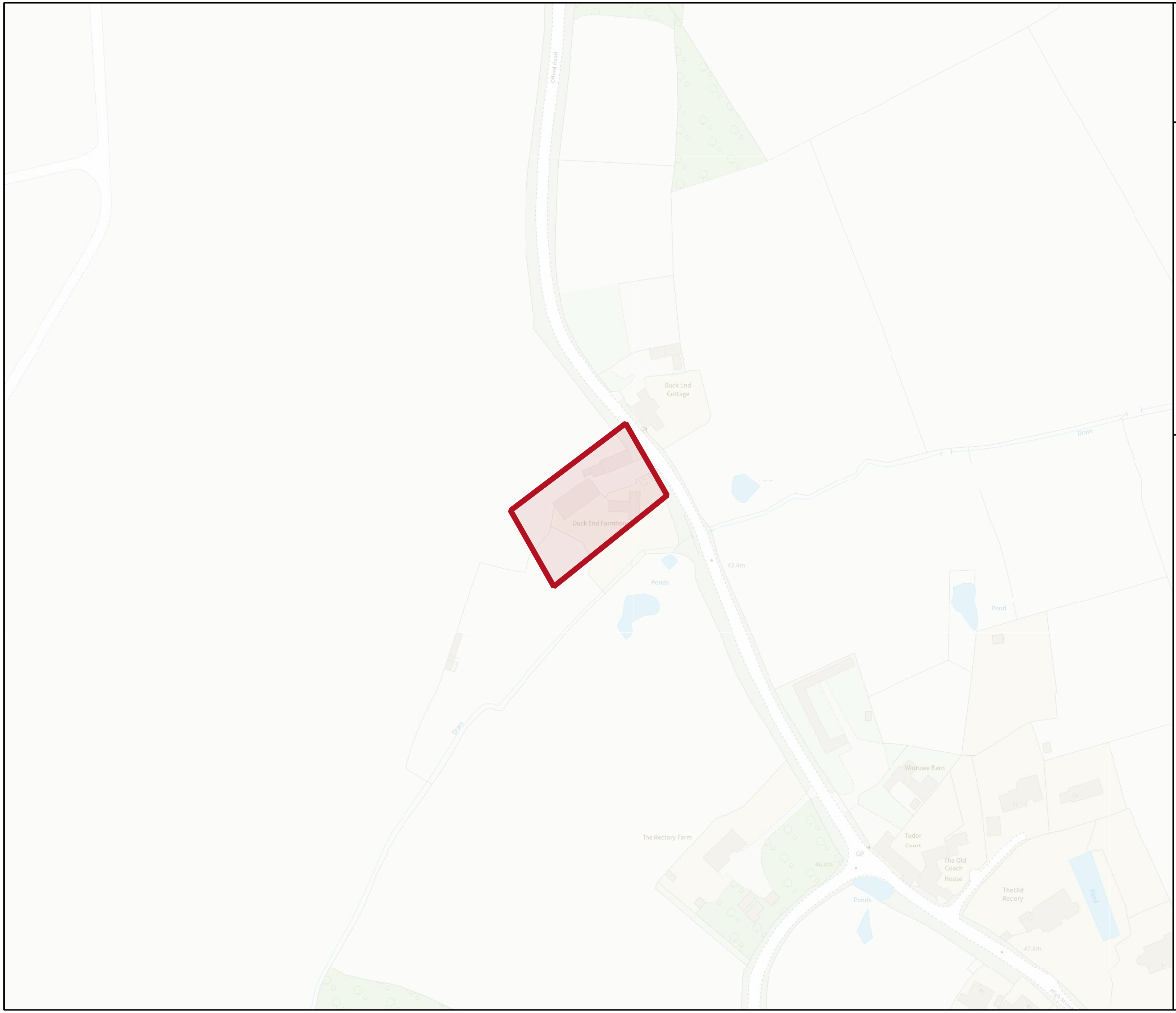
You will need to do a flood risk assessment if your site is any of the following:

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
524542/264308

Scale
1:2500

Created
24 May 2023 15:09

🟥	Selected area
🟦	Flood zone 3
🟦	Flood zone 2
⬛	Flood zone 1
—	Flood defence
—	Main river
●	Water storage area

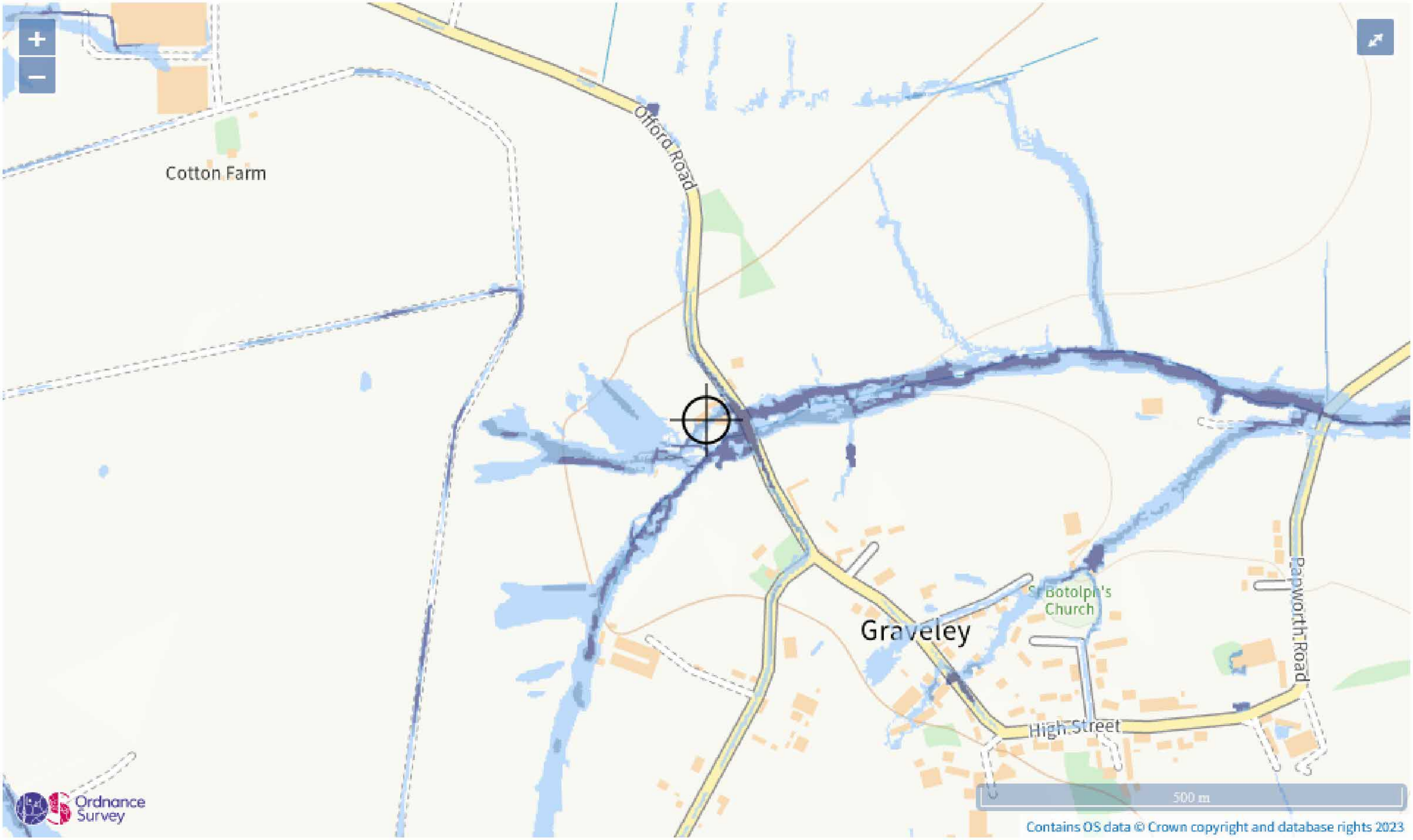
0 20 40 60m

Flood risk

Extent of flooding ⌄

Location

Enter a place or postcode



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low ⊕ Location you selected

Flood risk

High risk: depth ⌄

Location

Enter a place or postcode

Contains OS data © Crown copyright and database rights 2023

Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

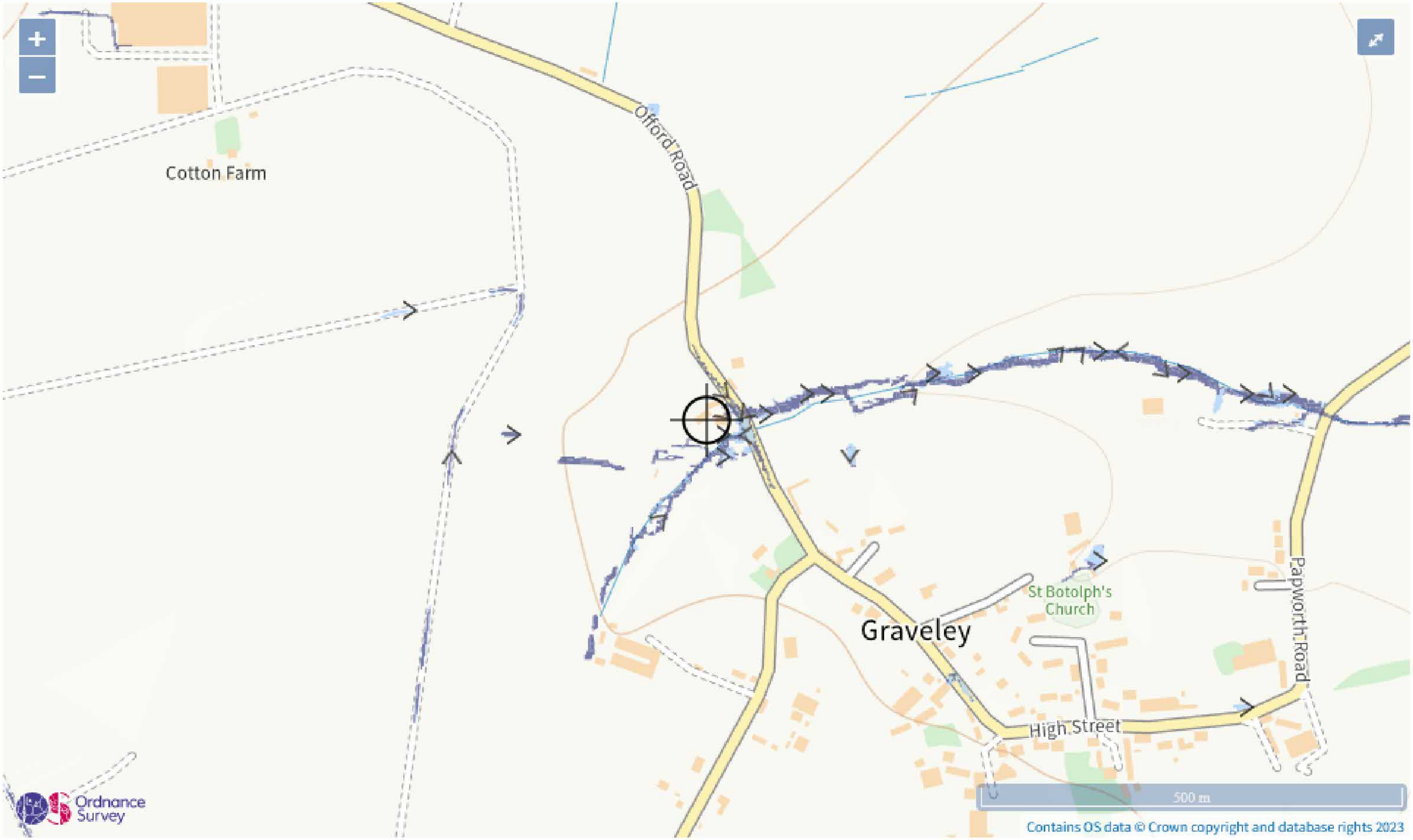
● Over 900mm ● 300 to 900mm ● Below 300mm ⌖ Location you selected

Flood risk

High risk: velocity ⌄

Location

Enter a place or postcode



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

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow ⌖ Location you selected

Flood risk

Medium risk: depth ⌄

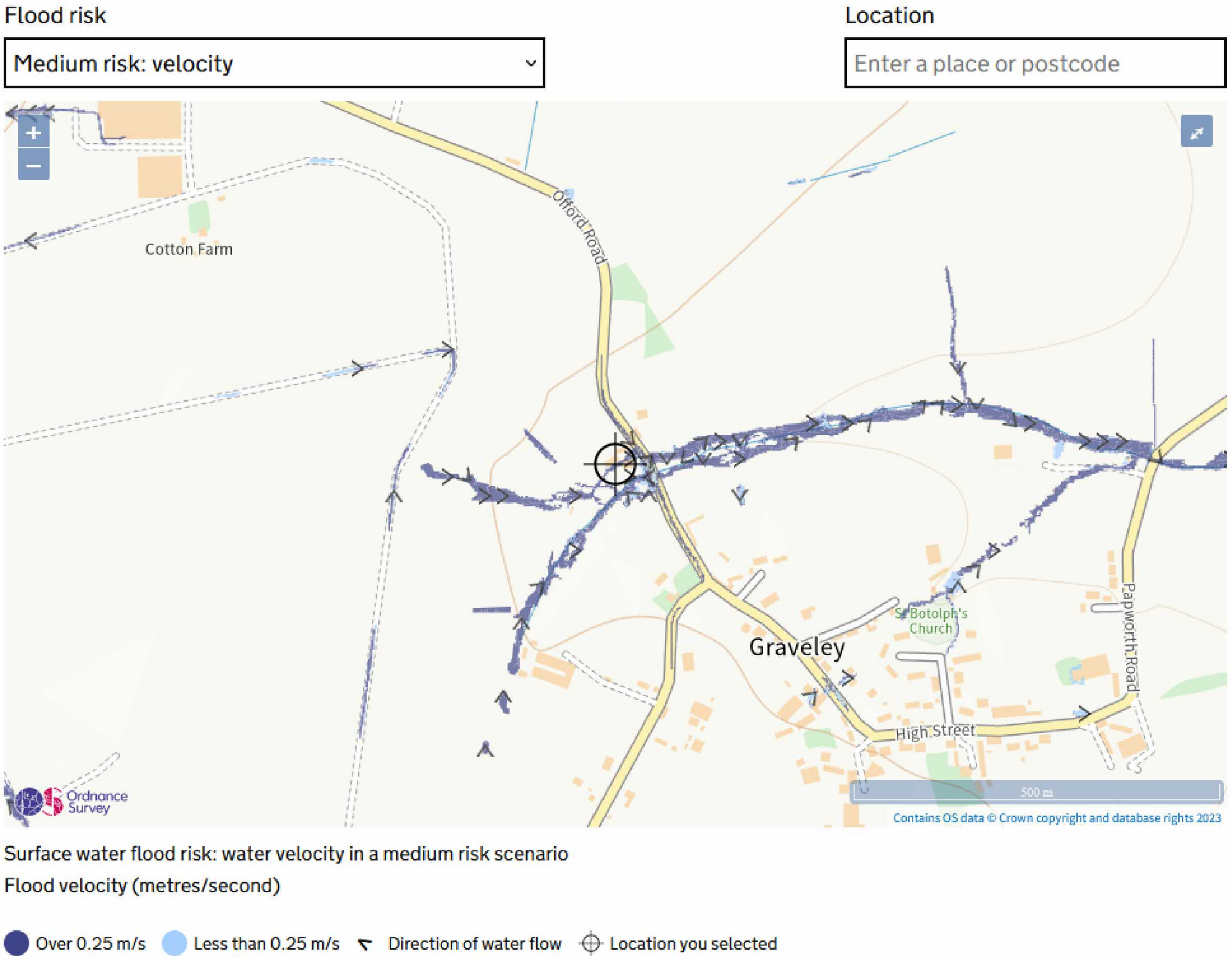
Location

Enter a place or postcode

Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

● Over 900mm ● 300 to 900mm ● Below 300mm ⌖ Location you selected



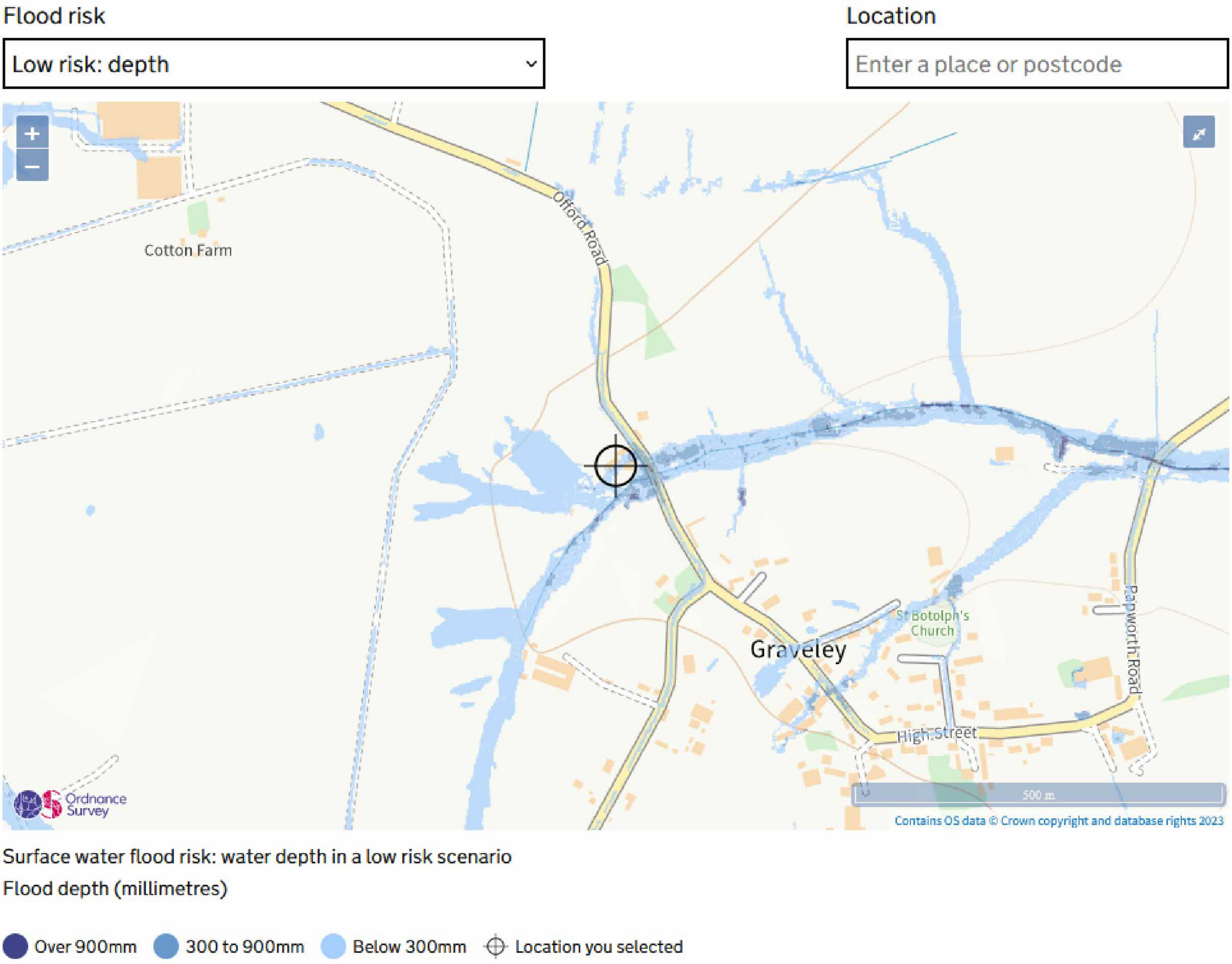
Flood risk: Medium risk: velocity

Location: Enter a place or postcode

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

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow ⌖ Location you selected



Flood risk

Low risk: depth

Location

Enter a place or postcode

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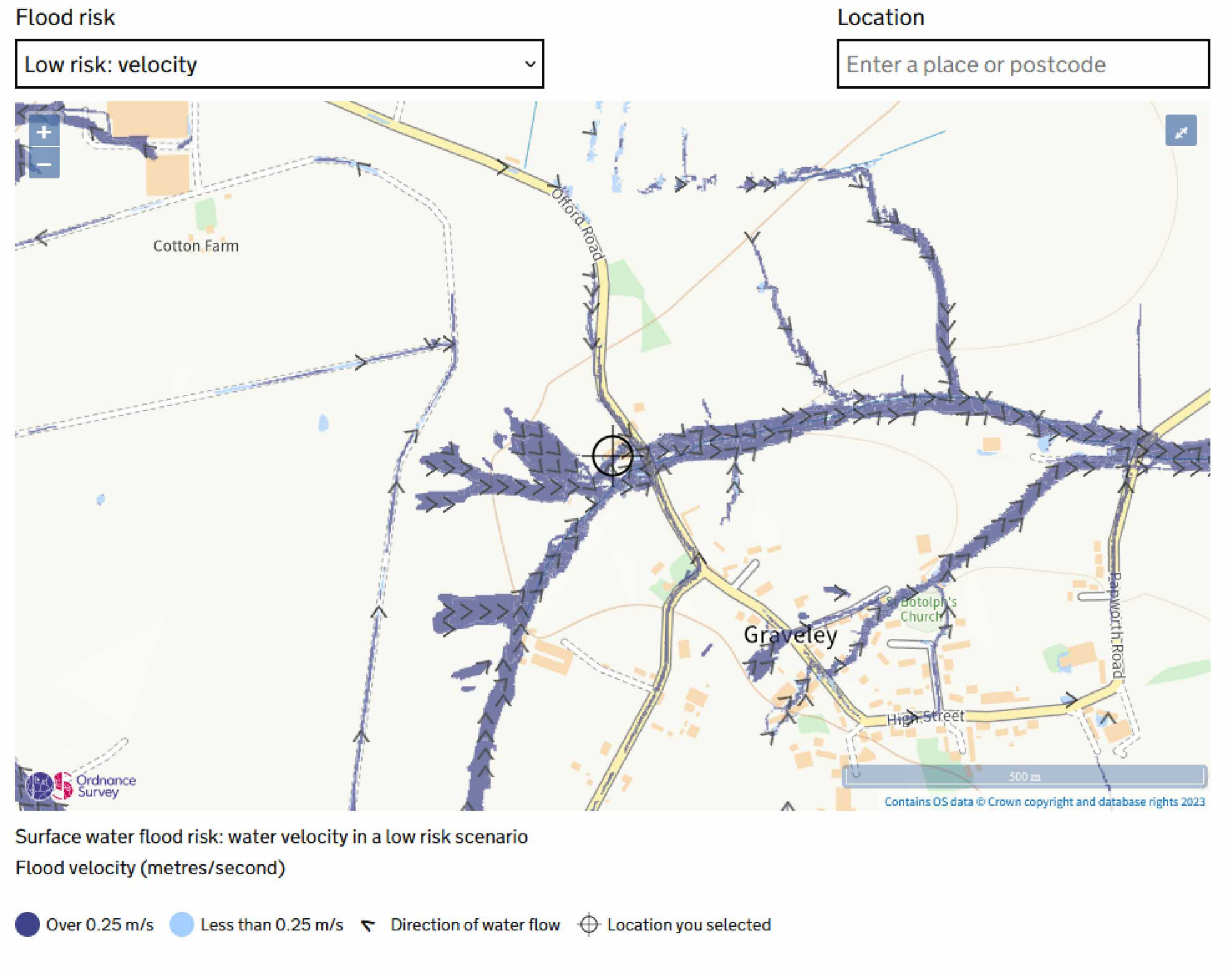
Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

● Over 900mm ● 300 to 900mm ● Below 300mm ⌖ Location you selected



Flood risk

Low risk: velocity

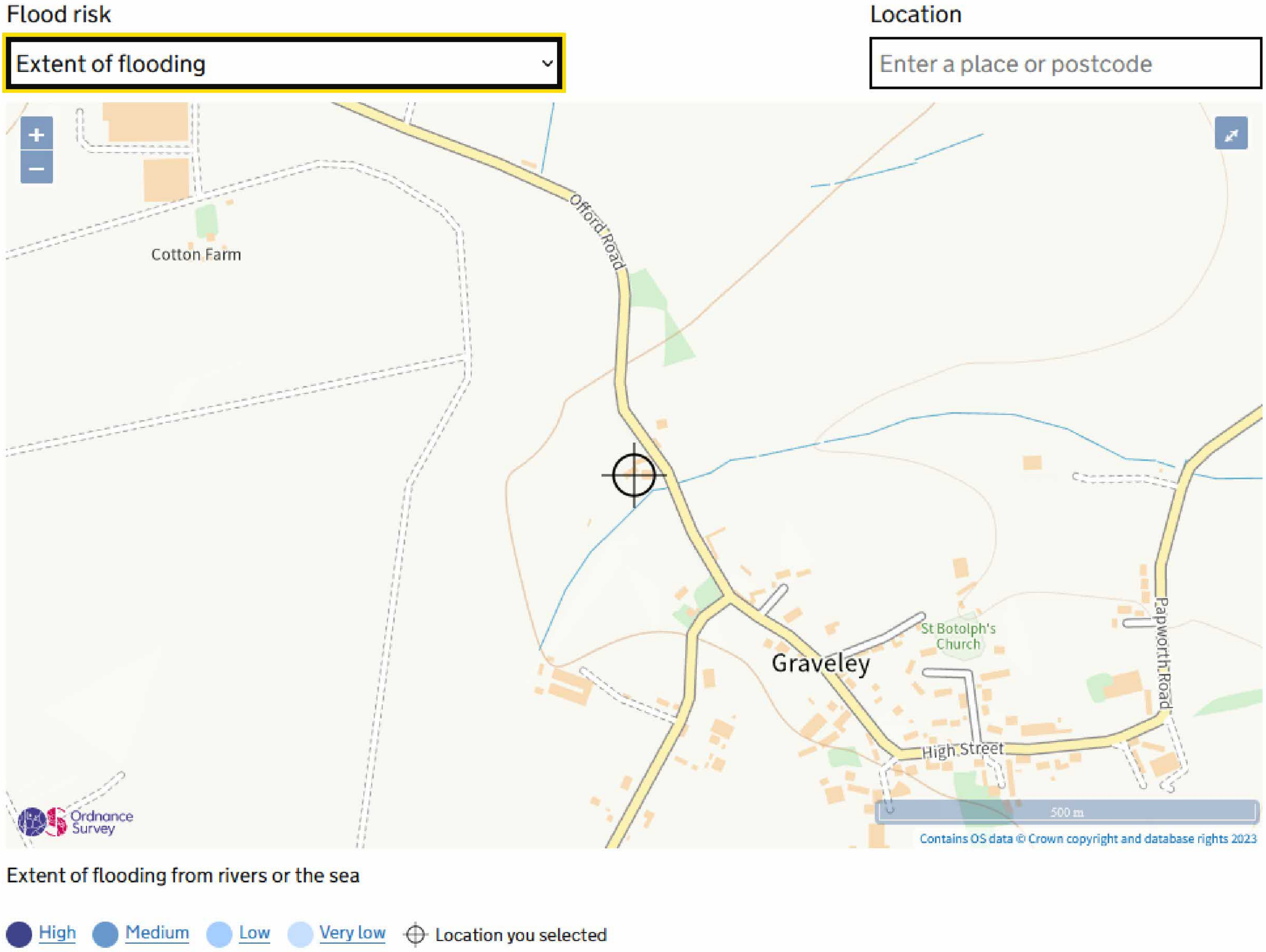
Location

Enter a place or postcode

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

Flood velocity (metres/second)

● Over 0.25 m/s ● Less than 0.25 m/s ↖ Direction of water flow ⌖ Location you selected



Flood risk

Extent of flooding ⌄

Location

Enter a place or postcode

Extent of flooding from rivers or the sea

● High ● Medium ● Low ● Very low ⌖ Location you selected

Flood risk

Extent of flooding ⌄

Location

Enter a place or postcode

Maximum extent of flooding from reservoirs:

● when river levels are normal ▨ when there is also flooding from rivers ⌖ Location you selected

APPENDIX V

GENERAL CONDITIONS

1. This report has been prepared and written specifically for the client named in the introduction and is exclusively for his/her/their benefit. No reliance may be placed in the contents of this report by any third party except with the express agreement of the original client and the written agreement of PRP. Such written agreement may require the payment of an additional fee.

2. This report has been prepared and written in the context of the proposals for the development of the site as stated by the client and will not be valid in a differing context. Furthermore, new information, improved practices, or legislation may necessitate alteration to the report in whole or in part after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of this report, it should be referred to us for re-assessment.

3. There may also be special conditions appertaining to the site which were not revealed by the investigation and which will not, therefore, have been taken into account in this report. Any assessments may be subject to amendment in the light of additional information becoming available.

4. Whilst an opinion may be expressed or implied in this report on possible configurations or on the possible presence of features based either visual, verbal or published evidence, this is for guidance only and no liability can be accepted for the accuracy of such opinions.

5. Comments on groundwater conditions will have been based on observations made only at the time of any investigation or published data unless otherwise stated. It should be noted, however, that groundwater levels vary due to seasonal and other effects.

6. This report is not a site categorisation, and hazards could occur which have not been detected.

7. The copyright in this report and other related plans and documents prepared by PRP is owned by them and no such report, plan or document may be reproduced, published or adapted without their written consent. Complete copies of the report may however be made and distributed by the client as an expedient in dealing with matters related to its commission.

8. Where indicated reliance has been placed on data supplied by the environment agency and the strategic flood risk assessment for the area available at the time of writing this report. No liability can be entertained by PRP if this data later proves to be inaccurate or in any way incomplete.