clive onions
consulting civil engineer

Ms Laura Day

Yew Tree Farm, Chapel Road, Oldbury-on-Severn BS35 1PW

Dwelling Extension

Flood Risk Assessment and Drainage Strategy

Clive Onions Ltd is complying with Government guidance and continuing to work and support UK business during the Covid-19 crisis and to help enable a speedy return to normal business, when safe to do so. We are working from home and will not visit site, but we are using video conferencing etc to keep in touch and share information.

2nd September 2021 V1

This report is based on the instructions given by our client. It is not intended for use by a third party, and no responsibility will be given to any third party.

The consultant has followed accepted procedure in providing the services, but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, the consultant takes no liability for and gives no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the services.

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Appendices

Report prepared by Hayley Burke - BSc (Hons)
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Version history

Version	Date	Prepared by	Approved by	Comment
D1	19.08.21	HB	CO	Issued for comment
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Issue history

Version	Date	Issued to	Method
D1	19.08.21	Ms Laura Day, George Harwood Ltd	Email pdf
V1	02.09.21	Ditto	Ditto

1.0 Introduction

1.1.1 It is proposed to extend an existing single storey dwelling in Oldbury-on-Severn with a larger kitchen and additional bedroom and associated patio.

1.1.2 The existing property is on high ground as part of the undulating natural land in the area, including The Toot and hill to the south.

1.1.3 The Environment Agency's (EA) Flood Map for Planning shows the site to be in Defended Flood Zone 3, close to two Flood Zone 2 islands. The EA Surface Water Flooding Map shows the site to be at very low risk of surface water flooding.

1.1.4 Clive Onions Limited has been appointed to prepare this Flood Risk Assessment and Drainage Strategy (FRADS) to show that the proposal is safe and does not increase flood risk off site; it describes a sustainable drainage strategy.

1.1.5 As minor householder development of less than 250m^2 this is not required to pass the Sequential Test or the Exception Test (Footnote 56 NPPF).

2.0 Site Location and Setting

2.1.1 The site is located northwest of Thornbury. The full address is Yew Tree Farm, Chapel Road, Oldbury-on-Severn, BS35 1PW.

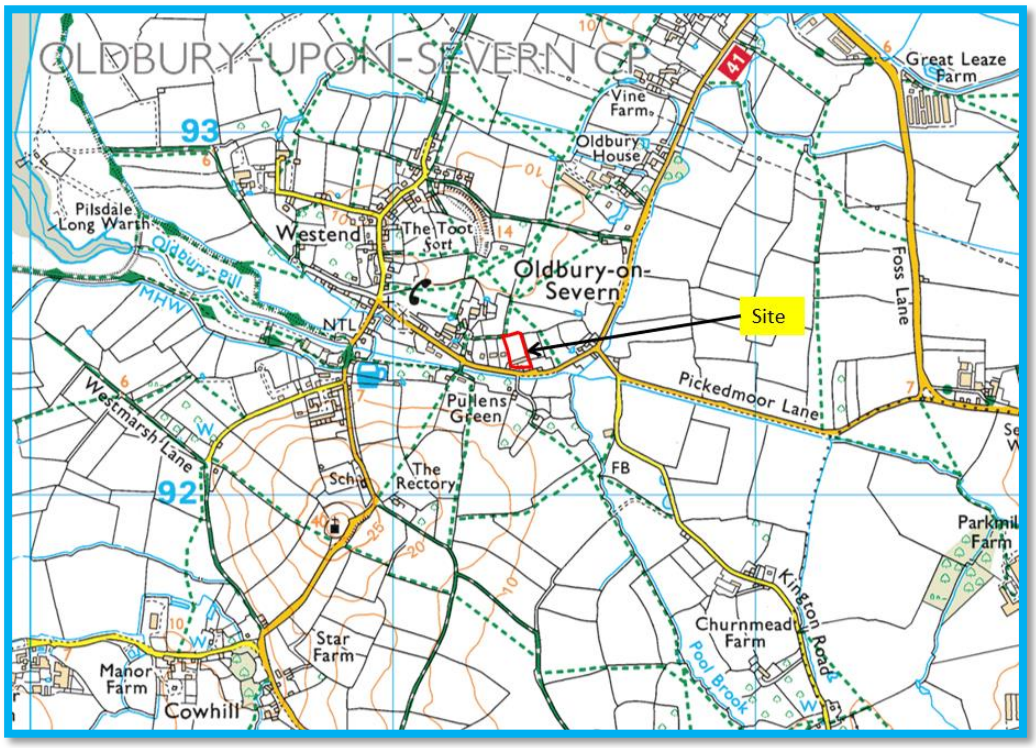


Fig 1 Site location (Streetmap). Note the site is on rising land towards The Toot, northwest of the site.

2.1.2 The site is located in the following setting:

- Northwest of the site the land falls locally and then rises to The Toot (about 14m AOD). North of the site is farmland used for arable and pastoral farming drained by field boundary ditches.
- East of the site are neighbouring residential properties fronting onto Chapel Road, beyond which is farmland.
- Immediately south of the site the land falls to Chapel Road, beyond which is Oldbury Pill flowing west towards the Severn Estuary. South of Oldbury Pill is farmland rising to a hill at 40m AOD.
- West of the site are residential properties leading into Oldbury village. The Severn Estuary is approximately 1.6km west of the site. The land is generally level.

2.1.3 The site can therefore be described as being situated in an area of undulating land on locally high ground which falls to the north and east, on the east side of Oldbury village, with Oldbury Pill to the south.

Fig 2 Satellite view of site and surrounding area (Google Earth).

3.0 Existing Development and Ground Conditions

3.1.1 The overall site is roughly rectangular in shape and is approximately 102m north-south and 50m east-west with a total approximate area of 0.50ha.

3.1.2 The site comprises 2 existing dwellings with a number of outbuildings and a large garden to the rear (in the north). The access falls steeply to the southeast of the site to Chapel Road.

Fig 3 Satellite view of site (Google Earth). The red line is the site boundary, and the yellow line illustrates the area within which the works is proposed.

3.1.3 Local levelling has been undertaken by George Harwood Ltd (Consulting Engineers) which has shown that Chapel Road is at 6.2m AOD (shown as 6.0m on Magic Maps) and with a rise of 3.58m to Finished Floor Level (FFL) gives the FFL for the existing building at 9.1m AOD.

Fig 4 Property adjacent to the site showing steeply rising drive (image of site obscured by tree) (Google Streetview).

3.1.4 The British Geology Survey shows the geology to be mudstone bedrock. The Cranfield Soilscape Viewer shows the soils to be loamy and clayey with impeded drainage.

4.0 Site Investigations

4.1 Infiltration Testing

4.1.1 T&P Regeneration Ltd undertook a geotechnical ground investigation at the site on 13th July 2021, to investigate the suitability of the soil for permeable paving to aid in the management of surface water runoff at the site.

4.1.2 Three tests were undertaken in trial pit HD01, in the location of the proposed patio, in accordance with BRE 365.

Table 1 Summary of Calculated Infiltration Rates

Water level drop (m)	Time period (mins)	Calculated infiltration rate (m/s)
0.23	1200	1.17×10^{-6}
0.13	180	3.49×10^{-6}
0.13	210	3.21×10^{-6}

4.1.3 The design infiltration rate is therefore given as 1.17×10^{-6}. The SuDS Manual in Table 20.1 states that infiltration rates better than 1 x 10-6m/s are suitable for permeable paving.

4.1.4 T&P Regeneration Ltd concluded that permeable paving would be a viable solution for surface water runoff.

4.1.5 It is noted that the existing patio drains satisfactory with no evident formal drainage system.

Fig 5 Existing impermeable patio with edge infiltration strips (Maintain A Drain).

4.2 CCTV Survey

4.2.1 Maintain A Drain (MAD) undertook a drainage investigation at the site on 8th July 2021, including a CCTV survey of the drains.

4.2.2 The roof water is currently drained directly to the ground via 3 rainwater pipes.

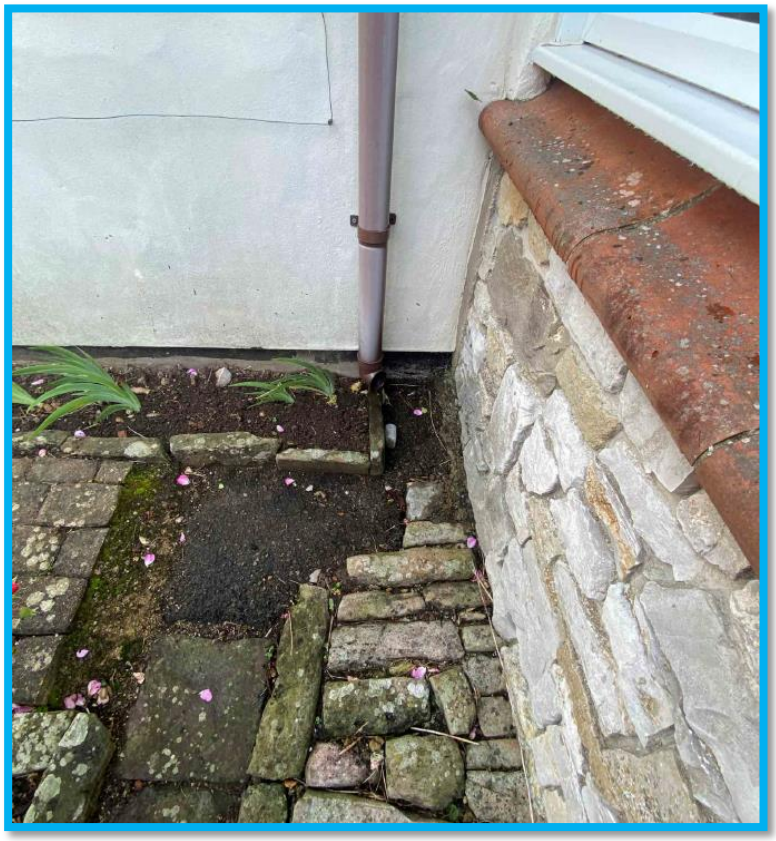


Fig 6 Typical roof drain with rainwater shoe dispersing to ground.

4.2.3 No ponding or other nuisance has been reported as a result of rainfall.

4.3 Proposed Development

4.3.1 Two extensions are proposed to the existing dwelling.

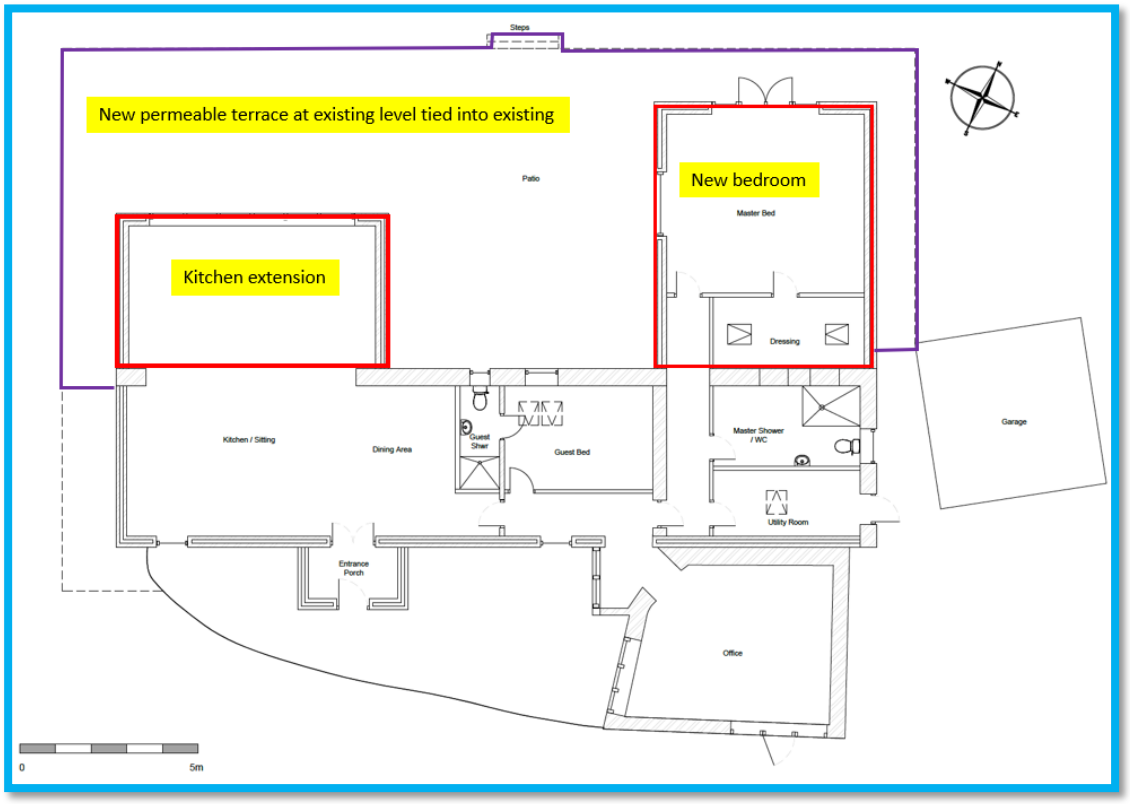


Fig 7 Proposed extensions of building in red, and patio in purple outline.

5.0 Flood Risk

5.1.1 Potential sources of flooding affecting the site are as follows:

- Tidal flood risk to the site is low due to the protection provided by the tidal defences and elevated position of the site.
- When considering the impact of climate change, defences are overtopped causing flooding in the area.
- Residual risks exist including defence failure, which are considered below.
- Fluvial flood risk to the site is from Oldbury Pill. The risks are at their greatest during tide lock when penstocks are closed.
- Surface water flood risk mapping shows the flood risk to the site to be very low.

5.2 Tidal Flooding

5.2.1 The EA Flood Map for Planning shows the site of the extension and patio works to be in Defended Flood Zone 3, with areas in the east and west in Flood Zone 2.

5.2.2 Defended Flood Zone 3 is defined as land and property in this flood zone which would have a high probability of flooding without the local flood defences. These protect the area against a flood from the sea with a 0.5% chance of happening each year.

Fig 8 EA Flood Map for Planning with 'works' site in yellow.

5.2.3 A specific Flood Risk Assessment was undertaken for Oldbury on Severn by JBA Consulting, on behalf of South Gloucestershire Council, dated September 2017.

5.2.4 The Assessment shows that the site is above the area at risk of the current day 5% fluvial and tidal events.

5.2.5 Furthermore, the site is shown to be only 100mm below the 0.5% predicted defended tidal flood level in 2117.

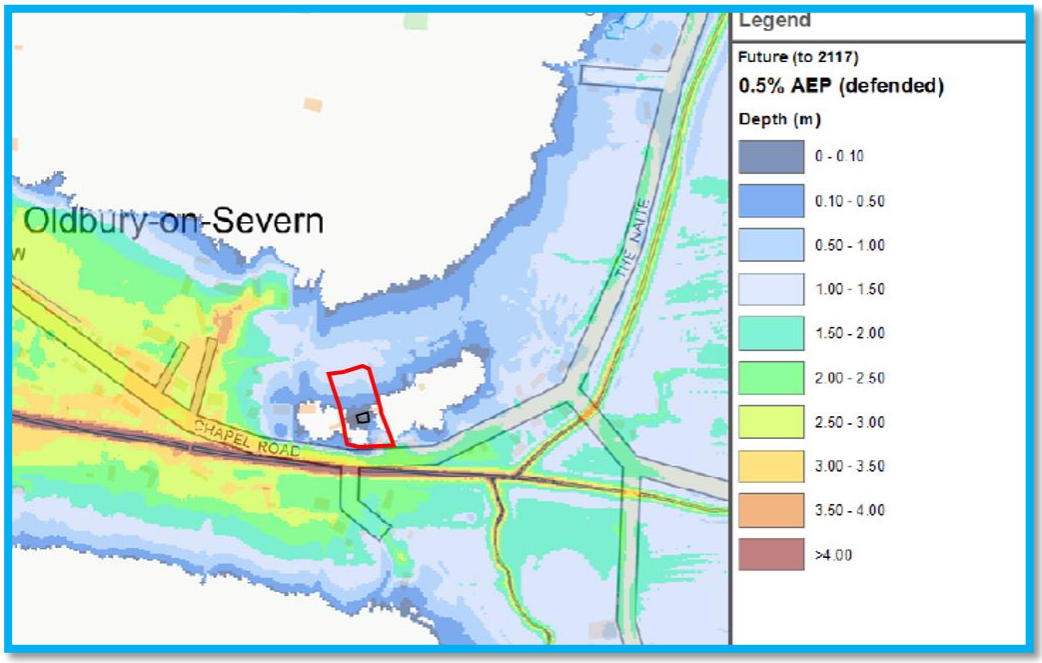


Fig 9 JBM Assessment 0.5% tidal event in 2117 showing site with 0 – 100mm potential depth of flooding and emphasising the local high ground (Figure C-17).

5.2.6 In the current day tidal breach scenario, this site is shown to be at very low risk of flooding, as is the general area.

5.2.7 The breach scenario map for the future has not been published.

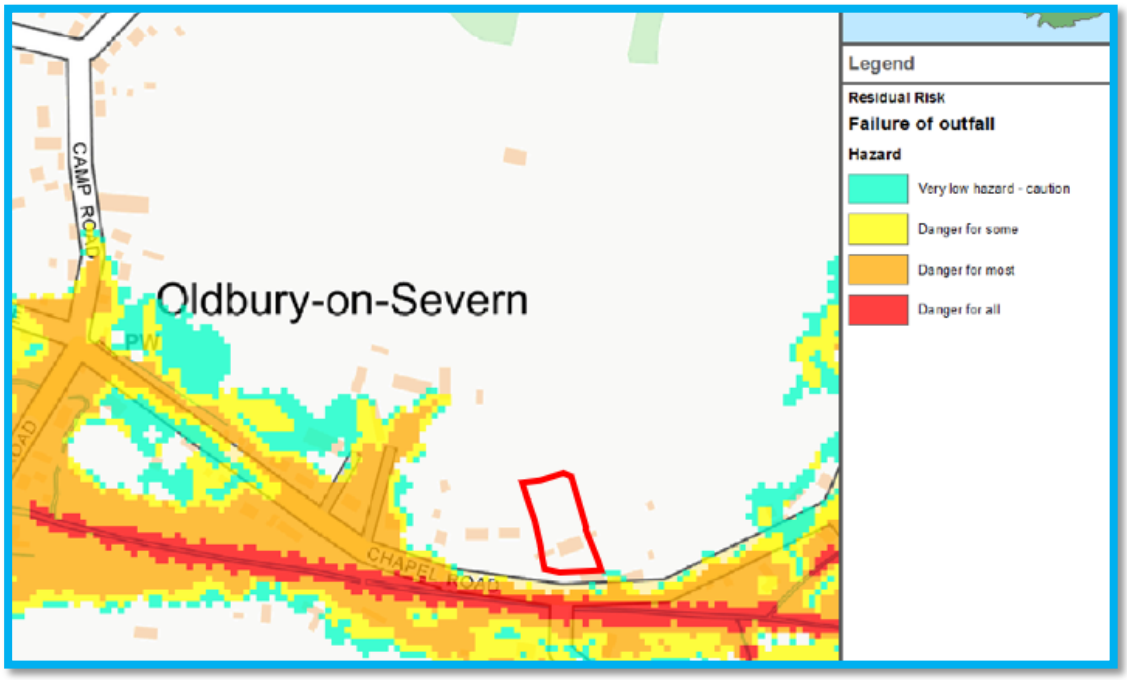


Fig 10 JBA current day breach scenario showing the site at very low risk of flooding (Figure D-3).

5.2.8 In the event of an undefended situation in 2117, the site is shown to be on locally high ground, but nevertheless is shown to be in the order of 1.5m deep. The land to the north, known as The Toot, is well above the predicted flood level and public footpaths lead to this high ground from the site.

5.2.9 It is noted that this undefended event is not the same as a 'breach' event, and is a very extreme event ignoring the presence of the defences. It does show that water would begin to fill the land along the Oldbury Pill valley and having to rise over 2m prior to affecting the site. The rising tide would give in the order of an hour's notice prior to water reaching the site.

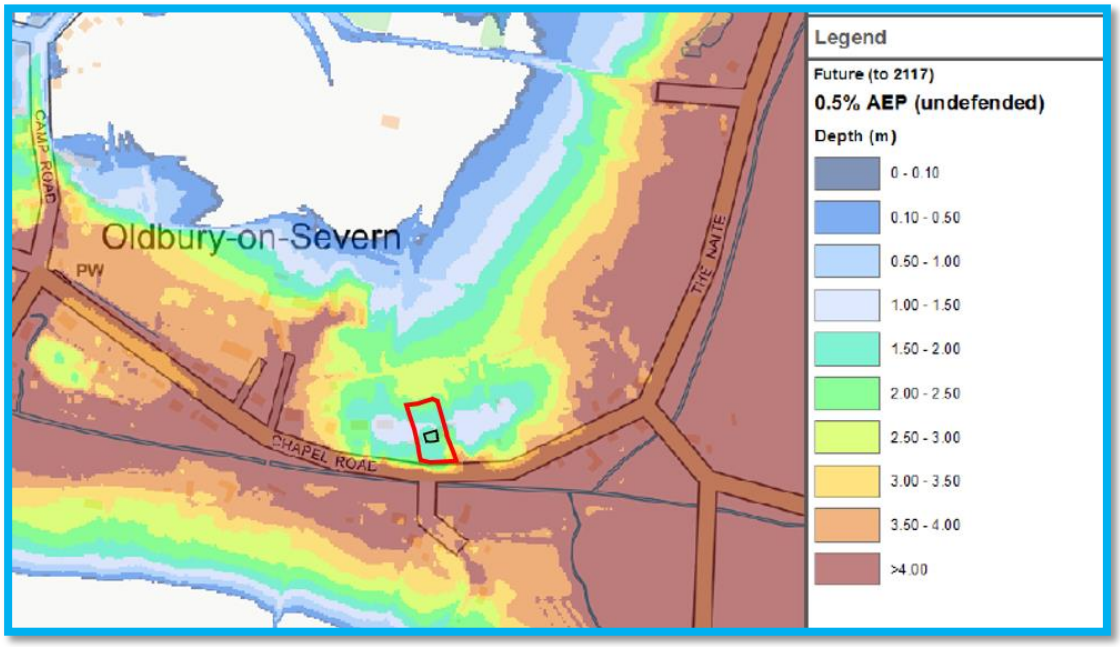


Fig 11 JBM Assessment 0.5% tidal undefended event in 2117 showing site with 1.5m – 2.0m potential depth of flooding and emphasising the local high ground (Figure C-21).

5.2.10 The EA has supplied the Product 4 site-specific tidal flood data (ref: 222717-WX, dated 13th July 2021) for the site, which shows that the defended flood level in the current 1 in 200 year event does not reach the site (0.00m AOD).

5.2.11 It is assumed that the site-specific Assessment undertaken by JBA is more refined than the EA's analysis and gives a more representative predicted flood level of less than 9.2m AOD in the 0.5% 2117 event (ie 9.1m AOD + 100mm depth of water, see Fig 9).

Defended

AEP	Maximum depth (in metres)	Maximum level (mAOD)
0.1% (1 in 1000)	0.89	7.10
0.5% (1 in 200)	0.00	0.00
0.5% with CC 2068 added	1.11	7.34
0.5% with CC 2118 added	3.89	9.99
20% (1 in 5)	0.00	0.00

Undefended

AEP	Maximum depth (in metres)	Maximum level (mAOD)
0.1% (1 in 1000)	3.74	9.84
0.5% (1 in 200)	3.22	9.32
0.5% with CC 2068 added	3.80	9.90
0.5% with CC 2118 added	4.62	10.72
20% (1 in 5)	2.49	8.61

Fig 12 Extract from EA Product 4 letter, based on 2020 model.

5.3 Fluvial Flooding

5.3.1 According to the JBA Assessment the site is shown to be significantly above the 1% Upper End fluvial flood risk in 2080.

5.3.2 It is noted that according to the current Flood Risk Assessments: Climate chagne guidance for resiential development, which is more vulnerable development, the allowance shoud be 'Central'.

5.3.3 From inspection it is clear that the site is at very low risk of fluvial flooding during its lifetime.

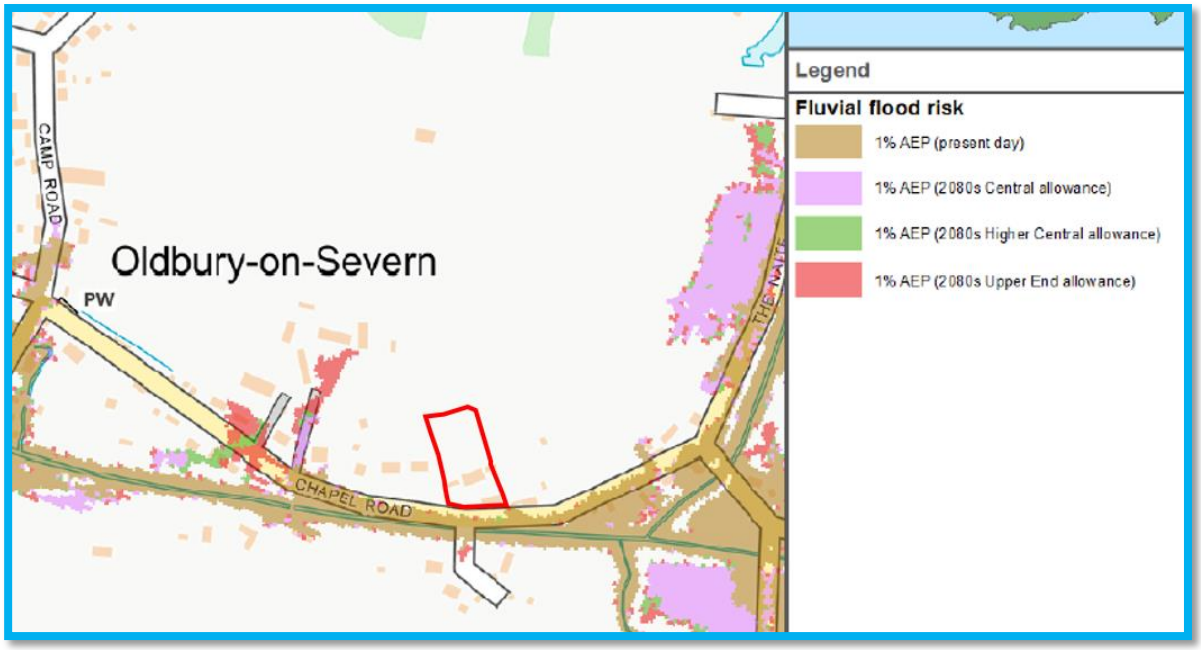


Fig 13 Extent of fluvial flood risk up to the 1% Upper End in 2080, showing site at very low risk.

5.3.4 The site is therefore shown to be at very low risk of flooding, except in the design 1 in 200 year flood event in the last 10 years of its lifetime, and in the event of a total failure of the defences.

5.3.5 Bearing in mind the proposed works are an extension to an existing single storey building, the proposal would be to retain the existing floor levels and use flood resilient floor construction.

5.4 Surface Water Flooding

5.4.1 The EA Surface Water Flooding Map shows the development site to be at very low risk of flooding.

5.4.2 A low point is shown in the northeast of the site, which reflects the presence of an open field boundary ditch visible on site.

5.4.3 Chapel Road, which provides access to the site, is also shown to be at low risk of shallow surface water flooding.

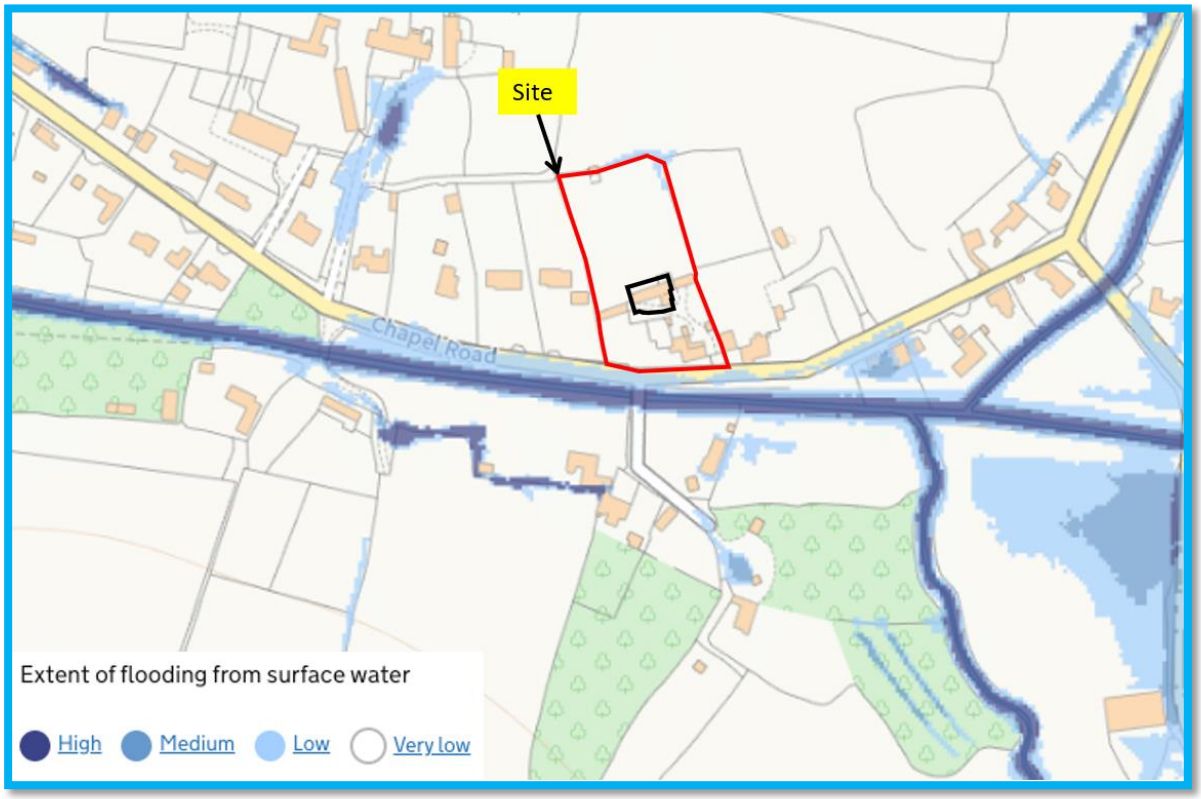


Fig 14 EA Surface Water Flooding Map showing development at very low risk of flooding, and shallow flooding in the northeast corner of the land ownership.

5.5 Other Sources of Flooding

5.5.1 The EA Reservoir Flooding Map shows the site to not be at risk of reservoir flooding.

5.5.2 No other sources of flooding have been identified.

6.0 Safe Escape

6.1.1 In the event of surface water or current day fluvial flooding Chapel Road is shown to provide safe access to the west and north.

6.1.2 The residents will need to register with the EA flood warning service.

6.1.3 In the event of tidal flooding, the recommendation would be to leave the area based on a warning issued by the EA.

6.1.4 If flooding has begun, the residents should stay in the building until the high tide has passed ~~past~~.

6.1.5 The main house within the site is also 2-storey and would provide safe refuge for the occupants of the proposed development.

6.1.6 If a very extreme event is predicted, and the residents have not left the building or site, there is safe escape along public footpaths to high ground at The Toot and homes in area on high ground (see Fig 1).

7.0 Proposed Surface Water Drainage

7.1.1 The areas forming the proposed extension and new patio have been calculated as follows:

- Existing impermeable patio 104m^2
- Proposed Kitchen and bedroom extensions 80m^2
- Proposed permeable patio 135m^2

7.1.2 From the above it can be seen that the impermeable area is being reduced overall by 24m^2.

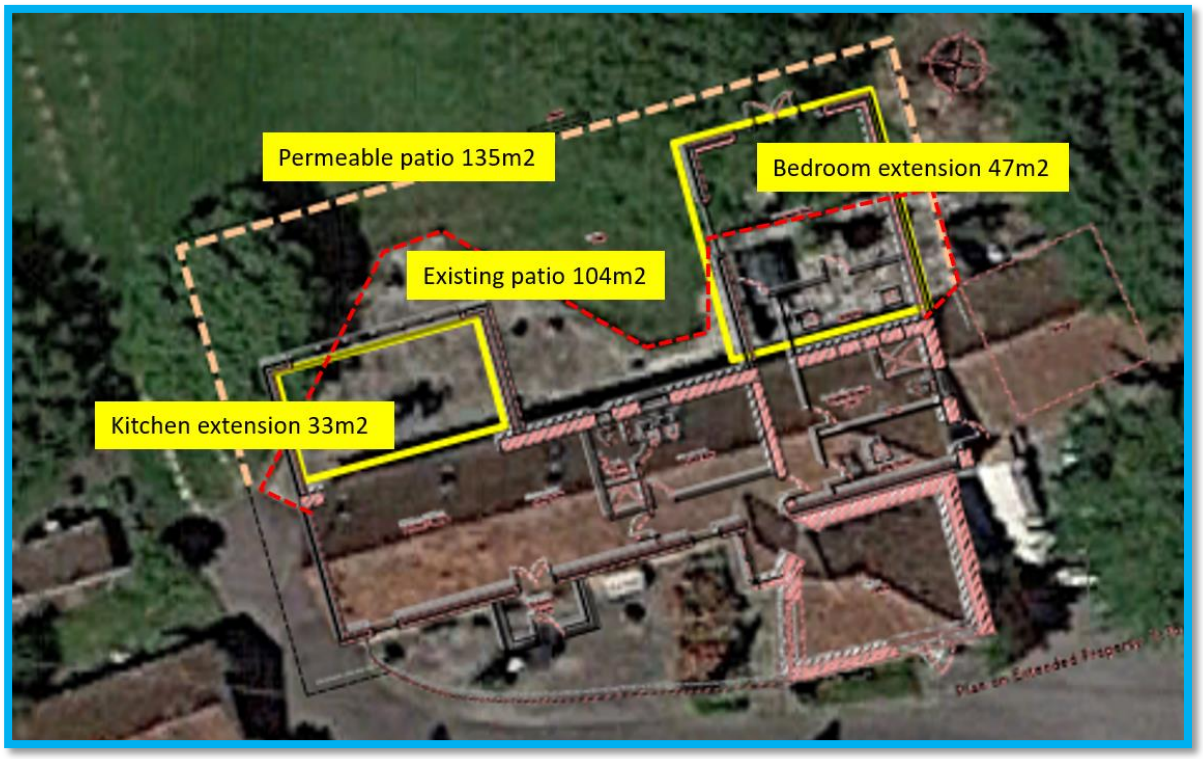


Fig 15 Google Earth image with proposed layout superimposed and annotated with areas.

7.1.3 The conventional pitched roof extensions will incorporate conventional gutters and rainwater pipes.

7.1.4 Whilst the ground has been shown to be suitable for permeable paving (with > 1 x 10-6 m/s infiltration rate) the patio is within 5m of the building and so the roof cannot be drained into the permeable paving. (Building Regulations requires a minimum of 5m between a building and soakaway).

7.1.5 The proposal is therefore to capture the rainwater pipes in a drainage channel (eg ACO drain) and drain to the north of the patio, then be piped under the lawn (around a tree) and into the existing ditch network.

7.1.6 The site has a ditch along the west boundary which discharges into the field boundary system to the north of the site.

7.1.7 The ditch as been inspected and is more than 450mm deep. It was dry at the time of inspection. The proposal is to maintain the ditch such that it is cleared to its intended depth and maintained as such.

7.1.8 The field boundary ditch along the site boundary will also be inspected and maintained.

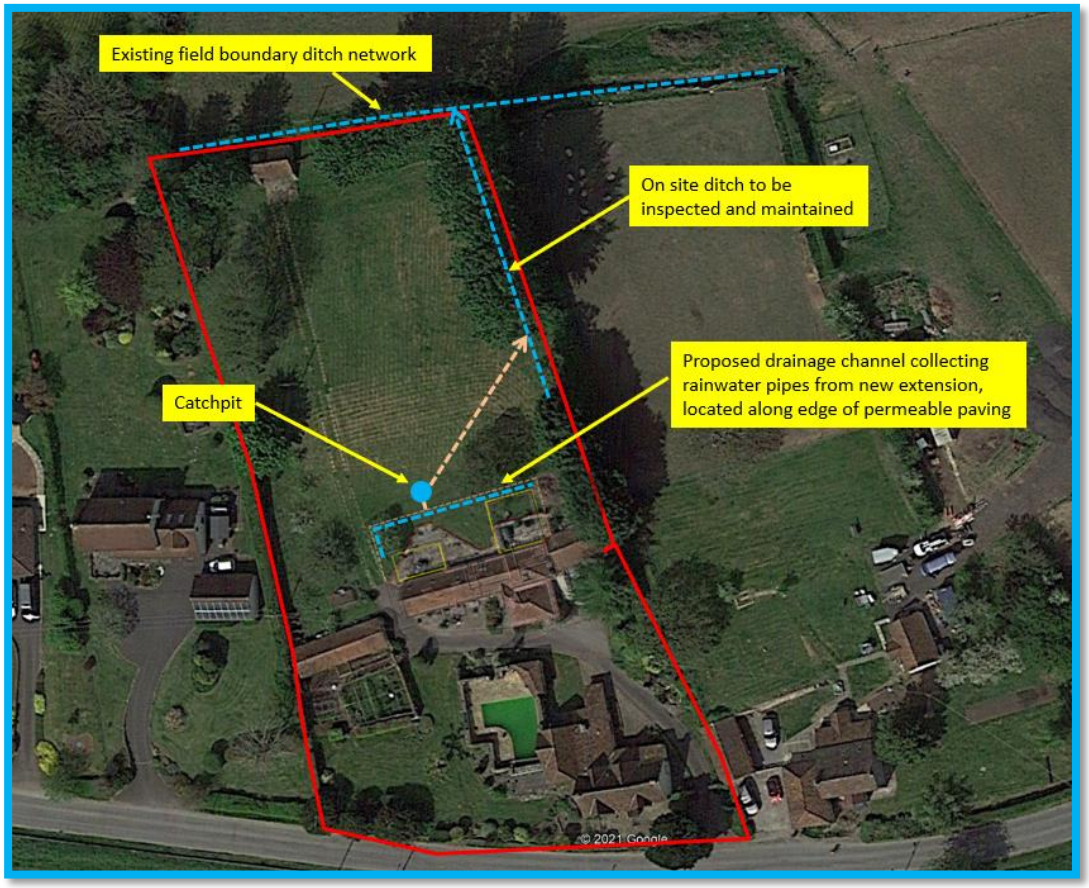


Fig 16 Proposed drainage strategy.

7.1.9 The runoff from the proposed extension of 80m^2 has been calculated and shows a rate of 1 l/s in the 1 in 100 year event with 40% climate change allowance. The storage required would be 1.71m^3 (Appendix 2).

7.1.10 Given that the impermeable area is being reduced by about 25% and the runoff rate even in the 1 in 100 year event is 1 l/s, a flow control device would very rarely be in operation.

7.1.11 It is therefore recommended that conventional pipe in trench be formed from the drainage channel to the field ditch. The improvement of the ditch is likely to result in a significant increase in volume/capacity.

7.1.12 It has been confirmed by the owner that there is a fall to the ditch and this can also be interpreted from Fig 9.

7.1.13 Where feasible the ditch will be modified with shallower slopes to give the appearance of a swale, given the presence of young children at the site, thus increasing its capacity further.

7.1.14 This drainage strategy shows that the overall impermeable area will be reduced, the patio will drain by infiltration and the flow rate and volume directed to the ditch are de minimus.

7.1.15 The proposal represents a sustainable solution which complies with Building Regulations and can be readily inspected and maintained.

7.1.16 In the extreme event beyond the 1 in 100 year event with climate change allowance, if the patio ponds, water will flow around the building and down the drive to Chapel Road, which complies with the guidance given in CIRIA 635, Designign for Exceedance.

8.0 Conclusions and Recommendations

8.1.1 It is proposed to remove an impermeable patio and form two small extensions with a new permeable patio at Yew Tree Barn, an existing single storey dwelling.

8.1.2 No nuisance ponding has been experienced, which is consistent with the dwelling being on locally high ground falling to the north and south (by 3.58m to Chapel Road).

8.1.3 With the site on localised high ground it is shown to be in Defended Flood Zone 3.

8.1.4 As minor householder development works the proposal is not required to pass the Sequential Test or the Exception Test and is therefore appropriate in terms of the NPPF.

8.1.5 The site is at risk of tidal flooding only, and the recent Oldbury on Severn site-specific Flood Risk Assessment by JBA shows the potential depth of water in the design 1 in 200 year event in 2117 only 100mm deep.

8.1.6 It is proposed to form the floor in flood resilient reinforced concrete, at the same level as the existing floor, given the connection with the existing property (ie the floors cannot be raised for accessibility reasons).

8.1.7 Infiltration testing has been undertaken and showed that an infiltration rate in excess of 1 x 10-6 m/s was obtained and permeable paving is appropriate and will be used for the new patio.

8.1.8 The proposed impermeable roof area will be 25% less than the existing total impermeable area, and the runoff will be in the order of 1 l/s in the 1 in 100 year event requiring only 1.71m^3 storage in the 15 minute storm (ignoring the existing impermeable paved area).

8.1.9 It is proposed to drain the roof to a drainage channel (ACO type) and drain this to an existing boundary ditch which will provide the attenuation.

8.1.10 The boundary ditch will be inspected and maintained with shallower sides for child safety, which will increase the volume and compensate for the runoff.

8.1.11 The drainage proposal represents a sustainable solution specific to the site and improves upon the existing, by managing all impermeable areas.

8.1.12 The development is therefore safe for its lifetime, will not increase flood risk elsewhere, and complies with the NPPF and PPG.

Appendix 1 Soakaway Test Results

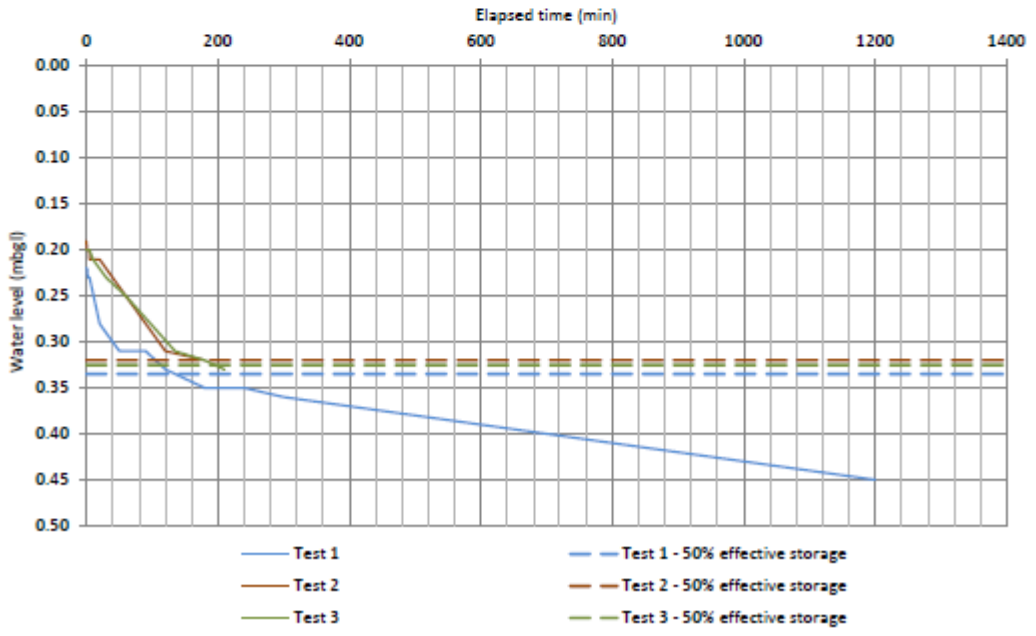
T&P Regen

Borehole Infiltration Test Results

Project Name:	Yew Tree Farm	Project ID:	CS-J-1176
Client:	Longcroft		
Hole ID:	HD01	Test Date: 13/07/2021	Logged: SB / Checked: JF

Test 1		Test 2		Test 3	
Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.22	0	0.19	0	0.20
1	0.22	1	0.20	1	0.20
2	0.23	2	0.20	2	0.20
3	0.23	3	0.20	3	0.20
4	0.23	4	0.20	4	0.20
5	0.23	5	0.21	5	0.20
20	0.28	10	0.21	10	0.21
30	0.29	20	0.21	30	0.23
50	0.31	60	0.25	60	0.25
60	0.31	120	0.31	135	0.31
90	0.31	180	0.32	180	0.32
120	0.33			210	0.33
180	0.35				
240	0.35				
300	0.36				
1200	0.45				

Borehole Diameter (m)			0.27
Soakaway Dimensions:	Test 1 - Depth (m)		0.45
	Test 2 - Depth (m)		0.45
	Test 3 - Depth (m)		0.45
	Test 1	Test 2	Test 3
Depth to water at start of test (m)	0.22	0.19	0.20
Depth to water at end of test (m)	0.45	0.32	0.33
Total head drop (m)	0.23	0.13	0.13
Depth to water at 75% level (m)	0.28	0.26	0.26
Depth to water at 50% level (m)	0.34	0.32	0.33
Depth to water at 25% level (m)	0.39	0.39	0.39
Base area of borehole (m^2)	0.057	0.057	0.057
Computed Internal Surface Area A_{p50} (m^2)	0.155	0.168	0.163
Effective Storage Volume V_{p75-25} (m^3)	0.007	0.007	0.007
Elapsed time at 75% level (mins)	19	65	76
Elapsed time at 25% level (mins)	625	277	303
Total discharge during test	100%	50%	52%
50% discharge in 24 Hours	Yes	Yes	Yes
Soil infiltration rate *f* (m/s)	1.17E-06	3.49E-06	3.21E-06
Design soil infiltration rate *f* (m/s)	**1.17E-06**		



Remarks:
Where highlighted in red, calculations have been inferred from the graph.

Appendix 2 Storage Calculation

Project Title	Yew Tree Farm	**Site Address**	Chapel Road, Oldbury-on-Severn
Project Number	21077	**Post Code**	BS35 1PL

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Required Volume Calculation

Assumed outflow	1	l/s
Impermeable Area Draining to System	80	m^2
Climate Change Factor	40	%
Runoff Coefficient	0.95	

						Balance	
Duration (hrs)	100 year depth (mm)	100 year + 40% (mm)	Intensity (mm/h)	Inflow (l/s)	Outflow (l/s)	Flow (l/s)	Storage (m^3)
0.25	**24.54**	**34.4**	**137.4**	**2.9**	**1**	**1.9**	**1.71**
0.5	32.62	45.7	91.3	1.9	1	0.9	1.67
0.75	37.62	52.7	70.2	1.5	1	0.5	1.30
1	41.32	57.8	57.8	1.2	1	0.2	0.80
2	49.68	69.6	34.8	0.7	1	-0.3	None
3	55.56	77.8	25.9	0.5	1.0	-0.5	None
4	60.21	84.3	21.1	0.4	1	-0.6	None
6	67.42	94.4	15.7	0.3	1	-0.7	None
8	72.79	101.9	12.7	0.3	1	-0.7	None
10	76.98	107.8	10.8	0.2	1	-0.8	None
12	80.38	112.5	9.4	0.2	1	-0.8	None
16	85.58	119.8	7.5	0.2	1	-0.8	None
20	89.40	125.2	6.3	0.1	1	-0.9	None
24	92.36	129.3	5.4	0.1	1	-0.9	None
32	96.66	135.3	4.2	0.1	1	-0.9	None
40	100.08	140.1	3.5	0.1	1	-0.9	None
48	103.03	144.2	3.0	0.1	1	-0.9	None
96	117.86	165.0	1.7	0.0	1	-1.0	None

FEH EXPORT DATA

FEH Web Service (2.0.0.0)	VERSION	Version	1.0.0
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FEH 2013	Rainfall model=		Design rainfall
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For a point	Calculation mode=		Point
Point	Calculation location=		North Bristol

Version :	V1	Created :	HB	Checked :	CO
Comments :	-	Date :	19.08.21	Date :	19.08.21