

Proposed Residential Development Land at Bradley Mill, Wrexham

Initial Appraisal of Flood Risk

Prepared by:	Lucy Raven BSc (Hons) <i>Project Manager, Weetwood Services Ltd.</i>
Checked by:	Andrew Grime BEng MBA CEng C.WEM MICE FCIWEM <i>Director, Weetwood Services Ltd.</i>
Date:	9 January 2019
Version:	Final v 1.1

1 Introduction

1.1 Purpose of Report

This Initial Appraisal of Flood Risk has been prepared by Weetwood Services Ltd ("Weetwood") on behalf of JMC Groundwork Ltd in relation to the residential development at Bradley Mill, Wrexham.

This note aims to address a consultation response letter received on 11 June 2018 from Natural Resources Wales (NRW) on the current planning application at the site (Ref: P2018/0426). The letter raises the following principle concerns relating to flood risk:

- Based on the Development Advice Map, the building is partially located in Zone C2. Highly vulnerable development proposed within Zone C2 is contrary to paragraph 6.2 of TAN15 and should not be permitted by the Local Planning Authority.
- The Flood Consequences Assessment (FCA) submitted in support of the application was compiled in 2011 as part of a previous planning application. The FCA should be updated to demonstrate compliance with current guidelines.

1.2 Site Location and Details

The site is located off Barretts Hill at Ordnance Survey National Grid Reference SJ 325 543.

The River Alyn forms the western boundary of the site and flows in a south-easterly direction. The River Alyn is classified as a main river.

The Mill Race is located directly to the north of the site and is technically classified as a main river. However, due to the demolition of a weir which historically controlled flow in Mill Race, the channel has become inactive.

Based a topographic survey of the site (**Appendix A**), the building has a finished floor level of 51.42 m AOD.

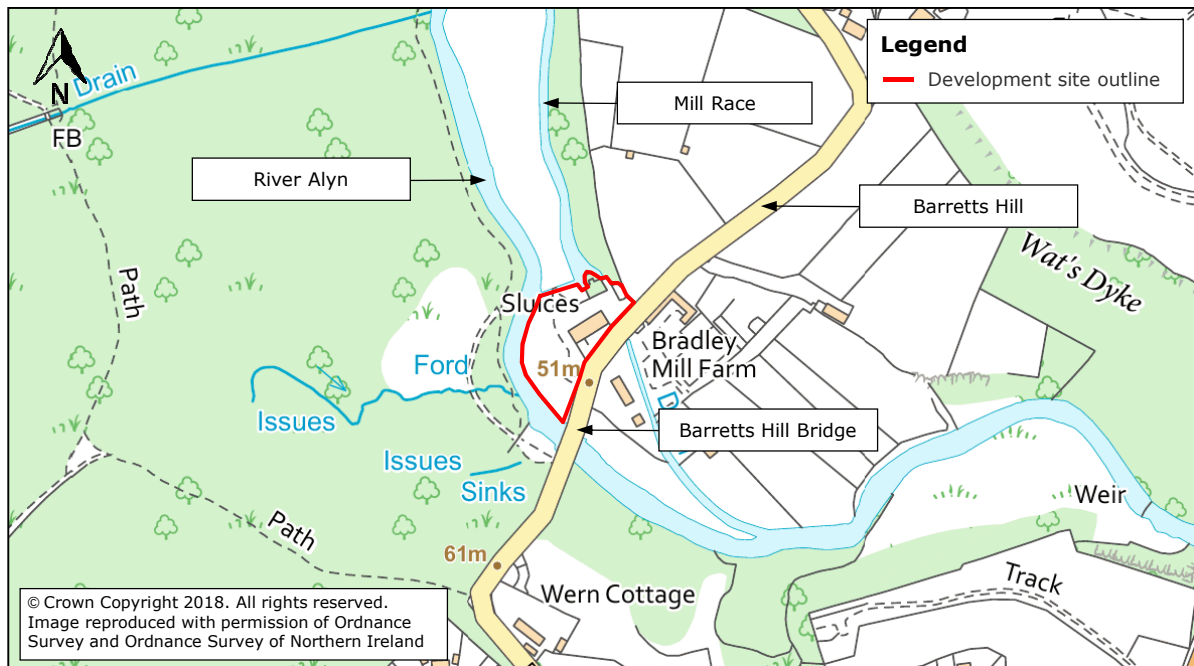


Figure 1: Site Location

2 Review of Flood Risk

2.1 Flood Zone Designation

According to the Development Advice Map (**Figure 2**) the site is located in Zone C2.

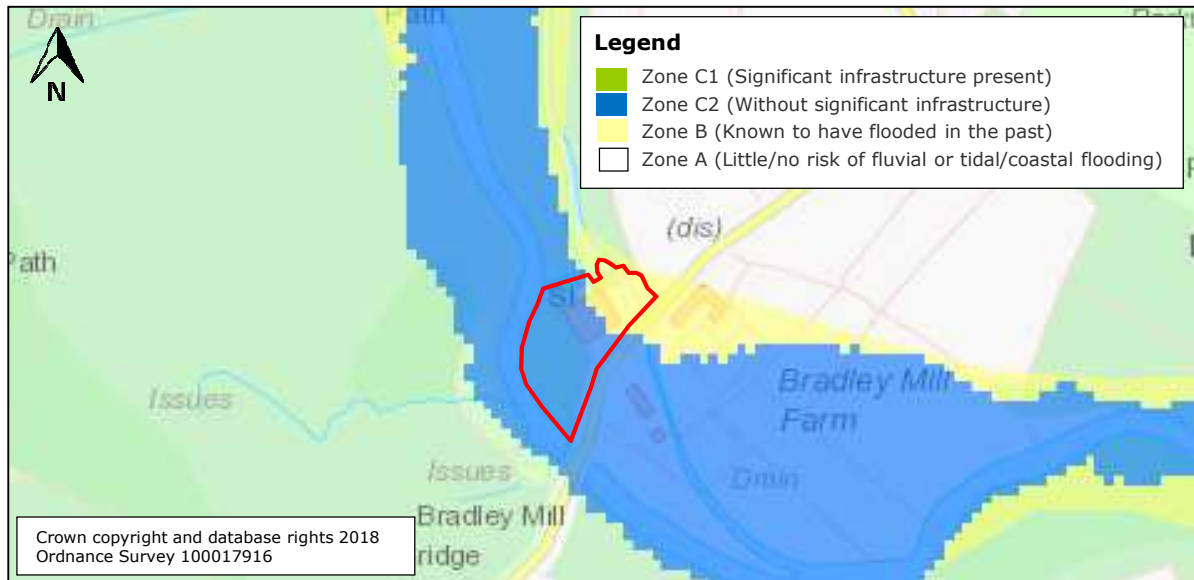


Figure 2: Development Advice Map
(Source: NRW website)

The Flood Risk Map (Rivers and Sea) (**Figure 3**) indicates that the site is located in the 1:100 fluvial annual probability flood outline, thereby supporting the sites Zone C2 designation.



Figure 3: Flood Risk Map (Rivers and Sea)
(Source: NRW website)

2.2 Hydraulic Modelling Study

The Hydraulic Modelling Study (HMS) of the River Alyn undertaken by Weetwood in 2011 showed the existing building to be located outside the 1:1,000 annual probability flood outline, and therefore not classified as Zone C2.

Since the HMS was first completed there have been some changes to best practice methodologies for hydrology and hydraulic modelling.

2.2.1 Model Updates

The following updates have been made to the existing Weetwood model of the River Alyn to accord with current guidance and policy:

- Update the model hydrology using the FEH statistical method
- Read in 2011 LiDAR data directly for the 2D domain (previously via a zpts file)
- Update the climate change allowances for the Dee River Basin to 20% and 45%, in accordance with 2016 Welsh Government guidance¹
- Update the bridge blockage proportions for Barretts Hill Bridge to 5% and 25%, in accordance with 2015 NRW guidance²
- Run the model in the latest versions of Flood Modeller and TUFLOW

2.2.2 Model Runs and Results

The following events have been modelled in order to assess the flood risk at the existing site during the baseline scenario:

- 1:100 annual probability event
- 1:100 + climate change (CC) (20%) annual provability event
- 1:100 +CC (45%) annual provability event
- 1:1,000 annual probability event

The model output plots illustrating the maximum flood extents and depths for the above events are provided in **Appendix B**.

Table 1 summarises the maximum level and depth of floodwaters expected on site and in the building during the aforementioned events.

Table 1: Flood Information (Baseline)

Annual Probability Event	Overall site		Building	
	Max Level (m AOD)	Max Depth (m)	Max Level (m AOD)	Max Depth (m)
1:100	50.70	0.87	No flooding	No flooding
1:100 +CC (20%)	51.01	1.16	No flooding	No flooding
1:100 +CC (45%)	51.27	1.43	No flooding	No flooding
1:1,000	51.32	1.48	No flooding	No flooding

The building is shown to remain dry during all of the aforementioned events. Therefore, based on the model outputs the building would be located outside Zone C2.

¹ <https://gov.wales/topics/planning/policy/policyclarificationletters/2016/cl-03-16-climate-change-allowances-for-planning-purposes/?lang=en>

² <http://www.naturalresources.wales/media/684120/ogn100-flood-risk-management-modelling-blockage-and-breach-scenarios.pdf>

Furthermore, safe access to the site could be provided to the north via Barretts Hill.

2.2.2.1 Blockage Scenario

The hydraulic model was also re-run to assess the impact of a blockage of Barretts Hill Bridge for the following scenarios:

- 1:100 +CC (20%) annual provability event – 5% bridge blockage
- 1:100 +CC (20%) annual provability event – 25% bridge blockage
- 1:1,000 annual probability event – 5% bridge blockage
- 1:1,000 annual probability event – 25% bridge blockage

This has been completed in accordance with latest guidance from NRW for assessing blockages. Given the size of the bridge, it is not deemed appropriate to consider a more significant blockage event.

The model output plots illustrating the maximum flood extents and depths for the above events are provided in **Appendix C**.

Table 2: Flood Information (Baseline) - Blockage

Annual Probability Event	Overall site		Building	
	Max Level (m AOD)	Max Depth (m)	Max Level (m AOD)	Max Depth (m)
<i>5% Blockage</i>				
1:100 +CC (20%)	51.21	1.39	No flooding	No flooding
1:1,000	51.46	1.67	No flooding	No flooding
<i>25% Blockage</i>				
1:100 +CC (20%)	51.36	1.56	No flooding	No flooding
1:1,000	51.65	1.83	51.54	0.12

Only minor flooding of the building would be anticipated during the 1:1,000 annual probability event plus a 25% bridge blockage, well below the tolerable depth outlined for residential developments in A1.15 of TAN15.

3 Conclusions

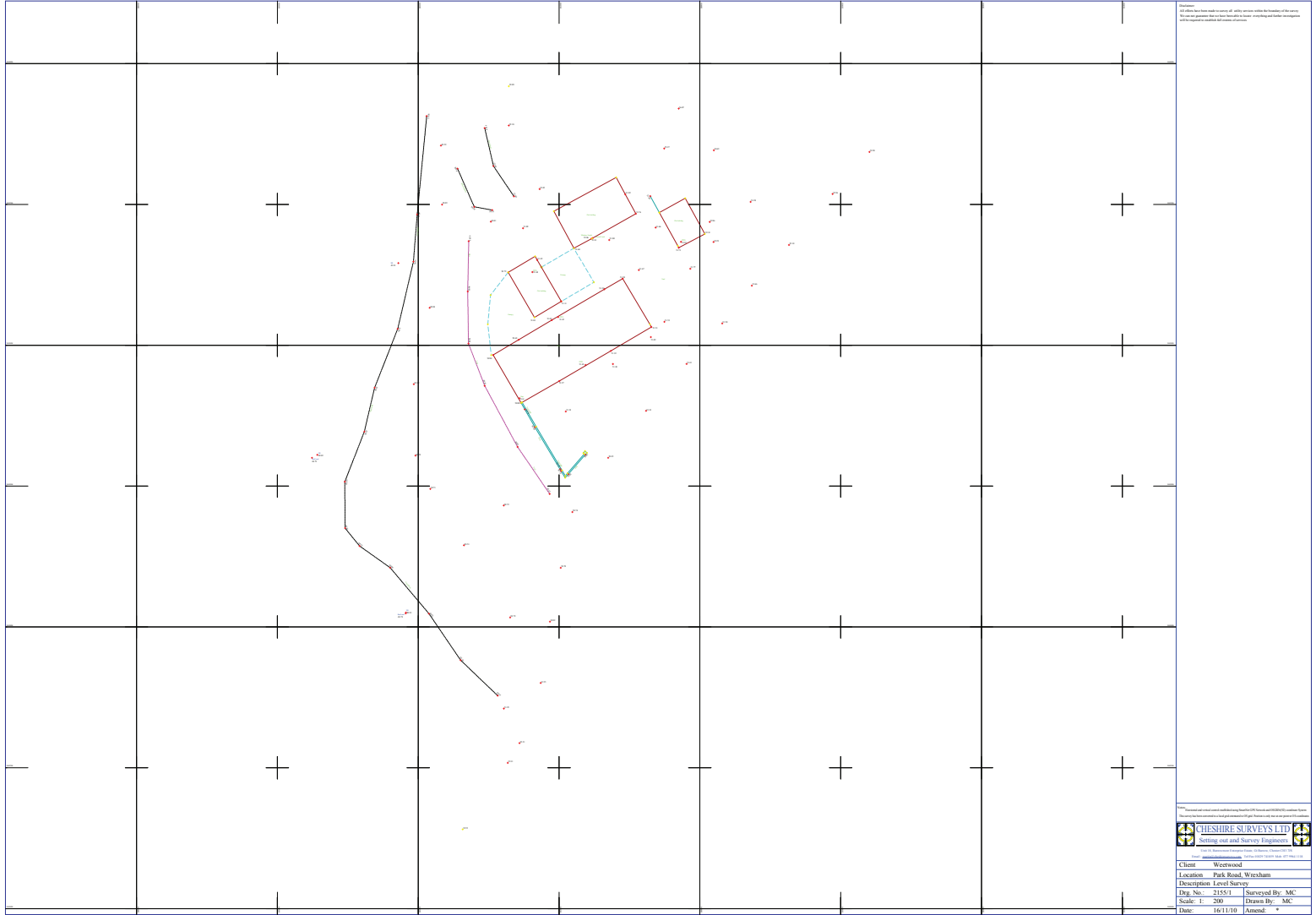
Following updates to the Weetwood model of the River Alyn the building is still shown to be located outside the 1:1,000 annual probability flood outline, and therefore outside Zone C2. As a result, the development would be located outside Zone C and application of the Justification Test should not be required.

Flooding of the building is only expected during the 1:1,000 annual probability event plus a 25% blockage of Barretts Hill Bridge, to a maximum depth of 0.12 m. The development would therefore be within the tolerances set out in A1.14 and A1.15 of TAN15.

This Initial Appraisal of Flood Risk therefore addresses the concerns raised in the NRW consultation response letter and indicates that the residential development may be considered acceptable in flood risk terms, in accordance with current guidance and policy.

APPENDIX A:

Topographic Survey



APPENDIX B:

Baseline Model Plots

Notes:

1. Do not scale from this drawing.

2. Map backdrop reproduced from Ordnance Survey digital map data. Crown Copyright under licence.

KEY:

Site Location

Depth (metres)

0.0 to 0.1

0.1 to 0.2

0.2 to 0.3

0.3 to 0.4

0.4 to 0.5

0.5 to 0.6

0.6 to 0.7

0.7 to 0.8

0.8 to 0.9

0.9 to 1.0

> 1.0

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Development • Planning • Environment

70 Cowcross Street

London

EC1M 6EJ

Tel: 0203 757 5444

Email: info@weetwood.net

Client:

JMC Groundworks Ltd.

Project Title:

Bradley Mill, Wrexham

Drawing Title:

Max Flood Depths: Baseline Scenario

1:100 AEP

Map Orientation:

N

W

E

S

Scale:

0

15

30

metres

Drawn:

DJ

Checked:

JC

Date:

4 January 2019

Drawing No:

1730_046_Q100_d

Rev:

B

The figure is a detailed map of the Bradley Mill Farm area, illustrating flood depths under a 1:100 AEP (Annual Exceedance Probability) scenario. A prominent red outline delineates a flooded region labeled 'Sluices', which is colored with a gradient from blue to red, indicating depths ranging from 0.0 to over 1.0 metres. A specific depth of 51m is noted within this area. The map also shows a 'Ford' and several 'Issues' and 'Sinks' locations. A dashed line represents a 'Path', and a 'Drain' is visible on the left. 'Wern Cottage' is situated on the right side of the map. A scale bar at the bottom right indicates distances of 0, 15, and 30 metres. The map backdrop is a grayscale Ordnance Survey digital map showing buildings, roads, and vegetation.

Notes:

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KEY:

Site Location

Depth (metres)

0.0 to 0.1

0.1 to 0.2

0.2 to 0.3

0.3 to 0.4

0.4 to 0.5

0.5 to 0.6

0.6 to 0.7

0.7 to 0.8

0.8 to 0.9

0.9 to 1.0

> 1.0

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Development • Planning • Environment

70 Cowcross Street

London

EC1M 6EJ

Tel: 0203 757 5444

Email: info@weetwood.net

Client:

JMC Groundworks Ltd.

Project Title:

Bradley Mill, Wrexham

Drawing Title:

Max Flood Depths: Baseline Scenario

1:100+CC (20%) AEP

Map Orientation:

Scale:

0 15 30 metres

Drawn:

DJ

Checked:

JC

Date:

4 January 2019

Drawing No:

1730_047_Q100_20CC_d

Rev:

B

The figure is a map of Bradley Mill Farm showing flood depths under a 1:100+CC (20%) AEP scenario. A red line outlines a specific area of interest, likely the sluices. The flood depth is represented by a color gradient from blue (0.0 to 0.1m) to red (>1.0m). The map includes various geographical features: a 'Ford' area, 'Issues' and 'Sinks' locations, 'Wern Cottage', and several 'Path' and 'Drain' lines. A scale bar at the bottom right shows distances of 0, 15, and 30 metres. The map backdrop is a standard Ordnance Survey digital map.

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KEY:

— Site Location

Depth (metres)

0.0 to 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.4
0.4 to 0.5
0.5 to 0.6
0.6 to 0.7
0.7 to 0.8
0.8 to 0.9
0.9 to 1.0
> 1.0

- Notes:
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- KEY:**
- Site Location
- Depth (metres)
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|------------|
| 0.0 to 0.1 |
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| 0.6 to 0.7 |
| 0.7 to 0.8 |
| 0.8 to 0.9 |
| 0.9 to 1.0 |
| > 1.0 |

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Depth (metres)

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- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- > 1.0

KEY:

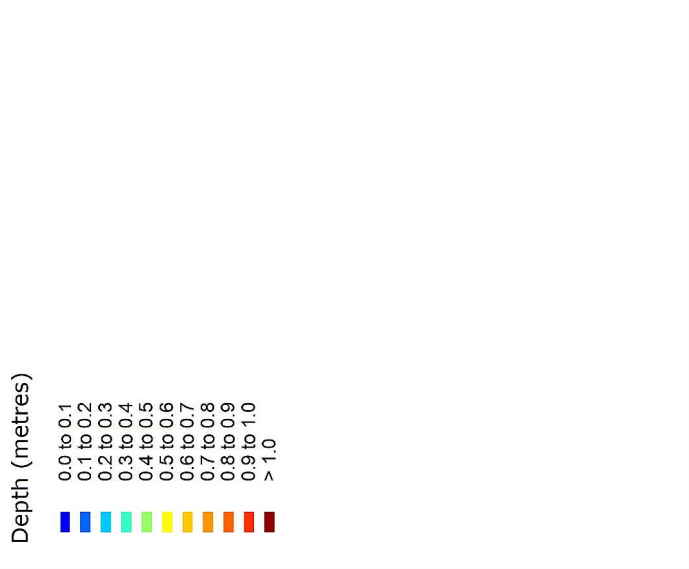
— Site Location

Depth (metres)

- 0.0 to 0.1
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- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- > 1.0

Depth (metres)

0.0 to 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.4
0.4 to 0.5
0.5 to 0.6
0.6 to 0.7
0.7 to 0.8
0.8 to 0.9
0.9 to 1.0
> 1.0



weetwood
Development • Planning • Environment

70 Cowcross Street
London
EC1M 6EJ

Tel: 0203 757 5444
Email: info@weetwood.net

weetwood
Development • Planning • Environment

70 Cowcross Street
London
EC1M 6EJ

Tel: 0203 757 5444
Email: info@weetwood.net

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Development • Planning • Environment

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London
EC1M 6EJ

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70 Cowcross Street
London
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Tel: 0203 757 5444
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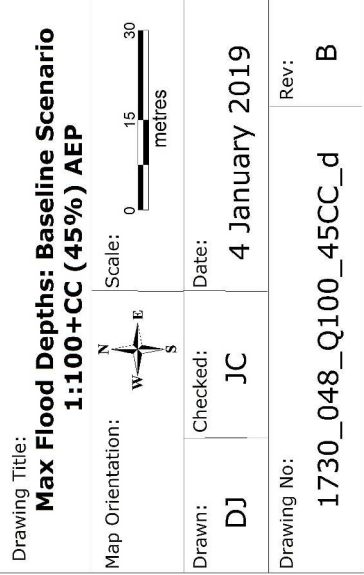
Project Title:

Bradley Mill, Wrexham

Drawing Title: Max Flood Depths: Baseline Scenario 1:100+CC (45%) AEP				Scale: 	
Map Orientation:					
Drawn:	DJ	Checked:	JC	Date:	4 January 2019
Drawing No:			Rev: 1730_048_Q100_45CC_d B		

Drawing Title: Max Flood Depths: Baseline Scenario 1:100+CC (45%) AEP				Scale: 	
Map Orientation:					
Drawn:	DJ	Checked:	JC	Date:	4 January 2019
Drawing No:			Rev: 1730_048_Q100_45CC_d B		

Drawing Title: Max Flood Depths: Baseline Scenario 1:100+CC (45%) AEP				Scale: 	
Map Orientation:					
Drawn:	DJ	Checked:	JC	Date:	4 January 2019
Drawing No:		1730_048_Q100_45CC_d		Rev:	B



Drawn: DJ	Checked: JC	Date: 4 January 2019
Drawing No: 1730_048_Q100_45CC_d		Rev: B

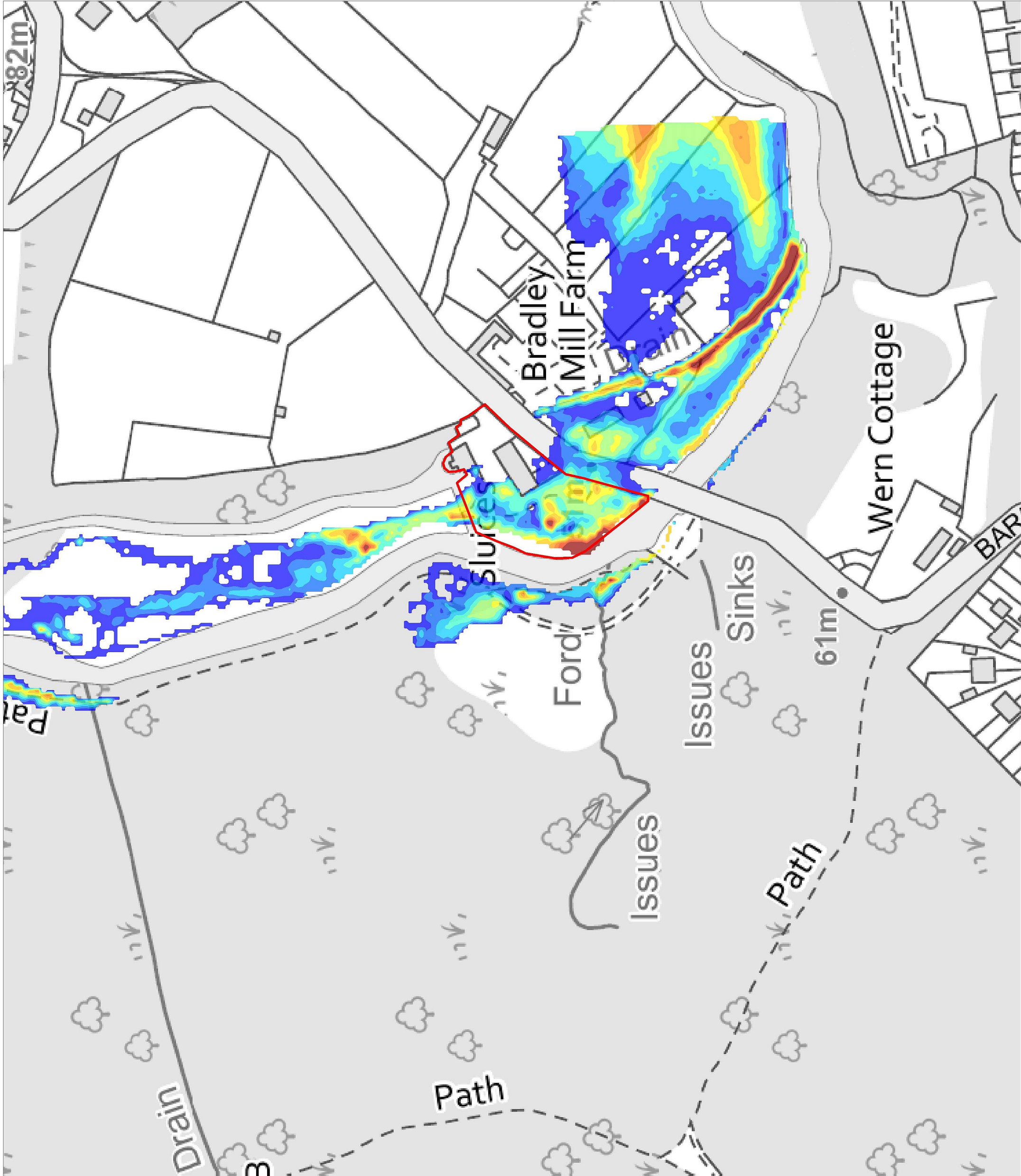
Drawn: DJ	Checked: JC	Date: 4 January 2019
Drawing No: 1730_048_Q100_45CC_d		Rev: B

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0.5 to 0.6

0.6 to 0.7

0.7 to 0.8

0.8 to 0.9

0.9 to 1.0

> 1.0

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Project Title:

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Drawing Title:

Max Flood Depths: Baseline Scenario
1:1,000 AEP

Map Orientation:

N

W

E

S

Scale:

0

15

30

metres

Drawn:

DJ

Checked:

JC

Date:

4 January 2019

Drawing No:

1730_049_Q1000_d

Rev:

B

This figure is a flood depth map for the Bradley Mill area in Wrexham. The map displays the site location (outlined in red) and surrounding features including Bradley Mill Farm, Wern Cottage, and various drainage paths. The flood depths are indicated by a color scale ranging from blue (0.0 to 0.1 metres) to red (> 1.0 metres). The map also includes labels for 'Issues', 'Sinks', 'Ford', 'Path', and 'Drain'. A scale bar indicates distances up to 30 metres, and a north arrow is provided for orientation.

APPENDIX C:

Baseline Model Plots – Blockage

Notes: 1. Do not scale from this drawing. 2. Map backdrop reproduced from Ordnance Survey digital map data. Crown Copyright under licence.		KEY: Site Location Depth (metres) 0.0 to 0.1 0.1 to 0.2 0.2 to 0.3 0.3 to 0.4 0.4 to 0.5 0.5 to 0.6 0.6 to 0.7 0.7 to 0.8 0.8 to 0.9 0.9 to 1.0 > 1.0		Weetwood Development • Planning • Environment 70 Cowcross Street London EC1M 6EJ Tel: 0203 757 5444 Email: info@weetwood.net		Client: JMC Groundworks Ltd.	Project Title: Bradley Mill, Wrexham	Drawing Title: Max Flood Depths: Blockage Scenario(5%) 1:100+CC (20%) AEP	Map Orientation: Scale: 0 15 30 metres N W E S	Drawn: DJ	Checked: JC	Date: 4 January 2019	Drawing No: 1730_050_Q100_20CC_BLK05_d	Rev: A
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KEY:

Site Location

Depth (metres)

0.0 to 0.1

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0.6 to 0.7

0.7 to 0.8

0.8 to 0.9

0.9 to 1.0

> 1.0

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Development • Planning • Environment

70 Cowcross Street

London

EC1M 6EJ

Tel: 0203 757 5444

Email: info@weetwood.net

Client:

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Project Title:

Bradley Mill, Wrexham

Drawing Title:

Max Flood Depths:

Blockage Scenario(5%)

1:1,000 AEP

Map Orientation:

Scale:

0 15 30 metres

Drawn:

DJ

Checked:

JC

Date:

4 January 2019

Drawing No:

1730_051_Q1000_BLK05_d

Rev:

A

The figure is a flood depth map overlaid on a site plan. The map shows various features including buildings, roads, and natural elements like trees and a drain. A color-coded overlay indicates flood depths, with a legend on the right side of the page defining the scale from 0.0 to 1.0+ metres. The colors range from blue (shallowest) to red (deepest). A red outline highlights a specific area of interest, likely the 'Sluices' mentioned in the labels. Other labels include 'Bradley Mill Farm', 'Wern Cottage', 'Ford', 'Issues', 'Sinks', 'Path', and 'Drain'. The map also includes a scale bar and a north arrow.

Notes:

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KEY:

Site Location

Depth (metres)

0.0 to 0.1

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0.5 to 0.6

0.6 to 0.7

0.7 to 0.8

0.8 to 0.9

0.9 to 1.0

> 1.0

Weetwood

Development • Planning • Environment

70 Cowcross Street

London

EC1M 6EJ

Tel: 0203 757 5444

Email: info@weetwood.net

Client:

JMC Groundworks Ltd.

Project Title:

Bradley Mill, Wrexham

Drawing Title:

Max Flood Depths:

Blockage Scenario(25%)

1:100+CC (20%) AEP

Map Orientation:

N

W

E

S

Scale: 0 15 30 metres

Drawn:

DJ

Checked:

JC

Date:

4 January 2019

Drawing No:

1730_050_Q100_20CC_BLK25_d

Rev:

A

A detailed flood depth map of the Bradley Mill Farm area. The map uses a color-coded scale to represent flood depths in metres, ranging from 0.0 to over 1.0. Key features include a red-outlined area labeled 'Sluices', a 'Ford' area, 'Sinks', a 'Path', a 'Drain', and 'Wern Cottage'. The map also shows various buildings, roads, and vegetation. A scale bar indicates distances up to 30 metres, and a north arrow is present. The map is titled 'Bradley Mill Farm' and includes a 'Max Flood Depths: Blockage Scenario(25%) 1:100+CC (20%) AEP' legend.

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KEY:

Site Location

Depth (metres)

0.0 to 0.1

0.1 to 0.2

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0.4 to 0.5

0.5 to 0.6

0.6 to 0.7

0.7 to 0.8

0.8 to 0.9

0.9 to 1.0

> 1.0

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70 Cowcross Street
London
EC1M 6EJ

Tel: 0203 757 5444
Email: info@weetwood.net

Client:

JMC Groundworks Ltd.

Project Title:

Bradley Mill, Wrexham

Drawing Title:

Max Flood Depths:
Blockage Scenario(25%)
1:1,000 AEP

Map Orientation:

N

W

E

S

Scale:

01530metres

Drawn:

DJ

Checked:

JC

Date:

4 January 2019

Drawing No:

1730_051_Q1000_BLK25_d

Rev:

A

A detailed flood depth map for a 1:1,000 AEP blockage scenario. The map shows a color-coded area of flooding, with colors ranging from blue (0.0 to 0.1 metres) to red (> 1.0 metres). The flooding is concentrated around a central area labeled 'Sluices', which is outlined in red. To the north of the sluices is 'Bradley Mill Farm'. To the south is a 'Ford'. The map also shows 'Issues' and 'Sinks' areas, a 'Path', and a 'Drain'. A scale bar indicates 61m. The map is overlaid on a grey background showing buildings, roads, and trees.



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