Belstead Brook Climate Change Modelling

Ipswich Borough Council

Project number: 60612179

March 2020

Quality information

Prepared by	Checked by	Verified by	Approved by
Chris Barnes Senior Engineer	Sarah Littlewood Principal Consultant	Emily Craven Associate Director	Emily Craven Associate Director

Revision History

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1	31/03/2020	Revision 1	EC	Emily Craven	Associate Director

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Prepared for:

Ipswich Borough Council

Prepared by:

AECOM Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

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Belstead Brook Climate Change Modelling

1.1 Introduction

1.1.1 AECOM was commission by Ipswich Borough Council (BC) to update the Ipswich BC Strategic Flood Risk Assessment (SFRA).

1.1.2 As part of this commission, the Belstead Brook model, completed by JBA Consulting in August 2015, was obtained from the Environment Agency and re-run to adopt the latest climate change allowances as set out in the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG).

1.1.3 The Bestead Brook is located in Suffolk and flows in a south-easterly direction from its source near Naughton village (NGR TM 02762 49320) to its confluence with the Orwell Estuary in southern Ipswich (NGR TM 16488 42107).

1.1.4 The model for the Belstead Brook was developed by JBA Consulting in 2015 as part of Lot 1 of the Water and Environment Framework (WEM). The model is a 1D/2D fully linked ISIS/TUFLOW model.

1.2 Comparison with Previous Modelling

1.2.1 The 1% AEP event from the 2015 model was re-run in the latest builds of Flood Modeller Pro and TUFLOW to capture any variation in the results as a result of changes in the software versions. The model was originally run in ISIS v6.7.0.110 and TUFLOW v2013-12-AD-iSP-w64. The re-runs of the model were done with Flood Modeller Pro v4.5.1.6163 and TUFLOW v2018-03-AE-iSP-w64.

1.2.2 A comparison of the supplied 1% AEP results (2015) with the 1% AEP results from the re-run (2020) showed some significant differences in the flood levels. The levels in the re-run model were shown to be higher. The most significant increases were between the railway and the A137 with increases over 300mm. A review of the 2D_MB result file from TUFLOW showed that the peak inflow and outflow from the TUFLOW 2D model domain were different at the peak when compared with the results provided. Checks against the inflow hydrology showed no difference in the models as expected.

1.2.3 Despite the difference in flood levels, the flood extent is very similar to the supplied outline with the largest increases in flood extent in the range of 6-7m. The differences in the flood levels may be partly explained by updates to the TUFLOW and Flood Modeller engines developed since the build of the original model.

1.2.4 The differences between the two sets of results for the 1% AEP event are shown in Appendix A Figure 1.

1.2.5 The purpose of this model re-run is to update flood extents to include climate change allowances for strategic planning purposes. With this in mind, and the results showing similar flood extents, the difference in levels is not considered to significantly impact the results of the updated climate change runs.

1.3 Climate Change Allowances

1.3.1 When it was developed in 2015, the Belstead Brook model was run with a 20% allowance for climate change in accordance with the relevant guidance at that time. To bring the model in line with the current guidance[1] published by the Environment Agency, the climate change allowances have been updated.

1.3.2 Climate change allowances of relevance to the study area are those for the Anglian River Basin District. As shown in Table 1 AECOM has run the model with the 25%, 35% and 65% allowances. A 20% allowance has also been run to allow for comparison with previous results.

[1] Flood Risk Assessments: Climate Change Allowances (2020) https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Table 1 - Adopted Climate Change Allowances

River Basin District	Allowance Category	Total Potential Change Anticipated for the '2020s' (2015-2039)	Total Potential Change Anticipated for the '2050s' (2040-2069)	Total Potential Change Anticipated for the '2080s' (2070-2115)
Anglian	Upper End	25%	35%	**65%**
	Higher Central	15%	20%	**35%**
	Central	10%	15%	**25%**

Note: Climate change allowances adopted in this study are identified in bold.

1.3.3 The peak flows for the 1% AEP event were scaled up by 25%, 35% and 65% for the three climate change scenarios and the resulting flows were revised in the IED files in Flood Modeller. The resulting flow peaks at each inflow location have been summarised in Table 2.

Table 2 - Peak Inflows for Modelled Events

Inflow Node	Peak Flows (m^3/s)				
	1% AEP	1% AEP + 20%	1% AEP + 25%	1% AEP + 35%	1% AEP + 65%
BB_02	2.8	3.3	3.5	3.8	4.6
BB_03	4.9	5.9	6.1	6.6	8.1
BB_04	8.7	10.4	10.9	11.7	14.4
BB_05	8.4	10.1	10.5	11.3	13.9
BB_06	8.1	9.7	10.1	10.9	13.4
BB_07	9.4	11.3	11.8	12.7	15.5
BB_08	9.9	11.9	12.4	13.4	16.3
BB_09	10	12.0	12.5	13.5	16.5
UT_01	1.5	1.8	1.9	2.0	2.5
UT_02	2.6	3.1	3.3	3.5	4.3
UT_03	2.0	2.4	2.5	2.7	3.3

1.4 Model Updates

1.4.1 Initial model runs using the updated climate change allowances resulted in model instability which caused the simulations to crash. These issues often occurred around key structures. Some changes were made to the model to improve model stability at key structures and in the floodplain. These changes are captured in the BELS_024_CC.DAT file which has only been used to run the models with the updated climate change allowances. The model updates included the following:

- On the orifice tab of all the bridges, orifice flow when surcharging has been turned on (was activated on a handful of structures already). Where this was turned on, 0.05m was applied as the lower and upper transition differences.
- At bridges the embankment markers were used to smooth inconsistent conveyance curves.
- dFLood was set to 10m. dFlood was originally at 3m with the additional climate change allowances the flood level was exceeding this threshold.
- Manning's 'n' roughness patches which were provided for the existing 0.1% AEP + Climate Change were applied in all updated climate change runs.

1.4.2 The updated models run successfully to completion. The plots showing the model convergence are comparable to those for the 2015 model that was provided to AECOM by the Environment Agency.

1.5 Updated Flood Extents

1.5.1 Appendix A Figure 2 shows the flood extents of the 1% AEP model run with the updated climate change allowances described in Section 1.3.

Appendix A Figures

Figure 1 Flood level comparison 1% AEP: Supplied vs. Re-Run Results

Figure 2 1% AEP Flood Extents including 25%, 35% and 65% climate change

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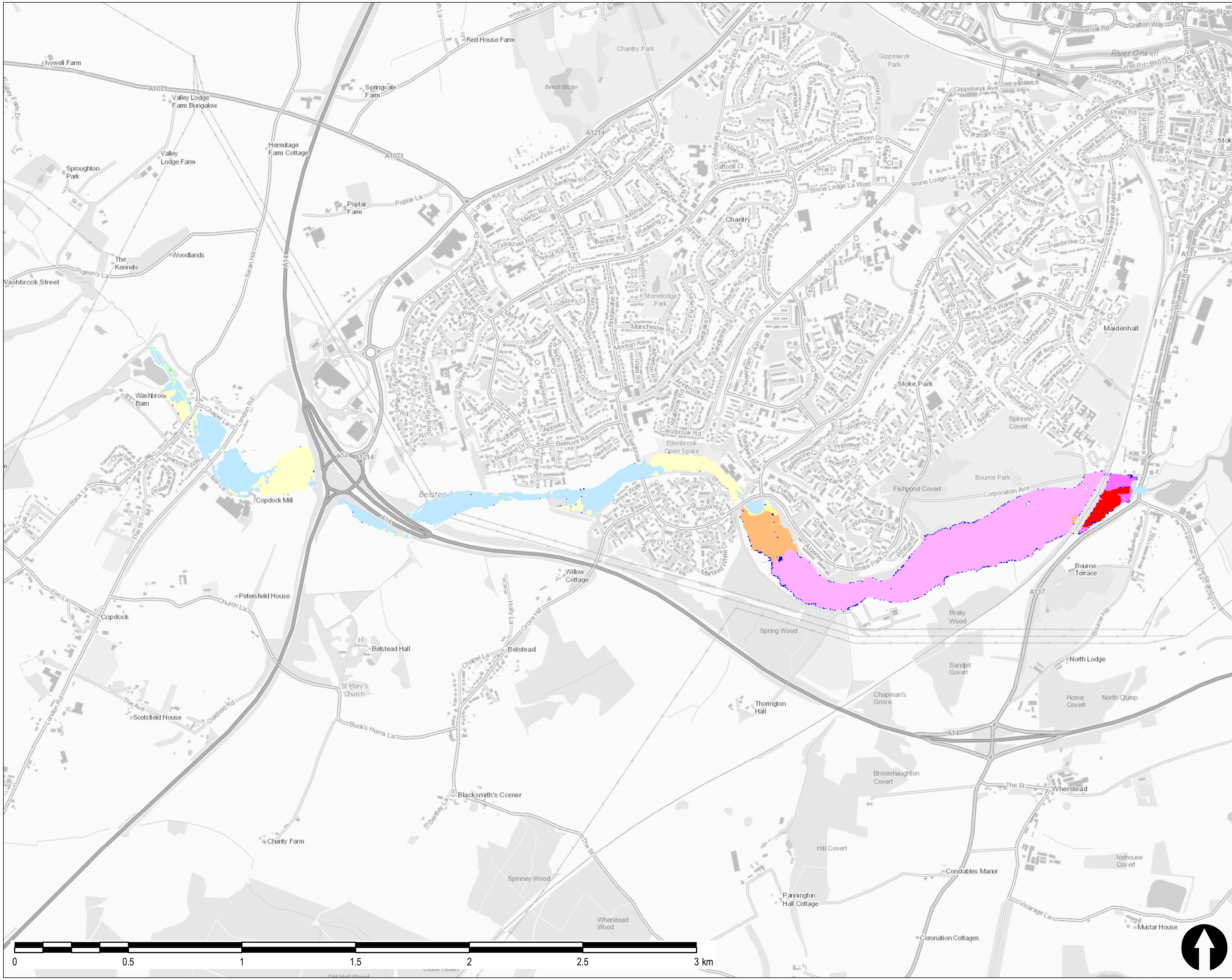

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LEGEND

Flood Level Difference (mm)

- > -300
- -200 to -300
- -100 to -200
- -50 to -100
- -20 to -50
- -5 to -20
- -5 to 5
- 5 to 20
- 20 to 50
- 50 to 100
- 100 to 200
- 200 to 300
- > 300
- Was Wet - Now Dry
- Was Dry - Now Wet

Drawing Status

DRAFT

Client

IPSWICH BOROUGH COUNCIL

Project Title

IPSWICH LEVEL 1 SFRA

Drawing Title

BELSTEAD BROOK FLOOD LEVEL COMPARISON 1% AEP EVENT SUPPLIED VS RE-RUN RESULTS

Drawn	Checked	Approved	Date
CB	SL	EC	31/03/2020

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60612179	1:15,000

AECOM
Sunley House
4 Bedford Park
Croydon, CR0 2AP
Telephone 020 8639 3500
www.aecom.com

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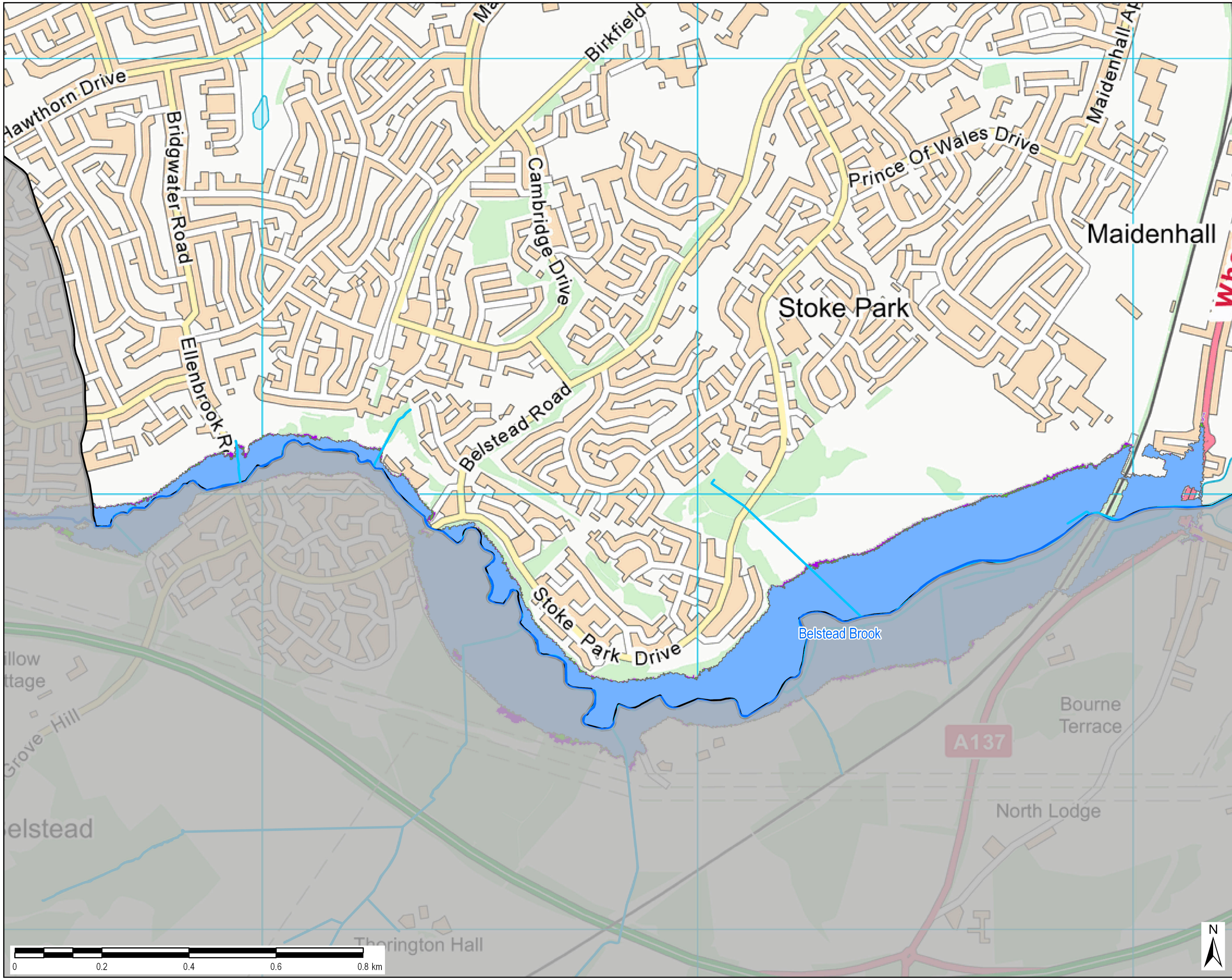
Rev: 1



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Legend

- Borough Boundary
- Main Rivers
- Ordinary Watercourses
- 1% AEP + 25% CC (1 in 100 year plus 25% climate change)
- 1% AEP + 35% CC (1 in 100 year plus 35% climate change)
- 1% AEP + 65% CC (1 in 100 year plus 65% climate change)

Notes

1.This map shows the Modelled Flood Outlines for the Belstead Brook and its tributaries.
2. The modelling outlines included on this mapt include climate change allowances for the 1 in 100 year event.

Purpose of Issue: DRAFT

Client: IPSWICH BOROUGH COUNCIL

Project Title: IPSWICH LEVEL 1 SFRA

Drawing Title: BELSTEAD BROOK FLOOD EXTENTS INCLUDING CLIMATE CHANGE

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AECOM
Midpoint
Alençon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.aecom.com

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FIGURE 2	01

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