NOTE TO FILE

JBA Project Code	2016s4927
Contract	Ashford Climate Change Runs
Client	Ashford Borough Council
Day, Date and Time	28 February 2017
Author	Georgina Latus
Subject	Ashford Climate change runs

1 Introduction

JBA Consulting was commissioned by Ashley Taylor, on behalf of Ashford Borough Council, to prepare updated flood risk mapping of climate change within the borough using available hydraulic models. The mapping outputs were required to reflect the new climate change guidance published by the Environment Agency on 19 February 2016. The outputs from the updated hydraulic modelling will be used to support the Ashford Borough Council Strategic Flood Risk Assessment (SFRA) published in July 2014 and the emerging Local Plan covering the period between 2011 and 2030.

The purpose of this Note to File is to provide a short report of the work undertaken to update the hydraulic modelling of the Borough. The deliverables supplied as part of the modelling updates are:

- Hydraulic model input and output files.
- Raw and cleaned flood extents for the updated 1 in 100-year plus climate change events (Esri format)
- Gridded outputs for maximum flood depth, velocity, water level, hazard rating (Ascii format):
- Tabulated peak water levels and flows from the 1D models
- Updated flood risk maps (replacing the 1 in 100-year plus climate change mapping in Appendix E of the SFRA)

2 Existing hydraulic modelling

As detailed in the 2014 SFRA, there are numerous watercourses that flow through Ashford Borough which form a source of flood risk. As a result, several hydraulic models have been developed to assess the risk of fluvial flooding across the borough. The models covering the borough include:

- Hamstreet;
- Great Stour through to Ashford Town;
- Great Stour (Wye to Thannington);
- Bethersden Stream;
- RADIS (Rother Area Stream Drainage Improvement Study); and
- Various JFlow models covering Brook Street, upper River Beult, East Stour and Upper Great Stour (upstream of Hothfield).

The Environment Agency are therefore in the process of submitting funding bids to complete this work as Flood and Coastal Risk Management (FCRM) projects for the RADIS and various JFlow models. The Environment Agency also stated that it is unlikely that any site allocations within Ashford Borough's emerging Local Plan will be located within the relatively small flood extents of the Bethersden Stream model.

It was therefore recommended that modelling updates were undertaken for the Hamstreet, Great Stour through to Ashford Town and Great Stour (Wye to Thannington) models only as part of this study on behalf of Ashford Borough Council.

A copy of the hydraulic models (Products 5 and 7) were provided and licensed by the Environment Agency for the purposes of this study. The details of each model provided are included in Table 2-1.

Table 2-1: Details of hydraulic models within Ashford Borough

Model name	Model description	Watercourses	Representation
Hamstreet Fluvial Model (June, 2011)	Model of the Speringbrook Sewer in Hamstreet developed by Capita Symonds with Scott Wilson in June 2011 to help understand the area that benefits from the 2007 Flood Alleviation Scheme on Bradbourne Lane.	Speringbrook Sewer from Bourne Wood to the confluence with the Royal Military Canal.	1D_2D linked ISIS-ESTRY-TUFLOW model
Ashford Fluvial Model (May, 2012)	Model of the Great Stour and tributaries across the Ashford area developed by JBA Consulting in May 2012 to improve model stability of the original 2010 South Ashford 2D modelling study.	Great Stour through to Ashford, as well as the Whitewater Dyke, Ruckinge Dyke, the East Stour and Aylesford Stream.	1D-2D linked ISIS-TUFLOW model
Great Stour (Wye to Thannington) Fluvial Model 1 (March, 2013)	Two hydrodynamic models of the Great Stour between Wye and Forwich developed by JBA Consulting in March 2013 as part of the Great Stour Flood Risk Mapping Study.	Model 1 covers the Great Stour from the M20 downstream of Ashford near Wye to the A2 road crossing at Thannington south of Canterbury. Only Model 1 was provided for the purposes of this study.	1D-2D linked ISIS-TUFLOW model

3 Environment Agency Climate Change Allowances (19 February 2016)[1]

Updated guidance for considering climate change in Flood Risk Assessments (FRAs) and SFRAs was published by the Environment Agency on the 19 February 2016. The new guidance supports the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance on Flood Risk and Coastal Change (PPG) and relate to the following elements of flood risk:

- Peak river flow
- Peak rainfall intensity
- Sea level
- Offshore wind speed
- Extreme wave height

Of importance for this assessment is the guidance relating to changes in peak river flows.

In addition to the change bought about by a changing climate, the new guidance also provides further information of the following issues that must now be considered as part of an assessment:

- The river basin district within which the assessment is located;
- The lifetime of the development being considered (the 'epoch' at which climate change influences have taken place); and
- The type of development being considered (based on planning policy – higher climate change impacts require testing for higher vulnerability classes of development)

Although Ashford Borough is located within both the South East and Thames river basin districts, all of the modelled watercourses (apart from a section of the Whitewater Dyke) are located within the South East River basin district. Therefore, the allowances for the South East river basin district have been used to assess the impact of climate change on fluvial flood risk across the borough. The climate change allowances for the South East river basin district is shown in Table 3-1.

[1] Environment Agency, (February, 2016), Flood risk assessments: climate change allowances

For the purposes of this study, the hydraulic modelling has been updated using all three allowance categories for the South East river basin district. In line with the Environment Agency's planned hydraulic updates, the hydraulic modelling has only been updated for the 2080s (2070 to 2115) planning epoch.

Table 3-1: Peak river flow climate change allowances for the South East river basin district

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)
South East	Upper End	25%	50^	105%
	High Central	15%	30%	45%
	Central	10%	20%	35%

3.1 Hydrology

No additional hydrological assessments were undertaken as part of this study. Therefore, the existing hydrology estimates provided in each model were used to update the peak river flows to account for the impact of climate change. In line with the allowances detailed in Table 3-1, the peak flow estimates for the design 1% AEP event in each model were updated increased by 35%, 45% and 105% respectively.

The updated peak river flow estimates for each model are provided in Appendix A.

It should, however, be noted that the South East river basin district allowances are larger than those for the Thames river basin district. This follows the research conducted by DEFRA and the Environment Agency in 2010 (FD2648[2]) which looked at the range of responses for 155 catchments across England and Wales under the UKCP09 probabilistic scenarios for climate change (medium and high emissions only), and found that the level of risk can vary substantially between river basin regions[3].

Given that a section of the modelled Whitewater Dyke is located within the Thames river basin district, it is considered that the allowances used to update the hydraulic modelling across Ashford will provide somewhat conservative results regarding fluvial flood risk from the Whitewater Dyke.

4 Baseline models

4.1 Hamstreet fluvial model

The flood risk modelling for the Hamstreet area utilised the Hamstreet ABD and Hazard Mapping study model originally developed in June 2011 by Capita Symonds and Scott Wilson for the Environment Agency. The hydraulic model consists of a linked 1D-2D model, whereby the ISIS 1D network was used to define within bank flows of the Speringbrook Sewer and its tributaries, and the single 2D TUFLOW domain was used to model the out-of-bank floodplain flows.

The model was originally run for the 50%, 20%, 5%, 2%, 1.3%, 1%, 1% plus climate change, 0.4%, and the 0.1% AEP design events.

4.1.1 Model scenarios and simulations

The existing design event ISIS Data file (Ham_0000F_29.DAT) was retained for the purposes of this study but the 1% AEP ISIS Event file (Hamstreet_100.ied) was updated with the flows in Appendix A for each climate change allowance for the South East river basin district.

One of the main objectives of the original modelling study was to establish the area that benefits from the Flood Alleviation Scheme constructed in 2007. The scheme involved the construction of a flood wall on

[2] Joint DEFRA/EA Flood and Coastal Erosion Risk Management R&D Programme, (May 2011), Practicalities for implementing regionalised allowances for climate change on flood flows
[3] Environment Agency, (September, 2011), Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (Ref LIT 5707) – Annex 1: provision of climate change allowances

Bourne Lane; the location and extent of which was agreed with the Environment Agency in 2010. The model therefore includes the defence and was run for both the defended and undefended scenarios.

As such, the 1 % AEP ISIS Run files were also updated to include the new event data for each climate change allowance, and the model was run for both the undefended and defended scenarios. It should be noted that "_ND_" and "_WD_" indicate the undefended and defended runs respectively.

4.1.2 Isis run parameters

In line with the original design event modelling, the model was simulated with a 3s 1D (ISIS) time step and a 1.5s 2D (TUFLOW) time step. This differs from the convention that the ISIS time step is typically half the 2D time step, and the 2D time step is no larger than half of the 2D grid cell size in metres (3m). However, following the blockage testing undertaken by JBA Consulting in June 2016 on the Speringbrook Sewer, very little difference was found in the modelled results when more conventional time steps were tested. Therefore, the original time steps were retained for the purposes of this study.

Similar to the blockage testing undertaken by JBA Consulting in June 2016, the versions of ISIS and TUFLOW used to simulate the model was updated to ISIS 3.7.2 and TUFLOW 2013-12-AE. Both were simulated with single precision versions of the software.

Details of the original and updated model files are included in **Table 4-1**.

Table 4-1: Updated model simulation file names for the Hamstreet fluvial model (June, 2011)

File type	File name	
ISIS Data File	Ham_0000F_29.dat	
ISIS Event File	1% AEP event	Hamstreet_100.ied
	1% AEP plus climate change (35%) event	Hamstreet_100_CC_35.ied
	1% AEP plus climate change (45%) event	Hamstreet_100_CC_45.ied
	1% AEP plus climate change (105%) event	Hamstreet_100_CC_105.ied
ISIS Run File	1% AEP event	Ham_0100F_ND_i029_t015.ief Ham_0100F_WD_i029_t015.ief
	1% AEP plus climate change (35%) event	Ham_0100F_CC_35_ND_i029_t015.ief Ham_0100F_CC_35_WD_i029_t015.ief
	1% AEP plus climate change (45%) event	Ham_0100F_CC_45_ND_i029_t015.ief Ham_0100F_CC_35_WD_i029_t015.ief
	1% AEP plus climate change (105%) event	Ham_0100F_CC_105_ND_i029_t015.ief Ham_0100F_CC_35_WD_i029_t015.ief
TUFLOW Control Files	1% AEP event	Ham_0100F_ND_015.tcf Ham_0100F_WD_015.tcf
	1% AEP plus climate change (35%) event	Ham_0100F_CC_35_ND_015.tcf Ham_0100F_CC_35_WD_015.tcf
	1% AEP plus climate change (45%) event	Ham_0100F_CC_35_ND_015.tcf Ham_0100F_CC_35_WD_015.tcf
	1% AEP plus climate change (105%) event	Ham_0100F_CC_35_ND_015.tcf Ham_0100F_CC_35_WD_015.tcf

4.2 Ashford fluvial model

The flood risk modelling for Ashford utilised the Ashford ABD and Hazard Mapping study model, originally developed in 2010 by Mott MacDonald for the Environment Agency, partially updated in 2012 by JBA.

Two versions of the modelling were available from the original study:

- Version 1 – a hydraulic model which is fully 1D-2D (channel-floodplain) linked throughout the study area, used for all events except for the 0.1% AEP events.
- Version 2 – a hydraulic model for the 0.1% AEP event which involves simplification of the modelling along Whitewater Dyke where notable model instability arose. In this area, the 1D-2D links terminate and a 2D only representation of the channel and floodplain continues between Ashford Road and the confluence of Whitewater Dyke with the East Stour (which also has a 2D only schematisation for the circa 360m upstream of the A2042).

The models were originally run for the 10%, 5%, 2%, 1%, 1% plus climate change, and 0.1% AEP design events.

4.2.1 Model scenarios and simulations

Initial testing of the updated climate change flow events within the model version 1 (which was also used for the previous 1% AEP plus climate change (20%) event), resulted in notable instabilities in the area that is simplified within model version 2 used for the 0.1% AEP event. Therefore, model version 2 with the 2D representation of the Whitewater Dyke (the 0.1% AEP event model) was taken forward in order to update the climate change modelling and mapping for Ashford.

It is notable that the previous study did not simulate a defended scenario for the 0.1% AEP event. Therefore, it was necessary to make several adjustments to the undefended scenario for the 0.1% AEP event model to reflect the defended scenario:

- Update the ISIS model to include the defended case hydrology inputs;
- Update the ISIS model to include the SPILL unit representing the link channel between the Great Stour and East Stour upstream of the railway line in Ashford; and
- Update the TUFLOW Geometry Control file to include defence Z-Lines which are deactivated in the undefended scenario. The TUFLOW Geometry Control file also reads in different bank Z-Lines files for the rest of the model which were updated.

4.2.2 Isis run parameters

In line with the previous study, the modelling was completed using ISIS version 3.5.1 (single precision) and TUFLOW Build 2011-09-AF-iSP-w32.

The time steps used for the previous flood risk modelling were 1s and 2s for ISIS and TUFLOW, respectively. However, in order to stabilise the model further, the time steps were reduced to 0.5s and 1.0s for ISIS and TUFLOW respectively for all undefended 1% AEP plus climate change events as well as the 1% AEP plus climate change (105%) defended event.

Details of the original and updated model files are included in **Table 4-2**.

4.2.3 Climate change flood flows from Aldington and Hothfield Flood Storage Areas

Aldington and Hothfield Flood Storage Areas (FSAs) impound flows during times of flood to reduce the flow passing downstream along the East Stour and Great Stour, respectively. To derive hydrological inputs to these watercourses for the defended scenario events in the 2010 study, separate models were constructed which explicitly included the presence of these reservoirs (ISIS Data File: ASH_1Dfor2D_def_v022_resinf.dat). To prepare defended case hydrological inputs, the Great Stour and East Stour channels were extracted from this model and hydrological inputs (scaled up by the relevant flow allowances) were implemented upstream of the FSAs. A time-series of flow vs time was then extracted downstream of each FSA for each event, which formed the upstream inflow for that watercourse.

Table 4-2: Updated model simulation file names for the Ashford fluvial model (May, 2012)

File type	File name	
ISIS Data Files	ASH_1Dfor2D_undef_v022_MU_008_1000yr.dat (undefended case) ASH_1Dfor2D_def_v022_MU_008_1000yr.dat (defended case)	
ISIS Event Files	1% AEP event	ReFH_Hydrographs_v22_Undef_D0100_csd051_sc085.ied ReFH_Hydrographs_v22_Def_D0100_csd051_sc085.ied
	1% AEP plus climate change (35%) event	ReFH_Hydrographs_v22_Undef_D0100_CC_35_csd051_sc085.ief ReFH_Hydrographs_v22_Def_D0100_CC_35_csd051_sc085.ied
	1% AEP plus climate change (45%) event	ReFH_Hydrographs_v22_Undef_D0100_CC_45_csd051_sc085.ief ReFH_Hydrographs_v22_Def_D0100_CC_45_csd051_sc085.ied
	1% AEP plus climate change (105%) event	ReFH_Hydrographs_v22_Undef_D0100_CC_105_csd051_sc085.ief ReFH_Hydrographs_v22_Def_D0100_CC_105_csd051_sc085.ied
ISIS Run File	1% AEP event	Ash_100yr_Undef_MU009.ief
	1% AEP plus climate change (35%) event	Ash_100yr_CC_35_Def_MU009.ief Ash_100yr_CC_35_Undef_MU009.ief
	1% AEP plus climate change (45%) event	Ash_100yr_CC_45_Def_MU009.ief Ash_100yr_CC_45_Undef_MU009.ief
	1% AEP plus climate change (105%) event	Ash_100yr_CC_105_Def_MU009.ief Ash_100yr_CC_105_Undef_MU009.ief
TUFLOW Control Files	0.1% AEP event	Ashford_022_undef_1000yr_sc070_MU009(WW2D)_002.tcf
	1% AEP plus climate change (35%) event	Ashford_022_undef_1000yr_sc070_MU009(WW2D)_002_100_CC_35.tcf Ashford_022_def_1000yr_sc070_MU009(WW2D)_002_100_CC_35.tcf
	1% AEP plus climate change (45%) event	Ashford_022_undef_1000yr_sc070_MU009(WW2D)_002_100_CC_45.tcf Ashford_022_def_1000yr_sc070_MU009(WW2D)_002_100_CC_45.tcf
	1% AEP plus climate change (105%) event	Ashford_022_undef_1000yr_sc070_MU009(WW2D)_002_100_CC_105.tcf Ashford_022_def_1000yr_sc070_MU009(WW2D)_002_100_CC_105.tcf

4.3 Great Stour (Wye to Thannington) fluvial model

The flood risk mapping of the Great Stour used one of the models from the Great Stour Flood Risk Mapping Study originally developed in March 2013 by JBA Consulting for the Environment Agency. Two hydrodynamic 1D-2D models were developed for the study area:

- Model 1 – extends from downstream of the M20 at Ashford and terminates upstream of Bingley's Island immediately south of Canterbury (the 2D domain of the model stops at the A2 road crossing)
- Model 2 – extends from the A2 road crossing upstream of Canterbury and to an area close to Upstreet on the Lower Stour (the 2D domain of this model stops are the topographic constriction in Stodmarsh Valley).

It was considered advantageous to split the study area into two separate models in order to optimise model development and simulation times, and permit future scenario testing to be undertaken efficiently. Given that Model 2 is not located within Ashford Borough boundary, only Model 1 was provided for the purposes of the study.

The models were originally run for the 20%, 5%, 2%, 1.3%, 1%, 1% plus climate change, 0.4%, and the 0.1% AEP design events.

4.3.1 Model scenarios and simulations

Similar to the updates completed for the Hamstreet fluvial model, the existing design event ISIS Data file (GStourM1_009.dat) was retained for the purposes of this study. Again, the 1% AEP ISIS Event file (GStourM1_100_010) was updated with the flows in Appendix A for each climate change allowance for the South East river basin district.

It should be noted that no formal defences were required to be considered within the modelled reach upstream of Canterbury in the original study. Therefore, no defences were included within Model 1 and the model was simulated for the undefended scenario only.

As such, the 1 % AEP ISIS Run file was updated to include the new event data for each climate change allowance, and the model for the Great Stour between Wye and Thannington was run for the undefended scenario only.

4.3.2 Isis run parameters

Given that all run parameters were within the acceptable limits for use in the original study, they were retained. The model was simulated at a standard unsteady fixed 1.5s 1D (ISIS) time step and a 3s 2D (TUFLOW) time step in line with conventional recommendations for grid size/time step relationships.

Upgrading the versions of ISIS and TUFLOW is not expected to cause model run issues and/or notable differences in the modelled outputs compared to those from the original flood mapping study conducted by 2013. As such, the ISIS 3.7.2 and TUFLOW 2013-12-AE were used to simulate the model, both of which were run with single precision versions of the software.

Details of the original and updated model files are included in **Table 4-2**.

Table 4-3: Updated model simulation file names for the Great Stour Fluvial Model 1 (March, 2013)

File type	File name	
ISIS Data Files	GStourM1_009.dat	
ISIS Event Files	1% AEP event	GStourM1_0100_002.ied
	1% AEP plus climate change (35%) event	GStourM1_0100_CC_35_002.ied
	1% AEP plus climate change (45%) event	GStourM1_0100_CC_45_002.ied
	1% AEP plus climate change (105%) event	GStourM1_0100_CC_105_002.ied
ISIS Run File	1% AEP event	GStourM1_0100_010.ief
	1% AEP plus climate change (35%) event	GStourM1_0100_CC_35_010.ief
	1% AEP plus climate change (45%) event	GStourM1_0100_CC_45_010.ief
	1% AEP plus climate change (105%) event	GStourM1_0100_CC_105_010.ief
TUFLOW Control Files	0.1% AEP event	GStourM1_0100_010.tcf
	1% AEP plus climate change (35%) event	GStourM1_0100_CC_35_010.tcf
	1% AEP plus climate change (45%) event	GStourM1_0100_CC_45_010.tcf
	1% AEP plus climate change (105%) event	GStourM1_0100_CC_105_010.tcf

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5 Model results

Each model was simulated for the 1 in 100-year plus climate change event using each of the required climate change allowances for the undefended and, where possible, the defended scenarios.

The result files were assigned similar naming conventions to the simulation files and have been recorded in **Table 5-1** for each event.

Table 5-1: Result files for each model simulation

Model	Scenario	File name
1% AEP plus climate change (35%)		
Hamstreet Fluvial Model	Undefended	HAM_0100F_CC_35_ND_015
	Defended	HAM_0100F_CC_35_WD_015
Ashford Fluvial Model	Undefended	ASHFORD_022_UNDEF_1000YR_SC070_MU009(WW2D)_002_100_CC_35
	Defended	ASHFORD_022_DEF_1000YR_SC070_MU009(WW2D)_002_100_CC_35
Great Stour (Wye to Thannington) Fluvial Model 1	Undefended	GStourM1_0100_CC_35_010
1% AEP plus climate change (45%)		
Hamstreet Fluvial Model	Undefended	HAM_0100F_CC_45_ND_015
	Defended	HAM_0100F_CC_45_WD_015
Ashford Fluvial Model	Undefended	ASHFORD_022_UNDEF_1000YR_SC070_MU009(WW2D)_002_100_CC_45
	Defended	ASHFORD_022_DEF_1000YR_SC070_MU009(WW2D)_002_100_CC_45
Great Stour (Wye to Thannington) Fluvial Model 1	Undefended	GStourM1_0100_CC_45_010
1% AEP plus climate change (105%)		
Hamstreet Fluvial Model	Undefended	HAM_0100F_CC_105_ND_015
	Defended	HAM_0100F_CC_105_WD_015
Ashford Fluvial Model	Undefended	ASHFORD_022_UNDEF_1000YR_SC070_MU009(WW2D)_002_100_CC_105
	Defended	ASHFORD_022_DEF_1000YR_SC070_MU009(WW2D)_002_100_CC_105
Great Stour (Wye to Thannington) Fluvial Model 1	Undefended	GStourM1_0100_CC_105_010

5.1 Digital deliverables

The following deliverables have been produced in digital format and supplied to the Environment Agency:

- Hydraulic model input and output files
- Raw and cleaned flood extents for the updated 1 in 100-year plus climate change events (ESRI format)
- Gridded outputs for maximum flood depth, velocity, water level, hazard rating (Ascii format):
- Tabulated peak water levels and flows from the 1D models.

5.2 Updated flood risk maps

The gridded output files (ascii format) have also been used to update and the flood maps that currently support Ashford Borough Council's 2014 SFRA and emerging Local Plan. The following updated maps (pdf format) are intended to replace those in Appendix E of the SFRA and have been supplied to the Council directly:

- **Undefended Flood Risk Mapping**
  - 1% AEP (1 in 100-year) Plus Climate Change (+ 35%, 45% or 105%) Fluvial Flood Depth
  - 1% AEP (1 in 100-year) Plus Climate Change (+ 35%, 45% or 105%) Fluvial Flood Velocity
  - 1% AEP (1 in 100-year) Plus Climate Change (+ 35%, 45% or 105%) Fluvial Flood Hazard
- **Defended Flood Risk Mapping**
  - 1% AEP (1 in 100-year) Plus Climate Change (+ 35%, 45% or 105%) Fluvial Flood Depth
  - 1% AEP (1 in 100-year) Plus Climate Change (+ 35%, 45% or 105%) Fluvial Flood Velocity
  - 1% AEP (1 in 100-year) Plus Climate Change (+ 35%, 45% or 105%) Fluvial Flood Hazard

It should be noted that hydraulic modelling for Ashford Borough has only been updated for the modelled watercourses within the Hamstreet, Ashford, and Great Stour (Wye to Thannington) fluvial models. Therefore, Flood Zone 3a has been used to delineate the extent of flooding from any watercourses within the Borough where depth, velocity and hazard data is not currently available. This is due to the fact that hydraulic modelling updates have not been undertaken for these watercourses as part of this study.

Furthermore, given that formal flood defences were not included within the Great Stour (Wye to Thannington) fluvial Model 1, the hydraulic model was simulated for the undefended scenario only. As such, the defended flood risk mapping for Ashford Borough shows the undefended flood risk from the Great Stour downstream of the M20 with the defended flood risk from the watercourses included in the Hamstreet and Ashford fluvial models.

It is therefore considered that the updated hydraulic modelling of the Great Stour provides a conservative indication of flood risk downstream of the M20 in the defended flood risk mapping.

6 Conclusions

The purpose of this Note to File is to provide a short report of the work undertaken to update the hydraulic modelling of Ashford Borough to reflect the new climate change guidance published by the Environment Agency on 19 February 2016.

Consultation with the Environment Agency confirmed that they are in the process of submitting funding bids to update the RADIS and various JFlow models as Flood and Coastal Risk Management (FCRM) projects. It was therefore recommended that modelling updates were undertaken for the Hamstreet, Great Stour through to Ashford Town and Great Stour (Wye to Thannington) models only as part of this study.

As such, copies of the hydraulic models (Products 5 and 7) were provided and licensed by the Environment Agency. Each model was updated to include the range of climate change allowances applicable to the South East river basin district and re-run for the undefended and, where possible, the defended scenarios.

A series of digital deliverables have been supplied to the Environment Agency. The gridded output files (ascii format) have also been used to update and the flood risk mapping for the Borough. Maximum flood depth, velocity and hazard maps (pdf format) have been produced for each flood event.

The outputs from the updated hydraulic modelling and updated flood risk maps are will be used to support the Ashford Borough Council Strategic Flood Risk Assessment (SFRA) published in July 2014 and the emerging Local Plan covering the period between 2011 and 2030. They are intended to replace those in Appendix E of the SFRA and have been supplied to the Council directly.

APPENDIX A

Based on the peak river flow estimates for the design 1% AEP event, the peak river flows in each model were increased by 35%, 45% and 105% respectively to reflect the new climate change guidance published by the EA in February 2016.

The updated peak river flow estimates for each model are provided below.

Site code	1% AEP peak river flow estimates (m^3/s)	1% AEP (+ 35%) peak river flow estimates (m^3/s)	1% AEP (+ 45%) peak river flow estimates (m^3/s)	1% AEP (+ 105%) peak river flow estimates (m^3/s)
Hamstreet Fluvial Model				
SS_02	2.244	3.030	3.254	4.601
SS_03	0.706	0.953	1.024	1.448
SS_04	0.848	1.145	1.230	1.739
SS_06inc	0.238	0.321	0.345	0.487
Ashford Fluvial Model				
ald_in2	0.680	0.918	0.986	1.394
int_inflow	0.119	0.161	0.173	0.244
MiddleEStour	0.051	0.069	0.074	0.105
Hoth.in	0.740	0.999	1.073	1.517
Rail.in	0.034	0.046	0.049	0.070
Chart.in	0.034	0.046	0.049	0.070
LowerGStour	0.043	0.057	0.062	0.087
WW_063	0.808	1.090	1.171	1.655
WW(2)	0.042	0.057	0.062	0.087
AYLS_55	0.748	1.010	1.085	1.533
AYLS(2)	0.102	0.138	0.148	0.209
KEN0222QT	0.850	1.148	1.233	1.743
ds_m20	0.612	0.826	0.887	1.255
LowerEStour	0.230	0.310	0.333	0.470
Nackholt	0.332	0.448	0.481	0.680
Boughton	0.332	0.448	0.481	0.680
Brook	0.094	0.126	0.136	0.192
us_wye	0.094	0.126	0.136	0.192
rd_054	0.799	1.079	1.159	1.638
Great Stour (Wye to Thannington) Fluvial Model 1				
Sto_01_Inf	40.220	54.297	58.319	82.451
Eas_01_Inf	1.705	2.301	2.472	3.495
Sto_02_Lat	9.980	13.473	14.471	20.460
Sto_03_Lat	5.259	7.100	7.626	10.782
Sto_04_Lat	11.352	15.325	16.460	23.271
Har_01_Inf	6.231	8.412	9.035	12.774
Sto_05_Lat	1.932	2.609	2.802	3.961