

1 Appendix Mapping: Supporting Information

1.1 Hydraulic models used in this SFRA

This appendix provides information on the hydraulic models used to inform the following Level 1 SFRAs:

- 2017 Greater Norwich Area SFRA covering the Norwich City Council, Broadland District Council, South Norfolk Council and parts of the Broads Authority administrative areas
- 2017 North Norfolk SFRA covering the North Norfolk District Council and parts of the Broads Authority administrative areas
- 2017 Great Yarmouth SFRA covering the Great Yarmouth Borough Council and parts of the Broads Authority administrative areas
- 2018 King’s Lynn and West Norfolk SFRA covering the Borough Council of King’s Lynn and West Norfolk

Table 1-1 provides details of existing Environment Agency hydraulic models supplied for use in the above SFRAs which are predominantly fluvially driven. For each model, the table lists the watercourse the model represents, the model details, the estimated timeframe for the next model update, how the model has been used to derive the SFRA Flood Zones and if the climate change scenarios have been mapped from this model (the climate change methodology is discussed further in Section 4 and 5 of the main SFRA reports). If an alternative approach has been used to map the extents associated with the climate change scenarios, this has been listed in the comments column.

Table 1-2 provides details of existing Environment Agency models supplied for use in the above SFRAs which represent tidal / coastal flood risks. For each model, the table lists the models' geographical coverage, the model details, the estimated timeframe for the next model update, how the model has been used to derive the SFRA Flood Zones and if the climate change scenarios have been mapped from this model (the climate change methodology is discussed further in Section 4 and 5 of the main SFRA reports).

Figure 1-1 displays the coverage of the existing and supplied hydraulic models used in the above SFRAs to map the functional floodplain and / or were mapped for the climate change scenarios.

Figure 1-2 displays the coverage of the existing and supplied hydraulic models where the outputs were used to update Flood Zones 2 and 3a. This was only required for the new 2017 models.

Important:

At the time of preparing the 2017 and 2018 SFRAs, there were several on-going flood modelling studies being undertaken by or on behalf of the Environment Agency. It is important that the Environment Agency are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific Flood Risk Assessment.

The expected model update in Table 1-1 and Table 1-2 shows if the hydraulic model used in the 2017 SFRAs, is due to be updated and when the updated model may become available. The stated timescales were provided at the time of preparing the 2017 and 2018 SFRAs and these may be subject to change.

Where alternative approaches have been used to map the extents associated with the climate change scenarios (i.e. where Flood Zone 2 used as a substitute for the 100-year with 65% climate change extent), developers may be required to further investigate the flood risk as part of a site-specific Flood Risk Assessment.

Flood Zones 2 and 3a reflect the Environment Agency’s Flood Zones at the time of preparing the SFRA, with expectation of where newly available 2017 and 2018 modelling was supplied for use in the assessment. The outputs of the newly available 2018 modelling have been spliced into the Flood Zones to create the SFRA Flood Zones 2 and 3a. The SFRA Flood Zone 2 and Flood Zone 3a column in Table 1-1 and Table 1-2 identifies which models this applies to. The SFRA is a tool for refining information on river and sea flooding risk shown on the Environment Agency flood maps. The Environment Agency’s Flood Zones, on their Flood Map for Planning website, may differ to the maps in the SFRA for a short period of time. The modelled fluvial and tidal flood risk datasets shown in the 2017 and 2018 SFRA and Appendix A, will be incorporated into the Environment Agency’s flood maps in due course. This affects the watercourses in Figure 1-2. Note, due to differences in mapping techniques, slight inconsistencies may remain once the Environment Agency flood maps are updated.

Table 1-1: Detailed hydraulic models used in the Level 1 SFRAs - predominantly fluvial

Watercourse	Model Details (date, consultant who developed the model, model name)	Expected model update	SFRA Flood Zone 2 and Flood Zone 3a	Model used to map the SFRA Flood Zone 3b	Return period event Flood Zone 3b is taken from	Climate Change 100-year 35% outline mapped from this model	Climate Change 100-year 65% outline mapped from this model	Climate Change 1,000-year 25% outline mapped from this model	Model run for breach	Comment
Wensum in Norwich	2017, CH2M, Norwich model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes	Yes		
Tud	2017, CH2M, Tud model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes	Yes		
Upper Wensum	2017, CH2M, Upper Wensum model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes	Yes		
Spixworth Beck	2014, CH2M, Spixworth Beck model	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
River Glaven	2012, Mott MacDonald, Glaven Flood Risk Study	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
Fenland	2016, JBA, Fenland Hazard Mapping	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes	Yes	
River Hun	2015, JBA, River Hun (ENS Study) model	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
River Burn	2010, CAPITA, Burn model	2018	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
River Bure and Ant	2012, CH2M, Bure and Ant model	2019	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	No	No	No		
River Bure Aysham to Ingworth	2014, JBA, Bure Aysham to Ingworth model	2018	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	25-year	Yes	Yes	Yes		
Upper Wissey	2013, JBA, Eastern Rivers MP8	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
Upper Nar	2013, JBA, Eastern Rivers MP7	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
Nar	2013, JBA, Eastern Rivers MP2	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
River Yare and Tas	2014, CH2M, Yare and Tas model	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	Yes	Yes	Yes		
Middle Wissey	2013, JBA, Eastern Rivers MP3	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	20-year	Yes	Yes	Yes		

Watercourse	Model Details (date, consultant who developed the model, model name)	Expected model update	SFRA Flood Zone 2 and Flood Zone 3a	Model used to map the SFRA Flood Zone 3b	Return period event Flood Zone 3b is taken from	Climate Change 100-year 35% outline mapped from this model	Climate Change 100-year 65% outline mapped from this model	Climate Change 1,000-year 25% outline mapped from this model	Model run for breach	Comment
Cut off channel	2013, JBA, Eastern Rivers MP1	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	20-year	Yes	Yes	Yes	Yes	
Weybourne Stream (Spring Beck)	2013, Royal Haskoning, Weybourne Stream (Spring Beck)	2018	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	25-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
River Tiffey	2008, JBA, River Tiffey model	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	20-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
River Ant	2006, Royal Haskoning, modelling River Ant	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	25-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
River Bure	2006, Royal Haskoning, modelling River Burn	2018	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	25-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
River Stiffkey	2006, Royal Haskoning, modelling River Stiffkey	2018	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	25-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
Spixworth Beck	2006, Royal Haskoning, modelling Spixworth Beck	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	No	25-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
Mundesley Beck (River Mun)	2011, JBA, Mundesley Beck Model	2018	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	No	Yes* (see comments field)	No		*Flood Zone 2 used as a substitute for the 100-year+65% CC extent
Waveney	2013, JBA, Waveney model	N/A	These reflect the Environment Agency's Flood Zones at the time of preparing the SFRAs.	Yes	20-year	No	No	No		

Table 1-2: Detailed hydraulic models used in the Level 1 SFRAs - tidal / coastal models

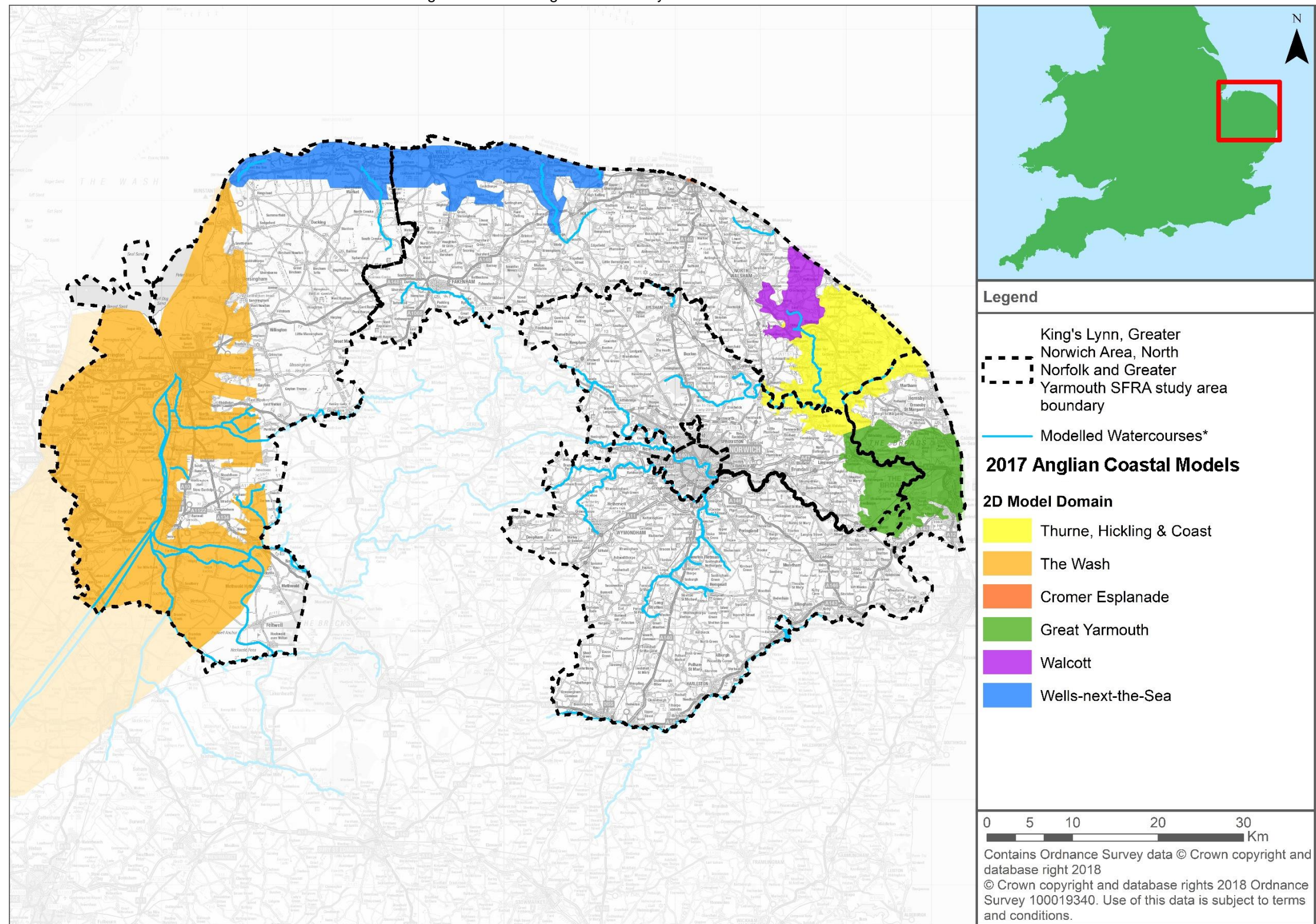
Model geographical coverage	Model Name	Expected Environment Agency model update	SFRA Flood Zone 2 and Flood Zone 3a	Model used to map the SFRA Flood Zone 3b	Return period event Flood Zone 3b is taken from	Climate Change 200-year outline mapped from this model	Climate Change 1000-year outline mapped from this model	Model run for breach	Comments
The Wash	2009 Wash (Anglian Area Central Tidal Hazard Mapping)	2017 Wash Model (below)	Not used to produced flood zones	No	No	No	No	Yes	Only used to model breach. Model superseded by the 2017 Wash Model.
River Nene (Tidal)	2011 Tidal Nene (Tidal Nene and Tidal Wellard Hazard Mapping)	N/A	Not used to produced flood zones	No	No	Yes	Yes	Yes	
Tidal Great Ouse	2015 Tidal Hazard Mapping (Tidal Great Ouse)	N/A	Not used to produced flood zones	No	No	Yes	Yes	Yes	
River Yare (tidal) and Great Yarmouth	2017, JBA, Anglian Coastal Modelling, Great Yarmouth tidal Model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes		
Thurne, Hickling and Coast	2017, JBA, Anglian Coastal Modelling, Thurne, Hickling and Coast tidal model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes		
Cromer	2017, JBA, Anglian Coastal Modelling, Cromer tidal model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes		
Walcott	2017, JBA, Anglian Coastal Modelling, Walcott tidal model	New 2017 modelling - No further updates are expected to this model	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes		
Wells-next-the-Sea	2017, JBA, Anglian Coastal Modelling, the Wells tidal Model	New 2017 modelling - the Environment Agency have caveated these outputs as draft and hence the may be subject to refinement.	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes	Yes	Updated April 2018
The Wash	2017, JBA, Anglian Coastal Modelling, the Wash tidal Model	New 2017 modelling - the Environment Agency have caveated these outputs as draft and hence the may be subject to refinement	The results from the 2017 model have been included in the SFRAs Flood Zones	Yes	20-year	Yes	Yes	No	Updated August 2018

Note: Numerous variables are used to map climate change for coastal / tidal models. As the above models are purely coastal / tidal models, the increases in peak flow shown in Table 1-1 do not strictly apply and hence these models are contained in a separate table in this appendix. The climate change methodology is discussed further in Section 4 and 5 of the main SFRA reports.

Figure 1-1 shows the coverage of detailed hydraulic models used in the Level 1 SFRAs where:

- The existing outputs were used to map the extent of Flood Zone 3b i.e. the function floodplain; and / or,
- The model was re-run and the outputs were subsequently mapped for the climate change scenarios.

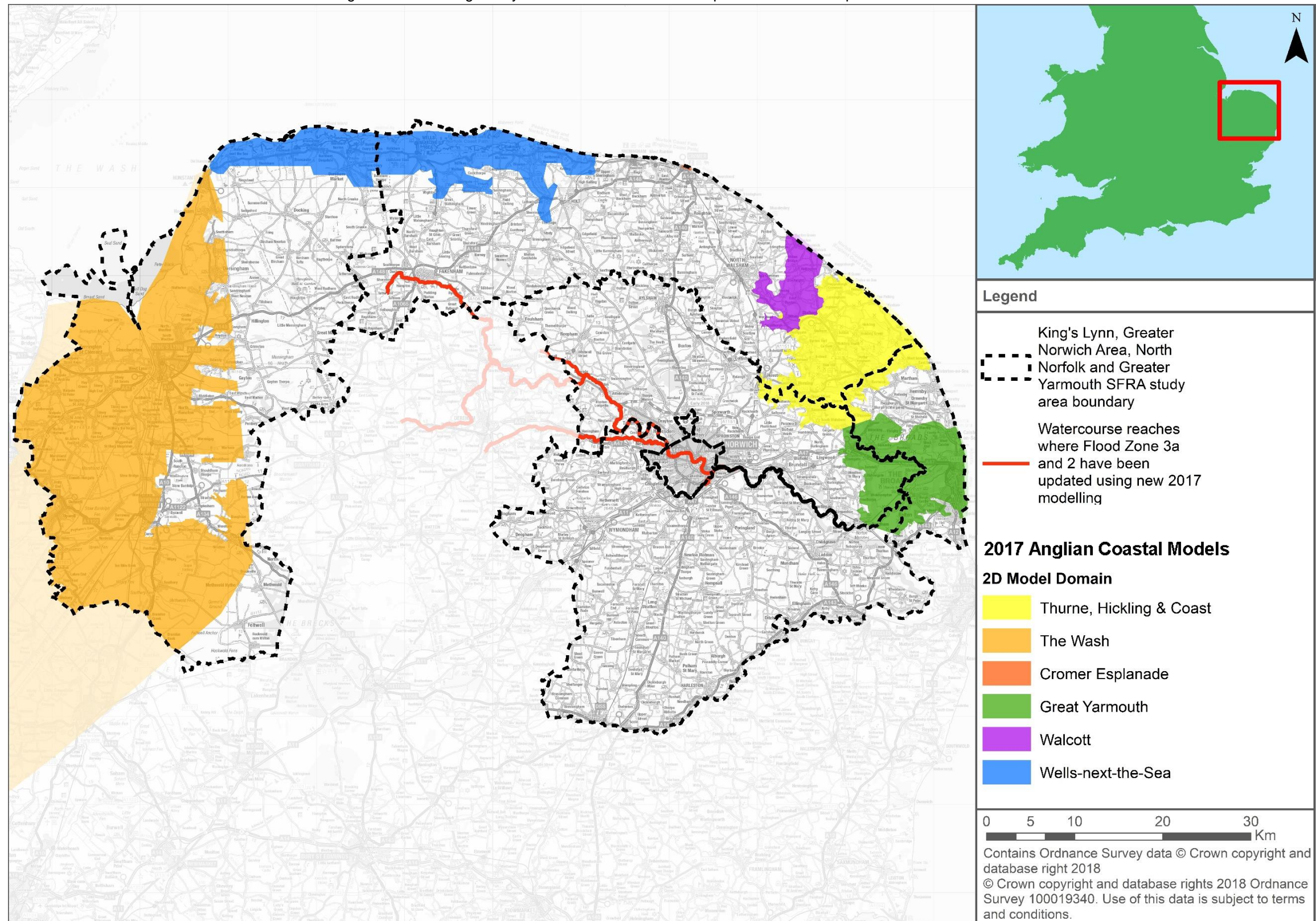
Figure 1-1: Coverage of detailed hydraulic models used in the Level 1 SFRAs



*Watercourses where detailed hydraulic models were made available for use at the time the SFRAs were being prepared.

Figure 1-2 shows the coverage of detailed hydraulic models used in the Level 1 SFRAs to update Flood Zones 2 and 3a. This relates to the 2017 River Wensum modelling and the 2017 Anglian Coastal Modelling (where available) only.

Figure 1-2: Coverage of hydraulic models where the outputs were used to update Flood Zones 2 and 3a



1.2 **Hydraulic models not used in this SFRA**

Table 1-3 provides details of existing hydraulic models, within the study area, that were not used, supplied and / or available during the preparation of the above SFRAs.

Table 1-3: Detailed hydraulic models within the study area not used in the Level 1 SFRAs

Model reach	Model Name	Expected Environment Agency model update	Comment
The Broads	2008, CH2M, Broads BESL model	2019	Updated model expected to be released in early 2019. As such, the existing model was not used when preparing the 2017 SFRAs.