

# **A14 Improvement Scheme Flood Risk Assessment**

## **Annex D1**

### **Hydraulic Modelling Overview**

**28/08/2014**

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## 1 Background

The purpose of this hydraulic modelling overview is to support the Flood Risk Assessment (FRA) being carried out for the proposed A14 scheme. The scheme involves approximately 36km of highway improvements, comprising 17km of road widening and 19km of new a new offline road approximately (see Figure 1).

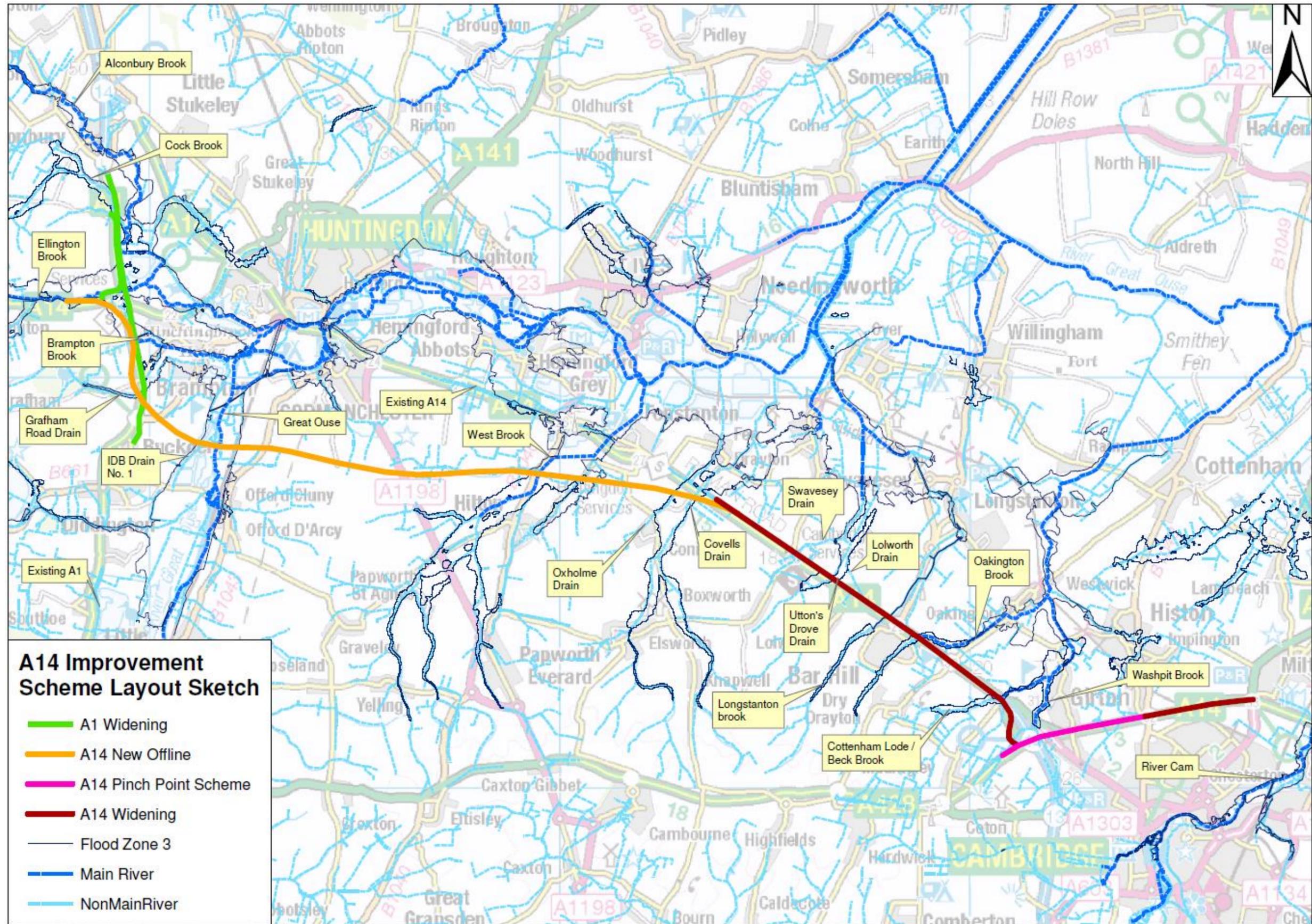
The A14 scheme is crossed by a number of watercourses. The hydraulic modelling works comprise of a number of independent hydraulic models for these watercourses. This report provides the overarching information that is relevant to all these models; while the specific information and model files have been covered in detail in the independent model reports (pro-forma reports). The independent reports also cover the key assumptions and limitation relevant to the hydraulic modelling. Hydraulic modelling was carried out for the existing situation as well as the proposed modification and design of the culverts under A14. The Key output of the hydraulic modelling is the comparison of the water levels between the existing and design scenario for various return periods; in order to show the impact of the proposed changes.

Table 1 presents information regarding the watercourses that cross the A14 improvement scheme (listed from East to West). The location of these watercourses is shown in Figure 1. Some watercourses have not been modelled because no model exists or because the model was not made available by the EA.

**Table 1 - Watercourses that cross the A14 improvement scheme**

<b>Watercourse</b>	<b>Comments</b>
Alconbury Brook	Modelling not required. Review of floodplain compensation requirements only for small section of realignment
Cock Brook	Not modelled because no model exists
Ellington Brook	Modelled
Brampton Brook	Modelled
Internal Drainage Board Drain No1	Not modelled – high level GIS assessment provided to FRA team
Grafham Road Drain	Not modelled, model was not available
Great Ouse	Modelled
West Brook / Hall Green Brook (Includes Eastern and Western Award Drains)	Modelled
Oxholme Drain	Modelled
Covell's Drain	Modelled
Utton's Drove Drain	Modelled
Longstanton Brook	Not modelled, no model available
Oakington Brook	Modelled
Beck / Cottenham Lode Brook	Not modelled, existing model extent does not cover the scheme.

Figure 1 – A14 FRA location map



## 2 Objectives of Modelling Work

The overall aim for the FRA modelling was to provide the detailed assessment of water levels and associated flood risk thereof for each watercourse crossing within the study extent for the existing situation and for the scheme design.

For each modelled watercourse the following procedure was applied:

- 1) Assessment of available hydraulic models to assign the baseline model from the two main sources of hydraulic models:
  - a) Atkins 2009 modelling
  - b) EA post 2009 modelling
- 2) No detailed review of the existing modelling was undertaken, and the work undertaken assumed that the existing models are all fit for purpose of the FRA.
- 3) Scheme models were built for each watercourse, by updating the baseline model with reference to scheme design drawings and specifications.
- 4) Model build Quality Assurance (QA) check was undertaken.
- 5) Simulations were undertaken for 3 Annual Exceedance Probability (AEP) cases, for baseline and scheme models; which are 1%AEP +CC, 1%AEP and a third return period of either 4% or 5%AEP (as available).
- 6) Model outputs QA Check and Review.
- 7) Model outputs and comparisons are provided in tabular format in the pro-forma reports, supported by associated figures. The comparisons are focused on the structures (bridges and culverts) of the proposed A14 scheme elements.

## 3 Available Data

### 1) Topography

- Environment Agency (EA) 1-2m horizontal resolution LiDAR data
- Topographic survey of the modelled watercourses
- Topographic survey of the A14 scheme corridor.

It should be noted that the most up to date existing models were used as baseline models with the assumption that the latest topographic survey information was already incorporated in them.

### 2) OS Mapping:

- MasterMap (1 to 1250 or 1 to 2500 Scale)
- 1 to 10,000 Scale Raster (in AutoCAD format)
- 1 to 25,000 Scale Raster
- 1 to 50,000 Scale Raster

### 3) Design specifications:

- A culvert schedule of proposed structures under the scheme locations was made available by the design team
- Detailed drawings of the overall scheme layout were provided
- Detailed drawings including cross section layouts were provided for the proposed aqueduct crossing on the River Ouse and for the bridge crossing on West Brook.

## 4 Modelling Approach

### 4.1 Hydrology

Model inflows were used as available from the incoming model data sets and no additional hydrology or flow estimation was undertaken as part of this work.

### 4.2 Hydraulic Modelling

Scheme models were produced following a general modelling approach detailed below:

1) Baseline model version was assigned from the available models. Each model was tested and results confirmed and compared to previous model. Minor updates were made to baseline models as required.

2) Design models were developed using available design drawings and specifications.

Minor refinements were developed in consultation with the design team to ensure appropriate representation of existing conditions.

Design models were simulated for option improvement for the proposed A14 viaduct and associated embankment crossing Great Ouse west of Godmanchester, and also for the A14 widening at Oakington Brook.

3) Model outputs were tabulated to provide the maximum stage for key model locations in the baseline and design scenarios.

### 4.3 Final site specific models

Each watercourse has been modelled independently to test the scheme. Individual reporting for each site specific model is provided in Annex D2 to D10 as detailed in Table 2

**Table 2 – Final site specific models**

Annex	Watercourse	Designation	In 2009 FRA?	Model developer	Software	Comment	2014 FRA Modelling
D2	Ellington Brook	Main River	No	EA	ISIS-TUFLOW		EA (2014)
D3	Brampton Brook	Main River	Yes	Atkins	ISIS 1D	EA Great Ouse 1d/2d model does have Brampton Brook but does not cover the scheme.	Re-used Atkins (2009) Model
D4	River Great Ouse		Yes	EA	ISIS-TUFLOW	Ouse Downstream and upstream models received. Downstream model was truncated and then composited to the upstream model.	Used EA (2014)
D5	West Brook / Hall Green Brook	Main River	Yes	EA	ISIS-TUFLOW	This model was required to represent floodplain scheme elements Model does not include Award drains. Grid size is 20m cell so not suitable to model Drains. Mike 11 model will be used for these features.	EA (2014)
D6	Award Drain (West Brook tributary)	Non-main river	Yes	Atkins	Mike11 2009	Mike11 model includes the West Brook watercourse. Results for West Brook are to be extracted from the ISIS-TUFLOW model not from this Mike11 model.	Atkins Mike 11 (2009) and EA (2014 ) Isis Tuflow
	Hilton Drain (West Brook tributary)	Non-main river	Yes				
D7	Oxholme Drain	Non-main river	Yes	Atkins	ISIS 1D		Re-used Atkins (2009)

Annex	Watercourse	Designation	In 2009 FRA?	Model developer	Software	Comment	2014 FRA Modelling
							model
D8	Covell's Drain	Non-main river	Yes	Atkins	ISIS 1D	EA Great Ouse 1d/2d model does have Covell Drain but does not extend far enough therefore 2009 ISIS model will be used.	Re-used Atkins (2009) model
D9	Utton's Drove Drain	Non-main river	Yes (post FRA)	Atkins	ISIS 1D	New EA model but does not have required coverage	Re-used Atkins (2009) model
D10	Oakington Brook (trib. of Beck Brook)	Main River (North of A14)	Yes	EA	ISIS-TUFLOW	Beck Brook branch does not extend upstream of the scheme	Used EA (2012) "Girton" model.
	Beck Brook / Cottenham Lode	Main River (North of A14)	No				N/A