A28 Sturry Link Road, Canterbury

Hydraulic Modelling Report

February 2017
**DOCUMENT VERIFICATION RECORD**

<table>
<thead>
<tr>
<th>CLIENT:</th>
<th>Amey OW Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHEME:</td>
<td>A28 Sturry Link Road, Canterbury – Hydraulic Modelling report</td>
</tr>
<tr>
<td>INSTRUCTION:</td>
<td>The instruction to carry out this Hydraulic Modelling was received from Ms B. Shrestha of Amey OW Limited</td>
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</tbody>
</table>

**DOCUMENT REVIEW & APPROVAL**

<table>
<thead>
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</thead>
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</tbody>
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**ISSUE HISTORY**

<table>
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<tr>
<th>ISSUE DATE</th>
<th>COMMENTS</th>
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Introduction

Waterco Consultants have been commissioned to undertake a detailed hydraulic modelling study of the Great Stour watercourse flowing through Sturry, Canterbury, to investigate fluvial flood risk at the location of a proposed elevated road bridge spanning the river, hereafter referred to as the study area. The proposed bridge forms part of the wider A28 Sturry Link Road project which will connect the A28 Sturry Road to the A291 Herne Bay Road.

A location plan and an aerial photograph showing the proposed development are included in Appendix A; an extract of the location plan is included in Figure 1. The grid reference of the study area is 617015E 159990N.

The outputs of the hydraulic modelling study provide a detailed, up-to-date assessment of the existing fluvial flood risk at the study area and quantify the change in flood risk elsewhere as a result of the proposed development.

Figure 1 – Location Plan

Study Area Description and Proposed Development

The study area is located downstream to the Canterbury Waste Water Treatment Works (WWTW) off the A28 Sturry Road. The Great Stour bifurcates at this location; the main watercourse follows the southernmost channel and both channels generally flow in the west to east direction. The proposed bridge will also traverse the Ashford to Ramsgate Railway, located to the north of the watercourse.
A topographical survey of the study area was undertaken by Hook Survey Partnership in June 2015 and is provided in Appendix B for information. The survey shows existing levels from the study area to the A28 Sturry Road fall west to east, from a level of approximately 4.37m AOD from the western end to 2.78m AOD.

A raised railway embankment runs in a southwest-northeast orientation to the north of the River Great Stour at an approximate average elevation of 5.3m AOD. To the south of the river, the A28 Sturry Road runs in the same orientation as the railway line, also slightly raised above the adjacent floodplain at an approximate average elevation of 4.5m AOD.

The proposed link road is to span across the two branches of Great Stour at an elevated ground level via support piers. A proposed development plan is included in Appendix C.

A total of six spans are proposed, supported by five sets of support columns and north and south approach embankments/abutments. At the southern end of the proposed highway, access onto the A28 Sturry Road will be provided via a new roundabout at an approximate level of 4.7m AOD. From this location the proposed road level will increase up the southern bridge approach embankment to a level of 8.8m AOD from where the highway is carried by bridge sections. The proposed roundabout, southern embankment and support piers are located within the Great Stour floodplain.

**Nearby Watercourses and Existing Flood Risk Data**

The Great Stour is an Environment Agency (EA) designated ‘main river’ at this location.

The current EA Flood Maps for Planning (February 2017) shows the study area to be located within EA Flood Zone 3 – an area considered to be at high risk of fluvial flooding with an annual probability of the flooding greater than 1% (1 in 100) AEP. Both the A28 Sturry Road (at the location of the proposed roundabout) and the railway embankment are shown to be in EA Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). An extract of the current EA Flood Zones is included in Appendix D for reference.

The Great Stour is a tidally influenced watercourse; however the tidal extent is nearly 1km downstream from the study area at Fordwich; therefore tidal flooding has not been specifically included in this study, although its influence on model boundary conditions has been considered.

It is understood that the current Great Stour flood maps are based on the outputs of a detailed EA 1D/2D flood Modeller Pro-TUFLOW model (**Model ref: GStourM2**). To provide a site-specific assessment of fluvial flood risk at the study area, the existing EA 1D/2D hydraulic model has been updated and utilised. In addition to providing a more accurate assessment of fluvial flood risk at the existing site, the change in flood risk elsewhere (if any) arising as a result of the proposed development has been quantified.

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1. A 1D/2D hydrodynamic model is comprised of a 1-Dimensional (1D) river network model (based on surveyed river cross-sections) coupled with a 2-Dimensional (2D) Digital Terrain Model (DTM) of the potential floodplain (created from LiDAR).
Hydraulic Modelling

A copy of the current EA Great Stour hydraulic model, GStourM2, has been sourced and used as the base for this study. To provide a more accurate assessment of flood risk at the study area, this model has been truncated to the local area and its resolution increased for improved accuracy.

Following an initial assessment of the existing fluvial flood risk through the study area, simulation outputs will be compared against those generated using the proposed development layout/levels to quantify the change in flood risk elsewhere as a result of the development, if any.

The latest version of the TUFLOW hydraulic modelling software 2016-03-AD available at the start of the project have been used for all simulations.

1D Model Details

The existing EA 1D FMP model network of Great Stour has been truncated to start at its two branches near Westwood Drive (NGR 615233 158800 and NGR 615292 158643) and end near Stour Valley Walk (NGR 618553 160099) in order to reduce run times. In total, approximately 5.9km of the Great Stour is modelled. The extent of the linked 1D/2D model is presented in Appendix E.

The upstream boundary of the truncated 1D model uses a discharge time (QT) boundary condition applied to the most upstream network line of Great Stour at two locations (Model network reference XS24 and S2_24X). Lateral inflow within the existing EA model is kept unchanged and applied in the truncated model.

At the downstream boundary of the truncated EA 1D model, a stage-time (HT) boundary condition has been applied (Model network reference 1-24704).

Both the upstream and downstream boundary conditions have been applied using QT and HT curves extracted from the existing EA model outputs.

Representation of structures within the model remains unchanged from the EA model. A small number of additional interpolated watercourse cross-sections were added into the EA model to improve 1D/2D model linkage and stability.

No other changes have been made to the existing EA 1D FMP model data, including river cross-sections, Manning’s n roughness etc.

2D Model Details

The existing EA 2D TUFLOW domain model extent has been truncated in line with the 1D model. The 2D domain is constructed primarily from 1m LiDAR data covering a total area of approximately 2.7km². The existing truncated EA model’s 2D Digital Terrain Model (DTM) has been updated to include site-specific topographical survey data (Appendix B).

The 2D cell size has been lowered from 6m in the existing EA model to 2m. This improvement in model resolution provides a more accurate representation of specific flow mechanisms local to the study area.
OS MasterMap data has been used to classify land use and assign Manning’s n roughness coefficients throughout the floodplain within the existing EA model. The coefficients used are given in Table 1 and remain unchanged for this study.

No other changes have been made to the existing EA 2D TUFLOW model.

To simulate and compare the proposed development arrangement (DEV1), an alternative 2D TUFLOW model domain has been created using the proposed level data provided (Appendix C), including the five support piers. Additionally, the DEV1 scenario model includes a representation of new 600mm diameter culvert underneath the proposed roundabout at A28 Sturry Road. The culvert, designed to maintain existing drainage ditch connectivity, is represented in the model using ESTRY - the 1D component of TUFLOW software.

**Table 1 – 2D Model Manning’s n Roughness Coefficients**

<table>
<thead>
<tr>
<th>Building</th>
<th>Manning’s n Roughness Coefficient (s/m(^{1/3}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads, Tracks and Paths</td>
<td>0.3</td>
</tr>
<tr>
<td>General surface – multi surface, step, structures</td>
<td>0.03</td>
</tr>
<tr>
<td>General surface</td>
<td>0.04</td>
</tr>
<tr>
<td>Glasshouse</td>
<td>0.2</td>
</tr>
<tr>
<td>Inland water</td>
<td>0.035</td>
</tr>
<tr>
<td>Landform, slope, cliff, Marsh Reeds or Saltmarsh</td>
<td>0.04</td>
</tr>
<tr>
<td>Boulders</td>
<td>0.045</td>
</tr>
<tr>
<td>Coniferous trees</td>
<td>0.1</td>
</tr>
<tr>
<td>Coniferous trees – scattered / Orchard, Scrub</td>
<td>0.05</td>
</tr>
<tr>
<td>Coppice or osiers</td>
<td>0.07</td>
</tr>
<tr>
<td>Non coniferous trees</td>
<td>0.07</td>
</tr>
<tr>
<td>Non-coniferous trees – scattered</td>
<td>0.04</td>
</tr>
<tr>
<td>Rough grassland</td>
<td>0.04</td>
</tr>
<tr>
<td>Rail, Road</td>
<td>0.02</td>
</tr>
<tr>
<td>Roadside</td>
<td>0.03</td>
</tr>
<tr>
<td>Structure – pylon</td>
<td>0.04</td>
</tr>
<tr>
<td>Tidal water – foreshore</td>
<td>0.035</td>
</tr>
<tr>
<td>Unclassified</td>
<td>0.04</td>
</tr>
<tr>
<td>Stability</td>
<td>0.3</td>
</tr>
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</table>
**Events considered**

To fully investigate the fluvial flood risk through the study area during both the existing (EXG) baseline and proposed development (DEV1) scenarios, a range of fluvial events have been simulated; namely the 5% (Q20), 1% (Q100), and 0.1% (Q1000) AEP events. The impact of future climate change (CC) has also been investigated during the 1% AEP event by increasing flows by 35% (Q100CC) as agreed with the EA. Peak flows extracted from the existing EA model for use in the new truncated version are given in Table 2.

**Table 2 – Primary Simulation Summary**

<table>
<thead>
<tr>
<th>Fluvial Event (AEP)</th>
<th>Great Stour (@ Model c/s X524) - Peak Flows (m3/s)</th>
<th>Great Stour (@ Model c/s S2_24X) - Peak Flows (m3/s)</th>
<th>Great Stour – Lateral Inflows (m3/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% (Q20)</td>
<td>12.97</td>
<td>34.05</td>
<td>1.26</td>
</tr>
<tr>
<td>1% (Q100)</td>
<td>19.16</td>
<td>41.11</td>
<td>1.88</td>
</tr>
<tr>
<td>1% + CC (Q100CC)</td>
<td>25.86</td>
<td>55.49</td>
<td>2.53</td>
</tr>
<tr>
<td>0.1% (Q1000)</td>
<td>24.81</td>
<td>54.10</td>
<td>3.25</td>
</tr>
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</table>

**Results & Conclusions**

This section of the report documents the results obtained from the primary simulations, both EXG and DEV1 models.

Calculated maximum water levels were extracted at each node along the 1D network model and compared for each simulation. A table of this data has been provided in Appendix F. Maximum flood depth, velocity and hazard mapping has been provided for each primary simulation in Appendix G.

Flood hazard ratings have been calculated in accordance with DEFRA document ‘FD2320: Flood Risks to People’ and EA guidance document ‘Supplementary Note on Flood Hazard Ratings and Thresholds’.

**EXG Simulations - Existing Site Arrangement**

During all EXG events considered, the floodplain local to the proposed development area is shown to experience widespread flooding. The A28 Sturry Road at the study area is shown to be flood free for all events, up to and including the 0.1% AEP event.

Comparison of the modelled maximum flood extents and levels extracted from the truncated model against the original EA model show a very good correlation for all events.

Maximum flood depths of approximately 0.32m occur during the 5% AEP fluvial event with maximum water levels varying between 3.9- 4m AOD. Maximum velocity during this event is 0.36m/s and hazard rating varies between ‘Caution’ to ‘Danger for Most’.

During the 1% AEP event maximum water level varies between 4.0-4.15m AOD with a maximum water depth of approximately 0.45m in the floodplain. Maximum velocity increases to 0.7m/s and hazard rating varies between ‘Caution’ to ‘Danger for Most’.
When the impact of climate change (+35%) is considered during the 1% AEP event, maximum water depths in the floodplain increase to approximately 0.71m. Maximum water levels are approximately 4.25m AOD during this event at the study area. Maximum velocity increases to 0.8m/s and hazard rating varies between ‘Caution’ to ‘Danger for Most’. An extract of the maximum depth flood map for this event is given in Figure 2 for information.

During the 0.1% AEP event maximum flood depths are around 0.65m whereas the computed maximum water level is 4.2m AOD. It is noted that the 1% AEP + CC scenarios is more extreme than the 0.1% AEP event. Maximum velocity through the study area is around 0.8m/s and hazard rating varies between ‘Caution’ to ‘Danger for Most’. An extract of the maximum depth flood map for this event is given in Figure 3 for information.

**DEV1 Simulations – Proposed Site Arrangement**

When the development levels are considered, the proposed road bridge, including approach embankments and proposed A28 roundabout, is entirely flood free. The maximum water levels at the study area and wider flood plain in the DEV1 scenario remain almost identical to the EXG scenario during all the fluvial events considered – a maximum variation of in-channel flood level of +4mm is shown.

Maximum velocities through the model domain also remains almost identical with the exception of small areas local to the proposed support piers where maximum velocities are increased by approximately 0.2m/s in the DEV1 scenario relative to the EXG scenario during all the fluvial events considered. Extracts of the DEV1 scenario maximum depth flood map for 1% + CC and 0.1% AEP events are provided in Figure 2 and Figure 3 for information.

**Flood Risk Elsewhere**

The potential impact of the proposed development on flood risk elsewhere has been quantified by comparing the results of the existing (EXG) site layout simulations with the proposed (DEV1). To provide a detailed assessment of the relative changes in flood depths throughout the floodplain, a series of water level difference maps comparing the post- and pre-development maximum water levels have been created and are included in the DEV1 section of Appendix G.

The generated DEV1 flood maps show there is negligible change in the modelled flood extents relative to existing site arrangement for all events considered with a maximum variation of in-channel water levels +4mm.

During all events considered changes in maximum flood depth as a consequence of the proposed development are negligible (± 20mm). The encroachment of the proposed roundabout and southern approach embankment into the floodplain has little impact on comparative flood levels. An extract of the 0.1% AEP maximum depth difference map is provided in Figure 4 for reference.
Figure 2 – Maximum Flood Depth – 1% AEP + CC event

Existing Site Layout (EXG)

Proposed Site Layout (DEV1)
Figure 3 – Maximum Flood Depth – 0.1% AEP event

Existing Site Layout (EXG)

Proposed Site Layout (DEV1)
Conclusions

Overall, the proposed development arrangement is considered to have negligible impact on flood risk through the study area, therefore compensatory storage is not required.
Appendix A – Location Plan and Aerial Image
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND

- Proposed Link Road

AERIAL PLAN

CONTAINS OS DATA © CROWN COPYRIGHT (2017)
BASEMAP: WORLD IMAGERY. SOURCES: ESRI, DIGITALGLOBE, GEOCHE, I-CUBED, EARTHSAT Geographics, CNES/ARIUS DS, USDA, USGS, AEX, GETMAPPING, AEROGIS, IGN, IGP, SWISSTOPO, GIS USER COMMUNITY
Appendix B – Survey Data
Eaves and ridge heights of surrounding buildings have been surveyed where possible.

Drainage has been surveyed where found, and all trees are identified where possible. Species, spread, height and girth are indicative only.

Notes

Hook Survey Legend

- Banking
- Hedge
- Undergrowth
- Tree
- Bush
- Telephone line
- Power line
- Contour line
- Building
- Open Building
- Glass Building
- Gate
- Survey Station
- Level
- Ordnance Survey Benchmark
- Foul Drainage
- Storm Drainage

Abbreviations

- Air Valve
- Borehole
- Bus Stop
- Cover Level
- Fire Hydrant
- Inspection Cover
- Electricity Pole
- Invert Level
- Lamp Post
- Manhole
- Marker
- LP
- MH
- MK
- RNP
- Name Plate
- Road Sign
- RS
- Rodding Eye
- RE
- RSJ
- Reinforced Steel Joint
- Animal Sett
- Sett
- Stop Valve
- SV
- Survey Station
- STN
- TP
- Telegraph Pole
- Tree Stump
- Stump
- TH
- Trial Hole
- Unable To Lift
- UTL
- Vent Pipe
- VP
- SVP
- Soil Vent Pipe
- Rain water Pipe
- RWP
- Power Pole
- PP
- IL
- IC
- FH
- EP
- CL
- BH
- AV
- Water Valve
- WV

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The Environ Design (Sturry) Limited
Land at Sturry Hill, Sturry,
Canterbury, Kent, CT2 0NG
Job No. : 
Scale : 
Client : 
Project : 
Revision : 
Drawn by : 
Dwg No. : 
Date : 
S15/4717/31
June 2015

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Warwickshire
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Email > midlands@hooksurvey.com
Tel 01608 430346

Land & Building Surveyors
at a scale of 1.0000 based around Stations H1 & H2
Psuedo Ordnance Survey Coordinate System
GREAT STOUR

Eaves and ridge heights of surrounding buildings are indicative only.

Drainage has been surveyed where found,

All trees are identified where possible.

Species, spread, height and girth

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Scale
0
5
Metres

Grid & Levels related to:
1:200

Topographical Survey Drawing title:
S15/4717
Environ Design (Sturry) Limited
Land at Sturry Hill, Sturry, Canterbury, Kent, CT2 0NG
Job No.:
Scale:
Client:
Project:
Revision:
Drawn by:
Dwg No.:
Date:
S15/4717/32
June 2015
D.S.

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Tel > 01322 277221

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Tel > 01608 430346

Land & Building Surveyors at a scale of 1:0000 based around Stations H1 & H2 Psuedo Ordnance Survey Coordinate System

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Sheet Layout
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40
Drainage has been surveyed where found.

All trees are identified where possible.

Species, spread, height and girth

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No. 1
No. 3
have been surveyed where possible.
Eaves and ridge heights of surrounding buildings
and traced where possible.
Drainage has been surveyed where found,
All trees are identified where possible.
Species, spread, height and girth
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Rain water Pipe
Power Pole
Water Valve

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Earth Rod
Scale

Grid & Levels related to:
1:200
Topographical Survey

Drawing title:
S15/4717
Environ Design (Sturry) Limited
Land at Sturry Hill, Sturry,
Canterbury, Kent, CT2 0NG
Job No.: 
Scale:
Client:
Project:
Revision:
Drawn by:
Dwg No.: 
Date:

S15/4717/38
June 2015
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Tel
> 01608 430346

Land & Building Surveyors
at a scale of 1.0000 based around Stations H1 & H2
Psuedo Ordnance Survey Coordinate System
HOOK
SURVEY
PARTNERSHIP
Sheet Layout
Appendix C – Proposed Development Details
Earthworks slopes amended to 1 in 2.5

Pier 1 moved to Ch.212.5

24.11.16
Appendix D – EA Flood Map
NOTES:
1. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND
- Proposed Link Road
- EA Main Rivers
- EA Flood Zone 2
- EA Flood Zone 3

CONTAINS OS DATA © CROWN COPYRIGHT (2017)
© ENVIRONMENT AGENCY COPYRIGHT AND/OR DATABASE RIGHT 2017. ALL RIGHTS RESERVED. SOME FEATURES OF THIS MAP ARE BASED ON DIGITAL SPATIAL DATA FROM THE CENTRE FOR ECOLOGY AND HYDROLOGY, © NERC (CEH). © CROWN COPYRIGHT AND DATABASE RIGHTS 2004 ORDNANCE SURVEY 100024198
Appendix E – 1D/2D Model Extents
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDANANCE DATUM UNLESS STATED OTHERWISE.

LEGEND
- Proposed Link Road (for info only)
- 1D Network
- 1D Model Node
- 1D Inflow
- Downstream Boundary
- 2D Model Boundary

0 0.1 0.2 0.4 0.6 0.8 1 m
0 50 100 200 300 400 500 m

DATE: 03/02/2017
PLOT NAME: w3254-Model_Extent
REV: B
DRAWN: SB
CHECKED: RCL
APPROVED: VG
PLOT SCALE @ A3: 1:12,000
PLOT STATUS: FINAL
PLOT TITLE: 1D/2D MODEL EXTENT

SCHEME:
A28 STURRY LINK ROAD, CANTERBURY

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDANANCE DATUM UNLESS STATED OTHERWISE.

CONTAINS OS DATA © CROWN COPYRIGHT (2017)
OS MASTERMAP © CROWN COPYRIGHT AND DATABASE RIGHTS (2017) OS 0100042840

0 0.1 0.2 0.4 0.6 0.8 1 km
0 50 100 200 300 400 500 m

PLOT SCALE @ A3: 1:5,000
Appendix F – Tabulated 1D Model Results Data
**Hydraulic Model Results - Great Stour @ Sturry, Canterbury**

1D Model Results - Maximum Water Levels (mAOD)

**Job Name:** Sturry Link, Canterbury  
**Job Number:** w3254  
**Model Type:** FMP-TUFLOW  
**Date:** 24/01/17

### Existing Site Arrangement (EXG) Simulations

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<tr>
<th>Model Ref</th>
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**Simulation Results.xlsx**
## Hydraulic Model Results - Great Stour @ Sturry, Canterbury

**1D Model Results - Maximum Water Levels (mAOD)**

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### Proposed Development Arrangement (DEV1) Simulations

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### Event Details

- **5% AEP Event; DEV1; NFC**
- **1% AEP Event; DEV1; NFC**
- **0.1% AEP Event; DEV1; NFC**
- **5% AEP Event; EXG; NFC**
- **1% AEP Event; EXG; NFC**
- **0.1% AEP Event; EXG; NFC**

### Simulation Results

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<th>WL Diff vs Q100 EXG (m)</th>
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**Simulation Results.xlsx**
Hydraulic Model Results - Great Stour @ Sturry, Canterbury

1D Model Results - Maximum Water Levels (mAOD)

**Job Name:** Sturry Link, Canterbury  
**Job Number:** w3254  
**Model Type:** FMP-TUFLOW  
**Date:** 24/01/17

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**Model Ref** | **Event Details** | **Q20 DEV1** | **Q100 DEV1** | **Q100 CC DEV1** | **Q1000 DEV1** |
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### Event Details

- **5% AEP Event; DEV1; Normal Flow Conditions (NFC)**
- **1% AEP Event; DEV1; NFC**
- **1% AEP + 35% CC Event; DEV1; NFC**
- **0.1% AEP Event; DEV1; NFC**

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### Proposed Development Arrangement (DEV1)

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### WL Diff

- **Max WL (mAOD)**
  - vs Q20 EXG
  - vs Q100 EXG
  - vs Q100 CC EXG
  - vs Q1000 EXG

### Existing Site Layout (EXG)

- **Node Ref:** Max WL (mAOD)
- **Node Ref:** Max WL (mAOD)
- **Node Ref:** Max WL (mAOD)
- **Node Ref:** Max WL (mAOD)

### Proposed Site Layout (DEV1)

- **Node Ref:** Max WL (mAOD)
- **Node Ref:** WL Diff vs Q20 EXG (m)
- **Node Ref:** WL Diff vs Q100 EXG (m)
- **Node Ref:** WL Diff vs Q100 CC EXG (m)
- **Node Ref:** WL Diff vs Q1000 EXG (m)
### Existing Site Arrangement (EXG) Simulations

<table>
<thead>
<tr>
<th>Model Ref</th>
<th>Event Details</th>
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<tbody>
<tr>
<td>Q20 EXG</td>
<td>5% AEP Event; EXG, Normal Flow Conditions (NFC)</td>
</tr>
<tr>
<td>Q100 EXG</td>
<td>1% AEP Event, EXG, NFC</td>
</tr>
<tr>
<td>Q100CC EXG</td>
<td>1% AEP +35% CC Event, EXG, NFC</td>
</tr>
<tr>
<td>Q1000 EXG</td>
<td>0.1% AEP Event, EXG, NFC</td>
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### Proposed Development Arrangement (DEV1) Simulations

<table>
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<tr>
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<th>Event Details</th>
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<tr>
<td>Q20 DEV1</td>
<td>5% AEP Event, DEV1, Normal Flow Conditions (NFC)</td>
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<tr>
<td>Q100 DEV1</td>
<td>1% AEP Event, DEV1, NFC</td>
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<td>Q100CC DEV1</td>
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</tr>
<tr>
<td>Q1000 DEV1</td>
<td>0.1% AEP Event, DEV1, NFC</td>
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### Existing Site Layout (EXG)

<table>
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<th>Max WL (nAOD)</th>
<th>Max WL (nAOD)</th>
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### Proposed Site Layout (DEV1)

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w/3254-170124-Simulation Results.xlsx
Appendix G – Flood Mapping
EXG Simulations
PLOT TITLE: MAXIMUM FLOOD DEPTH

5% AEP FLUVIAL EVENT EXISTING SITE LAYOUT (EXG)

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND

- 2D Model Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4

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PLOT SCALE @ A3: 1:5,000

PLOT SCALE @ A1: 1:15,000
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES
   ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- 2D Model Boundary

**Maximum Flood Depth (m)**

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4

EXISTING SITE LAYOUT (EXG)

1% AEP + 35% CC FLUVIAL EVENT

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CLIENT: Canterbury

PLOT TITLE: MAXIMUM FLOOD DEPTH

1% AEP + 35% CC FLUVIAL EVENT
EXISTING SITE LAYOUT (EXG)

PLOT SCALE @ A3: 1:5,000
**Legend**

- **2D Model Boundary**
- **Maximum Flood Depth (m)**
  - 0 - 0.3
  - 0.3 - 0.6
  - 0.6 - 1.2
  - 1.2 - 2.4
  - > 2.4

**Notes:**
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.

---

**Maximum Flood Depth**

0.1% AEP Fluvial Event

Existing Site Layout (EXG)

PLOT TITLE:

Kent County Council

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---

**Client:**

Amey

**Scheme:**

A28 Sturry Link Road, Canterbury

**Plot Title:**

Maximum Flood Depth

0.1% AEP Fluvial Event

Existing Site Layout (EXG)

---

**Plot Status:**

Final

---

**Plot Scale @ A3:**

1:5,000
LEGEND

- 2D Model Boundary

Maximum Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

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LEGEND

- 2D Model Boundary
- Maximum Velocity (m/s)
  - 0.0 - 0.3
  - 0.3 - 0.6
  - 0.6 - 0.9
  - 0.9 - 1.2
  - > 1.2

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

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LEGEND

- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)

NOTES:

1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

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MAXIMUM FLOOD HAZARD

1% AEP FLUVIAL EVENT
EXISTING SITE LAYOUT (EXG)

PLOT SCALE @ A3: 1:5,000

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

2D Model Boundary

Maximum Flood Hazard Rating (FD2320)

< 0.75 (Caution)
0.75 - 1.25 (Danger for Some)
1.25 - 2 (Danger for Most)
> 2.0 (Danger for All)

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PLOT TITLE: MAXIMUM FLOOD HAZARD
EXISTING SITE LAYOUT (EXG)

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND

2D Model Boundary
Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)

EXISTING SITE LAYOUT (EXG)
1% AEP + 35% CC FLUVIAL EVENT

PLOT SCALE @ A3: 1:10,000

CLIENT: Kent County Council

SCHEME: A28 STURRY LINK ROAD, CANTERBURY

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0 0.1 0.2 0.4 0.6 0.8 1 km
0 50 100 200 300 400 500 m

PLOT SCALE @ A3: 1:5,000

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0 0.1 0.2 0.4 0.6 0.8 1 km
0 50 100 200 300 400 500 m

PLOT SCALE @ A3: 1:10,000

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0 0.1 0.2 0.4 0.6 0.8 1 km
0 50 100 200 300 400 500 m
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDINANCE DATUM UNLESS STATED OTHERWISE.

PLOT TITLE: MAXIMUM FLOOD HAZARD
EXISTING SITE LAYOUT (EXG)

LEGEND
- 2D Model Boundary

Maximum Flood Hazard Rating (FD2320)
- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)

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DEV1 Simulations
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND

- 2D Model Boundary
- --- Proposed Link Road DEV1 (for info)

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4

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PLOT TITLE: MAXIMUM DEPTH DIFFERENCE

EXG vs DEV1

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

2D Model Boundary
Proposed Link Road DEV1 (for info)

Maximum Depth Variation

> +100mm
+50mm to +100mm
+20mm to +50mm
No Change (+/-20mm)
-20mm to -50mm
-50mm to -100mm
> -100mm

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client: Kent County Council
DATE: 23/01/2017
PLOT NAME: w3254-Q100_DEV1_D
REV: B
DRAWN: SB
CHECKED: EW
APPROVED: RCL
PLOT SCALE @ A3: UNLESS STATED OTHERWISE
1:10,000
PLOT STATUS: FINAL
PLOT TITLE: MAXIMUM FLOOD DEPTH
SCHEME: A28 STURRY LINK ROAD, CANTERBURY

LEGEND
- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

Maximum Flood Depth (m)
- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE
±

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MAXIMUM DEPTH DIFFERENCE

A28 STURRY LINK ROAD, CANTERBURY

1% AEP FLUVIAL EVENT
EXG vs DEV1

PLOT SCALE @ A3: 1:5,000
LEGEND

- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4

NOTES:

1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

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LEGEND

- 2D Model Boundary
- --- Proposed Link Road DEV1 (for info)

Maximum Depth Variation

- > +100mm
- +50mm to +100mm
- +20mm to +50mm
- No Change (+/-20mm)
- -20mm to -50mm
- -50mm to -100mm
- > -100mm

NOTES:

1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

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OS MASTERMAP © CROWN COPYRIGHT AND DATABASE RIGHTS (2017) OS 0100042840
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND

- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4

PLOT TITLE:
MAXIMUM FLOOD DEPTH

SCHEME:
A28 STURRY LINK ROAD, CANTERBURY

CLIENT:
LEGEND
2D Model Boundary
Proposed Link Road DEV1 (for info)
Maximum Flood Depth (m)
0 - 0.3
0.3 - 0.6
0.6 - 1.2
1.2 - 2.4
> 2.4

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

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OS 0100042840
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

0.1% AEP FLUVIAL EVENT
EXG vs DEV1

PLOT TITLE: MAXIMUM DEPTH DIFFERENCE

PLOT NAME: w3254-Q1000_DEV1_D_DIFF

LEGEND

- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

Maximum Depth Variation

- > +100mm
- +50mm to +100mm
- +20mm to +50mm
- No Change (+/-20mm)
- -20mm to -50mm
- -50mm to -100mm
- > -100mm

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PLOT TITLE: MAXIMUM VELOCITY
1% AEP FLUVIAL EVENT DEVELOPMENT SITE LAYOUT (DEV1)

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

SCALE: 1:5,000

CLIENT: LEGEND

- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

MAXIMUM VELOCITY (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2

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NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

SCHEME:
A28 STURRY LINK ROAD, CANTERBURY

CLIENT:
Kent County Council

FURTHER NOTE:
1% AEP + 35% CC FLUVIAL EVENT DEVELOPMENT SITE LAYOUT (DEV1)

PLOT TITLE:
MAXIMUM VELOCITY

PLOT SCALE @ A3: 1:5,000

DATE:
23/01/2017

DRAWN:
SB
CHECKED:
EW
APPROVED:
RCL

PLOT STATUS:
FINAL

PLOT NAME:
w3254-Q100CC_DEV1_V

LEGEND

2D Model Boundary

- Proposed Link Road DEV1 (for info)

Maximum Velocity (m/s)

<table>
<thead>
<tr>
<th>Velocity Range</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.3</td>
<td>Green</td>
</tr>
<tr>
<td>0.3 - 0.6</td>
<td>Yellow</td>
</tr>
<tr>
<td>0.6 - 0.9</td>
<td>Orange</td>
</tr>
<tr>
<td>0.9 - 1.2</td>
<td>Red</td>
</tr>
<tr>
<td>&gt; 1.2</td>
<td>Grey</td>
</tr>
</tbody>
</table>

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NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.

LEGEND

2D Model Boundary
Proposed Link Road DEV1 (for info)

Maximum Flood Hazard Rating (FD2320)

- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)

0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

0
50
100
150
200
250
300
350
400
450
500

km
m

DATE: 23/01/2017
PLOT NAME: w3254-Q20_DEV1_H
REV: B
DRAWN: SB
CHECKED: EW
APPROVED: RCL
PLOT SCALE @ A3: 1:10,000
PLOT STATUS: FINAL
PLOT TITLE: MAXIMUM FLOOD HAZARD

SCHEME: A28 STURRY LINK ROAD, CANTERBURY

CLIENT: KENT COUNTY COUNCIL

CONSULTANTS: AMEY WATERCO

PLOT TITLE: MAXIMUM FLOOD HAZARD
5% AEP FLUVIAL EVENT
DEVELOPMENT SITE LAYOUT (DEV1)

PLOT SCALE @ A3: 1:5,000

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PLOT TITLE: MAXIMUM FLOOD HAZARD

1% AEP FLUVIAL EVENT DEVELOPMENT SITE LAYOUT (DEV1)

PLOT STATUS: FINAL

DATE: 23/01/2017

PLOT SCALE @ A3: 1:10,000

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

VALUES:
- < 0.75 (Caution)
- 0.75 - 1.25 (Danger for Some)
- 1.25 - 2 (Danger for Most)
- > 2.0 (Danger for All)

SCALE: 1:5,000

LEGEND
- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

MAXIMUM FLOOD HAZARD RATING (FD2320)

CLIENT: LEGEND

SYMBOLS:
- 2D Model Boundary
- Proposed Link Road DEV1 (for info)

LEGEND:
- Maximum Flood Hazard Rating (FD2320)
  - < 0.75 (Caution)
  - 0.75 - 1.25 (Danger for Some)
  - 1.25 - 2 (Danger for Most)
  - > 2.0 (Danger for All)

NOTE:
- All data is for information purposes only and may not be accurate.

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