**Cambridge Waste Water Treatment Plant Relocation Project**
Anglian Water Services Limited

# Appendix 20.5 Fluvial Model Report

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DRAFT

# CAMBRIDGE WWTP RIVER AND OUTFALL MODELLING (USING MIKE 3)

**Project no. 123239**

Prepared for:

Anglian Water

July 2022

Enhancing lives, communities and the environment

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# 1. Introduction

## 1.1 Background

The Cambridge Wastewater Treatment Plant (WWTP) Relocation project, also known as CWWTPRP, includes the relocation of the existing WWTP. The project scope also includes an extension of the existing Riverside Sewer Tunnel to convey flows to the proposed new WWTP location and a new outfall to discharge effluent from the WWTP into the River Cam.

This report describes the river modelling to assess the impact of outfall discharges on fluvial flood levels in the River Cam.

## 1.2 Flood Risk Assessment

The project falls into the category of being 1 hectare or greater in Flood Zone 1 or a proposal located in Flood Zones 2 and 3 and therefore must be accompanied by a Flood Risk Assessment (FRA). The CWWTPRP is now at the stage where the FRA is required. The FRA will:

- Identify and assess the risks of all sources of flooding to and from the project.
- Demonstrate how these flood risks will be managed.
- Take climate change into account.
- Help develop the design of the new outfall.

For the FRA it is proposed that three stages of modelling are carried out to understand the impact of the new WWTP and associated outfall on the local fluvial and land environment:

- Stage 1: river modelling of the River Cam using an existing one-dimensional (1D) – two-dimensional (2D) hydraulic model of the River Cam. This is to assess fluvial flood levels throughout the River Cam and the relative impact of the new outfall compared to existing conditions.
- Stage 2: river and outfall modelling using a new local hydrodynamic model of the River Cam in the vicinity of the new outfall (in 2D or 3D). This is to assess velocities and mixing of the effluent as it enters the River Cam.
- Stage 3: outfall modelling using Computational Fluid Dynamics (CFD). This is to inform the design of the outfall, for example to prevent scour of the river bed and opposite bank.

There is also potential for a further consideration of fluvial-geomorphology modelling. Detailed design of the relevant parts of the project will link into and be informed by the modelling results.

This report only covers the Stage 2 modelling.

# 2. Scope

The scope[1] provided for this work in the Project Brief is:

> *"Carry our hydrodynamic modelling outfall and local upstream/downstream sections of the river using appropriate software (Mike 21 or Mike 3 or equivalent).*
>
> *The objectives of the model include a hydraulic assessment of the outfall arrangement and interface with the river:*
> *- hydraulic assessment of the outfall when the river is both at high level and low level*
> *- demonstrate that the outfall shouldn't result in erosion or a build-up of sediment*
> *- assessment of energy dissipation and flow spreading*
> *- assessment of location and alignment on the river*
> *- review impact on water quality and environment*
> *- review the requirement and extent of bank protection required in the vicinity of the outfall (upstream and downstream)"*

# 3. Hydraulic Modelling

## 3.1 Software

The software used for this Stage 2 modelling of the outfalls is MIKE 3 Flow Model Flexible Mesh (MIKE 3) developed by DHI. MIKE 3 provides the simulation tools to model 3D (three-dimensional) free surface flows. The hydrodynamic module included in MIKE 3 simulates unsteady flow.

## 3.2 Model domain

The extent of our model domain is:

- Upstream boundary: 550m upstream of the A14 Bridge. This is far enough upstream for 3D flow effects to fully develop well before the outfalls, preventing boundary effects influencing the model findings.

- Downstream boundary: immediately upstream of Baits Bites Lock. This is far enough downstream for the model to capture the near-field impact of the outfalls. Beyond this, the flow distribution in the river will be determined by the Baits Bite Lock structure itself.

Figure 3.1 shows the location of the outfalls, bathymetry points, river cross-sections and model domains. The domains are:

- River only (blue lines) for fully in-channel river levels (1 in 2 year flood and non-flood conditions); and

- River and floodplain (red lines) for high river levels (1 in 100 year plus climate change).

[1] TASK BRIEF No. 8. River Modelling.V3 Scope Change 1).xlsx - Email 02 Feb 2022.


*Figure 3.1. Model domains*

## 3.3 Bathymetry and Digital Terrain Model

The model digital terrain model (DTM) is a combination of bathymetry and LIDAR data for river and floodplain respectively. The source of bathymetry and DTM data is:

- River bathymetry: Randalls 2021 bathymetry data, imported as a point cloud. This has been extended slightly near Bates Bite Lock using the cross-sections from the river model.
- Floodplain levels: LIDAR composite DTM 2020, 1m resolution, downloaded from Defra (https://environment.data.gov.uk/DefraDataDownload/?Mode=survey).

**Riverbanks**

The Randall's survey provides some information on the existing riverbank system, including:

- The west side of the river has a towpath with bank protection.
- The east side of the river generally has natural vegetated riverbanks (without bank protection).
- The riverbanks in the vicinity of the A14 bridge crossing, immediately downstream of the existing outfall and upstream of the new outfall, are protected with sheet pilling and concrete capping beam (extending up to a level of approximately 4.2m AOD).

## 3.4 Model mesh

Figure 3.2 and Figure 3.3 show model mesh and bathymetry for this study. Types of mesh are:

- Quadrangular mesh (1m by 1m) for river; and
- Triangular mesh with maximum area of 100m$^2$ for floodplains.

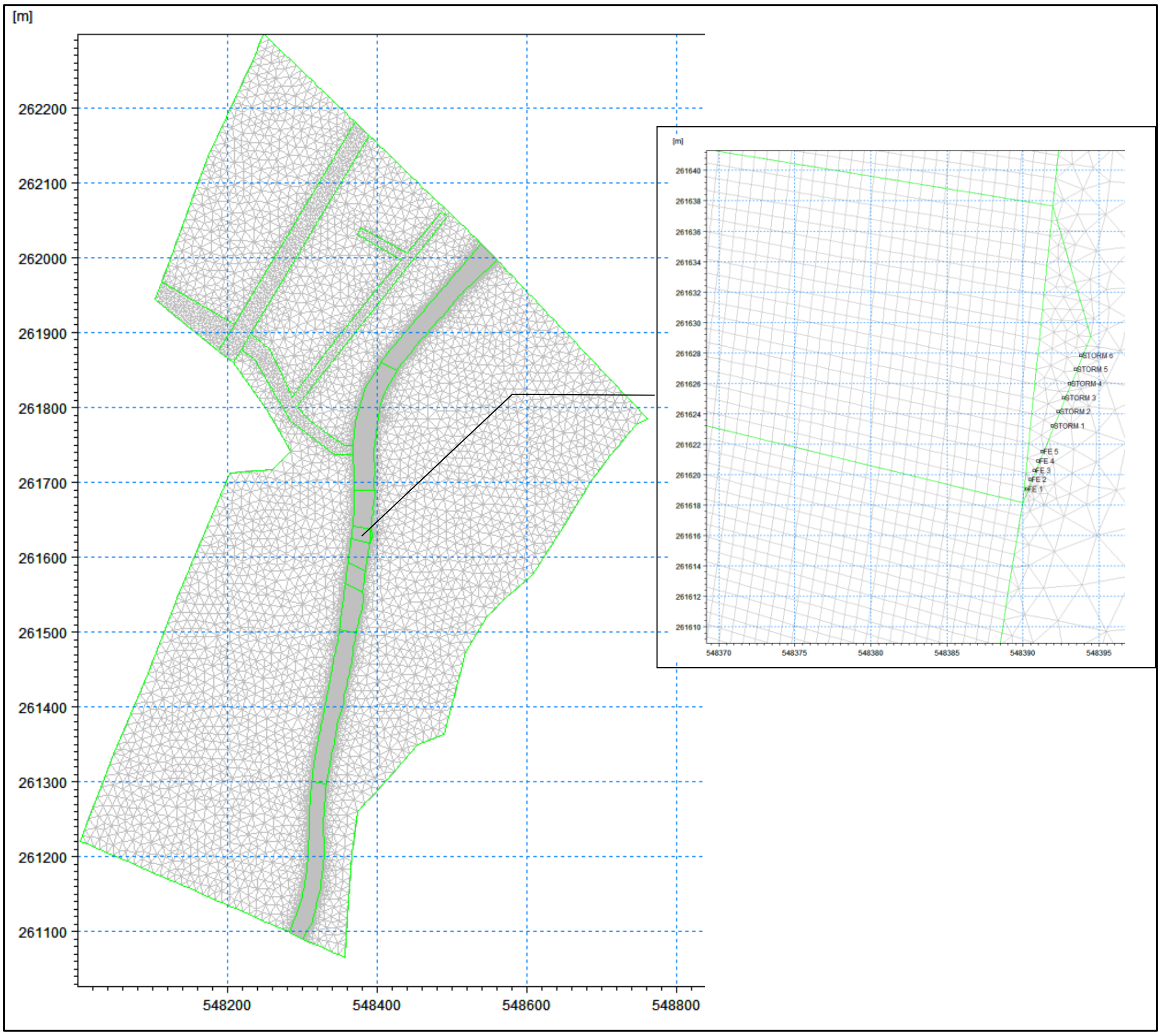



*Figure 3.2. Model mesh*

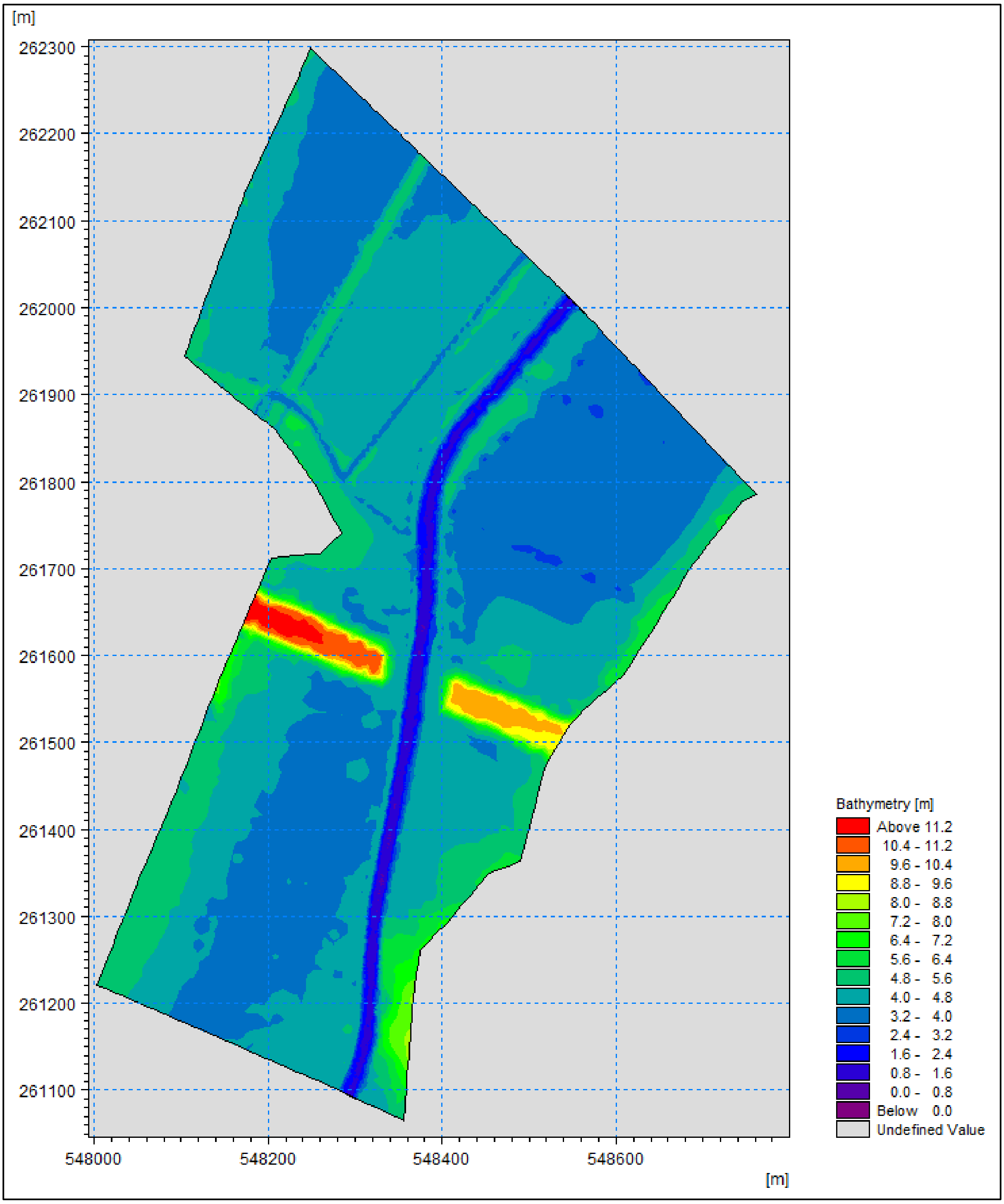



*Figure 3.3. Model bathymetry*

## 3.5 Model geometry

Existing and new outfall geometries are reproduced in Appendix A. These are:

- Drawing no. S/212/13/5C: Details of Effluent Outfall & Railway Crossing (Lemon & Blizard, September 1976) for existing outfall; and

- Sketches A and B – Rev 2 (Binnies, April 2022) for new outfall [Ref 2].

Table 3.1 presents the outfall details.

*Table 3.1. Outfall details*

| Description | Existing outfall | New outfall | |
|---|---|---|---|
| | | Final Effluent (FE) | Storm |
| Width/diameter (m) | 0.4 | 0.6 | 0.75 |
| Height (m) | 0.6 | 0.6 | - |
| Invert level (mOD) | 3.1 | 3.1 | 2.9 |
| Number of openings | 4[1)] | 5 | 6 |
| Max. total discharge ($m^3/s$) | 3.8[2)] | 2.0 | 5.0 |
| Max. velocity per opening (m/s) | 4.0[3)] | 1.1[3)] | 2.5[3)4)] |

1) The openings are angled approx. 22 degrees (relative to the riverbank) in a downstream direction.
2) Flow provided by the Binnies Network Modelling team from their sewer model of Cambridge, used in the WWTP design [Ref 1].
3) Maximum discharge velocities.
4) Assumed cross sectional area is 75% of pipe diameter (due to non-return valve).

## 3.6 Model boundaries

Model boundaries are:

- Upstream: 600m upstream of the new outfall with flow taken from the updated 2011 River Cam model [Ref 1];

- Downstream: immediately upstream of Bites Bite Lock (400m from the new outfall) with water level taken from the river model;

- Outfall flows applied where they come out of each of the outfall structure openings and enter the river. The internal part of the outfall is not modelled in this Stage (although this has been done in the Stage 3 CFD modelling). Therefore, it was assumed that the total outfall flow is distributed evenly between the outfall openings.

For low river level cases i.e., 1 in 2 year event, constant fluvial flood peak flows and water levels have been applied to the model boundary with 2 hours model simulation time. However, flows and water level hydrographs have been used for 1 in 100 year plus climate change simulations as shown in Figure 3.4. The simulation covers the period of maximum outfall flows (30 to 40 hours in the river simulation) for worst-case conditions in terms of outfall flow impact rather than the river peak flow.

For the dry weather flow (DWF) case, the river inflow was taken as a constant 2.4m$^3$/s. This is based on the 50% exceedance flow for the Cam at Bottisham gauging station[2]. The downstream water level was taken as a constant 3.85mAOD, which is a typical retention level for Baits Bite Lock[3].

[2] https://nrfa.ceh.ac.uk/data/station/meanflow/33003

[3] https://riverlevels.uk/baits-bite-lock-sluice-automation-dual-comms-cambridgeshire#.YsQYWnbMJPY

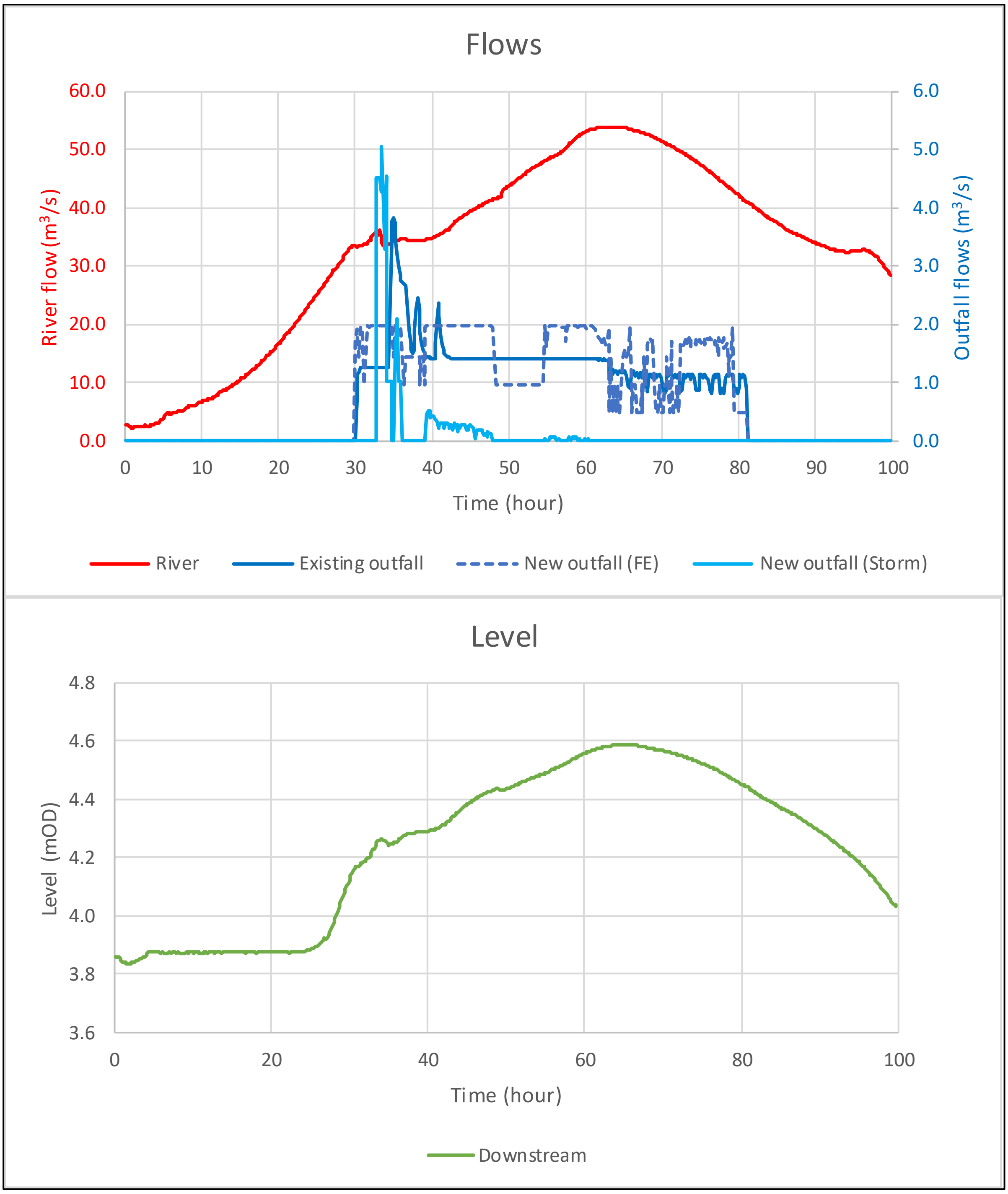



*Figure 3.4. 1 in 100 plus climate change flows and level*

## 3.7 Model scenarios

The scenarios that were simulated are listed in Table 3.2. Note that cases A to C are consistent with the cases tested in the CFD modelling (Stage 3). To give some context to these cases:

A. For the 1 in 2 year flood, the maximum outfall flow has been tested. This is likely to be a conservative combination as we would only expect storm flows through the outfall in higher magnitude floods.

B. Similarly for the first DWF case, the maximum outfall flow has been tested. This should be a very conservative assumption, as it seems very unlikely to get maximum storm flows through the outfall in combination with median river flows.

C. For the second DWF case, only the maximum final effluent (FE) outfall flow was tested. This is a more realistic combination.

D. For the 1 in 100 year plus climate change case, the maximum outfall flow was tested.

E. This is the equivalent case to Case A but for the existing outfall. Note the lower outfall flow rate with the new outfall.

F. This is the equivalent case to Case B but for the existing outfall. Again, note the lower outfall flow rate with the new outfall.

G. This is the equivalent case to Case D but for the existing outfall. Again, note the lower outfall flow rate with the new outfall.

Details of the model setup are given in Appendix B.

*Table 3.2. Modelling scenarios*

| Run no. | Case | Flow magnitude | River flow ($m^3/s$) | River level (mOD) | Existing outfall flow ($m^3/s$) | New outfall flows ($m^3/s$) | |
|---|---|---|---|---|---|---|---|
| | | | | | | FE | Storm |
| 1 | A | 1 in 2 year | 21.8 | 3.89 | - | 2.0 | 5.0 |
| 2 | B | DWF | 2.4 | 3.85 | - | 2.0 | 5.0 |
| 3 | C | DWF | 2.4 | 3.85 | - | 2.0 | - |
| 4 | D | 1 in 100 year plus climate change | 34.7* | 4.25* | - | 2.0 (peak) | 5.0 (peak) |
| 5 | E | 1 in 2 year | 21.8 | 3.89 | 3.8 | - | - |
| 6 | F | DWF | 2.4 | 3.85 | 3.8 | - | - |
| 7 | G | 1 in 100 year plus climate change | 34.7* | 4.25* | 3.8 (peak) | - | - |

*Flow and water level at the end of simulation.

# 4. Model results

## 4.1 General

The modelling results are presented as:

- Tables of peak water levels and surface velocities (Table 4.1 and 4.2). The node/section locations for these comparison points are shown in Figure 4.1.

- Velocity plots in plan view are shown on Figure 4.2 to Figure 4.8. The top half of the figures show surface and mid-depth velocities for the wider model domain (from the outfalls to the downstream end of the model) and the bottom half show a more detailed view of velocities in the immediate vicinity of the outfalls.

- Vertical velocity profiles at the outfall and further downstream of the outfall are shown on Figure 4.9 and Figure 4.10.

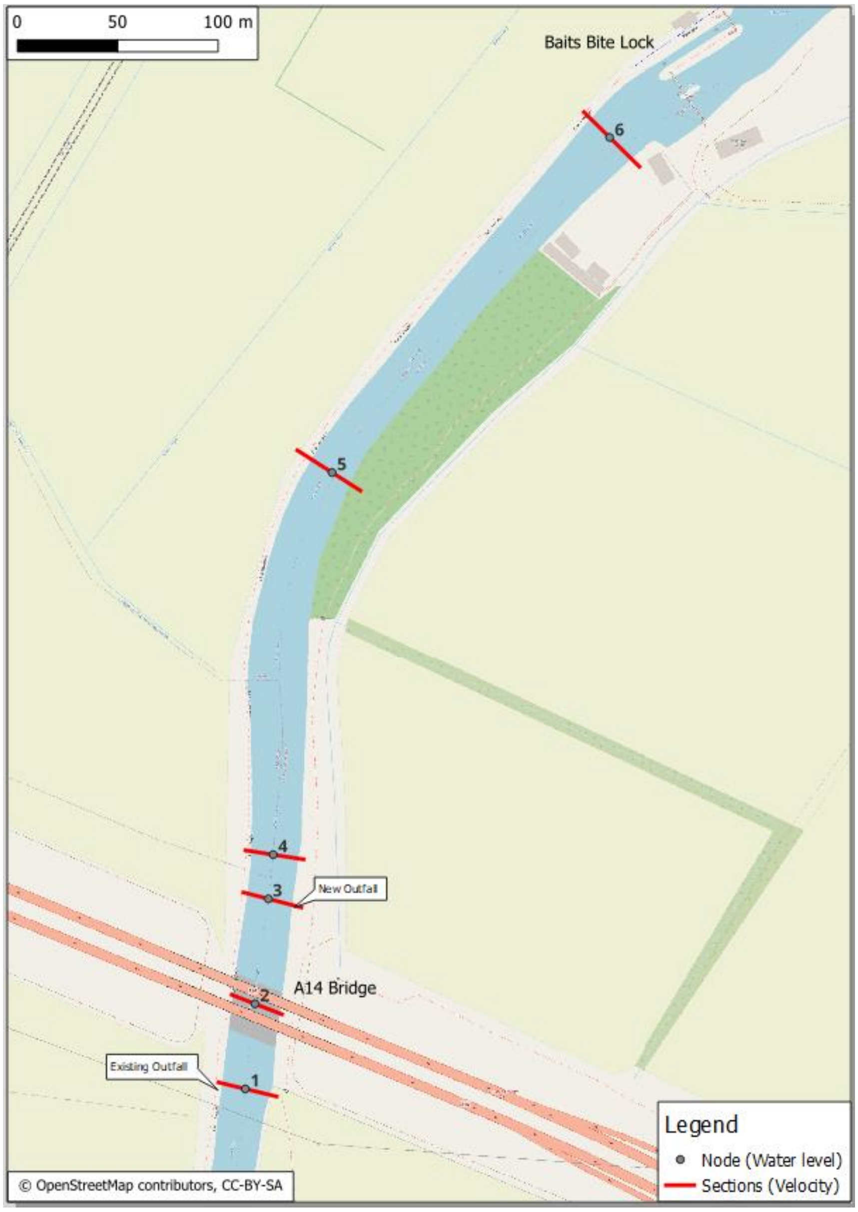



*Figure 4.1. Node/section locations*

## 4.2 Water Levels

Model results for water levels (Table 4.1) show that:

- For the 1 in 2 year flood (cases A and E), peak water levels with the new outfall are 0.02 to 0.03m higher than water levels with the existing outfall (nodes 1 to 4). Water levels are slightly higher because the new outfall flow rate tested is almost twice as high as for the existing outfall. There is no water level difference immediately upstream of Bates Bite Lock but this is a function of the specified boundary condition.

- For the DWF (cases B and F), peak water levels upstream of the new outfall (nodes 1 and 2) are 0.02 to 0.04m higher than water levels with the existing outfall. This is as expected as the discharge of the new outfall is almost twice of the existing outfall discharge. Downstream of the outfalls the difference is smaller.

- For the 1 in 100 year plus climate change flood (cases D and G), there is almost no difference in water levels at all nodes. The impact of the change in peak outfall flow is much smaller due to the much higher river flows.

*Table 4.1. Maximum water levels*

| Case | River flow | Outfall flow ($m^3/s$) | Node 1 Existing outfall | Node 2 A14 Bridge | Node 3 New outfall | Node 4 Opposite new outfall | Node 5 Between new outfall and the lock | Node 6 Upstream of the lock |
|---|---|---|---|---|---|---|---|---|
| | | | Maximum water level (mOD) | | | | | |
| A | 1 in 2 | 7.0[1] | 4.00 | 4.00 | 4.00 | 3.99 | 3.96 | 3.89 |
| B | DWF | 7.0[1] | 3.86 | 3.86 | 3.86 | 3.85 | 3.86 | 3.85 |
| C | DWF | 2.0[1] | 3.85 | 3.85 | 3.85 | 3.85 | 3.85 | 3.85 |
| D | 1 in 100 CC | 7.0[1] | 4.39 | 4.38 | 4.38 | 4.37 | 4.34 | 4.26 |
| E | 1 in 2 | 3.8[2] | 3.97 | 3.97 | 3.97 | 3.97 | 3.94 | 3.89 |
| F | DWF | 3.8[2] | 3.82 | 3.84 | 3.85 | 3.85 | 3.85 | 3.85 |
| G | 1 in 100 CC | 3.8[2] | 4.39 | 4.37 | 4.37 | 4.37 | 4.33 | 4.25 |

1. Cases A to D are for the new outfall
2. Cases E to F are for the existing outfall

## 4.3 Velocities

Model results for surface velocities (Table 4.2) show that:

- For the low and medium flow (cases A, B, E and F), the difference in surface velocities between the new and the existing outfalls from sections 4 to 6 are small (0.1m/s). Again, the small increase is due to the higher peak outfall flow.

- There is virtually no difference in surface velocities for the 1 in 100 year plus climate change floods (cases D and G).

Velocity plan plots (Figure 4.2 to Figure 4.8) show that:

- For case A, the 1 in 2 year flood with maximum flow through the new outfall, higher velocities associated with the outfall are only apparent very close to the outfall (above 1m/s for less than half the river width) and not at the water surface. Moving downstream the velocities are similar magnitude to those caused by the fluvial flood. This indicates that the outfall plume rapidly becomes well mixed with the fluvial flow.

- For case B, DWF with maximum flow (FE and storm) through the new outfall, the outfall impact is more apparent due to the lower ambient conditions in the river. The outfall plume is angled downstream and extends across the whole river width. The velocities that reach the opposite bank, however, are relatively modest (only around 0.5m/s). The plume of higher velocities then turns downstream, closer to the west river bank until the slight river bend. Beyond this the velocities become more evenly distributed. Remember that we consider the combination of river and outfall flows for this case quite unlikely to actually occur.

- For case C, DWF with only FE flow through the new outfall, the outfall plume is much weaker. The results show the same shape plume but velocities are only 0.1-0.2m/s.

- For case D, the 1 in 100 year flood plus climate change with maximum flow through the new outfall, it is hard to see any impact from the outfall. River velocities are high already, irrespective of the outfall. There is out of bank flow in the floodplain on both sides of the river.

- For case E, the 1 in 2 year flood with maximum flow through the existing outfall, there is a plume of high velocities close to the outfall. This is quickly turned to follow the river direction, without reaching the opposite bank. Unlike for the equivalent case with the new outfall (case A), there are small areas of high velocity on the water surface.

- For case F, DWF with maximum flow through the existing outfall, the plume of high velocities stretches across to the opposite bank due to the low ambient river velocities. The higher velocities persist on the east side until the river bend. There is more swirling and disturbance in the river away from the main plume (higher velocities directly opposite the outfall and on the west side through the A14 bridge) than for the equivalent case with the new outfall (case B).

- For case G, 1 in 100 year plus climate change with maximum flow through the existing outfall, there is an area of high velocity immediately downstream of the outfall at mid-depths but this quickly is masked by the high velocities from the fluvial flow.

The velocity cross-section plots (Figure 4.9 and Figure 4.10) show that:

- For the new outfall, the plume of high velocities is horizontal and quickly dissipates moving into the main river channel. This indicates good mixing and dilution. Velocities along the river bed and banks (except at the outfall structure itself) are not high. Downstream of the outfall, the outfall plume is not apparent.

- For the existing outfall, the plume of higher velocities turns down towards the river bed. This is quite different to the results for the new outfall. It is possible that the difference is because the new outfall is slightly recessed, allowing the plume to develop before entering the main river flow whereas the existing outfall is in line with the river bank. However, the results are surprising and it is possible the existing outfall simulations are not working as intended.

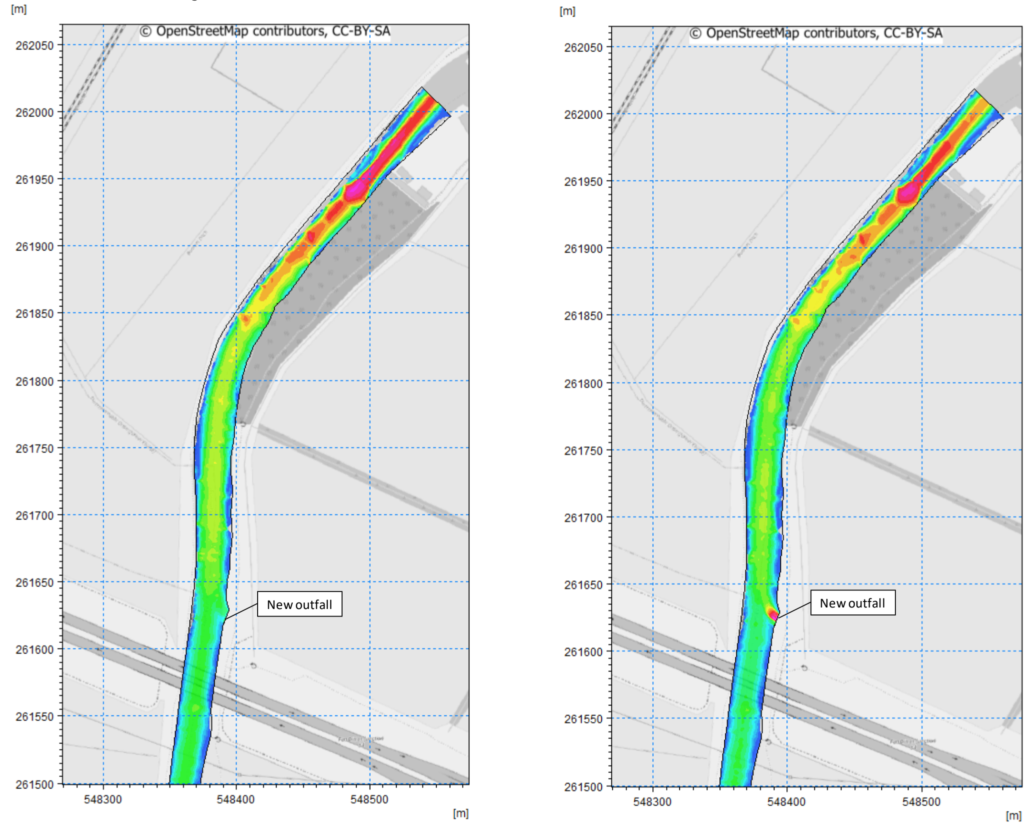
*Table 4.2. Maximum velocities*

| Case | River flow | Outfall flow ($m^3/s$) | Section 1 Existing outfall | Section 2 A14 Bridge | Section 3 New outfall | Section 4 Opposite new outfall | Section 5 Between new outfall and the lock | Section 6 Upstream of the lock |
|---|---|---|---|---|---|---|---|---|
| | | | Maximum surface velocity (m/s) | | | | | |
| A | 1 in 2 | 7.0[1] | 0.7 | 0.6 | 0.6 | 0.8 | 1.0 | 1.2 |
| B | DWF | 7.0[1] | 0.1 | 0.1 | 0.5 | 0.5 | 0.4 | 0.4 |
| C | DWF | 2.0[1] | 0.1 | 0.1 | 0.4 | 0.2 | 0.2 | 0.2 |
| D | 1 in 100 CC | 7.0[1] | 1.1 | 1.2 | 1.1 | 1.1 | 1.2 | 1.5 |
| E | 1 in 2 | 3.8[2] | 1.5 | 0.8 | 0.9 | 0.9 | 0.9 | 1.1 |
| F | DWF | 3.8[2] | 2.7 | 0.7 | 0.4 | 0.4 | 0.3 | 0.3 |
| G | 1 in 100 CC | 3.8[2] | 1.1 | 1.2 | 1.2 | 1.1 | 1.2 | 1.5 |

1. Cases A to D are for the new outfall
2. Cases E to F are for the existing outfall

| Surface velocity | Mid-depth velocity |
|---|---|

**CASE A (1 in 2 year, 7m$^3$/s new outfall)**




Enlarged view at new outfall

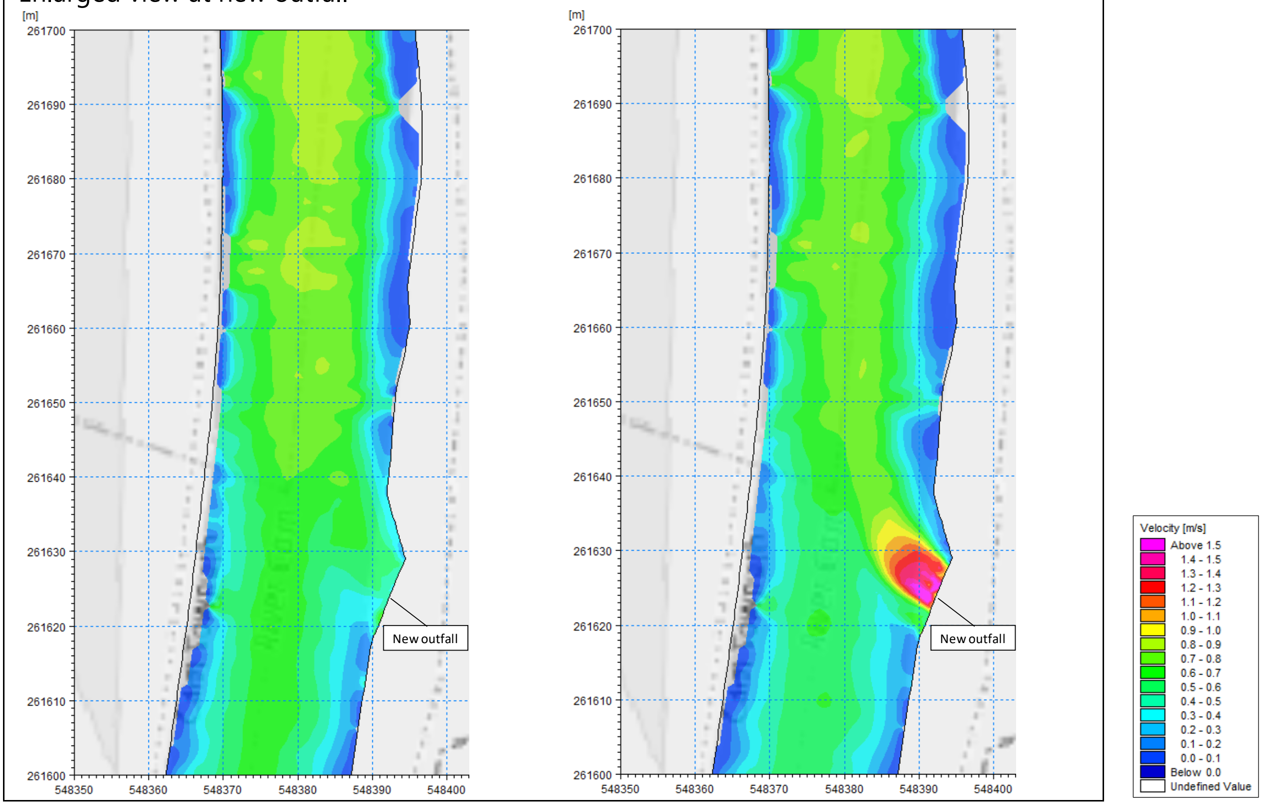



*Figure 4.2. Case A velocities*

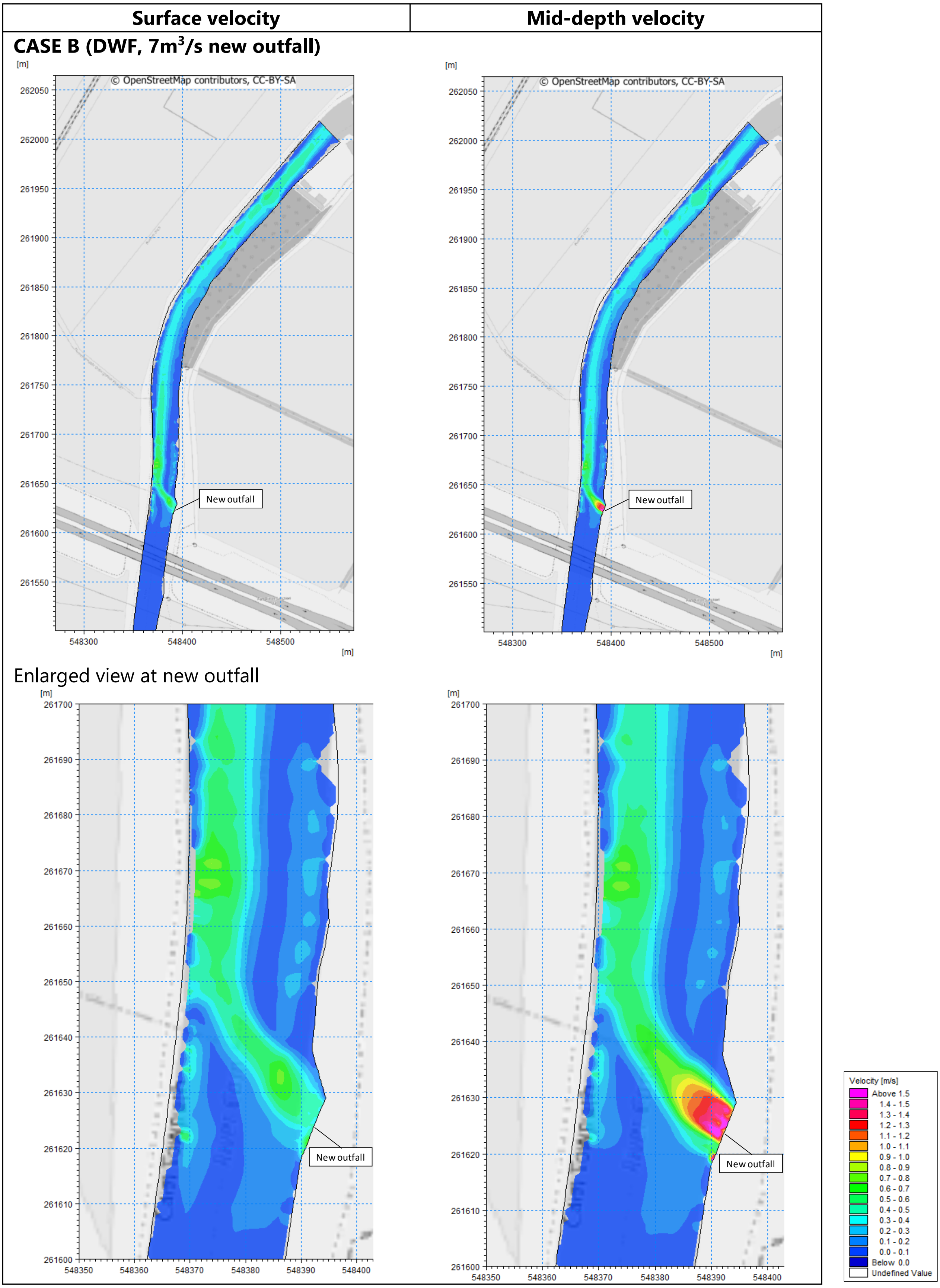



*Figure 4.3. Case B velocities*

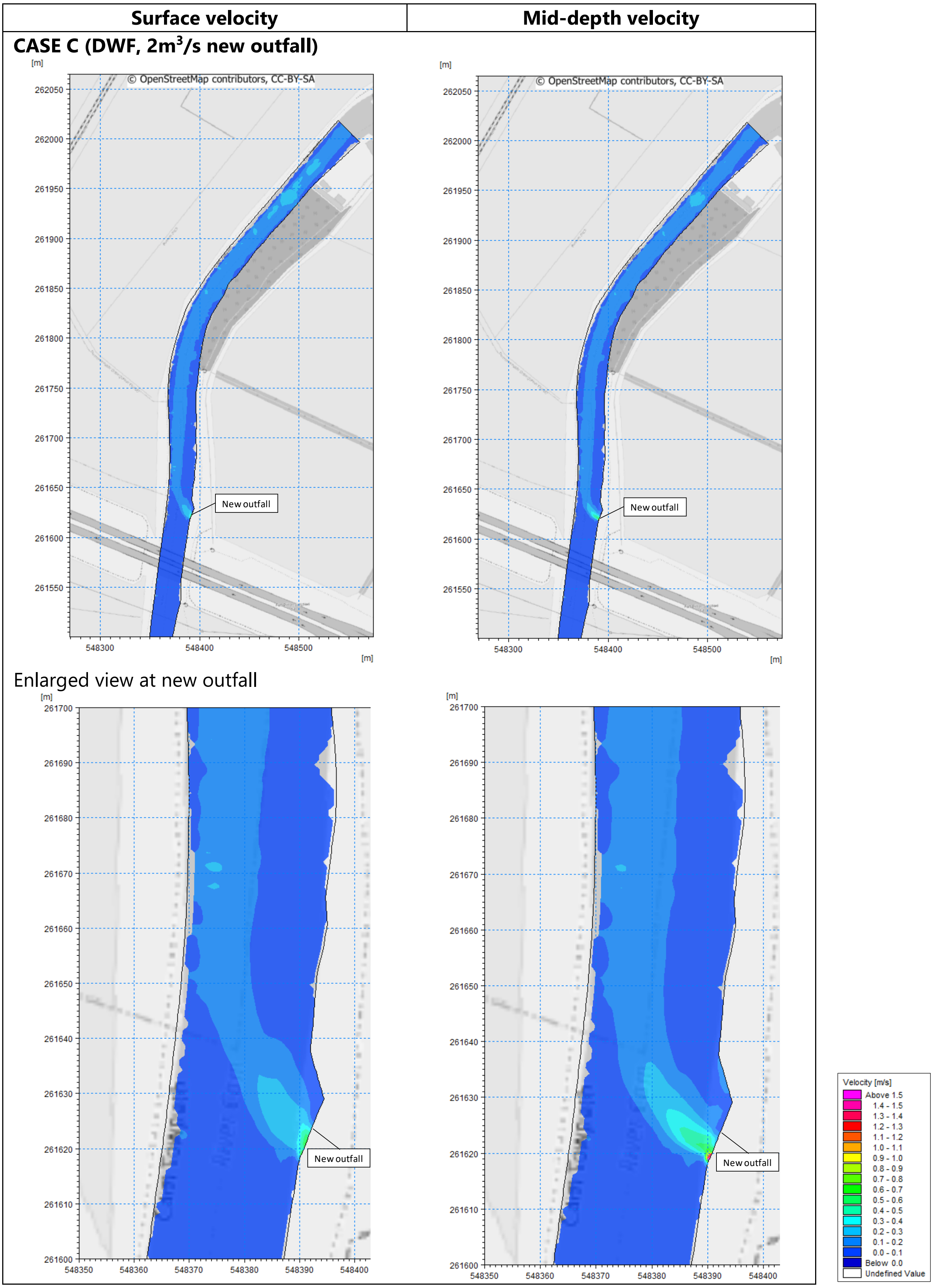



*Figure 4.4. Case C velocities*

| Surface velocity | Mid-depth velocity |
|---|---|

**CASE D (1 in 100+CC, 7m$^3$/s new outfall)**

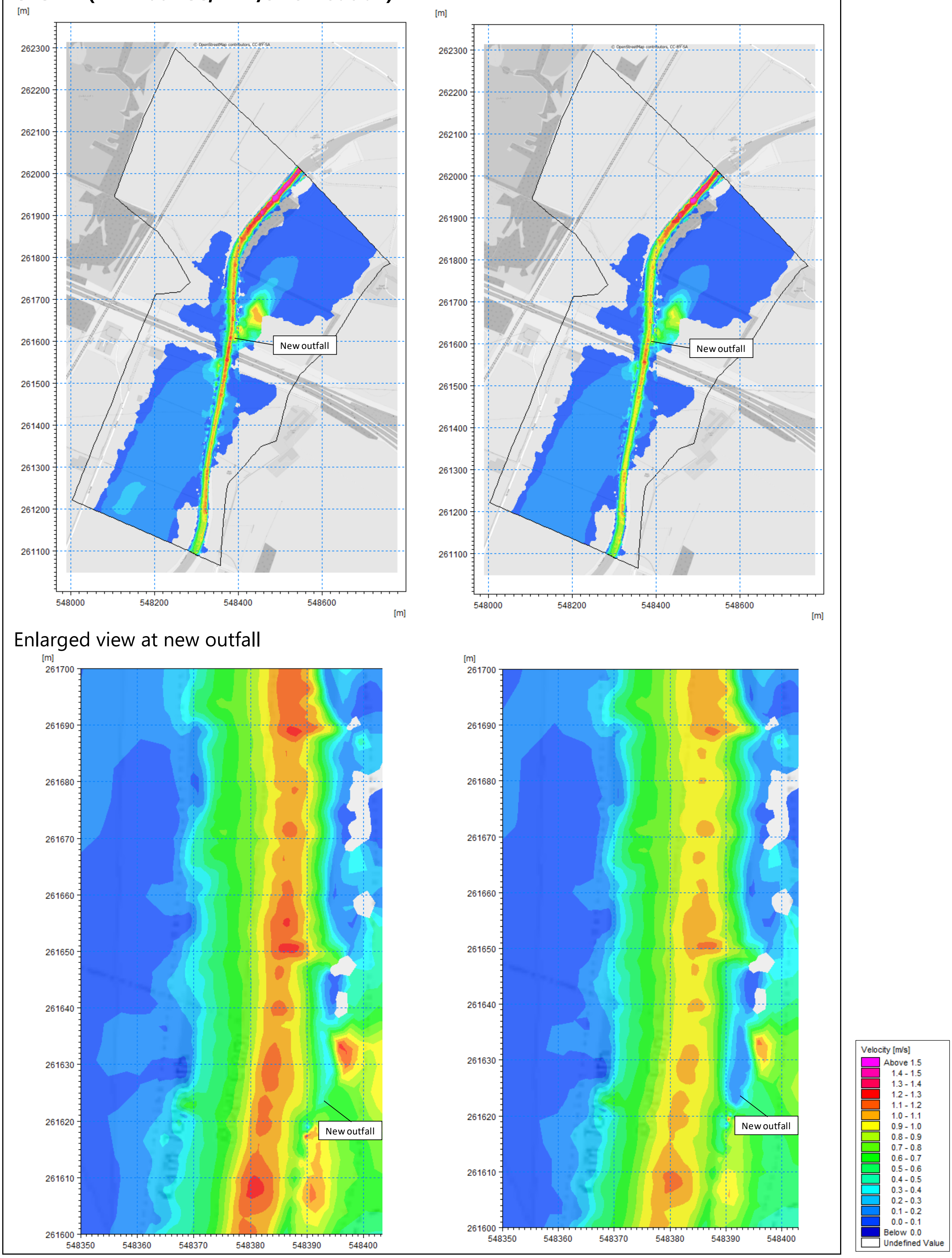



*Figure 4.5. Case D velocities*

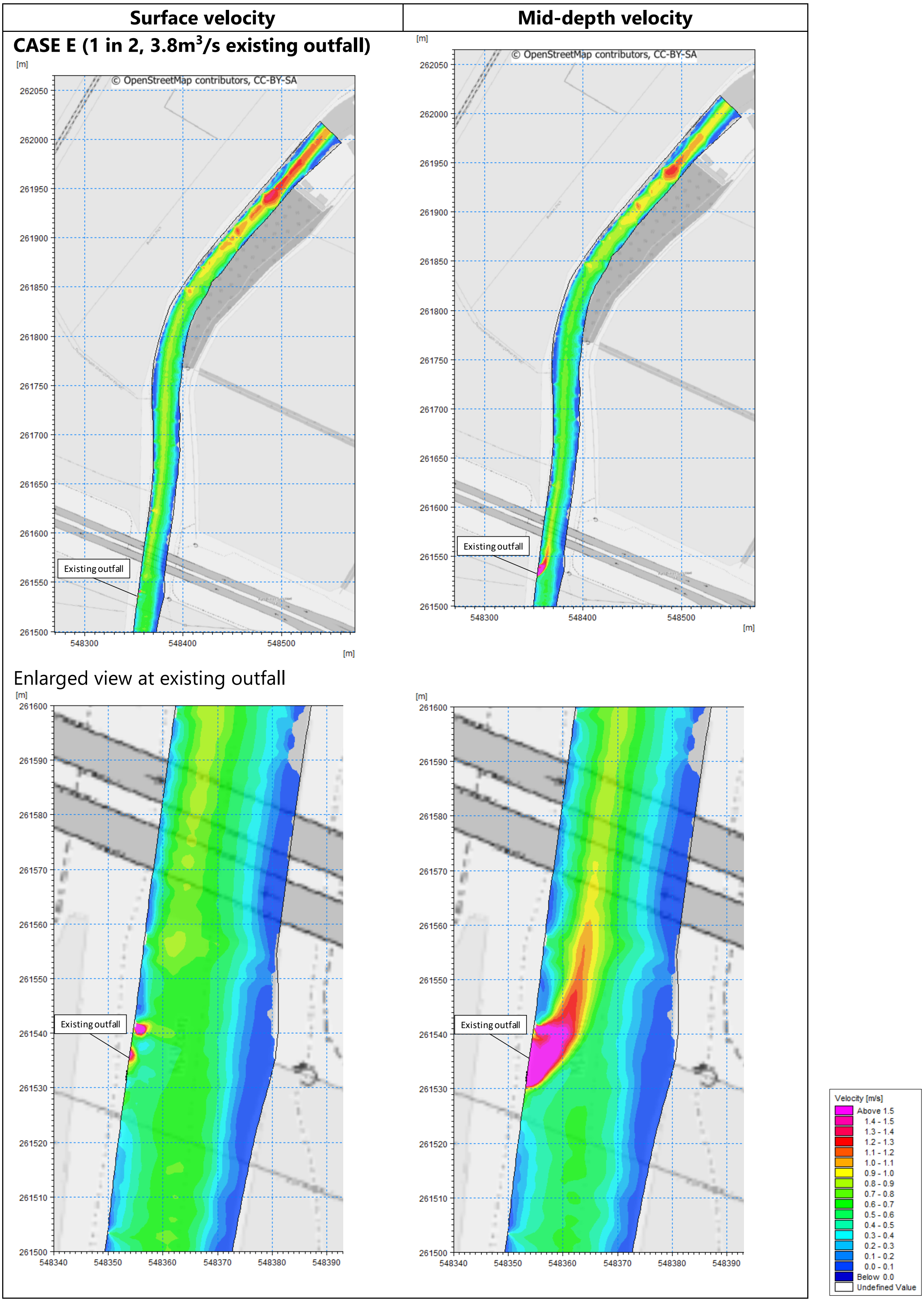



*Figure 4.6. Case E velocities*

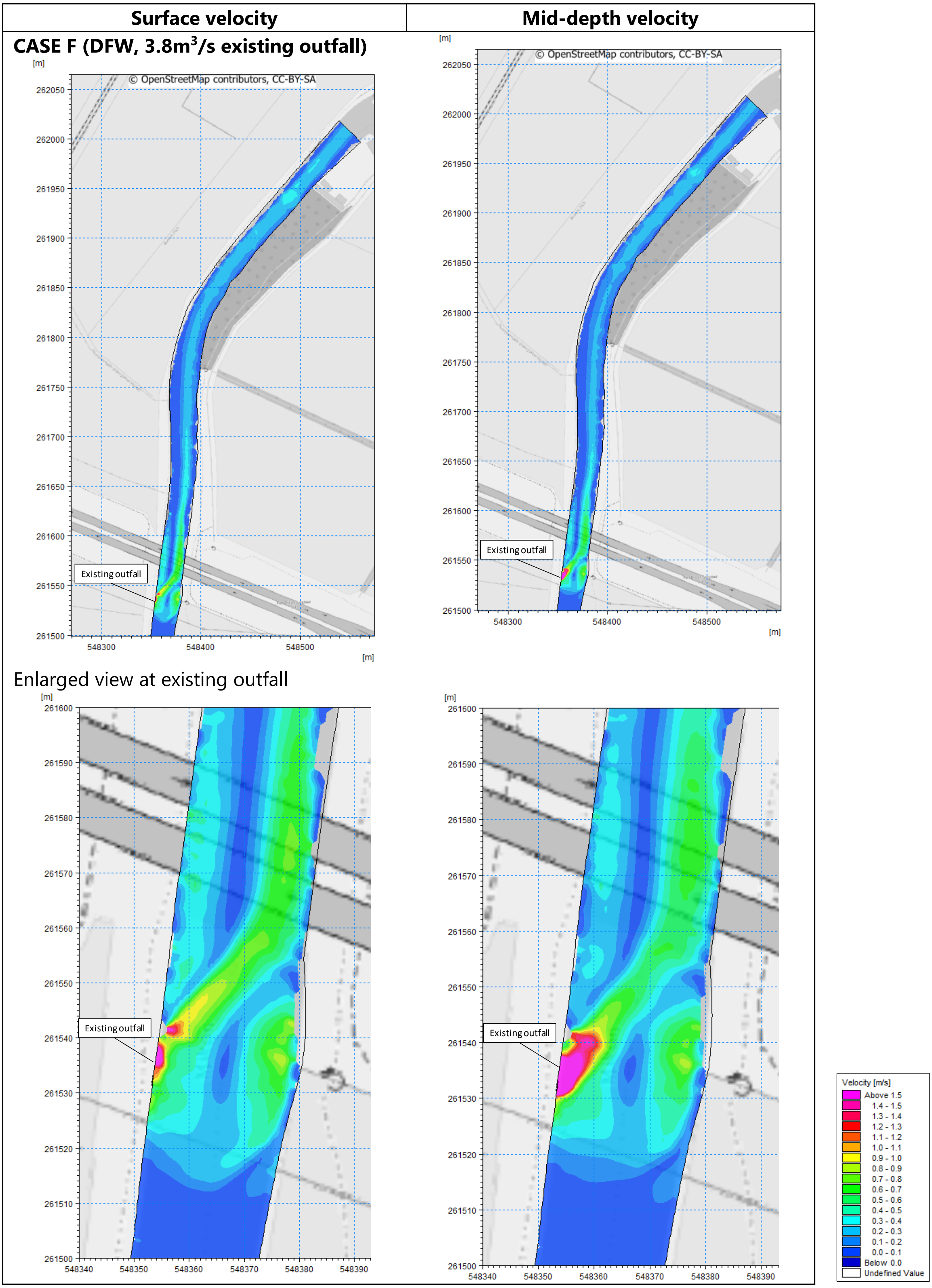
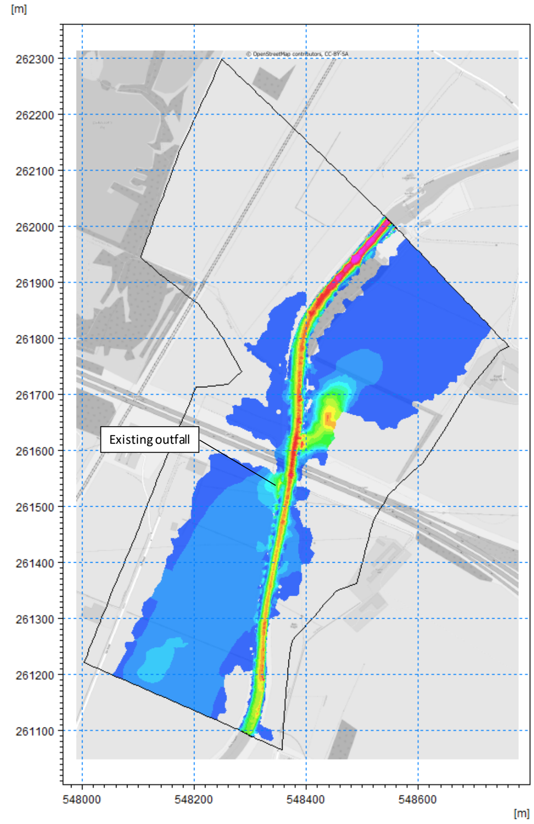
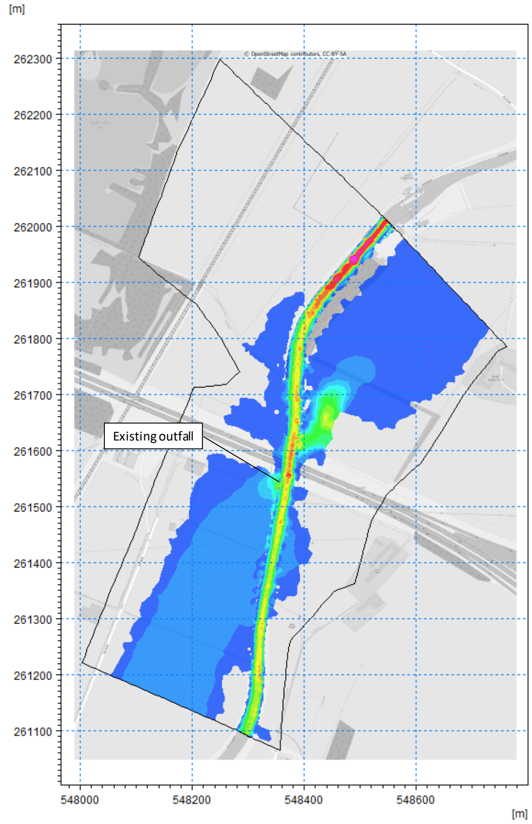



*Figure 4.7. Case F velocities*

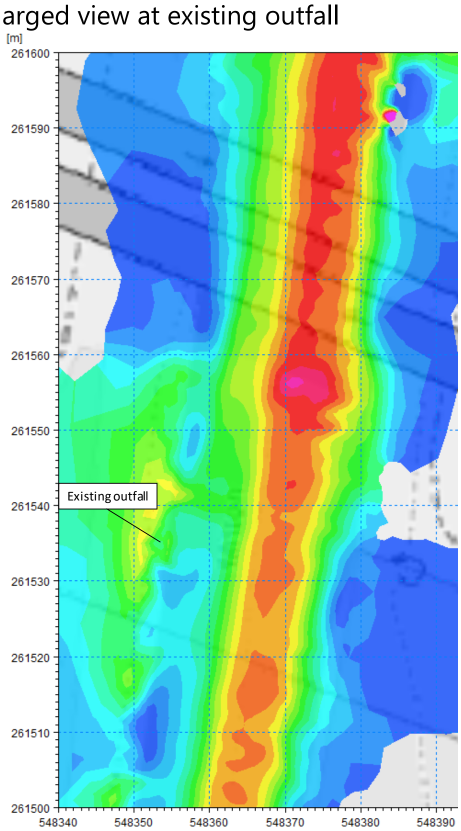
| **Surface velocity** | **Mid-depth velocity** |
|---|---|

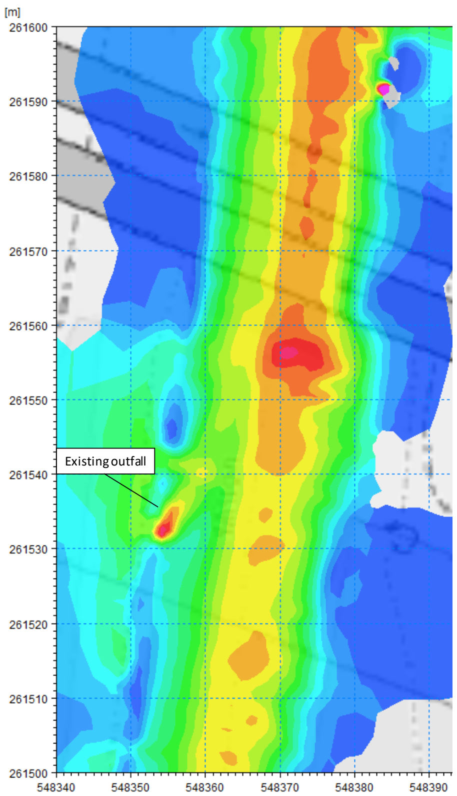
**CASE G (1 in 100+CC, 3.8m$^3$/s existing outfall)**




Enlarged view at existing outfall



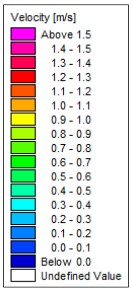
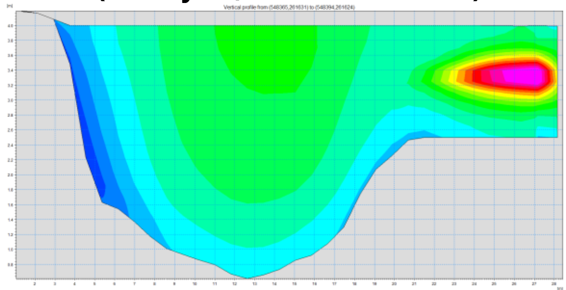
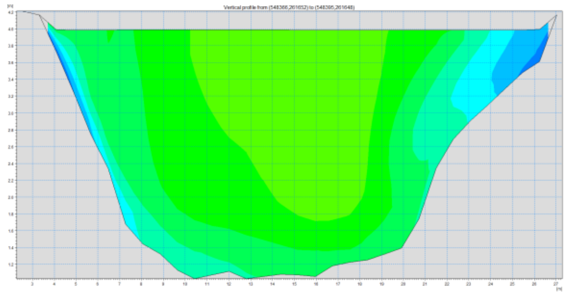




*Figure 4.8. Case G velocities*

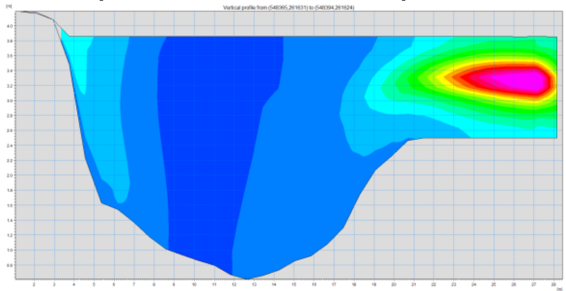
| At outfall (Section 3) | Downstream of outfall (Section 4) |
|---|---|

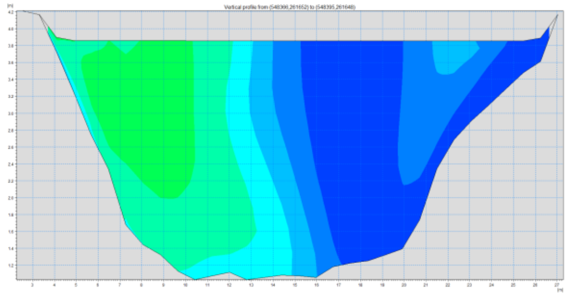
**CASE A (1 in 2 year, 7m³/s new outfall)**



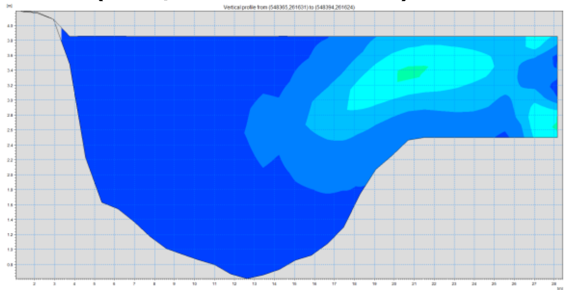


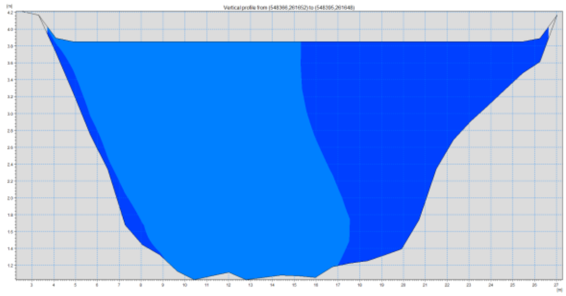
**CASE B (DWF, 7m³/s new outfall)**



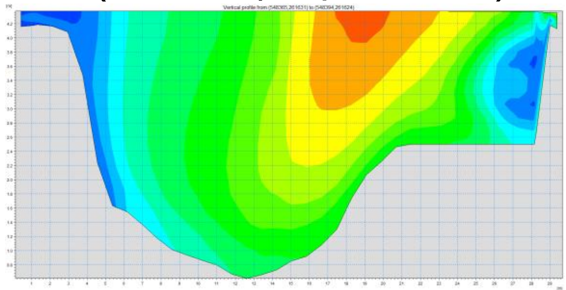


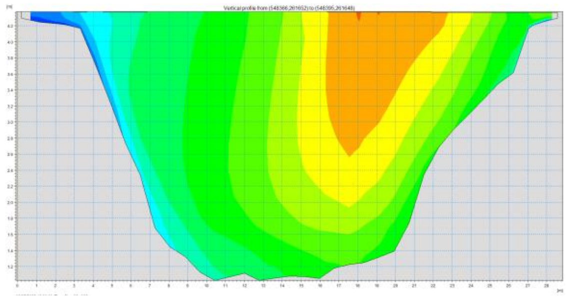
**CASE C (DWF, 2m³/s new outfall)**





**CASE D (1 in 100+CC, 7m³/s new outfall)**





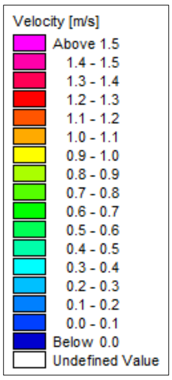
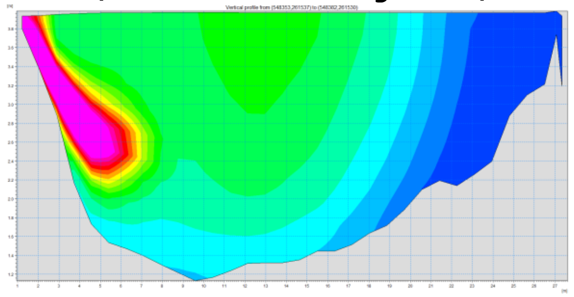
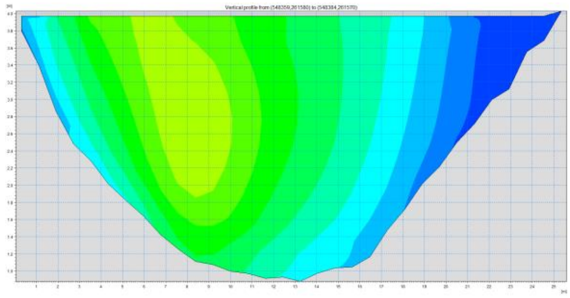



*Figure 4.9. New outfall vertical velocity profiles.*

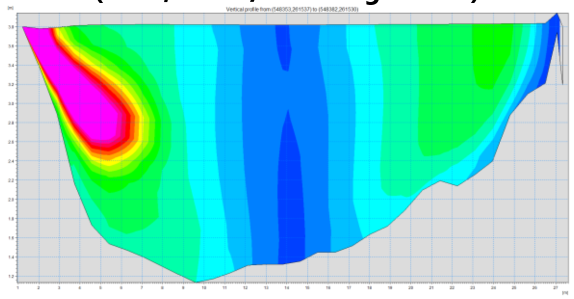
| At outfall (Section 1) | Downstream of outfall (section 2) |
|---|---|

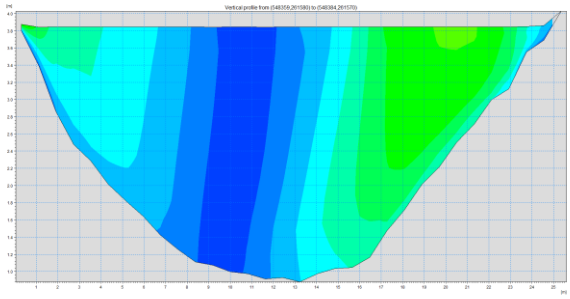
**CASE E (1 in 2, 3.8m$^3$/s existing outfall)**



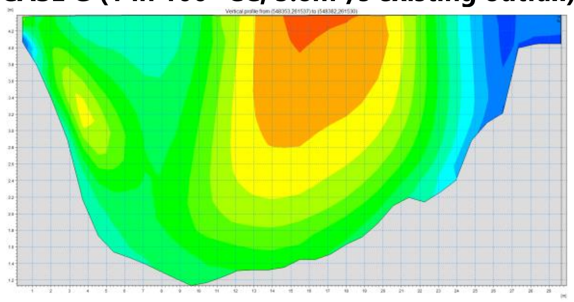


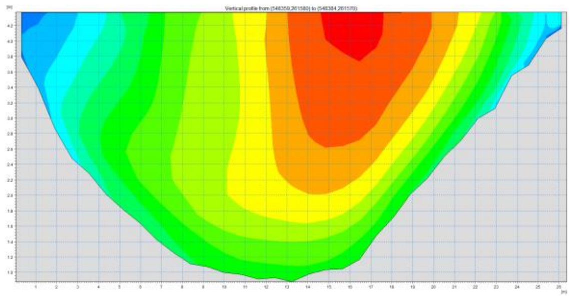
**CASE F (DFW, 3.8m$^3$/s existing outfall)**





**CASE G (1 in 100+CC, 3.8m$^3$/s existing outfall)**





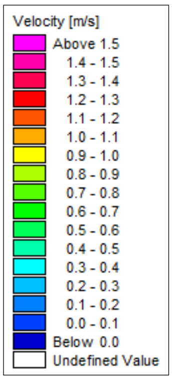



*Figure 4.10. Existing outfall vertical velocity profiles.*

# 5. Conclusions

This report describes hydraulic modelling undertaken to assess the impact of the new outfall within the Cambridge WWTP Relocation project design on conditions in the River Cam.

The modelling was undertaken using MIKE 3 software, using recent bathymetry data and information from the river modelling outputs derived in Stage 1.

A range of fluvial and outfall flows magnitudes were simulated. This covers both low and high river levels.

The river model results indicate that:

- The tested new outfall layout gives a good performance in terms of location/alignment on the river and flow spreading for each flow case. The outfall jet gets turned by the river flow and does not impact directly on the opposite bank.
- Velocities in the outfall plume are high close to the outfall but quickly reduce and are not exceptional compared to fluvial flood flows in the river. Therefore, given there is an apron in front of the outfall, there is no cause for concern from these model results that the new outfall would lead to erosion in the river.
- When there is flow through the outfall, velocities are high enough to prevent sediment build up in front of it. For the main FE outfall openings, there will be continuous flow, which should keep that area clear. For the storm outfall openings, it is expected that there could be many years between the outfall operating so sediment build up in this area could occur. One way to prevent this would be for periodic operation of the storm outfall for sediment flushing. The detailed impact at the outfall itself is better assessed using the Stage 3 CFD model results. There is no cause for concern about sediment accumulation further away from the outfall.
- There is good energy dissipation and flow spreading in the vicinity of the outfall. The effluent quickly mixes in with the ambient river flow.
- The outfall location and alignment appear to be working as intended. The angled exit is directing flows downstream. The only concern would be the potential for sediment build up in the recessed part of the outfall apron, as noted above. The new outfall alignment appears to give better initial mixing and less flow disturbance compared to the existing outfall.
- The rapid initial mixing apparent from the velocity results should minimise impacts on water quality and the environment. As above, the new outfall appears to offer improved performance compared to the existing outfall despite higher storm flows being considered. The effluent plume quickly mixes with the river flows for all the cases tested.
- The river banks and the protection provisions for the new outfall layout design is sufficient as high velocities occur close to the outfall but quickly reduce downstream of the outfall. There is no cause for concern about bank protection upstream of the new outfall. The protection for the existing outfall appears to work as intended, noting that the sheet pilling and concrete capping beam in the vicinity of the A14 bridge crossing will give protection from the higher velocity plume of the existing outfall.

# 6. References

[Ref 1] *Cambridge WWTP River Modelling - Final,* Binnies, 22 April 2022.

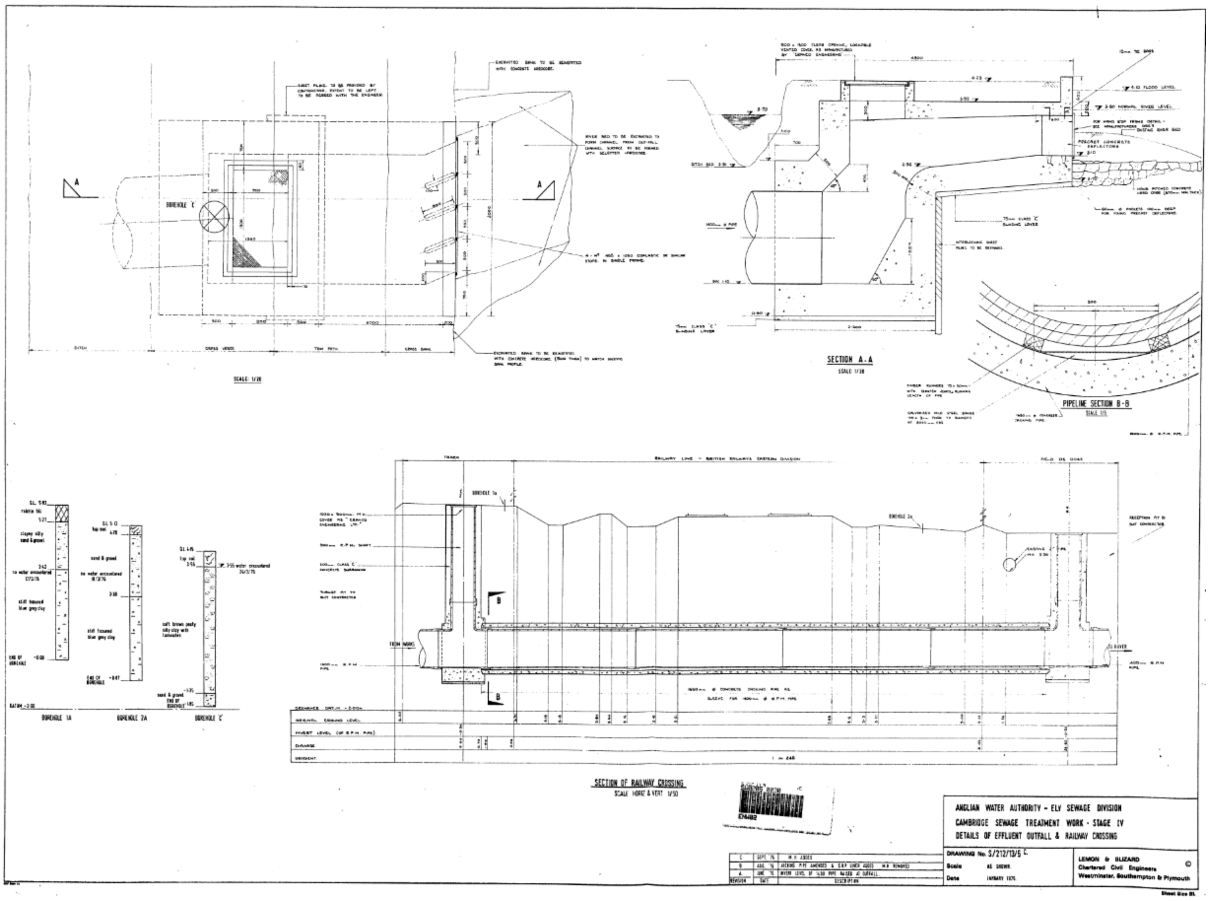
[Ref 2] *Modified Outfall Sketch (Rev B -draft at 12 Apr 2022).pdf.* Received by email from David Winzer, 12 April 2022.

[Ref 3] *Cambridge Wastewater Treatment Plant Relocation Project - Network Modelling Report - Spills to the watercourse* , Binnies, 9 Feb 2022

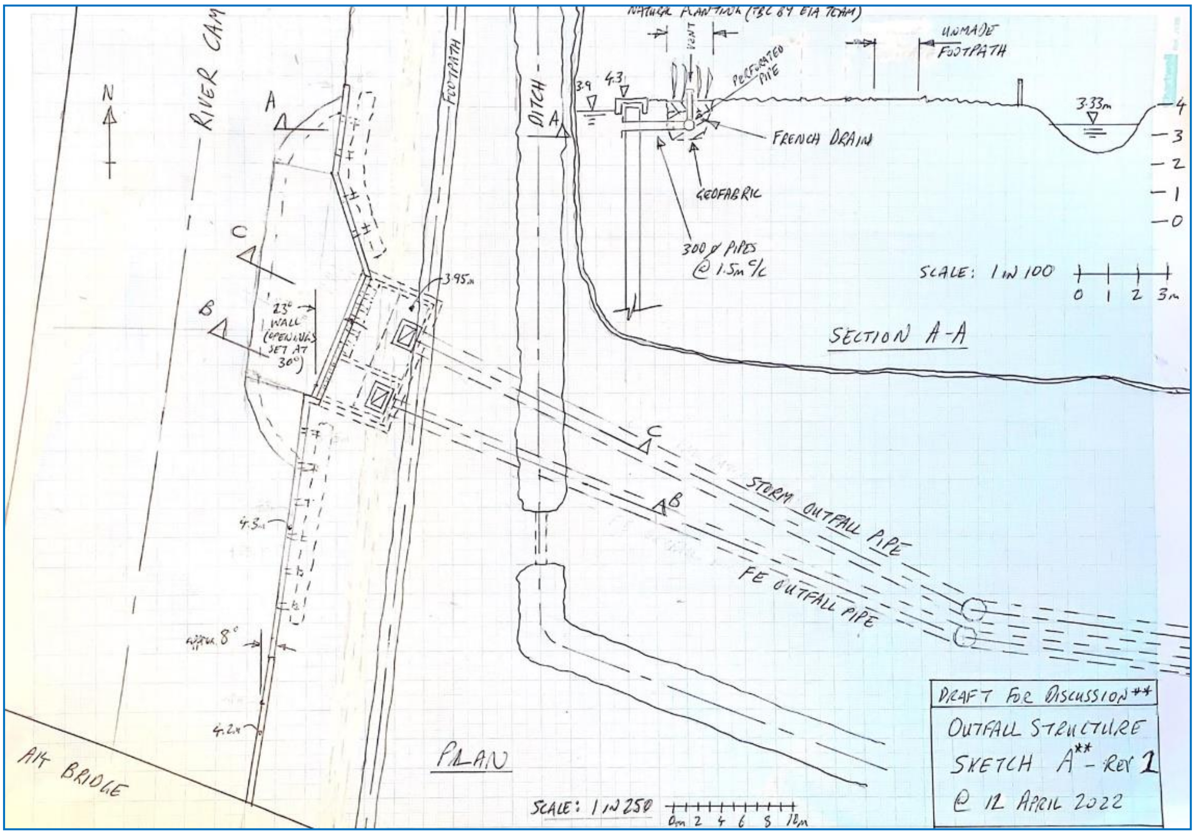
# APPENDICES

## Appendix A: Outfall layout

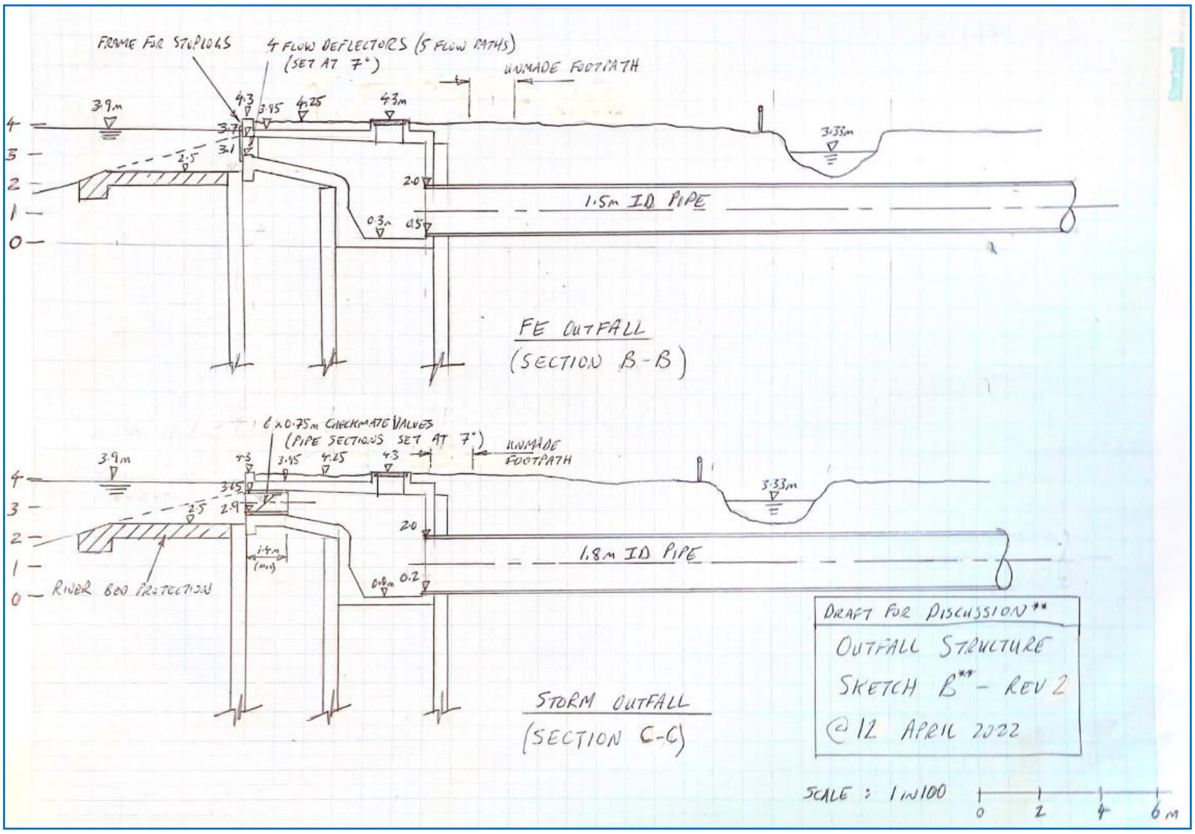
**Existing Outfall**



**New outfall**




*Sheet 1 from Modified Outfall Sketch (Rev B -draft at 12 Apr 2022).pdf by David Winzer [Ref 2]*




*Sheet 2 from Modified Outfall Sketch (Rev B -draft at 12 Apr 2022).pdf by David Winzer [Ref 2]*

# Appendix B: Mike 3 model set up

| Parameter | Description | Value/Note |
|---|---|---|
| Domain | Mesh | Type: Quadrangular and triangular<br>Vertical layers: 10 |
| Basic equation | Shallow water equations | - |
| Solution technique | Higher order | Min. time step: 0.005 seconds<br>Max. time step: 30 seconds<br>Critical CFL: 0.8 |
| Depth | No depth correction | - |
| Flood and dry | Flood and dry | Drying depth: 0.005 m<br>Wetting depth: 0.1 m |
| Density | Barotropic | - |
| Eddy viscosity | Horizontal: Smagorinsky formulation<br>Vertical: Two-equation turbulence model | Default |
| Bed resistance | Roughness height | Global: 0.1m<br>Bed protection: 0.07m<br>River: 0.05m |
| Coriolis forcing | No | - |
| Wind forcing | No | - |
| Ice coverage | No | - |
| Tidal potential | No | - |
| Precipitation/ Evaporation | No | - |
| Infiltration | No | - |
| Wave radiation | No | - |

# Get in touch

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Calling our Freephone information line on **0808 196 1661**

Writing to us at **Freepost: CWWTPR**

Visiting our website at **www.cwwtpr.com**

You can view all our DCO application documents and updates on the application on The Planning Inspectorate website:

**https://infrastructure.planninginspectorate.gov.uk/projects/eastern/cambridge-waste-water-treatment-plant-relocation/**