CIVIL ENGINEERING SOLUTIONS LTD

CES533 EVERGREEN FARM FLOOD MODELLING

FINAL REPORT

MAY 2019

Prepared by:
Civil Engineering Solutions Ltd
Bryn Meurig
Lombard Street
Dolgellau
Gwynedd
LL40 1DS

Tel: 01341 421 911

Email: info@ces.eu.com
Web: www.ces.eu.com

Client
Mr Dan McEwan
Fluid Planning

REVISION HISTORY

Revision Reference	Date Issued	Amendments	Issued to
Draft	13/05/2019		Fluid Planning

TERMS OF REFERENCE

This report has been commissioned by Fluid Planning. Jac Roberts of Civil Engineering Solutions Ltd has undertaken the work.

Prepared By: ……. Jac Roberts BSc
Engineer

Approved By: ……. Mark A Roberts BEng CEng FICE
Director

CONTACT DETAILS

Prepared by:

Civil Engineering Solutions Ltd
Bryn Meurig
Lombard Street
Dolgellau
Gwynedd
LL40 1DS

Tel: 01341 421 911

Email: info@ces.eu.com
Web: www.ces.eu.com

Client:

Mr Dan McEwan
Fluid Planning

DISCLAIMER

This document has been prepared solely as a Flood Modelling Report. Civil Engineering Solutions Ltd accepts no responsibility or liability for any use, which is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

COPYRIGHT

EXECUTIVE SUMMARY

Civil Engineering Solutions has been engaged to prepare flood risk modelling and SuDS drainage design associated with a proposed capping of a contaminated land tip at Evergreen Farm, West Hoathly Road, East Grinstead, RH19 4NE. The flood modelling has identified the current and proposed flood risk resulting from the works and has aided in the design of SuDS mitigative measures.

The recommendations include for a 500mm diameter culvert along the south western boundary to be connected to a proposed shallow swale along the north western boundary of the development site to ensure that the highway (Hoathly Road) is not affected by the development, and SuDS requirements have been satisfied.

The investigatory work undertaken has demonstrated the development can be constructed without adverse effects to third party landowners.

CONTENTS

LIST OF FIGURES

APPENDICES

1 INTRODUCTION

Civil Engineering Solutions have been commissioned by Mr Dan McEwan of Fluid Planning to prepare flood modelling outputs for a potential development site at Evergreen Farm, West Hoathly Road, East Grinstead, RH19 4NE. The site is centred at X: 538995, Y: 136292 and measures some 40Ha. As outlined in red in Figure 1 below.

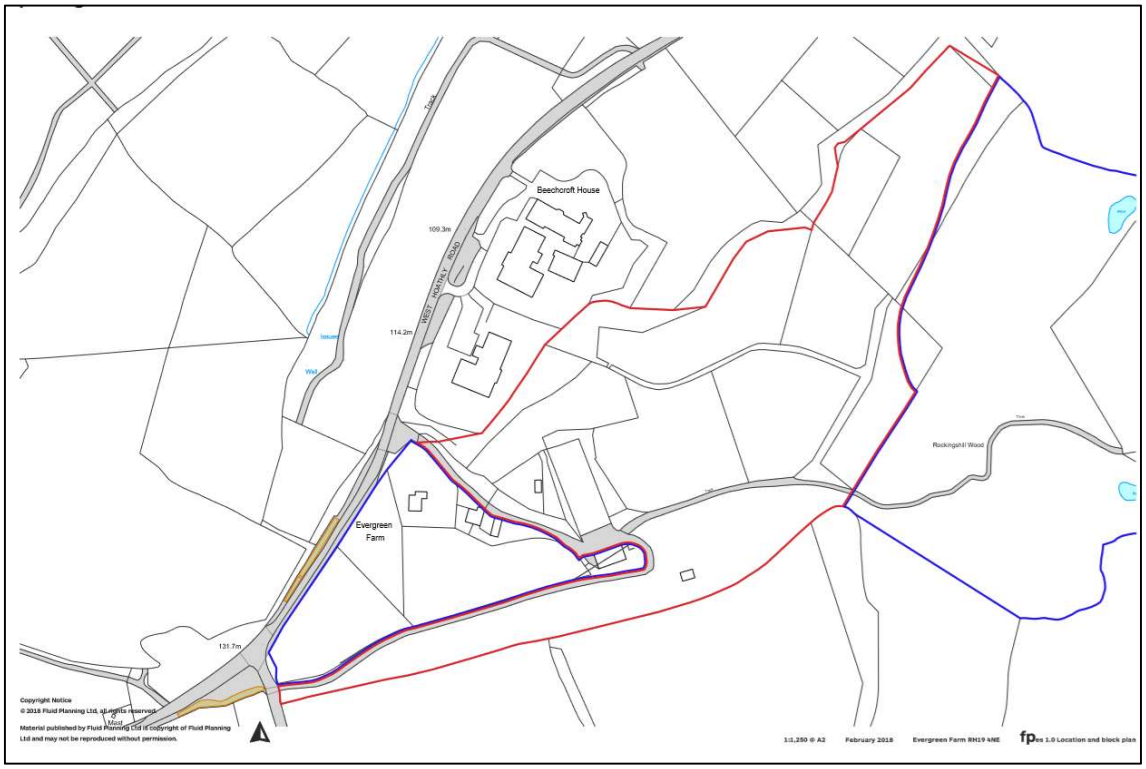

Figure 1: Fluid Planning Site Boundary

Site proposals include for a soil cap to be formed over an existing contaminated mound, with additional fill placed on top.

1.1 INFORMATION PROVIDED BY THE CLIENT

On commission, CES were provided with:

A Geotechnical Design Report for Landfill Cap report completed by “epg”. The report outlined suitable slopes for the site ground conditions. The slopes detailed, have been applied by CES in creating a proposed surface for assessing flood modelling impacts of the scheme.

Data obtained in support of flood modelling.

CES have obtained the following information relevant to the aims of this study:

LiDAR

The catchment area was reviewed using data downloaded from the Flood Estimation Handbook (FEH) website. This identifies a catchment extending to some 4.265km^2. LiDAR was obtained by purchasing from 'BlueSky' and 'Intermap' respectively (Available from via their online portals), covering the lower south and south west catchment. The remainder of the catchment was filled by Environment Agency LiDAR, freely available via their online portal.

The following reference tiles were used to prepare baseline topography to support flood modelling:

CM_00761354_BlueSky__LiDAR_0_5m.asc
CM_00766451_Intermap__NEXTmap.asc
Dtm_F0141167m_units_Export
Dtm_F0141169m_units_Export
Dtm_F0141170m_units_Export
Dtm_F0141172m_units_Export
Dtm_F0141173m_units_Export

Each of these tiles were imported into MapInfo Professional 2017 to form the baseline topography for pluvial modelling.

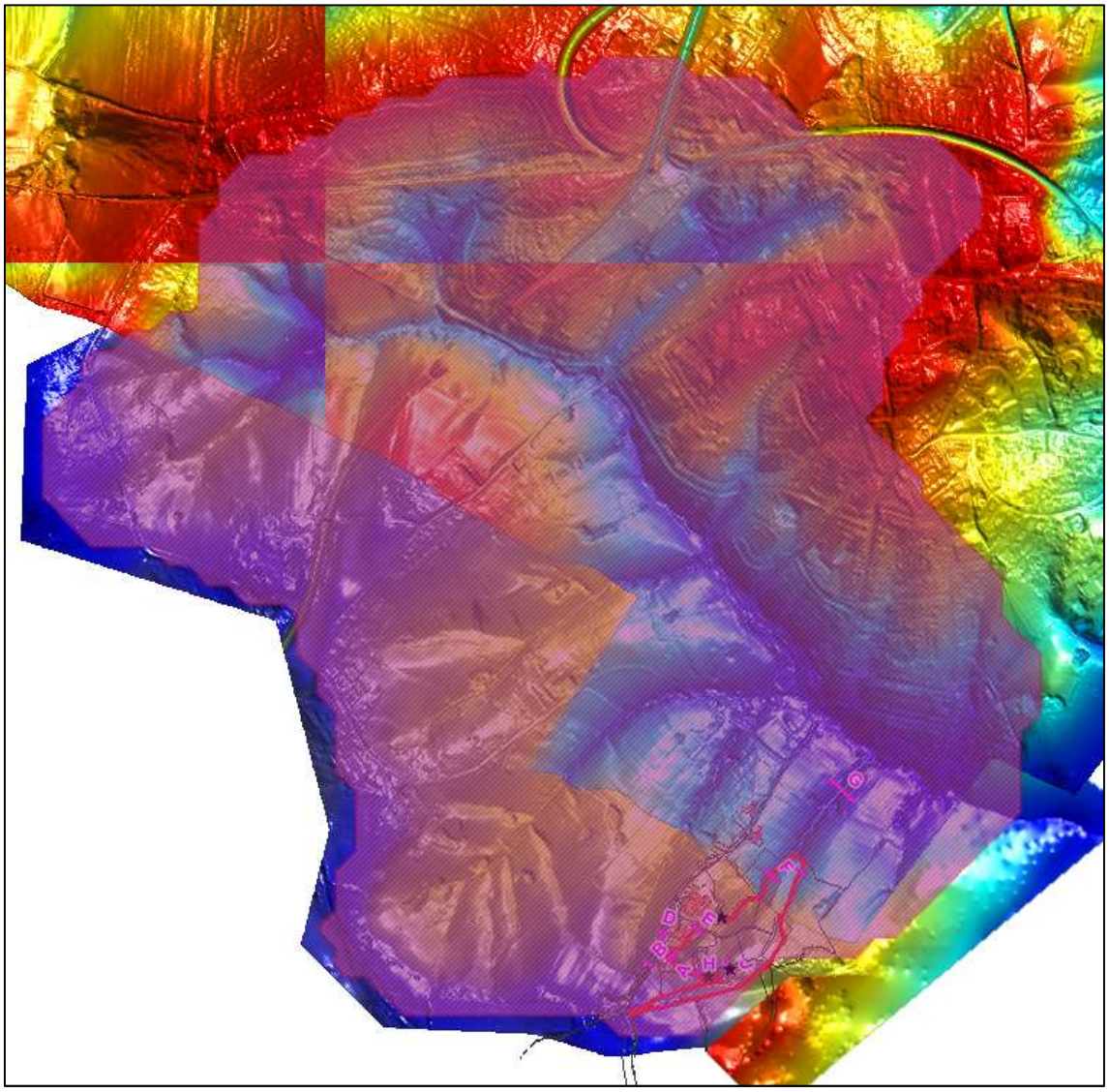

Figure 2: LiDAR coverage and Subject site boundary

FEH Rainfall Data

Rainfall information was accessed and downloaded through the FEH Website on 3rd December 2018. The catchment extent was identified using the web service and descriptors saved in xml and CD3 formats. The catchment boundary was also exported as a GIS shp file and imported into MapInfo to review catchment extents against LiDAR and mapping data.

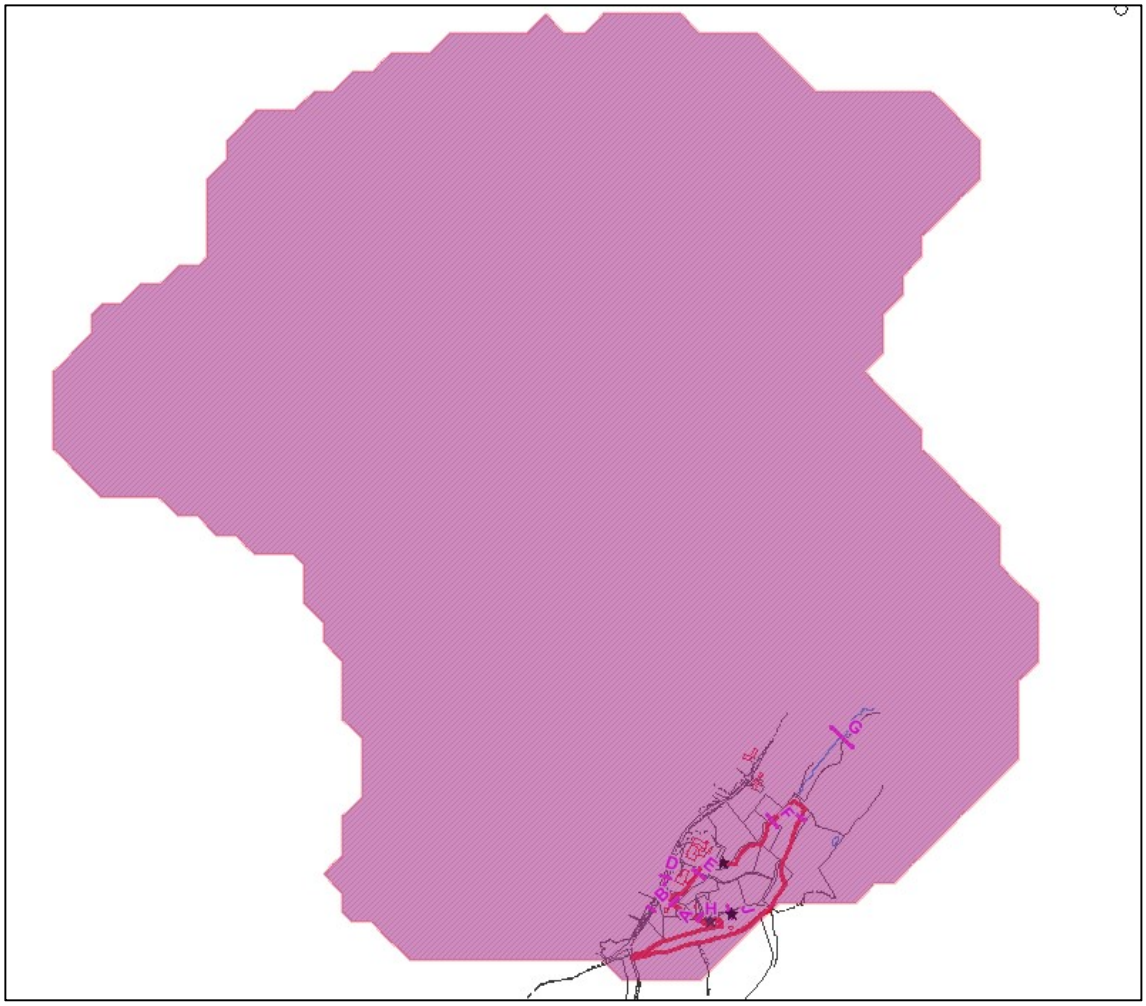

Figure 3: Catchment extents and Red line boundary

The catchment extent appeared to be consistent with the LiDAR data.

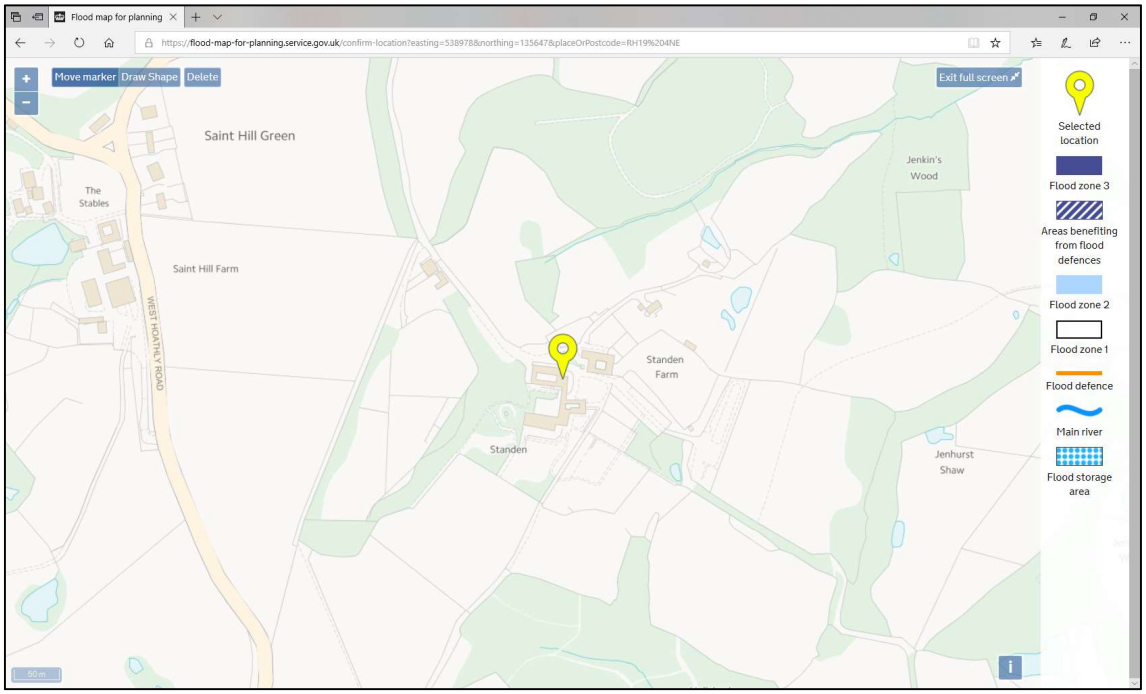

Figure 4: Environment Agency Flood Map

The Environment Agency flood map shows the whole site is located within Flood Zone 1.

Ordnance Survey Mastermap

Ordnance survey Mastermap data was purchased for the immediate catchment and downloaded as *.GML format. The OS Topographic Land Area table data was imported into MapInfo and the table structure edited to move the land use feature code to be the first attribute in the table. This table was then saved and exported to MID/MIF format to assist with the 2D flood modelling. This is particularly useful in defining manning roughness and soil permeability factors for the study area based on OS land use classifications.

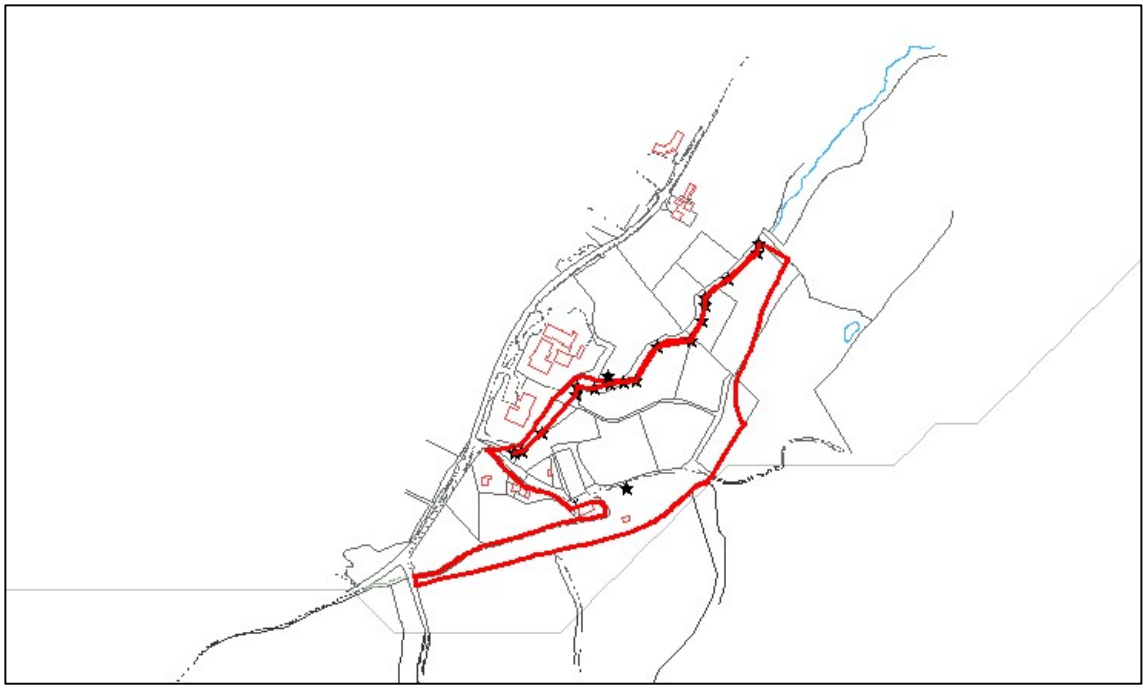

Figure 5: CES533 Evergreen Farm OS Mastermap Data and Red Line Boundary

2 FLOOD MODELLING

The client brief called for flood modeling outputs to be determined for the 100yCC event. A review of the published Environment Agency flood outputs for the site indicated the area is not at risk of tidal flooding.

FEH catchment descriptors *.xml" were imported into ReFH2 software provided by Wallingford Hydrosolutions to derive rainfall intensity profiles and depths for the one hour, three hour and six-hour rainfall durations with return periods of 100y and 1000y.

In order to derive pluvial flood data for the proposed development site, a catchment wide, bespoke two-dimensional direct rainfall model using TUFLOW was constructed.

CES developed two model scenarios to define the existing overland flow pathways to understand effects of the proposed land form and finally to test SuDS mitigation measures as follows:

Existing: to establish the current hydraulic characteristics of the site and the wider catchment,

Proposed: the proposed surface with strategic SuDS methods to negate impact of the proposed surface.

2.1 EXISTING

CES developed the 'baseline' model from LiDAR and Ordinance Survey Mapping. Specific site survey information was provided on the 3rd of December and incorporated into the model. Figure 6 below demonstrates the Existing Surface

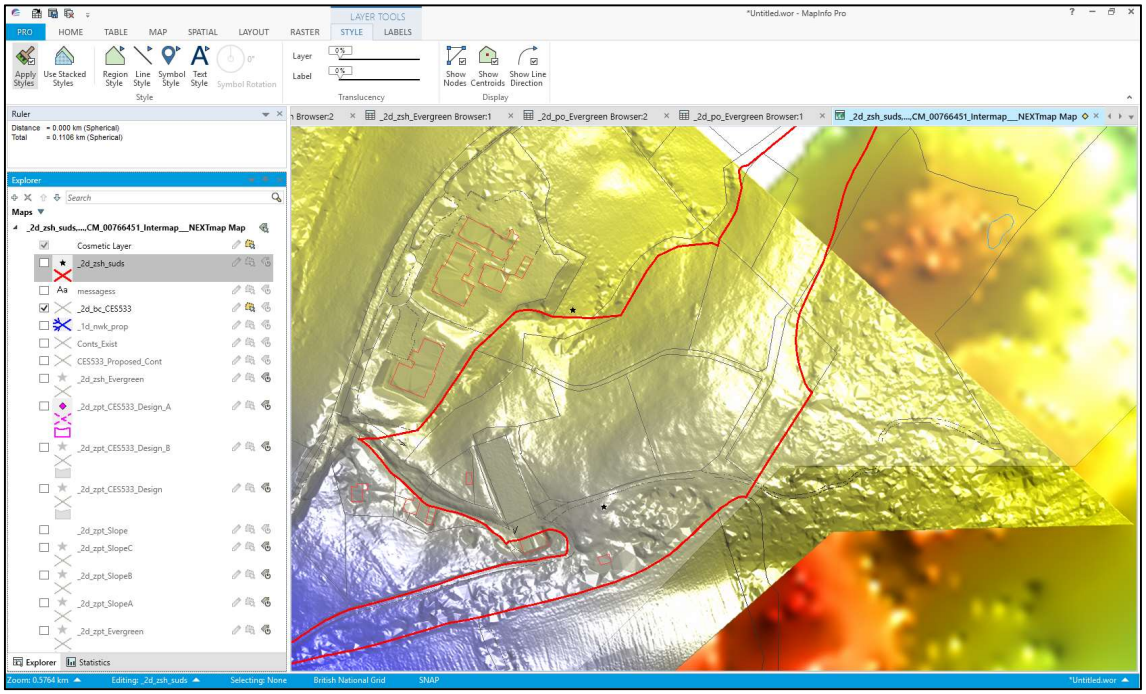

Figure 6: CES533 Evergreen Farm Existing Topography

The existing site ranges from 120m AOD at the crest of the existing mound to 95m AOD at the north eastern boundary.

Rainfall event simulating a one hour 100 year with 40% allowance for climate change was applied to the model to identify the overland flow pathways and maximum flood depths resulting from the synthetic storm. Figure 7 below:

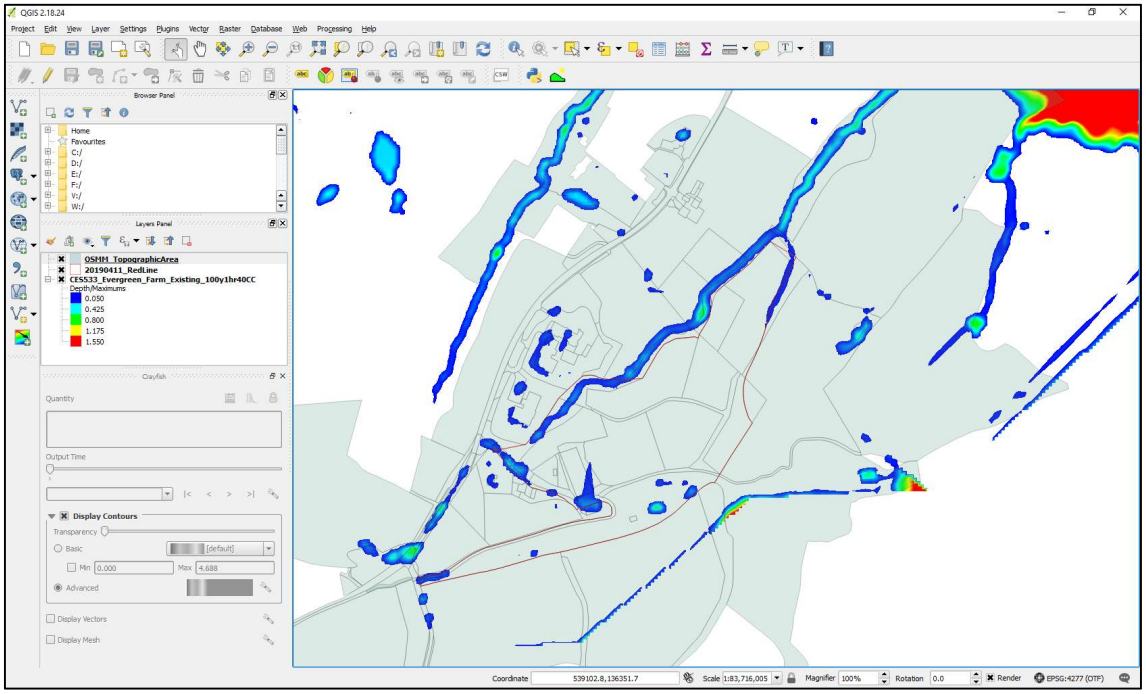

Figure 7: CES533 Evergreen Farm Existing 1in100yCC DMax

'PO' lines have been inserted into the modelling to establish 'Existing' flow rates at strategic points of interest. See Figure 11.

2.2 PROPOSED SURFACE

A second pluvial flood model was prepared, which included the design topography for the proposed cap to the existing contaminated mound with the proposed land profile. This model was simulated for the same rainfall event as the 'Existing' scenario detailed earlier.

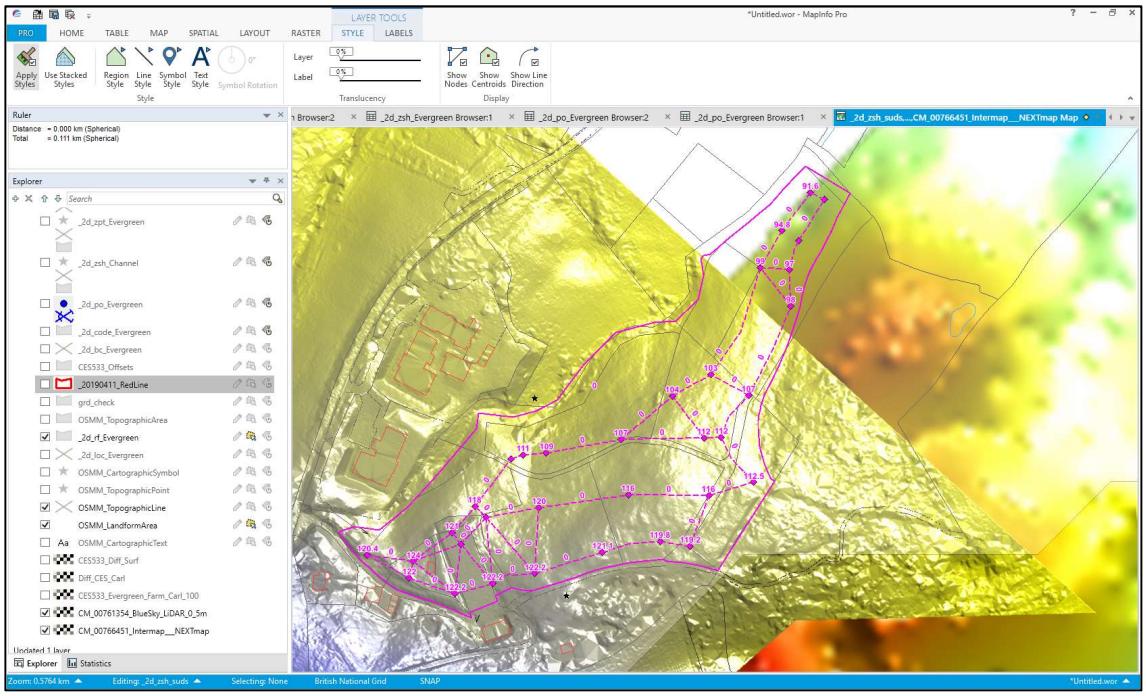

Figure 8: CES533 Evergreen Farm Proposed Topography

To mitigate the flood impacts to third parties, a swale (2m x 0.5m) has been included to provide a SuDS solution for the project, as seen marked as green in Figure 9. A 500mm diameter culvert has also been included to convey water from the southern boundary of the site to the proposed swale, to satisfy SuDS. This proposed culvert can be seen marked as blue in Figure 9.

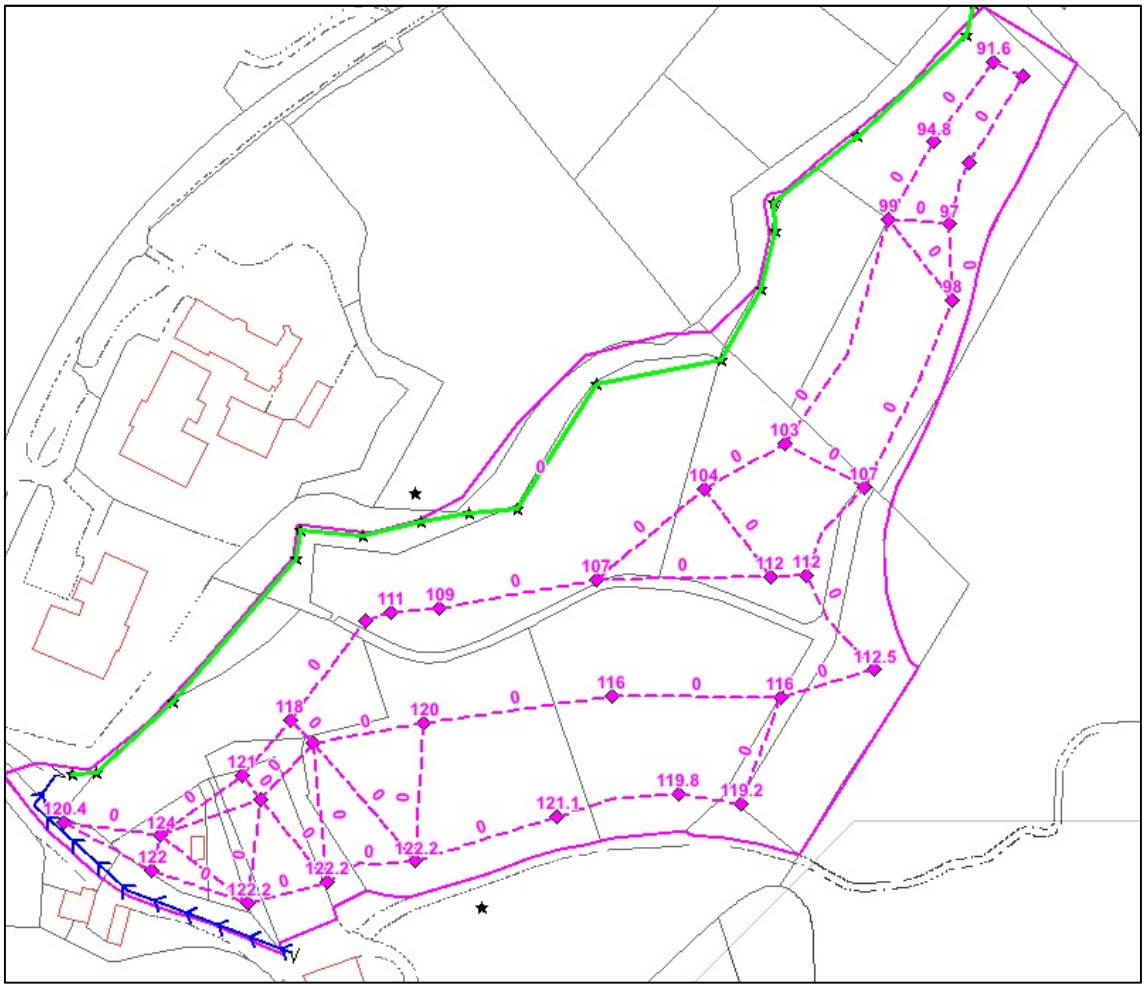

Figure 9: CES533 Evergreen Farm SuDS

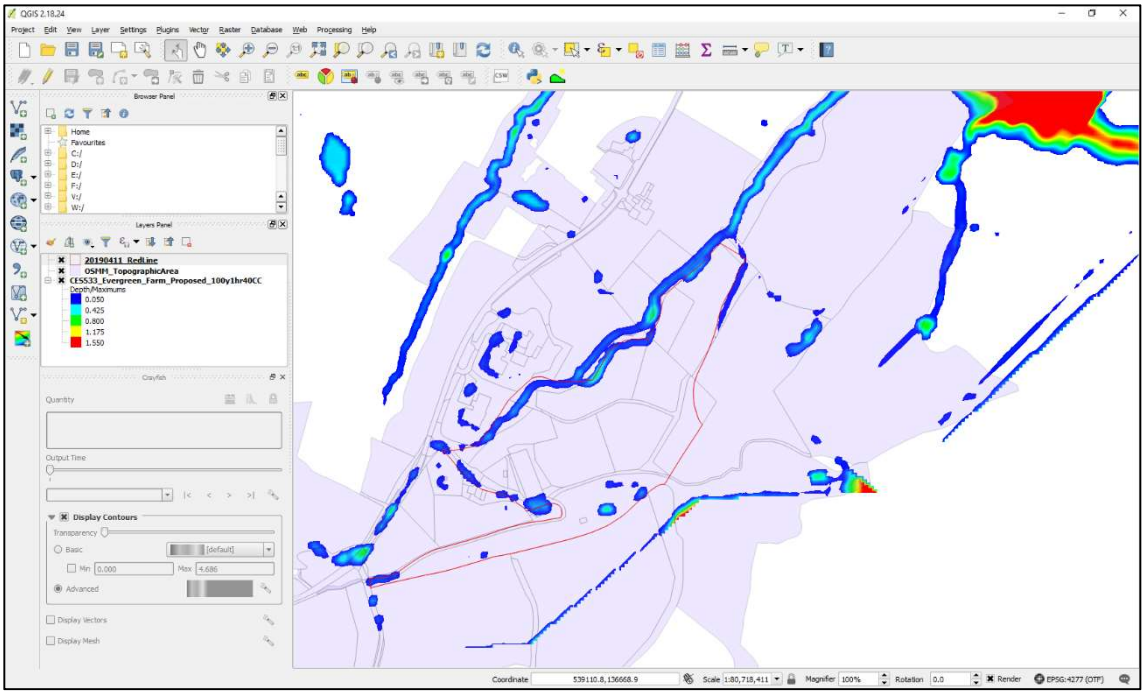

Figure 10: CES533 Evergreen Farm PropSurface 1in100yCC DMax

The proposed topography increases the crest level to 124m AOD. The proposed surface has been calculated by adhering to 'The environmental Protection Group's Geotechnical Design Report for Landfill Cap' guidance on slope stability, which is provided in Appendix A. The proposal seeks to raise peak crest levels by some 3m.

The proposed surface model was simulated with no other alterations from the existing.

The resulting model outputs were compared against the existing case using 'Point Objects' within the TuFLOW software. These were placed at strategic locations to fully understand the impacts of the proposed development with respect to flow rates. The location of the areas compared can be seen below in.Figure 11.

Both the Existing and Proposed model outputs were compared. The Proposed model identified no change in predicted offsite flood depths, durations or extents.

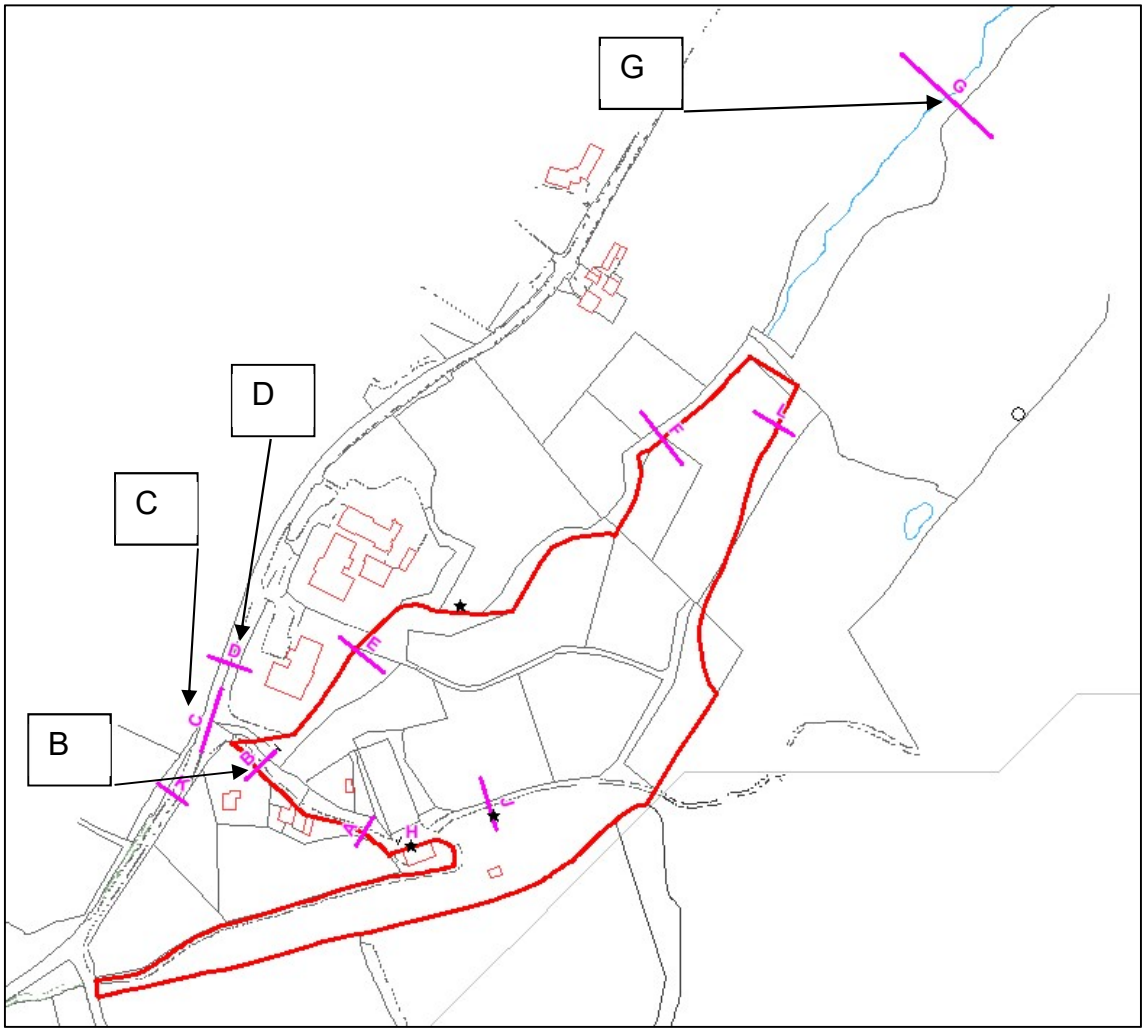

Figure 11: CES533 Evergreen Farm Point Object

- PO-B identifies the flow passing point B
- PO-C identifies the flow passing point C and onto West Hoathly Road (highway)
- PO-D identifies the flow passing point on West Hoathly Road (highway)
- PO-G identifies the total flow passing through the downstream watercourse

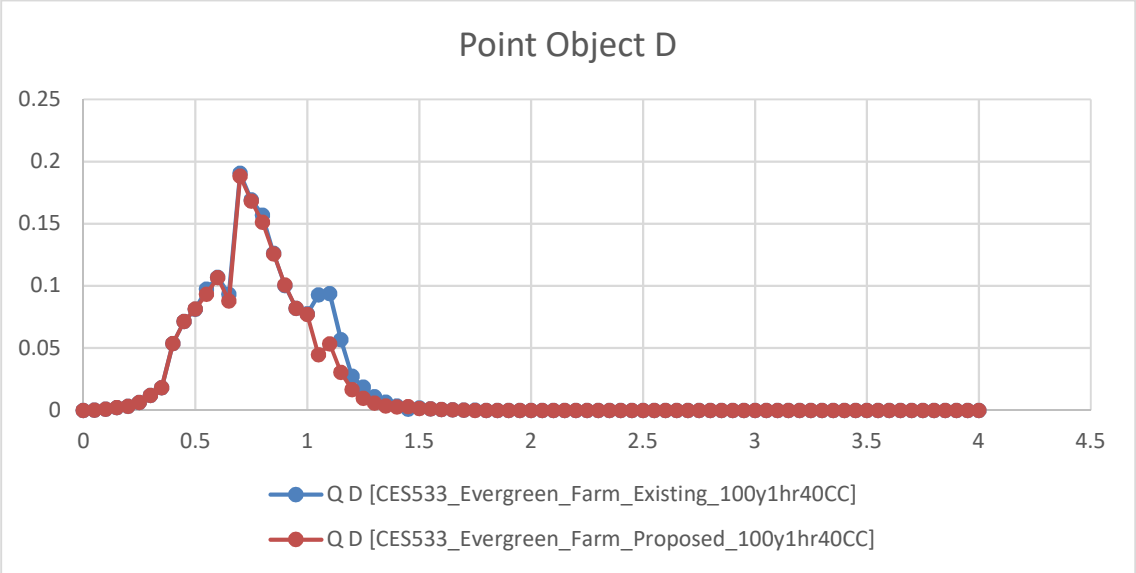

Figure 12: CES533 Evergreen Farm PO-D

Figure 12 shows the peak flow in m^3/s passing PO-G to be occurring at circa 0.7 hours into the storm. The modelling shows no increase in surface water when comparing existing and proposed cases.

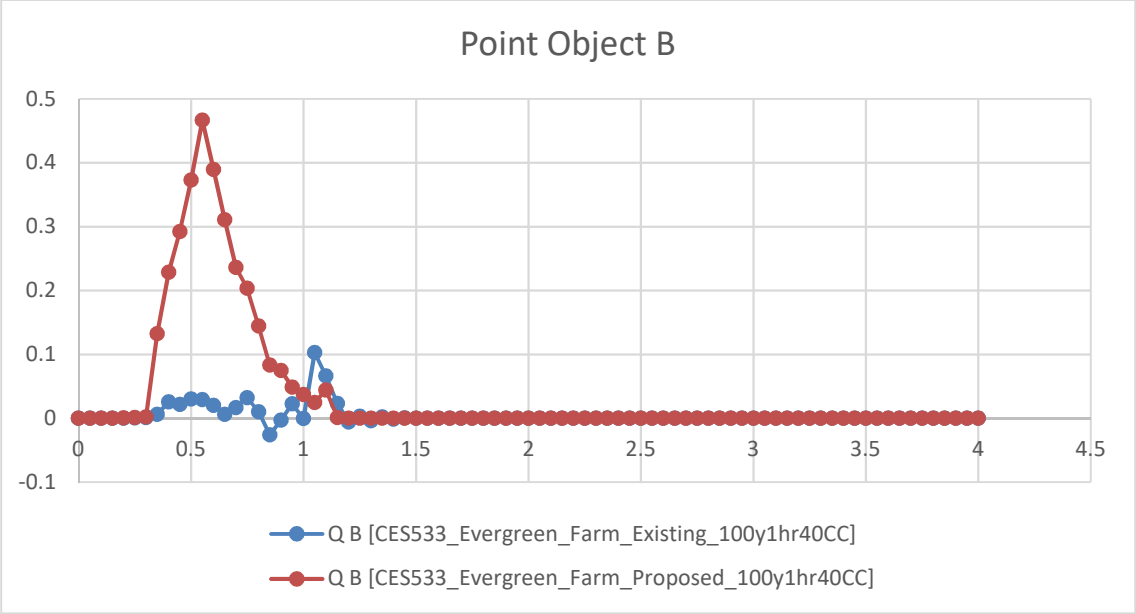

Figure 13: CES533 Evergreen Farm PO-B

PO-B is located at the across the existing access track leading from the highway, West Hoathly Road. Whilst there is an increase in overland flow rates at this location, water is re-directed by the proposed site drainage and SuDS provision into the existing watercourse leading to an overall reduction in 'off site' fluvial flows.

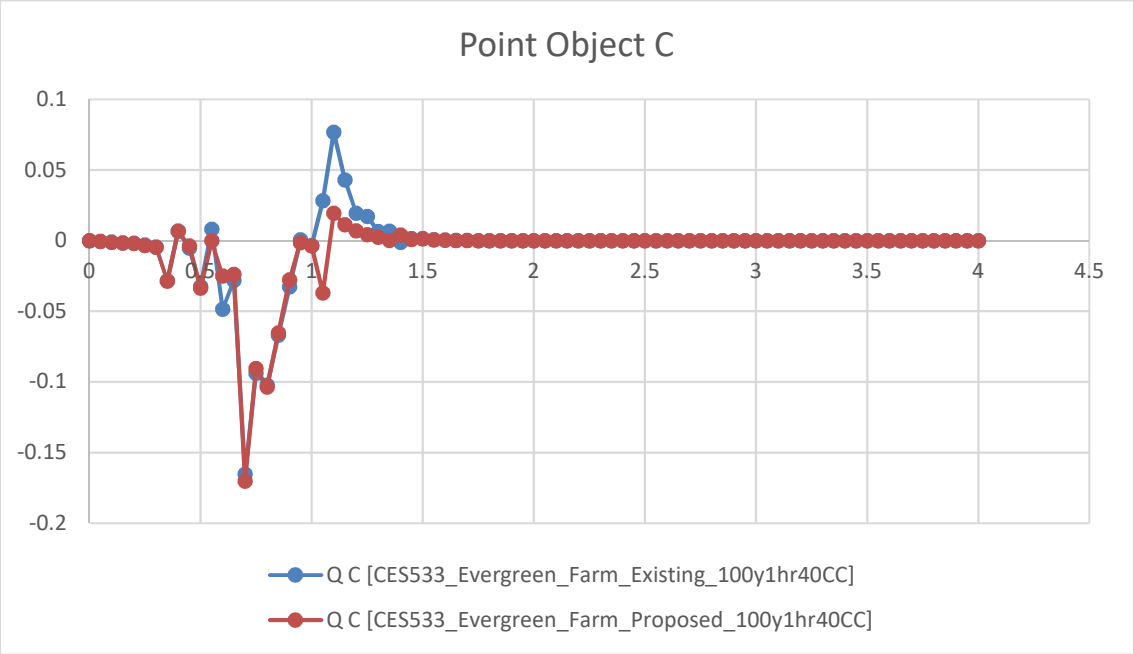

Figure 14: CES533 Evergreen Farm PO-C

As can be seen in Figure 14 above, there is a proposed net decrease in flows leaving our clients site post development, with a reduction in pluvial flows emanating from the access track

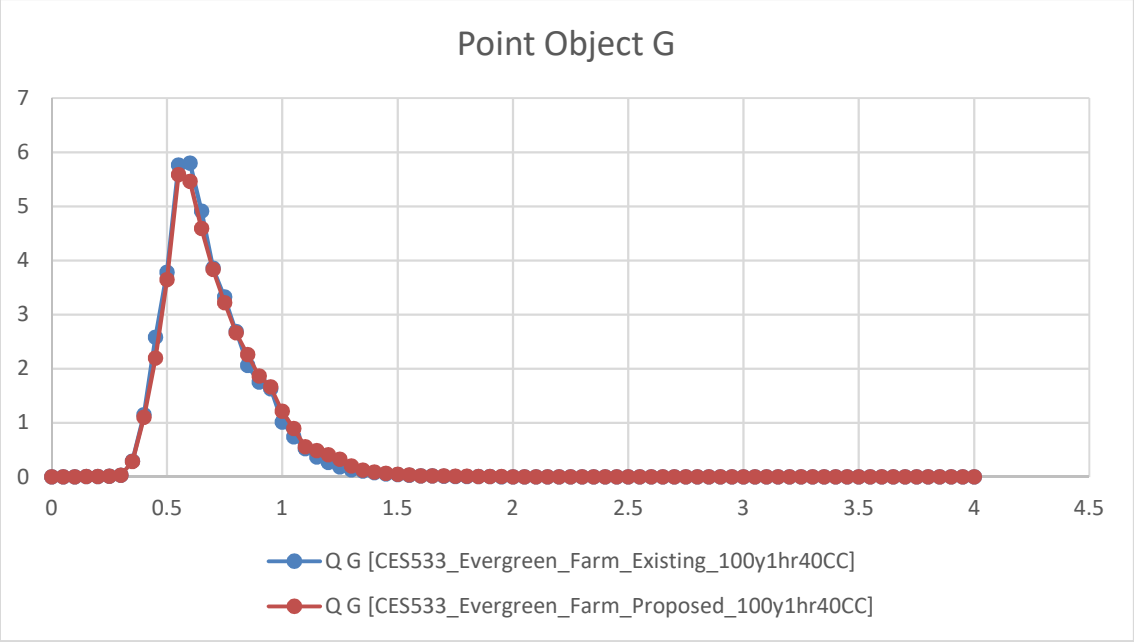

Figure 15: CES533 Evergreen Farm PO-G

As can be seen from Figure 15 above, the development does not increase peak flow rates at PO-G. Thus, no increase in flow that could impact persons, property or infrastructure downstream.

3 RECOMMENDATIONS

This report recommends that the SuDS solution described in the 'Proposed' option sufficiently mitigates the additional flood implications caused by the proposed development, without further third-party impacts.

4 CONCLUSION

Detailed catchment wide two-dimensional pluvial modelling has been used to identify existing flood risk and potential adverse effects on the adjacent highway resulting from construction of the earth cap. Mitigative SuDS measured have been identified and tested within the modelling to negate flood impacts to third parties.

The use of a culvert at the south east boundary of the site connected to a shallow swale at the north west boundary of the site, redirects flow back into the watercourse. The modelling has concluded that this strategy does not negatively impact third parties.

5 APPENDICES

APPENDIX A: EPG GEOTECHNICAL DESIGN REPORT

Appendix A: EPG GEOTECHNICAL DESIGN REPORT